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Information technology — Open Connectivity Foundation (OCF) Specification —

Part 9: Core optional specification

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

Partie 9: Spécification facultative du cœur

Reference number
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Contents

Page

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see patents.iec.ch).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

This document was prepared by the Open Connectivity Foundation (OCF) (as OCF Core Optional Specification, version 2.2.0) and drafted in accordance with its editorial rules. It was adopted, under the JTC 1 PAS procedure, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

A list of all parts in the ISO/IEC 30118 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

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

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

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

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

ISO/IEC 30118 consists of eighteen parts, under the general title Information technology — Open Connectivity Foundation (OCF) Specification. The parts fall into logical groupings as described herein:

- Core framework
  - Part 1: Core Specification
  - Part 2: Security Specification
  - Part 13: Onboarding Tool Specification
- Bridging framework and bridges
  - Part 3: Bridging Specification
  - Part 6: Resource to Alljoyn Interface Mapping Specification
  - Part 8: OCF Resource to oneM2M Resource Mapping Specification
  - Part 14: OCF Resource to BLE Mapping Specification
  - Part 15: OCF Resource to EnOcean Mapping Specification
  - Part 16: OCF Resource to UPlus Mapping Specification
  - Part 17: OCF Resource to Zigbee Cluster Mapping Specification
  - Part 18: OCF Resource to Z-Wave Mapping Specification
- Resource and Device models
  - Part 4: Resource Type Specification
  - Part 5: Device Specification
- Core framework extensions
  - Part 7: Wi-Fi Easy Setup Specification
  - Part 9: Core Optional Specification
- OCF Cloud
  - Part 10: Cloud API for Cloud Services Specification
  - Part 11: Device to Cloud Services Specification
  - Part 12: Cloud Security Specification

Information technology — Open Connectivity Foundation (OCF) Specification —

Part 9: Core optional specification

1 Scope

The OCF Core specifications are divided into a series of documents:

– Core specification: The Core specification document specifies the Framework, i.e., the OCF core architecture, interfaces, protocols and services to enable OCF profiles implementation for Internet of Things (IoT) usages and ecosystems. This document is mandatory for all Devices to implement.

– Core optional specification (this document): The Core optional specification document specifies the Framework, i.e., the OCF core architecture, interfaces, protocols and services to enable OCF profiles implementation for Internet of Things (IoT) usages and ecosystems that can optionally be implemented by any Device.

– Core extension specification(s): The Core extension specification(s) document(s) specifies optional OCF Core functionality that are significant in scope (e.g., Wi-Fi easy setup, Cloud).

2 Normative references

The following documents 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 DIS 20924, *Information Technology – Internet of Things – Vocabulary*, June 2018
https://www.iso.org/standard/69470.html

ISO/IEC 30118-1, Information technology – Open Connectivity Foundation (OCF) Specification – Part 1: Core specification
https://www.iso.org/standard/53238.html

ISO/IEC 30118-2, Information technology – Open Connectivity Foundation (OCF) Specification – Part 2: Security specification
https://www.iso.org/standard/74239.html

IETF RFC 3339, *Date and Time on the Internet: Timestamps*, July 2002
https://www.rfc-editor.org/info/rfc3339

IETF RFC 5234, *Augmented BNF for Syntax Specifications: ABNF*, January 2008
https://www.rfc-editor.org/info/rfc5234

IETF RFC 5424, *The Syslog Protocol*, March 2009
https://tools.ietf.org/html/rfc5424

IETF RFC 5646, *Tags for Identifying Languages*, September 2009
https://www.rfc-editor.org/info/rfc5646

IANA ifType-MIB Definitions
https://www.iana.org/assignments/ianaiftype-mib/ianaiftype-mib

IANA Media Types Assignment, March 2017
http://www.iana.org/assignments/media-types/media-types.xhtml

OpenAPI specification, *fka Swagger RESTful API Documentation Specification*, Version 2.0
https://github.com/OAI/OpenAPI-Specification/blob/master/versions/2.0.md

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 30118-1. 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
Alert
information provided by the Device by means of a specialised Resource Type that provides details with regard to potential problems, issues, or Device status of interest on which action can be taken

3.1.2
Rule
Resource that implements autonomous decision logic according to a condition-action pattern

3.1.3
Rule Action
Resource that is actuated with a defined value when the *Rule Result* (3.1.6) holds "true"

3.1.4
Rule Expression
definition of the *Rule* (3.1.1) logic in terms of the defined *Rule Inputs* (3.1.5), and which evaluates to a boolean *Rule Result* (3.1.6), for which "true" means that the *Rule* (3.1.1) has been triggered

3.1.5
Rule Input
Resources that contain the Properties whose values are evaluated as part of the *Rule Expression* (3.1.4)

3.1.6
Rule Result
Property which reflects the result of the evaluation of the *Rule Expression* (3.1.4)

3.1.7
Scene
static entity that stores a set of defined Property values for a Collection of Resources

Note 1 to entry: A *Scene* (3.1.3) is a prescribed setting of a set of Resources with each having a predetermined value for the Property that has to change.

3.1.8
Scene Collection
Collection that contains an enumeration of possible *Scene Values* (3.1.10) and the current *Scene Value* (3.1.10)

Note 1 to entry: The member values of the *Scene Collection* (3.1.8) are *Scene Members* (3.1.9).

3.1.9
Scene Member
Resource that contains mappings of *Scene Values* (3.1.10) to values of a Property in the Resource

3.1.10
Scene Value
Scene (3.1.3) enumerator representing the state in which a Resource can be

4 Document conventions and organization

4.1 Conventions

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

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

4.2 Notation

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

Required (or shall or mandatory)(M).

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

Recommended (or should)(S).

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

Allowed (may or allowed)(O).

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

DEPRECATED.

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

Conditionally allowed (CA).

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

Conditionally required (CR).

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

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

Words that are emphasized are printed in italic.

In all of the Property and Resource definition tables that are included throughout this document the "Mandatory" column indicates that the item detailed is mandatory to implement; the mandating of inclusion of the item in a Resource Payload associated with a CRUDN action is dependent on the applicable schema for that action.

4.3 Data types

Resources are defined using data types derived from JSON values as defined in clause 4.3 in ISO/IEC 30118-1.

5 Functional interactions

5.1 Introduction

The functional interactions between a Client and a Server are described in 5.2 through 5.7 respectively. The functional interactions use CRUDN messages (clause 8 in ISO/IEC 30118-1) and include Discovery, Notification, and Device management. These functions require support of core defined Resources as defined in Table 1.

Table 1 – List of optional Core Resources

Pre-defined URI	Resource Name	Resource Type	Related Functional Interaction	Mandatory
(none)	Configuration	"oic.wk.con"	Device management	No
(none)	Configuration	"oic.wk.con.p"	Device management	No
"/oic/mnt"	Maintenance	"oic.wk.mnt"	Device management	No
(none)	Network monitoring	"oic.wk.nmon"	Device management	No
(none)	Software update	"oic.wk.softwareupdate"	Device management	No
(none)	Icon	"oic.r.icon"	Icons	No
(none)	Scene List	"oic.wk.scenellist"	Scenes	No
(none)	Scene Collection	"oic.wk.scenecollection"	Scenes	No
(none)	Scene Member	"oic.wk.scenemember"	Scenes	No
(none)	Alerts	"oic.r.alert"	Alerts	No
(none)	Alerts Collection	"oic.r.alertcollection"	Alerts	No

5.2 Onboarding, provisioning and configuration

Onboarding and provisioning are fully defined by ISO/IEC 30118-2.

Should a Device support Client update of configurable information it shall do so via exposing an "oic.wk.con" Core Resource (Table 2) in "/oic/res".

Table 2 – Configuration Resource

Example URI	Resource Type Title	Resource Type ID ("rt" value)	OCF Interfaces	Description	Related Functional Interaction
"/example/oic/con"	Device configuration	"oic.wk.con"	"oic.if.rw"	The Resource Type through which configurable information specific to the Device is exposed.	Configuration

				The Resource Properties exposed in "oic.wk.con" are listed in Table 3.	
"/example/oic/con"	Platform configuration	"oic.wk.con.p"	"oic.if.rw"	The optional Resource Type through which configurable information specific to the Platform is exposed. The Properties exposed in "oic.wk.con.p" are listed in Table 4.	Configuration

Table 3 defines the "oic.wk.con" Resource Type. Complete details are provided in annex A.2.

Table 3 – "oic.wk.con" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
(Device) Name	"n" (Common Property of "/example/oic/con")	"string"	N/A	N/A	R, W	Yes	Human friendly name configurable by the end user (e.g. Bob's thermostat). The "n" Common Property of the oic.wk.con Core Resource and the "n" Common Property of the "/oic/d" Core Resource shall have the same Value. When the "n" Common Property Value of the oic.wk.con Core Resource is modified, it shall be reflected to the "n" Common Property of "/oic/d" Core Resource.
Location	"loc"	array of float (has two elements, the first is latitude, the second is longitude)	N/A	Degrees	R, W	No	Provides location information where available.
Location Name	"locn"	"string"	N/A	N/A	R, W	no	Human friendly name for location For example, "Living Room".
Currency	"c"	"string"	N/A	N/A	R,W	no	Indicates the currency that is used for any monetary transactions
Region	"r"	"string"	N/A	N/A	R,W	no	Free form text Indicating the current region in which the Device is located geographically.
Localized Names	"ln"	"array"	N/A	N/A	R,W	no	Human-friendly name of the Device, in one or more languages. This Property is an array of objects where each object has a "language" field (containing an IETF RFC 5646 language tag) and a "value" field containing the Device name in the indicated language. If this Property and the Device Name (n) Property are both supported, the Device Name (n) value shall be included in this array.
Default Language	"dl"	"language-tag"	N/A	N/A	R,W	no	The default language supported by the Device, specified as an IETF RFC 5646 language tag. By default, clients can treat any string Property as being in this language unless the Property specifies otherwise.

Table 4 defines the "oic.wk.con.p" Resource Type. Complete details are provided in annex A.3.

Table 4 – "oic.wk.con.p" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Platform Names	"mnpn"	"array"	N/A	N/A	R,W	No	Friendly name of the Platform. This Property is an array of objects where each object has a "language" field (containing an IETF RFC 5646 language tag) and a "value" field containing the platform friendly name in the indicated language. For example, [{"language":"en", "value":"Dave's Laptop"}]

5.3 Device management

5.3.1 Overview

Device management includes the following functions:

– Diagnostics and maintenance

– Network monitoring

5.3.2 Diagnostics and maintenance Resource Type

The Diagnostics and Maintenance Resource Type is intended to enable the resolution of issues encountered with the Devices while operating in the field. If diagnostics and maintenance is supported by a Device, the Core Resource "/oic/mnt" shall be supported as described in Table 5.

Table 5 – Optional diagnostics and maintenance Device management Core Resources

Pre-defined URI	Resource Type Title	Resource Type ID ("rt" value)	OCF Interfaces	Description	Related Functional Interaction
"/oic/mnt"	Maintenance	"oic.wk.mnt"	"oic.if.rw"	The Resource through which the Device is maintained and can be used for diagnostic purposes. The Properties exposed by "/oic/mnt" are listed in Table 6.	Device management

Table 6 defines the "oic.wk.mnt" Resource Type. At least one of the Factory_Reset, Reboot, or last error Properties shall be implemented. Complete details are provided in annex A.5.

Table 6 – "oic.wk.mnt" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Factory_Reset	"fr"	"boolean"	N/A	N/A	R, W	No	When writing to this Property: false – No action (Default*) true – Start Factory Reset

							When reading this Property, a value of true indicates a pending factory reset. Once the factory reset has been completed, the Device shall set the value back to false. This Property is functionally equivalent to a transition to a state of Hard Reset as defined in ISO/IEC 30118-2, clause 8.1
Reboot	"rb"	"boolean"	N/A	N/A	R, W	No	When writing to this Property: false – No action (Default) true – Start Reboot After Reboot, this value shall be changed back to the default value (i.e., false)
Last error	"err"	"integer"	HTTP error code	N/A	R	No	Last occurred error code, shall be cleared to 503 (service unavailable), when doing a Factory Reset or Reboot. All HTTP errors outside the 100, 200 or 300 range shall be stored.

NOTE Default indicates the value of this Property as soon as the Device is rebooted or factory reset.

5.3.3 Core behaviours on Device maintenance state changes

5.3.3.1 Overview

As defined in ISO/IEC 30118-2 a Device has a state machine through which it transitions during its operational lifetime.

ISO/IEC 30118-2 details actions on such state transitions for the Resources defined therein. This clause defines the actions to be taken on such state transitions for the Resources and functionality defined within this document.

The state transitions to be considered are:

– RFNOP to Soft Reset
– RFNOP to Hard Reset
– RFNOP to RFPRO
– RFPRO to RFNOP

Table 7 provides a summary of the actions to be taken in each case for functions defined in the ISO/IEC 30118-2 and this document, other extensions to these documents may define further behaviours.

Table 7 – Actions on Device state change

	Soft reset	Hard reset	RFNOP -> RFPRO	RFPRO -> RFNOP
SVR	As per ISO/IEC 30118-2 clause 8.5	As per ISO/IEC 30118-2 clause 8.1	As per ISO/IEC 30118-2 clause 8.3	As per ISO/IEC 30118-2 clause 8.4
Mandatory Core Resources	No change	Reset to defined defaults, see clause 5.3.3.3.3	No change	No change

Optional Core Resources	No change	Reset to defined defaults, see clause 5.3.3.3.4	No change	No change
Vertical Resources	No change	Reset to defined defaults; see clause 5.3.3.3	No change	No change
Created Resources	No change	Deleted	No change	No change
Observe Transactions	No change	Canceled; see clause 5.3.3.2	No change	Re-evaluate ACL; see clause 5.3.3.2
OCF Cloud	No change	See clause **Error! Reference source not found.**	No change	No change

5.3.3.2 Handling of Observe transactions

On a transition to hard reset all active Observe transactions shall be cancelled by the Server by sending a "Service Unavailable" response on each active Observe transaction.

On a state transition that allows for modification of the access controls that exist against a Resource (such as from RFPRO to RFNOP) it is possible that the access controls themselves as defined within the ISO/IEC 30118-2 are changed such that the original RETRIEVE operation that established the Observe would not have been allowed. In such instances the Server shall cancel the Observe by sending a "Service Unavailable" response on the Observe transaction.

5.3.3.3 Reset of Resource Properties to defined defaults

5.3.3.3.1 Overview

On a hard or factory reset Resource Properties are reset to default values. These are commonly referred to as *manufacturer defaults* however it is not possible in all instances to revert to such values as they may not be known or be practicable.

The default values to be applied for the mandatory and optional Core Resources, plus any Vertical Resources are defined in clauses 5.3.3.3.2 through 5.3.3.3.4 respectively.

5.3.3.3.2 Defaults for Vertical Resources

Default values for any Vertical Resources exposed by a Device are up to the implementation.

5.3.3.3.3 Defaults for mandatory Core Resources

Table 8 and Table 9 capture default values that shall be set for mandatory Properties of the mandatory Core Resources where those Resources contain Properties that can be changed by a Client. This excludes "/oic/res" as that has no mutable Properties.

Table 8 – Default values for "/oic/d"

Property	Default	Notes
"n"	""	Empty string if "/oic/con" is also exposed, otherwise not mutable.
"di"	See ISO/IEC 30118-2 requirements	.
"icv"	Unchanged	Not mutable
"dmv"	Unchanged	Not mutable
"piid"	See ISO/IEC 30118-2 requirements.	

Table 9 – Default values for "/oic/p"

Property	Default	Notes
"pi"	See ISO/IEC 30118-2 requirements.	
"mnmn"	Unchanged	Not mutable

5.3.3.3.4 Defaults for optional Core Resources

This clause details the actions to be taken with respect to the optional Core Resources.

The icon Resource ("oic.r.icon") has no mutable Properties, so no action is to be taken.

The network monitoring Resource ("oic.wk.nmon") shall have all Properties reset (i.e. behaviour as if an UPDATE with the "reset" Property set to "true" had been received). The "col" Property shall be set to "false".

Any Resources that were added to an instance of a Collection or a specialisation of a Collection (e.g. Scene List ("oic.wk.scenelist") or Scene Collection ("oic.wk.scenecollection")) by a Client shall be deleted.

The Device configuration Resource ("oic.wk.con") shall be modified in accordance with Table 10 for those Properties that are implemented.

Table 10 – Default values for Device configuration Resource

Property	Default	Notes
"loc"	[0.0,0.0]	
"locn"	""	Empty string
"c"	""	Empty string
"r"	""	Empty string
"ln"	[{}]	One item array with an empty object.
"dl"	Defined by the manufacturer	Recommend the primary language tag for the region into which the Device is marketed (e.g. "en" for primarily English speaking countries).

The platform configuration Resource ("oic.wk.con.p") shall be modified in accordance with Table 11

Table 11 – Default values for Platform configuration Resource

Property	Default	Notes
"mnpn"	[{}]	One item array with an empty object

5.3.4 Network monitoring Resource Type

Network monitoring is used for monitoring the current network state of the Device.

The network monitoring Resource Type is "oic.wk.nmon" and is described in Table 12. The Resource Type may occur multiple times if more than 1 network interface is implemented. The Common Property "n" may be used to distinguish the different network interfaces, like distinguish the 2.4 and 5G Wi-Fi network interfaces.

Table 12 – Optional monitoring Device management Core Resources

Example URI	Resource Type Title	Resource Type ID ("rt" value)	OCF Interfaces	Description	Related Functional Interaction
"/example/oic/nmon"	Network Monitoring	"oic.wk.nmon"	"oic.if.rw", "oic.if.baseline"	The Resource through which the Device is monitored. The Resource exposes Properties relevant to aspects that may be monitored. The Resource Properties exposed by Resource Type "oic.wk.nmon" are listed in Table 13	Device management

Table 13 defines "oic.wk.nmon" Resource Type. Complete details are provided in annex A.6.

Table 13 – "oic.wk.nmon" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Network indicator	"ianaifType"	"integer"	The integer value of the ianaifType	N/A	R	Yes	The network type this Resource is collecting information from as defined by IANA ifType-MIB Definitions.
reset	"reset"	"boolean"	True, all collected values should be reset. The server should reset the value automatically to false after the reset occurred.	N/A	RW	Yes	Reset of the collected values
Collecting status indication	"col"	"boolean"	True: collecting data. False: not collecting data	N/A	RW	Yes	Boolean to start/stop collecting data.
Transmission bytes	"tx"	"integer"	N/A	kilo bytes	R	No	Amount of transmitted kilo bytes from the collection
Reception bytes	"rx"	"integer"	N/A	kilo bytes	R	No	Amount of received kilo bytes from the collection.
Maximum message size tx	"mmstx"	"integer"	bytes	bytes	R	No	Maximum transmitted message, e.g. Max(tx) in the collection period
Maximum message size rx	"mmsrx"	"integer"	bytes	bytes	R	No	Maximum received message, e.g. Max(rx) in the collection period
Average message size -tx	"amstx"	"integer"	bytes	bytes	R	No	Average transmitted message size, e.g AVG(tx) in the collection period.

Average message size -rx	"amsrx"	"integer"	bytes	bytes	R	No	Average received message size e.g AVT(rx) in the collection period.

Examples of typical used values for ianaifType are 71 (ieee80211) for Wi-Fi and 6 (ethernetCsmacd) for Ethernet.

A Device should start collecting network monitoring data when receiving an UPDATE operation with the parameter "col" = true. A Device should stop collecting network data when receiving an UPDATE operation with parameter "col" = false. The collected network data should be reset when an UPDATE operation with parameter "reset" = true is received, if the parameter "reset" is false then the values should not be reset. Figure 1 illustrates the interactions with the network monitoring Resource.

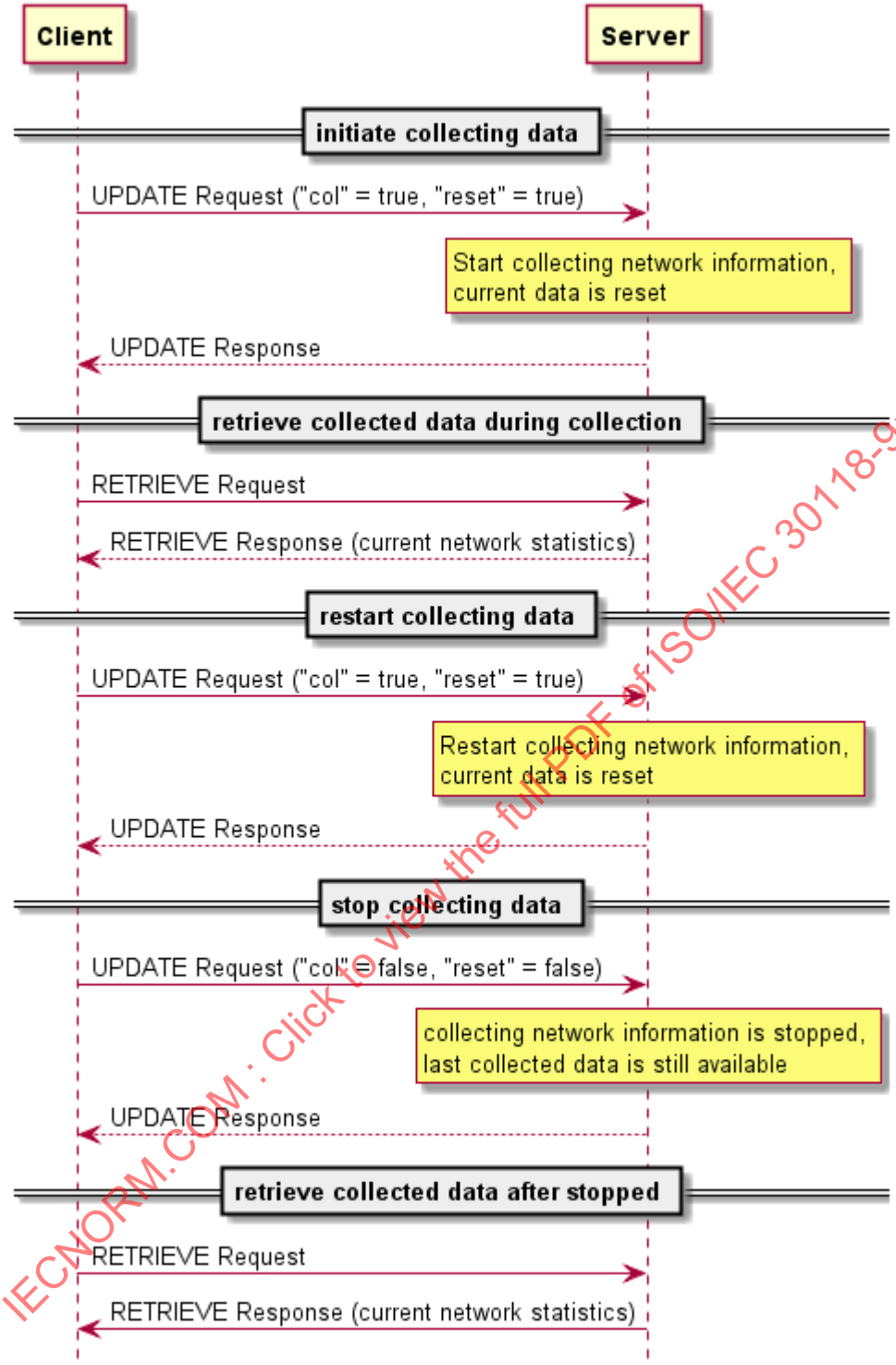

Figure 1 – Interactions with the network monitoring Resource

The state transition diagram for collecting or not collecting network information is described by Figure 2.

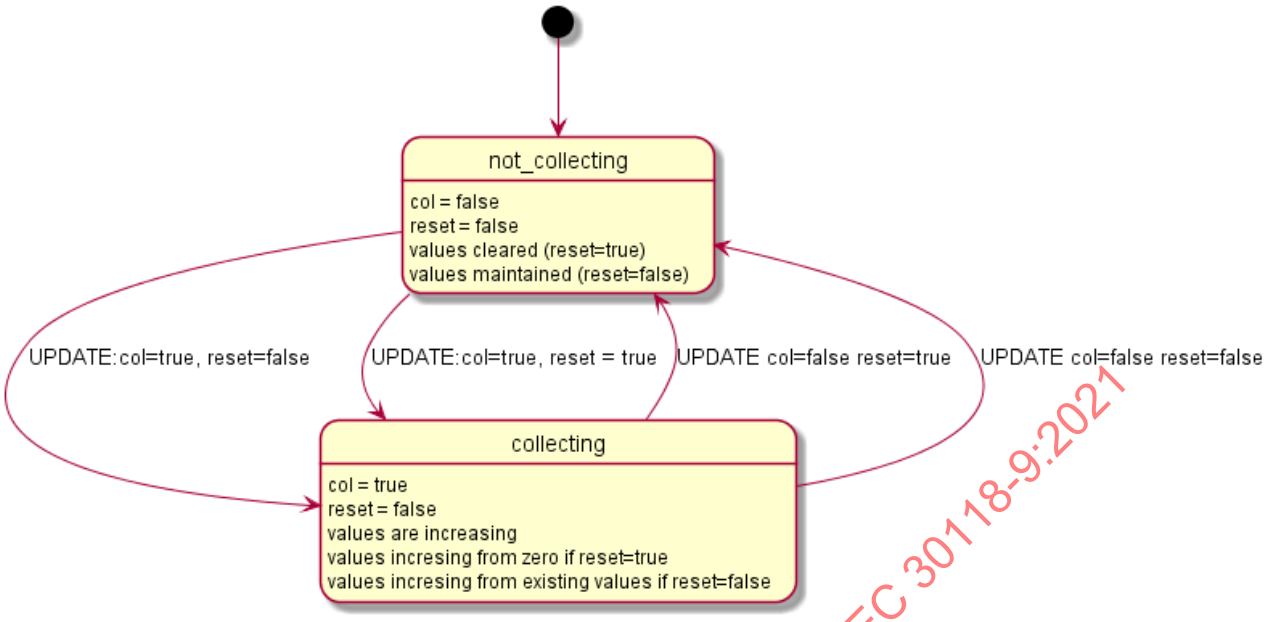

Figure 2 – State transition diagram for network information collection

5.3.5 Software update Resource Type

The software update Resource is used to control software updats of the Device.

In ISO/IEC 30118-2 there is already a manual triggered software update mechanism available. The triggering of the Client (manual) software update is achieved via the security Resource Type "oic.r.pstat" by using the appropriate bits in the "tm" Property. The software update triggering results in updates of the "cm" Property in the "oic.r.pstat" Resource Type (see ISO/IEC 30118-2 clause 13.8). The software update Resource adds additional features to the security specified mechanism, like:

– Specify the source to obtain the software package.
– Time scheduled software update actions.
– Status information, especially more info about various error situations.

If the Device implements the software update Resource, it is required to implement the software update behaviour to actually update the software of the Device as indicated by the "oic.r.pstat" "cm" bits as defined in ISO/IEC 30118-2 clause 13.8. Also the security defined software update process shall use the data that is set on the software update Resource like the "purl" Property.

The software update Resource Type is "oic.r.softwareupdate" and is described in Table 14.

Table 14 – Optional software update Resources

Example URI	Resource Type Title	Resource Type ID ("rt" value)	OCF Interfaces	Description	Related Functional Interaction
"/example/oic/swupd"	Software Update	"oic.r.softwareupdate"	"oic.if.rw", "oic.if.baseline"	The Resource exposes Properties to control and monitor the software update mechanism. The Properties exposed by Resource Type "oic.r.softwareupdate" are listed in Table 15.	Device management

Table 15 defines the Properties of the "oic.r.softwareupdate" Resource Type. Complete details are provided in annex A.12.

Table 15 – "oic.r.softwareupdate" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
New version	"nv"	"string"	N/A	N/A	R	No	New available software version.
Package url	"purl"	"string"	URL	N/A	RW	Yes	Source of the software package, might be an HTTPS or a CoAPs URL.
Action	"swupdateaction"	"string"	enum (see Table 17)	N/A	RW	Yes	Scheduled action to do a software update.
State	"swupdatestate"	"string"	enum (see Table 16)	N/A	R	Yes	State of the software update.
Result	"swupdateresult"	"integer"	N/A	N/A	R	Yes	Result of the software update. List of error codes are as defined in Table 18.
Lastupdate	"lastupdate"	"string"	date-time	N/A	R	No	Time of the last software update according to IETF RFC 3339. Initial set on date of manufacturing.
Signage	"signed"	"string"	enum	N/A	R	No	Signage method of the software package, currently the only allowed value is "vendor".
Updatetime	"updatetime"	"string"	date-time	N/A	RW	Yes	Scheduled time, according to IETF RFC 3339, to do action which is specified in the "swupdateaction" Property.

The values of the "swupdatestate" Property are described in Table 16.

Table 16 – State definitions and state transitions of the software update Resource

Description	Value of Property "swupdatestate"	equivalent "cm" bit values in "pstat".	Transition allowed from state
Idle, waiting for updates	"idle"	Bit 64 = 0 Bit 128 = 0 Bit 256 = 0	"nsa", "svv", "sva", "upgrading"
New software available (after checking for new software being available on the url indicated by "purl"). This step does not download the new software	"nsa"	Bit 64 = 0 Bit 128 = 0 Bit 256 = 1	"idle", "svv", "sva", "upgrading"
Software version validation (during downloading and checking the software integrity)	"svv"	Bit 64 = 0 Bit 128 = 0 Bit 256 = 1	"idle", "nsa", "sva", "upgrading"
Software version available (The software is downloaded and deemed to be valid)	"sva"	Bit 64 = 1 Bit 128 = 0 Bit 256 = 1	"idle", "nsa", "svv", "upgrading"
Upgrading	"upgrading"	Bit 64 = 1 Bit 128 = 1 Bit 256 = 1	"idle", "nsa", "svv", "sva"

The typical state transitions are described Figure 3.The state transitions can be trigged manually or by a timed action. The manual state triggers (i.e., "tm" Property of "oic.r.pstat") are described in ISO/IEC 30118-2 clause 13.8. The timed state triggers are managed using the "swupdateaction" and "updatetime" Properties of the software update Resource to trigger software update actions at some future date and time. The action names for scheduled actions are listed in Table 17. When the “updatetime” for the timed action is in the past then the update shall not take place, it is implementation dependent if the UPDATE with an “updatetime” value in the past will give an error on the UPDATE operation.

Table 17 – Value definitions for the Property "swupdateaction"

Description	Value of Property “swupdateaction”, for scheduled update actions.	Action taken	Equivalent "pstat" "tm" bits.
Nothing scheduled (not applicable).	"idle"	No action	
Initiate software availability check.	"isac"	Check on remote end point if a newer software version is available.	"tm" bit 256.
Initiate software versionvValidation.	"isvv"	Downloads and verifies if the software version is valid.	"tm" bit 64.
Initiate secure software update.	"upgrade"	Upgrades the software on the Device. It uses the downloaded and validated software package. If no validated software package is available on the Device, the Device takes the necessary steps to obtain a validated software package, by downloading and verifying the software from the external source.	"tm" bit 128.

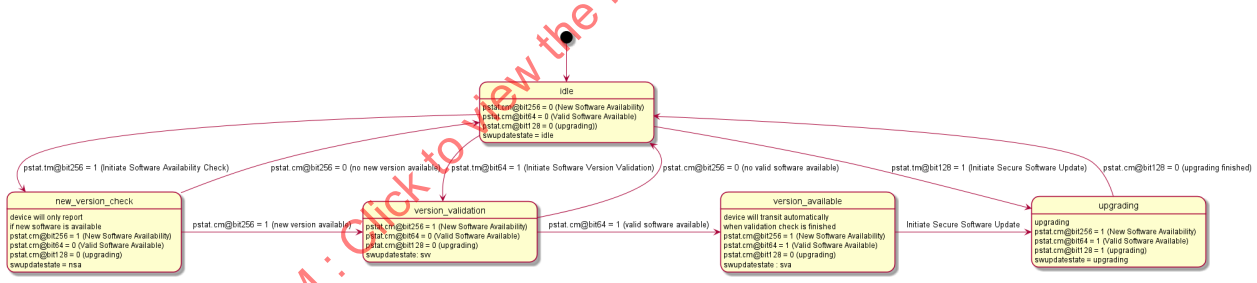

Figure 3 – Typical state transition diagram for software update

The "purl" Property indicates the URL to obtain the software package from. This URL shall be a fully qualified URL. If the value is an empty string ("") then the Device will use the built in vendor defined URL (see ISO/IEC 30118-2). If a built in URL is not implemented, setting the "purl" Property value to an empty string will result in an error code value of 6 as defined in Table 18.

Table 18 – List of codes of the "swupdateresult" Property.

Description	code
Idle.	0
Success, everything went well.	1
Not enough RAM.	2
Not enough Flash.	3

Connection lost.	4
Software validation failure.	5
Invalid URL to receive the software package.	6
Unsupported protocol for download URL.	7
Firmware update failed.	8
Software transport error codes. HTTP result codes when accessing the URL to download the software package.	400-600

Figure 4 depicts a typical update scenario. This scenario is using the observability of "pstat", so that the Client is informed on the changes of the "cm" bit value to track the progress.

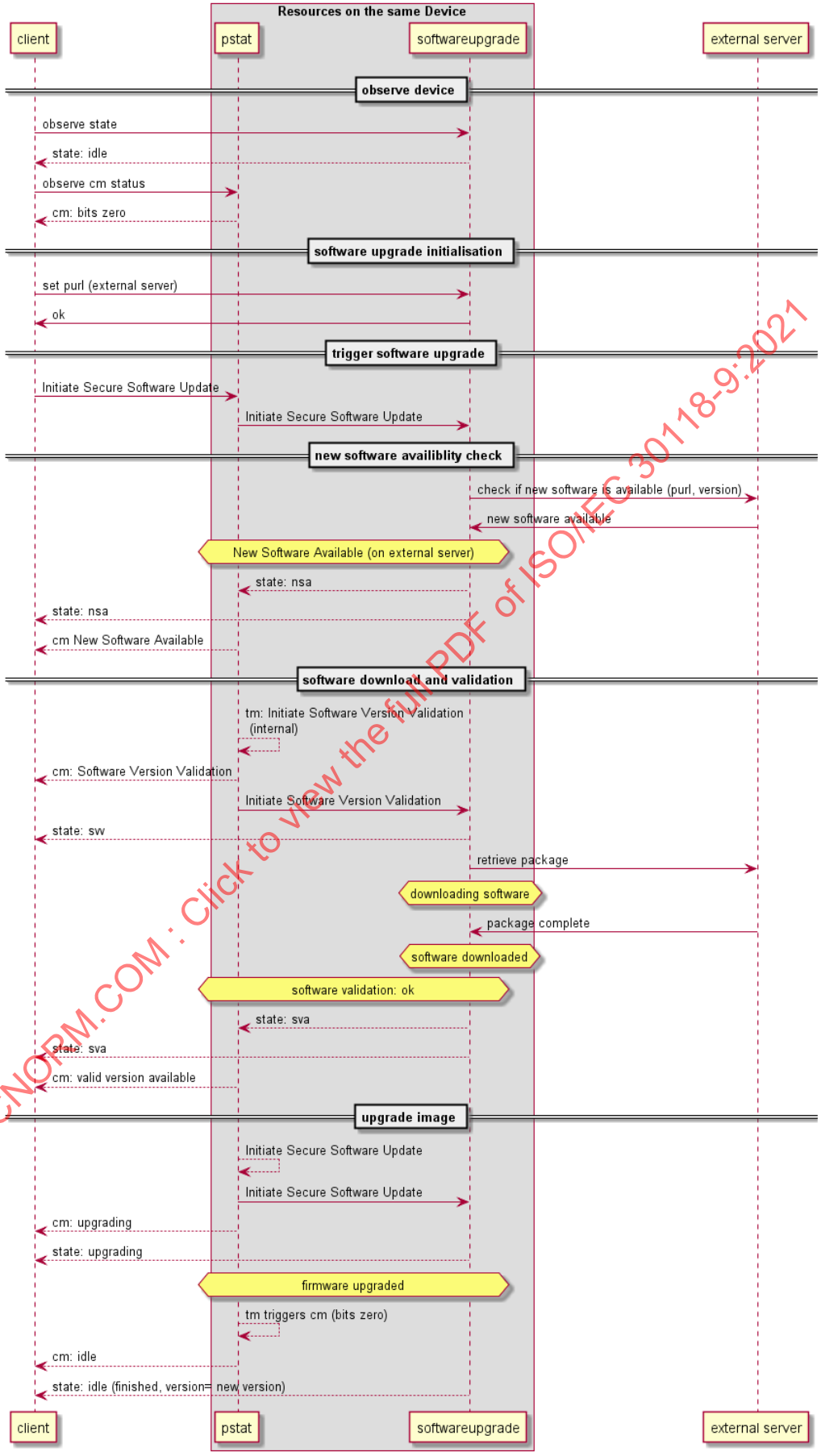

Figure 4 – Typical sequence for non-scheduled upgrading software

5.4 Scenes

5.4.1 Introduction

Scenes are a mechanism for automating certain operations.

A Scene is a static entity that stores a set of defined Property values for a Collection of Resources. Scenes provide a mechanism to store a setting over multiple Resources that may be hosted by multiple separate Servers. Scenes, once set up, can be used by multiple Clients to recall a setup.

Scenes can be grouped and reused, a group of Scenes is also a Scene.

In short, Scenes are bundled user settings.

5.4.2 Scenes Resource model

5.4.2.1 Introduction

Scenes are described by means of Resources. The Scene Resources are hosted by a Server and the top level Resource is listed in "/oic/res". This means that a Client can determine if the Scene functionality is hosted on a Server via Resource discovery as defined in clause 11.2 in ISO/IEC 30118-1. The setup of Scenes is driven by Client interactions. This includes creating new Scenes, and mappings of Server Properties that are part of a Scene.

The Scene functionality is created by multiple Resources and has the structure depicted in Figure 5. The sceneList and sceneCollection Resources are overloaded Collection Resources. The sceneCollection Resource contains a list of Scenes. This list contains zero or more Scenes. The sceneMember Resource contains the mapping between a Scene and what needs to happen according to that Scene on an indicated Resource.

Figure 5 – Generic Scene Resource structure

5.4.2.2 Scene creation

A Client desiring to interact with Scenes needs to first determine if the Server supports the Scene feature; the sceneMembers of a Scene that are Resources of end Device being updated by the Scene change do not have to be co-located on the Server supporting the Scene feature. This can be done by checking if "/oic/res" contains the "rt" of the sceneList Resource. This is depicted in first steps of Figure 6. The sceneCollection Resource is created by the Server using some out of bound mechanism, Client creation of Scenes is not supported at this time. This will entail defining the Scene with an applicable list of Scene Values and the mappings for each Resource being part of the Scene. The mapping for each Resource being part of the sceneCollection Resource is described by a Resource called sceneMember. The sceneMember Resource contains the link to a Resource and the mapping between the Scene listed in the "sceneValues" Property and the actual Property value of the Resource indicated by the Link.

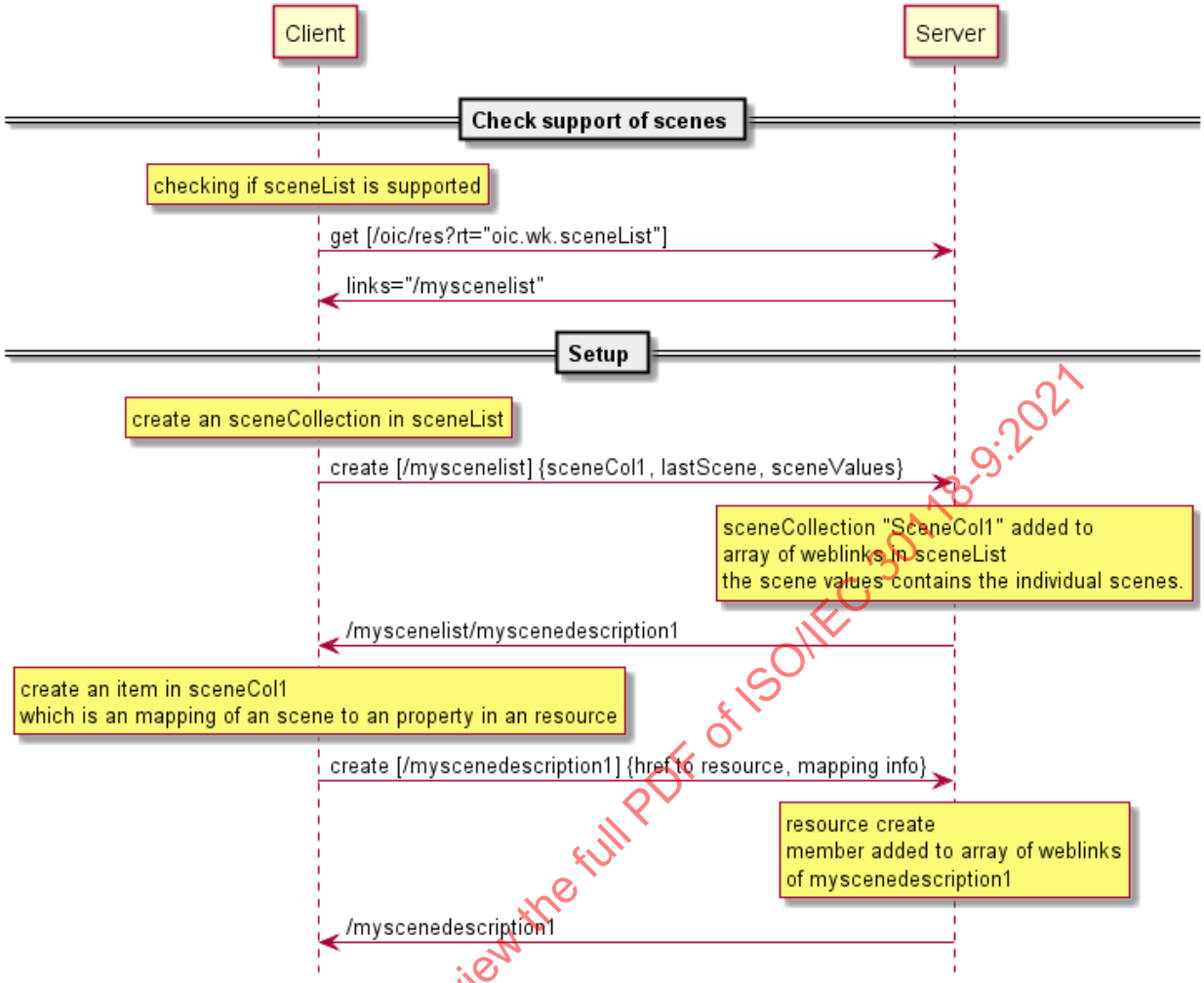

Figure 6 – Interactions to check Scene support and setup of specific Scenes

5.4.2.3 Interacting with Scenes

All capable Clients can interact with Scenes. The allowed Scene Values and the last applied Scene Value can be retrieved from the Server hosting the Scene. The Scene Value shall be changed by issuing an UPDATE operation with a payload that sets the "lastScene" Property to one of the listed allowed Scene Values. These steps are depicted in Figure 7. Note that the "lastScene" Property value does not imply that the current state of all Resources that are part of the Scene will be at the mapped value. This is due to that the setting the Scene Values are not modelled as actual states of the system. This means that another Client can change just one Resource being part of the Scene without having feedback that the state of the Scene is changed.

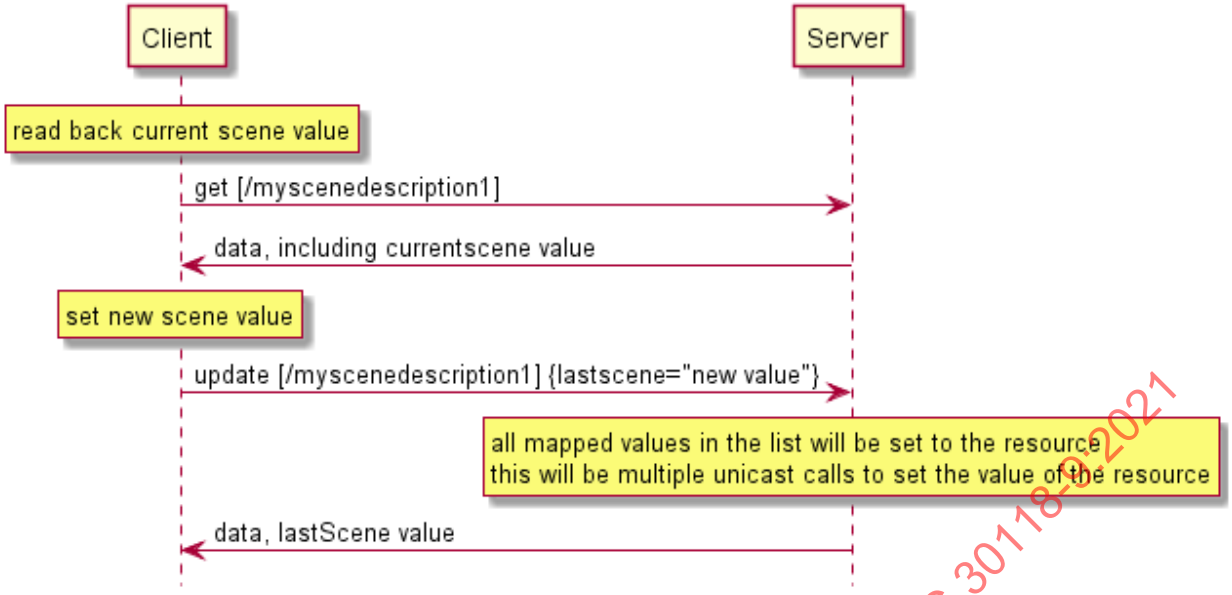

Figure 7 – Client interactions on a specific Scene

As described previously, a Scene can reference one or more Resources (i.e., sceneMembers) that are present on one or more Servers. The Scene Members are re-evaluated each time a Scene change takes place. This evaluation is triggered by a Client that is either embedded as part of the Server hosting the Scene, or separate to the Server having knowledge of the Scene via a RETRIEVE operation, Observing the referenced Resources using the mechanism described in clause 11.3.2 in ISO/IEC 30118-1. The embedded Client located in the same Device with the Server is a general Client but interacts only with Scene functionalities. During the evaluation the mappings for the new Scene Value will be applied to the Servers which contain sceneMembers from the Scene that is being updated. This behaviour is depicted in Figure 8.

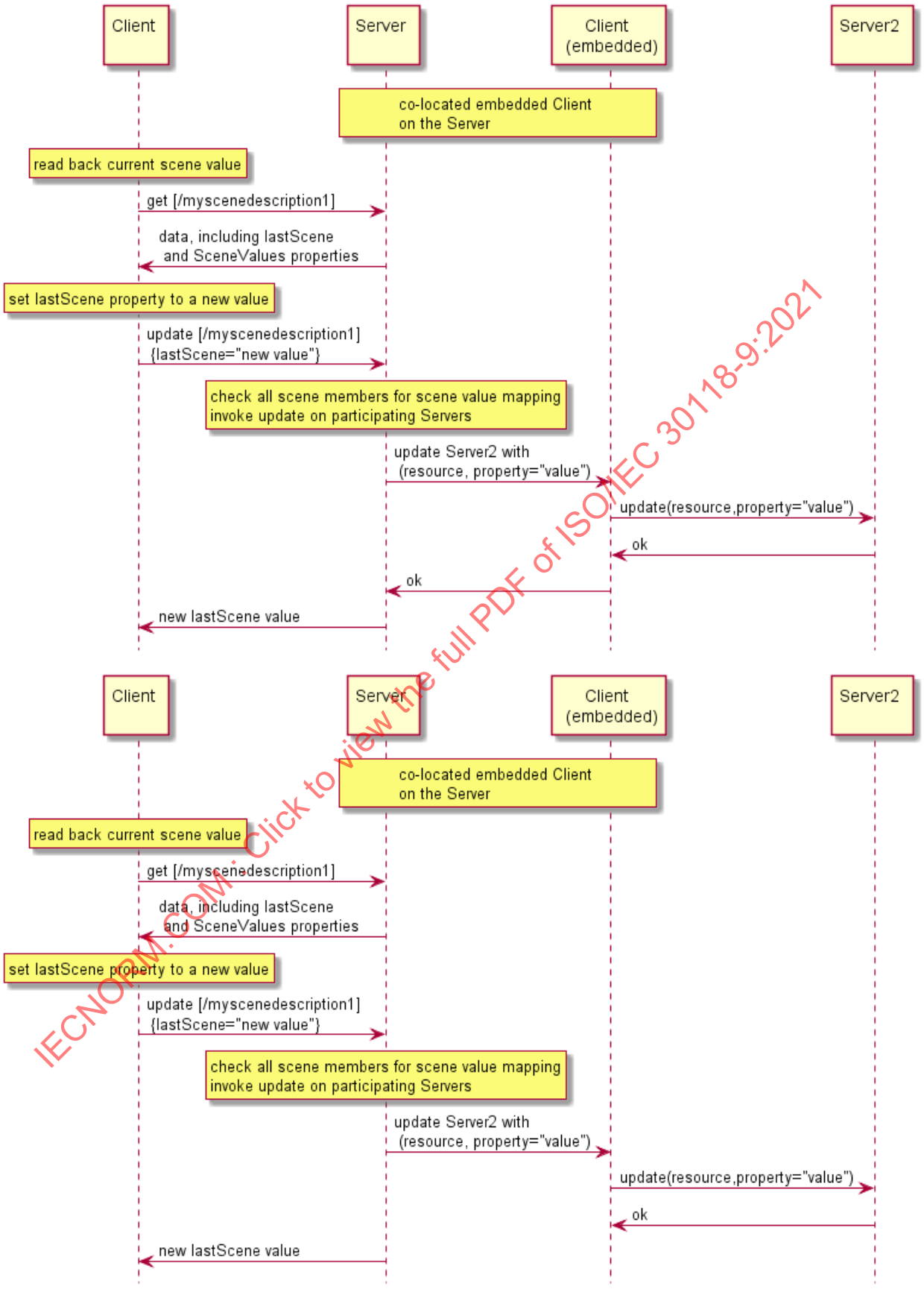

Figure 8 – Interaction overview due to a Scene change

5.4.2.4 Summary of Resource Types defined for Scene functionality

Table 19 summarizes the list of Resource Types that are part of Scenes. Complete details are provided in annex A.7, annex A.8, and annex A.9.

Table 19 – list of Resource Types for Scenes

Friendly Name (informative)	Resource Type (rt)	Short Description	Clause
sceneList	"oic.wk.scenelist"	Top Level Collection containing sceneCollections	A.7
sceneCollection	"oic.wk.scenecollection"	Description of zero or more scenes	A.8
sceneMember	"oic.wk.scenemember"	Description of mappings for each specific Resource part of the sceneCollection	A.9

5.4.3 Security considerations

Creation of Scenes on a Server that is capable of this functionality is dependent on the ACLs applied to the Resources and the Client having the appropriate permissions. Interaction between a Client (embedded or separate) and a Server that hosts the Resource that is referenced as a Scene Member is contingent on the Client having appropriate permissions to access the Resource on the host Server.

See ISO/IEC 30118-2 for details on the use of ACLs and also the mechanisms around Device Authentication that are necessary to ensure that the correct permissions exist for the Client to access the Scene Member Resource(s) on the Server.

5.5 Rules

5.5.1 Overview

Rules are Resources that implement autonomous decision logic according to a condition-action pattern. The Rule is evaluated based on the Property values of selected Resource instances. Rule Actions are triggered when a Rule Expression evaluates to "true" and consist of defined UPDATE operations that act upon Scene Collections by updating the "lastScene" Property to a defined value.

A Rule has the following components:

– A Collection of Links to the Resources (i.e., Rule Inputs) that contain the Properties whose values are evaluated as part of the Rule Expression.

– One Rule Expression that defines the Rule logic in terms of the defined Rule Inputs, and which evaluates to a boolean Rule Result, for which "true" means that the Rule has been triggered.

– A Collection of Links to one or more Rule Actions, which are processed when the Rule Result is evaluated to "true"; the Rule Action provides a specific value for the "lastScene" Property that is updated in the Linked Scene Collection.

Figure 9 shows how these components are organized with respect to the Rule Resource.

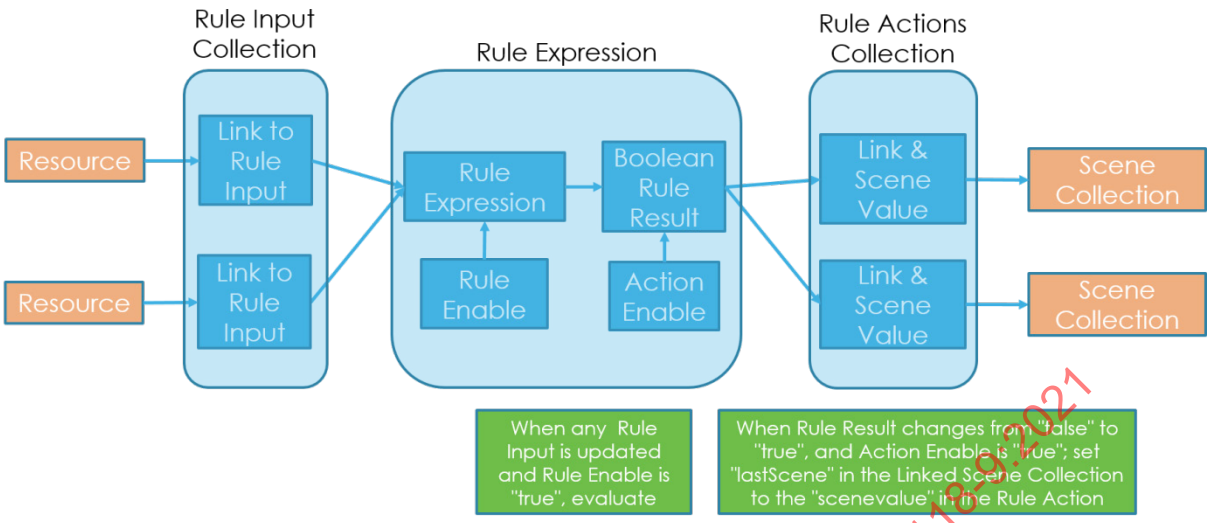

Figure 9 – Components of a Rule

5.5.2 Rule structure

5.5.2.1 Introduction and Rule Resource

A Rule is a Resource with a Resource Type of "oic.r.rule" that is a Collection. A Rule instance shall contain the following:

- A single Link to a Rule Input Collection (see clause 5.5.2.2).
- A single Link to a Rule Expression Resource (see clause 5.5.2.3) which contains:
  - One Rule Expression Property.
  - One boolean Rule Enable Property, which controls whether the Rule is or is not active.
  - One boolean Action Enable Property, which controls whether the Rule actions are or are not triggered when the Rule Result evaluates to "true"
  - One boolean Rule Result Property, which reflects the result of the evaluation of the Rule Expression.
- A single Link to a Rule Action Collection (see clause 5.5.2.4).

A summary for the Rule, Rule Input Collection, Rule Expression, Rule Action, and Rule Action Collection Resource Types is provided in Table 20.

Table 20 – Optional Rule Resources

Example URI	Resource Type Title	Resource Type ID ("rt" value)	OCF Interfaces	Description	Related Functional Interaction
"/example/ruleURI"	Rule	"oic.r.rule"	"oic.if.ll", "oic.if.baseline"	The Resource through which the Device exposes Rules. The Properties exposed by "oic.r.rule" are listed in Table 21.	Rules
"/example/ruleinputcollectionURI"	Rule Input Collection	"oic.r.rule.inputcollection"	"oic.if.ll", "oic.if.baseline"	A specialisation of a Collection that contains Links to the locally hosted Resources that provide input to the Rule Expression. The Properties exposed by "oic.r.rule.inputcollection" are listed in Table 22	Rules
"/example/rulexpressionURI"	Rule Expression	"oic.r.rule.expression"	"oic.if.rw","oic.if.baseline"	The Resource that contains the Rule Expression and Rule Result.	Rules

				The Properties exposed by "oic.r.rule.expression" are listed in Table 24.	
"/example/ruleactionURI"	Rule Action	"oic.r.rule.action"	"oic.if.rw","oic.if.baseline"	The Resource that contains the action to be taken on evaluation of the Rule Result to true. The Properties exposed by "oic.r.rule.action" are listed in Table 26.	Rules
"/example/ruleactioncollectionURI"	Rule Action Collection	"oic.r.rule.actioncollection"	"oic.if.ll", "oic.if.baseline"	A specialisation of a Collection that contains only instances of "oic.r.rule.ruleaction". The Properties exposed by "oic.r.rule.actioncollection" are listed in Table 25.	Rules

The Rule ("oic.r.rule") Resource is described in Table 21. Complete details are provided in annex A.13.

Table 21 – "oic.r.rule" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Links	"links"	"array"	See Table 13 in ISO/IEC 30118-1		R	Yes	See Table 13 in ISO/IEC 30118-1.
Resource Type	"rt"	"array"	["oic.r.rule"]		R	Yes	See Table 4 in ISO/IEC 30118-1
Resource Types	"rts"	"array"	Resource Types that may be linked from the Rule		R	Yes	See Table 11 in [Bookmark to Core Spec]

5.5.2.2 Rule input

Rule Inputs are Links in a Collection ("oic.r.rule.inputcollection") that is itself Linked from the Rule. Each Link in the Collection corresponds to a different input variable in the Rule Expression. Each Link therefore corresponds to a Resource defined by the Rule. For example, a Rule that evaluates a temperature input will include a Link to a Resource with a Resource Type of "oic.r.temperature". Resource Types for Rule Inputs shall be identical to the Resources to which they are linked. The Link has an "if" Link Parameter which shall be a single element array containing the OCF Interface used for the internal observe of the input Resource.

The Rule Input Collection ("oic.r.rule.inputcollection") Resource is described in Table 22. Complete details are provided in annex A.14.

Table 22 – "oic.r.rule.inputcollection" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Links	"links"	"array"	See Table 13 in ISO/IEC 30118-1		R	Yes	See Table 13 in ISO/IEC 30118-1.
Resource Type	"rt"	"array"	["oic.r.rule.inputcollection"]		R	Yes	See Table 4 in ISO/IEC 30118-1.
Resource Types	"rts"	"array"	Resource Types that may be linked from the Rule Input Collection		R	Yes	See Table 11 in ISO/IEC 30118-1.

Rule Inputs shall be indicated by the Link relation type "ruleinput" in the Link (i.e., "rel" Parameter), thus semantically describing the relationship between the "href" and the "anchor" Parameters contained in the Link. The "href" Parameter of the Link shall correspond to the input Resource and shall be a relative URI to a Resource that is hosted on the same Device as the Rule. The "anchor" Parameter of the Link corresponds to the variable name in the Rule Expression, the variable name (and thus the content of "anchor") is defined by the Rule Expression and shall be unique within the context of the Rule Expression. For example a Rule Expression with a variable of "mytemperature:temperature" has an associated Link within the Rule Input Collection with the "anchor" set to "mytemperature". For example:

```
{
 "anchor": "mytemperature",
 "href": "/mylocaltemperaturesensor",
 "rel": ["ruleinput"],
 "rt": ["oic.r.temperature"],
 "if": ["oic.if.s"]
}
```

5.5.2.3 Rule expression

The Rule Expression is a Resource ("oic.r.rule.expression") that contains a "rule" Property, which is defined as a string that contains a logical expression over the Rule Inputs, and which evaluates to a boolean value. This value is exposed in the "ruleresult" Property, which shall have a default value of "false". The expression shall conform to the ABNF syntax defined in clause 5.5.5.

Rule Inputs within the "rule" Property are specified by including the "anchor" Link Parameter from the associated Rule Input, including the desired Property Name from the linked Resource. Figure 10 shows an example for a Rule Input with an "anchor" named "mytemperature" following on from the example Rule Input shown in clause 5.5.2.2, and the Property Name of "temperature", thus the name "mytemperature:temperature" is used in the Rule Expression to refer to this Rule Input. Specifically, that is the value of the "temperature" Property of the Resource at the "href" of "/mylocaltemperaturesensor".

```
mytemperature:temperature >= "25"
```

Figure 10 – Example "rule" Property with single Rule Input

There are no restrictions on the number of Rule Inputs that may be part of a Rule Expression. Consider an additional example where the Rule Result evaluates to "true" if the temperature is greater than or equal to "25" and a door is open ("openState" Property of an instance of "oic.r.door"). Thus, given a Rule Input for "mydoor" as shown in Figure 11 we can construct the Rule Expression shown in Figure 12.

```
{
 "anchor": "mydoor",
 "href": "/mylocaldoor",
 "rel": ["ruleinput"],
 "rt": ["oic.r.door"],
 "if": ["oic.if.a"]
}
```

Figure 11 – Example Link to Rule Input Resource for "mydoor"

```
mytemperature:temperature >= "25" and mydoor:openState contains
"Open"
```

Figure 12 – Example "rule" Property with more than one Rule Input

The Rule Expression also contains two Properties that allow the enabling of the Rule and the actuating of any Rule Actions to be controlled by a Client.

The "ruleenable" Property controls whether the "ruleresult" Property is updated upon processing of the Rule Expression. If the "ruleenable" Property is set to "true", then the "ruleresult" Property shall be set according to evaluation of the Rule Expression each time any Rule Input changes, in effect the Rule observes the Rule Inputs. An initial evaluation of the Rule Expression shall occur when "ruleenable" is set to "true"; subsequent re-evaluation shall only take place when any of the Rule Input values change. If the "ruleenable" Property is set to "false", the Rule Expression shall not be re-evaluated irrespective of the state of the Rule Inputs. If the "ruleenable" Property is set to "false", the Server shall not change the values of any of the other Properties in the instance of Rule Expression; this simply means that the Rule is no longer re-evaluated whenever a Rule Input changes. The "ruleenable" Property shall have a default value of "false". A Server shall only expose a "ruleenable" Property set to "true" (or allow it to be set to "true" by a Client, such an attempt shall be rejected with an appropriate failure reason, e.g. "bad request") if there exists a Rule Input Link for each variable within the Rule Expression.

The "actionenable" Property controls whether the Rule Actions (see clause 5.5.2.4) are processed when the "ruleresult" Property is set to "true". If the "actionenable" Property is set to "true", all Rule Actions shall be processed when the "ruleresult" Property is set to "true" as a result of Rule Expression evaluation. No action shall be taken if the result of Rule Expression evaluation is "false", that is, the "ruleresult" Property changes from "true" to "false". If the "actionenable" Property is set to "false", the Rule Actions shall not be processed. The "actionenable" Property shall have a default value of "false"

Setting the "ruleenable" and "actionenable" Properties places the Rule into one of four modes that are summarized in Table 23.

Table 23 – Summary of "ruleenable" and "actionenable" Property behaviours

"ruleenable" Value	"actionenable" Value	Rule Expression Processed	Rule Action Processed	Notes
false	false	No	No	These are the default initial settings for a Rule
false	true	No	Yes if the "ruleresult" Property is set to "true" by a Client	The "ruleresult" Property may be updated from "false" to "true" in order to manually trigger the processing of any Rule Actions.
true	false	Yes	No	Rule Inputs may be updated and the "ruleresult" Property may be observed to test the logic and processing of the Rule Expression
true	true	Yes	Yes	The Rule Expression is processed and the "ruleresult" Property is updated when Rule Inputs are updated. Rule Actions are processed when the "ruleresult" Property value is set to "true"

As noted in Table 4; the "ruleresult" may be set to "true" by a Client. A Client shall only be able to set "ruleresult" in the mode that is noted, that is when "ruleenable" is "false" and "actionenable" is "true".

The Properties of the Rule Expression Resource are summarized in Table 24. Complete details are provided in annex A.15. An example flow showing use of the Rule Enable and Action Enable Properties is shown in Figure 13.

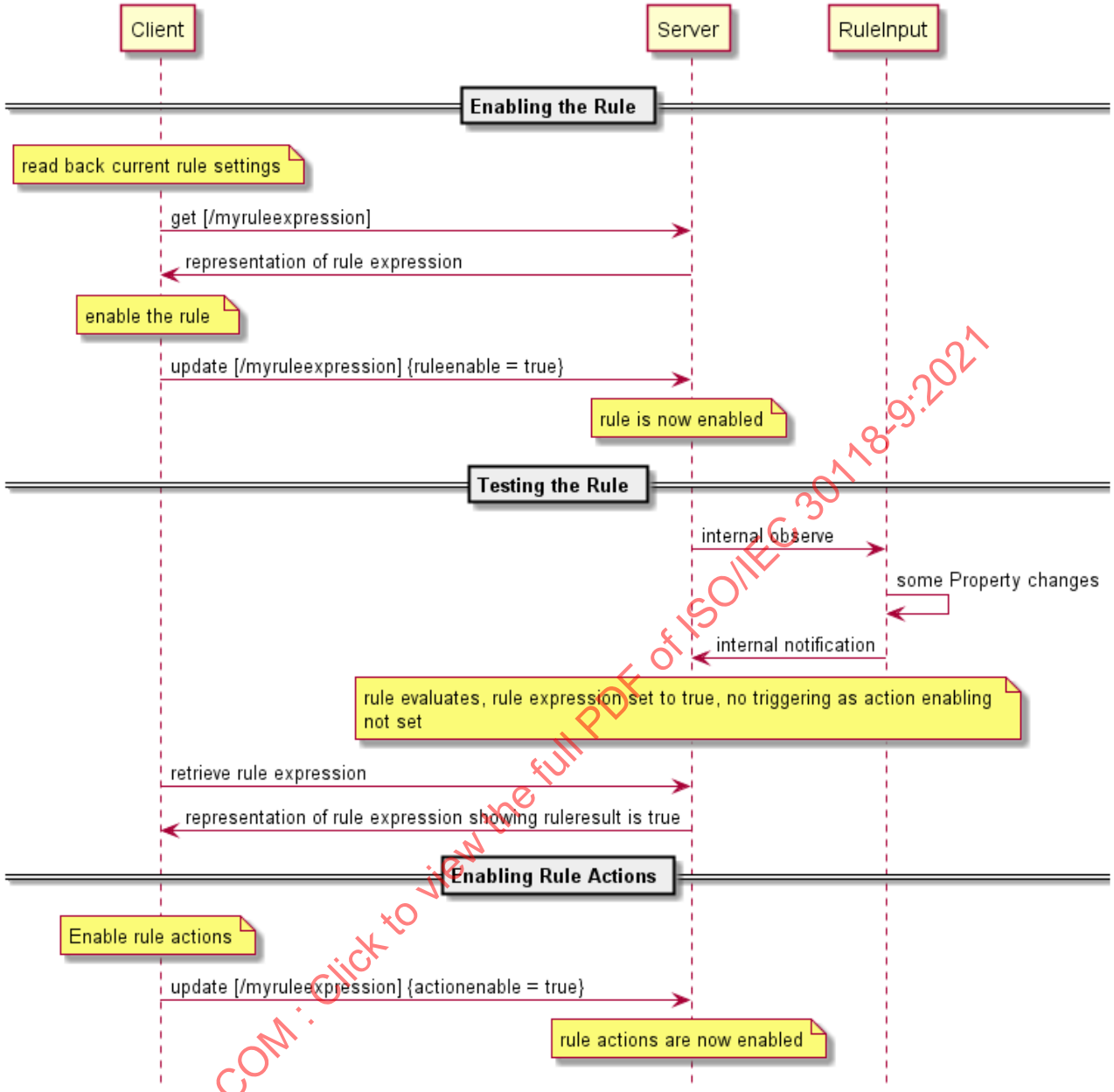

Figure 13 – Example use of Rule Enable and Action Enable

Table 24 – Properties of the Rule Expression Resource

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Rule Expression	"rule"	string	ABNF Clause 5.5.5		RW	Yes	Property that contains the logical expression that implements the Rule logic
Rule Enable	"ruleenable"	boolean			RW	Yes	Determines whether the Rule Result is updated from the Rule Expression
Action Enable	"actionenable"	boolean			RW	Yes	Determines whether Rule Actions are processed
Rule Result	"ruleresult"	boolean			RW	Yes	The boolean result of the most recent evaluation of the Rule Expression

5.5.2.4 Rule actions

Rule Actions (one or more) are Links in a Collection ("oic.r.rule.actioncollection") to instances of a Rule Action Resource ("oic.r.rule.action"). Each instance of "oic.r.rule.action" contains two Properties; a Link to a locally hosted instance of a Scene Collection, and an associated value of a "lastScene" Property from the allowed set provided by the "sceneValues" Property in the target Scene Collection.

A single Rule Action is a Resource Type ("oic.r.rule.action") with two Properties as described in Table 26. The Rule Action Collection is described in Table 25. Complete details are provided in annex A.16.

– "link" Property, an instance of a Link (single element array) to a locally-hosted Scene Collection ("oic.wk.scenecollection")
– "scenevalue" Property, value of the "lastScene" Property to be set.

Rule Actions are processed when the result of evaluating the Rule Expression is "true", if the "actionenable" Property is set to "true" as described in clause 5.5.2.3.

Processing a Rule Action shall result in an UPDATE operation being performed to set the "lastScene" Property in the linked instance of "oic.wk.scenecollection" to the value of the "scenevalue" Property in the Rule Action itself. All Rule Actions resulting from a Rule Expression evaluation shall be processed before any subsequent Rule Input changes are processed.

Table 25 – "oic.r.rule.actioncollection" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Links	"links"	"array"	See Table 13 in ISO/IEC 30118-1		R	Yes	See Table 13 in ISO/IEC 30118-1.
Resource Type	"rt"	"array"	["oic.r.rule.actioncollection"]		R	Yes	See Table 4 in ISO/IEC 30118-1.
Resource Types	"rts"	"array"	["oic.r.rule.action"]		R	Yes	See Table 11 in ISO/IEC 30118-1.

Table 26 – Properties of the Rule Action Resource.

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Link	"link"	Link	See clause 7.8.2 in ISO/IEC 30118-1		R	Yes	Link to an instance of a Scene Collection
Last Scene Value	"scenevalue"	string			RW	Yes	Value to be set on the "lastScene" Property in the linked Scene Collection.

5.5.3 Rule behaviour

Resources that are linked via a Rule Input are internally observed by the Rule (the Rule and the Linked Resource are all hosted on the same Device). For example, a thermostat Rule may observe a temperature sensor Resource, and may include additional Rule Inputs, e.g. for set-point and mode, that are additionally observed. The expression is re-evaluated whenever any one of the Rue Inputs changes.

See Figure 14 for an example of how a Rule is triggered and the action then taken.

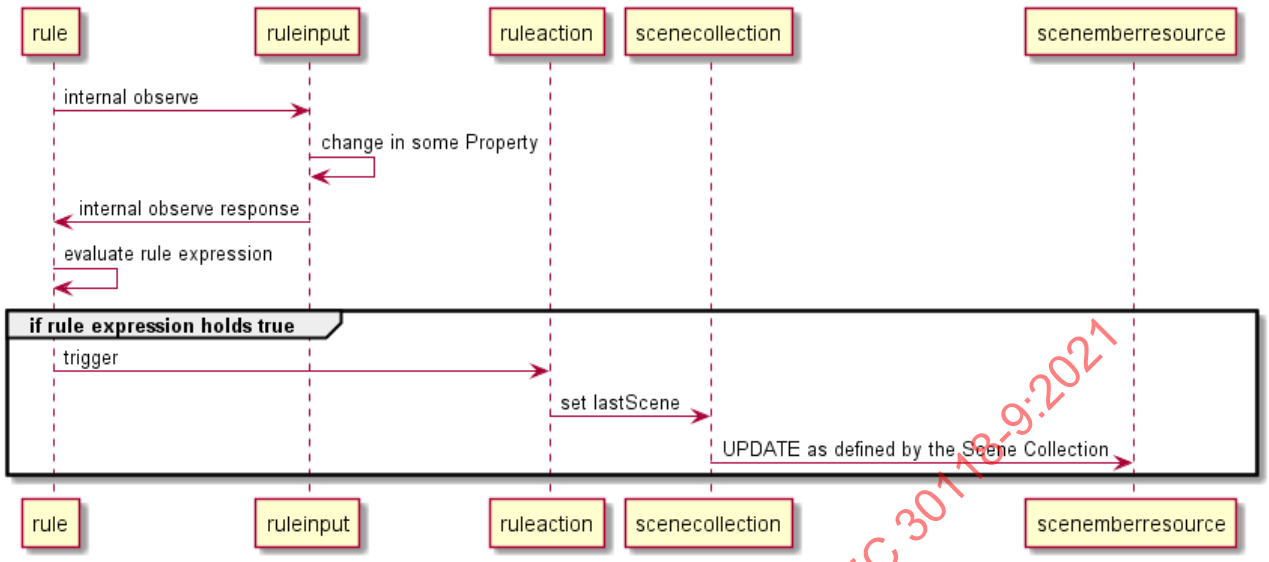

Figure 14 – Example operation of a Rule when "ruleenable" and "actionenable" Properties are both "true"

5.5.4 Rule configuration guidance

5.5.4.1 Pre-configured Rule

A Device that is capable of hosting a Rule may have as part of its configuration or implementation all the elements of the Rule pre-defined, i.e. there exists an instance of "oic.r.rule" with a Rule Input Collection of Links to pre-existing Resources acting as input variables, and a Rule Action Collection of Links to pre-existing Scene Collections. A Client may manipulate the Rule Expression Resource (see clause 5.5.2.3) or the linked Rule Input Resources or the linked Scene Collections as supported by the exposed Resource instances.

5.5.5 Rule Expression syntax

5.5.5.1 Overview

A Rule Expression consists of a string that conforms to the syntax in clause 5.5.5.2 using augmented BNF defined in IETF RFC 5424.

In the augmented BNF, "resourceproperty" is a colon separated string which takes the general form of "ruletag":"propname", where the "ruletag" corresponds to the "anchor" Link Parameter in a Rule Input Link and "propname" corresponds to the Property Name in the Linked Resource.

Additionally, the following syntax conditions apply to operators that may be part of a Rule Expression:

– relOp: left and right operands are equal, and of type [string, number, integer]

– stringOp: left and right operands are of type [string]

– existsOp : left operands are of type [string, boolean, number, integer, array, object]

Operator precedence shall be as defined within IETF RFC 5424, but in short, expressions in parentheses are evaluated first, then expressions using relOp, stringOp, and existsOp, and finally expressions using logOp. For example, given:

```
someresource:prop1 > "5" and someotherresource:prop2 contains "idle" and (someresource:prop3 = "blue")
```

Then the expression in parentheses is evaluated first, then the relOp expression, the stringOp expression, and finally the logOp expressions scanning from left to right.

5.5.5.2 Augmented BNF for Rule Expression syntax

```
rule ::= ruleExp
ruleExp ::= relExp| ruleExp wChar+ logOp wChar+ ruleExp| '(' wChar* ruleExp wChar* ')'
logOp ::= 'and'|'or'
resourceproperty ::= ruletag:propname
ruletag ::= ;anchor Link Parameter value from a Rule Input Resource
propname ::= ;Property name contained in a Rule Input Resource
relExp ::= resourceproperty wChar+ binOp wChar+ quotedVal| resourceproperty wChar+ existsOp
wChar+ boolVal
binOp ::= relOp|stringOp
relOp ::= '='|'!='|'<'|'<='|'>'|'>='
stringOp ::= 'contains'|'doesNotContain'|'startsWith'
existsOp ::= 'exists'
boolVal ::= 'true'|'false'
quotedVal ::= dQuote string dQuote
wChar ::= space|hTab|lineFeed|vTab|formFeed|return
hTab ::= ;UTF-8 code 0x09, horizontal tab character
lineFeed ::= ;UTF-8 code 0x0A, line feed character
vTab ::= ;UTF-8 code 0x0B, vertical tab character
formFeed ::= ;UTF-8 code 0x0C, form feed character
return ::= ;UTF-8 code 0x0D, carriage return character
space ::= ' ' ;UTF-8 code 0x20, space character
dQuote ::= '"' ;UTF-8 code 0x22, double quote character
path-rootless ::= (see RFC3986)
```

5.6 Icons

5.6.1 Overview

Icons are a primitive that are needed by various OCF subsystems, such as bridging. An optional Resource Type of "oic.r.icon" has been defined to provide a common representation of an icon Resource that can be used by Devices.

5.6.2 Resource

The icon Resource is as defined in Table 27.

Table 27 – Optional Icon Core Resource

Example URI	Resource Type Title	Resource Type ID ("rt" value)	OCF Interfaces	Description	Related Functional Interaction
"/example/oic/icon"	Icon	"oic.r.icon"	"oic.if.r"	The Resource through which the Device can obtain icon images. The Properties exposed by "/example/oic/mnt" are listed in Table 28.	Icon

Table 28 defines the details for the "oic.r.icon" Resource Type. Complete details are provided in annex A.4.

Table 28 – "oic.r.icon" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Mime Type	"mimetype"	"string"	N/A	N/A	R	Yes	Specifies the format (media type) of the icon. It should be a template string as specified

							in IANA Media Types Assignment
Width	"width"	"integer"	>= 1	pixels	R	Yes	Width of the icon in pixels greater than or equal to 1.
Height	"height"	"integer"	>= 1	pixels	R	Yes	Height of the icon in pixels greater than or equal to 1.
Icon	"media"	"uri"	N/A	N/A	R	Yes	URI to the location of the icon image.

5.7 Alerts

5.7.1 Overview

Alerts provide a means by which a Device provides information to an interested party with regard to error or other conditions that the Device is experiencing. An Alert contains human readable text that is dependent on the Device itself and the condition being reported. A Device may expose discrete instances of an Alert Resource Type ("oic.r.alert") or may also expose Alerts within an Alert Collection ("oic.r.alertcollection"). If the instance of "oic.r.alertcollection" is Observable (see clause 7.8.2.2.2 in ISO/IEC 30118-1) then a Client may Observe the Collection using the mechanisms defined in clause 11.3 in ISO/IEC 30118-1. As the Device adds and removes Alerts from the Collection notifications may be generated for any registered Observers, the format of which is dependent upon the OCF Interface used for the initial Observe, see clause 7.6.3 in ISO/IEC 30118-1.

5.7.2 Resource Types

The Alert and Alert Collection Resource Types are as defined in Table 29.

Table 29 – Optional Alert Core Resources

Example URI	Resource Type Title	Resource Type ID ("rt" value)	Interfaces	Description	Related Functional Interaction
"/example/alertURI"	Alert	"oic.r.alert"	"oic.if.r", "oic.if.baseline"	The Resource through which the Device exposes Alerts. The Properties exposed by "oic.r.alert" are listed in Table 30.	Alerts
"/example/alertcollectionURI"	Alert Collection	"oic.r.alertcollection"	"oic.if.ll", "oic.if.b", "oic.if.baseline"	A specialisation of a Collection that contains only instances of "oic.r.alert" that may be Observed by a Client in order to consume Alerts as they are created by the Device.	Alerts

Table 30 defines the "oic.r.alert" Resource Type. Complete details are provided in annex A.10.

Table 30 – "oic.r.alert" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Category	"category"	"string"			R	Yes	Device defined category for the Alert (e.g. "System", "I/O")
Generated Time	"generatedtime"	"date-time"			R	Yes	IETF RFC 3339 formatted time at which the Alert was generated.
Originator ID	"originatorid"	"string"			R	Yes	Identity of the originator of the Alert. May be the Device UUID of the

							Device or some other Device defined identity.
Severity	"severity"	"integer"	[0,7]		R	Yes	IETF RFC 5424 defined severity value
Subject	"subject"	"array"			R	No	Human-friendly subject of the Alert in one or more languages. This Property is an array of objects where each object has a "language" field (containing an IETF RFC 5646 language tag) and a "value" field containing the subject of the Alert name in the indicated language.
Account ID	"accounted"	"string"			R	No	Identity of the account with which the Device generating this Alert is associated.

The Alert Collection ("oic.r.alertcollection") Resource Type defines no Properties additional to those defined for all instances of a Collection in Table 13 of ISO/IEC 30118-1. However, the Alert Collection does impose restrictions of the values that shall be populated in the "rt" and "rts" Properties. These are described in Table 31. Complete details are provided in annex A.11.

Table 31 – "oic.r.alertcollection" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Links	"links"	"array"	See Table 13 in ISO/IEC 30118-1		R	Yes	See Table 13 in ISO/IEC 30118-1.
Resource Type	"rt"	"array"	["oic.r.alertcollection"]		R	Yes	See Table 4 in ISO/IEC 30118-1.
Resource Types	"rts"	"array"	["oic.r.alert"] or ["oic.r.alert","oic.r.value.conditional"]		R	Yes	See Table 11 in ISO/IEC 30118-1.

5.7.3 Example of use

Consider a Device that is capable of generating Alerts; it exposes an empty instance of an Alert Collection ("oic.r.alertcollection"); that is the array of Links (the "links" Property) contains no items.

As the Device under whatever conditions generates Alerts, the Device adds a Link to the Alert Resource in the instance of an Alert Collection. A Client that has discovered the Device and is Observing the Alert Collection using the links list OCF Interface ("oic.if.ll") will receive a notification containing the complete Alert Collection (not just any Links that were added). It is the responsibility of the Client to determine which Links were added (or removed if the Alert was removed); noting that the "generatedtime" Property may be used to determine the generated order. The Client then retrieves the Alert itself via a RETRIEVE to the "href" Link Parameter in the newly added Link to the Collection.

See A.10 for an example of an Alert Resource and the applicable schema.

Annex A
(normative)

Resource Type definitions

A.1 List of Resource Type definitions

All the clauses in Annex A describe the Resource Types with a RESTful API definition language. The Resource Type definitions presented in Annex A are formatted for readability, and so may appear to have extra line breaks. Table A.1 contains the list of defined Core Common Resources in this document.

Table A.1 – Alphabetized list of Core Resources

Friendly Name (informative)	Resource Type (rt)	Clause
Alerts	"oic.r.alert"	A.10
Alerts Collection	"oic.r.alertcollection"	A.11
Device Configuration	"oic.wk.con"	A.2
Platform Configuration	"oic.wk.con.p"	A.3
Icon	"oic.r.icon"	A.4
Maintenance	"oic.wk.mnt"	A.5
Network Monitoring	"oic.wk.nmon"	A.6
OCF Rule	"oic.r.rule"	A.13
OCF Rule Input Collection	"oic.r.rule.inputcollection"	A.14
OCF Rule Expression	"oic.r.rule.expression"	A.15
OCF Rule Action Collection	"oic.r.rule.actioncollection"	A.16
OCF Rule Action	"oic.r.rule.action"	A.17
Scenes (Top Level)	"oic.wk.scenelist"	A.7
Scenes Collections	"oic.wk.scenecollection"	A.8
Scene Member	"oic.wk.scenemember"	A.9
Software Update	"oic.r.softwareupdate"	A.12

A.2 Device Configuration

A.2.1 Introduction

Resource that allows for Device specific information to be configured.

A.2.2 Example URI

/exampleDeviceConfigurationResURI

A.2.3 Resource type

The Resource Type is defined as: "oic.wk.con".

A.2.4 OpenAPI 2.0 definition

```
{
  "swagger": "2.0",
```

```
"info": {
  "title": "Device Configuration",
  "version": "2019-02-28",
  "license": {
    "name": "OCF Data Model License",
    "url": "https://openconnectivityfoundation.github.io/core/LICENSE.md",
    "x-copyright": "Copyright 2016-2019 Open Connectivity Foundation, Inc. All rights reserved."
  },
  "termsOfService": "https://openconnectivityfoundation.github.io/core/DISCLAIMER.md"
},
"schemes": [
  "http"
],
"consumes": [
  "application/json"
],
"produces": [
  "application/json"
],
"paths": {
  "/exampleDeviceConfigurationResURI" : {
    "get": {
      "description": "Resource that allows for Device specific information to be configured.\n",
      "parameters": [
        {
          "$ref": "#/parameters/interface-all"
        }
      ],
      "responses": {
        "200": {
          "description" : "",
          "x-example": {
            "n":    "My Friendly Device Name",
            "rt":   ["oic.wk.con"],
            "loc":  [32.777,-96.797],
            "locn": "My Location Name",
            "c":    "USD",
            "r":    "MyRegion",
            "dl":   "en"
          },
          "schema": {
            "$ref": "#/definitions/Configuration"
          }
        }
      }
    },
    "post": {
      "description": "Update the information about the Device\n",
      "parameters": [
        {
          "$ref": "#/parameters/interface-rw"
        },
        {
          "name": "body",
          "in": "body",
          "required": true,
          "schema": {
            "$ref": "#/definitions/Update"
          },
          "x-example": {
            "n": "Nuevo Nombre Amistoso",
            "r": "MyNewRegion",
            "ln": [ { "language": "es", "value": "Nuevo Nombre Amistoso" } ],
            "dl": "es"
          }
        }
      ],
      "responses": {
        "200": {
          "description": "",
          "x-example":  {
            "n": "Nuevo Nombre Amistoso",
            "r": "MyNewRegion",
            "ln": [ { "language": "es", "value": "Nuevo Nombre Amistoso" } ],
            "dl":   "es"
          },
          "schema": {
```

```
            "$ref": "#/definitions/Update"
          }
        }
      }
    }
  }
},
"parameters": {
  "interface-rw" : {
    "in" : "query",
    "name" : "if",
    "type" : "string",
    "enum" : ["oic.if.rw"]
  },
  "interface-all" : {
    "in" : "query",
    "name" : "if",
    "type" : "string",
    "enum" : ["oic.if.rw", "oic.if.baseline"]
  }
},
"definitions": {
  "Configuration": {
    "properties": {
      "rt":  {
        "description": "Resource Type of the Resource",
        "items": {
          "enum": ["oic.wk.con"],
          "type": "string",
          "maxLength": 64
        },
        "minItems": 1,
        "uniqueItems": true,
        "readOnly": true,
        "type": "array"
      },
      "loc": {
        "description": "Location information (lat, long)",
        "items": {
          "type": "number"
        },
        "maxItems": 2,
        "minItems": 2,
        "type": "array"
      },
      "c": {
        "description": "Currency",
        "maxLength": 64,
        "type": "string"
      },
      "ln": {
        "description": "Localized names",
        "items":
          "properties": {
            "language": {
              "allOf": [
                {
                  "description": "Format pattern according to IETF RFC 5646 (language tag).",
                  "pattern": "^[A-Za-z]{1,8}(-[A-Za-z0-9]{1,8})*$",
                  "type": "string"
                },
                {
                  "description": "An RFC 5646 language tag."
                }
              ]
            },
            "value": {
              "description": "The Device name in the indicated language.",
              "maxLength": 64,
              "type": "string"
            }
          },
          "type": "object"
        },
        "minItems": 1,
        "type": "array"
      },
```

```
        "locn": {
          "description": "Human Friendly Name for location",
          "maxLength": 64,
          "type": "string"
        },
        "dl": {
          "allOf": [
            {
              "description": "Format pattern according to IETF RFC 5646 (language tag).",
              "pattern": "^[A-Za-z]{1,8}(-[A-Za-z0-9]{1,8})*$",
              "type": "string"
            },
            {
              "description": "Default Language as an RFC 5646 language tag."
            }
          ]
        },
        "n": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "id": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/id"
        },
        "r": {
          "description": "Region",
          "maxLength": 64,
          "type": "string"
        },
        "if" : {
          "description": "The OCF Interfaces supported by this Resource",
          "items": {
            "enum": [
              "oic.if.baseline",
              "oic.if.rw"
            ],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "uniqueItems": true,
          "readOnly": true,
          "type": "array"
        }
      },
      "type" : "object",
      "required": ["n"]
    },
    "Update" : {
      "properties": {
        "loc": {
          "description": "Location information (lat, long)",
          "items": {
            "type": "number"
          },
          "maxItems": 2,
          "minItems": 2,
          "type": "array"
        },
        "c": {
          "description": "Currency",
          "maxLength": 64,
          "type": "string"
        },
        "ln": {
          "description": "Localized names",
          "items": {
            "properties": {
              "language": {
                "allOf": [
                  {
                    "description": "Format pattern according to IETF RFC 5646 (language tag).",
                    "pattern": "^[A-Za-z]{1,8}(-[A-Za-z0-9]{1,8})*$",
                    "type": "string"
```

```
                    },
                    {
                      "description": "An RFC 5646 language tag."
                    }
                  ]
                },
                "value": {
                  "description": "The Device name in the indicated language.",
                  "maxLength": 64,
                  "type": "string"
                }
              },
              "type": "object"
            },
            "minItems": 1,
            "type": "array"
          },
          "locn": {
            "description": "Human Friendly Name for location",
            "maxLength": 64,
            "type": "string"
          },
          "dl": {
            "allOf": [
              {
                "description": "Format pattern according to IETF RFC 5646 (language tag).",
                "pattern": "^[A-Za-z]{1,8}(-[A-Za-z0-9]{1,8})*$",
                "type": "string"
              },
              {
                "description": "Default Language as an RFC 5646 language tag."
              }
            ]
          },
          "n": {
            "description": "The human friendly name to be set on the Resource, this is also reflected in
the same Property in oic.wk.d",
            "maxLength": 64,
            "type": "string"
          },
          "r": {
            "description": "Region",
            "maxLength": 64,
            "type": "string"
          }
        },
        "anyOf": [
          {
            "required": ["loc"]
          },
          {
            "required": ["locn"]
          },
          {
            "required": ["c"]
          },
          {
            "required": ["r"]
          },
          {
            "required": ["ln"]
          },
          {
            "required": ["dl"]
          },
          {
            "required": ["n"]
          }
        ],
        "type" : "object"
      }
    }
}
```

A.2.5 Property definition

Table A.2 defines the Properties that are part of the "oic.wk.con" Resource Type.

Table A.2 – The Property definitions of the Resource with type "rt" = "oic.wk.con".

Property name	Value type	Mandatory	Access mode	Description
rt	array: see schema	No	Read Only	Resource Type of the Resource
loc	array: see schema	No	Read Write	Location information (lat, long)
c	string	No	Read Write	Currency
ln	array: see schema	No	Read Write	Localized names
locn	string	No	Read Write	Human Friendly Name for location
dl	multiple types: see schema	No	Read Write	
n	multiple types: see schema	Yes	Read Write	
id	multiple types: see schema	No	Read Write	
r	string	No	Read Write	Region
if	array: see schema	No	Read Only	The OCF Interfaces supported by this Resource
loc	array: see schema	No	Read Write	Location information (lat, long)
c	string	No	Read Write	Currency
ln	array: see schema	No	Read Write	Localized names
locn	string	No	Read Write	Human Friendly Name for location
dl	multiple types: see schema	No	Read Write	
n	string	Yes	Read Write	The human friendly name to be set on the Resource, this is also reflected in the same Property in oic.wk.d
r	string	No	Read Write	Region

A.2.6 CRUDN behaviour

Table A.3 defines the CRUDN operations that are supported on the "oic.wk.con" Resource Type.

Table A.3 – The CRUDN operations of the Resource with type "rt" = "oic.wk.con".

Create	Read	Update	Delete	Notify
	get	post		observe

A.3 Platform Configuration

A.3.1 Introduction

Resource that allows for Platform specific information to be configured.

A.3.2 Example URI

/examplePlatformConfigurationResURI

A.3.3 Resource type

The Resource Type is defined as: "oic.wk.con.p".

A.3.4 OpenAPI 2.0 definition


```
{
  "swagger": "2.0",
  "info": {
    "title": "Platform Configuration",
    "version": "2019-03-04",
    "license": {
      "name": "OCF Data Model License",
      "url": "https://openconnectivityfoundation.github.io/core/LICENSE.md",
      "x-copyright": "Copyright 2016-2019 Open Connectivity Foundation, Inc. All rights reserved."
    },
    "termsOfService": "https://openconnectivityfoundation.github.io/core/DISCLAIMER.md"
  },
  "schemes": [
    "http"
  ],
  "consumes": [
    "application/json"
  ],
  "produces": [
    "application/json"
  ],
  "paths": {
    "/examplePlatformConfigurationResURI": {
      "get": {
        "description": "Resource that allows for Platform specific information to be configured.\n",
        "parameters": [
          {
            "$ref": "#/parameters/interface-all"
          }
        ],
        "responses": {
          "200": {
            "description": "",
            "x-example": {
              "rt":   ["oic.wk.con.p"],
              "mnpn": [ { "language": "en", "value": "My Friendly Device Name" } ]
            },
            "schema": { "$ref": "#/definitions/Conf_Platform" }
          }
        }
      },
      "post": {
        "description": "Update the information about the Platform\n",
        "parameters": [

          "$ref": "#/parameters/interface-rw"
        },
        {
          "name": "body",
          "in": "body",
          "required": true,
          "schema": { "$ref": "#/definitions/Update_Platform" },
          "x-example": {
            "n": "Nuevo nombre",
            "mnpn": [ { "language": "es", "value": "Nuevo nombre de Plataforma Amigable" } ]
          }
        }
        ],
        "responses": {
          "200": {
            "description": "",
            "x-example": {
              "n": "Nuevo nombre",
              "mnpn": [ { "language": "es", "value": "Nuevo nombre de Plataforma Amigable" } ]
```

```
            },
            "schema": { "$ref": "#/definitions/Update_Platform" }
          }
        }
      }
    }
  },
  "parameters": {
    "interface-rw": {
      "in": "query",
      "name": "if",
      "type": "string",
      "enum" : ["oic.if.rw"]
    },
    "interface-all": {
      "in": "query",
      "name": "if",
      "type": "string",
      "enum": ["oic.if.rw", "oic.if.baseline"]
    }
  },
  "definitions": {
    "Conf_Platform": {
      "properties": {
        "rt":  {
          "description": "Resource Type of the Resource",
          "items": {
            "enum": ["oic.wk.con.p"],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "uniqueItems": true,
          "readOnly": true,
          "type": "array"
        },
        "n":  {
          "$ref":
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "mnpn":  {
          "description": "Platform names",
          "items": {
            "properties": {
              "language": {
                "allOf": [
                  {
                    "$ref": "http://openconnectivityfoundation.github.io/core/schemas/oic.types-
schema.json#/definitions/language-tag"
                  },
                  {
                    "description": "An RFC 5646 language tag."
                  }
                ]
              },
              "value": {
                "description": "The Platform description in the indicated language.",
                "maxLength": 64,
                "type": "string"
              }
            },
            "type": "object"
          },
          "minItems": 1,
          "type": "array"
        },
        "id": {
          "$ref":
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/id"
        },
        "if": {
          "description": "The OCF Interfaces supported by this Resource",
          "items": {
            "enum": [
              "oic.if.rw",
```

```
              "oic.if.baseline"
            ],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "readOnly": true,
          "uniqueItems": true,
          "type": "array"
        }
      },
      "type" : "object"
    },
    "Update_Platform": {
      "properties": {
        "n":  {
          "description": "The human friendly name to be set on the Resource, this is also reflected in
the same Property in oic.wk.p",
          "maxLength": 64,
          "type": "string"
        },
        "mnpn" :  {
          "description": "Platform names",
          "items": {
            "properties": {
              "language": {
                "allOf": [
                  {
                    "$ref": "http://openconnectivityfoundation.github.io/core/schemas/oic.types-
schema.json#/definitions/language-tag"
                  },
                  {
                    "description": "An RFC 5646 language tag."
                  }
                ]
              },
              "value": {
                "description": "The Platform description in the indicated language.",
                "maxLength": 64,
                "type": "string"
              }
            },
            "type": "object"
          },
          "minItems": 1,
          "type": "array"
        }
      },
      "type": "object",
      "anyOf": [
        {
          "required": ["mnpn"]
        },
        {
          "required": ["n"]
        }
      ]
    }
  }
}
```


A.3.5 Property definition

Table A.4 defines the Properties that are part of the "oic.wk.con.p" Resource Type.

Table A.4 – The Property definitions of the Resource with type "rt" = "oic.wk.con.p".

Property name	Value type	Mandatory	Access mode	Description
rt	array: see schema		Read Only	Resource Type of the Resource
n	multiple types: see schema		Read Write	

mnpn	array: see schema		Read Write	Platform names
id	multiple types: see schema		Read Write	
if	array: see schema		Read Only	The OCF Interfaces supported by this Resource
n	string	Yes	Read Write	The human friendly name to be set on the Resource, this is also reflected in the same Property in oic.wk.p
mnpn	array: see schema	No	Read Write	Platform names

A.3.6 CRUDN behaviour

Table A.5 defines the CRUDN operations that are supported on the "oic.wk.con.p" Resource Type.

Table A.5 – The CRUDN operations of the Resource with type "rt" = "oic.wk.con.p".

Create	Read	Update	Delete	Notify
	get	post		observe

A.4 Icon

A.4.1 Introduction

This Resource describes the attributes associated with an Icon.

A.4.2 Example URI

/IconResURI

A.4.3 Resource type

The Resource Type is defined as: "oic.r.icon".

A.4.4 OpenAPI 2.0 definition

```
{
  "swagger": "2.0",
  "info": {
    "title": "Icon",
    "version": "2019-02-26",
    "license": {
      "name": "OCF Data Model License",
      "url": "https://openconnectivityfoundation.github.io/core/LICENSE.md",
      "x-copyright": "Copyright 2016-2019 Open Connectivity Foundation, Inc. All rights reserved."
    },
    "termsOfService": "https://openconnectivityfoundation.github.io/core/DISCLAIMER.md"
  },
  "schemes": [
    "http"
  ],
  "consumes": [
    "application/json"
  ],
  "produces": [
    "application/json"
  ],
  "paths": {
    "/IconResURI" : {
      "get": {
```

```
        "description": "This Resource describes the attributes associated with an Icon.\n",
        "parameters": [
          {
            "$ref": "#/parameters/interface"
          }
        ],
        "responses": {
          "200": {
            "description": "",
            "x-example": {
              "rt": ["oic.r.icon"],
              "mimetype": "image/png",
              "width": 256,
              "height": 256,
              "media": "http://findbetter.ru/public/uploads/1481662800/2043.png"
            },
            "schema": {
              "$ref": "#/definitions/Icon"
            }
          }
        }
      }
    }
  },
  "parameters": {
    "interface" : {
      "in" : "query",
      "name" : "if",
      "type" : "string",
      "enum" : ["oic.if.r", "oic.if.baseline"]
    }
  },
  "definitions": {
    "Icon" : {
      "properties": {
        "mimetype": {
          "description": "The Media Type of the icon",
          "maxLength": 64,
          "readOnly": true,
          "type": "string"
        },
        "rt": {
          "description": "Resource Type of the Resource",
          "items": {
            "enum": ["oic.r.icon"],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "uniqueItems": true,
          "readOnly": true,
          "type": "array"
        },
        "media": {
          "description": "Specifies the URI to the icon",
          "format": "uri",
          "maxLength": 256,
          "readOnly": true,
          "type": "string"
        },
        "n": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "id": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/id"
        },
        "width": {
          "description": "The width in pixels",
          "minimum": 1,
          "readOnly": true,
          "type": "integer"
        },
        "height": {
```

```
          "description": "The height in pixels",
          "minimum": 1,
          "readOnly": true,
          "type": "integer"
        },
        "if": {
          "description": "The OCF Interfaces supported by this Resource",
          "items": {
            "enum": [
              "oic.if.r",
              "oic.if.baseline"
            ],
            "maxLength": 64,
            "type": "string"
          },
          "minItems": 2,
          "uniqueItems": true,
          "readOnly": true,
          "type": "array"
        }
      },
      "type" : "object",
      "required": ["mimetype", "width", "height", "media"]
    }
  }
}
```


A.4.5 Property definition

Table A.6 defines the Properties that are part of the "oic.r.icon" Resource Type.

Table A.6 – The Property definitions of the Resource with type "rt" = "oic.r.icon".

Property name	Value type	Mandatory	Access mode	Description
mimetype	string	Yes	Read Only	The Media Type of the icon
rt	array: see schema	No	Read Only	Resource Type of the Resource
media	string	Yes	Read Only	Specifies the URI to the icon
n	multiple types: see schema	No	Read Write	
id	multiple types: see schema	No	Read Write	
width	integer	Yes	Read Only	The width in pixels
height	integer	Yes	Read Only	The height in pixels
if	array: see schema	No	Read Only	The OCF Interfaces supported by this Resource

A.4.6 CRUDN behaviour

Table A.7 defines the CRUDN operations that are supported on the "oic.r.icon" Resource Type.

Table A.7 – The CRUDN operations of the Resource with type "rt" = "oic.r.icon".

Create	Read	Update	Delete	Notify
	get			observe

A.5 Maintenance

A.5.1 Introduction

The Resource through which a Device is maintained and can be used for diagnostic purposes.
fr (Factory Reset) is a boolean.
  The value 0 means No action (Default), the value 1 means Start Factory Reset
After factory reset, this value shall be changed back to the default value
rb (Reboot) is a boolean.
  The value 0 means No action (Default), the value 1 means Start Reboot
After Reboot, this value shall be changed back to the default value

A.5.2 Well-known URI

/oic/mnt

A.5.3 Resource type

The Resource Type is defined as: "oic.wk.mnt".

A.5.4 OpenAPI 2.0 definition

```
{
  "swagger": "2.0",
  "info": {
    "title": "Maintenance",
    "version": "2019-03-04",
    "license": {
      "name": "OCF Data Model License",
      "url":
"https://github.com/openconnectivityfoundation/core/blob/e28a9e0a92e17042ba3e83661e4c0fbce8bdc4ba/LICEN
SE.md",
      "x-copyright": "Copyright 2016-2019 Open Connectivity Foundation, Inc. All rights reserved."
    },
    "termsOfService": "https://openconnectivityfoundation.github.io/core/DISCLAIMER.md"
  },
  "schemes": ["http"],
  "consumes": ["application/json"],
  "produces": ["application/json"],
  "paths": {
    "/oic/mnt" : {
      "get": {
        "description": "The Resource through which a Device is maintained and can be used for
diagnostic purposes. \nfr (Factory Reset) is a boolean.\n  The value 0 means No action (Default), the
value 1 means Start Factory Reset\nAfter factory reset, this value shall be changed back to the default
value\nrb (Reboot) is a boolean.\n  The value 0 means No action (Default), the value 1 means Start
Reboot\nAfter Reboot, this value shall be changed back to the default value\n",
        "parameters": [
          {"$ref": "#/parameters/interface-all"}
        ],
        "responses": {
            "200": {
              "description" : "",
              "x-example": {
                "rt":   ["oic.wk.mnt"],
                "fr":   false,
                "rb":   false,
                "err" : 503
              },
              "schema": { "$ref": "#/definitions/mnt" }
            }
        }
      },
      "post": {
        "description": "Set the maintenance action(s)\n",
        "parameters": [
          {"$ref": "#/parameters/interface-rw"},
          {
            "name": "body",
```

```
            "in": "body",
            "required": true,
            "schema": { "$ref": "#/definitions/mnt-update" },
            "x-example": {
              "fr":   false,
              "rb":   false
            }
          }
        ],
        "responses": {
            "200": {
              "description" : "",
              "x-example": {
                "fr":   false,
                "rb":   false
              },
              "schema": { "$ref": "#/definitions/mnt" }
            }
        }
      }
    }
  },
  "parameters": {
    "interface-all" : {
      "in" : "query",
      "name" : "if",
      "type" : "string",
      "enum" : ["oic.if.rw", "oic.if.baseline"]
    },
    "interface-rw" : {
      "in" : "query",
      "name" : "if",
      "type" : "string",
      "enum" : ["oic.if.rw"]
    }
  },
  "definitions": {
    "mnt" : {
      "properties": {
        "rt" : {
          "description": "Resource Type of the Resource",
          "items": {
            "enum":   ["oic.wk.mnt"],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "uniqueItems": true,
          "readOnly": true,
          "type": "array"
        },
        "fr" : {
          "description": "Factory Reset",
          "type": "boolean"
        },
        "err" : {
          "description": "Last HTTP occurred error",
          "maximum": 599,
          "minimum": 399,
          "readOnly": true,
          "type": "integer"
        },
        "n": {
          "$ref":
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "rb" : {
          "description": "Reboot Action",
          "type": "boolean"
        },
        "id" : {
          "$ref":
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/id"
        },
        "if" : {
```

```
          "description": "The OCF Interfaces supported by this Resource",
          "items": {
            "enum": [
              "oic.if.rw",
              "oic.if.baseline"
            ],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "readOnly": true,
          "uniqueItems": true,
          "type": "array"
        }
      },
      "anyOf" : [
        {
          "required": [ "fr" ]
        },
        {
          "required": [ "rb" ]
        },
        {
          "required": [ "err" ]
        }
      ],
      "type" : "object"
    },
    "mnt-update" : {
      "properties": {
        "fr" : {
          "description": "Factory Reset",
          "type": "boolean"
        },
        "n": {
          "$ref":
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "rb" : {
          "description": "Reboot Action",
          "type": "boolean"
        }
      },
      "anyOf" : [
        {
          "required": [
            "fr"
          ]
        },
        {
          "required": [
            "rb"
          ]
        }
      ],
      "type": "object"
    }
  }
}
```


A.5.5 Property definition

Table A.8 defines the Properties that are part of the "oic.wk.mnt" Resource Type.

Table A.8 – The Property definitions of the Resource with type "rt" = "oic.wk.mnt".

Property name	Value type	Mandatory	Access mode	Description
rt	array: see schema	No	Read Only	Resource Type of the Resource
fr	boolean	No	Read Write	Factory Reset

err	integer	Yes	Read Only	Last HTTP occurred error
n	multiple types: see schema	No	Read Write	
rb	boolean	No	Read Write	Reboot Action
id	multiple types: see schema	No	Read Write	
if	array: see schema	No	Read Only	The OCF Interfaces supported by this Resource
fr	boolean	No	Read Write	Factory Reset
n	multiple types: see schema	No	Read Write	
rb	boolean	Yes	Read Write	Reboot Action

A.5.6 CRUDN behaviour

Table A.9 defines the CRUDN operations that are supported on the "oic.wk.mnt" Resource Type.

Table A.9 – The CRUDN operations of the Resource with type "rt" = "oic.wk.mnt".

Create	Read	Update	Delete	Notify
	get	post		observe

A.6 Network Monitoring

A.6.1 Introduction

The Resource through which a Device can monitor network traffic.

A.6.2 Example URI

/nmonResURI

A.6.3 Resource type

The Resource Type is defined as: "oic.wk.nmon".

A.6.4 OpenAPI 2.0 definition

```
{
  "swagger": "2.0",
  "info": {
    "title": "Network Monitoring",
    "version": "2019-03-27",
    "license": {
      "name": "OCF Data Model License",
      "url":
"https://github.com/openconnectivityfoundation/core/blob/e28a9e0a92e17042ba3e83661e4c0fbce8bdc4ba/LICEN
SE.md",
      "x-copyright": "Copyright 2016-2019 Open Connectivity Foundation, Inc. All rights reserved."
    },
    "termsOfService": "https://openconnectivityfoundation.github.io/core/DISCLAIMER.md"
  },
  "schemes": ["http"],
  "consumes": ["application/json"],
  "produces": ["application/json"],
  "paths": {
    "/nmonResURI" : {
      "get": {
        "description": "The Resource through which a Device can monitor network traffic.\n",
```



```
      "parameters": [
        {"$ref": "#/parameters/interface-all"}
      ],
      "responses": {
          "200": {
            "description" : "",
            "x-example": {
              "rt":   ["oic.wk.nmon"],
              "ianaifType":   71,
              "reset":   false,
              "col" : false,
              "tx" : 10,
              "rx" : 15,
              "mmstx" : 50,
              "amstx" : 35,
              "mmsrx" : 35,
              "amsrx" : 20
            },
            "schema": { "$ref": "#/definitions/nmon" }
          }
      }
    },
    "post": {
      "description": "Start/Stop collecting and reset the networking monitor Resource\n",
      "parameters": [
        {"$ref": "#/parameters/interface-rw"},
        {
          "name": "body",
          "in": "body",
          "required": true,
          "schema": { "$ref": "#/definitions/nmon-update" },
          "x-example": {
            "col":   true,
            "reset":   true
          }
        }
      ],
      "responses": {
          "200": {
            "description" : "",
            "x-example": {
              "rt":   ["oic.wk.nmon"],
              "ianaifType":   71,
              "reset":   false,
              "col" : true,
              "tx" : 0,
              "rx" : 0,
              "mmstx" : 0,
              "amstx" : 0,
              "mmsrx" : 0,
              "amsrx" : 0
            },
            "schema": { "$ref": "#/definitions/nmon" }
          }
      }
    }
  }
},
"parameters": {
  "interface-rw" : {
    "in" : "query",
    "name" : "if",
    "type" : "string",
    "enum" : ["oic.if.rw"]
  },
  "interface-all" : {
    "in" : "query",
    "name" : "if",
    "type" : "string",
    "enum" : ["oic.if.rw", "oic.if.baseline"]
  }
},
"definitions": {
  "nmon" : {
    "properties": {
      "amstx" : {
        "description": "Average transmitted message size in bytes (tx) in the collection period",
```

```
          "readOnly": true,
          "type": "integer"
        },
        "reset" : {
          "description": "True: reset the collected values",
          "readOnly": false,
          "type": "boolean"
        },
        "mmsrx" : {
          "description": "Maximum received message size in bytes (rx) in the collection period",
          "readOnly": true,
          "type": "integer"
        },
        "mmstx" : {
          "description": "Maximum transmitted message size in bytes (tx) in the collection period",
          "readOnly": true,
          "type": "integer"
        },
        "tx" : {
          "description": "Amount of transmitted kilo bytes from the collection",
          "readOnly": true,
          "type": "integer"
        },
        "rt" : {
          "description": "Resource Type of the Resource",
          "items": {
            "enum": ["oic.wk.nmon"],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "uniqueItems": true,
          "readOnly": true,
          "type": "array"
        },
        "ianaifType" : {
          "description": "The type of the network connection, as defined by iana
https://www.iana.org/assignments/ianaiftype-mib/ianaiftype-mib",
          "readOnly": true,
          "type": "integer"
        },
        "rx" : {
          "description": "Amount of received kilobytes from the collection",
          "readOnly": true,
          "type": "integer"
        },
        "id" : {
          "$ref":
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/id"
        },
        "amsrx" : {
          "description": "Average received message size in bytes (rx) in the collection period",
          "readOnly": true,
          "type": "integer"
        },
        "n" : {
          "$ref":
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "col" : {
          "description": "True: Device is collecting values",
          "readOnly": false,
          "type": "boolean"
        },
        "if" : {
          "description": "The OCF Interfaces supported by this Resource",
          "items": {
            "enum": [
              "oic.if.rw",
              "oic.if.baseline"
            ],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
```

```
          "readOnly": true,
          "uniqueItems": true,
          "type": "array"
        }
      },
      "type" : "object",
      "required": ["reset", "col", "ianaifType"]
    },
    "nmon-update" : {
      "properties": {
        "reset" : {
          "description": "True: reset the collected values",
          "readOnly": false,
          "type": "boolean"
        },
        "n" : {
          "$ref":
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "col" : {
          "description": "True: Device is collecting values",
          "readOnly": false,
          "type": "boolean"
        }
      },
      "type" : "object",
      "required": ["reset", "col"]
    }
  }
}
```

A.6.5 Property definition

Table A.10 defines the Properties that are part of the "oic.wk.nmon" Resource Type.

Table A.10 – The Property definitions of the Resource with type "rt" = "oic.wk.nmon".

Property name	Value type	Mandatory	Access mode	Description
amstx	integer	No	Read Only	Average transmitted message size in bytes (tx) in the collection period
reset	boolean	Yes	Read Write	True: reset the collected values
mmsrx	integer	No	Read Only	Maximum received message size in bytes (rx) in the collection period
mmstx	integer	No	Read Only	Maximum transmitted message size in bytes (tx) in the collection period
tx	integer	No	Read Only	Amount of transmitted kilo bytes from the collection
rt	array: see schema	No	Read Only	Resource Type of the Resource
ianaifType	integer	Yes	Read Only	The type of the network connection, as defined by iana https://www.iana.org/assignments/ianaiftype-mib/ianaiftype-mib
rx	integer	No	Read Only	Amount of received kilobytes from the collection
id	multiple types: see schema	No	Read Write	
amsrx	integer	No	Read Only	Average received message size in bytes (rx) in the collection period
n	multiple types: see schema	No	Read Write	
col	boolean	Yes	Read Write	True: Device is collecting values

if	array: see schema	No	Read Only	The OCF Interfaces supported by this Resource
reset	boolean	Yes	Read Write	True: reset the collected values
n	multiple types: see schema	No	Read Write	
col	boolean	Yes	Read Write	True: Device is collecting values

A.6.6 CRUDN behaviour

Table A.11 defines the CRUDN operations that are supported on the "oic.wk.nmon" Resource Type.

Table A.11 – The CRUDN operations of the Resource with type "rt" = "oic.wk.nmon".

Create	Read	Update	Delete	Notify
	get	post		observe

A.7 Scene List

A.7.1 Introduction

Toplevel Scene Resource.
This Resource is a generic Collection Resource.
The rts value contains oic.wk.scenecollection Resource Types.

A.7.2 Example URI

/SceneListResURI

A.7.3 Resource type

The Resource Type is defined as: "oic.wk.scenelist".

A.7.4 OpenAPI 2.0 definition

```
{
  "swagger": "2.0",
  "info": {
    "title": "Scene List",
    "version": "2019-03-04",
    "license": {
      "name": "OCF Data Model License",
      "url": "https://openconnectivityfoundation.github.io/core/LICENSE.md",
      "x-copyright": "Copyright 2016-2019 Open Connectivity Foundation, Inc. All rights reserved."
    },
    "termsOfService": "https://openconnectivityfoundation.github.io/core/DISCLAIMER.md"
  },
  "schemes": [
    "http"
  ],
  "consumes": [
    "application/json"
  ],
  "produces": [
    "application/json"
  ],
  "paths": {
    "/SceneListResURI?if=oic.if.ll": {
      "get": {
        "description": "Toplevel Scene Resource.\nThis Resource is a generic Collection Resource.\nThe
rts value contains oic.wk.scenecollection Resource Types.\n",
        "parameters": [
          {
            "$ref": "#/parameters/interface-all"
```

```
          }
        ],
        "responses": {
          "200": {
            "description" : "",
            "x-example": [
              {"href": "/scenecollection1","rt": ["oic.wk.scenecollection"],"if":["oic.if.ll",
"oic.if.baseline"]},
              {"href": "/scenecollection2","rt": ["oic.wk.scenecollection"],"if":["oic.if.ll",
"oic.if.baseline"]}
            ],
            "schema": {
              "$ref": "#/definitions/slinks"
            }
          }
        }
      }
    },
    "/SceneListResURI?if=oic.if.baseline": {
      "get": {
        "description": "Toplevel Scene Resource.\nThis Resource is a generic Collection Resource.\nThe
rts value contains oic.wk.scenecollection Resource Types.\n",
        "parameters": [
          {
            "$ref": "#/parameters/interface-all"
          }
        ],
        "responses": {
          "200": {
            "description" : "",
            "x-example": {
              "rt":  ["oic.wk.scenelist"],
              "if":  ["oic.if.ll", "oic.if.baseline"],
              "n":   "list of scene collections",
              "rts": ["oic.wk.scenecollection"],
              "links": [
                {"href": "/scenecollection1","rt": ["oic.wk.scenecollection"],"if":["oic.if.ll",
"oic.if.baseline"]},
                {"href": "/scenecollection2","rt": ["oic.wk.scenecollection"],"if":["oic.if.ll",
"oic.if.baseline"]}
              ]
            },
            "schema": { "$ref": "#/definitions/Collection" }
          }
        }
      }
    }
  },
  "parameters": {
    "interface-all" : {
      "in" : "query",
      "name" : "if",
      "type" : "string",
      "enum" : ["oic.if.ll", "oic.if.baseline"]
    }
  },
  "definitions": {
    "Collection": {
      "properties": {
        "links": {
          "description": "A set of simple or individual OCF Links.",
          "items": {
            "$ref": "#/definitions/oic.oic-link"
          },
          "type": "array"
        },
        "n": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "id": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/id"
        },
        "if": {
```

```
        "type": "array",
        "description": "The OCF Interfaces supported by this Resource",
        "items": {
          "enum": [
            "oic.if.ll",
            "oic.if.baseline"
          ],
          "type": "string",
          "maxLength": 64
        },
        "minItems": 2,
        "uniqueItems": true,
        "readOnly": true
      },
      "rts": {
        "description": "The list of allowable Resource Types in Links included in the Collection",
        "items": {
          "enum": ["oic.wk.scenecollection"],
          "type": "string",
          "maxLength": 64
        },
        "minItems": 1,
        "uniqueItems": true,
        "readOnly": true,
        "type": "array"
      },
      "rt": {
        "description": "Resource Type of the Resource",
        "items": {
          "enum": ["oic.wk.scenelist"],
          "type": "string",
          "maxLength": 64
        },
        "minItems": 1,
        "readOnly": true,
        "uniqueItems": true,
        "type": "array"
      }
    },
    "type": "object",
    "required": [
      "rt",
      "if",
      "links"
    ]
  },
  "slinks" : {
    "type" : "array",
    "items" : {
      "$ref": "#/definitions/oic.oic-link"
    }
  },
  "oic.oic-link": {
    "properties": {
      "if": {
        "description": "The OCF Interfaces supported by the Linked Resource",
        "items": {
          "enum": [
            "oic.if.ll",
            "oic.if.baseline"
          ],
          "type": "string",
          "maxLength": 64
        },
        "minItems": 1,
        "uniqueItems": true,
        "readOnly": true,
        "type": "array"
      },
      "rt": {
        "description": "The Resource Type of the Linked Resource",
        "items": {
          "enum": ["oic.wk.scenecollection"],
          "type": "string",
          "maxLength": 64
        },
        "minItems": 1,
```

```
          "uniqueItems": true,
          "readOnly": true,
          "type": "array"
        },
        "anchor": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/anchor"
        },
        "di": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/di"
        },
        "eps": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/eps"
        },
        "href": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/href"
        },
        "ins": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/ins"
        },
        "p": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/p"
        },
        "rel": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/rel_array"
        },
        "title": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/title"
        },
        "type": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/type"
        }
      },
      "required": [
        "href",
        "rt",
        "if"
      ],
      "type": "object"
    }
  }
}
```


A.7.5 Property definition

Table A.12 defines the Properties that are part of the "oic.wk.scenelist" Resource Type.

Table A.12 – The Property definitions of the Resource with type "rt" = "oic.wk.scenelist".

Property name	Value type	Mandatory	Access mode	Description
links	array: see schema	Yes	Read Write	A set of simple or individual OCF Links.
n	multiple types: see schema	No	Read Write	
id	multiple types: see schema	No	Read Write	
if	array: see schema	Yes	Read Only	The OCF Interfaces supported by this Resource
rts	array: see schema	No	Read Only	The list of allowable Resource Types in

				Links included in the Collection
rt	array: see schema	Yes	Read Only	Resource Type of the Resource
if	array: see schema	Yes	Read Only	The OCF Interfaces supported by the Linked Resource
rt	array: see schema	Yes	Read Only	The Resource Type of the Linked Resource
anchor	multiple types: see schema	No	Read Write	
di	multiple types: see schema	No	Read Write	
eps	multiple types: see schema	No	Read Write	
href	multiple types: see schema	Yes	Read Write	
ins	multiple types: see schema	No	Read Write	
p	multiple types: see schema	No	Read Write	
rel	multiple types: see schema	No	Read Write	
title	multiple types: see schema	No	Read Write	
type	multiple types: see schema	No	Read Write	

A.7.6 CRUDN behaviour

Table A.13 defines the CRUDN operations that are supported on the "oic.wk.scenelist" Resource Type.

Table A.13 – The CRUDN operations of the Resource with type "rt" = "oic.wk.scenelist".

Create	Read	Update	Delete	Notify
	get			observe

A.8 Scene Collection

A.8.1 Introduction

Collection that models a set of Scenes.
This Resource is a generic Collection Resource with additional Properties.
The rts value contains oic.scenemember Resource Types.
The additional Properties are
lastScene, this is the Scene Value last set by any Client
sceneValues, this is the list of available Scenes
lastScene shall be listed in sceneValues.

A.8.2 Example URI

/SceneCollectionResURI

A.8.3 Resource type

The Resource Type is defined as: "oic.wk.scenecollection".

A.8.4 OpenAPI 2.0 definition


```
{
  "swagger": "2.0",
  "info": {
    "title": "Scene Collection",
    "version": "2019-03-04",
    "license": {
      "name": "OCF Data Model License",
      "url": "https://openconnectivityfoundation.github.io/core/LICENSE.md",
      "x-copyright": "Copyright 2016-2019 Open Connectivity Foundation, Inc. All rights reserved."
    },
    "termsOfService": "https://openconnectivityfoundation.github.io/core/DISCLAIMER.md"
  },
  "schemes": [
    "http"
  ],
  "consumes": [
    "application/json"
  ],
  "produces": [
    "application/json"
  ],
  "paths": {
    "/SceneCollectionResURI?if=oic.if.ll" : {
      "get": {
        "description": "Collection that models a set of Scenes.\nThis Resource is a generic Collection
Resource with additional Properties.\nThe rts value contains oic.scenemember Resource Types.\nThe
additional Properties are\n  lastScene, this is the Scene Value last set by any Client\n  sceneValues,
this is the list of available Scenes\n  lastScene shall be listed in sceneValues.\n",
        "parameters": [
          {
            "$ref": "#/parameters/interface-all"
          }
        ],
        "responses": {
          "200": {
            "description" : "",
            "x-example": [
              {"href": "/scenemember1","rt": ["oic.wk.scenemember"],"if":["oic.if.baseline"]},
              {"href": "/scenemember2","rt": ["oic.wk.scenemember"],"if":["oic.if.baseline"]}
            ],
            "schema": {
              "$ref": "#/definitions/slinks"
            }
          }
        }
      }
    },
    "/SceneCollectionResURI?if=oic.if.baseline" : {
      "get": {
        "description": "Collection that models a set of Scenes.\nThis Resource is a generic Collection
Resource with additional Properties.\nThe rts value contains oic.scenemember Resource Types.\nThe
additional Properties are\n  lastScene, this is the Scene Value last set by any Client\n  sceneValues,
this is the list of available Scenes\n  lastScene shall be listed in sceneValues.\n",
        "parameters": [
          {
            "$ref": "#/parameters/interface-all"
          }
        ],
        "responses": {
          "200": {
            "description" : "",
            "x-example": {
              "lastScene": "off",
              "sceneValues": ["off","Reading","TVWatching"],
              "rt":       ["oic.wk.scenecollection"],
              "n":        "My Scenes for my living room",
              "rts":      ["oic.wk.scenemember"],
              "links": [
                {"href": "/scenemember1","rt": ["oic.wk.scenemember"],"if":["oic.if.baseline"]},
```

```
                {"href": "/scenemember2","rt": ["oic.wk.scenemember"],"if":["oic.if.baseline"]}
              ]
            },
            "schema": {
              "$ref": "#/definitions/SceneCollection"
            }
          }
        }
      },
      "post": {
        "description": "Provides the action to change the last set Scene selection.\nCalling this
method shall update all Scene Members to the prescribed membervalue.\nWhen this method is called with
the same value as the current lastScene value\nthen all Scene Members shall be updated.\n",
        "parameters": [
          {
            "$ref": "#/parameters/interface-update"
          },
          {
            "name": "body",
            "in": "body",
            "required": true,
            "schema": {
              "$ref": "#/definitions/SceneCollectionUpdate"
            },
            "x-example": {
              "lastScene": "Reading"
            }
          }
        ],
        "responses": {
          "200": {
            "description" : "Indicates that the value is changed.\nThe changed Properties are provided
in the response.\n",
            "x-example": {
              "lastScene": "Reading"
            },
            "schema": {
              "$ref": "#/definitions/SceneCollectionUpdate"
            }
          }
        }
      }
    }
  },
  "parameters": {
    "interface-update" : {
      "in" : "query",
      "name" : "if",
      "type" : "string",
      "enum" : ["oic.if.a"]
    },
    "interface-all" : {
      "in" : "query",
      "name" : "if",
      "type" : "string",
      "enum" : ["oic.if.ll", "oic.if.baseline"]
    }
  },
  "definitions": {
    "SceneCollection": {
      "properties": {
        "rt": {
          "description": "Resource Type of the Resource",
          "items": {
            "enum": ["oic.wk.scenecollection"],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "readOnly": true,
          "uniqueItems": true,
          "type": "array"
        },
        "lastScene": {
          "description": "Last selected Scene from the set of sceneValues",
          "type": "string"
        },
```

```
        "links": {
          "description": "A set of simple or individual OCF Links.",
          "items": {
            "$ref": "#/definitions/oic.oic-link"
          },
          "type": "array"
        },
        "sceneValues": {
          "description": "All available Scene Values",
          "items": {
            "type": "string"
          },
          "readOnly": true,
          "type": "array"
        },
        "n": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "id": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/id"
        },
        "rts": {
          "description": "Resource Type of the Resources within the Collection",
          "items": {
            "enum": ["oic.wk.scenemember"],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "readOnly": true,
          "uniqueItems": true,
          "type": "array"
        },
        "if" : {
          "description": "The OCF Interfaces supported by this Resource",
          "items": {
            "enum": [
              "oic.if.ll",
              "oic.if.baseline",
              "oic.if.a"
            ],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "uniqueItems": true,
          "readOnly": true,
          "type": "array"
        }
      },
      "type" : "object"
    },
    "SceneCollectionUpdate": {
      "properties": {
        "lastScene": {
          "description": "Last selected Scene from the set of sceneValues",
          "type": "string"
        }
      },
      "type" : "object"
    },
    "slinks" : {
      "type" : "array",
      "items" : {
        "$ref": "#/definitions/oic.oic-link"
      }
    },
    "oic.oic-link": {
      "type": "object",
      "properties": {
        "if": {
          "description": "The OCF Interfaces supported by the Linked Resource",
          "items": {
```

```
            "enum": [
              "oic.if.baseline"
            ],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "uniqueItems": true,
          "readOnly": true,
          "type": "array"
        },
        "rt": {
          "description": "Resource Type of the Linked Resource",
          "items": {
            "enum": ["oic.wk.scenemember"],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "uniqueItems": true,
          "readOnly": true,
          "type": "array"
        },
        "anchor": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/anchor"
        },
        "di": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/di"
        },
        "eps": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/eps"
        },
        "href": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/href"
        },
        "ins": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/ins"
        },
        "p": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/p"
        },
        "rel": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/rel_array"
        },
        "title": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/title"
        },
        "type": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/type"
        }
      },
      "required": [
        "href",
        "rt",
        "if"
      ]
    }
  }
}
```


A.8.5 Property definition

Table A.14 defines the Properties that are part of the "oic.wk.scenecollection" Resource Type.

Table A.14 – The Property definitions of the Resource with type "rt" = "oic.wk.scenecollection".

Property name	Value type	Mandatory	Access mode	Description
rt	array: see schema		Read Only	Resource Type of the Resource
lastScene	string		Read Write	Last selected Scene from the set of sceneValues
links	array: see schema		Read Write	A set of simple or individual OCF Links.
sceneValues	array: see schema		Read Only	All available Scene Values
n	multiple types: see schema		Read Write	
id	multiple types: see schema		Read Write	
rts	array: see schema		Read Only	Resource Type of the Resources within the Collection
if	array: see schema		Read Only	The OCF Interfaces supported by this Resource
lastScene	string		Read Write	Last selected Scene from the set of sceneValues
if	array: see schema	Yes	Read Only	The OCF Interfaces supported by the Linked Resource
rt	array: see schema	Yes	Read Only	Resource Type of the Linked Resource
anchor	multiple types: see schema	No	Read Write	
di	multiple types: see schema	No	Read Write	
eps	multiple types: see schema	No	Read Write	
href	multiple types: see schema	Yes	Read Write	
ins	multiple types: see schema	No	Read Write	
p	multiple types: see schema	No	Read Write	
rel	multiple types: see schema	No	Read Write	
title	multiple types: see schema	No	Read Write	
type	multiple types: see schema	No	Read Write	

A.8.6 CRUDN behaviour

Table A.15 defines the CRUDN operations that are supported on the "oic.wk.scenecollection" Resource Type.

Table A.15 – The CRUDN operations of the Resource with type "rt" = "oic.wk.scenecollection".

Create	Read	Update	Delete	Notify
	get	post		observe

A.9 Scene Member

A.9.1 Introduction

Single Link that models a Scene Member.

A.9.2 Example URI

/SceneMemberResURI

A.9.3 Resource type

The Resource Type is defined as: "oic.wk.scenemember".

A.9.4 OpenAPI 2.0 definition

```
{
  "swagger": "2.0",
  "info": {
    "title": "Scene Member",
    "version": "2019-03-04",
    "license": {
      "name": "OCF Data Model License",
      "url": "https://openconnectivityfoundation.github.io/core/LICENSE.md",
      "x-copyright": "Copyright 2016-2019 Open Connectivity Foundation, Inc. All rights reserved."
    },
    "termsOfService": "https://openconnectivityfoundation.github.io/core/DISCLAIMER.md"
  },
  "schemes": [
    "http"
  ],
  "consumes": [
    "application/json"
  ],
  "produces": [
    "application/json"
  ],
  "paths": {
    "/SceneMemberResURI" :{
      "get": {
        "description": "Single Link that models a Scene Member.\n",
        "parameters": [
          {
            "$ref": "#/parameters/interface-baseline"
          }
        ],
        "responses": {
          "200": {
            "description" : "",
            "x-example": {
              "rt": ["oic.wk.scenemember"],
              "id": "0685B960-FFFF-46F7-BEC0-9E6234671ADC1",
              "n": "my binary switch (for light bulb) mappings",
              "if": ["oic.if.baseline"],
              "link": {
                "href": "binarySwitch",
                "rt":   ["oic.r.switch.binary"],
                "if":   ["oic.if.a", "oic.if.baseline"],
                "eps": [
                  {"ep": "coap://[fe80::b1d6]:1111", "pri": 2},
                  {"ep": "coaps://[fe80::b1d6]:1122"},
                  {"ep": "coap+tcp://[2001:db8:a::123]:2222", "pri": 3}
                ]
```

```
            },
            "SceneMappings": [
              {
                "scene":           "off",
                "memberProperty":  "value",
                "memberValue":     "true"
              },
              {
                "scene":           "Reading",
                "memberProperty":  "value",
                "memberValue":     "false"
              },
              {
                "scene":           "TVWatching",
                "memberProperty":  "value",
                "memberValue":     "true"
              }
            ]
          },
          "schema": {
            "$ref": "#/definitions/SceneMember"
          }
        }
      }
    }
  }
},
"parameters": {
  "interface-baseline" : {
    "in" : "query",
    "name" : "if",
    "type" : "string",
    "enum" : ["oic.if.baseline"]
  }
},
"definitions": {
  "SceneMember": {
    "properties": {
      "rt": {
        "description": "Resource Type of the Resource",
        "items": {
          "enum": ["oic.wk.scenemember"],
          "type": "string",
          "maxLength": 64
        },
        "minItems": 1,
        "readOnly": true,
        "uniqueItems": true,
        "type": "array"
      },
      "SceneMappings": {
        "description": "Array of mappings per Scene, can be one(1)",
        "items": {
          "properties": {
            "memberProperty": {
              "description": "Property name that will be mapped",
              "readOnly": true,
              "type": "string"
            },
            "memberValue": {
              "description": "Value of the Member Property",
              "readOnly": true,
              "type": "string"
            },
            "scene": {
              "description": "Specifies a Scene Value that will be acted upon",
              "type": "string"
            }
          },
          "required": [
            "scene",
            "memberProperty",
            "memberValue"
          ],
          "type": "object"
        },
        "type": "array"
```

```
        },
        "n": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "id": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/id"
        },
        "link": {
          "$ref": "#/definitions/oic.oic-link"
        },
        "if": {
          "description": "The OCF Interfaces supported by this Resource",
          "items": {
            "enum": [
              "oic.if.baseline"
            ],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "readOnly": true,
          "uniqueItems": true,
          "type": "array"
        }
      },
      "type" : "object",
      "required": [
        "rt",
        "if",
        "SceneMappings"
      ]
    },
    "oic.oic-link": {
      "properties": {
        "if": {
          "description": "The OCF Interfaces supported by the target Resource",
          "items": {
            "enum": [
              "oic.if.baseline",
              "oic.if.ll",
              "oic.if.b",
              "oic.if.lb",
              "oic.if.rw",
              "oic.if.r",
              "oic.if.a",
              "oic.if.s"
            ],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "uniqueItems": true,
          "readOnly": true,
          "type": "array"
        },
        "rt": {
          "description": "Resource Type of the target Resource",
          "items": {
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "readOnly": true,
          "uniqueItems": true,
          "type": "array"
        },
        "anchor": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/anchor"
        },
        "di": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/di"
```

```
        },
        "eps": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/eps"
        },
        "href": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/href"
        },
        "ins": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/ins"
        },
        "p": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/p"
        },
        "rel": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/rel_array"
        },
        "title": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/title"
        },
        "type": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/type"
        }
      },
      "required": [
        "href",
        "rt",
        "if"
      ],
      "type": "object"
    }
  }
}
```


A.9.5 Property definition

Table A.16 defines the Properties that are part of the "oic.wk.scenemember" Resource Type.

Table A.16 – The Property definitions of the Resource with type "rt" = "oic.wk.scenemember".

Property name	Value type	Mandatory	Access mode	Description
rt	array: see schema	Yes	Read Only	Resource Type of the Resource
SceneMappings	array: see schema	Yes	Read Write	Array of mappings per Scene, can be one(1)
n	multiple types: see schema	No	Read Write	
id	multiple types: see schema	No	Read Write	
link	multiple types: see schema	No	Read Write	
if	array: see schema	Yes	Read Only	The OCF Interfaces supported by this Resource
if	array: see schema	Yes	Read Only	The OCF Interfaces supported by the target Resource
rt	array: see schema	Yes	Read Only	Resource Type of the target Resource

anchor	multiple types: see schema	No	Read Write	
di	multiple types: see schema	No	Read Write	
eps	multiple types: see schema	No	Read Write	
href	multiple types: see schema	Yes	Read Write	
ins	multiple types: see schema	No	Read Write	
p	multiple types: see schema	No	Read Write	
rel	multiple types: see schema	No	Read Write	
title	multiple types: see schema	No	Read Write	
type	multiple types: see schema	No	Read Write	

A.9.6 CRUDN behaviour

Table A.17 defines the CRUDN operations that are supported on the "oic.wk.scenemember" Resource Type.

Table A.17 – The CRUDN operations of the Resource with type "rt" = "oic.wk.scenemember".

Create	Read	Update	Delete	Notify
	get			observe

A.10 Alert

A.10.1 Introduction

This Resource provides a mechanism for a Server to expose information to an interested party with regard to error or other conditions that the Device is experiencing (Alerts).
category is a string that contains the Device defined category for the Alert.
timestamp is an RFC3339 formatted time at which the Alert was generated.
originatorid is a string that contains the identity of the originator of the Alert.
severity is an integer that contains the RFC5424 defined severity of the Alert.
subject is an array containing human readable text in one or more languages.
accountid is a string containing the identity of the account with which the Device is associated.

A.10.2 Example URI

/AlertResURI

A.10.3 Resource type

The Resource Type is defined as: "oic.r.alert".

A.10.4 OpenAPI 2.0 definition

```
{
  "swagger": "2.0",
  "info": {
    "title": "Alert",
    "version": "2019-02-28",
```



```
    "license": {
      "name": "OCF Data Model License",
      "url": "https://openconnectivityfoundation.github.io/core/LICENSE.md",
      "x-copyright": "Copyright 2019 Open Connectivity Foundation, Inc. All rights reserved."
    },
    "termsOfService": "https://openconnectivityfoundation.github.io/core/DISCLAIMER.md"
  },
  "schemes": ["http"],
  "consumes": ["application/json"],
  "produces": ["application/json"],
  "paths": {
    "/AlertResURI" : {
      "get": {
        "description": "This Resource provides a mechanism for a Server to expose information to
an\ninterested party with regard to error or other conditions that the Device is experiencing
(Alerts).\ncategory is a string that contains the Device defined category for the Alert.\ntimestamp is
an RFC3339 formatted time at which the Alert was generated.\noriginatorid is a string that contains the
identity of the originator of the Alert.\nseverity is an integer that contains the RFC5424 defined
severity of the Alert.\nsubject is an array containing human readable text in one or more
languages.\naccountid is a string containing the identity of the account with which the Device is
associated.\n",
        "parameters": [
          {"$ref": "#/parameters/interface"}
        ],
        "responses": {
            "200": {
              "description" : "",
              "x-example":
                {
                  "rt":           ["oic.r.alert"],
                  "accountid":    "MyAccountID",
                  "category":     "MyCategory",
                  "timestamp":    "2018-02-28T08:00:00Z",
                  "originatorid": "MyOriginatorID",
                  "severity":     3,
                  "subject":      [{"language":"en-US","value":"System error"}]
                },
              "schema": { "$ref": "#/definitions/Alert" }
            }
        }
      }
    }
  },
  "parameters": {
    "interface" : {
      "in" : "query",
      "name" : "if",
      "type" : "string",
      "enum" : ["oic.if.r", "oic.if.baseline"]
    }
  },
  "definitions": {
    "Alert" : {
      "properties": {
        "category": {
          "description": "Category into which the notification is classified",
          "maxLength": 64,
          "readOnly": true,
          "type": "string"
        },
        "rt": {
          "description": "Resource Type",
          "items": {
            "maxLength": 64,
            "type": "string",
            "enum": ["oic.r.alert"]
          },
          "minItems": 1,
          "readOnly": true,
          "uniqueItems": true,
          "type": "array"
        },
        "severity": {
          "description": "RFC 5424 severity of the alert",
          "maximum": 7,
          "minimum": 0,
          "readOnly": true,
```

```
          "type": "integer"
        },
        "timestamp": {
          "description": "An RFC3339 formated time indicating when the data was observed (e.g.: 2016-
02-15T09:19Z, 1996-12-19T16:39:57-08:00)",
          "format": "date-time",
          "readOnly": true,
          "type": "string"
        },
        "subject": {
          "description": "Alert subject matter.",
          "items": {
            "properties": {
              "language": {
                "allOf": [
                  {
                    "description": "An identifier formatted according to IETF RFC 5646 (language
tag).",
                    "pattern": "^[A-Za-z]{1,8}(-[A-Za-z0-9]{1,8})*$",
                    "type": "string"
                  },
                  {
                    "description": "An RFC 5646 language tag.",
                    "readOnly": true
                  }
                ]
              },
              "value": {
                "description": "Alert subject matter in the indicated language.",
                "maxLength": 255,
                "readOnly": true,
                "type": "string"
              }
            },
            "type": "object"
          },
          "minItems": 1,
          "readOnly": true,
          "type": "array"
        },
        "originatorid": {
          "description": "ID of the creator of the event",
          "maxLength": 64,
          "readOnly": true,
          "type": "string"
        },
        "n": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "id": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/id"
        },
        "accountid": {
          "description": "ID of the account",
          "maxLength": 64,
          "readOnly": true,
          "type": "string"
        },
        "if": {
          "description": "The OCF Interfaces supported by this Resource",
          "items": {
            "enum": [
              "oic.if.r",
              "oic.if.baseline"
            ],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 2,
          "readOnly": true,
          "uniqueItems": true,
          "type": "array"
        }
```

```
      },
      "type" : "object",
      "required": ["category", "timestamp", "originatorid", "severity"]
    }
  }
}
```

A.10.5 Property definition

Table A.18 defines the Properties that are part of the "oic.r.alert" Resource Type.

Table A.18 – The Property definitions of the Resource with type "rt" = "oic.r.alert".

Property name	Value type	Mandatory	Access mode	Description
category	string	Yes	Read Only	Category into which the notification is classified
rt	array: see schema	No	Read Only	Resource Type
severity	integer	Yes	Read Only	RFC 5424 severity of the alert
timestamp	string	Yes	Read Only	An RFC3339 formated time indicating when the data was observed (e.g.: 2016-02-15T09:19Z, 1996-12-19T16:39:57-08:00)
subject	array: see schema	No	Read Only	Alert subject matter.
originatorid	string	Yes	Read Only	ID of the creator of the event
n	multiple types: see schema	No	Read Write	
id	multiple types: see schema	No	Read Write	
accountid	string	No	Read Only	ID of the account
if	array: see schema	No	Read Only	The OCF Interfaces supported by this Resource

A.10.6 CRUDN behaviour

Table A.19 defines the CRUDN operations that are supported on the "oic.r.alert" Resource Type.

Table A.19 – The CRUDN operations of the Resource with type "rt" = "oic.r.alert".

Create	Read	Update	Delete	Notify
	get			observe

A.11 Alert Collection

A.11.1 Introduction

This Resource is a Collection containing instances of Alerts (oic.r.alert).
This is the response using the baseline interface.

A.11.2 Example URI

/AlertCollectionResURI

A.11.3 Resource type

The Resource Type is defined as: "oic.r.alertcollection".

A.11.4 OpenAPI 2.0 definition

```
{
  "swagger": "2.0",
  "info": {
    "title": "Alert Collection",
    "version": "2019-03-04",
    "license": {
      "name": "OCF Data Model License",
      "url": "https://openconnectivityfoundation.github.io/core/LICENSE.md",
      "x-copyright": "Copyright 2019 Open Connectivity Foundation, Inc. All rights reserved."
    },
    "termsOfService": "https://openconnectivityfoundation.github.io/core/DISCLAIMER.md"
  },
  "schemes": ["http"],
  "consumes": ["application/json"],
  "produces": ["application/json"],
  "paths": {
    "/AlertCollectionResURI?if=oic.if.ll" : {
      "get": {
        "description": "This Resource is a Collection containing instances of Alerts
(oic.r.alert).\nThis is the response using the links list OCF Interface.\n",
        "parameters": [
          {"$ref": "#/parameters/interface-all"}
        ],
        "responses": {
          "200": {
            "description" : "",
            "x-example": [
              {"href": "/myAlert1ResURI", "rt": ["oic.r.alert"], "if": ["oic.if.r","oic.if.baseline"],
"eps": [{"ep": "coaps://[fe80::b1d6]:1122"}]},
              {"href": "/myAlert2ResURI", "rt": ["oic.r.alert"], "if": ["oic.if.r","oic.if.baseline"],
"eps": [{"ep": "coaps://[fe80::b1d6]:1122"}]},
              {"href": "/myAlert3ResURI", "rt": ["oic.r.alert"], "if": ["oic.if.r","oic.if.baseline"],
"eps": [{"ep": "coaps://[fe80::b1d6]:1122"}]},
              {"href": "/myAlert4ResURI", "rt": ["oic.r.alert"], "if": ["oic.if.r","oic.if.baseline"],
"eps": [{"ep": "coaps://[fe80::b1d6]:1122"}]}
            ],
            "schema": { "$ref": "#/definitions/AlertCollection-ll" }
          }
        }
      }
    },
    "/AlertCollectionResURI?if=oic.if.b" : {
      "get": {
        "description": "This Resource is a Collection containing instances of Alerts
(oic.r.alert).\nThis is the response using the Batch interface.\n",
        "parameters": [
          {"$ref": "#/parameters/interface-all"}
        ],
        "responses": {
          "200": {
            "description" : "",
            "x-example": [
              {
                "href": "/Alert1ResURI",
                "rep":{
                  "rt":           ["oic.r.alert"],
                  "accountid":    "MyAccountID",
                  "category":     "MyCategory",
                  "timestamp":    "2018-02-28T08:00:00Z",
                  "originatorid": "MyOriginatorID",
                  "severity": 3,
                  "subject": [{"language":"en-US","value":"System error"}]
                }
              },
```

```
              {
                "href": "/Alert2ResURI",
                "rep":{
                  "rt":           ["oic.r.alert"],
                  "accountid":    "MyAccountID",
                  "category":     "MyCategory",
                  "timestamp":    "2018-02-28T08:15:00Z",
                  "originatorid": "MyOriginatorID",
                  "severity": 4,
                  "subject": [{"language":"en-US","value":"Network error"}]
                }
              }
            ],
            "schema": { "$ref": "#/definitions/AlertCollection-b" }
          }
        }
      }
    },
    "/AlertCollectionResURI?if=oic.if.baseline" : {
      "get": {
        "description": "This Resource is a Collection containing instances of Alerts
(oic.r.alert).\nThis is the response using the baseline interface.\n",
        "parameters": [
          {"$ref": "#/parameters/interface-all"}
        ],
        "responses": {
          "200": {
            "description" : "",
            "x-example": {
              "rt":    ["oic.r.alertcollection"],
              "rts":   ["oic.r.alert"],
              "if":    ["oic.if.ll", "oic.if.b", "oic.if.baseline"],
              "links": [
                {"href": "/myAlert1ResURI", "rt": ["oic.r.alert"], "if":
["oic.if.r","oic.if.baseline"], "eps": [{"ep": "coaps://[fe80::b1d6]:1122"}]},
                {"href": "/myAlert2ResURI", "rt": ["oic.r.alert"], "if":
["oic.if.r","oic.if.baseline"], "eps": [{"ep": "coaps://[fe80::b1d6]:1122"}]},
                {"href": "/myAlert3ResURI", "rt": ["oic.r.alert"], "if":
["oic.if.r","oic.if.baseline"], "eps": [{"ep": "coaps://[fe80::b1d6]:1122"}]},
                {"href": "/myAlert4ResURI", "rt": ["oic.r.alert"], "if":
["oic.if.r","oic.if.baseline"], "eps": [{"ep": "coaps://[fe80::b1d6]:1122"}]}
              ]
            },
            "schema": { "$ref": "#/definitions/AlertCollection-baseline" }
          }
        }
      }
    }
  },
  "parameters": {
    "interface-all" : {
      "in" : "query",
      "name" : "if",
      "type" : "string",
      "enum" : ["oic.if.ll", "oic.if.b", "oic.if.baseline"]
    }
  },
  "definitions": {
    "AlertCollection-b" : {
      "type": "array",
      "minItems": 0,
      "uniqueItems": true,
      "items": {
        "type": "object",
        "additionalProperties": true,
        "properties": {
          "href": {
            "$ref":
"https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/href"
          },
          "rep": {
            "$ref":
"http://openconnectivityfoundation.github.io/core/swagger2.0/oic.r.alert.swagger.json#/definitions/Aler
t"
          }
        },
```

```
        "required": [
          "href",
          "rep"
        ]
      }
    },
    "AlertCollection-baseline" : {
      "properties": {
        "n": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "id": {
          "$ref" :
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/id"
        },
        "rt": {
          "items": {
            "type": "string",
            "enum": ["oic.r.alertcollection"],
            "maxLength": 64
          },
          "minItems": 1,
          "type": "array",
          "uniqueItems": true,
          "readOnly": true
        },
        "rts": {
          "items": {
            "type": "string",
            "enum": ["oic.r.alert"],
            "maxLength": 64
          },
          "minItems": 1,
          "type": "array",
          "uniqueItems": true,
          "readOnly": true
        },
        "if": {
          "description": "The OCF Interfaces supported by this Resource",
          "items": {
            "enum": [
              "oic.if.ll",
              "oic.if.b",
              "oic.if.baseline"
            ],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 3,
          "readOnly": true,
          "uniqueItems": true,
          "type": "array"
        },
        "links": {
          "description": "A set of simple or individual Links.",
          "items": {
            "$ref": "#/definitions/oic.oic-link"
          },
          "type": "array"
        }
      },
      "type" : "object",
      "required": ["rt","rts","if","links"]
    },
    "AlertCollection-ll" : {
      "type": "array",
      "items": {
        "$ref": "#/definitions/oic.oic-link"
      }
    },
    "oic.oic-link": {
      "type": "object",
      "properties": {
        "anchor": {
```

```
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/anchor"
        },
        "di": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/di"
        },
        "eps": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/eps"
        },
        "href": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/href"
        },
        "ins": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/ins"
        },
        "p": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/p"
        },
        "rel": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/rel_array"
        },
        "title": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/title"
        },
        "type": {
          "$ref": "https://openconnectivityfoundation.github.io/core/schemas/oic.links.properties.core-
schema.json#/definitions/type"
        },
        "if": {
          "description": "The OCF Interfaces supported by the target Resource",
          "items": {
            "enum": [
              "oic.if.r",
              "oic.if.baseline"
            ],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 2,
          "uniqueItems": true,
          "type": "array",
          "readOnly": true
        },
        "rt": {
          "description": "Resource Type of the target Resource",
          "items": {
            "maxLength": 64,
            "type": "string",
            "enum": ["oic.r.alert"]
          },
          "minItems": 1,
          "type": "array",
          "uniqueItems": true,
          "readOnly": true
        }
      },
      "required": [
        "href",
        "rt",
        "if"
      ]
    }
  }
}
```


A.11.5 Property definition

Table A.20 defines the Properties that are part of the "oic.r.alertcollection" Resource Type.

Table A.20 – The Property definitions of the Resource with type "rt" = "oic.r.alertcollection".

Property name	Value type	Mandatory	Access mode	Description
href	multiple types: see schema	Yes	Read Write	
rep	multiple types: see schema	Yes	Read Write	
n	multiple types: see schema	No	Read Write	
id	multiple types: see schema	No	Read Write	
rt	array: see schema	Yes	Read Only	
rts	array: see schema	Yes	Read Only	
if	array: see schema	Yes	Read Only	The OCF Interfaces supported by this Resource
links	array: see schema	Yes	Read Write	A set of simple or individual Links.
anchor	multiple types: see schema	No	Read Write	
di	multiple types: see schema	No	Read Write	
eps	multiple types: see schema	No	Read Write	
href	multiple types: see schema	Yes	Read Write	
ins	multiple types: see schema	No	Read Write	
p	multiple types: see schema	No	Read Write	
rel	multiple types: see schema	No	Read Write	
title	multiple types: see schema	No	Read Write	
type	multiple types: see schema	No	Read Write	
if	array: see schema	Yes	Read Only	The OCF Interfaces supported by the target Resource
rt	array: see schema	Yes	Read Only	Resource Type of the target Resource

A.11.6 CRUDN behaviour

Table A.21 defines the CRUDN operations that are supported on the "oic.r.alertcollection" Resource Type.

Table A.21 – The CRUDN operations of the Resource with type "rt" = "oic.r.alertcollection".

Create	Read	Update	Delete	Notify
	get			observe

A.12 software update

A.12.1 Introduction

The Resource performing scheduled software update.

A.12.2 Example URI

/softwareupdateResURI

A.12.3 Resource type

The Resource Type is defined as: "oic.r.softwareupdate".

A.12.4 OpenAPI 2.0 definition

```
{
  "swagger": "2.0",
  "info": {
    "title": "software update",
    "version": "20190408",
    "license": {
      "name": "OCF Data Model License",
      "url":
"https://github.com/openconnectivityfoundation/core/blob/e28a9e0a92e17042ba3e83661e4c0fbce8bdc4ba/LICEN
SE.md",
      "x-copyright": "Copyright 2019 Open Connectivity Foundation, Inc. All rights reserved."
    },
    "termsOfService": "https://openconnectivityfoundation.github.io/core/DISCLAIMER.md"
  },
  "schemes": ["http"],
  "consumes": ["application/json"],
  "produces": ["application/json"],
  "paths": {
    "/softwareupdateResURI" : {
      "get": {
        "description": "The Resource performing scheduled software update.",
        "parameters": [
          {"$ref": "#/parameters/interface"}
        ],
        "responses": {
            "200": {
              "description" : "Schedule an software update.",
              "x-example":
                {
                  "rt": ["oic.r.softwareupdate"],
                  "if": ["oic.if.rw", "oic.if.baseline"],
                  "nv" : "my version",
                  "purl": "https://myvendor/myexampleurl",
                  "swupdateaction": "idle",
                  "swupdatestate" : "idle",
                  "swupdateresult" : 0,
                  "lastupdate" : "2015-01-09T14:30:00Z",
                  "signed" : "vendor",
                  "updatetime" : "2015-01-09T14:30:00Z"
                },
              "schema": { "$ref": "#/definitions/swupdate" }
            }
        }
      },
      "post": {
        "description": "Mechanism to schedule a start of the software update.",
        "parameters": [
          {"$ref": "#/parameters/interface"},
          {
            "name": "body",
            "in": "body",
            "required": true,
            "schema": { "$ref": "#/definitions/swupdate-update" },
            "x-example":
              {
                  "purl":  "https://myvendor/newversion",
```

```
                "swupdateaction": "upgrade",
                "updatetime" : "2030-01-09T14:30:00Z"
            }
          }
        ],
        "responses": {
            "200": {
              "description" : "",
              "x-example":
                {
                  "nv" : "my new version",
                  "purl":  "https://myvendor/myexampleurl",
                  "swupdateaction": "upgrade",
                  "swupdatestate" : "idle",
                  "swupdateresult" : 0,
                  "lastupdate" : "2015-01-09T14:30:00Z",
                  "signed" : "vendor",
                  "updatetime" : "2030-01-09T14:30:00Z"
                },
                "schema": { "$ref": "#/definitions/swupdate" }
            }
        }
      }
    }
  },
  "parameters": {
    "interface": {
      "in": "query",
      "name": "if",
      "type": "string",
      "enum": ["oic.if.rw", "oic.if.baseline"]
    }
  },
  "definitions": {
    "swupdate": {
      "properties": {
        "rt": {
          "items": {
            "enum": [
              "oic.r.softwareupdate"
            ],
            "type": "string",
            "maxLength": 64
          },
          "minItems": 1,
          "type": "array",
          "readOnly": true,
          "uniqueItems": true
        },
        "nv": {
          "description": "New available Software version",
          "maxLength": 64,
          "type": "string",
          "readOnly" : true
        },
        "purl": {
          "description": "Source of the software package, might be a HTTPS or CoAPs URL",
          "maxLength": 64,
          "type": "string",
          "format": "uri"
        },
        "swupdateaction": {
          "description": "Scheduled action to do a software update",
          "maxLength": 64,
          "type": "string",
          "enum": [
              "idle",
              "isac",
              "isvv",
              "upgrade"
            ]
        },
        "swupdatestate": {
          "description": "State of the software update",
          "readOnly": true,
          "type": "string",
          "enum": [
```

```
              "idle",
              "nsa",
              "svv",
              "sva",
              "upgrading"
            ]
        },
        "swupdateresult": {
          "description": "Result of the software update, list of result codes",
          "readOnly": true,
          "type": "integer"
        },
        "lastupdate": {
          "description": "Time of the last software update (in RFC3339 format), Initial set on date of
manufacturing",
          "readOnly": true,
          "maxLength": 64,
          "type": "string",
          "format": "date-time"
        },
        "signed": {
          "description": "Signage method of the software package, currently the only allowed value is
'vendor'.",
          "readOnly": true,
          "type": "string",
          "enum": [
              "vendor"
            ]
        },
        "updatetime": {
          "description": "Scheduled time (in RFC3339 format) to do action which is specified in
'swupdateaction' Property.",
          "maxLength": 64,
          "type": "string",
          "format": "date-time"
        },
        "n": {
          "$ref":
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/n"
        },
        "id": {
          "$ref":
"https://openconnectivityfoundation.github.io/core/schemas/oic.common.properties.core-
schema.json#/definitions/id"
        },
        "if": {
          "description": "The interface set supported by this resource",
          "items": {
            "enum": [
              "oic.if.rw",
              "oic.if.baseline"
            ],
            "type": "string"
          },
          "minItems": 2,
          "maxItems": 2,
          "type": "array",
          "readOnly": true,
          "uniqueItems": true
        }
      },
      "required": ["purl", "swupdateaction", "swupdatestate", "swupdateresult", "updatetime"]
    },
    "swupdate-update": {
      "properties": {
        "purl": {
          "$ref": "#/definitions/swupdate/properties/purl"
        },
        "swupdateaction" : {
          "$ref": "#/definitions/swupdate/properties/swupdateaction"
        },
        "updatetime": {
          "$ref": "#/definitions/swupdate/properties/updatetime"
        }
      },
      "required": ["purl", "swupdateaction", "updatetime"]
```

```
      }
    }
}
```

A.12.5 Property definition

Table A.22 defines the Properties that are part of the "oic.r.softwareupdate" Resource Type.

Table A.22 – The Property definitions of the Resource with type "rt" = "oic.r.softwareupdate".

Property name	Value type	Mandatory	Access mode	Description
rt	array: see schema	No	Read Only	
nv	string	No	Read Only	New available Software version
purl	string	Yes	Read Write	Source of the software package, might be a HTTPS or CoAPs URL
swupdateaction	string	Yes	Read Write	Scheduled action to do a software update
swupdatestate	string	Yes	Read Only	State of the software update
swupdateresult	integer	Yes	Read Only	Result of the software update, list of result codes
lastupdate	string	No	Read Only	Time of the last software update (in RFC3339 format), Initial set on date of manufacturing
signed	string	No	Read Only	Signage method of the software package, currently the only allowed value is 'vendor'.
updatetime	string	Yes	Read Write	Scheduled time (in RFC3339 format) to do action which is specified in 'swupdateaction' Property.
n	multiple types: see schema	No	Read Write	
id	multiple types: see schema	No	Read Write	
if	array: see schema	No	Read Only	The interface set supported by this resource
purl	multiple types: see schema	Yes	Read Write	
swupdateaction	multiple types: see schema	Yes	Read Write	
updatetime	multiple types: see schema	Yes	Read Write	

A.12.6 CRUDN behaviour

Table A.23 defines the CRUDN operations that are supported on the "oic.r.softwareupdate" Resource Type.

Table A.23 – The CRUDN operations of the Resource with type "rt" = "oic.r.softwareupdate".

Create	Read	Update	Delete	Notify
	get	post		observe

A.13 OCF Rule

A.13.1 Introduction

A Rule is a Collection made up of 3 Links:
- A Link to an instance of a Collection of Rule Inputs.
- A Link to a Rule Expression (the logic of the Rule).
- A Link to a Collection of Rule Actions.

A.13.2 Example URI

/RuleResURI

A.13.3 Resource type

The Resource Type is defined as: "oic.r.rule".

A.13.4 OpenAPI 2.0 definition

```
{
  "swagger": "2.0",
  "info": {
    "title": "OCF Rule",
    "version": "20190910",
    "license": {
      "name": "OCF Data Model License",
      "url":
"https://github.com/openconnectivityfoundation/core/blob/e28a9e0a92e17042ba3e83661e4c0fbce8bdc4ba/LICEN
SE.md",
      "x-copyright": "copyright 2019 Open Connectivity Foundation, Inc. All rights reserved."
    },
    "termsOfService": "https://openconnectivityfoundation.github.io/core/DISCLAIMER.md"
  },
  "schemes": ["http"],
  "consumes": ["application/json"],
  "produces": ["application/json"],
  "paths": {
    "/RuleResURI?if=oic.if.ll": {
      "get": {
        "description": "A Rule is a Collection made up of 3 Links. \n A Link to an instance of a
Collection of Rule Inputs. \n A Link to a Rule Expression (the logic of the Rule). \n A Link to a
Collection of Rule Actions.",
        "parameters": [
          {"$ref": "#/parameters/interface-all"}
        ],
        "responses": {
          "200": {
            "description" : "Retrieves the rule as Links List.",
            "x-example":
            [
              {
                "href": "/ruleinputcollection",
                "rt":   ["oic.r.rule.inputcollection"],
                "if":   ["oic.if.ll","oic.if.baseline"],
                "p":    {"bm": 3},
                "eps": [
                    {"ep": "coaps://[fe80::b1d6]:1111"}
                ]
              },
              {
                "href": "/ruleexpression",
                "rt":   ["oic.r.rule.expression"],
                "if":   ["oic.if.rw","oic.if.baseline"],
```

```
                "p":    {"bm": 3},
                "eps": [
                    {"ep": "coaps://[fe80::b1d6]:1111"}
                ]
              },
              {
                "href": "/ruleactioncollection",
                "rt":   ["oic.r.rule.actioncollection"],
                "if":   ["oic.if.ll","oic.if.baseline"],
                "p":    {"bm": 3},
                "eps": [
                    {"ep": "coap://[fe80::b1d6]:1111"}
                ]
              }
            ],
            "schema": { "$ref": "#/definitions/slinklist" }
          }
        }
      }
    },
    "/RuleResURI?if=oic.if.baseline": {
      "get": {
        "description": "A Rule is a Collection made up of 3 Links: \n- A Link to an instance of a
Collection of Rule Inputs. \n- A Link to a Rule Expression (the logic of the Rule). \n- A Link to a
Collection of Rule Actions.",
        "parameters": [
          {"$ref": "#/parameters/interface-all"}
        ],
        "responses": {
          "200": {
            "description" : "Retrieves the baseline response for the rule.",
            "x-example":
            {
              "rt": ["oic.r.rule"],
              "if": ["oic.if.ll","oic.if.baseline"],
              "rts":
["oic.r.rule.inputcollection","oic.r.rule.expression","oic.r.rule.actioncollection"],
              "links": [
                {
                  "href": "/ruleinputcollection",
                  "rt":   ["oic.r.rule.inputcollection"],
                  "if":   ["oic.if.ll","oic.if.baseline"],
                  "p":    {"bm": 3},
                  "eps": [
                    {"ep": "coaps://[fe80::b1d6]:1111"}
                  ]
                },
                {
                  "href": "/ruleexpression",
                  "rt":   ["oic.r.rule.expression"],
                  "if":   ["oic.if.rw","oic.if.baseline"],
                  "p":    {"bm": 3},
                  "eps": [
                    {"ep": "coaps://[fe80::b1d6]:1111"}
                  ]
                },
                {
                  "href": "/ruleactioncollection",
                  "rt":   ["oic.r.rule.actioncollection"],
                  "if":   ["oic.if.ll","oic.if.baseline"],
                  "p":    {"bm": 3},
                  "eps": [
                    {"ep": "coap://[fe80::b1d6]:1111"}
                  ]
                }
              ]
            },
            "schema": { "$ref": "#/definitions/sbaseline" }
          }
        }
      }
    }
  },
  "parameters": {
    "interface-all": {
      "in": "query",
      "name": "if",
```