OCF Smart Home Device Specification

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OPEN CONNECTIVITY
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CONTENTS

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Tables

1 Scope

The OCF Smart Home Device specification is an Application Profile specification.

The Smart Home Device specification specifies the Smart Home devices. The Smart Home Device definitions use Resource definitions from the OCF Resource Type Specification.

The Smart Home Device Specification is built on top of the Core Specification. The Core Specification specifies the core architecture, interfaces protocols and services to enable the implementation of profiles for IoT usages and ecosystems. The Core specification also defines the main architectural components of network connectivity, discovery, data transmission, device & service management and ID & security. The core architecture is scalable to support simple devices (constrained devices) and more capable devices (smart devices).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

OCF Core Specification, *Open Connectivity Foundation Core Specification*, Version 1.0.

OCF Resource Type Specification, *Open Connectivity Foundation Resource Type Specification*, Version 1.0.

OCF Security Specification, *Open Connectivity Foundation Security Capabilities*, Version 1.0

IETF RFC 7049, *Concise Binary Object Representation (CBOR)*, October 2013
http://www.ietf.org/rfc/rfc7049.txt

IETF RFC 7159, *The JavaScript Object Notation (JSON) Data Interchange Format*, March 2014
http://www.ietf.org/rfc/rfc7159.txt

RAML, *Restful API modelling language,* Version 0.8.
https://github.com/raml-org/raml-spec/blob/master/versions/raml-08/raml-08.md

IETF RFC 4566, SDP: Session Description Protocol, July 2006
https://tools.ietf.org/html/rfc4566

3 Terms, definitions symbols and abbreviations

3.1 Terms and definitions

3.1.1
Actuator
Resource with support of the UPDATE operation.

3.1.2
CRUDN
Create Retrieve Update Delete Notify
This is an acronym indicating which operations are possible on the Resource.

3.1.3
CSV
Comma Separated Value
Comma Separated Value is a construction to have more fields in 1 string separated by commas. If a value itself contains a comma then the comma can be escaped by adding "\" in front of the comma.

113 **3.1.4**
114 **OCF**
115 Open Connectivity Foundation
116 The organization that created these specifications.

117 **3.1.5**
118 **RAML**
119 RESTful API Modelling Language
120 RAML is a simple and succinct way of describing practically-RESTful APIs. See RAML.

121 **3.1.6**
122 **REST**
123 Representational State Transfer
124 REST is an architecture style for designing networked applications and relies on a stateless, client-
125 server, cacheable communications protocol.

126 **3.1.7**
127 **SDP**
128 Session Description Protocol
129 SDP describes multimedia sessions for the purposes of session announcement, session invitation,
130 and other forms of multimedia session initiation. It is fully defined in https://github.com/raml-
131 org/raml-spec/blob/master/versions/raml-08/raml-08.md
132 IETF RFC 4566.

133 **3.1.8**
134 **Smart Home Bridge Device**
135 A Smart Home Device that is capable of representing other devices that exist on the network.

136 **3.1.9**
137 **Smart Home Device**
138 A Device that is conformant to the normative requirements contained in this specification.

139 **3.1.10**
140 **Sensor**
141 Resource without support of the UPDATE operation.

142 **3.2   Symbols and abbreviations**

143 None defined.

144 **4   Document conventions and organization**

145 This document lists all the Devices used in the smart home domain. The devices are specified by
146 which mandatory and optional Resources are used.

147 For the purposes of this document, the terms and definitions given in OCF Core Specification and
148 OCF Resource Type Specification apply.

149 **4.1   Conventions**

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

154 **4.2   Notation**

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

157 Required (or shall or mandatory).

158 These basic features shall be implemented to comply with a Smart Home Device. The phrases
159 "shall not", and "PROHIBITED" indicate behavior that is prohibited, i.e. that if performed means
160 the implementation is not in compliance.

161 Recommended (or should).

162 These features add functionality supported by a Smart Home Device and should be
163 implemented. Recommended features take advantage of the capabilities a Smart Home Device,
164 usually without imposing major increase of complexity. Notice that for compliance testing, if a
165 recommended feature is implemented, it shall meet the specified requirements to be in
166 compliance with these guidelines. Some recommended features could become requirements
167 in the future. The phrase "should not" indicates behavior that is permitted but not recommended.

168 Allowed (or allowed).

169 These features are neither required nor recommended by a Smart Home Device, but if the
170 feature is implemented, it shall meet the specified requirements to be in compliance with these
171 guidelines.

172 Conditionally allowed (CA).

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

175 Conditionally required (CR).

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

179 DEPRECATED

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

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

187 Words that are emphasized are printed in *italic*.

188 **4.3   Data types**

189 See OCF Core Specification.

190 **4.4   Document structure**

191 The Smart Home Device specification defines a Device for usage in the Smart Home vertical. This
192 document describes a Device and makes use of functionality defined in the OCF Core Specification
193 and OCF Resource Type Specification.

194 The OCF Core Specification provides building blocks to define Devices. The following functionality
195 is used:

196 • Required Core Resources.

197 • Required transports.

198 Note that other mandatory functions in the OCF Core Specification might be needed to create an
199 OCF compliant device, but are not mentioned in this document.

The Smart Home Device profile consists of using RAML as a specification language and using JSON Schemas as payload definitions for all CRUDN actions. The mapping of the CRUDN actions is specified in the CORE.

Other building blocks used in this document are the Resource Types specified in the OCF Resource Type Specification.
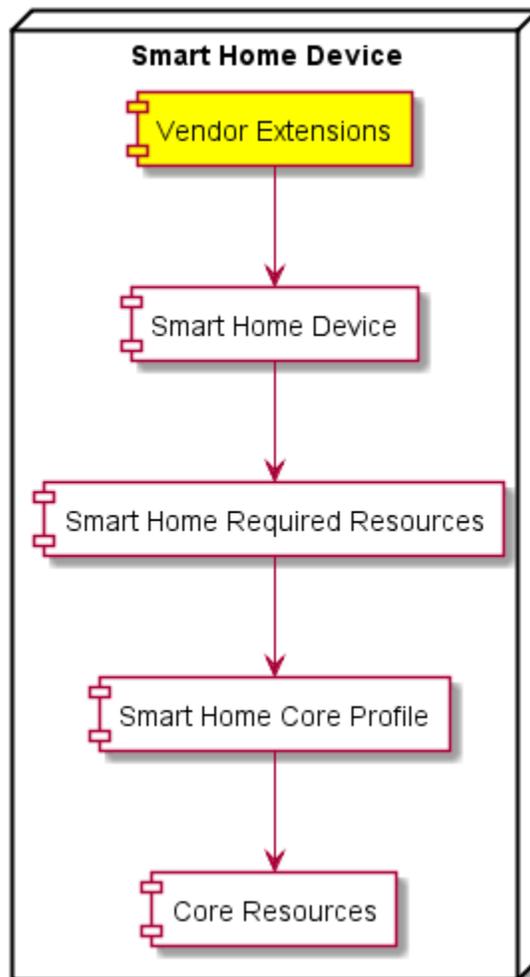
Figure 1 Smart Home device building blocks.

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

5   Operational Scenarios

5.1   Specification Version

Devices conformant to this specification version shall add the string "ocf.sh.1.0.0" to the dmv Property in oic.wk.d.

6 Core Resource model

6.1 Introduction

The Core Resource model is described in the OCF Core Specification.

6.2 Device Type

The device types of all Smart Home devices shall have a Resource Type name ("rt") prefixed with "oic.d."

Examples of Device Types are:

- oic.d.fan

- oic.d.thermostat

The full list of Smart Home defined Device names and types are in Table 9-1. This table also includes the list of minimal Resource(s) that a Device shall implement for that device type. A device may expose additional OCF and vendor defined Resources than indicated in this Table.

The OCF Core Specification defines a Device Resource with a URI of "/oic/d". A Smart Home Device shall include in the Resource Type ID of "/oic/d" the device type from Table 9-1 of the physical device hosting the Server; the inclusion of the device type shall be done using one of the methods provided by Section 11.3.4 of the OCF Core Specification (i.e. add to the array of values). An instance of "/oic/d" with its Resource Type name modified in this manner shall expose all mandatory Properties for "/oic/d" defined in the OCF Core Specification.

Therefore a Smart Home Device may be discovered by adding a query for the "rt" of the Device Type itself (e.g. oic.d.fan) to the OCF Core Specification defined multicast endpoint discovery method (see also Section 7.1).

A Smart Home Device may additionally define a Resource with a vendor defined URI that is discoverable within "/oic/res" with a Resource Type ID from Table 9-1. In this instance the Resource shall have the Resource Properties and be subject to the same semantics as oic.wk.d as defined in the OCF Core Specification. In the case where the Resource tagged in this manner additionally follows the Collection semantics defined in the OCF Core Specification then the Resources that are part of that Collection shall at a minimum include the Resources defined for the Resource Type ID in Table 9-1.

6.3 Profile of OCF Core Specification

This section describes the profiling of the Core Resources and transport mechanisms and functions that are defined in the OCF Core Specification.

The required OCF Core Specification Resources are also required for a Smart Home profile implementation.

In addition to the required Resources the optional OCF Core Specification Resources in Table 6-1 shall be required for a Smart Home Profile.

Table 6-1 Required Resources for Smart Home Devices

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

252 For each of the Resources listed in Table 6-1 Required Resources for Smart Home Devices, Table
253 6-2 Required Properties in Resource details the Properties within those Resources that shall be
254 required for a Smart Home Profile.

Table 6-2 Required Properties in Resource

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

256

257 A Smart Home Device shall support CoAP based endpoint discovery as defined in Section 10.2 of
258 the OCF Core Specification.

259 The messaging protocol for a Smart Home Device shall be CoAP (see OCF Core Specification).

260 A Smart Home Device shall support a network layer as defined in Section 9 of the OCF Core
261 Specification including any necessary defined bridging functions that ensure inter-operability with
262 IPv6.

7   Discovery

7.1   Endpoint Discovery

265 Clients may discover Servers by using the mechanisms defined by the OCF Core Specification
266 Section 10. A Client may populate an "rt" query parameter with the Device Types that the Client
267 wants to discover, or if no "rt" query parameter is provided then the search is for all available
268 Device Types irrespective.

269 Smart Home Devices may be discovered by Device Type or implemented Resource Type. This
270 difference is conveyed by the wanted "rt" argument of the OCF Core Specification discovery
271 method (see section 11.3 of the OCF Core Specification).

272 The values that may be used for discovering a specific Device Type are listed in Table 9-1 . The
273 values that may be used to discover a specific Resource Type are listed in the OCF Resource
274 Type Specification in section 6.

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

7.2   Resource Discovery

278 Section intentionally left blank

8   Security

280 A Smart Home Device shall implement the mandated security Resources specified in the OCF
281 Security Specification. Additionally, it is recommended that exposed Resources as defined by the
282 OCF Resource Type Specification be accessible only via encrypted channels following completion
283 of the onboarding process as defined in the OCF Security Specification; it is not recommended to
284 allow access via unencrypted channels.

9   Device Types

9.1   Standardized device types

287 Device Types can mandate that specific Resources be implemented. The required Resource per
288 Device Type is listed in Table 9-1. Additionally, specific Resources that use enumeration values

289 to indicate supported states or modes may mandate usage of standardized enumeration values.
290 The mandated allowed values are indicated for each applicable Resource Type, the Property of
291 interest on that Resource Type and to which device type it applies.

292 Per Table 9-1, some Smart Home Device types support two instances of the same Resource Type.
293 When this is the case, the Resources shall support different CRUDN actions, e.g. one Resource
294 acts as a Sensor (CRUDN action write not supported) and the other Resource acts as an Actuator
295 (CRUDN actions read and write supported at a minimum) unless otherwise specified.

296 **Table 9-1 Alphabetical list of device types ("rt"), including required Resources.**

297

Device Name (informative)	Device Type ("rt") (Normative)	Required Resource name	Required Resource Type
Air Conditioner	oic.d.airconditioner	Binary Switch	oic.r.switch.binary
		Temperature	oic.r.temperature
Air Purifier	oic.d.airpurifier	Binary Switch	oic.r.switch.binary
Air Quality Monitor	oic.d.airqualitymonitor	Air Quality Collection	oic.r.airqualitycollection
Blind	oic.d.blind	Open Level	oic.r.openlevel
Camera	oic.d.camera	Media	oic.r.media
Clothes Washer Dryer	oic.d.washerdryer	Binary Switch	oic.r.switch.binary
		Operational State	oic.r.operational.state
Cooker Hood	oic.d.cookerhood	Airflow Control	oic.r.airflowcontrol
		Binary Switch	oic.r.switch.binary
		Mode	oic.r.mode
Cooktop	oic.d.cooktop	Heating Zone Collection	oic.r.heatingzonecollection
Dehumidifier	oic.d.dehumidifier	Binary Switch	oic.r.switch.binary
		Humidity	oic.r.humidity

Dishwasher	oic.d.dishwasher	Binary Switch	oic.r.switch.binary
		Mode	oic.r.mode
Door	oic.d.door	Open Level	oic.r.openlevel
Dryer (Laundry)	oic.d.dryer	Binary switch	oic.r.switch.binary
		Mode	oic.r.mode
Fan	oic.d.fan	Binary Switch	oic.r.switch.binary
Food Probe	oic.d.foodprobe	Temperature (Sensor)	oic.r.temperature
Freezer	oic.d.freezer	Temperature(2)(1 Sensor and 1 Actuator)	oic.r.temperature
Garage Door	oic.d.garagedoor	Door	oic.r.door
Generic Sensor	oic.d.sensor	Any Resource Type that supports and exposes in "/oic/res" the oic.if.s interface.	oic.r. <x> Where this equates to any Resource Type that supports the oic.if.s Interface.
Humidifier	oic.d.humidifier	Binary Switch	oic.r.switch.binary
Light	oic.d.light	Binary Switch	oic.r.switch.binary
Oven	oic.d.oven	Binary Switch	oic.r.switch.binary
		Temperature (2) (1 Sensor and 1 Actuator)	oic.r.temperature
Printer	oic.d.printer	Binary Switch	oic.r.switch.binary
		Operational State	oic.r.operational.state
	oic.d.multifunctionprinter	Binary switch	oic.r.switch.binary

Printer Multi-Function		Operational State (2)[1]	oic.r.operational.state
		Automatic Document Feeder	oic.r.automaticdocumentfeeder[2]
Receiver	oic.d.receiver	Binary Switch	oic.r.switch.binary
		Audio Controls	oic.r.audio
		Media Source List (2)	oic.r.media.input, oic.r.media.output
Refrigerator	oic.d.refrigerator	Temperature (2) (1 Sensor and 1 Actuator)	oic.r.temperature
Robot Cleaner	oic.d.robotcleaner	Binary Switch	oic.r.switch.binary
		Mode	oic.r.mode
Scanner	oic.d.scanner	Binary Switch	oic.r.switch.binary
		Operational State	oic.r.operational.state
		Automatic Document Feeder	oic.r.automaticdocumentfeeder
Security Panel	oic.d.securitypanel	Mode	oic.r.mode
Set Top Box	oic.d.stb	Binary Switch	oic.r.switch.binary
Smart Lock	oic.d.smartlock	Lock Status	oic.r.lock.status
Smart Plug	oic.d.smartplug	Binary Switch	oic.r.switch.binary
Switch	oic.d.switch	Binary Switch	oic.r.switch.binary
Television	oic.d.tv	Binary Switch	oic.r.switch.binary

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[1] A Multi-Function Printer shall expose two instances of an Operational State resource; each in discrete Collections, one for the Printer specific operational state information and one for the Scanner specific operational state information. The friendly name for the Collections should indicate the device modality (printer or scanner).

[2] A Multi-Function Printer shall only expose an Automatic Document Feeder resource if the device has the Automatic Document Feeder capability.

		Audio Controls	oic.r.audio
		Media Source List	oic.r.media.input
Thermostat	oic.d.thermostat	Temperature (2) (1 Sensor and 1 Actuator)	oic.r.temperature
Washer (Laundry)	oic.d.washer	Binary Switch	oic.r.switch.binary
		Operational State	oic.r.operational.state
Water Valve	oic.d.watervalve	Open Level	oic.r.openlevel

9.2 Standardized enumeration values

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

- Generic list of supported values

- Mandated list of supported values when applied to a specific Device

9.3 Alphabetical list of standardized enumeration types

This section lists the standardized enumeration types that are used in the oic.r.mode, oic.r.operational.state, and oic.r.consumable Resources.

- aborted
  - An internal device, communication or security error
- active
  - Unit is active
- airDry
  - unit is air drying
- armedAway
  - unit is armed for away
- armedInstant
  - unit is armed instantly
- armedMaximum
  - unit is armed at maximum level
- armedNightStay

320   o   unit is armed in night stay

321   •   armedStay

322   o   unit is armed in stay mode

323   •   cancelled

324   o   the job was cancelled either by the remote client or by the user

325   •   completed

326   o   job finished successfully

327   •   down

328   o   unit is unavailable

329   •   dry

330   o   unit is dry mode

331   •   disabled

332   o   unit's current operational mode is disabled

333   •   enabled

334   o   unit's current operational mode is enabled

335   •   filterMaterial

336   o   filter material that is used by a device

337   •   idle

338   o   new jobs can start processing without waiting

339   •   ink

340   o   generic ink cartridge for a device

341   •   inkBlack

342   o   black ink cartridge for a device

343   •   inkCyan

344   o   cyan ink cartridge for a device

345   •   inkMagenta

346   o   magenta ink cartridge for a device

347   •   inkTricolour

348   o   tricolour ink cartridge for a device

349   •   inkYellow

| 350 | | | o | yellow ink cartridge for a device |

- 351 • notsupported
  - o ability to set a specific operational mode by a client is not supported
- 353 • pause
  - o unit is paused (by user)
- 355 • pending
  - o job initiated, engine is preparing
- 357 • pendingHeld
  - o job is not a candidate for processing for any number of reasons, will return to pending state if reasons are solved.
- 360 • preWash
  - o unit is pre wash mode
- 362 • processing
  - o processing the job
- 364 • rinse
  - o unit is rinse mode
- 366 • stopped
  - o error condition occurred
- 368 • spin
  - o unit is in spin mode
- 370 • testing
  - o calibrating, preparing the unit
- 372 • toner
  - o generic toner cartridge for a device
- 374 • tonerBlack
  - o black toner cartridge for a device
- 376 • tonerCyan
  - o cyan toner cartridge for a device
- 378 • tonerMagenta
  - o magenta toner cartridge for a device

380   • tonerYellow

381   o   yellow toner cartridge for a device

382   • wash

383   o   unit is in wash mode

384   • wrinklePrevent

385   o   unit is in winkle prevent mode

9.4   Standardized list of supported values for Mode Resource Type (oic.r.mode)

387 The following enumeration values apply to both the supportedModes and modes Properties within
388 the Mode Resource Type.

389   **Table 9-2 list of required oic.r.mode supported values per device type ("rt")**

Device Name (informative)	Device Type (rt) (Normative)	Required enumeration value
Security Panel	oic.d.securityPanel	active
		armedAway
		armedInstant
		armedMaximum
		armedNightStay
		armedStay

390

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

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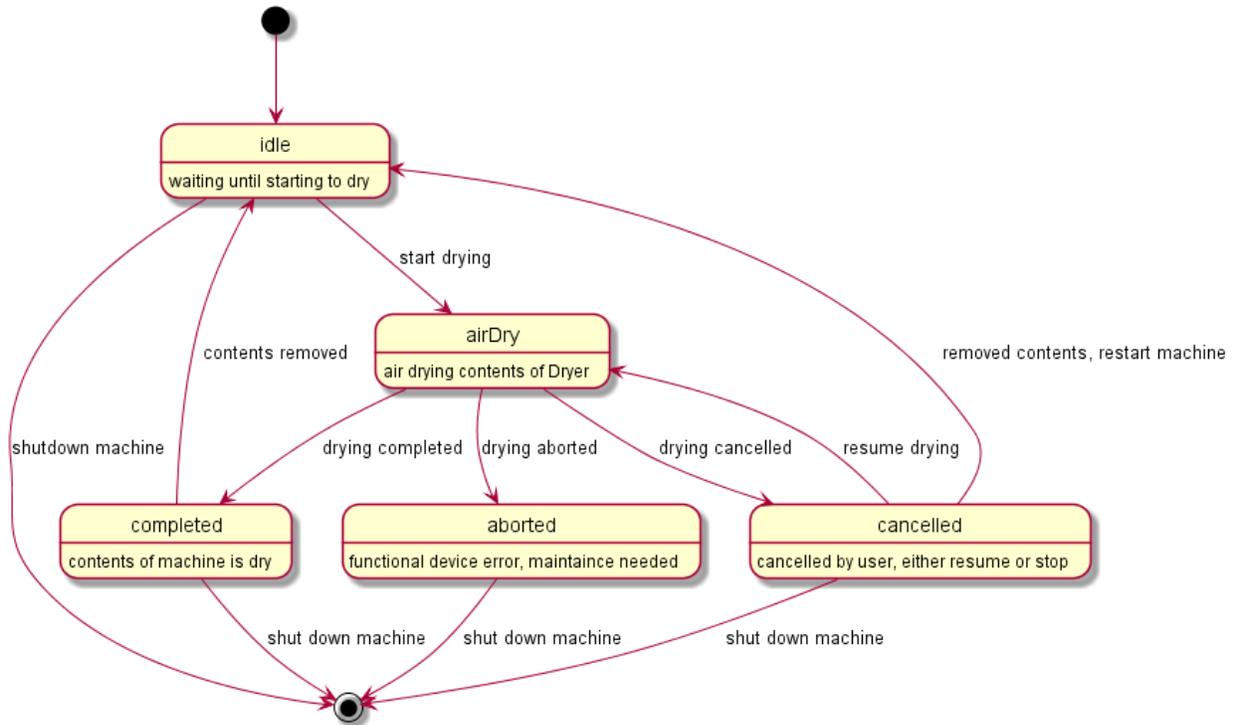

394
395   **Figure 2 Example of mode transitions of a Dryer.**

396

397   **9.5   Standardized list of supported values for Operational State Resource Type**
398   **(oic.r.operational.state)**

399   The following enumeration values apply to the jobStates and machineStates Properties within the
400   operational state Resource Type.

401   **Table 9-3 list of required oic.r.operational.state supported values per Device Type ("rt")**

Device Name (informative)	Device Type (rt) (Normative)	Required enumeration value machineStates	Required enumeration value jobStates
Printer	oic.d.printer	idle	pending
		processing	pendingHeld
		stopped	processing
			cancelled
			aborted
			completed

Printer Multi-Function	oic.d.multifunctionPrinter	See printer	See printer
		See scanner	See scanner
scanner	oic.d.scanner	idle	cancelled
		processing	aborted
		testing	completed
		stopped	pending
		down	processing

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

406

An example machine and job states of an Printer, not all state transitions are listed.
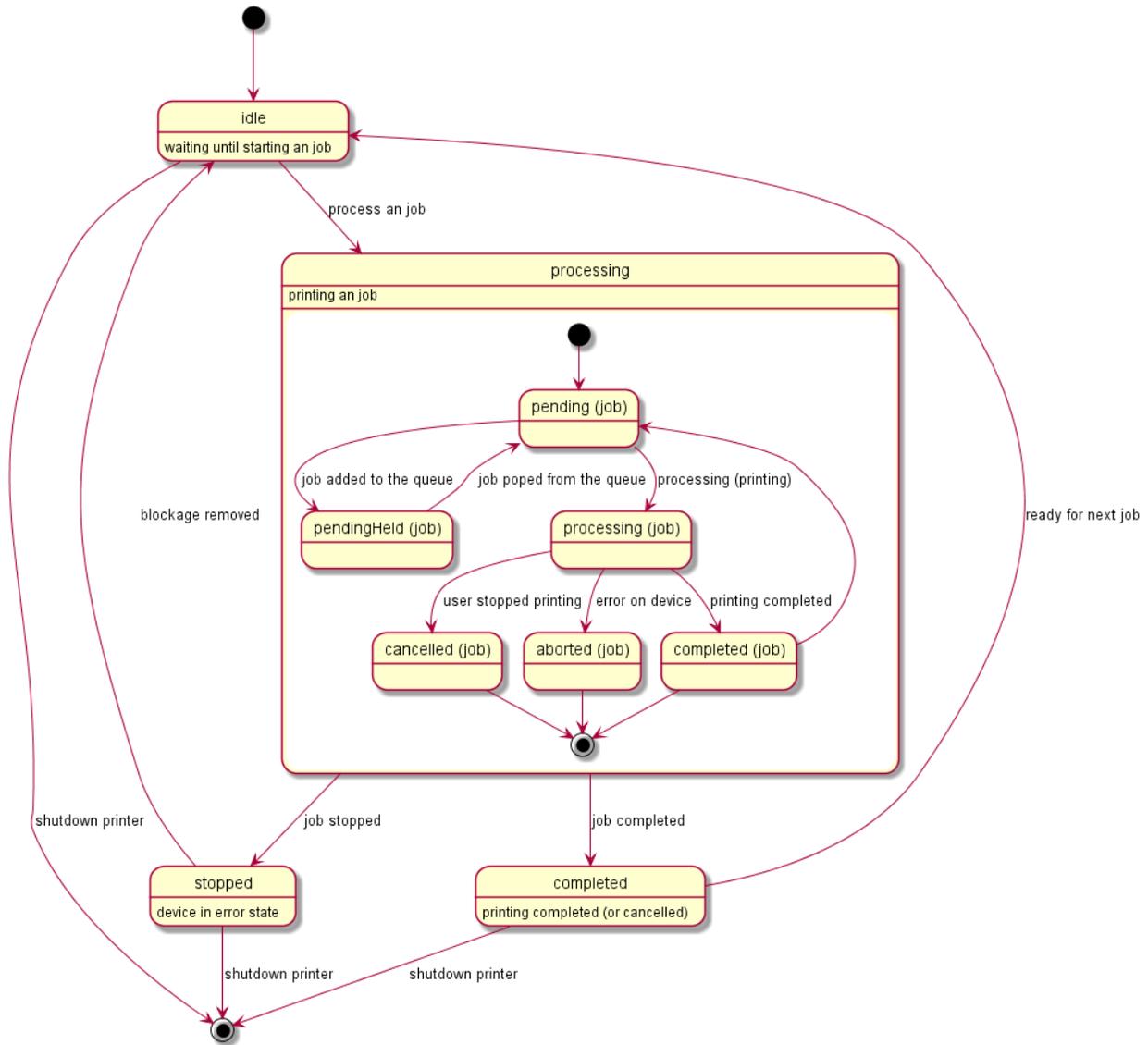

407
408   **Figure 3 Example of mode transitions of a Printer.**

409

410   **9.6   Standardized list of supported values for Consumable and Consumable Collection**
411   **Resource Types (oic.r.consumable, oic.r.consumablecollection)**

412   The following enumeration values may be populated in both the supportedconsumables (in
413   oic.r.consumablecollection) and typeofconsumable (in oic.r.consumable) Properties within the
414   Consumable and Consumable Collection Resource Types. The typeofconsumable Property shall
415   only be populated with a value exposed within the supportedconsumables Property in a specific
416   instance of the Consumable Collection Resource Type.

417   This constitutes the known set of possible values for these Properties in the Consumable and
418   Consumable Collection Resources. A vendor may extend this set by providing vendor defined
419   enumerations following the convention defined in the OCF Resource Type Specification.

Table 9-4 list of defined enumeration values for oic.r.consumable,
oic.r.consumablecollection

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

422

9.7   Camera Media Format (oic.r.media)

The supported camera media formats can be discovered by looking at the SDP (see
https://github.com/raml-org/raml-spec/blob/master/versions/raml-08/raml-08.md

IETF RFC 4566) list of the media Resource Type. The recommended list of supported media
formats are listed in Table 9-5.

Table 9-5 Recommended media profiles.

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

429