



OIC SMART HOME DEVICE SPECIFICATION V1.1.0

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71 **1 Scope**

72 The OIC Smart Home Device specification is an Application Profile specification.

73 The Smart Home Device specification specifies the Smart Home devices. The Smart Home Device
74 definitions use Resource definitions from the OIC Resource Type Specification

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

81 **2 Normative references**

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

85 OIC Core Specification, *Open Interconnect Consortium Core Specification*, Version 1.1.

86 OIC Resource Type Specification, *Open Interconnect Consortium Resource Type Specification*,
87 Version 1.1.

88 OIC Security Specification, *Open Interconnect Consortium Security Capabilities*, Version 1.1

89 IETF RFC 7049, *Concise Binary Object Representation (CBOR)*, October 2013

90 <http://www.ietf.org/rfc/rfc7049.txt>

91

92 IETF RFC 7159, *The JavaScript Object Notation (JSON) Data Interchange Format*, March 2014

93 <http://www.ietf.org/rfc/rfc7159.txt>

94 RAML, *Restful API modelling language*, Version 0.8.

95 <https://github.com/raml-org/raml-spec/blob/master/raml-0.8.md>

96 IETF RFC 4566, SDP: Session Description Protocol, July 2006 <https://www.ietf.org/rfc/rfc4566.txt>

97 **3 Terms, definitions symbols and abbreviations**

98 **3.1 Terms and definitions**

99 **3.1.1**

100 **Actuator**

101 Resource with support of the UPDATE operation.

102 **3.1.2**

103 **Smart Home Bridge Device**

104 A Smart Home Device that is capable of representing other devices that exist on the network.

105 **3.1.3**

106 **Smart Home Device(s)**

107 A Device(s) that is(are) conformant to the normative requirements contained in this specification.

108 **3.1.4**

109 **Sensor**

110 Resource without support of the UPDATE operation.

111 **3.2 Symbols and abbreviations**

112 **3.2.1**

113 **CRUDN**

114 Create Retrieve Update Delete Notify

115 This is an acronym indicating which operations are possible on the Resource.

116 **3.2.2**

117 **CSV**

118 Comma Separated Value

119 Comma Separated Value is a construction to have more fields in 1 string separated by commas. If
120 a value itself contains a comma then the comma can be escaped by adding “\” in front of the
121 comma

122 **3.2.3**

123 **OIC**

124 Open Interconnect Consortium

125 The organization that created these specifications

126 **3.2.4**

127 **RAML**

128 RESTful API Modelling Language

129 RAML is a simple and succinct way of describing practically-RESTful APIs. See RAML.

130 **3.2.5**

131 **REST**

132 Representational State Transfer

133 REST is an architecture style for designing networked applications and relies on a stateless, client-
134 server, cacheable communications protocol.

135 **3.2.6**

136 **SDP**

137 Session Description Protocol

138 SDP describes multimedia sessions for the purposes of session announcement, session invitation,
139 and other forms of multimedia session initiation. It is fully defined in IETF RFC 4566

140 **3.3 Conventions**

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

145 **4 Document conventions and organization**

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

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

150 **4.1 Notation**

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

153 Required (or shall or mandatory).

154 These basic features shall be implemented to comply with OIC Core Architecture. The phrases
155 “shall not”, and “PROHIBITED” indicate behavior that is prohibited, i.e. that if performed means
156 the implementation is not in compliance.

157 Recommended (or should).

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

164 Allowed (or allowed).

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

168 Conditionally allowed (CA)

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

171 Conditionally required (CR)

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

175 DEPRECATED

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

182 Strings that are to be taken literally are enclosed in “double quotes”.

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

184 **4.2 Data types**

185 See OIC Core Specification.

186 **4.3 Document structure**

187 The Smart Home Device specification defines a Device for usage in the Smart Home vertical. This
188 document describes a Device and makes use of functionality defined in the OIC Core Specification
189 and OIC Resource Type Specification.

190 The OIC Core Specification provides building blocks to define Devices. The following functionality
191 is used:

- 192 • Required Core Resources.
- 193 • Required transports.

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

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

199 Other building blocks used in this document are the Resource Types specified in the OIC Resource
200 Type Specification.



201
202

Figure 1 Smart Home device building blocks.

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

207 **5 Operational Scenarios**

208 **5.1 Specification Version**

209 Devices conformant to this specification version shall add the string “sh.1.1.0” to the OIC Core
210 Specification defined dmV Property in oic.wk.d.

211 **6 Core Resource model**

212 **6.1 Introduction**

213 The Core Resource model is described in the OIC Core Specification.

214 **6.2 Device Type**

215 The device types of all Smart Home Devices defined by this Specification shall have a Resource
216 Type name (“rt”) prefixed with “oic.d.”

217 Examples of Device types are:

- 218 • oic.d.fan
- 219 • oic.d.thermostat

220 The full list of Smart Home defined Device names and types are in Table 10-1. This table also
 221 includes the list of minimal Resource(s) that a Device shall implement for that device type. A device
 222 may expose additional OIC and vendor defined Resources than indicated in this Table.

223 The OIC Core Specification defines a Device Resource with a URI of "/oic/d". A Smart Home Device
 224 shall include in the Resource Type ID of "/oic/d" the device type from Table 10-1; the inclusion of
 225 the device type shall be done using one of the methods provided by Section 11.3.4 of the OIC
 226 Core Specification (i.e. add to the array of values). An instance of "/oic/d" with its Resource Type
 227 name modified in this manner shall expose all mandatory Properties for "/oic/d" defined in the OIC
 228 Core Specification.

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

232 A Smart Home Device may additionally define a Resource with a vendor defined URI that is
 233 discoverable within "/oic/res" with a Resource Type ID from Table 10-1. In this instance the
 234 Resource shall have the Resource Properties and be subject to the same semantics as oic.wk.d
 235 as defined by the OIC Core Specification. In the case where the Resource tagged in this manner
 236 additionally follows the Collection semantics defined in the OIC Core Specification then the
 237 Resources that are part of that Collection shall at a minimum include the Resources defined for
 238 the Resource Type ID in Table 10-1.

239 6.3 Profile of OIC Core Specification

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

242 The required OIC Core Specification Resources are also required for a Smart Home profile
 243 implementation.

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

246 **Table 6-1 Required Resources for Smart Home Devices**

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

247 For each of the Resources listed in Table 6-1 Required Resources for Smart Home Devices, Table
 248 6-2 Required Properties in Resource details the Properties within those Resources that shall be
 249 required for a Smart Home Profile.

250 **Table 6-2 Required Properties in Resource**

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

251
 252 A Smart Home Device shall support CoAP based endpoint discovery as defined in Section 10.2 of
 253 the OIC Core Specification.

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

255 A Smart Home Device shall support a network layer as defined in Section 9 of the OIC Core
256 Specification including any necessary defined bridging functions that ensure inter-operability with
257 IPv6.

258 **7 Discovery**

259 **7.1 Endpoint Discovery**

260 Clients may discover Servers by using the mechanisms defined by the OIC Core Specification
261 Section 10. A Client may populate an “rt” query parameter with the Device Types that the Client
262 wants to discover, or if no “rt” query parameter is provided then the search is for all available
263 Device Types irrespective.

264 Smart Home Devices may be discovered by Device Type or implemented Resource Type. This
265 difference is conveyed by the wanted “rt” argument of the OIC Core Specification discovery method
266 (see section 11.3 of the OIC Core Specification).

267 The values that may be used for discovering a specific Device Type are listed in Table 10-1 . The
268 values that may be used to discover a specific Resource Type are listed in the OIC Resource Type
269 Specification in section 6.

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

272 **7.2 Resource Discovery**

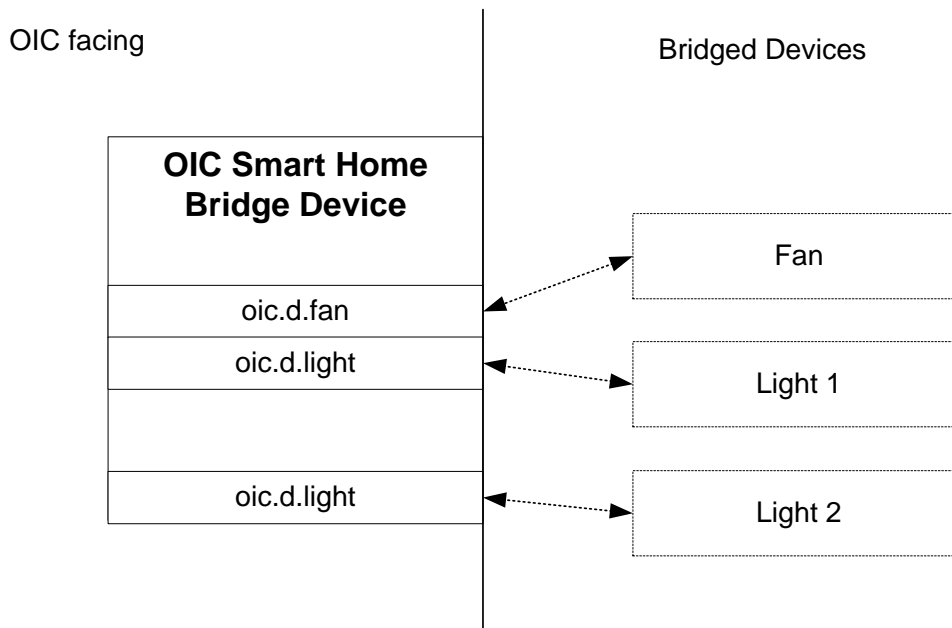
273 Section intentionally left blank

274 **8 Smart Home Bridge Device**

275 This section describes the functionality of a Smart Home Bridge Device; such a device is illustrated
276 in Figure 2 Schematic overview of a Smart Home Bridge Device bridging

277 A Smart Home Bridge Device is a device that represents one or more other devices as Smart Home
278 Devices on the network. The represented devices themselves are out of the scope of this document.
279 The bridging is implementation and vendor specific. The only difference between a Device and a
280 bridged device is how the device is encapsulated in a Smart Home Bridge Device.

281 A Smart Home Bridge Device shall be indicated on the network with a Device Type of “oic.d.bridge”.
282 This provides to a client an explicit indication that the discovered Device is performing a bridging
283 function. This is useful for a number of reasons; 1) when establishing a home network the Client
284 can determine that the bridge is reachable and functional when no bridged devices are present, 2)
285 allows for specific actions to be performed on the bridge taking into account the known functionality
286 a bridge supports, 3) should the bridged devices be subject to a progressive reveal it enables user
287 indications to be provided showing that sequence of discovery, 4) allows for explicit discovery of
288 all devices that are serving a bridging function which benefits trouble shooting and maintenance
289 actions on behalf of a user. When such a device is discovered the exposed Resources on the
290 Smart Home Bridge Device describe other devices. For example as shown in Figure 2 Schematic
291 overview of a Smart Home Bridge Device bridging non-OIC devices. Note that there is no
292 requirement to enable a 1:1 mapping from the bridged device to the OIC representation, how the
293 bridged device is represented within OIC is entirely up to the implementation.



294

295 **Figure 2 Schematic overview of a Smart Home Bridge Device bridging non-OIC devices**

296 It is expected that the Smart Home Bridge Device creates a set of devices during the start-up of
 297 the Smart Home Bridge Device. The exposed set of devices can change as bridged devices are
 298 added or removed from the bridge. The adding and removing of bridged devices is implementation
 299 dependent. When a Smart Home Bridge Device changes its set of exposed devices it shall notify
 300 any subscribed Clients.

301 A Smart Home Bridge Device shall respond to network discovery commands on behalf of the
 302 exposed bridged devices. All bridged devices with all their Resources shall be discoverable via
 303 “/oic/res” of the Smart Home Bridge Device. The Resources of bridged devices shall either be
 304 directly included as Links in “/oic/res” of the Smart Home Bridge Device or as Links within a
 305 Collection (see Section 6.2 for application of a Device Type to a Collection Resource) that is itself
 306 directly included in “/oic/res”.

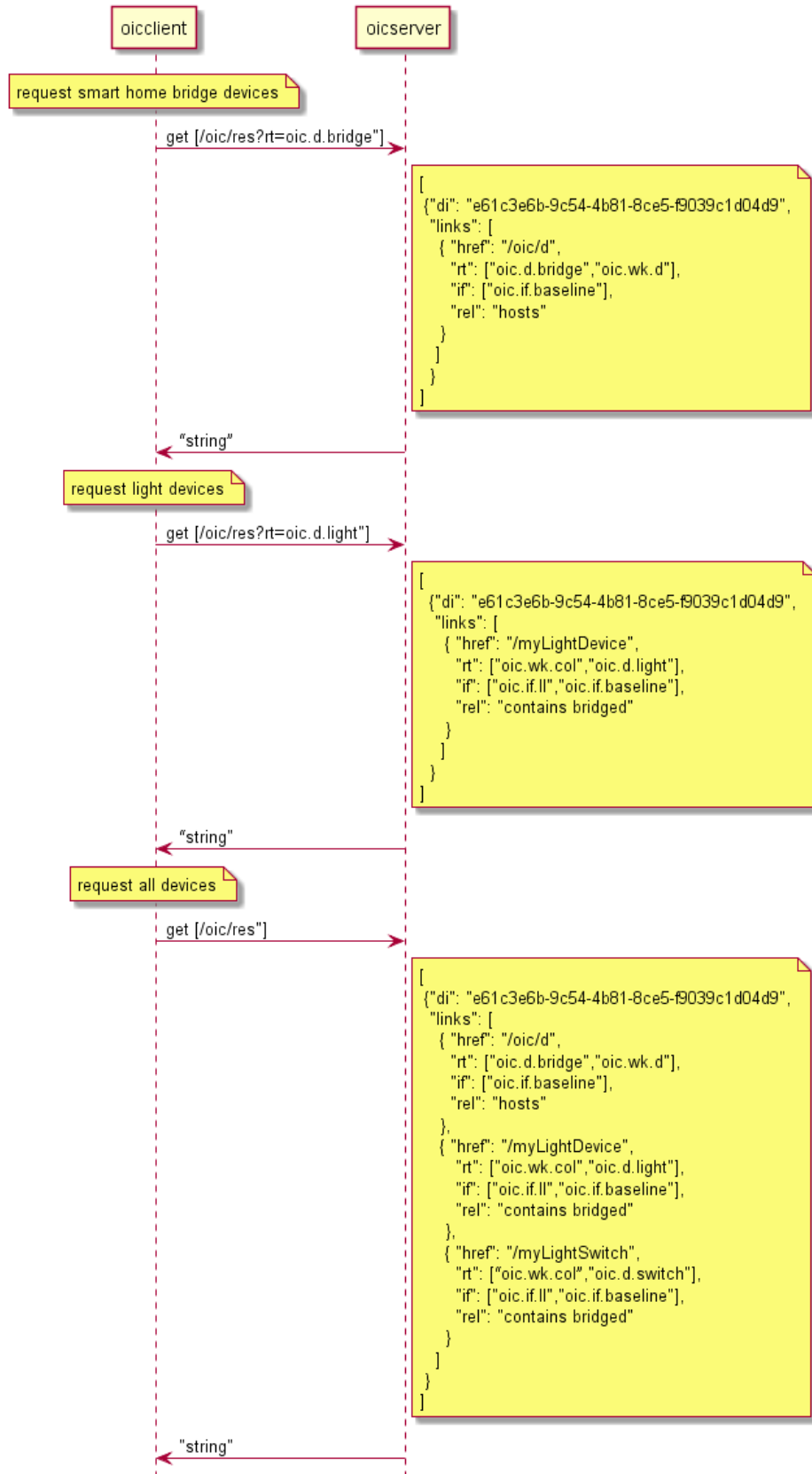
307 The response to a RETRIEVE on “/oic/res” shall only include the devices that match the RETRIEVE
 308 request.

309 The resource reference determined from each Link exposed by “/oic/res” on the Smart Home
 310 Bridge shall be unique. The Smart Home Bridge shall meet the requirements defined in the OIC
 311 Core Specification for population of the Properties and Link parameters in “/oic/res”.

312 The relationship between the Smart Home Bridge and the devices exposed therein is indicated via
 313 the population of the “rel” element within the Link in “/oic/res”. The value “contains bridged” should
 314 be used when the bridged device is not part of the Smart Home Bridge device. Conversely, when
 315 the bridge and embedded bridged devices share a common physical platform, the value “contains”
 316 should be used.

317 Figure 3 Requesting different device types within a Smart Home Bridge provides one possible
 318 instantiation of a Smart Home Bridge. Note the use of the Device Type for a Smart Home Bridge
 319 and the Device Type of the exposed devices that are modelled leveraging the Collection semantics
 320 defined by the OIC Core Specification. This is for illustrative purposes only.

Detecting devices on a oic smart home bridge device



322

323

Figure 3 Requesting different device types within a Smart Home Bridge

324 **9 Security**

325 A Smart Home Device shall implement the mandated security Resources specified in OIC Security
326 Specification. Additionally a Smart Home Device shall secure all links used to access Resources
327 using DTLS.

328 **10 Device Types**

329 **10.1 Standardized device types**

330 Device Types can mandate that specific Resources be implemented. The required Resource per
331 Device Type is listed in Table 10-1. Additionally, specific Resources that use enumeration values
332 to indicate supported states or modes may mandate usage of standardized enumeration values.
333 The mandated allowed values are indicated for each applicable Resource Type, the Property of
334 interest on that Resource Type and to which device type it applies.

335 Per table 10-1, some Smart Home Device types support two instances of the same Resource Type.
336 When this is the case, the Resources shall support different CRUDN actions, e.g. one Resource
337 acts as a Sensor (CRUDN action write not supported) and the other Resource acts as an Actuator
338 (CRUDN actions read and write supported at a minimum) unless otherwise specified.

339 **Table 10-1 Alphabetical list of device types (“rt”), including required Resources.**

340

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
Blind	oic.d.blind	Open Level	oic.r.openlevel
Camera	oic.d.camera	Media	oic.r.media
Dishwasher	oic.d.dishwasher	Binary Switch	oic.r.switch.binary
		Mode	oic.r.mode
Door	oic.d.door	Open Level	oic.r.openlevel
Dryer	oic.d.dryer	Binary switch	oic.r.switch.binary
		Mode	oic.r.mode

Fan	oic.d.fan	Binary Switch	oic.r.switch.binary
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.
Light	oic.d.light	Binary Switch	oic.r.switch.binary
Oven	oic.d.oven	Binary Switch	oic.r.switch.binary
		Temperature (2)	oic.r.temperature
Printer	oic.d.printer	Binary Switch	oic.r.switch.binary
		Operational State	oic.r.operational.state
Printer Multi-Function	oic.d.multifunctionprinter	Binary switch	oic.r.switch.binary
		Operational State (2) 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)	oic.r.temperature

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.

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
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
		Audio Controls	oic.r.audio
		Media Source List	oic.r.media.input
Thermostat	oic.d.thermostat	Temperature (2)	oic.r.temperature
Washer	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

341 **10.2 Standardized enumeration values**

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

- 345
- Generic list of supported values
- 346
- Mandated list of supported values when applied to a specific Device

347 **10.3 Alphabetical list of standardized enumeration types**

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

- 350 • aborted
 - 351 ○ An internal device, communication or security error
- 352 • active
 - 353 ○ Unit is active
- 354 • airDry
 - 355 ○ unit is air drying
- 356 • armedAway
 - 357 ○ unit is armed for away
- 358 • armedInstant
 - 359 ○ unit is armed instantly
- 360 • armedMaximum
 - 361 ○ unit is armed at maximum level
- 362 • armedNightStay
 - 363 ○ unit is armed in night stay
- 364 • armedStay
 - 365 ○ unit is armed in stay mode
- 366 • cancelled
 - 367 ○ the job was cancelled either by the remote client or by the user
- 368 • completed
 - 369 ○ job finished successfully
- 370 • down
 - 371 ○ unit is unavailable
- 372 • dry
 - 373 ○ unit is dry mode
- 374 • idle
 - 375 ○ new jobs can start processing without waiting
- 376 • pause

- 377 ○ unit is paused (by user)
- 378 • pending
 - 379 ○ job initiated, engine is preparing
- 380 • pendingHeld
 - 381 ○ job is not a candidate for processing for any number of reasons, will return to
 - 382 ○ pending state if reasons are solved.
- 383 • preWash
 - 384 ○ unit is pre wash mode
- 385 • processing
 - 386 ○ processing the job
- 387 • rinse
 - 388 ○ unit is rinse mode
- 389 • stopped
 - 390 ○ error condition occurred
- 391 • spin
 - 392 ○ unit is in spin mode
- 393 • testing
 - 394 ○ calibrating, preparing the unit
- 395 • wash
 - 396 ○ unit is in wash mode
- 397 • wrinklePrevent
 - 398 ○ unit is in winkle prevent mode

399 **10.4 Standardized list of supported values for Mode Resource Type (oic.r.mode)**

400 The following enumeration values apply to both the supportedModes and modes Properties within
 401 the Mode Resource Type. The 'Required enumeration value' for each device type lists the minimum
 402 set of values that are populated in supportedModes.

403 **Table 10-2 list of required oic.r.mode supported values per device type (“rt”)**

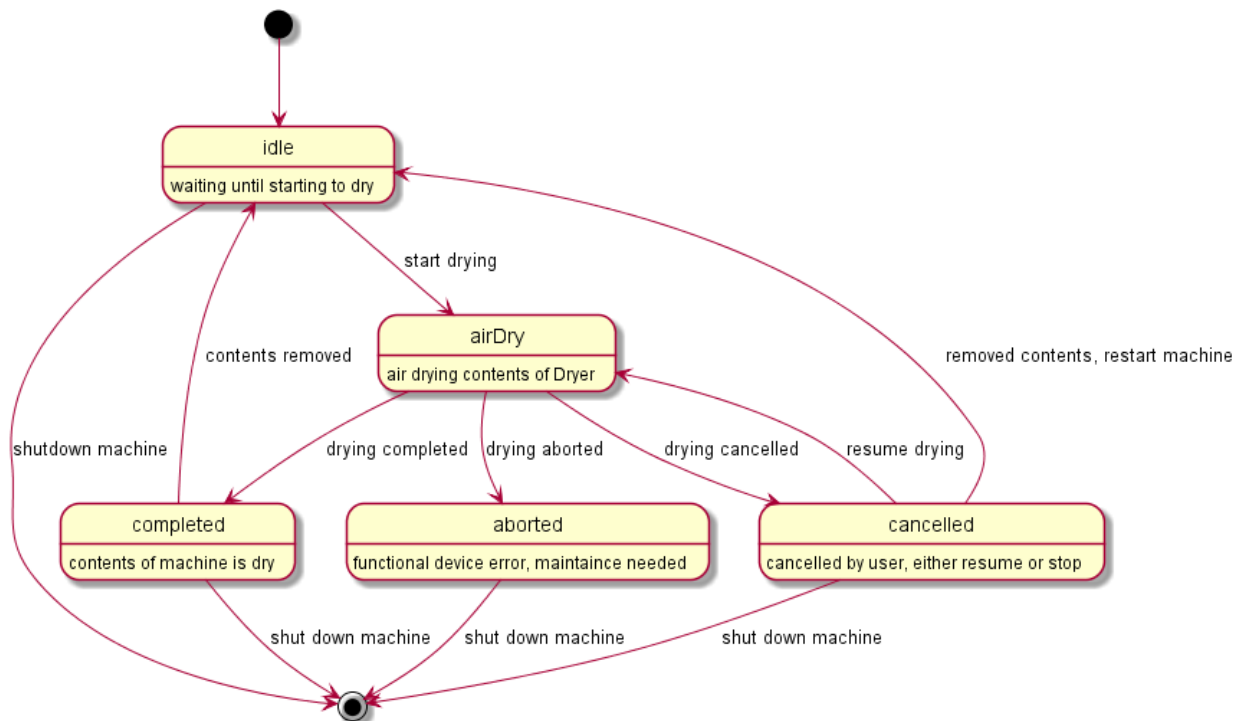
Device Name (informative)	Device Type (rt) (Normative)	Required enumeration value
Security Panel	oic.d.securityPanel	active

		armedAway
		armedInstant
		armedMaximum
		armedNightStay
		armedStay

404

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

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



408

409 **Figure 4 Example of mode transitions of a Dryer.**

410

411 **10.5 Standardized list of supported values for Operational State Resource Type**
 412 **(oic.r.operational.state)**

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

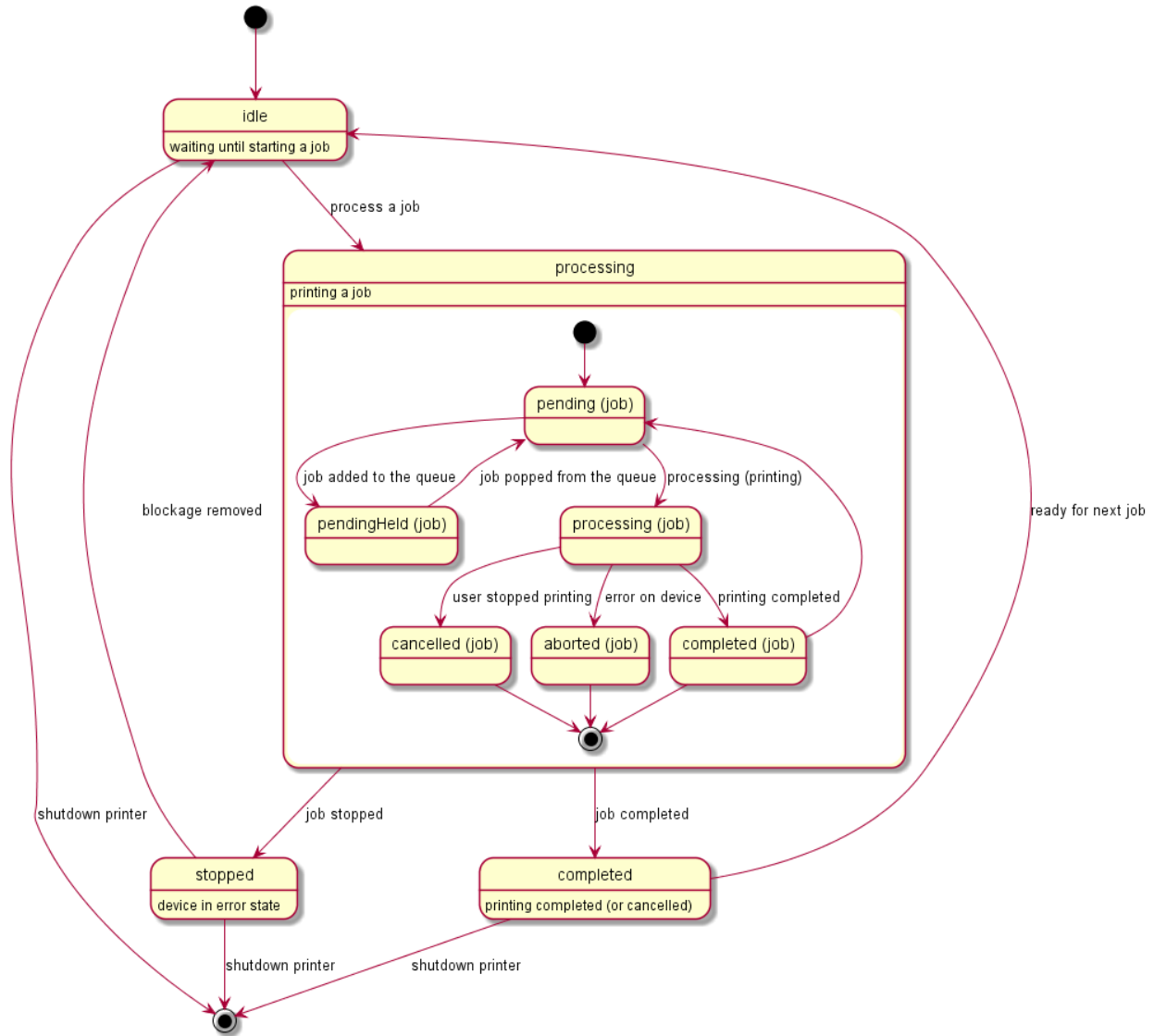
415 **Table 10-3 list of required oic.r.operational.state supported values per Device Type (“rt”)**

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

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

420

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



421
422 **Figure 5 Example of mode transitions of a Printer.**

423

424 **10.6 Camera Media Format (oic.r.media)**

425 The supported camera media formats can be discovered by looking at the SDP (see IETF RFC
426 4566) list of the media Resource Type. The recommended list of supported media formats are
427 listed in Table 10-4.

428

Table 10-4 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/AA C	MPEG-2 TS	RTP	Recommended minimal resolution 1920x1080 (width, height)
Still image	JPEG	JPEG	RTP	Recommended minimal resolution 1920x1080 (width, height)

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