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NEXT-GENERATION NETWORKS, INTERNET OF
THINGS AND SMART CITIES

Internet of things and smart cities and communities –
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oneM2M – Home appliances information model and mapping

Recommendation ITU-T Y.4500.23

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Recommendation ITU-T Y.4500.23

oneM2M – Home appliances information model and mapping

Summary

Recommendation ITU-T Y.4500.23 describes the oneM2M defined information model for home appliances, including the description of how it is mapped with other information models from external organizations. It also explains the ontology for the home domain information model.

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NOTE – The structure of this Recommendation departs slightly from the usual editorial style of ITU-T Recommendations to preserve existing cross-referencing from external documents.

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Recommendation ITU-T Y.4500.23

oneM2M – Home appliances information model and mapping

1 Scope

This Recommendation describes the oneM2M defined information model for home appliances, including the description of how it is mapped with other information models from external organizations. It also explains the ontology for the home domain information model.

The Recommendation contains oneM2M Release 2 specification - oneM2M Home Appliances Information Model and Mapping V2.0.0 and is equivalent to standards of oneM2M partners including ARIB, ATIS [b-ATIS.oneM2M.TS0023], CCSA [b-CCSA M2M-TS-0023], ETSI [ETSI TS 118 123], TTA, TSDSI [b-TSDSI STD T1.oneM2M TS-0023], TTA [b-TTAT.MM-TS.0023 v2.0.0] and TTC [b-TTC TS-M2M-0023].

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T Y.4500.1] Recommendation ITU-T Y.4500.1 (2018), *oneM2M – Functional architecture*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 application entity(AE) [b-ITU-T Y.4500.11]: Represents an instantiation of application logic for end-to-end M2M solutions.

3.1.2 common services entity (CSE) [b-ITU-T Y.4500.11]: Represents an instantiation of a set of common service functions of the M2M environments. Such service functions are exposed to other entities through reference points.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 Device Class ID: URN to identify the device model definition.

3.2.2 ModuleClass ID: URN to identify the ModuleClass model definition.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AE Application Entity

CSE Common Services Entity

HEMS Home Energy Management System

IPE	Interworking Proxy application Entity
M2M	Machine to Machine
RGB	Red, Green and Blue (Colour mode)
SDT	Smart Device Template
URN	Uniform Resource Name

5 Conventions

The key words "Shall", "Shall not", "May", "Need not", "Should", "Should not" in the present document are to be interpreted as described:

Shall/Shall not:

Requirements

- 1) effect on Standard: Standard needs to describe the required feature (i.e., specify a technical solution for the Requirement);
2. effect on products: every implementation (M2M Solution that complies to this Standard) must support it;
- 3) effect on deployments: every deployment (M2M Service based on this Standard) must use the Standardized feature where applicable – otherwise e.g., interoperability problems with other services could arise.

Should/Should not

Recommendation

- 1) effect on Standard: Standard needs to describe a solution that allows the presence and the absence of the feature;
- 2) effect on products: an implementation may or may not support it, however support is recommended;
- 3) effect on deployments: a deployment may or may not use it, however usage is recommended.

May/Need not:

Permission/Option

- 1) effect on Standard: Standard needs to describe a solution that allows the presence and the absence of the required feature;
- 2) effect on products: an implementation may or may not support it;
- 3) effect on deployments: A deployment may or may not use it.

6 Home appliance information model

6.1 Introduction

The present document intends to provide the unified means in the oneM2M system by defining a home appliance information model for the home domain devices such as TV, refrigerator, air conditioner, clothes washer, oven and robot cleaner. For the reasons of interworking with external technologies and efficiency, the principle of the home appliance information model is designed based on HGI SDT 3.0 [b-HGI SDT].

The principle of defining the home appliance information model is introduced in clause 6.2. ModuleClasses which oneM2M systems support are explained in clause 6.3. In the subsequent clause 6.4, device models are defined.

6.2 Design principle of the home appliance information model

6.2.1 Basic design principle of information modelling

The design principle of the oneM2M abstract information model of home appliances, is to use smart device template (SDT) 3.0 as introduced in oneM2M TR-0017 [b-oneM2M TR-0017]. Note that those terms starting with a capital letter in this clause are SDT terms and are explained in [b-HGI SDT].

Domain is a unique name which acts like a namespace (e.g., "org.oneM2M.home.modules"). It is set by the organization creating the SDT, allowing reference to a package of definitions for the contained ModuleClasses and device models.

ModuleClasses specify a single service (e.g., audioVolume, powerOn/Off) with one or more Actions, Properties, DataPoints and Events. Each service which is described as a ModuleClass can be re-used in many Devices.

Device model is a physical, addressable, identifiable appliance, sensor and actuator with one or more Modules, Properties and SubDevices.

SubDevice is a device which may be embedded in a Device and/or is addressed via another Device.

Module is an instantiation of a ModuleClass for a specific Device or SubDevice.

Figure 6.2.1-1 depicts the basic structure of SDT 3.0.

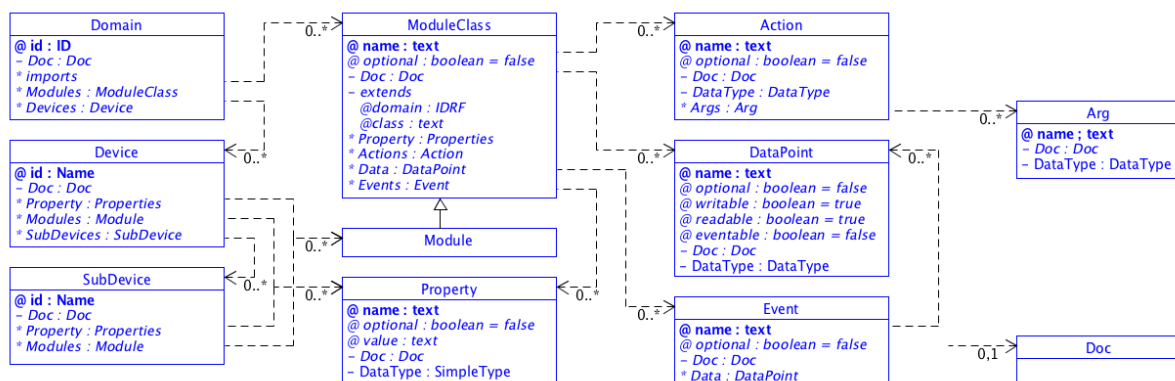


Figure 6.2.1-1 – Design structure of the home appliance information model using SDT 3.0

6.2.2 Description rules for Module Classes and device models

When the Home Appliance Information Model is described based on SDT, the following rules shall be applied:

- Rule 1: CamelCase rule:
 - When naming each element, lowerCamelCase shall be used.
- Rule 2: Rule for description of Action, DataPoint:
 - DataPoint shall be used to represent stateless operations. (e.g., powerState of binarySwitch for on/off operations).
 - Action shall be used when describing stateful condition, handling unknown internal state conditions (e.g., upVolume/downVolume by increasing/decreasing the audioVolume in steps, handling transactional procedures, or checking integrity using username plus password at the same time).
- Rule 3: Rule for description of DataPoint and Property:

- Non-functional information shall be described as a Property. Functional information shall be described as a DataPoint. (E.g., non-functional information: version, id; functional information: targetTemperature, targetVolume).
- Rule 4: Definition of the Domain:
 - The Domain, in the case of the home appliance information model, is specified as "org.onem2m.home".
 - The sub-domain for Device and ModuleClass shall be specified as "org.onem2m.home.devices" and "org.onem2m.home.moduleclasses" respectively.
- Rule 5: Naming rule for the element:
 - the name of each element should be concise and avoid repeating its parent element name; but
 - it may include the name of its parent element for readability (e.g., lightDimmerUp, lightDimmerDown under lightDimmer).
- Rule 6: Criteria for marking elements as optional or mandatory:
 - An element shall only be defined as mandatory if it's foreseen to be universally mandatory to all implementing technologies.
- Rule 7: Enumeration type:
 - When describing the meaning of values for enumeration type elements, they may be described in another clause.

The enumeration types for home appliance information model are based on <xs:integer> and the numeric values are interpreted as specified in clause 6.5.

6.3 ModuleClasses

6.3.1 alarmSpeaker

This ModuleClass provides the capability to initiate an alarm, see Table 6.3.1-1.

Table 6.3.1-1 – DataPoints of alarmSpeaker ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
tone	hd:tone	true	true	true	Representing the tones of the alarm
light	hd: alertColourCode	true	true	true	Representing the lighting mode of the alarm.
alarmStatus	xs:boolean	true	true	false	"True" indicates the alarm start while "False" indicates the alarm stop.

6.3.2 audioVideoInput

This ModuleClass provides capabilities to control and monitor the audio video input source of a device such as a TV or SetTopBox, see Table 6.3.2-1.

Table 6.3.2-1 – DataPoints of audioVideoInput ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
inputSourceID	xs:integer	true	true	false	Activated input source ID in the supported input source list, supportedInputSources.
supportedInputSources	list of hd:supportedInputSource	true	false	false	List of supported input sources for the given device (see clause 6.5.2).

6.3.3 audioVolume

This ModuleClass provides capabilities to control and monitor volume, see Tables 6.3.3-1 and 6.3.3-2.

Table 6.3.3-1 – Actions of audioVolume

Return Type	Name	Argument	Optional	Documentation
none	upVolume	none	true	Increase volume by the amount of the stepValue up to the maxValue.
none	downVolume	none	true	Decrease volume by the amount of the stepValue down to 0.

Table 6.3.3-2 – DataPoints of audioVolume

Name	Type	Readable	Writable	Optional	Documentation
volumePercentage	xs:integer	true	true	false	The rounded percentage of the current volume in the range of [0, maxVolume]. 0 percentage shall mean no sound produced.
stepValue	xs:integer	true	false	true	Step value used by UpVolume and DownVolume Actions.
maxValue	xs:integer	true	false	true	Maximum value allowed for Volume.
muteEnabled	xs:boolean	true	true	false	The current status of the mute enablement. "True" indicates enabled and "False" indicates not enabled.

6.3.4 battery

battery ModuleClass indicates the detection of low battery and gives an alarm if a triggering criterion is met. The charge value in the module shows the current battery charge level, see Table 6.3.4-1 and Table 6.3.4-2.

Table 6.3.4-1 – DataPoints of battery ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
level	xs:integer	true	false	false	The rounded percentage of the current level of battery in the range of [0, 100]. 0 percentage shall mean no battery remained.
capacity	xs:integer	true	false	true	The total capacity of battery in mAh.
charging	xs:boolean	true	false	true	The status of charging. "True" indicates enabled and "False" indicates not enabled.
discharging	xs:boolean	true	false	true	The status of discharging. "True" indicates enabled and "False" indicates not enabled.
lowBattery	xs:boolean	true	false	true	To indicate that the battery is in low charge level.
batteryThreshold	xs:integer	true	true	true	When the battery level is less than batteryThreshold then the lowBattery is true (and optionally to generate an alarm, see clause 6.3.1).

Table 6.3.4-2 – Properties of battery ModuleClass

Name	Type	Value	Optional	Documentation
propElectricEnergy	xs:integer		true	Rated electric energy.
propVoltage	xs:integer		true	Rated voltage.
propMaterial	xs:string		true	The material (e.g., lithium ion, nickel and lead) of the cell.

6.3.5 binarySwitch

This ModuleClass provides capabilities to control and monitor the state of power, see Table 6.3.5-1 and Table 6.3.5-2.

Table 6.3.5-1 – Actions of binarySwitch ModuleClass

Return Type	Name	Argument	Optional	Documentation
none	toggle	none	true	Toggle the switch.

Table 6.3.5-2 – DataPoints of binarySwitch ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
powerState	xs:boolean	true	true	false	The current status of the binarySwitch. "True" indicates turned-on and "False" indicates turned-off.

6.3.6 bioElectricalImpedanceAnalysis

This ModuleClass provides the analysis of human body tissue based on impedance measurement, see Table 6.3.6-1.

Table 6.3.6-1 – DataPoints of bioElectricalImpedanceAnalysis ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
water	xs:float	true	false	false	The water content measurement from the BIA; the common unit is percentage.
fat	xs:float	true	false	false	The fat content measurement from the BIA; the common unit is percentage.
muscle	xs:float	true	false	false	The muscle content measurement from the BIA; the common unit is percentage.
bone	xs:float	true	false	false	The bone content measurement from the BIA; the common unit is percentage.
visceraFat	xs:float	true	false	false	The viscera fat content measurement from the BIA; the common unit is percentage.
kcal	xs:float	true	false	false	The kcal (kilocalories) measurement from the BII.
resistance	xs:float	true	false	false	The resistance of human body; the common unit is ohm.

6.3.7 boiler

This ModuleClass provides the status of boiling function for water heaters, see Table 6.3.7-1.

Table 6.3.7-1 – DataPoints of boiler ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
status	xs:boolean	true	true	false	The status of boiling.

6.3.8 brightness

This ModuleClass describes the brightness of a light e.g., from a lamp. Brightness is scaled as a percentage. A lamp or a monitor can be adjusted to a level of light between very dim (0% is the minimum brightness) and very bright (100% is the maximum brightness), see Table 6.3.8-1.

Table 6.3.8-1 – DataPoints of brightness ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
brightness	xs:integer	true	true	false	The status of brightness level in percentage.

6.3.9 clock

This ModuleClass provides the information about current date and time, see Table 6.3.9-1.

Table 6.3.9-1 – DataPoints of clock ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
currentTime	xs:time	true	true	false	Information of the current time
currentDate	xs:date	true	true	false	Information of the current date

6.3.10 colour

This ModuleClass provides the capabilities to set the value of red, green, blue for the colour device, see Table 6.3.10-1.

Table 6.3.10-1 – DataPoints of colour ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
red	xs:integer	true	true	false	The R value of RGB; the range is [0,255]
green	xs:integer	true	true	false	The G value of RGB; the range is [0,255]
blue	xs:integer	true	true	false	The B value of RGB; the range is [0,255]

6.3.11 colourSaturation

The colourSaturation ModuleClass, see Table 6.3.11-1, describes a colour saturation value. The value is an integer. A colourSaturation has a range of [0,100]. A colourSaturation value of 0 means producing black and white images. A colourSaturation value of 50 means producing device specific normal colour images. A colourSaturation value of 100 means producing device very colourful images.

Table 6.3.11-1 – DataPoints of colourSaturation ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
colourSaturation	xs:integer	true	true	false	The status of colour saturation level.

6.3.12 doorStatus

This ModuleClass provides the status of a door. It is intended to be part of a larger object such as a refrigerator and an oven that might have multiple doors, see Table 6.3.12-1.

Table 6.3.12-1 – DataPoints of doorStatus ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
doorState	hd:doorState	true	false	false	"Closed" indicates that door is closed, "Open" indicates that the door is open, "Opening" indicates that the door is opening, "Closing" indicates that the door is closing, "Stopped" indicates that the door is in stationary state.
openDuration	m2m:timestamp	true	false	true	The time duration the door has been open.
openAlarm	xs:boolean	true	true	true	The state of the door open alarm. "True" indicates that the open alarm is active. "False" indicates that the open alarm is not active.

6.3.13 electricVehicleConnector

This ModuleClass provides the information about charging/discharging devices for electric vehicles, see Table 6.3.13-1 and Table 6.3.13-2.

Table 6.3.13-1 – DataPoints of electricVehicleConnector ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
status	xs:boolean	true	false	false	The status of connection.

Table 6.3.13-2 – Properties of electricVehicleConnector ModuleClass

Name	Type	Value	Optional	Documentation
propChargingCapacity	xs:integer		true	Rated charging capacity.
propDischargingCapacity	xs:integer		true	Rated discharging capacity.

6.3.14 energyConsumption

This ModuleClass describes the energy consumed by the device since power up, see Table 6.3.14-1. One particular use case for the energyConsumption ModuleClass is smart meters.

Table 6.3.14-1 – DataPoints of energyConsumption ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
power	xs:float	true	false	false	The power of the device. The common unit is Watt (W).
absoluteEnergyConsumption	xs:float	true	false	true	The absolute energy consumption, reflecting the real measurement of accumulative energy. The common unit is Watt-hour (Wh).
roundingEnergyConsumption	xs:integer	true	false	true	This energy consumption data can be calculated by using significantDigits and multiplyingFactors.
significantDigits	xs:integer	true	false	true	The number of effective digits for data.
multiplyingFactors	xs:float	true	false	true	The unit for data (multiplying factors), e.g., 1 kWh, 0,1 kWh, 0,01 kWh, etc.
voltage	xs:float	true	false	true	The voltage of the device. The common unit is volts (V).
current	xs:float	true	false	true	The current of the device. The common unit is ampere (A).
frequency	xs:float	true	false	true	The frequency of the device. The common unit is hertz (Hz).

6.3.15 energyGeneration

This ModuleClass provides information about generation data on electric generator devices such as a photo voltaic power system, fuel cells, or microgeneration, see Table 6.3.15-1.

Table 6.3.15-1 – DataPoints of energyGenerationModuleClass

Name	Type	Readable	Writable	Optional	Documentation
powerGenerationData	xs:float	true	false	true	Amount of instantaneous generation data.
roundingEnergyGeneration	xs:integer	true	false	true	This energy generation data can be calculated by using significantFigures and multiplyingFactors.
significantDigits	xs:integer	true	false	true	The number of effective digits for data.
multiplyingFactors	xs:float	true	false	true	The unit for data (multiplying factors), e.g., 1 kWh, 0,1 kWh, 0,01 kWh, etc.

6.3.16 faultDetection

This ModuleClass provides information about whether a fault has occurred in the actual device, see Table 6.3.16-1.

Table 6.3.16-1 – DataPoints of faultDetection ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
status	xs:boolean	true	false	false	Status of fault detection.
code	xs:integer	true	false	true	Code of the fault.
description	xs:string	true	false	true	Message of the fault.

6.3.17 height

This ModuleClass provides the capability to report the measurement of height, see Table 6.3.17-1.

Table 6.3.17-1 – DataPoints of height ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
height	xs:float	true	false	false	The height measurement. The common unit is centimetre (cm).

6.3.18 hotWaterSupply

This ModuleClass provides information about the status of supplying hot water into tanks or bathtubs, see Table 6.3.18-1.

Table 6.3.18-1 – DataPoints of hotWaterSupply ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
status	xs:boolean	true	false	false	The status of watering operation.
bath	xs:boolean	true	true	true	The status of filling bath tub.

6.3.19 keypad

This ModuleClass, see Table 6.3.19-1, provides the capability to require a user defined service through the key-in number. For example, a user can define key 1 as "require a takeout from restaurant XXX with combo meal 1". The IoT service provider or user can define the services.

Table 6.3.19-1 – DataPoints of keypad ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
keyNumber	xs:integer	true	false	false	The number of key.

6.3.20 motionSensor

This ModuleClass provides the capabilities to indicate the occurrence of motion and raises an alarm if the triggering criterion is met, see Table 6.3.20-1.

Table 6.3.20-1 – DataPoints of motionSensor ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
alarm	xs:boolean	true	false	false	The detection of the motion occurrence.
silentTime	xs:integer	true	true	true	The time that the motionSensor restrains from sending an alarm in case continuous motions are detected after one alarm is produced. This DataPoint can be used to avoid repeated alarm reports.
sensitivity	xs:integer	true	true	true	The level of the detection accuracy of the motion sensor. This DataPoint can be used to control the number of the report.

6.3.21 oximeter

This ModuleClass provides the capability to report the measurement of blood characteristics, see Table 6.3.21-1.

Table 6.3.21-1 – DataPoints of oximeter ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
diastolicPressure	xs:integer	true	false	false	The measurement of diastolic pressure by Oximeter. The common unit is millimetre of mercury (mmHg).
systolicPressure	xs:integer	true	false	false	The measurement of systolic pressure by Oximeter. The common unit is millimetre of mercury (mmHg).
pulseRate	xs:integer	true	false	false	The measurement of pulse rate by Oximeter. The common unit is in beats per minute.
oxygenSaturation	xs:integer	true	false	false	The measurement of oxygen saturation by Oximeter. The common unit is in percentage.

6.3.22 powerSave

This ModuleClass provides capabilities to enable power saving mode and monitor the current status, see Table 6.3.22-1.

Table 6.3.22-1 – DataPoints of powerSave ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
powerSaveEnabled	xs:boolean	true	true	false	The current status of the Power Saving Mode. "True" indicates enabled and "false" indicates not enabled.

6.3.23 pushButton

This ModuleClass, see Table 6.3.23-1, provides the capability to indicate the operation of a button style switch. A typical application can be an SOS button.

Table 6.3.23-1 – DataPoints of pushButton ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
pushed	xs:boolean	true	false	false	To indicate the press of the button.

6.3.24 recorder

This ModuleClass provides the capability to record the video/audio for a defined duration, see Table 6.3.24-1.

Table 6.3.24-1 – DataPoints of recorder ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
duration	xs:integer	true	true	false	The duration for video/audio recording. Set to trigger the recorder. The common unit is seconds.

6.3.25 refrigeration

This ModuleClass, see Table 6.3.25-1, describes a refrigeration function. This is not a Refrigerator device. The filter state is a read-only value providing the percentage life time remaining for the water filter. RapidFreeze is a boolean that controls the rapid freeze capability if present. RapidCool is a boolean that controls the rapid cool capability if present. Defrost is a boolean that controls the defrost cycle if present.

Table 6.3.25-1 – DataPoints of refrigeration ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
filterLifetime	xs:integer	true	false	true	Percentage life time remaining for the water filter.
rapidFreeze	xs:boolean	true	true	true	Indicates whether the unit has a rapid freeze capability active.
rapidCool	xs:boolean	true	true	true	Indicates whether the unit has a rapid cool capability active.
defrost	xs:boolean	true	true	true	Indicates whether a defrost cycle is currently active.

6.3.26 relativeHumidity

This ModuleClass provides the capability for the device to report the humidity based on a specified rule that is vendor discretionary, see Table 6.3.26-1.

Table 6.3.26-1 – DataPoints of relativeHumidity ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
relativeHumidity	xs:float	true	false	false	The measurement of the relative humidity value; the common unit is percentage.
desiredHumidity	xs:float	true	true	true	Desired value for Humidity.

6.3.27 rinseLevel

This ModuleClass, see Table 6.3.27-1, provides capabilities to control and monitor the level of rinse. It is intended to be part of object which uses rinse such as a washing machine.

Table 6.3.27-1 – DataPoints of rinseLevel ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
rinseLevel	hd:liquidLevel	true	true	false	The level of rinse (see clause 6.5.3). A higher value indicates a higher rinse level.

6.3.28 runMode

This ModuleClass provides capabilities to control and monitor the operational modes of appliances, see Table 6.3.28-1.

Table 6.3.28-1 – DataPoints of runMode ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
operationMode	hd:supportedModes	true	true	false	Currently active mode.
supportedModes	list of hd:supportedModes	true	true	false	List of possible modes the device supports (see clause 6.5.7)

6.3.29 signalStrength

This ModuleClass provides the capability to monitor the strength of the signal see Table 6.3.29-1.

Table 6.3.29-1 – DataPoints of signalStrength ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
lqi	xs:integer	true	false	false	The current value of link quality indicator, which reflects the scaling of rssi by dividing the received signal strength over reference signal strength. The common unit for lqi is percentage [0,100]. For the detailed definition, please see IEEE 802.15.4 [b-IEEE 802.15.4], clause 6.7.8.
rssi	xs:float	true	false	true	The current value of received signal strength indicator, which reflects the raw signal level.

6.3.30 smokeSensor

This ModuleClass provides the capabilities to indicate the detection of smoke and raises an alarm if the triggering criterion is met, see Table 6.3.30-1.

Table 6.3.30-1 – DataPoints of smokeSensor ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
alarm	xs:boolean	true	false	false	The detection of smoke.
detectedTime	m2m:timestamp	true	true	true	The time the smoke is detected.

6.3.31 spinLevel

This ModuleClass provides capabilities to control and monitor the level of spin. It is intended to be part of objects which use spinning functions such as a washing machine and a dryer, see Table 6.3.31-1.

Table 6.3.31-1 – DataPoints of spinLevel ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
spinLevelStrength	hd:spinLevelStrength	true	true	false	The value of spin-dry level (see clause 6.5.4). A higher value indicates a higher spin level.

6.3.32 televisionChannel

This ModuleClass provides capabilities to set and get channels of a device that has a channel list, see Table 6.3.32-1 and Table 6.3.32-2.

Table 6.3.32-1 – Actions of televisionChannel ModuleClass

Return Type	Name	Argument	Optional	Documentation
none	upChannel	none	true	Change the current channel to the next channel in the stored list of available channels. If the current channel is the last one in the list, the new set channel may be the first one in the list.
none	downChannel	none	true	Change the current channel to the previous channel in the stored list of available channels. If the current channel is the first one in the list, the new set channel may be the last one in the list.

Table 6.3.32-2 – DataPoints of televisionChannel ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
channelId	xs:integer	true	true	false	Current channel ID.
availableChannels	list of xs:integer	true	false	true	The list of available channel numbers which may be built by automatic scan and/or manual selection.
previousChannel	xs:integer	true	false	true	The channel number which was selected previously.

6.3.33 temperature

This ModuleClass provides capabilities to represent the current temperature and target temperature of devices such as an air conditioner, refrigerator, oven, etc., see Table 6.3.33-1.

Table 6.3.33-1 – DataPoints of temperature ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
currentTemperature	xs:float	true	false	false	The current temperature.
targetTemperature	xs:float	true	true	true	The desired temperature to reach.
unit	xs:string	true	false	true	The unit for the temperature values. The default is Celsius (C).
minValue	xs:float	true	false	true	Minimum value of targetTemperature.
maxValue	xs:float	true	false	true	Maximum value of targetTemperature.
stepValue	xs:float	true	false	true	Step value allowed for targetTemperature.

6.3.34 temperatureAlarm

This ModuleClass provides the capabilities to indicate the detection of abnormal temperatures and raises an alarm if the triggering criterion is met, see Table 6.3.34-1.

Table 6.3.34-1 – DataPoints of temperatureAlarm ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
alarm	xs:boolean	true	false	false	The detection of abnormal temperature.
temperature	xs:float	true	false	true	To report the value of the temperature. The common unit is Celsius (C).
temperatureThreshold	xs:integer	true	true	true	The threshold to trigger the alarm.

6.3.35 timer

This ModuleClass provides capabilities to monitor and control the times when the appliance executes its operations (i.e. when it starts, when it ends, etc.), see Table 6.3.35-1 and Table 6.3.35-2.

Table 6.3.35-1 – Actions of timer ModuleClass

Return Type	Name	Argument	Optional	Documentation
none	activateClockTimer	none	true	Activate current clock timer.
none	deactivateClockTimer	none	true	Deactivate current clock timer.

Table 6.3.35-2 – DataPoints of timer ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
referenceTimer	xs:integer	true	false	true	A Timer (e.g., a time-based value, App Defined Epoch, Progressive) expressed in seconds. The value indicates a time counter to be used as reference for the other time-based data points of this ModuleClass. Usually it is the time since the last event of power on of the producer (or more in detail the boot of its connectivity node).
targetTimeToStart	xs:integer	true	true	true	A TimeSpan (e.g., a time-based value, App Defined Epoch, Fixed) expressed in seconds. The value indicates the time when the appliance is expected to start its operation, starting counting from the last ReferenceTimer.
targetTimeToStop	xs:integer	true	true	true	A TimeSpan (e.g., a time-based value, App Defined Epoch, Fixed) expressed in seconds. The value indicates the time when the appliance is expected to stop its operation, starting counting from the last ReferenceTimer.
estimatedTimeToEnd	xs:integer	true	false	true	A Timer (e.g., a time-based value, App Defined Epoch, Progressive) expressed in seconds. The value indicates the time to the ends of appliance operations. It is calculated at runtime by device itself during the execution of its operation.
runningTime	xs:integer	true	false	true	It is a Timer (e.g., a time-based value, App Defined Epoch, Progressive) expressed in seconds. It indicates the time of the current operation. Usually its value is increasing of one value each second. It starts counting from 0 when the operation starts and stops counting when the operation ends.
targetDuration	xs:integer	true	false	true	A TimeSpan (e.g., a time-based value, App Defined Epoch, Fixed) expressed in seconds. The value indicates a time, representing the target duration of the operation as per user selection.
absoluteStartTime	m2m:timestamp	true	true	true	An absolute time to specify the start time.
absoluteStopTime	m2m:timestamp	true	true	true	An absolute time to specify the stop time.

6.3.36 turbo

This ModuleClass, see Table 6.3.36-1, provides capabilities to enable turbo mode and monitor the current status of the turbo function. It is intended to be part of objects which use turbo function such as an air conditioner, a washing machine, etc.

Table 6.3.36-1 – DataPoints of turbo ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
turboEnabled	xs:boolean	true	true	false	The current status of the Turbo Mode. "True" indicates enabled and "False" indicates not enabled.

6.3.37 waterFlow

This ModuleClass is for controlling water strength of a device, see Table 6.3.37-1.

Table 6.3.37-1 – DataPoints of waterFlow ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
waterLevelStrength	hd:waterFlowStrength	true	true	false	The desired level of water flow (see clause 6.5.8). A higher value indicates higher water flow.

6.3.38 waterLevel

This ModuleClass provides the level and supply source of water for an appliance, see Table 6.3.38-1.

Table 6.3.38-1 – DataPoints of waterLevel ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
liquidLevel	hd:liquidLevel	true	true	false	The desired level of water (see clause 6.5.3).

6.3.39 waterSensor

This ModuleClass provides the capabilities to indicate whether or not water has been sensed and raises an alarm if the triggering criterion is met, see Table 6.3.39-1.

Table 6.3.39-1 – DataPoints of waterSensor ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
alarm	xs:boolean	true	false	false	The detection of water.

6.3.40 weight

This ModuleClass provides the capability to report the measurement of weight, see Table 6.3.40-1.

Table 6.3.40-1 – DataPoints of weight ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
weight	xs:float	true	false	false	The weight measurement. The common unit is kilogram (kg).

6.3.41 wind

This ModuleClass is for controlling wind strength and direction of a device, see Table 6.3.41-1.

Table 6.3.41-1 – DataPoints of wind ModuleClass

Name	Type	Readable	Writable	Optional	Documentation
windStrength	hd:windStrength	true	true	false	The current strength of the wind(see clause 6.5.9).
directionUp	xs:boolean	true	true	true	The current status of the upward blowing enablement. "True" indicates enabled and "False" indicates not enabled.
directionDown	xs:boolean	true	true	true	The current status of the downward blowing enablement. "True" indicates enabled and "False" indicates not enabled.
directionRight	xs:boolean	true	true	true	Right side enablement (0:off, 1:on) The current status of the rightward blowing enablement. "True" indicates enabled and "False" indicates not enabled.
directionLeft	xs:boolean	true	true	true	The current status of the leftward blowing enablement. "True" indicates enabled and "False" indicates not enabled.
directionAuto	xs:boolean	true	true	true	The current status of the automatic blowing enablement. "True" indicates enabled and "False" indicates not enabled.

6.4 Device models

6.4.1 deviceAirConditioner

An air conditioner is a home appliance used to alter the properties of air (primarily temperature and humidity) to more comfortable conditions. This air conditioner information model provides capabilities to control and monitor air conditioner specific functions and resources, see Table 6.4.1-1.

Table 6.4.1-1 – Modules of deviceAirConditioner device model

Module instance name	Module class name	Optional	Description
binarySwitch	binarySwitch	true	See clause 6.3.5
runMode	runMode	true	See clause 6.3.28
temperature	temperature	true	See clause 6.3.33
timer	timer	true	See clause 6.3.35
turbo	turbo	true	See clause 6.3.36
wind	wind	true	See clause 6.3.41

6.4.2 deviceClothesWasher

A clothes washer is a home appliance that is used to wash laundry, such as clothing and sheets. This information model provides capabilities to interact with specific functions and resources of clothes washers, see Table 6.4.2-1.

Table 6.4.2-1 – Modules of deviceClothesWasher device model

Module Instance Name	Module class name	Optional	Description
binarySwitch	binarySwitch	true	See clause 6.3.5
timer	timer	true	See clause 6.3.35
runMode	runMode	true	See clause 6.3.28
temperature	temperature	true	See clause 6.3.33
waterLevel	waterLevel	true	See clause 6.3.38
rinseLevel	rinseLevel	true	See clause 6.3.27
waterFlow	waterFlow	true	See clause 6.3.37
spinLevel	spinLevel	true	See clause 6.3.31

6.4.3 deviceElectricVehicleCharger

An electric vehicle charger is a device that is used for charging or discharging electric vehicles, see Table 6.4.3-1.

Table 6.4.3-1 – Modules of deviceElectricVehicleCharger device model

Module instance name	Module class name	Optional	Description
faultDetection	faultDetection	false	See clause 6.3.16
binarySwitch	binarySwitch	false	See clause 6.3.5
runMode	runMode	false	See clause 6.3.28
battery	battery	false	See clause 6.3.10
electricVehicleConnector	electricVehicleConnector	false	See clause 6.3.13

6.4.4 deviceLight

A light is a device that is used to control the state of an illumination device, see Table 6.4.4-1.

Table 6.4.4-1 – Modules of deviceLight device model

Module instance name	Module class name	Optional	Description
faultDetection	faultDetection	true	See clause 6.3.16
binarySwitch	binarySwitch	false	See clause 6.3.5
runMode	runMode	true	See clause 6.3.28
colour	colour	true	See clause 6.3.10
colourSaturation	colourSaturation	true	See clause 6.3.11
brightness	brightness	true	See clause 6.3.8

6.4.5 deviceMicrogeneration

A microgeneration is a home energy management system (HEMS) device that is used to create energy. Examples of microgeneration devices are photovoltaic devices or fuel cells, see Table 6.4.5-1 and Table 6.4.5-2.

Table 6.4.5-1 – Modules of deviceMicrogeneration device model

Module instance name	Module class name	Optional	Description
faultDetection	faultDetection	true	See clause 6.3.16
binarySwitch	binarySwitch	true	See clause 6.3.5
runMode	runMode	true	See clause 6.3.28
energyGeneration	energyGeneration	false	See clause 6.3.15

Table 6.4.5-2 – Device specific properties of deviceMicrogeneration device model

Name	Type	Value	Optional	Documentation
propGenerationSource	xs:string	-	false	The type of generating source.

6.4.6 deviceOven

An oven is a home appliance used to roast and heat food in a complete stove. This information model is applicable to different types of ovens: gas ovens, electrical ovens, steam ovens, microwave ovens, etc. This information model provides capabilities to interact with specific functions and resources of ovens, see Table 6.4.6-1.

Table 6.4.6-1 – Modules of deviceOven device model

Module instance name	Module class name	Optional	Description
binarySwitch	binarySwitch	true	See clause 6.3.5
runMode	runMode	true	See clause 6.3.28
timer	timer	true	See clause 6.3.35
temperature	temperature	true	See clause 6.3.33

6.4.7 deviceRefrigerator

A refrigerator is a home appliance used to store food at temperatures which are a few degrees above the freezing point of water. This information model provides capabilities to interact with specific functions and resource of refrigerators, see Table 6.4.7-1.

Table 6.4.7-1 – Modules of deviceRefrigerator device model

Module instance name	Module class name	Optional	Description
binarySwitch	binarySwitch	true	See clause 6.3.5
powerSave	powerSave	true	See clause 6.3.22
doorstatusdoorStatus	doorStatus	true	See clause 6.3.12
frozenTemperature	temperature	true	See clause 6.3.33
freshTemperature	temperature	true	See clause 6.3.33
customTemperature	temperature	true	See clause 6.3.33
refrigeration	refrigeration	true	See clause 6.3.25

6.4.8 deviceRobotCleaner

A robot cleaner is an autonomous robotic vacuum cleaner that has intelligent programming and a limited vacuum cleaning system. This robot cleaner information model provides capabilities to control and monitor robot cleaner specific functions and resources, see Table 6.4.8-1.

Table 6.4.8-1 – Modules of deviceRobotCleaner device model

Module instance name	Module class name	Optional	Description
binarySwitch	binarySwitch	true	See clause 6.3.5
runMode	runMode	true	See clause 6.3.28
battery	battery	true	See clause 6.3.10
timer	timer	true	See clause 6.3.35

6.4.9 deviceSmartElectricMeter

A smart electric meter is a metering device that is used to measure consumption data for electricity, see Table 6.4.9-1 and Table 6.4.9-2.

Table 6.4.9-1 – Modules of deviceSmartElectricMeter device model

Module instance name	Module class name	Optional	Description
faultDetection	faultDetection	true	See clause 6.3.16
binarySwitch	binarySwitch	true	See clause 6.3.5
runMode	runMode	true	See clause 6.3.28
clock	clock	true	See clause 6.3.9
energyConsumption	energyConsumption	false	See clause 6.3.14
energyGeneration	energyGeneration	true	See clause 6.3.15

Table 6.4.9-2 – Device specific properties of deviceSmartElectricMeter device model

Name	Type	Value	Optional	Documentation
propMeasuringScope	xs:string	-	true	Measuring scope of the meter (e.g., whole house, room, or device).

6.4.10 deviceStorageBattery

A storage battery is a HEMS device that is used to provide the home with electrical energy, see Table 6.4.10-1.

Table 6.4.10-1 – Modules of deviceStorageBattery device model

Module instance name	Module class name	Optional	Description
faultDetection	faultDetection	true	See clause 6.3.16
binarySwitch	binarySwitch	true	See clause 6.3.5
runMode	runMode	true	See clause 6.3.28
battery	battery	false	See clause 6.3.10

6.4.11 deviceTelevision

A television (TV) is a home appliance used to show audio and visual content such as broadcasting programmes and network streaming. This TV information model provides capabilities to control and monitor TV specific resources, see Table 6.4.11-1.

Table 6.4.11-1 – Modules of deviceTelevision device model

Module instance name	Module class name	Optional	Description
binarySwitch	binarySwitch	true	See clause 6.3.5
audioVolume	audioVolume	true	See clause 6.3.6
televisionChannel	televisionChannel	true	See clause 6.3.32
audioVideoInput	audioVideoInput	true	See clause 6.3.5

6.4.12 deviceThermostat

A thermostat is used to control the ambient temperature of rooms within for example a house. This information model provides capabilities to interact with specific functions of thermostats, see Table 6.4.12-1.

Table 6.4.12-1 – Modules of deviceThermostat device model

Module instance name	Module class name	Optional	Description
runMode	runMode	true	See clause 6.3.28. The possible values of the supportedModes datapoint for the Thermostat device are included in clause 6.5.7
timer	timer	true	see clause 6.3.35
temperature	temperature	false	see clause 6.3.33

6.4.13 deviceWaterHeater

A water heater is a device that is used to provide hot water through home facilities, see Table 6.4.13-1.

Table 6.4.13-1 – Modules of deviceWaterHeater device model

Module instance name	Module class name	Optional	Description
faultDetection	faultDetection	true	See clause 6.3.16
binarySwitch	binarySwitch	false	See clause 6.3.5
runMode	runMode	true	See clause 6.3.28
clock	clock	true	See clause 6.3.9
boiler	boiler	true	See clause 6.3.7
hotWaterSupply	hotWaterSupply	true	See clause 6.3.18

6.5 Enumeration type definitions

6.5.1 hd:deviceType

Used for DeviceType property of device models, see Table 6.5.1-1.

Table 6.5.1-1 – Interpretation of deviceType

Value	Interpretation	Note
1	deviceAirConditioner	See clause 6.4.1
2	deviceClothesWasher	See clause 6.4.2
3	deviceElectricVehicleCharger	See clause 6.4.3
4	deviceLight	See clause 6.4.4
5	deviceMicrogeneration	See clause 6.4.5
6	deviceOven	See clause 6.4.6
7	deviceRefrigerator	See clause 6.4.7
8	deviceRobotCleaner	See clause 6.4.8
9	deviceSmartElectricMeter	See clause 6.4.9
10	deviceStorageBattery	See clause 6.4.10
11	deviceTelevision	See clause 6.4.11
12	deviceThermostat	See clause 6.4.12
13	deviceWaterHeater	See clause 6.4.13
0	undefinedVendorExt	For vendor specific usage
NOTE – See clause 6.4 "Device models".		

6.5.2 hd:supportedInputSources

Used for supportedInputSources DataPoint of AudioVideoInput ModuleClass, see Table 6.5.2-1.

Table 6.5.2-1 – Interpretation of supportedInputSources

Value	Interpretation	Note
1	tuner	
2	component	
3	composite	
4	svideo	
5	rgb	
6	dvi	
7	hdmi	
8	displayPort	
9	scart	
10	externalStorage	
11	network	
NOTE – See clause 6.3.2 "audioVideoInput".		

6.5.3 hd:liquidLevel

Used for DataPoint indicating level of liquid such as rinseLevel, see Table 6.5.3-1.

Table 6.5.3-1 – Interpretation of liquidLevel

Value	Interpretation	Note
1	zero	
2	low	
3	medium	
4	high	
5	maximum	
NOTE – See clause 6.3.27 "rinseLevel", clause 6.3.38 "waterLevel".		

6.5.4 hd:spinLevelStrength

Used for DataPoints indicating strength of a spinLevel, see Table 6.5.4-1.

Table 6.5.4-1 – Interpretation of strength

Value	Interpretation	Note
1	zero	
2	sensitive	
3	weak	
4	medium	
5	strong	
6	maximum	
NOTE – See clause 6.3.31 "spinLevel".		

6.5.5 hd:doorState

Used for doorState DataPoint of doorStatus ModuleClass, see Table 6.5.5-1.

Table 6.5.5-1 – Interpretation of doorState

Value	Interpretation	Note
1	Closed	
2	Open	
3	Opening	
4	Closing	
5	Stopped	
NOTE – See clause 6.3.12 "doorStatus".		

6.5.6 hd:tone

Used for tone DataPoint of alarmSpeaker ModuleClass, see Table 6.5.6-1.

Table 6.5.6-1 – Interpretation of tone

Value	Interpretation	Note
1	Fire	
2	Theft	
3	Emergency	
4	Doorbell	
5	DeviceFail	
NOTE – See clause 6.3.1 "alarmSpeaker".		

6.5.7 hd:supportedModes

Used for supportedModes DataPoint of runMode ModuleClass, see Table 6.5.7-1.

Table 6.5.7-1 – Interpretation of supportedModes

Value	Interpretation	Note
1	antifreeze	This mode sets the thermostat to a minimum temperature to avoid home system to freeze when the habitants are not there for a long time
2	manual	This mode allows for direct change of the temperature indication for the thermostat by the user
3	eco	This is to set the thermostat to the economic mode
4	program	The program mode is used to set the thermostat to a predefined mode
5	off	
6	ready	
7	running	
8	paused	
9	aborted	
10	cancelled	
11	completed	
12	washing	
13	spinning	
14	drying	
15	rinsing	
16	warming up	
17	cooking	
18	cooling	
19	dehumidifying	
20	energy saving	
21	charging	
22	homing	
23	docking	
NOTE – See clause 6.3.28 "runMode".		

6.5.8 hd:alertColourCode

Used for light DataPoint of alarmSpeaker ModuleClass, see Table 6.5.8-1.

Table 6.5.8-1 – Interpretation of alertColourCode

Value	Interpretation	Note
1	Red	This colour indicates the alarm status.
2	Green	This colour indicates the alarm has been cleared.
NOTE – See clause 6.3.1 "alarmSpeaker".		

6.5.9 hd:waterFlowStrength

Used for DataPoints indicating strength of a waterflow, see Table 6.5.9-1.

Table 6.5.9-1 – Interpretation of waterFlowStrength

Value	Interpretation	Note
1	zero	
2	sensitive	
3	weak	
4	medium	
5	strong	
6	maximum	
NOTE – See clause 6.3.37 "waterFlow".		

6.5.10 hd:windStrength

Used for DataPoints indicating strength of wind, see Table 6.5.10-1.

Table 6.5.10-1 – Interpretation of windStrength

Value	Interpretation	Note
1	zero	
2	sensitive	
3	weak	
4	medium	
5	strong	
6	maximum	
NOTE – See clause 6.3.41 "wind".		

6.6 Universal and common properties for device models

Properties specified in Table 6.6-1 are applicable to all device models. Some properties are mandatory for all device models and called "universal properties", since they are universally seen in typical device types and carry necessary information to identify each device instance. Others are optional for all device models and called "common properties", since they are commonly used in many device types but not always.

Universal and common properties are not repeated in the property table of each device model in clause 6.4, where only device specific properties shall be specified. Universal and common properties shall be instantiated in each device model following the optionality specified in Table 6.6-1.

NOTE – The instantiated values of the universal properties might be empty in case of exceptional scenarios, e.g., interworking with non-oneM2M device models.

Table 6.6-1 – Universal and common properties

Name	Type	Value	Optional	Documentation
propDeviceSerialNum	xs:string	-	false	Device serial number (assigned by manufacturer)
propDeviceType	hd:deviceType	-	false	Device type (see clause 6.5.1)
propDeviceModelName	xs:string	-	false	Device model name
propDeviceManufacturer	xs:string	-	false	Manufacturer name of the device
propDeviceName	xs:string	-	true	Device name
propDeviceSubModelName	xs:string	-	true	Device sub-modelname
propDeviceAliasName	xs:string	-	true	Device alias name
propDeviceFirmwareVersion	xs:string	-	true	Device firmware version
propHardwareVersion	xs:string	-	true	Device hardware version
propOsVersion	xs:string	-	true	Version of the operation system (defined by manufacturer)
propProtocol	xs:string	-	true	A comma separated list of MIME types for all supported communication protocol(s) of the device. Example: "application/x-alljoin;version=1.0,application/x-echonet-lite;version=1.0" indicates the device supports both AllJoyn v1.0 and Echonnet Lite v1.0
propCountry	xs:string	-	true	Country code of the device
propLocation	xs:string	-	true	Location where the device is installed. It may be configured via the user interface provided by the 'presentationURL' property or any other means
propSystemTime	xs:datetime	-	true	Reference time for the device
propManufacturerDetailsLink	xs:url	-	true	URL to manufacturer's website
propDateOfManufacture	xs:datetime	-	true	Manufacturing date of device
propSupportURL	xs:url	-	true	URL that points to product support information of the device
propPresentationURL	xs:url	-	true	To quote UPnP: "the control point can retrieve a page from this URL, load the page into a web browser and depending on the capabilities of the page, allow a user to control the device and/or view device status. The degree to which each of these can be accomplished depends on the specific capabilities of the presentation page and device"

7 The principle of resource mapping for home appliance information model

7.1 Introduction

Home appliance information models which are defined in clause 6 need to be represented as resources in the oneM2M system. This clause defines the principle of resource mapping based on `<flexContainer>`. The individual information mapping is provided in annexes A, B, C and D.

7.2 The resource mapping rules

7.2.1 Introduction

The present clause specifies the rule to map the "home appliance information model" in clause 5, to oneM2M resources.

7.2.2 Resource mapping for device model

When the AE exposes a controlling interface for a home domain device which is specified as an information model in clause 6.4, a specialization of the `<flexContainer>` resource shall be created as the mapping of the model following conversion rules:

- Rule 1-1: Each device model defined in clause 6.4 shall be mapped to a specialization of `<flexContainer>` resource with associated 'DeviceClass ID' (e.g., "org.onem2m.home.device.tv") on *containerDefinition* attributes.
- Rule 1-2: Each entry of a 'Module' table shall be mapped to child resource(s) which is mapped as a specialized `<flexContainer>` following the rule in clause 7.2.3 'Resource mapping for ModuleClass'.
- Rule 1-3: Each entry of a 'Property' table shall be mapped to a child resource which is mapped as a specialization of the `<flexContainer>` resource following the rule in clause 7.2.5.
- Rule 1-4: XSD file for each device model shall be named following naming convention: 'HD-<name of Device model>-v<version of TS>.xsd' For example, XSD file for 'deviceAirConditioner' is named as 'HD-deviceAirConditioner-v1_0_0.xsd'.

7.2.3 Resource mapping for ModuleClass

The ModuleClass models (in clause 6.3) shall be mapped to the specializations of `<flexContainer>` resource. The following rules shall be applied.

When the device model in clause 6.4 is mapped to the `<flexContainer>` resource and if the device supports the functionality associated with a ModuleClass in the model, a `<flexContainer>` resource which is mapped from ModuleClass definitions shall be created as a child resource:

- Rule 2-1: The ModuleClass ID shall be specified on the *containerDefinition* attribute (e.g., "org.onem2m.home.moduleclass.audiovolume").
- Rule 2-2: Each entry of 'Action', 'Property' and 'DataPoint' in ModuleClass definitions shall be mapped following the resource mapping rules for them.
- Rule 2-3: XSD file for each ModuleClass shall be named following naming convention: 'HD-mod-<name of ModuleClass>-v<version of TS>.xsd' For example, XSD file for 'binarySwitch' is named as 'HD-mod-binarySwitch-v1_0_0.xsd'. The Device model which refer any ModuleClass shall include the XSD of the ModuleClasses.

7.2.4 Resource mapping for Action

When the device model in clause 6.4 or the ModuleClass model in clause 6.3 is mapped to the `<flexContainer>` resource and if the device supports the functionality associated with the Action in the model, a `<flexContainer>` resource which is mapped from the Action definition shall be created as a child resource:

- Rule 3-1: The Action ID shall be specified on the containerDefinition attribute (e.g., "org.onem2m.home.moduleclass.audiovolume.upvolume").
- Rule 3-2: When the Action supports any 'Arguments' or 'Return Type', they are mapped to [customizedAttribute] with its variable names.
- Rule 3-3: XSD file for each Action shall be named following naming convention: 'HD-act-<name of Action>-v<version of TS>.xsd'. For example, XSD file for 'toggle' is named as 'HD-act-toggle-v1_0_0.xsd'. The device or ModuleClass which refers any Action shall include the XSD of the Action.
- Rule 3-4: When the Action does not support any 'Argument' or 'Return Type', the Action shall be triggered by updating with null Content parameter.

7.2.5 Resource mapping for Property

When the device model (in clause 6.4) or the ModuleClass model (in clause 6.3) is mapped to the <flexContainer> resource and if the device supports a Property, the following rules shall be applied:

- Rule 4-1: Each entry of Property table in Device model or ModuleClass model, shall be mapped to the [customAttribute] of <flexContainer> resource which is mapped from associated Device model or ModuleClass model, with its Property name with prefix 'prop'.

7.2.6 Resource mapping for DataPoint

When the ModuleClass model (in clause 6.3) is mapped to the <flexContainer> resource and if the ModuleClass supports a DataPoint, the following rules shall be applied:

- Rule 5-1: Each entry of DataPoint table in ModuleClass model, shall be mapped to [customAttribute] of <flexContainer> resource which is mapped from associated ModuleClass model, with its DataPoint name.

7.3 Short names

7.3.1 Introduction

XML and JSON representations require the explicit encoding of the names of resource attributes, (in the case of XML) and resource types. Whenever a protocol binding transfers such a name over a oneM2M reference point, it shall use a shortened form of that name. Short names enable payload reduction on involved telecommunication interfaces.

The mapping between the full names and their shortened form is given in the clauses that follow.

7.3.2 Resource types

In protocol bindings resource type names for device models shall be translated into the short names of Table 7.3.2-1.

Table 7.3.2-1 – Specialization type short names (Device models)

Resource type name	Short name
deviceAirConditioner	deACr
deviceClothesWasher	deCWr
deviceElectricVehicleCharger	dEVCr
deviceLight	devLt
deviceMicrogeneration	devMn
deviceOven	devOn
deviceRefrigerator	devRr
deviceRobotCleaner	deRCr
deviceSmartElectricMeter	dSEMr
deviceStorageBattery	deSBy
deviceTelevision	devTn
deviceThermostat	devTt
deviceWaterHeater	deWHr

In protocol bindings resource type names for module classes shall be translated into the short names of Table 7.3.2-2.

Table 7.3.2-2 – Specialization type short names (ModuleClasses and Module instances)

Resource type name	Short name
alarmSpeaker	alaSr
audioVideoInput	auVIt
audioVolume	audVe
battery	batty
binarySwitch	binSh
bioElectricalImpedanceAnalysis	bEIAs
boiler	boilr
brightness	brigs
clock	clock
colour	color
colourSaturation	colSn
customTemperature	cusTe
doorStatus	dooSe
electricVehicleConnector	elVCr
energyConsumption	eneCn
energyGeneration	eneGn
faultDetection	fauDn
freshTemperature	freTe
frozenTemperature	froTe

Table 7.3.2-2 – Specialization type short names (ModuleClasses and Module instances)

Resource type name	Short name
height	heigt
hotWaterSupply	hoWSy
keypad	keypd
motionSensor	motSr
oximeter	oximr
powerSave	powS0
pushButton	pusBn
recorder	recor
refrigeration	refrn
relativeHumidity	relHy
rinseLevel	rinLl
runMode	runMe
signalStrength	sigSh
smokeSensor	smoSr
spinLevel	spiLl
televisionChannel	telCl
temperature	tempe
temperatureAlarm	temAm
timer	timer
turbo	turbo
waterFlow	watFw
waterLevel	watLl
waterSensor	watSr
weight	weigt
wind	wind

In protocol bindings resource type names for actions shall be translated into short names of Table 7.3.2-3.

Table 7.3.2-3 – Specialization type short names (Actions)

Resource type name	Short name
activateClockTimer	acCTr
deactivateClockTimer	deCTr
downChannel	dowCl
downVolume	dowVe
toggle	togge
upChannel	uphCl

7.3.3 Resource attributes for properties and data points

In protocol bindings resource attributes names for properties of device models shall be translated into the short names of Table 7.3.3-1.

Table 7.3.3-1 – Resource attribute short names (Device properties)

Attribute name	Occurs in	Short name
country	deviceAirConditioner, deviceClothesWasher, deviceOven, deviceRefrigerator, deviceRobotCleaner, deviceTelevision, deviceThermostat	couny
dateOfManufacture	deviceRefrigerator	daOMe
deviceAliasName	deviceAirConditioner, deviceClothesWasher, deviceOven, deviceRefrigerator, deviceRobotCleaner, deviceTelevision	deANe
deviceFirmwareVersion	deviceAirConditioner, deviceClothesWasher, deviceOven, deviceRefrigerator, deviceRobotCleaner, deviceTelevision, deviceThermostat	deFVn
deviceManufacturer	All devices	devMr
deviceModelName	All devices	deMNe
deviceName	deviceAirConditioner, deviceClothesWasher, deviceOven, deviceRefrigerator, deviceRobotCleaner, deviceTelevision, deviceThermostat	devNe
deviceSerialNum	All devices	deSNm
deviceSubModelName	deviceAirConditioner, deviceClothesWasher, deviceOven, deviceRefrigerator, deviceRobotCleaner, deviceTelevision	dSMNe
deviceType	All devices	devTe
generationSource	deviceMicrogeneration	genSe
hardwareVersion	deviceRefrigerator	harVn
location	deviceElectricVehicleCharger, deviceLight, deviceMicrogeneration, deviceSmartElectricMeter, deviceStorageBattery, deviceWaterHeater	locan
manufacturerDetailsLink	deviceRefrigerator	maDLk
manufacturerName	deviceRefrigerator,	manNe
measuringScope	deviceThermostat	meaSe
osVersion	deviceRefrigerator	oseVn
protocol	deviceElectricVehicleCharger, deviceLight, deviceMicrogeneration, deviceSmartElectricMeter, deviceStorageBattery, deviceWaterHeater	protl
supportURL	deviceRefrigerator	suURL
systemTime	deviceRefrigerator	sysTe

In protocol bindings resource attributes names for properties of module classes shall be translated into the short names of Table 7.3.3-2.

Table 7.3.3-2 – Resource attribute short names (ModuleClass properties)

Attribute name	Occurs in	Short name
chargingCapacity	electricVehicleConnector	chaCy
dischargingCapacity	electricVehicleConnector	disCy
electricEnergy	battery	eleEy
material	battery	matel
voltage	battery	volte

In protocol bindings resource attributes names for data points of module classes shall be translated into the short names of Tables 7.3.3-3 and 7.3.3-4.

Table 7.3.3-3 – Resource attribute short names (ModuleClass data points) (1/2)

Attribute name	Occurs in	Short name
absoluteEnergyConsumption	energyConsumption	abECn
absoluteStartTime	timer	abSTe
absoluteStopTime	timer	abST0
alarm	motionSensor, smokeSensor, temperatureAlarm, waterSensor	alarm
alarmStatus	alarmSpeaker	alaSs
availableChannels	televisionChannel	avaCs
bath	hotWaterSupply	bath
batteryThreshold	battery	batTd
blue	colour	blue
bone	bioelectricalImpedanceAnalysis	bone
brightness	brightness	brigs
capacity	battery	capay
channelId	televisionChannel	chaId
charging	battery	charg
code	faultDetection	code
colourSaturation	colourSaturation	colSn
current	energyConsumption	currt
currentDate	clock	curDe
currentTemperature	temperature	curT0
currentTime	clock	curTe
defrost	refrigeration	defrt
description	faultDetection	descn
desiredHumidity	relativeHumidity	desHy
detectedTime	smokeSensor	detTe
diastolicPressure	oximeter	diaPe
directionAuto	wind	dirAo

Table 7.3.3-3 – Resource attribute short names (ModuleClass data points) (1/2)

Attribute name	Occurs in	Short name
directionDown	wind	dirDn
directionLeft	wind	dirLt
directionRight	wind	dirRt
directionUp	wind	dirUp
discharging	battery	discg
doorState	doorStatus	dooSe
duration	recorder	duran
estimatedTimeToEnd	timer	eTTed
fat	bioElectricalImpedanceAnalysis	fat
filterLifetime	refrigeration	filLe
frequency	energyConsumption	freqy
green	colour	green
height	height	heigt
inputSourceID	audioVideoInput	inSId
kcal	bioElectricalImpedanceAnalysis	kcal
keyNumber	keypad	keyNr
level	battery	level
light	alarmSpeaker	light
liquidLevel	waterLevel	liqLl
lowBattery	battery	lowBy
lqi	signalStrength	lqi
maxValue	audioVolume, temperature	maxVe
minValue	temperature	minVe
multiplyingFactors	energyConsumption, energyGeneration	mulFs
muscle	bioElectricalImpedanceAnalysis	musce
muteEnabled	audioVolume	mutEd
openAlarm	doorStatus	opeAm
openDuration	doorStatus	opeDn
operationMode	runMode	opeMe
oxygenSaturation	oximeter	oxySn

Table 7.3.3-4 – Resource attribute short names (ModuleClass data points) (2/2)

Attribute name	Occurs in	Short name
power	energyConsumption	power
powerGenerationData	energyGeneration	poGDa
powerSaveEnabled	powerSave	poSEd
powerState	binarySwitch	powSe
previousChannel	televisionChannel	preCl
pulseRate	oximeter	pulRe
pushed	pushButton	pusBn
rapidCool	refrigeration	rapCl
rapidFreeze	refrigeration	rapFe
red	colour	red
referenceTimer	timer	refTr
relativeHumidity	relativeHumidity	relHy
resistance	bioElectricalImpedanceAnalysis	resie
rinseLevel	rinseLevel	rinLl
roundingEnergyConsumption	energyConsumption	roECn
roundingEnergyGeneration	energyGeneration	roEGn
rsi	signalStrength	rsi
runningTime	timer	runTe
sensitivity	motionSensor	sensy
significantDigits	energyConsumption, energyGeneration	sigDs
silentTime	motionSensor	silTe
status	boiler, electricVehicleConnector, faultDetection, hotWaterSupply	stats
stepValue	audioVolume, temperature	steVe
strength	spinLevel, waterFlow, wind	streh
supportedInputSources	audioVideoInput	suISs
supportedModes	runMode	supMs
systolicPressure	oximeter	sysPe
targetDuration	timer	tarDn
targetTemperature	temperature	tarTe
targetTimeToStart	timer	tTTSt
targetTimeToStop	timer	tTTSp
temperature	temperatureAlarm	tempe
temperatureThreshold	temperatureAlarm	temTd
tone	alarmSpeaker	tone
turboEnabled	turbo	turEd
unit	temperature	unit
visceraFat	bioElectricalImpedanceAnalysis	visFt
voltage	energyConsumption	volte

Table 7.3.3-4 – Resource attribute short names (ModuleClass data points) (2/2)

Attribute name	Occurs in	Short name
volumePercentage	audioVolume	volPe
water	bioElectricalImpedanceAnalysis	water
weight	weight	weigt

7.4 containerDefinition values

7.4.1 Introduction

Each specialization has a *containerDefinition* attribute which can be used as an unique identifier and contains the information of the resource. In this clause, the detailed values of *containerDefinition* attributes in every specialization for the home appliance information models are given.

7.4.2 Device models

The *containerDefinition* attribute of specializations for device models shall have the values specified in Table 7.4.2-1.

Table 7.4.2-1 – containerDefinition values of specializations for device models

Resource type name	containerDefinition value
deviceAirConditioner	"org.onem2m.home.device.deviceAirConditioner"
deviceClothesWasher	"org.onem2m.home.device.deviceClothesWasher"
deviceElectricVehicleCharger	"org.onem2m.home.device.deviceElectricVehicleCharger"
deviceLight	"org.onem2m.home.device.deviceLight"
deviceMicrogeneration	"org.onem2m.home.device.deviceMicrogeneration"
deviceOven	"org.onem2m.home.device.deviceOven"
deviceRefrigerator	"org.onem2m.home.device.deviceRefrigerator"
deviceRobotCleaner	"org.onem2m.home.device.deviceRobotCleaner"
deviceSmartElectricMeter	"org.onem2m.home.device.deviceSmartElectricMeter"
deviceStorageBattery	"org.onem2m.home.device.deviceStorageBattery"
deviceTelevision	"org.onem2m.home.device.deviceTelevision"
deviceThermostat	"org.onem2m.home.device.deviceThermostat"
deviceWaterHeater	"org.onem2m.home.device.deviceWaterHeater"

7.4.3 ModuleClasses

The *containerDefinition* attribute of specializations for module classes shall have the values specified in Table 7.4.3-1.

Table 7.4.3-1 – containerDefinition values of specializations for module classes

Resource type name	containerDefinition value
alarmSpeaker	"org.onem2m.home.moduleclass.alarmSpeaker"
audioVideoInput	"org.onem2m.home.moduleclass.audioVideoInput"
audioVolume	"org.onem2m.home.moduleclass.audioVolume"
battery	"org.onem2m.home.moduleclass.battery"
binarySwitch	"org.onem2m.home.moduleclass.binarySwitch"
bioElectricalImpedanceAnalysis	"org.onem2m.home.moduleclass.bioElectricalImpedanceAnalysis"
boiler	"org.onem2m.home.moduleclass.boiler"
brightness	"org.onem2m.home.moduleclass.brightness"
clock	"org.onem2m.home.moduleclass.clock"
colour	"org.onem2m.home.moduleclass.colour"
colourSaturation	"org.onem2m.home.moduleclass.colourSaturation"
customTemperature	"org.onem2m.home.moduleclass.customTemperature"
doorStatus	"org.onem2m.home.moduleclass.doorStatus"
electricVehicleConnector	"org.onem2m.home.moduleclass.electricVehicleConnector"
energyConsumption	"org.onem2m.home.moduleclass.energyConsumption"
energyGeneration	"org.onem2m.home.moduleclass.energyGeneration"
faultDetection	"org.onem2m.home.moduleclass.faultDetection"
freshTemperature	"org.onem2m.home.moduleclass.freshTemperature"
frozenTemperature	"org.onem2m.home.moduleclass.frozenTemperature"
height	"org.onem2m.home.moduleclass.height"
hotWaterSupply	"org.onem2m.home.moduleclass.hotWaterSupply"
keypad	"org.onem2m.home.moduleclass.keypad"
motionSensor	"org.onem2m.home.moduleclass.motionSensor"
oximeter	"org.onem2m.home.moduleclass.oximeter"
powerSave	"org.onem2m.home.moduleclass.powerSave"
pushButton	"org.onem2m.home.moduleclass.pushButton"
recorder	"org.onem2m.home.moduleclass.recorder"
refrigeration	"org.onem2m.home.moduleclass.refrigeration"
relativeHumidity	"org.onem2m.home.moduleclass.relativeHumidity"
rinseLevel	"org.onem2m.home.moduleclass.rinseLevel"
runMode	"org.onem2m.home.moduleclass.runMode"
signalStrength	"org.onem2m.home.moduleclass.signalStrength"
smokeSensor	"org.onem2m.home.moduleclass.smokeSensor "
spinLevel	"org.onem2m.home.moduleclass.spinLevel"
televisionChannel	"org.onem2m.home.moduleclass.televisionChannel"
temperature	"org.onem2m.home.moduleclass.temperature"
temperatureAlarm	"org.onem2m.home.moduleclass.temperatureAlarm"
timer	"org.onem2m.home.moduleclass.timer"
turbo	"org.onem2m.home.moduleclass.turbo"

Table 7.4.3-1 – containerDefinition values of specializations for module classes

Resource type name	containerDefinition value
waterFlow	"org.onem2m.home.moduleclass.waterFlow"
waterLevel	"org.onem2m.home.moduleclass.waterLevel"
waterSensor	"org.onem2m.home.moduleclass.waterSensor"
weight	"org.onem2m.home.moduleclass.weight"
wind	"org.onem2m.home.moduleclass.wind"

7.4.4 Actions

The *containerDefinition* attribute of specializations for actions shall have the values specified in Table 7.4.4-1.

Table 7.4.4-1 – containerDefinition values of specializations for actions

Resource type name	containerDefinition value
activateClockTimer	"org.onem2m.home.moduleclass.timer.activateclocktimer"
deactivateClockTimer	"org.onem2m.home.moduleclass.timer.deactivateclocktimer"
downChannel	"org.onem2m.home.moduleclass.televisionchannel.downchannel"
downVolume	"org.onem2m.home.moduleclass.audiovolume.downvolume"
toggle	"org.onem2m.home.moduleclass.binaryswitch.timer"
upChannel	"org.onem2m.home.moduleclass.televisionchannel.upchannel"

7.5 XSD definitions

7.5.1 Introduction

The present clause provide list of files which defines data types in XSD for device models, ModuleClasses and actions.

Generation process of XSD file is explained in Annex A using some examples.

7.5.2 XSD definitions for device models

The XSD definitions for device models are listed in Table 7.5.2-1.

Table 7.5.2-1 – Data type definition of device models

Device model	File name	Note
deviceAirConditioner	HD-deviceAirConditioner-v<TS-version>.xsd	
deviceClothesWasher	HD-deviceClothesWasher-v<TS-version>.xsd	
deviceElectricVehicleCharger	HD-deviceElectricVehicleCharger-v<TS-version>.xsd	
deviceLight	HD-deviceLight-v<TS-version>.xsd	
deviceMicrogeneration	HD-deviceMicrogeneration-v<TS-version>.xsd	
deviceOven	HD-deviceOven-v<TS-version>.xsd	
deviceRefrigerator	HD-deviceRefrigerator-v<TS-version>.xsd	
deviceRobotCleaner	HD-deviceRobotCleaner-v<TS-version>.xsd	
deviceStorageBattery	HD-deviceStorageBattery-v<TS-version>.xsd	
deviceSmartElectricMeter	HD-deviceSmartElectricMeter-v<TS-version>.xsd	
deviceTelevision	HD-deviceTelevision-v<TS-version>.xsd	
deviceThermostat	HD-deviceThermostat-v<TS-version>.xsd	
deviceWaterHeater	HD-deviceWaterHeater-v<TS-version>.xsd	
NOTE – The string '<TS-version>' shall be interpreted as the version of the present document.		

7.5.3 XSD definitions for ModuleClass

The XSD definitions for ModuleClass are listed in Table 7.5.3-1.

Table 7.5.3-1 – Data type definition of ModuleClasses

ModuleClass ID	File name	Note
alarmSpeaker	HD-mod-alarmSpeaker-v<TS-version>.xsd	
audioVideoInput	HD-mod-audioVideoInput-v<TS-version>.xsd	
audioVolume	HD-mod-audioVolume-v<TS-version>.xsd	
battery	HD-mod-battery-v<TS-version>.xsd	
binarySwitch	HD-mod-binarySwitch-v<TS-version>.xsd	
bioElectricalImpedanceAnalysis	HD-mod-bioElectricalImpedanceAnalysis-v<TS-version>.xsd	
boiler	HD-mod-boiler-v<TS-version>.xsd	
brightness	HD-mod-brightness-v<TS-version>.xsd	
clock	HD-mod-clock-v<TS-version>.xsd	
colour	HD-mod-colour-v<TS-version>.xsd	
colourSaturation	HD-mod-colourSaturation-v<TS-version>.xsd	
doorStatus	HD-mod-doorStatus-v<TS-version>.xsd	
electricVehicleConnector	HD-mod-electricVehicleConnector-v<TS-version>.xsd	
energyConsumption	HD-mod-energyConsumption-v<TS-	

Table 7.5.3-1 – Data type definition of ModuleClasses

ModuleClass ID	File name	Note
	version>.xsd	
energyGeneration	HD-mod-energyGeneration-v<TS-version>.xsd	
faultDetection	HD-mod-faultDetection-v<TS-version>.xsd	
height	HD-mod-height-v<TS-version>.xsd	
hotWaterSupply	HD-mod-hotWaterSupply-v<TS-version>.xsd	
keypad	HD-mod-keypad-v<TS-version>.xsd	
motionSensor	HD-mod-motionSensor-v<TS-version>.xsd	
oximeter	HD-mod-oximeter-v<TS-version>.xsd	
powerSave	HD-mod-powerSave-v<TS-version>.xsd	
pushButton	HD-mod-pushButton-v<TS-version>.xsd	
recorder	HD-mod-recorder-v<TS-version>.xsd	
refrigeration	HD-mod-refrigeration-v<TS-version>.xsd	
relativeHumidity	HD-mod-relativeHumidity-v<TS-version>.xsd	
rinseLevel	HD-mod-rinseLevel-v<TS-version>.xsd	
runMode	HD-mod-runMode-v<TS-version>.xsd	
signalStrength	HD-mod-signalStrength-v<TS-version>.xsd	
smokeSensor	HD-mod-smokeSensor-v<TS-version>.xsd	
spinLevel	HD-mod-spinLevel-v<TS-version>.xsd	
televisionChannel	HD-mod- HD-mod--v<TS-version>.xsd	
temperature	HD-mod-temperature-v<TS-version>.xsd	
temperatureAlarm	HD-mod-temperatureAlarm-v<TS-version>.xsd	
timer	HD-mod-timer-v<TS-version>.xsd	
turbo	HD-mod-turbo-v<TS-version>.xsd	
waterFlow	HD-mod-waterFlow-v<TS-version>.xsd	
waterLevel	HD-mod-waterLevel-v<TS-version>.xsd	
waterSensor	HD-mod-waterSensor-v<TS-version>.xsd	
weight	HD-mod-weight-v<TS-version>.xsd	
wind	HD-mod-wind-v<TS-version>.xsd	
NOTE – The string '<TS-version>' shall be interpreted as the version of the present document.		

7.5.4 XSD definitions for Action

The XSD definitions for Actions are listed in Table 7.5.4-1.

Table 7.5.4-1 – Data type definition of Action

Action	File name	Note
activateClockTimer	HD-act-activateClockTimer-v<TS-version><TS-version>.xsd	
deactivateClockTimer	HD-act-deactivateClockTimer-v<TS-version><TS-version>.xsd	
downChannel	HD-act-downChannel-v<TS-version><TS-version>.xsd	
downVolume	HD-act-downVolume-v<TS-version><TS-version>.xsd	
toggle	HD-act-toggle-v<TS-version><TS-version>.xsd	
upChannel	HD-act-upChannel-v<TS-version><TS-version>.xsd	
upVolume	HD-act-upVolume-v<TS-version><TS-version>.xsd	
NOTE – The string '<TS-version>' shall be interpreted as the version of the present document.		

8 Mapping with other information models from external organizations

This clause is intended to specify how the home appliance information model (HAIM) defined in the clause 6 can be mapped with existing external models from AllJoyn, OIC, ECHONET, etc. The mapping is to enable the interworking between the oneM2M system and external technologies at the information model level. This means a oneM2M native application which understands only oneM2M standardized HAIM can interact with non-oneM2M home appliances of different technologies in a consistent way without knowing the technology specific details. An interworking proxy application entity (IPE) is responsible for translating the HAIM to/from technology specific information model bidirectional following the mapping specification in this clause. Using HAIM as a bridge, home appliances and applications of different technologies can also interact with each other via the oneM2M system (with IPEs).

The mapping details will be specified in future release. ModuleClasses, properties, device models and data types in HAIM may be further updated if gaps are identified for mapping.

9 Ontology for the home appliance information model aligned with oneM2M base ontology

Table 9-1 shows a mapping of the home appliance information model to the oneM2M base ontology in oneM2M TS-0012 [b-oneM2M TS-0012].

The table only shows mapping of SDT concepts that are used to classify all concepts in the home appliance information model. Therefore, since any concept in the home appliance information model can be classified according to a specific SDT concept it also (transitively) maps to the related class of the oneM2M base ontology.

Table 9-1 – Mapping between SDT concepts in the home appliance information model and the oneM2M base ontology

SDT concept in the home appliance information model	Mapping relationship	Class in base ontology	Property in base ontology	Comment
SDT: Device	sub-class of	Device		
SDT: SubDevice	sub-class of	Device		The base ontology allows a Device to consist of (sub-) Devices
SDT: Action	sub-class of	Operation		
SDT: Args (of an Action)	sub-class of	OperationInput		
SDT: ReturnType (of an Action)	sub-class of	OperationOutput		
SDT: Event	sub-class of	Operation		
SDT: Data (of an Event)	sub-class of	OutputDataPoint		
SDT: Module	sub-class of	Service		The base ontology allows a Service to have subServices. Each SDT:Module implements one SDT:ModuleClass. Therefore SDT:Module can be considered a subclass of SDT:ModuleClass and therefore subclass of oneM2M:Service. See note.
SDT: ModuleClass	sub-class of	Service		See note
SDT: UnitOfMeasure	sub-class of	MetaData		
SDT: DataPoint	sub-class of	InputDataPoint		If SDT:DataPoint is writable
SDT: DataPoint	sub-class of	OutputDataPoint		If SDT:DataPoint is readable
SDT: Property (of a Device)	sub-class of	ThingProperty		
SDT: Property (of a ModuleClass)	sub-class of	Aspect		Aspect (of the Functionality)
SDT: SimpleType	sub-property of		hasDataType	The base ontology's SimpleTypeVariable class has data properties: hasDataType hasDataRestriction
SDT: Constraint	sub-property of		hasDataRestriction	
NOTE – In RESTful technologies the Service (i.e. the electronic representation of a functionality in a network) is implicitly bound to its functionality by the naming of the used resources (e.g., the functionality of ModuleClass "AudioVolume" is implemented as a Service through CRUD operations on a [audioVolume] <flexContainer> specialization).				

Annex A

oneM2M specification update and maintenance control procedure

(This annex forms an integral part of this Recommendation.)

The provisions of Annex L in [ITU-T Y.4500.1] regarding the oneM2M specification update and maintenance control procedure shall apply to this Recommendation.

Appendix I

Resource mapping examples

(This appendix does not form an integral part of this Recommendation.)

I.1 Introduction

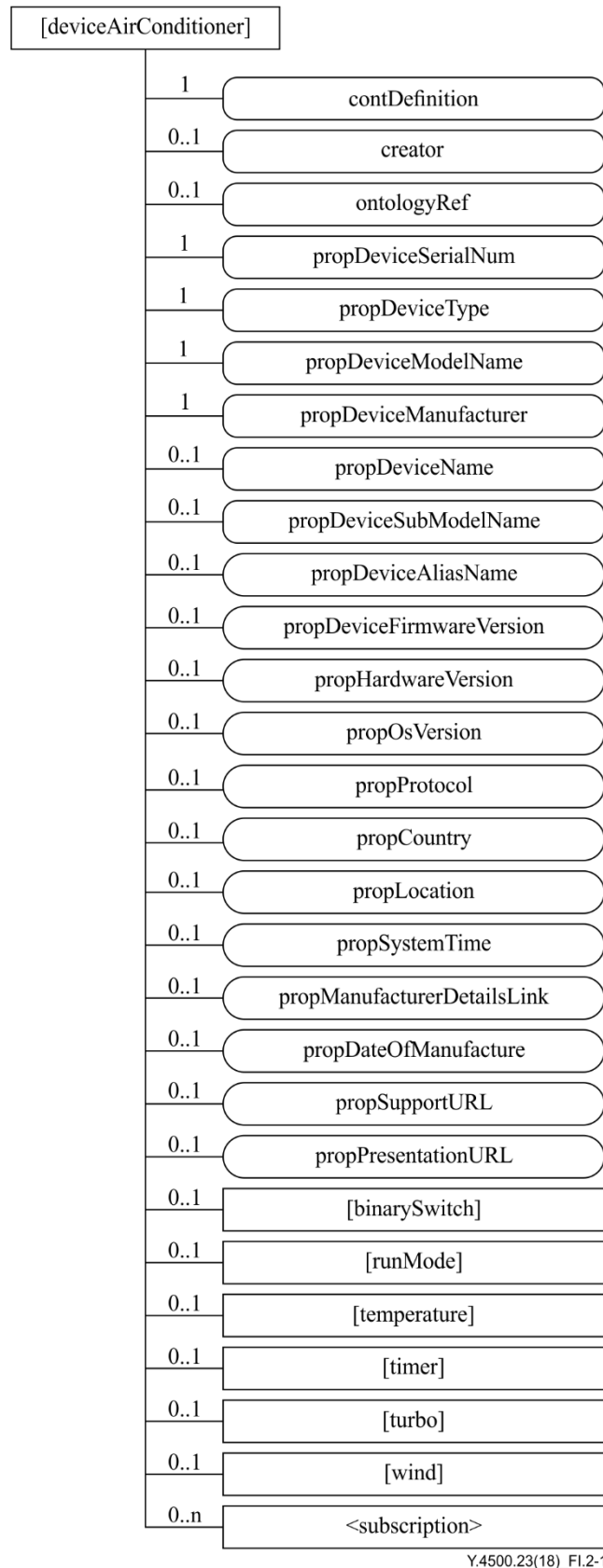
The AE may construct oneM2M resource tree on a hosting CSE as the mapping of associated devices and each XSD definition for the device information models is generated following the 'resource mapping rules' in clause 7.2.

The present clause explains how to use the oneM2M resource tree to map the device models for each device (see clause 6.4).

I.2 Example for device model 'deviceAirConditioner'

The present clause explains the creation process for the device typed 'deviceAirConditioner' (see clause 6.4.1 for device model definition of 'airConditioner').

Using the definition, 'deviceAirConditioner' model is mapped to the [deviceAirConditioner] resource which is a specialization of <flexContainer> resource (see Figure I.2-1).



Y.4500.23(18)_FI.2-1

Figure I.2-1 – Structure of [deviceAirConditioner] resource

The AE creates the [deviceAirConditioner] specialization of <flexContainer> resource for the device model [deviceAirConditioner] resource.

The [deviceAirConditioner] resource contains the child resource specified in Table I.2-1.

Table I.2-1 – Child resources of [deviceAirConditioner] resource

Child resources of [airConditioner]	Child resource type	Multiplicity	Description
<i>[variable]</i>	<i><flexContainer> as defined in the specialization [binarySwitch]</i>	0..1	This resource is used to map 'binarySwitch' ModuleClass defined in clause 6.
<i>[variable]</i>	<i><flexContainer> as defined in the specialization [runMode]</i>	0..1	This resource is used to map 'runMode' ModuleClass defined in clause 5.
<i>[variable]</i>	<i><flexContainer> as defined in the specialization [temperature]</i>	0..1	This resource is used to map 'temperature' ModuleClass defined in clause 5.
<i>[variable]</i>	<i><flexContainer> as defined in the specialization [timer]</i>	0..1	This resource is used to map 'timer' ModuleClass defined in clause 5.
<i>[variable]</i>	<i><flexContainer> as defined in the specialization [turbo]</i>	0..1	This resource is used to map 'turbo' ModuleClass defined in clause 5.
<i>[variable]</i>	<i><flexContainer> as defined in the specialization [wind]</i>	0..1	This resource is used to map 'wind' ModuleClass defined in clause 5.
<i>[variable]</i>	<i><subscription></i>	0..n	See clause 9.6.8 in oneM2M TS-0001 [b-oneM2M TS-0001]

The [deviceAirConditioner] will contain [customAttributes] with variable names for each of the Properties. Thus, attributes of the [deviceAirConditioner] resource are defined in Table I.2-2.

Table I.2-2 – Attributes of [deviceAirConditioner] resource

Attributes of [airConditioner]	Multiplicity	RW/ RO/ WO	Description
<i>resourceType</i>	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001].
<i>resourceID</i>	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001].
<i>resourceName</i>	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001].
<i>parentID</i>	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001].
<i>expirationTime</i>	1	RW	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001].
<i>accessControlPolicyIDs</i>	0..1 (L)	RW	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001].
<i>creationTime</i>	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001].
<i>lastModifiedTime</i>	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001].
<i>labels</i>	0..1	RW	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001].
<i>containerDefinition</i>	1	WO	The value is "org.onem2m.home.device.airconditioner"
<i>Creator</i>	0..1 (L)	RW	See clause 9.6.35 in oneM2M TS-0001 [b-oneM2M TS-0001].
<i>ontologyRef</i>	0..1 (L)	RW	See clause 9.6.35 in oneM2M TS-0001 [b-oneM2M TS-0001].
<i>propDeviceSerialNum</i>	1	RO	This [customAttribute] is used to map Property 'deviceSerialNum'.
<i>propDeviceType</i>	1	RO	This [customAttribute] is used to map Property 'deviceType'.
<i>propDeviceModelName</i>	1	RO	This [customAttribute] is used to map Property 'deviceModelName'.
<i>propDeviceManufacture</i>		RO	This [customAttribute] is used to map Property 'deviceManufacture'
<i>propDeviceName</i>	0..1	RO	This [customAttribute] is used to map Property 'deviceName'
<i>propDeviceSubModelName</i>	0..1	RO	This [customAttribute] is used to map Property 'deviceSubModelName'.
<i>propDeviceAliasName</i>	0..1	RO	This [customAttribute] is used to map Property 'deviceAliasName'.
<i>propDeviceFirmwareVersion</i>	0..1	RO	This [customAttribute] is used to map Property 'deviceFirmwareVersion'.
<i>propDeviceHardwareVersion</i>	0..1	RO	This [customAttribute] is used to map Property 'deviceHardwareVersion'.

Table I.2-2 – Attributes of [deviceAirConditioner] resource

Attributes of [airConditioner]	Multiplicity	RW/ RO/ WO	Description
<i>propOsVersion</i>	0..1	RO	This [customAttribute] is used to map Property 'osVersion'.
<i>propLocation</i>	0..1	RO	This [customAttribute] is used to map Property 'location'.
<i>propDateOfManufacture</i>	0..1	RO	This [customAttribute] is used to map Property 'dateOfManufacture'.
<i>propSupportURL</i>	0..1	RO	This [customAttribute] is used to map Property 'supportURL'.
<i>propPresentationURL</i>	0..1	RO	This [customAttribute] is used to map Property 'presentationURL'.

I.3 Example of ModuleClass 'binarySwitch'

The [binarySwitch] resource is used to share information regarding the modeled binary switch module as a ModuleClass. The [binarySwitch] resource is a specialization of the <flexContainer> resource. The Structure of a [binarySwitch] resource is shown in Figure I.3-1.

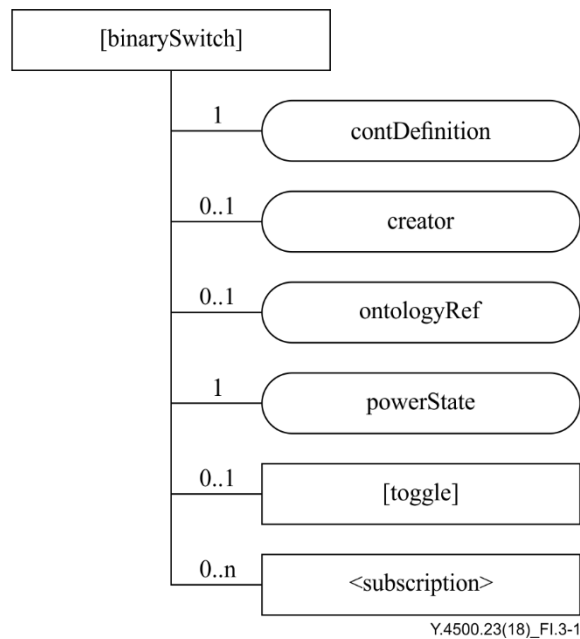


Figure I.3-1 – Structure of [binarySwitch] resource

The [binarySwitch] resource contains the child resources specified in Table I.3-1.

Table I.3-1 – Child resources of [binarySwitch] resource

Child resources of [binarySwitch]	Child resource type	Multiplicity	Description
[variable]	<flexContainer> as defined in the specialization [toggle]	0..1	This resource is used to map 'toggle' Action defined in clause 6.3.5.
[variable]	<subscription>	0..n	See clause 9.6.8 in oneM2M TS-0001 [b-oneM2M TS-0001]

The [binarySwitch] resource contains the attributes specified in Table I.3-2.

Table I.3-2 – Attributes of [binarySwitch] resource

Attributes of [binarySwitch]	Multiplicity	RW/ RO/ WO	Description
resourceType	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
resourceID	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
resourceName	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
parentID	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
expirationTime	1	RW	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
accessControlPolicyIDs	0..1 (L)	RW	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
creationTime	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
lastModifiedTime	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
labels	0..1	RW	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
containerDefinition	1	WO	The value is "org.onem2m.home.moduleclass.binaryswitch"
creator	0..1 (L)	RW	See clause 9.6.35 in oneM2M TS-0001 [b-oneM2M TS-0001]
ontologyRef	0..1 (L)	RW	See clause 9.6.35 in oneM2M TS-0001 [b-oneM2M TS-0001]
powerState	1	RW	See clause 5.3.5

I.4 Example of Action 'toggle'

The *[toggle]* resource is used to share information regarding the modeled toggle as an Action. The *[toggle]* resource is a specialization of the *<flexContainer>* resource. Figure I.4-1 shows the structure of a *[toggle]* resource.

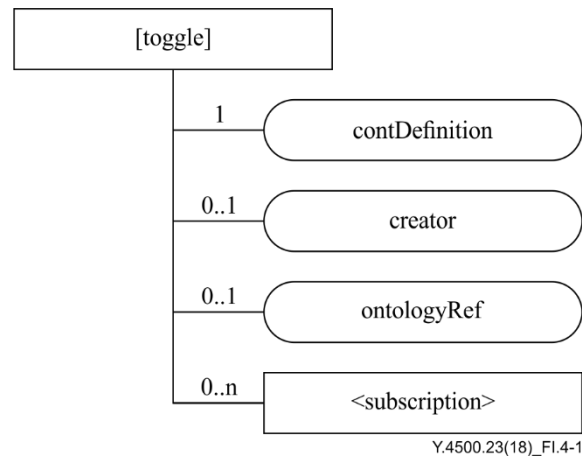


Figure I.4-1 – Structure of *[toggle]* resource

The *[toggle]* resource contains the child resource specified in Table I.4-1.

Table I.4-1 – Child resources of *[toggle]* resource

Child resources of <i>[toggle]</i>	Child resource type	Multiplicity	Description
<i>[variable]</i>	<i><subscription></i>	0..n	See clause 9.6.8 in oneM2M TS-0001

The *[toggle]* resource contains the attributes specified in Table I.4-2.

Table I.4-2 – Attributes of *[toggle]* resource

Attributes of <i>[toggle]</i>	Multiplicity	RW/ RO/ WO	Description
<i>resourceType</i>	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
<i>resourceID</i>	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
<i>resourceName</i>	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
<i>parentID</i>	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
<i>expirationTime</i>	1	RW	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
<i>accessControlPolicyIDs</i>	0..1 (L)	RW	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]

Table I.4-2 – Attributes of [toggle] resource

Attributes of [toggle]	Multiplicity	RW/ RO/ WO	Description
<i>creationTime</i>	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
<i>lastModifiedTime</i>	1	RO	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
<i>labels</i>	0..1	RW	See clause 9.6.1.3 in oneM2M TS-0001 [b-oneM2M TS-0001]
<i>containerDefinition</i>	1	WO	The value is "org.onem2m.home.moduleclass.binaryswitch.toggle"
<i>creator</i>	0..1 (L)	RW	See clause 9.6.35 in oneM2M TS-0001 [b-oneM2M TS-0001]
<i>ontologyRef</i>	0..1 (L)	RW	See clause 9.6.35 in oneM2M TS-0001 [b-oneM2M TS-0001]

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