Lightweight M2M – Device Capability management Object (LwM2M Object – DevCapMgmt)

Approved Version 1.0.2 – 08 Mar 2017

Open Mobile Alliance

OMA-TS-LWM2M_DevCapMgmt-V1_0_2-20170308-A

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1. Scope

This document defines the technical specification for an Object to be used in conjunction with the Lightweight M2M enabler in order to manage Device Capability on the Device.

2. References

2.1 Normative References

[LwM2M] "OMA LightweightM2M", Version 1.0, Open Mobile Alliance™, URL:http://www.openmobilealliance.org/

[RFC2119] "Key words for use in RFCs to Indicate Requirement Levels", S. Bradner, March 1997, URL:http://www.ietf.org/rfc/rfc2119.txt

2.2 Informative References

[OMADICT] "Dictionary for OMA Specifications", Version 2.9, Open Mobile Alliance™, OMA-ORG-Dictionary-V2_9, URL:http://www.openmobilealliance.org/

3. Terminology and Conventions

3.1 Conventions

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in [RFC2119].

All sections and appendixes, except “Scope” and “Introduction”, are normative, unless they are explicitly indicated to be informative.

3.2 Definitions

Device Capability	Physical characteristics and related parameters supported by a device.

3.3 Abbreviations

OMA	Open Mobile Alliance

4. Introduction and Scope

M2M devices may support advanced features, such as various Sensors, various Controls, capabilities on Communication, on Visio, and even more. Use case could be to address the need of remotely adapting the M2M Device Capability according to a given level of subscription; in many circumstances also, Enterprises, regulations and others, have policies against the usage of some features but allow the use of other features available on such a M2M Device.

Device Capability Management aims at specifying the mechanisms required for the remote management of device capabilities, i.e. not only addressing the ability of remotely enable and disable device capabilities, but also to expose to Servers the capabilities of removable hardware when attached to the device.

The objective of this document is to specify an LWM2M object which allows to enable remote management of M2M device capabilities.

5. Device Capability Management Functionality

The following basic device capability management functionalities can be considered:

1. Enablement/Disablement of a given LwM2M Device capability
2. Exposure of removable hardware capability of the LwM2M Device

5.1 LwM2M Device Capability general properties

The **Group** Resource specifies which kind of LwM2M Device Capability on this Device, is likely to be managed: 9 basic groups are identified for LwM2M Devices. Any LwM2M Device Capability should refer to one of the following categories:

- **SENSOR** dedicated to acquire data on physical events
- **CONTROL** dedicated to adjust various levels
- **CONNECTIVITY** dedicated to provide Communication capability
- **NAVIGATION** dedicated to provide geo localisation capability
- **STORAGE** dedicated to provide memory capability
- **VISION** dedicated to provide vision capability : video capability , photo capability
- **SOUND** dedicated to provide sound capability : buzzer, speaker
- **ANALOG INPUT** refers to a generic analog input capability
- **ANALOG OUTPUT** refers to a generic analog output capability

Property Resource is a list of LwM2M capabilities within a given Group, which can be managed together (Enable/Disable) in the device.

The Vocabulary List of Group and Properties are provided in Appendix B.

Description Resource just provides Device Manufacturer Text informations relative to a given Instance of the Device Capability Object.

5.2 LwM2M Device Capability Disable/Enable functionality

To be operational on a LwM2M Device, a manageable Device Capability MUST be in the '**Enabled**' State which is reflected by the "Enabled" resource set to 'True'.

The **opEnable** and **opDisable** Resource used as commands by the LwM2M Server, MUST respectively transfer the Device Capability State to 'Enabled' and 'Disabled' state.

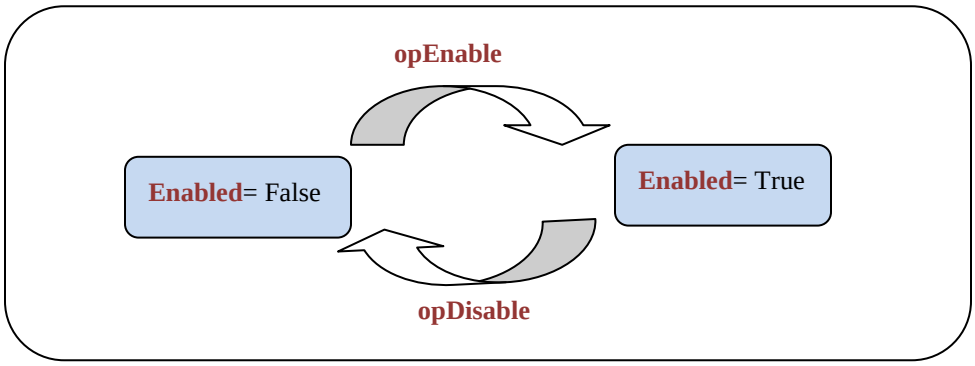

Figure 1 : Device Capability Enablement

When a LwM2M Device Capability "Enabled" resource is under "Observation" ("OBSERVE" command [LwM2M]), the notification of the value change MUST be reported ("NOTIFY" command: [LwM2M]) to the Server, only if the value of "NotifyEn" Resource was set to 'True'.

5.3 LwM2M Device Capability Attachment and Exposure functionalities.

Hardware may be not permanently present on a device. It can be plugged to and removed from a device. When a removable hardware is plugged on a LwM2M device, the Device has to "attach" that new hardware before being able to use it. When this Device attachment operation is successful, the LwM2M Client MUST set to 'True', the "Attached" Resource value of the associated LwM2M Device Capability Instance.

When the removable hardware is unplugged from the Device, the LwM2M Client MUST set to 'False' the "Attached" Resource value.

If the Notification capability is enable (NotifyEn set to 'True'), and the "Attached" Resource is under "Observation", the Server MUST be notified (through the "NOTIFY" operation) when the "Attached" Resource state changed.

This "Attached" resource is optional, so when this resource is not present in a Device Capability Instance, it means this Device Capability Instance doesn't manage removable hardware.

When the "Attached" resource is present in a Device Capability Instance and there is no removable associated to it, the "Attached" resource value MUST be permanently set to 'True'.

For being operational on a Device, a manageable and removable Hardware MUST have its associated Device Capability Resources "Attached" and "Enabled" both set to 'True'.

6. LwM2M Object: Device Capability Management

This LwM2M Object is dedicated to manage the device capabilities of a device e.g. sensors, communication, etc.

Object definition

Name	Object ID	Instances	Mandatory	Object URN
DevCapMgmt	15	Multiple	Optional	urn:oma:lwm2m:oma:15

Resource definitions

ID	Name	Operations	Instances	Mandatory	Type	Range or Enumeration	Units	Description
0	Property	R	Single	Mandatory	String			List of Device Capabilities inside a given Group. The format is a free list ASCII-represented integers separated by a semi colon. (e.g. 0;1;10) The list of capabilities per Group is given in Appendix B: Device Capabilities Vocabulary
1	Group	R	Single	Mandatory	Integer	0-15		**Group name of Device Capabilities** **0: SENSOR**: luminosity, presence,temp,humidity **1: CONTROL**: Light, Power, Sound **2: CONNECTIVITY**: Bluetooth, wifi, … **3: NAVIGATION**: gps, galieo **4: STORAGE**: external memory, **5: VISION**: cam, video-cam, night_cam. **6: SOUND**: speaker, buzzer **7: ANALOG_INPUT**: generic input **8: ANALOG_OUTPUT**: generic output 9-15: reserved
2	Description	R	Single	Optional	String			Device Capability Description (manufacturer specified string)

3	Attached	R	Single	Optional	Boolean			When the resource doesn't exist, it means the associated Device Capability is not removable. When this resource is "False", it means the associated Device Capability is removable and is currently not attached to the device. When this resource is "True", it means the associated Device Capability – if removable – is currently attached to the Device. When a Device Capability is not removable, and the "Attached" Resource is present, the "Attached" value but be set to "True".
4	Enabled	R	Single	Mandatory	Boolean			This resource indicates whether the Device Capability is enabled regardless whether the Device Capability is attached or not. If the value of this resource is "True" the Device Capability is in Enabled State. If the value is "False" the Device Capability is in Disabled State; The 'Attached' and 'Enabled' resources are independent. A Device Capability MAY have 'True' as value for 'Enabled' Resource while having 'False' as value for the 'Attached' Resource. That means the Device Capability is still not available and can't be used until it is attached to the Device, but will be useable once the Device Capability is attached.
5	opEnable	E	Single	Mandatory				This command is used to enable the Device Capability to transfer the Device Capability from Disabled State to Enabled state. In Enabled State, the Device Capability is allowed to work when it is attached to the Device.
6	opDisable	E	Single	Mandatory				This command is used to disable the Device Capability to transfer the Device Capability from Enabled State to Disabled State. In Disabled state the Device Capability is not allowed to work.

7	NotifyEn	RW	Single	Optional	Boolean			When the Resources “Enabled” or “Attached” are under “Observation”, this resource specifies whether the LwM2M Server MUST be notified when the value of the Resource on “Observation” changed. If the Resource “NotifyEn” is not present or the value is ‘False’, the LwM2M Server will be not notified about this change. If the “NotifyEn” Resource is present and the value is ‘True’, the LwM2M Server will be notified.

Table 1 : Resources Definitions

7. Device Capability Management JSON Schema

```
{
    "$schema": "http://json-schema.org/draft-04/schema#",
     "title": "Device Capability Management",
    "description": " DevCapability ",
    "type": "object",
         "properties": {
                   "Property": {
                         "description": "A list of Device Capabilities”,
                         "type": "string",
                         "readonly": true
                  },
                   "Group": {
                         "description": "Device Capabilities categories ",
                          "type": "integer",
                           "enum": [SENSOR, CONTROL, CONNECTIVITY,NAVIGATION,STORAGE, VISION,
                                   ANALOG_INPUT, ANALOG_OUTPUT],
                           "readonly": true
                    },
                    "Description": {
                             "description": "Manufacturer-specified string”,
                             "type": "string",
                              "readonly": true
                    },
                    "Attached": {
                             "description": "Used for removable hardware capability",
                             "type": "boolean",
                              "readonly": true
                    },
                    "Enabled": {
                             "description": "Specifies if a Device Capability is operational",
                             "type": "boolean",
                              "readonly": true
                    },
                    "opEnable": {
                             "description": "Operation for enabling a Device Capability",
                             "type": "boolean",
                              "writeonly": true
                    },
                    "opDisable": {
                             "description": "Operation for disabling a Device Capability",
                             "type": "boolean",
                              "writeonly": true
                    },
                    "NotifyEn": {
                             "description": "Allow to Notify a Server when the Device Capability
                                             Enabled State is changing",
                             "type": "boolean",
                              "writeonly": true
                    },
         },
         "required": ["Property",”Group”,"Enabled",”OpEnable”, “OpDisable”]
}
```

Figure 2 : JSON schema of Device Capability Management Objet

Appendix A. Change History (Informative)

A.1 Approved Version History

Reference	Date	Description
OMA-TS-LWM2M_DevCapMgmt-V1_0-20150512-A	12 May 2015	Status changed to Approved by TP TP Ref # OMA-TP-2015-0080-INP_LWM2M_DevCapMgmt_V1_0_RRP_for_final_Approval
OMA-TS-LWM2M_DevCapMgmt-V1_0_1-20151123-A	23 Nov 2015	Status changed to Approved by TP TP Ref # OMA-TP-2015-0202-INP_LWM2M_DevCapMgmt_V1_0_1_RRP_for_Notification
OMA-TS-LWM2M_DevCapMgmt-V1_0_2-20170308-A	08 Mar 2017	Status changed to Approved by TP TP Ref # OMA-TP-2017-0021R01-INP_LWM2M_DevCapMgmt_1.0.2_for_Final_Approval_Notification

Appendix B. Device Capabilities Vocabulary

	LwM2M Device Capability Group	Property ID	Property
0	SENSOR	0x00	Luminosity
		0x01	Presence
		0x02	Temperature
		0x03	Hygrometrie
		0x04	Pressure
		0x05-0x7F	reserved
1	CONTROL	0x00	Light
		0x01	Power
		0x02	Sound
		0x03-0x7F	reserved
2	CONNECTIVITY	0x00	Bluetooth
		0x01	Infrared
		0x02	WLAN
		0x03	NFC
		0x03	CellNetwork
		0x03-0x7F	reserved
3	NAVIGATION	0x00	GPS
		0x01	Galileo
		0x02	
		0x03	
		0x04-0x7F	reserved
4	STORAGE	0x00	Internal Memory
		0x01	External Memory
		0x02-0x7F	reserved
		0x02-0x7F	reserved
5	VISION	0x00	Camera
		0x01	Video Camera
		0x02	
		0x04-0x7F	reserved
6	SOUND	0x00	Speaker
		0x01	Buzzer
		0x02	Microphone
		0x03-0x7F	reserved
7	ANALOG_INPUT	0x00-0xFF	Property Proprietary Range
8	ANALOG_OUTPUT	0x00-0xFF	Property Proprietary Range

Table 2: Device Capabilities Groups and Properties

Note: To each Property is associated 2 ID's range:

- [0x00-0x7F] range is allocated in that specification according to the table above,
- [0x80-0xFF] range is available to the Device Manufacturer (proprietary property ID Range) if no pre-defined property is appropriate for a specific Device capability**.**