



# Lightweight Machine to Machine Requirements

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**Open Mobile Alliance**

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# 1. Scope

**(Informative)**

This document contains use cases and requirements for the OMA DM Lightweight M2M enabler. It describes a set of functional requirements for M2M service enablement between the LwM2M Server and the LwM2M Client and the device management from the LwM2M Server to the LwM2M Clients.

## 2. References

### 2.1 Normative References

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

### 2.2 Informative References

[OMADICT] “Dictionary for OMA Specifications”, Open Mobile Alliance™,  
OMA-ORG-Dictionary-V2\_9, [URL:http://www.openmobilealliance.org/](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

Bootstrap Provisioning	The process of providing initial parameters and/or applications on the LwM2M Device so that it can be brought under management
Connection Address	Connection Address is a network identifier that is used by the LwM2M server to access the LwM2M device via a specific communication bearer.
Connectivity Status	Connectivity Status is a state for a specific network connection of a LwM2M Device. It tells that whether a LwM2M Device and LwM2M Server are able to exchange message through a specific network bearer or not. There are two statuses, connected or disconnected.
Device Discovery	The process of identifying the LwM2M Device by the LwM2M Server
Device Registration	The process of adding the information of the LwM2M Device to the database so that remote access and management to the LwM2M Device is achievable
Device State	Device State is a unique condition that represents available capabilities of LwM2M Device. Information Note: possible Device State value could be ‘Active’, ‘Idle’, ‘Sleep’.
Disabling Device	Disabling a device or a Physical Resource is the process of disable their full capabilities, with the exception of being able to process an Enabling request.
Enabling Device	Enabling a device or a Physical Resource is the process of enable its capabilities.
LwM2M Client	A logical component residing in the LwM2M Device conforming to the requirements for the LwM2M Client specified in this enabler. This LwM2M Client serves as an end-point of the LwM2M protocol, and communicates with the LwM2M Server to execute the operations from the LwM2M Server for the device and the service management
LwM2M Device	A LwM2M Device is a device that runs (a) M2M application(s) and communicates through the Network Provider’s network.
LwM2M Server	A logical component residing within the M2M Service Provider or the Network Provider which serves as an end-point of the LwM2M protocols. The LwM2M Server provides the following high level functionalities: discovery and registration, bootstrap provisioning, and device and service management
LwM2M Service	LwM2M Service is a service that is provided to M2M Users by M2M Service Provider
M2M Network Subscriber	M2M Network Subscriber is a M2M User or a M2M Service Provider that has a contractual relationship with the Network Provider to use the network communication service.
M2M Service Provider	A M2M Service Provider provides (a) M2M service(s) to the M2M User by communicating to the LwM2M Client through the Network Provider’s network.
M2M Service Subscriber	M2M Service Subscriber is the M2M User that has a contractual relationship with a M2M Service Provider to use M2M Services.
M2M User	A M2M User uses the service provided by the M2M Service Provider.
Network Provider	A Network Provider offers network communication services over its wireless and/or wireline network.
Physical Resource	Physical Resource is any physical entity that works as a part of the LwM2M device or works as a peripheral.
Power Saving Mode	Power Saving Mode is a setting for the LwM2M Device that helps to decrease its power consumption and meanwhile keep full or partial capabilities available

Resource Constrained Device      A device that consumes low power and is limited in its CPU, memory, I/O for processing of requests.

### 3.3 Abbreviations

**LwM2M**      Lightweight M2M  
**OMA**      Open Mobile Alliance



## 4. Introduction

**(Informative)**

This enabler defines the application layer communication protocol between the LwM2M Server and the LwM2M Client which is placed in the LwM2M Device. In contrast to the OMA DM enabler which mainly concentrates on managing mobile devices, the OMA Lightweight M2M enabler focuses not only on management but also on service enablement for LwM2M Devices. The target LwM2M Devices for this enabler are in particular Resource Constrained Devices. Therefore, this enabler provides a light and compact protocol and a flat data structure.

## 5. Lightweight M2M release description (Informative)

The Lightweight M2M enabler provides an underlying layer agnostic protocol to allow M2M service enablement and management between the LwM2M Server and the LwM2M Client.

### 5.1 End-to-end Service Description

The Lightweight M2M enabler will provide a solution for Resource Constrained LwM2M Devices which will greatly reduce the costs of deploying M2M services. This advantage will be of great benefit to every stakeholder in the M2M industry. Moreover, the Lightweight M2M enabler minimizes the traffic impact on the communication network caused by the growing number of M2M Devices. Furthermore, power consumption of M2M Devices will be reduced.

## 6. Requirements

(Normative)

### 6.1 High-Level Functional Requirements

Label	Description	Release
LightweightM2M-HLF-001	The Lightweight M2M enabler SHALL support a unique ID to identify the LwM2M Device.	1.0
LightweightM2M-HLF-002	The Lightweight M2M enabler SHALL support binary addressing scheme.	1.0
LightweightM2M-HLF-003	The Lightweight M2M enabler SHALL support remote retrieval of the currently installed firmware version of the LwM2M Device.	1.0
LightweightM2M-HLF-004	The Lightweight M2M enabler SHALL support firmware update of the LwM2M Device.	1.0
LightweightM2M-HLF-005	The Lightweight M2M enabler SHALL provide a mechanism that allows the LwM2M Client to indicate the result of a firmware update operation.	1.0
LightweightM2M-HLF-006	The Lightweight M2M enabler SHALL provide a mechanism that allows the LwM2M Client to report its power source status.	1.0
LightweightM2M-HLF-007	The Lightweight M2M enabler SHALL provide a mechanism that allows the LwM2M Client to report an error situation.	1.0
LightweightM2M-HLF-008	The Lightweight M2M enabler SHALL provide a mechanism that allows to remotely restart the LwM2M Device.	1.0
LightweightM2M-HLF-009	The Lightweight M2M Enabler SHALL support Factory Reset operation.	1.0
LightweightM2M-HLF-010	The Lightweight M2M enabler SHALL provide a mechanism that allows remote enabling and disabling of the LwM2M Device.	1.0
LightweightM2M-HLF-011	The Lightweight M2M enabler SHALL provide a mechanism that allows remote enabling and disabling of Physical Resources attached to the LwM2M Device.	1.0
LightweightM2M-HLF-012	The LightweightM2M enabler SHALL support configuration of the LwM2M Device.	1.0
LightweightM2M-HLF-013	The Lightweight M2M enabler SHALL support a mechanism to trigger the LwM2M Client to open a connection to the LwM2M Server.	1.0
LightweightM2M-HLF-014	The Lightweight M2M enabler SHALL support IP-based communication.	1.0
LightweightM2M-HLF-015	The Lightweight M2M enabler SHALL support SMS based communication methods.	1.0
LightweightM2M-HLF-016	The Lightweight M2M enabler SHALL support session based communication.	1.0
LightweightM2M-HLF-017	The Lightweight M2M enabler SHALL support sessionless communication.	1.0
LightweightM2M-HLF-018	The Lightweight M2M enabler SHALL support a mechanism to request the LwM2M Client to configure the Power Saving Mode.	FFS
LightweightM2M-HLF-019	The Lightweight M2M enabler SHALL support a mechanism for periodic reporting of a specific resource of the LwM2M Device.	1.0
LightweightM2M-HLF-020	The Lightweight M2M enabler SHALL support an event-trigger report mechanism for the LwM2M Device.	1.0
LightweightM2M-HLF-021	The Lightweight M2M enabler SHALL support the configuration of the event-trigger reporting mechanism.	1.0
LightweightM2M-HLF-022	The Lightweight M2M enabler SHALL support a mechanism to configure the reporting period of a specific resource in the LwM2M Device.	1.0
LightweightM2M-HLF-023	The Lightweight M2M enabler SHALL support Device Discovery, Device Registration and Bootstrap Provisioning of the LwM2M Devices.	1.0

LightweightM2M-HLF-024	The Lightweight M2M enabler SHALL provide a configurable threshold based reporting mechanism for data from the LwM2M Device or from Physical Resources attached to it.	1.0
LightweightM2M-HLF-025	The Lightweight M2M enabler SHALL provide a mechanism for the LwM2M Device to report the radio signal strength and the time when this measurement was taken.	1.0
LightweightM2M-HLF-026	The Lightweight M2M enabler SHALL provide a mechanism to retrieve the Connectivity Status information from the LwM2M Device.	1.0
LightweightM2M-HLF-027	The Lightweight M2M enabler SHALL provide a mechanism to report the Connectivity Status information from the LwM2M Device.	1.0
LightweightM2M-HLF-028	In case of cellular network connectivity the Lightweight M2M enabler SHALL provide a mechanism to include the identification of the radio cell in the Connectivity Status information.	1.0
LightweightM2M-HLF-029	The Lightweight M2M enabler SHALL provide a mechanism to remotely configure which bearer is being used by the LwM2M Client to report data.	FFS
LightweightM2M-HLF-030	The Lightweight M2M enabler SHALL provide a mechanism for retrieval of the LwM2M Device State.	1.0
LightweightM2M-HLF-031	The Lightweight M2M enabler SHALL provide a mechanism for reporting of the LwM2M Device State change.	1.0
LightweightM2M-HLF-032	The Lightweight M2M enabler SHALL support multiple types of resource access. Information Note: possible resource access type could be 'readonly', 'readwrite', 'executable'	1.0
LightweightM2M-HLF-033	The Lightweight M2M enabler SHALL provide a mechanism to group resources in the LwM2M Device.	1.0
LightweightM2M-HLF-034	The Lightweight M2M enabler SHALL support a mechanism for the LwM2M Server to manage a resource in the LwM2M Device.	1.0
LightweightM2M-HLF-035	The Lightweight M2M enabler SHALL support a mechanism to transfer the data of multiple resources per request.	1.0
LightweightM2M-HLF-036	The Lightweight M2M enabler SHALL support a mechanism for the acknowledgement of message delivery.	1.0
LightweightM2M-HLF-037	The Lightweight M2M enabler SHALL support a mechanism to retrieve the Connection Address from the LwM2M Device.	1.0
LightweightM2M-HLF-038	The Lightweight M2M enabler SHALL support a mechanism to retrieve a connection log from the LwM2M Device.	FFS
LightweightM2M-HLF-039	The Lightweight M2M enabler SHALL support a mechanism to remotely prohibit the connection of the device to the network for a certain duration.	1.0
LightweightM2M-HLF-040	The Lightweight M2M enabler SHALL support a mechanism to automatically restore a remotely temporarily prohibited network connectivity of the LwM2M Device after the end of a defined time period.	1.0

Table 1: High-Level Functional Requirements

## 6.1.1 Security

Security requirements are described below:

Label	Description	Release
LightweightM2M - SEC-001	The Lightweight M2M enabler SHALL support secure communication between the LwM2M Server and the LwM2M Client.	1.0
LightweightM2M - SEC-002	The Lightweight M2M enabler SHALL support a mechanism to prevent a replay attack.	1.0

Table 2: High-Level Functional Requirements – Security Items

### 6.1.1.1 Authentication

Authentication requirements are described below:

Label	Description	Release
LightweightM2M-AT-001	The Lightweight M2M enabler SHALL support a mechanism for mutual authentication between the LwM2M Client and the LwM2M Server	1.0

**Table 3: High-Level Functional Requirements – Authentication Items**

### 6.1.1.2 Authorization

Authorization requirements are described below:

Label	Description	Release
LightweightM2M-AZ-033	The Lightweight M2M Enabler SHALL support a mechanism to authorize the commands per resource from the LwM2M Server.	1.0

**Table 4: High-Level Functional Requirements – Authorization Items**

### 6.1.1.3 Data Integrity

Data Integrity requirements are described below:

Label	Description	Release
LightweightM2M-DI-001	The Lightweight M2M enabler SHALL provide a mechanism for ensuring integrity.	1.0

**Table 5: High-Level Functional Requirements – Data Integrity Items**

### 6.1.1.4 Confidentiality

Confidentiality requirements are described below:

Label	Description	Release
LightweightM2M-CF-001	The Lightweight M2M enabler SHALL provide a mechanism for ensuring confidentiality.	1.0

**Table 6: High-Level Functional Requirements – Confidentiality Items**

## Appendix A. Change History (Informative)

### A.1 Approved Version History

Reference	Date	Description
OMA-RD-LightweightM2M-V1_0-20170208-A	08 Feb 2017	Status changed to Approved by TP TP Ref # OMA-TP-2017-0009-INP_LightweightM2M-V1_0_ERP_for_Final_Approval

## Appendix B. Use Cases

(Informative)

### B.1 Streetlight Control

#### B.1.1 Short Description

John is a streetlights supervisor – responsible to manage streetlights system at his home town. There are thousands of streetlights in the city and he expects to have low-cost M2M sensors embedded in these streetlights. He needs a capability to remotely turn on/off a specific streetlight or a group of streetlights. He needs a capability to know the control status of each streetlight. He needs a capability to make sure that remote instructions sent to these streetlights are only accepted from authorized users (such as himself).

The following figure shows a typical construct of street light control system.

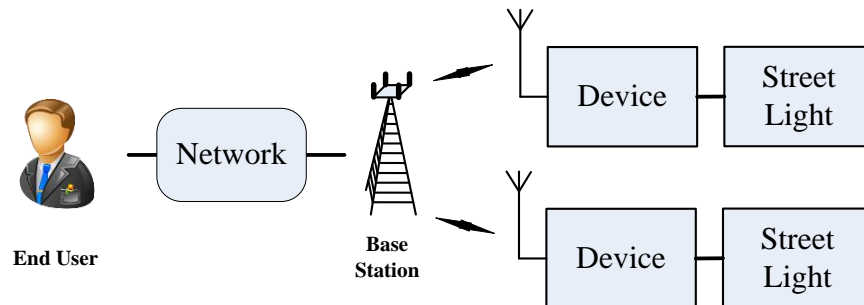


Figure 1: The Streetlight Control System

#### B.1.2 Market benefits

The market already has millions of streetlights deployed. This streetlight control system will help to save energy.

### B.2 Air Conditioning Control

#### B.2.1 Short description

Ted is a HVAC supervisor – responsible to manage air-conditioning systems at his multi-story corporate office. There are multiple air-conditioning systems in his office for full HVAC support. He expects to have low-cost M2M sensors embedded in these HVAC systems. He needs a capability to remotely turn on/off a specific air conditioning system or a group of systems. He needs a capability to specify the air-conditioning system to provide its metering data. He needs a capability to configure the temperature threshold for turning on/off the air-conditioning systems.

The following Figure 2 shows the infrastructure of a HVAC M2M system.

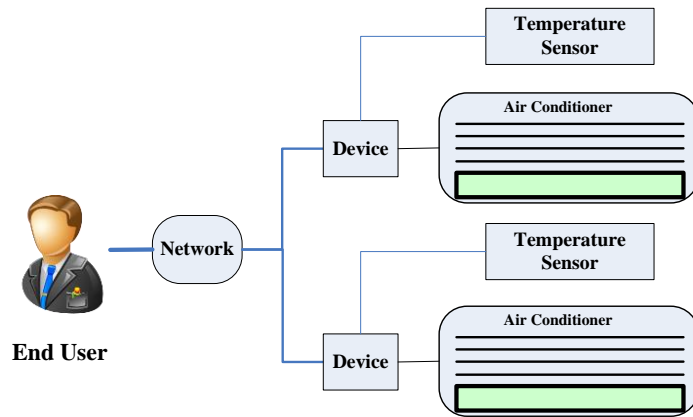


Figure 2: The Infrastructure of Air Conditioning M2M System

## B.2.2 Market Benefits

There already have millions of air conditioners deployed at offices. These air conditioners are now operated directly by human. If the low cost LwM2M Device is embedded into the air conditioner, the air conditioner can be controlled /configured remotely. This will absolutely help people to save energy.

## B.3 Usecase for Terminology Explanation

### B.3.1 Short description

AcmeAssetMgmt is a company that provides mobile asset management service for cars using NetOperator’s wireless network. AcmeAssetMgmt embeds the LwM2M Device in Peter’s car. The LwM2M Client in the LwM2M Device has the capability to provide M2M services (e.g., navigation, location, remote alarm report, shut engine, etc.).

In case #1, Peter has subscribed mobile services with NetOperator for the LwM2M Device. The LwM2M Client in the LwM2M Device in Peter’s car is able to access NetOperator’s wireless network and exchange messages with AcmeAssetMgmt’s LwM2M Server. In case Peter’s car is stolen, Peter can use his smart phone to interact with AcmeAssetMgmt’s LwM2M Server to find its current location and remotely shut down its engine. LwM2M Server will also inform his smart phone of any alarm(s) received from Peter’s car. In the above case, AcmeAssetMgmt is a M2M Service Provider, NetOperator is a Network Provider, and Peter is M2M User. Peter has a M2M service subscription with AcmeAssetMgmt, so Peter is a M2M Service Subscriber. Peter has a subscription with NetOperator, so Peter is a M2M Network Subscriber.

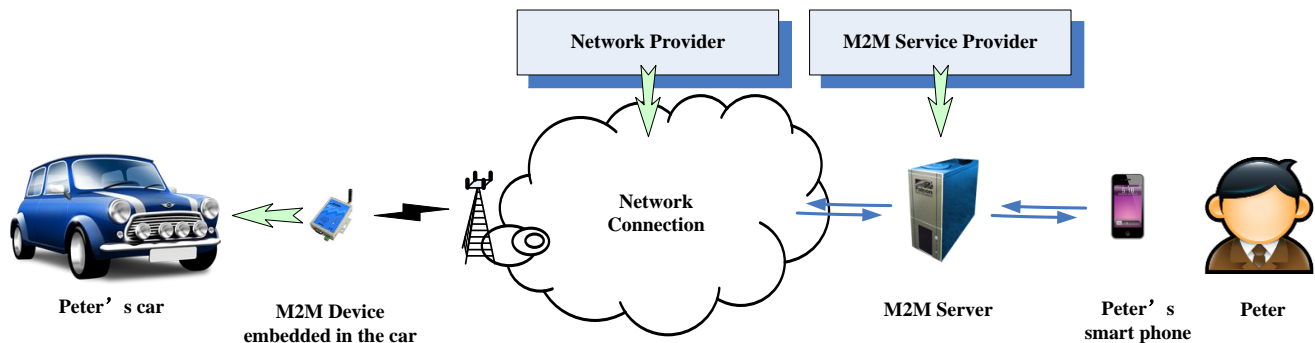


Figure 3: The Concept of a M2M service system

In case #2, Peter uses a smart phone as a router to provide network connection for the LwM2M Client in the LwM2M Device. Peter already has a network service subscription with a Network Provider for his smart phone. When the smart phone leaves



the car or Peter shuts it down, the LwM2M Client in the LwM2M Device lost the network connection. In this case, Peter plays the role of M2M Service Subscriber and M2M User. But there is no existing M2M Network Subscriber.

In case #3, AcmeAssetMgmt decides to have a subscription with NetOperator directly. Now, AcmeAssetMgmt plays the role of M2M Service Provider and M2M Network Subscriber at the same time. Peter is a M2M Service Subscriber and a M2M User, not a M2M Network Subscriber.

In case #4: Tom, Peter's friend, wants to borrow the car for weekend. Peter wishes that Tom can enjoy the M2M service during the weekend. So Peter registers Tom's information with AcmeAssetMgmt. After the registration, Tom can enjoy a similar service as for Peter. During that weekend, Peter unregisters his own information with AcmeAssetMgmt, because he doesn't want to control the car when Tom drives it. If this happens, Peter is a M2M Service Subscriber and he is not a M2M User any more.

In case #5: NetOperator provides a similar service as AcmeAssetMgmt. Peter terminates the contract with AcmeAssetMgmt and signs a new subscription with NetOperator in order to use the M2M service and the network service provided by NetOperator. NetOperator is M2M Service Provider and Network Provider at the same time.

## B.4 Temporarily suspending the device connection

### B.4.1 Short Description

Ben is a system administrator at the M2M Service Provider responsible for managing a large number of LwM2M Devices and multiple services. During a particularly high traffic peak, the system is at a risk of being brought down. Hence, he wishes to temporarily, for a certain period of time, prohibit a certain set of devices from connecting and hence be able to deal with the remaining ones running a service which is considered a higher priority. However, the affected devices are allowed and meant to proceed fulfilling their general function (e.g., data collection, asset control, etc.) during this outage. It is only their network connection that is temporarily affected.

In principle, this consists of the following steps:

- The LwM2M Client in the LwM2M Device attempts to download service data from a M2M Service Provider Server.
- However, the M2M Service Provider's M2M Server is under heavy utilization and hence Ben wants to temporarily disable its low priority services and LwM2M Devices supporting these services.
- In order to manage the utilization properly, the M2M Service Provider administrator (i.e., Ben) issues a command to the low-priority LwM2M Devices to basically suspend their reconnecting to the network over a certain period of time (e.g., 5min or 2 hours).

### B.4.2 Market Benefits

The M2M Service Provider and Ben can manage and administer their overall system which includes all of their network infrastructure and LwM2M Devices efficiently and effectively without wasting network and LwM2M Device resources while being able to prioritise the services they support.