LwM2M Interoperability for Utilities

Launch of a new work program at OMA SpecWorks dedicated to Interoperability for Utilities

May 24 & 25, 2023

Agenda

- Introduction and Housekeeping - Seth Newberry
- Why Device Management - Olivier Carmona
- Introduction to LwM2M - Olivier Carmona
- LwM2M Security - Olivier Carmona
- LwM2M Use Cases - Olivier Carmona
- LwM2M Interoperability - Travis Shanahan
- How to Participate - Seth Newberry
- Open Discussion and Q&A

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Housekeeping

- Recording and slide deck will be made available for attendees via email and on the OMA SpecWorks website.
- Questions can be asked via the webinar chat and will be answered at the end of the presentation.
- Additional questions can be sent to snewberry@omaorg.org.

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Our Presenters

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OMA SpecWorks

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VP Sales & Mktg
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Senior Research Architect
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Device Management: Why?

Connected Water Meters Are Thriving

Over 400 million smart water meters from dozens of vendors will be available worldwide in 2026* because they:

- Provide accurate billing
- Reduce manual operations by remotely diagnosing anomalies
- Interact with customers beyond billing
- Help customers know their distribution networks thanks to data analytics

- *Smart Water Magazine and ABI Research

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Other Connected Tools are Also Thriving

- Pressure sensors
- Leakage sensors
- Flow sensors
- Water quality sensors
- Dataloggers
- Smart valves
- And much more

These enable more efficient management of operations and proactive identification and treatment through real-time data.

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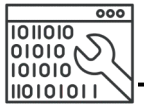
Result: Invisible Infrastructure Costs

The number of devices from multiple vendors increases the complexity and cost of combining them in a unique SCADA system

- **Proprietary data formats**
- reduce fluid communication between systems



- **Proprietary device management** makes remote control costly and has a ripple affect with other systems

This combination creates a myriad of security breaches

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The Cost of Infrastructure Maintenance

Operating costs has grown OPEX/CAPEX ratio from 50/50 to 70/30*, due to:

- Too many field operations
- Too much network expertise required at installation or retiring a system
- Too many remote operations done one by one

*Bluefield Research, 2021

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Purpose of the Project

OMA is the originator and copyright holder of the LwM2M specification.

LwM2M came to market as a light-weight version of the widely deployed OMA Device Management protocol.

Developed as a less chatty, low power, transport protocol for highly constrained IOT devices.

LwM2M became popular as IOT devices proliferated with a strong following in the utilities space.

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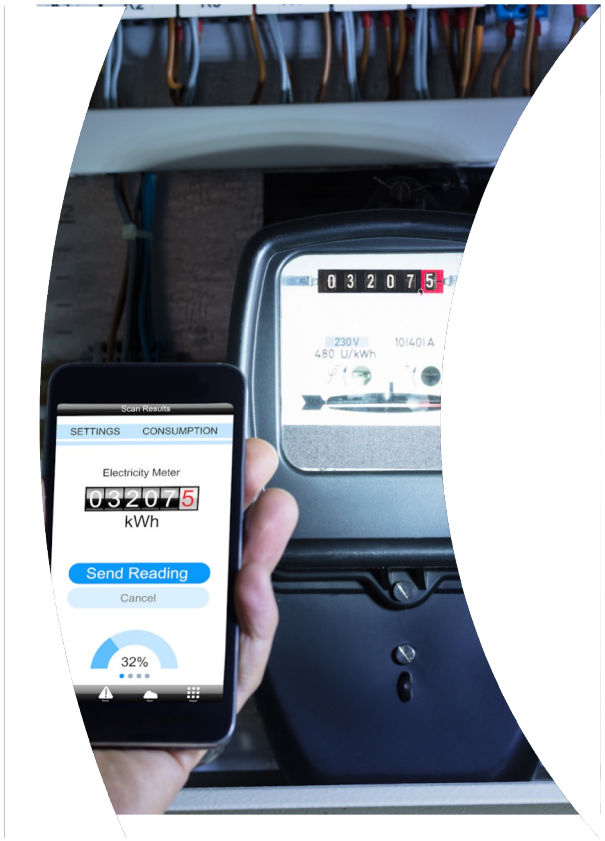
Purpose of the Project



OMA is seeing an uptick in members from the utility industry who are interested in LwM2M.

Utility RFPs are increasingly calling out LwM2M in their tenders and utility suppliers are developing around LwM2M at an increasing rate.

Not all the implementations conform to the specification, creating interoperability issues.

OMA wants to provide a single-point-of-reference for this important industry segment

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Introduction
to LwM2M

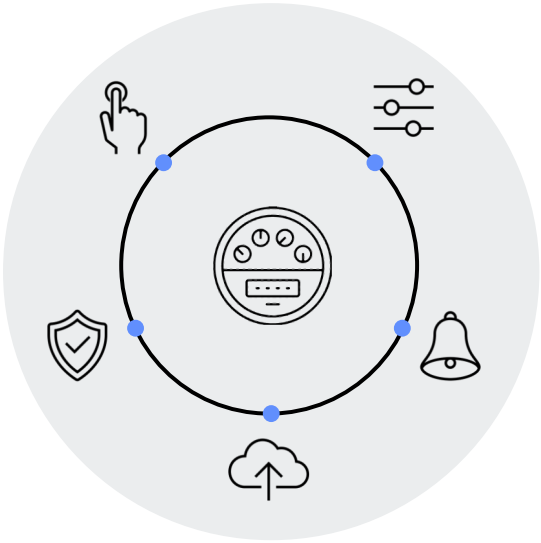
LwM2M Offers Standard Device Management

•Zero-touch Provisioning

LwM2M Bootstrap defines it all, and can also serve to update certificate, decommission,...

•Remote Update of the Firmware

LwM2M protocol defines a finite state machine.



•Remote Control of a Set of Devices

LwM2M offers a set of read, write, execute, observe operations to do it all, plus a set of security layers (DTLS, OSCORE).

•Data Format Self-Discovery

LwM2M protocol provides a data model, easily extensible, but above all it allows to discover the data structure on the fly: no "packet decoder" is needed.

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•Works over NB-IoT

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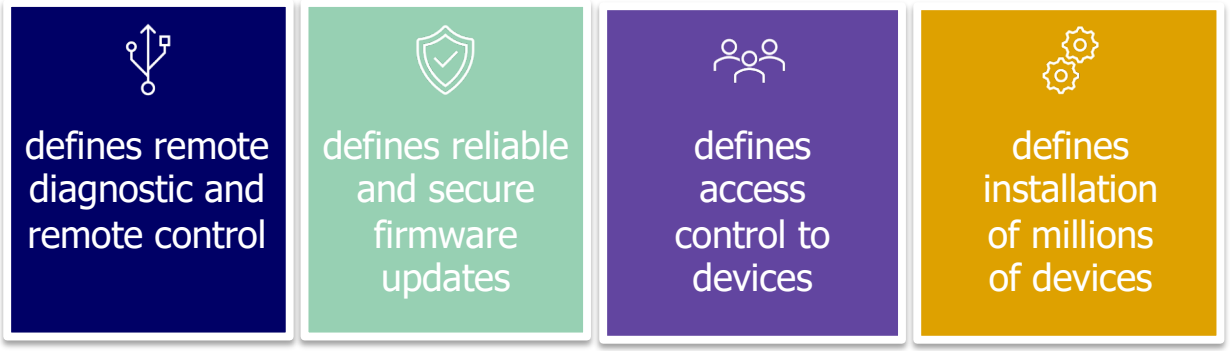
LwM2M in a Nutshell

…is based on LwM2M widely adopted standards

OMA SpecWorks developed LwM2M to address the needs of low-power and low-bandwidth devices. It…



…and it is being adopted globally by telcos, automotive, and… utilities.

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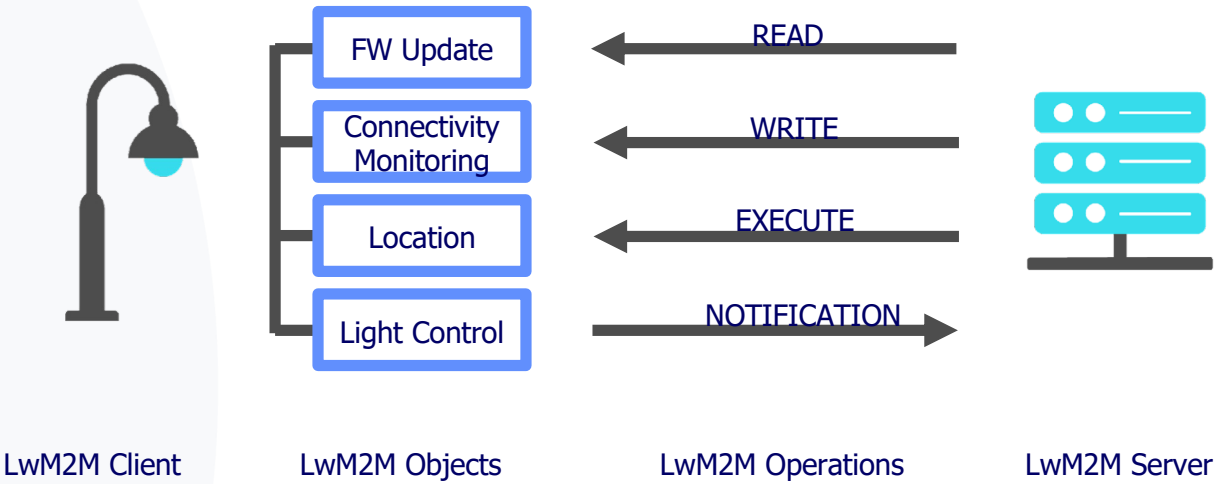
LwM2M Concepts



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LwM2M Objects

- A collection of Resources relevant for a particular use case
- Each resource has a defined semantic, type and allowed operations
- Well-known 16-bit IDs
- Resources and Objects can have multiple Instances
- Objects/Resources are accessed with simple URIs:

  /{Object ID}/{Object Instance}/{Resource ID}

```
/
+- 3          (Device Object)
|  +- 0
|     +- 2   (serial number, R)
|     +- 4   (reboot, E)
|     +- 9   (battery level, R)
|     +- 14  (current time, RW)
|
+- 4            (Connectivity Monitoring Object)
|  +- 0
|     +- 1     (available networks, R)
|     |  +- 0  (1st available network)
|     |  +- 1  (2nd available network)
|     +- 2     (signal strength, R)
|     +- 8     (cell ID, R)
|
+- 3303         (Temperature Object)
   +- 0
   |  +- 5700  (1st sensor value, R)
   |  +- 5701  (1st sensor units, R)
   +- 1
      +- 5700  (2nd sensor value, R)
      +- 5701  (2nd sensor units, R)
```

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Example: Connected Automatic Door

Two presence sensors and a powered sliding door

Business requirements:

- Door override
- Disabling one or both ways
- Counting the number of activation

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LwM2M Objects

- LwM2M is extensible. Devices can implement their own LwM2M Objects
- The LwM2M Server must know the Object layout
- To avoid collisions, several Object ID ranges are defined:

0 – 1023	Objects produced by the OMA
2048 – 10240	Objects registered by 3rd party standards organizations
10241 – 32768	Objects registered by companies or individuals
32769 – 42768	IDs reserved by vendors. Objects are not published

Example: The Presence Object in IPSO

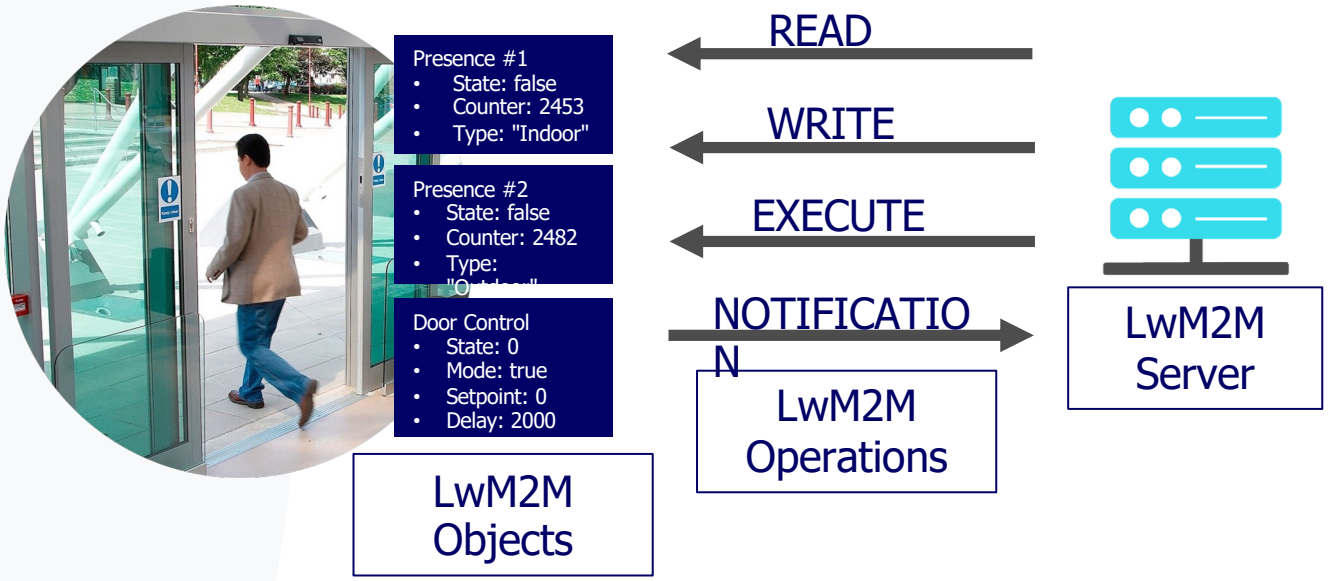
Object	Object ID	Object URN	Multiple Instances?	Description
IPSO Presence	3302	urn:oma:lwm2m:ext:3302	Yes	Presence sensor with digital sensing, optional delay parameters

Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Units	Descriptions
Digital Input State	5500	R	No	Mandatory	Boolean		The current state of the presence sensor
Digital Input Counter	5501	R	No	Optional	Integer		The cumulative value of active state detected.
Digital Input Counter Reset	5505	E	No	Optional	Opaque		Reset the Counter value
Sensor Type	5751	R	No	Optional	String		The type of the sensor, for instance PIR type
Busy to Clear delay	5903	R,W	No	Optional	Integer	ms	Delay from the detection state to the clear state in ms
Clear to Busy delay	5904	R,W	No	Optional	Integer	ms	Delay from the clear state to the busy state in ms

Example: A Custom Door Control Object

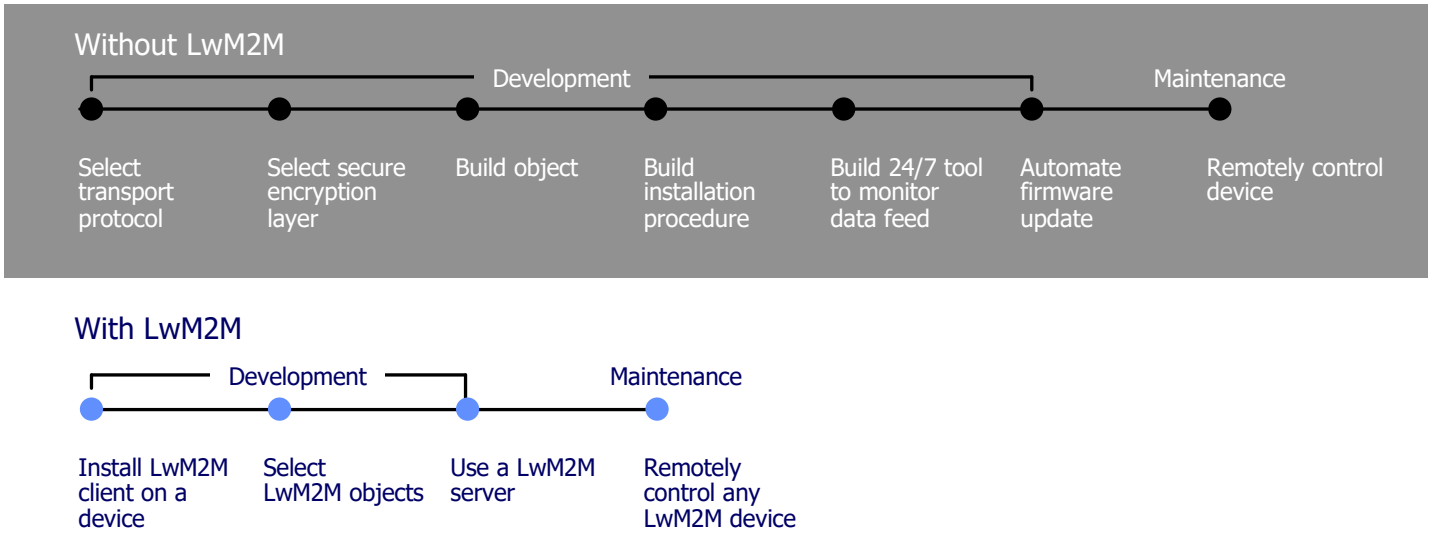
Resource Name	Resource ID	Access Type	Multiple Instances?	Mandatory	Type	Units	Descriptions
Door State	0	R	No	Yes	Integer	/100	The current opening state of the door. 0: closed. 100: open
Automatic Mode	1	RW	No	Yes	Boolean		True: automatic mode. False: controlled by the LwM2M Server
Door Setpoint	2	RW	No	Yes	Integer	/100	The opening setpoint of the door when Mode is not automatic. 0: closed. 100: open
Closing Delay	3	RW	No	Optional	Integer	ms	Delay to wait before closing the door in the absence of presence detection

Example: Automatic Door Device



LwM2M Streamline Development

LwM2M shortcuts your deployment, allows replication



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LwM2M offers strong business solutions

- **Reduce Capital Expenditures**
  - Downscale device specifications, fast-track your time-to-market, and outsource infrastructure management
- **Advanced Security**
  - Guarantee data and payload enciphering meeting regulator expectations
- **Keep Existing Tools**
  - Offer a seamless transition from legacy to new generation deployments
- **Reduce Operational Expenditures**
  - Reduce on-site maintenance, automate operations, and accelerate device fixes to save resources
- **Fast-Track Deployment**
  - Launch your project faster without burdening your internal and development teams
- **Energy Efficiency**
  - Operate on the most constrained devices as well as on high latency-networks

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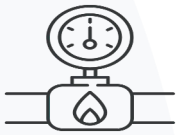
LwM2M provides strong impact overall



Smart Metering

Street Lighting

Container Tracking

•Reduces operating costs by up to 30%	•Reduces capital expenditures by up to 50%	•Increases tracker lifetime to several dozen of weeks
•Increases battery lifetime by up to 30%	•Diminishes communication cost by up to 70%	•Cut maintenance cost by 70%

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LwM2M
Security

LwM2M Meets The Needs Of Regulation

Secure interfaces: LwM2M offers encryption with DTLS (with PKI or PSK) and/or OSCORE, both independently reviewed protocols.

No universal passwords: LwM2M bootstrap offers a powerful mechanism solving that. LwM2M access control adds to it.

Remote software / certificate update: LwM2M firmware update.

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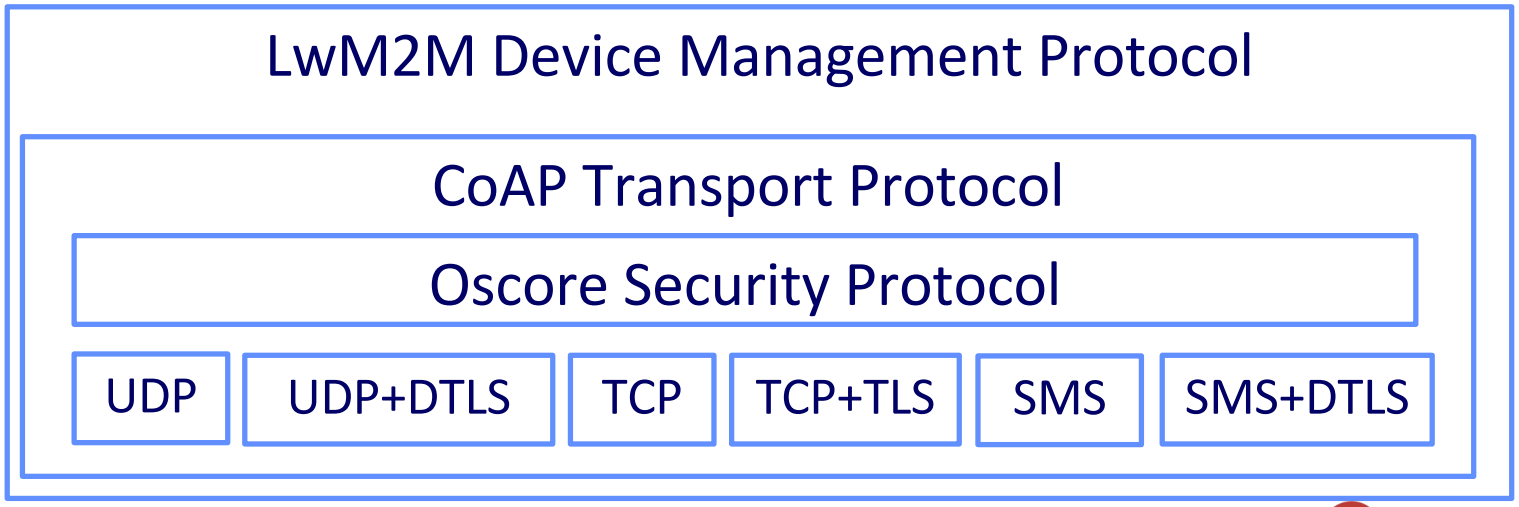
LwM2M Encryption Layers

Support for Internet Engineering Task Force standards: DTLS & OSCORE.

DTLS / TLS: Encryption at transport level either through Public Shared Keys or Public Key Infrastructure.

OSCORE: Encryption at application level.



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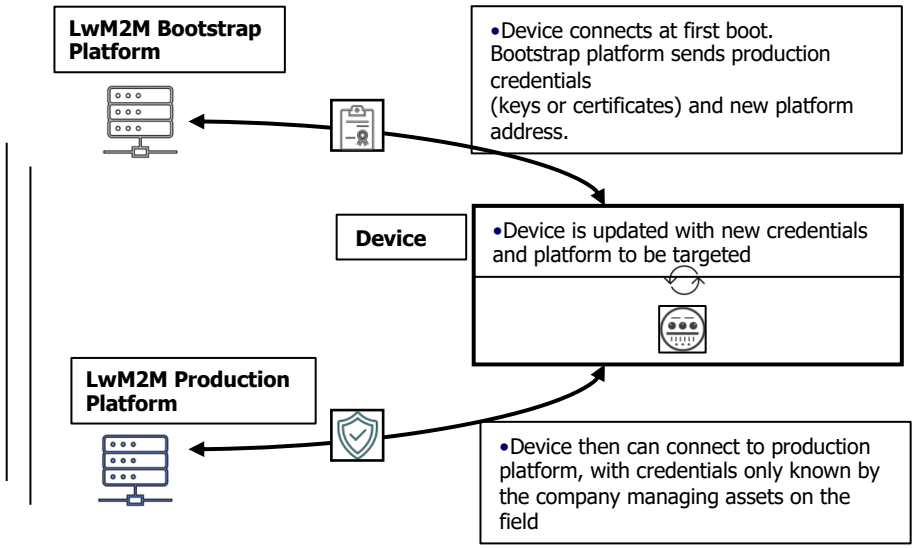
LwM2M Bootstrap

Securely onboards your devices implementing your own keys / credentials

To ensure that the login credentials for the device management platform are uniquely known, LwM2M allows device credentials to be changed and the target device management platform to be assigned or changed at the beginning or later.



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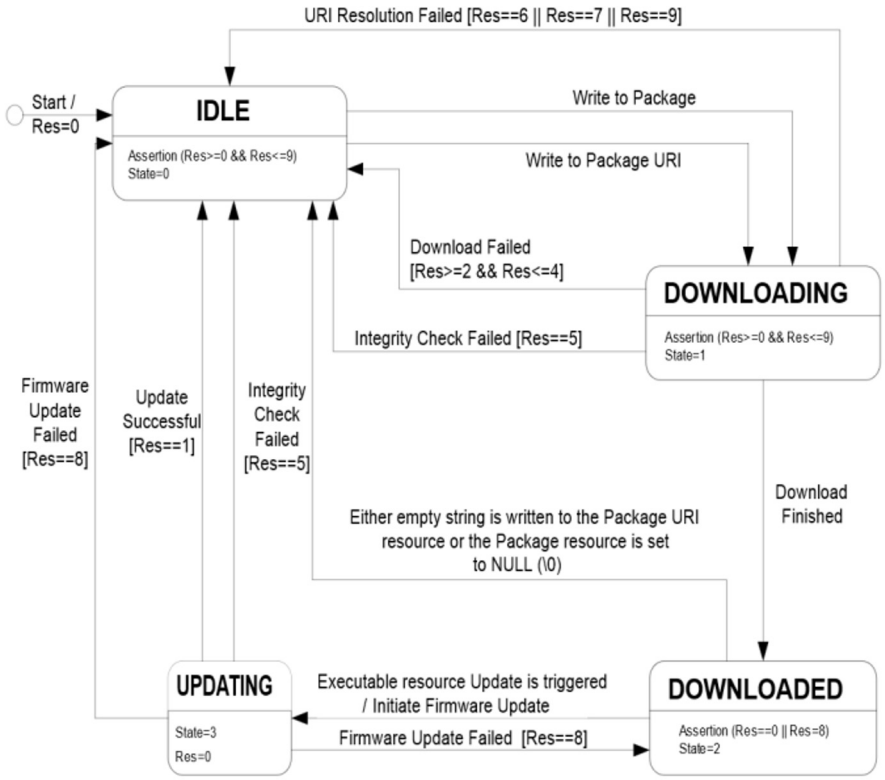
LwM2M Firmware Update

Fail-safe mechanism that masks many of the complexities and deals with special cases.



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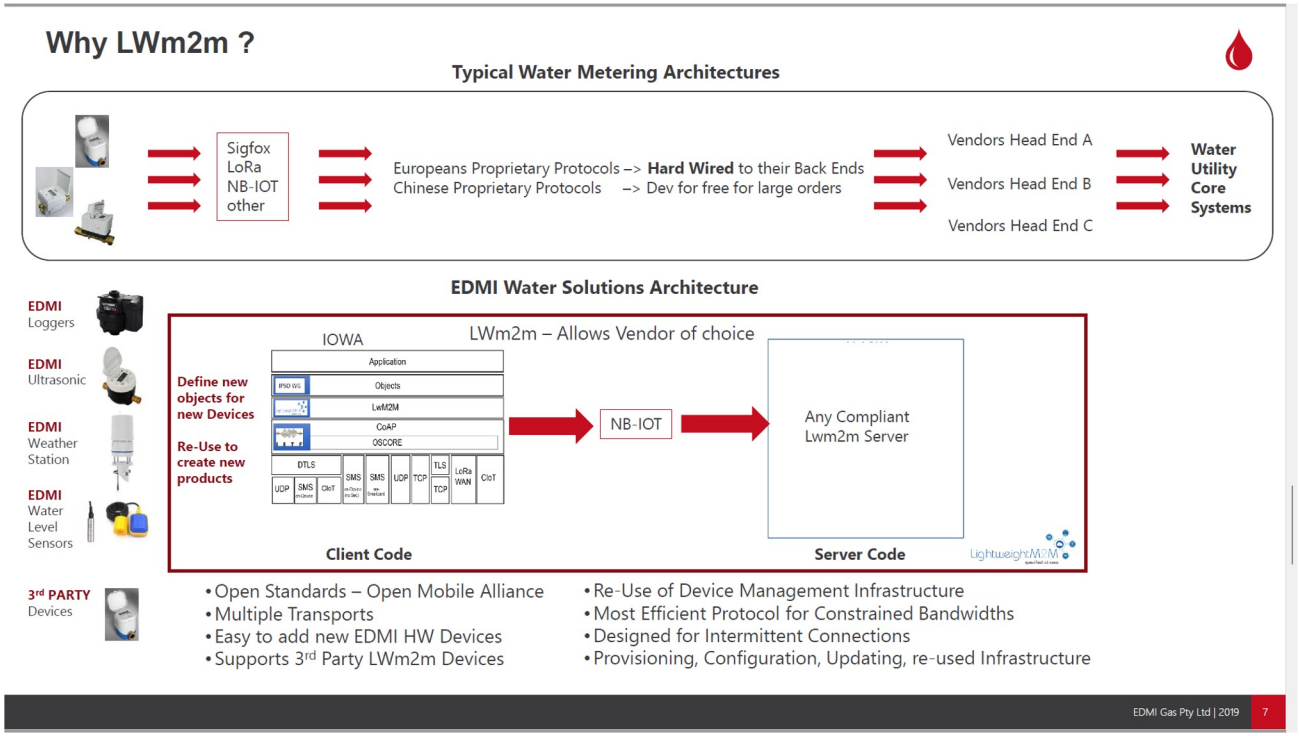
LwM2M Use Cases: EDMI Range of LWM2M Devices

EDMI: Range of LWM2M Devices



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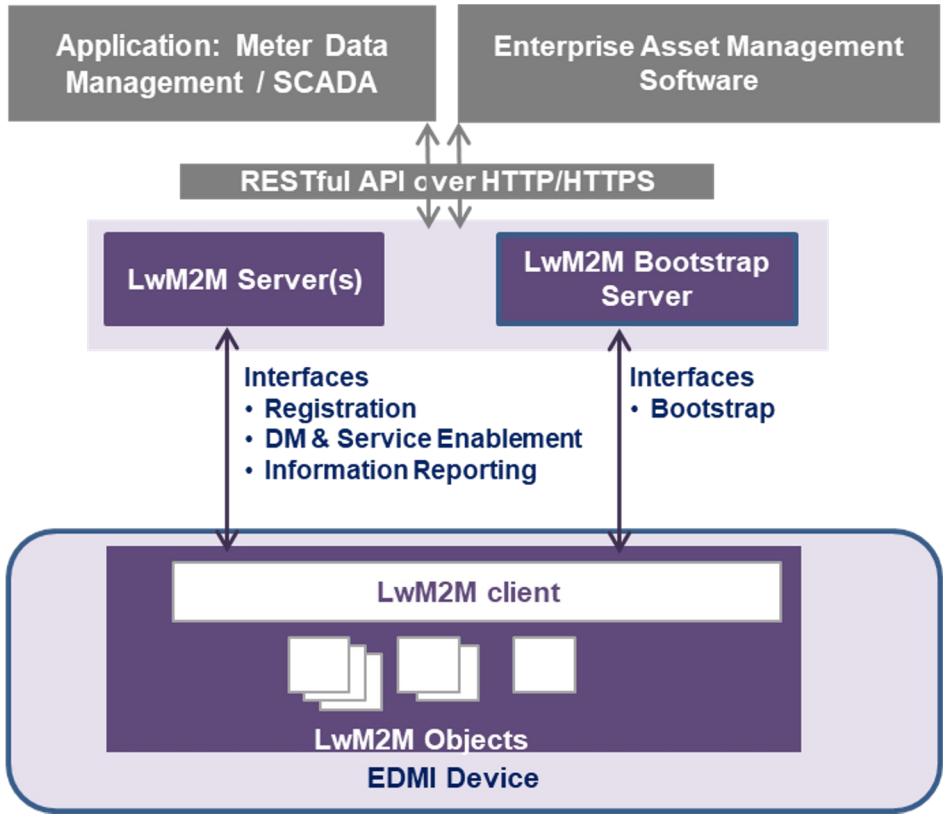
EDMI Typical Architecture



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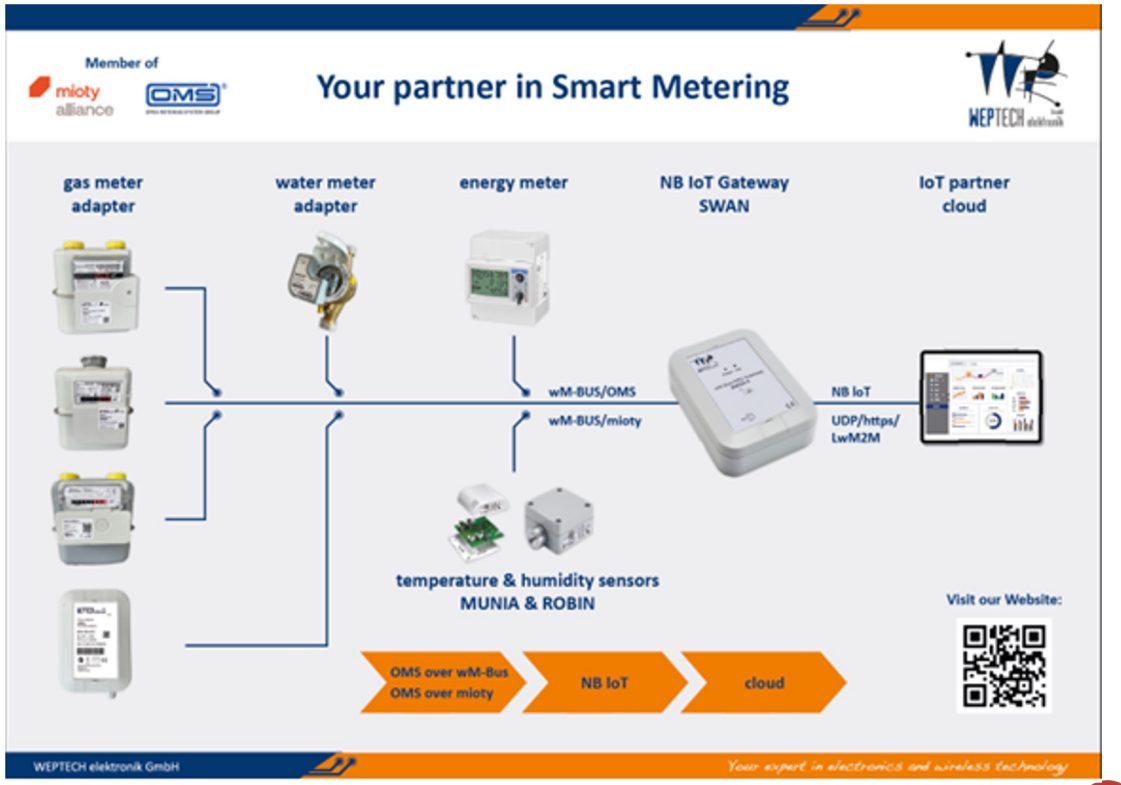
WEPTECH: LwM2M Gateways



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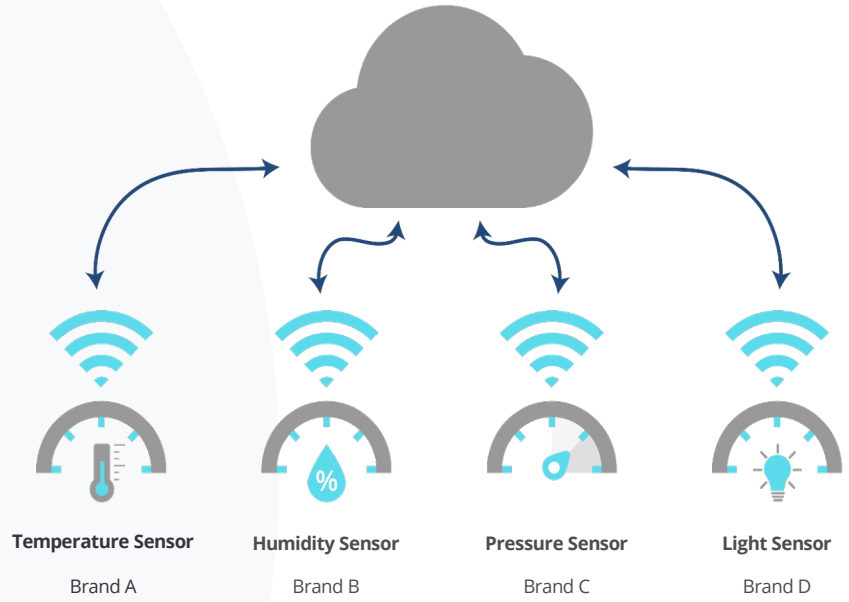
Interoperability
Status

LwM2M Standard Lifecycle Management

Allows device lifecycle whatever brand, whatever device.



Do it once.
Use it everywhere.

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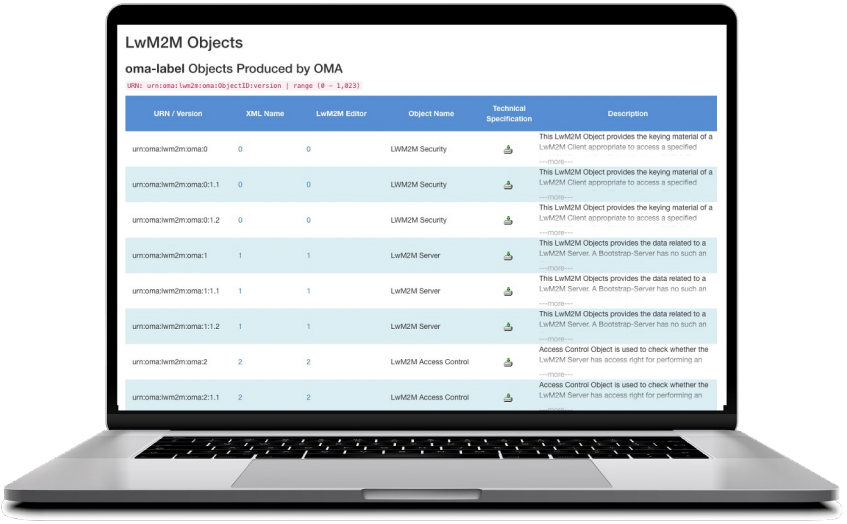
LwM2M Standard Data Format

Allows device operation interoperability beyond lifecycle management.

- 1,000+ objects to help your business
- Open for contributions
- Maintained by OMA SpecWorks, it also contains objects from IPSO, GSMA, uCIFI, OneM2M, and individuals
- Objects cover the most common Device Management and business use cases



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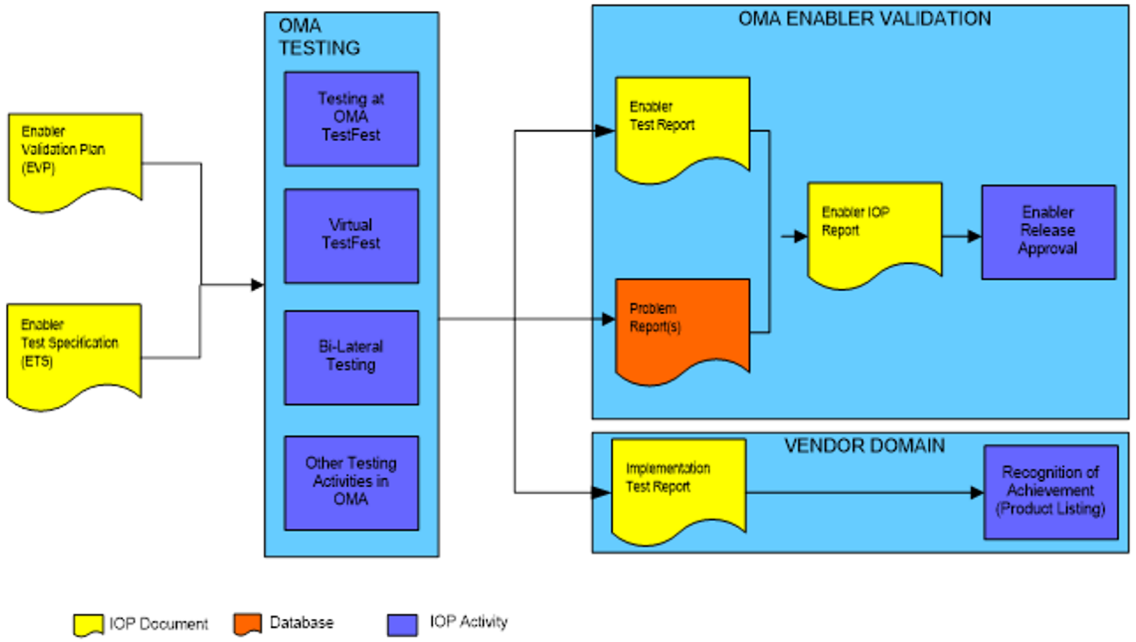
LwM2M Interoperability Tools

- OMA SpecWorks conduct TestFest on a regular basis.
- TestFest results are made available globally on a repository.



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Utility-Specific Needs

- Define possibly missing objects.
- Define business use cases.
- Define the associated interoperability documents.

We are looking to achieve global industry consensus and as such started two task forces:

- Task force to reach out to utilities to build the most relevant solutions.
- Task force to write those specifications.

Meet on a biweekly basis.

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How to
Participate

About OMA Specworks

- Established in 2002, OMA has developed hundreds of highly scalable specifications including those found in:
  - Public Safety (Push to Talk over Cellular)
  - Mobile Device Provisioning (OMA Device Management)
  - Location (OMA Secure User Plane)
  - IOT (LightWeight M2M)
- OMA has dozens of Liaison Agreements including:
  - ETSI
  - 3GPP
  - Wi-Sun
  - ATIS

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About OMA SpecWorks

OMA has a robust program of interoperability test events that allow implementers to test their products against other implementations using OMA test cases.

OMA is a California 501(c)3 member-based association. Members contribute financially to the association to support the tools, staff, legal governance and work program that develops the Specifications and Test programs.

OMA has a Board of Directors and a number of active Working Groups where the technical work takes place.

OMA Specifications are developed by the members of the Working Groups under FRAND licensing terms.

The Specifications are publicly available and free for anyone to download.

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How To Participate

Companies who wish to participate in creating requirements or technical specifications for the LwM2M Utility IOT program are invited to join the OMA.

Membership allows companies to participate in developing the specifications and test cases and participate in test events. Members have access to the drafts, they may make technical contributions to the specification and may vote on the draft specifications.

A complete list of membership rights is found on the OMA website at: https://omaspecworks.org/membership/membership-benefits/

If your company is interested in participating in this work, please get in touch with Seth Newberry at snewberry@omaorg.org.

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Thank you for joining!

Next Steps:

1. You can ask questions in the chat now!
2. We will send you the slide deck and the recording by email.
3. Questions can be sent to snewberry@omaorg.org.
4. Review membership information to participate: https://omaspecworks.org/membership/membership-benefits/

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Backup

Slides for offline access when distributed after the webinar

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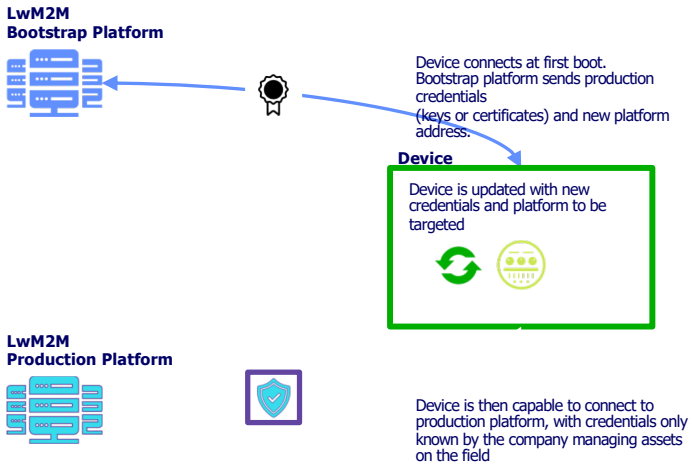
Details on
LwM2M Features

LwM2M: Much More Than A Transport Protocol

LwM2M provides numerous features, like firmware update or receive only wanted notifications

- LwM2M bootstrap platform, enables you to change the credentials of the devices at the very first boot, and to give the target device management platform at the last moment of the onboarding process
- This platform can be used at any time in case of keys or certificate renewal



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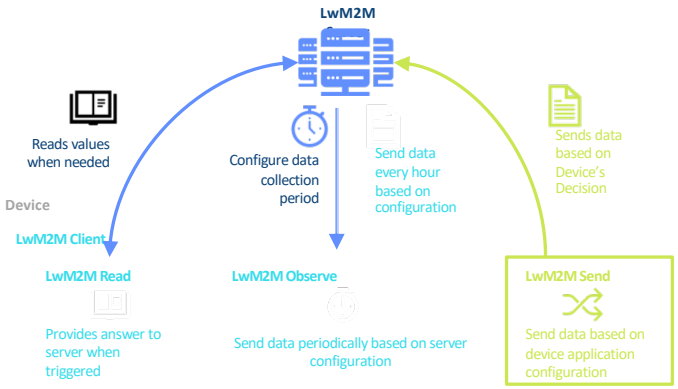
LwM2M: Client & Server Interaction

Your device can sleep and send data without actively waiting for a server request



Server requests data directly from client

Server provides client with data request schedule, and client sends data according to server's schedule

Client sends data directly to server (LwM2M Send Operations)

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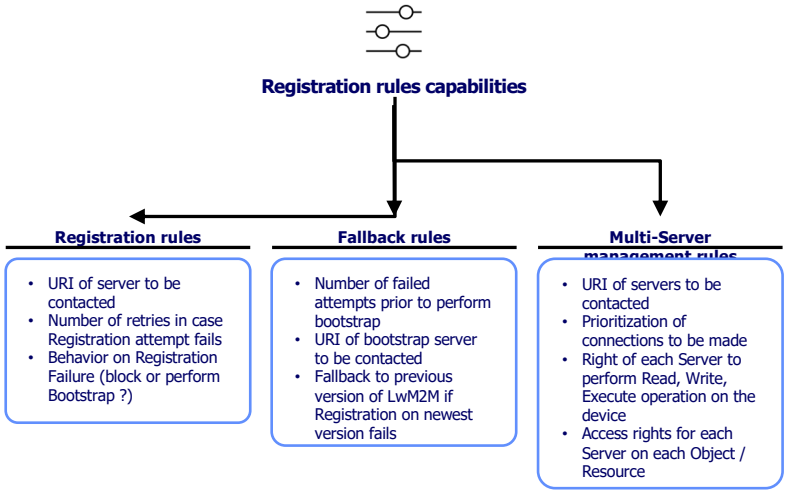
LwM2M: Failsafe

You can define fallback scenarios if Server is not accessible

You can configure all aspects of client-server interactions to cope even with the most complicated end-to-end architectures:

- Basic Registration rules: configure nominal case, and rule to apply in case of failure
- Fallback rules: define all fallback scenarios, from going back to bootstrap to downgrading the version of the protocol
- Multi-Server management: define prioritization and access rights between all targeted device management servers



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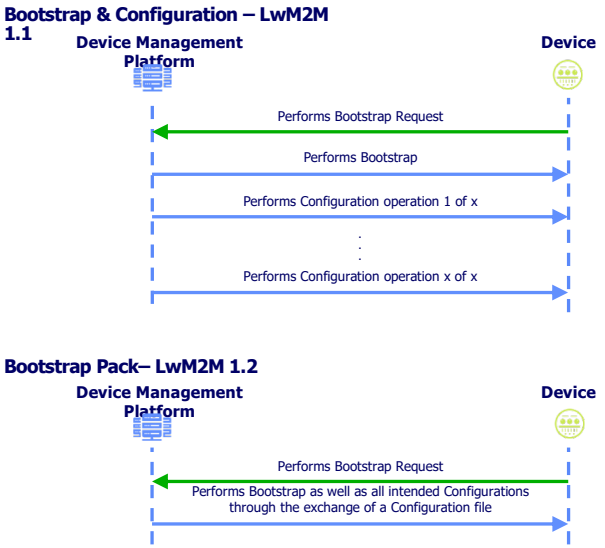
LwM2M: Bootstrap Is Compact

Use Bootstrap pack capabilities to enroll and configure your devices without killing your communication cost

- Until LwM2M v.1.1, IOWA enabled you to enroll your devices on a Device Management Server relying on bootstrap and further standard operations for device configurations

- From LwM2M v.1.2, IOWA provides you a more optimized way to provision and configure a device through the Bootstrap pack: one single exchange combining the bootstrap request and the exchange of a single file to configure the device to minimize the communications required



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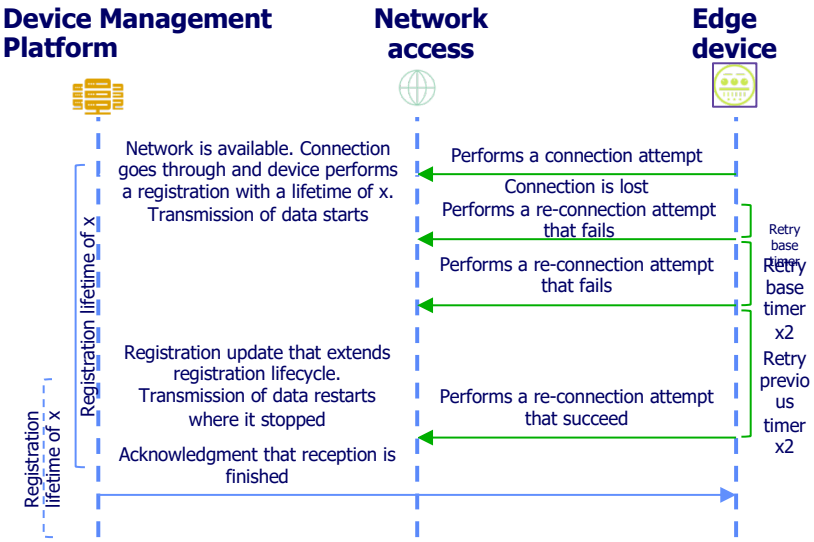
LwM2M: Work Even On Unreliable Connections

CoAP can go through, even on most unreliable networks

- LWM2M Client allows you to define precise CoAP congestion control rules to perform re-connection retries with the server in case of very high latency or network loss. Both retry timers and retry counts are accessible
- Additionally, LwM2M registration lifetime as well as registration updates can also be configured to avoid performing security handshakes for each connection



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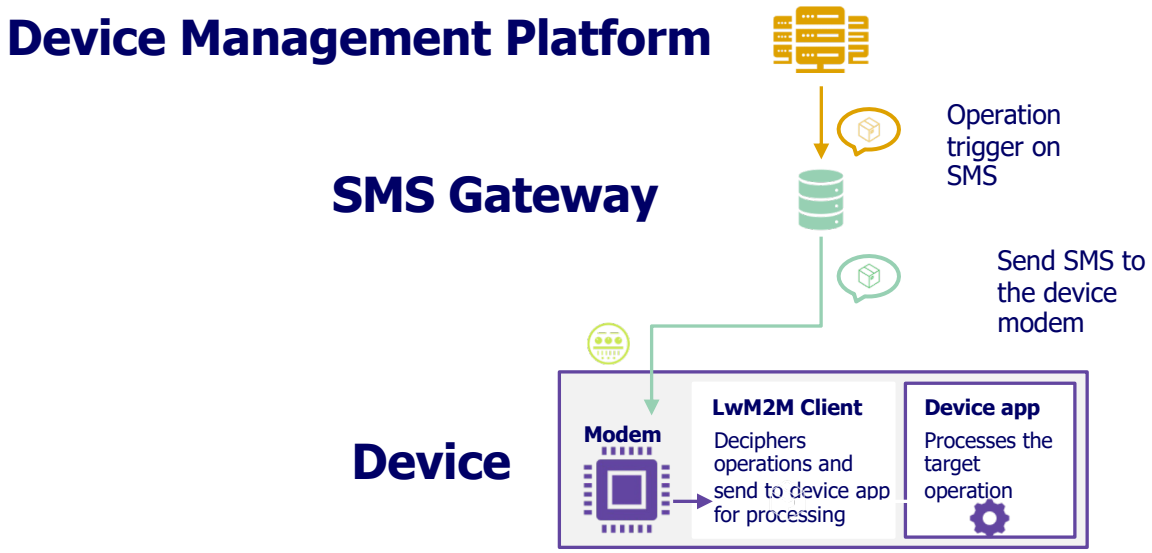
LwM2M: Works On UDP, TCP, SMS, and More

Works on UDP, TCP and even use SMS to trigger device registration, device wake up or other sorts of standard operations



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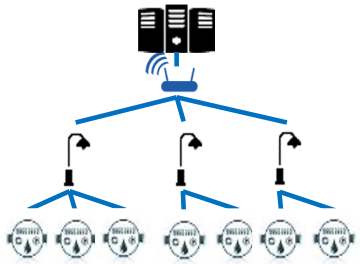
NB IoT & LwM2M

Why Cellular IoT?

- Private, AdHoc Connectivity:
- Create an infrastructure and maintain it without economies of scale.
- Advanced Metering Infrastructure



- Public, Internet connectivity:
- Use the infrastructure of the telecom operators, and benefit from constantly decreasing known rates.
- Telco Grade Security
- Bidirectionnal

NB-IoT
LTE-M

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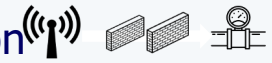
Why NB-IoT?

NB-IoT

- Deep Penetration 
- Low Consumption 
- Low Cost $
- Applications: Metering, lighting, etc.

LTE-M

- Fast motion resistant 
- Higher Bandwidth 
- Applications: Elevators, cars, etc.

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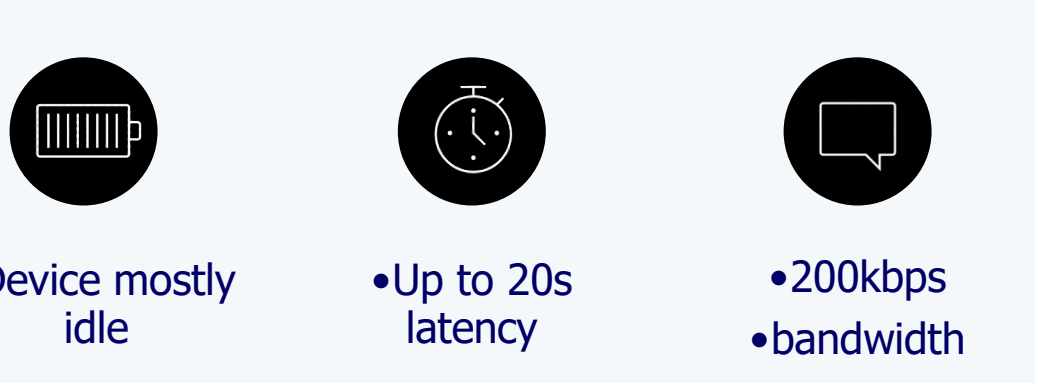
LwM2M Perfect Choice for NB IoT

LwM2M brings to NB-IoT a secure, extensible protocol for device life cycle management



Requires an asynchronous protocol such as LwM2M

LwM2M & NB-IoT match perfectly

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