



 **oma SpecWorks**
For a Connected World

LightweightM2M
specified at oma

LwM2M Interoperability for Utilities

Update on work program at OMA
SpecWorks dedicated to
Interoperability for Utilities

Nov 15, 2023

Our Presenters



Olivier Carmona
VP Sales & Mktg
Ioterop



Travis Shanahan
Senior Research Architect
Itron

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 helpdesk@omaorg.org.



Why IoT Device Management Interoperability?

What is interoperability for IoT devices?

What is an IoT device?

IoT is about devices wirelessly connected to the internet, operating on high-latency networks, and having limited resources, including energy.

What is Interoperability?

Ability of different devices to seamlessly communicate, allowing them to exchange data and perform tasks without barriers.



IoT Connected Devices Are Thriving At Utilities

Enabling efficient management of operations and proactive identification and treatment through real-time data.

- Meters
- Distributed automation
- Distributed energy resource management systems
- Sensors monitoring production, transmission and distribution
- And much more



... but each device conveys its own cloud control interface, its own security, its own data format.

Device Management Interoperability is critical for utilities

IoT proliferation creates infrastructure costs and security breaches



How to manage various devices if each device presents its own device management interface?



How to ensure data integrity if each device presents data in a proprietary format potentially inconsistent?



How to ensure network security if you have heterogeneous security systems across your fleet?

=> IoT standardization is essential for a sustainable ecosystem



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Why LwM2M?



LwM2M Offers Device Management Protocol for IoT

Developed by OMA SpecWorks to address the needs of IoT devices



LwM2M defines, secure remote operations.



LwM2M offers data format for a large variety of use cases.

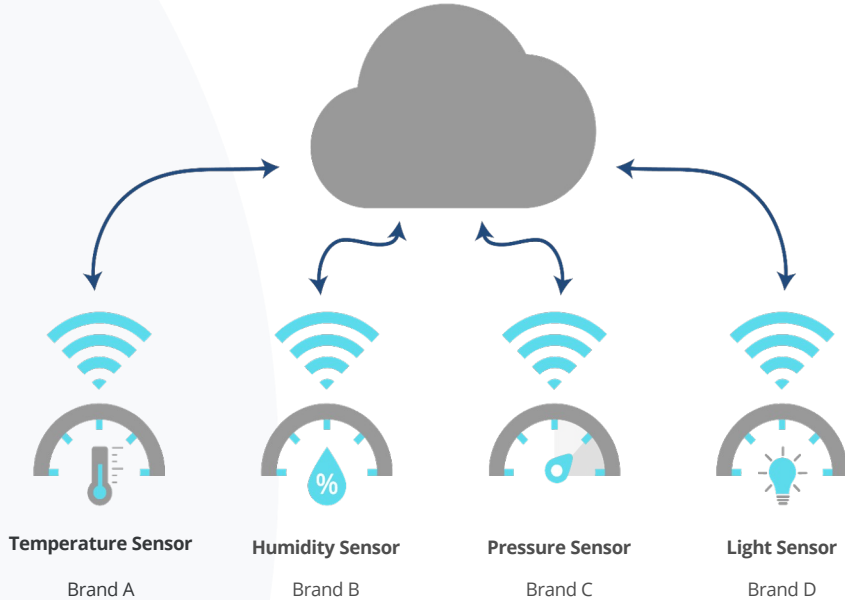


LwM2M defines access controls, encryption, and firmware update.

Deployed since 2016 for cellular IoT

LwM2M Standard Lifecycle Management

Allows device lifecycle whatever brand, whatever device.

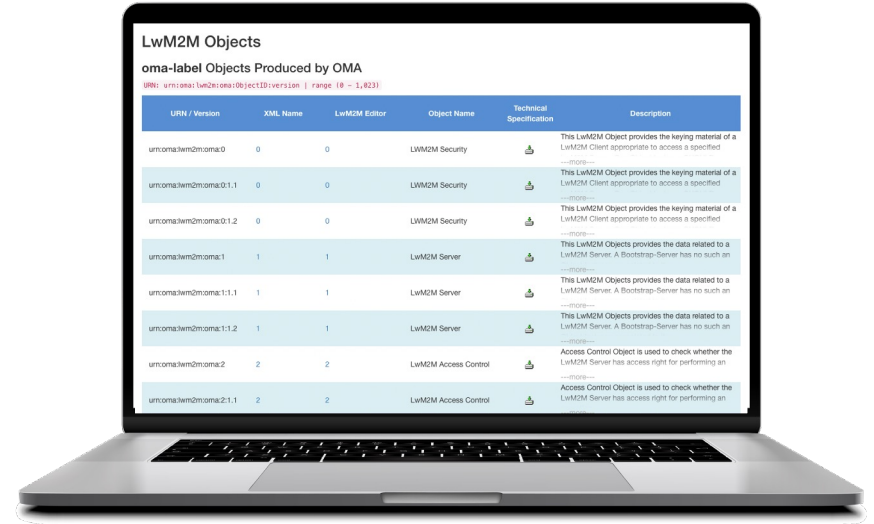


Do it once.
Use it everywhere.

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



LwM2M Answers Regulator Security Requirements

Answer to the three laws of cybersecurity

You Shall Encrypt

LwM2M defines encryption at link and application level

You Shall Not Use Unique Password

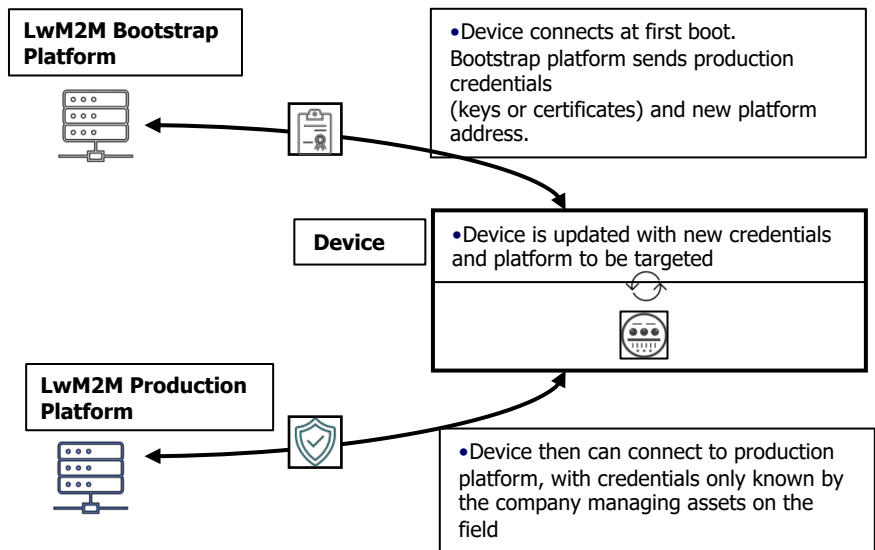
LwM2M defines a bootstrap operation for installation or for recovery in the field

You Shall Update Firmware

LwM2M defines a firmware update operation.

LwM2M Offers A Safe Control Plane

LwM2M Bootstrap, an operation to install or recover devices in the field



LwM2M Protocol Encompasses All Comm Protocols

Works on any physical layer thanks to CoAP transport protocol versatility

High Latency Network

LwM2M on top of CoAP over
UDP IPv4

Link Layer Security: DTLS

Application Level Security:
OSCORE

NB-IoT, Satellite

Low Latency Network

LwM2M on top of CoAP over
TCP IPv4/v6 or over **SMS**

Link Layer Security: TLS

Application Level Security:
OSCORE

LTE-M, LTE

Mesh Network

LwM2M on top of CoAP over
UDP or **TCP IPv6**

Link Layer Security: TLS

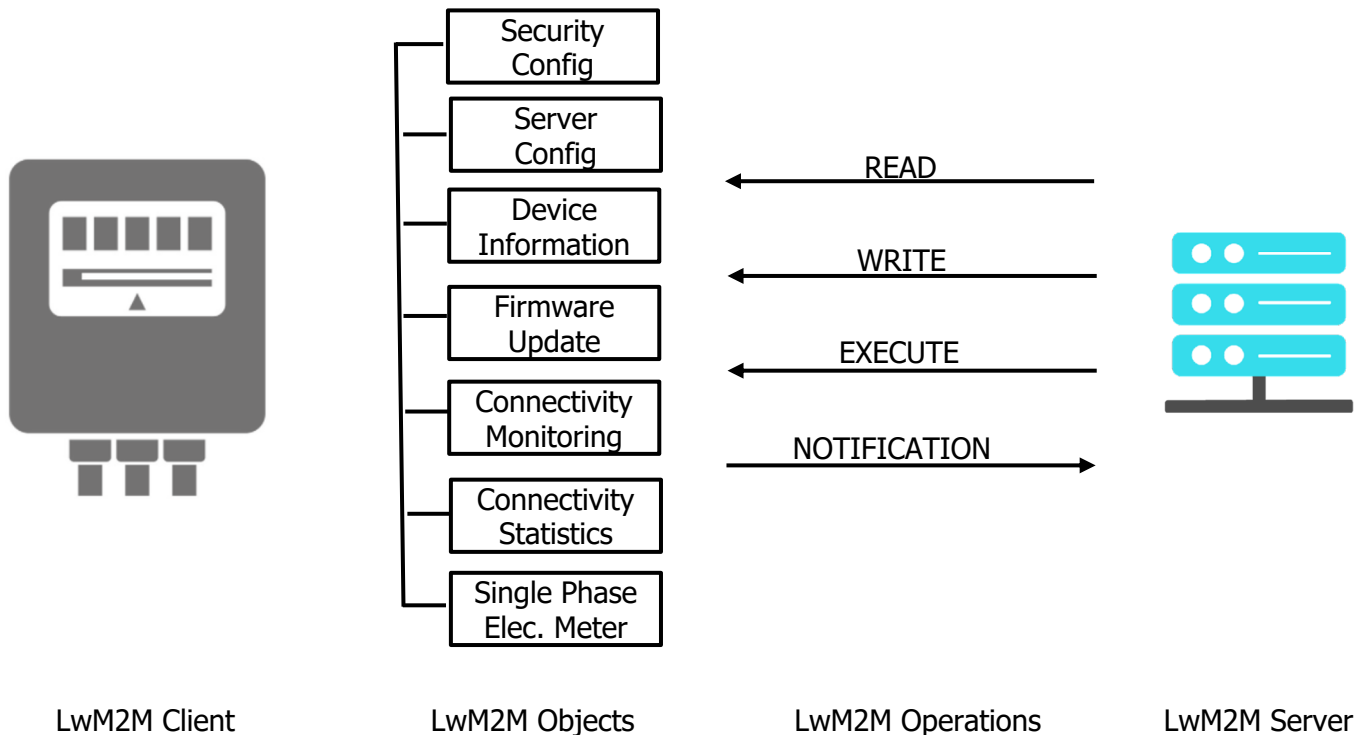
Application Level Security:
OSCORE

WiSUN



What is LwM2M?

LwM2M Concepts Applied To Electrical Meters



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
- Resources can be optional
- 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)
...

```

LwM2M Library of IP Smart Objects (IPSO)

Overall five classes of devices:

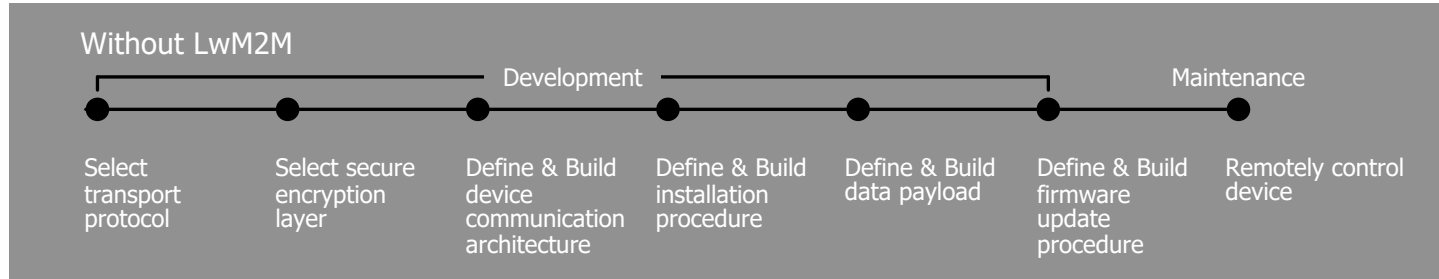
- Device Lifecycle Management
- Connectivity Management
- Security Management
- Generic Sensor or Actuator Management
- Application Dedicated Object

Spread over a range of 65535:

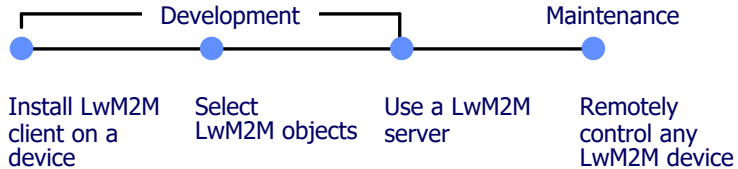
0 – 1023	Objects produced by the OMA
2048 – 10240	Objects registered by 3rd party standards organizations
10241 – 26240	Objects registered by companies or individuals
32769 – 42768	IDs reserved by vendors. Objects are not published

LwM2M Accelerates Device Development

Plus, ensures product safety with a secure control plane



With LwM2M





Utilities Deployment

Utilities Deploying: South East Water, Water Utility, Australia

Solution for advanced water meter combining additional sensors

South East Water introduced LwM2M/IPS0 objects 10262 to 10284 for versatile data collection, including metering, leakage detection config, water flow, temperature, pressure, battery level, and more. Benefits:

LwM2M Benefist:

- Efficient payload, no unnecessary communications.
- Adaptive data transfer.
- Compatibility with various devices:



Utilities Deploying: Jemena, Gas Utility, Australia

Solution for monitoring gas network distribution

- Jemena is upgrading its gas network monitoring by choosing NB-IoT to replace 2G devices in 2G phase-out initiative.

LwM2M Benefits:

- LwM2M over NB-IoT enables to log more data without draining batteries or overburdening bandwidth.



Utilities Deploying: Power Utilities, Poland

Solution for electrical metering

PySense DIN100-LITE modem facilitates data transmission via LTE cellular networks from RS485-equipped devices. Key features include LTE connectivity, Wireless M-Bus support, RS485 interface, and remote management with LwM2M. Application: Remote meter reading, PLC communication.

LwM2M Benefits:

- Deploy massively devices while keeping overall data consumption low over cellular IoT.





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Interoperability Program

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

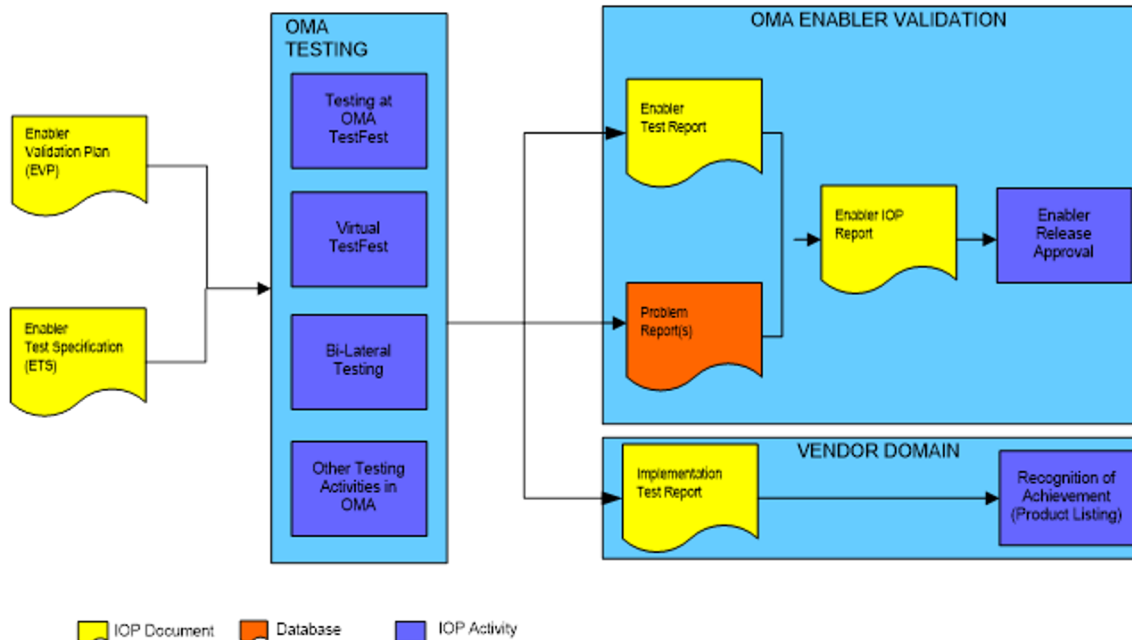




LwM2M Interoperability Roadmap

LwM2M Interoperability Tools

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



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.

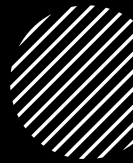




Specification Validation Event



Interoperability Testing



Current State



Test Fest/ SVE



Core Objects vs Industry app objects



Testing Tools



Validation/Certification

Current State – Test Fest

- https://www.openmobilealliance.org/release/LightweightM2M/ETS/OMA-ETS-LightweightM2M_INT-V1_2-20231003-A.pdf

[4. Introduction](#)

[5. LightweightM2M Conformance Test Cases](#)

[6. LightweightM2M Interoperability Test Cases](#)

[6.1. LwM2M Interfaces Test Cases \[0-99\]](#)

[6.1.1. Bootstrap Interface: \[0-99\]](#)

[6.1.1.1. LightweightM2M-1.1-int-0 -- Client Initiated Bootstrap](#)

[6.1.1.2. LightweightM2M-1.1-int-1 -- Client Initiated Bootstrap Full \(PSK\)](#)

[6.1.1.3. LightweightM2M-1.1-int-2 -- Client Initiated Bootstrap Full \(Cert\)](#)

[6.1.1.4. LightweightM2M-1.1-int-3 -- Simple Bootstrap from Smartcard](#)

[6.1.1.5. LightweightM2M-1.1-int-4 -- Bootstrap Delete](#)

[6.1.1.6. LightweightM2M-1.1-int-5 -- Server Initiated Bootstrap](#)

[6.1.1.7. LightweightM2M-1.1-int-6 -- Bootstrap Sequence](#)

[6.1.1.8. LightweightM2M-1.1-int-7 -- Fallback to bootstrap](#)

[6.1.1.9. LightweightM2M-1.1-int-8 -- Bootstrap Read](#)

[6.1.1.10. LightweightM2M-1.1-int-9 -- Bootstrap and Configuration Consistency](#)

[6.1.1.11. LightweightM2M-1.1-int-10 -- Client Initiated Bootstrap Full \(EST\)](#)

[6.1.2. LightweightM2M-1.2-int-11 -- Client Initiated Bootstrap \(OSCORE Security\)](#)

[6.1.2.1. LightweightM2M-1.2-int-12 -- Client bootstrap through use of Bootstrap-Pack Request to the BS](#)

[6.1.2.2. LightweightM2M-1.2-int-19 -- Client Initiated Bootstrap over MOTT](#)

[6.2. Registration Interface \[100-199\]](#)

[6.2.1. LightweightM2M-1.1-int-101 -- Initial Registration](#)

[6.2.2. LightweightM2M-1.1-int-102 -- Registration Update](#)

[6.2.3. LightweightM2M-1.1-int-103 -- Deregistration](#)

[6.2.4. LightweightM2M-1.1-int-104 -- Registration Update Trigger](#)

[6.2.5. LightweightM2M-1.1-int-105 -- Discarded Register Update](#)

[6.2.6. LightweightM2M-1.1-int-106 -- TCP Binding](#)

[6.2.7. LightweightM2M-1.1-int-107 -- Extending the lifetime of a registration](#)

[6.2.8. LightweightM2M-1.1-int-108 -- Turn on Queue Mode](#)

[6.2.9. LightweightM2M-1.1-int-109 -- Behavior in Queue Mode](#)

[6.2.10. LightweightM2M-1.2-int-110 -- Initial Registration using Profile ID](#)

[6.2.11. LightweightM2M-1.2-int-111 -- Initial Registration Using Mix of Profile ID and Object List](#)

[6.3. Device management & Service Enablement Interface \[200-299\]](#)

[6.3.1. LightweightM2M-1.1-int-201 -- Querying basic information in Plain Text format](#)

[6.3.2. LightweightM2M-1.1-int-202 -- Querying basic information in Opaque format](#)

[6.3.3. LightweightM2M-1.1-int-203 -- Querying basic information in TLV format](#)

[6.3.4. LightweightM2M-1.1-int-204 -- Querying basic information in JSON format](#)

Testing Profiles

DMSO Core Objects

- Bootstrap
- FW Update
- Network Connectivity

Industrial Device related objects

- Water Elec and Gas meters
- UCIFI streetlights and smart city objects
- Others?

Industrial optimization testing

- Bootstrap pack
- Compact composite sends
- Constrained network simulations

Testing Goals



Interoperability Testing: Participants test their products and services to verify that they can work seamlessly with other vendors, ensuring that devices and services from different manufacturers can communicate effectively.



Standard Compliance: Products and services are assessed to ensure that they adhere to the OMA's established standards and specifications, promoting consistency and compatibility in the mobile industry.



Issue Resolution: Any interoperability issues or discrepancies discovered during testing are addressed and resolved, helping to improve the overall quality and compatibility of mobile technologies.

Step	Description
1.	Define Objectives and Scope: Clearly define the objectives of the Virtual TestFest and determine the scope of testing, e.g., test v1.0, v1.1 & v1.2 of the LwM2M Protocol.
2.	<p>Form an Organizing Team: Assemble a dedicated team with assigned roles and responsibilities. Historically, OMA TestFest Events were run by OMA staff. Now that OMA employs party-time contractors, it is a good opportunity for some members to step forward and take some role during the event:</p> <ul style="list-style-type: none"> •TestFest Manager: •TestFest Project Manager: •TestFest Registration Support:
3.	Set a Date and Duration: Choose suitable dates and decide on the duration of the event.
4.	<p>Select Virtual Platforms: Choose appropriate virtual collaboration tools and platforms.</p> <ul style="list-style-type: none"> •Etherpad, •Slack, •Zoom,
5.	Develop Test Scenarios: Create detailed test scenarios and test cases.
6.	Invite Participants: Identify potential participants and send formal invitations.
7.	One-page TestFest Event: Prepare one-page website to promote the TestFest event.
8.	Setup Testing Environments: Ensure participants have access to required testing environments.
9.	Schedule Test Sessions: Create a schedule accommodating participants from different time zones.
10.	Facilitate Test Sessions: Appoint moderators and record test results and issues.
11.	GitHub Issues Tracking and Resolution: Use LwM2M-for-Developers as tracking system and collaborate to resolve issues.
12.	<p>Reporting and Documentation: Compile comprehensive reports and share them with participants:</p> <ul style="list-style-type: none"> •Implementation Test Results, •TestFest Accumulative Test Results
13.	Open &Closing Ceremony: Organize an Opening & closing presentation to acknowledge the event and contributions.
14.	Post-Event Evaluation: Gather feedback from participants and use it for improvements.
15.	Follow-Up Actions: Address identified issues and plan for follow-up activities.
16.	<p>Archive Documentation: Archive all relevant documentation for future reference.</p> <ul style="list-style-type: none"> •Product Listing •TestFest Events
17.	Promote Future TestFests: Promote the event's success within the OMA community.

Nov 2023 Virtual TestFest



<https://21247113.hs-sites.com/unlocking-utility-benefits-with-lwm2m-2>



Testing Tools

SVE Nov '24

Test Harness vs Framework

Independent 3rd party
validations



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



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.

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.

Questions for the Audience

Does your security strategy include device interoperability?

- a) Yes.
- b) No.

Would you like to learn more about LwM2M?

- a) Yes.
- b) No.

Backup

Slides for offline access when distributed after the
webinar