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Build your Smart Meter Journey with IoT

23 November 2021 // Webinar

# Build your Smart Meter Journey with IoT

Smart Metering using IoT:

- We're looking at Cellular LPWAN in this case – NB-IoT in particular.

- Smart Meter:
  - Integrated with NB-IoT communications module, or an;
  - Add-on NB-IoT communications module.

- Communications Network:
  - NB-IoT cellular coverage;
  - Preferably an eSIM;
  - NB-IoT data plan.

- Meter Device Management.

- Meter Data Management or Head-end System.

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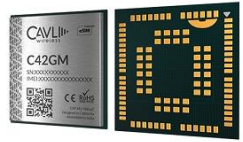
Old vs New Smart Meters

Building & Selecting meters:

- Add-on Comms & Metering module.

- Pulse metering, limited.

- Integrated Meters.

- Ultrasonics with additional sensors.

- Value-added use cases, such as water leakage detection.

- Gas Metering.

- Electricity Metering.
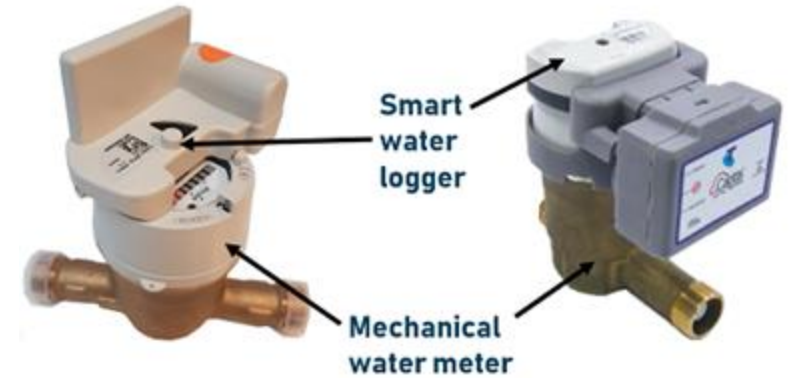
Images Courtesy of Unity Water website [1]

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NB-IoT Communications Modules Approach

Module
MCU, RAM & Flash

Interface AT commands
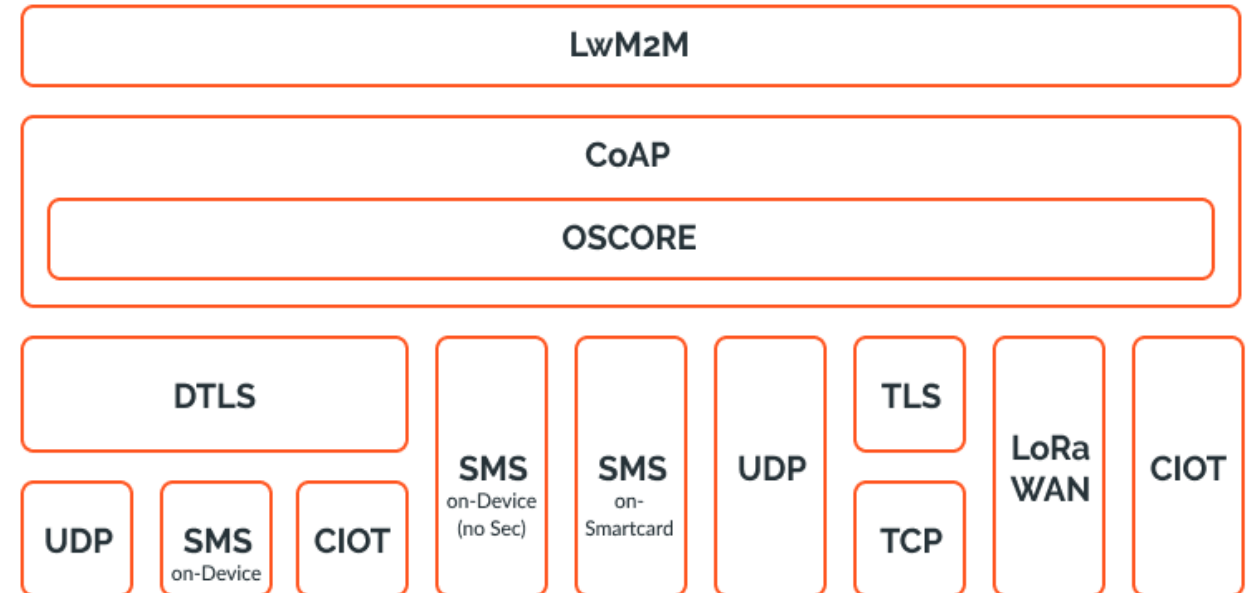**(LwM2M/MQTT client**
from vendor)

Additional MCU, RAM &
Flash on base-board

(User's own LwM2M
client)

NB-IoT Comms Protocols – Low Power

- OMA LwM2M V1.1/1.2 standards protocols.

- Security end-to-end from device, to connectivity to application objects.

- Bootstraps & registers LwM2M devices.

- Device sensor data ingested by Observe/Notify mechanism.

- Various Object/Resources for sensor data.

- Multiple access technologies.

Constrained IoT Devices (low power)

LwM2M

CoAP

OSCORE

DTLS			SMS on-Device (no Sec)	SMS on-Smartcard	UDP	TLS	LoRa WAN	CIOT
UDP	SMS on-Device	CIOT				TCP		

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Expanding Object Data Models

- Editor to create your own data model.
- Templates for creating your own custom data models.
- Mandatory Objects
- Optional Objects
- 3rd Party Objects (reusable)
- IPSO smart objects
- Custom Objects

[3] OMA Specworks : Lightweight Object & Resource Registry

ObjectID Classes

Category	URN	Object ID range	Description	Operations	
oma-label	`urn:oma:lwm2m:oma:<id>:<version>`	0 - 1023	Objects Produced by OMA. Only OMA can use this range. 0-499 DM&SE Working Group 500-1023 IPSO Working Group	View	Register
reserved		1024 - 2047	Reserved for future use	--	--
ext-label	`urn:oma:lwm2m:ext:<id>:<version>`	2048 - 10240	Objects registered by 3rd party standards organisations or alliances	View	Register
x-label	`urn:oma:lwm2m:x:<id>:<version>`	10241 - 26240 26241 - 32768 32769 - 42768	Objects registered by companies or individuals. Objects Produced by Vendors to re-use Block of objects reserved by vendors (Max 50). Private range, Objects will not be published	View -- View	Register -- Reserve

ResourceID Classes

Category	Resource ID Range	Description	Operations	
Common Resources	0 - 2047	Common resource defined inside Objects. Inside of an Object the resourceIDs must be unique but it can be reused in different Objects.	--	--
Reusable Resources	2048 - 26240	Resources registered by companies, standards organisations or alliances. Note: ResourceID is finally allocated by OMNA Staff. Private registrations are not allowed	View	Register
Private Resources	26241 - 32768	Private resource range, no registration is necessary and open to re-use.	--	--

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Example of Water Meter Object

Water meter

Description

The uCIFI water meter measures water volume that was distributed through a water meter, in pulse count as well as in m3. It also detects anomalies in the water meter.

Object definition

Name	Object ID	Object Version	LWM2M Version
Water meter	3424	1.0	1.0
Object URN		Instances	Mandatory
urn:oma:lwm2m:ext:3424		Multiple	Optional

Resource Definitions

ID	Name	Operations	Instances	Mandatory	Type	Range or Enumeration	Units	Description
1	Cumulated water volume	R	Single	Mandatory	Float		m3	Number of cubic meters of water distributed through the meter since last reset.
2	Cumulated water meter value reset	E	Single	Optional				Reset the cumulated meter value.
3	Type of meter	RW	Single	Optional	String			Type of water meter.
4	Cumulated pulse value	R	Single	Optional	Integer			Cumulated number of pulses detected on the meter.
5	Cumulated pulse value reset	E	Single	Optional				Reset the cumulated pulse value.
6	Pulse ratio	RW	Single	Optional	Integer			Ratio to calculate water volume from pulse value.
7	Minimum flow rate	R	Single	Optional	Float		m3/s	Minimum flow rate since last metering value.
8	Maximum flow rate	R	Single	Optional	Float		m3/s	Maximum flow rate since last metering value.
9	Leak suspected	R	Single	Optional	Boolean			Set to True if water leak is suspected.
10	Leak detected	R	Single	Optional	Boolean			Set to True if leak is detected.
11	Back flow detected	R	Single	Optional	Boolean			Set to True if water back flow is detected.
12	Blocked meter	R	Single	Optional	Boolean			Set to True if water meter is blocked.
13	Fraud detected	R	Single	Optional	Boolean			Set to True if fraud is detected.

[3] OMA Specworks : Lightweight Object & Resource Registry

Embedded SIMs & SIM Management

- eSIM / eUICC over plastic SIMs
- Removable vs non-Removable (soldered)
- Provisioning of eSIM remotely
- Activation / Deactivation
- eSIM with multiple Carriers
- Optimal Data Usage
- Efficient FoTA delivery
- Value-added use cases:
  - Location based services.
  - Others.

2FF - Mini SIM

Height: 25mm
Width: 15mm
Thickness: 0.76mm

3FF - Micro SIM

Height: 15mm
Width: 12mm
Thickness: 0.76mm

4FF - Nano SIM

Height: 12.3mm
Width: 8.8mm
Thickness: 0.67mm

MFF2 - M2M Form Factor (eSIM)

Height: 6.0mm
Width: 5.0mm
Thickness: 0.67mm

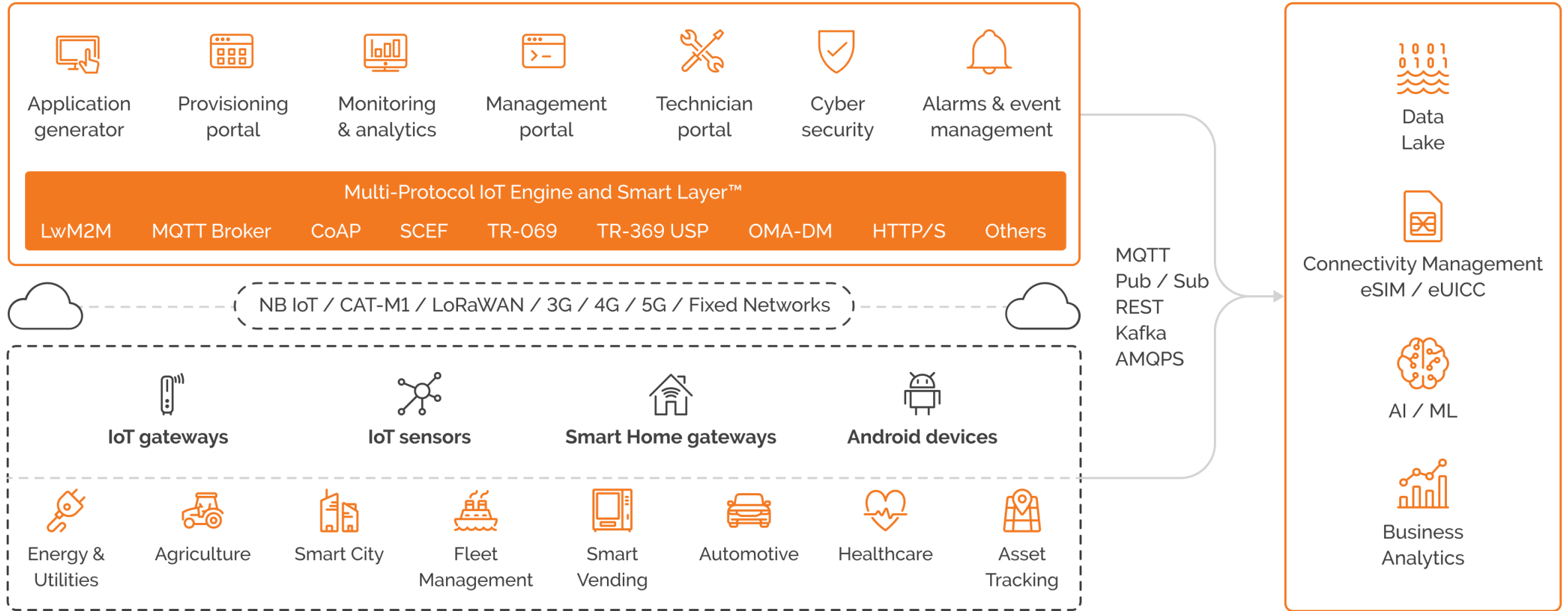*Illustration - Image Courtesy of Hologram website [2]*

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Cellular Network Access

A few network provider pointers to look out for:

- Needed Cellular coverage.

- NB-IoT supported in region.

- Alternate to use CAT-M1 but with battery lifetime limitations.

- Data plans in most regions are aggressive to attract high volume IoT users for NB-IoT / CAT-M1.

- Choosing an eSIM, in region Communications partner, or using roaming partners.

- Combining eSIM management and device management for best product & service lifetime operations.

Meter Device Management

Application generator

Provisioning portal

Monitoring & analytics

Management portal

Technician portal

Cyber security

Alarms & event management

Multi-Protocol IoT Engine and Smart Layer™

LwM2M   MQTT Broker   CoAP   SCEF   TR-069   TR-369 USP   OMA-DM   HTTP/S   Others

NB IoT / CAT-M1 / LoRaWAN / 3G / 4G / 5G / Fixed Networks

IoT gateways   **IoT sensors**   **Smart Home gateways**   **Android devices**

Energy & Utilities   Agriculture   Smart City   Fleet Management   Smart Vending   Automotive   Healthcare   Asset Tracking

MQTT
Pub / Sub
REST
Kafka
AMQPS

Data Lake

Connectivity Management eSIM / eUICC

AI / ML

Business Analytics

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Meter Data Management & Head-end Systems

One-IoT™

External Connectors & Cloud Services

Multi Protocol Adapter

DM Engine

Data stream & integration

RTDB & RDBMS

Data Analytics

Device Management tools

MQTT
RESTful
Pub / Sub
Kafka
AMQPS

SCEF-T8

Microsoft Azure

aws

Google Cloud

ERICSSON

ORACLE

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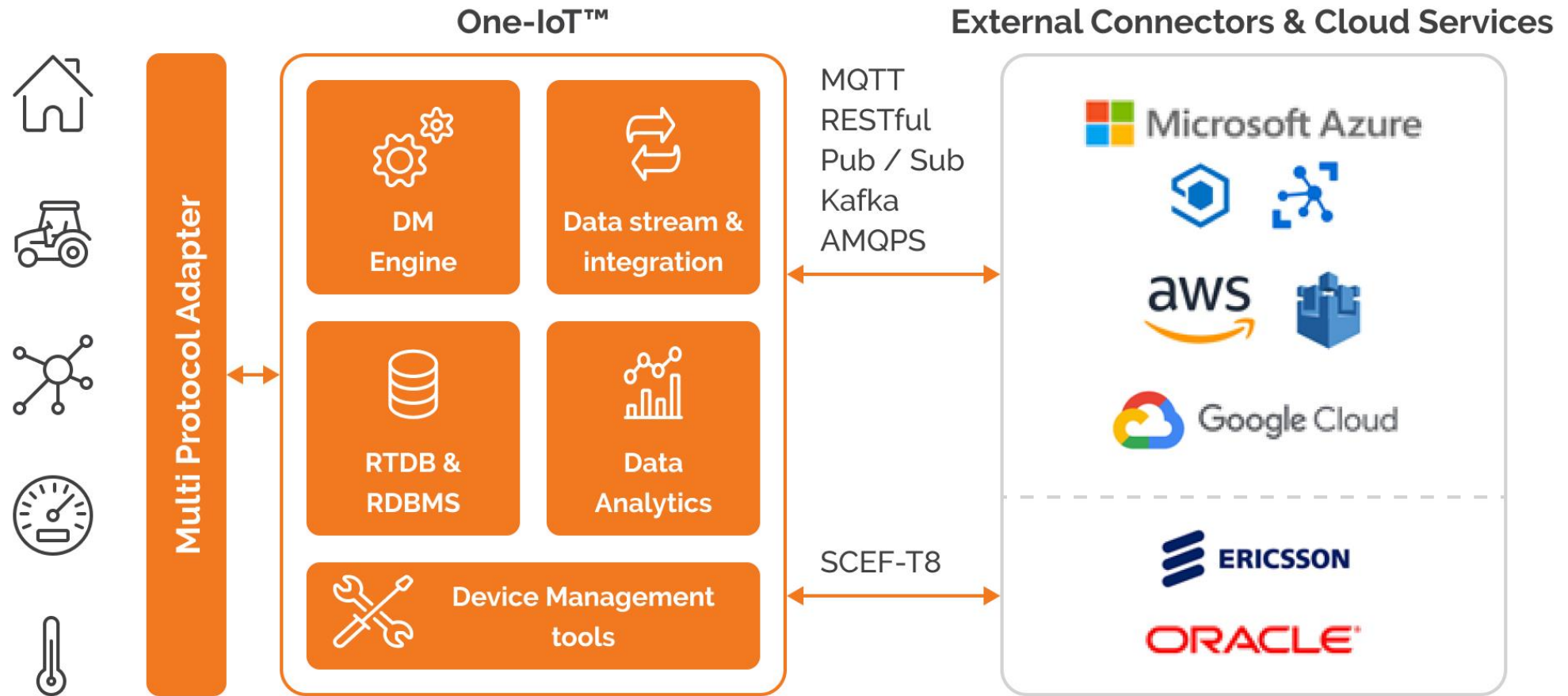
Thank you!

References

References

- [1] Unity Water Website – <u>link here</u>
- [2] Hologram Website – <u>link here</u>
- [3] OMA Specworks : Lightweight Object Registry – <u>link here</u>
- <u>Friendly Technologies website</u>
- <u>One-IoT™ Device Management product pages</u>
- <u>Friendly IoT & DM YouTube Channel</u>   ▶ YouTube

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