Standards pour l'IoT

Connectivité LPWA Cellulaire et couche de services

1er juin 2017, INSA Toulouse

Nicolas Damour

Sierra Wireless is building the Internet of Things.

INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES TOULOUSE

SIERRA WIRELESS®

Sierra Wireless – Introduction

Founded in 1993

1,100 employees worldwide

2016 revenue: $615 million

#1 IoT module supplier worldwide

25 years of steady innovation

Connected Machines

IoT Hardware

IoT Connectivity

IoT Platform

Enterprise Services

Sierra Wireless – Solutions Embarquées

AirPrime
Embedded Solutions

Comprehensive
IoT Modules Portfolio

essential connectivity ◆ application integration

- **Unified "CF3" 22x23mm Format**
- All modules are pin-to-pin compatible
- Snap-in socket or LGA solder-down

Legato™

www.legato.io

open source™

- Yocto-built Linux distrib
- Application Framework
- Development Tools
- Multi-Language Support

Project mangOH

www.mangoh.io

open source hardware

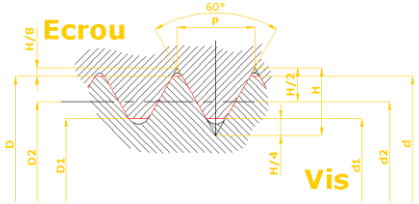
MangOH Green	MangOH Red
Arduino connector	**Raspberry Pi connector**
120mm x 100mm	69mm x 61mm
ATmega32U4 MCU	ARM Cortex M4 MCU
2x CF3 cellular sockets	1x CF3 cellular socket
MicroSD + 2xSIM	MicroSD + 1xSIM
Accelero, Gyro	Accelero, Gyro, Altimeter
2x USB, RJ45, 1 RS232	2x USB
3x IoT Connectors	1x IoT Connector

Available now from Element14

http://fr.farnell.com/sierra-wireless/mangoh-green-starter-kit/mangoh-green-starter-kit/dp/2522308

Des standards et des normes – pour quoi faire ?

ISO 261
General purpose metric screw threads



Diamètre Nominal D	Pas de vis P	Diamètre intérieur D1	Diamètre sur flanc D2
M1	0,25 mm	0,729 mm	0,838 mm
M2	0,40 mm	1,567 mm	1,740 mm
M3	0,50 mm	2,459 mm	2,675 mm
M4	0,70 mm	3,242 mm	3,545 mm
M5	0,80 mm	4,134 mm	4,480 mm
M6	1,00 mm	4,918 mm	5,350 mm
M8	1,25 mm	6,647 mm	7,188 mm
M10	1,50 mm	8,376 mm	9,026 mm

Richesse de l'offre de marché
Sécurité des investissements
Réduction des coûts

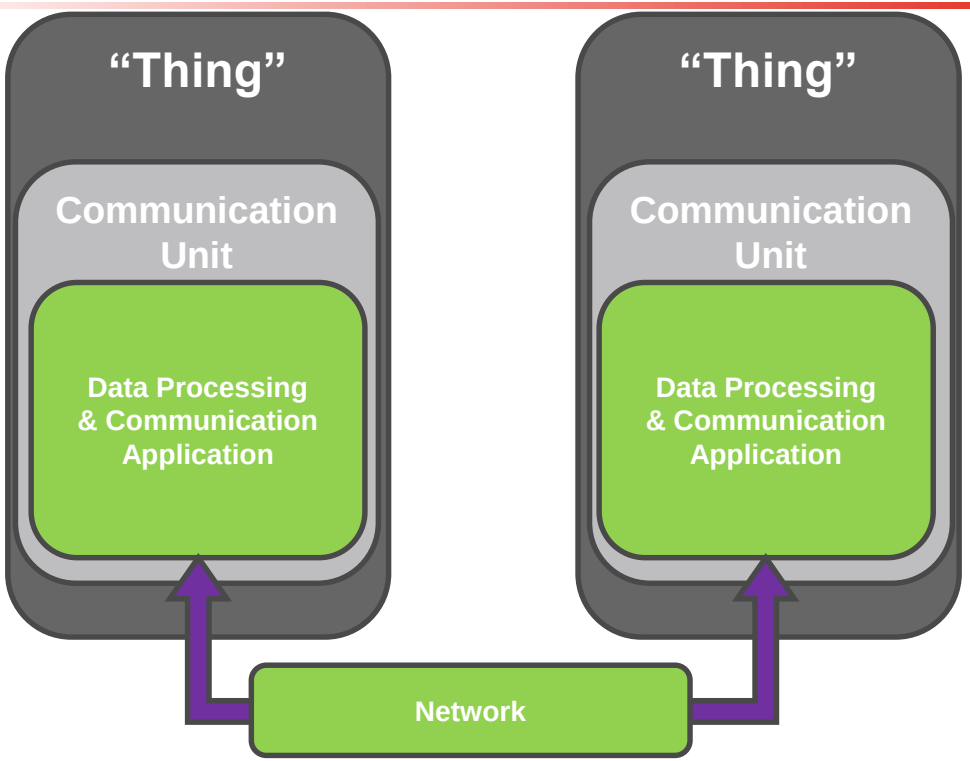
ISO/IEC 30141
Architecture de référence de l'Internet des objets

ISO/IEC 21823-1
Interopérabilité des systèmes de l'Internet des objets

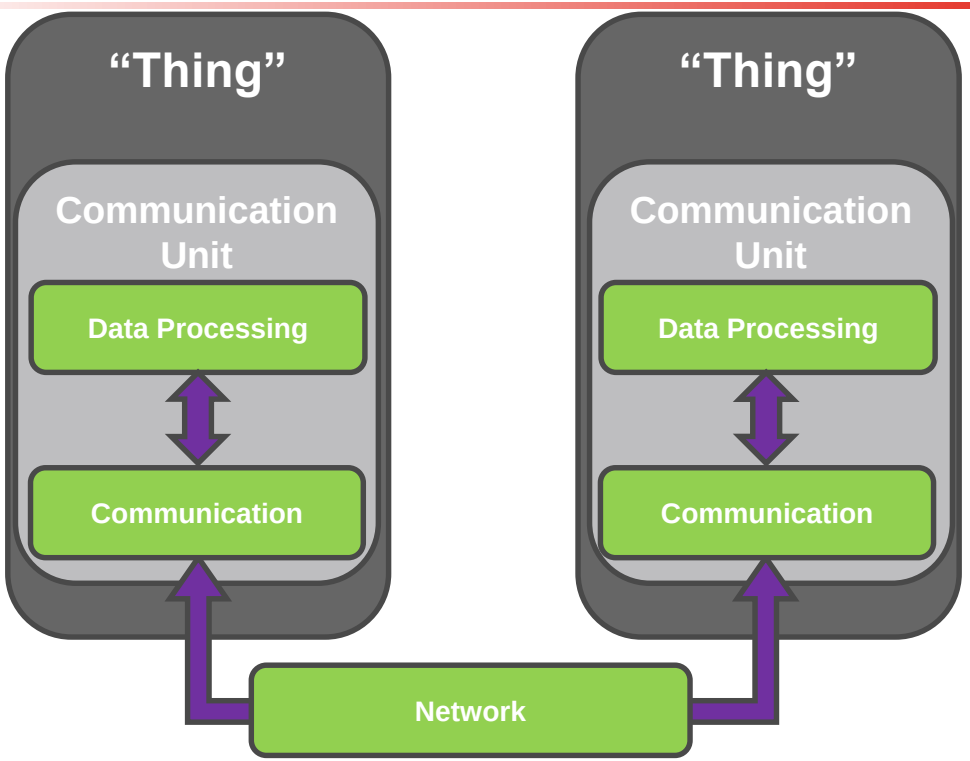
Organismes de normalisation pour l'IoT

L’Internet des objets – approche horizontale

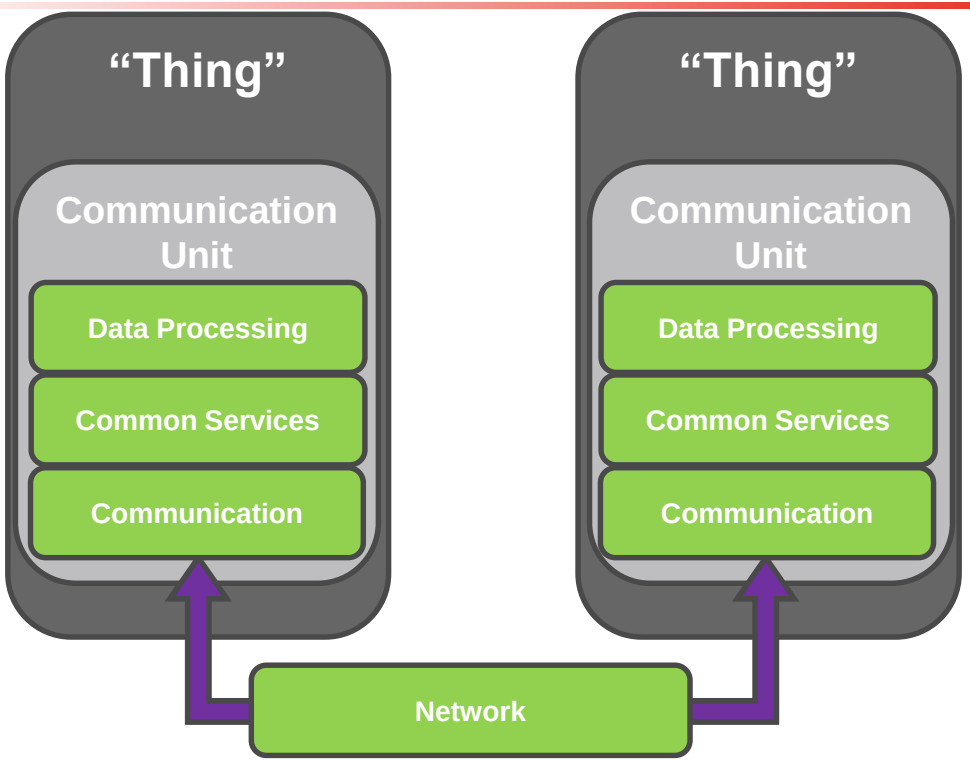
L'Internet des Objets – une couche



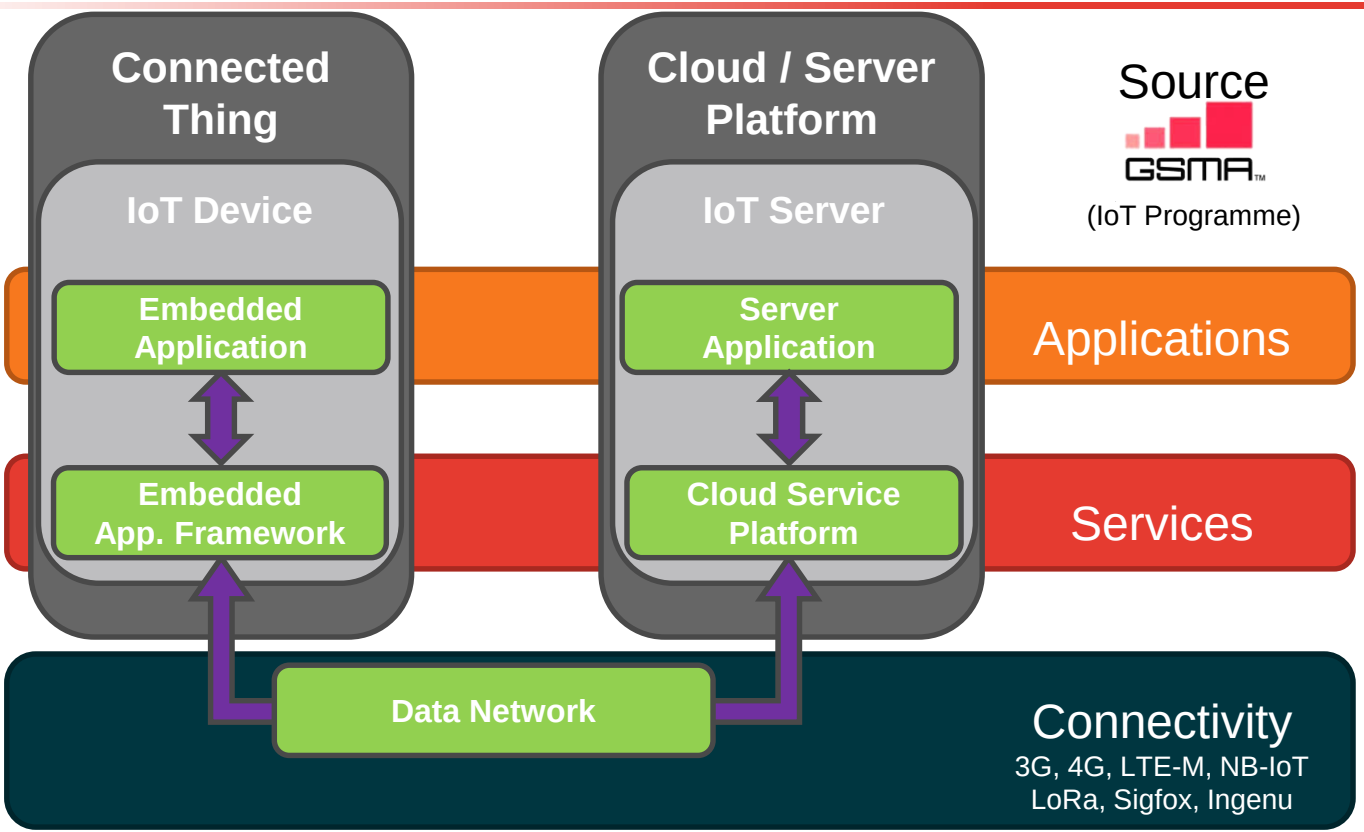
L'Internet des Objets – deux couches



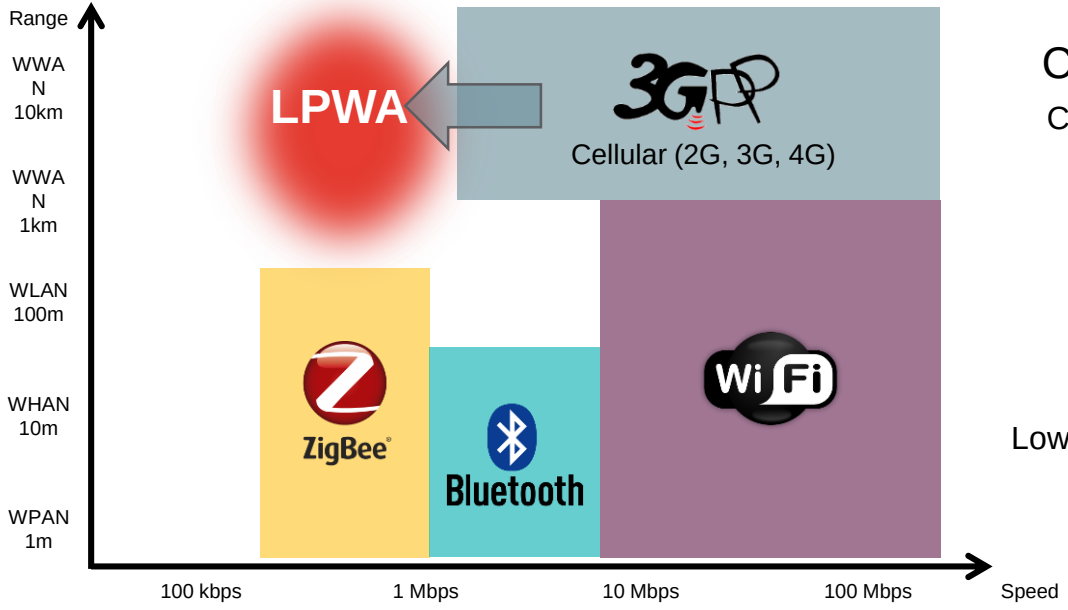
L'Internet des Objets – trois couches



L'Internet des Objets – modèle de couches



Couche de connectivité : le Low Power Wide Area



Contraintes

Consommation
Couverture
Coût

Permet

Low complexity/cost
Low power

Low Power Wide Area – Une revolution pour l'IoT

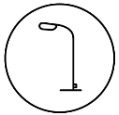
Consomation réduite

Couverture étendue

Complexité réduite

Smart Meter

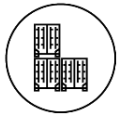
Wearables



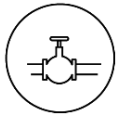
Street Lighting

Home Automation

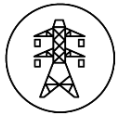
Toll Collection



Container Tracking



Pipeline Management



Smart Grid

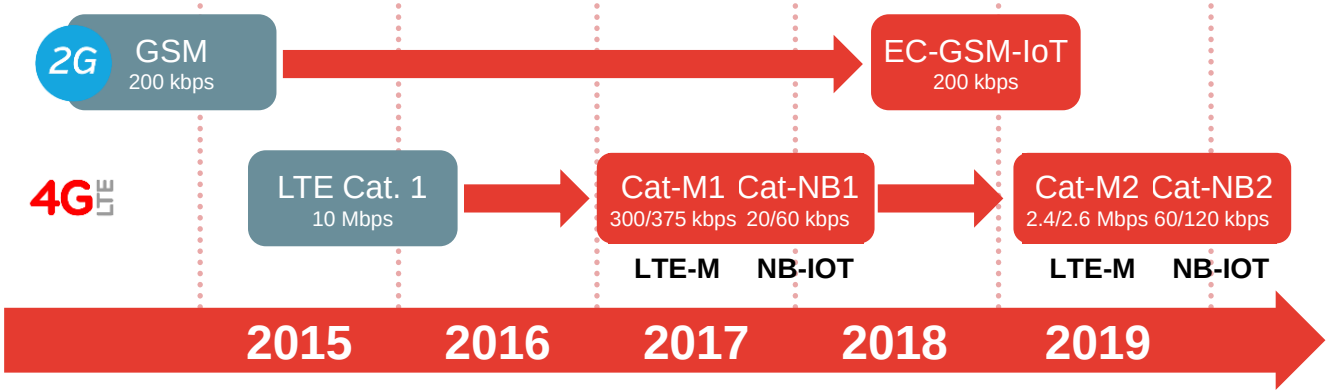
Low Power Wide Area – Panorama

Ad-hoc Networks - Proprietary - Unlicensed Bands

LoRa™ sigfox QOWISIO ULTRA NARROW BAND INGENU

Cellular Networks - Standardized - Licensed Bands

3GPP™



LPWA cellulaire – La promesse des “3 Cs”

Consommation
réduite

Couverture
étendue

Complexité
réduite

Complexité réduite – Quelques chiffres

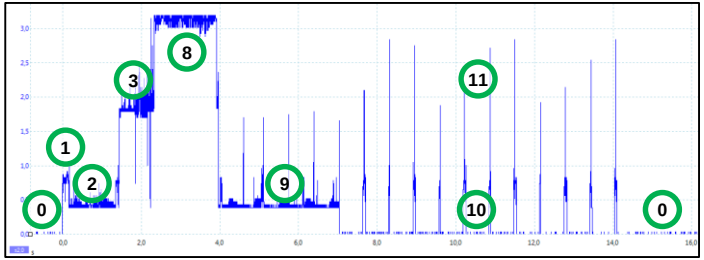
Consommation réduite

10-20 years lifetime
On AA batteries
(2500 mAh)

Couverture étendue

Complexité réduite

Consommation réduite avec PSM et eDRX



Power consumption for 1 data transmission - With PSM

PSM - Power Saving Mode

Lets the device “hibernate” between data transmissions while remembering its network state (no need to re-register)

Power consumption in hibernation: 4 µA

Gain on battery lifetime: x2 (compared to shutting modem off)

Ex: Tx 670 bytes / Rx 350 bytes on 2500mAh AA battery

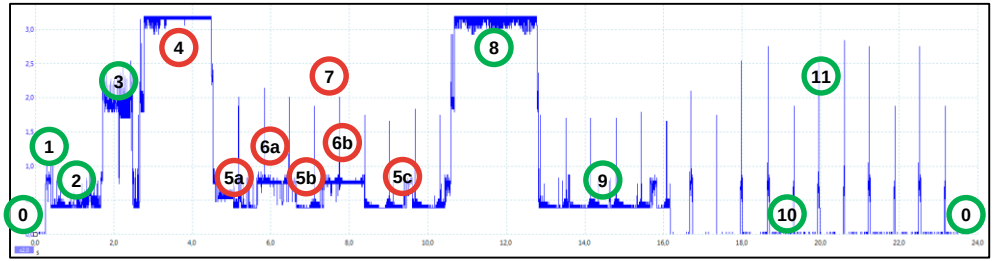
1 transmission every 1 hour => 1 year battery life

1 transmission every 6 hours => 5 years battery life

1 transmission every 24 hours => 19 years battery life

eDRX - Extended Discontinuous Reception

Lets the device listen more infrequently to incoming messages



Power consumption for 1 data transmission - Without PSM (coming from “OFF” state)

0	Power Saving Mode or Off	4 µA or 0 µA	---	---
1	Wake-up or Boot	80 mA	0,185 s	14,80 mAs
2	Processing	45 mA	0,430 s	19,35 mAs
3	Look up cells	190 mA	0,915 s	173,85 mAs
4	Register onto network	320 mA	1,6 s	512,00 mAs
5	Processing	45 mA	4,09 s	184,05 mAs
6	Processing	80 mA	2,13 s	170,40 mAs
7	Listen to network pages	8 mAs each	x 16	128,00 mAs
8	Actual data transmission	320 mA	1,6 s	512,00 mAs
9	Processing	45 mA	3,1 s	139,50 mAs
10	Idle mode	300 µA	7,07 s	2,12 mAs
11	Listen to network pages	8 mAs each	X 16	128,00 mAs
	TOTAL GREEN			**989,62 mAs**
	TOTAL RED			**994,45 mAs**
	TOTAL GREEN + RED			**1984,07 mAs**

Complexité réduite – Quelques chiffres

Consommation réduite

10-20 years lifetime
On AA batteries
(2500 mAh)

Couverture étendue

164dB MCL (+20dB)
Open Range x 7
Basement Coverage

Complexité réduite

Couverture étendue – 164dB en LTE-M et en NB-IoT

LTE-M Channel	Maximum Coupling Loss	Performance	Nb of Repeats
PSS/SSS	164dB	Acquisition Time=850 ms	-
PBCH	164dB	Acquisition Time=240 ms	5
MDPCCH	164dB	99% detection using 128 repeats	256
PDSCH	164dB	1400 bps using 512 repeats	2048
PUSCH	164dB	250 bps using 1536 repeats	2048
PRACH	164dB	90% detection using 64-128 Repeats	128
PUCCH	164dB	90% detection using 16-32 Repeats	32

HARQ: Hybrid Automatic Repeat Request

Detailed coverage study available online
http://hub.sierrawireless.com/coverage_analysis_lte_m

PSS/SSS Primary/Secondary Synchronization Signals
PBCH Physical Broadcast Channel
MDPCCH MTC Physical Downlink Control Channel
PDSCH Physical Downlink Shared Channel
PUSCH Physical Uplink Shared Channel
PRACH Physical Random Access Channel
PUCCH Physical Uplink Control Channel

Complexité réduite – Quelques chiffres

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(2500 mAh)

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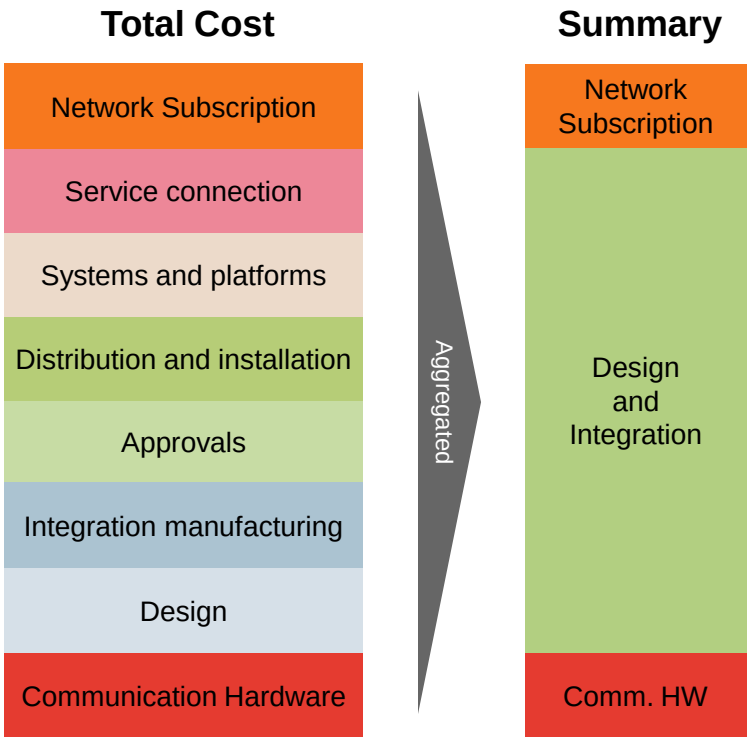
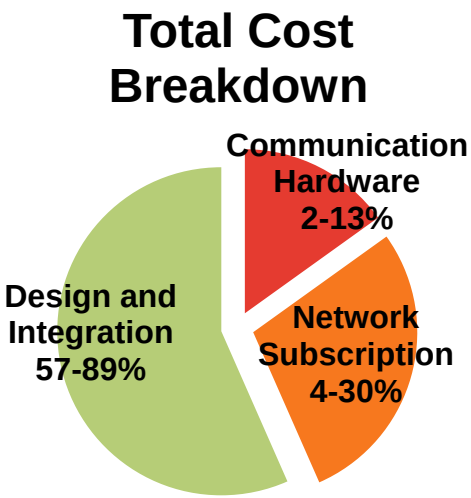
Basement Coverage

Complexité réduite

-75% (rel. Cat-1)
Target: 2G Price
Single WW Product

Complexité réduite et coût total de la solution





LPWA cellulaire – Les 3 Cs en résumé

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LPWA cellulaire – Avantages des réseaux cellulaires

Disponibilité du service

2016 – 2017 – 2018
580+ Networks
180+ Countries

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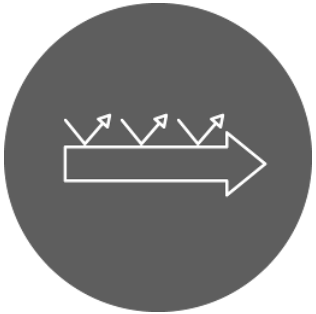

Investissement durable

Long-term availability
Global Standard
Scalable and Flexible

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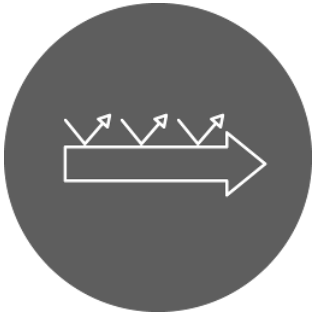

Investissement durable

Long-term availability
Global Standard
Scalable and Flexible

Ecosystème de confiance

QoS & Security
Operator roaming
Embedded SIM - OTA

Mobile World Congress 2017 – Demos

Live networks already on (US, Europe, Asia)
Mass deployments in 2017 and 2018

4G LTE-M Live Deployments Worldwide – Right now

Press Release at Mobile World Congress:
http://tinyurl.com/ltem-orange-press-release-2017

Combined with 4G NB-IoT,
This provides a global network for 3GPP LPWA

Orange LTE-M Lab available in Paris
https://partner.orange.com/open-iot-lab/

Apply now

Comparaison technologique – Résumé

Attribute	LoRa	Sigfox	M1	NB1
Throughput	UL/DL 290 to 50000bps depending on coverage	**UL 6x 12 bytes /hour** **DL 4x 8 bytes /day**	UL 375bkps DL 300kbps	UL 63bkps DL 28kbps
Spectrum	Unlicensed ISM Bands: 433/868/915 MHz		LTE Bands	LTE & 2G Bands
Network: - Availability - Lifetime 10 years+ - Roll out	In deployment Parts of EU + US Uncertain Greenfield		2017 and 2018 Global Yes SW upgrade	
Coverage	**Partial** No MNO Roaming (yet)	**Partial**	Highest and Global Roaming	
Communication	Mostly Uni-directional		Fully bi-directional	
Infrastructure Service Layer	Messaging		IP and Messaging	
Scalability	Poor radio performance especially in ISM band Limited Base Station density **No listen-before-talk => network collapse**		Highest Base Station density	
SW upgrade	Barely possible + severely impacts battery lifetime		Supported natively in the standard	
Security	Ad-Hoc, Not Strong	Very weak	Strong channel encryption (3GPP) + SW upgrade for security patches	
MNO Contract Lock-in	Yes: if using an MNO No: if self-operating	Yes	No: GMA eUICC SIM - Remote SIM provisioning enable/change MNO over the air	

Couche de services – Normes pertinentes

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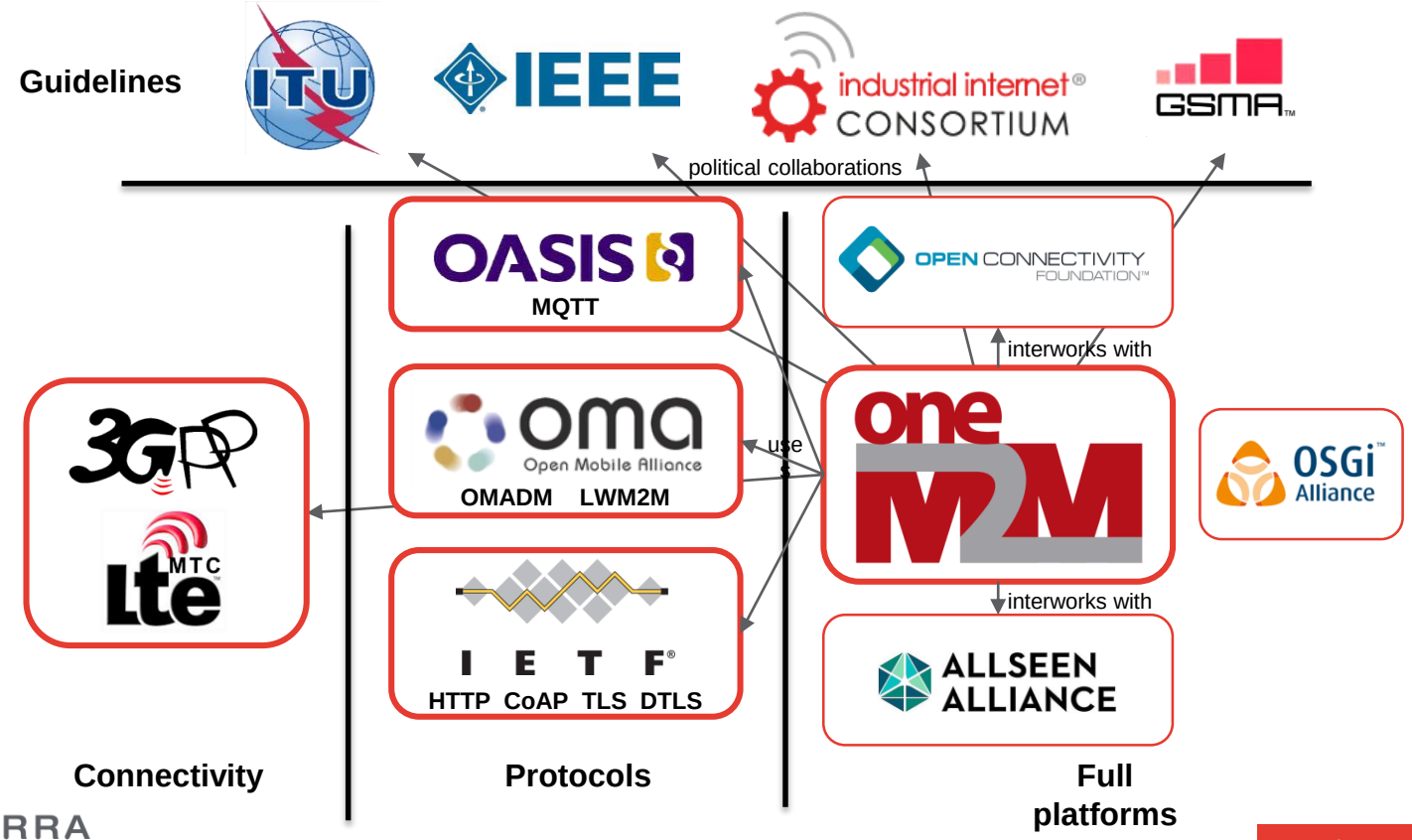
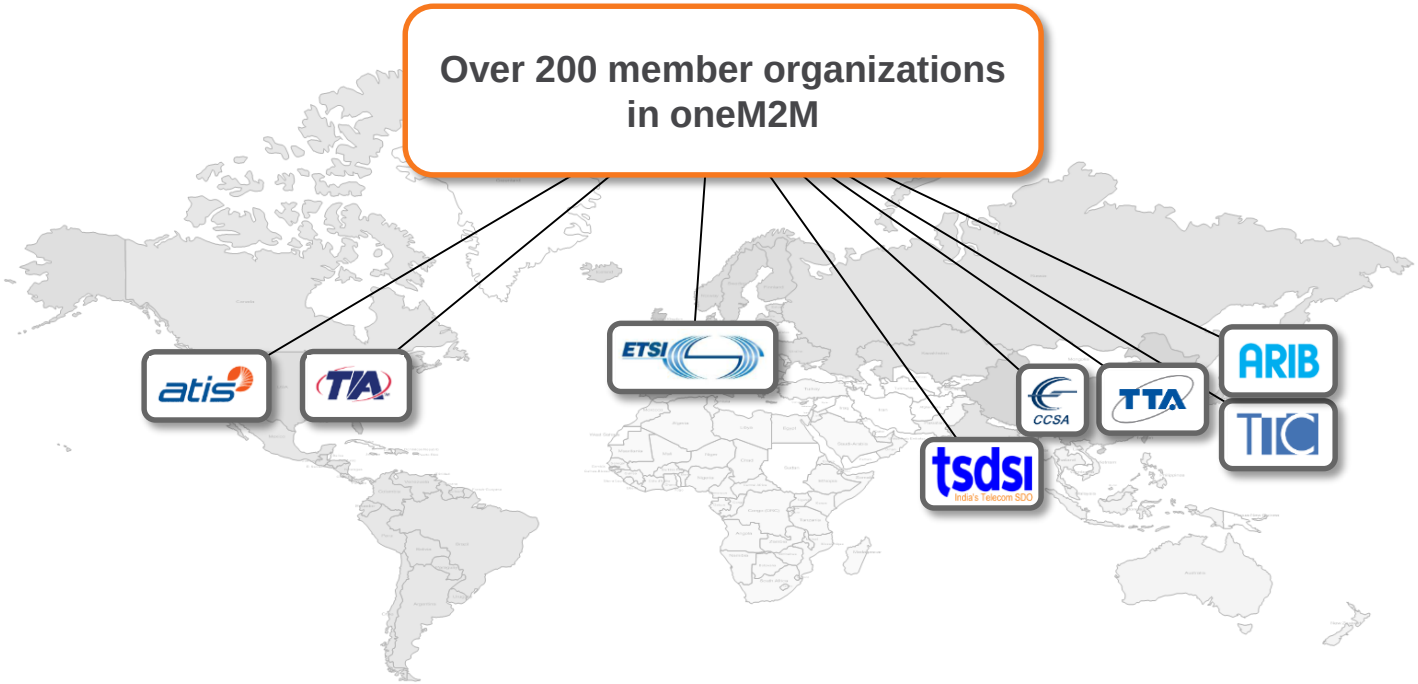


oneM2M – a Partnership Project



oneM2M – Purpose and Value Proposition

Value #1

Provides the **Common IoT functions** to applications so that they can focus on their own application logic

Value #2

Bridges systems from **different vertical industries** (lighting, energy, security, fleet, environment…) while allowing each system to use its own semantic

Value #3

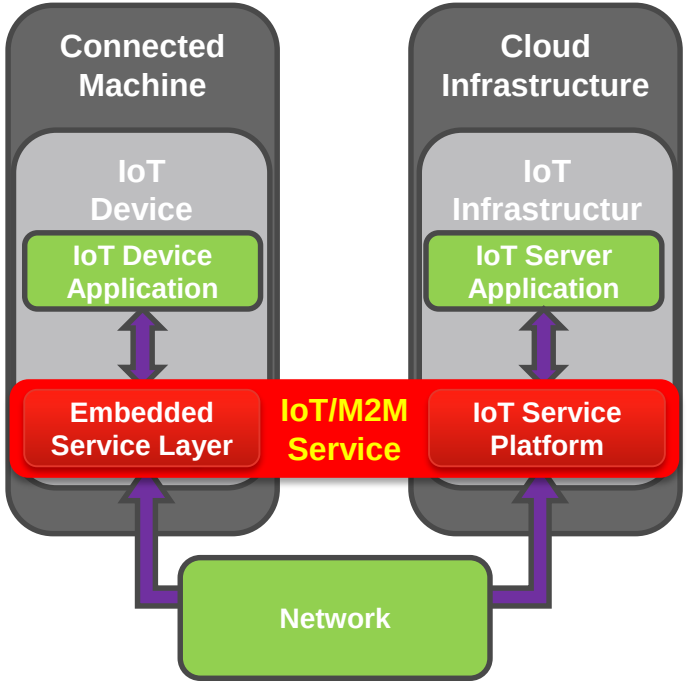
Works with **any communication technology** (Cellular, xDSL, Satellite, Wifi, Bluetooth, ZigBee…)

Value #4

Hides the network complexity from the applications while using these networks in the best way

Value #5

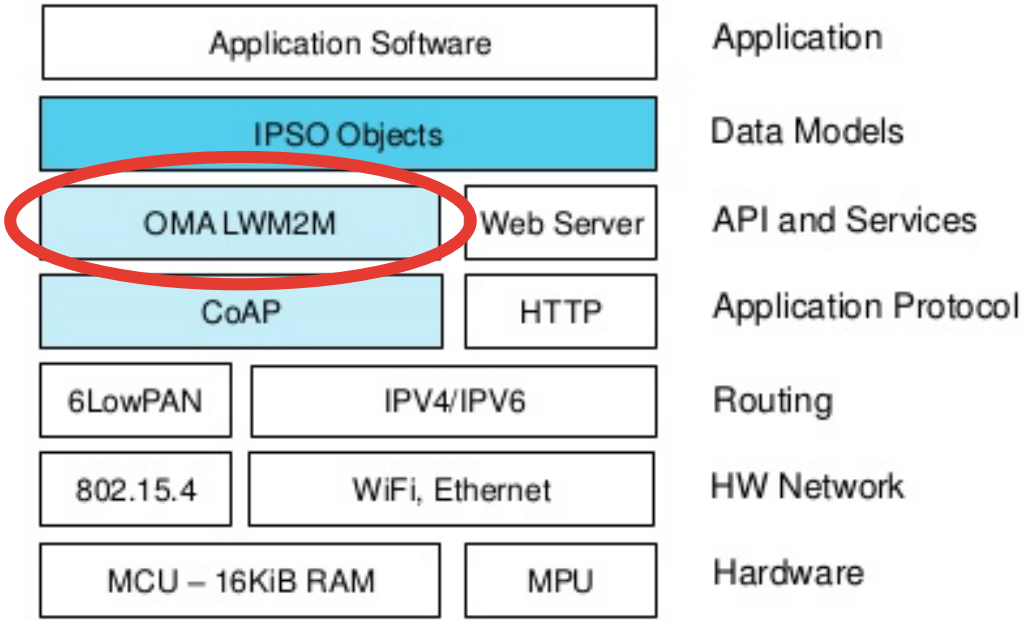
Interworks with virtually every other IoT technology thanks to its interworking framework



OneM2M – Common Services Functions

Registration	Discovery	Security	Group Management
Data Management & Repository	Subscription & Notification	Device Management	Application & Service Management
Communication Management	Network Service Exposure	Location	Service Charging & Accounting

OMA LWM2M – Protocole allégé et modèle de données



LightweightM2M – Summary

LightweightM2M is originally a **Device Management** technology
Extended to support generic data exchange

Device

Manager

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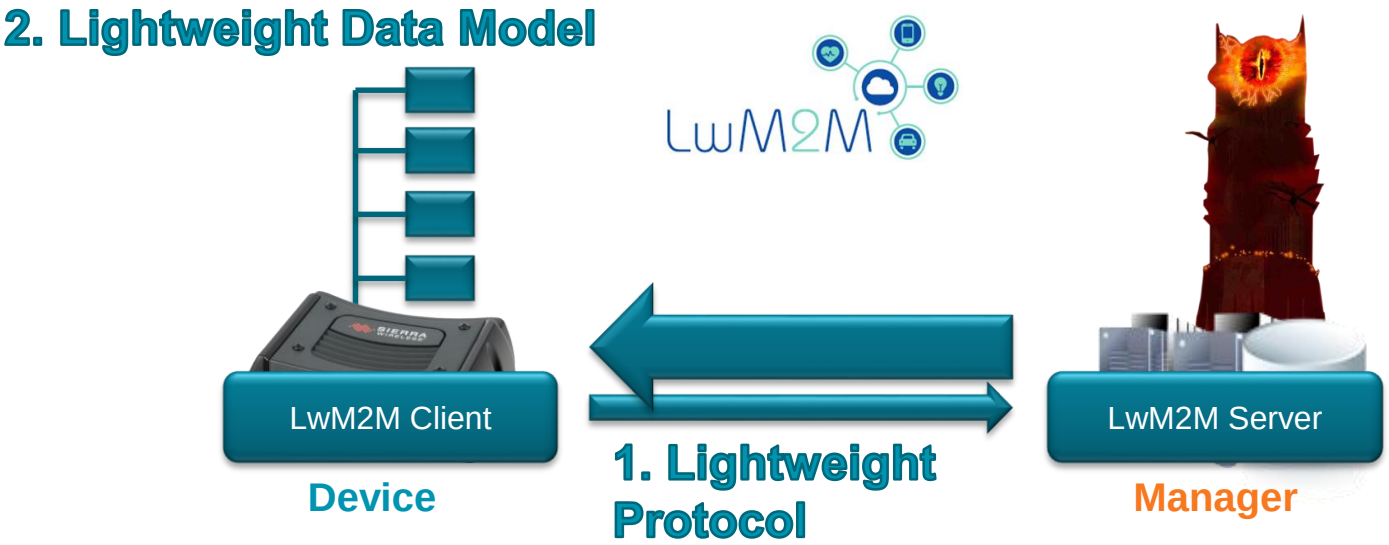

OneM2M – Summary

OneM2M is a rich and adaptable service layer technology

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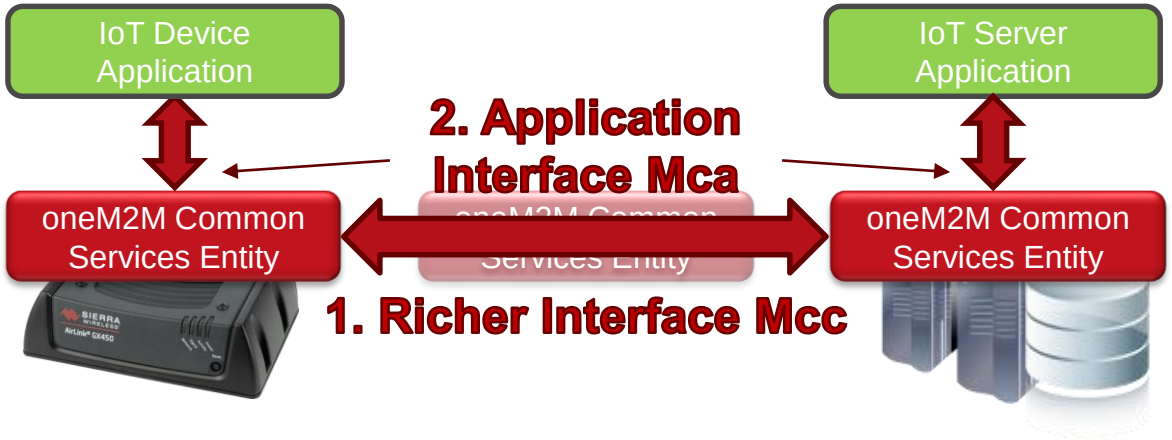

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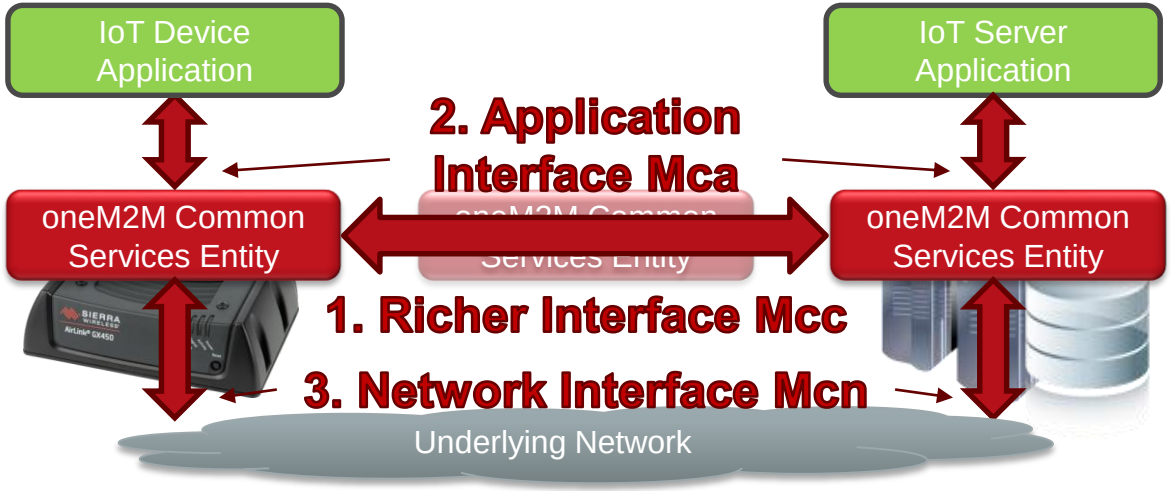

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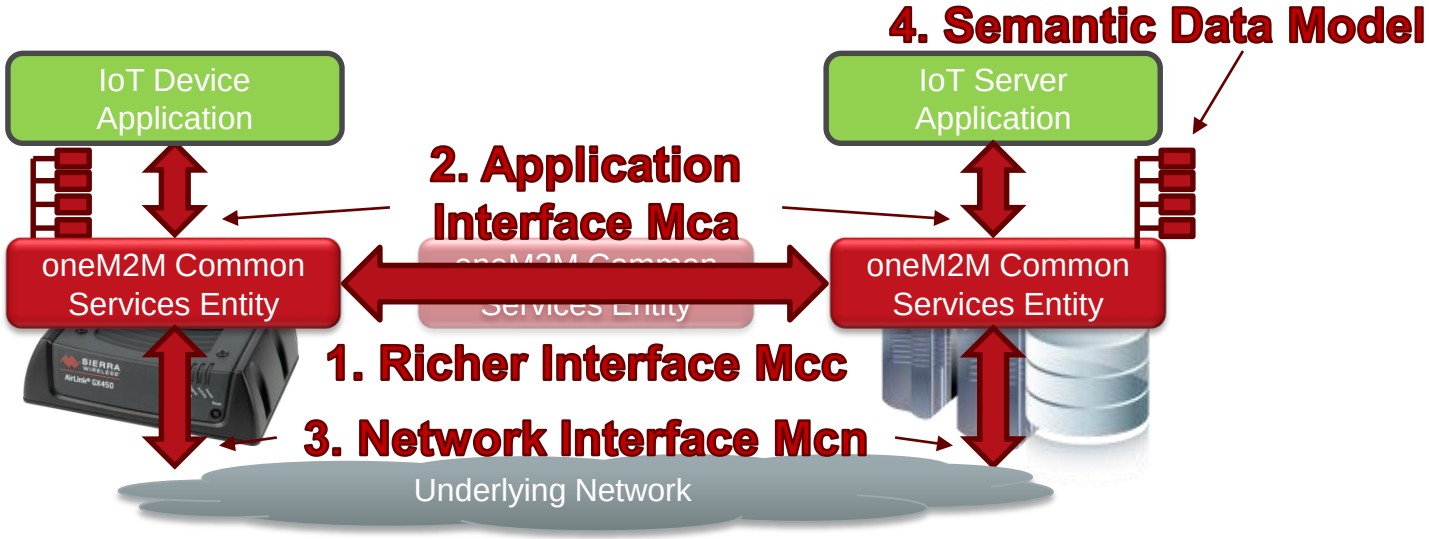

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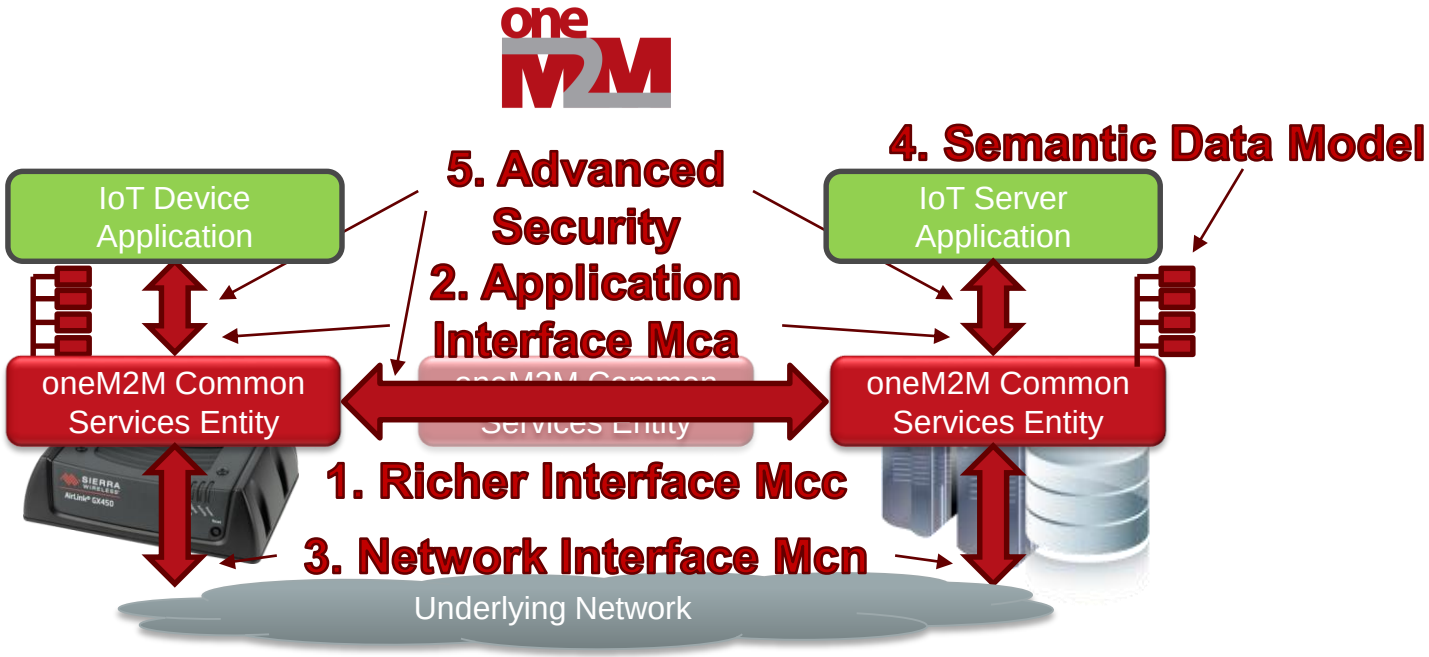

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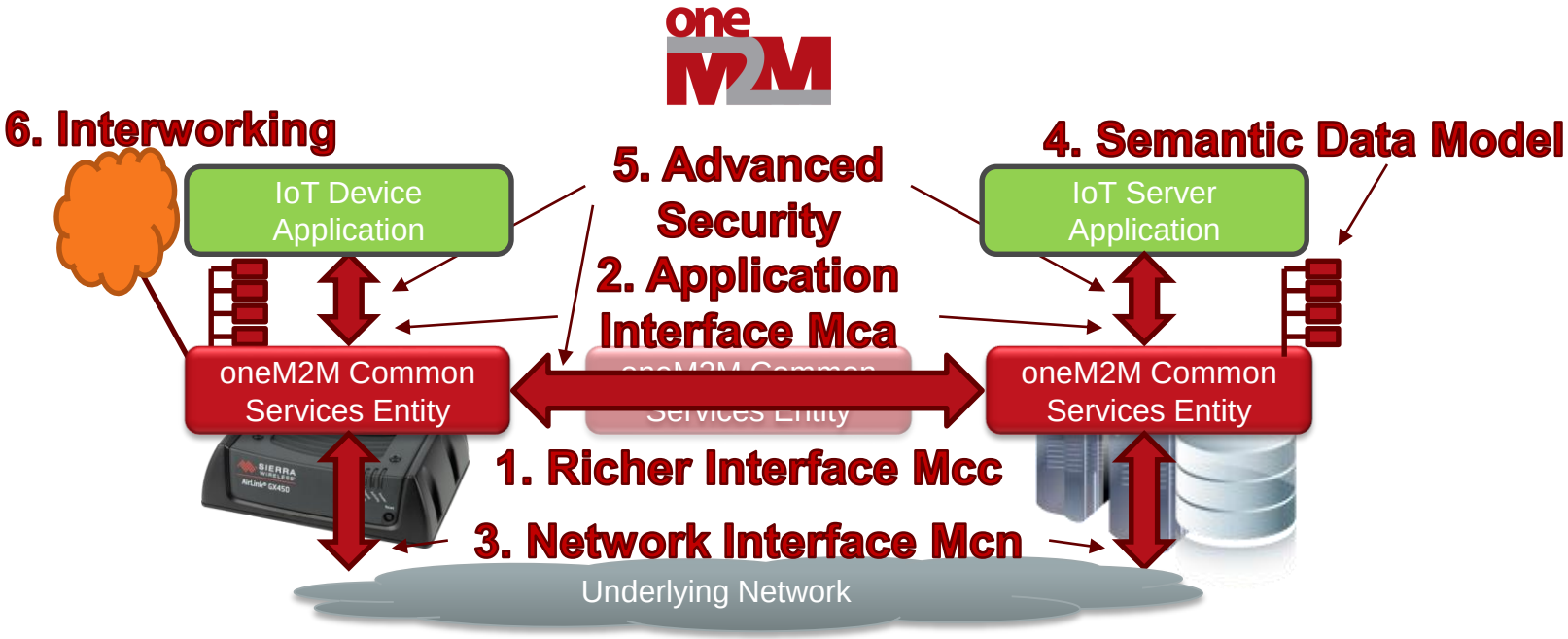

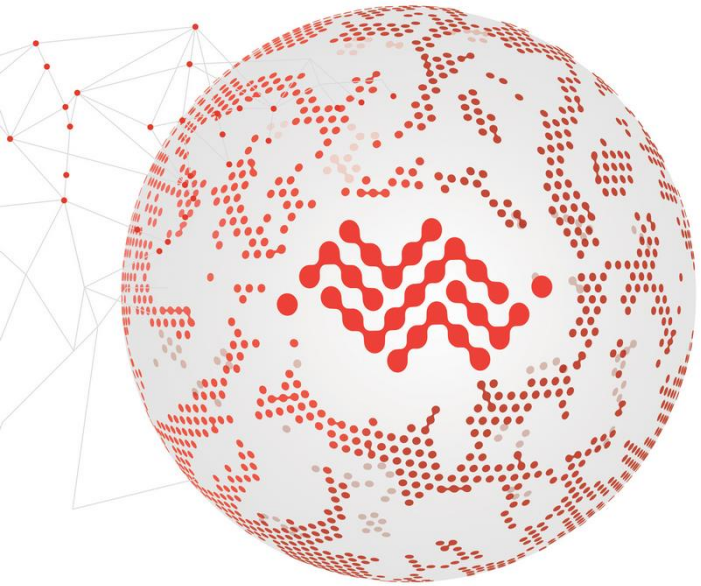

Sierra Wireless is building the Internet of Things.

Merci !

Nicolas Damour, CTO Office

Sierra Wireless S&S - Labège

ndamour@sierrawireless.com

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