



Challenges of M2M in 5G

Mischa Dohler

Professor, King's College London, UK
Fellow & Distinguished Lecturer, IEEE
Board of Directors, Worldsensing
Editor-in-Chief, ETT

KTH, Stockholm, Sweden

09/05/2014



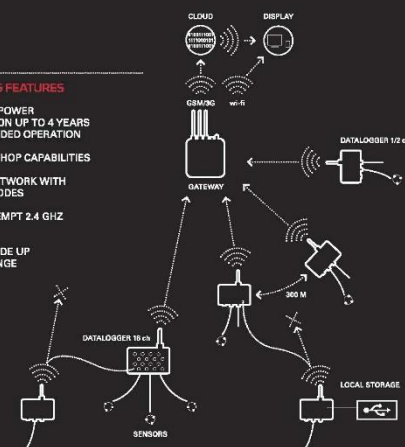
1

M2M Usage Today

Industrial M2M Applications

LOADSENSING FEATURES

- **ULTRA LOW POWER CONSUMPTION** UP TO 4 YEARS OF UNATTENDED OPERATION
- **TRUE MULTI-HOP CAPABILITIES**
- **A SINGLE NETWORK WITH UP TO 500 NODES**
- **LICENSE EXEMPT 2.4 GHZ ISM BAND**
- **NODE TO NODE UP TO 300M RANGE**



WIRELESS DATALOGGING:
Reading almost all sensors.

MESH NETWORK:
Real multi-hop enables smart dynamic communication paths, sending readings through any node of the network.


LONG AUTONOMY:
4-5 years for sample every 30 min.

NO RE-CASING:
Installation directly into the field, no need of another box or extra components. Plug and start monitoring.

PLUG & WEB:
Plug the sensors and start visualizing/configuring your sensor network through a friendly web portal displaying real-time and historical data.

EASY PLUG & PLAY:
Sensor connection through user friendly connector.

ROBUST:
Engineered and tested for extra robustness, temperature variations, lightning and water protection.




→ STRUCTURES / GEOTECHNICS

- Tunnels
- Bridges
- Dams
- Buildings
- Railways & Highways
- Foundations
- Slope stability
- Land slides
- Lateral earth support structures
- Soil mechanics



→ DIGITAL OILFIELDS

- Pipelines
- Hydrocarbon detection
- Oil detection
- Gas detection
- Terminal & tank monitoring



→ ENVIRONMENT

- Water quality
- Air pollution
- Pluviometry, Soil moisture
- Chlorophyll, pigments
- Irrigation



→ INDUSTRY

- Pipes pressure and temperature
- Structures
- Wastewater
- Electricity
- Chemical



LoadSensing by WORLD SENSING Industrial

+34 934 180 685 - www.loadsensing.com - sales@worldsensing.com

DATASHEET

LoadSensing by WORLD SENSING Industrial

WORLDSENSING INTRODUCES THE LS WIRELESS DATALOGGING SYSTEM: COMBINING EASE OF USE WITH INDUSTRY LEADING PERFORMANCE.

LS DATALOGGERS READ 95% OF THE SENSORS IN THE MARKET, PROVIDING REMOTE MONITORING AND REAL-TIME DATA OF YOUR INFRASTRUCTURE.

LOADSENSING SIMPLIFIES INSTRUMENTATION DEPLOYMENTS, MINIMISING INSTALLATION AND MAINTENANCE COSTS.



→ WIRELESS MONITORING FINALLY USEFUL FOR THE REAL INSTRUMENTATION WORLD

→ SMART AUTO-ORGANISED SENSOR NETWORKS

→ BI-DIRECTIONAL COMMUNICATION GIVES REMOTE CONFIGURATION CAPABILITIES

→ ROBUST EQUIPMENT READY FOR HARSH ENVIRONMENTS

M2M in Smart City Rollouts

Smart Parking



© Worldsensing

Smart Bins



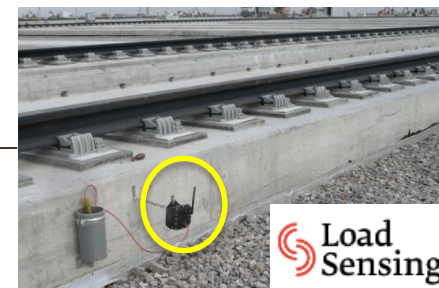
Smart City Control Platform



Traffic Flow



Critical Infrastr.



Travel Time



**Proven Technologies
With Solid Deployment
Track-Record Today!**

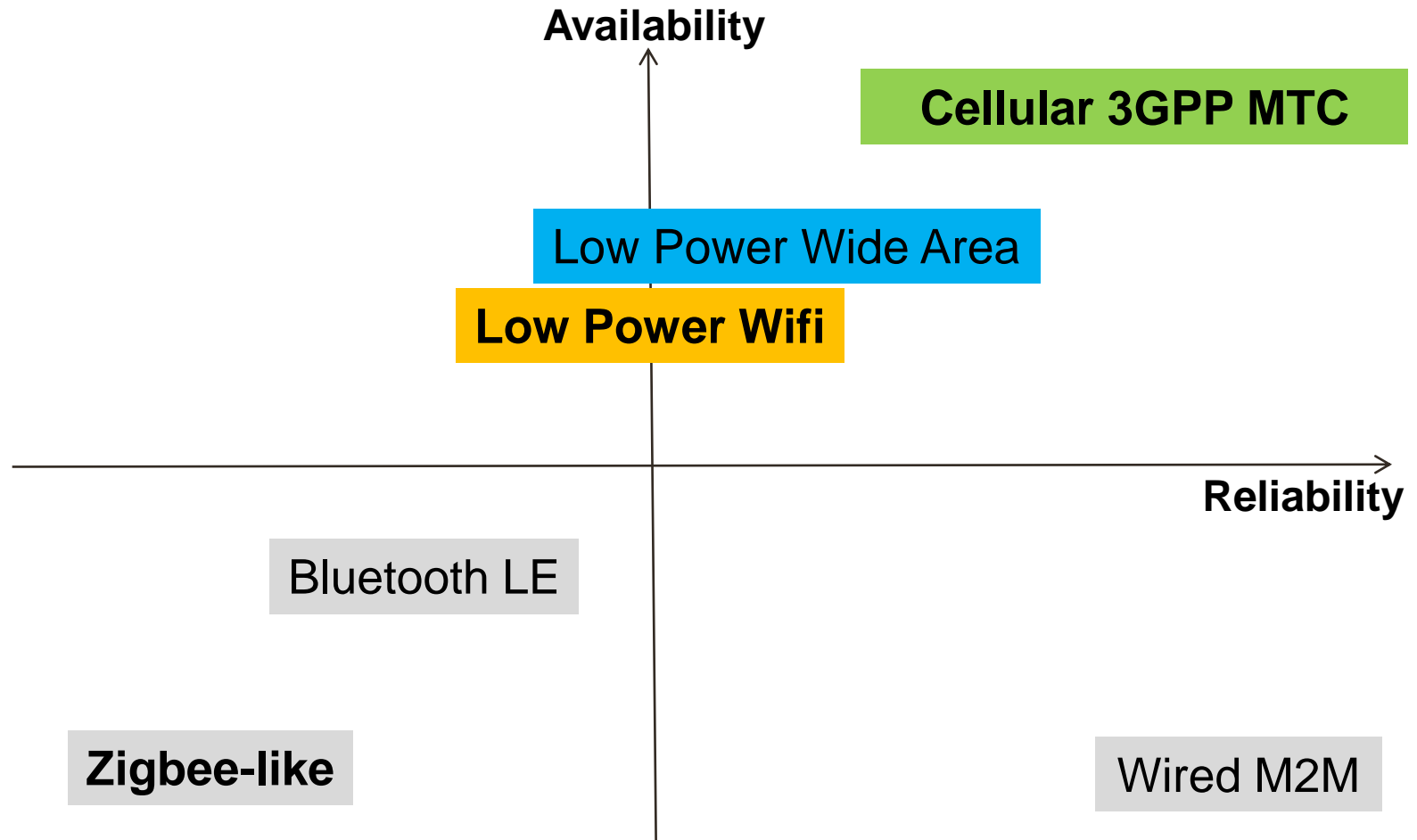
Historic Sites



2

Data Access Technologies

M2M Prime Business Criteria

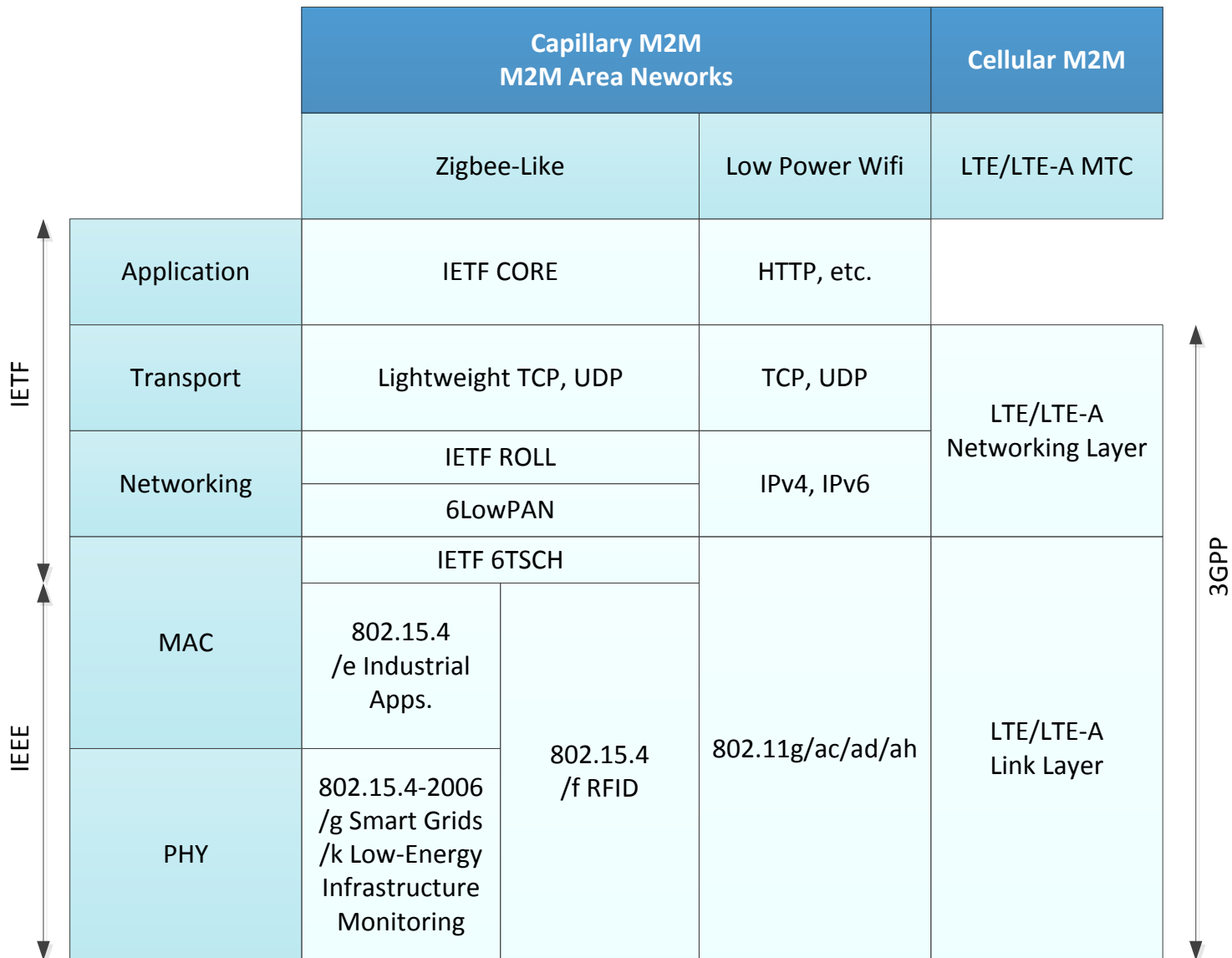


Availability = coverage, roaming, mobility, critical mass in rollout, etc.

Reliability = resilience to interference, throughput guarantees, low outages, etc.

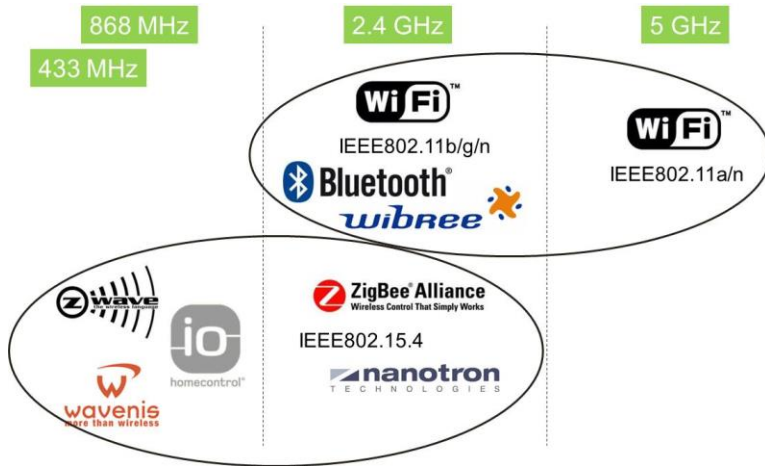
(Total **Cost** of Ownership = CAPEX, OPEX.)

Standardized M2M Protocol Stacks



Problems of ZigBee-like Solutions

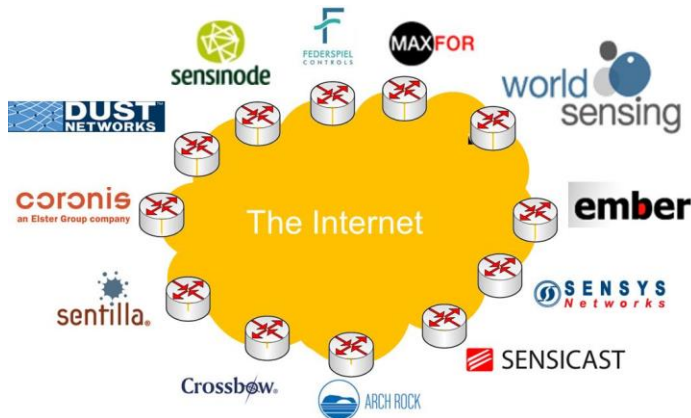
Interference in ISM



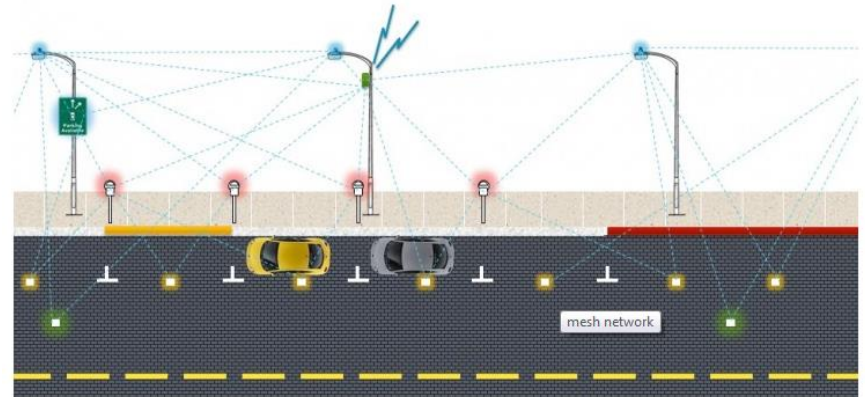
No Global Infrastructure



Lack of Interoperability



Higher Total Cost



Industries start to understand!

bluetooth / internet of things / wi-fi

Zigbee and Z-wave are out. Broadcom's new chips bet on Bluetooth and Wi-Fi for IoT

by [Stacey Higginbotham](#) MAY. 29, 2013 - 1:36 PM PDT

 22 Comments    +1 

A▼ A▲

SUMMARY: *The wide array of wireless radio technologies used to get devices online may soon shrink as major players in the chip world start choosing the standards they will support for the internet of things.*

 [tweet this](#)

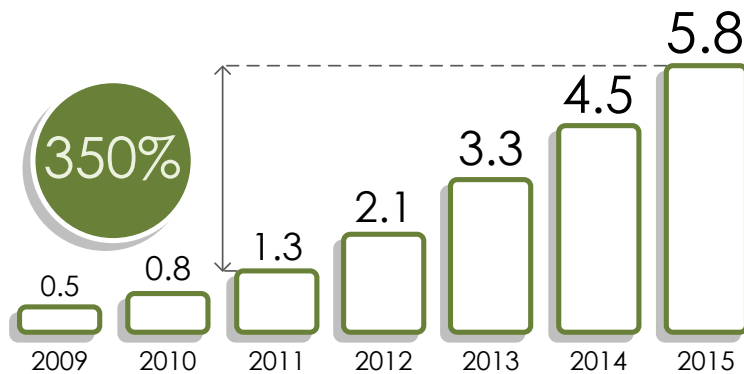


photo: Shutterstock / Jiri Hera

Advantages of Low-Power WiFi

Ubiquitous Infrastructure

Number of Wi-Fi Public Hotspots in the World
(in million), 2009-2015



Source: Wireless Broadband Access (WBA), Informa, Nov. 2011

Interference Management



**NAV Medium
Reservation**

Vibrant Standard

**IEEE
802.11™**

300 members



Sound Security



WPA2/PSK/TLS/SSL

LP-Wifi vs ZigBee Capillary M2M

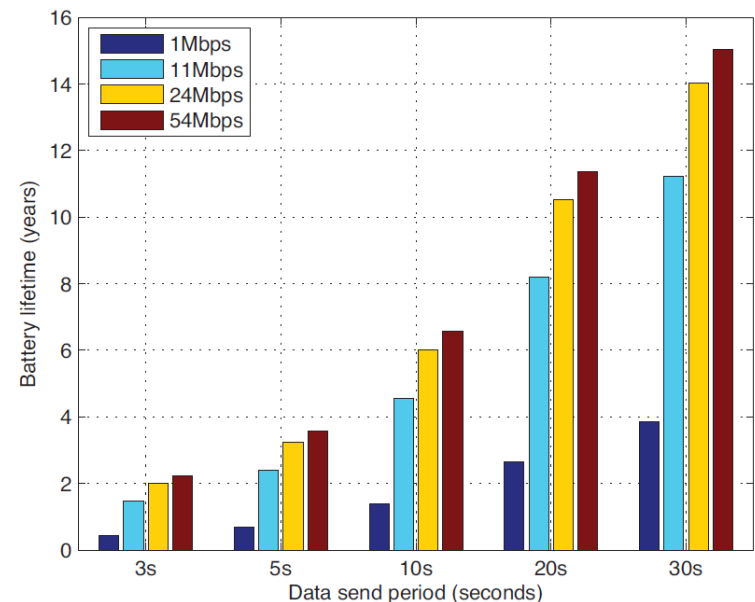
6LoWPAN vs. LOW-POWER WI-FI AT 54MBPS

	6LoWPAN		Low-power Wi-Fi	
<i>Packet size</i>	8 Bytes	1024 Bytes	8 Bytes	1024 Bytes
<i>Time (ms)</i>	6	23.61	11.3	16.58
<i>Energy (mJ)</i>	2.5	9.17	0.55	1.28

10x

“Low-power Wi-Fi provides a significant improvement over typical Wi-Fi on both latency and energy consumption counts.”

“LP-Wifi consumes approx the same as 6LoWPAN for small packets but is much better for large packets.”



Advantages of LPWA M2M Networks

Large Coverage



Low Cost




Available Today





Operator Model




Current Eco-System

- **Sigfox** (market leader in Q1 2014): 
 - technical: sub-GHz, UNB, very long range, one-way
 - business approach: operator, yearly license fee; €20+ million VC

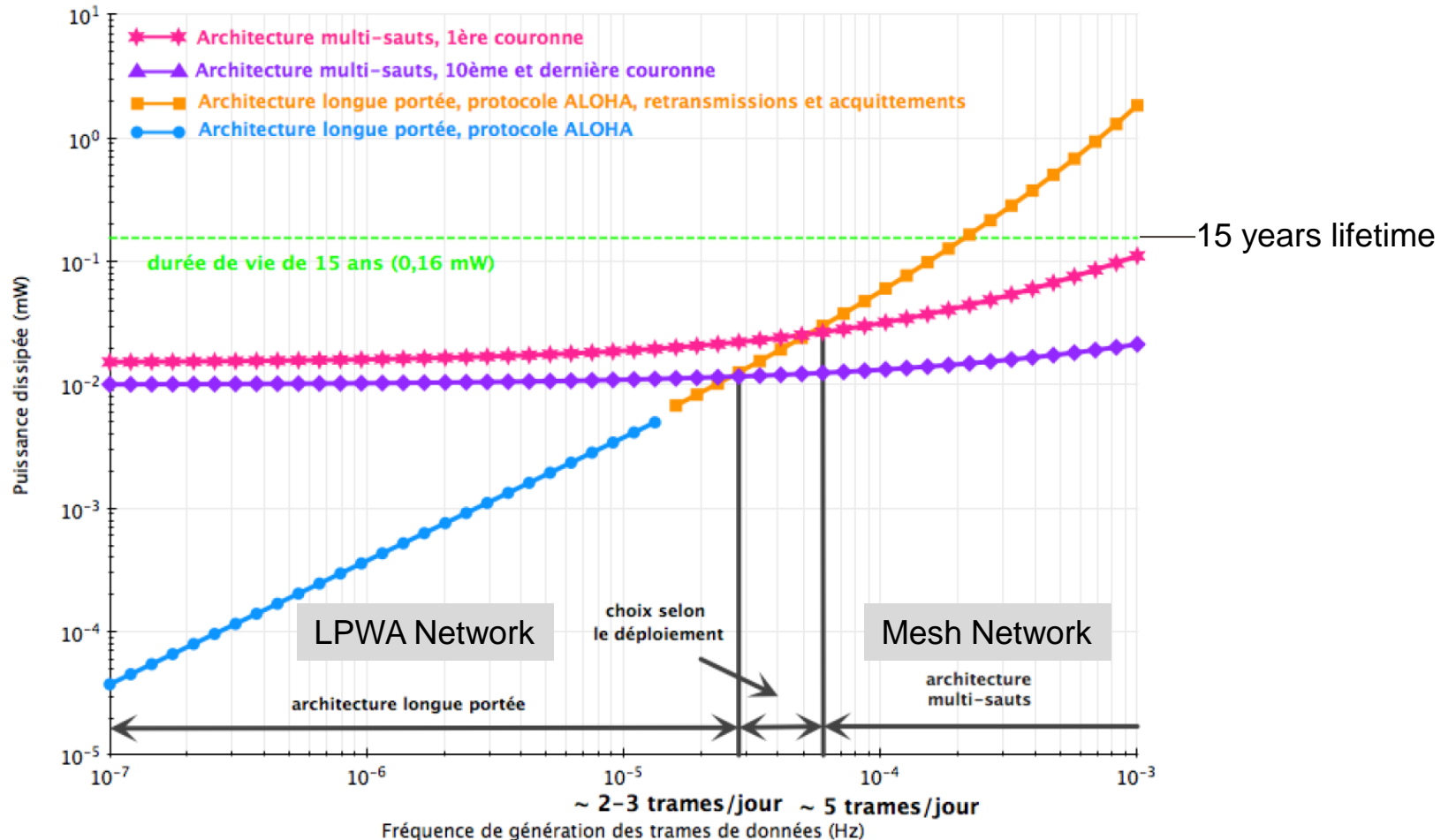
- **On-Ramp**: 
 - technical: 2.4GHz ISM band; “Random Phase Multiple Access”; 170dB link budget
 - business approach: equipment provider mainly; Managed Service SLA possible

- **Cycleo (now Semtech)**: 
 - technical: sub-GHz, CDMA-based, long range
 - business approach: equipment provider

- **Neul**: 
 - technical: initially TVWS only; now shift into other bands too (notably licensed!)
 - business approach: originally only equipment; now SLA possible

Performance Comparison

© Orange, excerpt from PhD Thesis of Dr Quentin Lampin:



(a) $N = 100$ et $d = 10$

3

M2M (MTC) in 5G Cellular Systems

Advantages of Cellular M2M

Ubiquitous Coverage



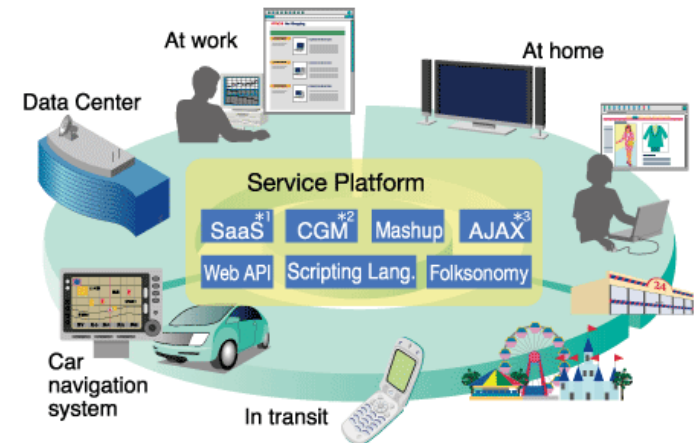
Mobility & Roaming



Interference Control



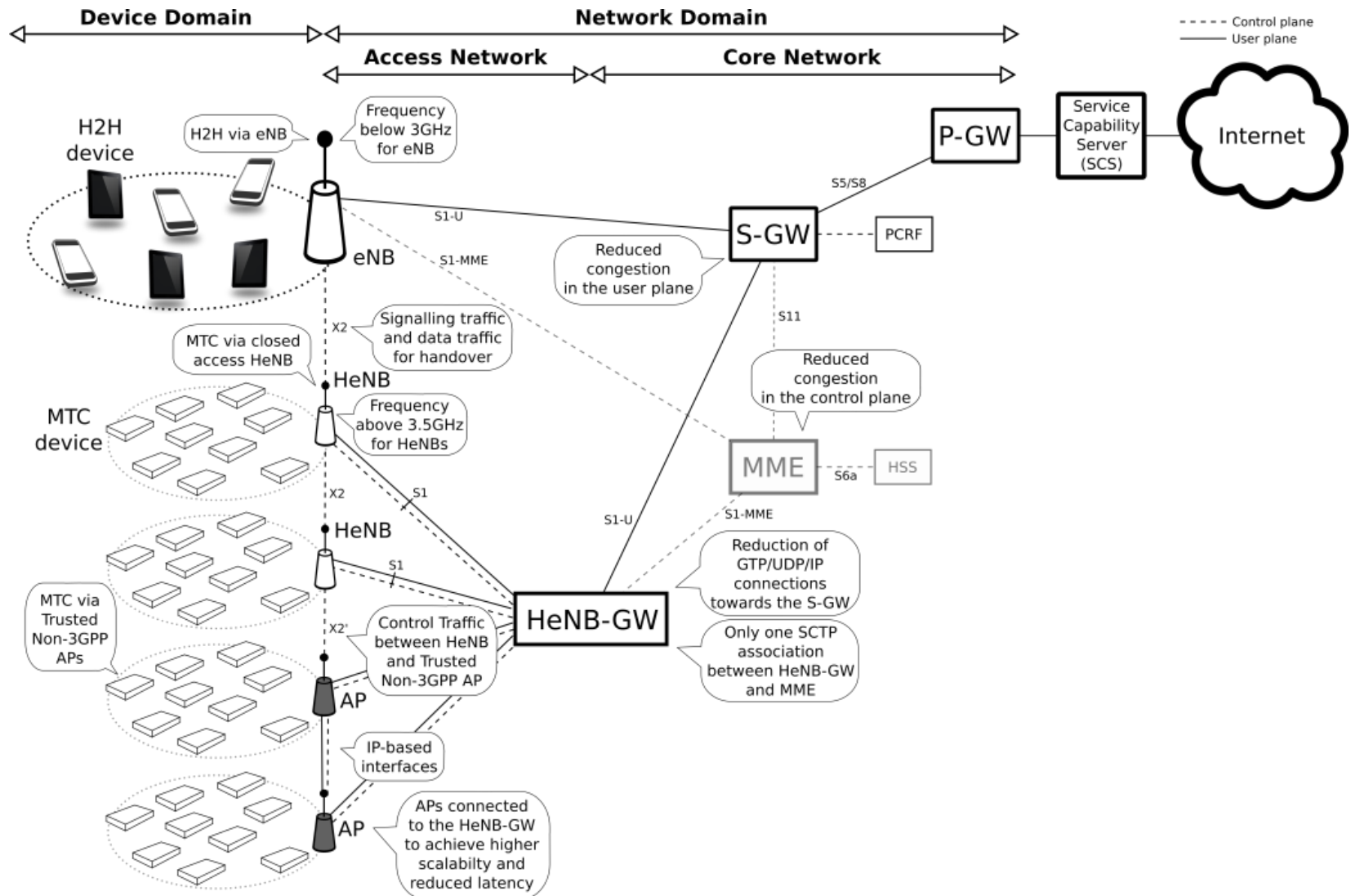
Service Platforms



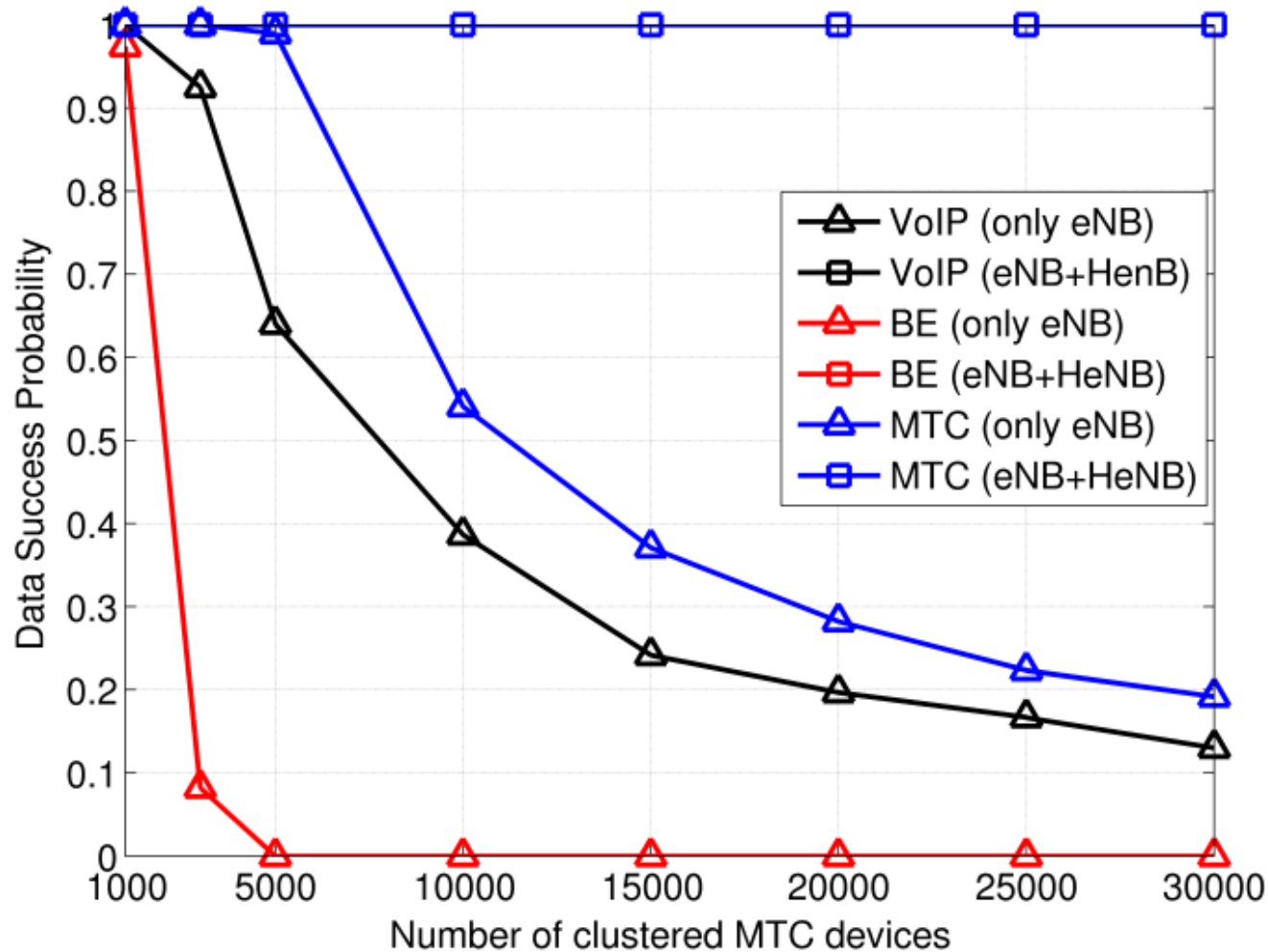
Creation of oneM2M Partnership project



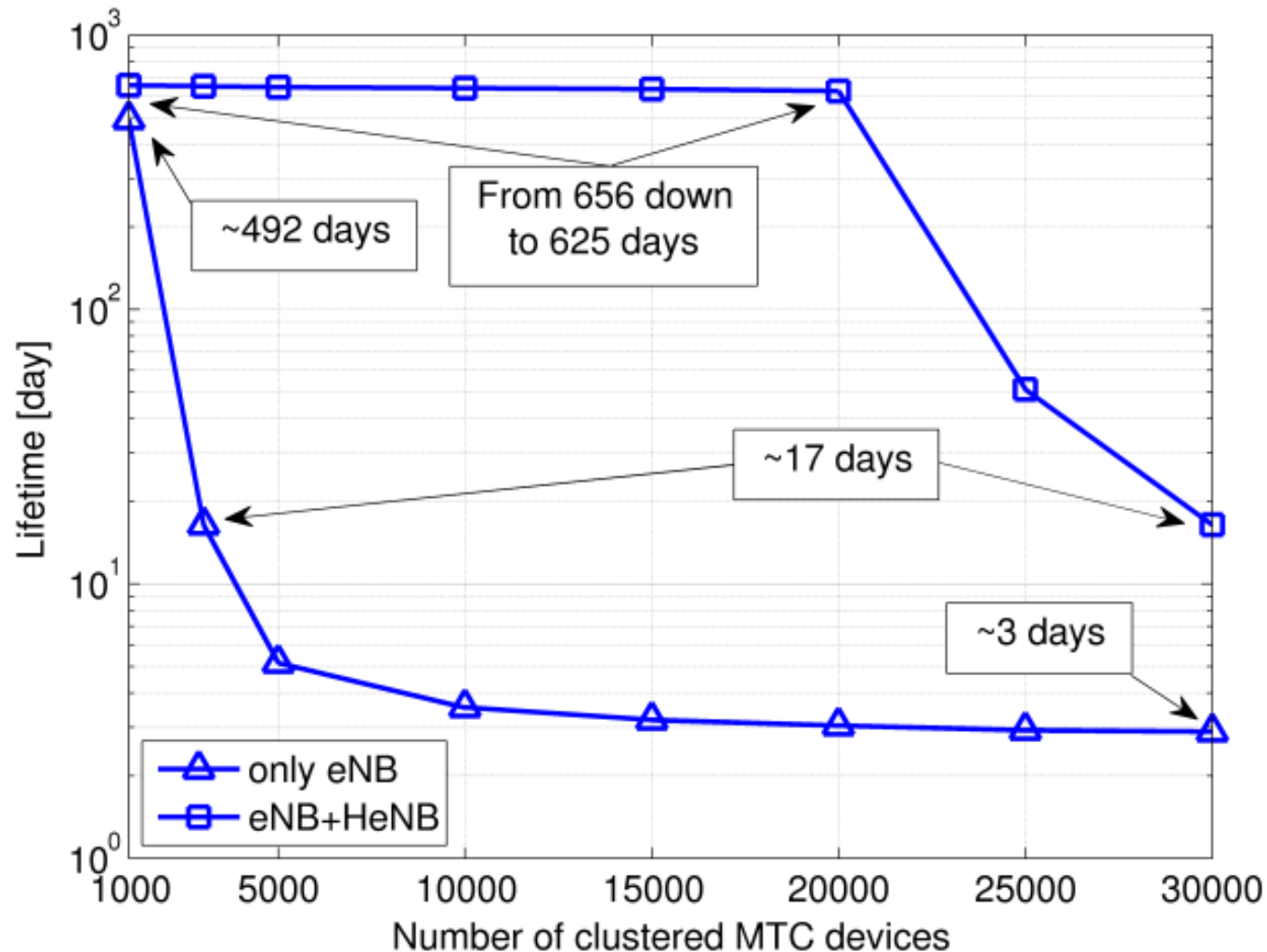
5G HetNets M2M Architecture



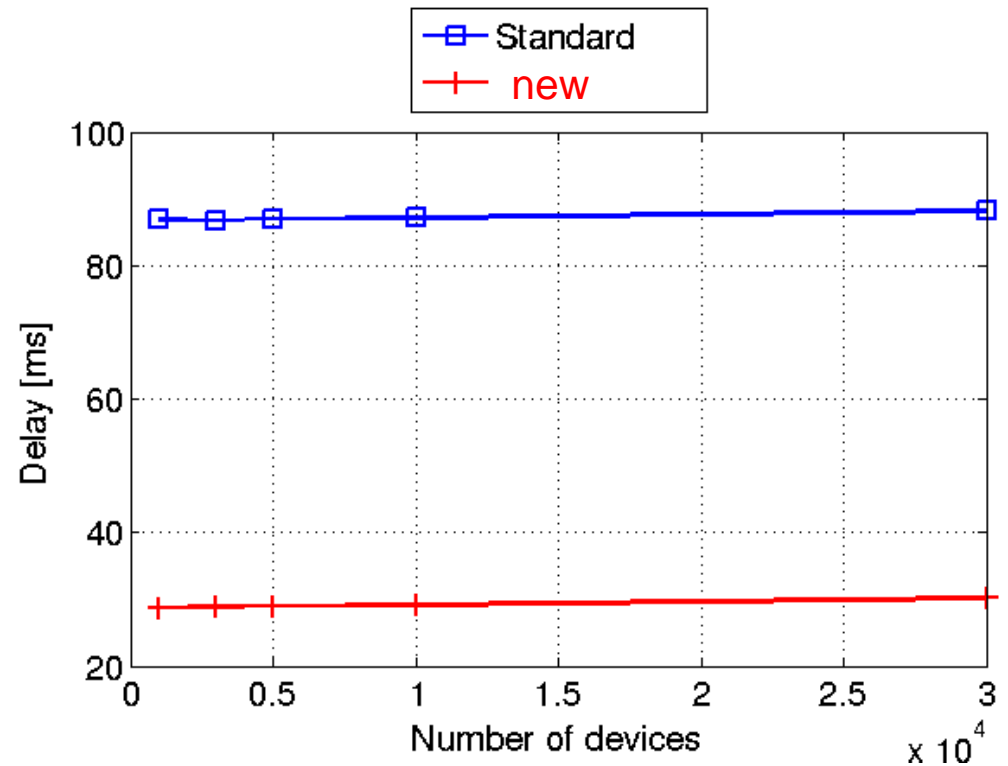
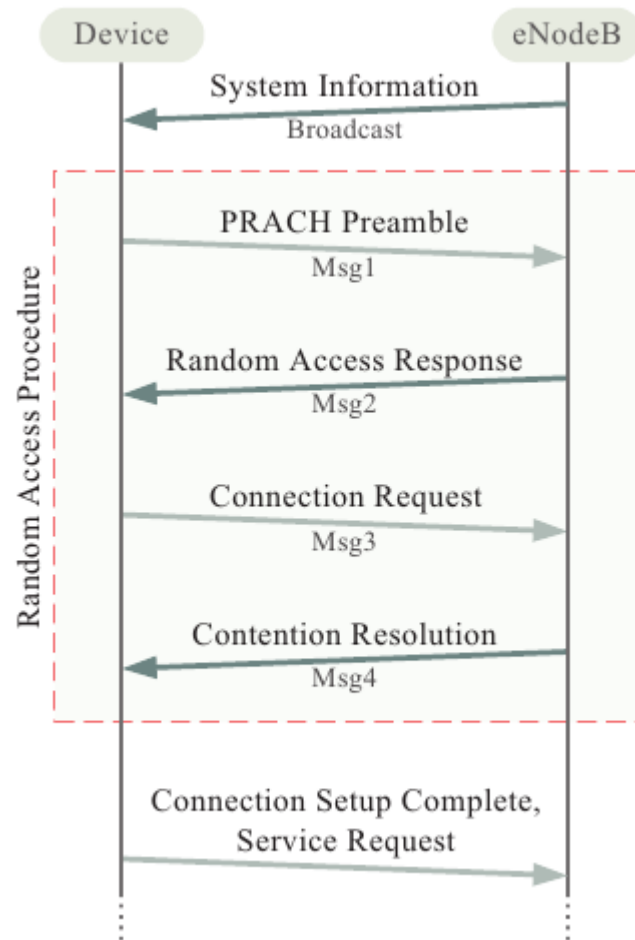
5G M2M: Dealing with Scalability



5G M2M: Dealing with Lifetime



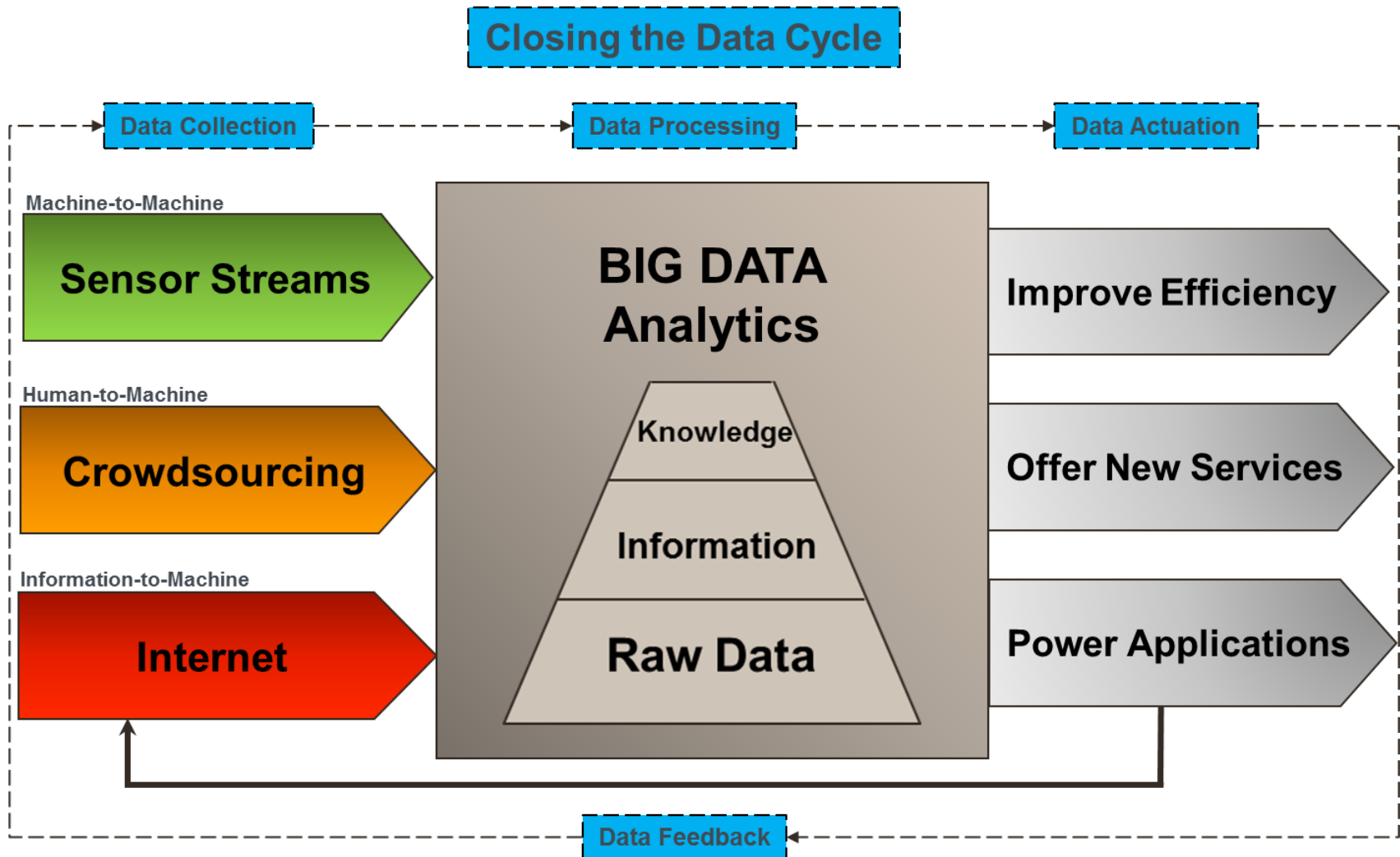
5G M2M: Dealing with Delay



4

Concluding Remarks

Closing the Data Cycle





M2M in 5G

Mischa Dohler

Professor, King's College London, UK
Fellow & Distinguished Lecturer, IEEE
Board of Directors, Worldsensing
Editor-in-Chief, ETT

