



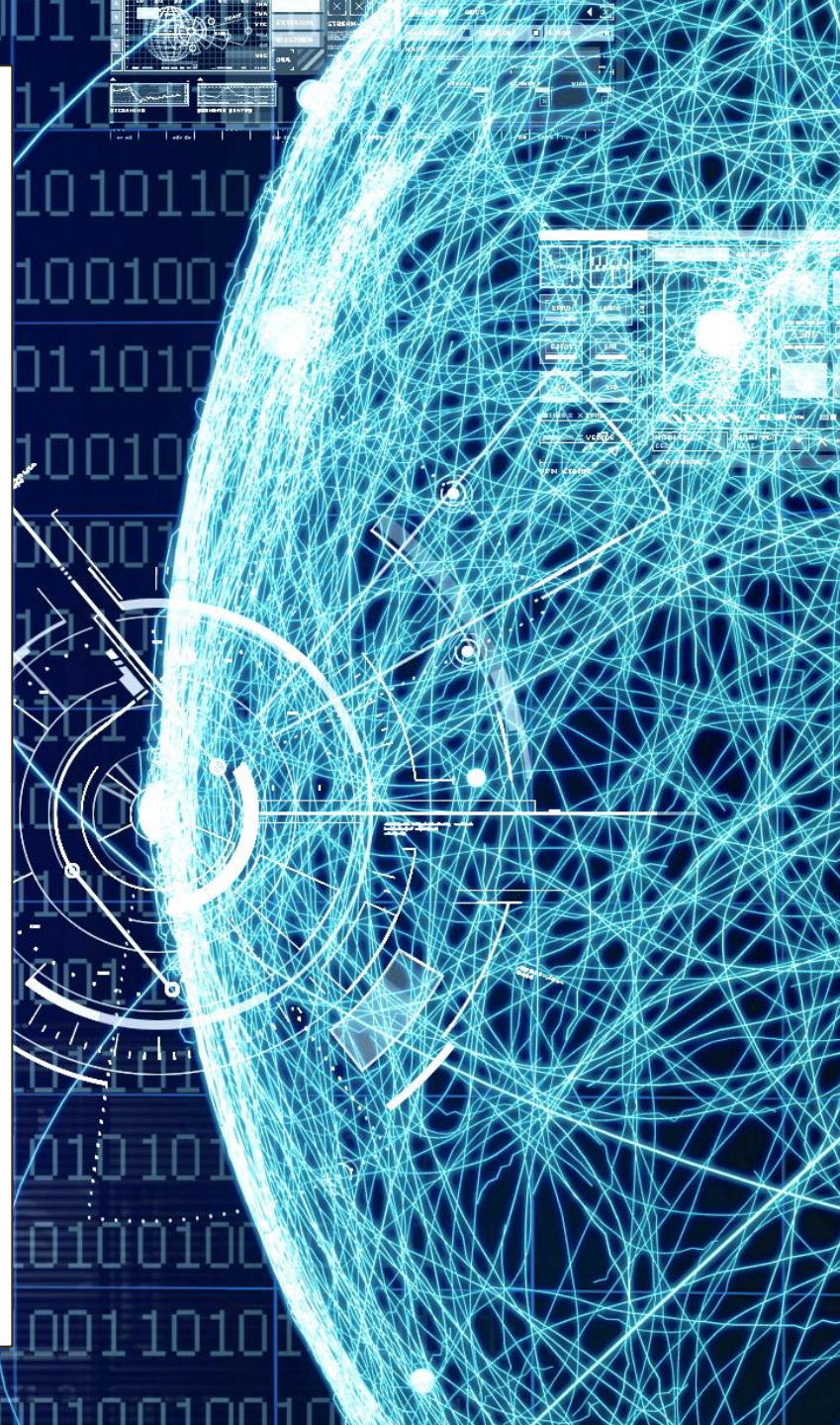
# Smart Cities

Technologies, Big Data & Privacy

**Mischa Dohler**

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

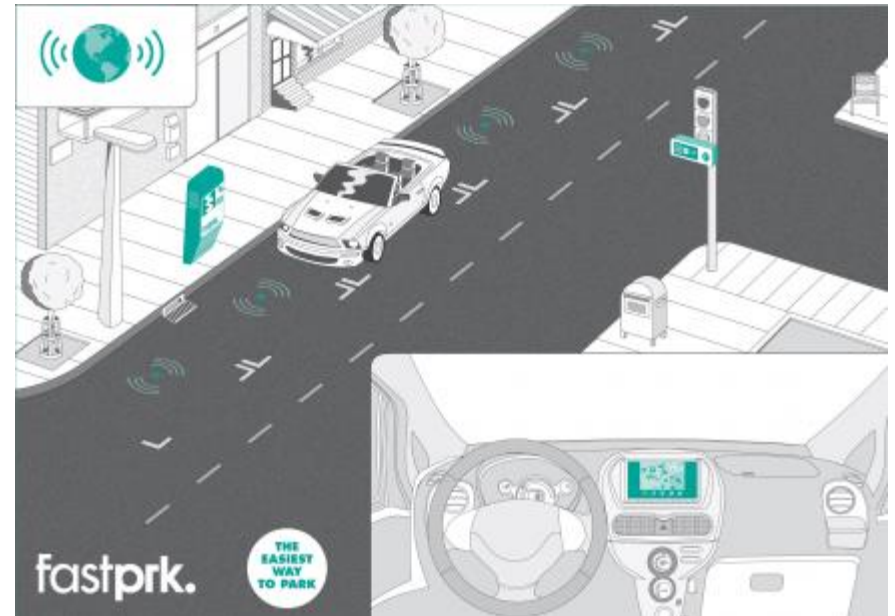
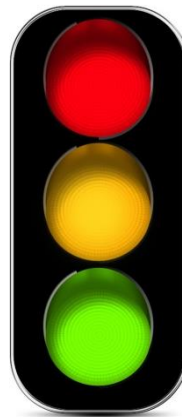
Keynote @ URSI  
Paris, France  
26/03/2014



# 1

## Smart City Applications

# Smart Cities IoT/M2M Applications





# Industrial IoT/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 500M 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.



**DATASHEET**

**Loadensing**  
by WORLD SENSING Industrial

→ **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
- Fluviometry, Soil moisture
- Chlorophylli, pigments
- Irrigation

→ **INDUSTRY**

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

**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**

→ **BI-DIRECTIONAL COMMUNICATION GIVES REMOTE CONFIGURATION CAPABILITIES**

→ **SMART AUTO-ORGANISED SENSOR NETWORKS**

→ **ROBUST EQUIPMENT READY FOR HARSH ENVIRONMENTS**

**Loadensing** by WORLD SENSING Industrial

+34 934 180 655 - [www.loadsensing.com](http://www.loadsensing.com) - [sales@worldsensing.com](mailto:sales@worldsensing.com)

# Today's Smart City Rollouts

## Smart Parking

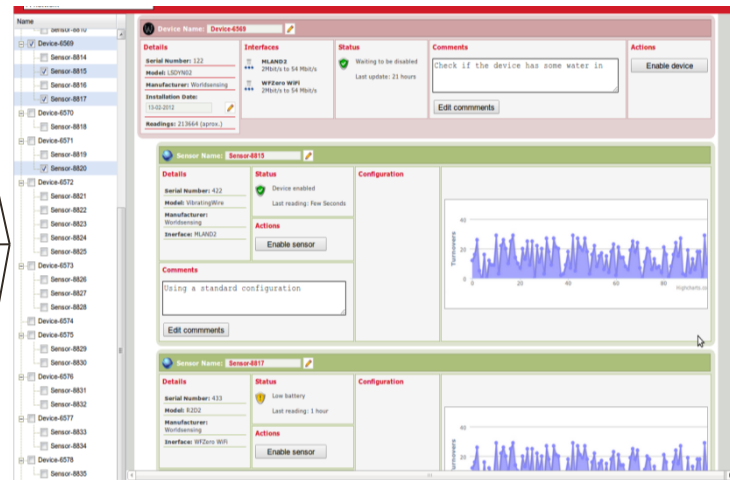


© Worldsensing

## Smart Bins



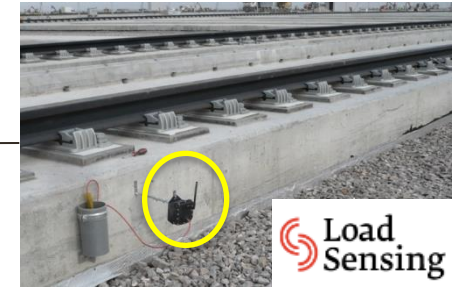
## Smart City Control Platform



## Traffic Flow



## Critical Infrastr.



## Travel Time



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

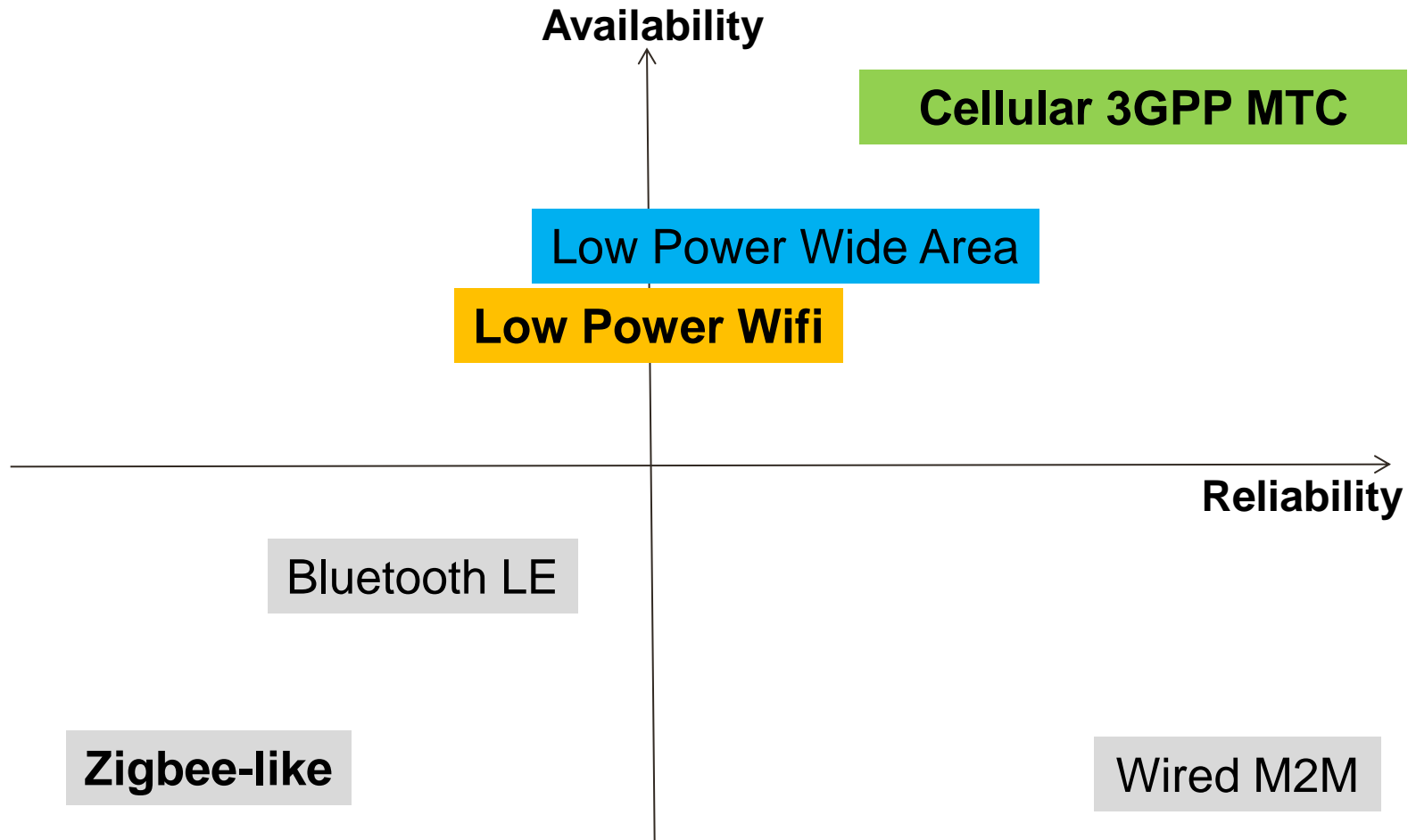
## Historic Sites



# 2

## Data Access Technologies

# M2M Prime Business Criteria

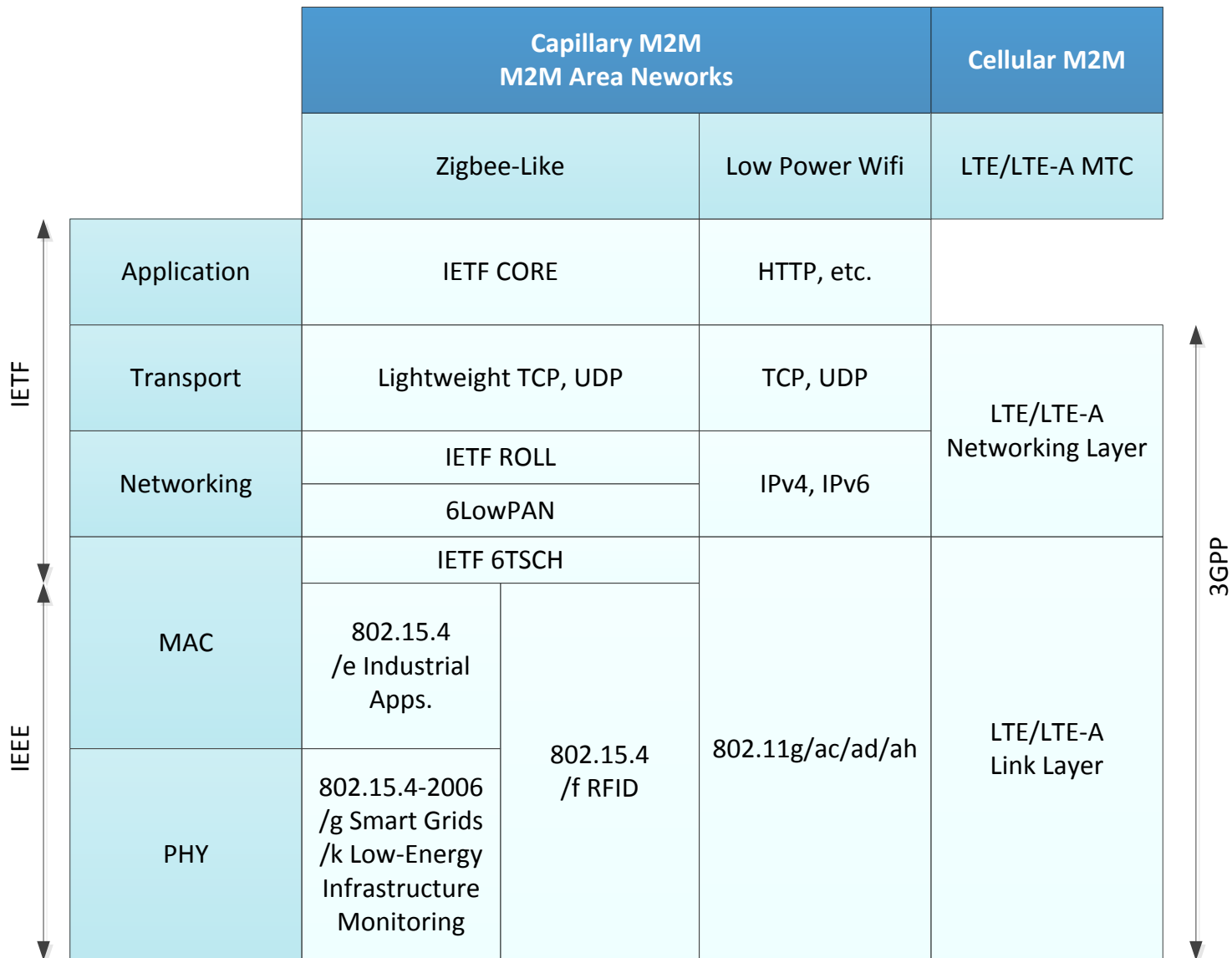


**Availability** = coverage, roaming, mobility, critical mass in rollout, etc.

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

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

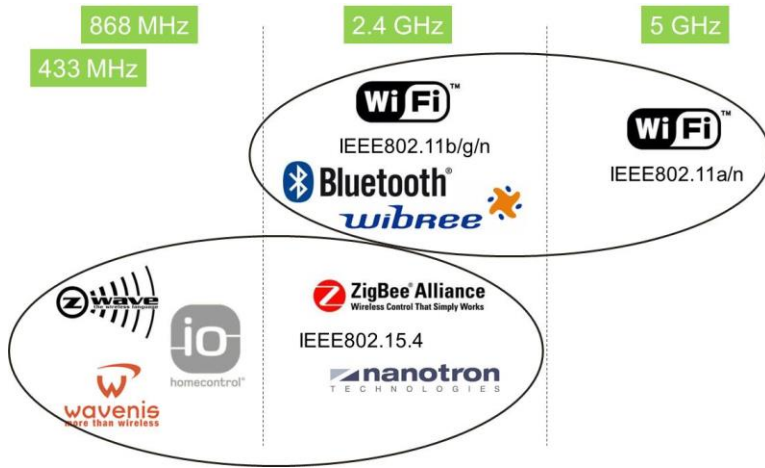
# Standardized M2M Protocol Stacks





# Problems of ZigBee-like Solutions

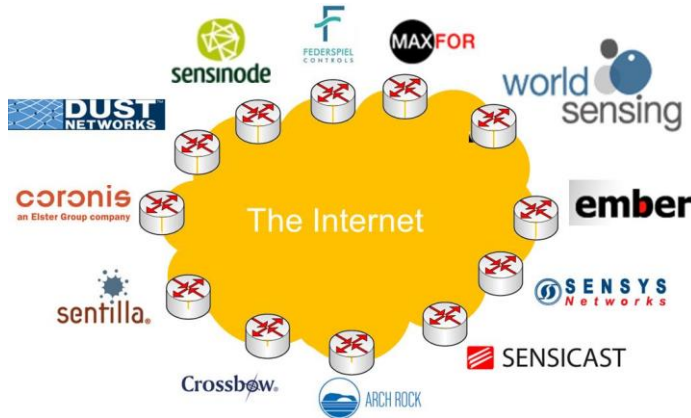
## Interference in ISM



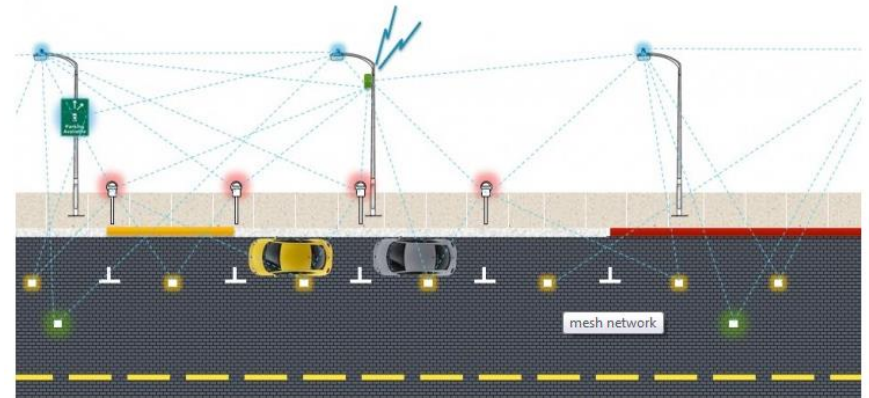
## No Global Infrastructure



## Lack of Interoperability



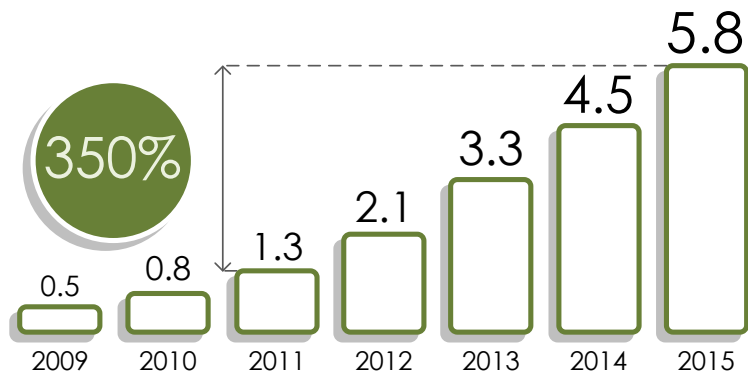
## Higher Total Cost



# 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



# Advantages of LPWA M2M Networks

**Large Coverage**



**Low Cost**







**Available Today**



**Operator Model**



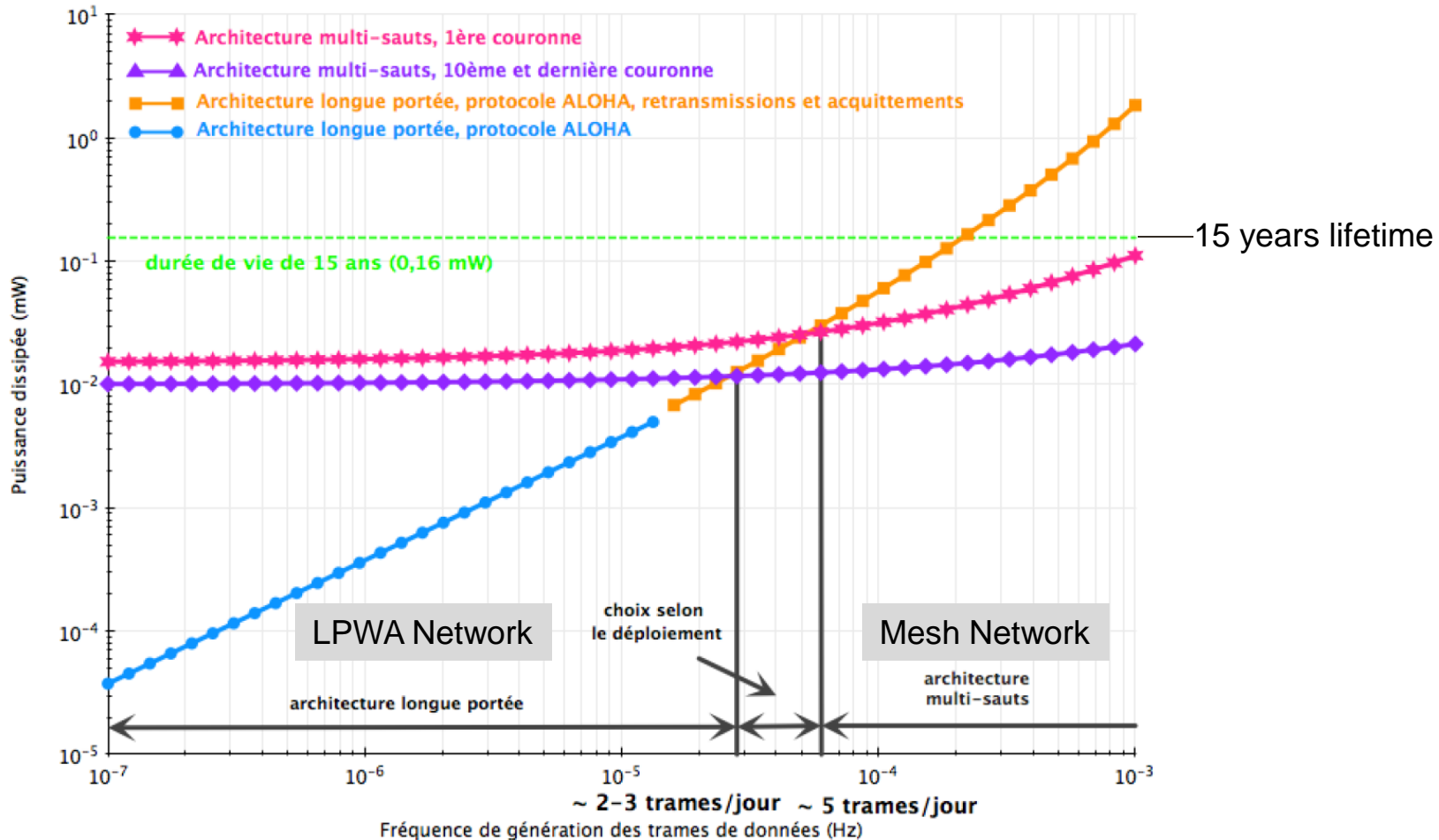
# Current Eco-System

- **Sigfox** (market leader in Q1 2014): 
  - technical: sub-GHz, UNB, very long range, one-way
  - business approach: operator, yearly license fee; Intel Ventures €10 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  $d = 10$

# Advantages of Cellular M2M

## Ubiquitous Coverage



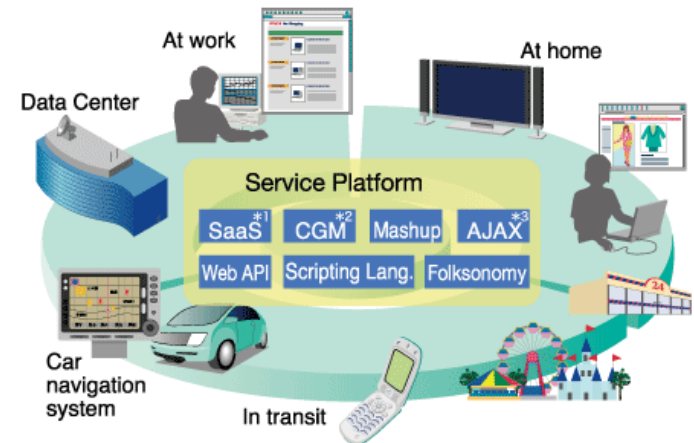
## Mobility & Roaming



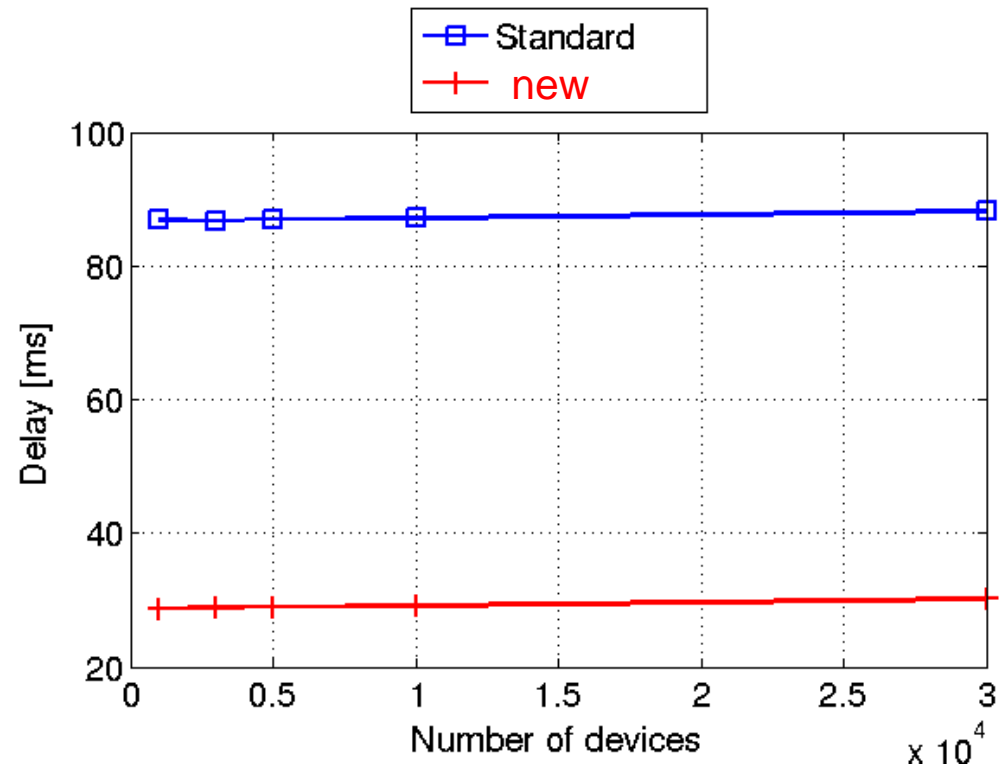
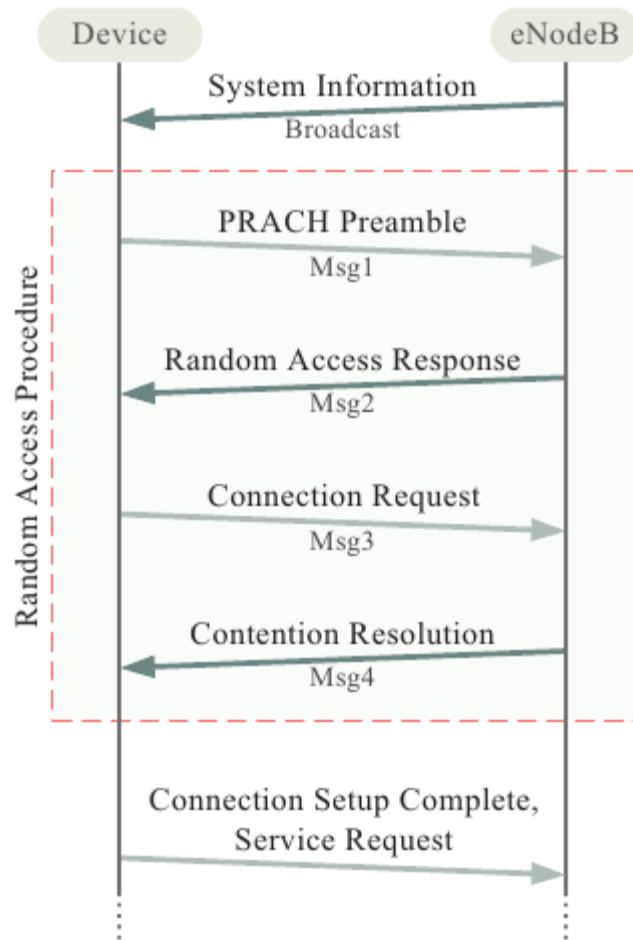
## Interference Control



## Service Platforms



# Improving RACH Procedure

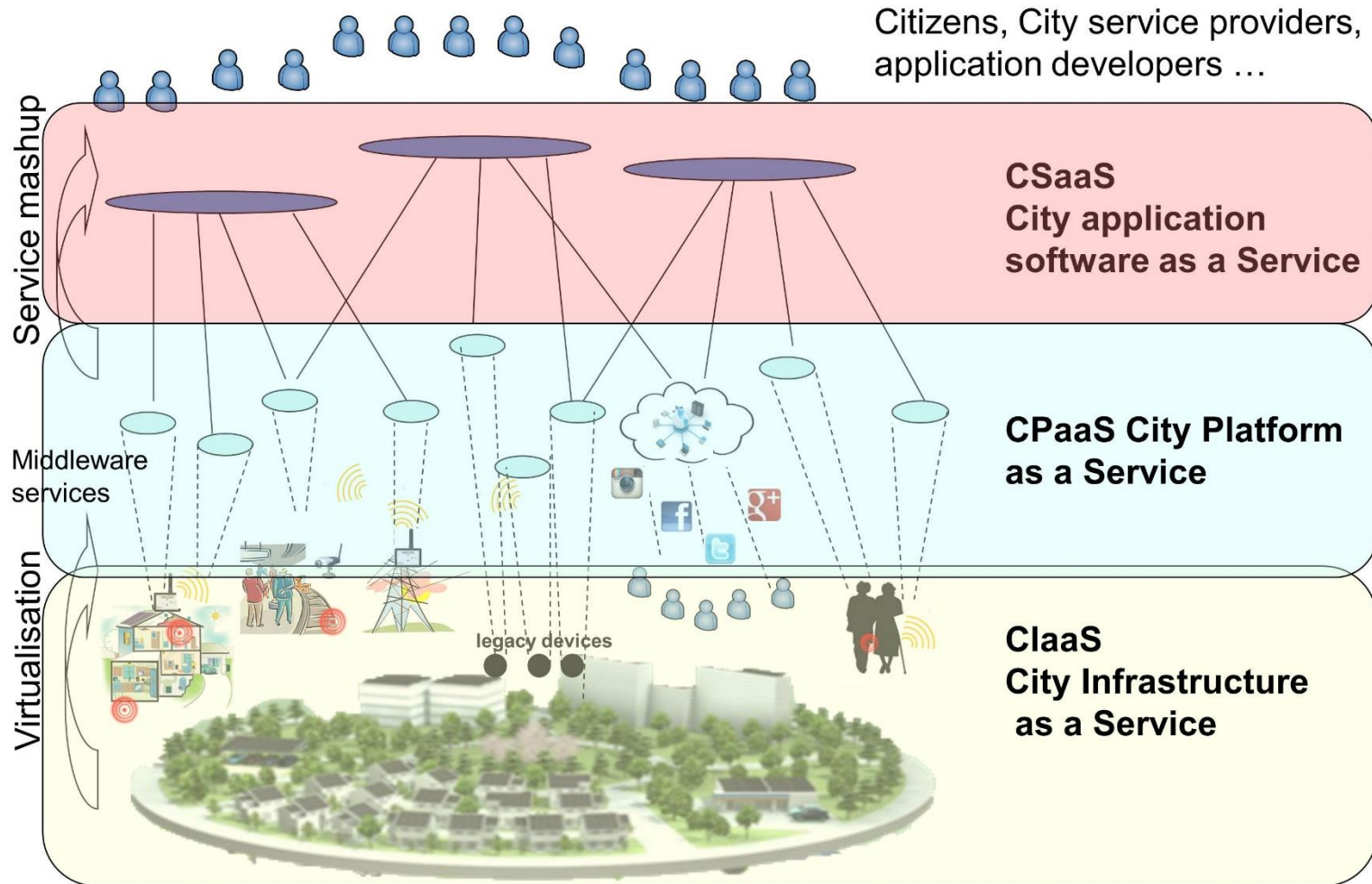


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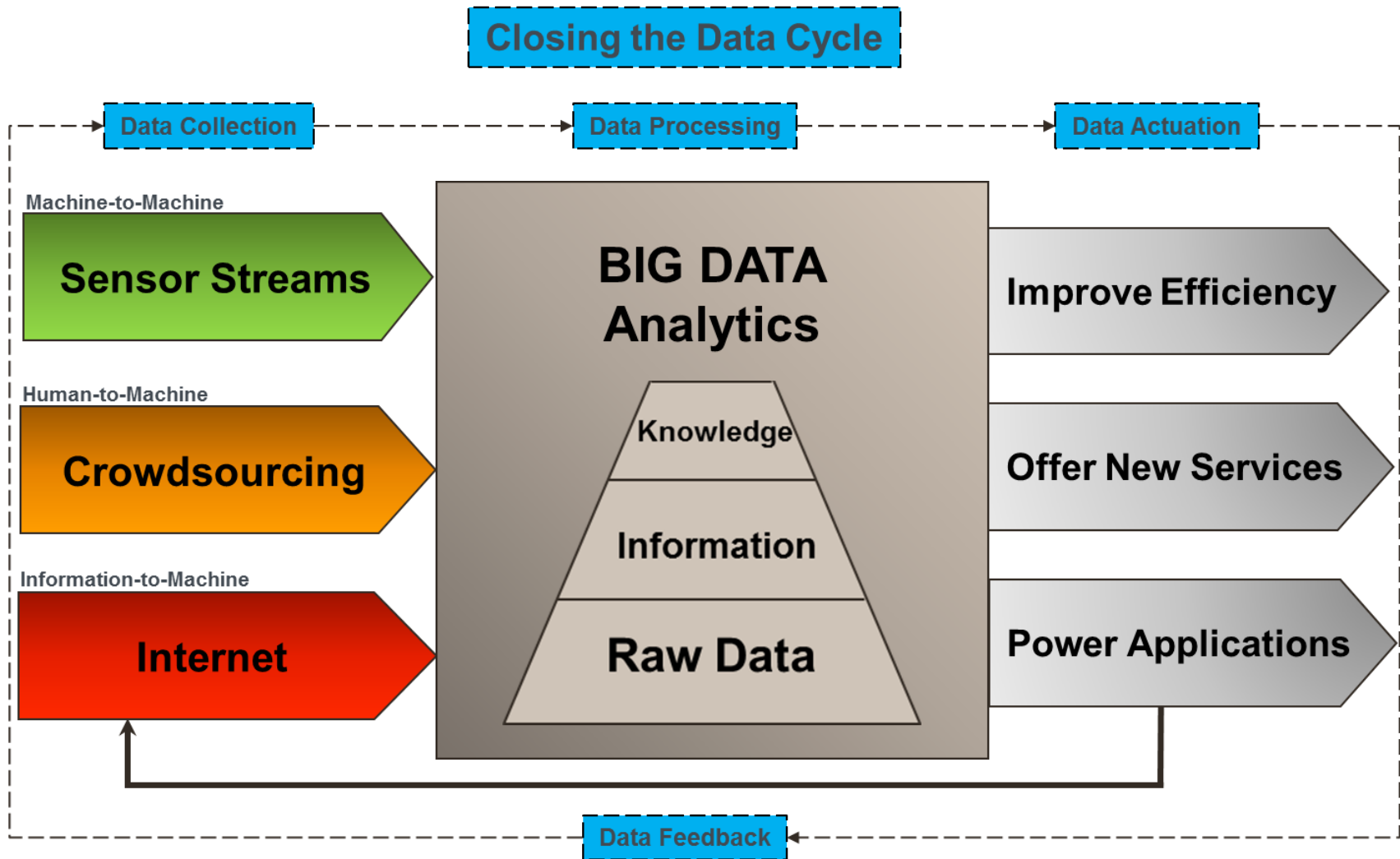
## Virtualization, Data and Privacy



# Virtualization & Cloudification

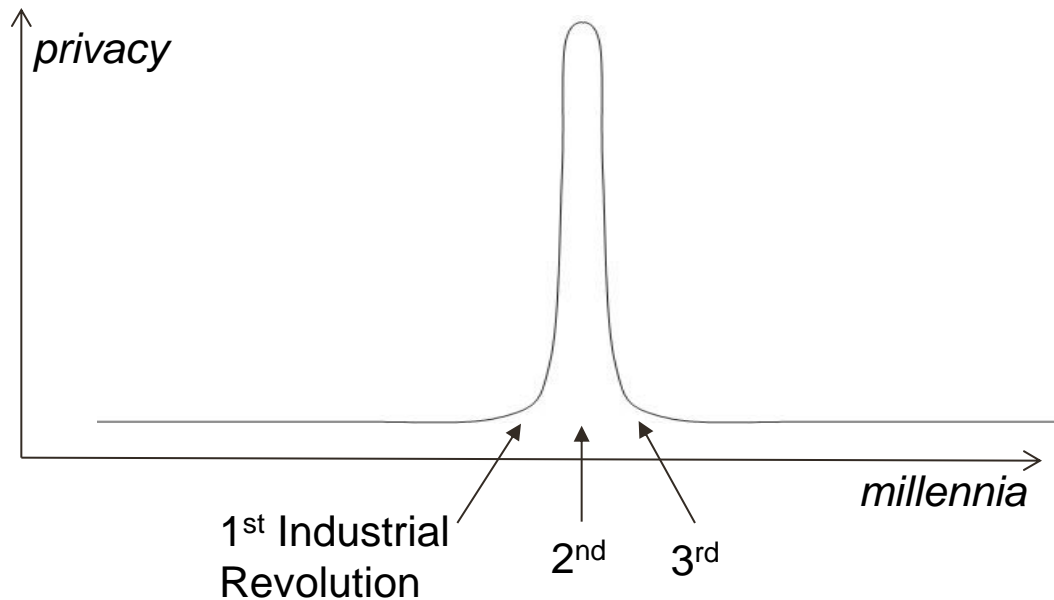


# Closing the Data Cycle



# Privacy – Illusion or Fundamental Right?

## Data Privacy



# 4

## Concluding Remarks

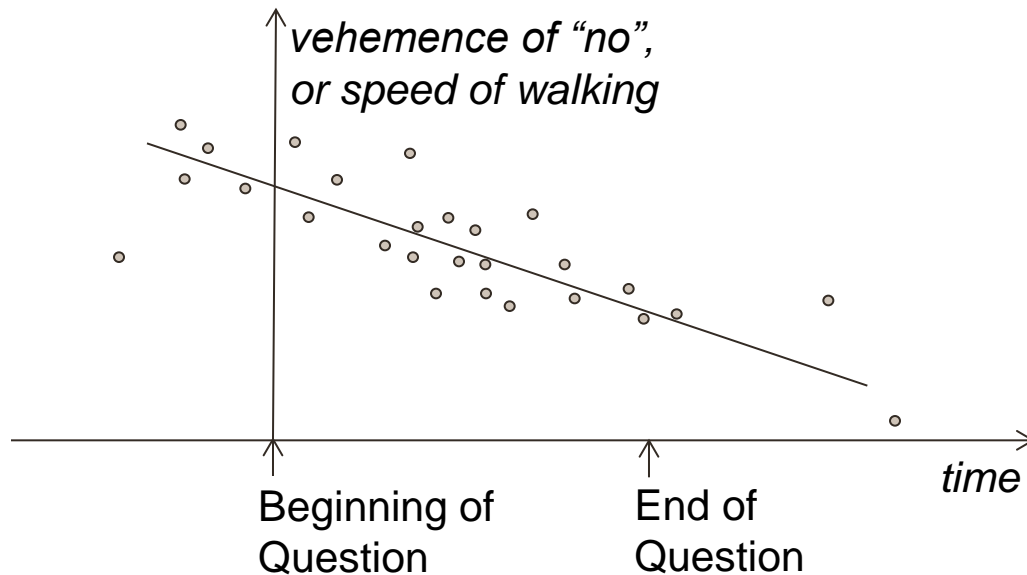


# Do citizens care about Smart Cities?



# Surprising Correlations

## Really Surprising Outcome!



*The biggest challenge of this early part of the 21<sup>st</sup> century is to bootstrap the undoubtedly high-potential smart city market in cities which are essentially broke.*

*“A developed country is not a place where the poor have cars. It’s where the rich use public transportation.”*  
Gustavo Petro, Mayor of Bogota





**KING'S**  
*College*  
**LONDON**



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