



# OM2M an Open autonomic and semantic platform for M2M

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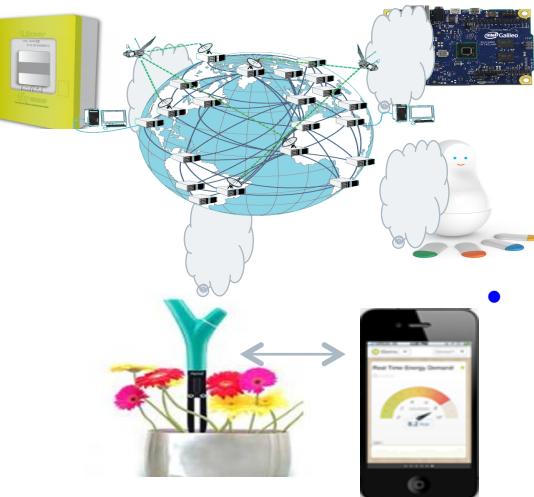
# Outline

- › Definition
- › Products and Complex systems
- › Standard
- › Opensource
- › Smart
- › Conclusion

# › What are IoT?

- **Generally:** a network of networks which enables to identify digital entities and physical objects

- *inanimate (including plants) or animate (animals and human beings)*
    - *standardized electronic identification systems*
    - *wireless mobile devices*
    - *possible to retrieve, store, transfer and process data relating to them*
    - *Strong relation between physical and virtual worlds*
- (source: Benghozi, Bureau, Massit-Folléa, 2008)



- **Conceptually:** new identities for objects

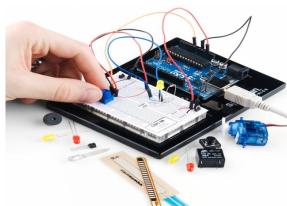
- *identities and virtual personalities operating in smart spaces*
  - *using intelligent interfaces to connect and communicate within social, environmental, and user context*

(source: Eposssmart systems working group, M.A Feki- Internet of things design Talks)



- **Technically:** an extension of the Internet

- convergence of digital identifiers (URL website addresses for instance) and physical elements
- (source: Mohamed Ali - Ecole de printemps sur l'Internet des Objets & Technologies M2M – Hammamet, Tunisie)



- **From the user point of view:** a new space for general innovative services linked to the real world

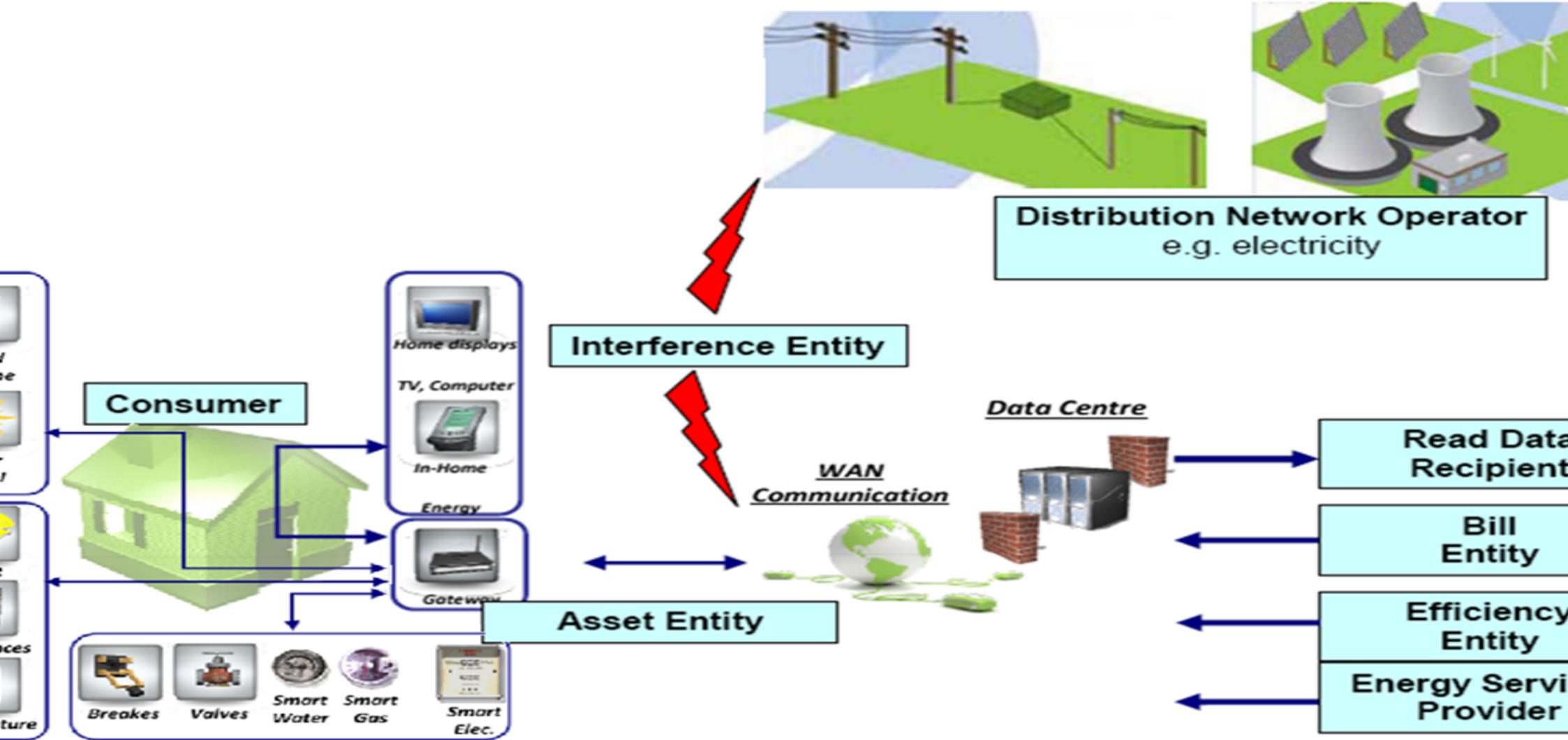
# Iconic products : Nest-Google

- › Save energy, money ?

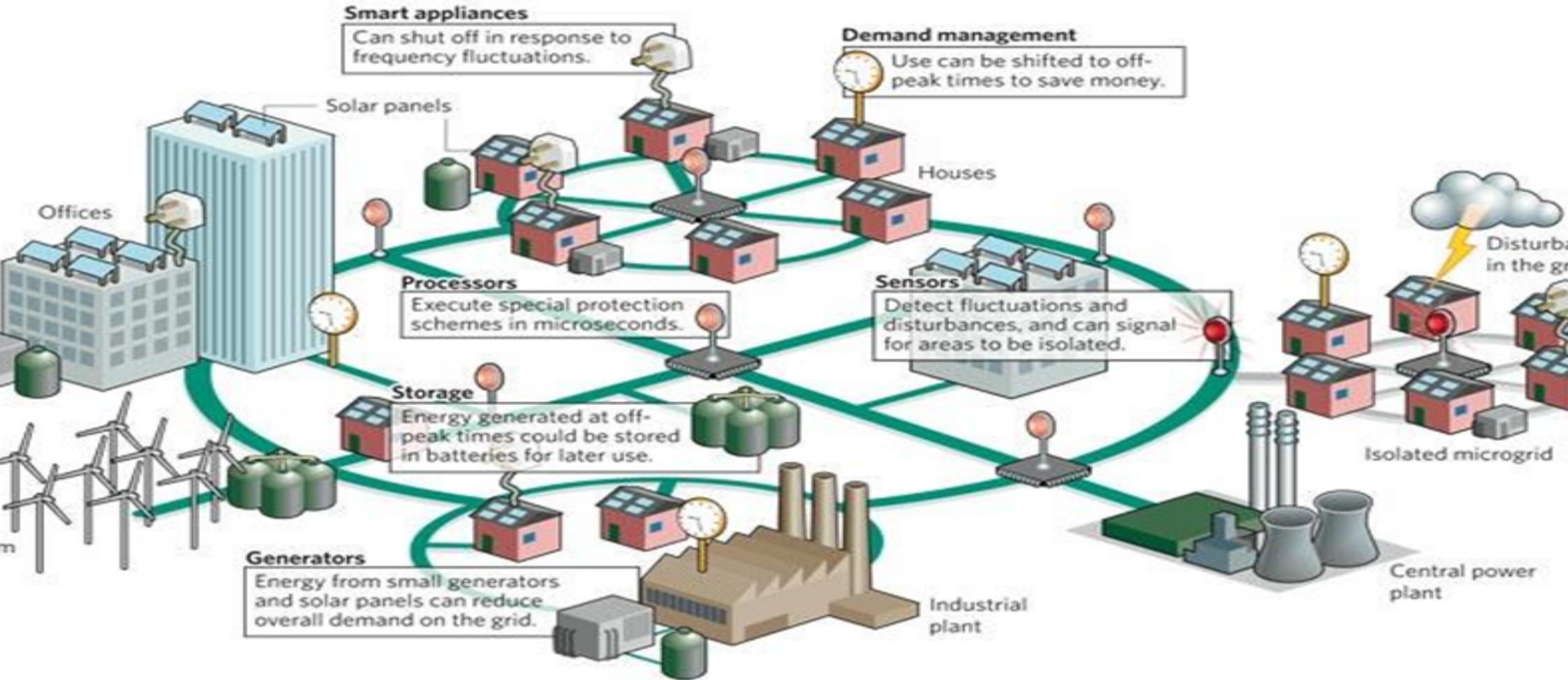


nest

# M2M smart metering application scenario



# M2M smart grid application scenario





# Smart cities



smart districts



Smart ...

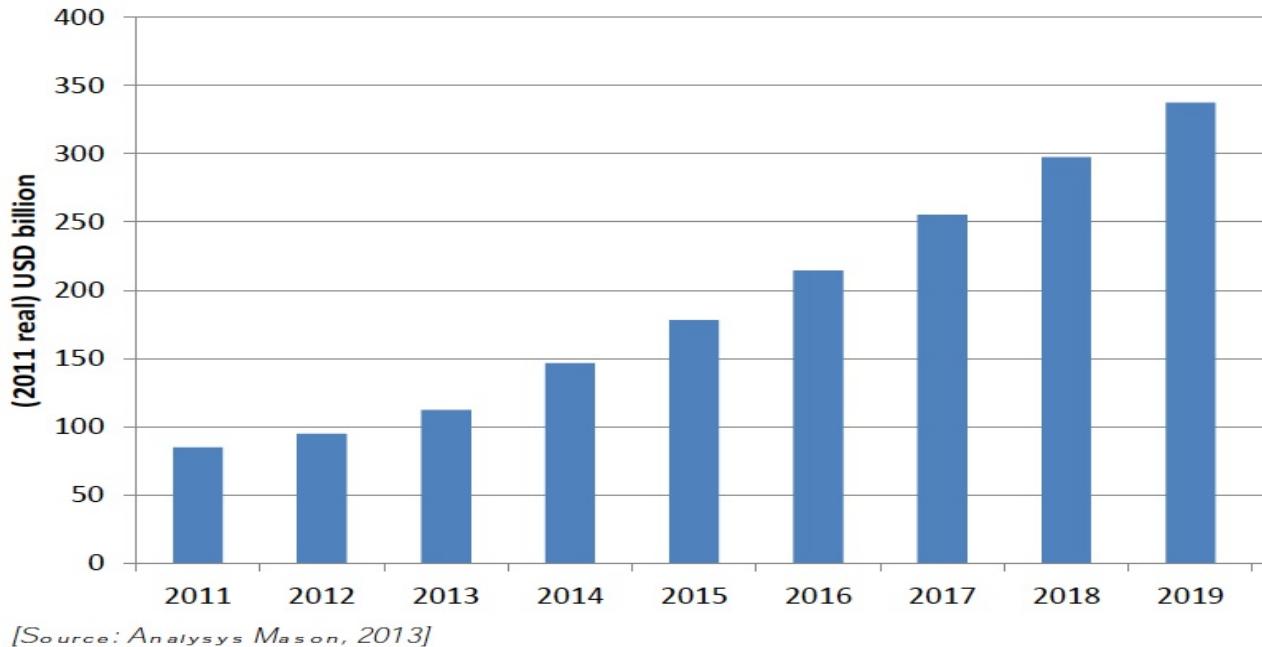


smart grid

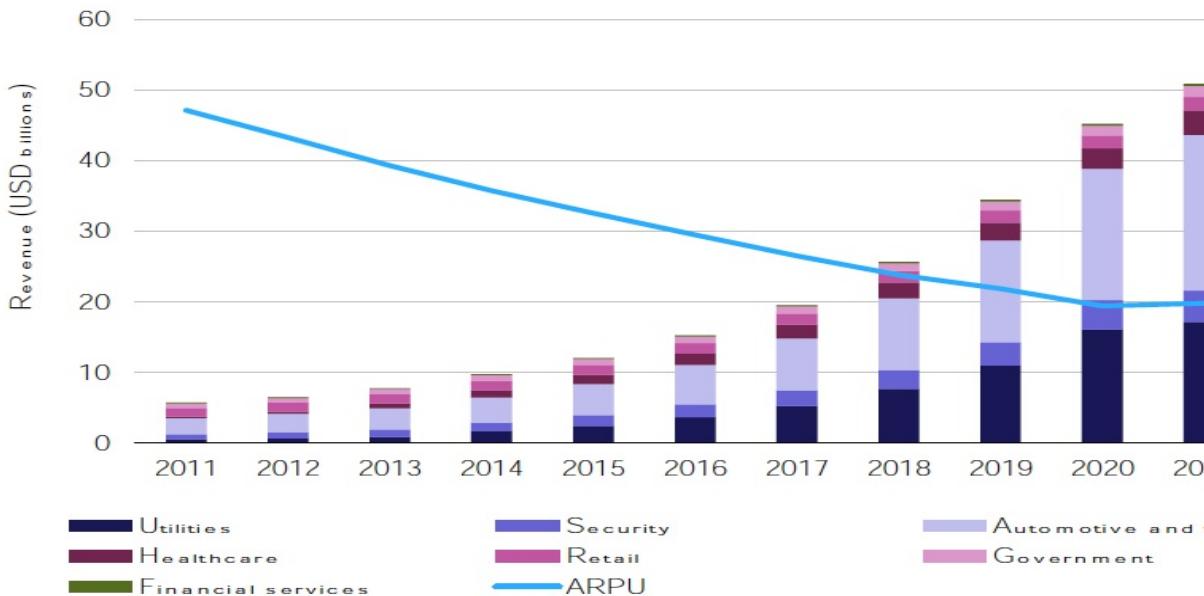
=> Cities<sup>smart</sup>

# IoT market

M2M market revenue for operator

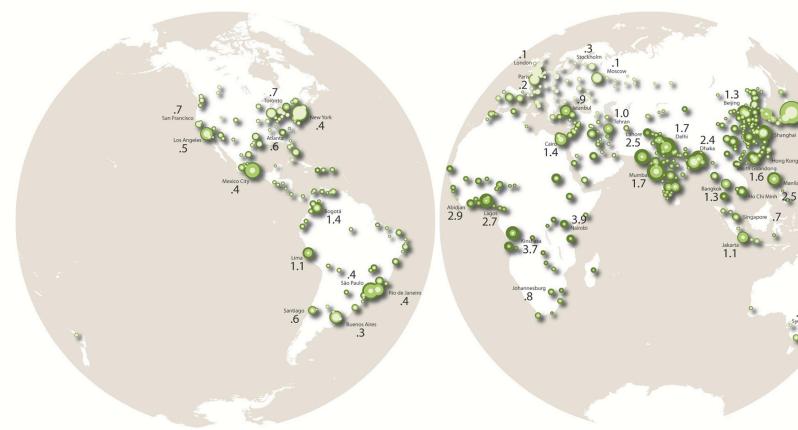


M2M market per domain

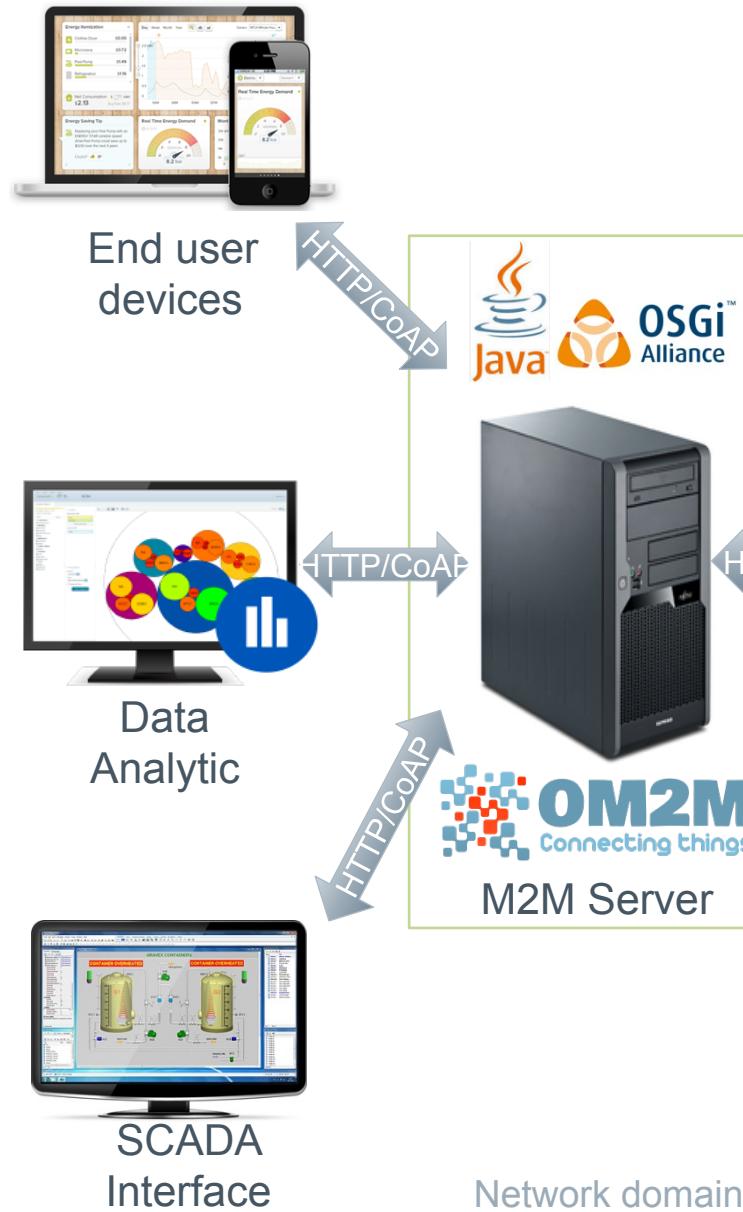


# First remarks

- › Smart objects may fall within the gadget and marketing products
- › Smart objects produce a lot of data and need datacenter
- › It has a strong business potential with smart objects
- › Smart objects can provide solutions to complex problems
- › Various fields are tackled with smart objects
- › The constraints on the smart objects can be different: security, response time, confidentiality
- › Smart cities is a real challenge



# Architecture

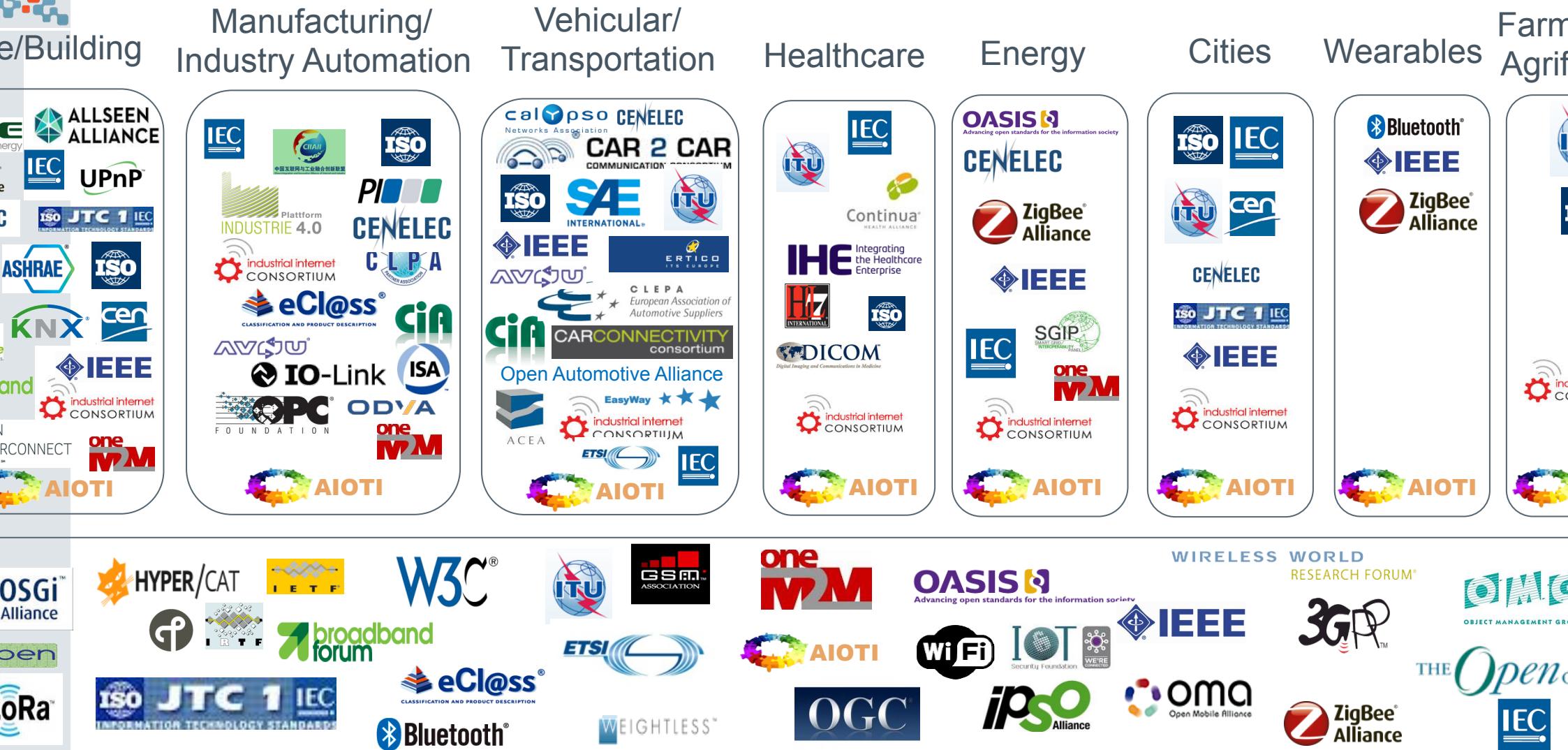


# market fragmentation



- The current marketplace is extremely fragmented, which has increased the R&D cost in each specific domain.
- Silo model is not an efficient way to communicate, it is a barrier to further development.
- Many vertical solutions have been designed independently and separately for different applications, which impedes large-scale interoperable deployment.

# IoT SDOs and Alliances Landscape (Vertical and Horizontal Domains)



Horizontal/Telecommunication

# Architecture OneM2M

**Reference Point**

**Common Services Entity**

**Application Entity**

**Network Services Entity**

**Node**

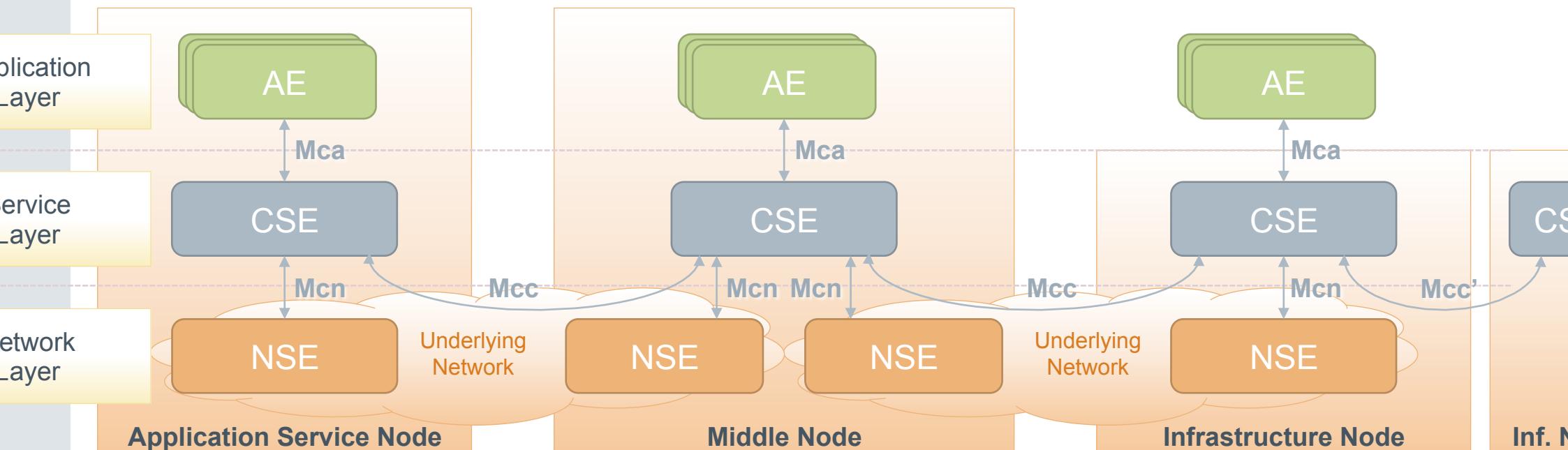
One or more interfaces - Mca, Mcn, Mcc and Mcc' (between 2 service providers)

Provides the set of "service functions" that are common to the M2M environments

Provides application logic for the end-to-end M2M solutions

Provides services to the CSEs besides the pure data transport

Logical equivalent of a physical (or possibly virtualized, especially on the server side) device



# Common Service 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

# OM2M: Open platform for IoT

- › Compliant to SmartM2M Standard (April 2014) and with OneM2M Standard (october 2015)
- › Horizontal service platform for IoT interoperability
- › Restful API with a generic set of service capabilities
- › OSGi-based architecture extensible via plugins
- › Allow developing services independently of the underlying network
- › Facilitate deployment of vertical applications
- › Main features:  
Machine registration, application deployment, container management, resource discovery, access right authorization, subscription / notification, group management, and resource announcement.
- › Eclipse foundation project: [eclispe.org/om2m](http://eclipse.org/om2m)
- › OM2M is an open source
- › Member of Eclipse IoT Working Group.

**WHAT IS OM2M?**

The OM2M project, initiated by LAAS-CNRS, is an open source implementation of the ETSI M2M standard. It provides a horizontal M2M service platform for developing services independently of the underlying network, with the aim to facilitate the deployment of vertical applications and heterogeneous devices.

Project Wiki Source Code Forum Mailing List Bug Tracker

OM2M is an [iot.eclipse.org](http://iot.eclipse.org) project under the EPL license.

**Standardized Platform**  
OM2M follows the ETSI M2M standard. It provides a horizontal Service Capability Layer (SCL) that can be deployed in an M2M network, a gateway, or a device. Each SCL provides Application Enablement, Generic Communication, Reachability, Addressing and Repository, Interworking proxy, Entity Management, etc.

**RESTful API**  
OM2M exposes a RESTful API providing primitive procedures for machines authentication, resources discovery, applications registration, containers management, synchronous and asynchronous communications, access rights authorization, groups organisation, and re-targeting.

**New and Noteworthy**  
New and Noteworthy is here to describe the new features of each release from the previous one. You can choose directly from the list (Will be available soon).

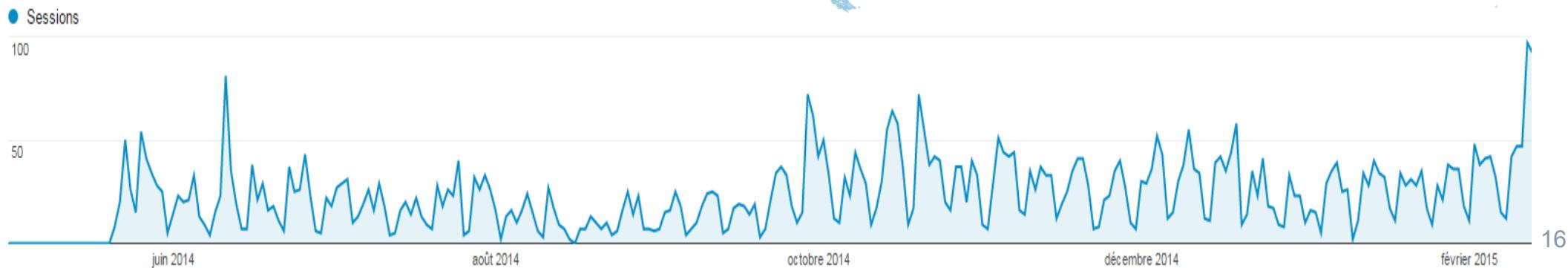
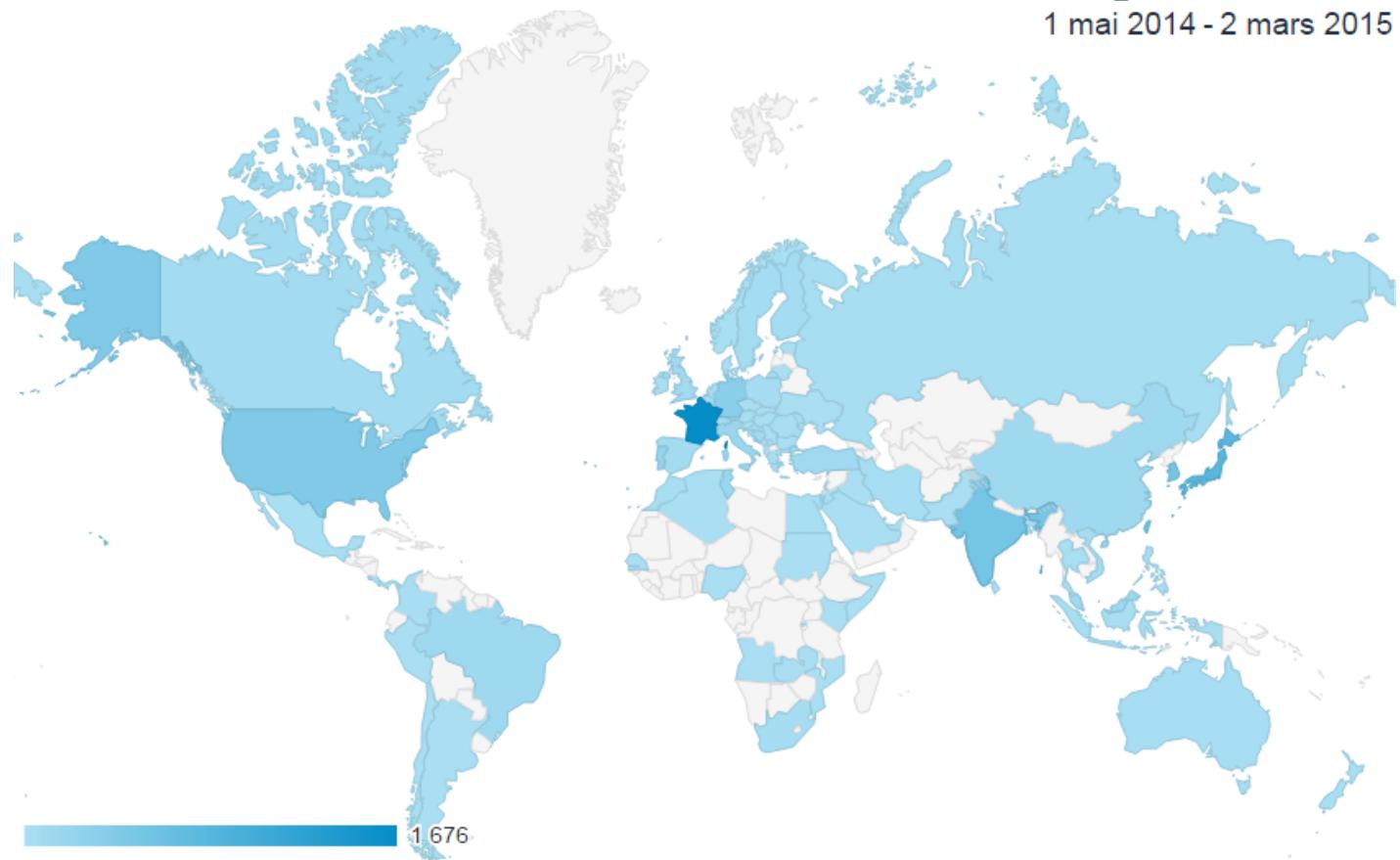
**Get and use OM2M**  
You can get OM2M by cloning the repository, build it and get started following the OM2M Get Started. For all documentation, you can take a look at the OM2M Eclipse Wiki.

**Modularity & Extensibility**  
OM2M is a java implementation running on top of an OSGi Equinox runtime, making it highly extensible via plugins. It is built as an Eclipse product using Maven and Tycho. Each plugin offers specific functionalities and can be remotely installed, started, stopped, updated, and uninstalled without requiring a reboot.

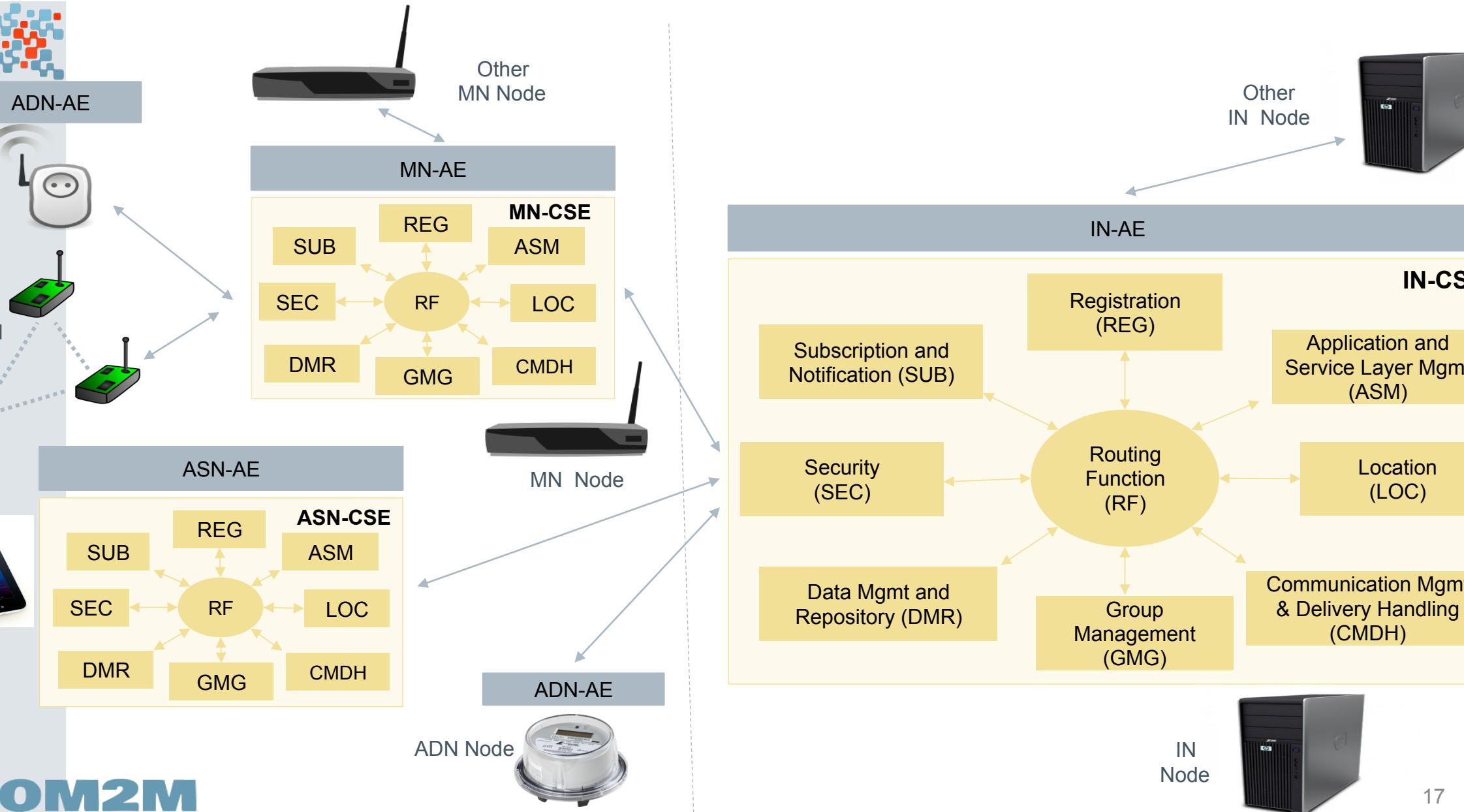
**Prerequisites**  
• JAVA 1.7\* is required to run OM2M.  
• Apache Maven 3\* is required to build OM2M.

# Website stats

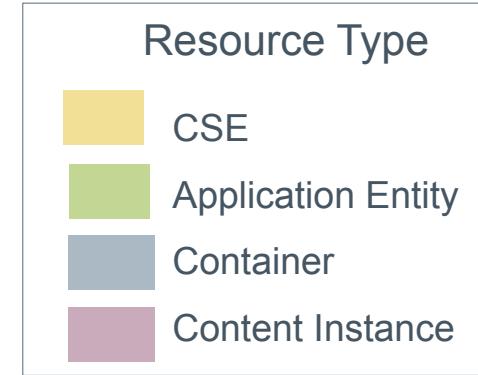
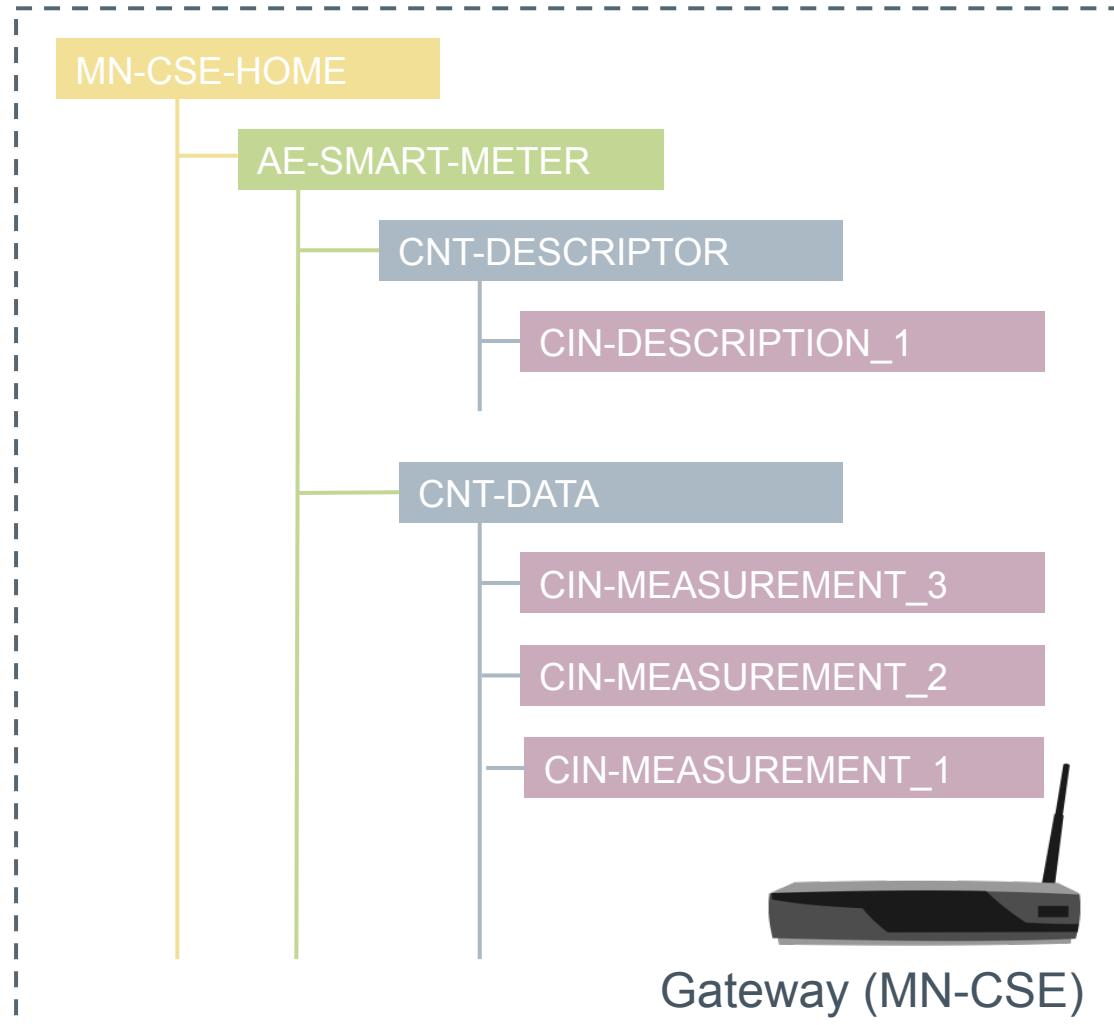
1.	France	1 676 (23,68 %)
2.	Japan	824 (11,64 %)
3.	Taiwan	567 (8,01 %)
4.	India	540 (7,63 %)
5.	South Korea	531 (7,50 %)
6.	United States	424 (5,99 %)
7.	Germany	328 (4,63 %)
8.	Portugal	216 (3,05 %)
9.	Tunisia	169 (2,39 %)
10.	Italy	163 (2,30 %)



# OM2M high level architecture

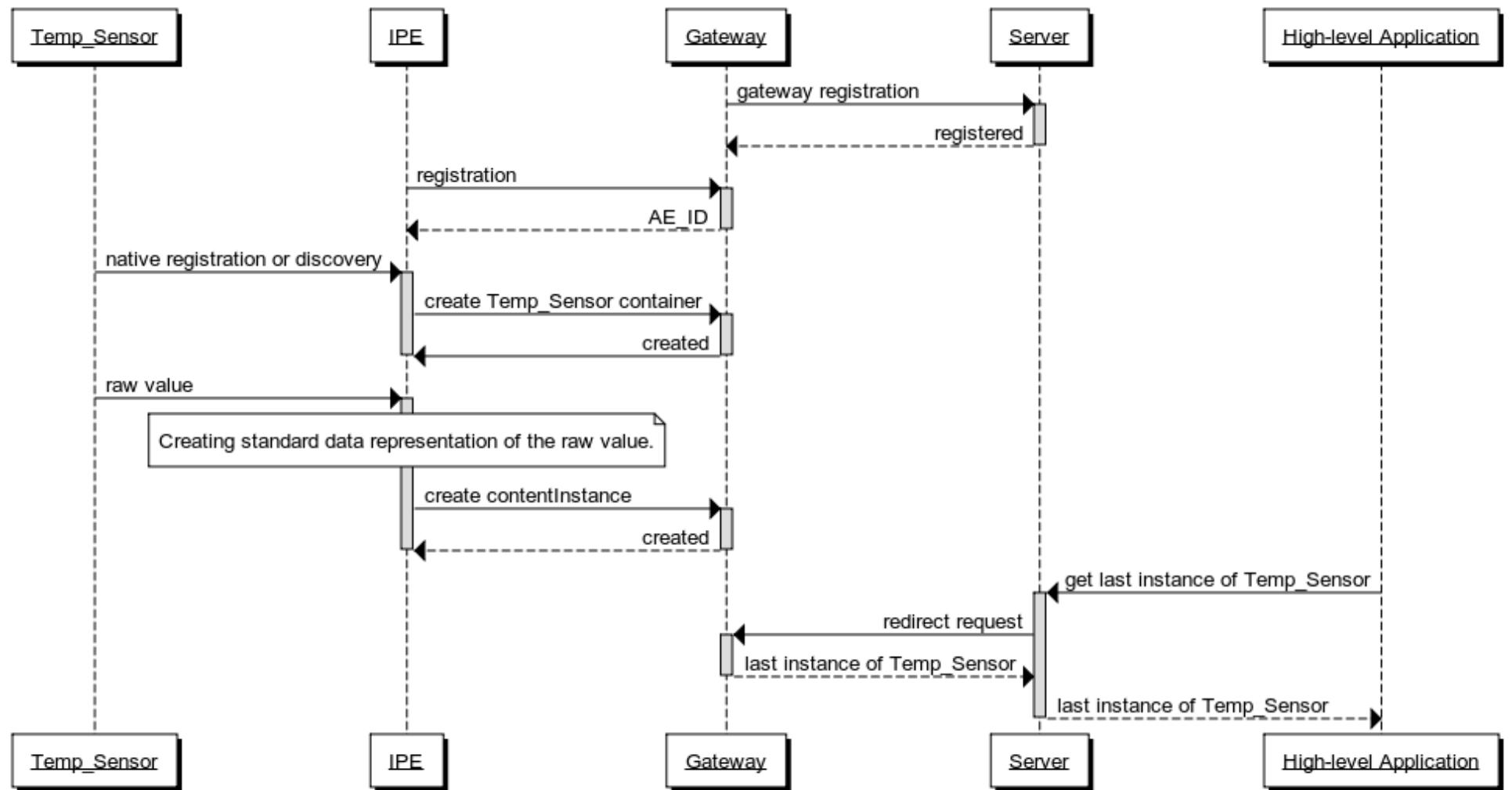


# OM2M resource tree example



Smart Meter  
(ADN)

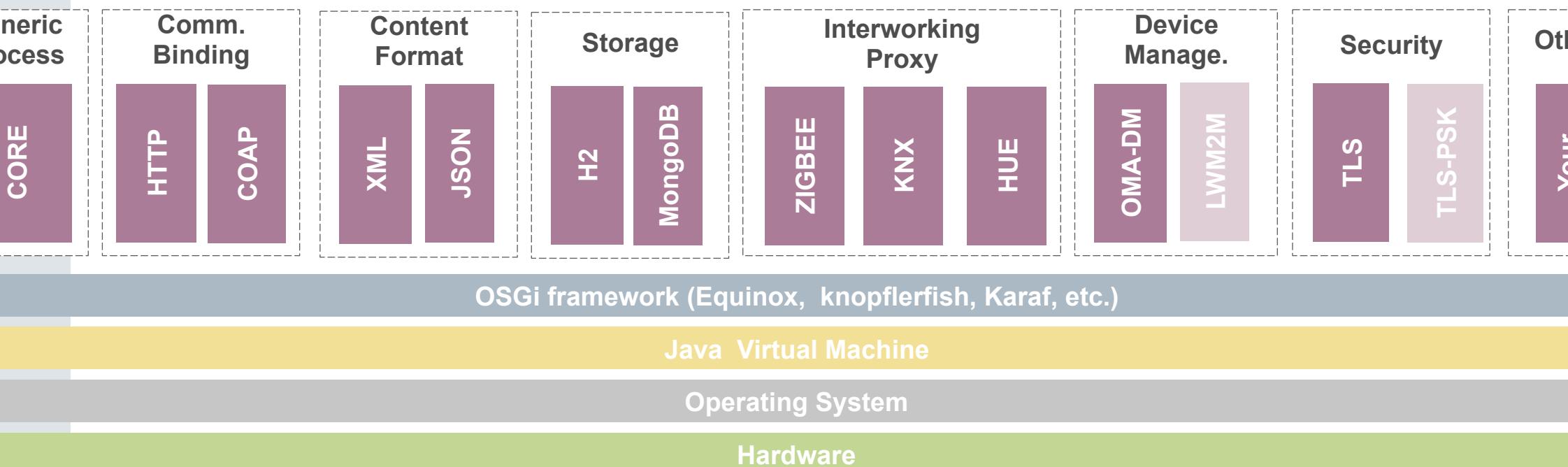
# How the value is retrieved



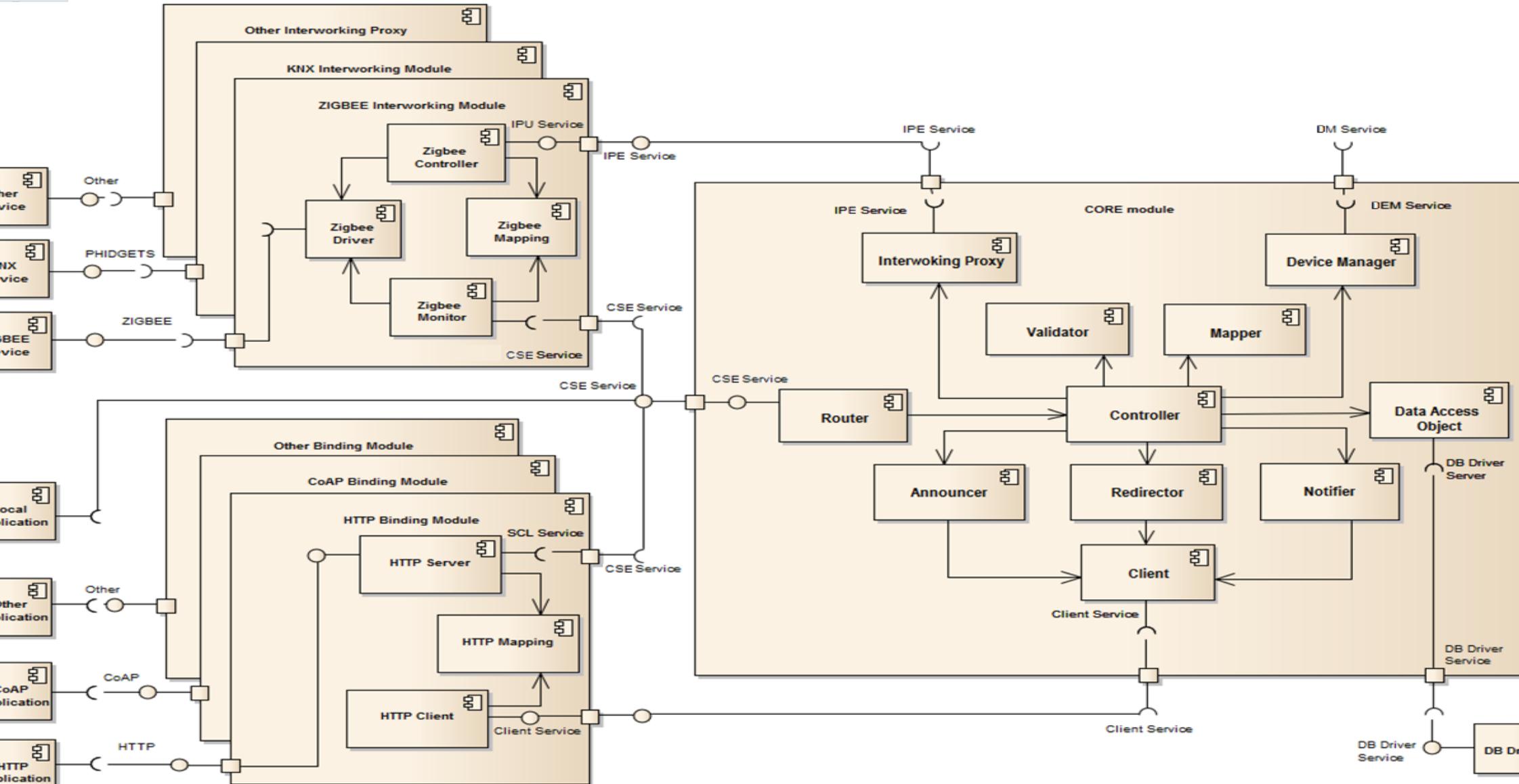
[www.websequencediagrams.com](http://www.websequencediagrams.com)

# OM2M Building Blocks

- OM2M is a java platform running on top of an OSGi runtime
  - Highly extensible via plugins.
  - Flexible OSGi container: Equinox, Knopflerfish, or others.
  - Flexible database: SQL or NoSQL.
- Each CSE includes required plugins and is build as an Eclipse product using maven and Tycho.



# OM2M components diagram overview

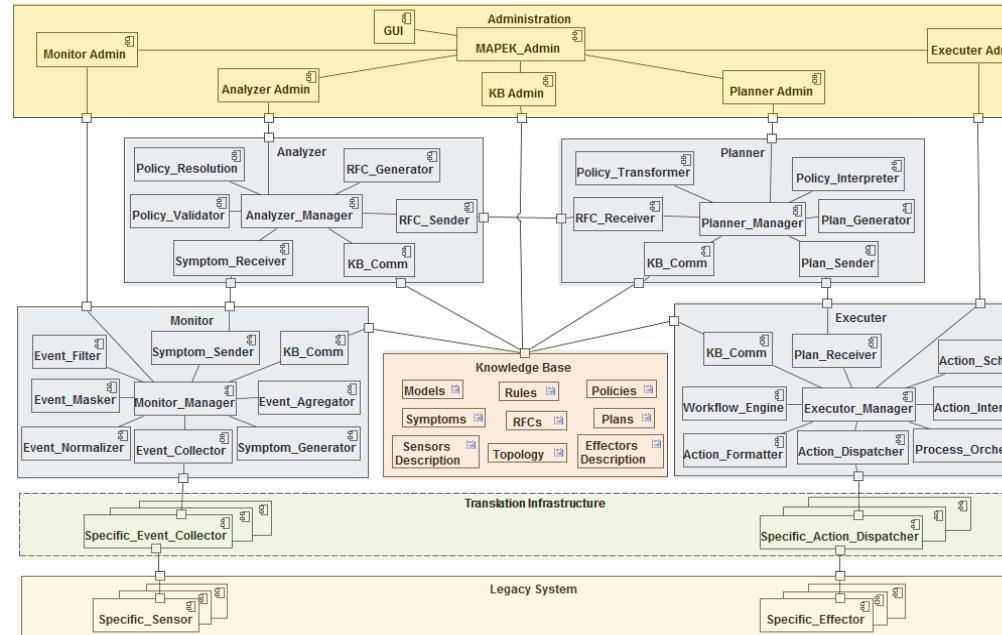
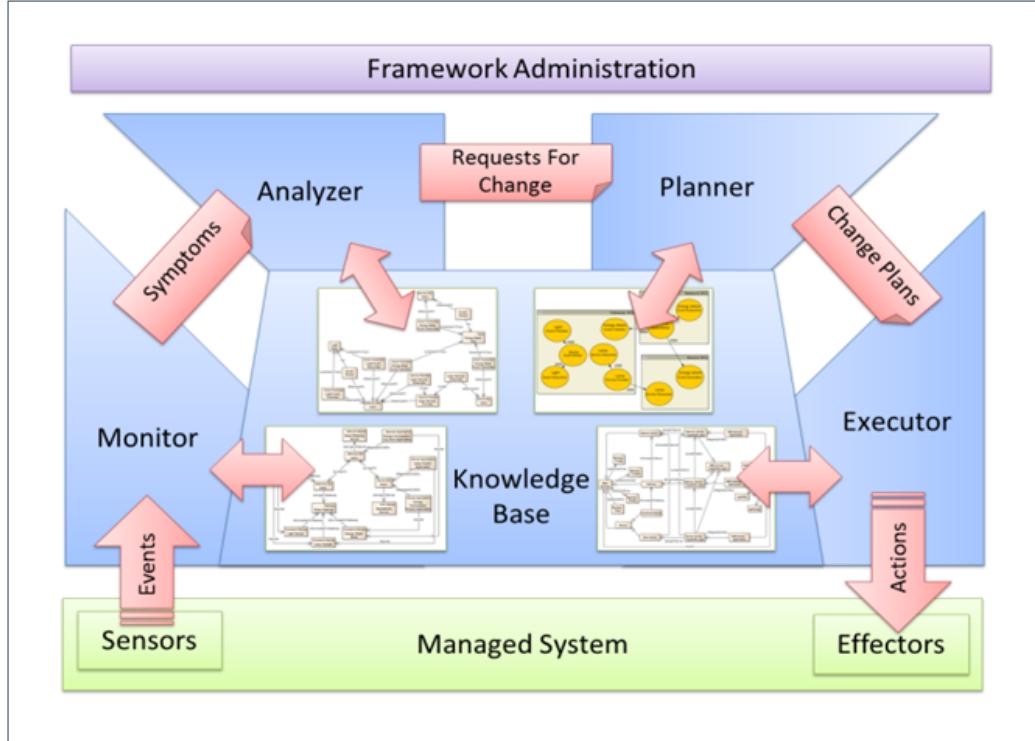


# Second remarks

- › Standards can decrease the costs of development and maintenance
- › Standards allow to have multiple suppliers
- › Standards make it easier for users
- › Difficulties to chose the good standard
- › A standard like OneM2M allows to hide the heterogeneity
- › Opensource increases the numbers of users and create communities
- › Opensource increases the visibility of your work
- › Opensource helps to extend the capacity of the software
- › Opensource can create important feedback to standard

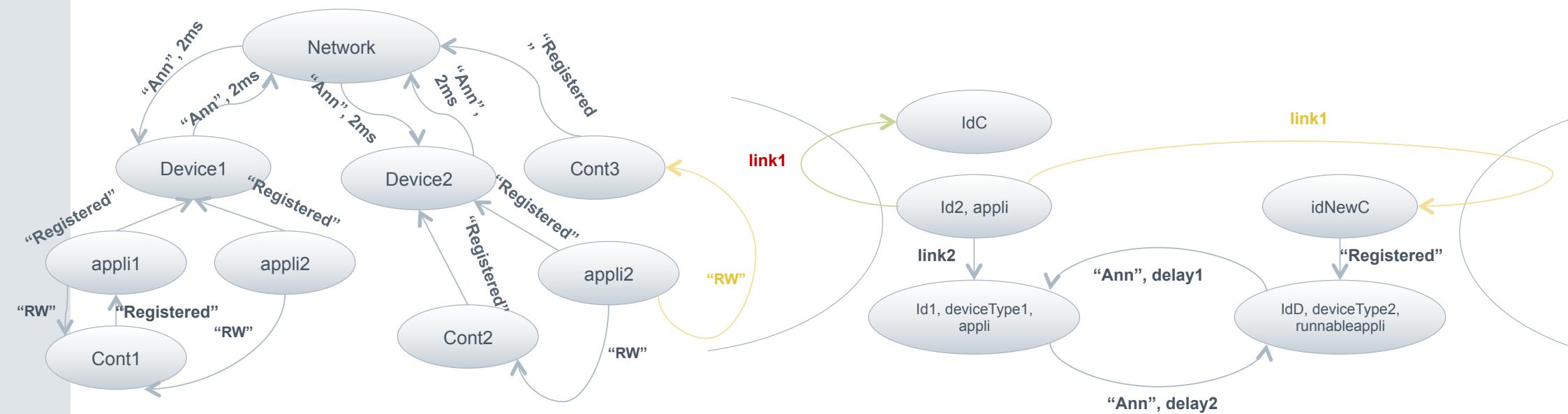
# Management of smart system

- › Autonomic computing:
  - Self-configuration, Self-healing, Self-optimization, Self-protection
  - FRAMESELF: Multi-model autonomic loop
  - Logics, graph grammars, queuing models, timed automata



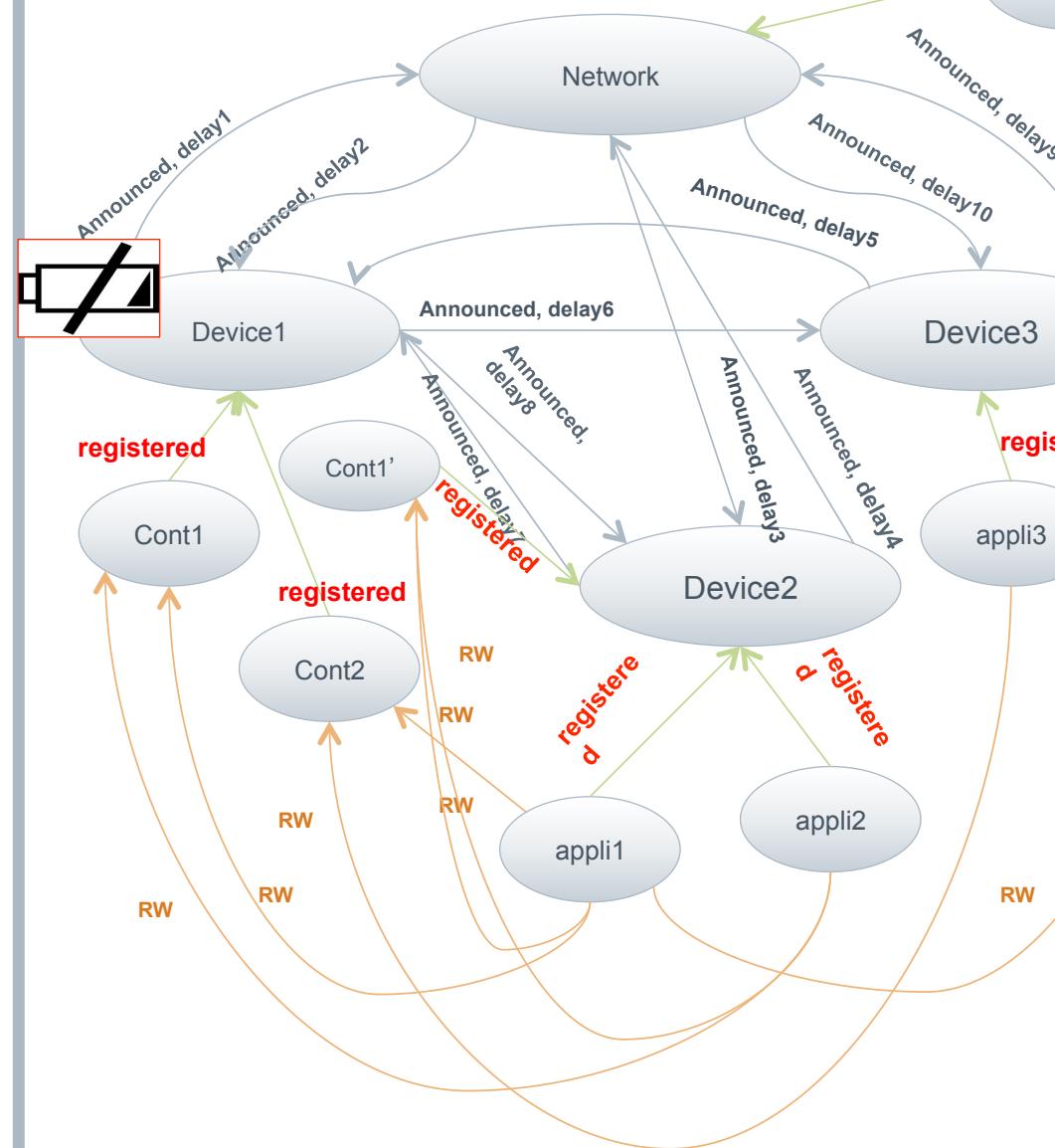
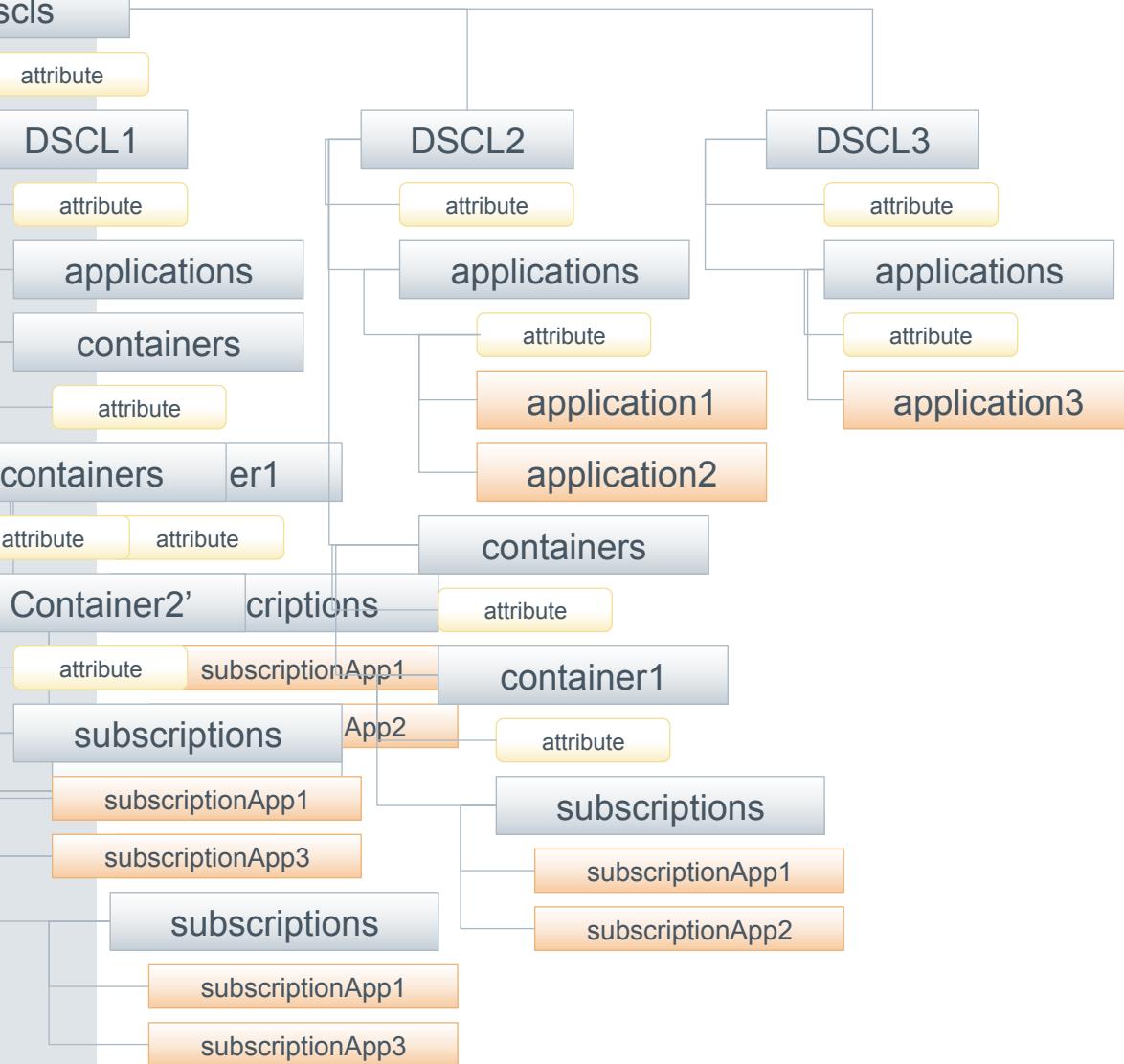
# Graph-based modeling and graph rewriting systems

- The state of the system at a given time is represented by an attributed graph.



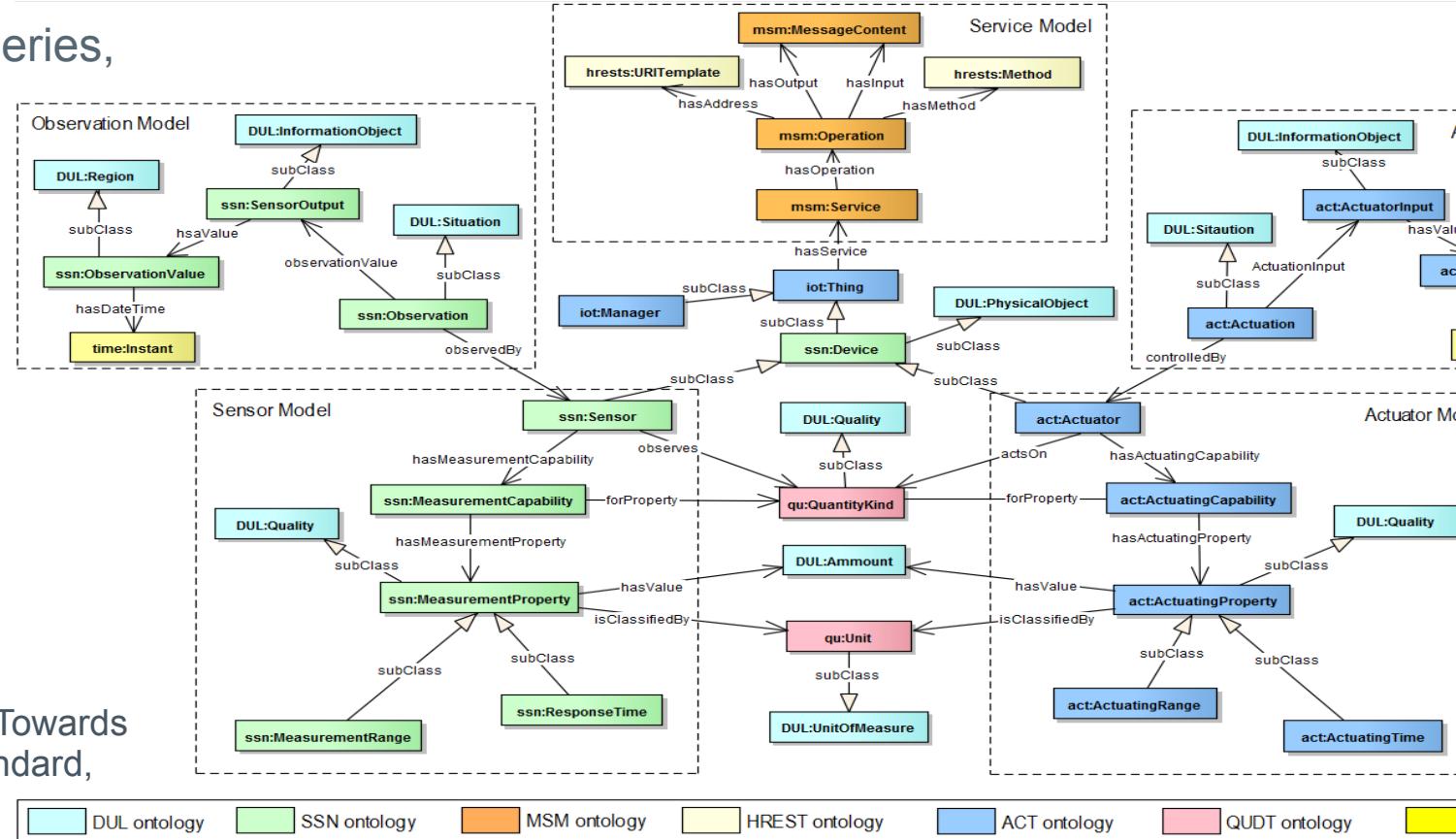
GRR: Redirection of an input and/ or output of an application

- System modification are modeled by graph rewriting rules (GRR).



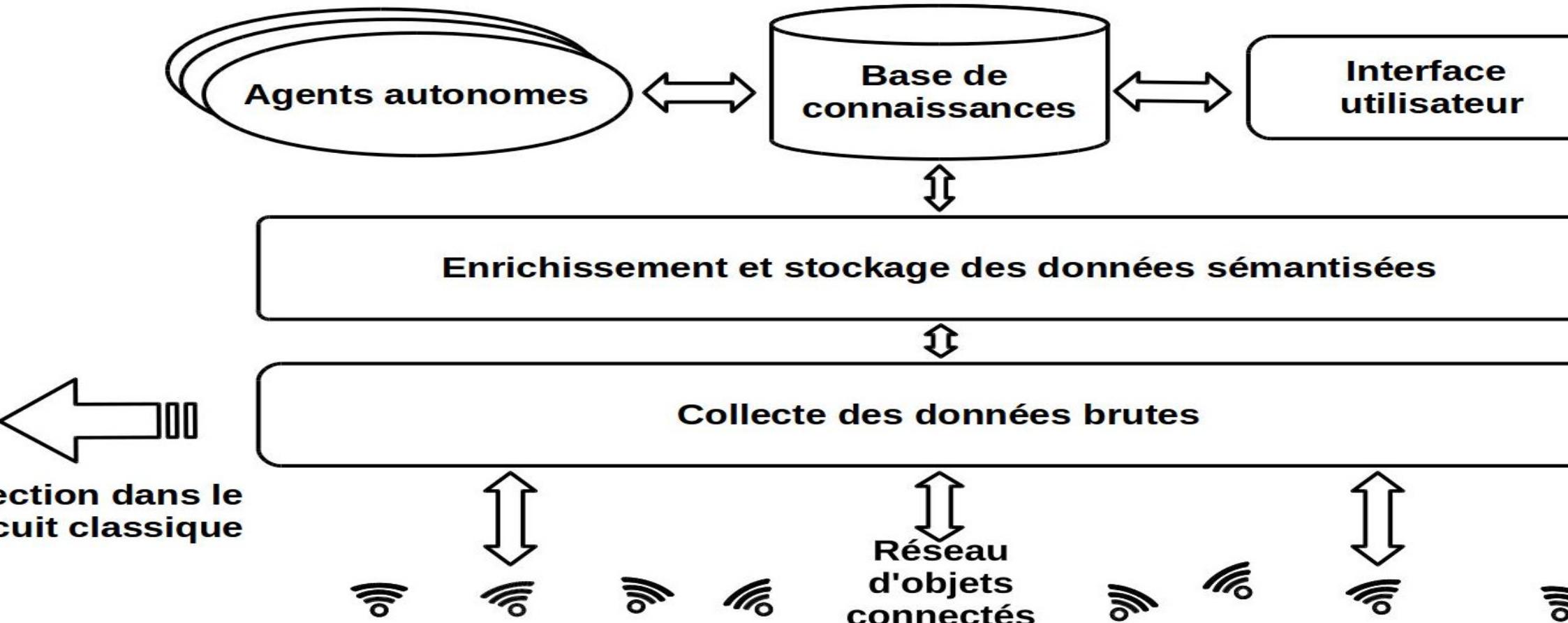
# Data management Semantic in M2M

- › Formal description - Machine process ability
  - › Reasoning/Computation:
    - semantics enabled search,
    - answering complex queries,
    - hypothesis validation,
    - mining
  - › Ontology: IoT-O
- ⇒ Base for a proposition  
for standardisation



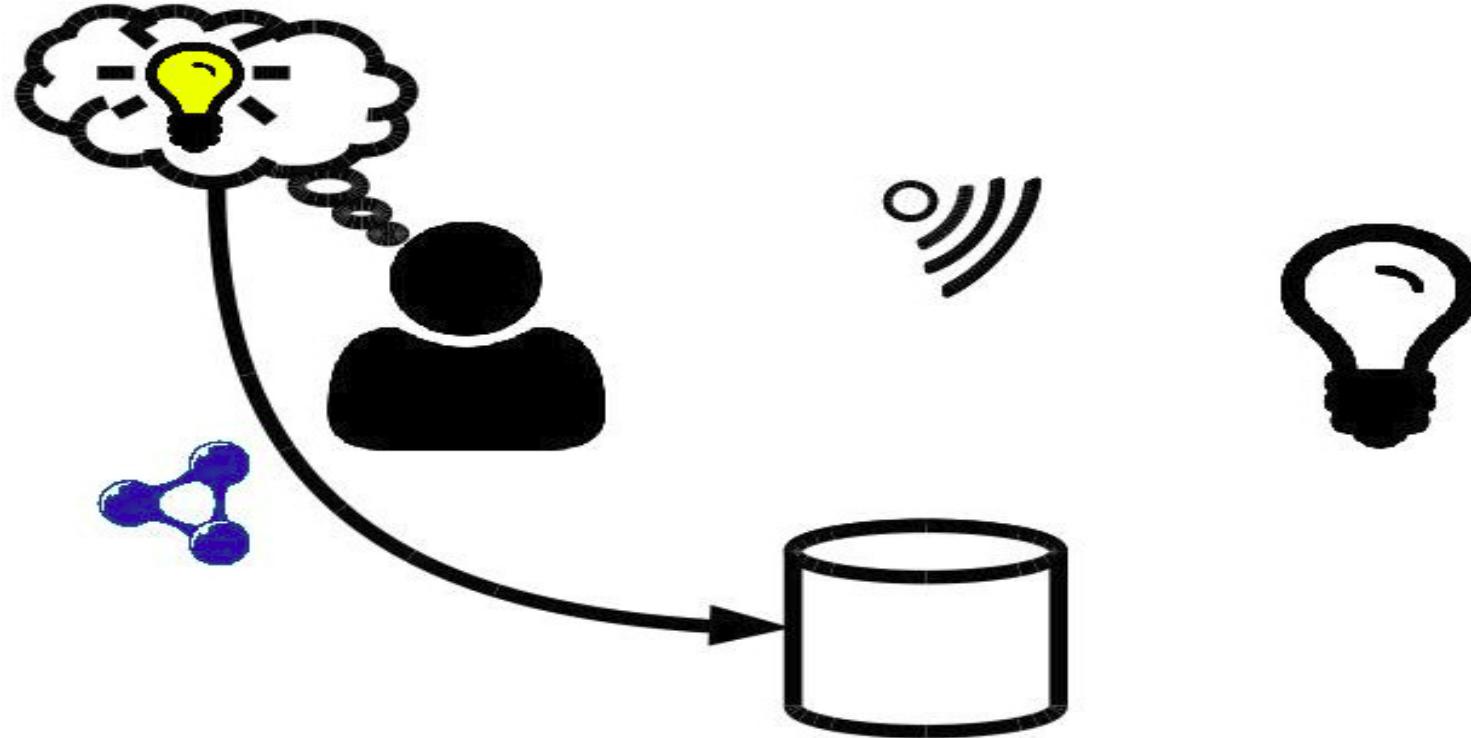


# Gestion autonome de ADREAM

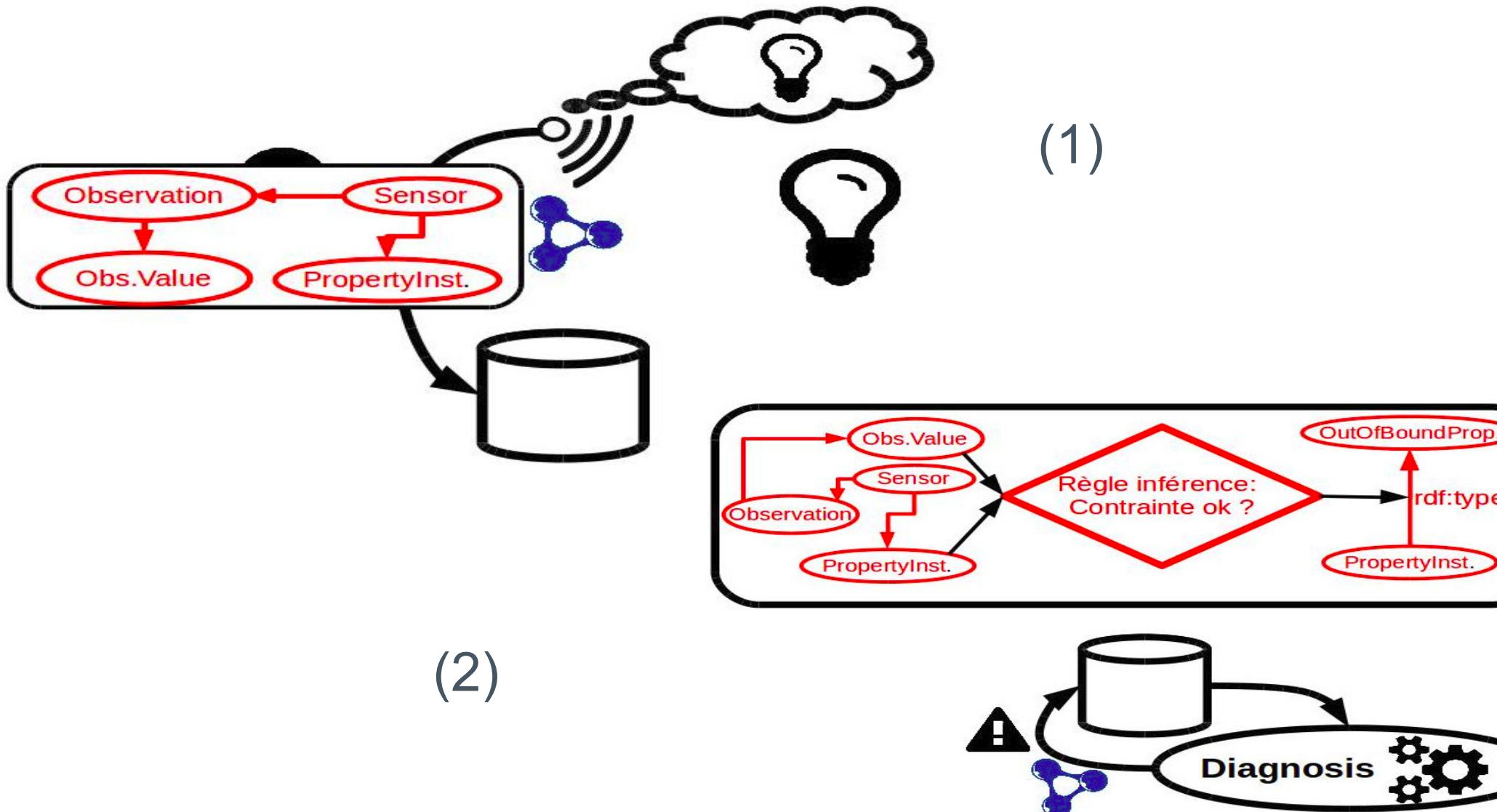




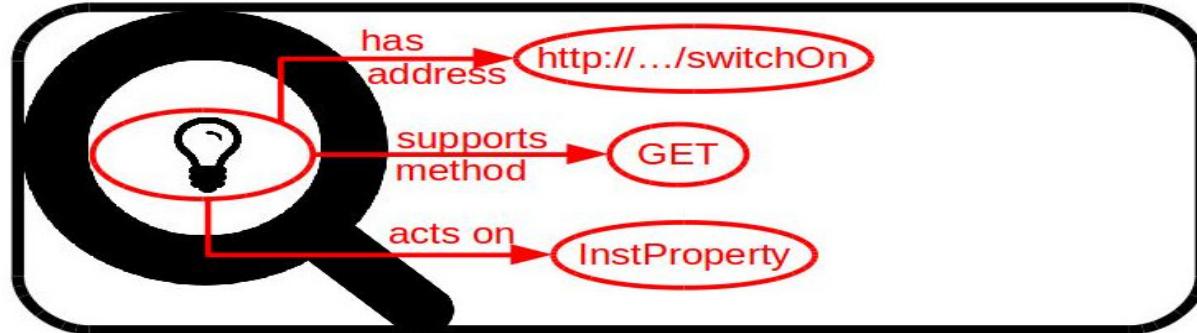
# Création de contrainte



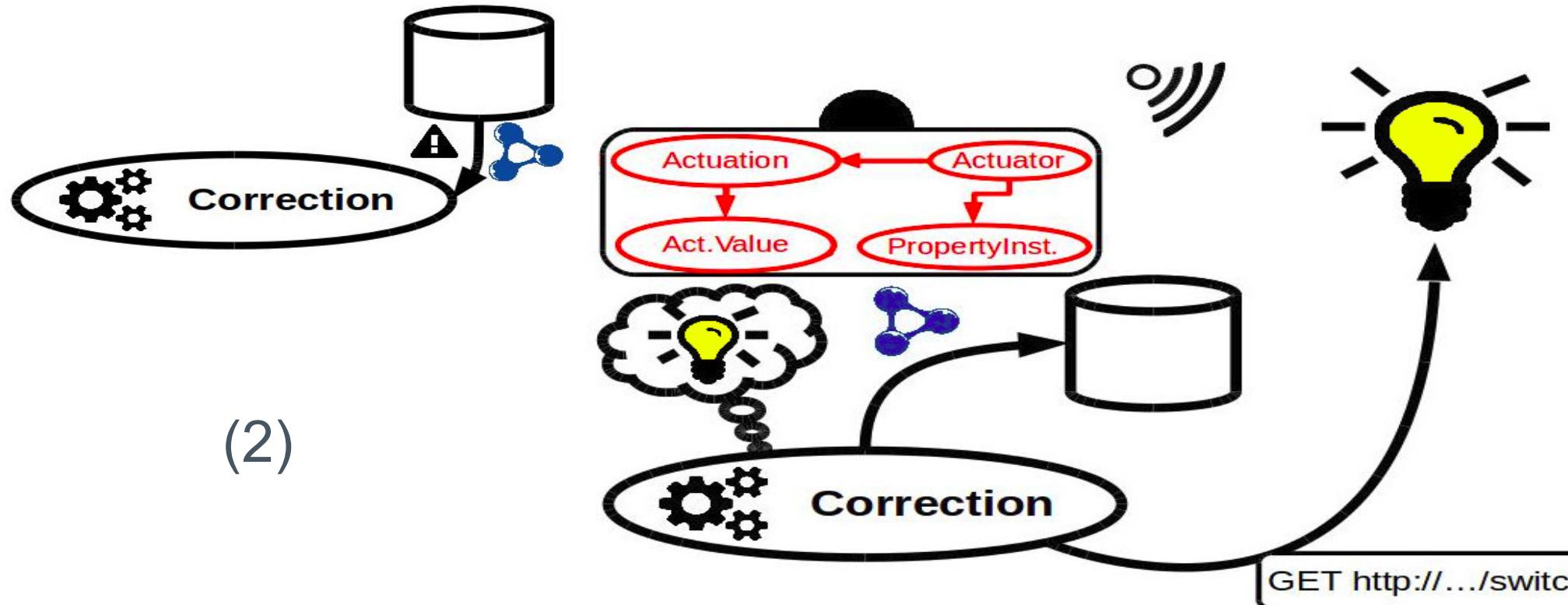
# Enrichissement d'observations



# Correction

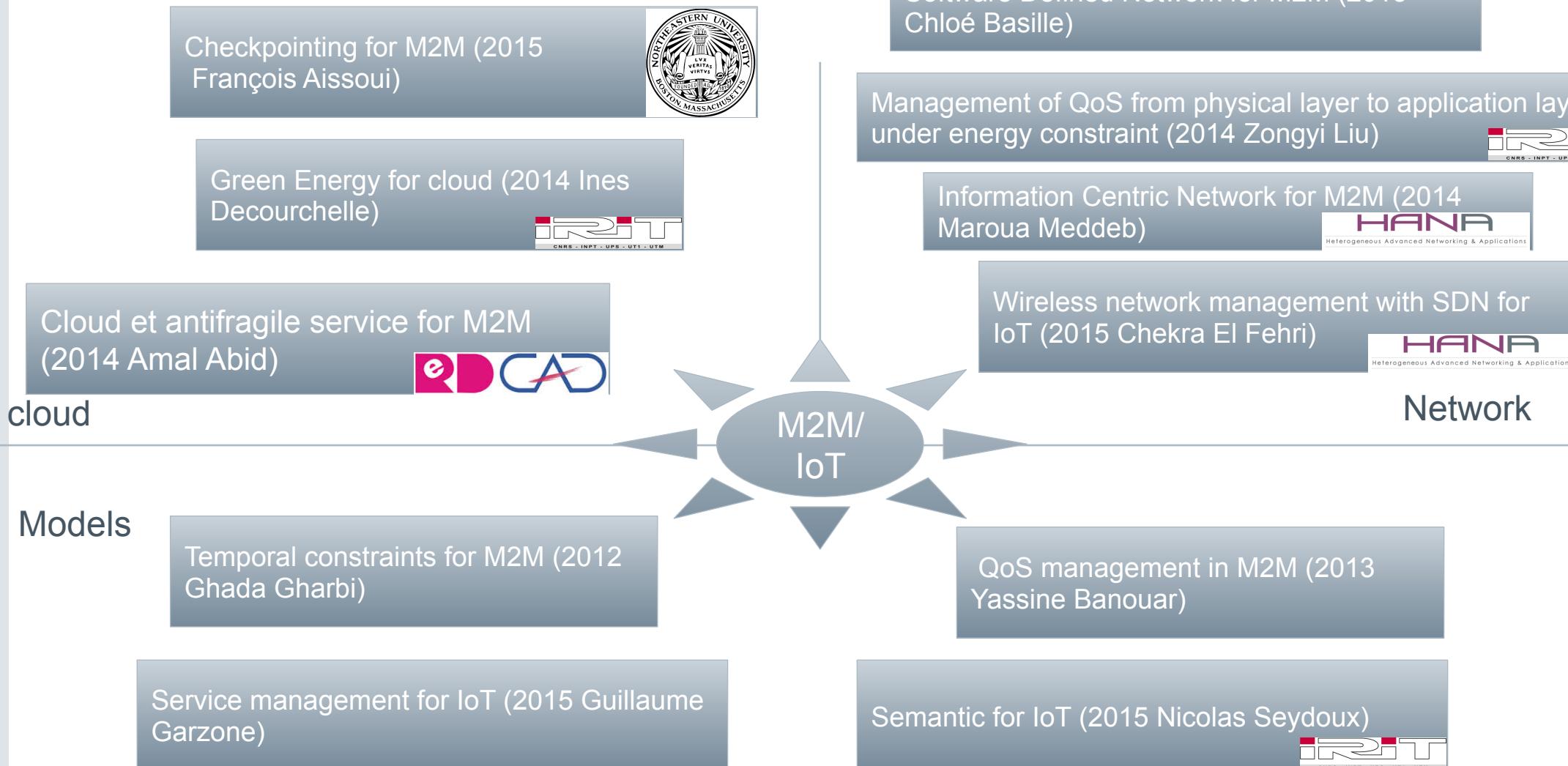


(1)



GET http://.../switchOn

# Actual Research activities : under the Phd works

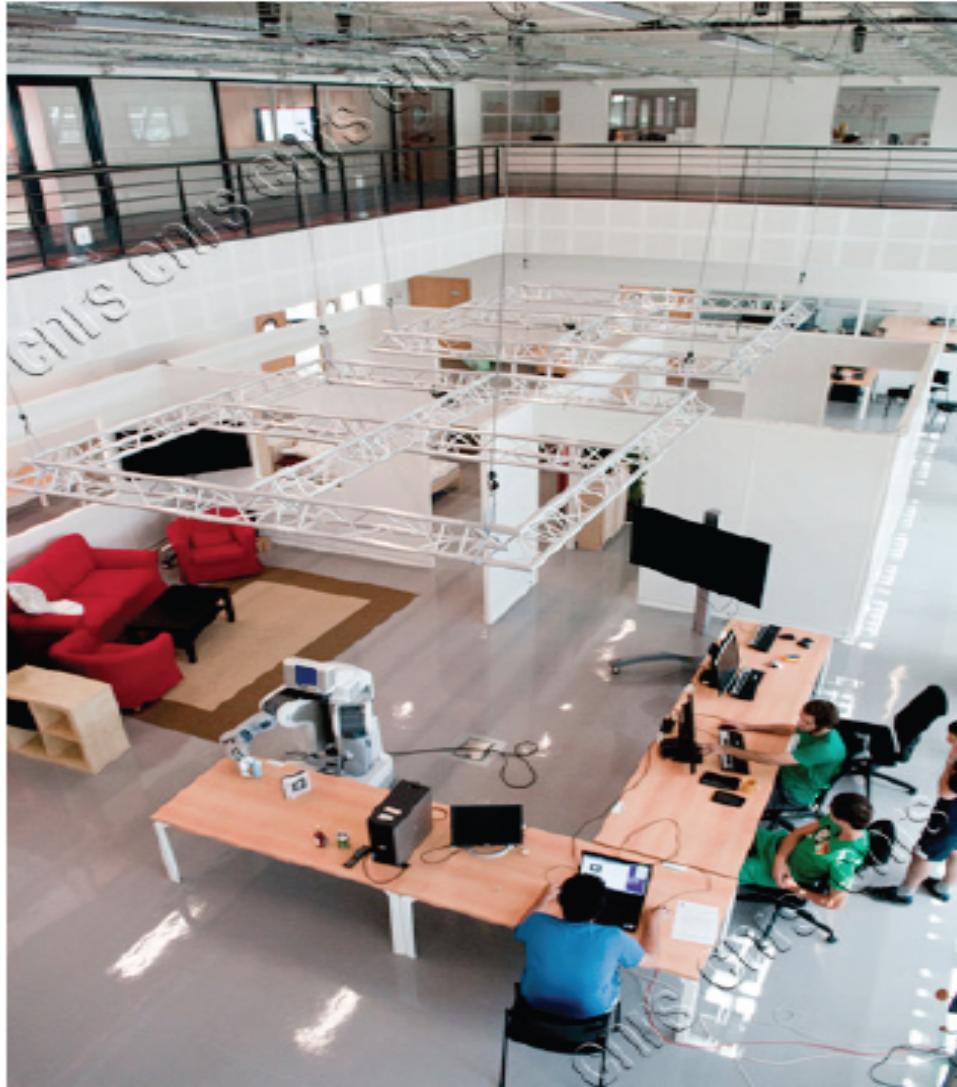


# ADREAM Platform

*Instrumented building with photovoltaic production and optimization of energy*



# Building modularity





Thank you for your attention



[www.om2m.org](http://www.om2m.org)