FIWARE

Presentation@ Eclipse IoT Days
Grenoble, April 28 2016

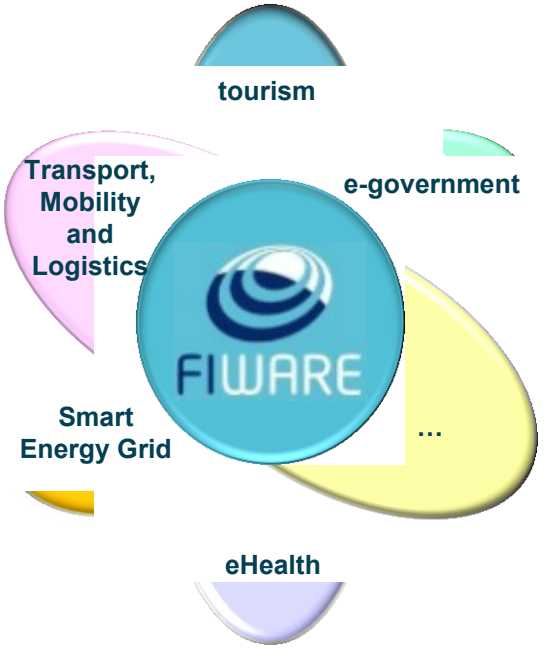
Gilles Privat, Orange Labs

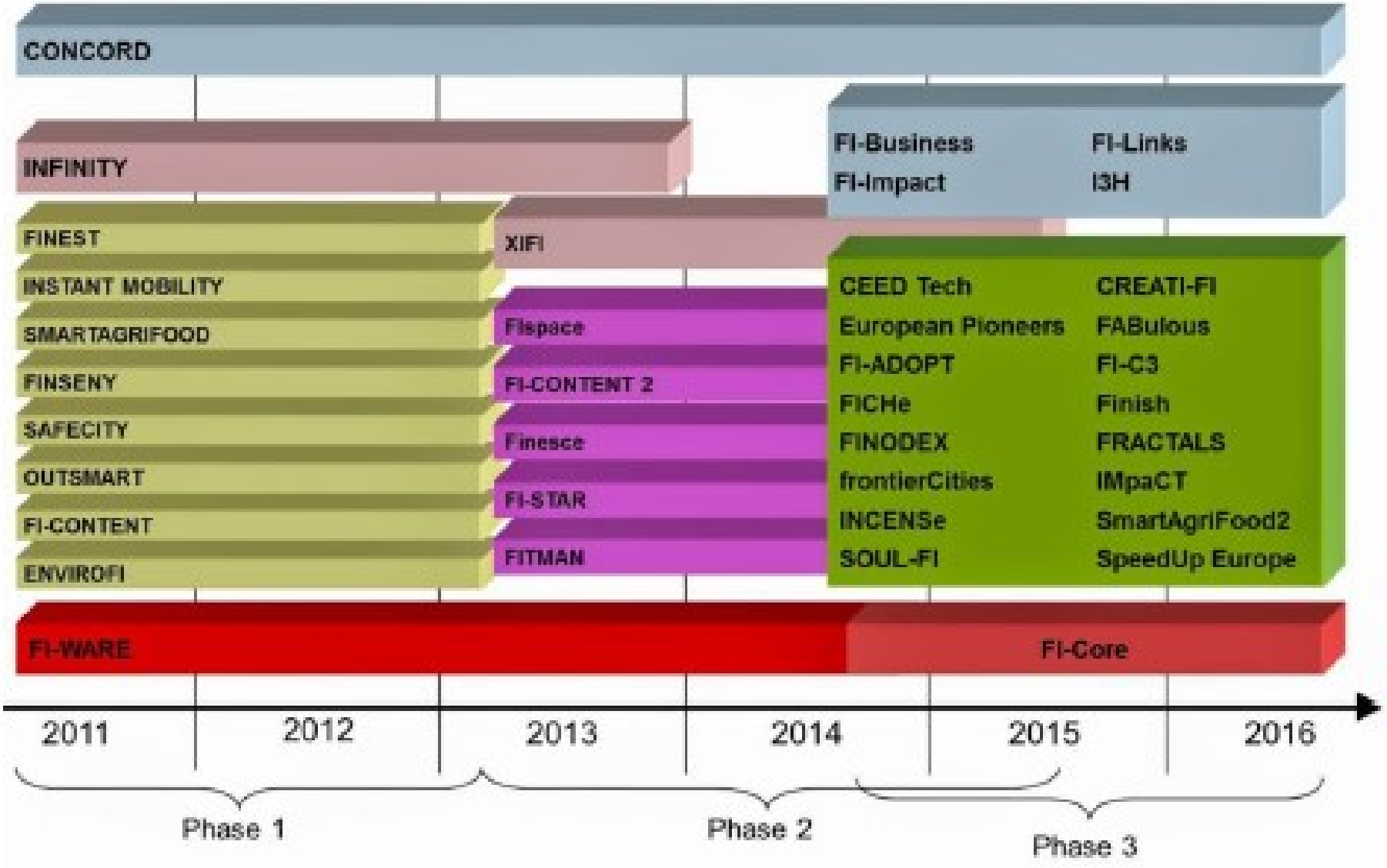
http://fiware.org

http://lab.fiware.org

The FIWARE Programme (originally FI-PPP)

- Goal: capture opportunities derived from the new wave of digitalization of life and businesses that is coming
- Strategy: Build an ecosystem that will work as catalyst for capturing the opportunities, engaging data providers and entrepreneurs
- Pillars:
  - FIWARE : a generic, open standard platform which serve the needs of developers in multiple domains
  - FIWARE Lab : a meeting point where innovation happens and data providers plus entrepreneurs can be engaged
  - FIWARE Ops : the suite of tools easing deployment and operation of FI-WARE instance nodes
  - FIWARE Accelerate : a program that funds developers and entrepreneurs, and ignites roll-out of the ecosystem
  - FIWARE Mundus : reach a global footprint, opening to regions that share the same vision and ambition



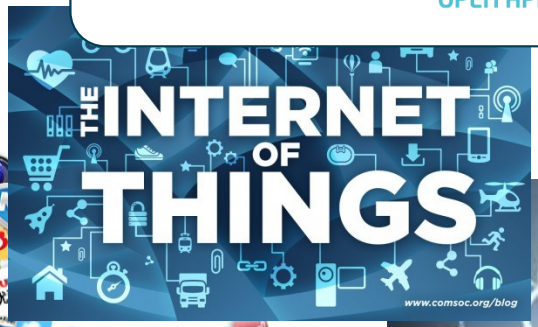

CONCORD
INFINITY
FINEST
INSTANT MOBILITY
SMARTAGRIFOOD
FINSENY
SAFECITY
OUTSMART
FI-CONTENT
ENVIROFI
XIFI
Fispace
FI-CONTENT 2
Finesce
FI-STAR
FITMAN
FI-Business
FI-Impact
FI-Links
I3H
CEED Tech
European Pioneers
FI-ADOPT
FICHe
FINODEX
frontierCities
INCENSe
SOUL-FI
CREATI-FI
FABulous
FI-C3
Finish
FRACTALS
IMpaCT
SmartAgriFood2
SpeedUp Europe
FI-WARE
FI-Core
2011
2012
2013
2014
2015
2016
Phase 1
Phase 2
Phase 3

Understanding FIWARE (Open Standard Platform)

(advanced OpenStack-based Cloud + rich library of Generic Enablers)

FIWARE

OPEN APIs FOR OPEN MINDS



Driven by implementation

Sustainability ensured

FIWARE

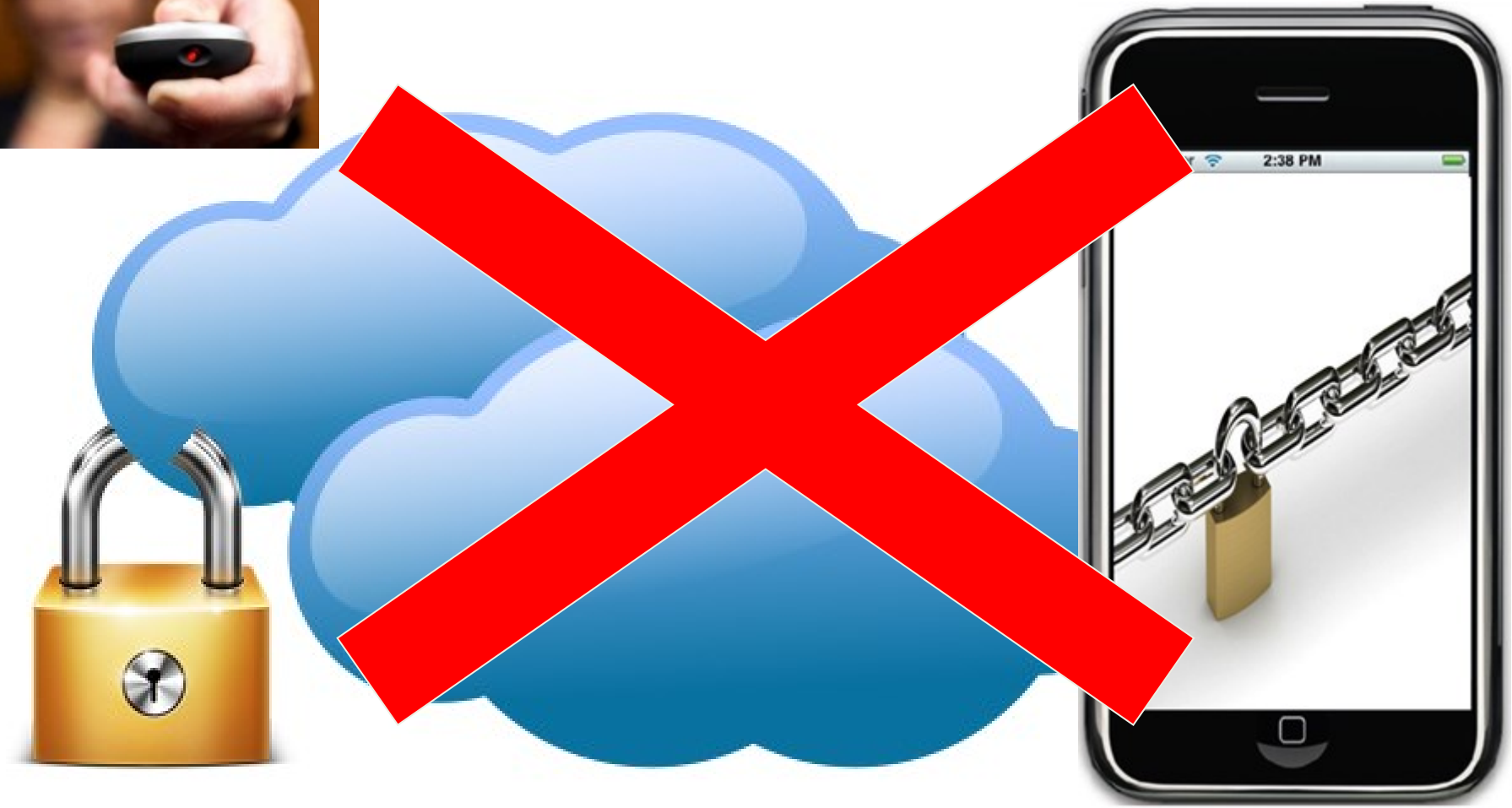
Why an open standard platform is required

- Avoid vendor lock-in:
  - Standard Southbound APIs for sensor providers
  - Standard Northbound APIs offered to applications
  - Portability across platform providers
  - Interoperability of apps on top of different providers

- Larger community of developers (critical mass, economies of scale)
  - True innovation
  - More competition, leading to cost savings

- Not any standard is enough
  - Modularity
  - Allow different business models
  - Integration with standard open data platform
  - Non-intrusive (smooth integration with legacies)

Open Source. Avoid vendor lock-in
You have the control



FIWARE

PRESS RELEASE

ATOS, ENGINEERING, ORANGE AND TELEFÓNICA ANNOUNCE THE CREATION OF THE FIWARE FOUNDATION TO ACCELERATE THE DEVELOPMENT OF SERVICES IN THE INTERNET OF THINGS

1. The four companies are now announcing their plans to bring FIWARE to other domains like Smart Industry or Smart Agrifood beyond Smart Cities.
2. The FIWARE Accelerator program has demonstrated how innovative SMEs and startups can build IoT-enabled solutions and introduce great improvements in business processes across several sectors.
3. The FIWARE platform provides a solid technology foundation for digitizing the European Industry

FIWARE Generic Enablers (GEs)

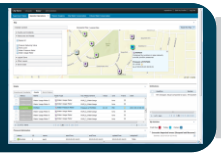
- A FIWARE Generic Enabler (GE):
  - set of general-purpose **platform functions** available through **APIs**
  - Building with other GEs a **FIWARE Reference Architecture**

- **FIWARE GE Specifications are open** (public and royalty-free)
- **FIWARE GE implementation (FIWARE GEi):**
  - Platform product that implements a given GE Open Spec
  - There might be multiple compliant GEis of each GE Open Spec
- **One open source reference implementation** of each FIWARE GE (**FIWARE GEri**):
  - Well-known open source license
  - Publicly available **Technical Roadmap** updated in every release

- Available FIWARE GEis, GEris and incubated enablers are published on the **FIWARE Catalogue**

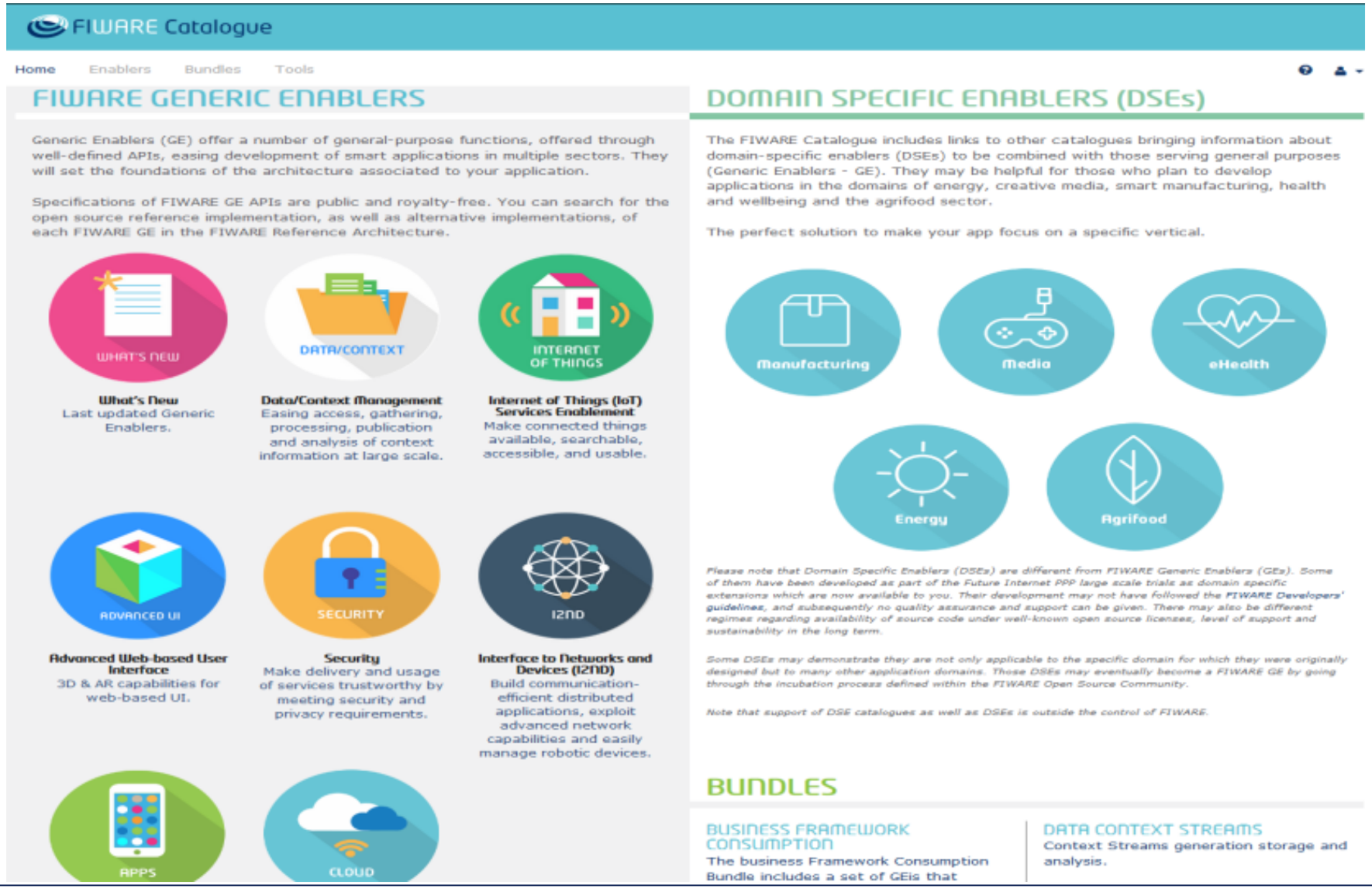
FIWARE major differential features

FIWARE Catalogue

Cloud		• Federation of infrastructures (private/public regions) • Automated GE deployment
Data/Services Delivery		• Complete Context Management Platform • Integration of Data and Media Content
IoT		• Easy plug&play of devices using multiple protocols • Automated Measurements/Action ←→Context updates
Apps		• Visualization of data (operation dashboards) • Publication of data sets/services
Web UI		• Easy incorporation of advanced 3D and AR features • Visual representation of context information
Security		• Security Monitoring • Built-in Identity/Access/Privacy Management
I2ND		• Advanced networking (SDN) and middleware • Interface to robots

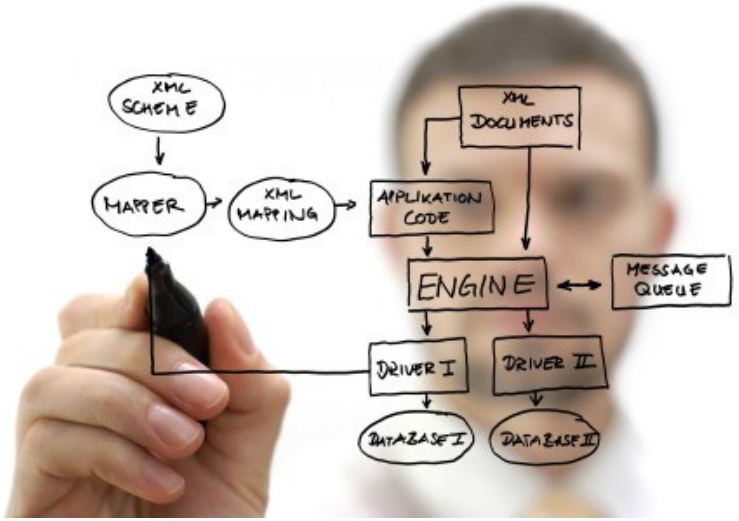
FIWARE

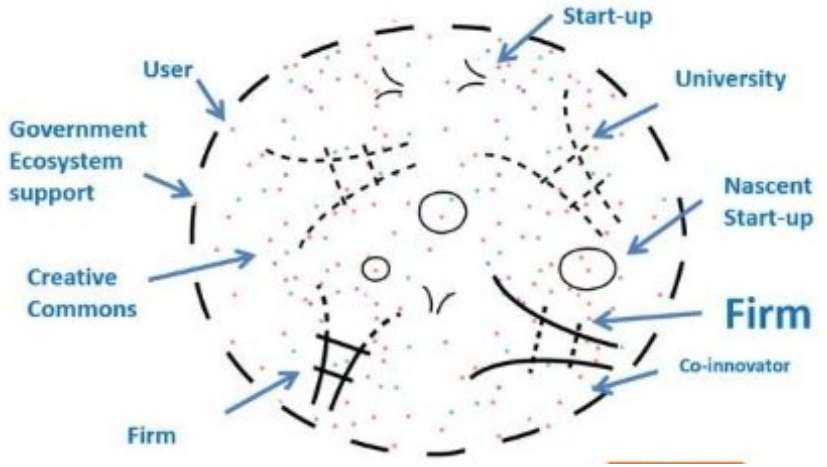
catalogue.fiware.org



FIWARE Chapters

Platform ←→ Ecosystem





Open Standard Platform

Sustainable Open Innovation Ecosystem

FIWARE
OPEN APIs FOR OPEN MINDS

FIWARE Lab
Spark your imagination

FIWARE Ops
Easing your operations

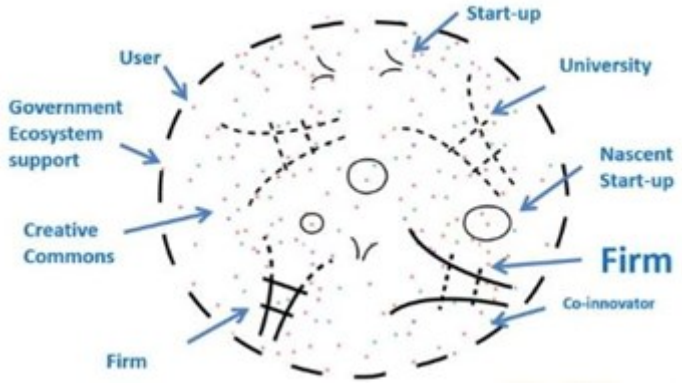
FIWARE

A live instance of FIWARE available to developers for free experimentation

Not only platform, tools…this is powered by data!

FIWARE Lab

Spark your imagination



FIWARE

FIWARE Lab: the “meeting point” where innovation takes place

FIWARE LAB

App Customers and Data providers

- Connect to entrepreneurs
- Put their data at work
- Bring new innovative services to end users
- Be more efficient
- Social Reputation

Entrepreneurs, Developers

- Develop once for a large market
- Easily meet potential customers
- Marketing, promotion
- Ability to test with real data and end users
- Simple yet powerful APIs that accelerate product development

FIWARE Lab

Spark your imagination

FIWARE Technology Providers

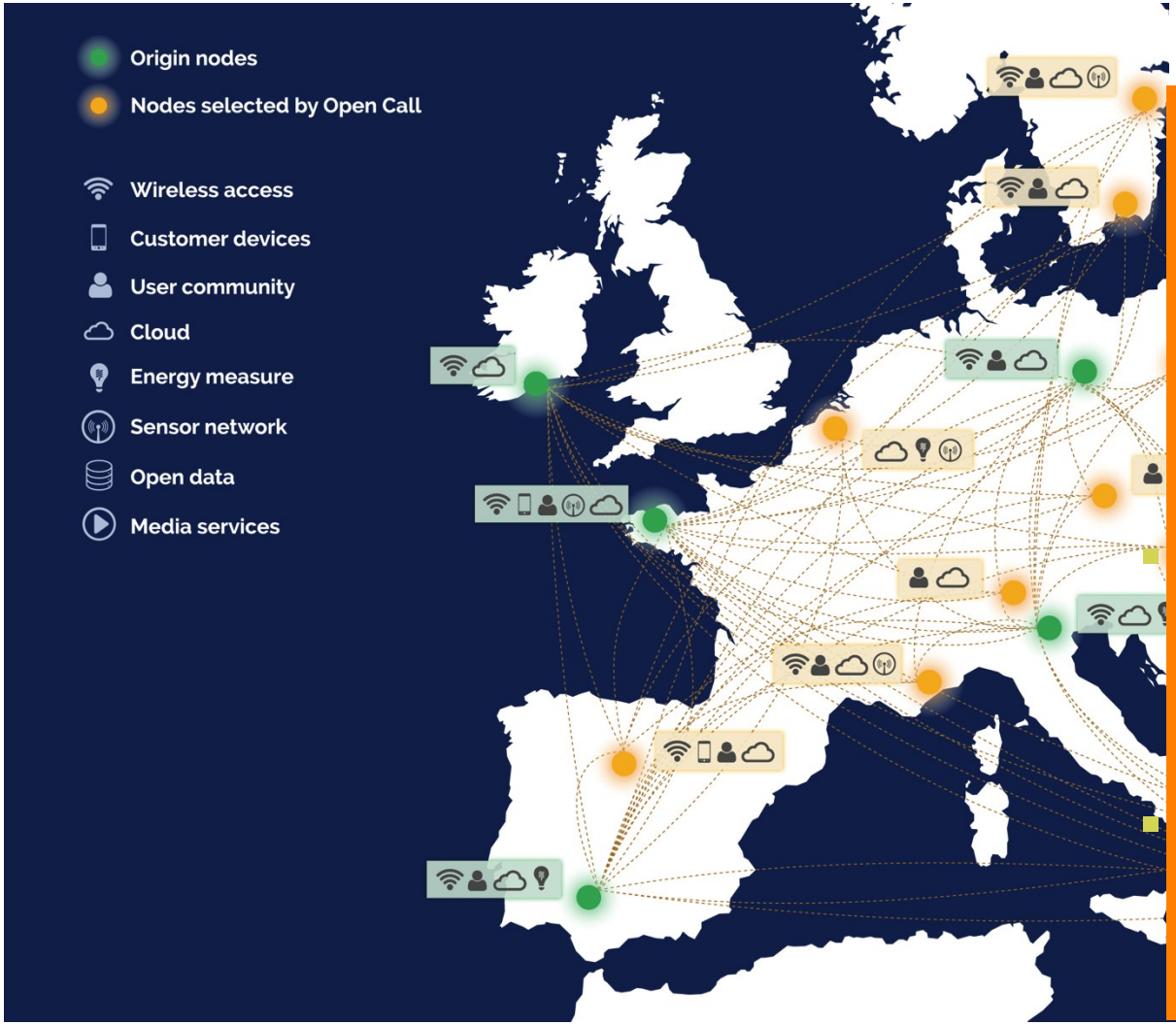
- “Coopetitive” approach
- Connect to entrepreneurs: jointly exploit the opportunities

- 4,2 M€ promotion campaign
  - Campus Party events
  - Startup Weekend events
  - Chambers of Commerce
  - 870 K€ in prizes
- 100 M€ of funding devoted to entrepreneurs in phase 3 of the FIWARE program

FIWARE

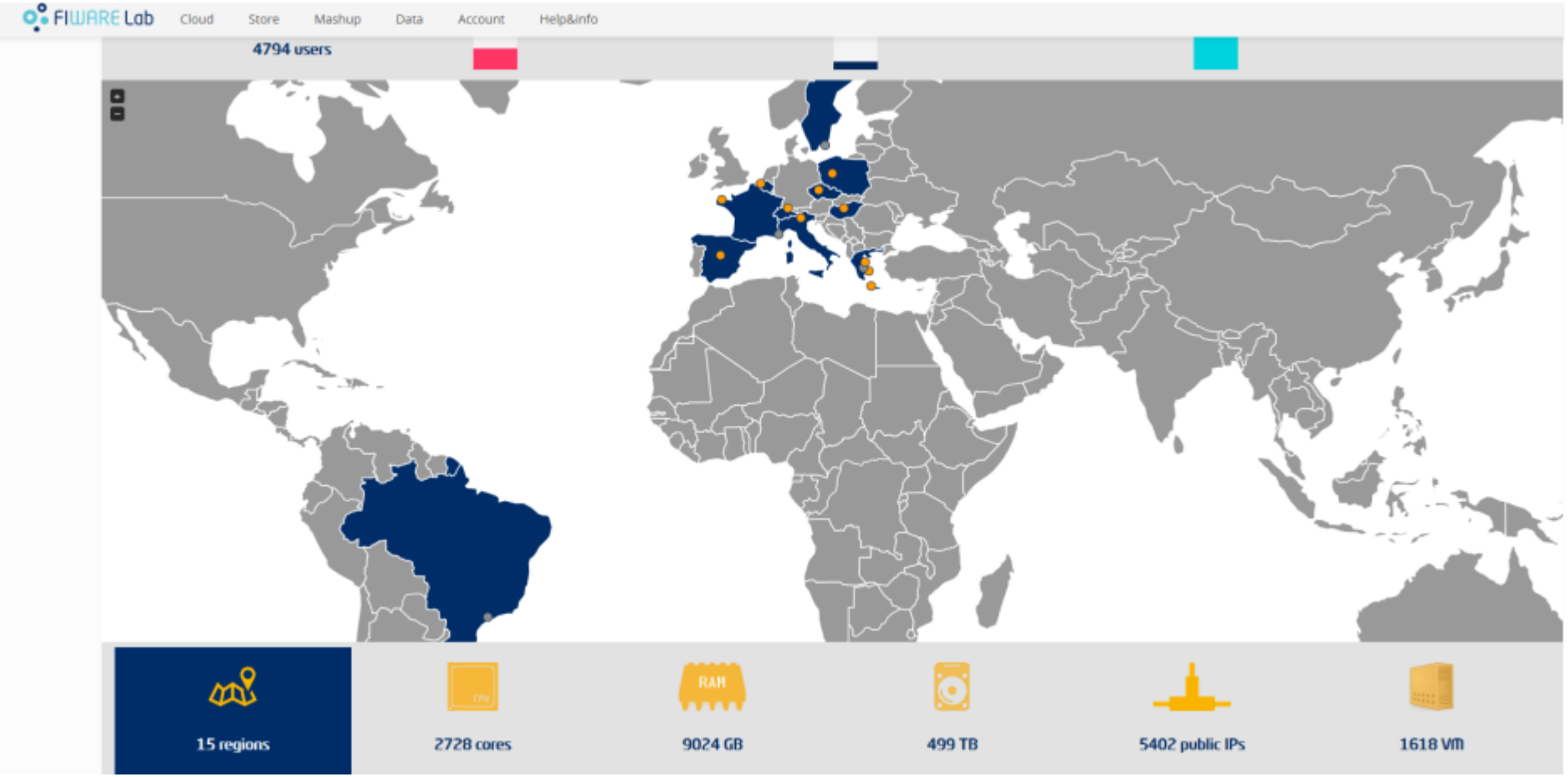
Extending the FIWARE Lab offering for service providers and developers

FIWARE Lab
Spark your imagination



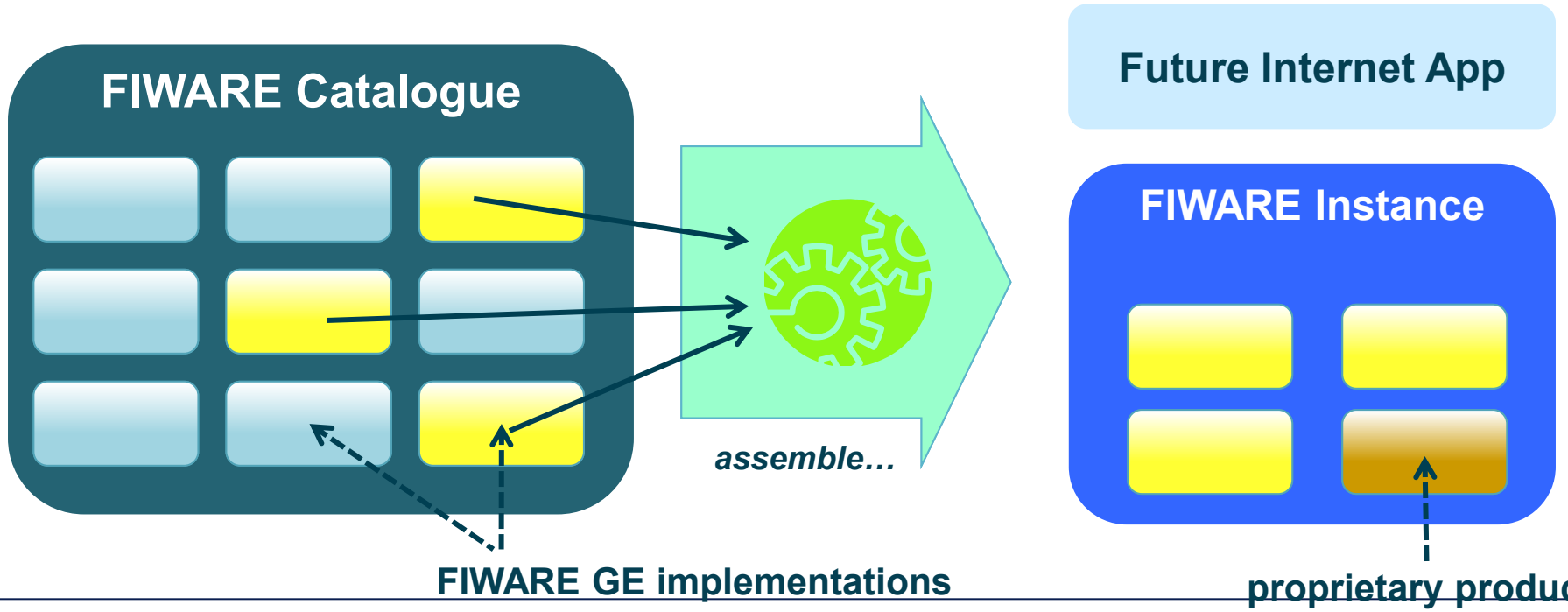
- 12 nodes in Europe providing up to 3000+ cores, 16TB+ Ram, 750TB+ HD
- Creation of nodes in Mexico (1000+ cores) and Brazil
- Level 1 and Level 2 support for the nodes
- Showcases for developers, infrastructures, smart businesses

FIWARE Lab nodes around the world

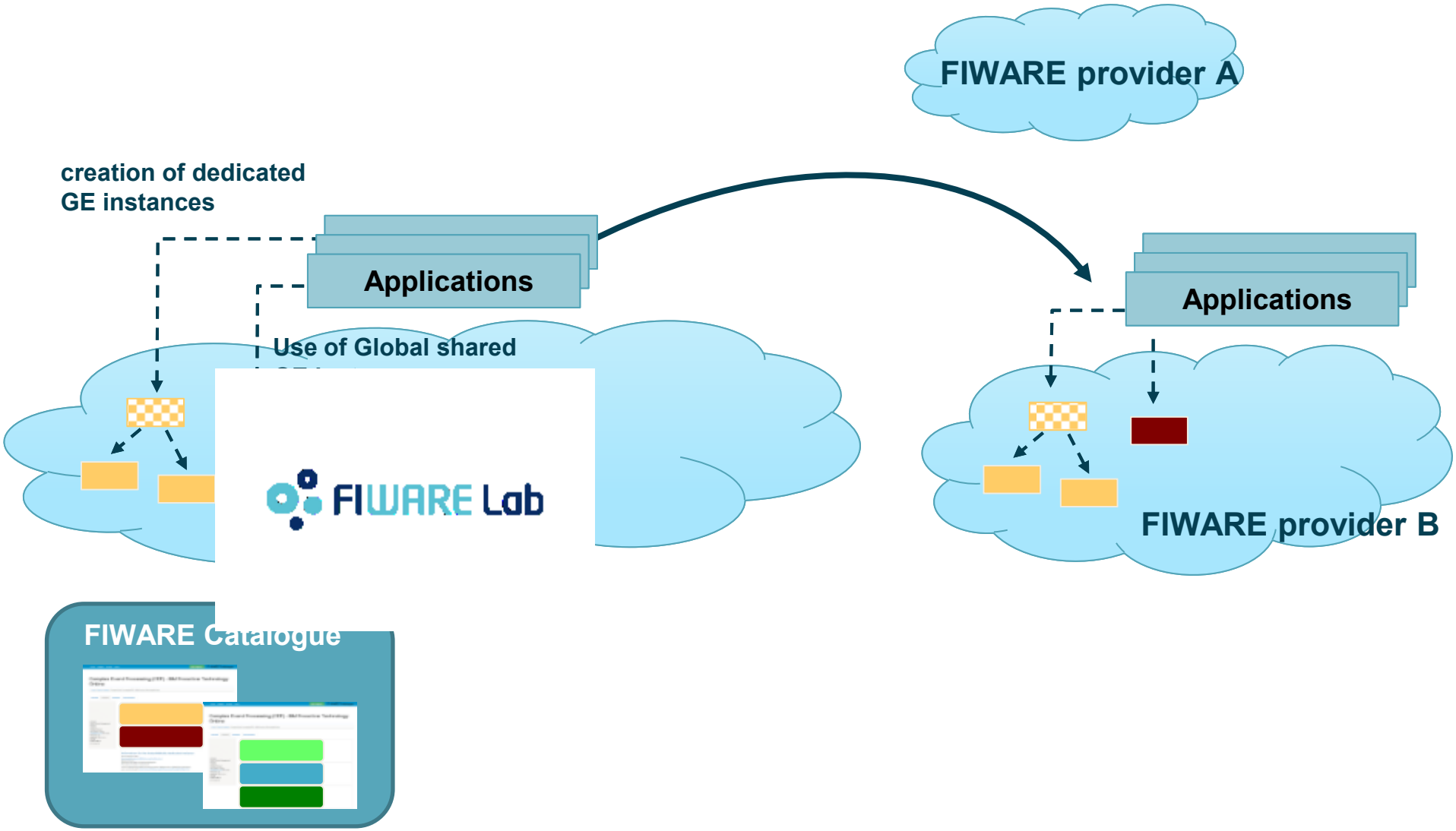


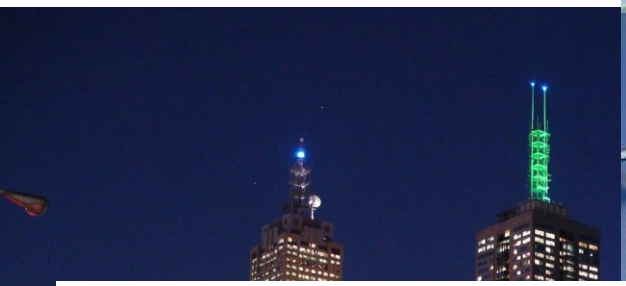
FIWARE Instances

- Future Internet Applications run on top of “FIWARE Instances” that are built by “FIWARE Instance Providers” upon:
  - selection of FIWARE GEis (products) from the FIWARE Catalogue.
  - assembly of selected FIWARE GEis with proprietary added-value products.



Building the FIWARE ecosystem: the vision





What does FIWARE bring to Smart Cities?

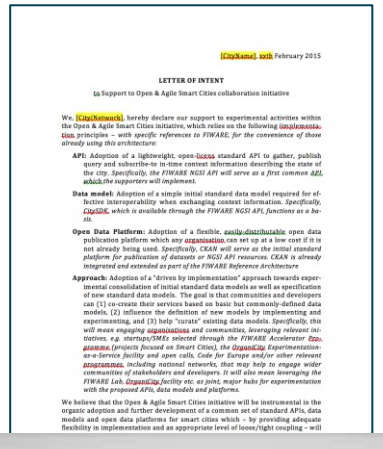
Why standards are relevant for Smart Cities

- The current lack of standards means an impediment for the development of Smart Cities
  - The target market for solution and services is not large enough to attract investment
  - Solutions and services become tailor made, therefore expensive.
  - Cities get locked-in to solution/application providers

- Pillars of the FIWARE programme support the creation of a sustainable ecosystem:
  - The FIWARE platform brings the necessary standards
  - The FIWARE Lab becomes the meeting point where cities meet entrepreneurs and innovation takes place
  - The FIWARE Acceleration programme helps to attract a first wave of developers (startups/SMEs)
  - The FIWARE mundus programme helps to expand globally
  - The FIWARE Ops suite of tools ease the task to deploy FIWARE instances

Open and Agile Smart Cities initiative

- Launch of the Open and Agile Smart at CeBIT:
  - Denmark: Copenhagen, Aarhus and Aalborg
  - Finland: Helsinki, Espoo, Vantaa, Oulu, Tampere, Turku
  - Spain: Valencia, Santander, Málaga, Sevilla
  - Portugal: Porto, Lisbon, Fundão, Palmela, Penela and Águeda
  - Belgium: Brussels, Ghent and Antwerp
  - Italy: Milan, Palermo and Lecce
  - Brazil: Olinda (Recife), Anapólis (Goiás), Porto Alegre (Rio Grande do Sul), Vitória (Espírito Santo), Colinas de Tocantins (Tocantins) and Taquaritinga (São Paulo)
- Other countries and cities welcome to join !
- Some of them already in the pipeline



[CityName], xxth February 2015

LETTER OF INTENT

to Support to Open & Agile Smart Cities collaboration initiative

We, [CityNetwork], hereby declare our support to experimental activities within the Open & Agile Smart Cities initiative, which relies on the following implementation principles – *with specific references to FIWARE, for the convenience of those already using this architecture:*

API: Adoption of a lightweight, open-license standard API to gather, publish query and subscribe-to in-time context information describing the state of the city. *Specifically, the FIWARE NGSI API will serve as a first common API, which the supporters will implement.*

Data model: Adoption of a simple initial standard data model required for effective interoperability when exchanging context information. *Specifically, CityGML, which is available through the FIWARE NGSI API, functions as a basis.*

Open Data Platform: Adoption of a flexible, easily-distributable open data publication platform which any organization can set up at a low cost if it is not already being used. *Specifically, CKAN will serve as the initial standard platform for publication of datasets or NGSI API resources. CKAN is already integrated and extended as part of the FIWARE Reference Architecture*

Approach: Adoption of a "driven by implementation" approach towards experimental consolidation of initial standard data models as well as specification of new standard data models. The goal is that communities and developers can (1) co-create their services based on basic but commonly-defined data models, (2) influence the definition of new models by implementing and experimenting, and (3) help "curate" existing data models. *Specifically, this will mean engaging organizations and communities, leveraging relevant initiatives, e.g. startups/SMEs selected through the FIWARE Accelerator Programme, (projects focused on Smart Cities), the OrganiCity Experimentation-as-a-Service facility and open calls, Code for Europe and/or other relevant programmes, including national networks, that may help to engage wider communities of stakeholders and developers. It will also mean leveraging the FIWARE Lab, OrganiCity facility etc. as joint, major hubs for experimentation with the proposed APIs, data models and platforms.*

We believe that the Open & Agile Smart Cities initiative will be instrumental in the organic adoption and further development of a common set of standard APIs, data models and open data platforms for smart cities which – by providing adequate flexibility in implementation and an appropriate level of loose/tight coupling – will

(*) Ordered by country and date of incorporation

FIWARE

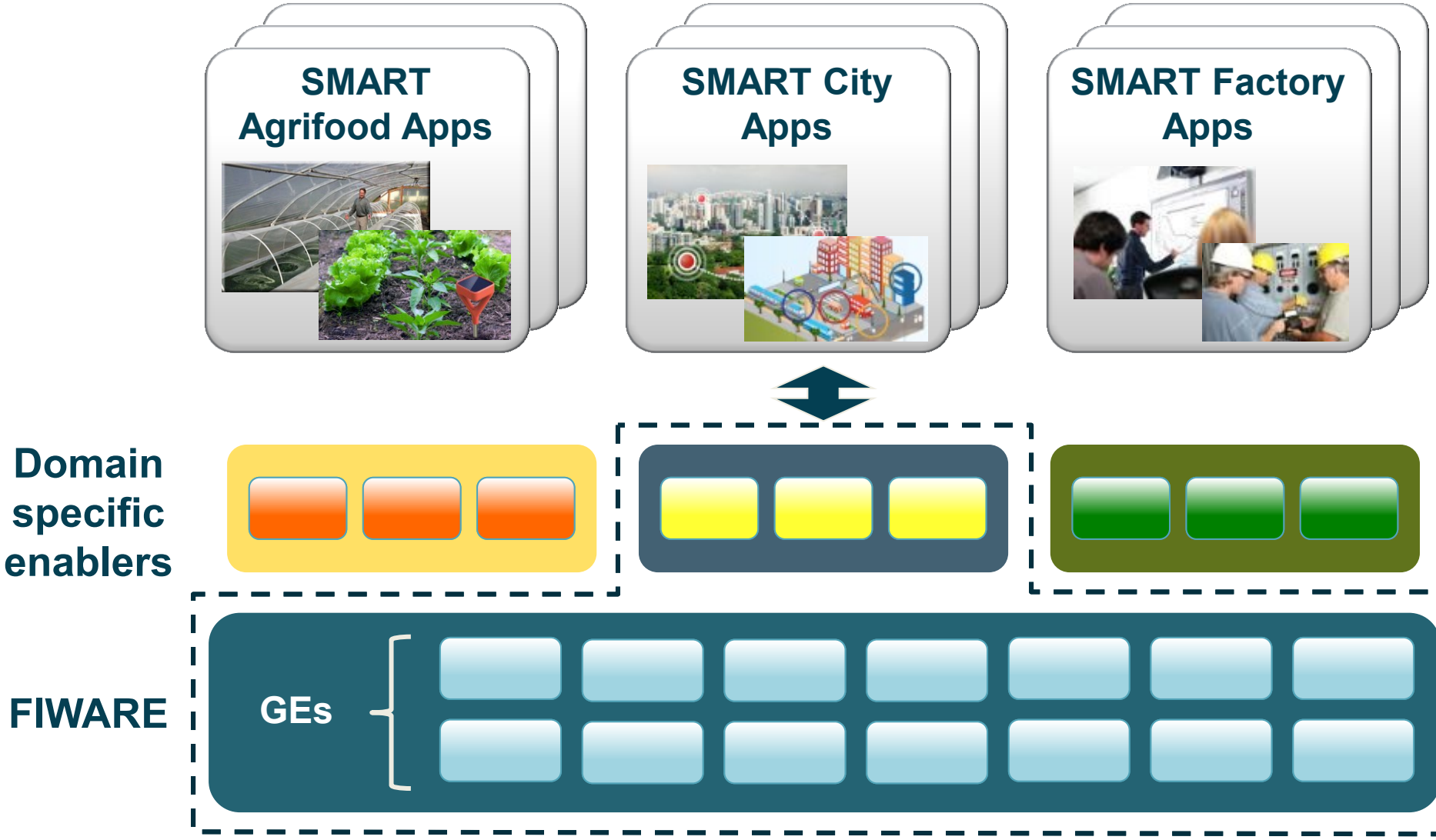
From silos to platforms
From clusters to ecosystems :
Cross-fertilization of data

- within a given environment (building, plant, city)…
- between vertical application domains (energy, transportation, logistics, etc…)

FI-WARE
Open APIs for Open Minds

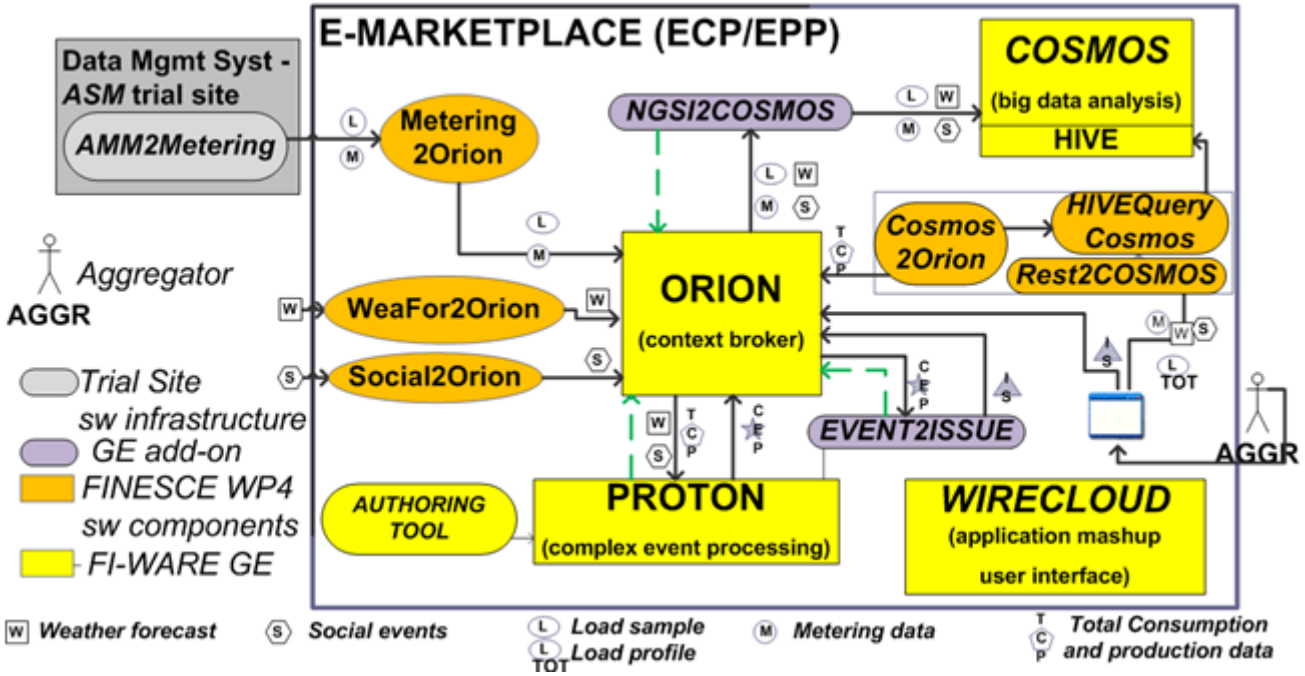
FIWARE

Modularity; integration with legacies
Domain-specific platforms = FIWARE + specific enablers



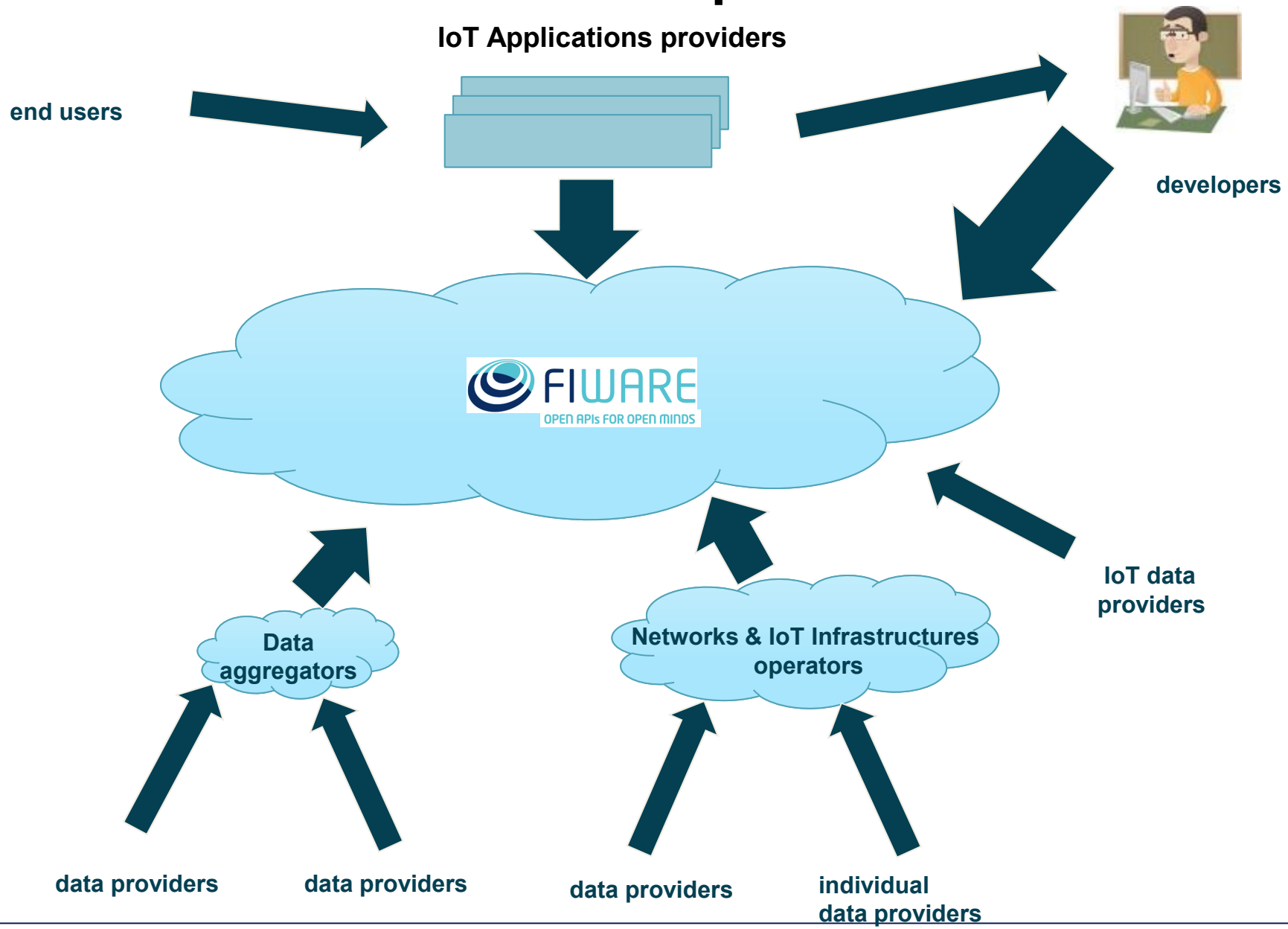
Example: FIWARE for Smart Energy

- FIWARE Sustainable Smart City Malmö, Sweden
- FIWARE Smart Region Horsens, Denmark & Madrid
- FIWARE X-border Virtual Utility, Aachen
- FIWARE for the Energy Marketplace in Terni, Italy
- FIWARE for Power management, Ireland



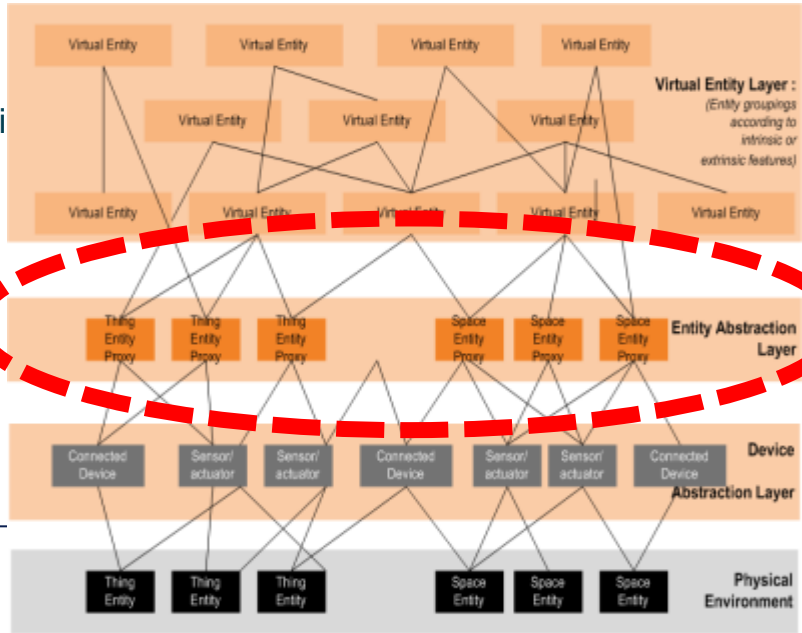
GE and DSE integration

FIWARE as a multi-sided IoT platform

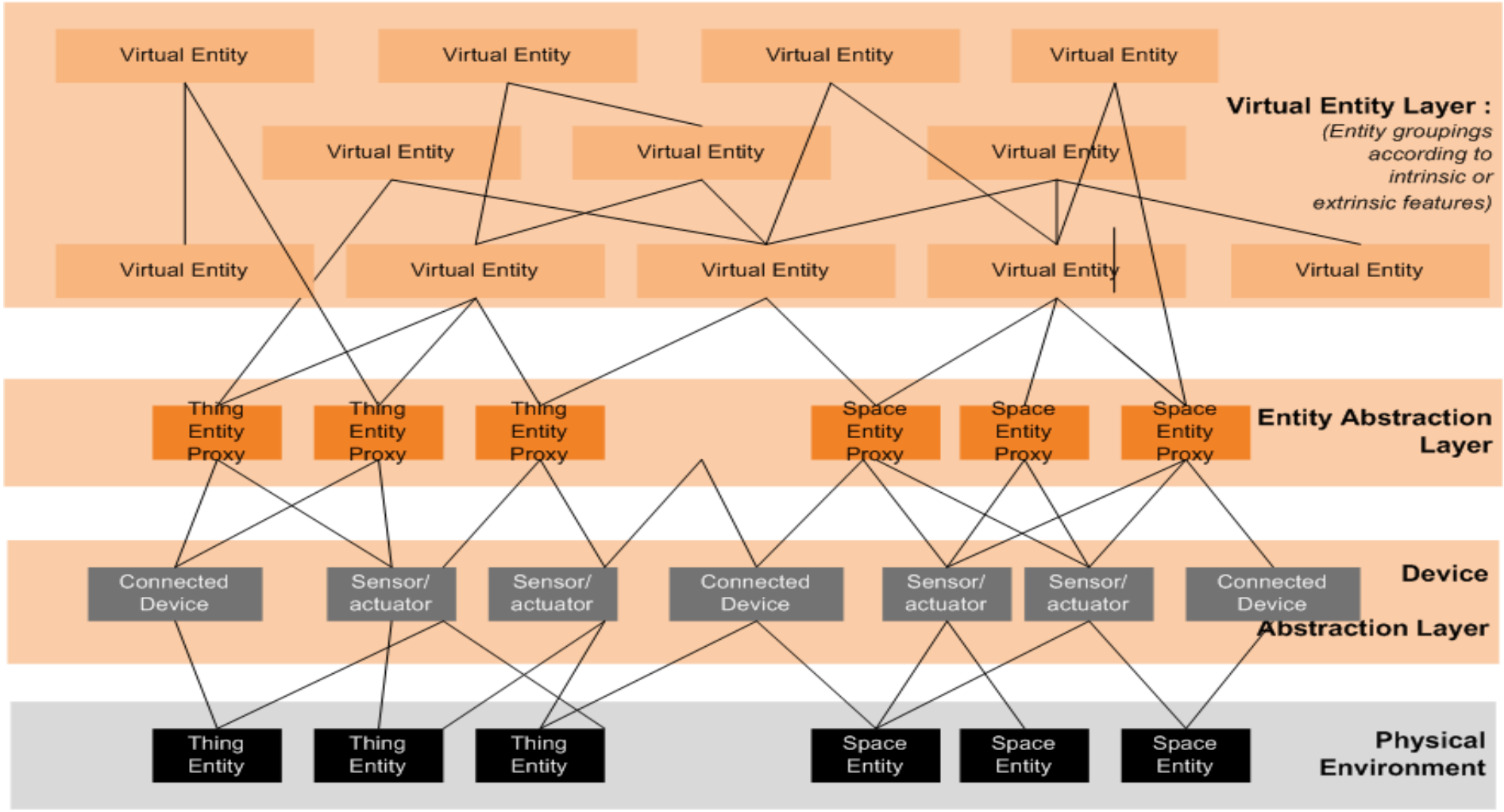


Raising the level of data abstraction in IoT infrastructures

- Beyond *device* and protocol abstraction!
- Capturing the invariants in target *environment* instances
- Abstracting all relevant *physical entities* in the environment
  - rooms, places (→ akin to context entities in context middleware)
  - non-connected appliances and legacy systems
  - passive items
- Providing higher layers of abstraction
  - virtual entities based on properties and categories (intri
  - entity & device instance groups (extrinsic and ad hoc)



pivotal layer


Virtual Entity
Virtual Entity
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Virtual Entity
Virtual Entity
Virtual Entity
Virtual Entity
Virtual Entity Layer :
(Entity groupings according to intrinsic or extrinsic features)
Thing Entity Proxy
Thing Entity Proxy
Thing Entity Proxy
Space Entity Proxy
Space Entity Proxy
Space Entity Proxy
Entity Abstraction Layer
Connected Device
Sensor/ actuator
Sensor/ actuator
Connected Device
Sensor/ actuator
Sensor/ actuator
Connected Device
Device Abstraction Layer
Thing Entity
Thing Entity
Thing Entity
Space Entity
Space Entity
Space Entity
Physical Environment

Consolidating multiple sources of data

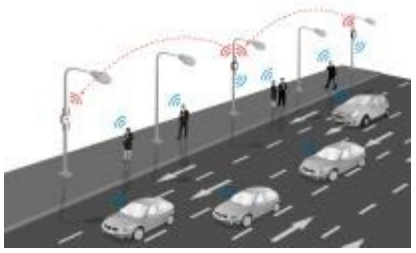
- Primary data may come from many types of sources:
  - peer and lower-level infrastructures
  - networked sensor systems
  - external information systems
  - crowdsourcing (individual smartphone sensors)

- They are attached by FIWARE to relevant entities

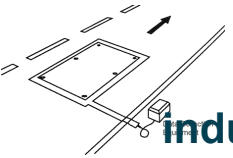
What's the current traffic density in street "X"?

Notify me in case of congestion of street "X"

FIWARE high-level API



{« street X » :
« hasState » : [
« TrafficDensity »
.....
]
}



inductive-loop vehicle detector

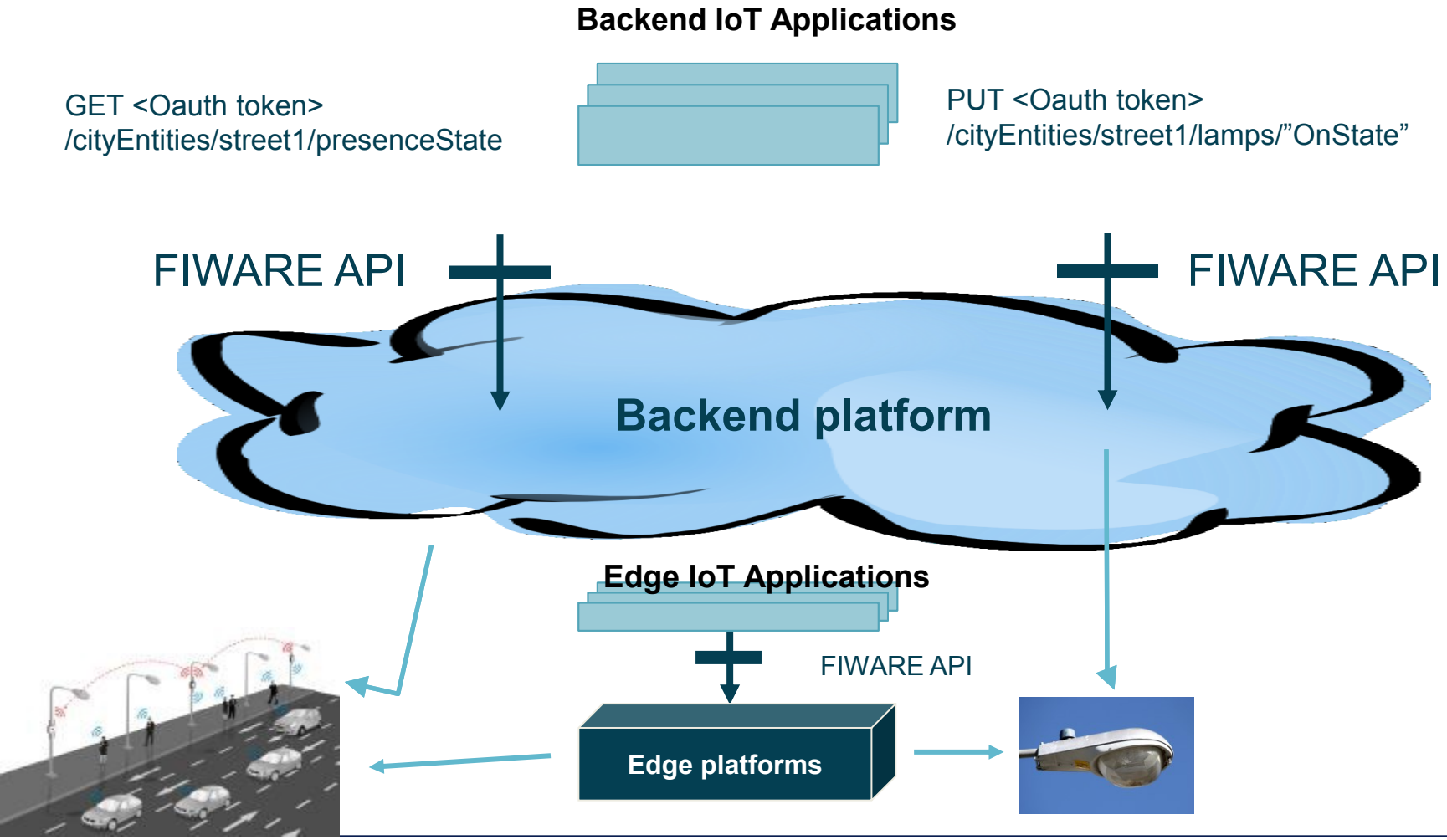
driver smartphones

surveillance cameras

FIWARE

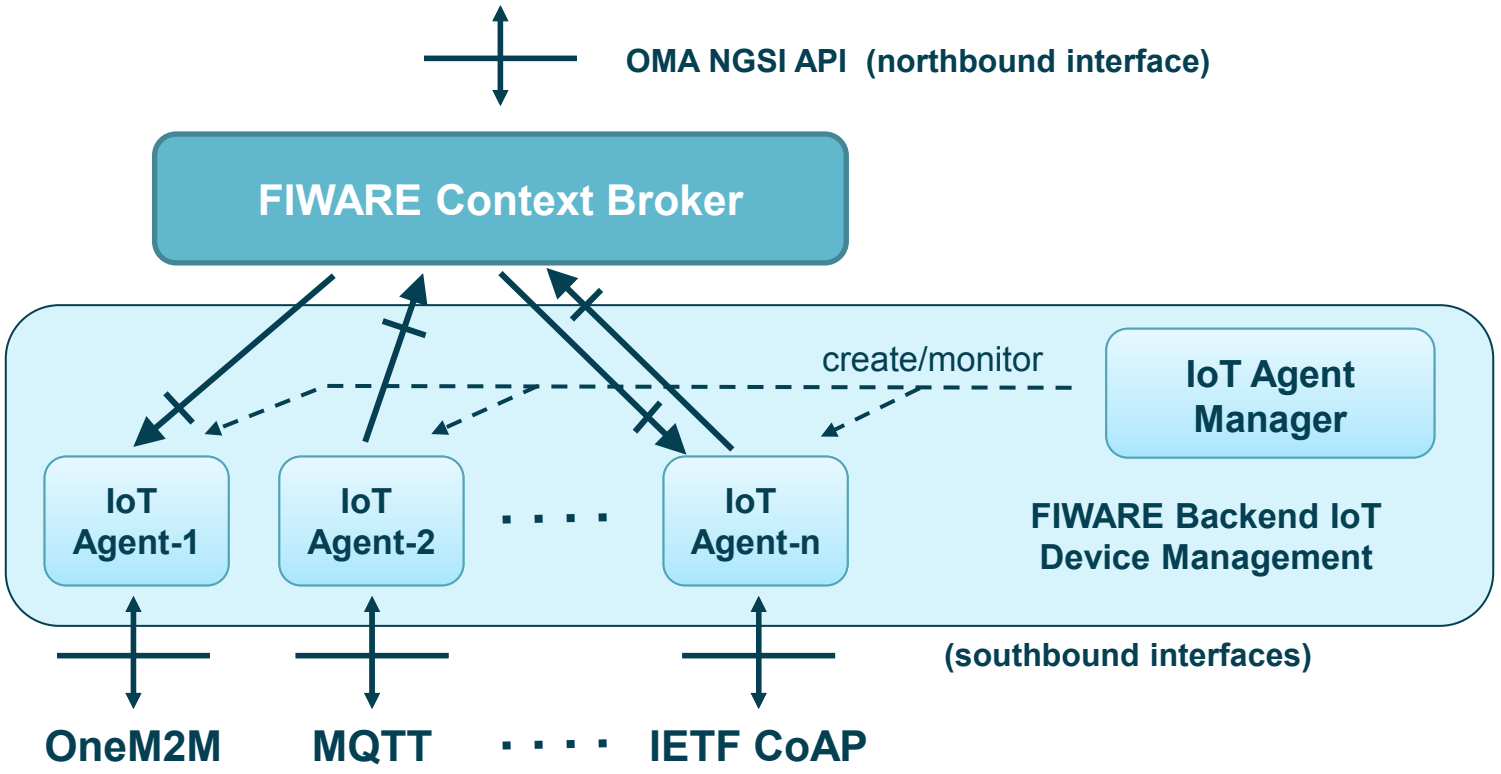
Acting upon entities through devices

- IoT devices are acted upon through changes in the state of entites

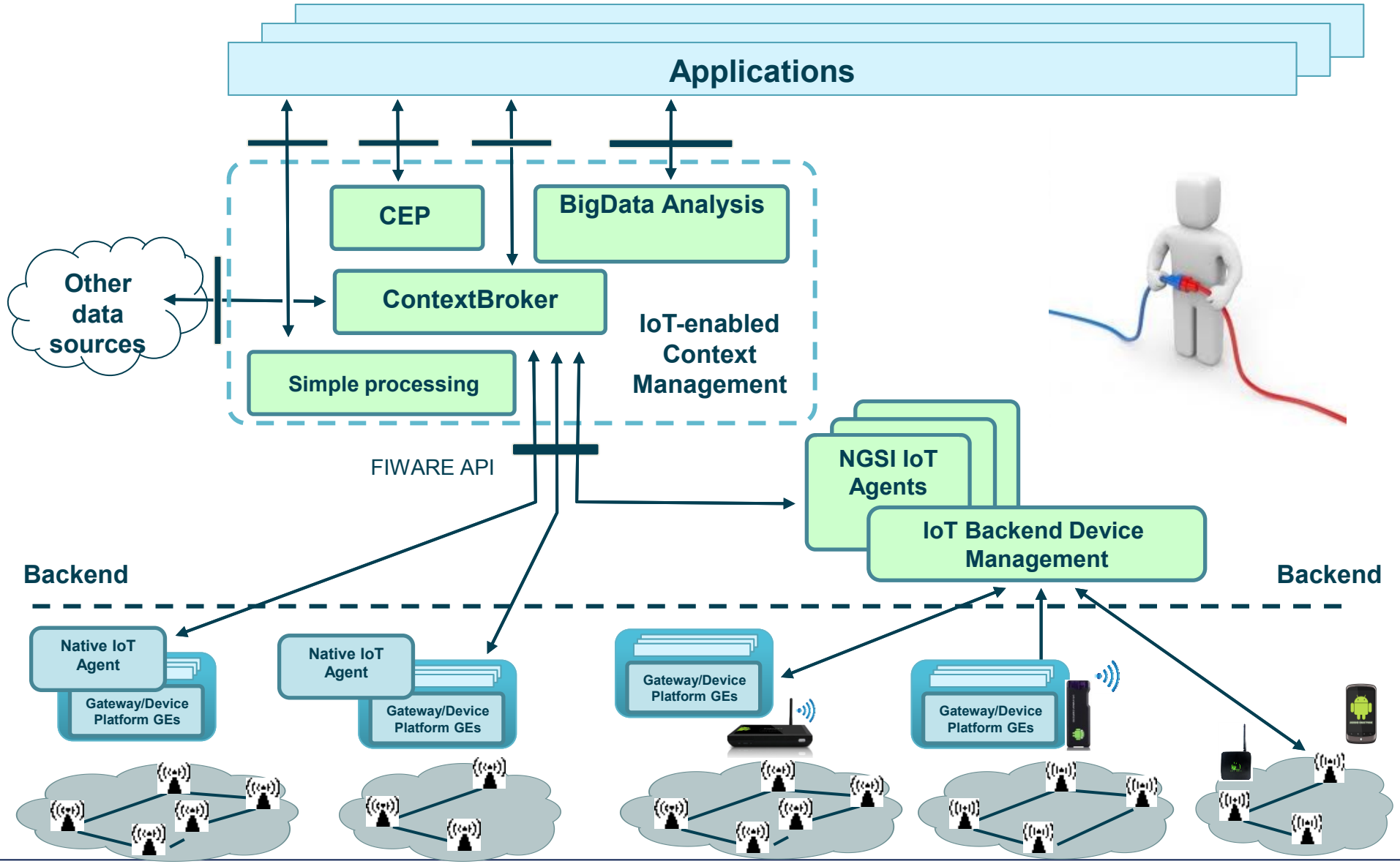


Integration with sensor networks

- The FIWARE backend IoT Device Management GE enables creation and configuration of NGSI IoT Agents that connect to sensor networks
- Each NGSI IoT Agent can behave as Context Consumers or Context Providers, or both

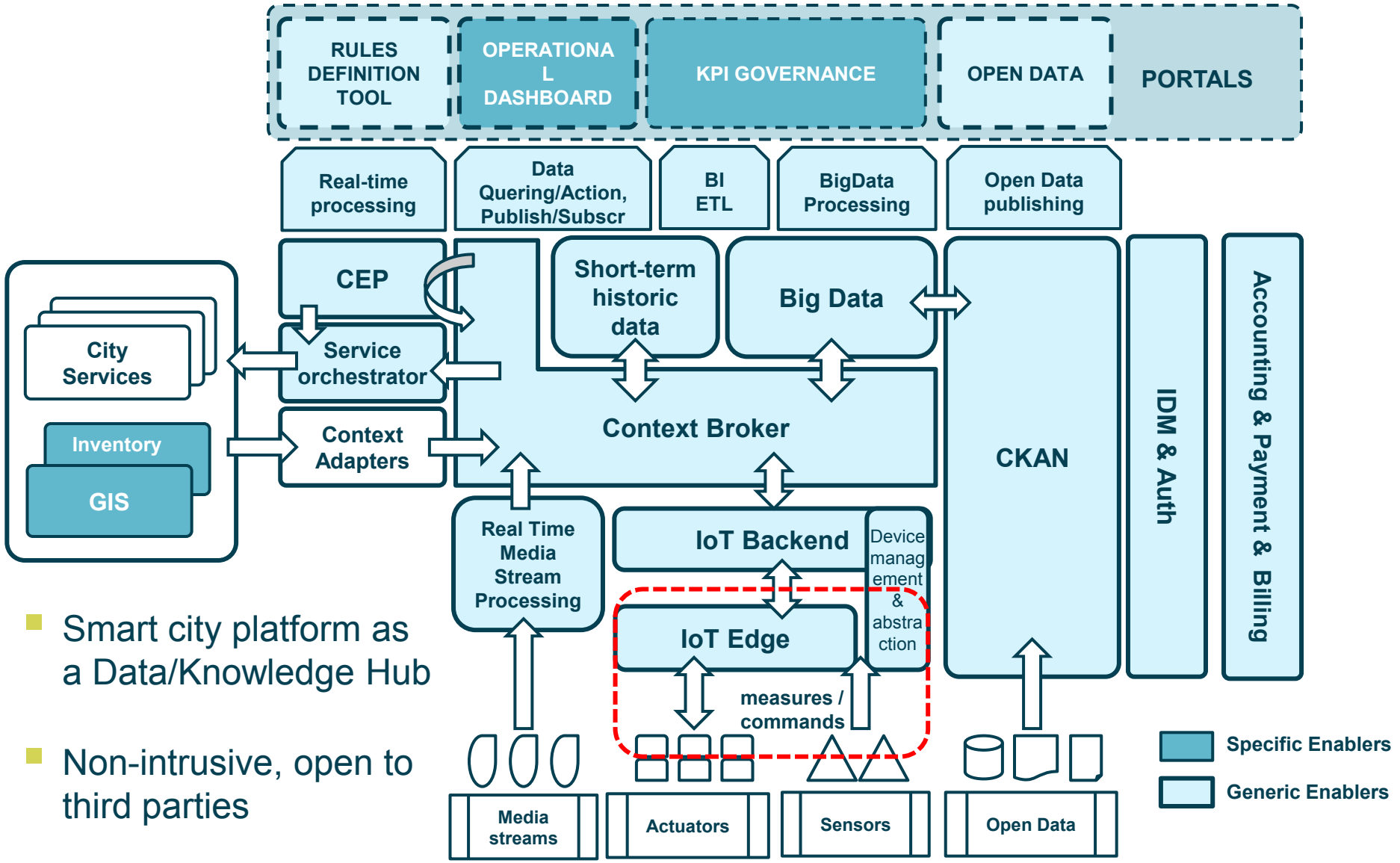


FIWARE IoT & overall Data Management



FIWARE

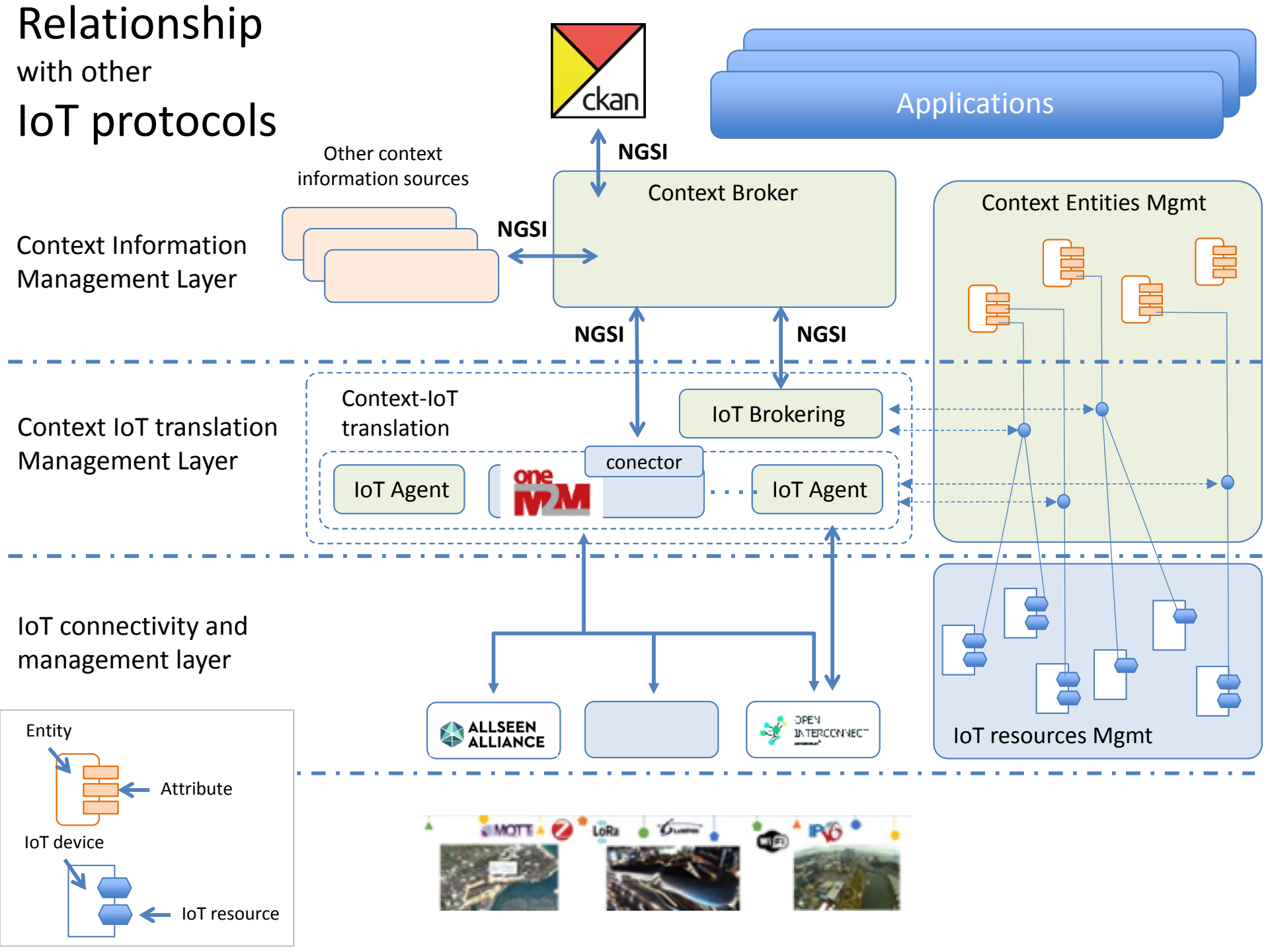
Example: Smart City platform



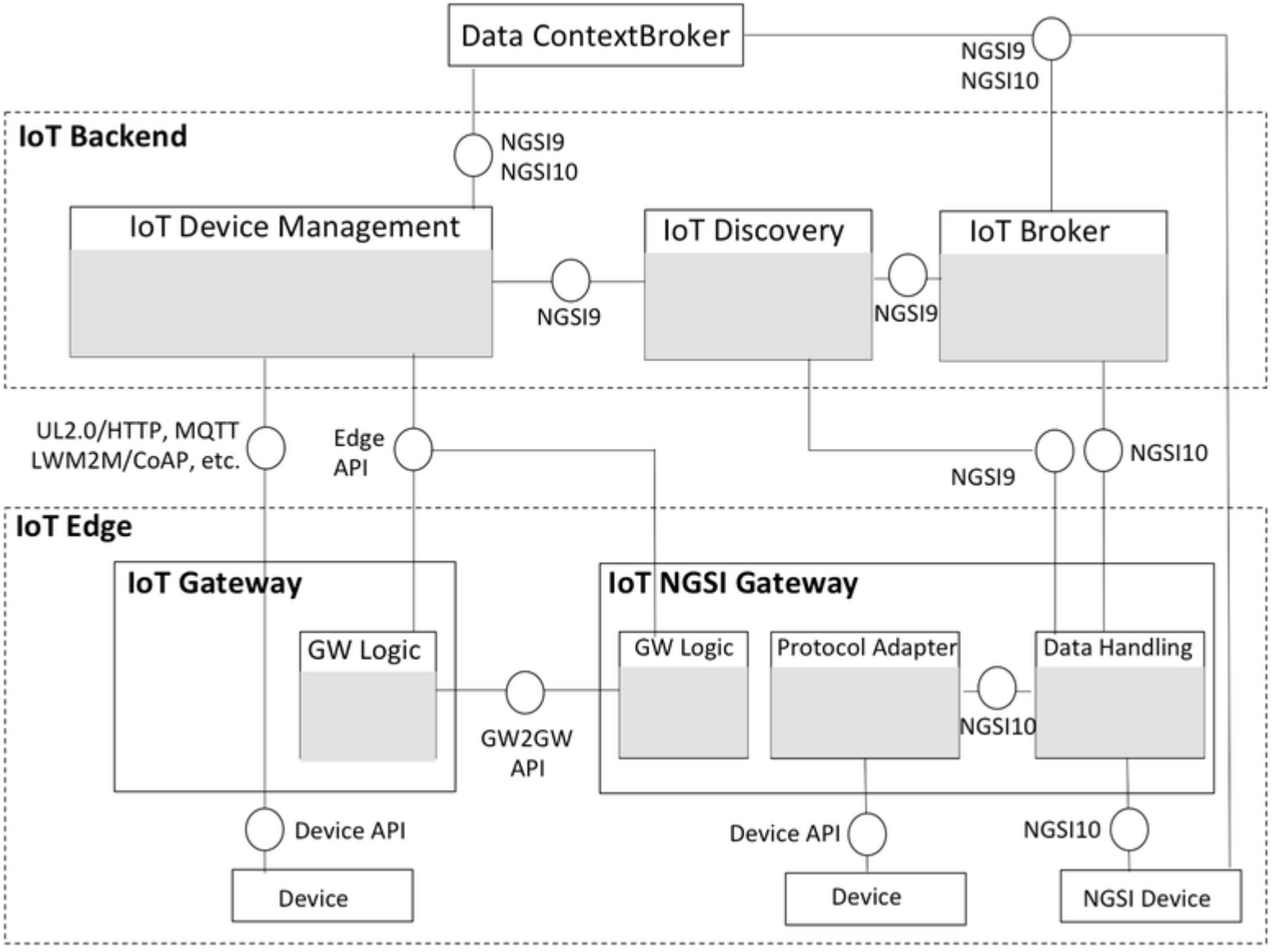
- Smart city platform as a Data/Knowledge Hub
- Non-intrusive, open to third parties

FIWARE

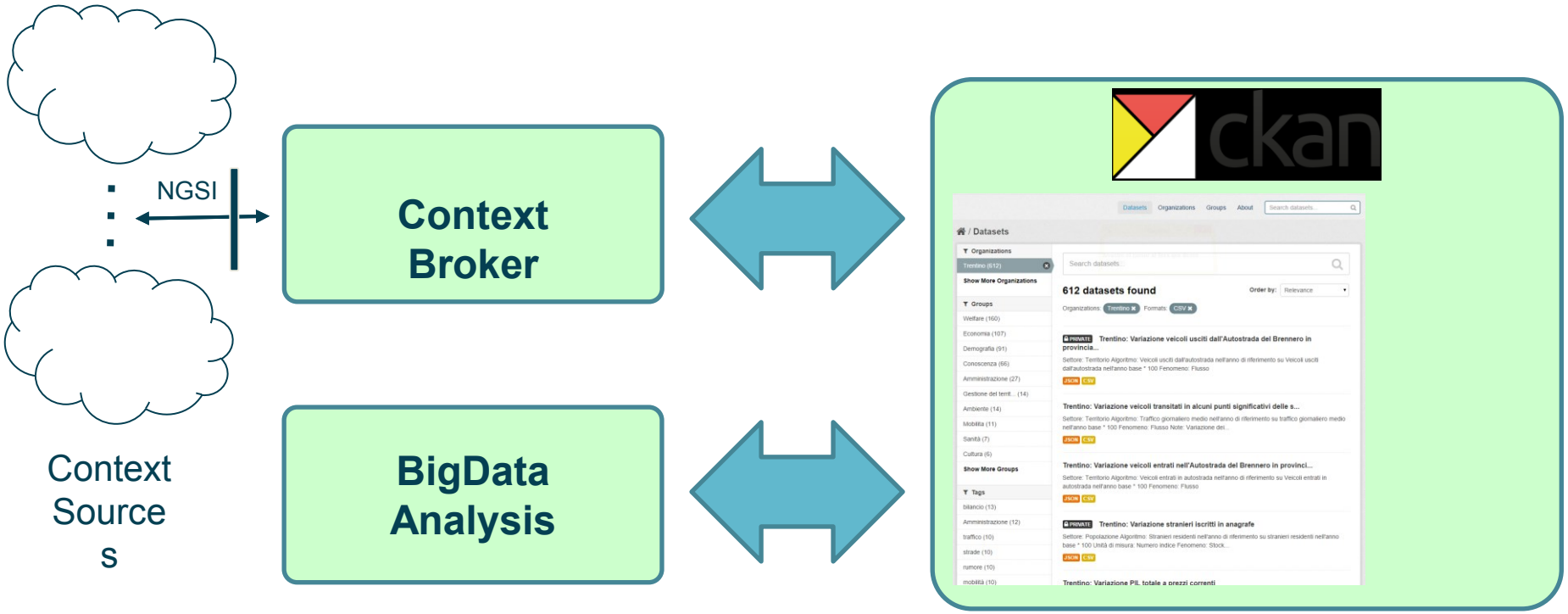
Relationship with other IoT protocols



FIWARE IoT architecture

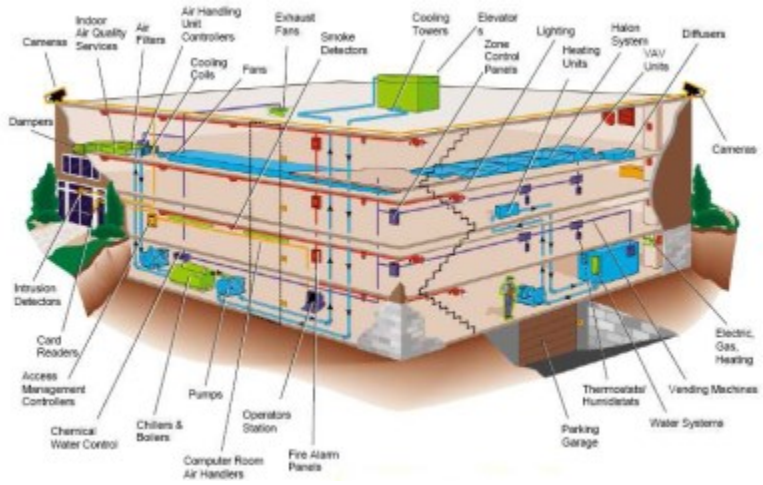


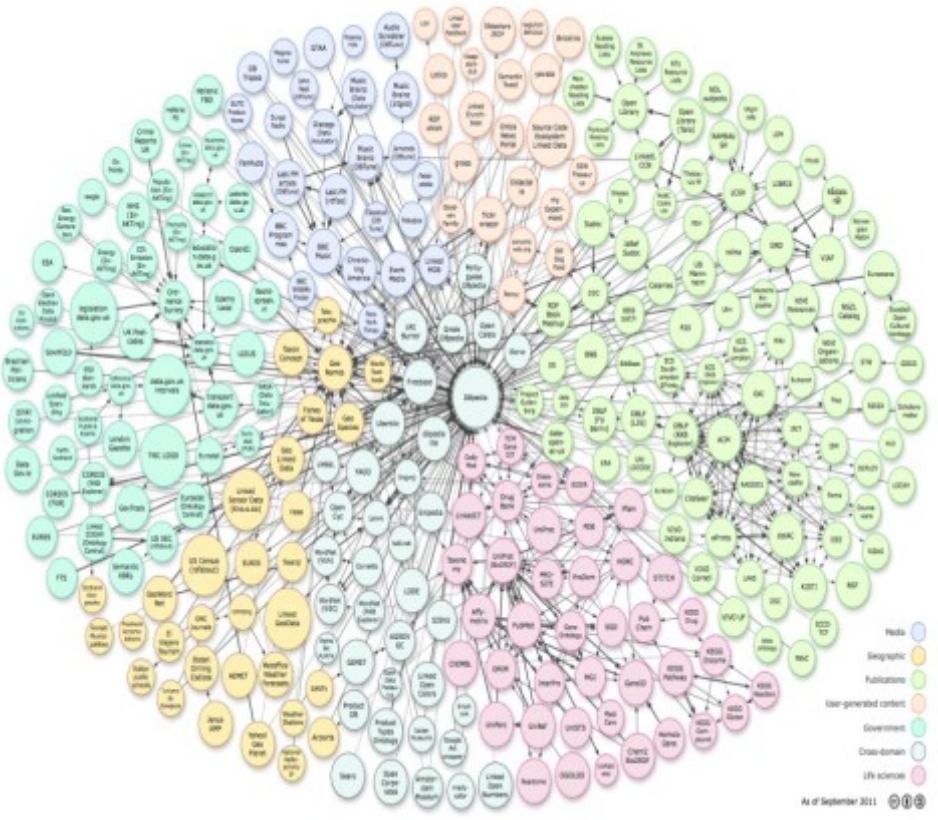
Open Data publication



Bringing IoT to the next level with Linked Data

- IoT systems no longer isolated islands
- They become part of the larger linked data archipelago



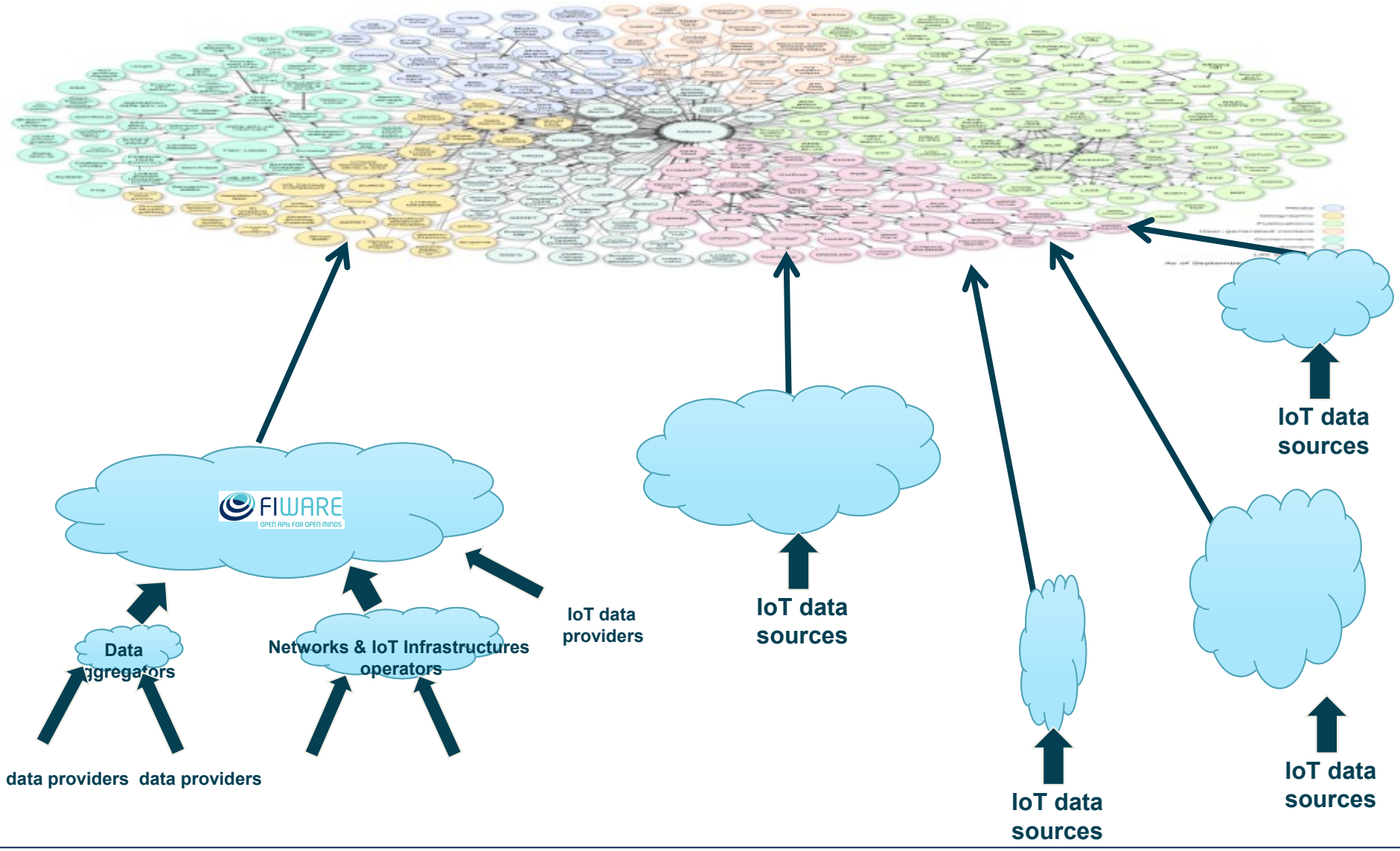


Evolution of FIWARE APIs towards Linked Data & Web of Things

- abiding by linked data principles
  - use URIs as names
  - use HTTP URIs,
    so that people can look up those names
  - when someone looks up a URI,
    provide useful information
  - include links to other URIs,
    so that they can discover more things

- Naming and identifying devices
  - URI of network interface (HTTP or CoAP) or proxy
- Naming and identifying physical things
  - physical things are interfaced or represented through dereferenceable URIs of their own
  - device resources may allow to monitor or control things, either directly or indirectly

Federating IoT infrastructures with Linked Data



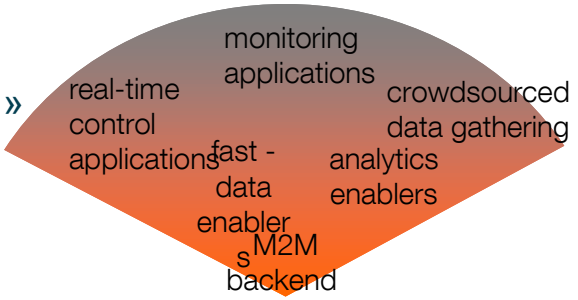
Linked data from the Web of Things

- Narrow waist =REST identifiers shared by different infrastructures and abstraction layers
  - entities are resources, states are subresources, instant values are representations
    - devices are resources, reading from sensors and actuator controls are representations

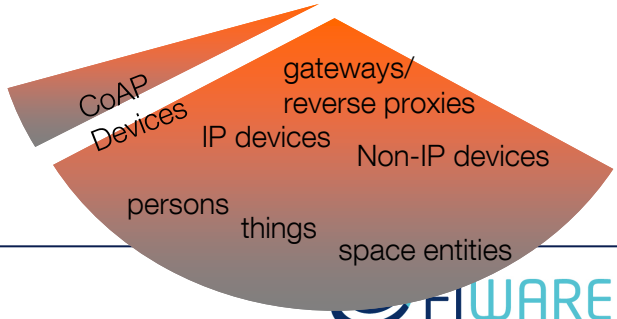
→HTTP or CoAP URIs for all resources and subresources

→JSON-LD for semantic mapping of identifiers

- resource descriptions are hyperlinks → »follow your nose «
- no declarative descriptions à la WSDL!



REST = HTTP/CoAP URIs + CRUD + hyperlinks



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