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FED4IoT

TTC Online Seminar – Standardization and Technology Trends for IoT in Smart Cities

Standardization trends on FIWARE

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Orchestrating a brighter world

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Overview

- FIWARE Introduction
- FIWARE Open Source Platform based on NGSI(-LD)
- ETSI ISG CIM – Standardizing NGSI-LD
- NGSI-LD Adoption and Relation to Fed4IoT
- Conclusion

FIWARE Introduction

What is FIWARE?

- **FIWARE** has grown out of the **Future Internet PPP** set up by the **European Commission** in 2010, funding **37 innovation projects** with a total investment of **600M€** over 6 years
- After end of Future Internet PPP, **FIWARE Foundation** was created – it *coordinates* the **FIWARE Community**, actively *promotes* the FIWARE adoption, *provides* shared resources to the community and *validates* the FIWARE technologies.
- **FIWARE** is also a **curated framework of open source platform components** to accelerate the development of **Smart Solutions**, NGSI(-LD) is the API at the core, enabling the integration of components
- FIWARE Foundation has grown to **>360 members** in 3.5 year, with **267 individual** members, an **increase of 50%** within the last 1.5 years

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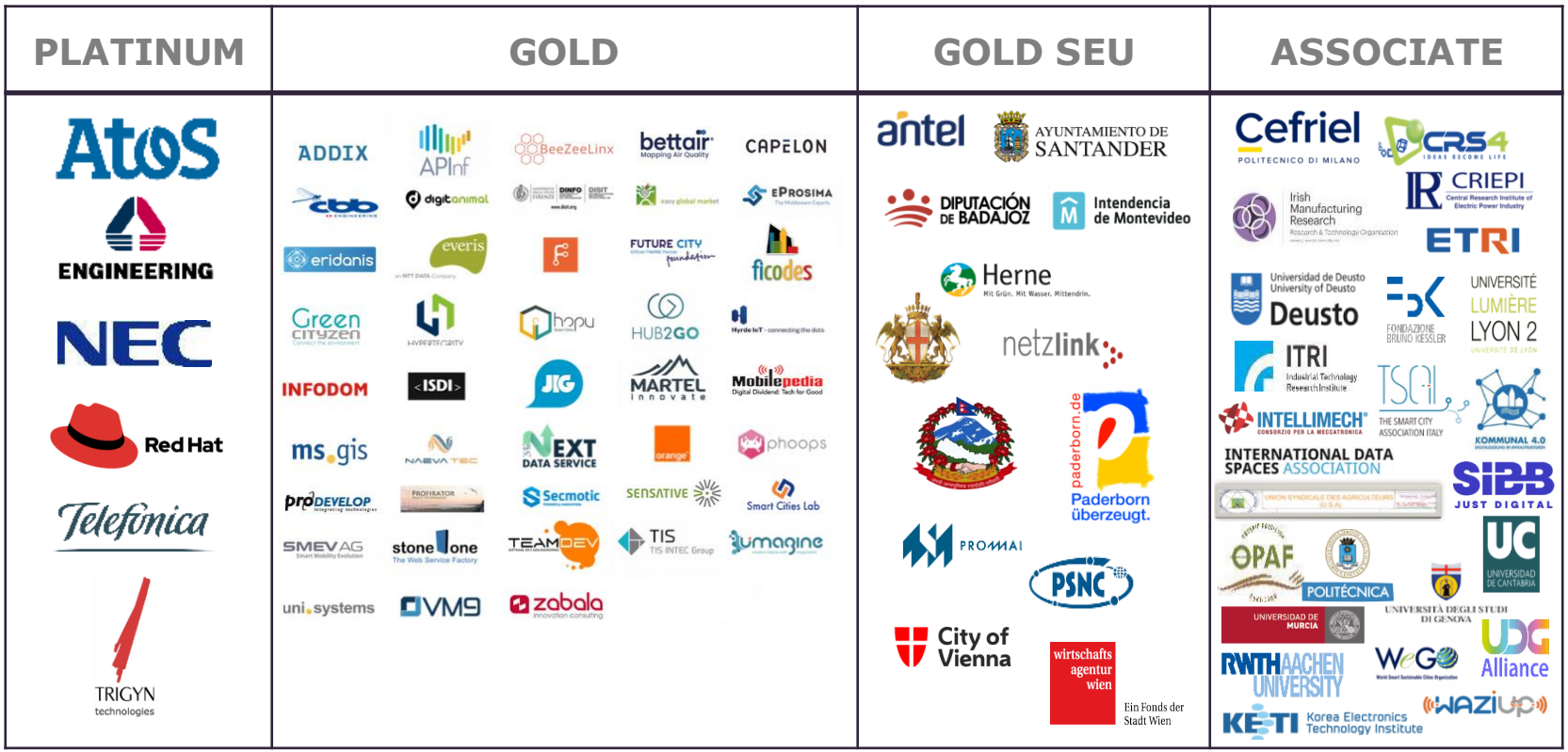
The FIWARE Foundation Membership



Individual Members: 267

Source: FIWARE Foundation

Status: October 2020

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FIWARE Open Source Platform

based on NGSI(-LD)

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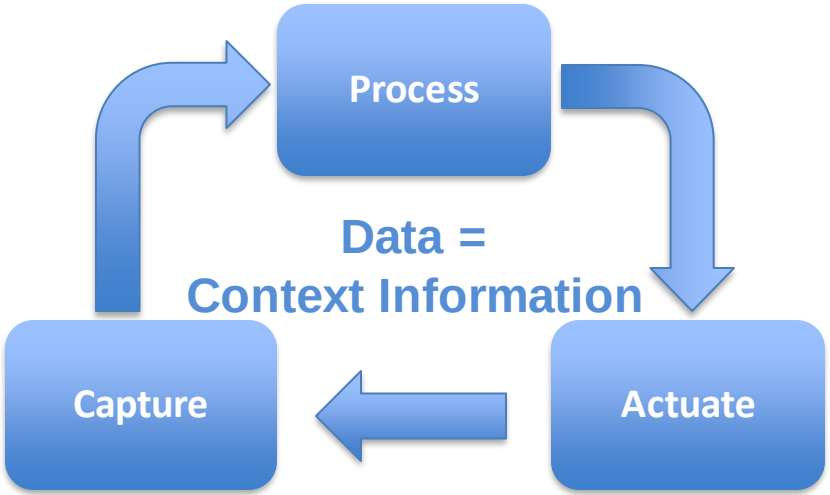
- Smart Solutions/Organizations gather data from many different sources (including but not limited to IoT) to build a "context representation" (→ "digital twins") which is constantly analyzed and processed in order to automate certain processes or bring support to smart decisions



CONTEXT MATTERS

Source: FIWARE Foundation

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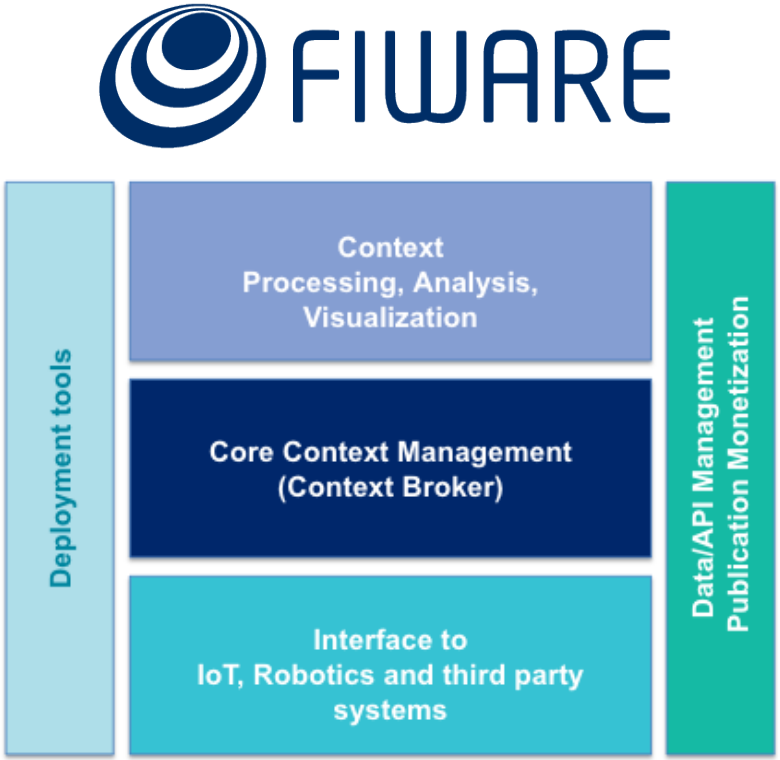
FIWARE Open Source Platform



A framework of open source platform components to access and manage heterogeneous context information through open APIs

A standard for exchange of context information: FIWARE-NGSI
→ **ETSI NGSI-LD**

Generic Enablers and Solutions to provide Smart Services with a Context Broker as main component

Source: FIWARE Foundation

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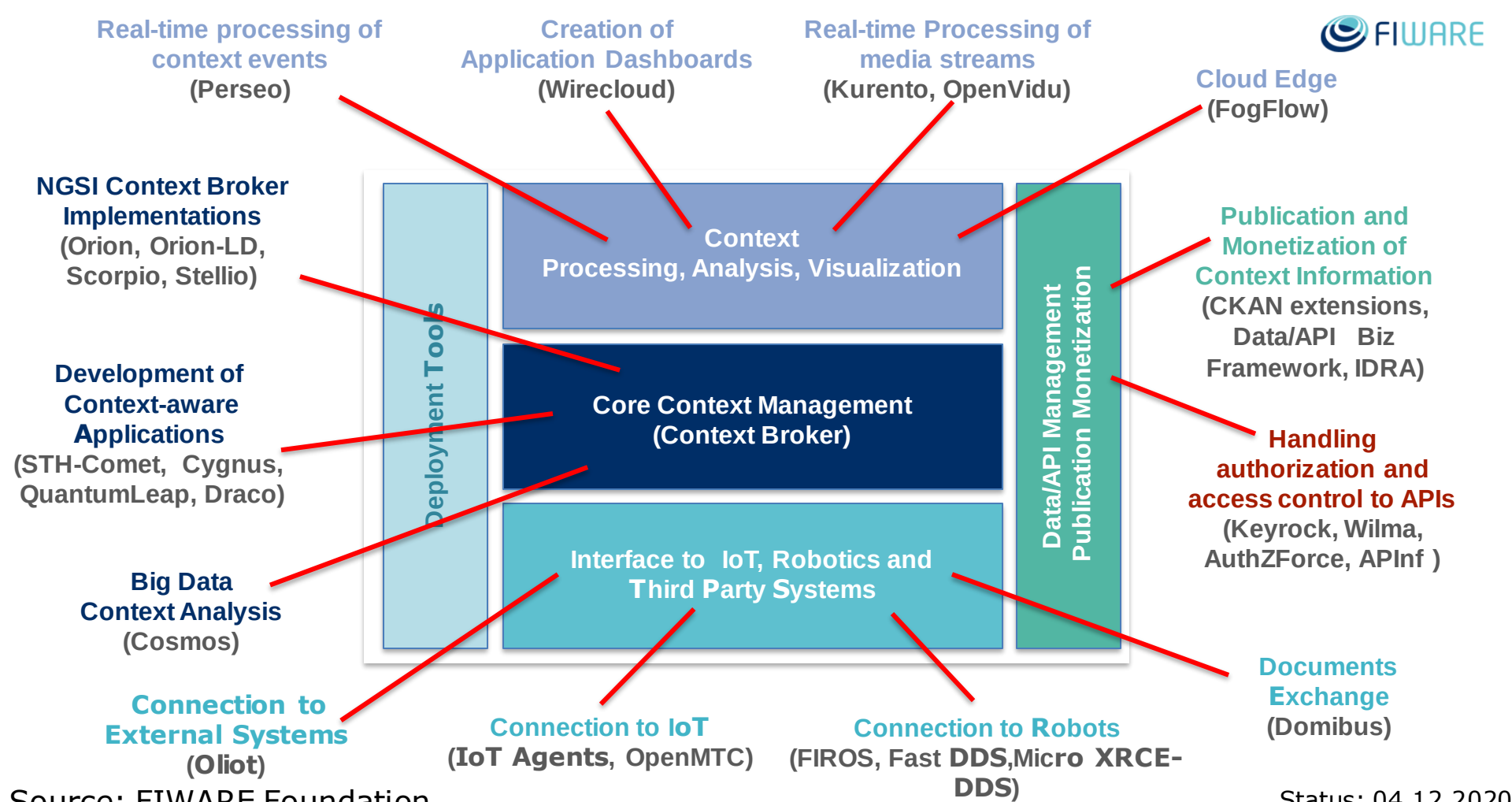

Source: FIWARE Foundation

Status: 04.12.2020

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ETSI ISG CIM

Standardizing NGSI-LD

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NGSI-LD – Evolution and specification in ETSI ISG CIM

European Telecommunications Standards Institute (ETSI)

- ETSI produces globally-applicable standards for Information and Communications Technologies (ICT)
- It is officially recognized by the European Commission as a European Standards Organization
- Industry Specification Groups (ISG) allow participation of non-ETSI-members

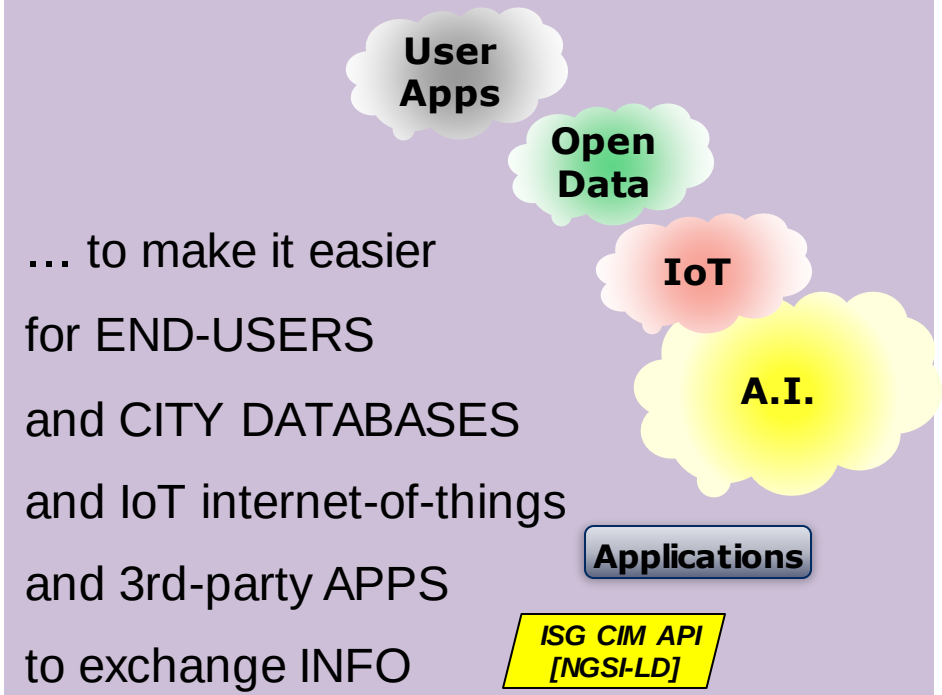
ETSI ISG for cross-cutting Context Information Management (ETSI ISG CIM)

- Established in 2017
- Currently about 30 supporting organizations
- **Evolution of NGSI Context Interfaces → NGSI-LD**

https://www.etsi.org/deliver/etsi_gs/CIM/001_099/009/01.03.01_60/gs_CIM009v010301p.pdf

2010 OMA NGSI	***2012-2016: NGSI v1/v2***	***2019: NGSI-LD***
Context API in Open Mobile Alliance (OMA)	FIWARE project develops binding and evolves OMA NGSI standard	Evolution as ETSI ISG CIM specification based on JSON-LD

ETSI ISG CIM: Mission



Source: ETSI ISG CIM

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Vision for NGSI-LD: Large Scale Platform for IoT Information

NGSI LD

- Current reality: **information silos**

→ Integrate information silos

- Current reality: **heterogeneous information** accessible through a plethora of APIs

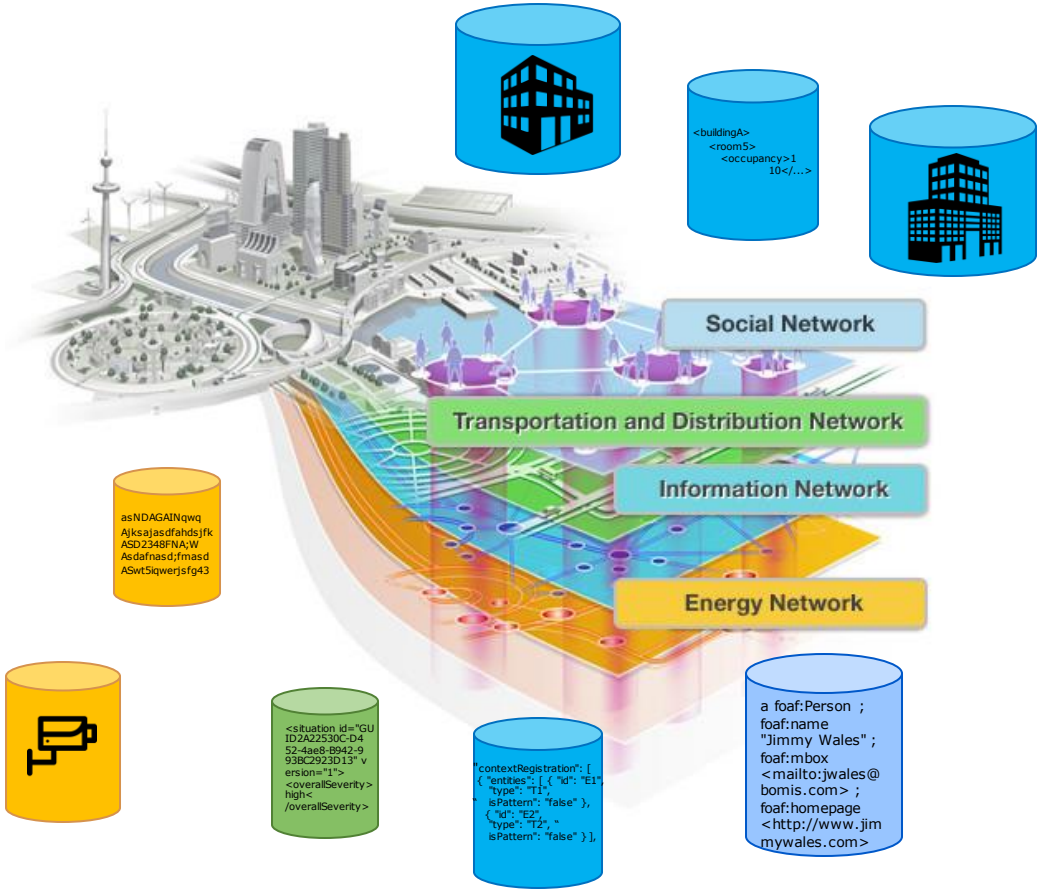
→ Information on suitable abstraction level, accessible through single API

- Smart city: **large scale** heterogeneous deployments

→ Applications need to find relevant information

- Dynamically **changing sources**

→ Applications need to be independent of specific sources



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High-Level Design Goals of NGSI-LD

NGSI LD

- *Evolution of OMA/FIWARE NGSI Context Interfaces*
- Put NGSI-LD Information Model on a solid conceptual grounding
  - Property graph model
  - Enable semantic concept definitions
  - Enable linking to existing information

  } **Linked Data**
- Enable applications to specify WHAT information they require (based on the NGSI-LD Information Model) – including *geographic scoping* and temporal interface
- Support central as well as distributed and federated NGSI-LD system architectures with arbitrary information distribution

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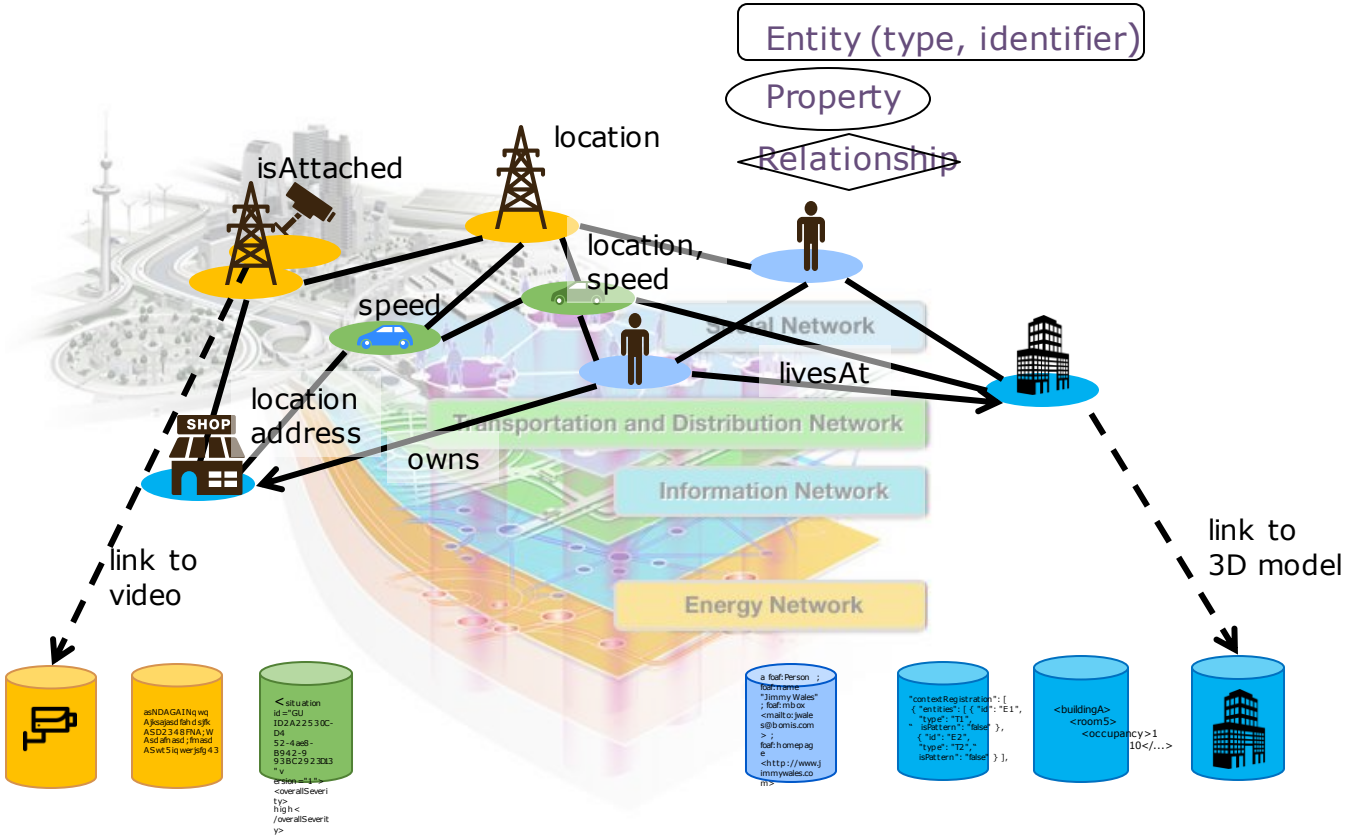
NGSI-LD Information Model (Property Graph)



Advantages of NGSI-LD Entity Graph

- = knowledge graph
- ~ index structure, follow relationships to find relevant entities
- retrieve relevant subset of entities and use advanced graph tools

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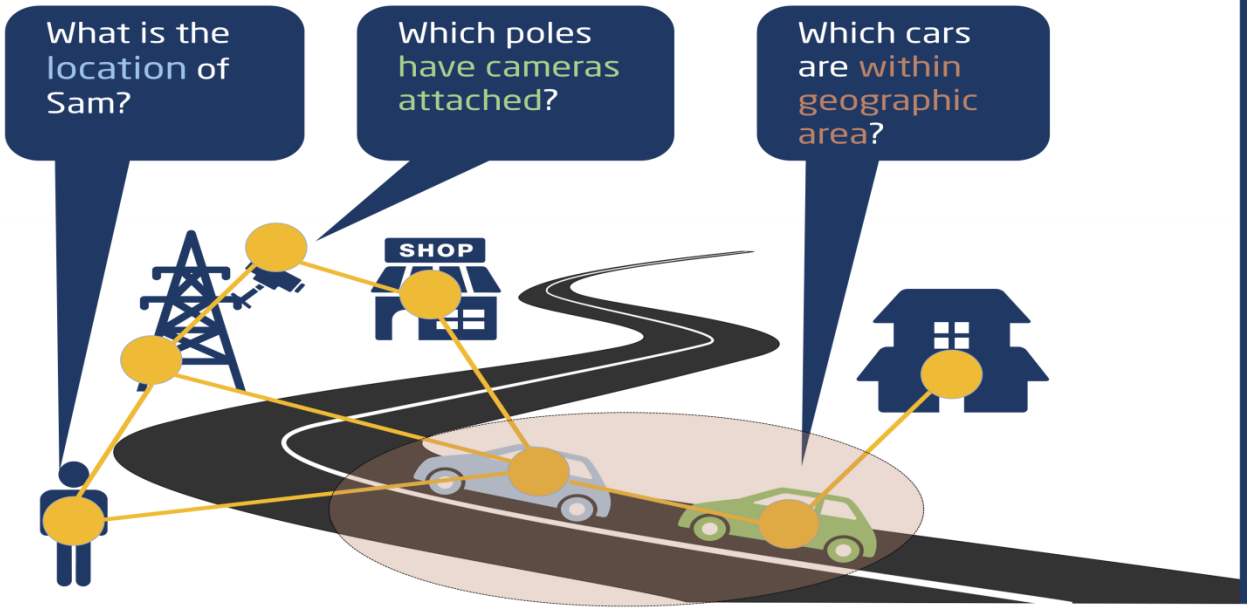
NGSI-LD API



NGSI-LD Features

- Knowledge graph: Entities have Properties and Relationships
- Annotated Properties and Relationships
- Synchronous query and asynchronous subscription/ notification interaction
- Filtering & paging
- Geographic scoping
- Temporal queries
- Support for centralized, distributed and federated architectures

Key aspects of NGSI-LD

- NGSI-LD has a *knowledge graph* as its information model
- NGSI-LD provides an API for retrieving and managing information
- NGSI-LD supports different *architectural models* (central, distributed, federated)

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NGSI-LD Adoption

and Relation to Fed4IoT

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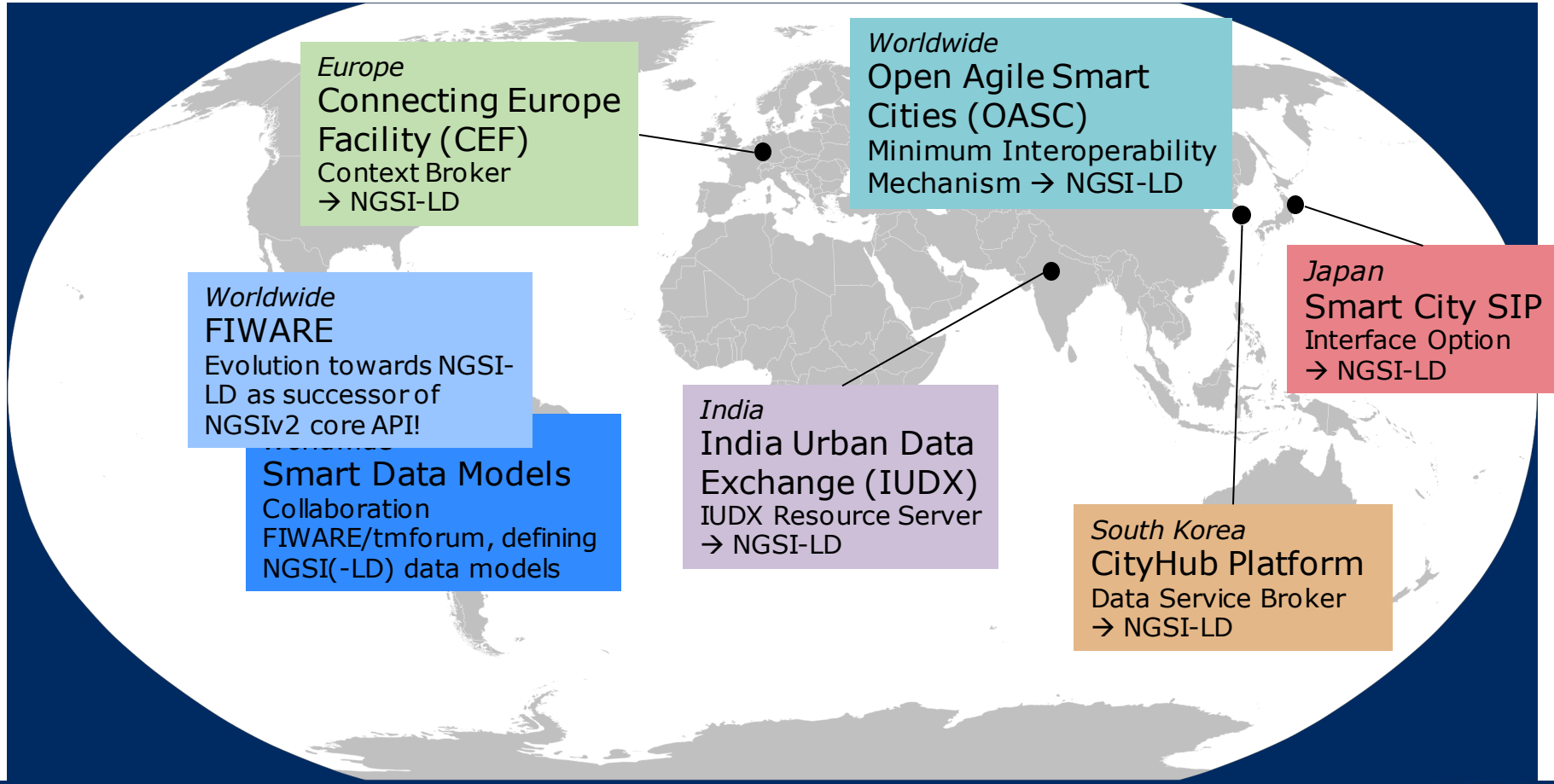
Organizations Worldwide Moving Towards NGSI-LD



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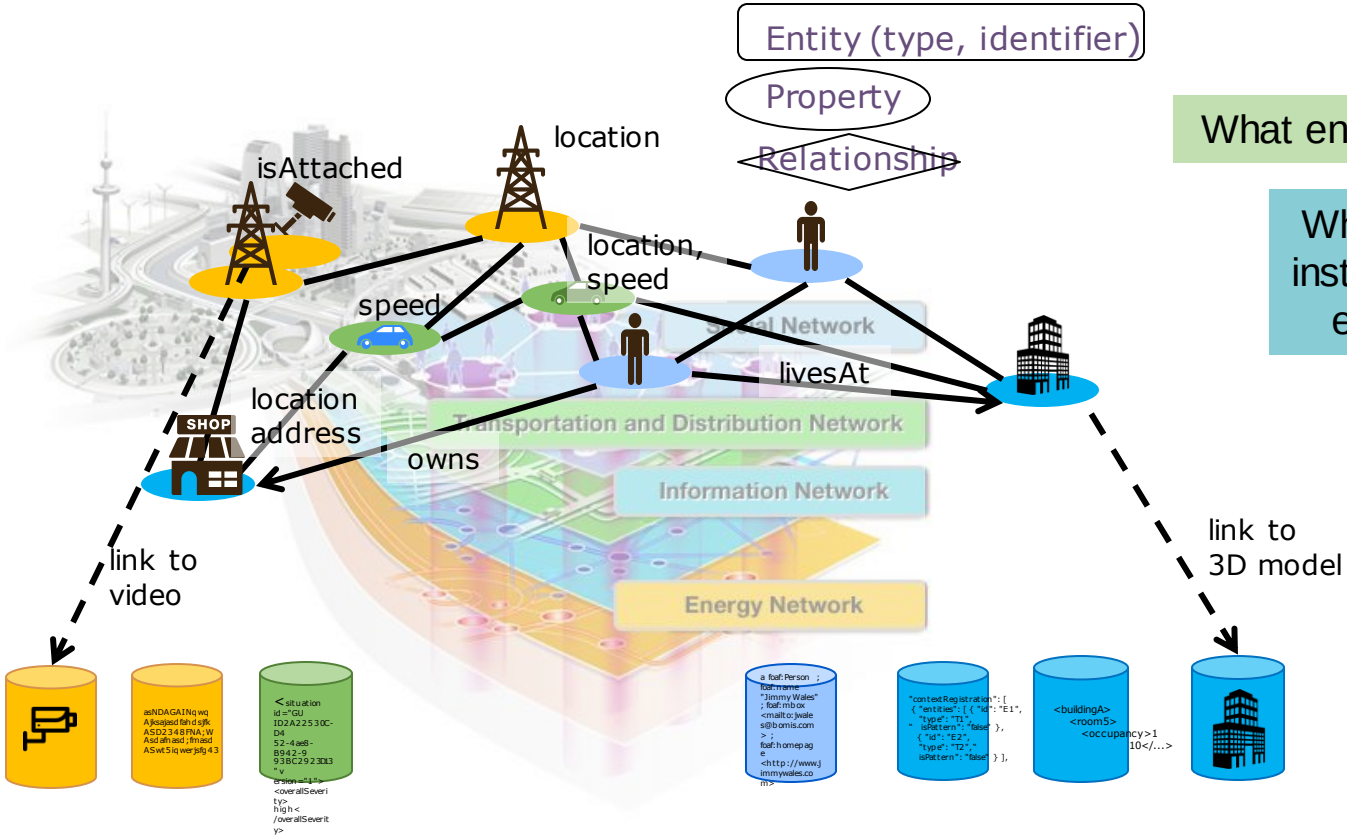
NGSI-LD Information Model

NGSI LD



What entity types are there?

What properties can instances of a certain entity type have?

What relationships can instances of a certain entity type have?

→ **Data Models**

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FIWARE & tmforum: Smart Data Models

NGSI LD

Overview: https://data-models.fiware.org/
Github Repository: https://github.com/smart-data-models

ALERTS
Alerts Events related to risk or warning conditions which require action taking.
READ MORE

PARKS & GARDENS
Data models intended to make an efficient, effective and sustainable management of green areas.
READ MORE

DEVICE
IoT devices (sensors, actuators, wearables, etc.) with their characteristics and dynamic status.
READ MORE

TRANSPORTATION
Transportation data models for smart mobility and efficient management of municipal services.
READ MORE

ENVIRONMENT
Enable to monitor air quality and other environmental conditions for a healthier living.
READ MORE

POINT OF INTEREST
Specific point locations that someone may find useful or interesting. For instance, weather stations, touristic landmarks, etc.
READ MORE

INDICATORS
Key performance indicators intended to measure the success of an organization or of a particular activity in which it engages.
READ MORE

WASTE MANAGEMENT
Enable efficient, recycling friendly, municipal or industrial waste management using containers, litters, etc.
READ MORE

CIVIC ISSUE TRACKING
Data models for civic issue tracking interoperable with the de-facto standard Open311.
READ MORE

STREET LIGHTING
Modeling street lights and all their controlling equipment towards energyefficient and effective urban illuminance.
READ MORE

PARKING
Real time and static parking data (on street and off street) interoperable with the EU standard DATEX II.
READ MORE

WEATHER
Weather observed, weather forecasted or warnings about potential extreme weather conditions.
READ MORE

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NGSI-LD in Fed4IoT

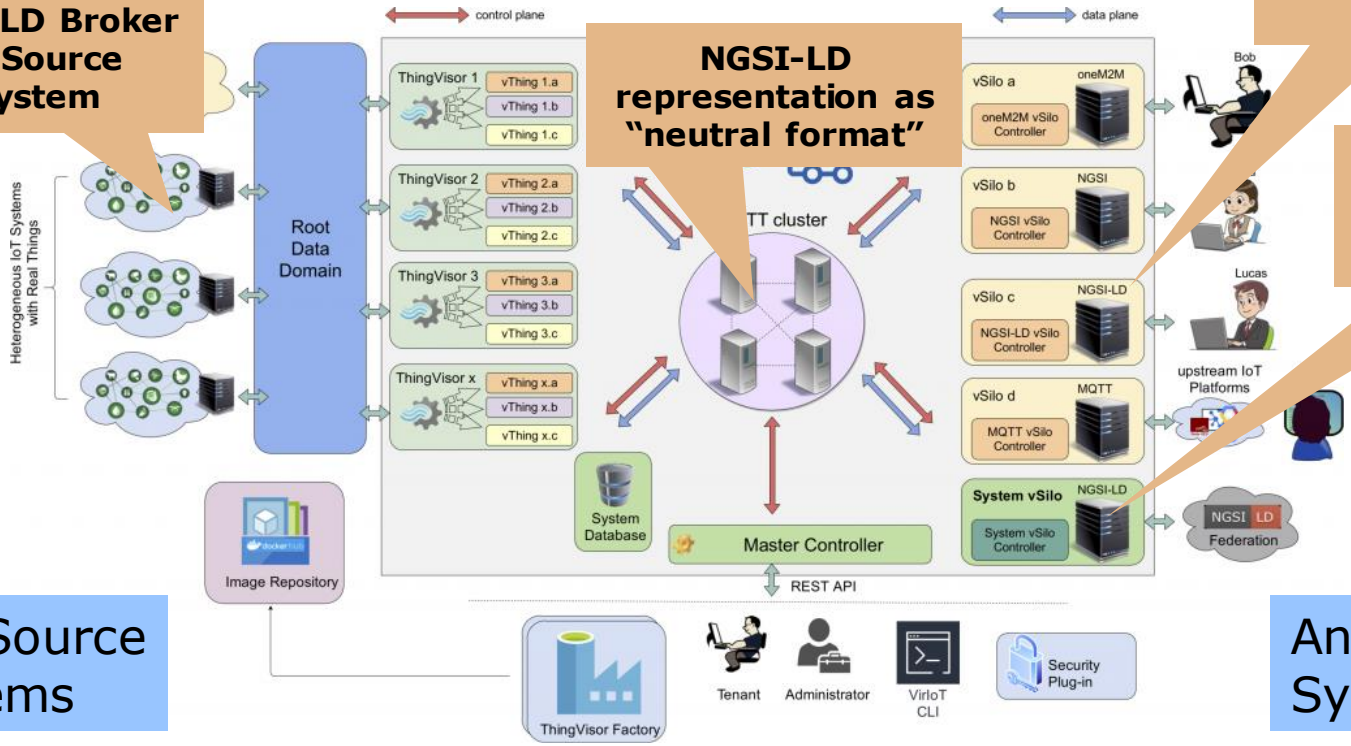
Virtualization of IoT Systems

NGSI-LD Broker as Source System

NGSI-LD representation as "neutral format"

NGSI-LD Broker as Target System

NGSI-LD API / Broker as basis for federation with other systems



Any Source Systems

Any Target Systems

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Conclusions

Conclusions

- **FIWARE** is an **open source community** and **ecosystem**
- **FIWARE** is also a **framework of open source platform components**
- **FIWARE** can be used in a **variety of application domains**
- **NGSI(-LD) based Broker** is at the **core** of the **FIWARE framework**
- **NGSI-LD** is specified by **ETSI ISG CIM**
- **NGSI-LD adoption** is growing **worldwide**
- **Fed4IoT** uses **NGSI-LD** and drives work in **ETSI ISG CIM**

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