SENSINACT, OPEN IOT PLATFORM FOR SMARTER CITIES

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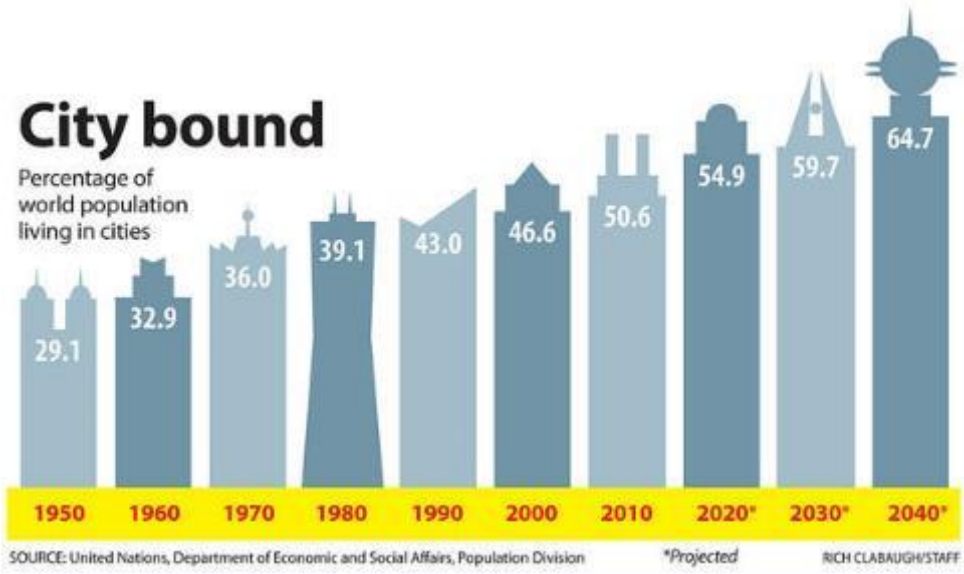
Eclipse IoT Days 2017 - Grenoble, France

OUTLINE

- Why Cities Need to be Smarter?
- sensiNact, IoT Platform for Smarter Cities
- Deployments in Europe and Japan
- Summary and Perspectives

WHY CITIES NEED TO BE SMARTER?



- More than half of the world population lives in cities
- Urban population percentage is around 75% in Europe

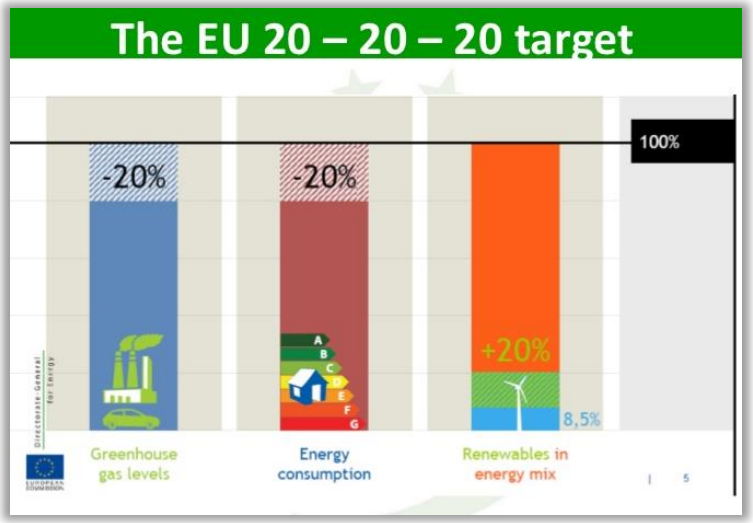
- On 2% of the earth's surface, cities use 75% of the world resources

Resources in civil infrastructure (water, energy, public transportation, parking spaces, buildings, roads, bridges, etc.) to be shared by the increasing population

=> direct consequences on the city life

Uexküll, Jakob. Shaping our future: Creating the World Future Council. Foxhole, Devon,

Energy



In Europe, **50%** of energy consumed today is imported – expected to reach **70%** by **2030**

Water

Worldwide, up to **60%** of water is lost due to leaky pipes—to the tune of **US$14 billion every year.**[1]

IBM

TRANSPORT

In Europe and US, drivers spend **from 5 to 10 working days** per year **stuck in the traffic**

City data sources

Smart City Platform

Data collection, analysis, knowledge, extraction, planning, action

Social networks

Mobile applications

WorldWideWeb

Legacy Devices

IoT Devices

City data sources

Citizen-centric services

Smart City Platform

Data collection, analysis, knowledge, extraction, planning, action

Social networks

Mobile applications

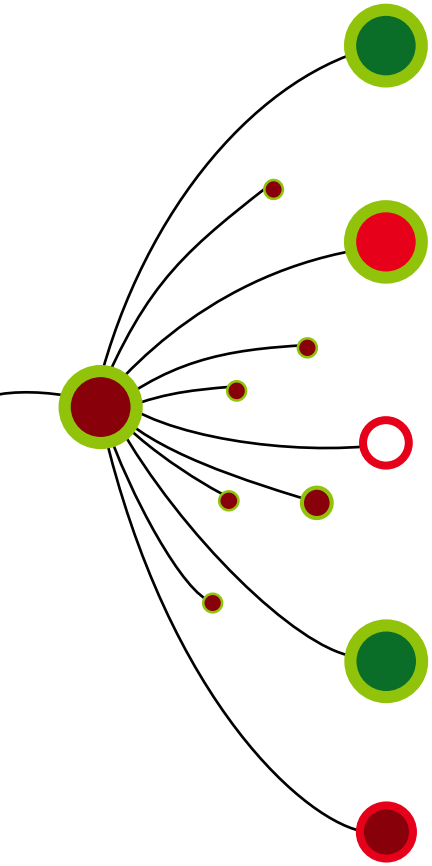
WorldWideWeb

Legacy Devices

IoT Devices

City data sources

MANY CHALLENGES



Heterogeneity/Interoperability: How to handle the numerous types of devices, protocols, standards?

Scalability: How to handle the big number of connections/big data coming from millions of devices?

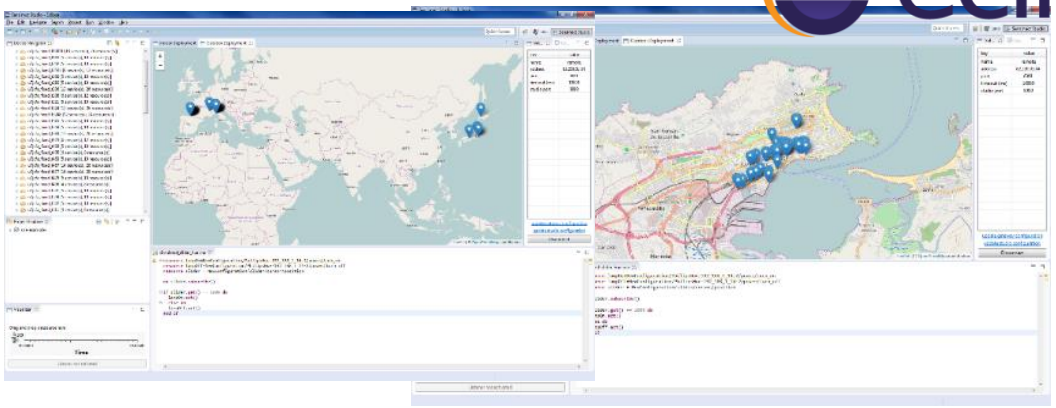
Dynamicity: plug&play, self-configuration, self-management, self-mathcmaking

Dependability: rapid prototyping yet reliable dependable applications

Security and privacy

SENSINACT – IOT PLATFORM FOR SMARTER CITIES

sensiNact Studio



Tool for **rapid and dependable** application building

Various **northbound** protocols

Homogeneous Access
- to **real-time data**: on-demand, periodically, event-based
- **historic data**

RESTful API
GET PUT POST DELETE

JSON-RPC

LWM2M

CDMI

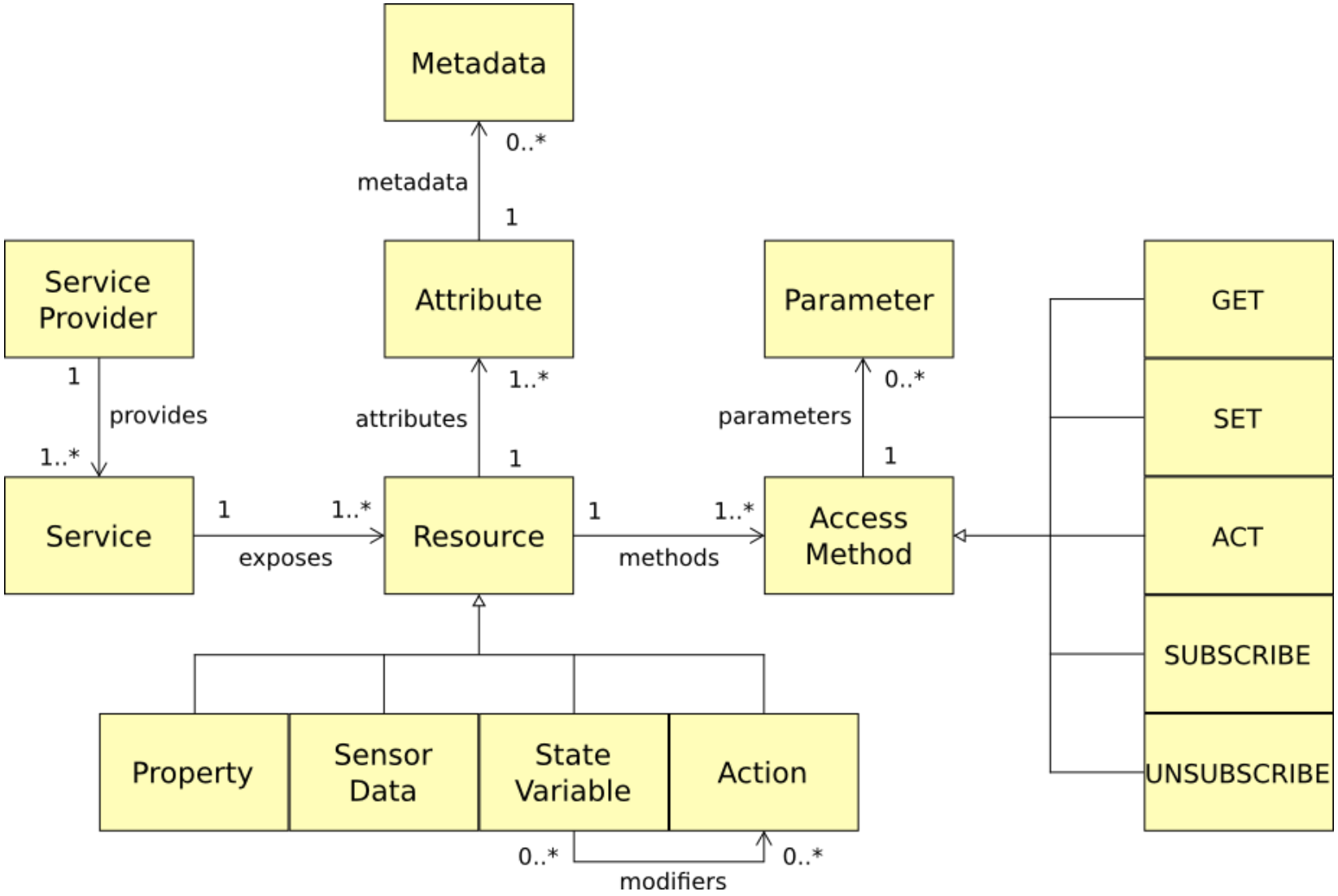
sensiNact Platform

Various **IoT** protocols and platforms

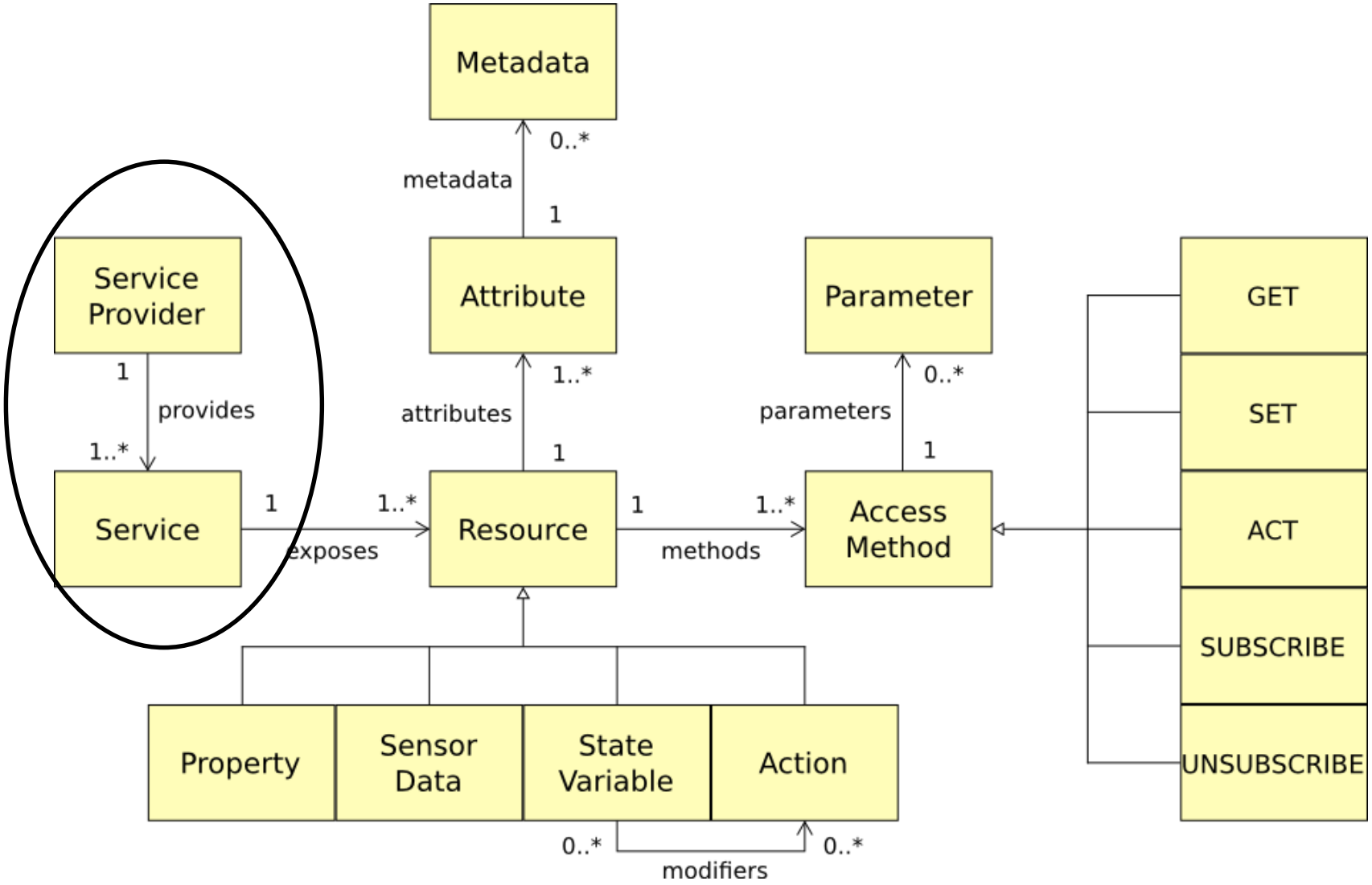
IoT platforms

Heterogeneous IoT devices and platforms

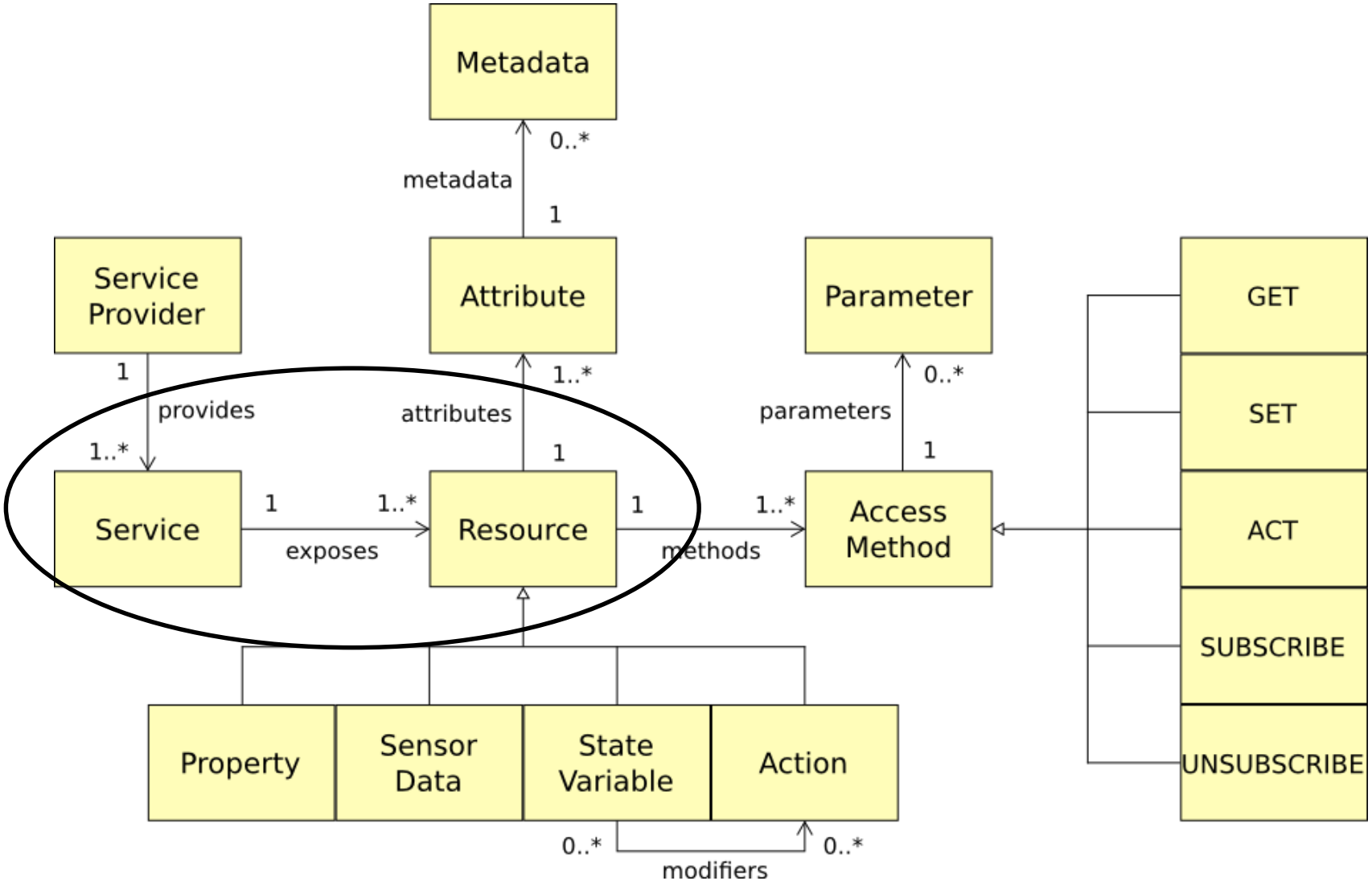
SENSINACT SERVICE MODEL



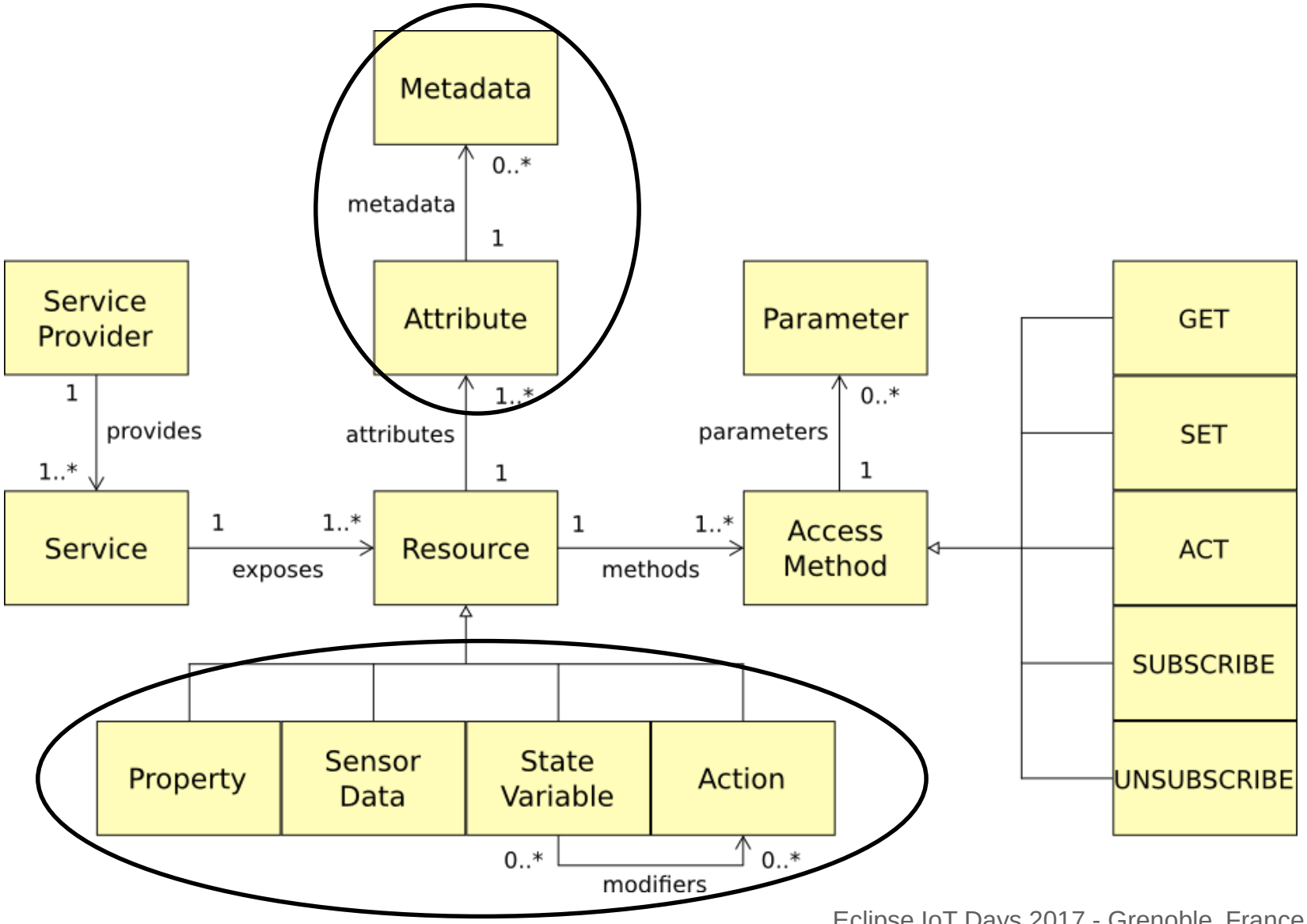
SENSINACT SERVICE MODEL



SENSINACT SERVICE MODEL



SENSINACT SERVICE MODEL



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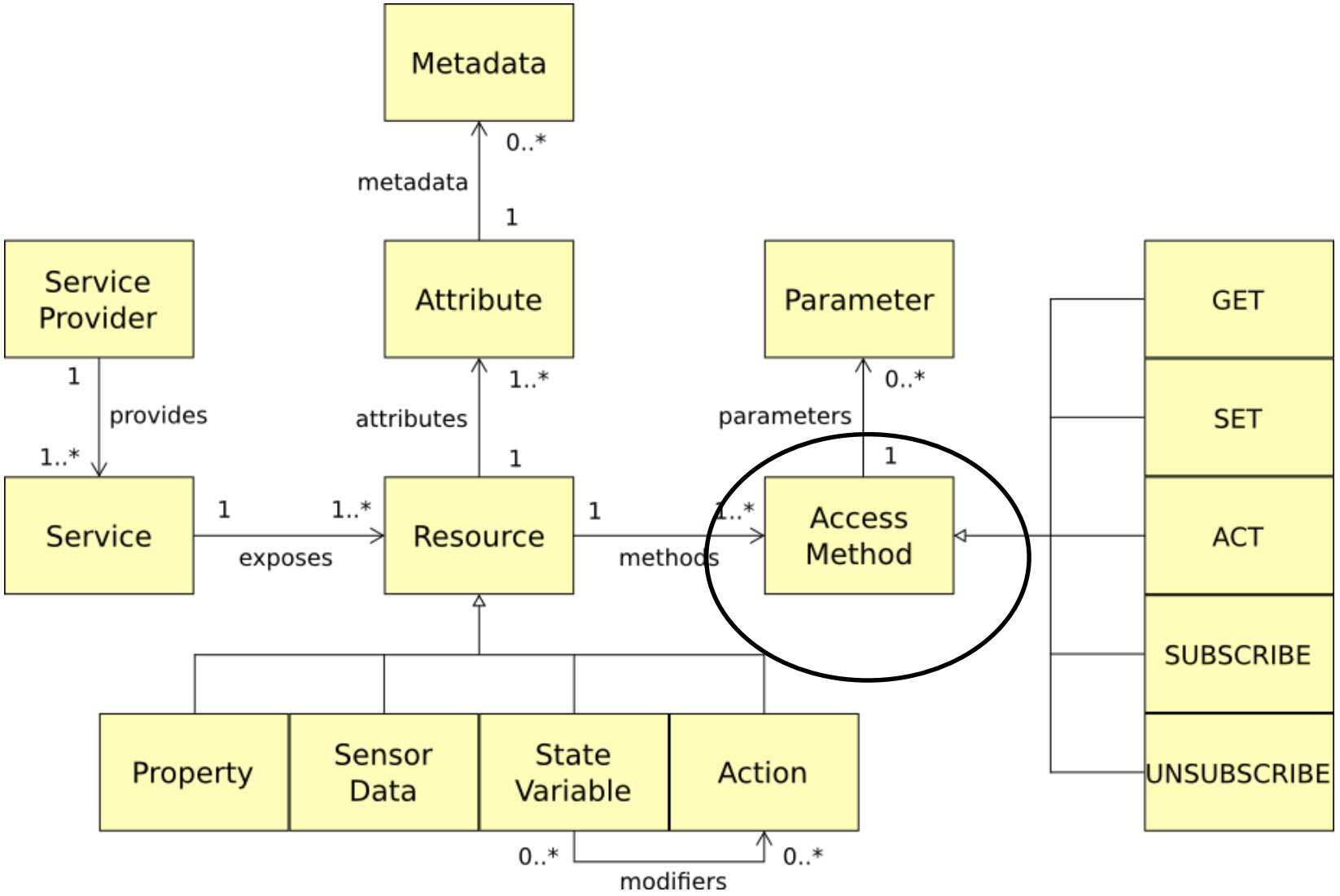

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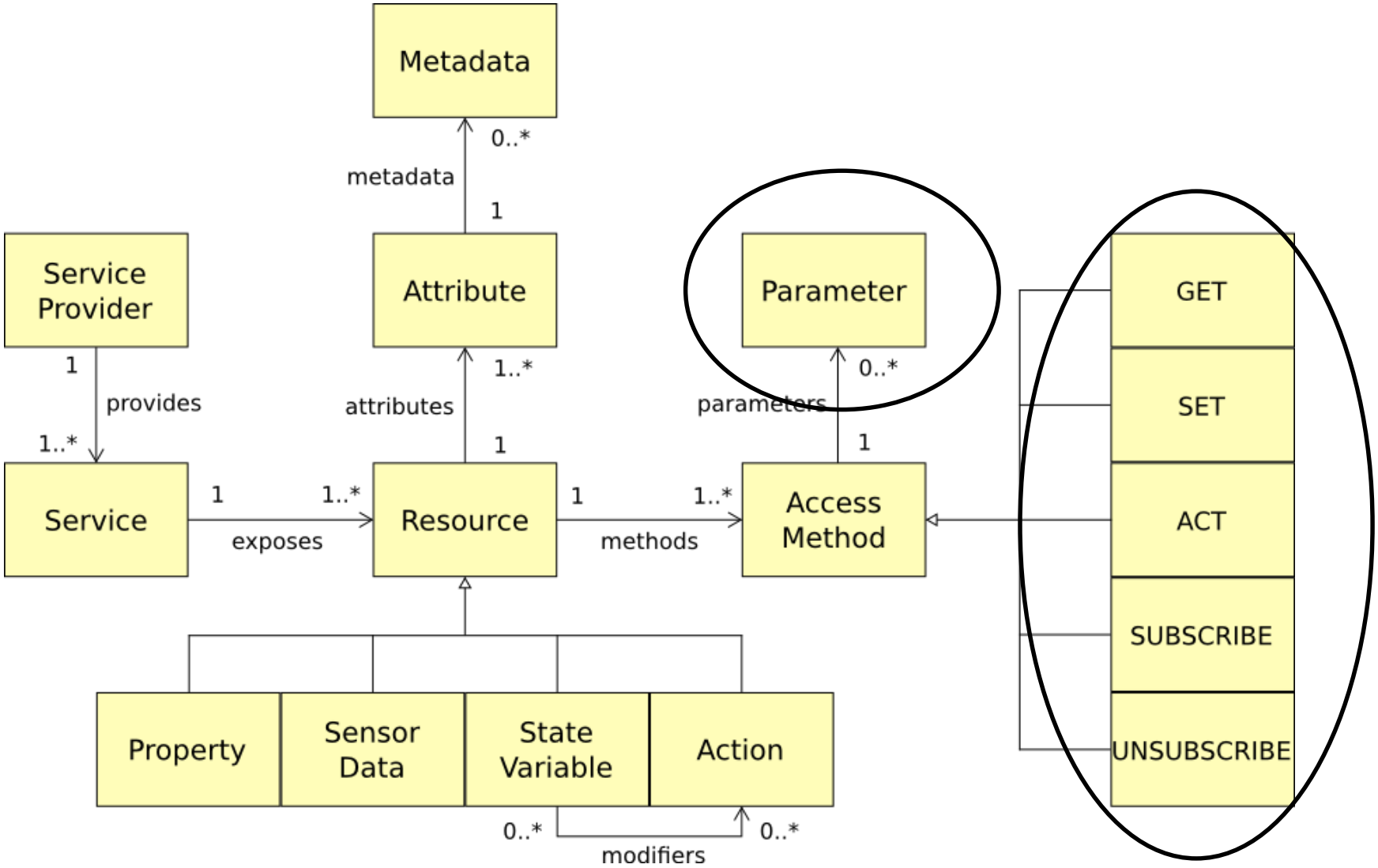
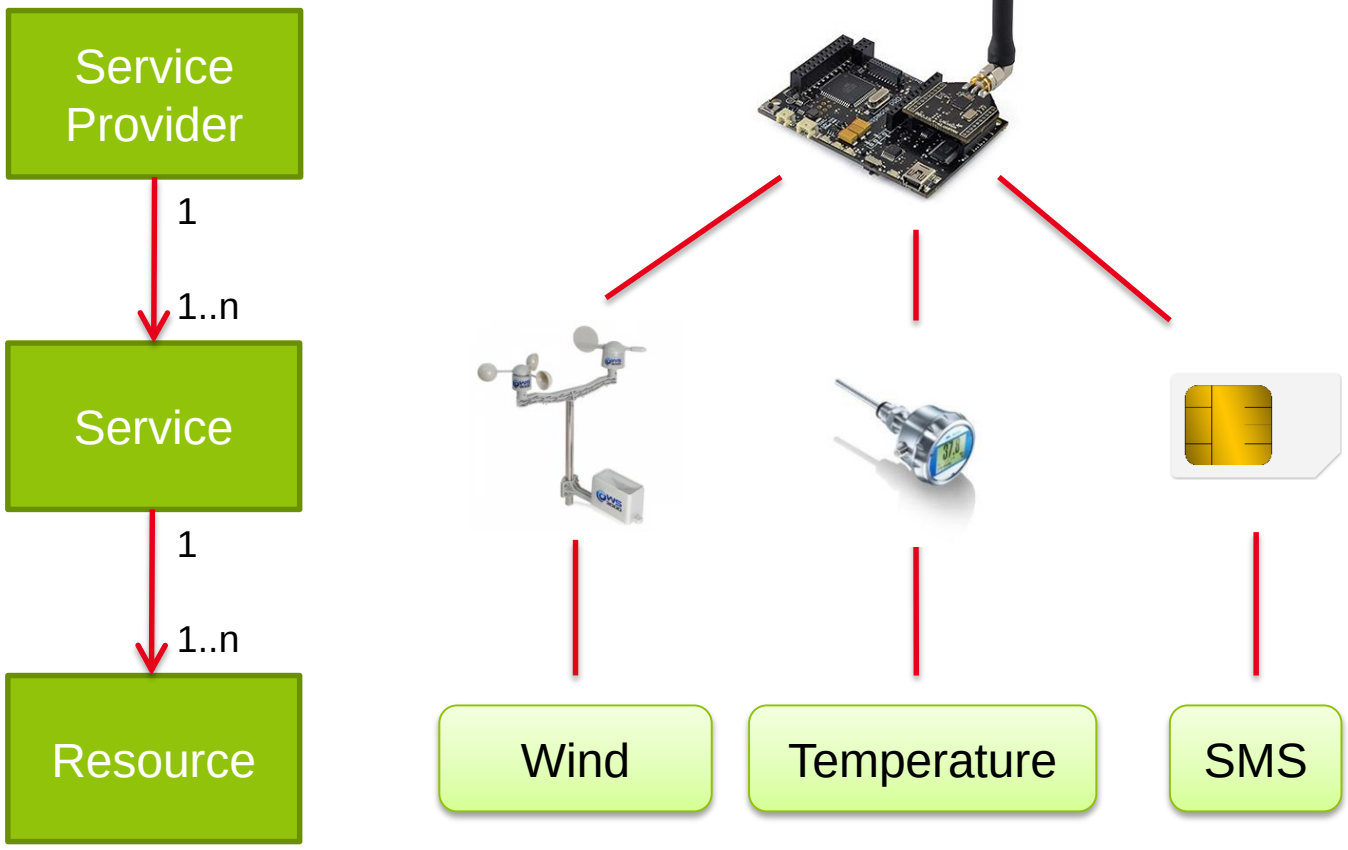


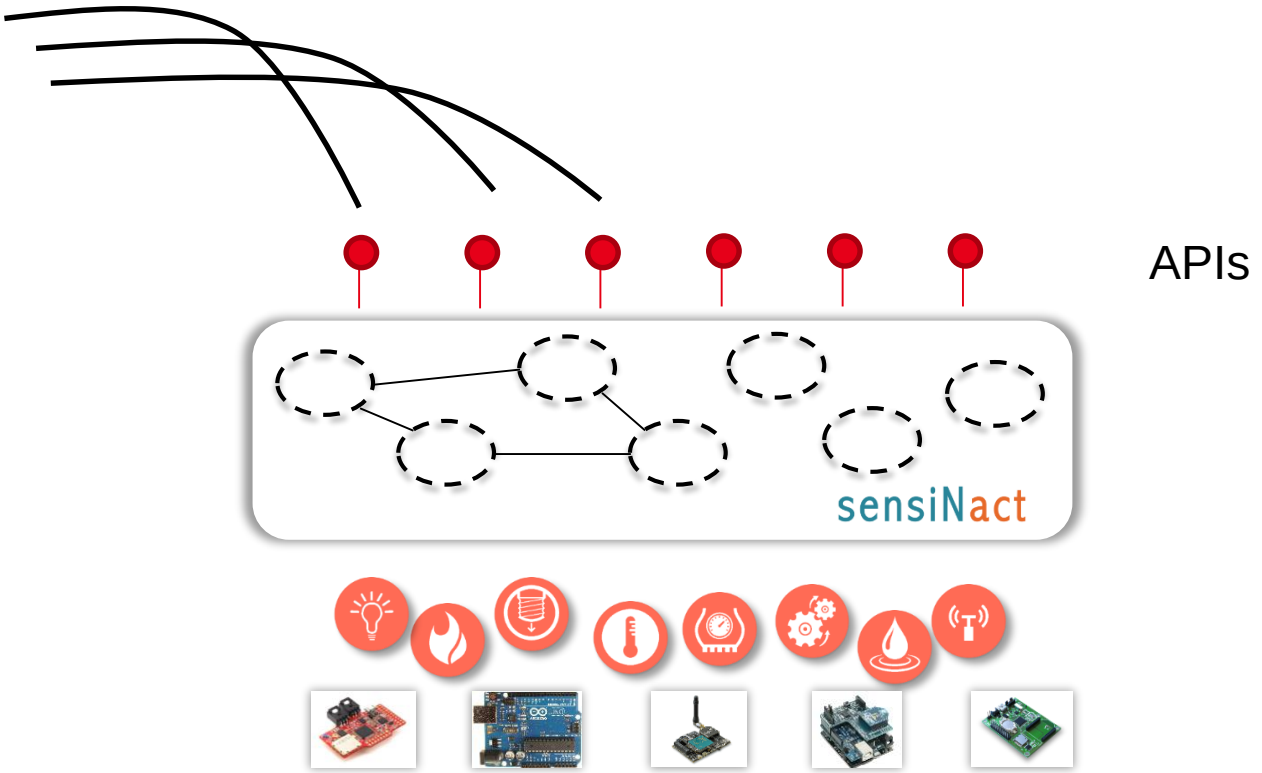
EXAMPLE SENSINACT SERVICE PROVIDER



SENSING AND ACTUATION SERVICES

DEVELOPPERS

develop, deploy,
monitor, manage

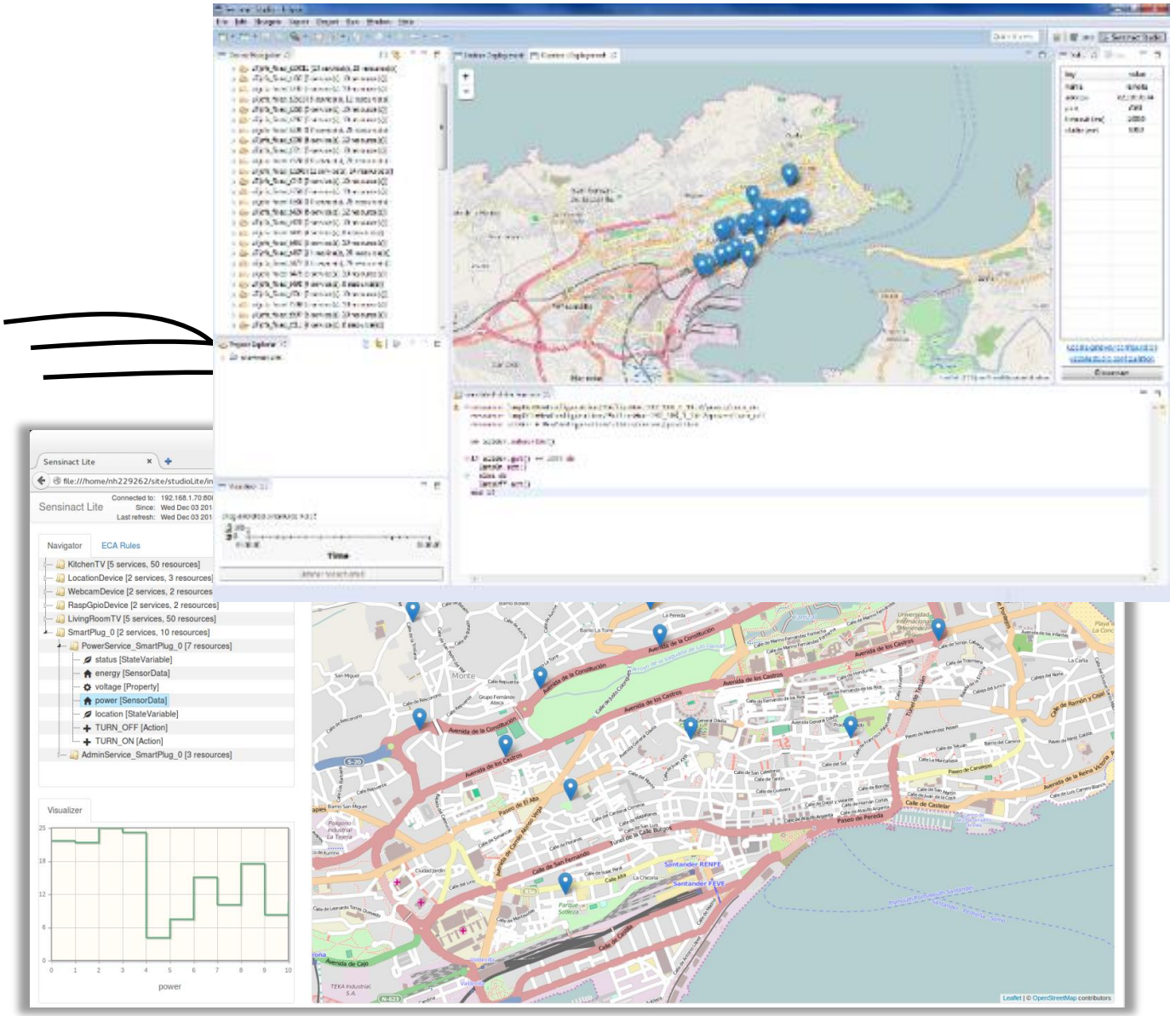


APIs

SENSINACT STUDIO - DEVELOPMENT ENVIRONMENT

DEVELOPPERS

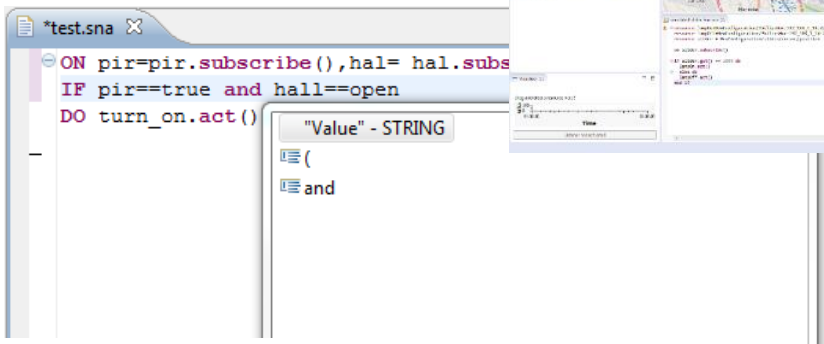
develop, deploy,
monitor, manage

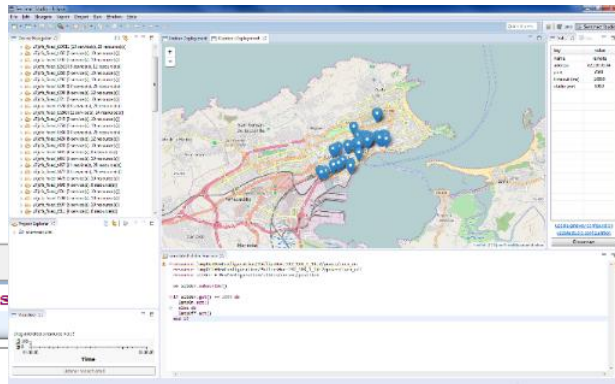


DEDICATED DOMAIN SPECIFIC LANGUAGE

- **A DSL for building IoT applications based on Event Condition Action rules**
- **ON Event IF Condition DO Action**

```
ON presence=PIRService.pir.subscribe()
IF presence==true
DO  LightService.lightOn.act();
ELSE
DO  LightService.lightOff.act();
```





```
ON presence=during(PIRService1.pir.subscribe()==true,
                   PIRService2.pir.subscribe()==true,
                   3)
IF presence==true
DO  LightService.lightOn.act();
ELSE
DO  LightService.lightOff.act();
```

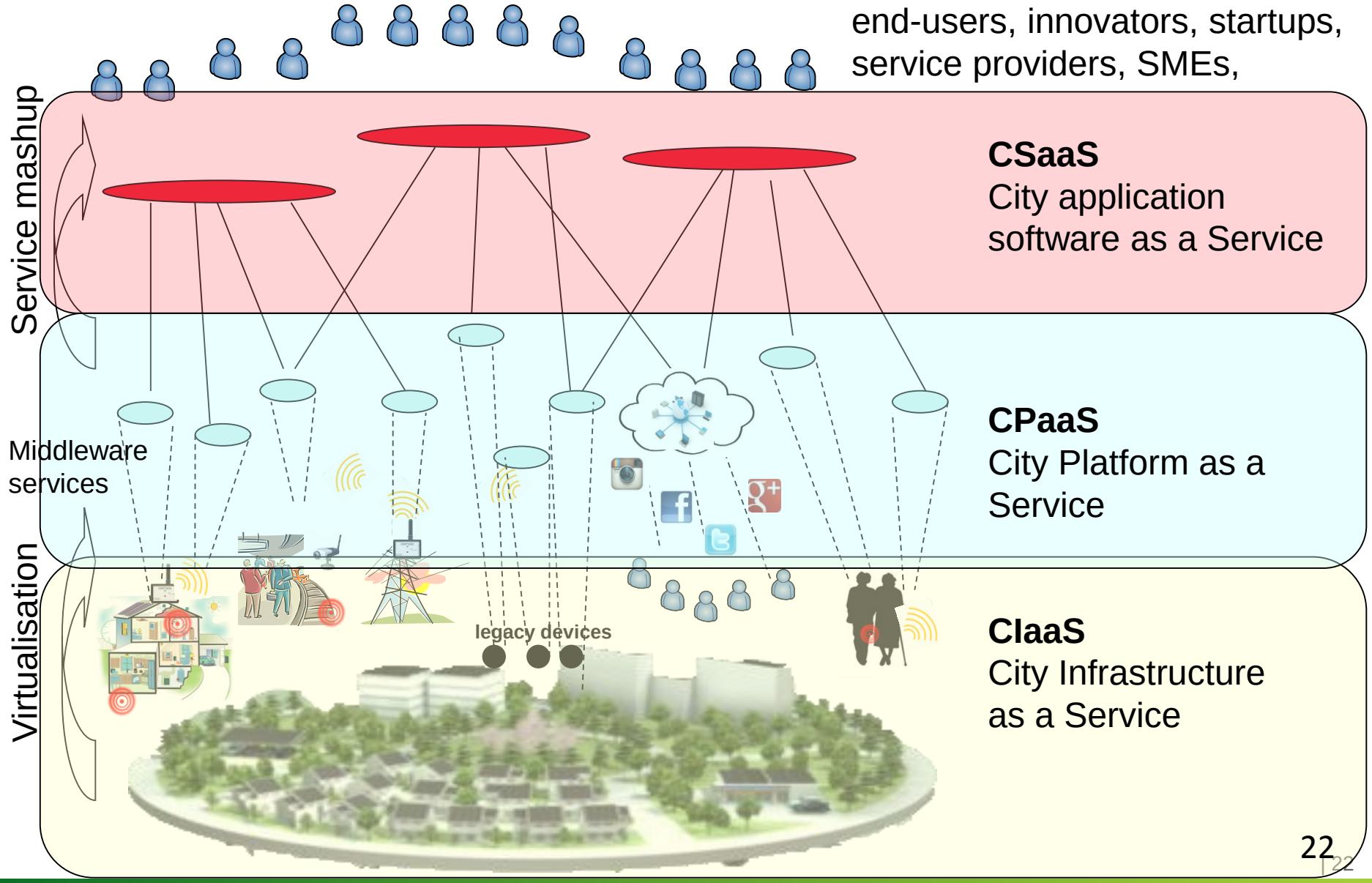
SENSINACT IN COLLABORATIVE PROJECTS

	OUTSMART	**OUTSMART** - Provisioning of urban/regional smart services and business models enabled by the Future Internet
Technical coordinator	BUTLER	**BUTLER** - uBiquitous, secUre inTernet-of-things with Location and contExt-awaReness
coordinator	CLOUT	**CLOUT** - Cloud of Things for empowering the citizen clout in smart cities
	sociotal	**SOCIOTAL** - creating a socially aware and citizen-centric Internet of Things!
coordinator	FESTIVAL	**FESTIVAL** - Federated interoperable smart ICT services development and testing platform
WP leader	ORGANICITY	**ORGANICITY** - Co-creating smart cities of the future
WP leader	WISE IoT	**WISE-IoT** - Wordlwide Interoperability for SEmantics IoT
coordinator	bigCLOUT	**BigClouT** – ClouT with Big Data with Bristol and Grenoble
	UNIFY - IoT	**Unify-IoT** - Supporting Internet of Things Activities on Innovation Ecosystems
	IoF 2020	**IoF2020** - Internet of Food and Farm 2020
WP leader	ACTIVAGE PROJECT	**ACTIVAGE** - ACTivating InnoVative IoT smart living environments for AGEing well

CLOUT PROJECT

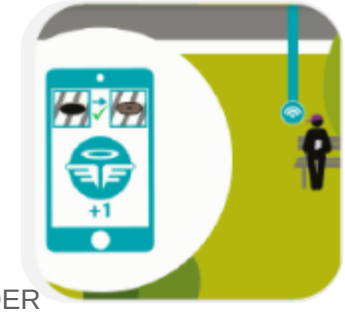
Cloud of Things for empowering the citizen clout in smart cities

CLOUD MODEL FOR IOT SERVICES



FIELD TRIALS IN 4 PILOT CITIES

PARTICIPATORY SENSING



SANTANDER

HEALTH MANAGEMENT

MITAKA

CLOUT

SAFETY AND EMERGENCY

GENOVA

SMART SPACES

FUJISAWA

SMART SANTANDER INFRASTRUCTURE

Environmental monitoring

Smart irrigation

mobile nodes on city buses and taxis

Parking sensors

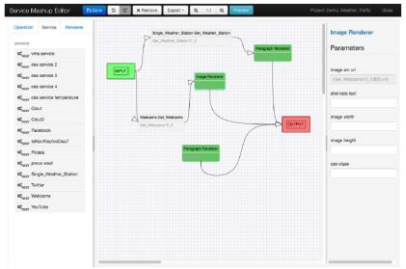
Guiding drivers

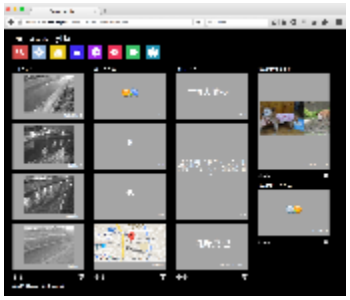
Trafic sensors

GENOVA ENVIRONMENTAL DATA IN THE CLOUD

MOBILE ATMOSPHERIC SENSING WITH GARBAGE COLLECTING CARS

INTERCONTINENTAL TRIAL





Service development tool

Data Mashup

City dashboard

Intercontinental coopetition

sensiNact

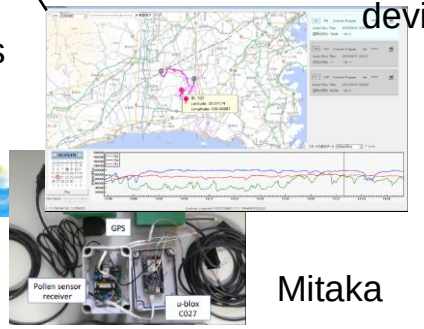
> 10 000 physical devices

> 150 physical devices

> 150 physical devices + > 500 000 virtual devices

Santander

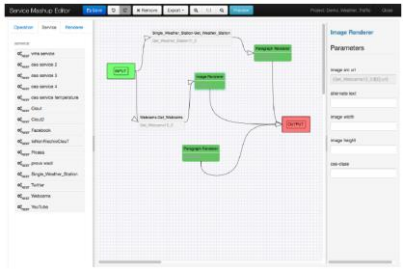
Genova

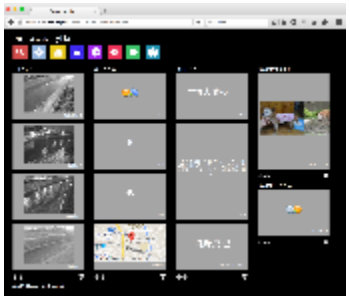


Mitaka

Fujisawa

INTERCONTINENTAL TRIAL





Service development tool

Data Mashup

City dashboard

Intercontinental coopetition

RESTful API
GET PUT POST DELETE

RESTful API
GET PUT POST DELETE

MQTT

OSGi™

sensiNact

SNIA CDMI

orion

XMPP

webservice

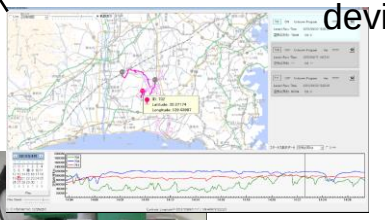
> 150 physical devices + > 500 000 virtual devices

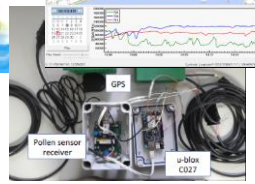
> 10 000 physical devices

> 150 physical devices

Santander

Genova

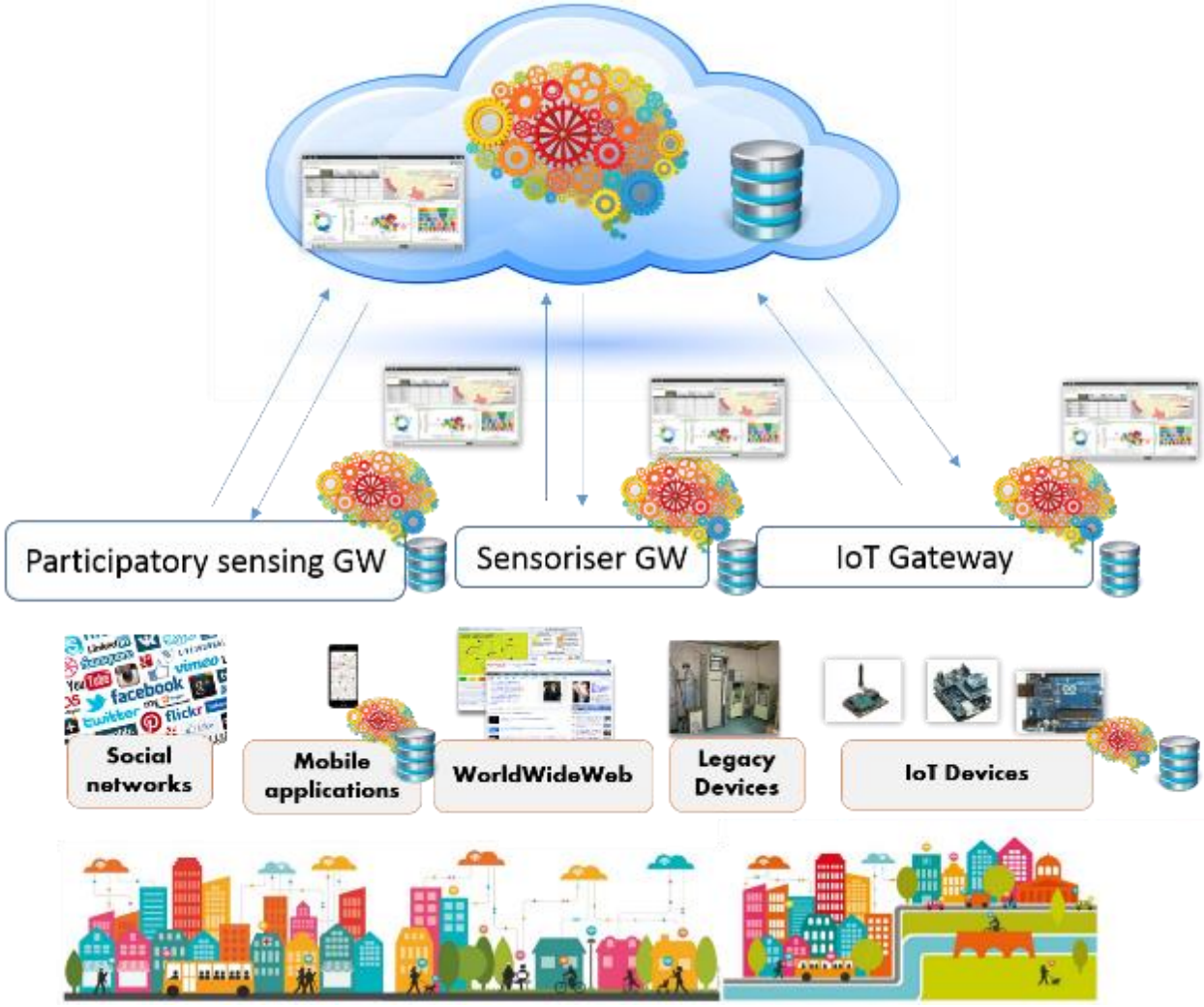




Mitaka

Fujisawa

CLOUT EXPANDED WITH BIG DATA AND NEW CITIES (GRENOBLE, BRISTOL, TSUKUBA)



Cloud computing, analysis and visualisation on aggregated big data

Edge computing for adaptive processing, distributed intelligence and management.

Programmable city data platform including IoT and other data sources

FESTIVAL PROJECT

Santander

Smart ICT tetbed

Infrastructure, testbeds, software, internet of things

Software and Smart Services

Infrastructure, testbeds

Internet of Things

- Join forces and connect & federate EU and JP platforms for experimenters (researchers, developpers, SMEs, web entrepreneurs, etc.)
- Concrete, tangible smart ICT applications deployments, experimentations in the federated testbeds with real-user involvement

Osaka KNOWLEDGE CAPITAL

Grand Front Osaka

Maya Train Station

FESTIVAL PROJECT

Santander

Smart ICT tetbed

Infrastructure, testbeds, software, internet of things

FIRE

Infrastructure, testbeds

Software and Smart Services

Internet of Things

- Join forces and connect & federate EU and JP platforms for experimenters (researchers, developpers, SMEs, web entrepreneurs, etc.)
- Concrete, tangible smart ICT applications deployments, experimentations in the federated testbeds with real-user involvement

Osaka KNOWLEDGE CAPITAL

Grand Front Osaka

Maya Train Station

EXPERIMENTATION AS A SERVICE

Federation through an Uniform Access Layer offering **Experimentation as a Service**

Open Data Federation

SANTANDER

VILLE DE LYON

› Access to city data sets

IoT Gateway

Experimentation Facilities

SmartSantander
Large scale smart city

iHouse

› Experimental SmartHouse

› Experimental datacenter facility

ATR DC

PTL

› Advanced Microelectronics
› Integration Testbed

IT Resource Manager

Platforms

FIWARE Lab by ENGINEERING

› Cloud Environment
› Manage Virtual Machines
› Access Generic Enablers

JOSE

› Japan-wide
› Open Testbed
› Wireless Sensors
› SDN capabilities
› Cloud ressources

Living Lab Manager

Living Labs

TUBA - Lyon

The Lab - Osaka

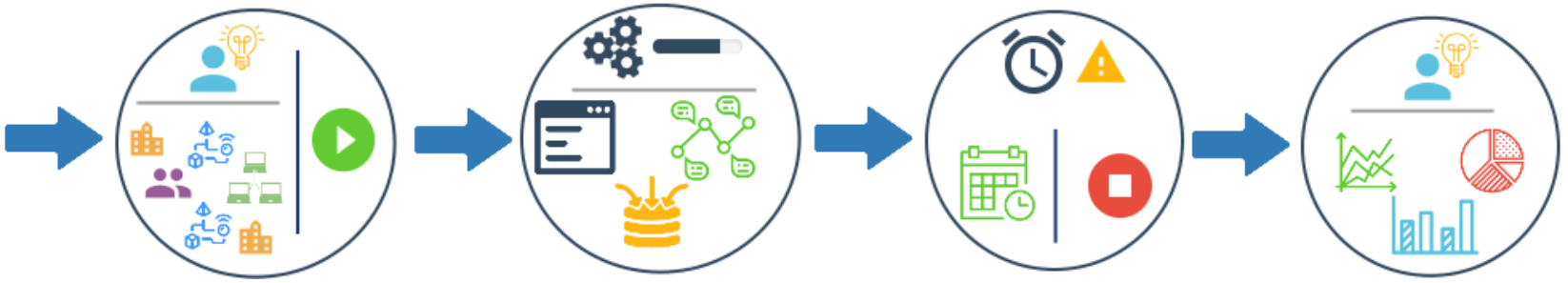
› Access to large base of end users
› Co creation processes
› Feedback from citizens

EXPERIMENTATION WORKFLOW

Secure access

Experiment Creation

Resource discovery and assigment



Experiment starting and resource reservation

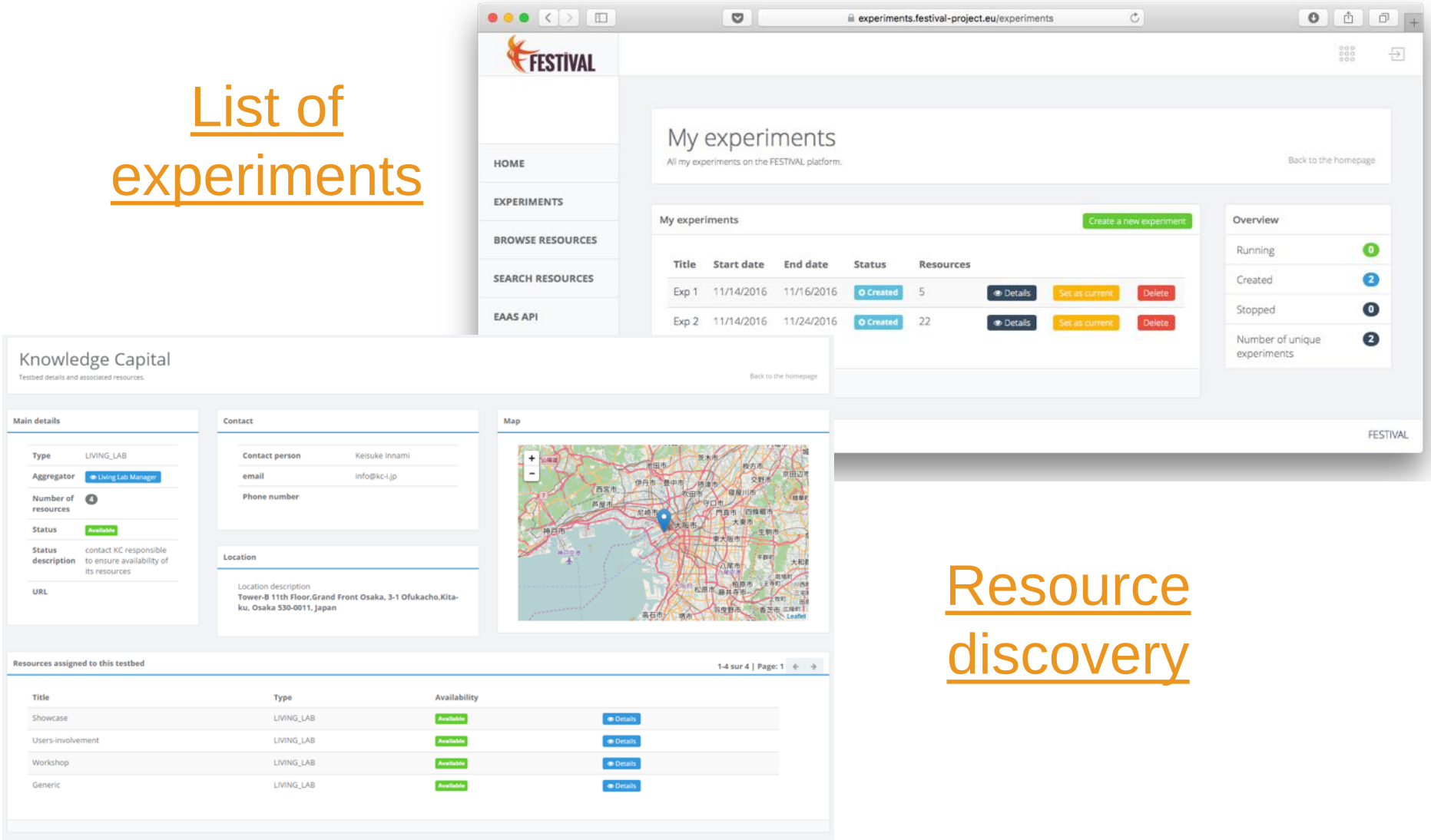
Experiment execution and mesurements collection

Experiment conclusion

Results and KPI visualisation

EXPERIMENTATION PORTAL

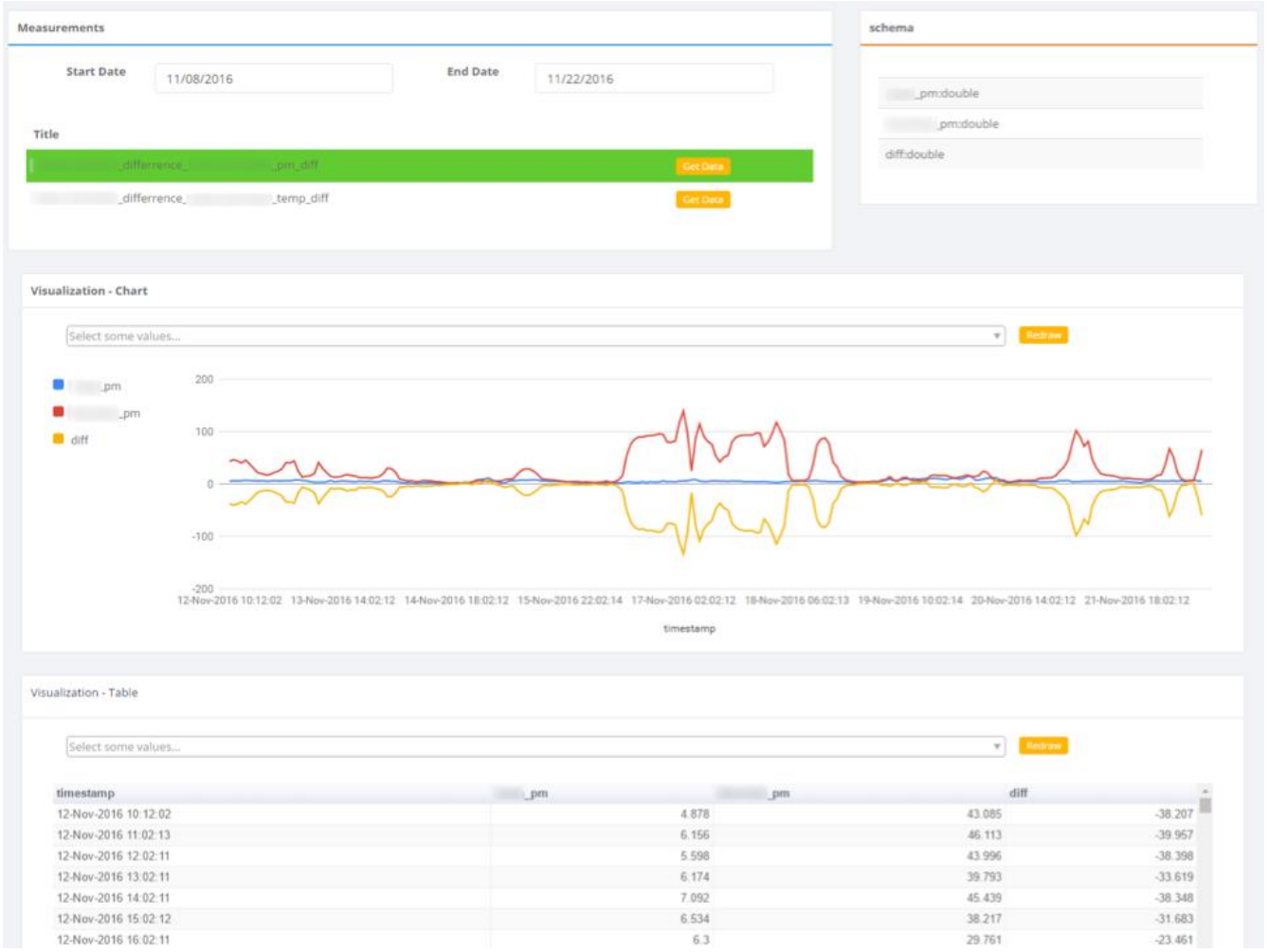
List of experiments



Resource discovery

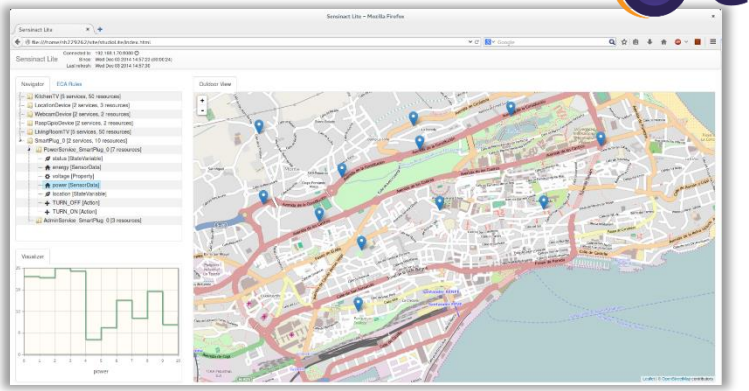
EXPERIMENTATION PORTAL

Visualization of measurements collected during execution



FESTIVAL

eclipse



Monitor, control, deploy

OSGi™ sensiNact Platform

OSGi™ sensiNact GW

KNX

enocean

PTL

OSGi™ sensiNact GW

openHAB
empowering the smart home

ECHONET

iHouse

FEDERATION OF SMART STATIONS

FESTIVAL

ckan

Open data (bus/train schedule, weather, etc..)

JOSE: Japan-wide Orchestrated Smart / Sensor Environment

OSGi sensiNact

MQTT.org

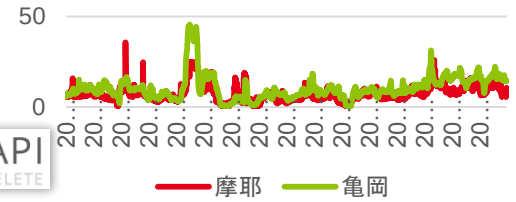
Air quality sensor

Vibration sensor

pollen sensor

Person counter

Data analysis



RESTful API
GET PUT POST DELETE

Information

Smart station applications

Kameoka station

Maya station

WISE IoT Wordlwide Interoperability for SEmantics IoT

Grenoble | PyeongChang | Sevilla | Busan | Santander | Daegu

Smart ski resort | Environmental monitoring | Enhanced mobility | Health monitoring

Wise-IoT Recommendation service

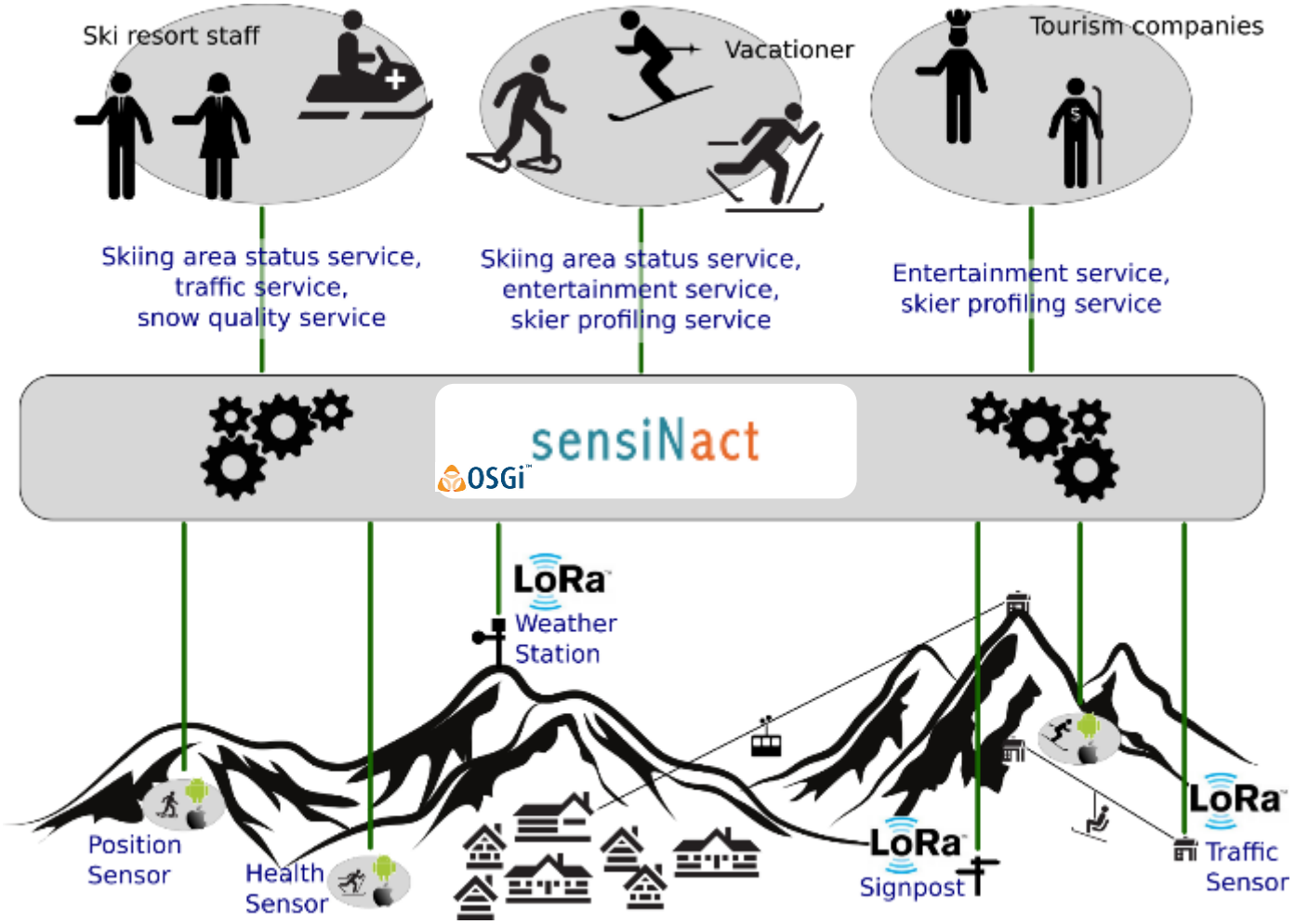
oneM2M | FIWARE NGSI

Industrial Internet Consortium | OPEN INTERCONNECT | OSGi Alliance | GS1 | ALLSEEN ALLIANCE

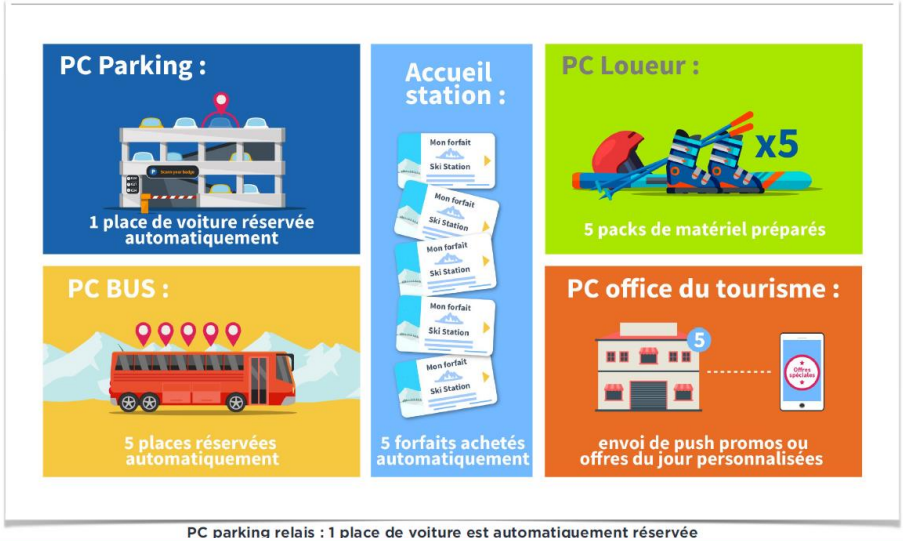
MQTT | Z-Wave | LoRa | 6LoWPAN | Wi Fi

Eclipse IoT Days 2017 - Grenoble, France

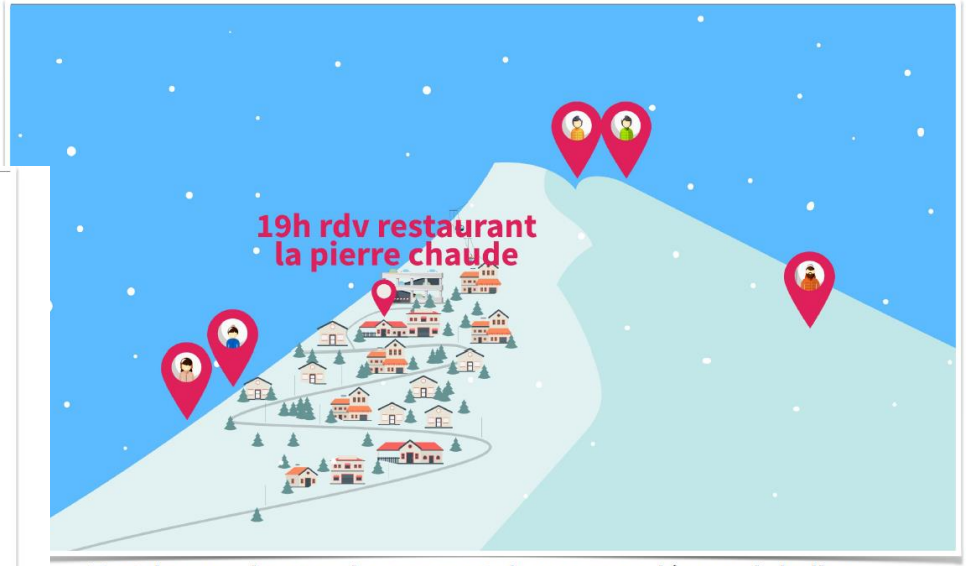
IOT FOR SMART SKI RESORTS



VARIOUS USE CASES



PC parking relais : 1 place de voiture est automatiquement réservée



Tout le monde prend son smartphone pour découvrir le lieu et le chemin pour s'y rendre (= un restaurant).

ORGANICITY PROJECT

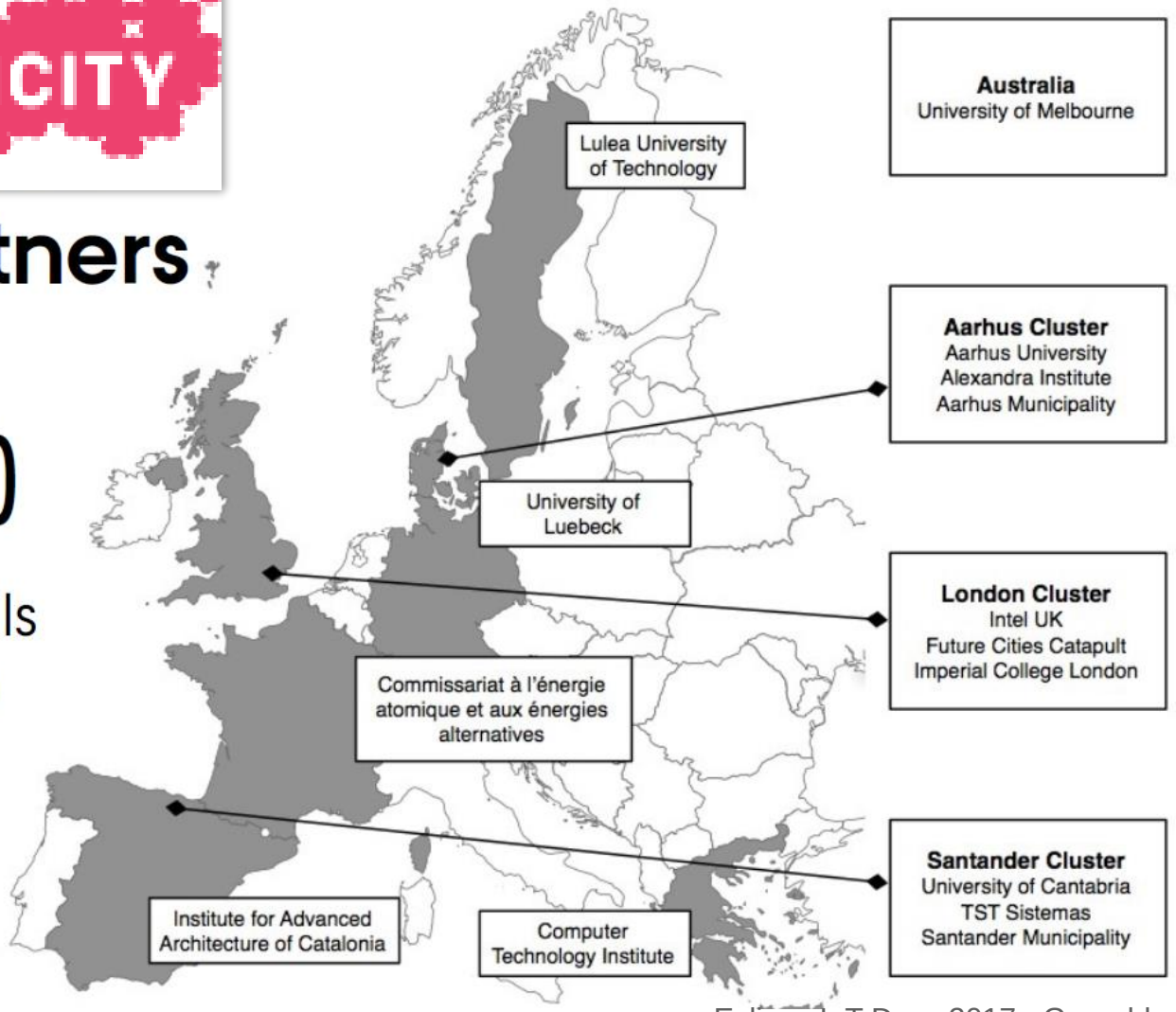
ORGANICITY

15 partners

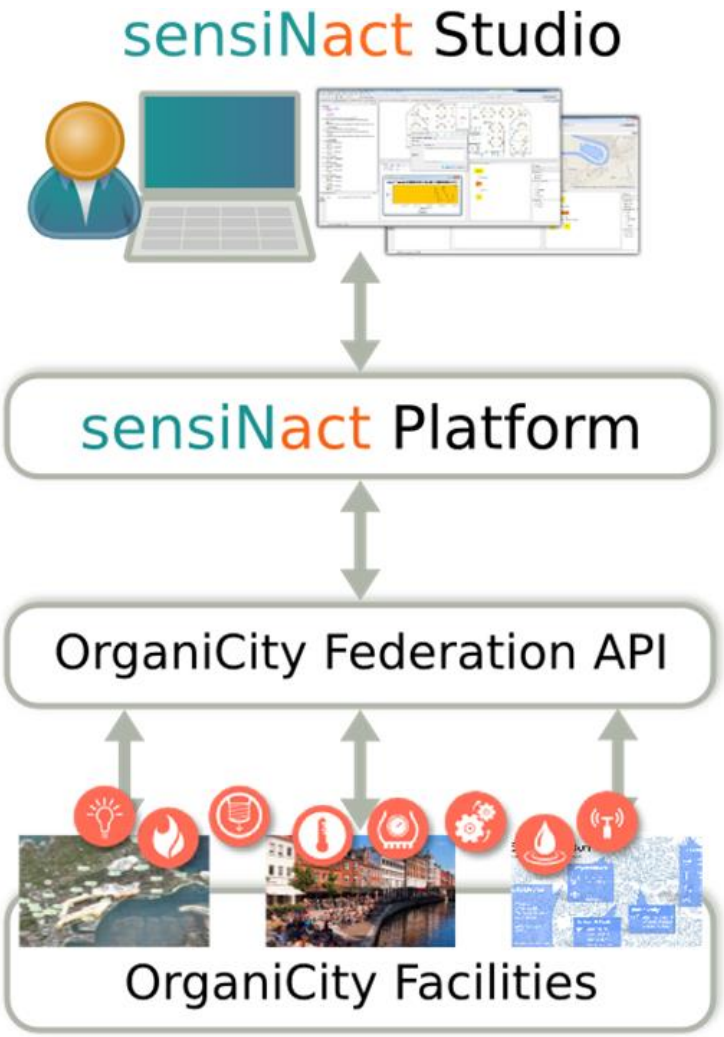
€7.2 M

(€1.8 M)

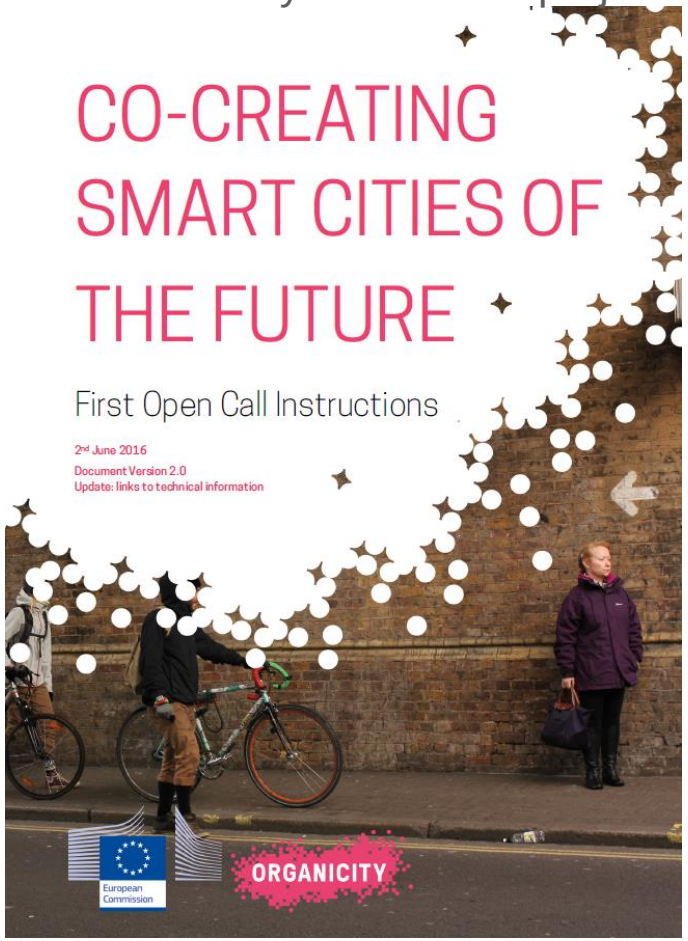
2 open calls
36 months
2015-17



ORGANICITY FEDERATION



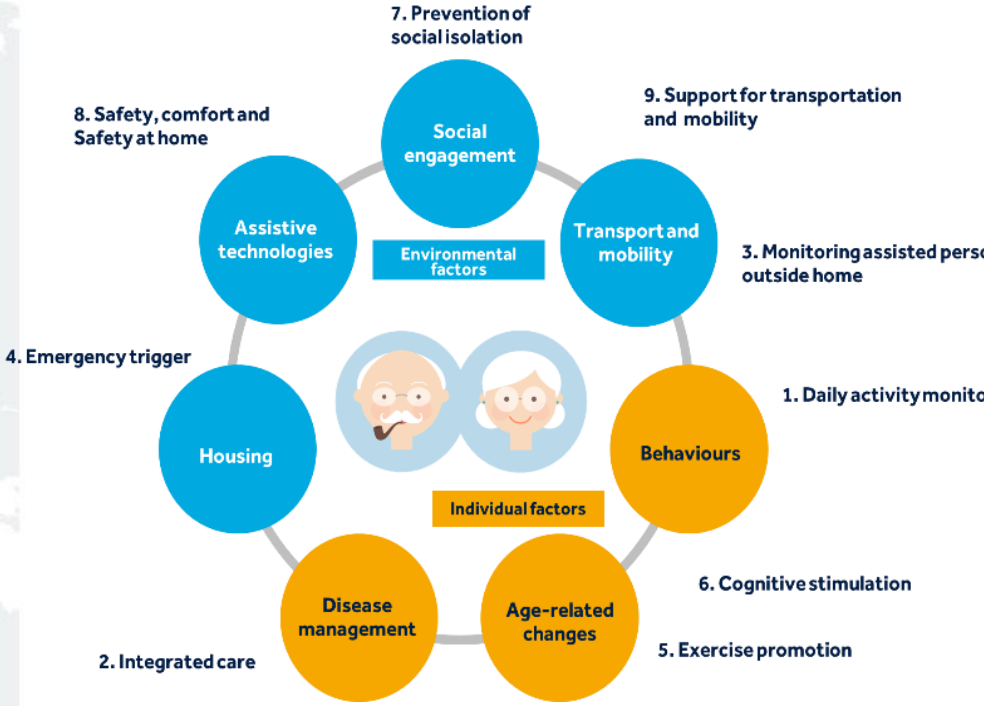
OrganiCity is inviting proposals for experiments to run in our three lead cities: Santander, Aarhus and London. The open call offers funding of up to 60.000 € to kick start your ideas or projects.



Internet of Food and Farm 2020

ACTivating InnoVative IoT smart living environments for AGEing well

ACTIVAGE PROJECT



SENSINACT FEATURES

- **Plug&play**: Device as a Service Approach. Flexibility of adding/removing/updating devices with a minimum impact on the running platform.
- **Modular**: Modular development and deployment for enhanced system maintenance and evolution
- **Dependable**: sensiNact's formal data and service models facilitate reliable IoT applications development.
- **Scalable**: sensiNact's three layers architecture (device/gateway/cloud) allows distribution of data processing at different levels.
- **Easy&quick**: sensiNact's comprehensive data model and APIs help to rapidly build IoT applications.

sensiNact smart city platform joins to Eclipse community!

https://projects.eclipse.org/proposals/eclipse-sensinact

Believing in open platforms for smarter cities?
Interested in joining the forces?
Just let us know!

levent.gurgen@cea.fr

Defining cities of the future together

- Each city is unique!
- Yet, today's worldwide economic, social and environmental **challenges are related**
- Many **technical requirements are common**, they should be addressed **globally**.
- Important to **mutualize resources**, **cooperate** and **exchange lessons learnt and best experiences** among different stakeholders and ecosystems
- **Openness is the key!**
  - **Giving more clout to citizens**
  - **Smarter citizens => smarter cities**

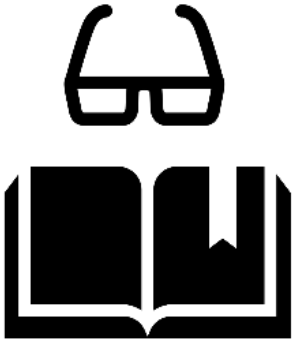
Urban Technology Alliance

- **Bring together various actors of the smart city ecosystem**
  - **Cities, large and small industries, research centers and universities, non-profit organizations, etc.**
  - **Have the voice of each stakeholder for defining cities of the future, enabling cooperation and exchange of best practices.**
  - **Demand driven analysis of requirements**
- **Join forces to provide necessary platforms and tools for building together the cities of the future**
  - **Developer friendly APIs; interoperable, flexible, extensible data models; rapid and robust application development tools, etc.**

Defining cities of the future together

Large industry

Cities



Researchers

Startups/SMEs

Objectives of Urban Technology Alliance

- Provide **direct contact between city authorities and solution developers** to identify real requirements for smarter urban environments
- **Provide open source platforms, components and tools** addressing the current and future technical challenges in urban environments.
- **One-stop showcase** for a comprehensible set of (integrated) smart city solutions by a multi-disciplinary stakeholders, tailored to specific needs of the member cities
- Provide **large networking possibilities**, between cities, SMEs/startups and with large corporations for exploring collaboration opportunities (funding by private-sector or public authorities such as EU H2020).
- Provide **increased visibility** to its members **at international scale**.
- **Create a business ecosystem** among the members to join the forces and build integrated end-to-end solutions and promote them worldwide.
- **Organize pilot deployments and testbeds** with the member cities for validation and promotion.
- Guidance to the cities from prestigious **neutral** and **independent** research centers, non-profit organizations about the latest smart city technologies, standards and innovative applications.
- Organize events to **exchange best practices, lessons learnt, know-how** with other national and international initiatives.

Specific Task Groups

- **Architectural task group** to deal with the technical issues, requirements analysis, interoperable architectures, integration plans among the projects in the group, etc.

- **Business task group** to promote networking among the members, identify new opportunities and work on new win-win business models.

Specific Task Groups

- **Testbed task group** to organize pilot deployments to demonstrate and test solutions in close to real life environments with the help of the member cities.

- **Social task group** to remind us that the citizen is the center of all the preoccupations, and deal with non-technical issues such as ethics, privacy, design, art, etc.

CORE MEMBERS (TO BE COMPLETED)

CLOUT

http://clout-project.eu

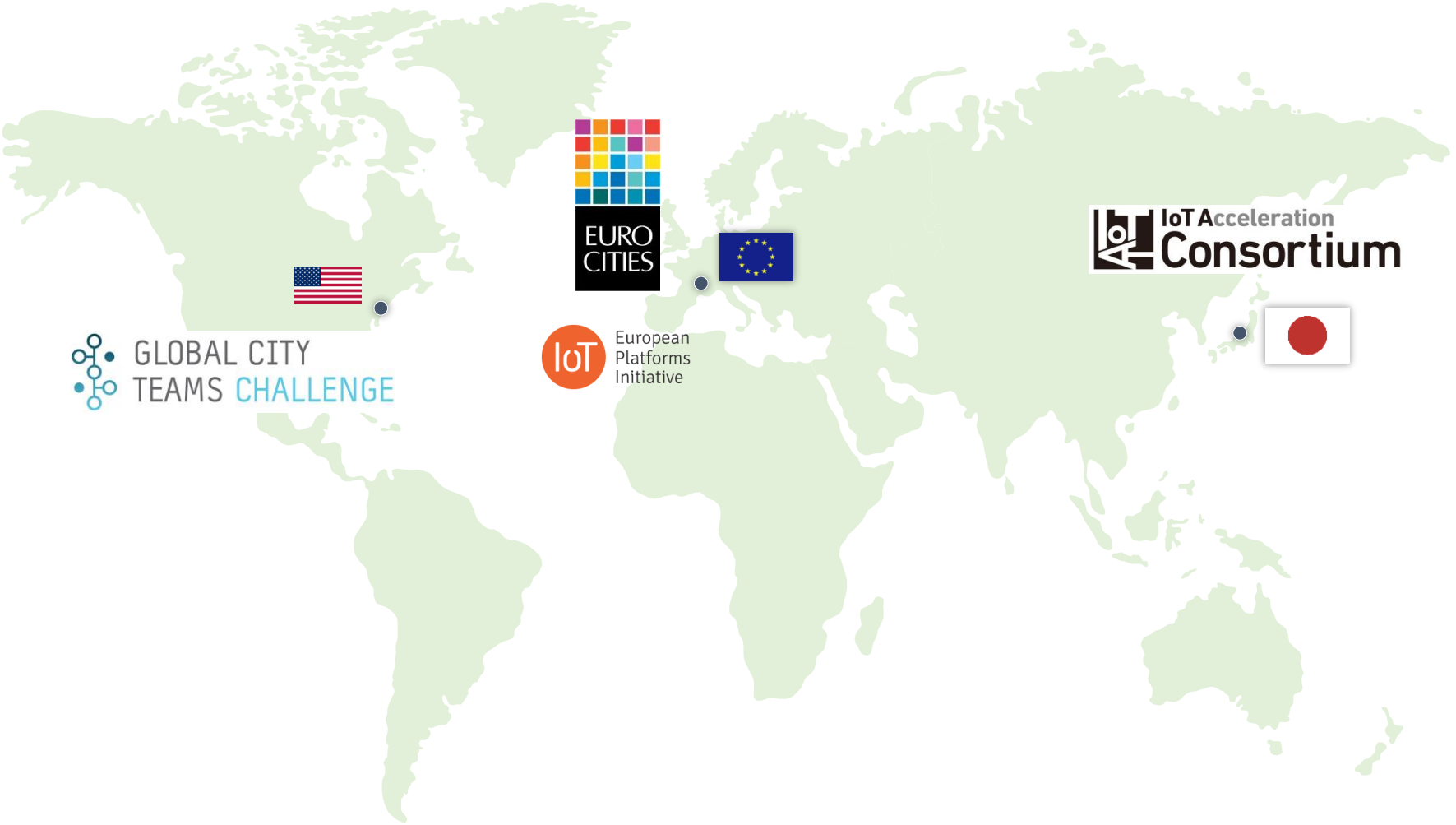
FESTIVAL

www.festival-project.eu

BIGCLOUT

http://bigclout.eu

LINKS WITH OTHER WORLDWIDE COMMUNITIES AND INITIATIVES



Joining forces with eclipse

BigClout Festival

- One of the largest and most active open source community
  - 250+ members, ~1200 committers from 30 countries on 5 continents
  - 300+ Open Source Projects
  - **2 million** unique visitors/month, **1.5 million downloads**/month (average)
  - Expertise in open source **community management**, ~30 employees
  - **Business oriented** ecosystem
  - Proven **IT infrastructure** and **IP management**
  - Principles of **openness, transparency and meritocracy**

- Eclipse Working Groups
  - Host leading open source technologies in the domain

LocationTech

SCIENCE eclipse.org

iot eclipse.org

PolarSys

openMDM Measured Data Management

openPASS

Thank you for your attention!

Join Us!

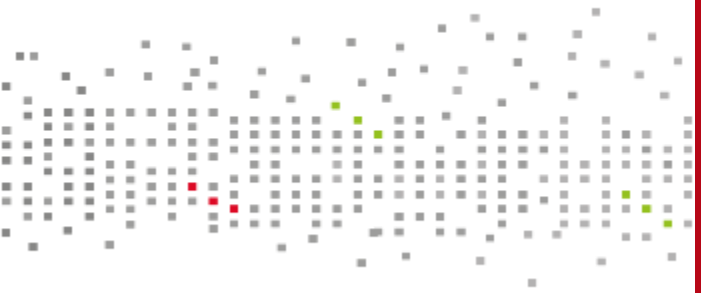
Contact

Levent Gürgen

levent.gurgen@cea.fr

Co-funded by the European Commission and NICT

THANK YOU FOR YOUR ATTENTION!



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