Horizontal platforms to globally sense-process-act; is it that simple?

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FROM RESEARCH TO INDUSTRY
cea tech

www.cea.fr

leti & list

- Personal Computers were revolutionary!

- Personal Computers were revolutionary!

- But the real revolution was when we inter-connected them!

  => Internet

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  => Internet

- Embedded devices are revolutionary!

- Personal Computers were revolutionary!

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  => Internet

- Embedded devices are revolutionary!
- But the real revolution will be when we will inter-connect them!

=> Internet of Things

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- But the real revolution was when we inter-connected them!

  => Internet

- Embedded devices are revolutionary!
- But the real revolution will be when we will inter-connect them!

=> Internet of Things or Internet of Everything, Web of Things, Cyber-Physical Systems, Industrial Internet, Industry 4.0, Web 3.0, M2M, etc.

From vertical embedded systems…

- Traditional embedded systems: dedicated to specific tasks in a given application domain.

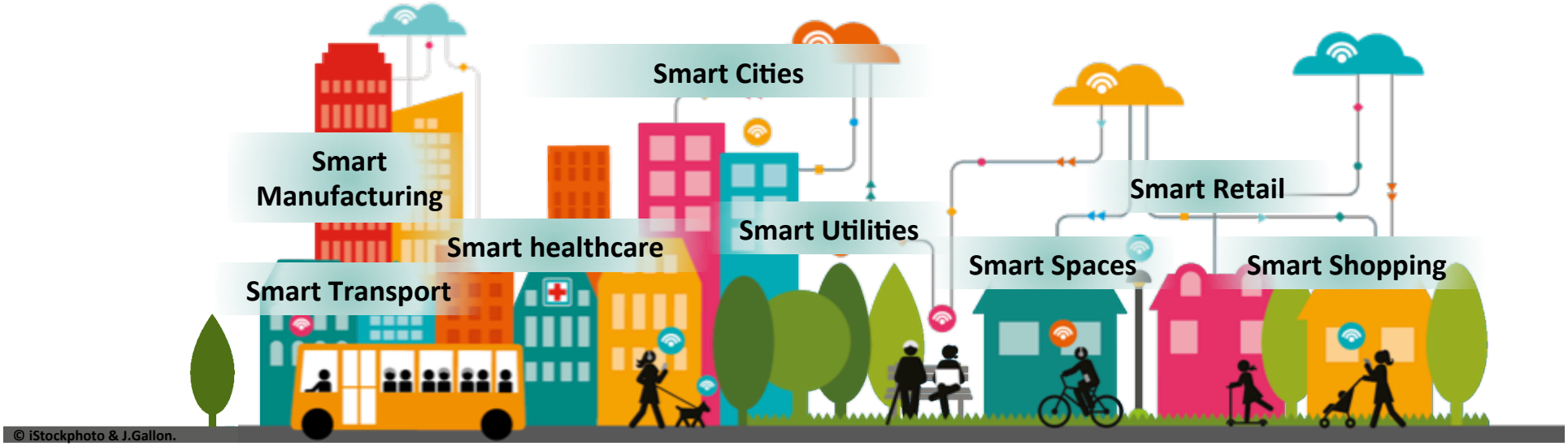
From vertical embedded systems…
…to horizontal Internet of Things ???

- Traditional embedded systems: dedicated to specific tasks in a given application domain.
- Internet of things: communicating and collaborating embedded systems that are massively deployed, that can perform universal tasks across domains

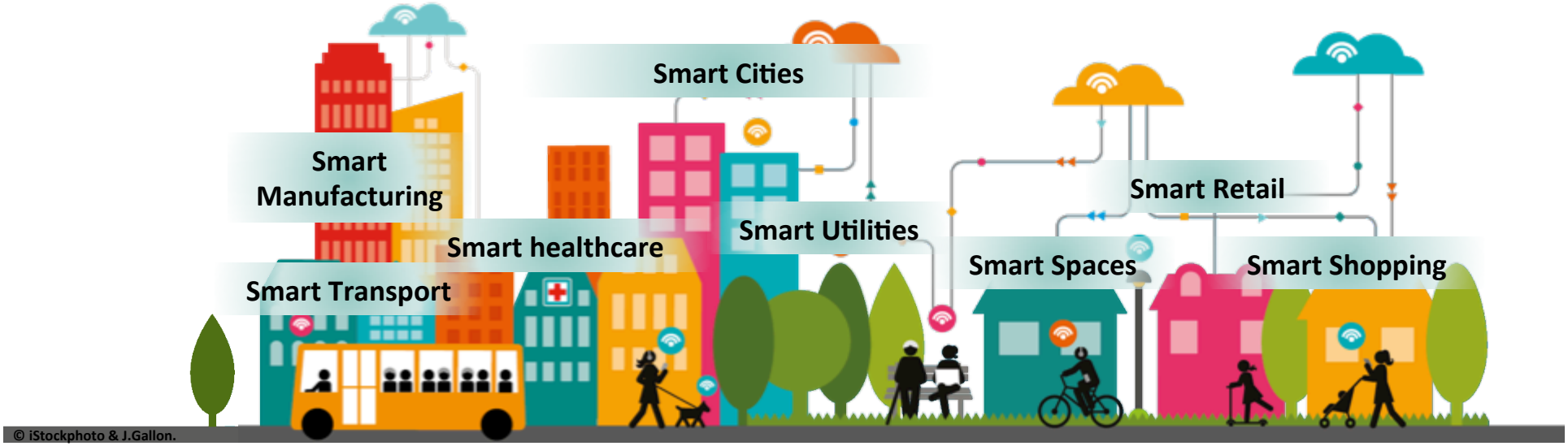




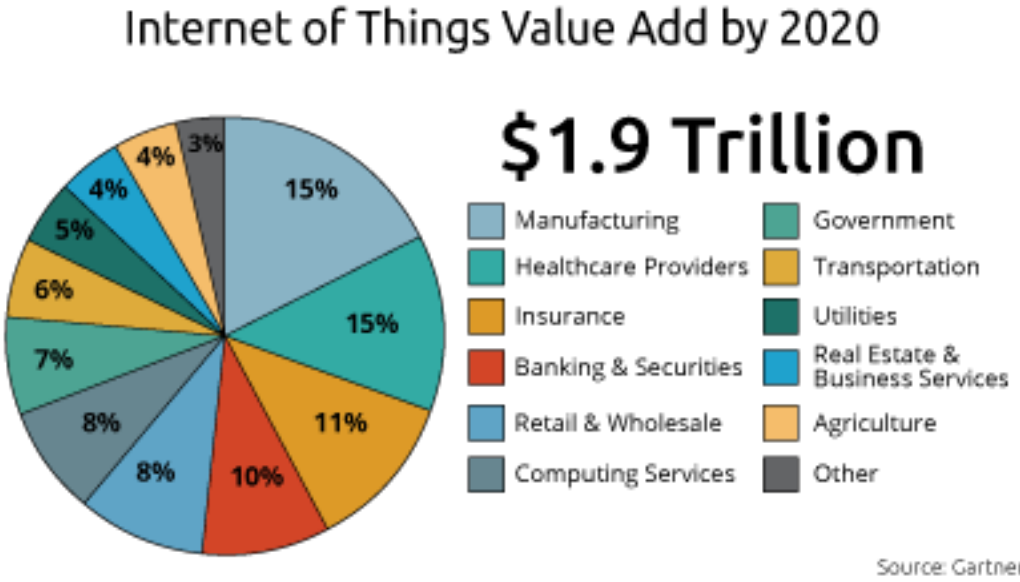
Many application domains



Many application domains



Many opportunities



Today: Domain-centric, vertical solutions

SmartHome

- Monitoring and controlling
- Saving energy comfortably
- Interacting with appliances
-…

SmartHealth

- Monitoring medicine intake
- Personalized diabetes assistance
- Providing training tips
- …

SmartTransport

- Promoting carpooling
- Minimizing taxi delays
- Avoiding traffic jams
- …

SmartCity

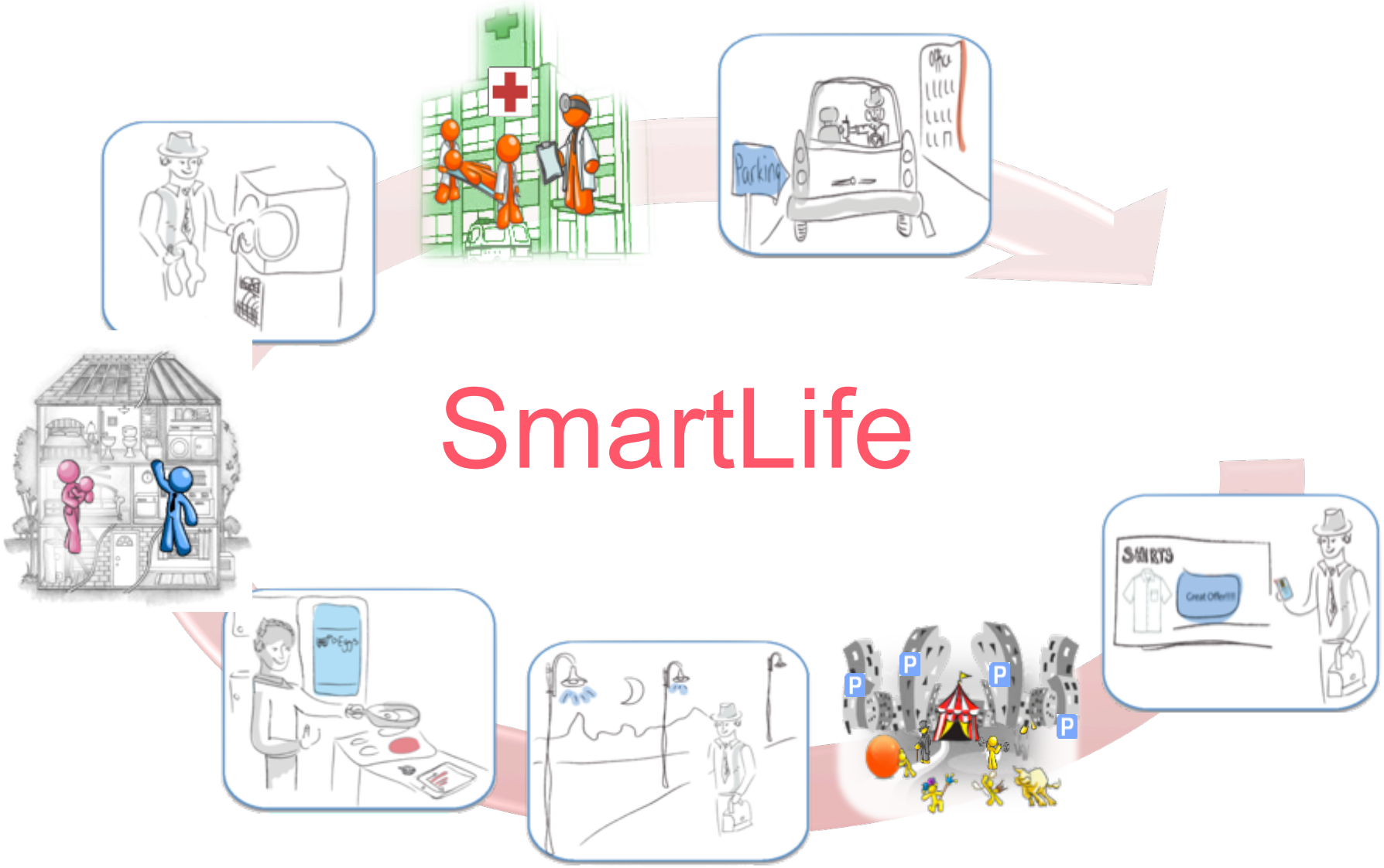
- Managing parking space
- Lighting up a city efficiently
- Monitoring Air Quality
- …

SmartShopping

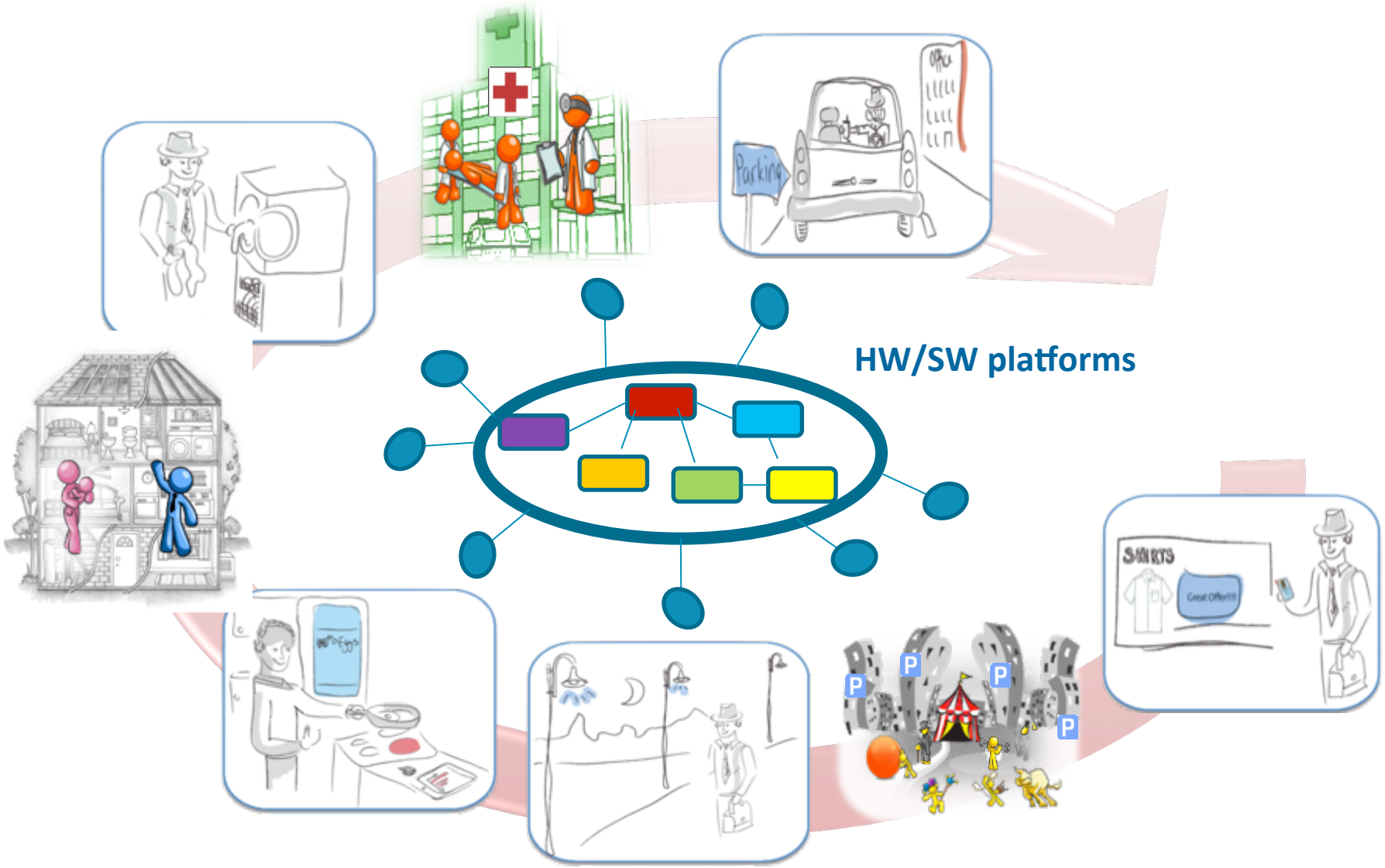
- Managing sparkdeals
- Getting advice on buying goods
- Retrieving discount
- …

leti *Illustrations from the EU FP7 BUTLER project*

Tomorrow: horizontal smart solutions ???

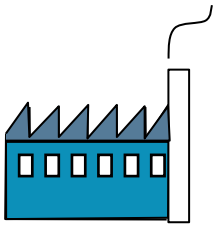


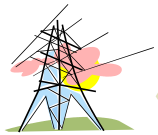
Tomorrow: horizontal smart solutions ???



Illustrations from the EU FP7 BUTLER project

Physical world

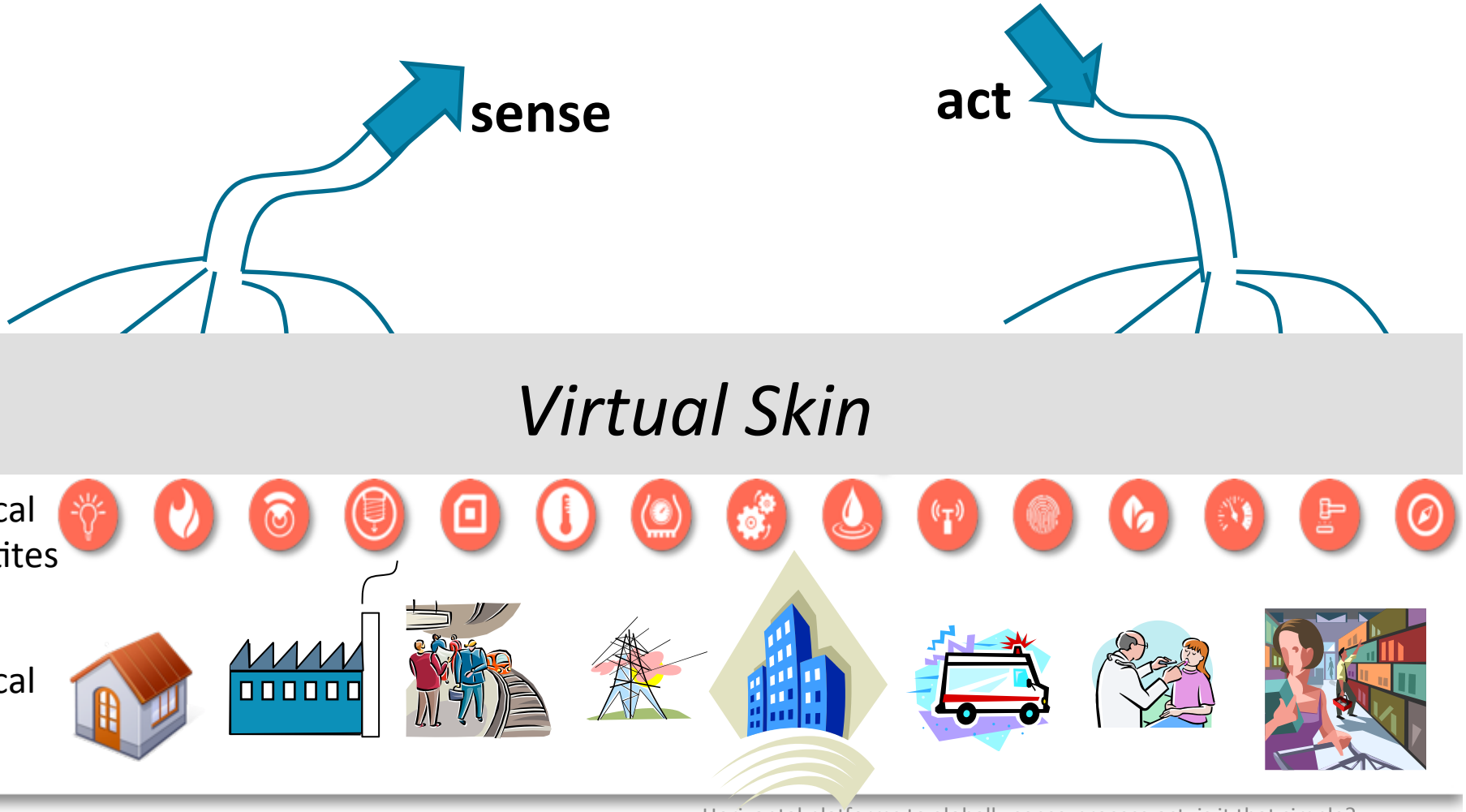



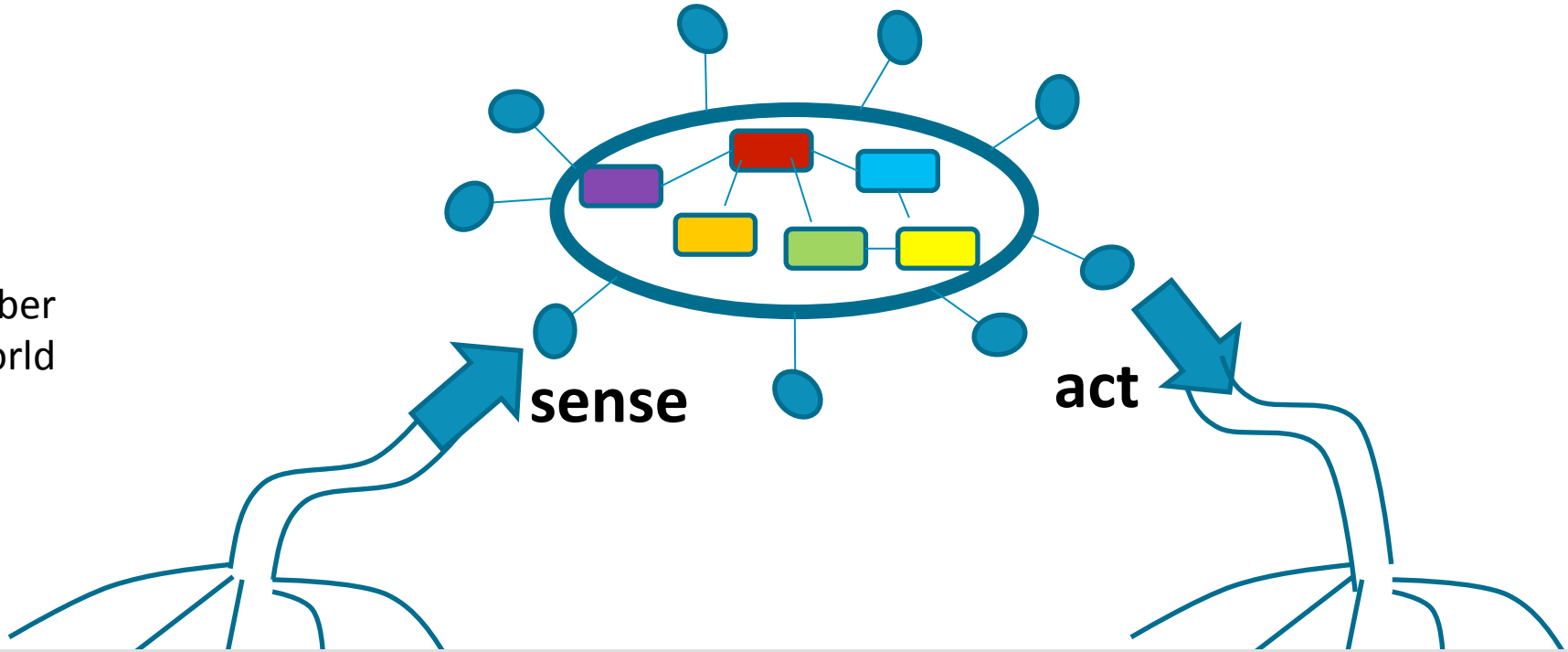




Physical quantites

Physical world





Virtual Skin

Physical
quantites

Physical
world

monitor

create

deploy

Cyber world

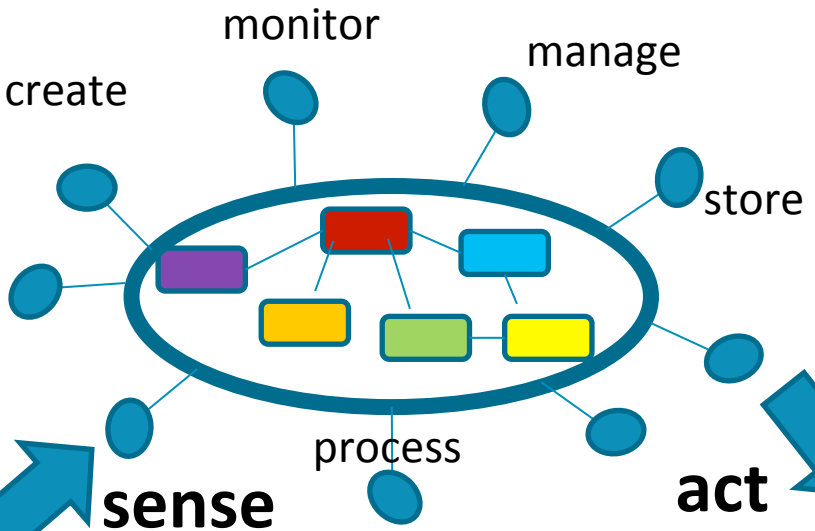
sense

act

Virtual Skin

Physical quantites

Physical world



Cyber world

sense

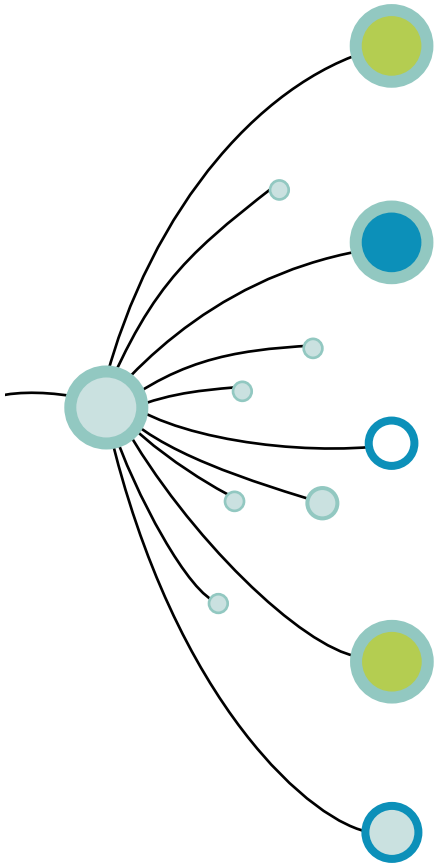
act

Virtual Skin

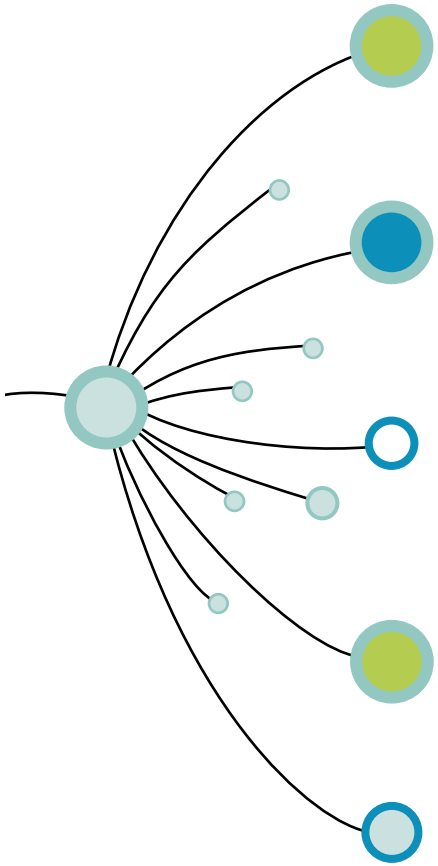
Physical quantites

Physical world

Many challenges

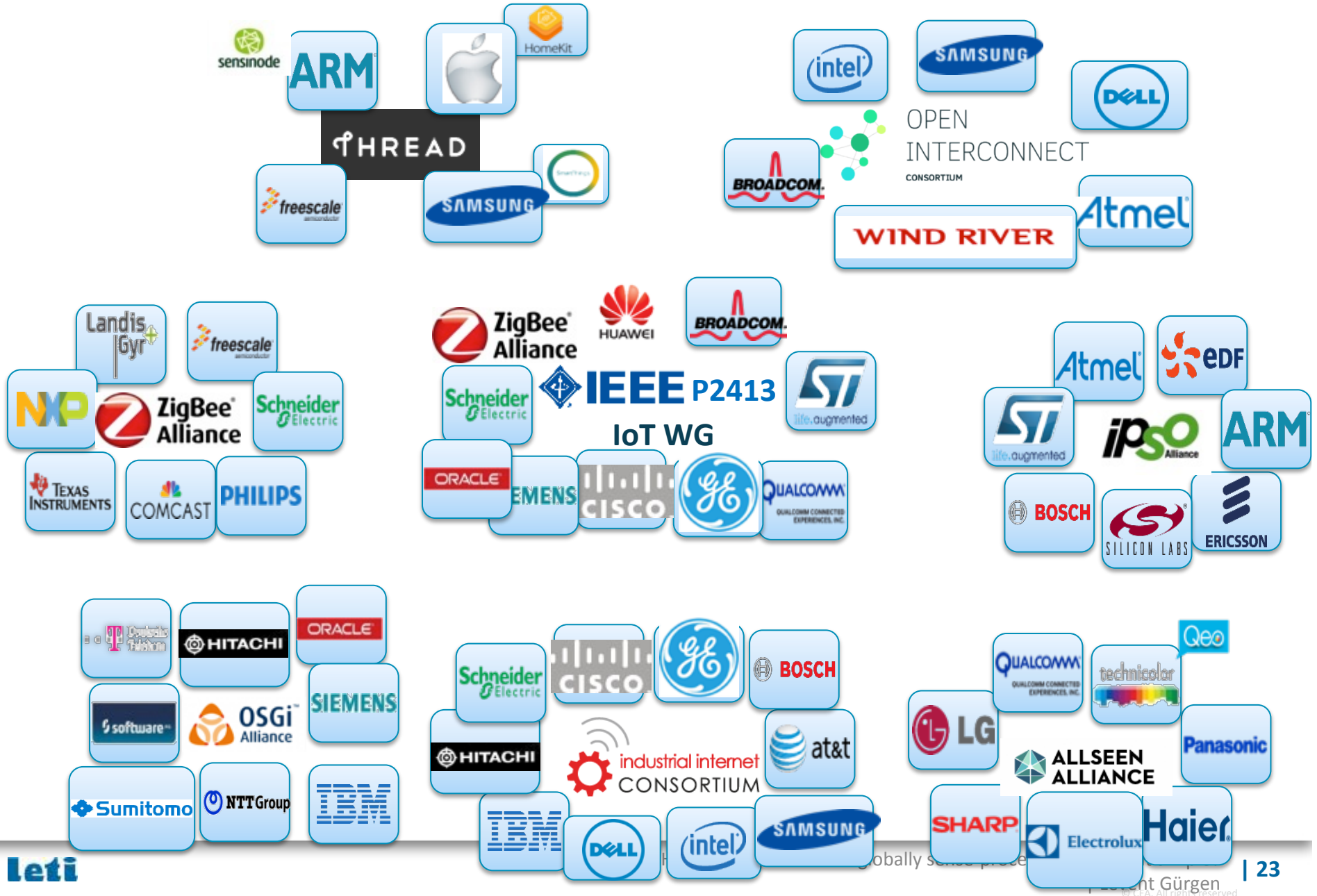


Many challenges



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

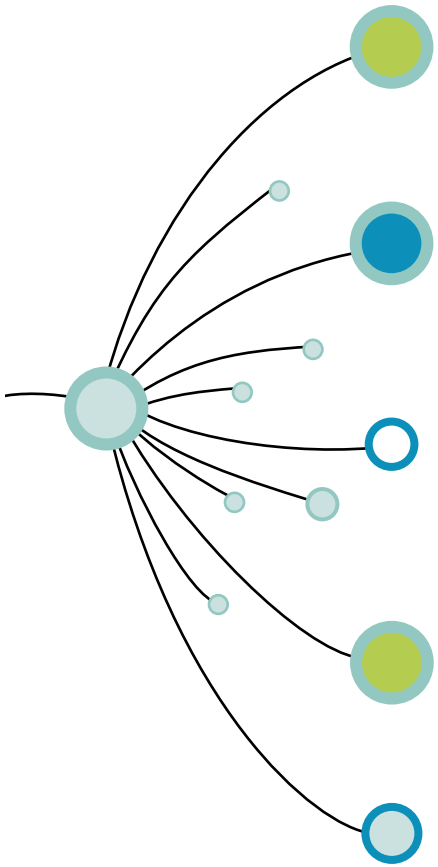
Many actors, platforms, ecosystems…



Standard-based vs. Innovation-oriented

- Standardise then innovate vs. innovate then standardise
- Top-down vs bottom-up
- Slow penetration to large markets vs fast penetration to niche markets
- Large scale (city, energy, etc.) vs small scale (health, well-being, home) deployments
- Horizontal from the verticals vs verticals from the horizontal
- Large groups vs SMEs and startups
  - *"By 2017, 50 Percent of Internet of Things Solutions Will Originate in Startups That Are Less Than Three Years Old"*, Gartner

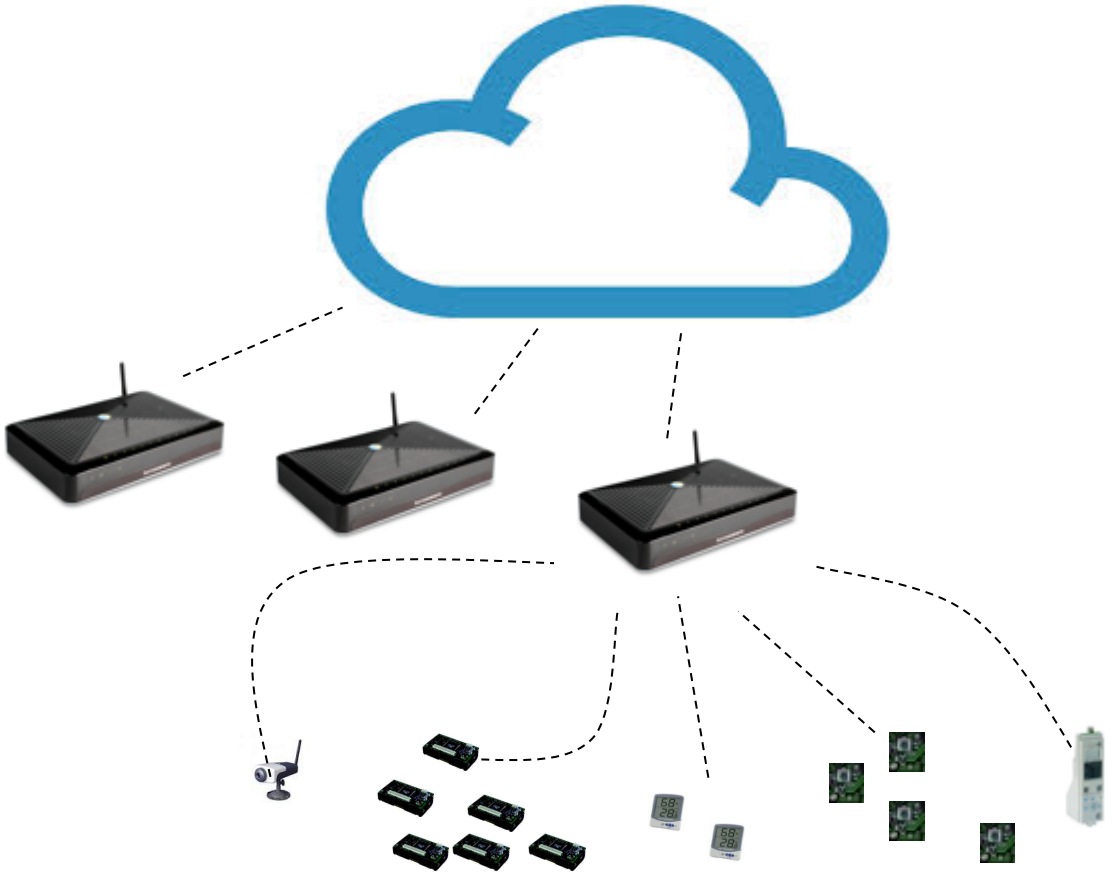
Many challenges



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?

Distributed processing (fog comuting, edge computing, in-network aggregation, etc.)



Stream data processing

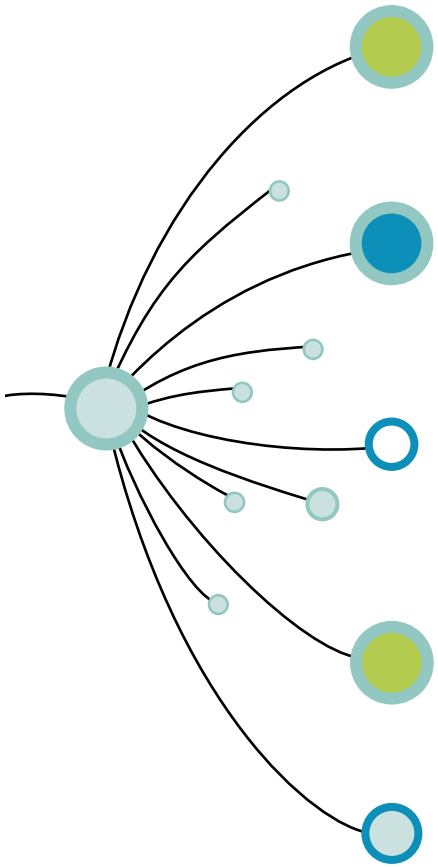
Stream data processing

Stream data processing

Stream data processing

Communication costs more than computing, exploit computing capabilities as much as possible

Many challenges



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

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

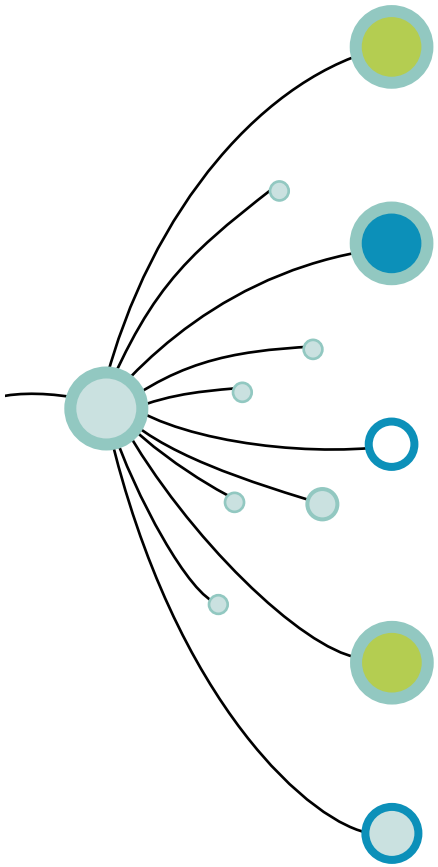
Plug&play, self-management with no (or minimum) human intervention

auto-discovery
self-optimisation
auto-scaling
continuous-deployment

auto-discovery
self-configuration
self-matchmaking

auto-description
self-optimisation
self-healing
energy-harvesting

Many challenges



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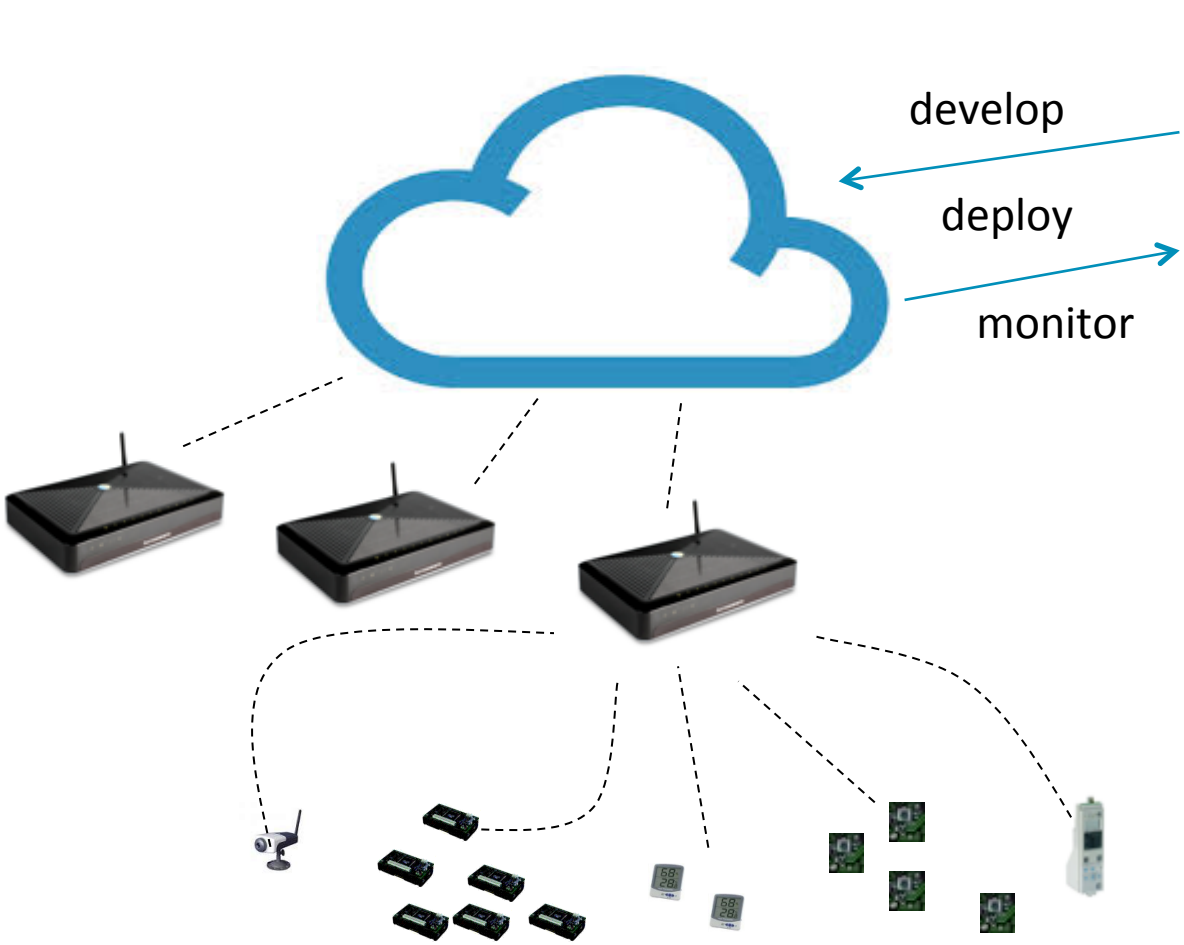
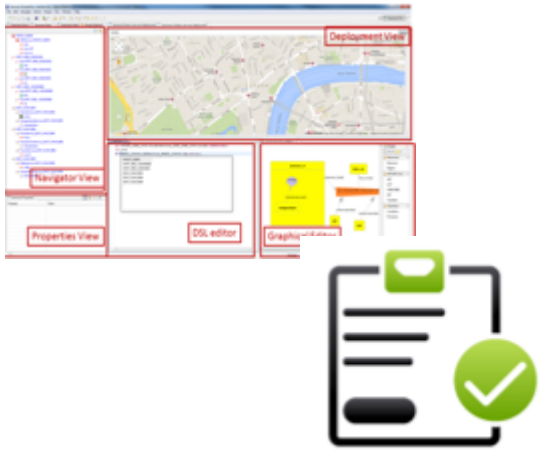
Dynamicity: plug&play, self-configuration, self-management, self-mathcmaking

Dependability: rapid prototyping yet reliable dependable applications

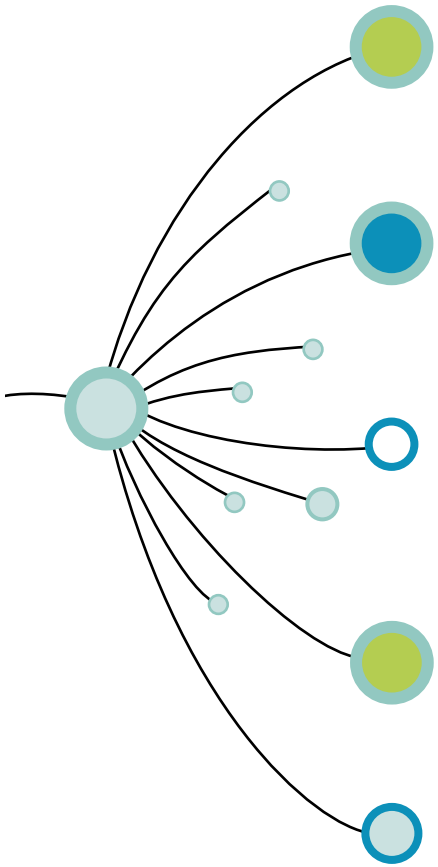
Be careful! You are dealing with the physical world





Dependability
Correctness
Safety
Real-time
Verification
Reliability
Security
…

Many challenges



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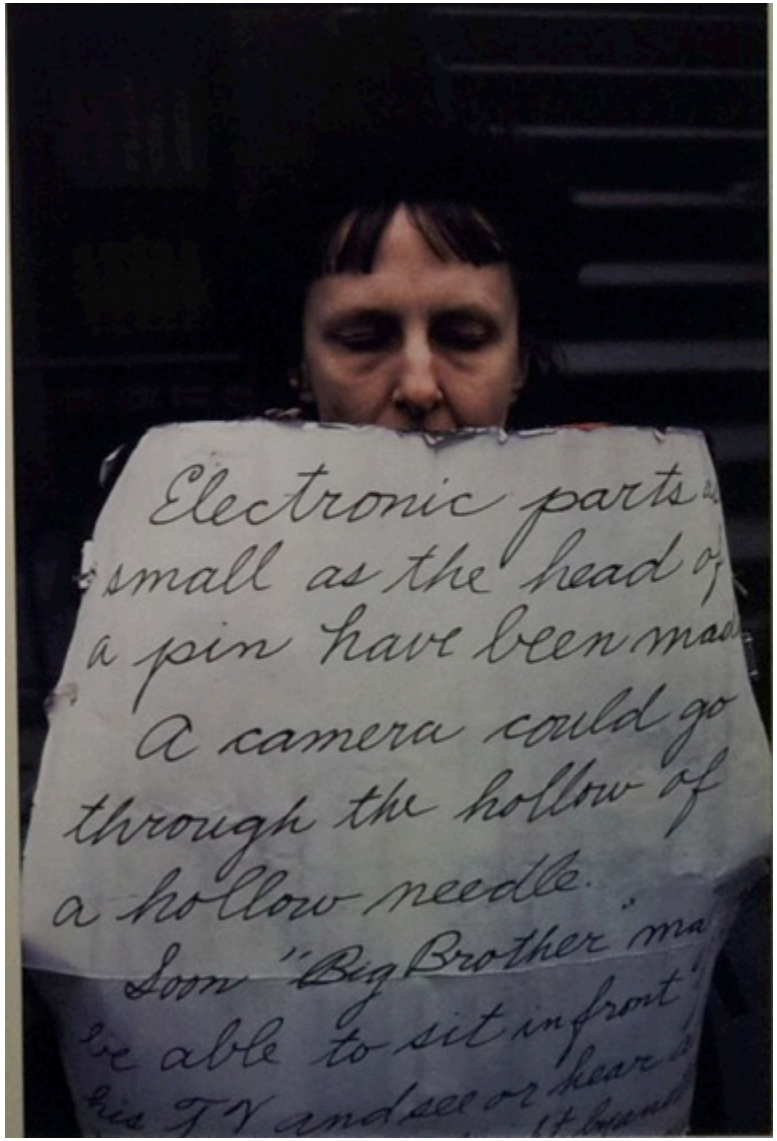
Dynamicity: plug&play, self-configuration, self-management, self-mathcmaking

Dependability; rapid prototyping yet reliable dependable applications

And privacy…

Privacy was/is/will be a concern



Electronic parts as small as the head of a pin have been made. A camera could go through the hollow of a hollow needle.
Soon 'Big Brother' may be able to sit in front of his TV and see or hear all …

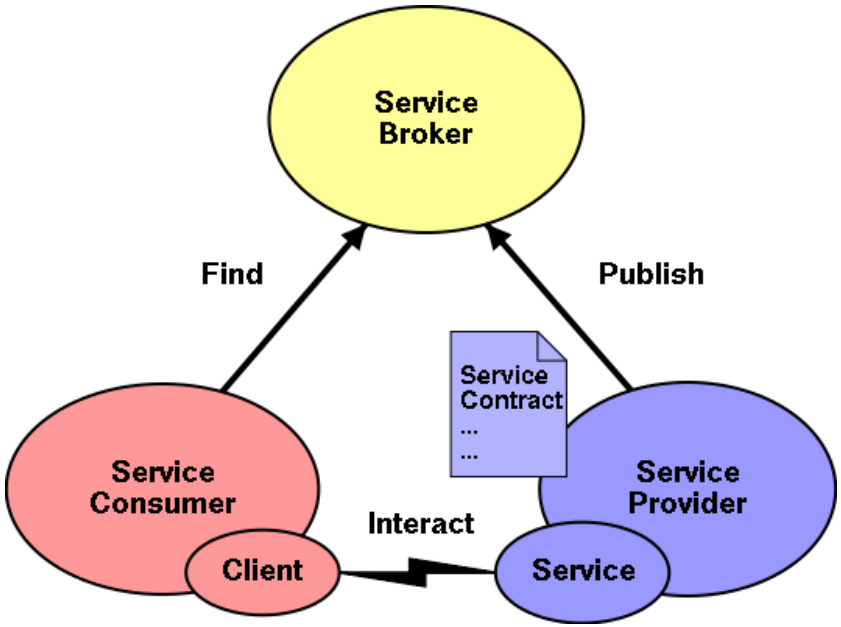
NY, 1963

© Joel Meyerowitz

sensiNact - service-oriented approach for IoT application development and deployment

Service oriented approach

- A paradigm for organizing and utilizing **distributed** capabilities that may be **under the control of different ownership domains (OASIS)**



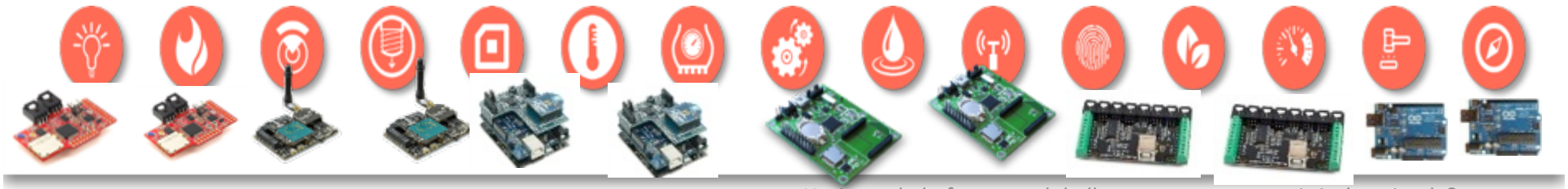
- Sensing as a Service: Temperature service, Air pollution detection service, Presence detection service, Location service, etc.
- Acting as a Service: Door service, Light service, Shutter service, Alarm service, Display service, SMS service, Heater Service, etc.

SOA in IoT

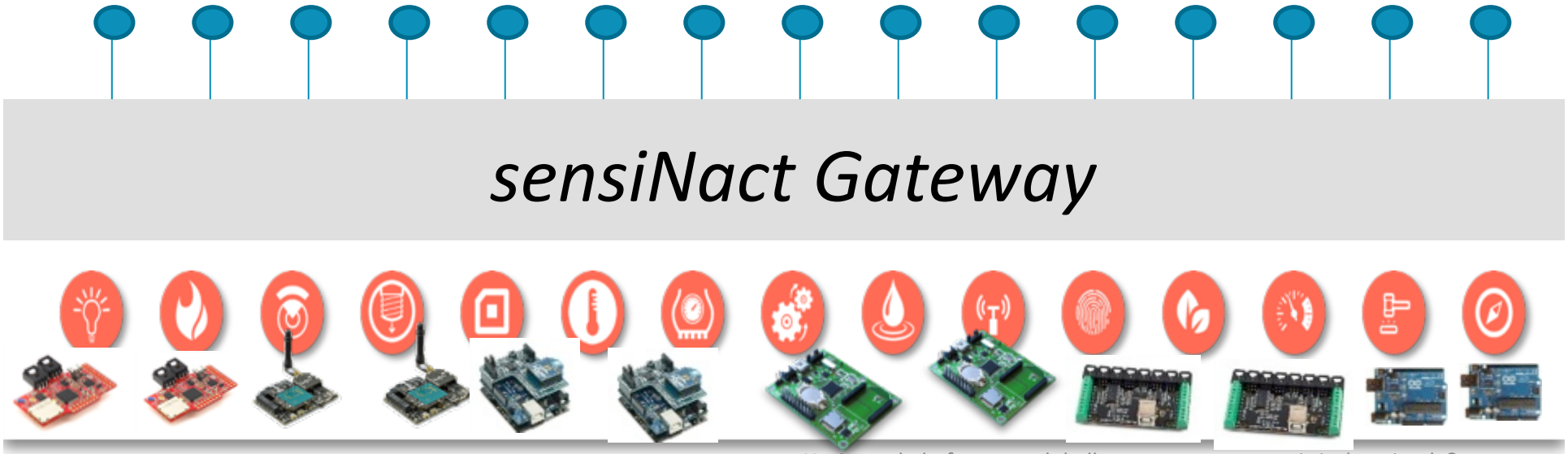
- SOA ≠ SOAP
- Service (definition from The Open Group)
  - is a logical representation of a repeatable business activity that has a specified outcome (sensing/acting on the real world)
  - is self-contained (temperature service gives just the temperature of a given place at a given time)
  - *may be* composed of other services (temperature service in a broader region can be composed of several temperature services)
  - is a "black box" to consumers of the service (I just want to know the temperature, I don't care if it is Zigbee or CoAP)
- SOA abstracts business processes from underlying technology
- Services are designed without knowing who their consumers are and can be implemented with various technologies
- Monolithic vertical systems could be decomposed as reusable and sharable services to be extended and offered across organizational boundaries.

Heterogenous IoT devices

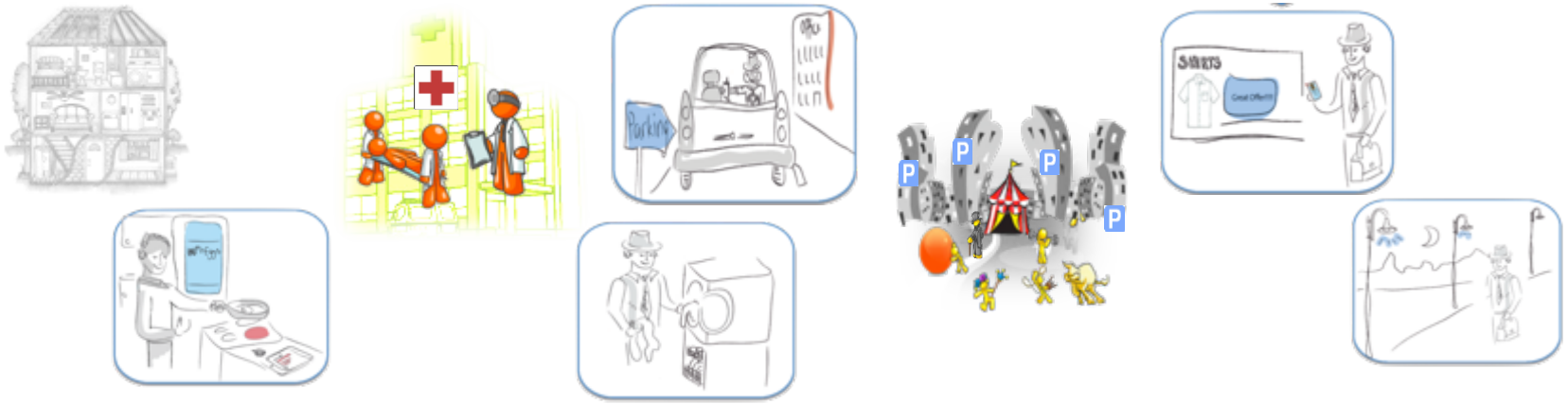
Virtual Skin



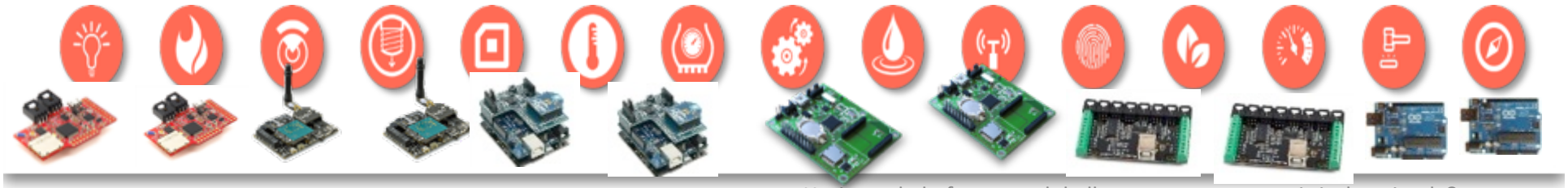
Heterogenous IoT devices



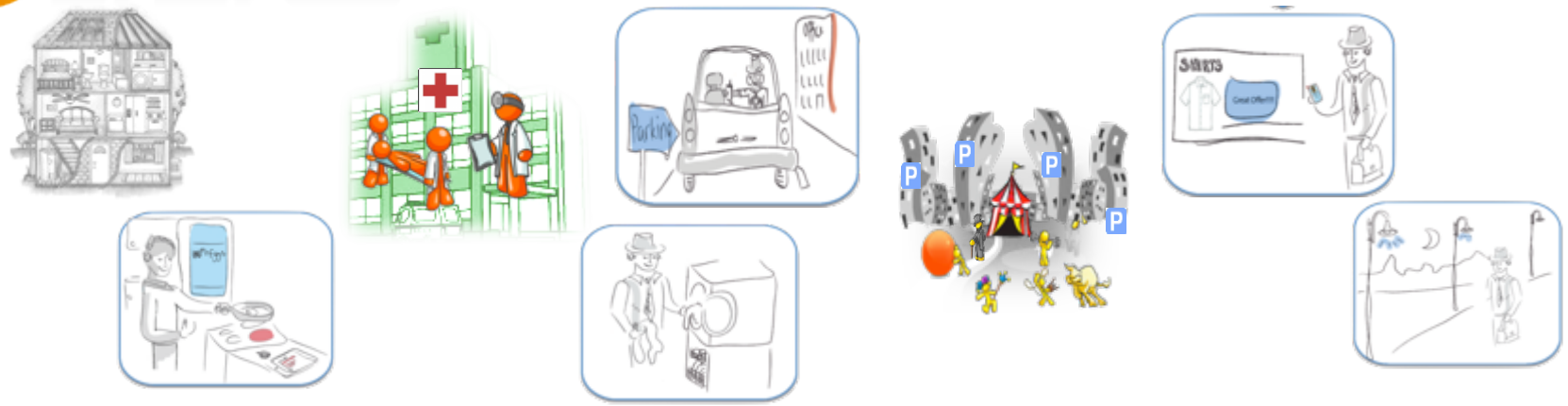
Various application domains



sensiNact Gateway



BUTLER SMARTLIFE horizontal platform

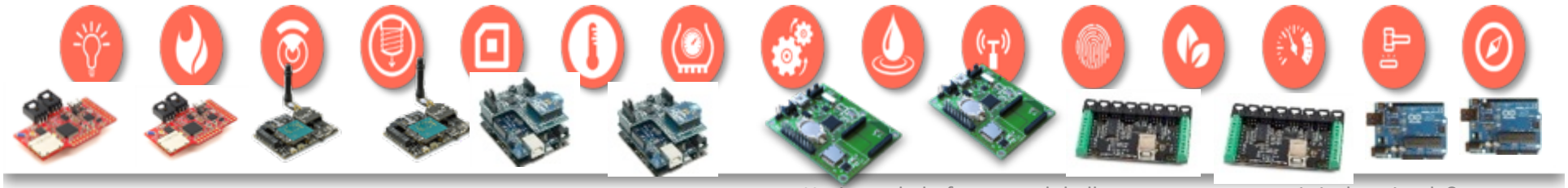


sensiNact gateway

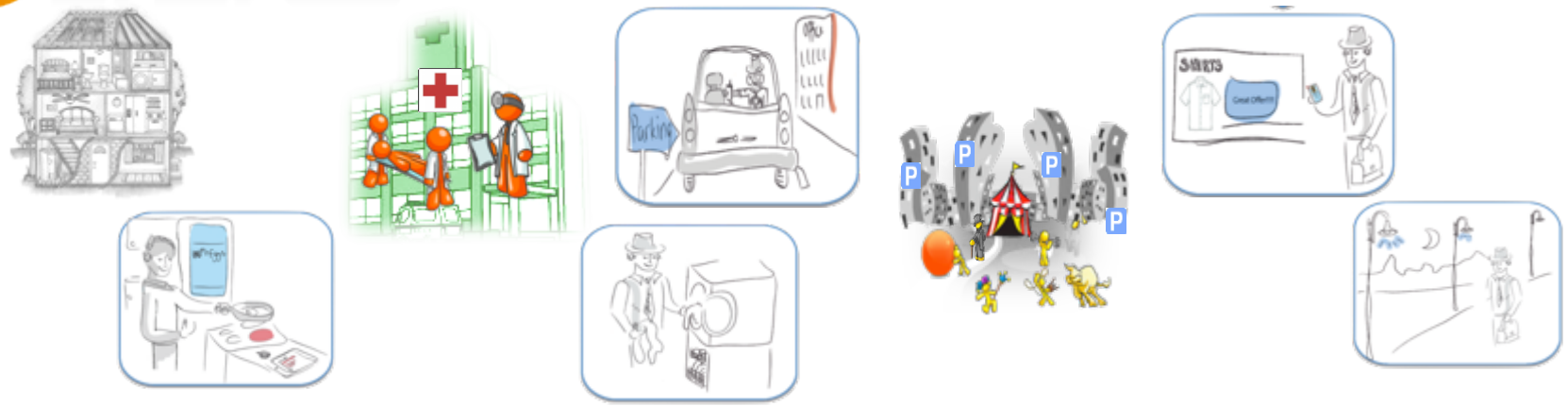
APIs, Data as a Service, user portal, service management portal

user context | environmental context | user future behaviour | user preferences | user location

Device as a Service; device/service discovery, generic APIs for resource access



BUTLER SMARTLIFE horizontal platform

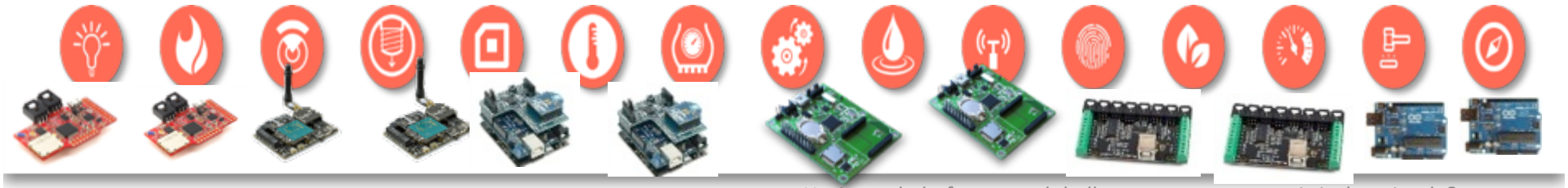


Smart server

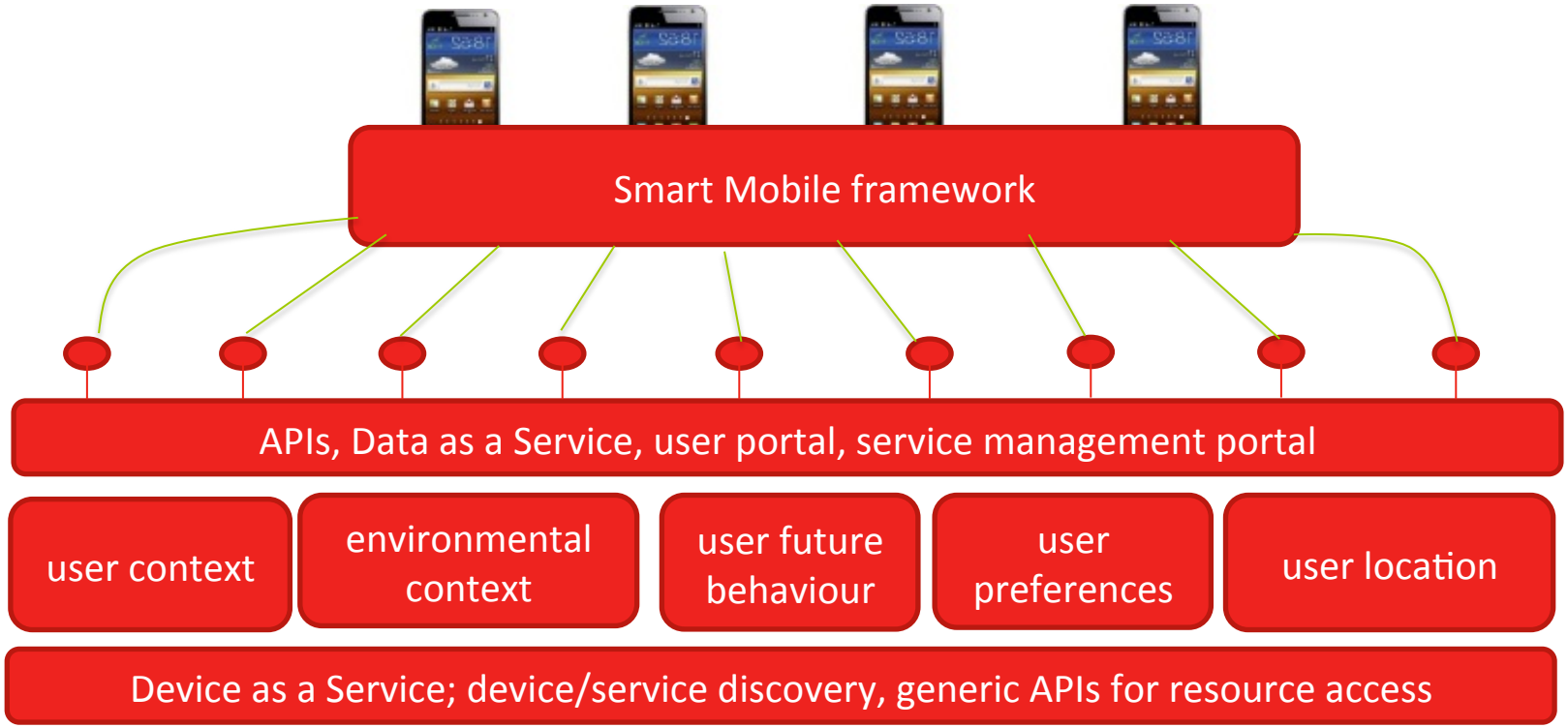
APIs, Data as a Service, user portal, service management portal

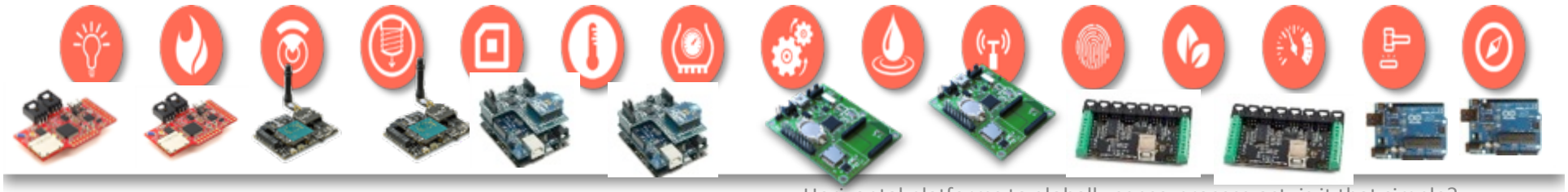
user context | environmental context | user future behaviour | user preferences | user location

Device as a Service; device/service discovery, generic APIs for resource access

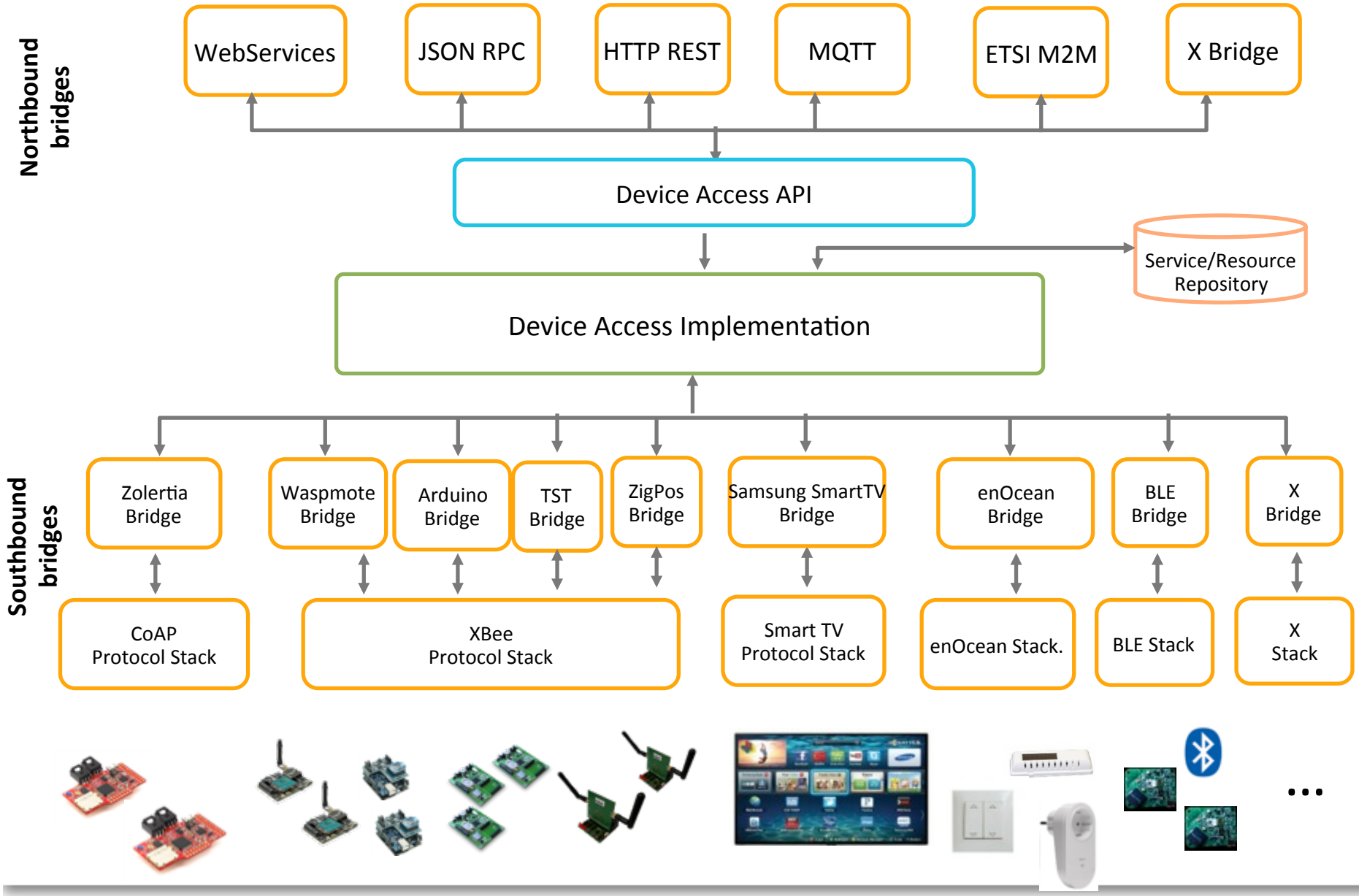


BUTLER SMARTLIFE horizontal platform



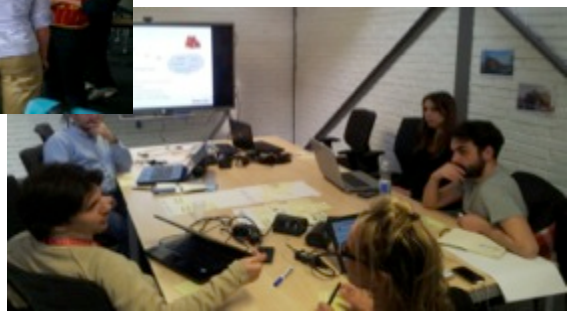


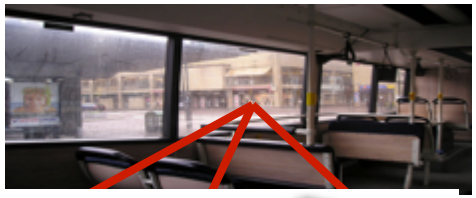
sensiNact gateway (aka smart gateway)

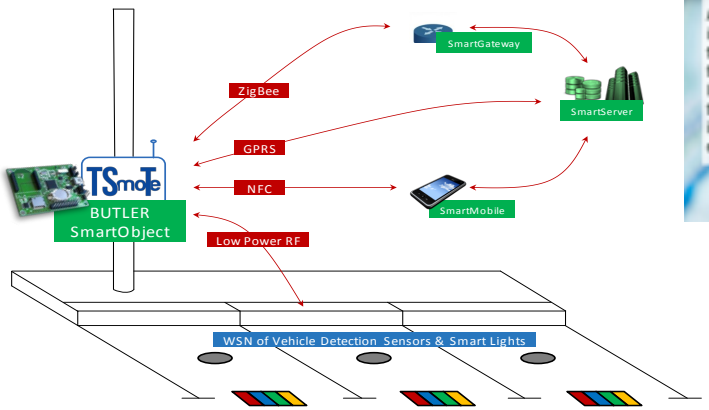


Validation via trials

- Smart Shopping & Parking in Santander
- Smart Healthcare in Bilbao
- Smart Office in Nice, Lucern, Milano
- Smart Transport in Dresden
- Smart City in Santander







ERICSSON

inno

cea

gemalto
security to be free

TELECOM ITALIA

uBiquitous, secUre inTernet-of-things with Location and contExt-awaReness

MAYA TECHNOLOGIES

Banco Santander

JACOBS UNIVERSITY

tecnalia Inspiring Business

CWC Oulu

EU FP7 call: FP7-ICT-2011-7

Integrated Project

October 2011 → **October 2014**

15 M€

1234 man-months

FBCONSULTING

ISMB Istituto Superiore Mario Boella

KATHOLIEKE UNIVERSITEIT LEUVEN

iHomeLab

AYUNTAMIENTO DE SANTANDER

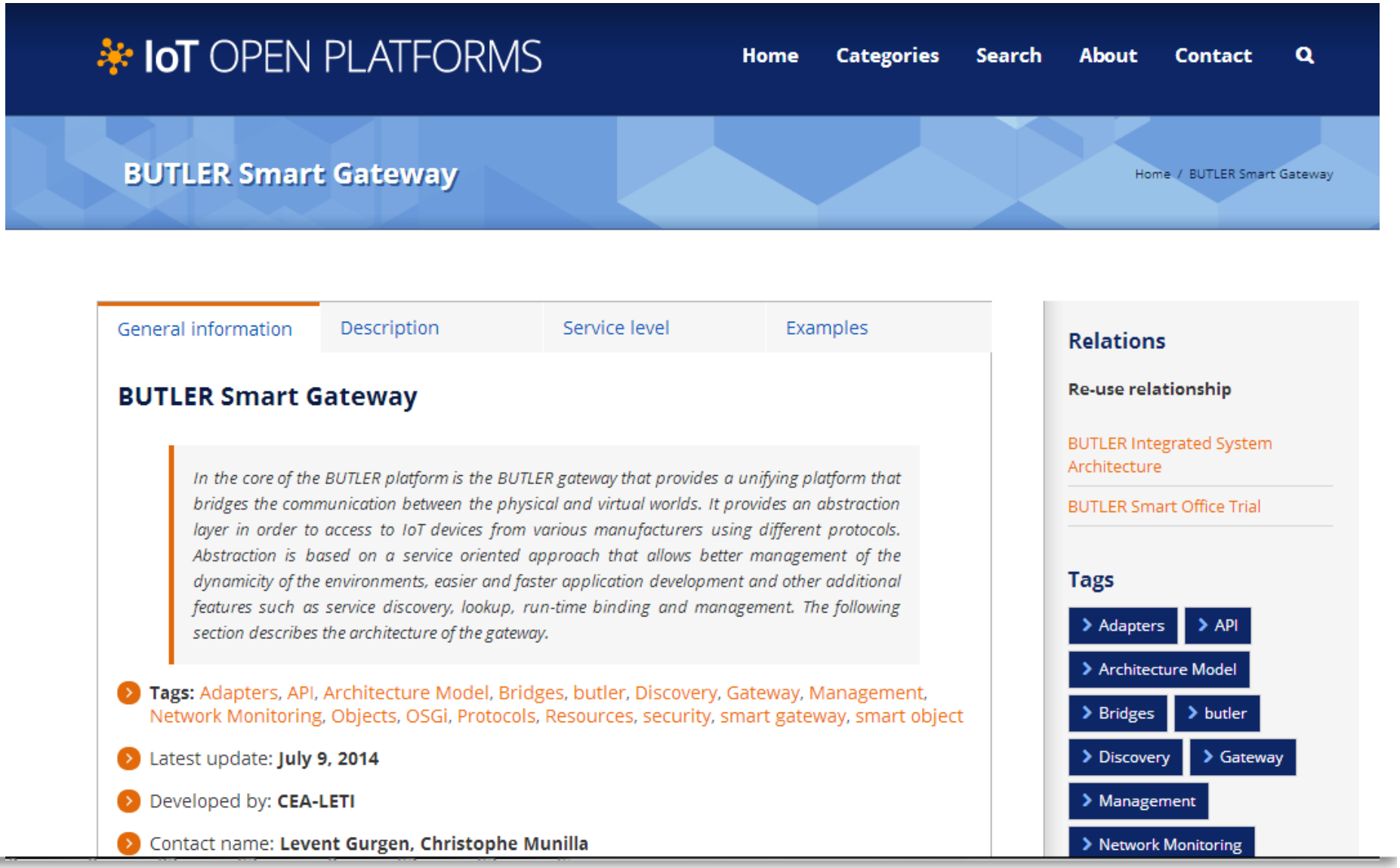
TST

UNIVERSITÉ DU LUXEMBOURG

ZIGPOS

Open Platforms Portal: open-platforms.eu
Launched on June 2014

More info on the BUTLER platform can be found there…



Open Platforms Requirements

Using other's production to build my own upon?

⇒I need to …

Identify it

- Information repository : API, implementation,
- Communication plan

Trust it

- Community backing
- Proven quality/ security / interoperability
- Label ecosystem

Understand it

- Training material
- Support
- Community events

Use it

- Accessible IPR
- Engineering Resources/ tools
- Use cases

Open Platforms Portal Features

- Search for use cases & open-platforms to build your offer

- Document your own open-platforms & use cases to increase your visibility

ClouT: Cloud of Things for empowering the citizen clout in smart cities

AT A GLANCE

Project coordinator :
Clout-EU: **Levent Gürgen, CEA-LETI, France**
ClouT-JP: **Yoshio Saito, NTT East, Japan**

Partners:
ClouT-EU
Engineering, Italy
Universidad de Cantabria, Spain
ST Microelectronics SRL, Italy
Ayuntamiento de Santander, Spain
Comune di Genova, Italy

ClouT-JP
NTT East
NTT R&D
Keio University
Panasonic System Solution
National Institute of Informatics

Duration: **36 months**

Total cost: **€2,32M for ClouT-EU**
€1 ,5M for ClouT-JP, funded by NICT

Programme: **FP7-ICT-2013- EU-Japan**

Further information:
http://clout-project.eu
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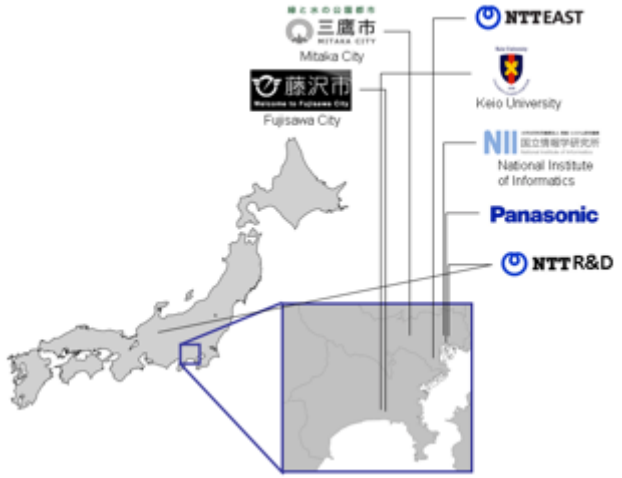
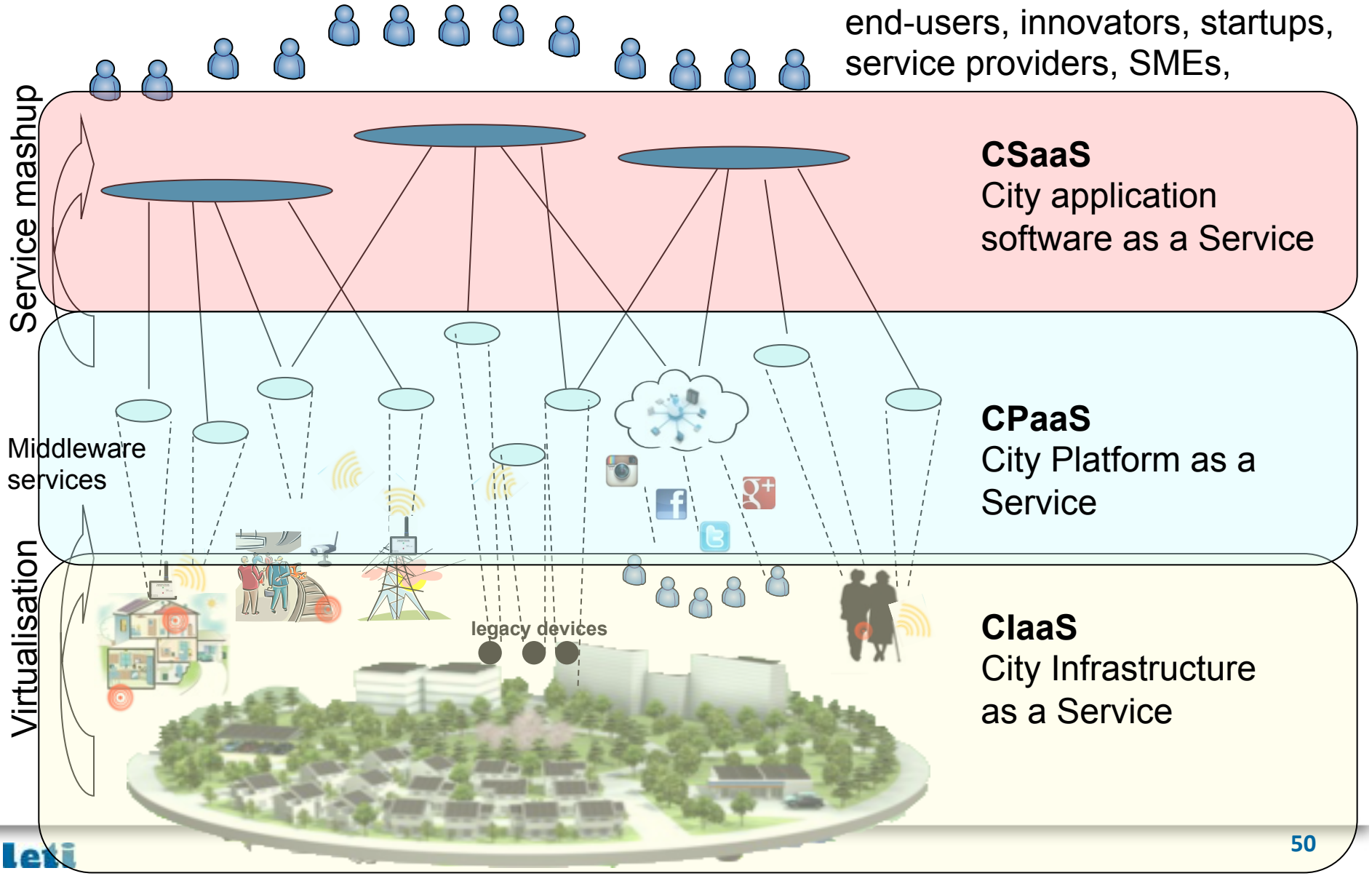
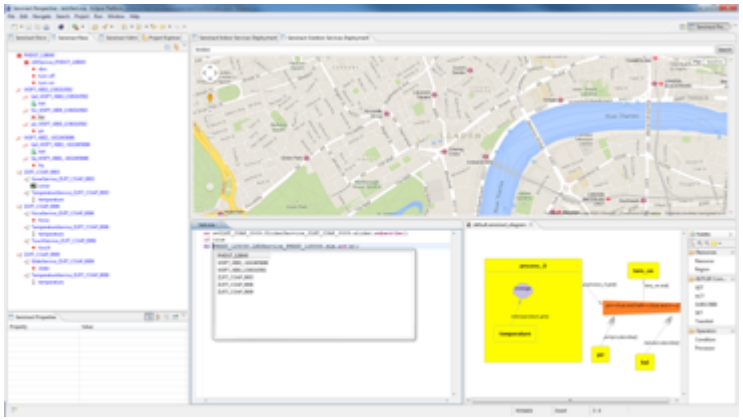


Cloud model for IoT Services



sensiNact Studio

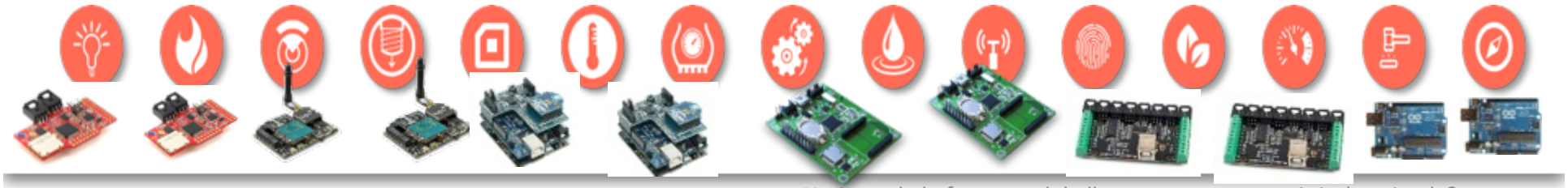


sensiNact Cloud

Develop
Verify
Deploy
Monitor

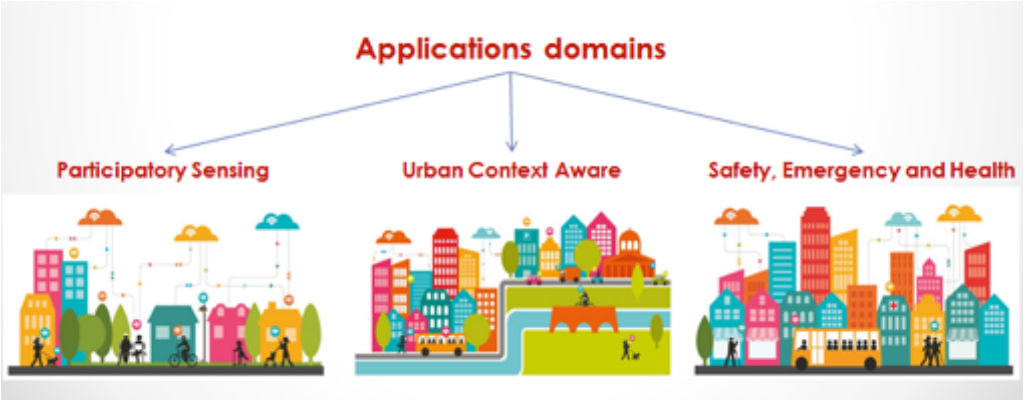
Virtualise
Store
Process
Manage

sensiNact

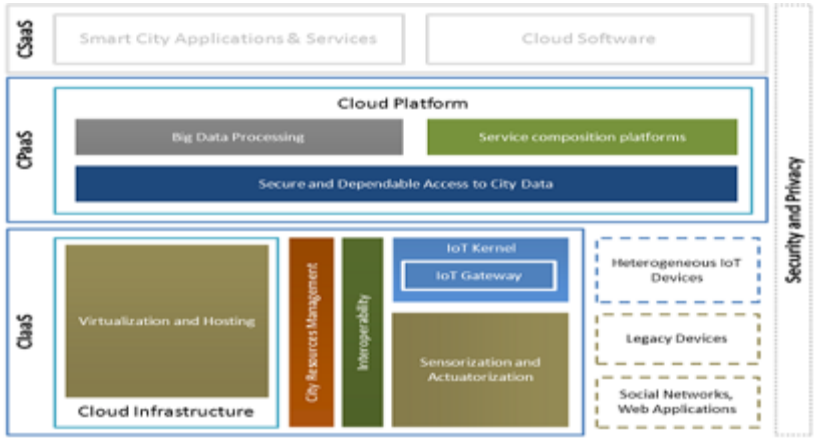


Main achievements at mid-term of the project

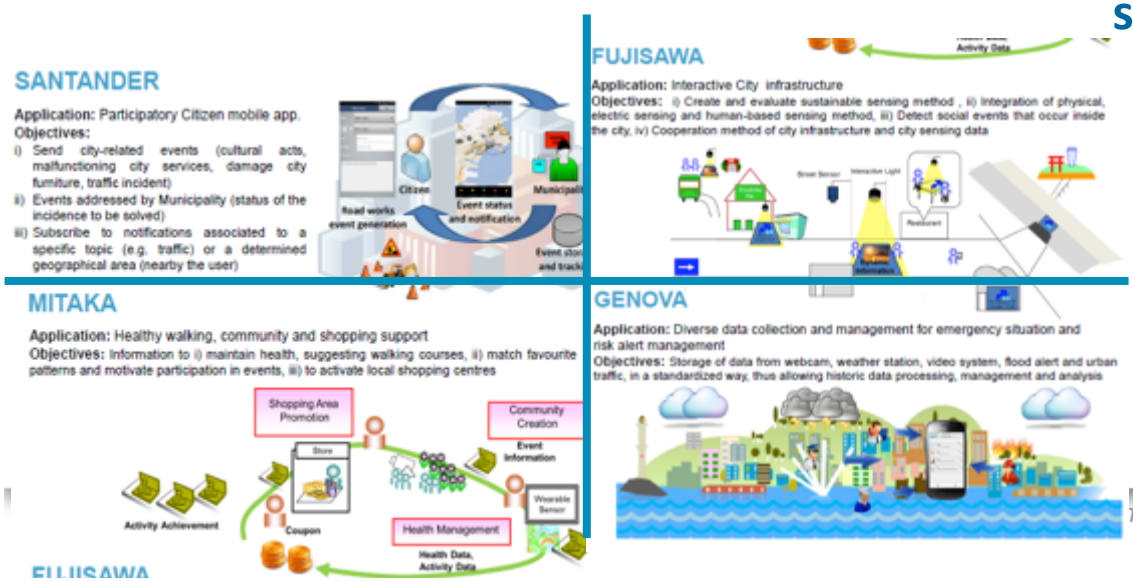
10 use cases from 3 application domains



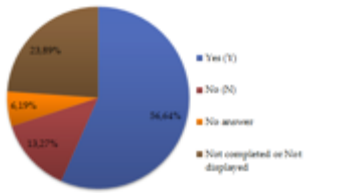
First reference architecture and its implementation



Development of field trials in 4 pilot cities

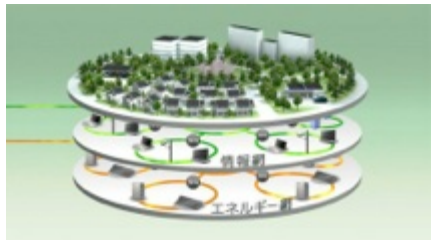


Continuous interaction with stakeholders (meetings, surveys)



Field trials in 4 pilot cities

- Participatory sensing
  - Participatory citizen
  - Sensing loop citizens



- Urban context-aware
  - Multi-modal transportation
  - Event perception support
  - Interactive city infrastructures
  - Sharing IoT devices in the Cloud
  - Augmented mobility

Santander **Fujisawa**

CLOUT

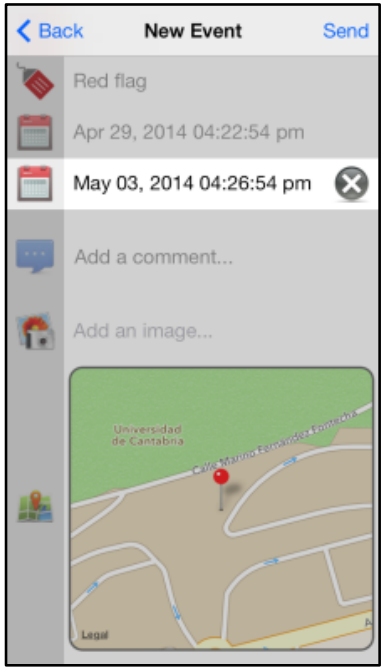
Genova **Mitaka**

- Safety, emergency and health management
  - Risk warning and management
  - Caring of elderly people
  - Health and active walking support

Cloud enhanced Participatory sensing in Santander

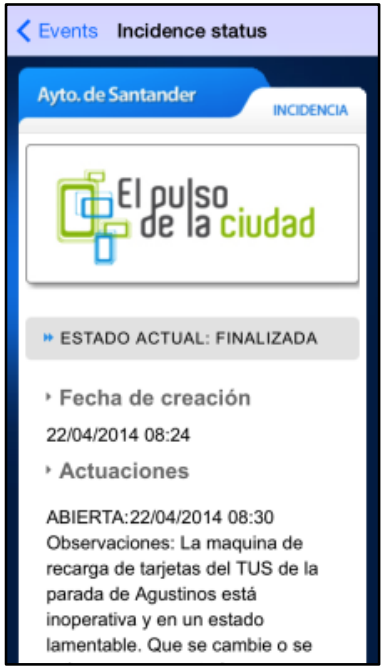
1. Reported events

2. New event

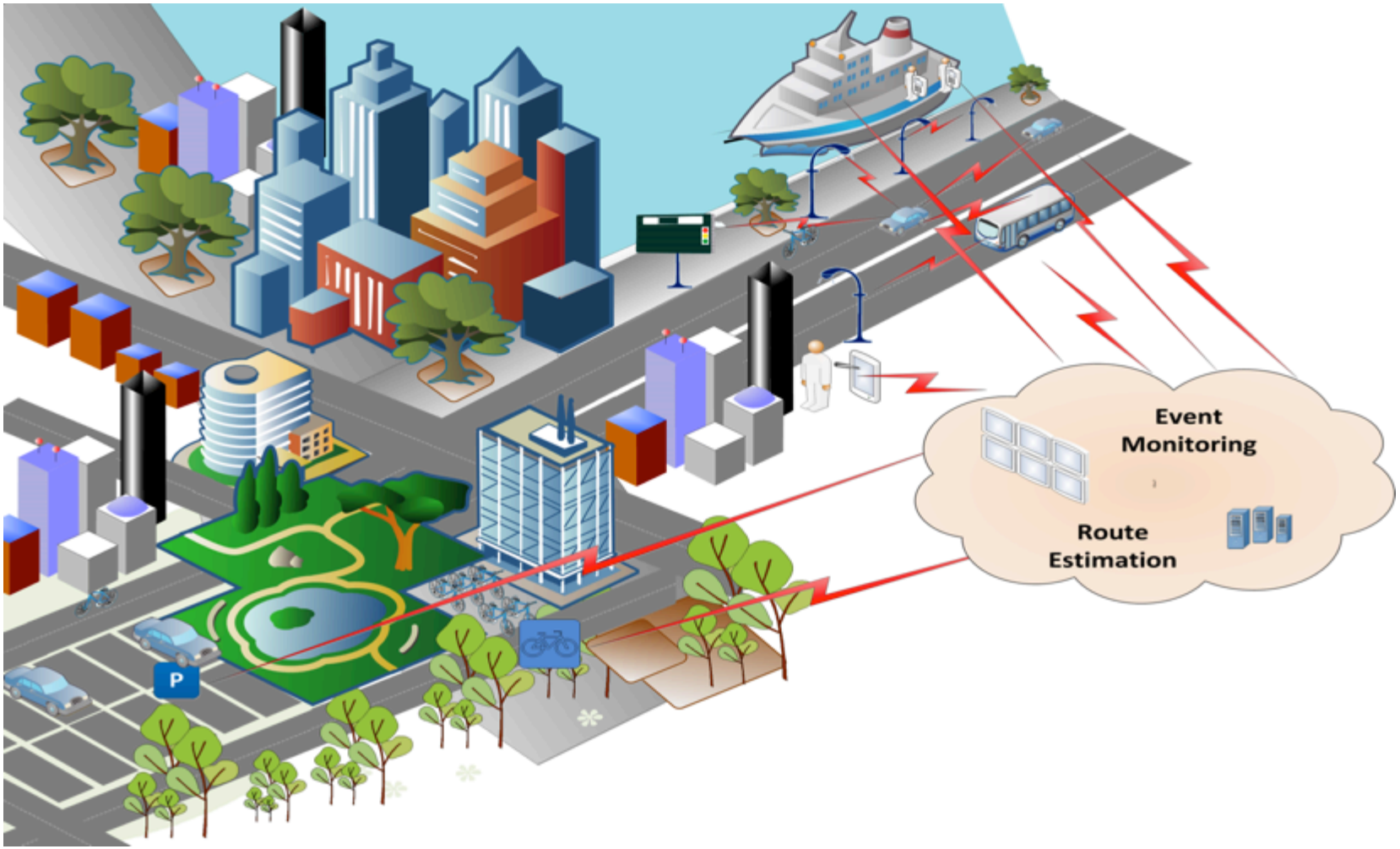


3. Event information

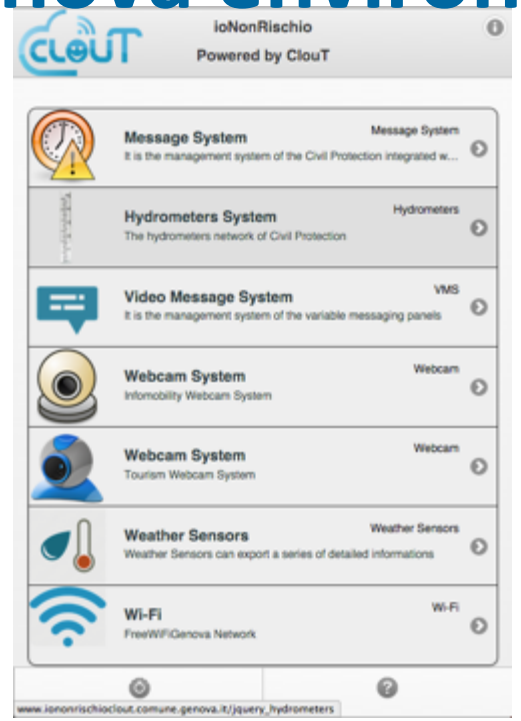
4. Incidence status

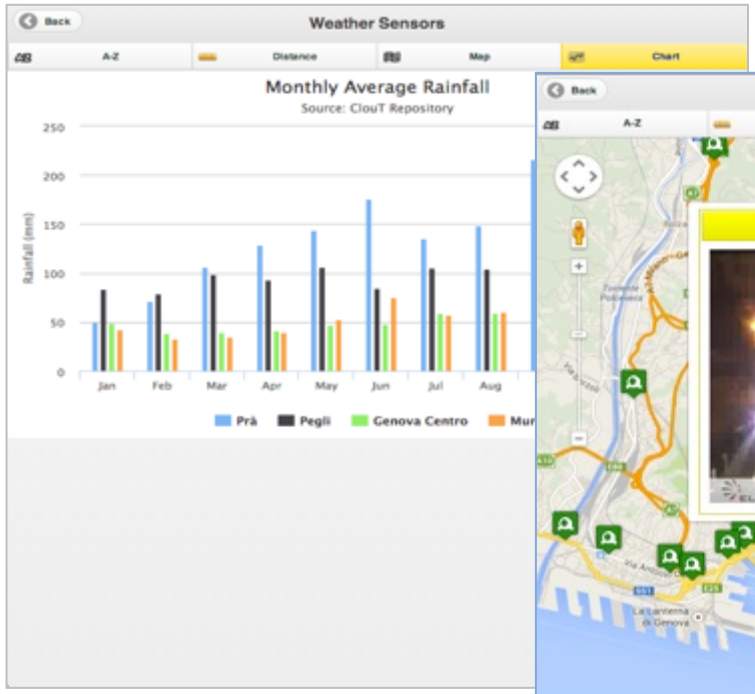


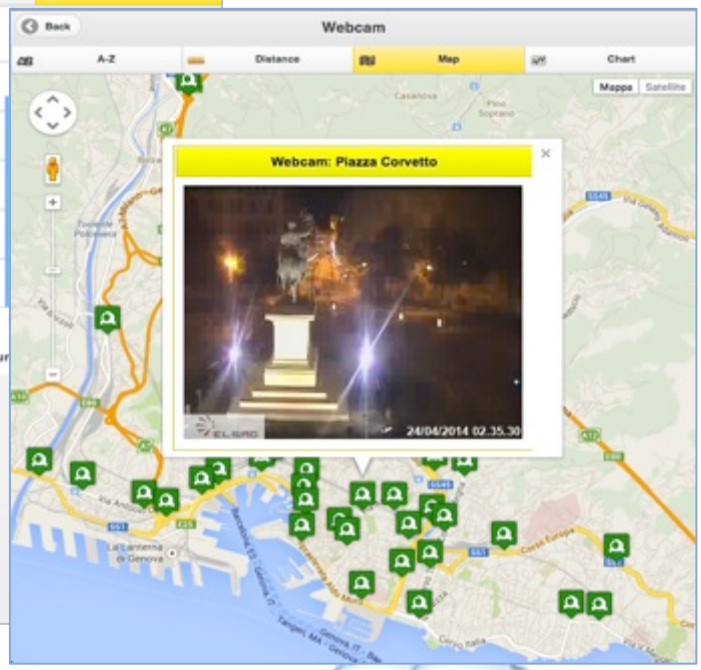
Santander Traffic Mobility Management

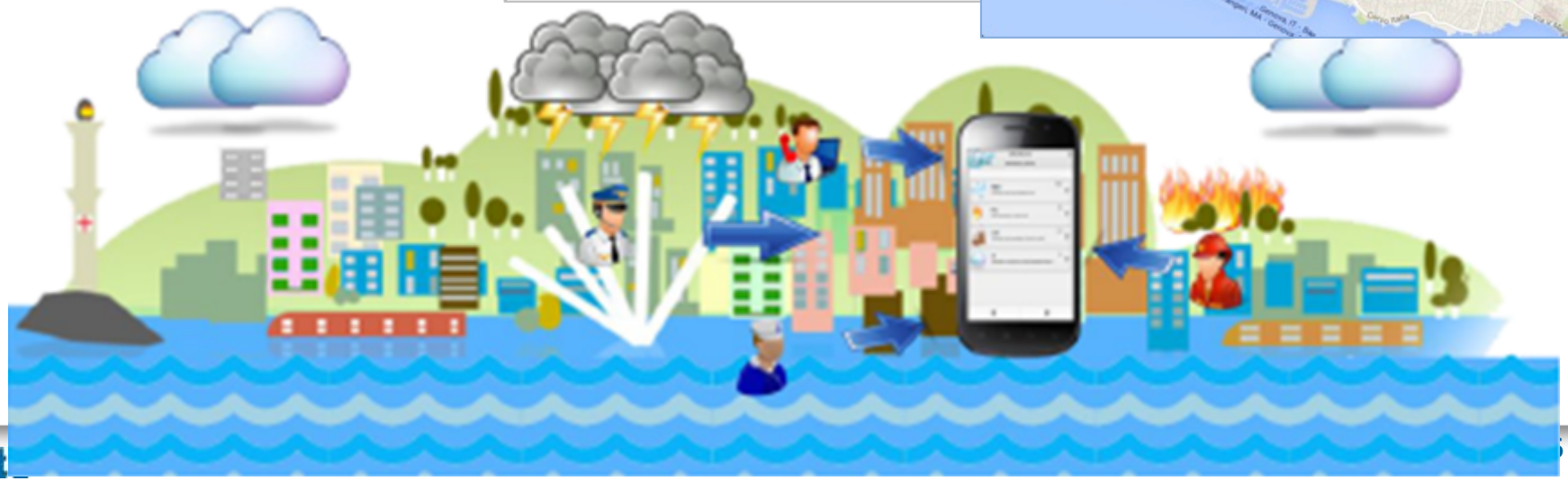


Genova environmental data in the Cloud

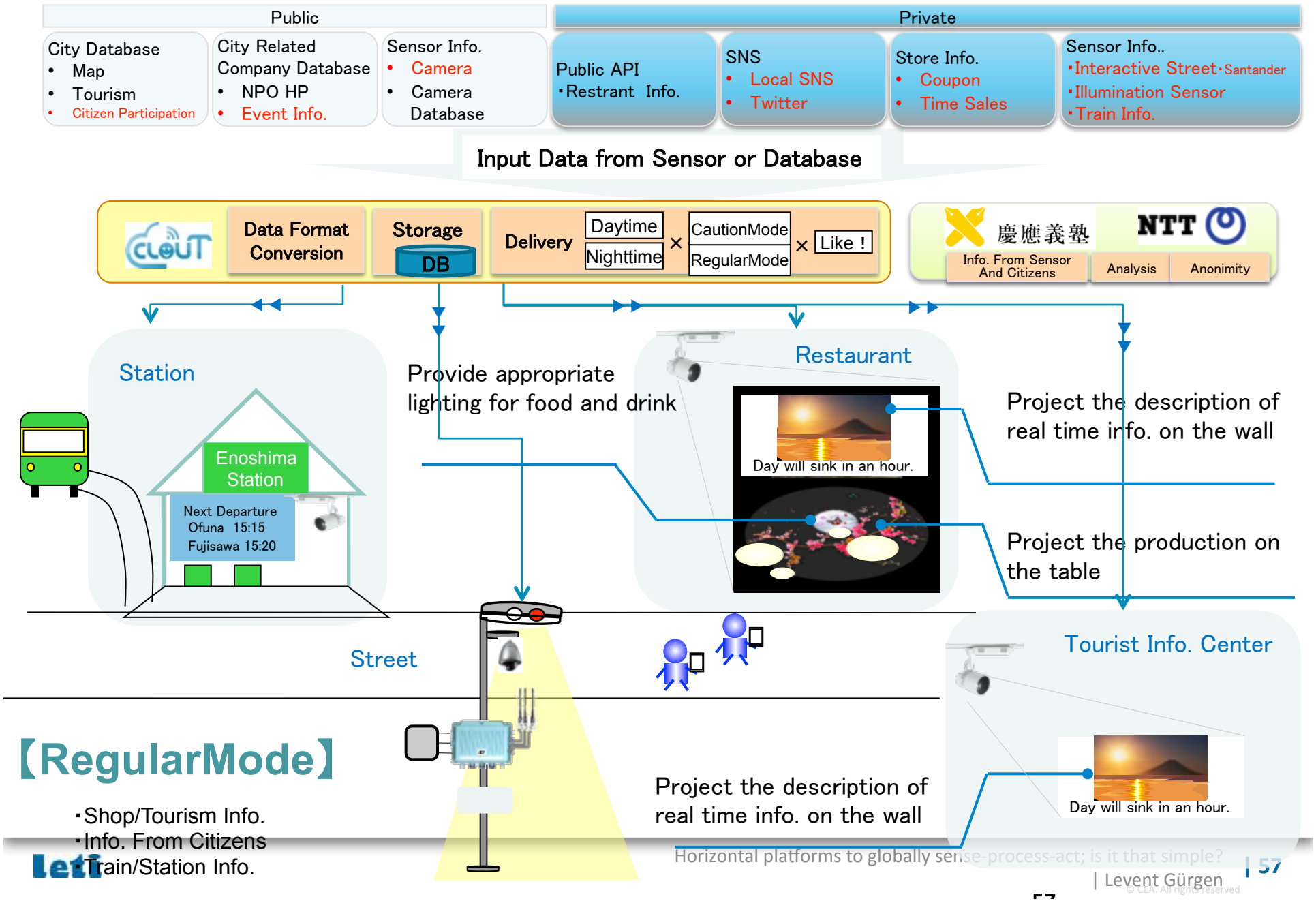




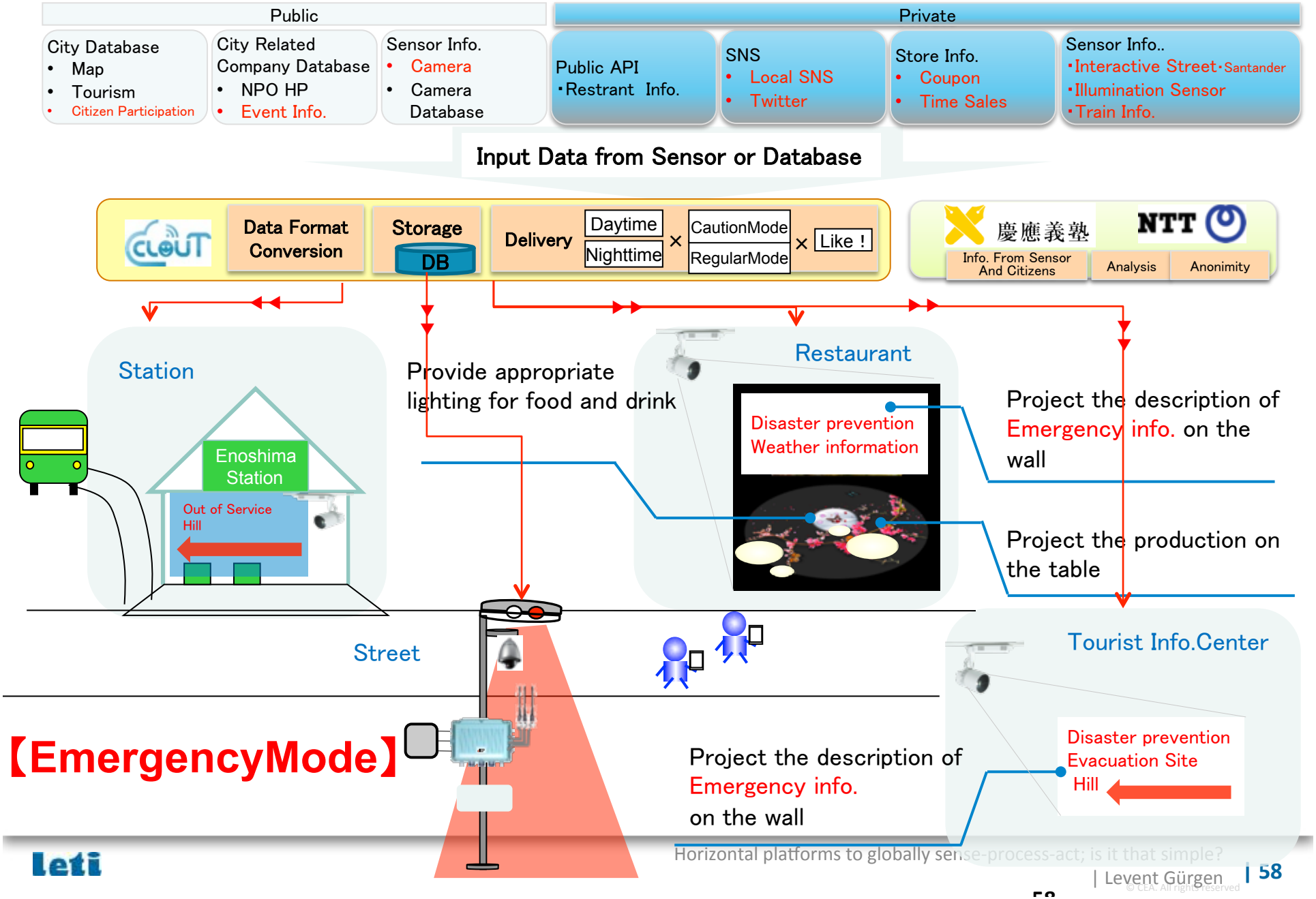




Interactive city Fujisawa Regular Mode

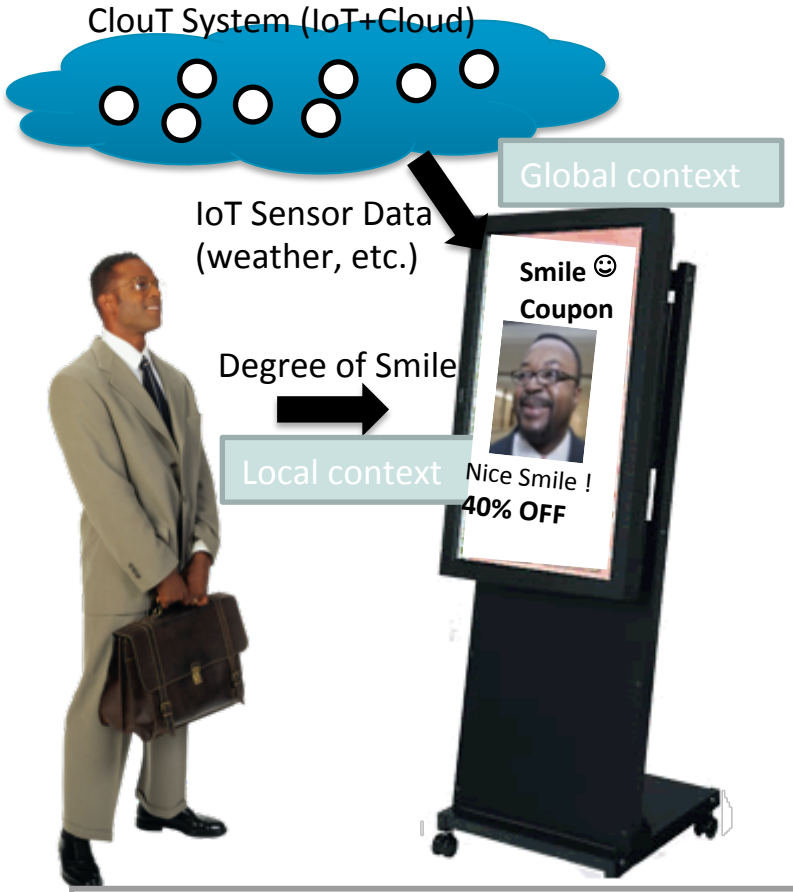


Interactive city Fujisawa Emergency Mode



Discover Smile in Fujisawa

Smily Coupon ☺

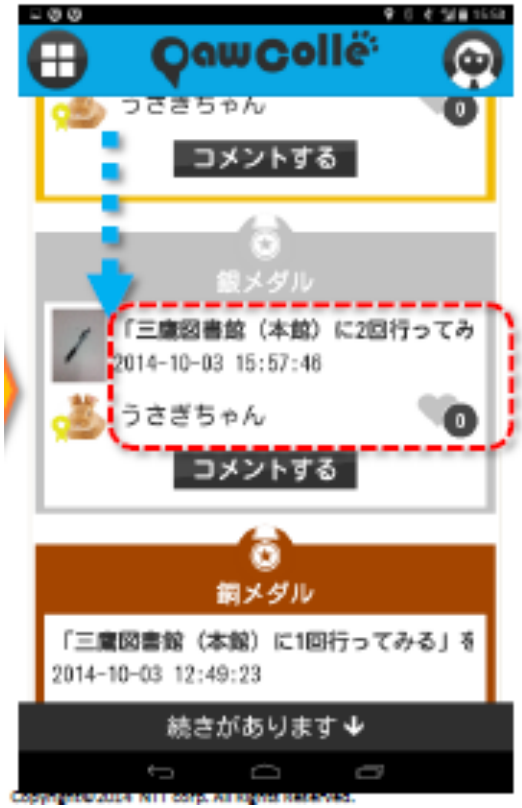


Early Prototype

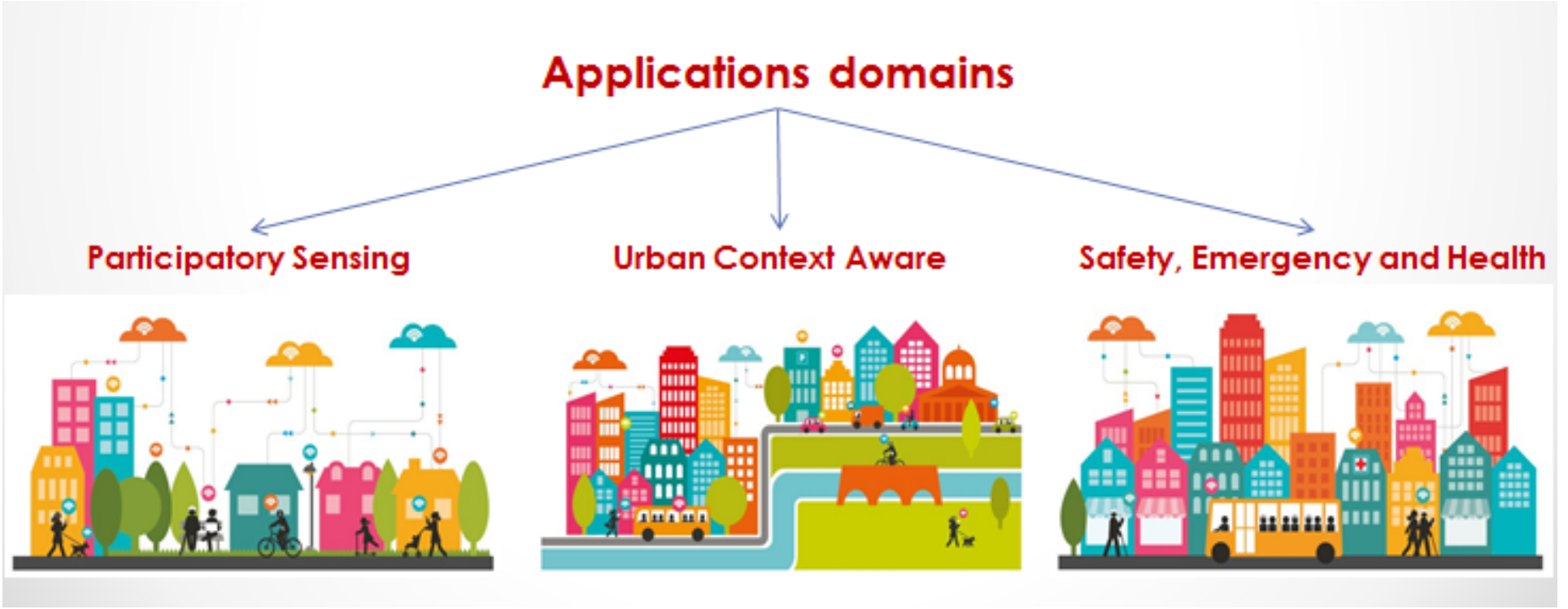
- Leveraging local context (smile) + city context (via ClouT) for dynamic coupon system
- Enhancing affection to the coupon for changing human behavior !

Care giving with participatory sensing and city data

- Going out support for active seniors
  - Motivate them to go walking and participate community events for preventing elderly people's isolation, vitalizing stores and promoting health.



Check out our video explaining the ClouT concept!



New H2020 project - FESTIVAL: FEderated interoperable SmarT ICT services deVelopment And testing pLatforms

Come and see us at the BUTLER booth…

and visit

http://www.iot-butler.eu/

http://clout-project.eu/

http://sociotal.eu/