Smart Cities and Regions Innovation Business Unit
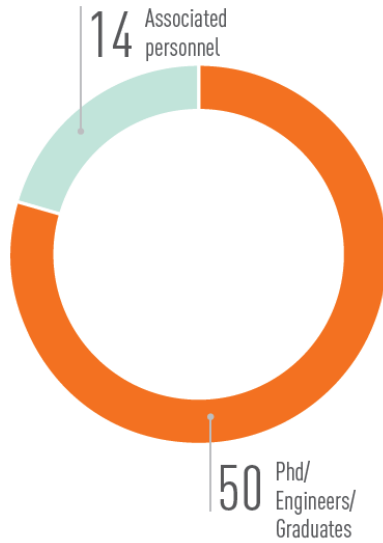
i2cat

Abril 2016

Content

- **i2cat at a glance**
- Smart Cities and Regions Innovation Business Unit
- Our offering
- Our expertise

i2CAT Foundation is a non-profit research and innovation centre which promotes mission-oriented R+D+i activities on advanced Internet architectures, applications and services. The centre stands up for a new open innovation framework, fostering the collaboration between companies, public administration, the academic environment and end-users.
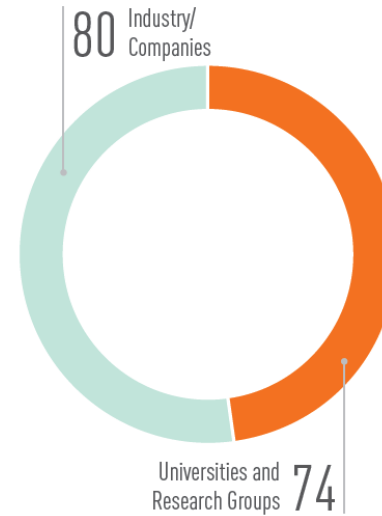
I2CAT IN FIGURES

STAFF

14 Associated personnel

50 Phd/ Engineers/ Graduates

CURRENT PROJECTS

25 National Projects

European Projects 27

R+D+I COOPERATION

80 Industry/ Companies

Universities and Research Groups 74

EXECUTED PROJECTS
+130

PUBLISHED PAPERS
+120

PATENTS
4
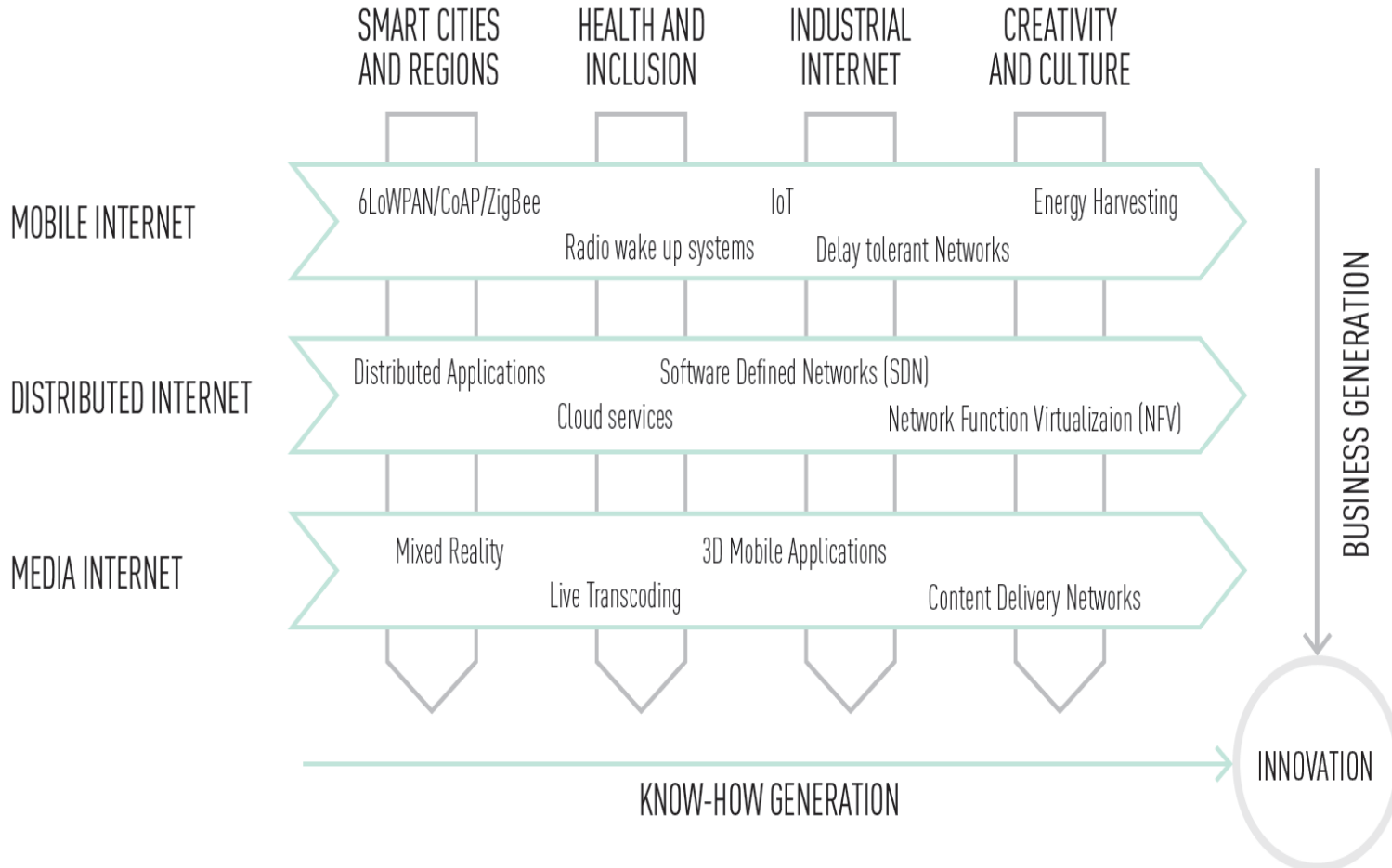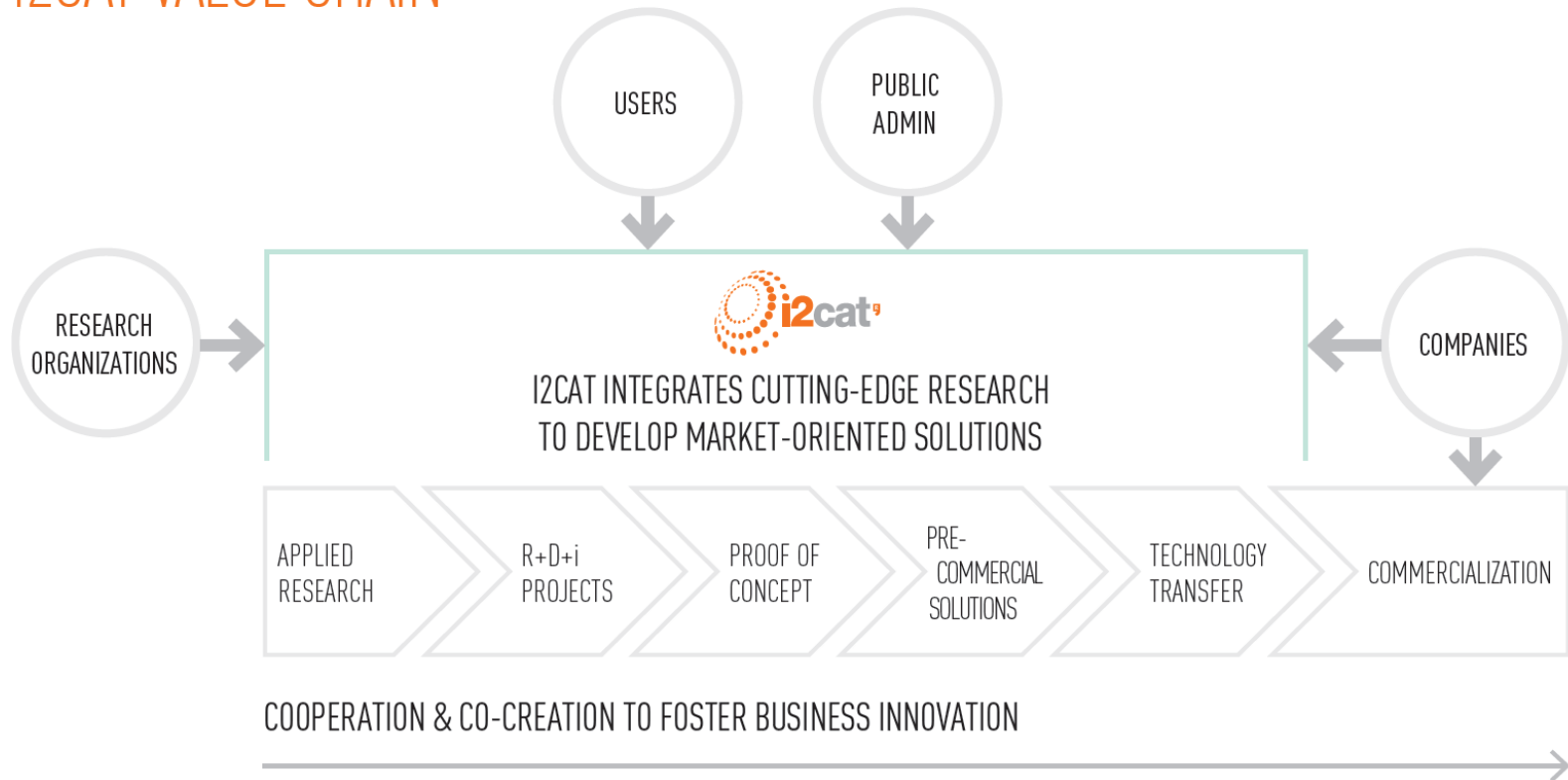
SPIN-OFFS
2

BOARD OF TRUSTEES

What we do

i2CAT has a wide experience in multiple national and European R+D+i projects, leading research lines in new fixed & mobile network architectures, wireless sensor networks, and content-based multimedia technologies, with the aim to develop new products, services and applications in the fields of eHealth, Smart Cities & Smart Regions, Advanced Manufacturing and Culture/Creativity.

I2CAT FOCUS

	SMART CITIES AND REGIONS	HEALTH AND INCLUSION	INDUSTRIAL INTERNET	CREATIVITY AND CULTURE
MOBILE INTERNET	6LoWPAN/CoAP/ZigBee	Radio wake up systems	IoT — Delay tolerant Networks	Energy Harvesting
DISTRIBUTED INTERNET	Distributed Applications	Cloud services	Software Defined Networks (SDN)	Network Function Virtualizaion (NFV)
MEDIA INTERNET	Mixed Reality	Live Transcoding	3D Mobile Applications	Content Delivery Networks

BUSINESS GENERATION

KNOW-HOW GENERATION

INNOVATION

I2CAT VALUE CHAIN

USERS

PUBLIC ADMIN

RESEARCH ORGANIZATIONS

COMPANIES

I2CAT INTEGRATES CUTTING-EDGE RESEARCH TO DEVELOP MARKET-ORIENTED SOLUTIONS

APPLIED RESEARCH

R+D+i PROJECTS

PROOF OF CONCEPT

PRE-COMMERCIAL SOLUTIONS

TECHNOLOGY TRANSFER

COMMERCIALIZATION

COOPERATION & CO-CREATION TO FOSTER BUSINESS INNOVATION

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Smart Cities and Regions IBU

Cities will become the habitat of the most population in this century.

Internet has appeared in the cities mainly through their citizens
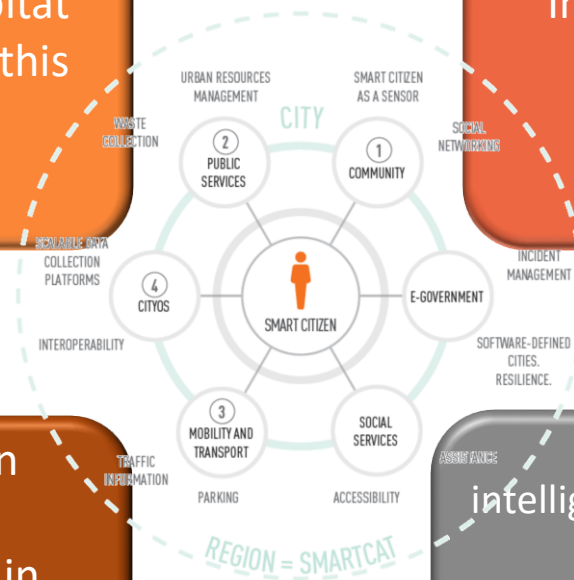
The amount of information and communications that happens through Internet in every city is outstanding. But these data are not open and accesible.

An open, ubiquitous and intelligent Internet can facilitate all this information collection, processing and valorization, transforming it in add-value knowledge mostly for the benefit of the citizens

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Our general Offering

ICT Resarch&Development services on demand

- Customized hardware and software developments
- Technological studies, and feasibility testing
- Integration and adaptation of new technologies
- Partnership in Research, Development and Innovation projects (National, H2020, SME instrument, Foster your Innovation)
- Collaboration with our board members university partners: UPC, URL, UPF

Access to experimental advanced internet infrastructure

- Access to experimental platforms: Industrial Ring
- Implementation of prototypes and pilots

Training services

- Specialized training in ICT technologies (in-company tailored courses)
- Participation and representation in associations and groups for standardization

Living Labs: User Centric Innovation methodology

Content

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Our Expertise

Smart cyber-physical systems
Sensors
Energy: harvesting, efficiency
Communications:
WiFi :
802.11 a/b/g/n/ac/ad (Basic connectivity),
802.11e (QoS),802.11ah (IoT), 802.11s (mesh
networks), 802.11p (Vehicular
communications), Wi-Fi Direct (device to
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networks
IPv6 over BLE standardization
Customized Wireless and Sensors
applications
Visible Light Communication
Near light Communication

Smart mobility
- V2x communications (V2V, V2I)
- Real Time Traffic Optimation

Software Defined Cities
- Software Defined Networks
- Cloud Computing
- Fog Computing
- Wireless SDN solutions
- 5G infrastructure convergence
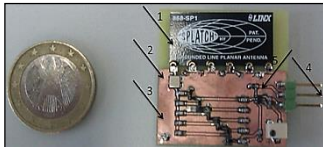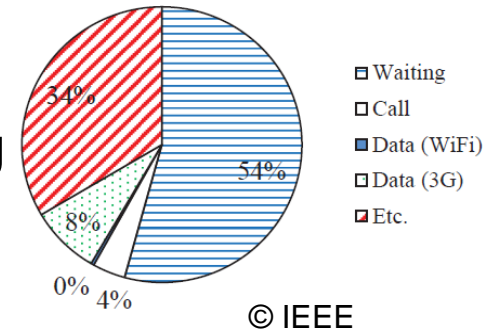- City Operation Systems
- Advanced GIS systems

Living Labs

Media Internet
- Media Networks
- Inmersion and interaction

Wake-Up Radio (WuR) Systems

- Objective:
  - Minimize energy waste caused by waiting communication

© IEEE

- Idea:
  - Put the communication chipsets into deep sleep mode
 - Activate the destination node, through its WuR receiver (WuRx), by sending a wake-up signal


A WuR system prototype developed by UITU

WuTx   **WuRx**
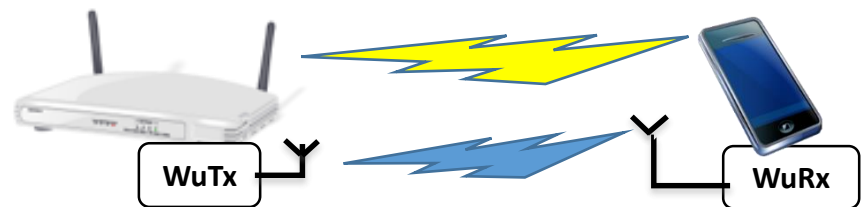
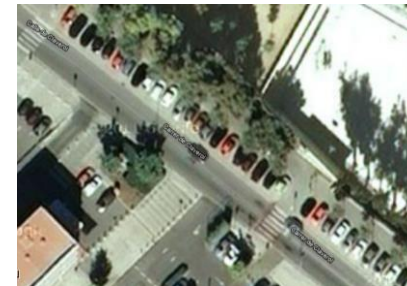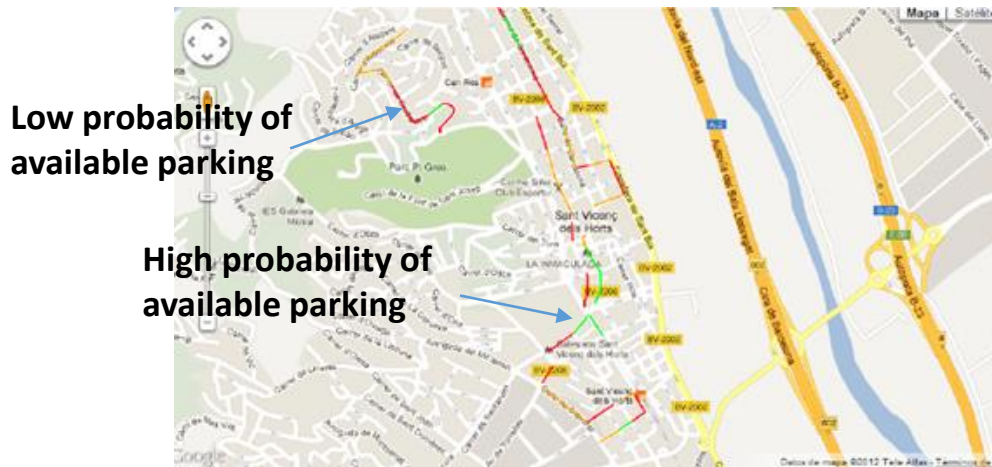| Power (mW)	Tx	Rx	Idle	Sleep
WLAN chip set	2000	1500	390	20
WuR - 868MHz	450	0.009	0.009	-

Automatic Dumpster occupancy detection

• Ongoing self-funded project.

• **Goal**: Minimize garbage collection time by having the garbage collector truck remotely detect the occupancy level of the dumpster.

• Current design consists of:

  • Wake-up radio technology, range of around 50 meters, to minimize battery consumption in the dumpster sensor. Sensor battery life unlimited.

  • Dumpster occupancy estimation base don ultra-sound sensor.
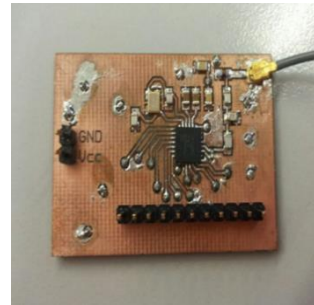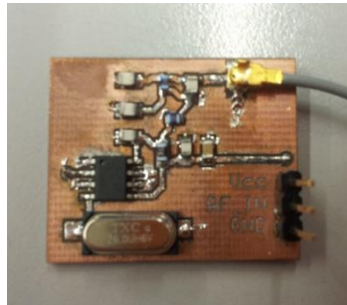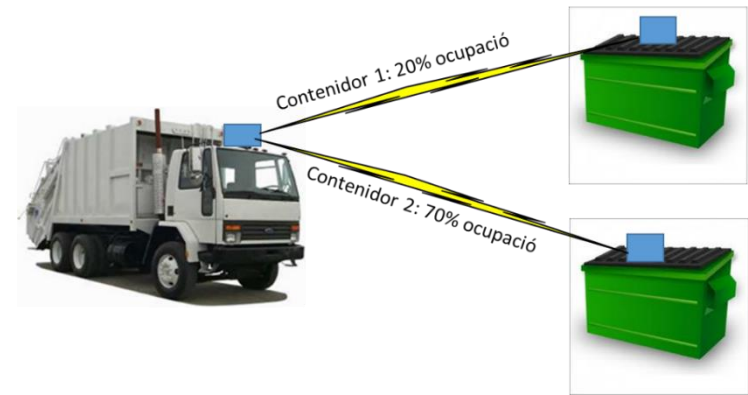
Infrastructure-less Smart Cities

- Collaboration with Orange.
- Usage of a public bus as a data collection platform
  - Sensor nodes distributed by the city
  - Monitor parking availability using ultrasounds emitted from a bus
  - Data collected by the bus and transferred using a cellular connection

Low probability of available parking

High probability of available parking

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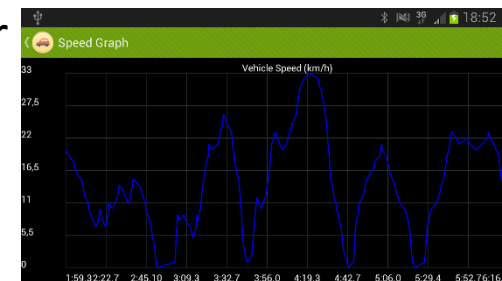- Media Networks
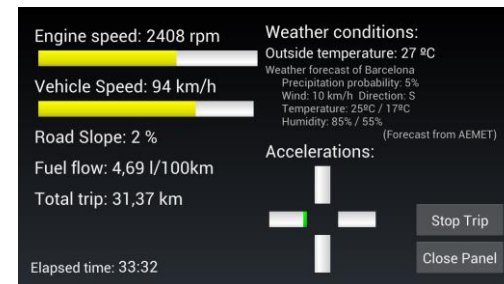- Inmersion and interaction

Real-time traffic estimation for Smart Cities

- Collaboration with SUMMA in the city of Sant Cugat.

- **Goal**: Obtain real-time estimations of traffic flow using Ultrasound sensors.

- Sensors are deployed in strategic points in the city center and networked using a **Wireless Sensor Network**.
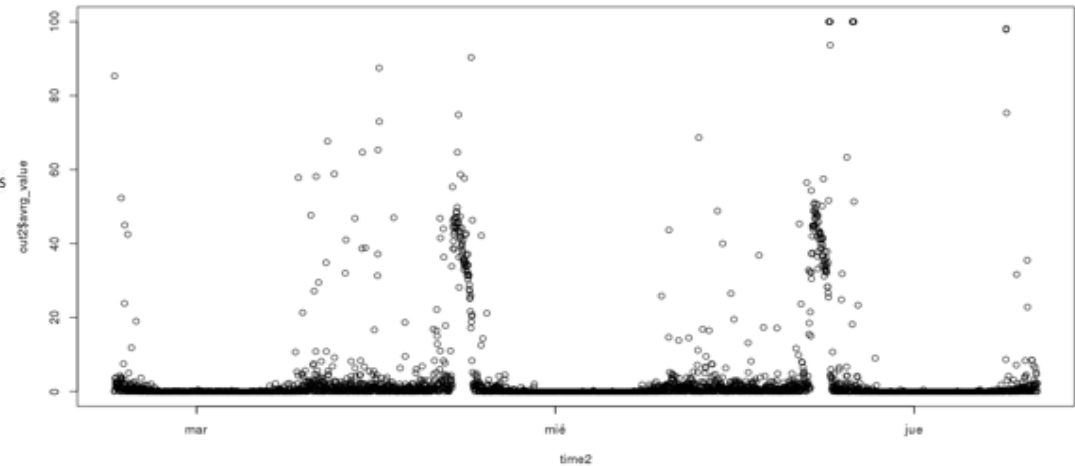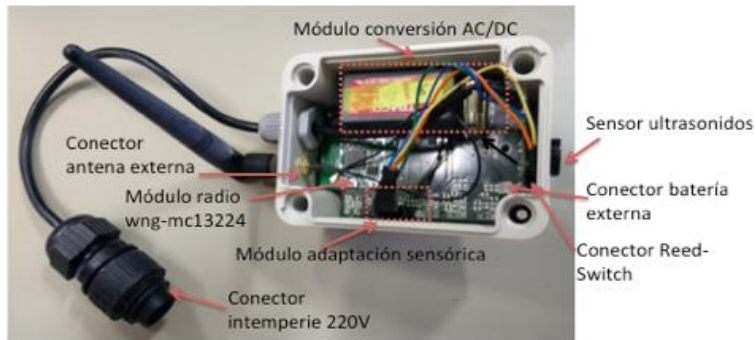
Vehicle – Smartphone integration

- Self-funded Project.

- Android base smartphone app.

- Diagnostic interface based on OBDII.

- What can you do?

    1. Obtain and record driving data.

    2. Detect and accident and automatically trigger alarms (e.g send SMS).

    3. Generate customized driving reports, for the driver or for a third party interested in driving assessment.

    4. Identify events, for instance a certain congestion pattern might indicate congestion.

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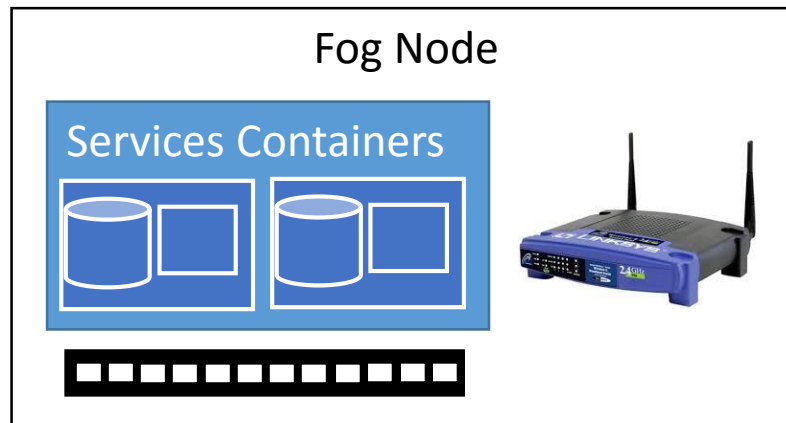- City Operation Systems
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Living Labs

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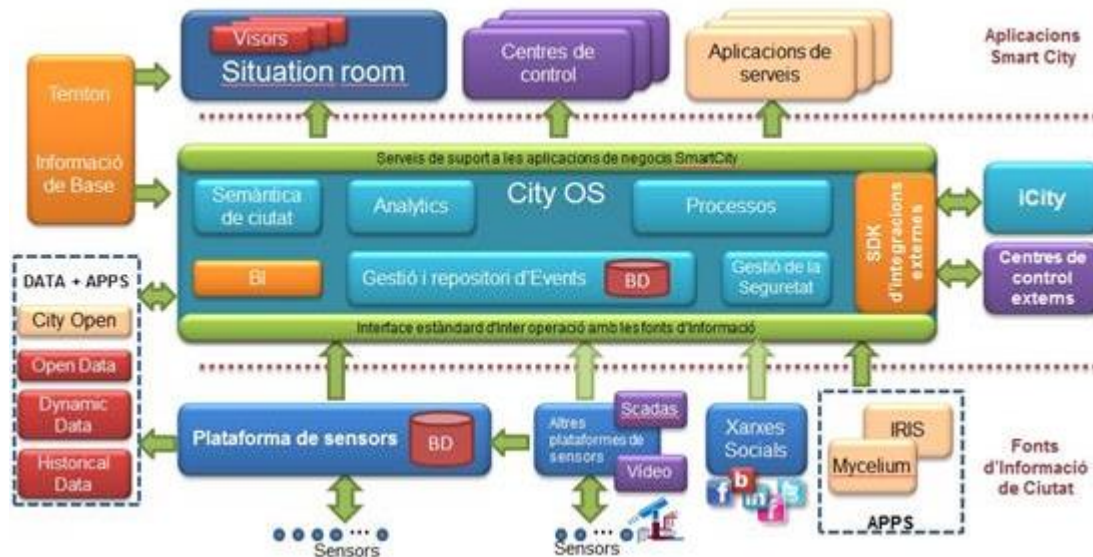- Inmersion and interaction

Fog Computing

- Distributed capacity (computing+storage)
- Service orchestration and management
- Multi-tenant infrastructures
- Lightweight data centres
- Mobile fog nodes
- Multiple connectivity technologies

Fog Node

Services Containers

City Operation Systems

- Support to the Barcelona City Council on the design of the Smart City OS

Smart City Platform

Generalitat de Catalunya
Departament d'Empresa i Ocupació
**Direcció General de Telecomunicacions
i Societat de la Informació**

- Analysis of the current situation
  - Location adoption of platforms Smart City / Smart Region
  - Technological barriers and challenges faced by municipalities
- Description of the technological platform
  - Features of the technological platform
  - Description of the blocks and functional modules
- Examples - platforms Smart City / Smart Region
  - Examples of technological platforms
  - Case studies

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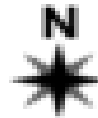- Real Time Traffic Optimation

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City Augmented Reality

Ajuntament de Terrassa

ITINERARY POINTS ON THE MAP
Location on the map of waypoints. Colour codes indicates which ones have AR

EXPRESS TOUR
This option points on a map all the points that have AR

POINTS OF INTEREST LIST
Index of all the application points, those with the symbol of the eye have AR

EXTRA SECTION
A list where you can find all kinds of content related to industrial and modernist Terrassa.

INFO
Section with general information about mNACTEC Terrassa City Council and more.

AN EXCEPTIONAL GUIDE
The architect Lluís Muncunill star of that time, helps you navigate the app and explains interesting facts along the way!

City Augmented Reality

# City Augmented Reality

Ajuntament de Terrassa

Empuries+

Relevant information about historical and artístic heritage, , through different direct and indirect observation sources (images, videos, sounds and graphics documents).

Interactive map: A bird's eye view of the two cities (Greek and Roman) with real time location of POI and users

Access to unpublished videos and content: 3D virtual tours and details of the most important temples of the most famous archaeological finds

Multilingual option: the application is available in Catalan, Spanish and English

Audio guide: each text has its full voice in the three languages

Augmented Reality in mobile devices with 3D on real areas

Example of restitution viewing of the ruins of Empuries
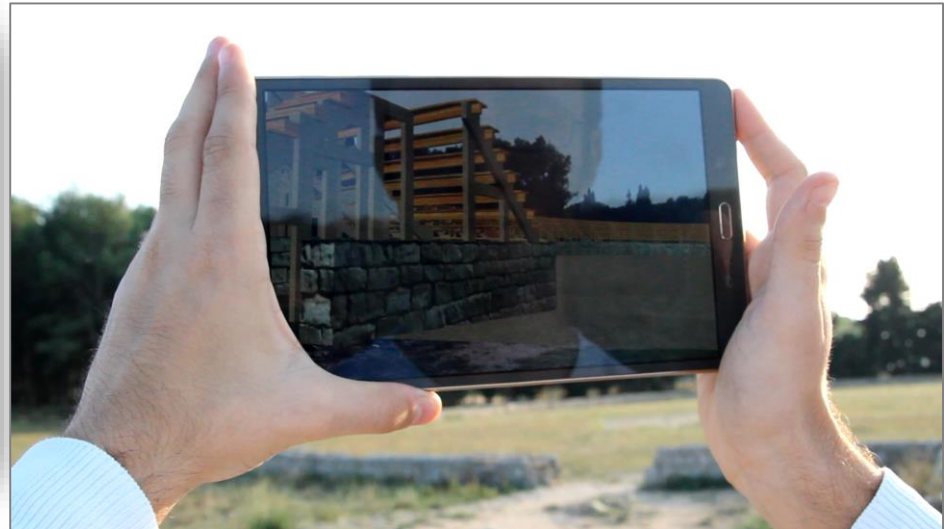
Video: Example of restitution viewing of the ruins of Empuries Amphitheatre on the app