SEVENTH FRAMEWORK PROGRAMME

SMARTSANTANDER

A City deployment: Connecting FIRE experiments and service provision to citizens

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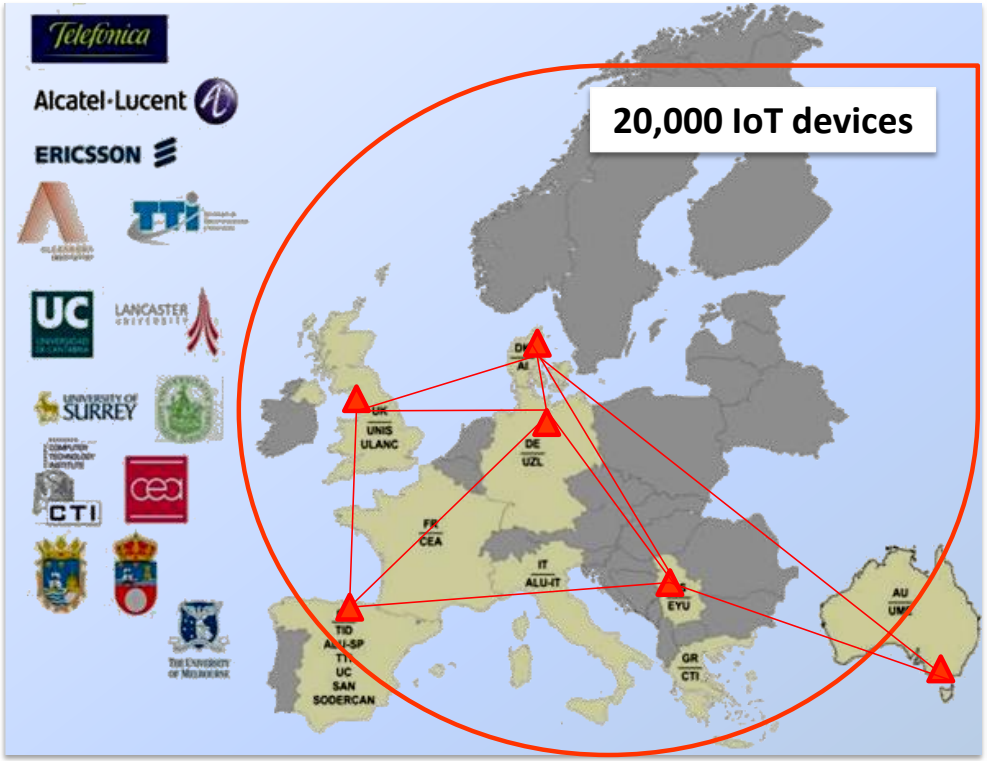
Outline

- What is SmartSantander about?
- How is SmartSantander becoming a reality?
- SmartSantander Architecture
- 2 Smart: Experimentation + service
- SmartSantander IoT topology
- City deployment
- Additional testbeds for federation
- Conclusions

What is SmartSantander about?

SmartSantander aims at providing a European **experimental test facility** for the **research** and **experimentation** of architectures, key enabling technologies, **services** and applications for the Internet of Things (IoT) in the context of the **smart city**.



Smart Santander Highlights

- **Targeting:**
  - Researchers
  - End users
  - Service providers
- **Duration**
  36 months
- **Consortium**
  15 Organizations
  8 EU countries + AU
- **Budget / Funding**
  8.6 M€ / 6 M€
- **Resources**
  746.2 PM

How is SmartSantander becoming a reality?

- Phased roll-out and deployment:

	Phase 1	Phase 2	Phase 3
Time	November 2011	November 2012	August 2013
Scale	2.000 IoT devices	5.000 IoT devices	20.000 IoT devices
Resources	Mainly WSN nodes and GWs	More heterogeneity WSNs, RFID, GW	Federated with other FIRE facilities
Facility services	Basic experi-mentation support	Advanced tools for experimentation	Advanced cross-testbed tools
Application domains	Transport, metering, environment	TBD	TBD

Basis for 1st call experiments
Call publication: Sep '11
Experiments: Dec '11 – Jul '12

Basis for 2nd call experiments
Call publication: Sep '12
Experiments: Dec '12 – Jul '13

Smart Santander Architecture

- 3-tiered architecture
  - IoT node: Responsible for sensing the corresponding parameter (temperature, CO, noise, light, car presence,...).
  - Repeaters: High-rise placed mainly in street lights, in order to behave as forwarding nodes to transmit all the information associated to the different measured parameters.
  - Gateway: Gather all the information retrieved by IoT nodes and repeaters, processing it and making it available to the SmartSantander backbone.

2 Smart: Experimentation + service

- Hardware independency →Two radio modules:
  - Dgimesh: Service provision and network management via a propietary routing protocol.
  - Native 802.15.4: Intended for experimentation.

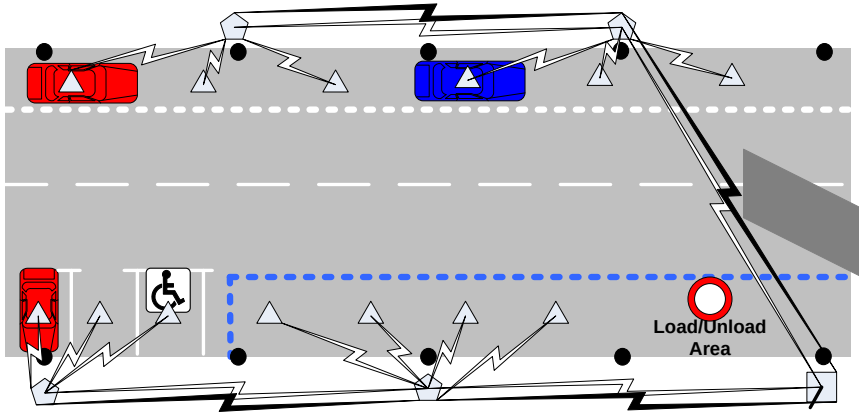
IoT Node/
Repeater

Gateway

2 Smart: Experimentation + service

- Software independency
  - Network management: Commands sending, **(M)OTAP** from GW to IoT nodes/repeaters → **Golden image** to allow restore nodes to stable and manageable state.
  - Service provision: Transmission of data (associated to a certain service), retrieved from IoT nodes/repeaters to the gateway.
  - Experimentation: Load of different programs using (M)OTAP → try different experiments over a determined set of nodes.

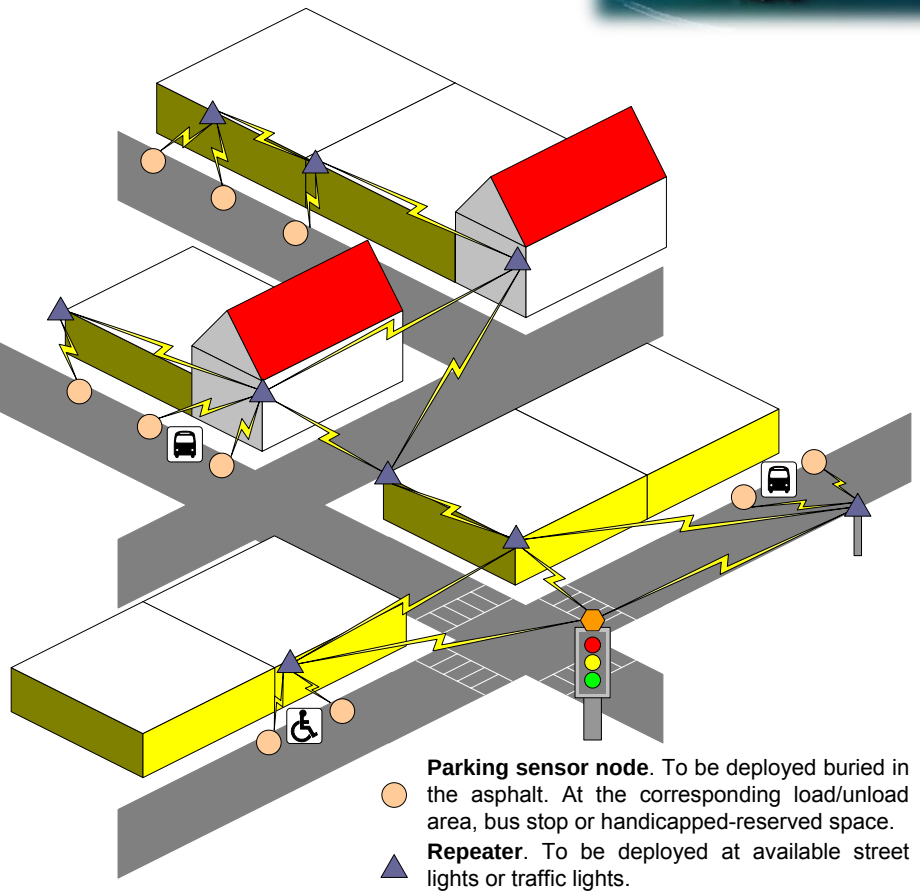
Smart Santander IoT topology



- Streetlight
- Parking sensor: Sensor node with one transceiver (Digimesh)
- Repeater: Sensor node with two transceivers (Digimesh and 802.15.4)
- Gateway: Node with communication with sensor networks (Digimesh and 802.15.4) and communication with external networks (WiFi, GPRS, ethernet)

- Digimesh Link
- 802.15.4 Link
- WiFi/GPRS, ethernet Link

SmartSantander Backbone



- **Parking sensor node**. To be deployed buried in the asphalt. At the corresponding load/unload area, bus stop or handicapped-reserved space.
- **Repeater**. To be deployed at available street lights or traffic lights.
- **Gateway**. Connected to Internet/Intranet.
- **Radio link**

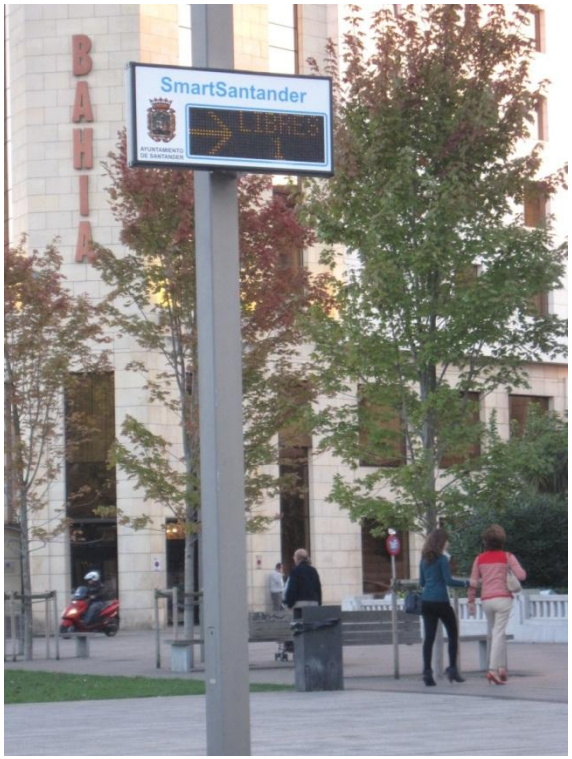
City deployment: Phase 1

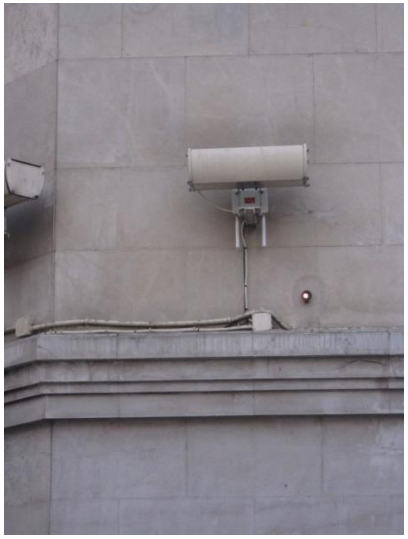
- Phase 1 deployment
  - 1300 installed on lamp posts
    - 650 targeted to service provision (Temperature, Co, luminosity)
    - 650 targeted to experimentation
  - 325 buried in the asphalt (parking sensors)

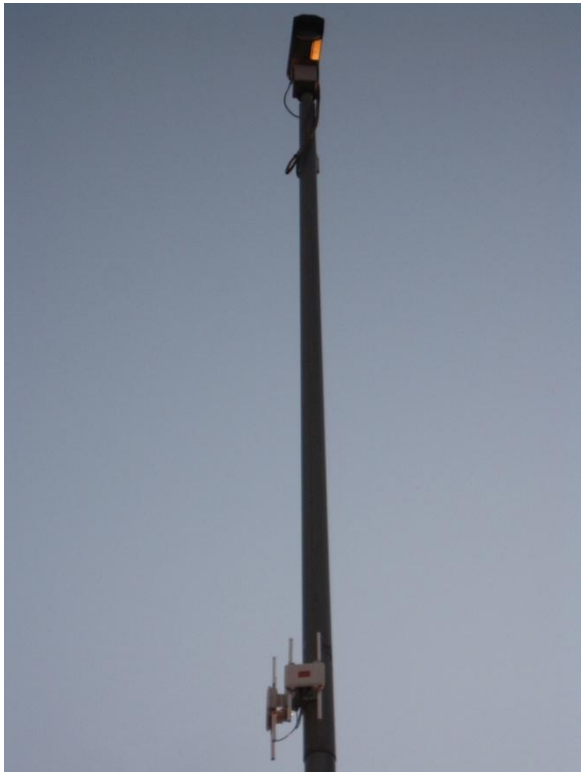
City deployment: Parking sensors

City deployment: Repeaters

City deployment: Meshliums and panel







Additional testbeds for federation

- Additional testbeds increasing the heterogeneity
  - Smart campus, Guildford, UK
    - 350 freely programmable IoT experimentation nodes
      - 250 wireless sensor nodes in an office environment providing energy consumption at desk, light, temperature, motion, and noise
      - 100 embedded Linux gateway devices (Ethernet, Wifi, Bluetooth)
  - Lübeck testbed deployment
    - 320 wireless sensor nodes with USB backbone, indoor
    - 60 wireless sensor nodes without wired backbone, outdoor
  - Belgrade testbed deployment
    - 20 mobile devices, deployed on public buses
      - equipped with GPRS, GPS, temperature, humidity, air pressure, CO, CO2 and NO2
      - Access to data and re-programming possible
    - Additional 60 devices available, but for data access only

Conclusions

- Massive deployment of IoT devices within a city environment.
- Platform with a twofold approach: experimentation + service provision to citizens.
- Network management: Commands sending, (M)OTAP and Golden Image.
- There is still a gap between the technology available in the labs and the technology needed in real deployments.
  - Housing of the IoT devices.
  - Embedding IoT infrastructures in the urban landscape.
  - Battery power constraints.
- Sustainability of the infrastructure.

Thanks for your attention

http://www.smartsantander.eu/map/