SMARTSANTANDER

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

Jose Antonio Galache
Laboratories for R+D+I in Telecommunications, 39005-Santander; Spain
University of Cantabria
jgalache@tlmat.unican.es
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:

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Phase 2</th>
<th>Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time</strong></td>
<td>November 2011</td>
<td>November 2012</td>
</tr>
<tr>
<td><strong>Scale</strong></td>
<td>2,000 IoT devices</td>
<td>5,000 IoT devices</td>
</tr>
<tr>
<td><strong>Resources</strong></td>
<td>Mainly WSN nodes and GWs</td>
<td>More heterogeneity WSNs, RFID, GW</td>
</tr>
<tr>
<td><strong>Facility services</strong></td>
<td>Basic experimentation support</td>
<td>Advanced tools for experimentation</td>
</tr>
<tr>
<td><strong>Application domains</strong></td>
<td>Transport, metering, environment</td>
<td>TBD</td>
</tr>
</tbody>
</table>

**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 proprietary routing protocol.
  - Native 802.15.4: Intended for experimentation.
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 node** with one transceiver (Digimesh)
- **Repeater** with two transceivers (Digimesh and 802.15.4)
- **Gateway** with communication with sensor networks (Digimesh and 802.15.4) and communication with external networks (WiFi, GPRS, ethernet)

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/