

ITU Kaleidoscope 2016
ICTs for a Sustainable World

A Stack4Things-based platform for Mobile CrowdSensing services

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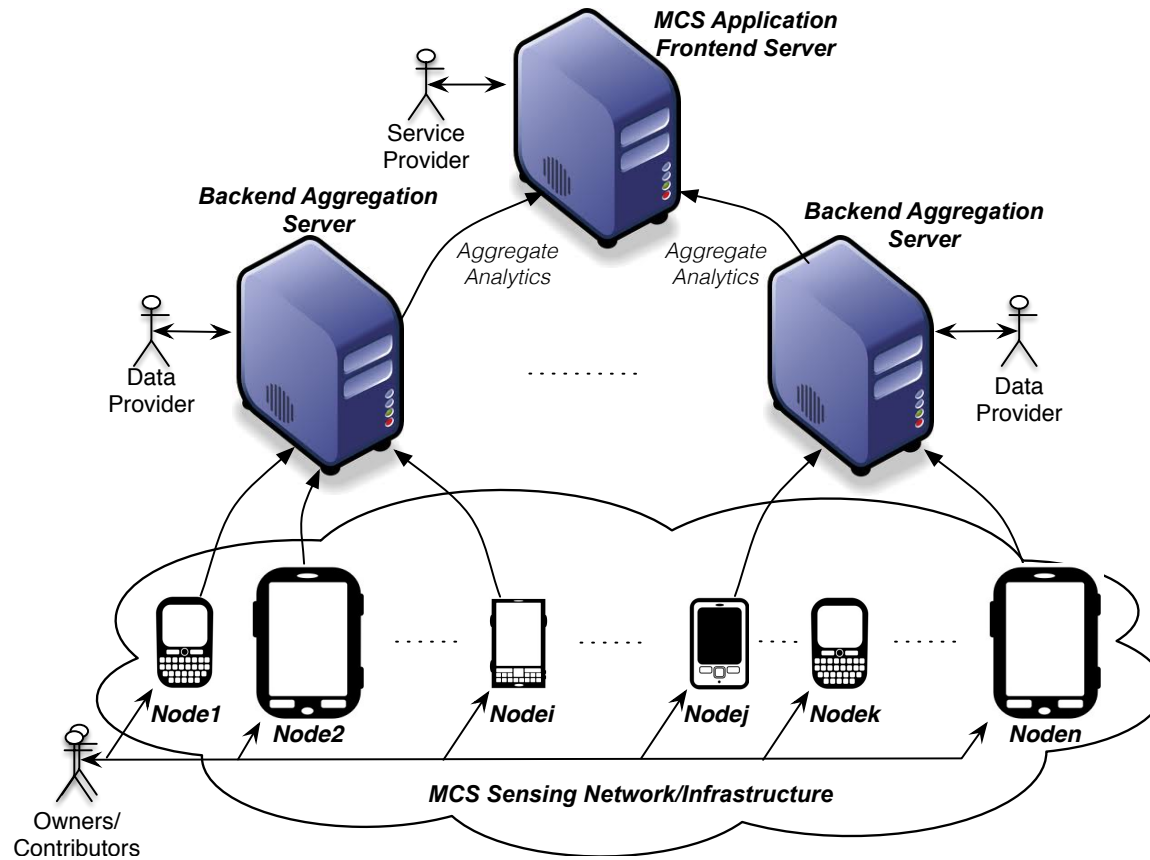
Bangkok, Thailand
14-16 November 2016

Outline

- Scenario
- Taxonomy
- Approach
- Platform
- Use case
- Conclusions



MCS reference scenario

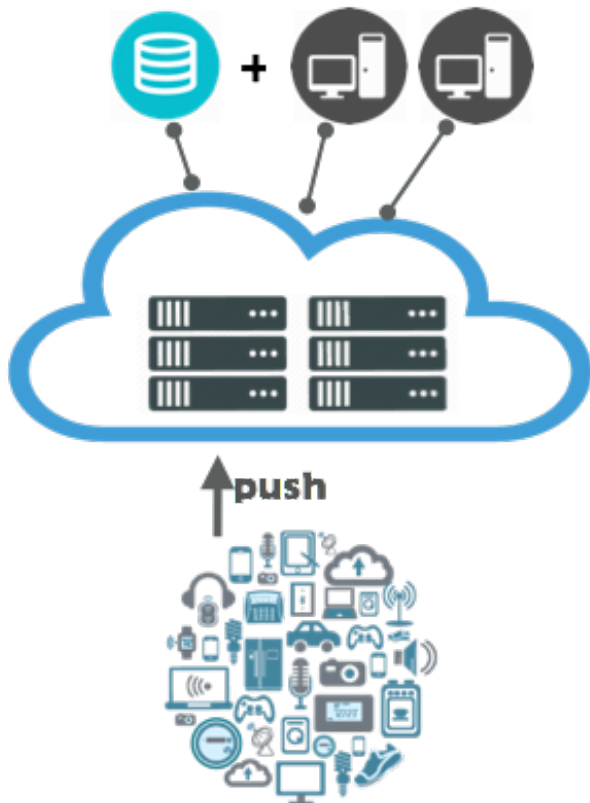


A taxonomy of MCS applications

MCS applications (categorized by)	Approach	
	<i>Participatory</i>	<i>Opportunistic</i>
<i>Owner involvement</i>	Active, human-assisted sensing / tagging	Background, unmanned data collection
<i>User benefit</i>	Public interest	Individual utility
<i>Fruition modality</i>	Pull / non-contextual	Push / contextual
<i>Interaction model</i>	Centralized (client-server)	Distributed (mesh)
<i>Incentive mechanism</i>	Credit systems (bank)	Credit collection race



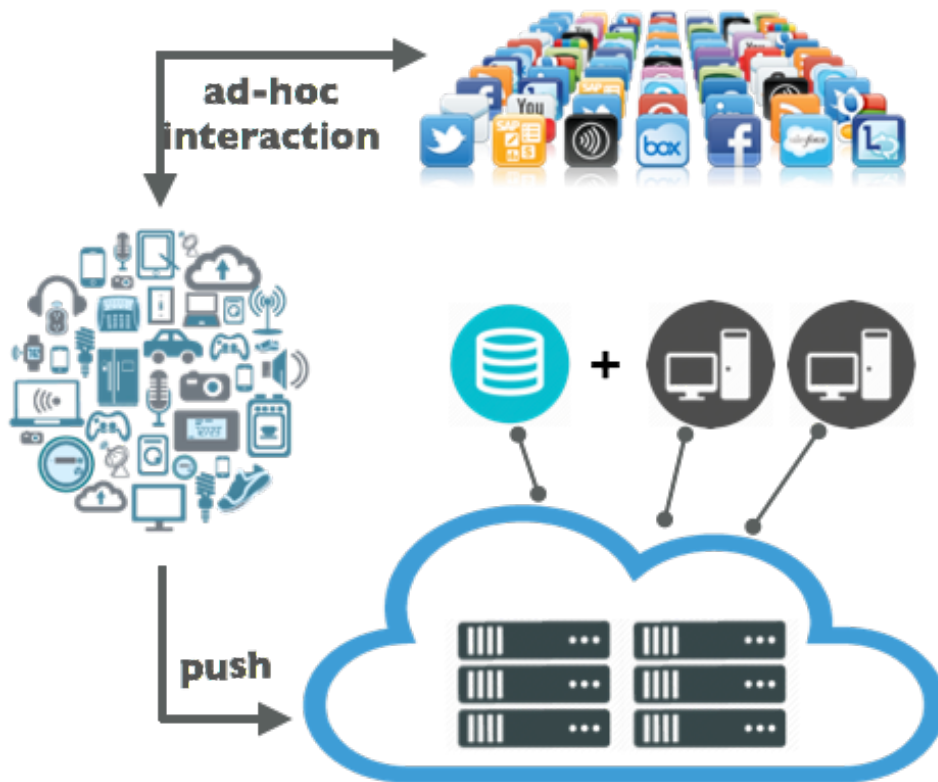
Cloud and IoT integration: data-oriented



- IoT devices **send** data to the Cloud
- app built on top of **standard** cloud facilities (VMs, storage, network)
- app makes use of stored (**non-real time**) IoT data
- indirect, IoT **device-initiated** only, retrieval of actuation commands



Cloud and IoT integration: application-specific



- app uses **ad-hoc mechanisms** to interact with IoT devices
- **no explicit interactions** between Cloud components and IoT infrastructure
- **static** infrastructure deployment

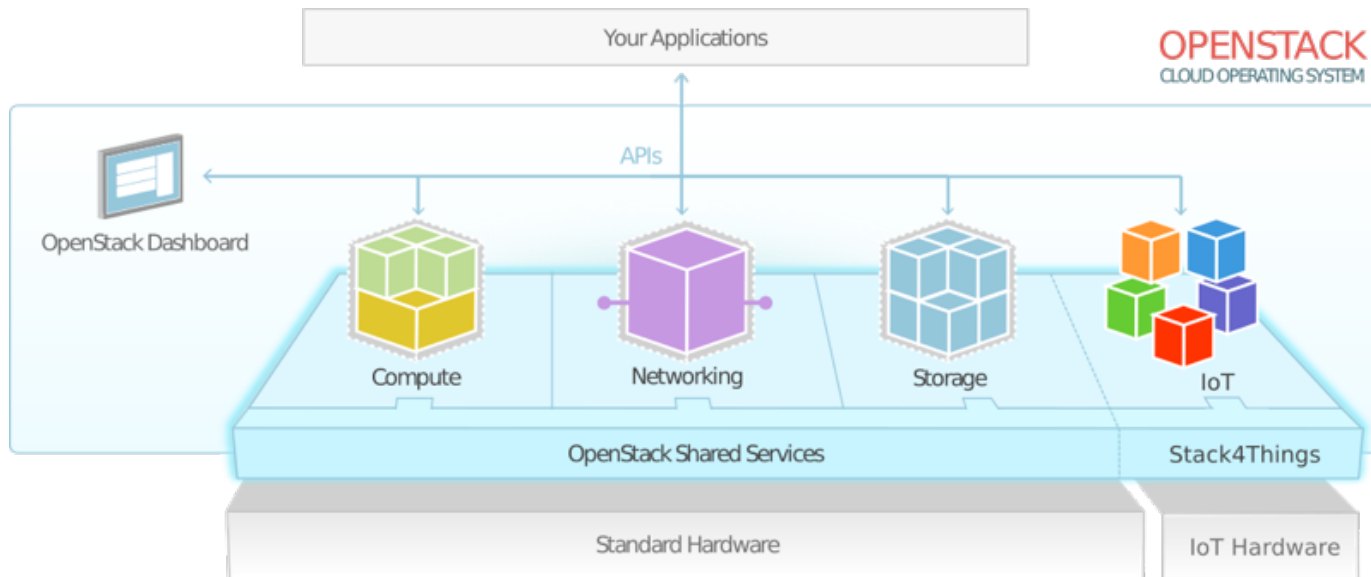
Cloud and IoT integration: full thing “cloudification”



- IoT infrastructure as a **natural extension** of a datacenter
- well-defined Cloud **API** as a resource management interface
- **separation of concerns** between infrastructure and application (when needed)
- from Cloud to **Fog/Edge** computing
- device computation **offloading**



IoT-Cloud engine: Stack4Things

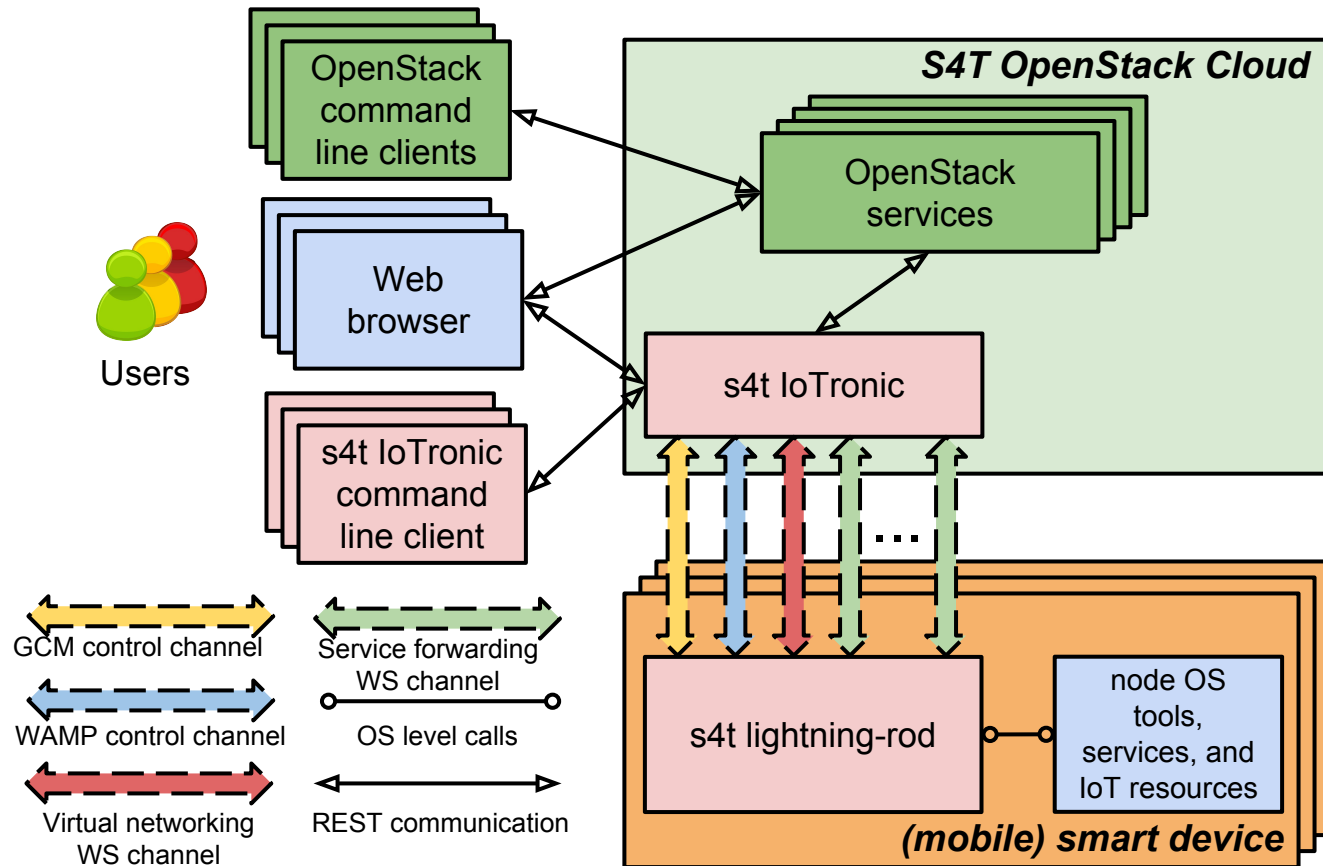


- an **open source** project helping administrators to *manage* IoT device *fleets* without caring about their physical location, their network configuration, their underlying hardware/software setup
- a **Cloud-oriented horizontal** solution providing IoT object *virtualization*, *customization*, and *orchestration*

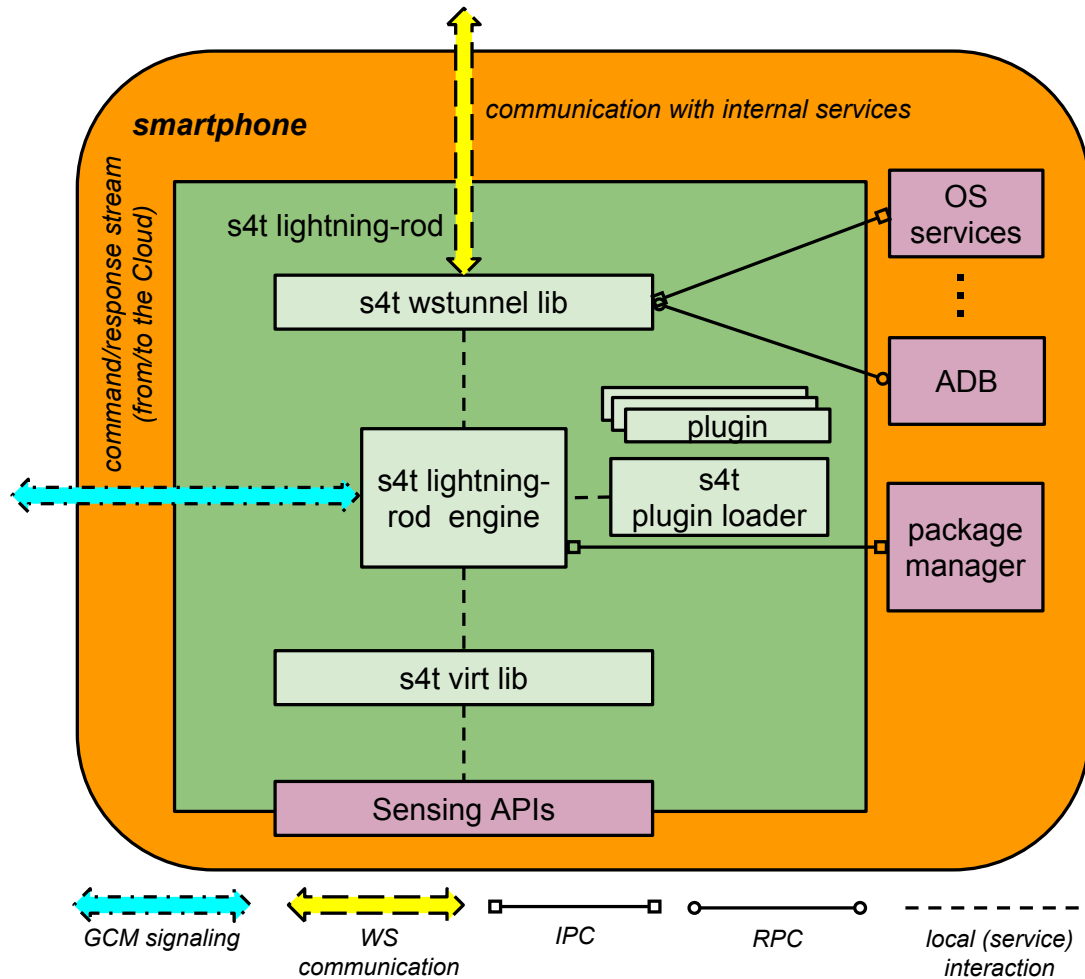
<http://stack4things.unime.it>



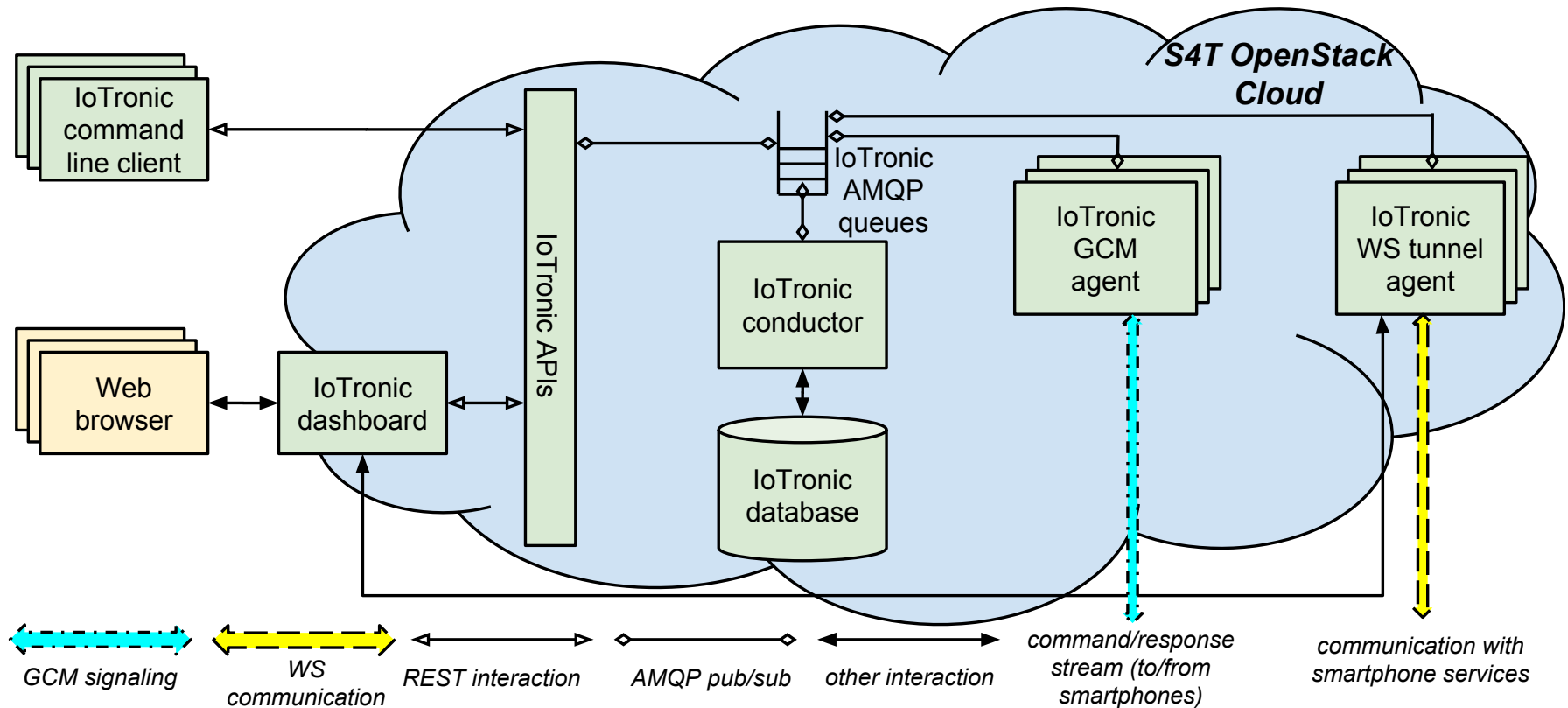
A Service-Oriented MCS infrastructure



Stack4Things node-side architecture for an MCS platform



Stack4Things Cloud-side architecture for an MCS platform



Use case: MCS for Smart City services

#SmartME
as
crowdfunding
initiative and
experimental
Smart City
testbed

The screenshot displays the #SmartME website interface. At the top, there are navigation links for #SmartME, Technologies, Timeline, and Community. The main content area is divided into several sections:

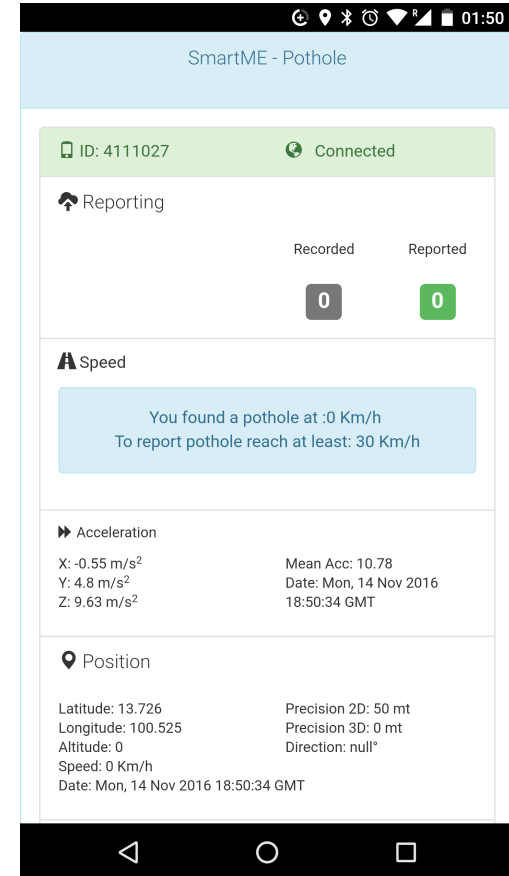
- #SmartME**: A header with a logo of a building and the text "Innovatively making the city of Messina 'smart!'".
- Credits**: A list of partners including University of Messina, CIAM, DH Labs, and MDSLAB.
- Location**: Messina - Sicily, Italy.
- Skills**: A list of skills including Open Data, Smart City, Archive, Sensors, and Internet of Things (IoT).
- The Project**: A text block describing the #SmartME project as a crowd-funded initiative by researchers at the University of Messina, aimed at creating a virtual ecosystem based on the Internet of Things (IoT) paradigm. It mentions the deployment of low-cost microcontroller boards on buses, lamp posts, and buildings.
- The Map**: A map of Messina, Sicily, showing the city's layout and various sensor locations marked with red triangles.
- Latest News**: A section with two news items: "March 17, 2016 Deployment" and "April 28, 2015 Deployment", both with "Read more" links.

<http://smartme.unime.it>



Example of a S4T-powered MCS app

- **Pothole** Detection and Mapping (PDM)
 - **Android** app + **Cloud** backend
 - Web **portal**
- MCS **enhanced** by the IoT-Cloud
 - **runtime** injection of code to nodes for computation at the **edge**
 - (locally) querying Roads API to actually **anchor** potential sites to the road



PDM web portal

The screenshot displays the PDM web portal interface. At the top, there are navigation tabs: "Home", "Dettagli segnalazioni buca", and "Riparazione buca". Below these is a section titled "Intervallo intensità d'urto" (Impact intensity range) with "Inizio: 4" and "Fine: 20" dropdown menus, and "Filtra" and "Reset" buttons. The main area is a map of Messina, Italy, with a "Mappa" and "Satellite" toggle. A popup window is open over the map, displaying the following information:

- Id : 56d74fbaf6b54de076f81d
- Sito verificato dalle Google API
- Indirizzo : Str. Panoramica dello Stretto, 57, 98167 Messina ME, Italy
- Latitudine : 38.232513487834446
- Longitudine : 15.569818307840425
- Intensita' minima rilevata : 4.72013
- Intensita' massima rilevata : 4.72013
- Numero di segnalazioni : 1
- Data di prima notifica : 2013-03-11 08:23:29
- Data ultima notifica : 2013-03-11 08:23:29



Conclusions

- a **taxonomy** and model for MCS
- relating MCS to IoT and **edge** computing
- adapted **IaaS** framework for IoT to serve as a service-oriented **platform** for MCS
- instantiate / deploy **custom** code at runtime
- **offloading** capabilities exercised through MCS app



Credits / Question time

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Thanks!

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