M3 in education and research: experiences and lesson learned

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

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Innovation House – Otaniemi
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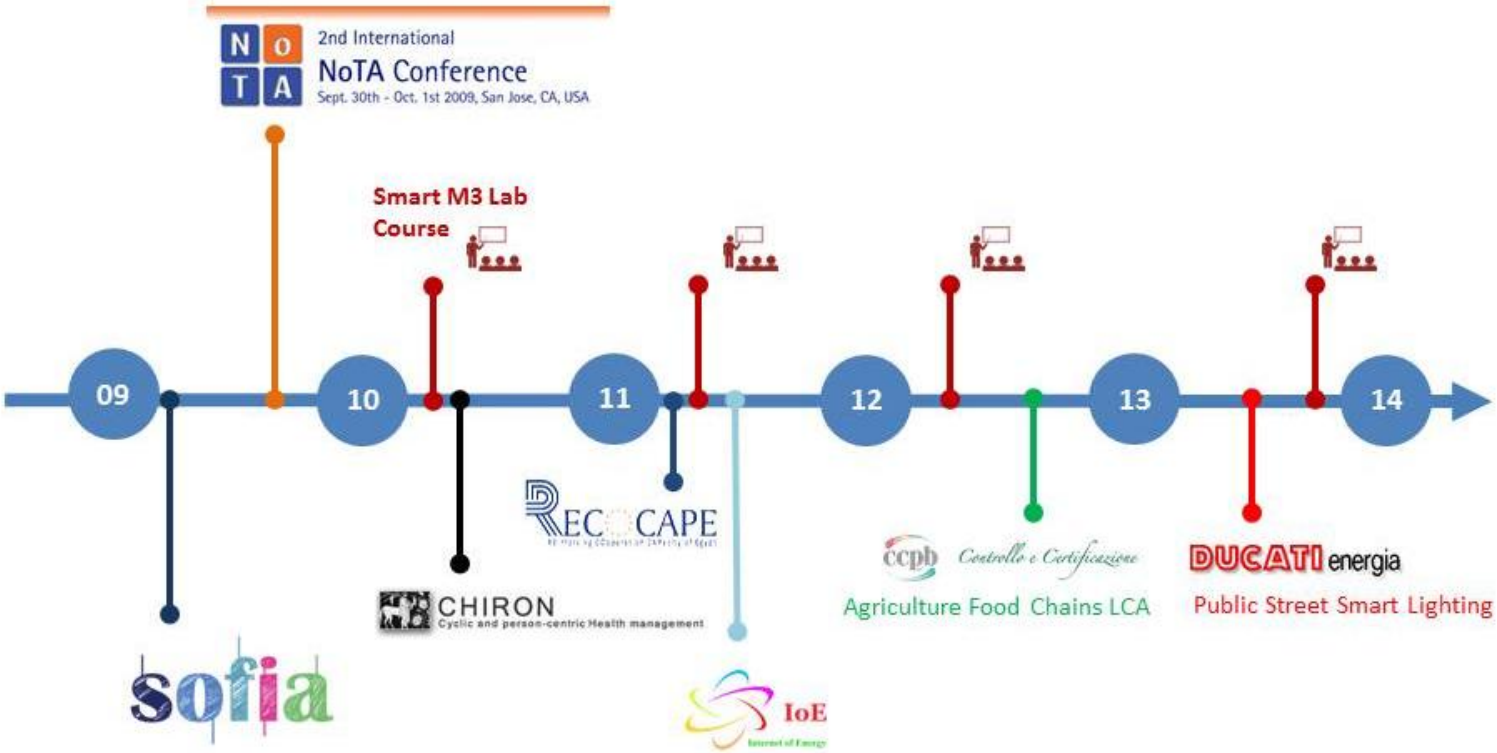
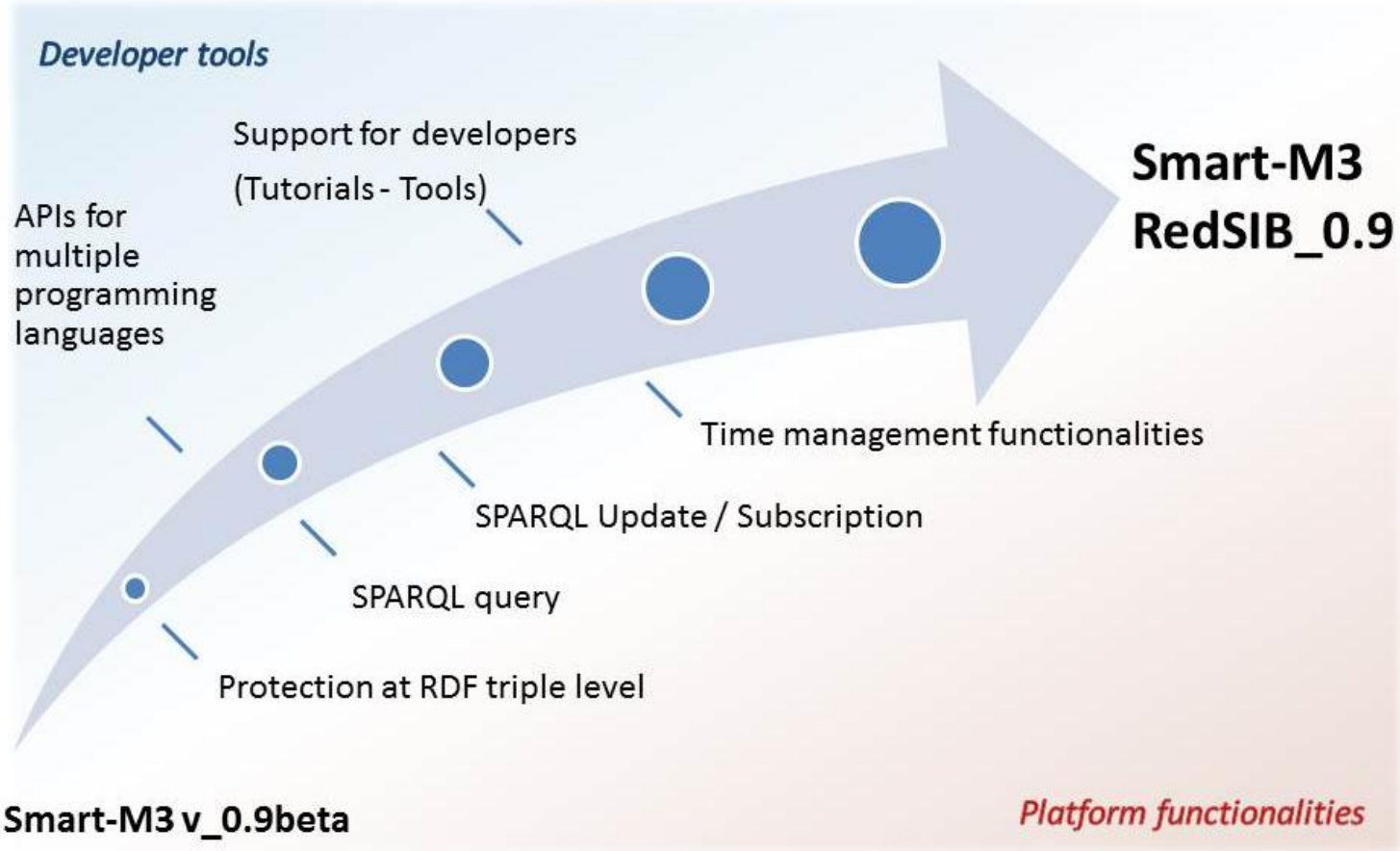
UNIBO & M3 timeline



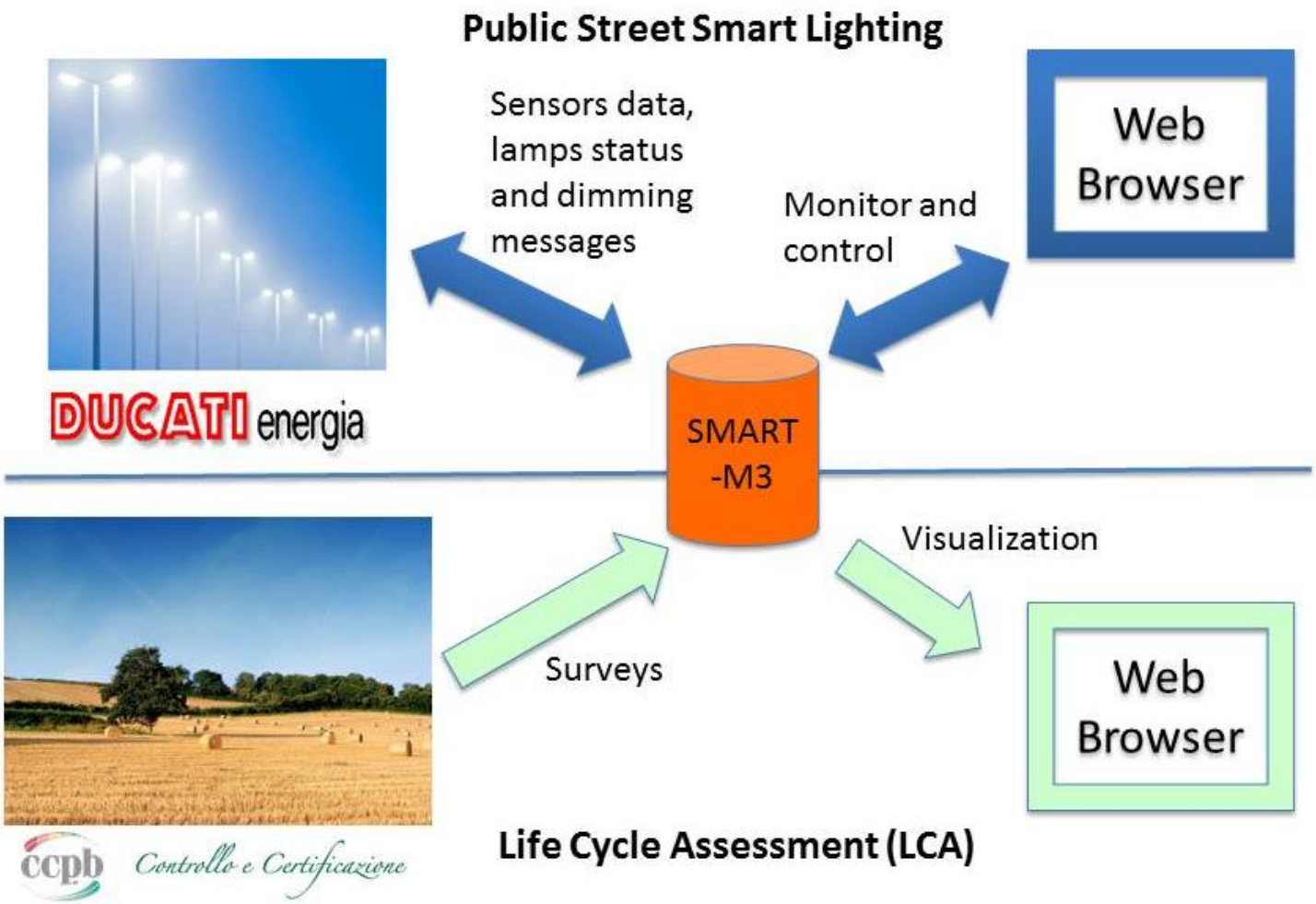
Smart-M3 evolution



UNIBO Contribution

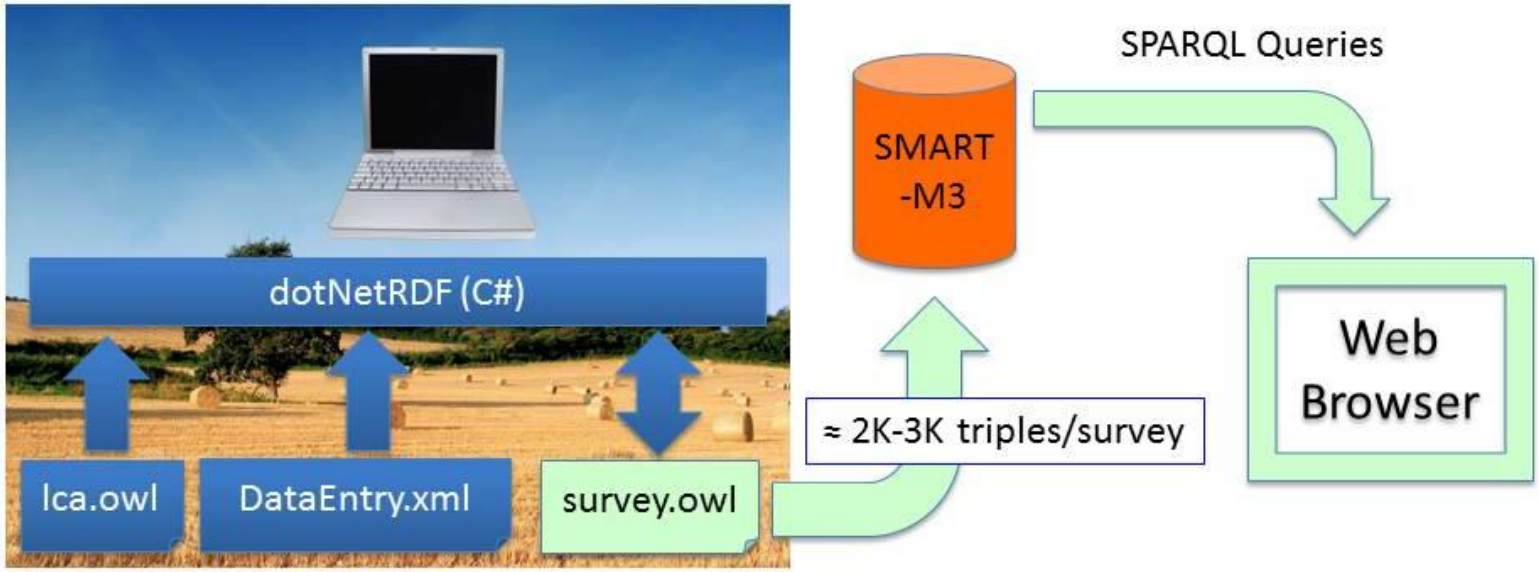
Platform	APIs	Domains	Education
• Protection • SPARQL support query and subscription • Powered by RedLand or Virtuoso • OSGI SIB	• Python • Java • C# • PHP • Javascript	• Public street smart lighting • Agricolture food chains LCA • Home health monitoring • EV charging urban scenario	• University courses and labs • RECOCAPE international cooperation project

Many domains, one solution

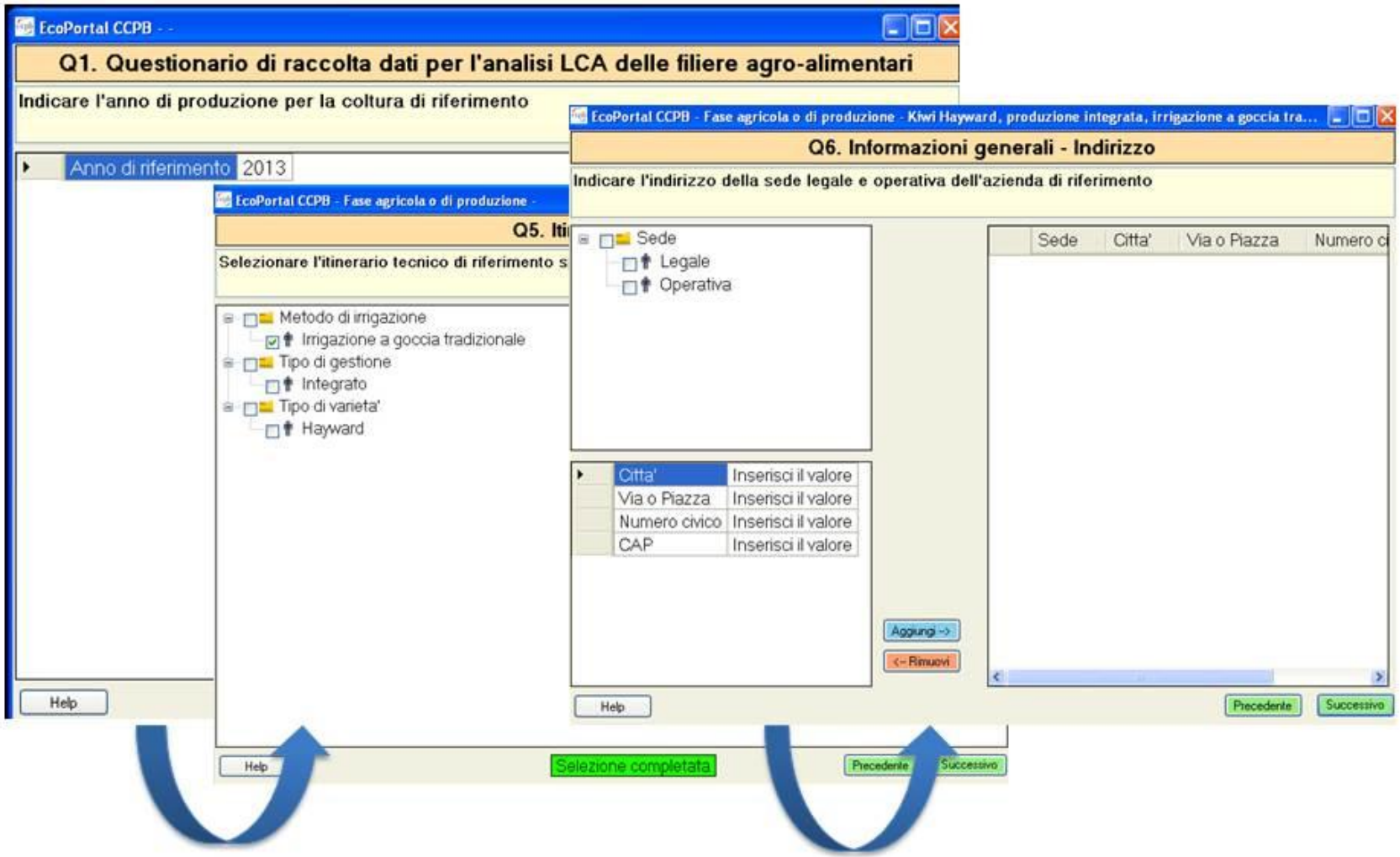


Life Cycle Assessment of agriculture food chains

- Ontology based Data entry GUI for on site operators
- Local caching (i.e. no Internet access) and re-configurable (i.e. ontology based)
- Showing collected surveys on a Web browser



Reconfigurable Data Entry Interface



Survey results visualization using SPARQL queries from PHP

Scheda Questionario

Questionario

Pero Abate, produzione integrata a bassa densita' - Anno 2011

AZIENDA AGRICOLA GHELFI BRUNO

Produzione Complessiva

Durata economica della coltura (anni)	
Prodotto totale inviato alla fase successiva (q)	225
Resa media nell'ultimo triennio (q/ha)	350
Resa nell'anno di riferimento (q/ha)	210
SAU (ha)	11
Sesto d'impianto	3.5X1

Commento:

SAU Altre Colture

SAU (ha)	Varieta'	Tipo di coltura
0,4	CONFERENCE	Pero
3,4	VARIE	Melo
1,2	WILLIAM	Pero
5,5	ABATE	Pero

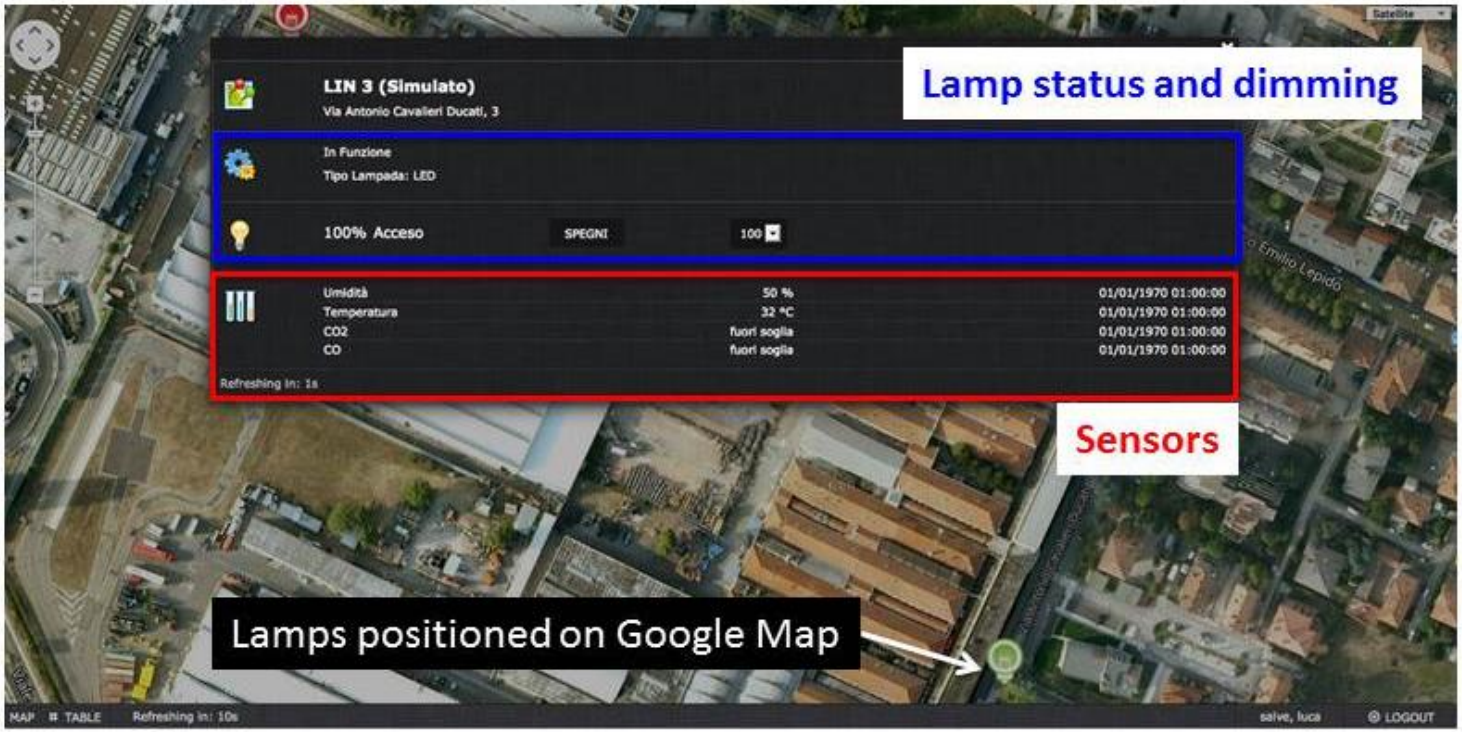
DEBUG: query time

Info Questionario	0.06s
Produzione Complessiva	0.052s
SAU Altre Colture	0.237s
Consumi Energetici	0.64s
Produzione di Energia da Fonti Rinnovabili	0.04s
Fase Impianto	4.442s
Impianto Materiali	2.073s
Impianto Irrigazione	0.053s
Impianto Concimazioni	0.061s
Impianto Fitosanitari	0.044s
Operazioni Colturali	7.451s
Operazioni Materiali	0.06s
Operazioni Concimazioni	1.425s
Operazioni Fitosanitari	0.065s
Materiali in Uscita	0.056s
Trasporto Fase Succ.	0.04s
	16.799s

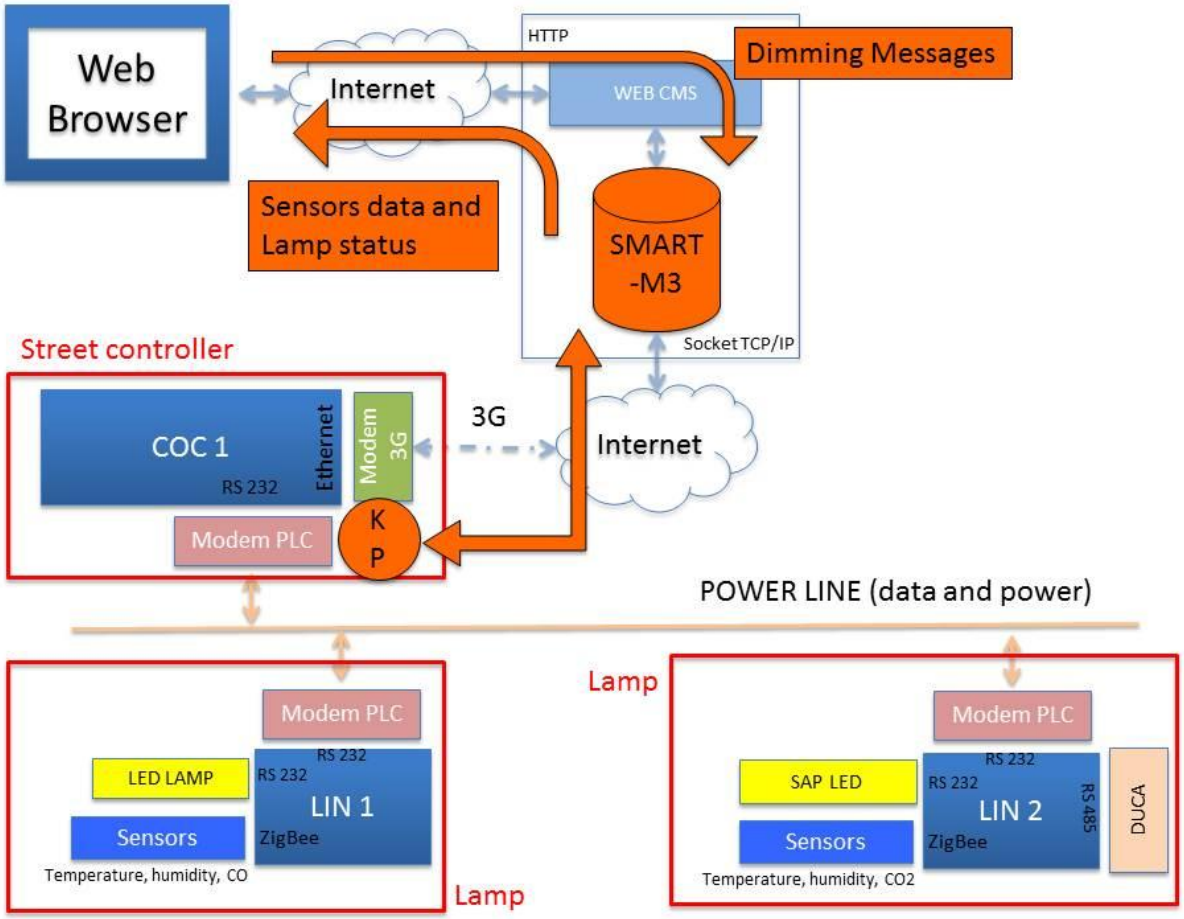
http://mml.arces.unibo.it/sib_ducati/cms/admin/it/questionari_async/modifica/Questionario_634952516621197509

Smart Lighting on Public Streets

- Point-to-point lamp dimming
- Sensors (e.g. temperature, humidity, CO, CO2) on each lamp
- Power line communications



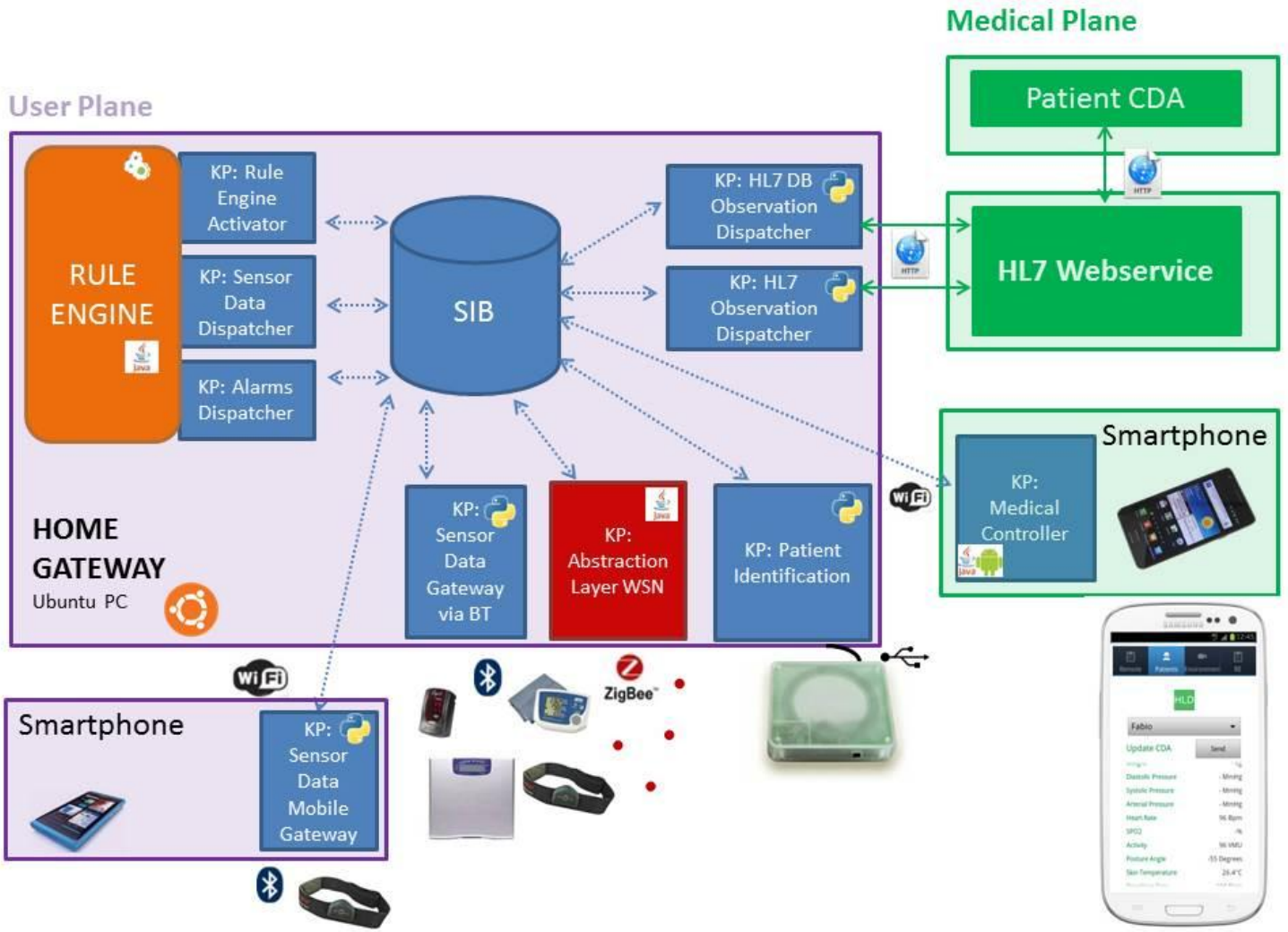
Smart Lighting on Public Streets: Ecosystem Architecture



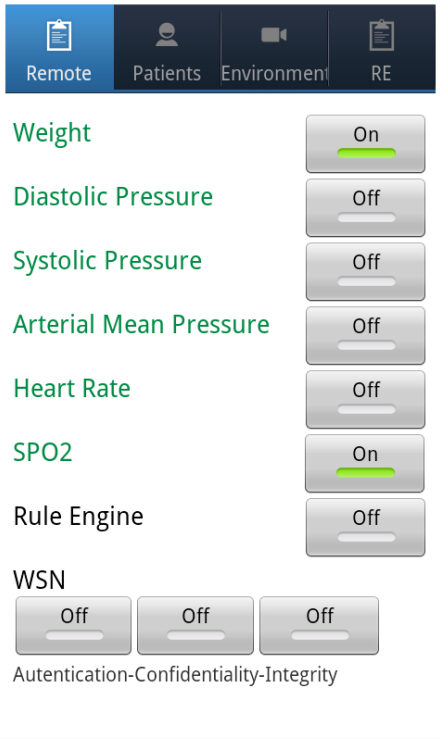
Health monitoring at home
ARTEMIS Project CHIRON

- Patient at home
  - Local gateway to collect sensor data
  - Heterogeneous physiological and environmental sensors
- Local gateway services
  - Rule engine to detect anomalous situations
- Provide information to the medical world
  - Medical standards (HL7)
  - Standard solutions (Database, SMS services)

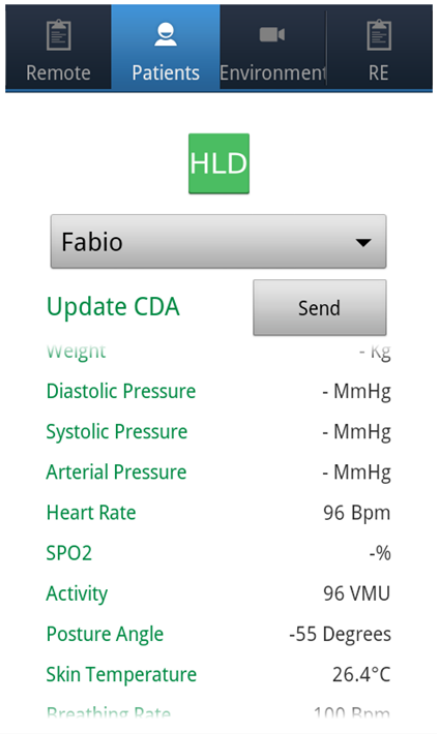
CHIRON ecosystem architecture for health monitoring at home



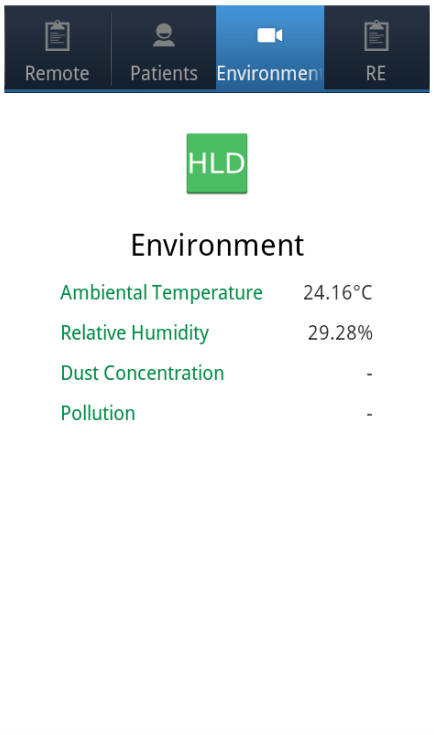
GUI for Health monitoring at home in CHIRON



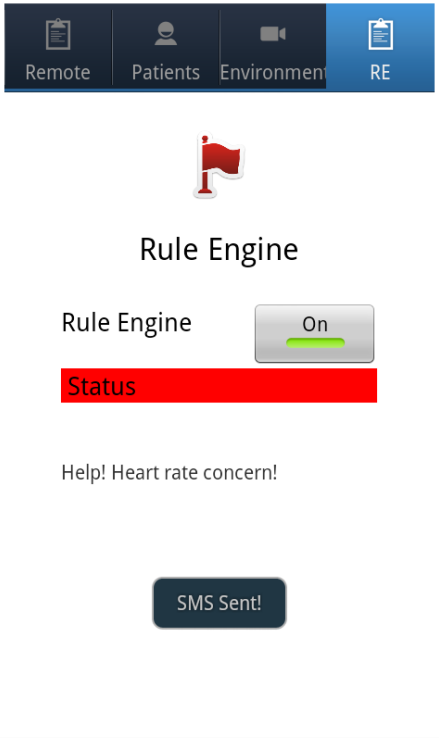
Controller



Patient Data

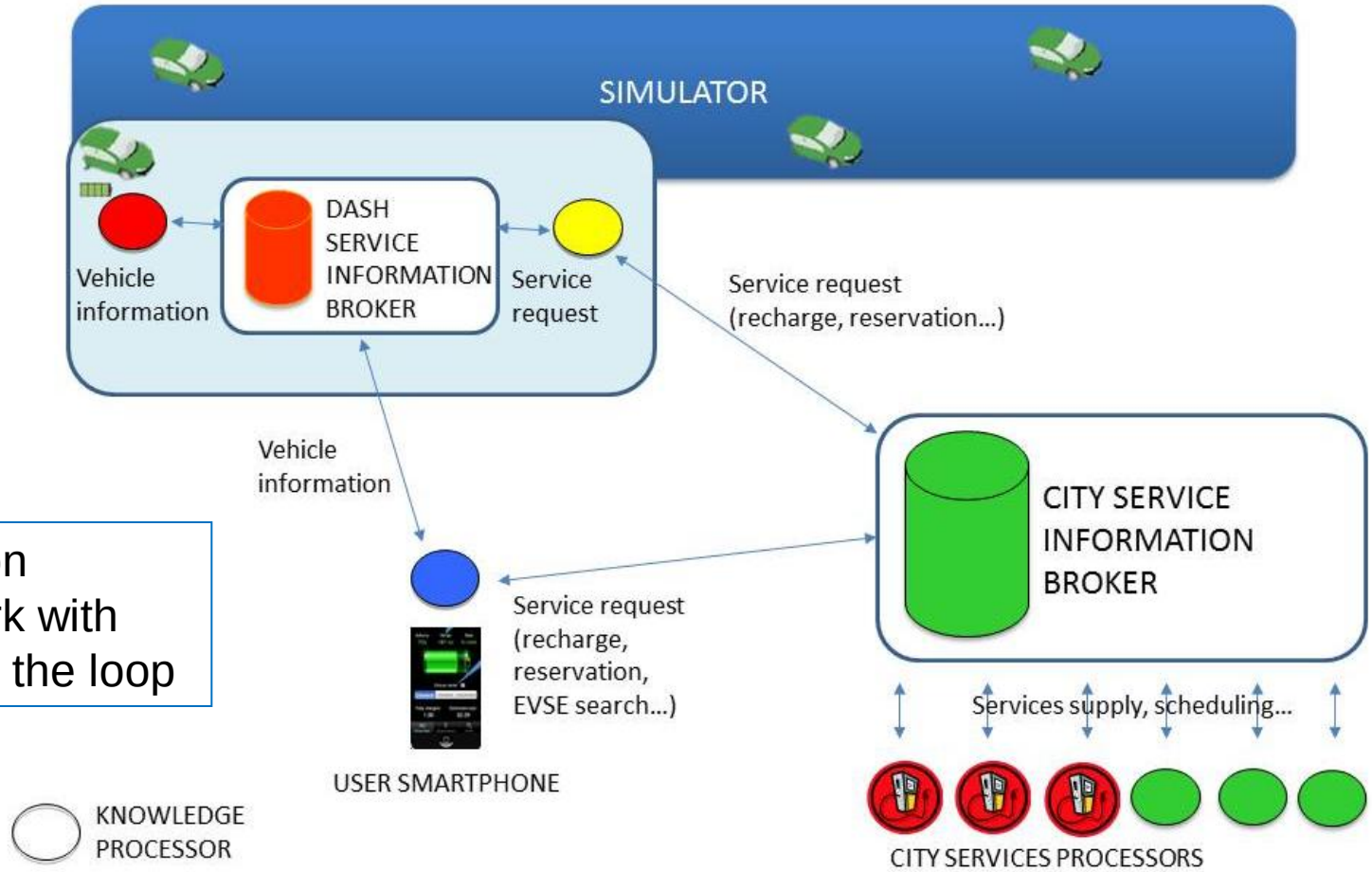


Environmental Data



Rule Engine Status

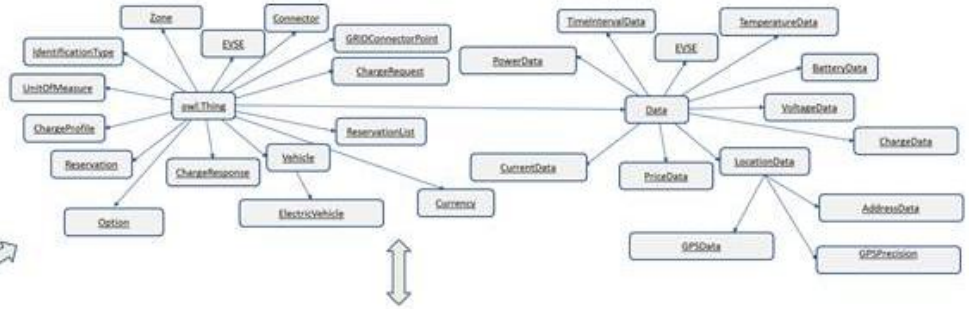
ARTEMIS Project Internet of Energy: Electric Vehicles Recharging in Urban Scenarios



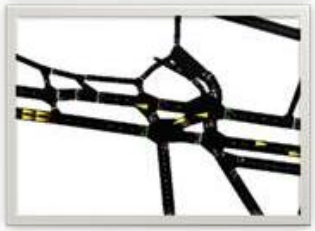
Simulation framework with person in the loop

IoE: Ontology, models and GUIs for Electric Vehicles recharging in urban scenarios

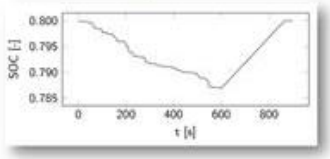
- **Information interoperability**
  - SMART M3 middleware
  - Common ontology



- **Mobile Services**



- **Urban traffic simulation**



- **EV battery model**

In co-operation with SIEMENS and AICIA (Seville)

Smart-M3 Lab
Lab of Interoperability of Embedded Systems

- Starting from academic year 2009/10:
  - the lab provides a design style
  - the lab is a test bed for research results

- Topics:
  Semantic Web, smart space applications, Smart-M3 programming approach, design template

- Students are divided in teams of 3 to 5 persons. Each group proposes and develops a project

Projects spans from applications (E.g. Games, domotics, ..) to APIs (E.g. PHP and JavaScritpt)

8	6	5	12
2010	2011	2012	2013

Nr Projects / Year

ongoing

Interaction between projects, e.g. games use a common ontology

Smart-M3 Lab Contribution

Student projects and feedback

Course Website

http://didattica.arces.unibo.it/mod/resource/view.php?id=468

- Course Description
- Tutorials
- Tools
- LabExercise and Projects

Tutorial

SMART-M3 v.0.9: A semantic event processing engine supporting information level interoperability in ambient intelligence

http://amsacta.unibo.it/3877/