

M3 in education and research: experiences and lesson learned



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

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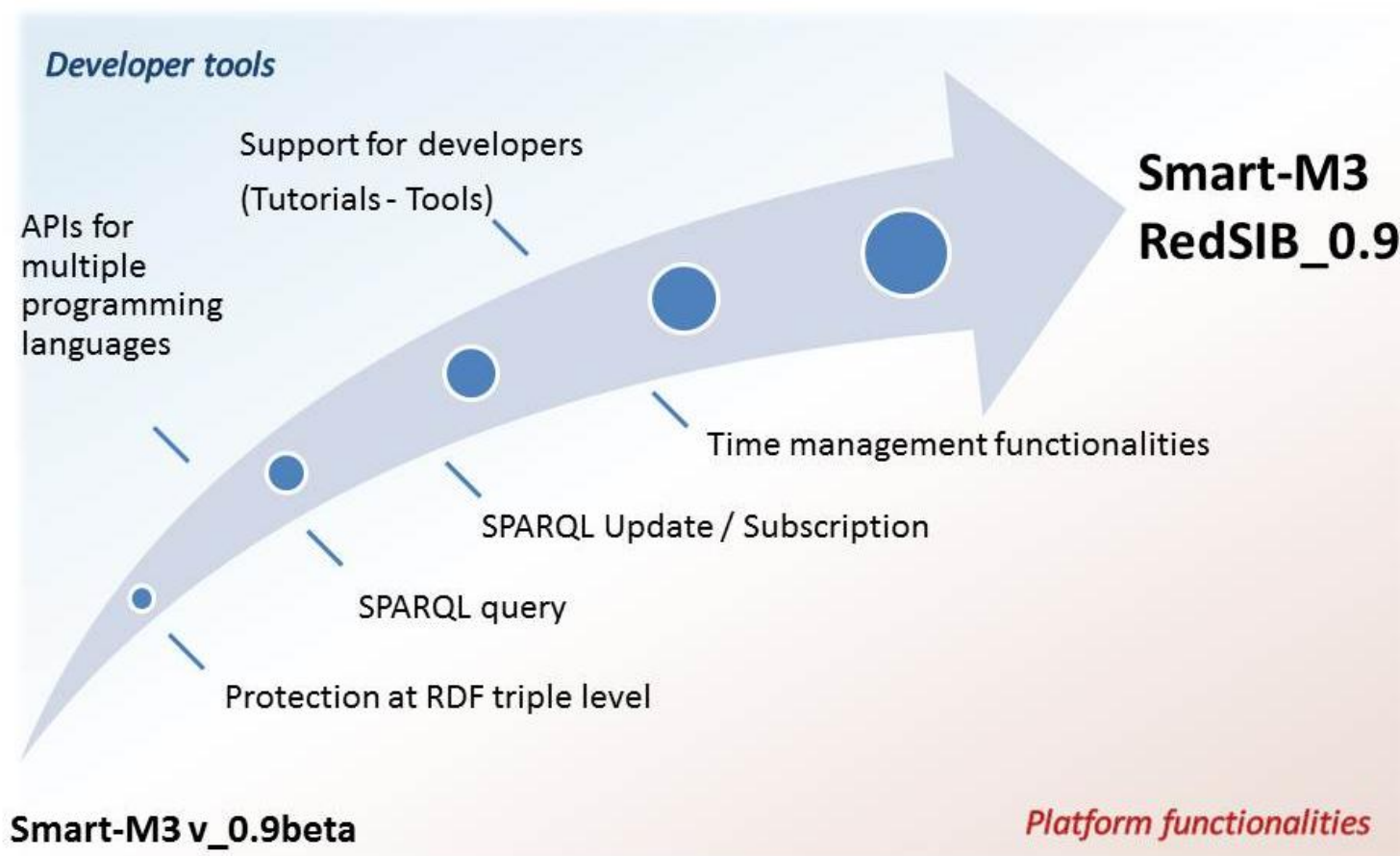
www.unibo.it

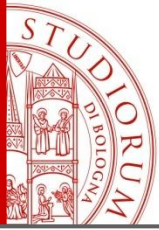
Innovation House – Otaniemi
12th November 2013

UNIBO & M3 timeline



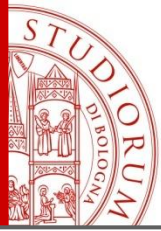
Smart-M3 evolution



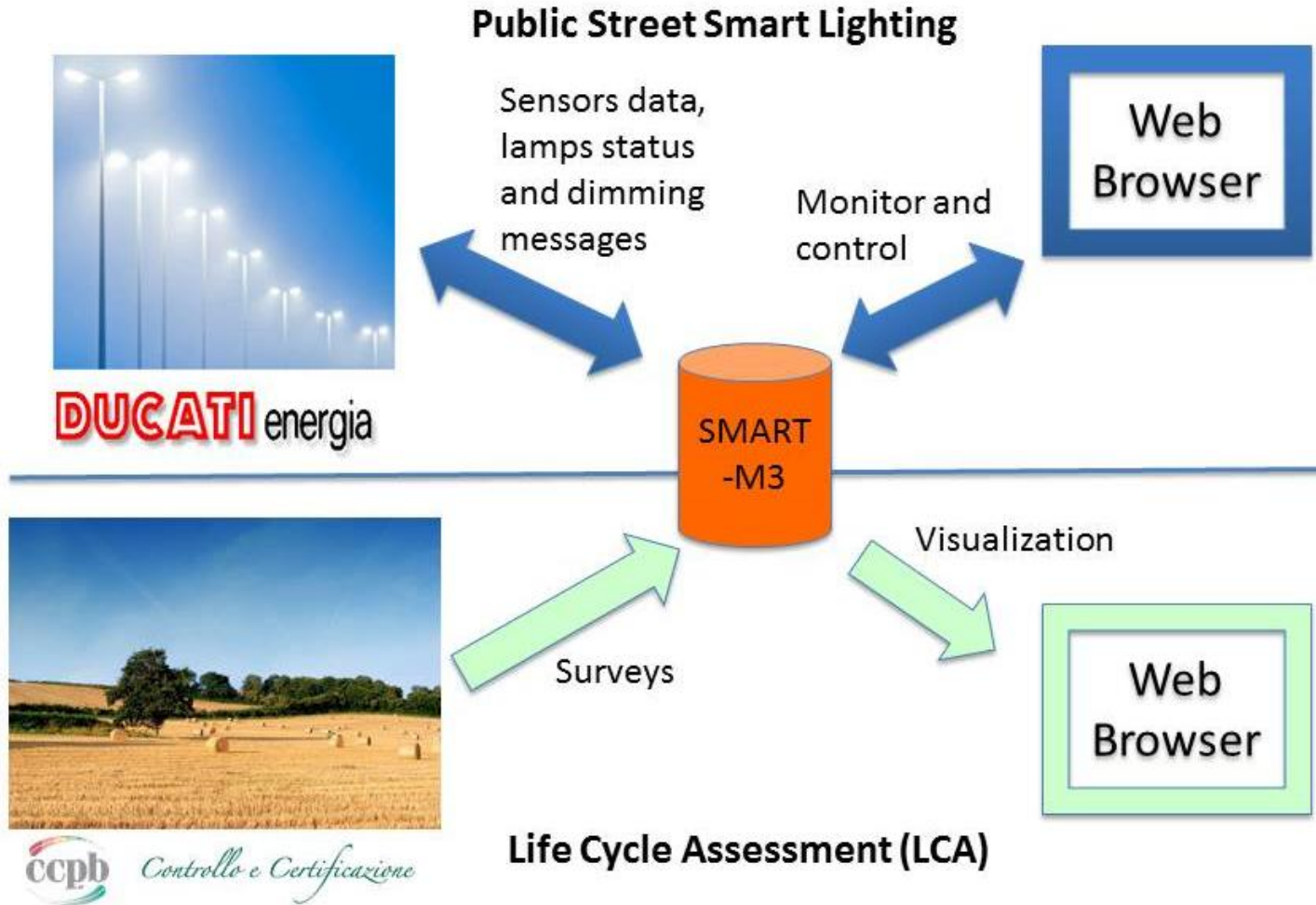


UNIBO Contribution

Platform	APIs	Domains	Education
<ul style="list-style-type: none">• Protection• SPARQL support query and subscription• Powered by RedLand or Virtuoso• OSGI SIB	<ul style="list-style-type: none">• Python• Java• C#• PHP• Javascript	<ul style="list-style-type: none">• Public street smart lighting• Agriculture food chains LCA• Home health monitoring• EV charging urban scenario	<ul style="list-style-type: none">• University courses and labs• RECOCAPE international cooperation project

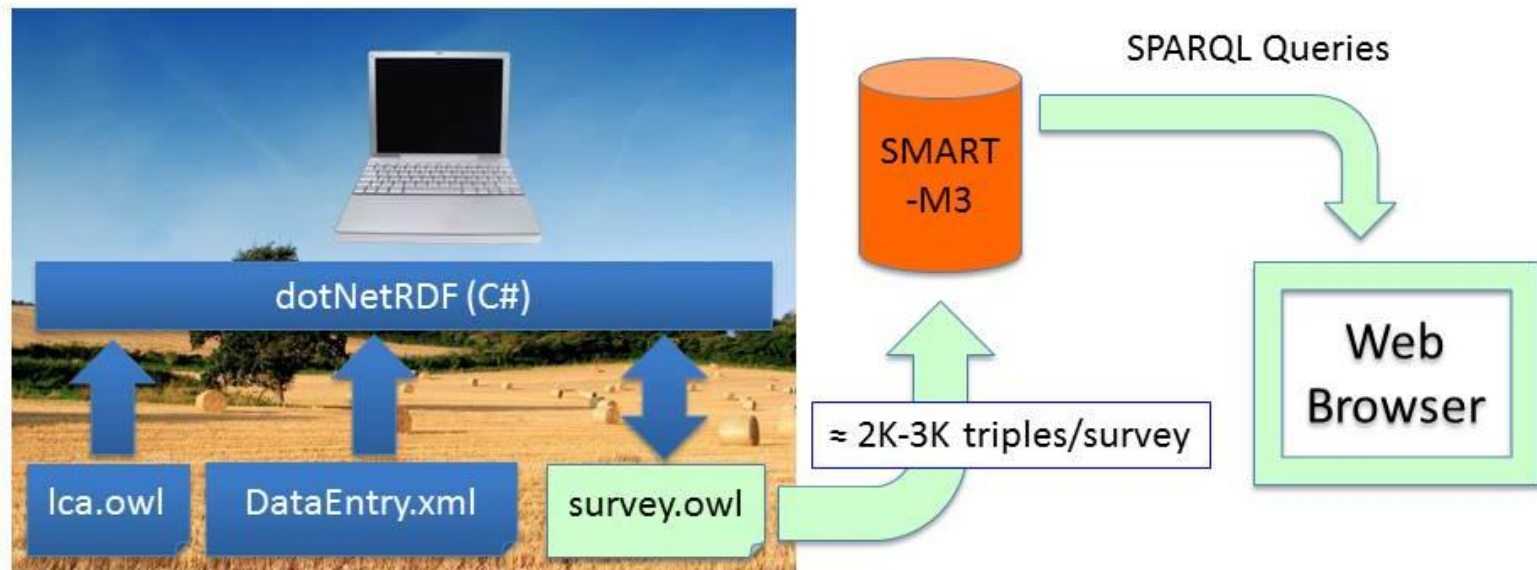


Many domains, one solution



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

The screenshot displays the EcoPortal CCPB interface with several overlapping windows:

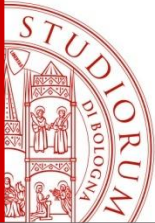
- Q1. Questionario di raccolta dati per l'analisi LCA delle filiere agro-alimentari**: The main window, showing the instruction "Indicare l'anno di produzione per la coltura di riferimento" and a text input field containing "2013".
- Q5. Itinerario tecnico di riferimento**: A window titled "Selezionare l'itinerario tecnico di riferimento s...". It contains a tree view with the following structure:
 - Metodo di irrigazione
 - Irrigazione a goccia tradizionale
 - Tipo di gestione
 - Integrato
 - Tipo di varietà
 - Hayward

- Q6. Informazioni generali - Indirizzo**: A window titled "Indicare l'indirizzo della sede legale e operativa dell'azienda di riferimento". It contains a tree view for "Sede" with sub-items "Legale" and "Operativa". Below it is a table for address details:

Citta'	Inserisci il valore
Via o Piazza	Inserisci il valore
Numero civico	Inserisci il valore
CAP	Inserisci il valore

Buttons "Aggiungi ->" and "<- Rimuovi" are located below the table.

Navigation and status elements include "Help" buttons, "Precedente" and "Successivo" buttons, and a green status bar at the bottom that reads "Selezione completata". Blue arrows indicate the flow between the windows.



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

Lamp status and dimming

LIN 3 (Simulato)
Via Antonio Cavalieri Ducati, 3

In Funzione
Tipo Lampada: LED

100% Acceso SPEGNI 100%

Sensors

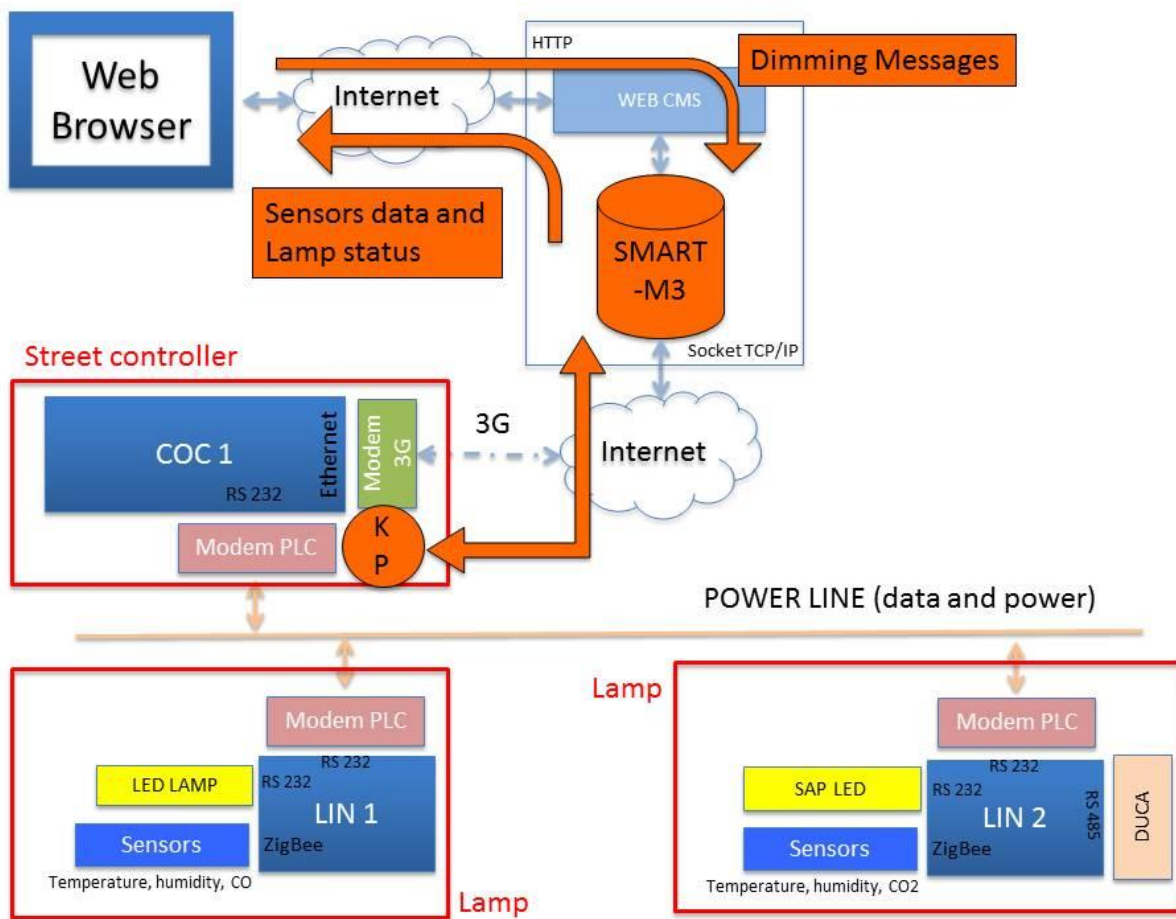
Umidità	50 %	01/01/1970 01:00:00
Temperatura	32 °C	01/01/1970 01:00:00
CO2	fuori soglia	01/01/1970 01:00:00
CO	fuori soglia	01/01/1970 01:00:00

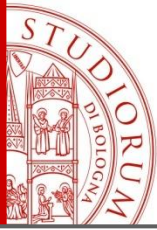
Refreshing in: 1s

Lamps positioned on Google Map

MAP TABLE Refreshing in: 10s salve, luca LOGOUT

Smart Lighting on Public Streets: Ecosystem Architecture

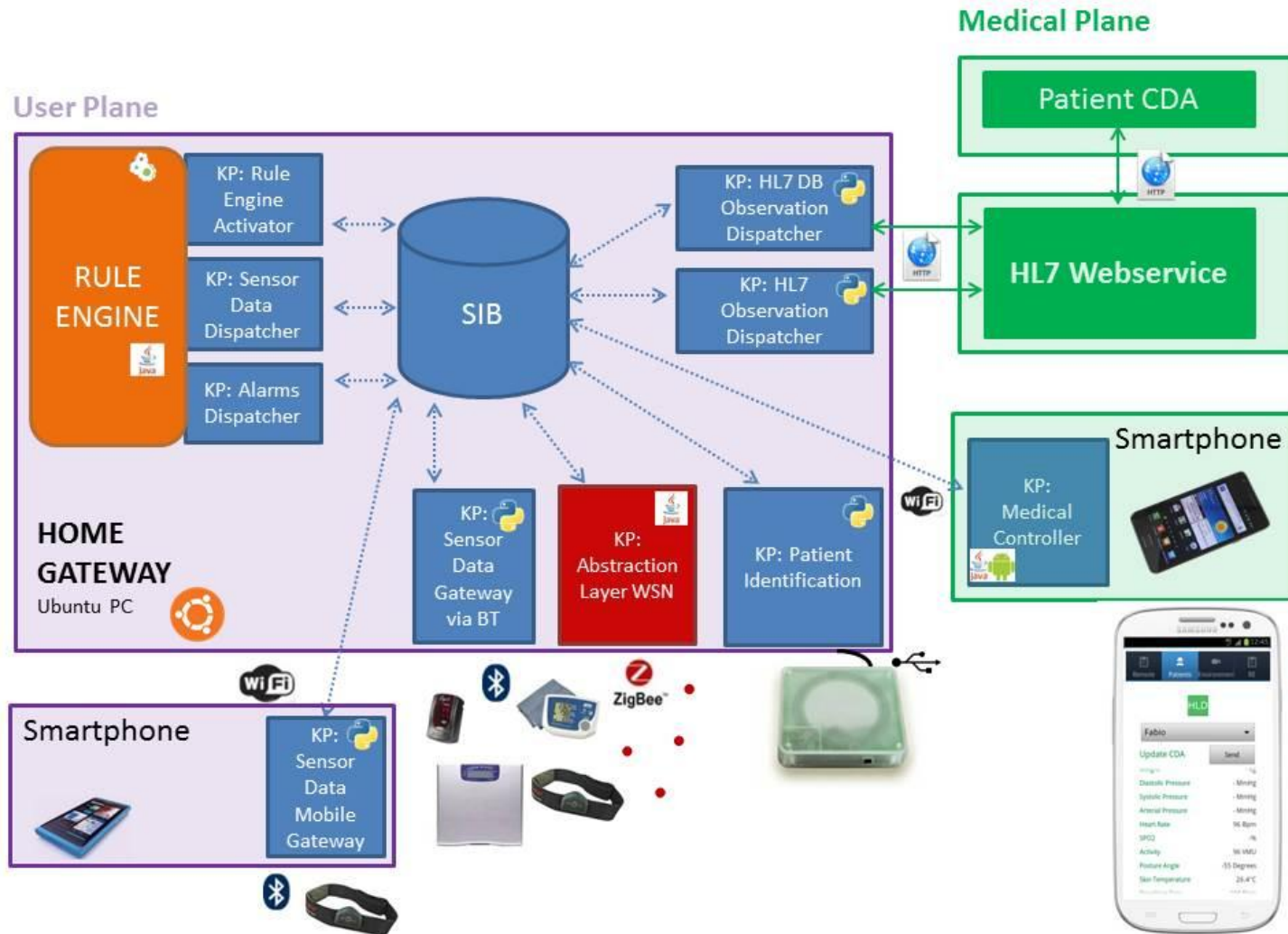


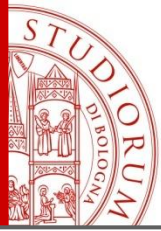


Health monitoring at home ARTEMIS Project CHIRON

- 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

Remote Patients Environment RE

Weight

Diastolic Pressure

Systolic Pressure

Arterial Mean Pressure

Heart Rate

SPO2

Rule Engine

WSN

Autentication-Confidentiality-Integrity

Controller

Remote Patients Environment RE

HLD

Fabio

Update CDA

Weight - Kg

Diastolic Pressure - MmHg

Systolic Pressure - MmHg

Arterial Pressure - MmHg

Heart Rate 96 Bpm

SPO2 -%

Activity 96 VMU

Posture Angle -55 Degrees

Skin Temperature 26.4°C

Breathing Rate 100 Bpm

Patient
Data

Remote Patients Environment RE

HLD

Environment

Ambiantal Temperature 24.16°C

Relative Humidity 29.28%

Dust Concentration -

Pollution -

Environmental
Data

Remote Patients Environment RE

Rule Engine

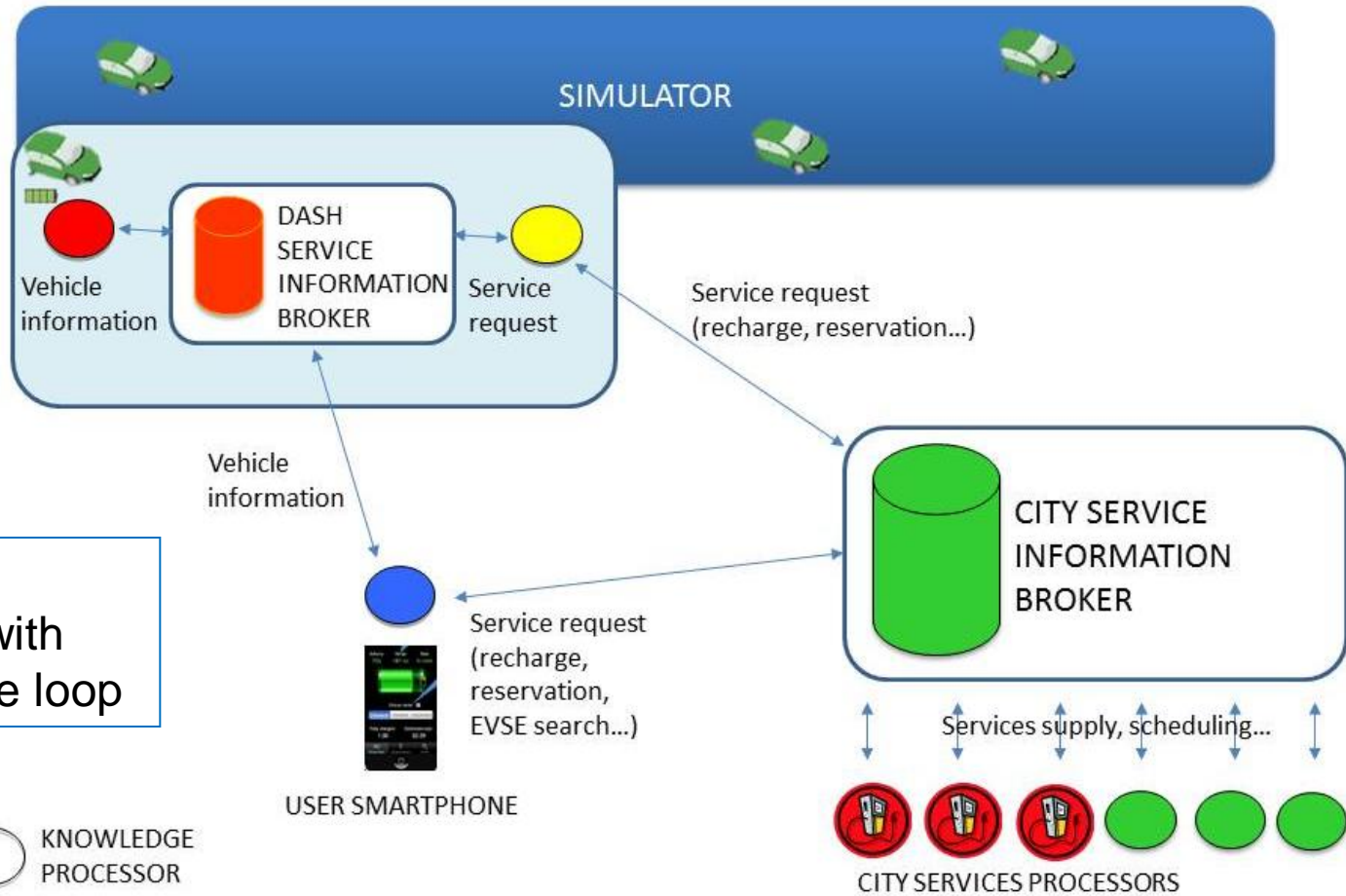
Rule Engine

Status

Help! Heart rate concern!

Rule Engine
Status

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

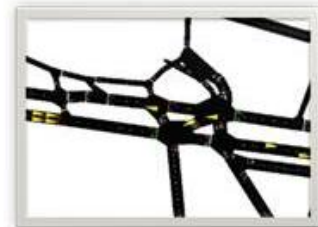
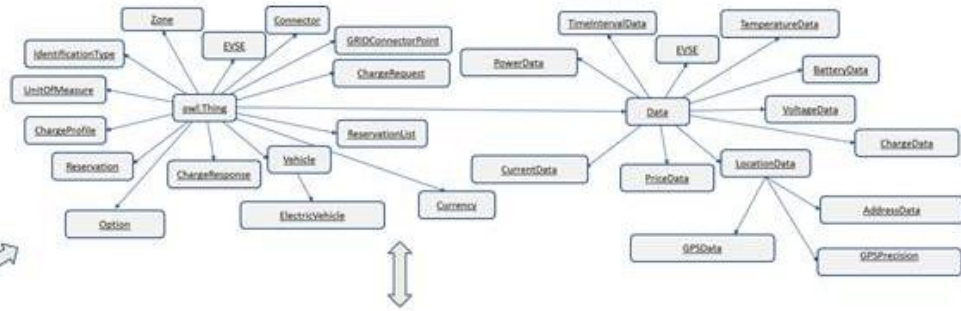


Simulation framework with person in the loop

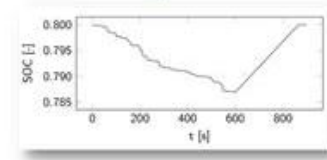
IoE: Ontology, models and GUIs for Electric Vehicles recharging in urban scenarios

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

▶ Mobile Services



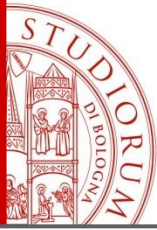
▶ Urban traffic simulation



▶ EV battery model

In co-operation with SIEMENS and AICIA (Seville)

Reservation ID	Vehicle ID	EVSE ID	ICCP Name	Start of	End of	Price
2700001-0001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	10.000.2012	10.000.2012	1.00
2700001-0001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	10.000.2012	10.000.2012	1.00
2700001-0001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	10.000.2012	10.000.2012	1.00
2700001-0001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	10.000.2012	10.000.2012	1.00
2700001-0001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	10.000.2012	10.000.2012	1.00
2700001-0001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	10.000.2012	10.000.2012	1.00
2700001-0001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	10.000.2012	10.000.2012	1.00
2700001-0001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	10.000.2012	10.000.2012	1.00
2700001-0001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	10.000.2012	10.000.2012	1.00
2700001-0001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	10.000.2012	10.000.2012	1.00
2700001-0001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	10.000.2012	10.000.2012	1.00
2700001-0001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	1001-0001-0001-0001-0001	10.000.2012	10.000.2012	1.00



Smart-M3 Lab

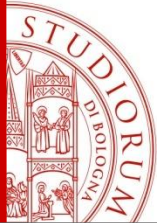
Lab of Interoperability of Embedded Systems

- 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 JavaScript)

				<u>ongoing</u>
	8	6	5	12
	2010	2011	2012	2013
<u>Nr Projects / Year</u>				

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/>

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