FIWARE
OPEN APIs FOR OPEN MINDS

SEVENTH FRAMEWORK PROGRAMME

FUTURE INTERNET SMART UTILITY SERVICES

FINESCE

An energy marketplace dashboard as a practical example of Future Internet enablers integration

FINESCE WP4 - Terni Trial Site (Italy)

Rome, June 25th, 2015

ENGINEERING

Massimiliano Nigrelli – massimiliano.nigrelli@eng.it

Outline

- Scenario
- Energy marketplace concept
- Energy marketplace architecture
- Marketplace infrastructure
- “Marketplace GE” Evaluation
- FINESCE DSEs in the marketplace
- Conclusions
- *Energy marketplace dashboard (DEMO)*

Scenario

FUTURE INTERNET SMART UTILITY SERVICES

FINESCE

- Growing density of Renewable Energy Sources (RES) in the electrical grid
  - **Issues:** misalignment between RES production and users consumption, reverse power flows, power losses, voltage drops

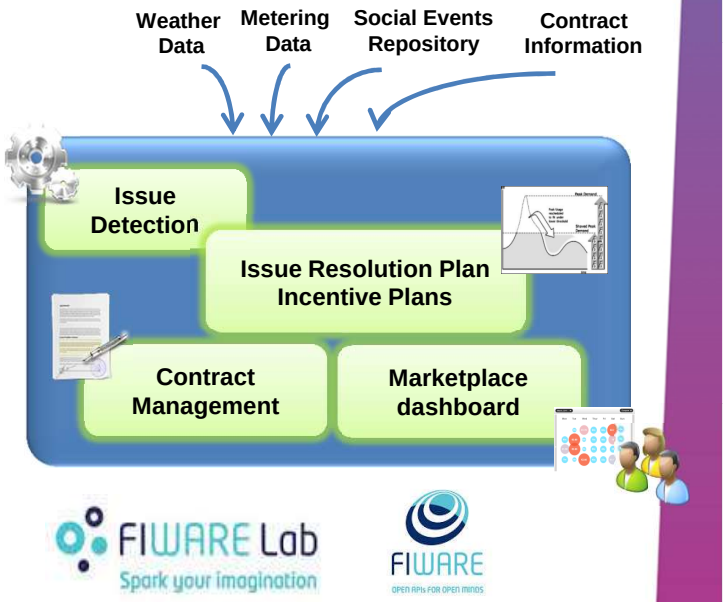
- **Proposed solution:** an **energy marketplace**, fed with “raw” data about consumption/production coming from a pilot area in the **city of Terni**, built with the aid of **FIWARE GEs** to enable both demand response and “**issue** solving” actions on **MV/LV grid**

Energy marketplace concept

FUTURE INTERNET SMART UTILITY SERVICES

FINESCE

- The marketplace acts as an **energy "*information hub*" for different stakeholders**: Aggregator(s), DSO(s), Market Regulator, Energy Retailer(s), final Customer(s)
- The marketplace is equipped with:
  - a monitoring dashboard that a DSO uses for day-to-day operation (are data coming from the meters?, load and metering profile of each user, etc.); approves "issue solving" actions proposed by an Aggregator;
  - a dashboard that an Aggregator uses to publish "issue solving" actions that a Retailer can turn into a plan of incentives/disincentives which are finally translated into a contract proposal for the final customer



FIWARE Lab
Spark your imagination

FIWARE
OPEN APIs FOR OPEN MINDS

How it started……

FUTURE INTERNET SMART UTILITY SERVICES

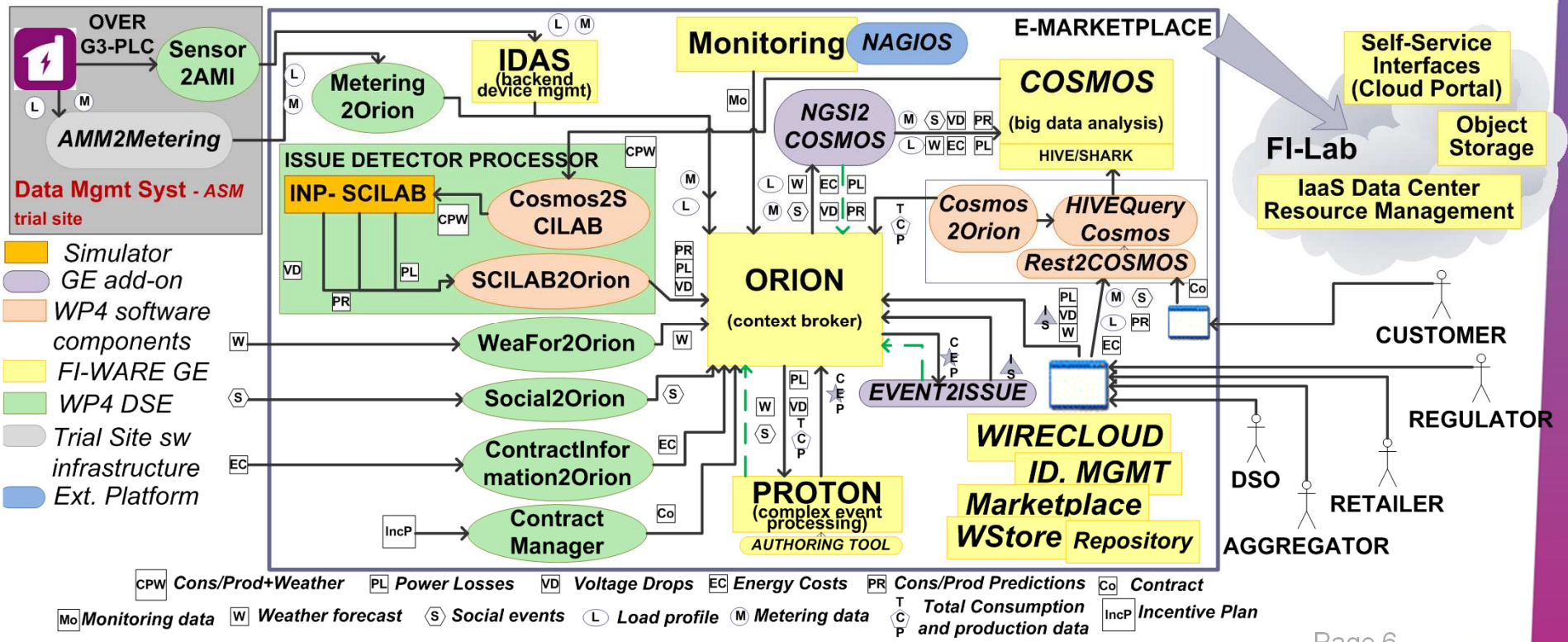
FINESCE

- Read documentation available in the catalogue
- VMs instantiated on FI-PPP Testbed (then moved to FI-Lab…….which now is FIWARE Lab)
- Started implementation for the marketplace architecture placing the code (DSEs, ad-hoc software modules on FIWARE cloud VMs)
- Issues?? Asked GE owner (email, skype calls) - GE owners sometimes learned from our experience
- Operational issues (in the context of an EC funded project) – used Fiware-lab-help mailing list

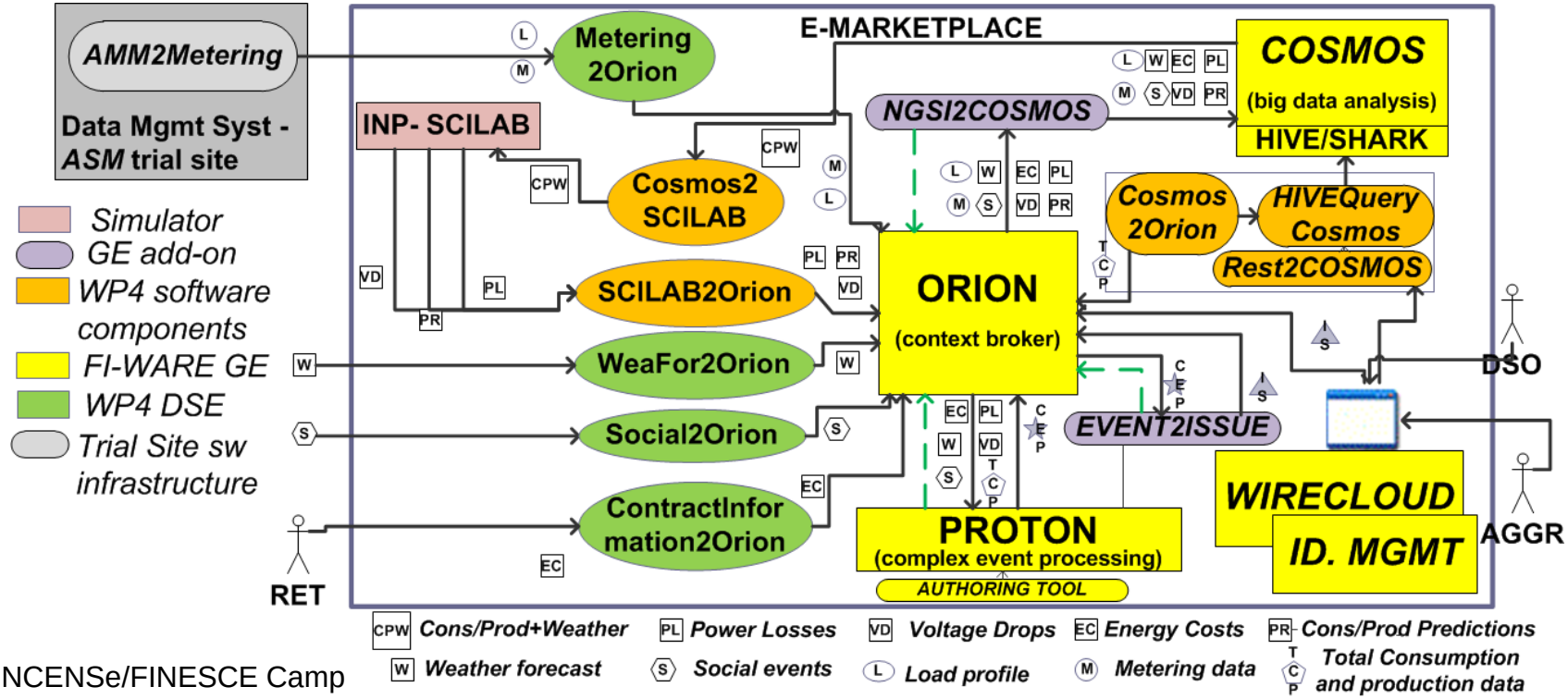
Energy marketplace architecture (final)

FUTURE INTERNET SMART UTILITY SERVICES

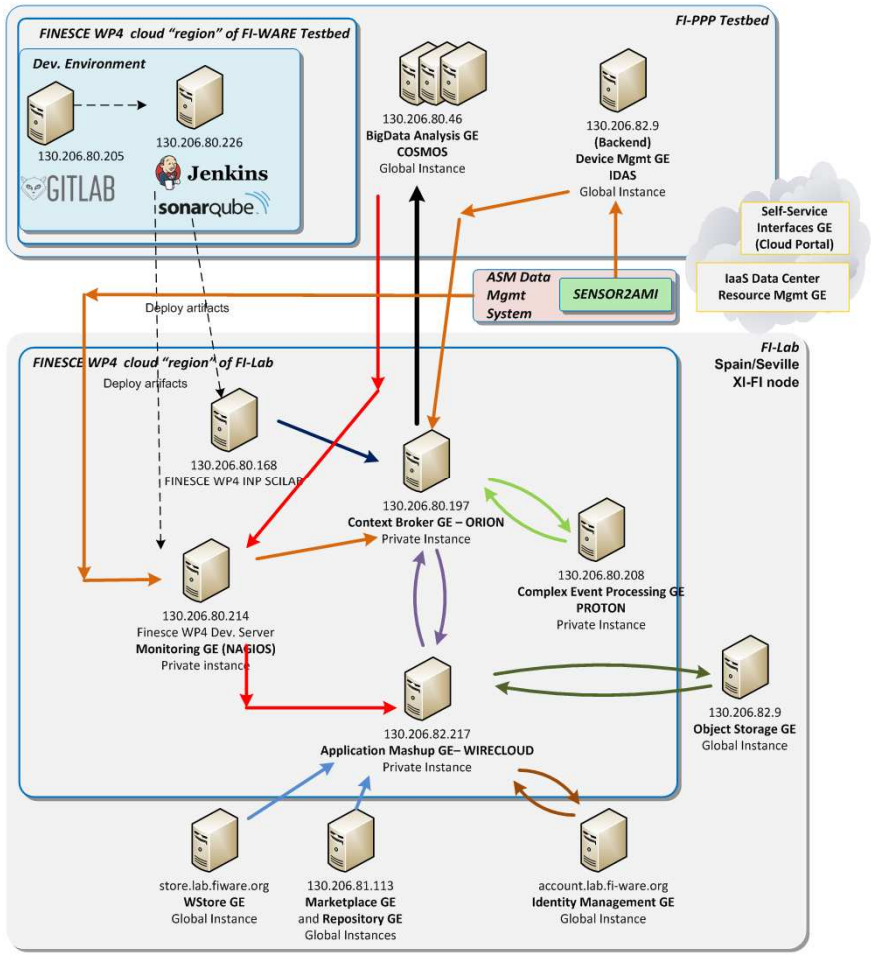
FINESCE



Energy marketplace architecture (M20)



Marketplace infrastructure



- GE Global instances on FIWARELab (OpenStack-like)
- GE Private instances on VMs onto FIWARELab (FINESCE WP4 cloud region)
- DSO's data management system and local infrastructure (Sensor2AMI)
- Development environment on FI-PPP Testbed

GE evaluation («Learning by doing»)

FUTURE INTERNET SMART UTILITY SERVICES

FINESCE

GE Name	Evaluation - **Issues**
Context Broker	good performance; new versions constantly released
CEP	good performance; Auth Tool UI tailored on tech people
Big Data Analysis	work as expected; some problems with data retrieval service (Shark)
Application MashUp	work as expected; high standards performance and stability
Cloud GEs	VMs and GE instances easy to be created; not frequent unexpected “crashes”; issues with virtual eth interfaces (flush tcp/ip needed)
IDM (KEYROCK)	integration into Wirecloud’s infrastructure well documented and easy to be done
(Backend) Device Management	satisfying level of support; insert different observations in a single call is not possible (January 2015); *upgraded version available*

Advantages and benefits of using GEs

FUTURE INTERNET SMART UTILITY SERVICES

FINESCE

ADVANTAGES / GENERIC ENABLERS	Cloud GEs	COSMOS Big Data Analysis GE	WIRECLOUD Application Mashup GE	ORION Context Broker GE	PROTON Complex Event Processing GE	OBJECT STORAGE GE	KEYROCK Identity Management GE	IDAS (Backend) Device Management GE
free support (contact person available via email)	■	■	■	■	■	■	■	■
no hardware to be purchased	■	■						
free usage (no costs per hour / no licensing costs)	■	■	■	■	■	■	■	■
cloud based (available as SaaS) + no hardware to be purchased + no installation activities to be carried forward (GE Global instance)		■		■		■		■
openness: no vendor lock in		■	■	■	■	■	■	■
no need of extreme hardware configuration		■				■		■
comes with native integration with other GEs, thus being part of an entire ecosystem		■	■	■	■		■	■
cloud based: installable from image available on a catalogue (coming with a default configuration) on a cloud-based VM (GE private instance)			■	■	■			
natively integrated in the FIWARE cloud infrastructure						■	■	

- Availability of a contact person (the “GE owner”)
- No costs of hardware, hosting and licensing in the context of the FI-PPP programme
- Future Internet “ecosystem”
- Based on “open standards” and so GEs can easily be integrated with other products either open source or COTS

FINESCE DSEs in the marketplace

FUTURE INTERNET SMART UTILITY SERVICES

FINESCE

The specification of these DSEs are publicly available (Finesce **GitHub**), royalty free and the code has been released as open source (mostly Apache 2.0 license).

FINESCE WP4 DSEs are:

- different in nature (Timer application, client/server application, web services)
- All based on RESTFul technology (Jersey/XML)
- All sending data to an instance of Orion Context Broker GE (centric “piece” of the architecture)

FINESCE DSEs in the marketplace

FUTURE INTERNET SMART UTILITY SERVICES

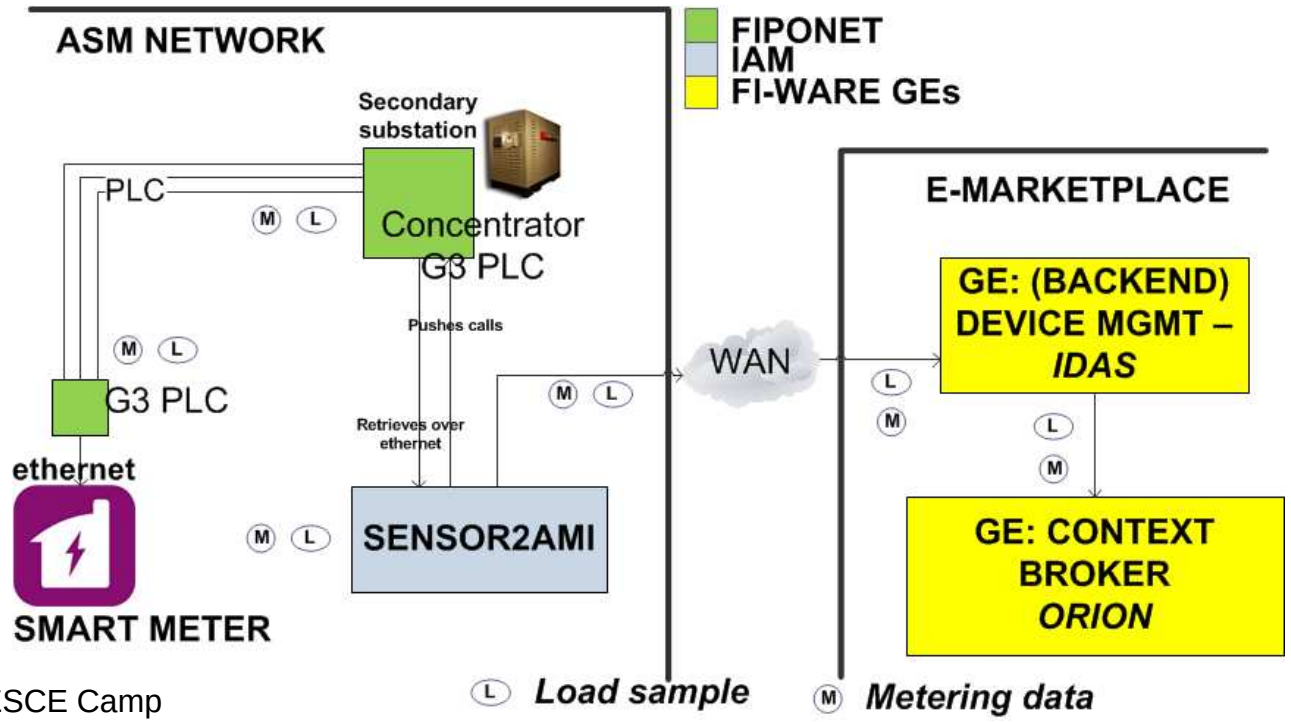
FINESCE

DSE module name	Description
WeaFor2Orion	a Timer application that collects weather forecast data from a third-party weather forecasting service and then sends them to an instance of ORION Context Broker
Metering2Orion	a client/server application that accepts metering data coming from a trial site, translates it into an NGSI10-compliant format and then publishes it onto an instance of ORION Context Broker
Social2Orion / ContractInformation2Orion	a web service by which a social information provider/retailer sends social events data/energy related costs to an instance of ORION Context Broker
Issue detector processor	a Timer application that detects issues related to power losses and voltage drops (in the lines of a smart LV grid) and then sends it to an instance of ORION Context Broker GE
Contract Manager	a web service which translates the incentives included in an Incentive Plan into a new Contract proposal that will be saved into an instance of ORION Context Broker.

Protocol Adapter DSE (Sensor2AMI)

FUTURE INTERNET SMART UTILITY SERVICES

FINESCE



Conclusions

- The **energy marketplace dashboard** represents
  - a tool to enable both **demand response** and **“issue solving”** actions thus improving stakeholders **operational efficiency**
  - a **live example** of an IT solution implementing a GE-based architecture

- **WP4 DSEs** (in combination with related GEs) available as open source software may **allow YOU (the SMEs!!) to smooth the learning curve** when joining the FIWARE ecosystem applied to the energy domain

- **FIWARE GEs adoption** is appealing based on factors such as availability and type of **support**, **no costs** of infrastructure, **interoperability** and **open standards**, although operational issues have been risen from time to time and some GEs are more mature than others (i.e. Orion, Proton, Wirecloud…..)

FUTURE
INTERNET
SMART
UTILITY
SERVICES

FINESCE