EU level platforms: building consensus and interoperability

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ACS | Automation of Complex Power Systems
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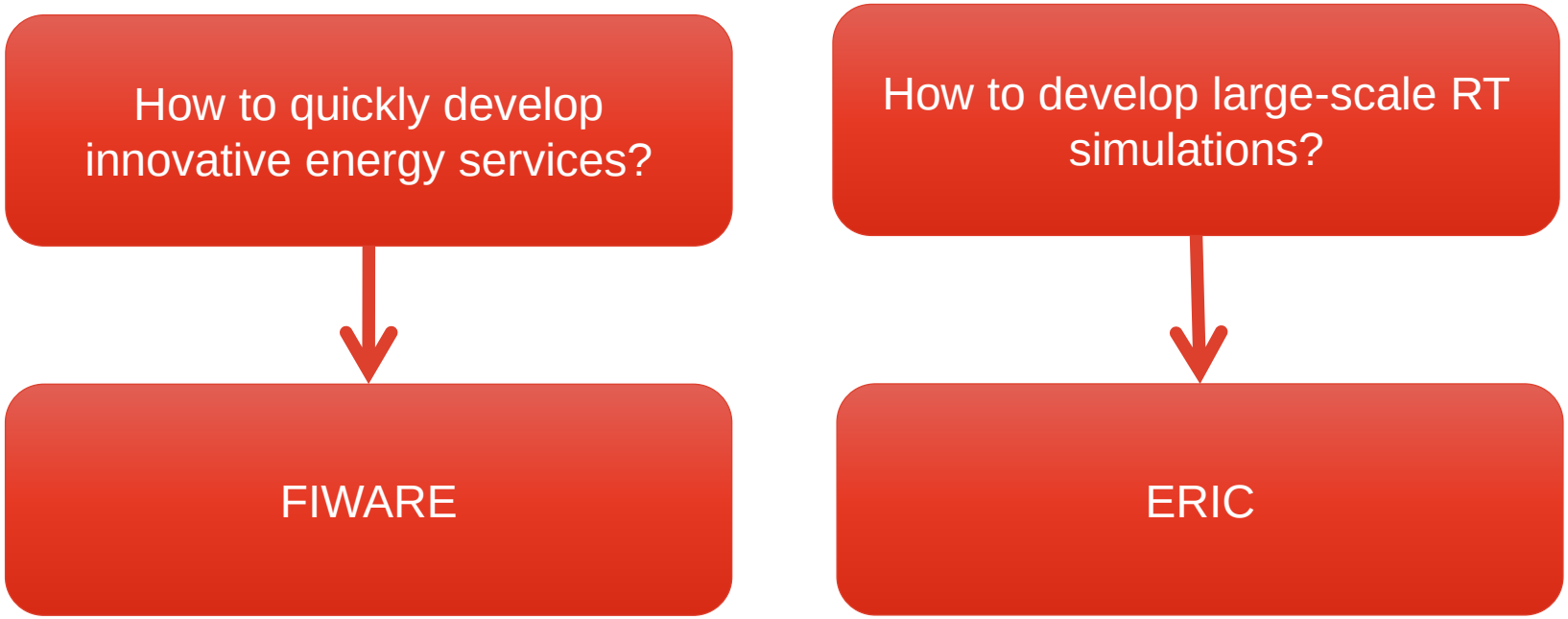
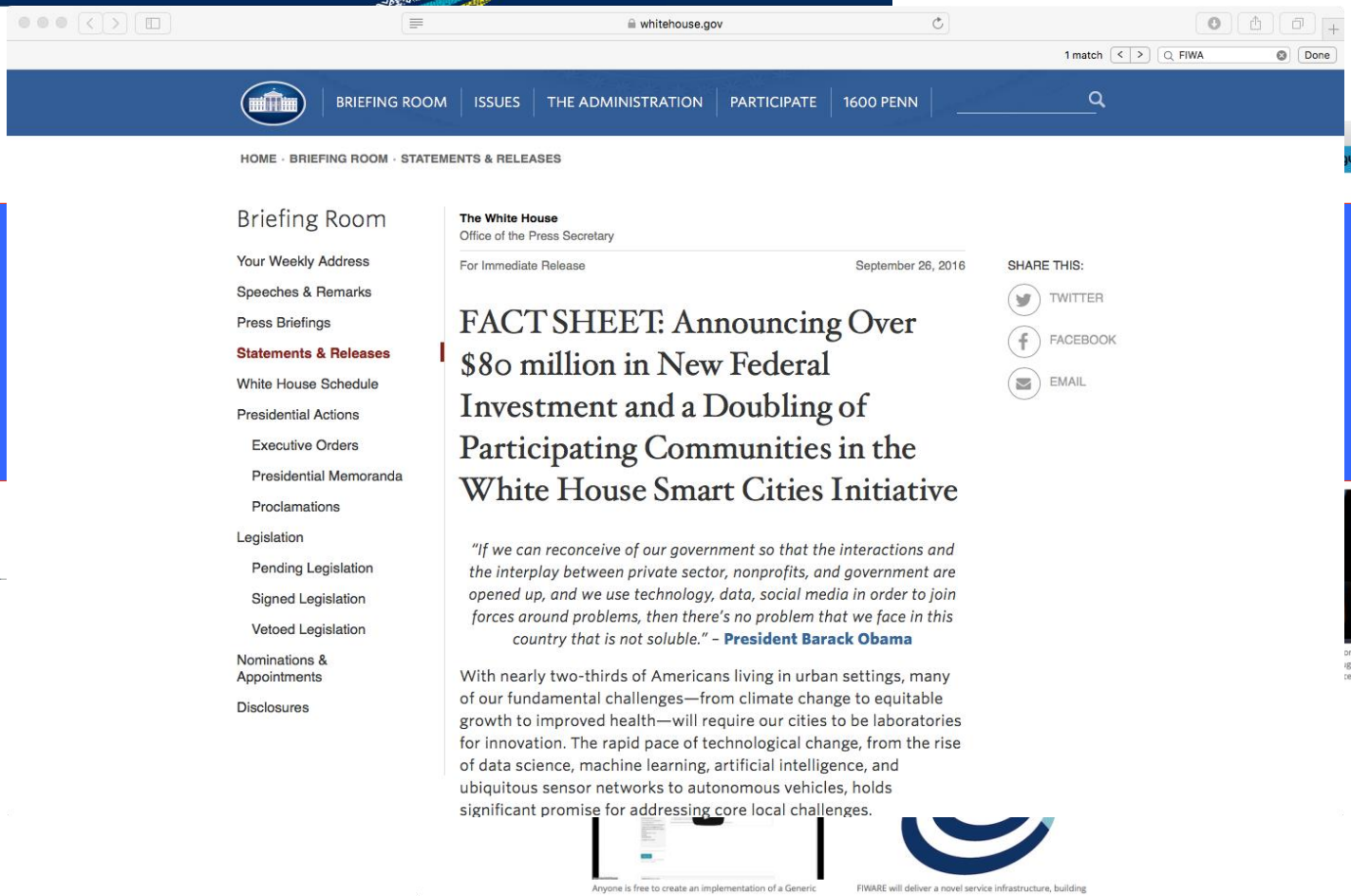
Why platforms?

- Platforms define an eco-system where people can cooperate
- Platform can be developed for a variety of purposes
- Common goal is always to obtain cooperation and interoperability
- These goals are critical in the vision of the Energy Union

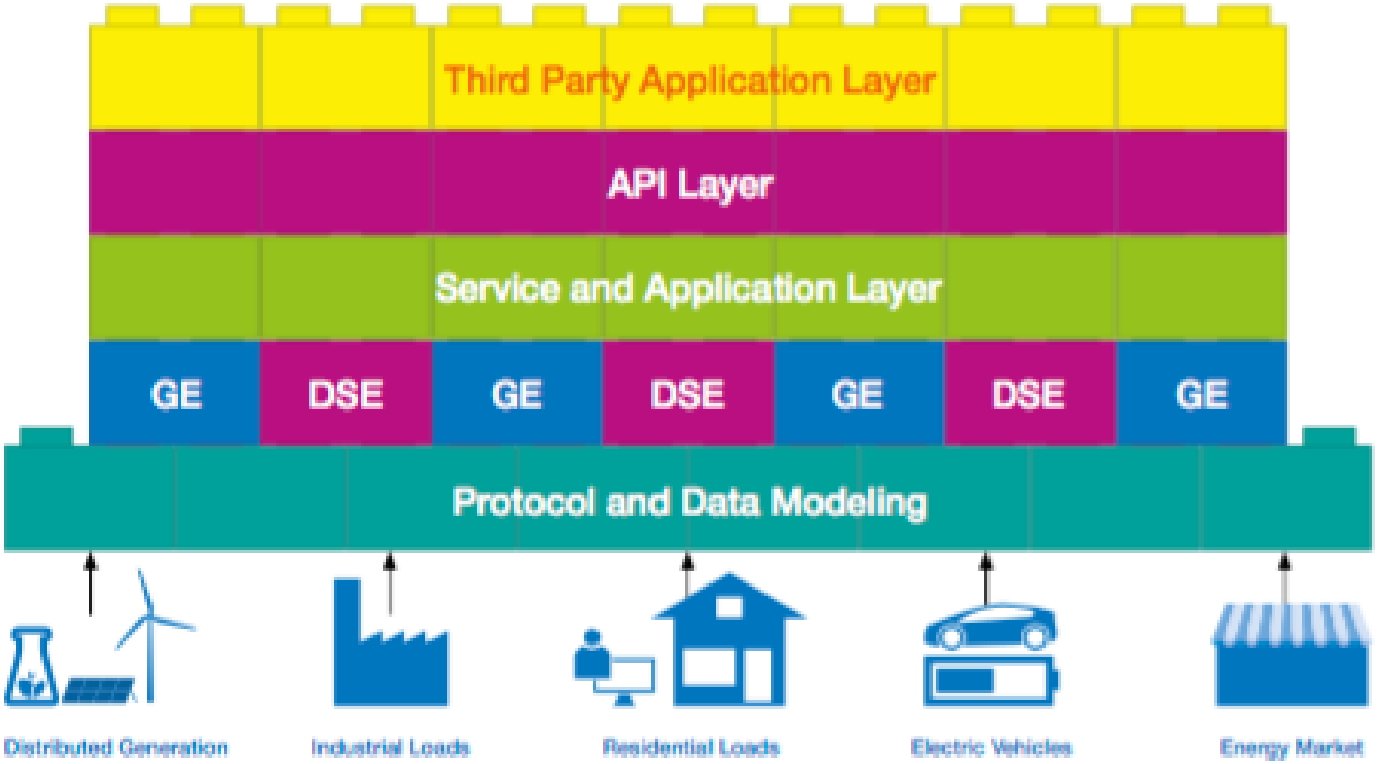


FIWARE and its catalogue



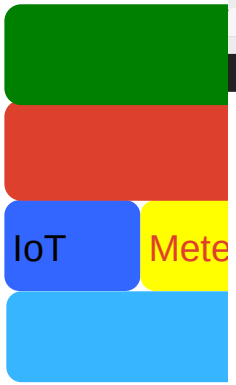
Future Internet for Energy

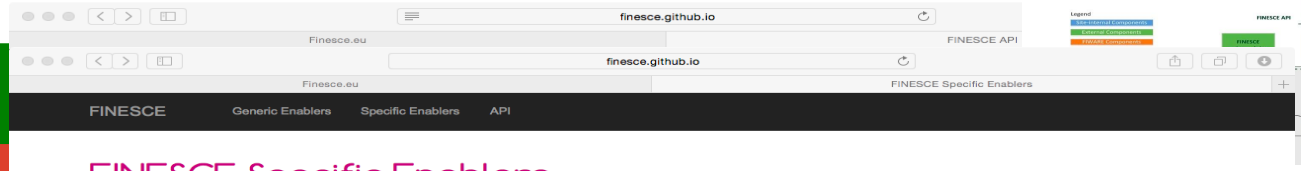
FINESCE: a FIWARE based platform for energy



Open APIs … just like LEGO

What is already available?





FINESCE Specific Enablers

Home / Specific Enablers

Browse by Trial Site:

All

Contract Information (ContractInformation2Orion **)

ContractInformation2Orion is a REST service (developed in Java) which allows clients (e.g. Retailers) to register data about cost of energy produced from the DERs, costs of transmission system and power plants, energy costs in an instance of ORION Context Broker GE.

TERNI (DSE INSTANCE DEPLOYED ON FI-LAB)

Social Events Interface (Social2Orion **)

Social2Orion is a REST service (developed in Java) which allows clients (e.g. Social Events Information Providers) to register data about social events (affecting consumption/production in a specific area such as a concert or a football match) in an instance of ORION Context Broker GE

TERNI (DSE INSTANCE DEPLOYED ON FI-LAB)

Weather Condition Interface (WeaFor2Orion **)

WeaFor2Orion consists of: a REST service (developed in Java) which allow clients (e.g. Weather Condition Information Providers) to register data about weather conditions and predictions in a specific area onto an instance of ORION Context Broker GE + a Java client which retrieves weather conditions and predictions from an external service (forecast.io in our implementation) and then "passes" the data to the above mentioned REST service.

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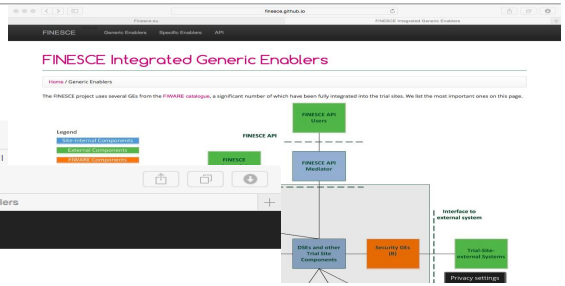
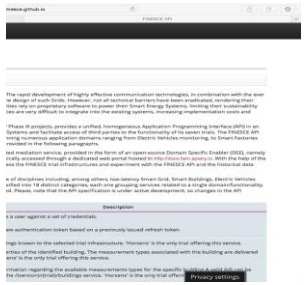
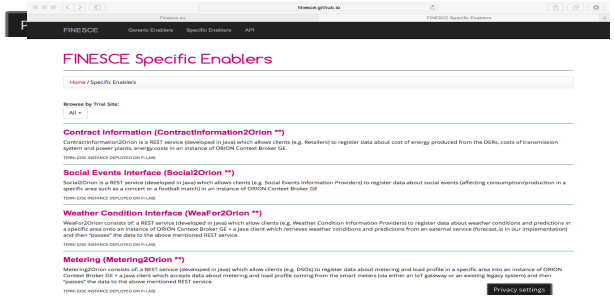
Metering (Metering2Orion **)

Metering2Orion consists of: a REST service (developed in Java) which allow clients (e.g. DSOs) to register data about metering and load profile in a specific area into an instance of ORION Context Broker GE + a Java client which accepts data about metering and load profile coming from the smart meters (via either an IoT gateway or an existing legacy system) and then "passes" the data to the above mentioned REST service.

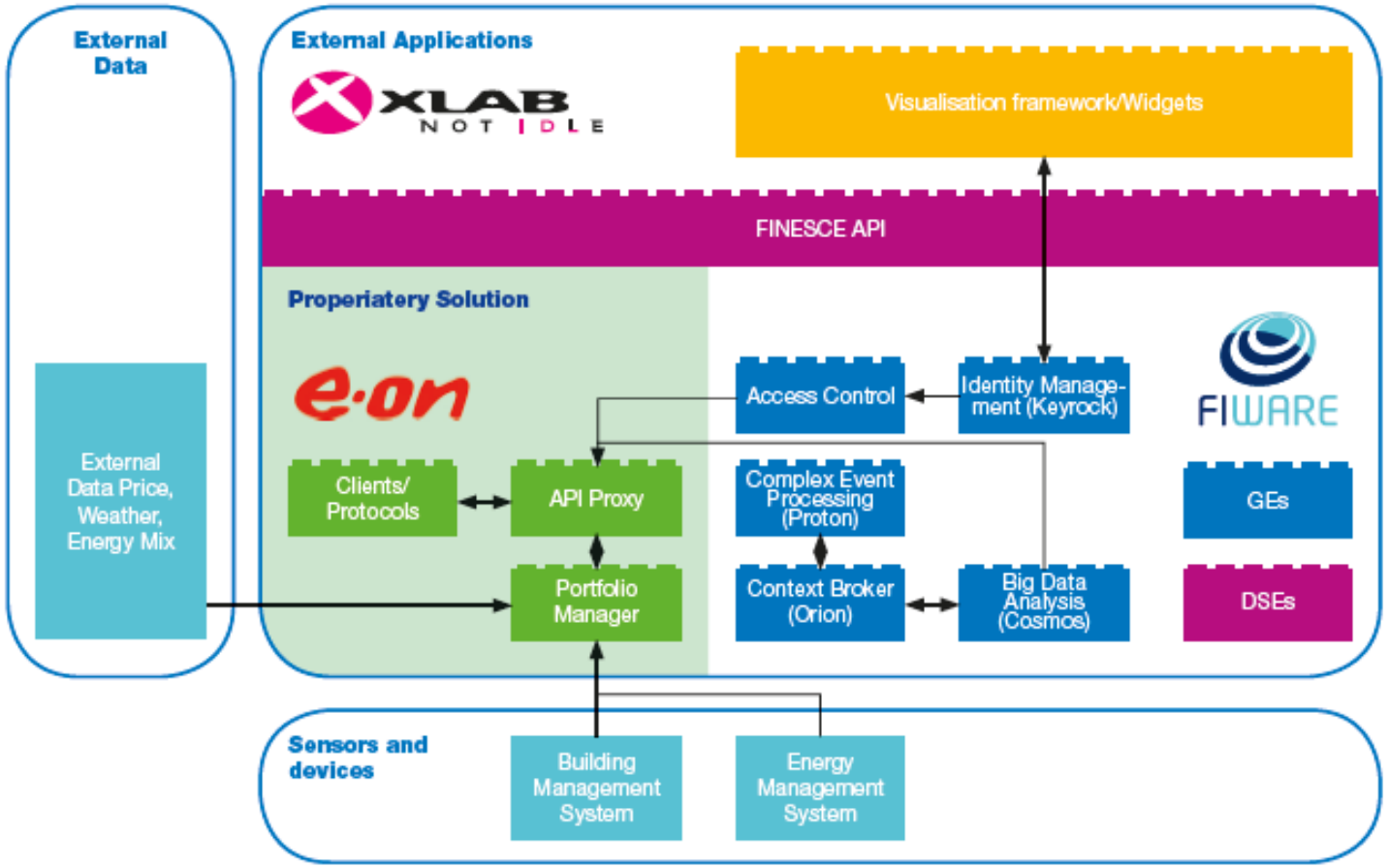
TERNI (DSE INSTANCE DEPLOYED ON FI-LAB)



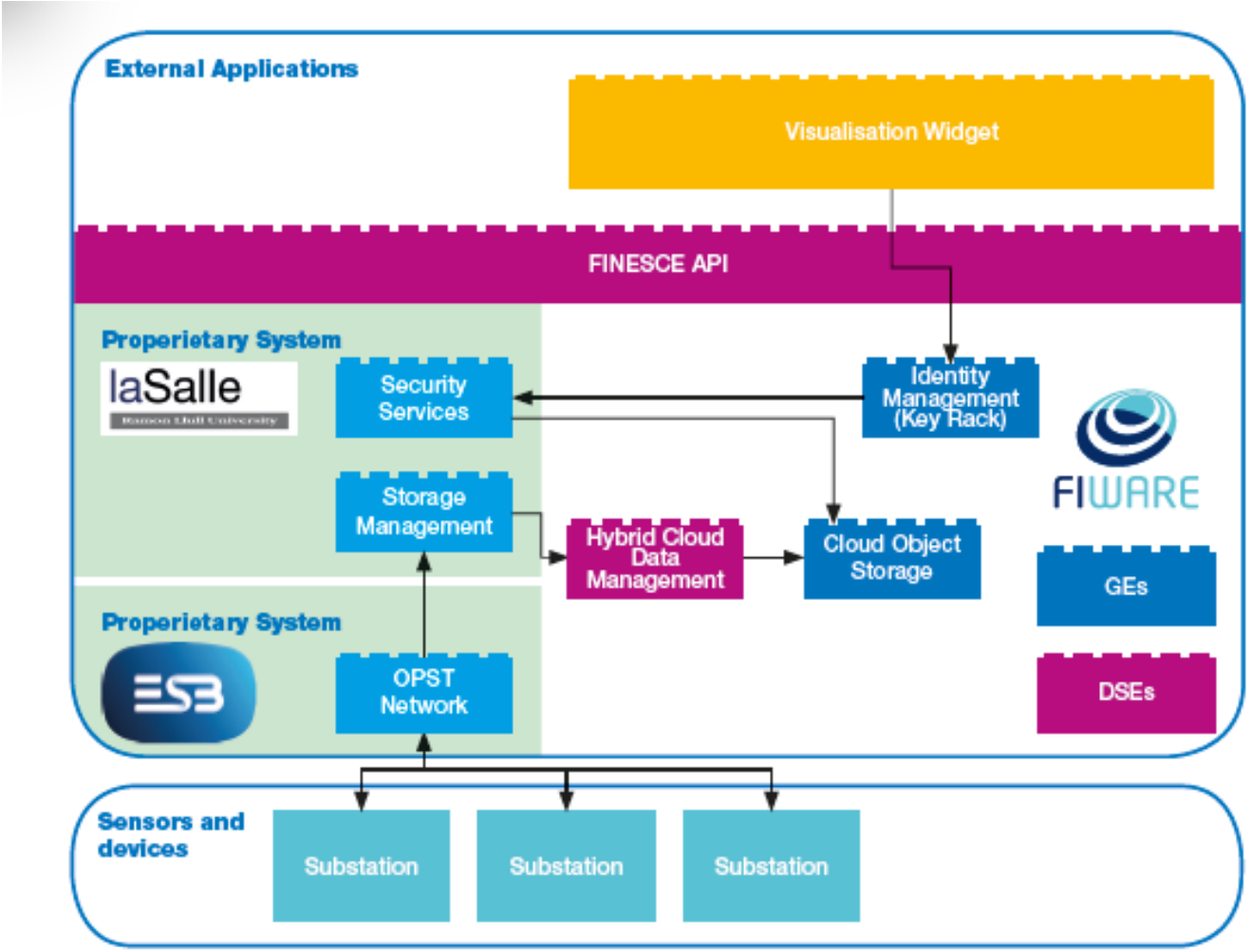




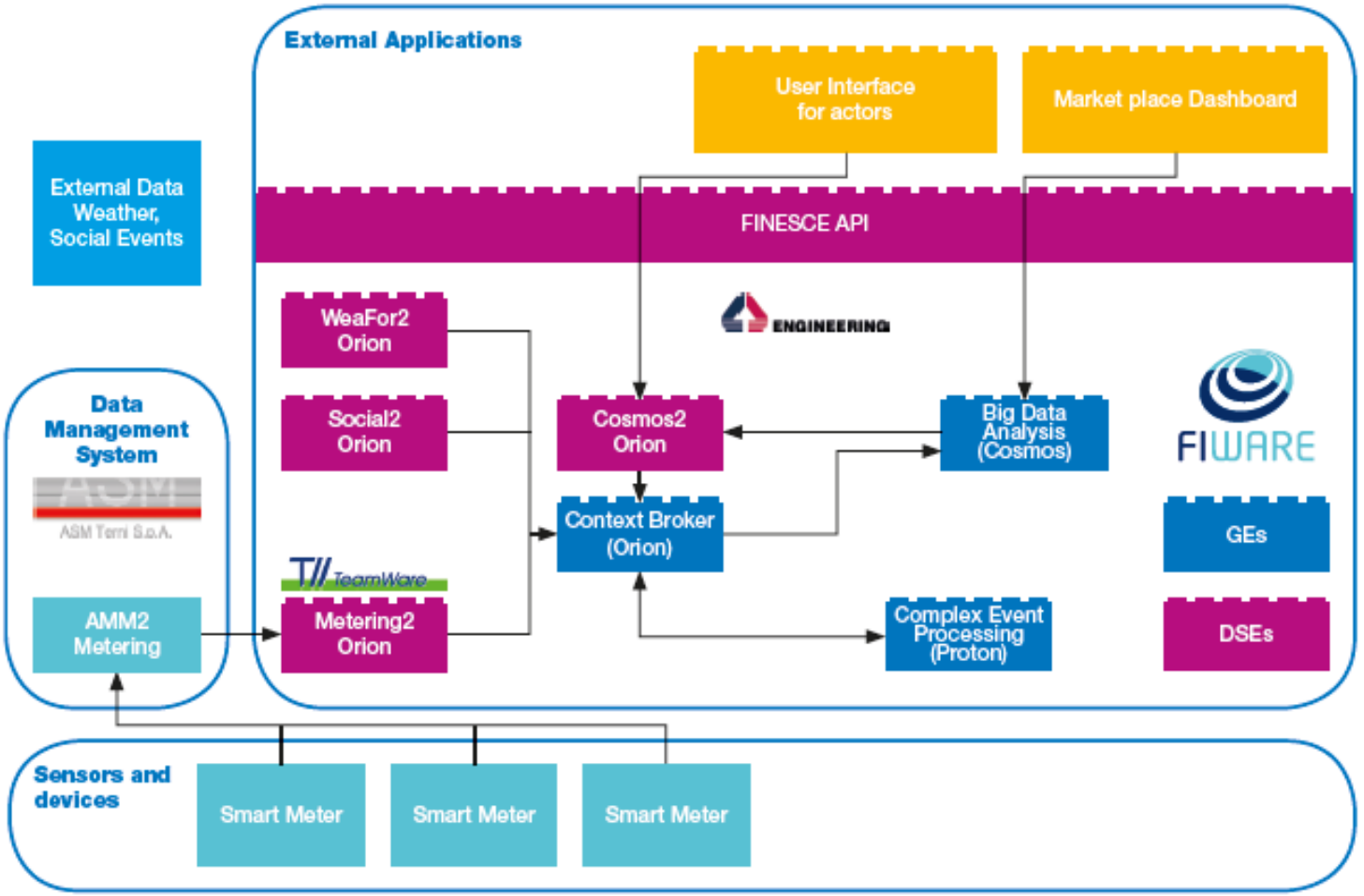
How to use it: example of architecture – E.ON Field Test



How to use it: example of architecture – ESB Field Test (II)

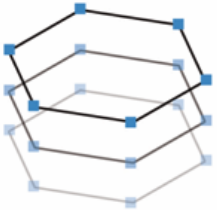


How to use it: example of architecture – ASM Terni (III)



The concept of open platform

- Creating a consortium of Industry interested in developing and supporting the platform
- Creating a forum where the needs for future developments are discussed
- Exploiting university resources to have the needed support
- Sharing the results in an open source version
- Allowing partners to develop supported versions (similar to the Linux concept)
- 20-30 companies already on board



Flexible
Electrical
Networks

FORSCHUNGS CAMPUS
öffentlich-private Partnerschaft für Innovationen

GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung

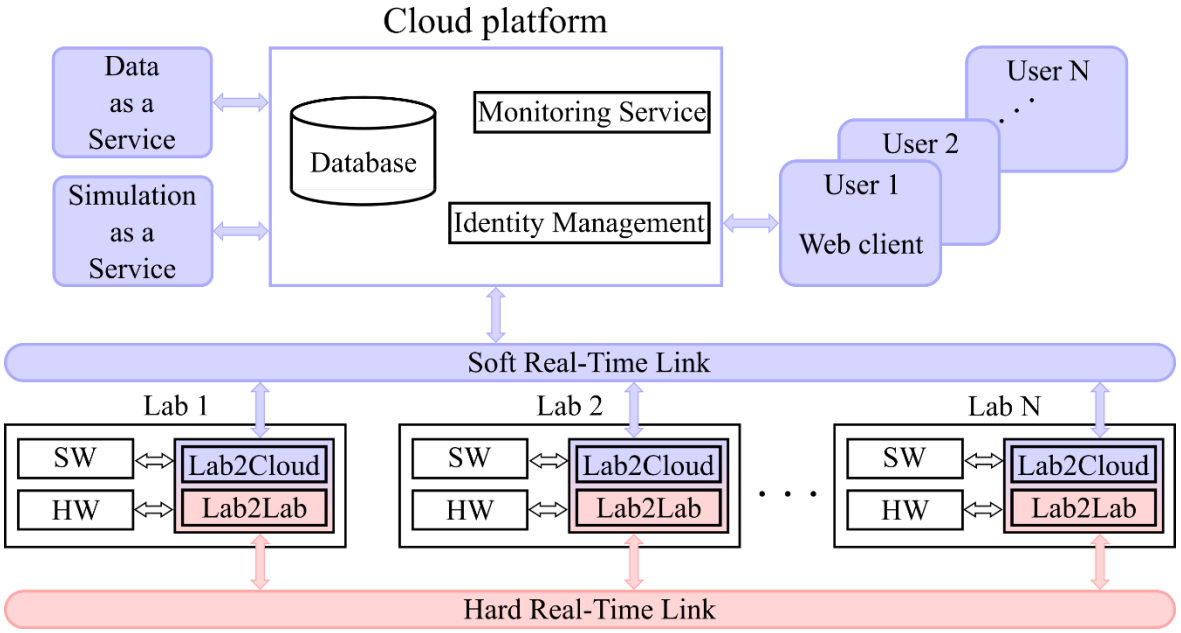
Virtual integration of laboratories for real-time co-simulation
Introduction

- The Energy Union strategy proposed by the European Commission
  - defines five directions for making energy more secure, affordable and sustainable (Energy security, solidarity and trust; A fully integrated European energy market; Energy efficiency contributing to moderation of demand; Decarbonizing the economy; **Research, Innovation and Competitiveness**)
  - **Research, Innovation and Competitiveness** calls for
    - An **integrated** approach to create synergies and bring new technologies
    - Fully **coordinated** and focused research for enabling breakthroughs in energy sector
    - Achieving the **maximum** possible results from **every investment**

- Virtual integration of laboratories over long distance for real-time co-simulation of power systems can be seen as an important tool to support a continental level integration of testing and validation

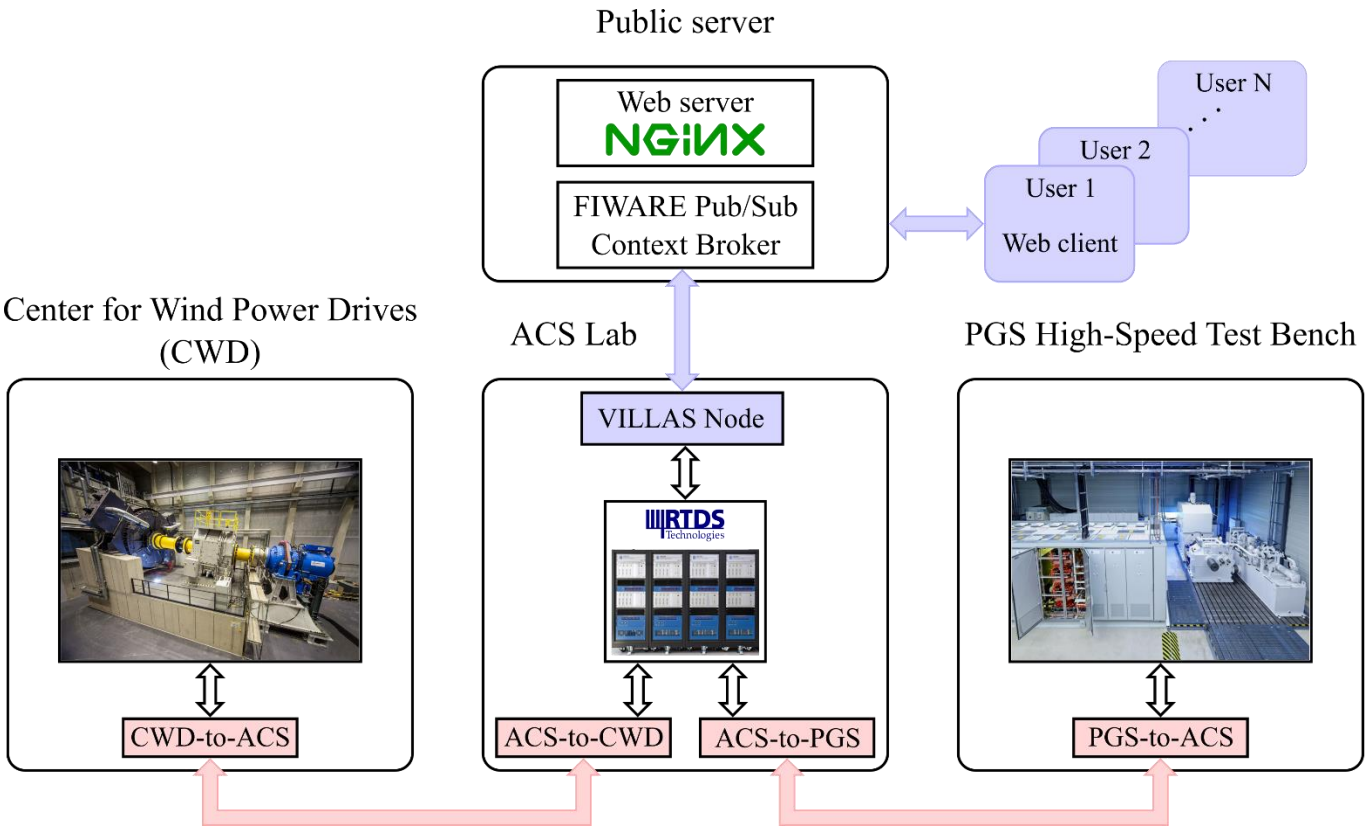
Framework for virtual integration of laboratories for co-simulation
Conceptual architecture

- Architecture diagram of a framework for virtual integration of laboratories
  - Laboratory-to-laboratory (Lab2Lab) interfaces for Hard Real-Time integration
    - Fast and reliable communication between Lab2Lab interfaces is essential
    - Integration over a shared communication medium such as the Internet is a challenge
  - Laboratory-to-Cloud (Lab2Cloud) interface for Soft Real-Time integration
  - Importance of portability of Lab2Lab and Lab2Cloud interfaces among laboratories for integration of different local assets (digital real-time simulators, measurement devices, estimation and control algorithms)



Virtual integration of laboratories for real-time co-simulation
Example of integration over Campus Area Network

- VILLAS - Virtually Interconnected Laboratories for LArge systems Simulation/emulation

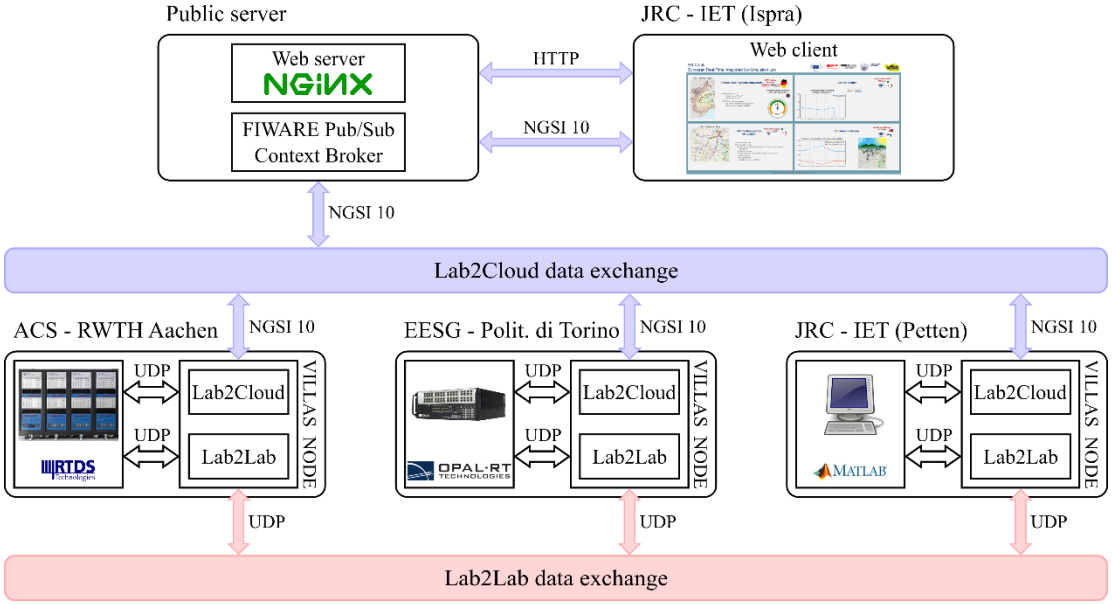


Virtual integration of laboratories for real-time co-simulation
Example of integration over Wide Area Network (Internet)

- ERIC Lab - European Real-time Integrated Co-simulation Laboratory
  - A network of European laboratories for a science-based support of policy decision making toward future electricity systems
- The concept has been demonstrated in a collaboration with Politecnico di Torino (PoliTo) and Energy Security, Systems and Market Unit of the EC Joint Research Center (JRC)

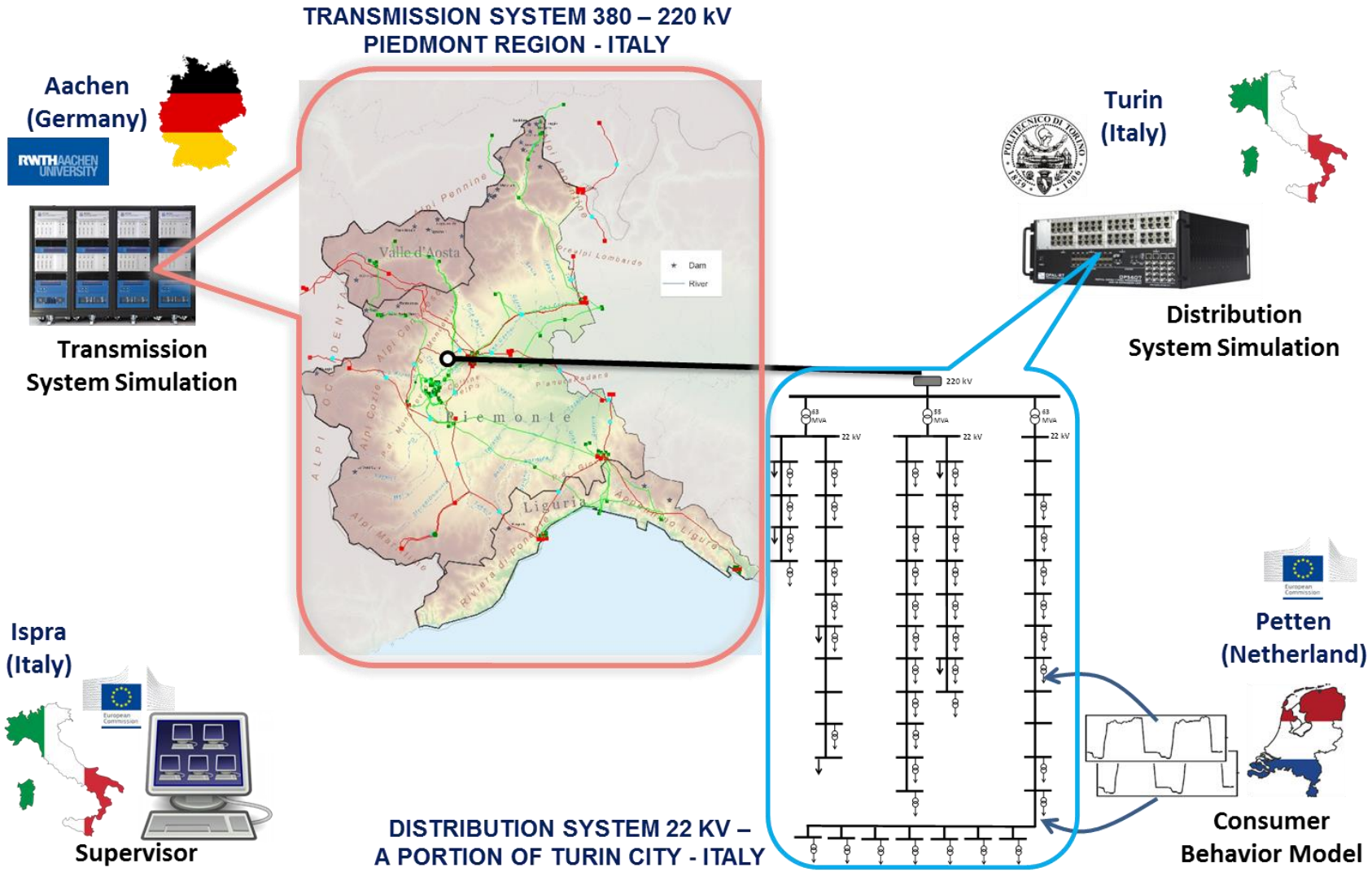
Example of virtual integration over Wide Area Network (Internet) ERIC Lab demonstration

- High-level architecture diagram of ERIC Lab demonstration
  - VILLASnode (**V**irtually **I**nterconnected **L**aboratories for **LA**rge systems **S**imulation/emulation)
    - In-house developed software
    - Lab2Lab and Lab2Cloud interfaces (managing data exchange between nodes)
    - Statistics of Quality of Service (QoS) of communication links
  - Development of a Simulation as a Service concept based on a FIWARE platform
    - Cloud-based infrastructure that delivers a suite of generic enablers
    - Driven by the European Union (global deployment of applications for Future Internet)



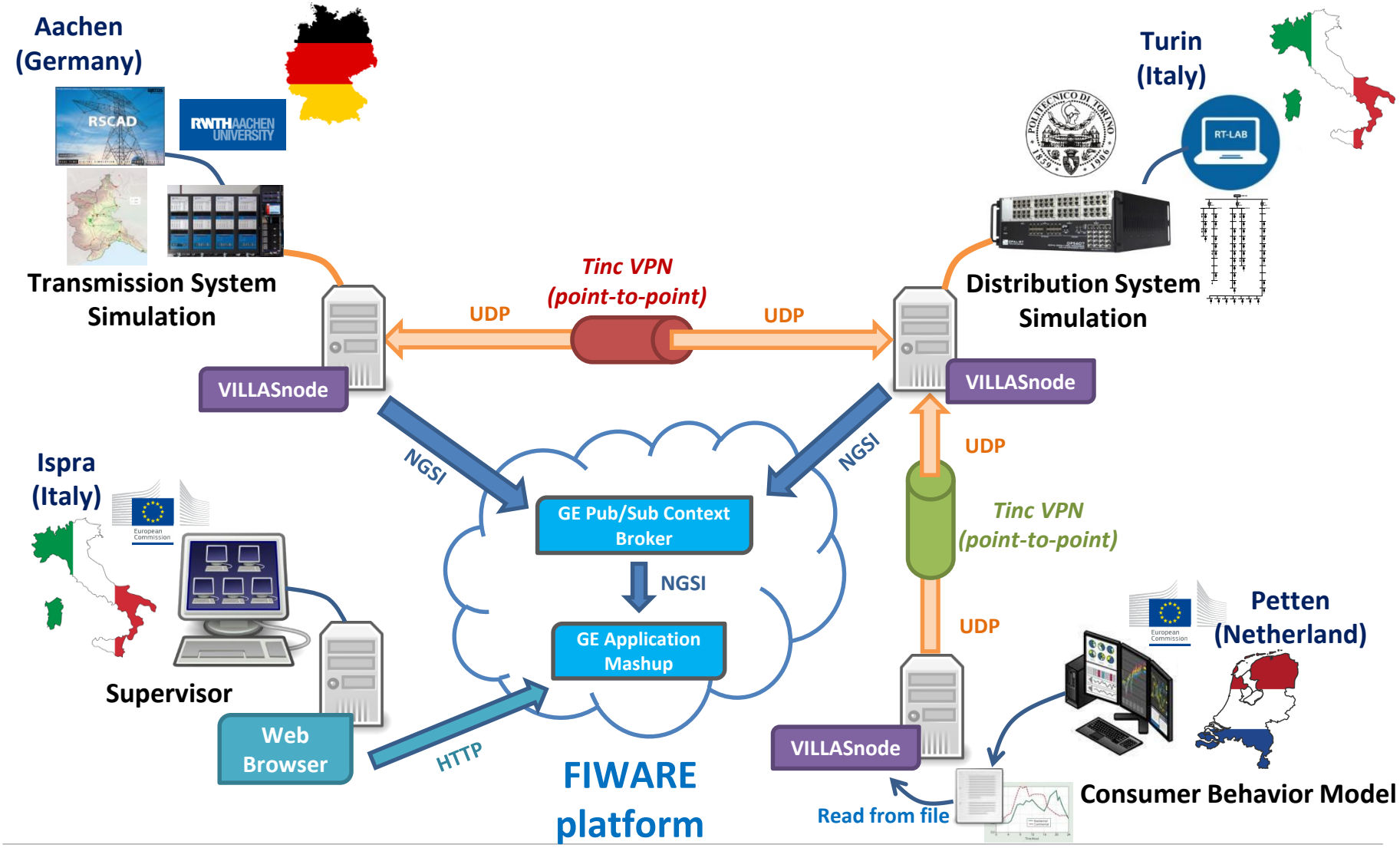
Example of virtual integration over Wide Area Network (Internet) ERIC Lab demonstration

- Simulation scenario of ERIC Lab demonstration

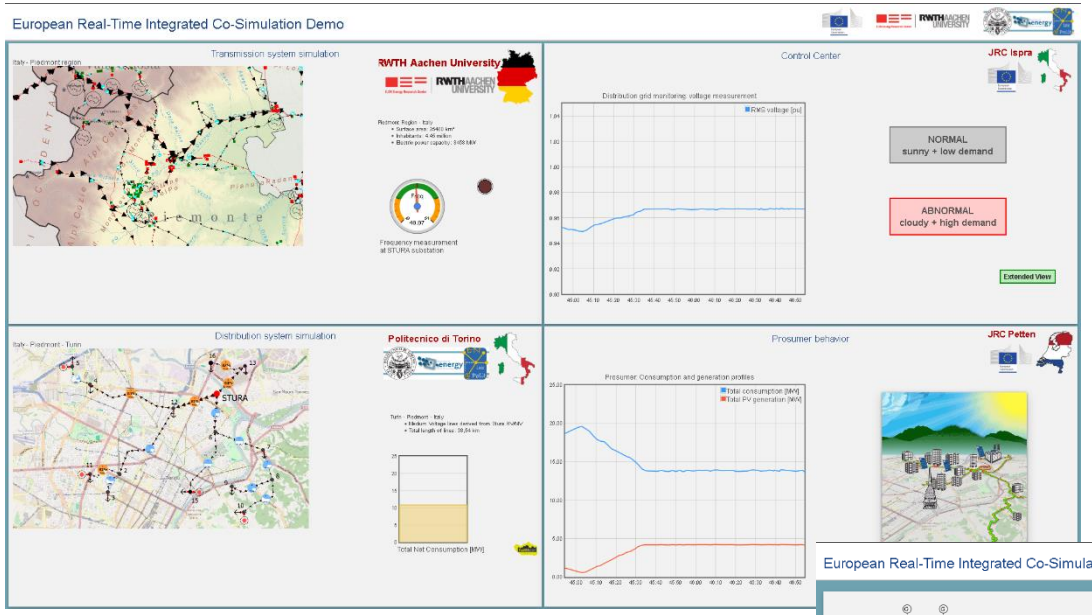


Example of integration over Wide Area Network (Internet)
ERIC Lab demonstration

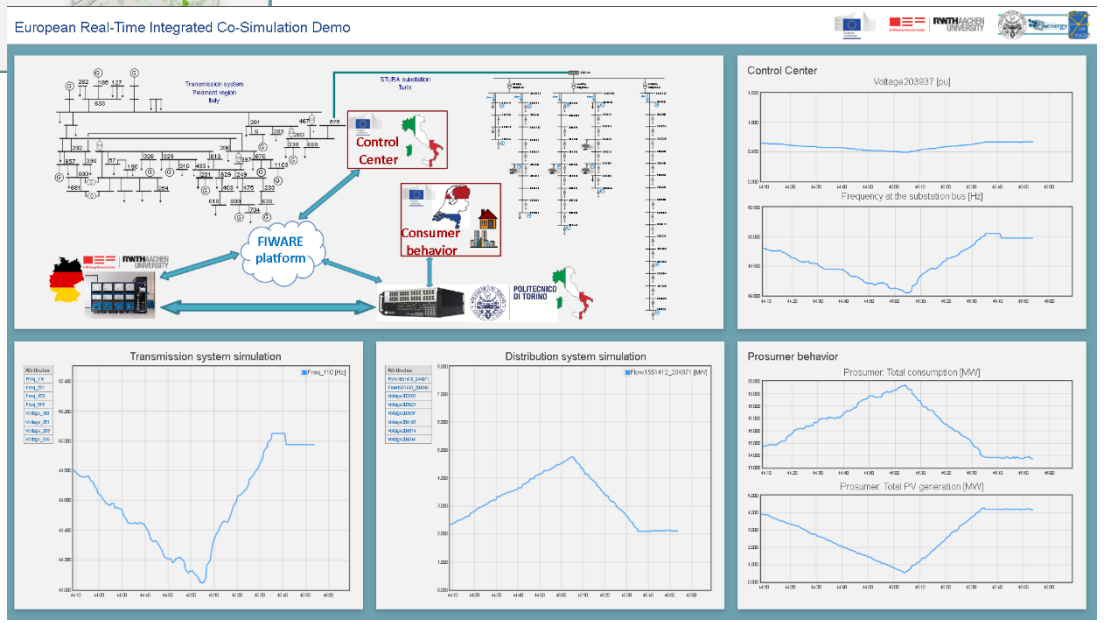
- Realization of simulation scenario of ERIC Lab demonstration



Example of virtual integration over Wide Area Network (Internet) ERIC Lab demonstration



- Web-client for consolidated monitoring of simulation
  - Conceptual layout (to the left)
  - Technical layout (below)



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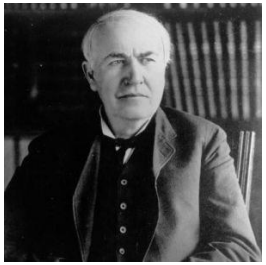
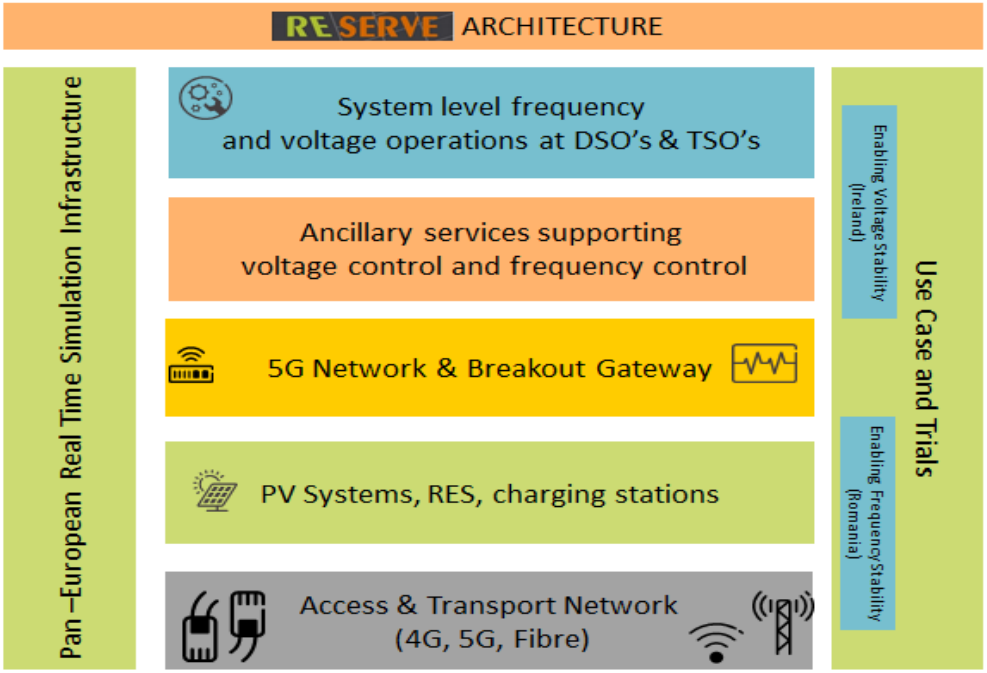
Looking at the future: Automation for 100% renewable H2020 RE-SERVE



"We are like tenant farmers chopping down the fence around our house for fuel, when we should be using natures' inexhaustible sources of energy (sun, wind and power). I would put my money on the sun and solar energy. What a source of power! I hope we don't have to wait until oil and coal run out before we tackle that."
Thomas Edison (1931)

- Revolutionary concept for frequency and voltage control able to support a future scenario of 100% renewables
- Development of a testing platform to prove the concept together with the DSO of Ireland and Romania



Conclusions

- Platforms are key elements for rapid development and collaboration
- It is key to develop efforts that can be considered at European level
- The presentation introduced two different efforts in two critical and interrelated areas: energy services and large RT simulation
- It is important to keep the momentum and grow these initiatives