

# EU level platforms: building consensus and interoperability

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# Why platforms?

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- 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



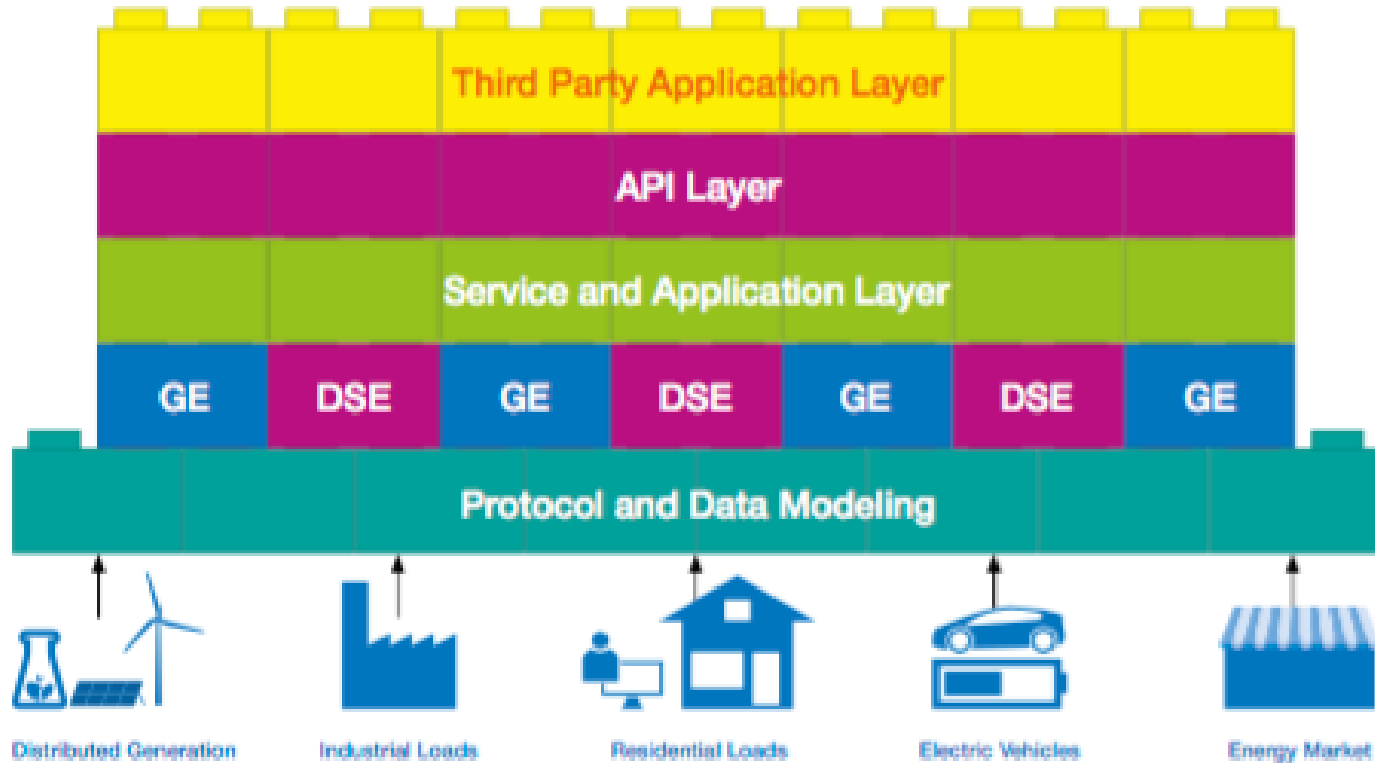
# FIWARE and its catalogue

The image shows two overlapping browser windows. The top window displays the FIWARE website with a dark blue header featuring the FIWARE logo and the tagline 'Open APIs for Open Minds'. Below the header is a large graphic of a DNA helix. The bottom window shows the White House website, specifically the 'Briefing Room' section. The navigation bar includes links for 'BRIEFING ROOM', 'ISSUES', 'THE ADMINISTRATION', 'PARTICIPATE', and '1600 PENN'. The main content area is titled 'Briefing Room' and lists various categories like 'Your Weekly Address', 'Speeches & Remarks', 'Press Briefings', 'Statements & Releases' (highlighted in red), 'White House Schedule', 'Presidential Actions', 'Executive Orders', 'Presidential Memoranda', 'Proclamations', 'Legislation', 'Pending Legislation', 'Signed Legislation', 'Vetoed Legislation', 'Nominations & Appointments', and 'Disclosures'. The 'Statements & Releases' section features a fact sheet titled 'FACT SHEET: Announcing Over \$80 million in New Federal Investment and a Doubling of Participating Communities in the White House Smart Cities Initiative'. The fact sheet includes a quote from President Barack Obama: 'If we can reconceive of our government so that the interactions and the interplay between private sector, nonprofits, and government are opened up, and we use technology, data, social media in order to join forces around problems, then there's no problem that we face in this country that is not soluble.' - President Barack Obama. Below the quote, it states: 'With nearly two-thirds of Americans living in urban settings, many of our fundamental challenges—from climate change to equitable growth to improved health—will require our cities to be laboratories for innovation. The rapid pace of technological change, from the rise of data science, machine learning, artificial intelligence, and ubiquitous sensor networks to autonomous vehicles, holds significant promise for addressing core local challenges.'

# Future Internet for Energy

The screenshot displays the website **finesce.eu** in a browser window. The main content area features a map of Europe with several pink dots indicating trial sites. Surrounding the map are logos of various partner organizations, including **ERICSSON**, **RWTH AACHEN UNIVERSITY**, **e-on**, **INSERO**, **QSC**, **BAUM**, **fir**, **SYNELIXIS**, **acciona**, **ENGINEERING**, **ASM**, **ALSTOM**, and **Alcatel-Lucent**. A sidebar on the right contains social media links for Facebook, Twitter, Google+, and Xing. A bottom section includes a date **25 MAR 2015** and event information: **Net Futures 2015 - Brussels, Belgium** and **Review: E-world energy & Review: Open Day Trial Site**.

# FINESCE: a FIWARE based platform for energy



# Open APIs ... just like LEGO



[Home](#) / [Specific Enablers](#)

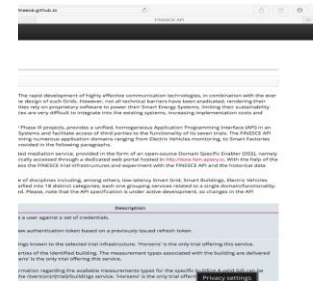
All ▾

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.

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

WearFor2Orion 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.

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.

[illegible][Home / Specific Exercises](#)

Browse by Trial Site

Browse

### Contract Info

## Contract Information (ContractInformation2Orion \*\*)

ContractInformation2Orcin is a REST service [developed in java] which allows clients (e.g. Retservers) 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.

TERM: (DATE INSTITUTE DEPLOYED ON FI-LAB)

### Social Events Interface (Social2Orion \*\*)

SocialQOrion is a REST service (developed in Java) which allows clients (e.g. Social Explorer) to query a specific area such as a concert or a football match) in an instance of ORION Centre.

TECH-EDGE INSTANCE DEPLOYED ON FLARE									
IP	OS	ARCH	TYPE	NAME	STATUS	IP	OS	ARCH	TYPE
10.10.10.1	Ubuntu	x86_64	Worker	flaredge-1	Running	10.10.10.2	Ubuntu	x86_64	Worker
10.10.10.3	Ubuntu	x86_64	Worker	flaredge-2	Running	10.10.10.4	Ubuntu	x86_64	Worker
10.10.10.5	Ubuntu	x86_64	Worker	flaredge-3	Running	10.10.10.6	Ubuntu	x86_64	Worker
10.10.10.7	Ubuntu	x86_64	Worker	flaredge-4	Running	10.10.10.8	Ubuntu	x86_64	Worker
10.10.10.9	Ubuntu	x86_64	Worker	flaredge-5	Running	10.10.10.10	Ubuntu	x86_64	Worker
10.10.10.11	Ubuntu	x86_64	Worker	flaredge-6	Running	10.10.10.12	Ubuntu	x86_64	Worker
10.10.10.13	Ubuntu	x86_64	Worker	flaredge-7	Running	10.10.10.14	Ubuntu	x86_64	Worker
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10.10.10.73	Ubuntu	x86_6							

### Weather Condition Interface (Weafor2Orion™)

a specific area onto an instance of ORION Context Broker GE + a Java client which and then "passes" the data to the above mentioned REST service.

TSPM (386) INSTANCE DEPLOYED ON FI-LAB)

### Metering (Metering2Orion \*\*)

Context Broker GE = a Java client which accepts data about metering and load from "meters" (the data is then placed into the HEST database).

TERM-EDGE INSTANCE DEPLOYED ON FLARE

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**RESEARCH**

**U.S. DEPARTMENT OF JUSTICE**

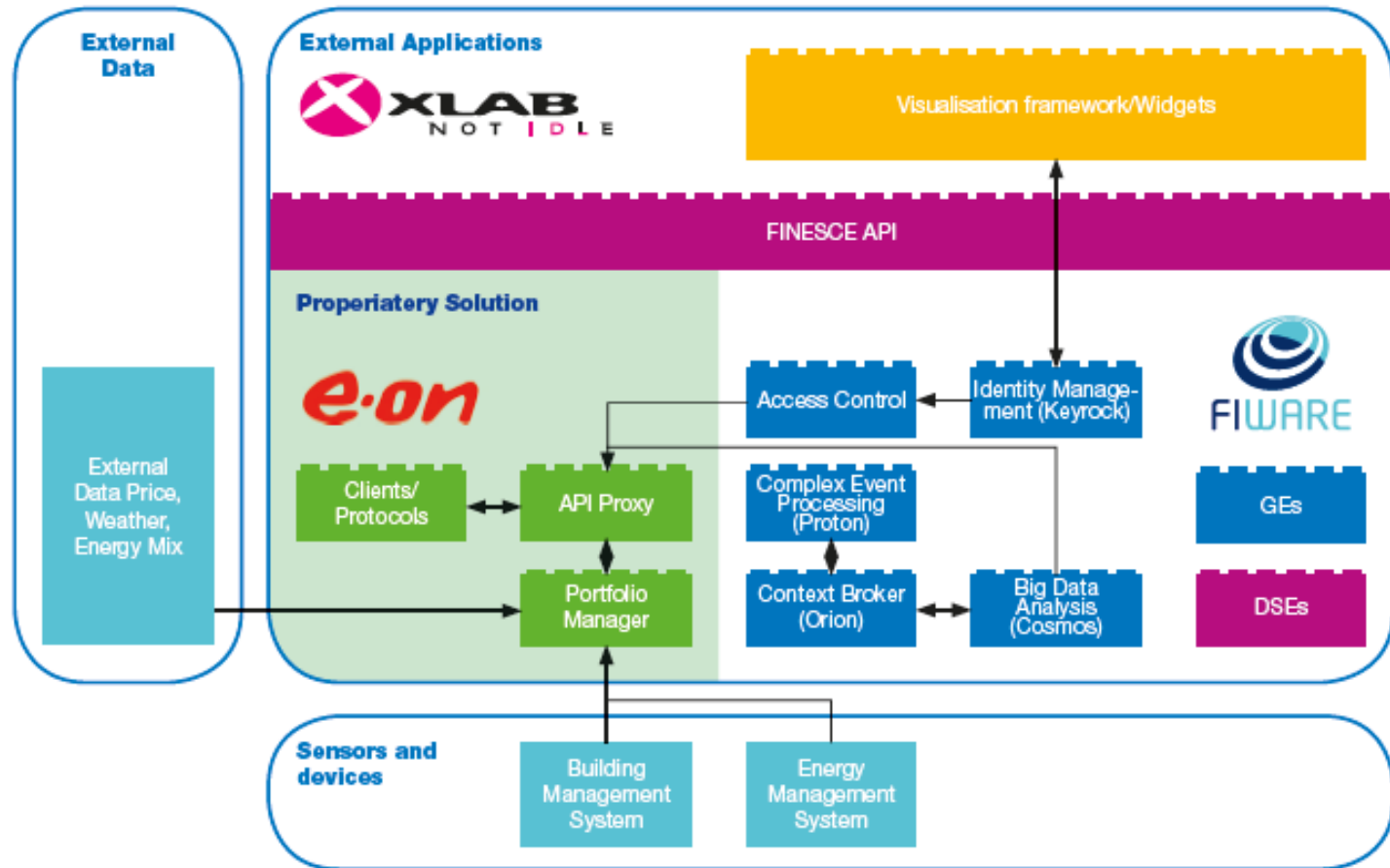
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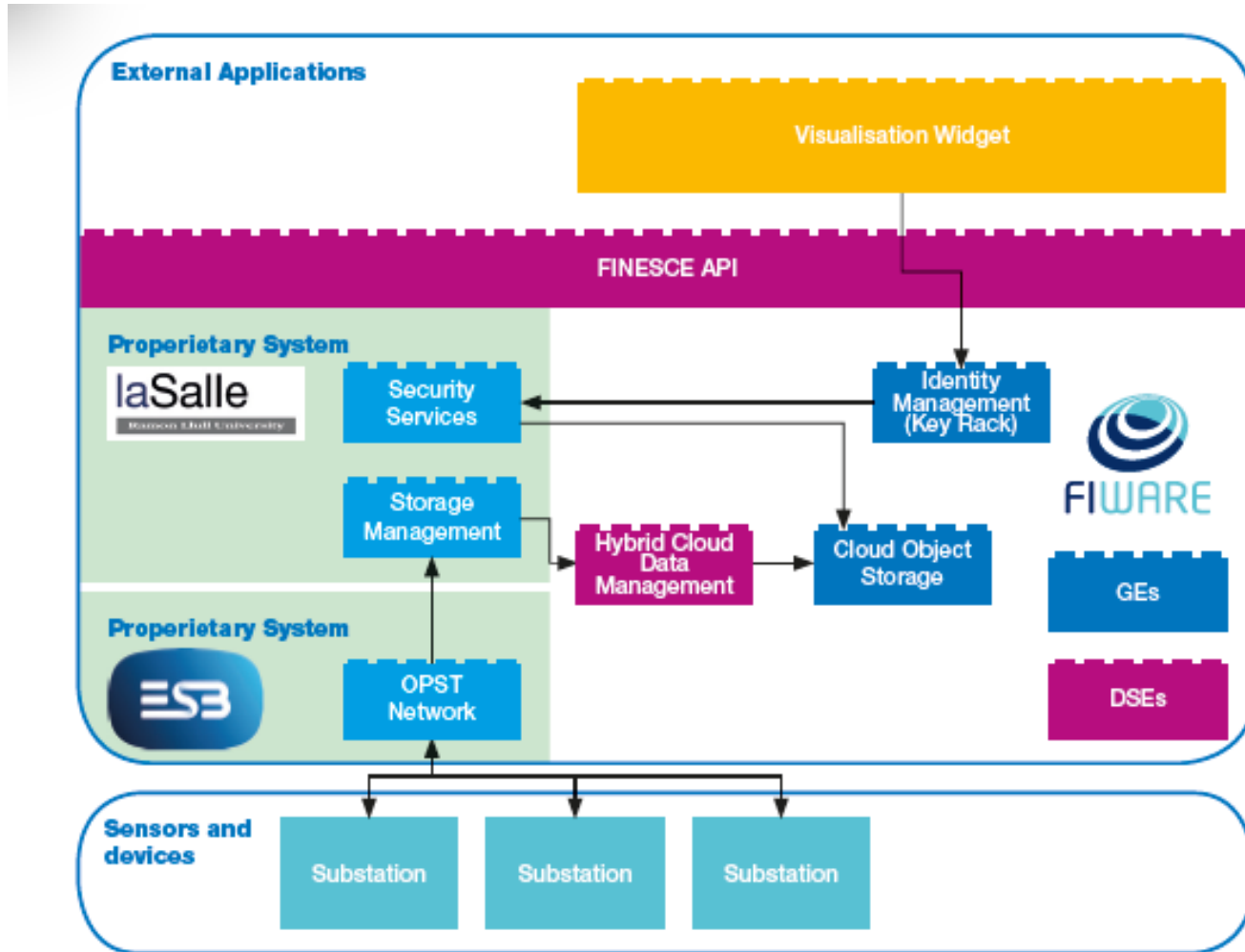
**Energy Research Center**

Energy Research Center |

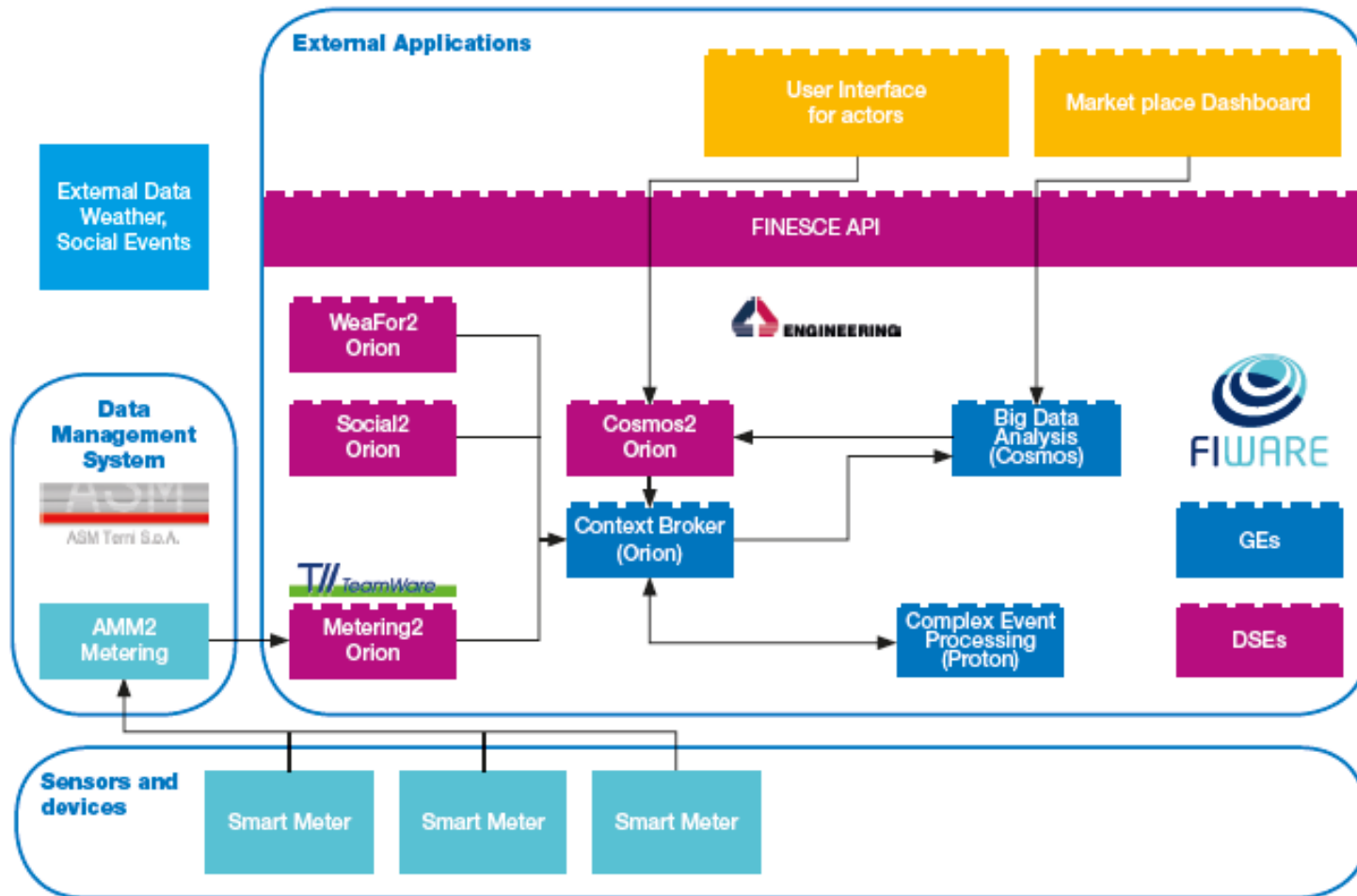
# How to use it: example of architecture – E.ON Field Test



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



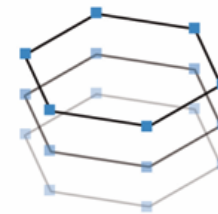
# How to use it: example of architecture – ASM Terni (III)



# The concept of open platform

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- 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

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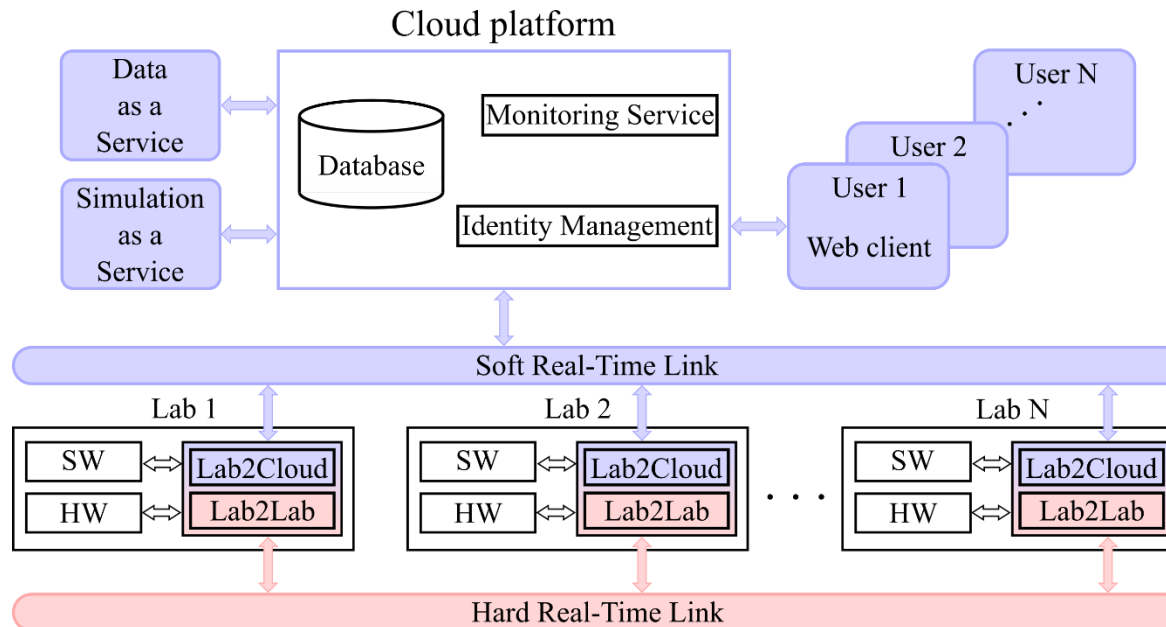
- The Energy Union strategy proposed by the European Commission
  - ≡ defines five directions for making energy more secure, affordable and sustainable (Energy security, solidarity and trust; A fully integrated European energy market; Energy efficiency contributing to moderation of demand; Decarbonizing 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

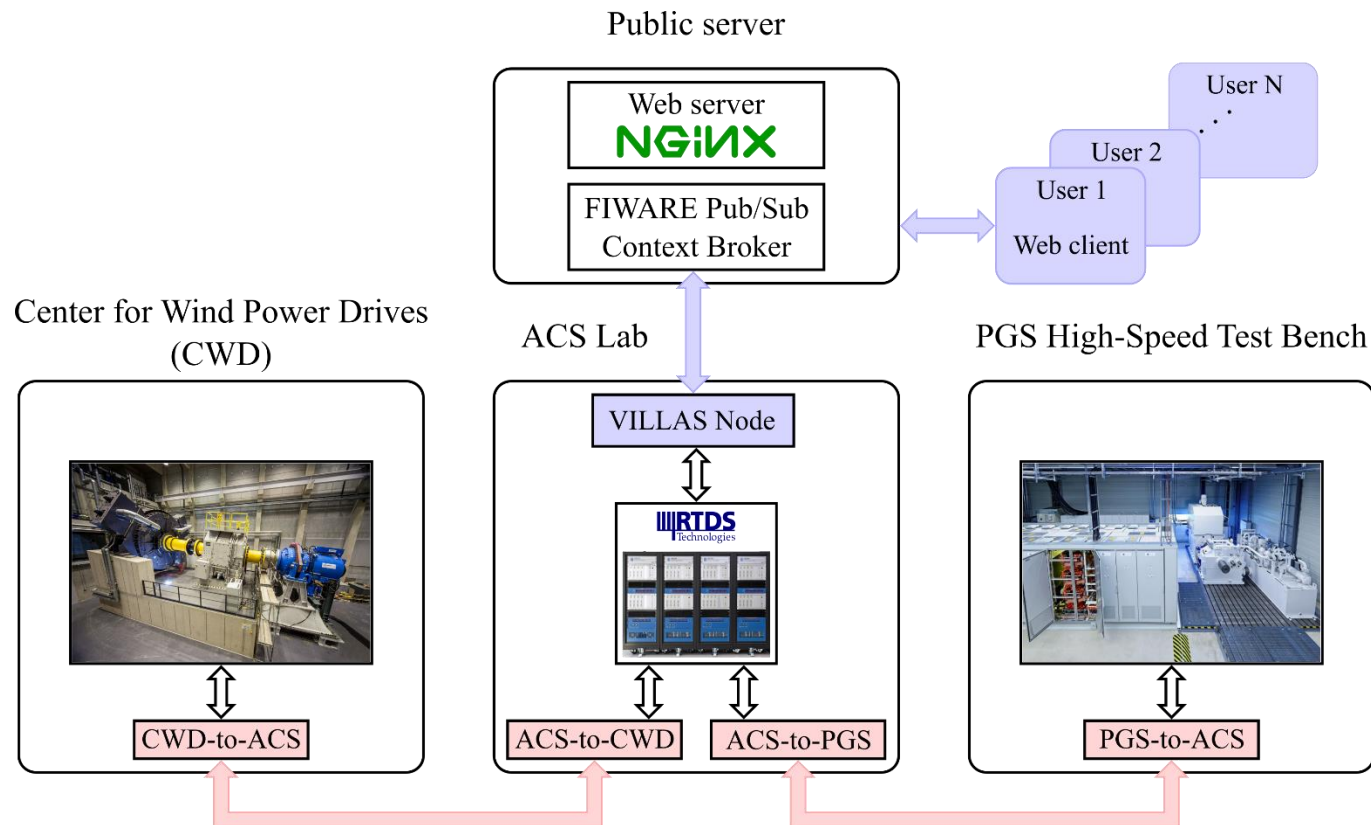
- ≡ Laboratory-to-laboratory (Lab2Lab) interfaces for Hard Real-Time integration
  - = Fast and reliable communication between Lab2Lab interfaces is essential
  - = Integration over a shared communication medium such as the Internet is a challenge
- ≡ Laboratory-to-Cloud (Lab2Cloud) interface for Soft 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)

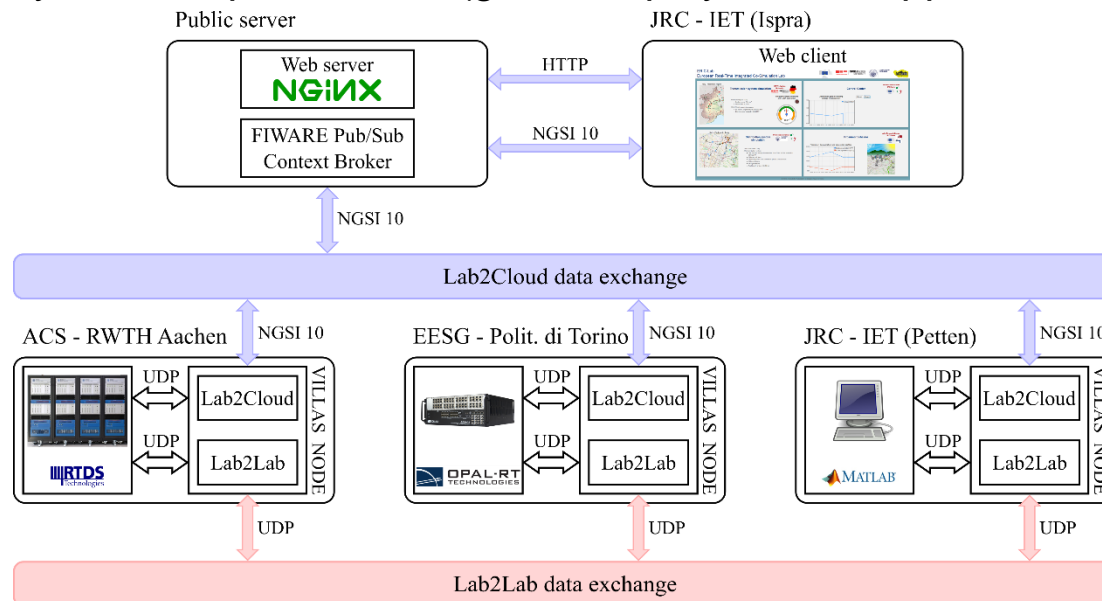


# Example of virtual integration over Wide Area Network (Internet)

## ERIC Lab demonstration

### ■ High-level architecture diagram of ERIC Lab demonstration

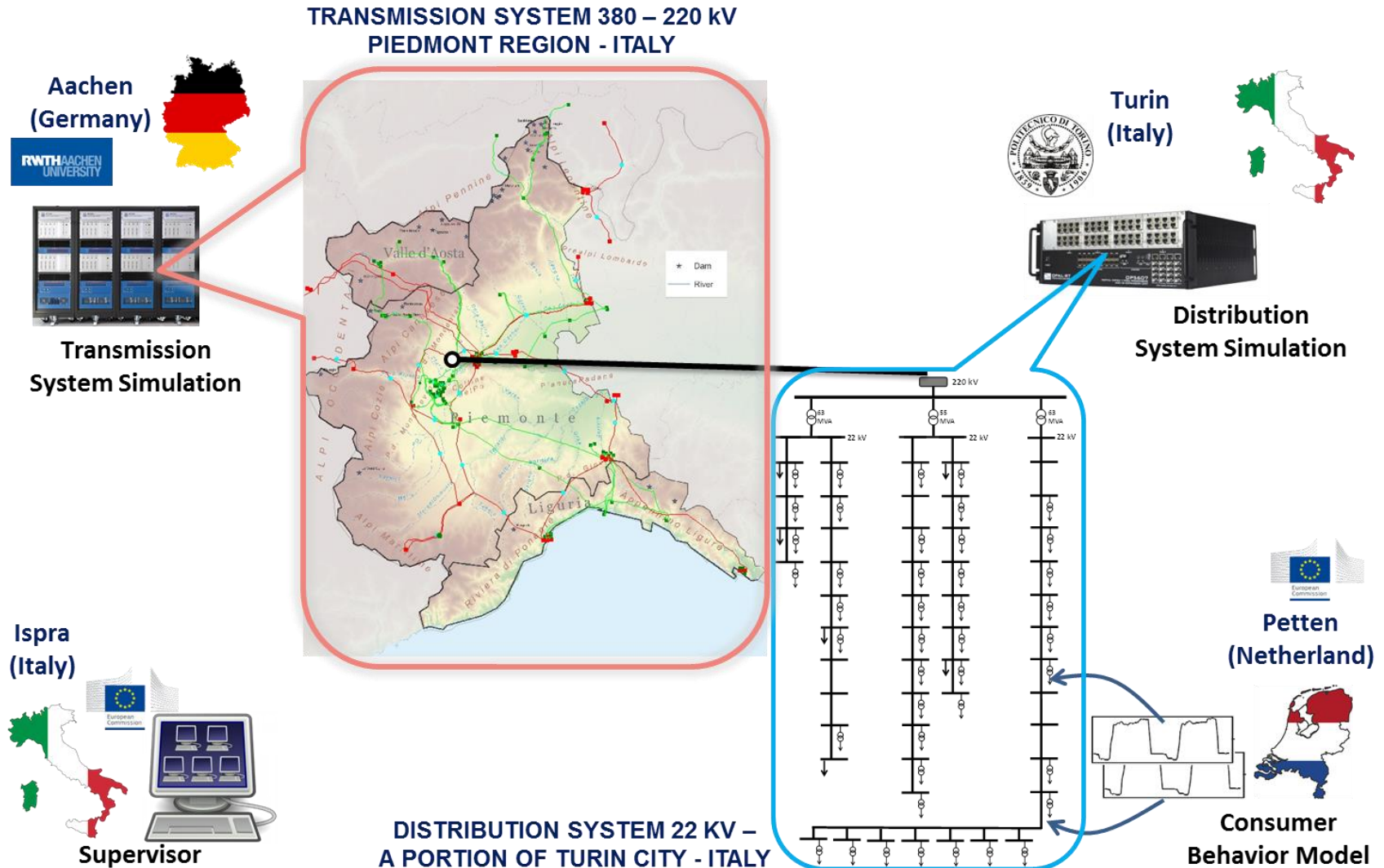
- ≡ VILLASnode (**V**irtually **I**nterconnected **L**aboratories for **L**arge systems **S**imulation/emulation)
  - = In-house developed software
  - = Lab2Lab and Lab2Cloud interfaces (managing data exchange between nodes)
  - = Statistics of Quality of Service (QoS) of communication links
- ≡ Development 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

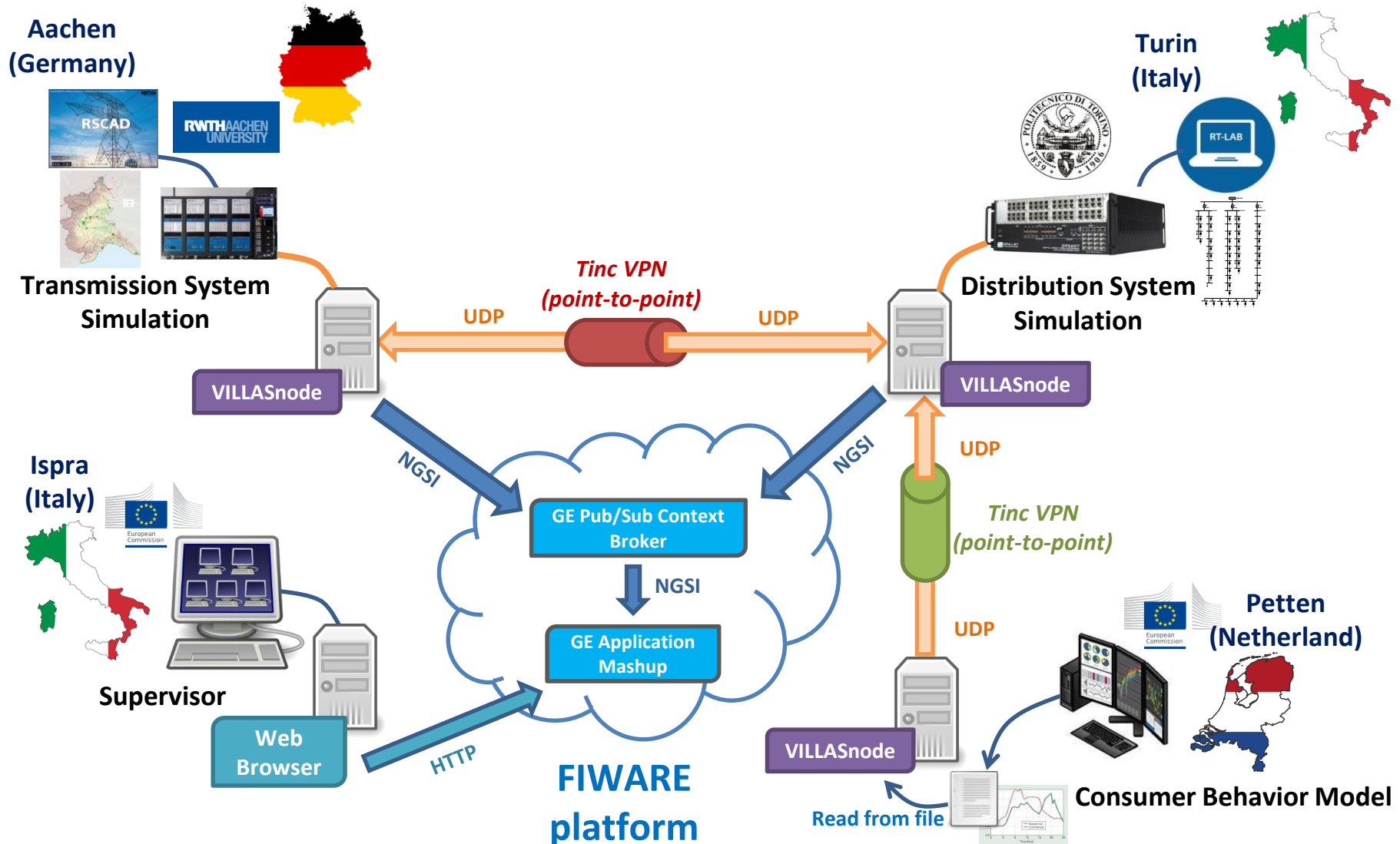
### ■ Simulation scenario of ERIC Lab demonstration



# Example of integration over Wide Area Network (Internet)

## ERIC Lab demonstration

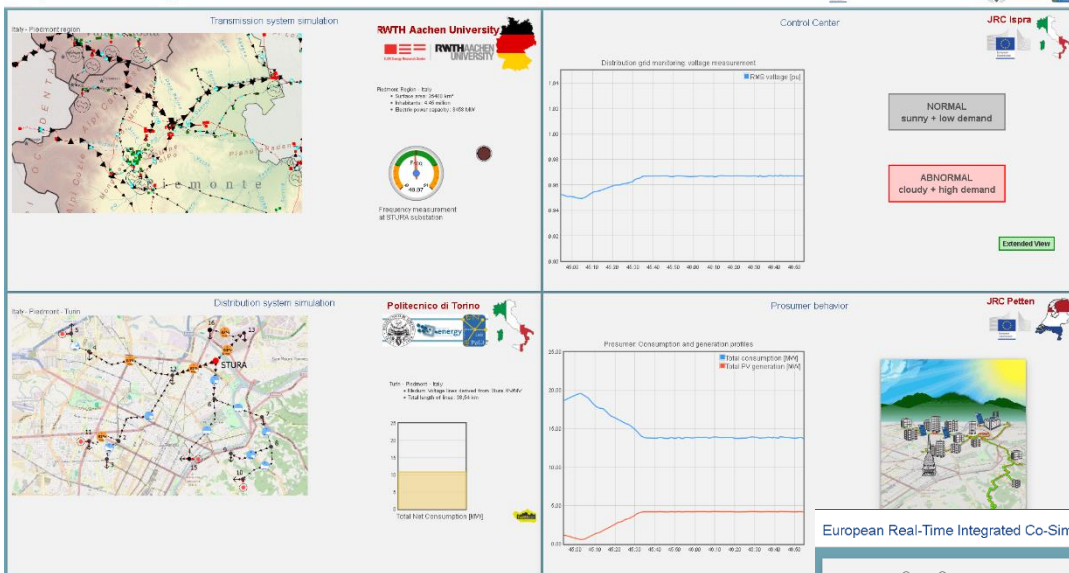
### ■ Realization of simulation scenario of ERIC Lab demonstration



# Example of virtual integration over Wide Area Network (Internet)

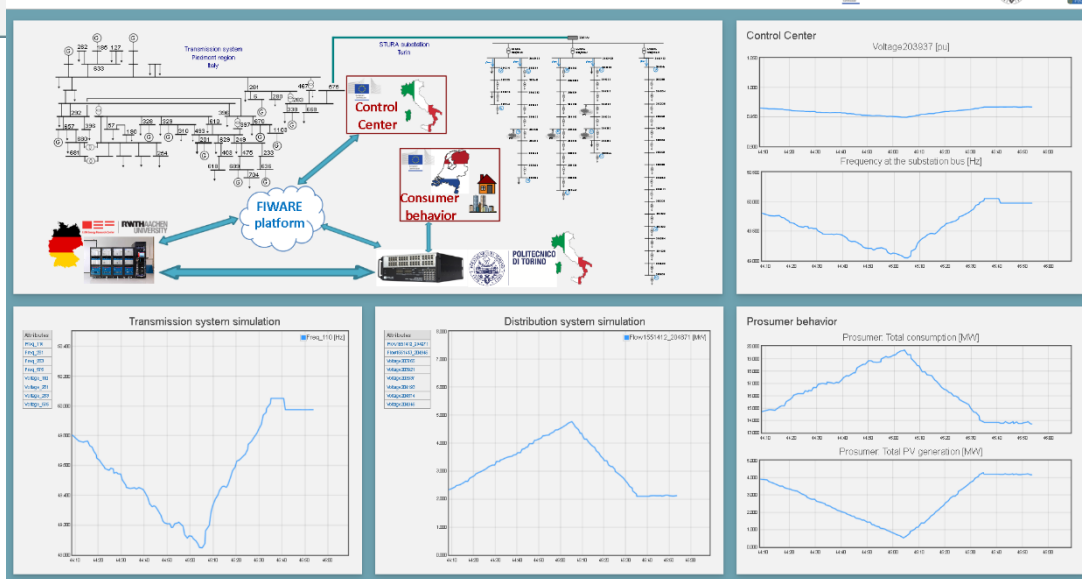
## ERIC Lab demonstration

European Real-Time Integrated Co-Simulation Demo



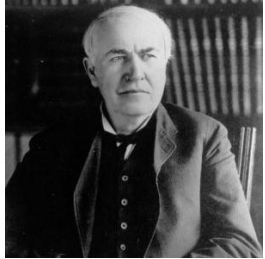
- Web-client for consolidated monitoring of simulation
- ≡ Conceptual layout (to the left)
- ≡ Technical layout (below)

European Real-Time Integrated Co-Simulation Demo



# Looking at the future: Automation for 100% renewable

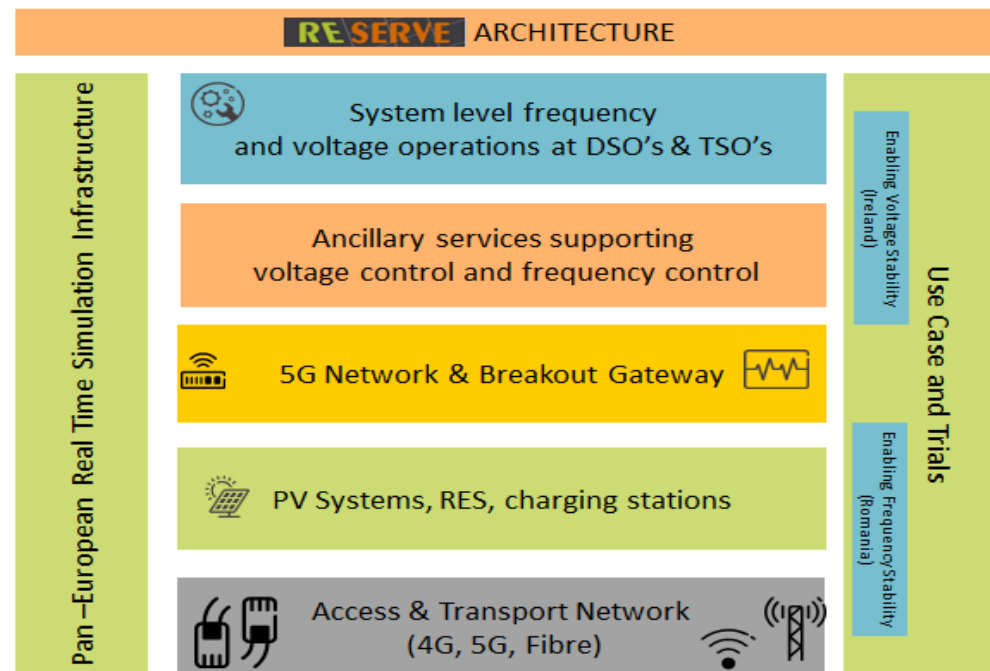
## H2020 RE-SERVE



*“We are like tenant farmers chopping down the fence around our house for fuel, when we should be using nature’s 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

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- 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