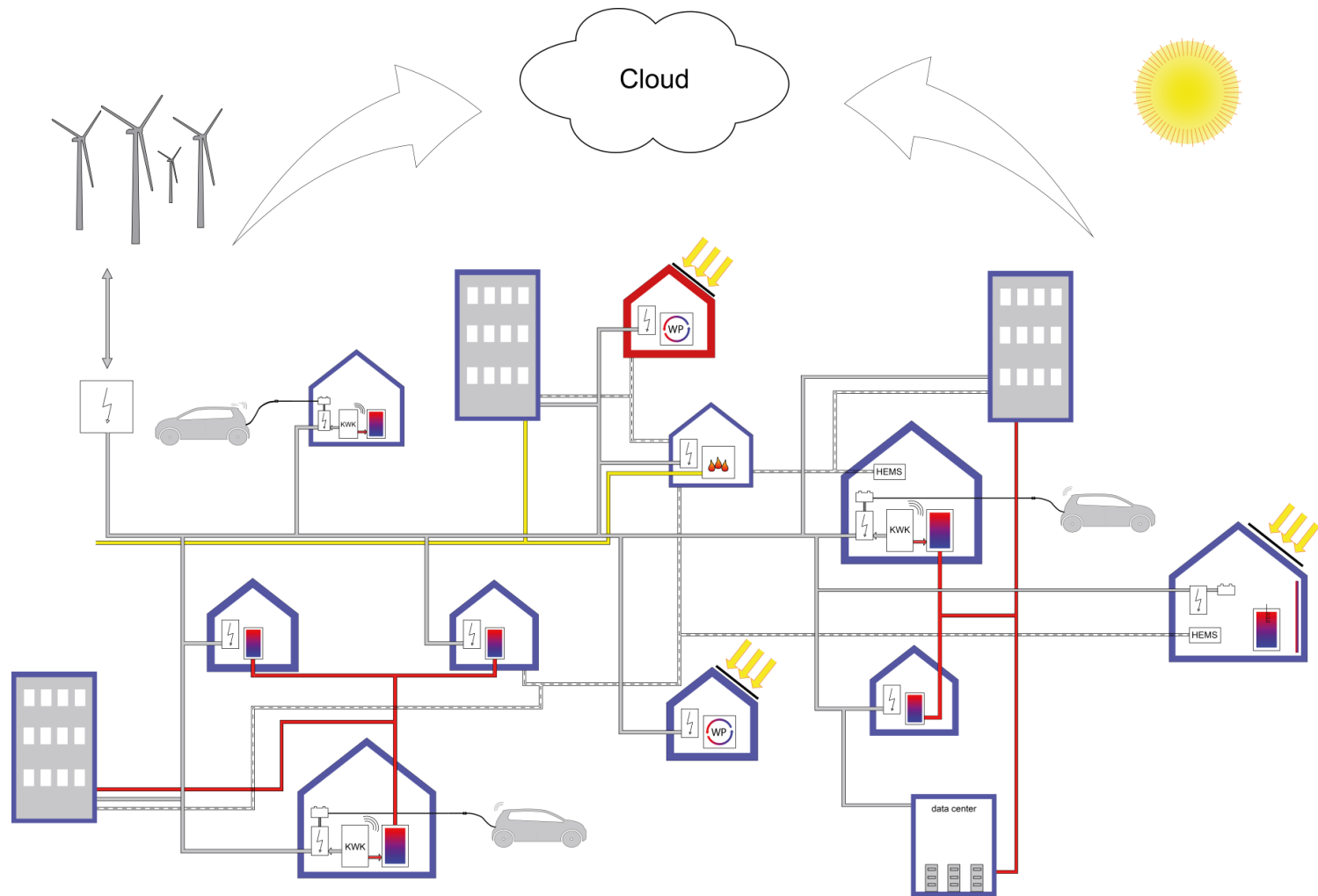


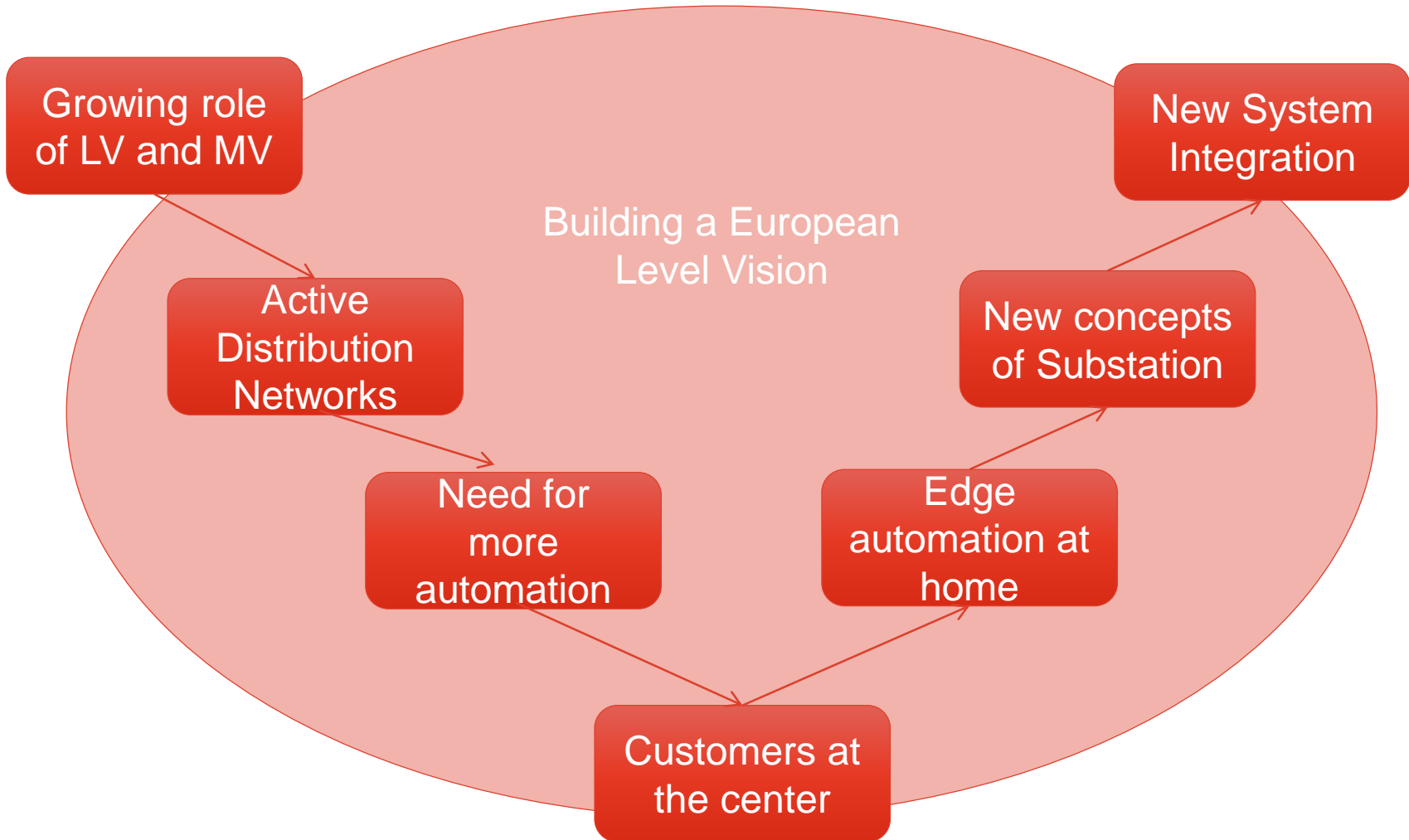
R&I opportunities at the crossroads of energy and 5G

Univ.-Prof. Antonello Monti, Ph.D.

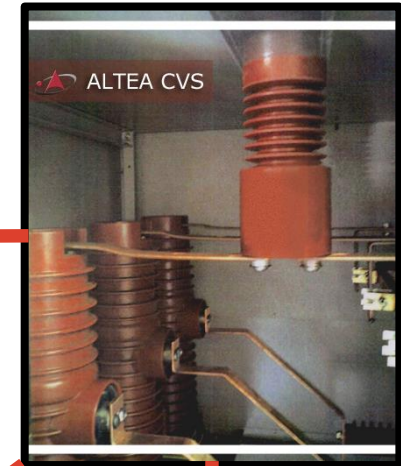
Future Energy Systems



A process of transformation



Key Ingredients



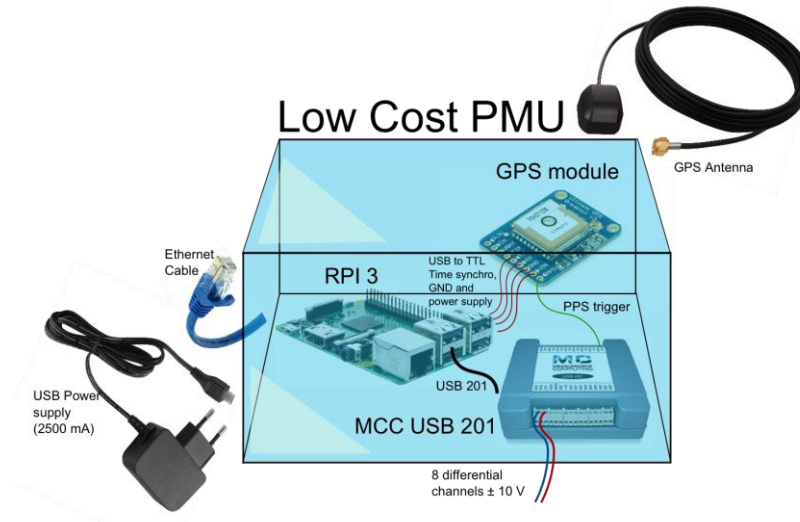
An evolving view of the customer role



Customer 1.0
No connectivity



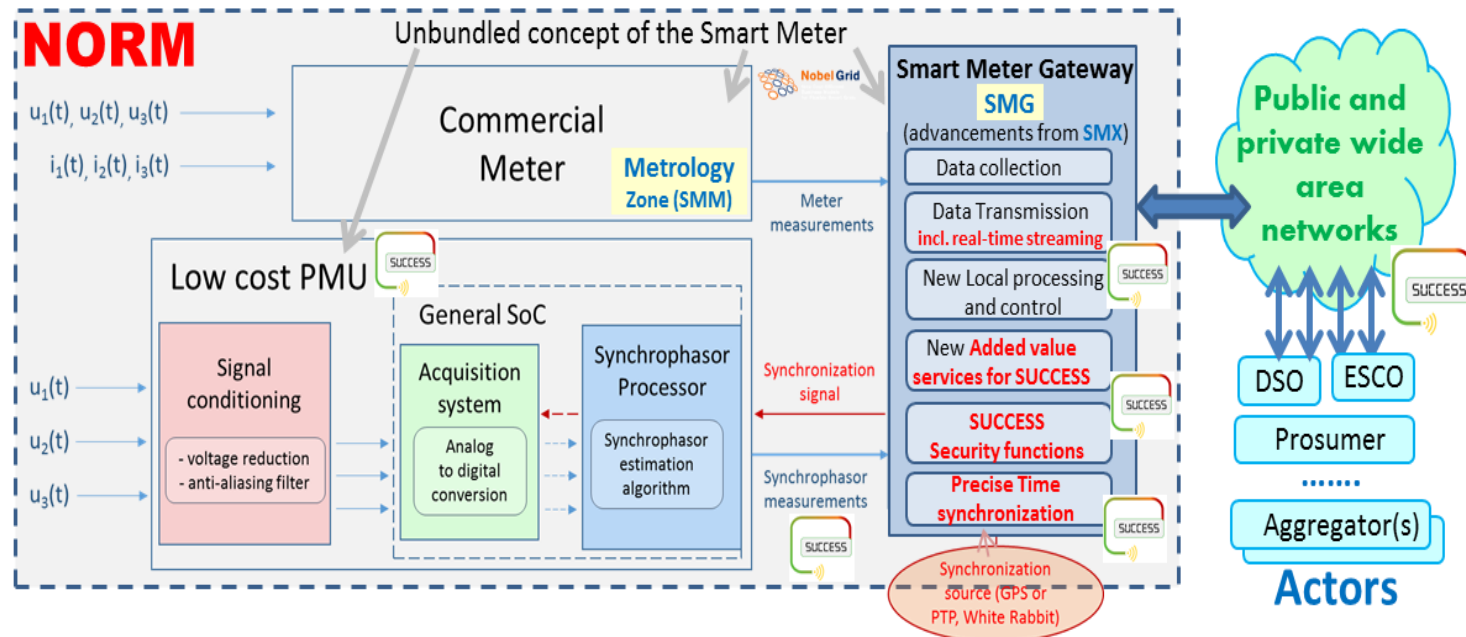
Customer 2.0
Limited Connectivity
(Billing use case)



Customer 3.0
High Quality Connectivity
Active player
Service provider/user




- Concerns:
 - Utilities will have to deal with components not owned by the utility
 - Customer hardware as main gateway of system threats



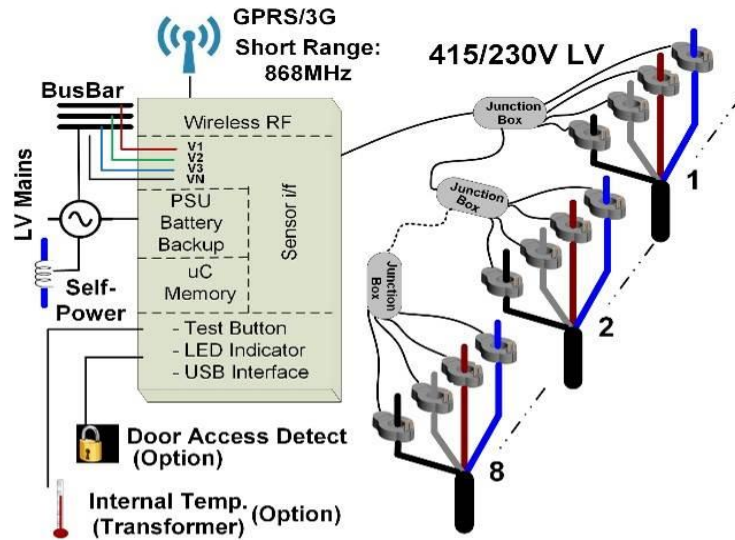
NORM ...beyond the meter .. Next Generation Open Real Time Smart Meter
 A service oriented secured gateway for customer participation

A short view on sensors

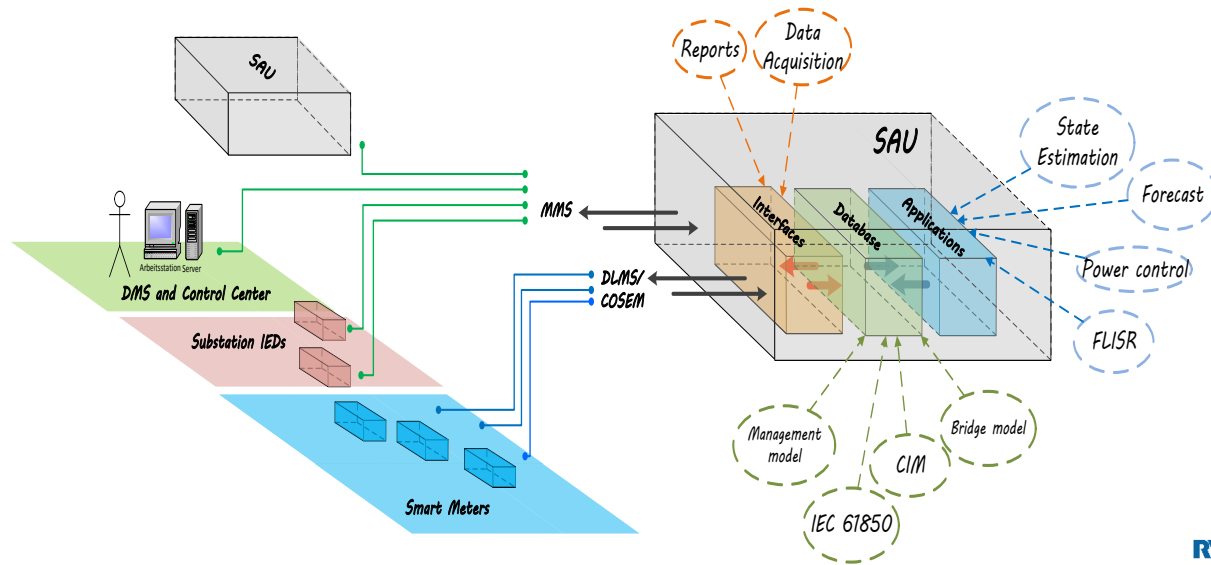
- Reduced number to limit investments
- Dual use (protections and monitoring)
- Smart processing for extracting more info from few sources: classical observability is not needed
- Getting digital as soon as possible



Active
Distribution
Management
System
A Project by RWTH



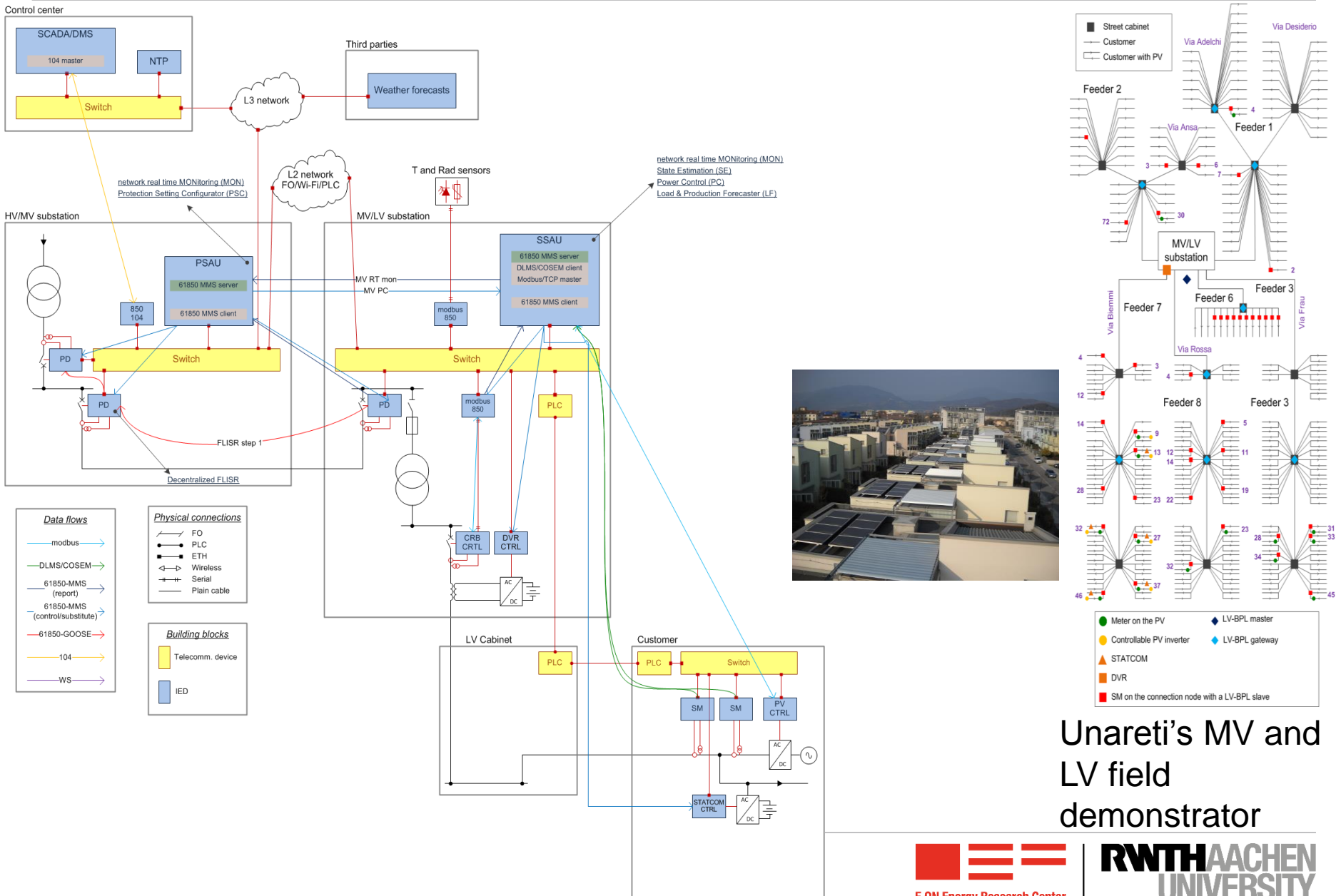
Substation Automation Unit: Distributed Intelligence solution for Active Distribution Networks



- A complete set of services for Substation Automation in a single low cost machine
- Structured with a distributed intelligence approach to support scalability in Distribution Networks
- Running live in the grid of Unareti (A2A)



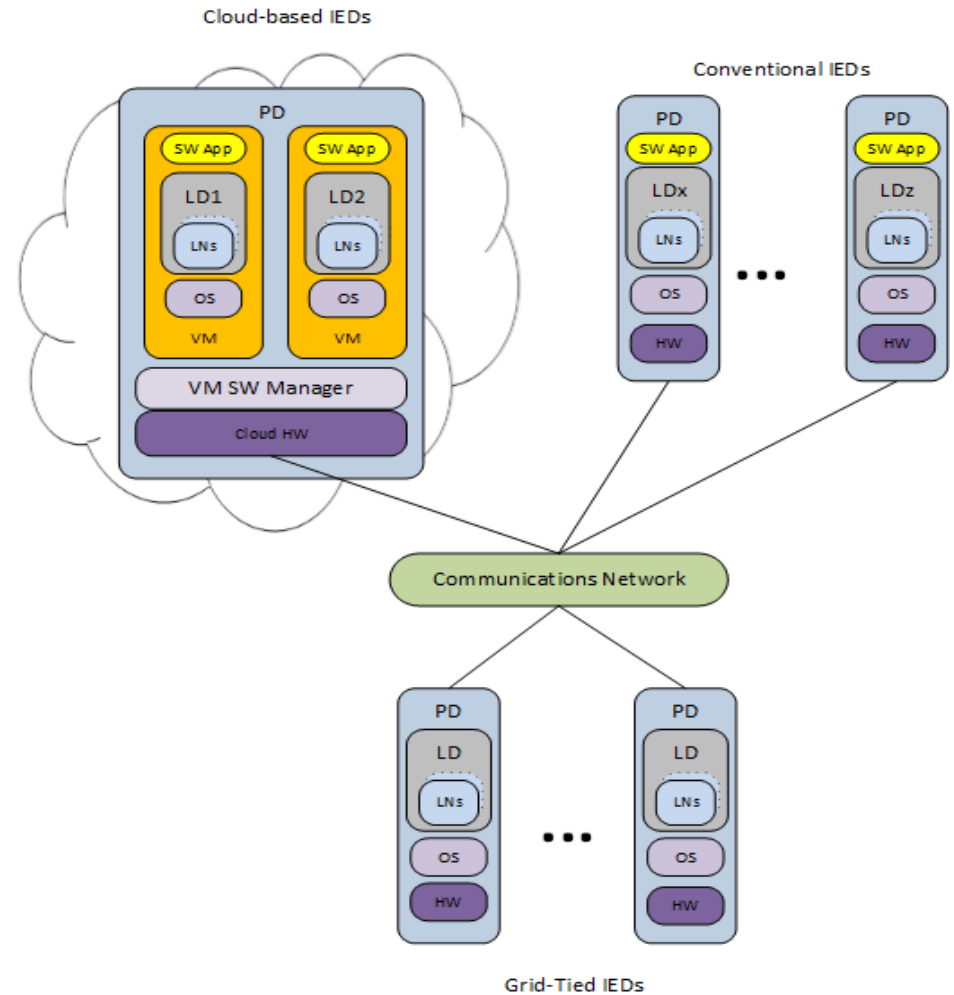
The real life experience



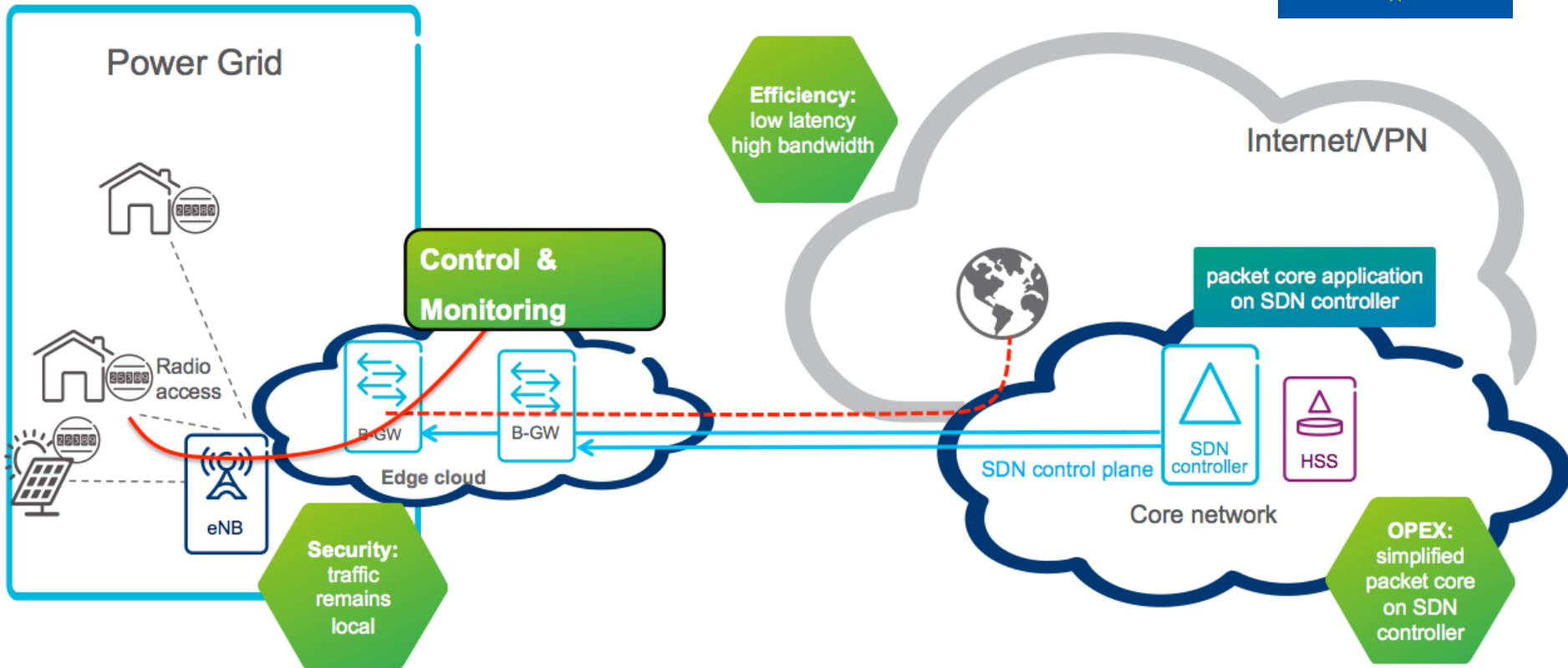
Unareti's MV and LV field demonstrator

Going virtual

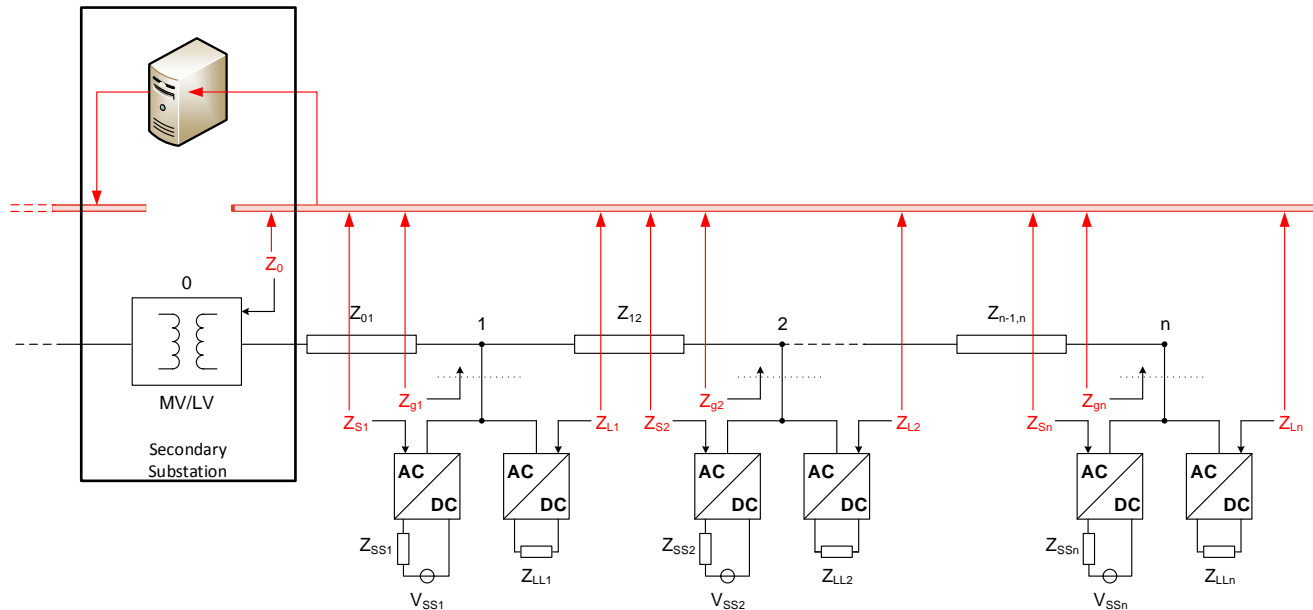
- Intelligent Electronic Devices (IED) can be fully virtualized by defining proper interfaces with the field
- Substation intelligent hardware becomes simply dedicated to digitalization and data transfer
- This architecture fits very well with the new standards for sensor interfaces and the concept of Data Aggregator in a substation



5G enables fast and secure virtualization



Courtesy of ERICSSON Eurolab



- Massive penetration of Distributed Energy Resources
- New automation concepts for Voltage and Frequency stability based on the full exploitation of power electronics
- 5G as key technology supporting the interaction among the DERs and with the Substation Automation

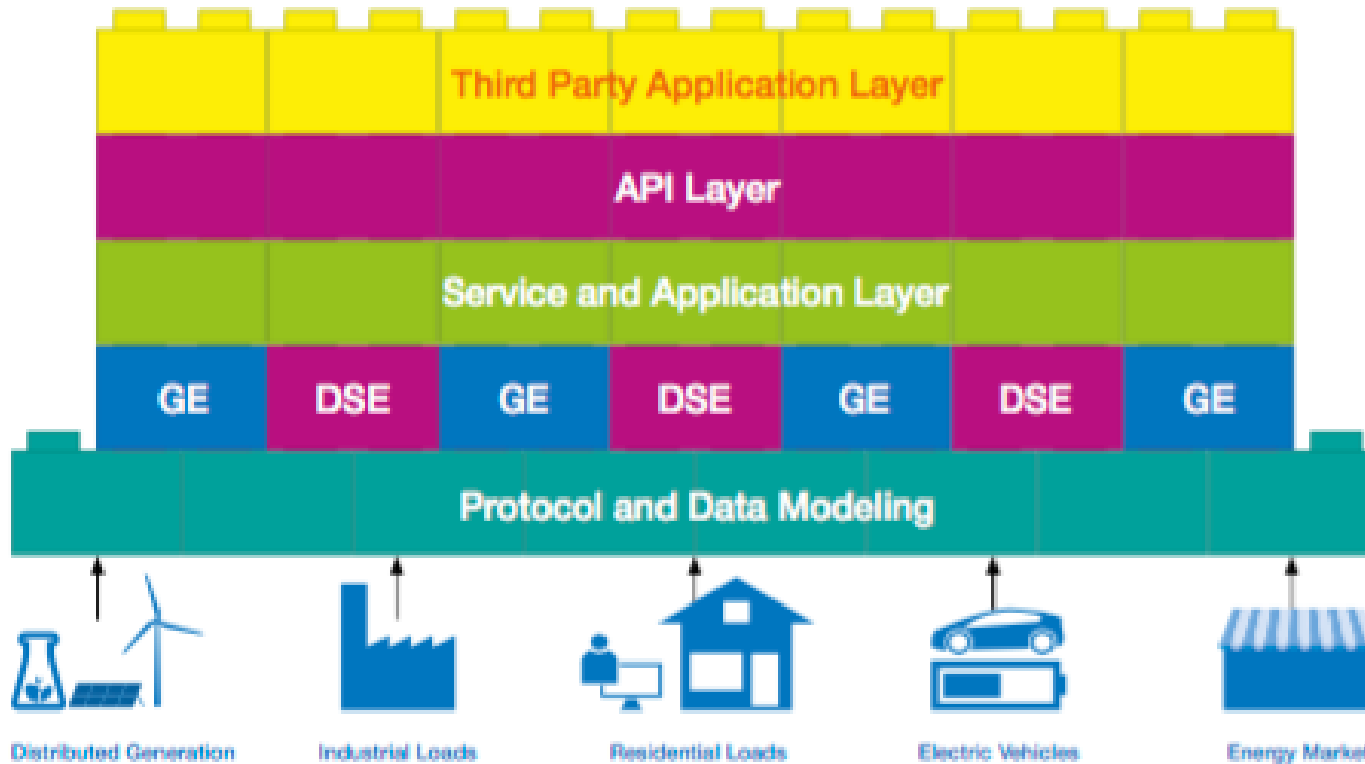
FIWARE and its catalogue

The screenshot shows a web browser displaying the White House website. The top navigation bar includes links for BRIEFING ROOM, ISSUES, THE ADMINISTRATION, PARTICIPATE, and 1600 PENN. The main content area features a 'Briefing Room' sidebar with a 'Statements & Releases' link highlighted. The central article is titled 'FACT SHEET: Announcing Over \$80 million in New Federal Investment and a Doubling of Participating Communities in the White House Smart Cities Initiative', dated September 26, 2016. A quote from President Barack Obama is included: "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. The article text begins with: "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." At the bottom of the article, there are two small images: one showing a generic implementation and another showing a novel service infrastructure building.

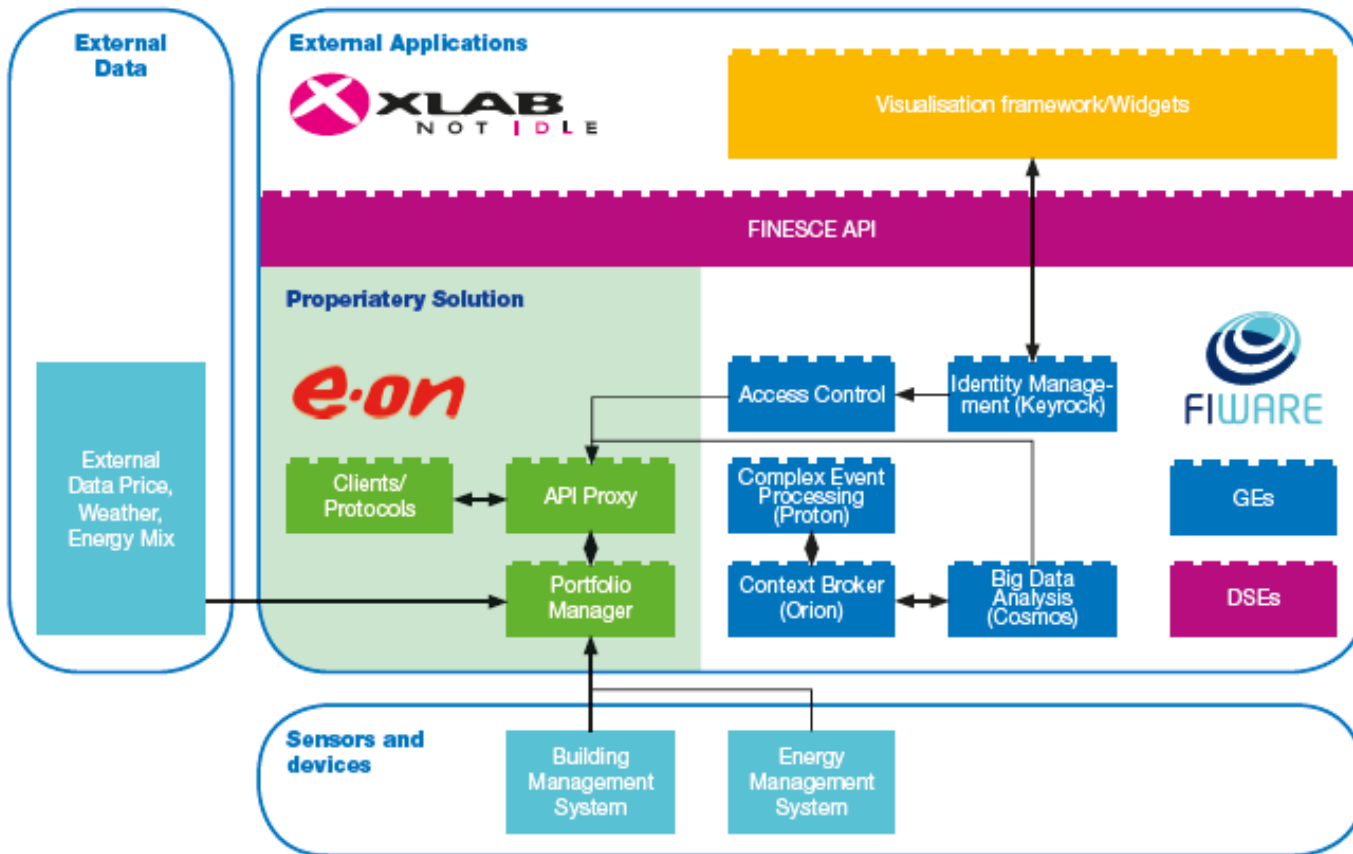
Open APIs for DSO ... just like LEGO



FINESCE: a FIWARE based platform for energy



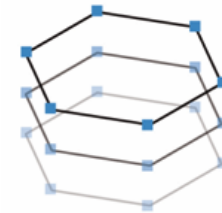
How to use it: example of architecture – E.ON Field Test



Going beyond the project

- Created 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)

- Promoting open API for DSO
- Developing solutions and identifying common elements to be standardized



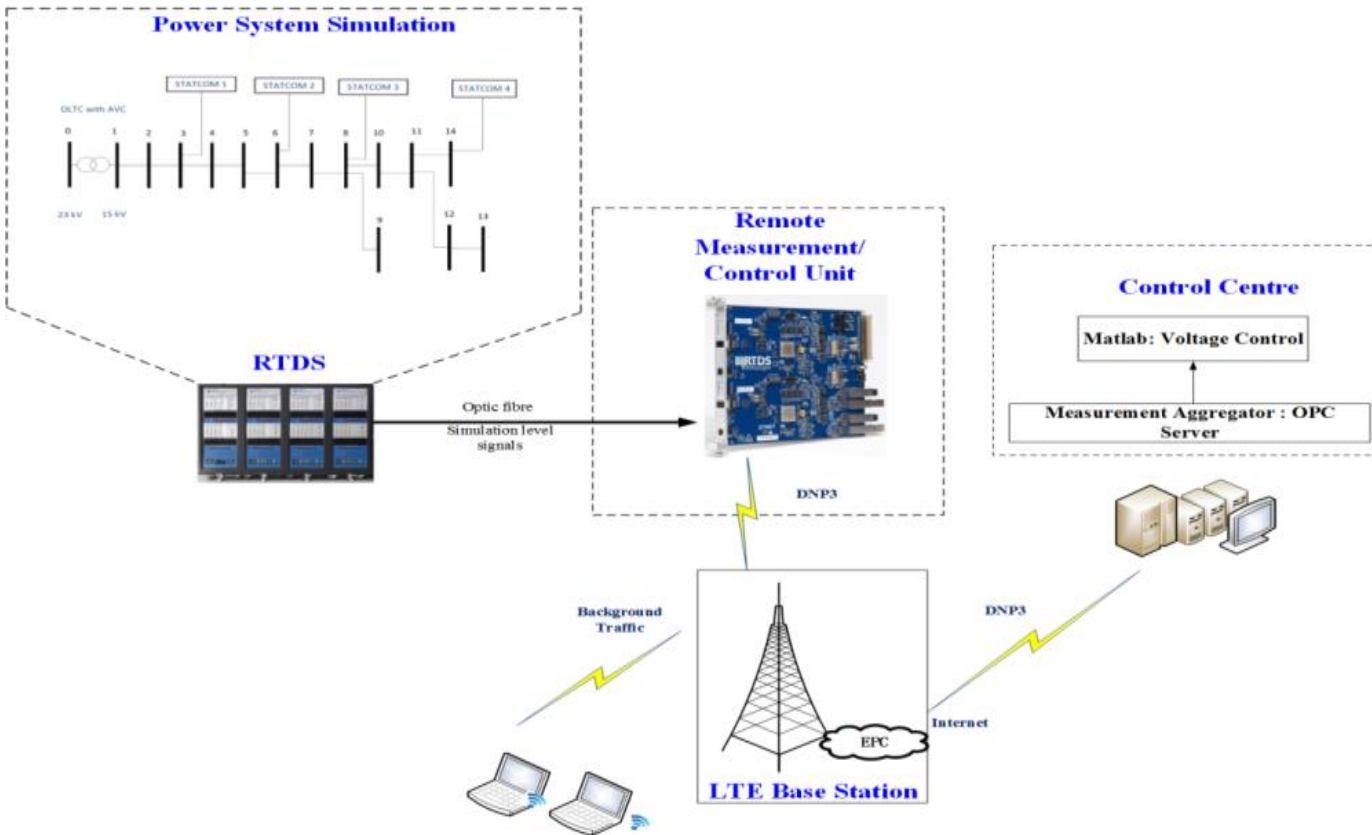
Flexible
Electrical
Networks

FORSCHUNGS
CAMPUS
öffentlich-private Partnerschaft
für Innovationen

GEFÖRDERT VOM
 Bundesministerium
für Bildung
und Forschung

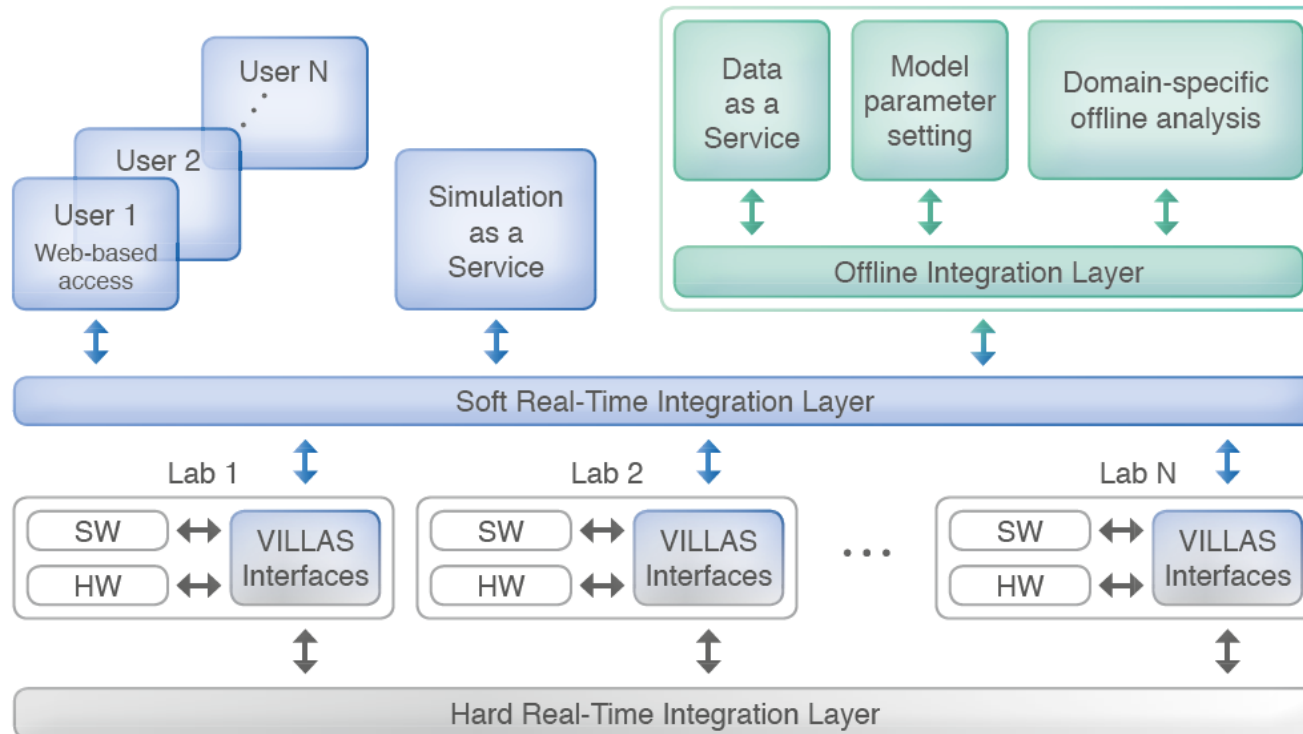


First level: test ICT and Energy together in a laboratory thanks to real-time simulation and Hardware in the Loop



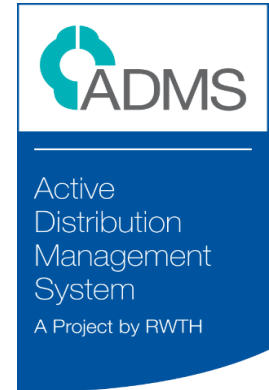


- Scaling up at European level thanks:
 - Open Source solution for RT simulation of electrical systems
 - Open Source SW for laboratory interconnection: getting a virtual view of the whole European Infrastructure



Conclusions

- ICT and Energy are more and more interconnected
- This cooperation is opening completely new frontiers
- 5G has the potential to be a real game changer



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