Austrian Innovative ICT Solution with European Systems-Level Validation

Overview of the OpenNES and ERIGrid Projects

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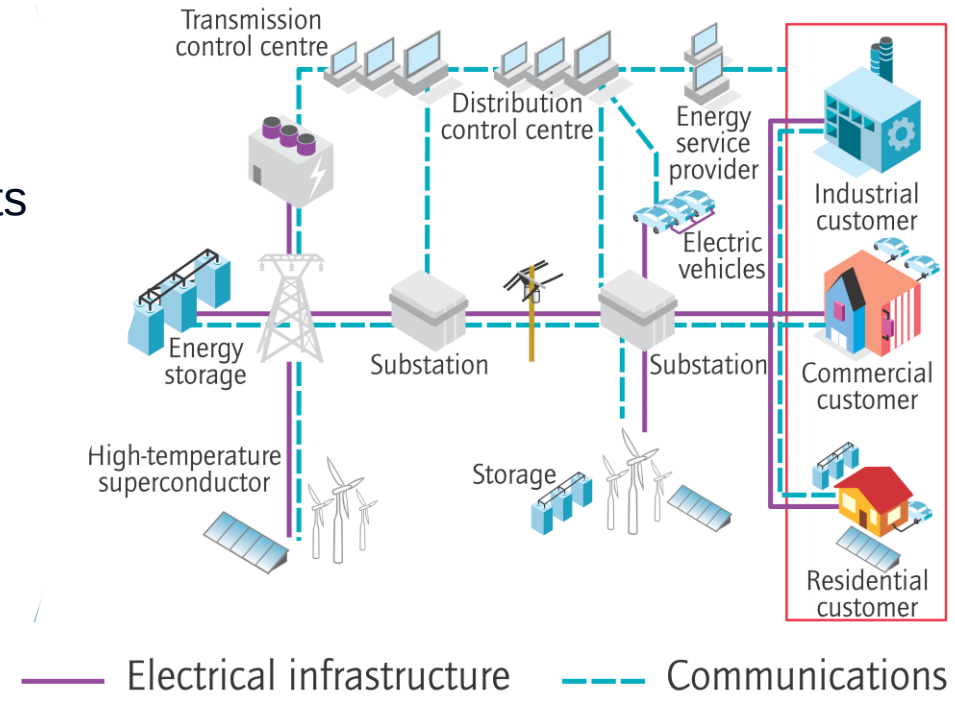
Outline

- Background and Motivation
- Need for Smart Grid Development and Validation Support
- OpenNES Model-Driven Design of Smart Grid Control Application
- ERIGrid System-Level Validation of Smart Grid Applications
- Conclusions

Background and Motivation

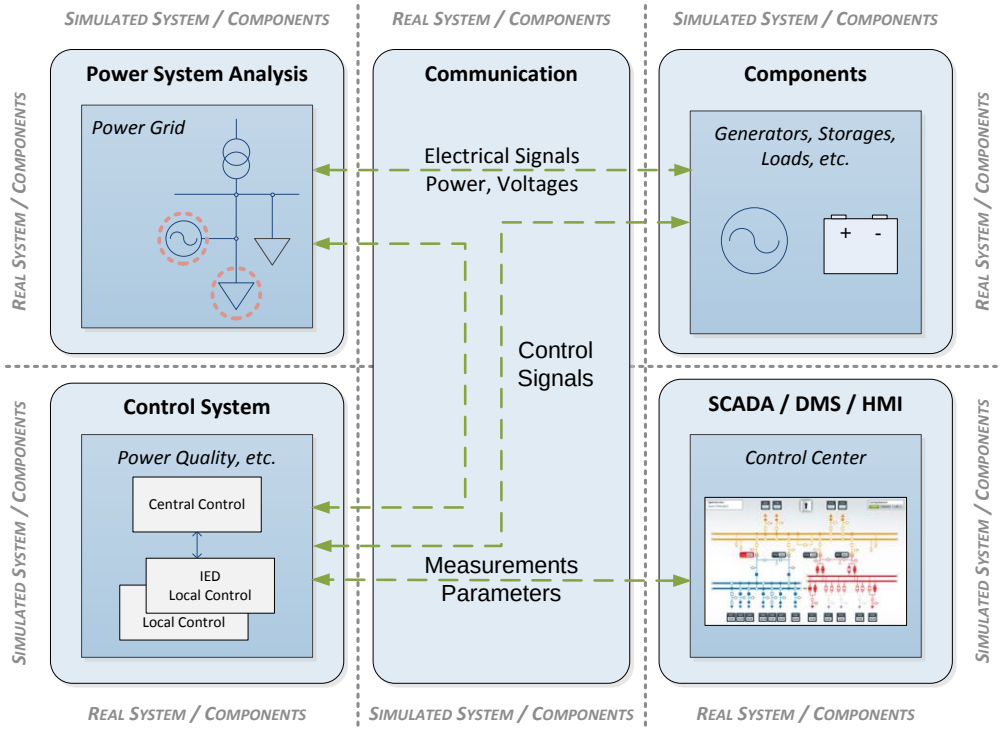
- The large scale integration of distributed, renewable generators and controllable loads makes the operation of the electricity grids more complex
- Advanced ICT approaches and smart algorithms are required to master the steadily increasing complex requirements
- Communication, automation and control systems are key elements of future smart grids
- Further trends: deeper involvement of consumers and market interaction



Source: IEA

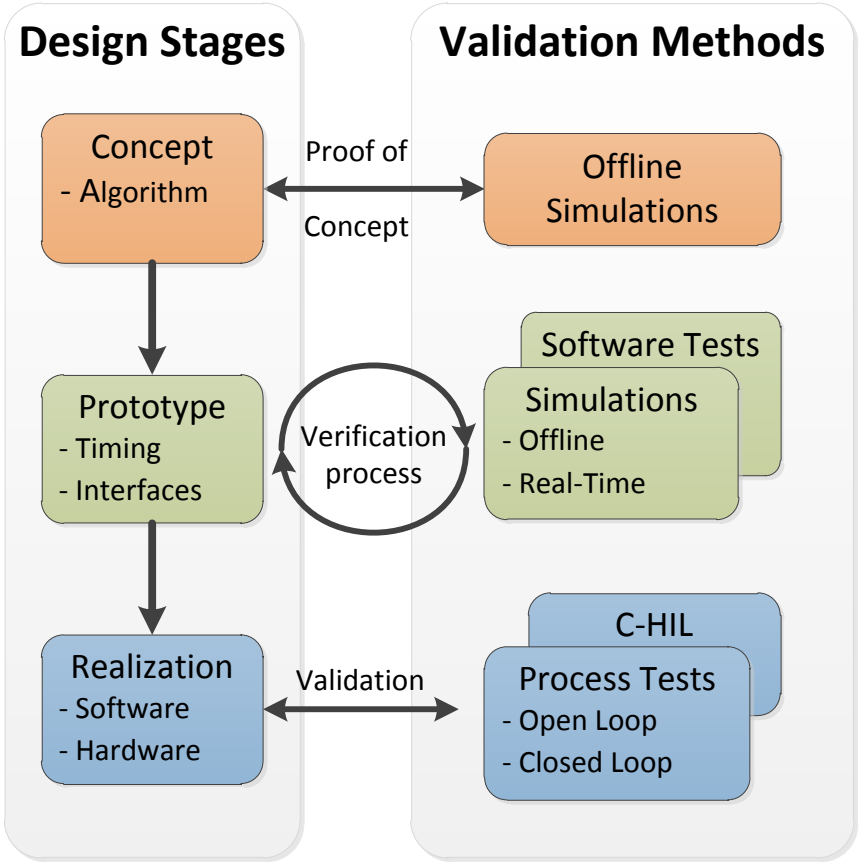
Need for Smart Grid Development and Validation Support

- Past
  - Individual domains of communication systems and power grids have been often designed and validated separately
- Future
  - Requirements in the smart grid context now demand a sim-ultaneous coverage of both domains
  - The complex design & validation process of smart grid systems requires appropriate tools and procedures



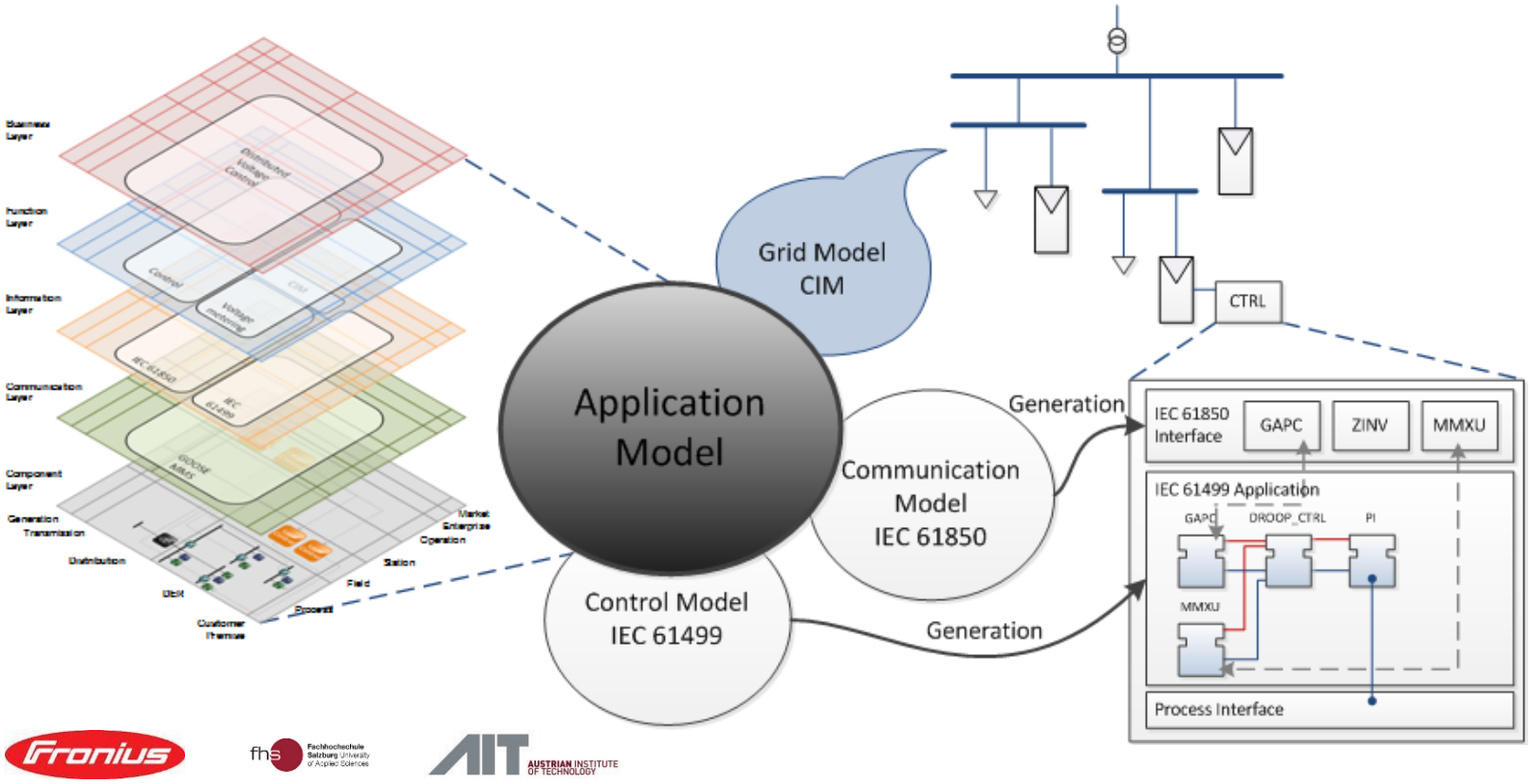
Need for Smart Grid Development and Validation Support

- Design stages and validation methods for developing smart grid solutions
  - Example: development and validation process of smart grid controller's (simplified)



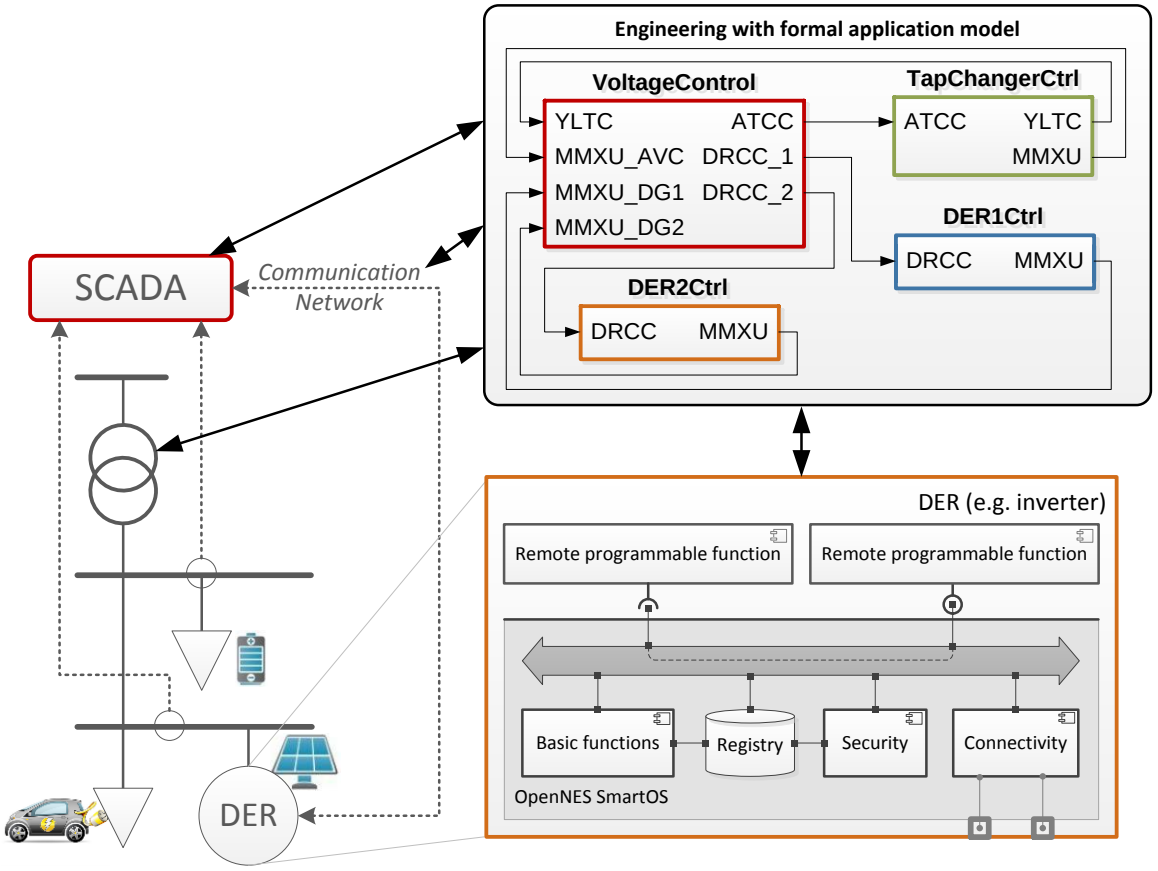
OpenNES Model-Driven Design of SG Control Application

- Motivation and vision: **“From design to implementation”**



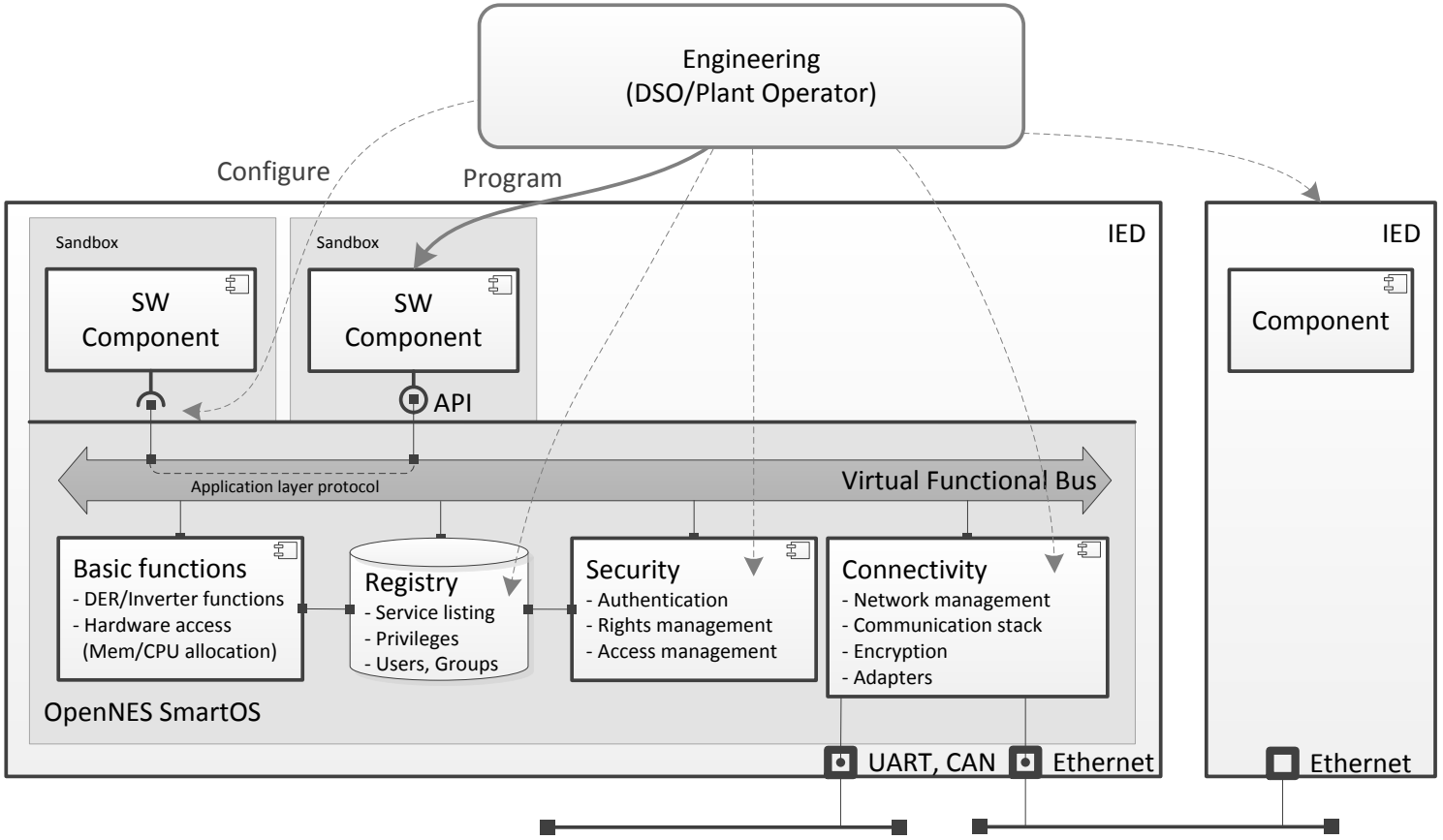
OpenNES Model-Driven Design of SG Control Application

- Objectives
  - Remote programmable DER device functions
  - Modelling support for control applications used in DER devices
  - A generic and open communication infrastructure



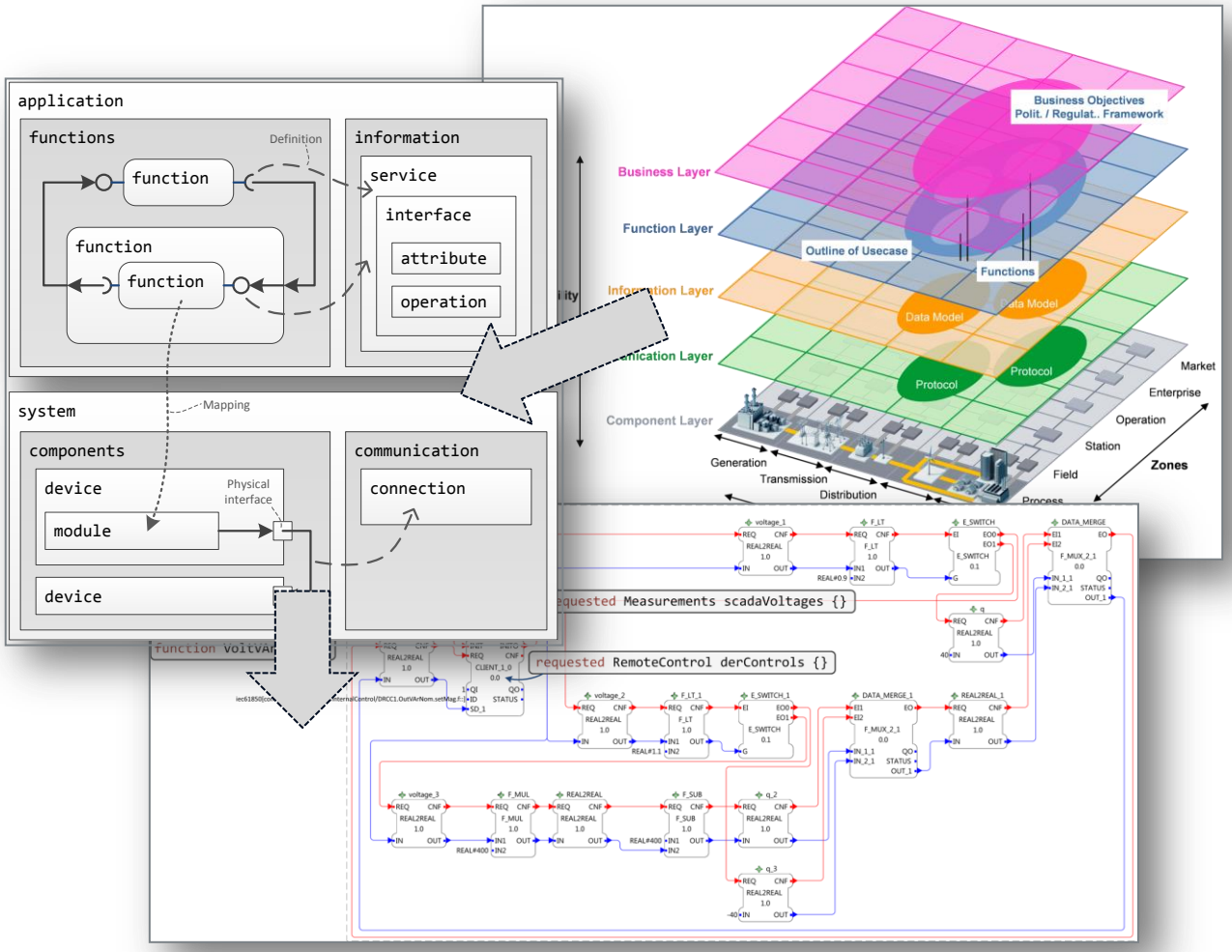
OpenNES Model-Driven Design of SG Control Application

- SmartOS for DER devices



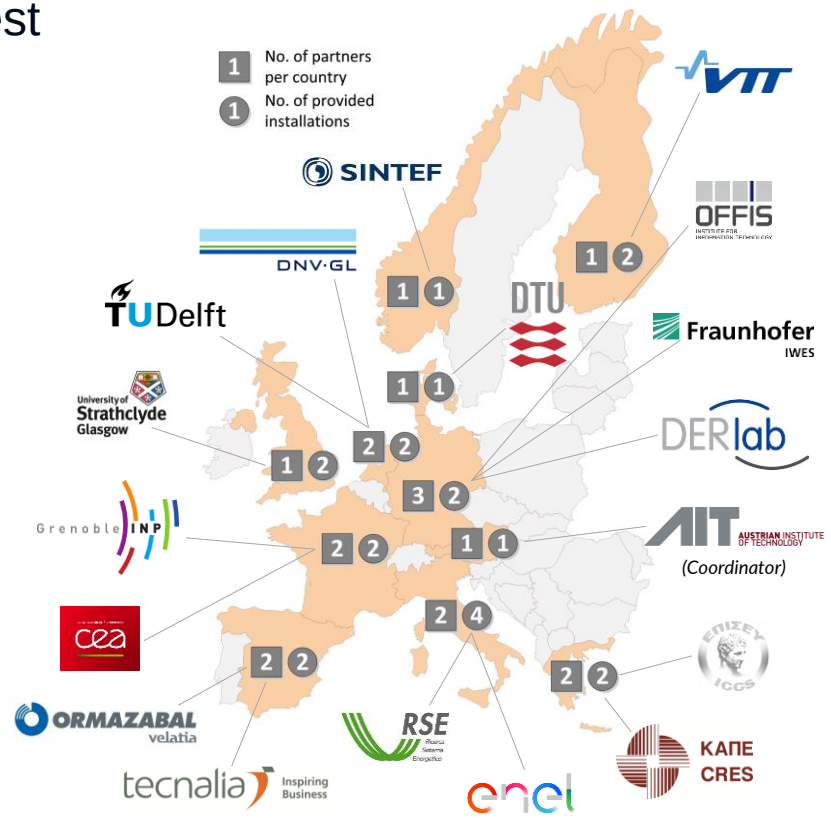
OpenNES Model-Driven Design of SG Control Application

- From domain-specific descriptions in the Smart Grid Architecture Model (SGAM) to executable control code (e.g., IEC 61850/ IEC 61499)



ERIGrid System-Level Validation of Smart Grid Applications

- H2020 Research Infrastructure (RI) project
  - Integrating and opening existing national and regional research infrastructures of European interest
- Funding instrument
  - Research and Innovation Actions (RIA)
  - Integrating Activity (IA)
- 18 Partners from 11 European Countries
- Involvement of 21 first class smart grid labs
- 10 Mio Euro funding from the EC (~1000 person month)

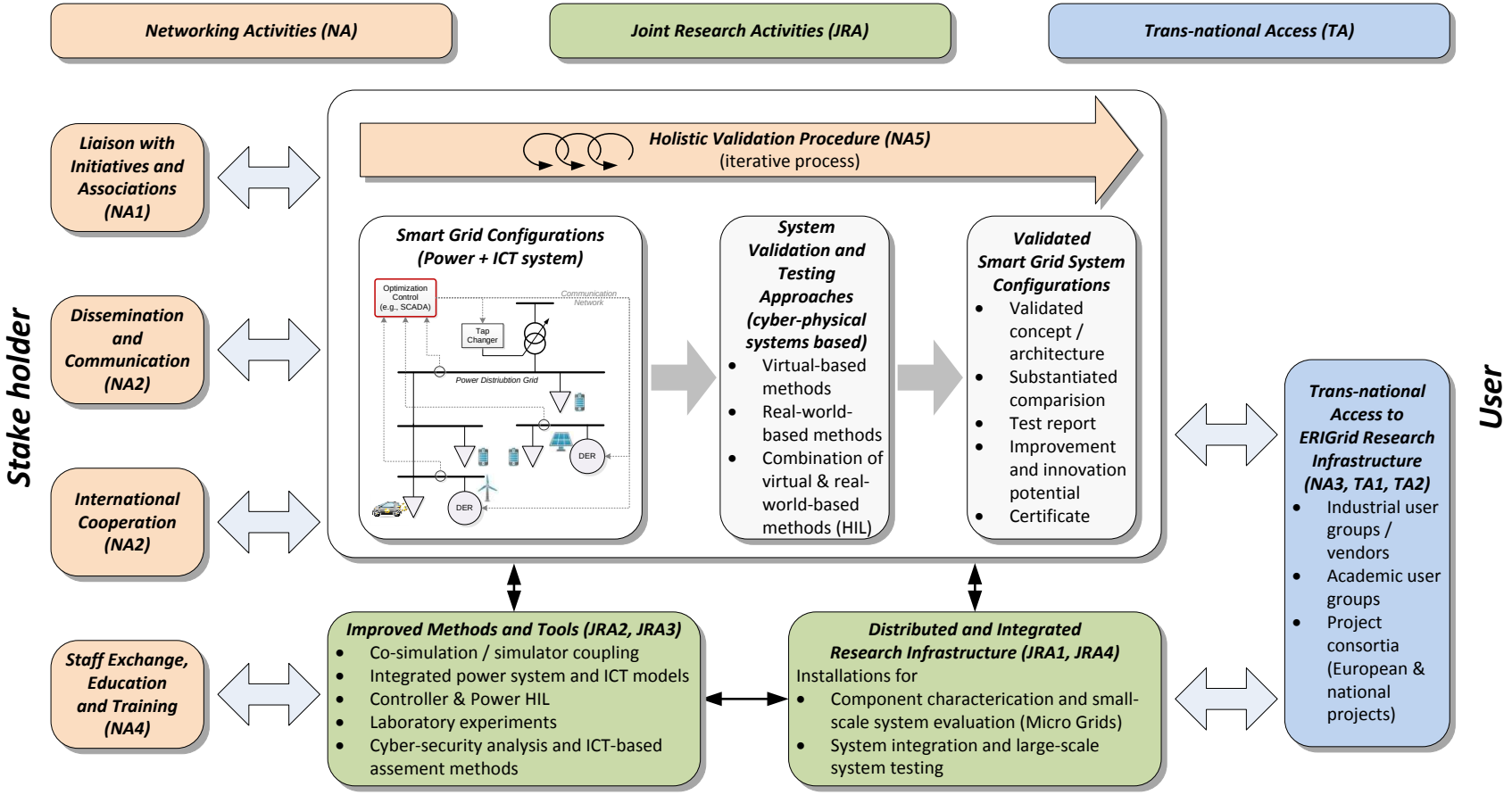


ERIGrid System-Level Validation of Smart Grid Applications

- Challenges
  - Smart grid – cyber-physical energy system: vastly complex, inter-dependent domains and heterogeneous components
  - Rigorous testing strategies required for validation of integrated systems
- Holistic testing approach – integrating different domains on system level
  - Incorporating components and sub-systems of different domains
  - Across distributed research infrastructures

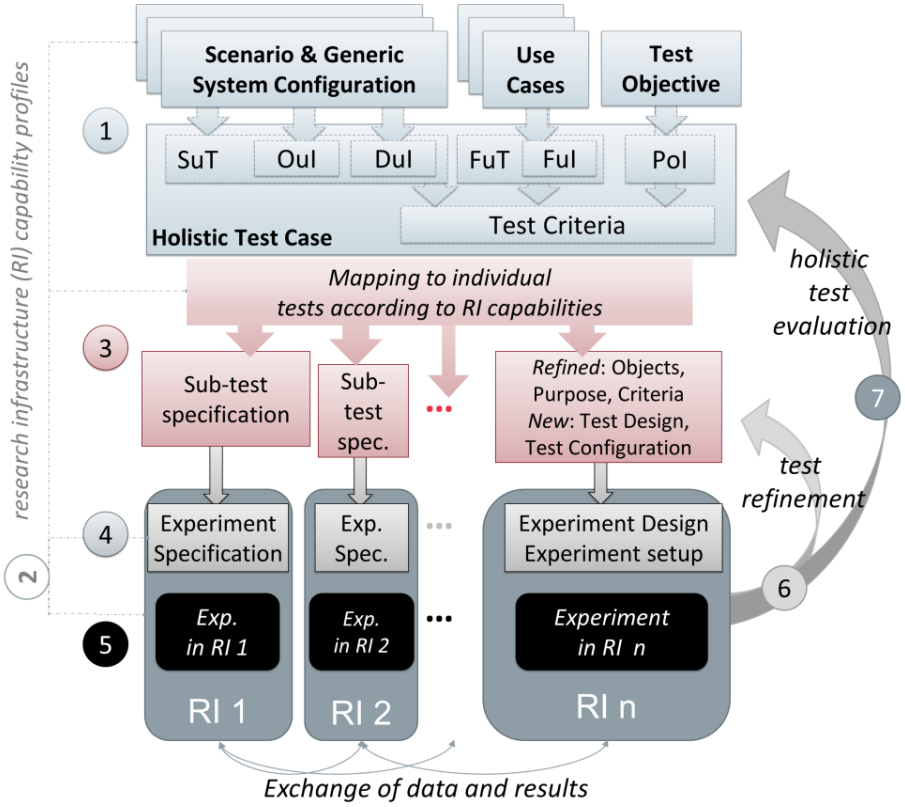
ERIGrid System-Level Validation of Smart Grid Applications

- Leading research infrastructure in Europe for the domain of SG



ERIGrid System-Level Validation of Smart Grid Applications

- Holistic test case specification: derived from a scenario and corresponding system con-figuration as well as use cases
- Research infrastructures profiling with regard to testing capabilities
- Mapping
  - Holistic test case to sub-tests
  - Sub-tests to labs
  - Specification of experiments



- Analysis and combination of results to obtain the criteria with which the holistic test is evaluated

Conclusions

- Future smart grid systems becoming more complex due to an higher automation degree
- In order to efficiently master the design, development and validation process advanced methods and tools are necessary
- Model-driven engineering and domain-specific concepts/models seems to be a promising approach
- Future activities and research should be focused on
  - Improvement and integration of design and validation tools from different domains (power system + ICT + markets + consumer behaviour)
  - Development of system level validation procedures and benchmark criteria
  - Improvement of research infrastructures supporting system level validation
  - Education, training and standardization is also a key factor

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Thank you!

Time for discussion

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