European Research Infrastructure supporting Smart Grid Systems Technology Development, Validation and Roll Out

TRANSNATIONAL ACCESS PROVISION

RESEARCH INFRASTRUCTURE DESCRIPTION AND
TRANSNATIONAL ACCESS CONDITIONS

OFFIS – Institute for Information Technology

Grant Agreement No:	**654113**
Funding Instrument:	**Research and Innovation Actions (RIA) – Integrating Activity (IA)**
Funded under:	**INFRAIA-1-2014/2015: Integrating and opening existing national and regional research infrastructures of European interest**
Starting date of project:	**01.11.2015**
Project Duration:	**54 month**

Project co-funded by the European Commission within the H2020 Programme (2014-2020)

1 Research Infrastructure

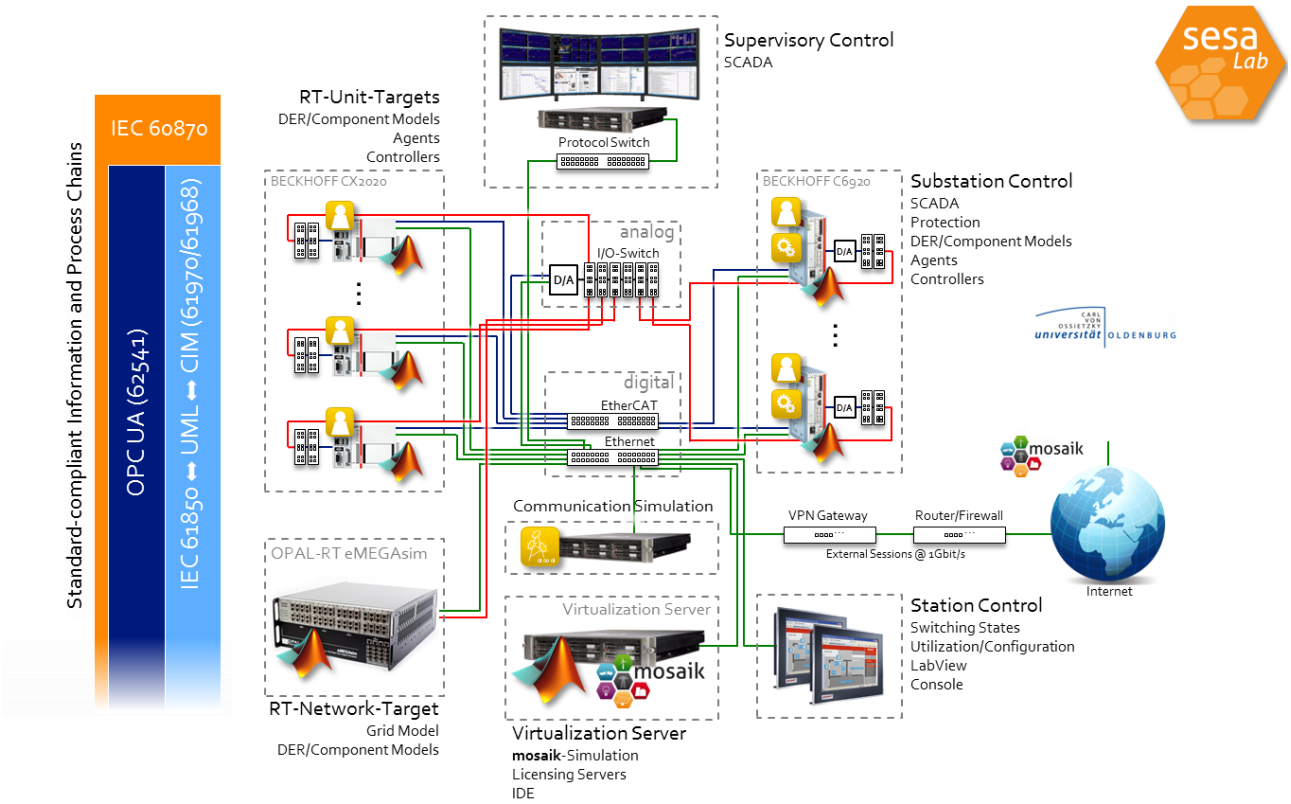
Name of Infrastructure/Installation	**Smart Energy Simulation and Automation Laboratory (SESA-Lab)**
Location	OFFIS – Oldenburg, Germany
Web Site	*www.offis.de/en*

2 Description of the Research Infrastructure

The core of the automation lab is a real-time simulator (eMEGAsim) from OPAL-RT that allows for the execution of highly detailed, dynamic power grid- and network component models on dedicated FPGA-based signal processors. With this the dynamic/ transient behaviour of an electric AC system can be resolved with an accuracy of up to 10 µs (max. 100 kHz). The power grid simulator provides analogue interfaces that forward the AC signals of the grid. This HIL operation of real devices and components.
In addition to that, the lab consists of additional embedded (FPGA-based) platforms that are directly connected to the eMEGAsim (analogue and digital I/O) and can be used for various purposes, such as real-time platforms, which can execute device- and component models on MATLAB/Simulink basis in real-time (similar to the power grid simulator), or as standard industry components that are able to implement standard-compliant controllers or even complex agent-based control strategies. The systems with the highest performance are additionally operated as substation platforms in order to realize control- and protection systems.
A special feature of the SESA-Lab installation is the topology free allocation and combination of inputs and outputs. That means access and visibility can be controlled in a rule-based manner for the Ethernet- and EtherCATbased component-to-component communication. Furthermore, the analogue inputs and outputs of the real-time platforms can be virtually interconnected. This allows a flexible connection of the dynamic component models with different nodes of the real-time simulation without significant manual changeovers. The virtual and topology free connection even enables the parallel operation of independent simulations/experiments in standard-compliant power system automation environments.

Another part of the lab is a virtualization server that can provide virtual machines for mosaik-based (open source power/ICT simulation coordinator) simulations (lower-resolution parts of the analysed scenario that run conjointly in parallel with the hardware-based real-time simulation), development environments, or licensing servers for possible runtime environments. The external interface allows connections to research infrastructures provided by the University of Oldenburg, e.g., the HERO cluster (High-End Computing Resource Oldenburg) that can be used for significantly more extensive complex mosaik-based simulation scenarios that are co-simulated and synchronized with the hardware-based component simulations of the SESA-Lab. However, the interface foremost provides the possibility to integrate infrastructures from external research- and cooperation partners into the SESA-Lab. This is of special interest for the functional integration of testing equipment for power electronics and components located at external universities and institutes – which is comfortably to handle with mosaik.
The SESA-Lab relies on integrated standard-compliant information- and process chains based on

the IEC Common Information Model (CIM; IEC 61970/61968), IEC 61850, and the OPC Unified Architecture (UA). This covers the whole process starting in the (planned) control centre down to the controllers and various field devices.
A control centre simulation has been added to the SESA-Lab environment realizing a transparent SCADA-based viewpoint and operation of the co-simulated (both hard- and software, remote and on-site facilities/components) system, as well as the protocol families covered by the IEC 60870, the industry standard for telecontrol and power system control. In order to realistically influence message transfer time and communication reliability, a communication emulator capable of adding latency and jitter to nanoseconds accuracy and repeatability has been deployed in the lab.



3 Services offered by the Research Infrastructure

- Prototyping for Smart Grid control concepts
  - Black / White / Grey Box testing
  - Centralized and decentralized control approaches (e.g., Multi-Agent Systems)
  - Standard compliant communication and control from devices up to SCADA systems
- Large scale Smart Grid simulations
  - Holistic system approach (design of experiment based statistical experiments)
  - Coupling heterogeneous simulations
  - Integrating frequency and time domains
  - Parallel simulation of scenarios (up to 100.000 simulator instances per scenario)
  - Transparent SCADA viewpoint and control of the conjointly (heterogeneous) simulated system

4 Brief description of the organization managing the Research Infrastructure

The OFFIS – Institute for Information Technology is associated institute of the Carl von Ossietzky University of Oldenburg in Germany and federally base-funded by the state of Lower Saxony. It is primarily dedicated to technology transfer of computer science knowledge into enterprises and organisations and has a total turnover of more than 13 million €. Approximately 230 researchers work in the three application areas Energy, Healthcare, and Transportation.

The ERIGrid project is executed by the Energy division, which dedicates its research to a variety of aspects regarding the future smart grid and deals with topics like interoperability, standard-compliant IT integration of distributed producers and consumers, large and flexible distributed software architectures for business contexts within the energy domain, simulation, and intelligent data management.

5 Transnational Access conditions offered by OFFIS

All the offered experimental systems included in the SESA-Lab are in the same building in OFFIS.

User groups from one up to four persons are welcome for a typical stay from 2-4 weeks. This period could be extended or remote access provided after the stay depending on the individual user project. The scheduling of the experiments depends on the usage of the lab and has to be agreed on before the stay. Furthermore, a user agreement must be signed before the stay. Support and advice on accommodation and transportation to OFFIS will be offered by OFFIS staff.

During the stay, an office space will be provided for the user group and access to the related facilities will be given. A training and introduction to the lab facilities will be given shortly after arrival. An introduction to mosaik can be given as well. For using hardware in the lab the support by staff is necessary. Supervision and help by the staff will be provided throughout the whole stay.

OFFIS's researchers will support the realisation and follow-up of the experiments and will support the results interpretation, data processing and analysis, and test report preparation.

Reimbursement of expenses:

User expenses for the Transnational Access are paid by ERIGrid (EU H2020 Programme). This includes travels to SESA-Lab (OFFIS) by train or plane, accommodation, daily subsistence, and daily transportation during the stay.

For the user projects taking place in SESA-Lab, OFFIS will refund the stay expenses when the stay is finished: the user must declare the incurred expenses and present the invoices/receipts to OFFIS in order to get the refund. Logical expenses must be made by the user: travels will be made in economy class and conventional hotels (not luxury) or equivalent accommodation will be used. Lunch cannot be provided at OFFIS's canteen free to the user.

6 Contact details for Research Infrastructure

<table>
<tr><td colspan="4">Smart Energy Simulation and Automation Laboratory (SESA-Lab) – OFFIS
Address: Escherweg 2, 26121 Oldenburg, Germany
Website: http://www.offis.de/en</td></tr>
<tr><td colspan="2">For Management/Organization Issues:</td><td colspan="2">For Technical issues:</td></tr>
<tr><td>Davood Babazadeh

Tel.: +49 441 9722 233
E-mail:
davood.babazadeh@offis.de</td><td>  </td><td>Martin Büscher

Tel.: +49 441 9722 740
E-mail:
martin.buescher@offis.de</td><td>  </td></tr>
</table>