CIM CGMES Applications in research projects for DER

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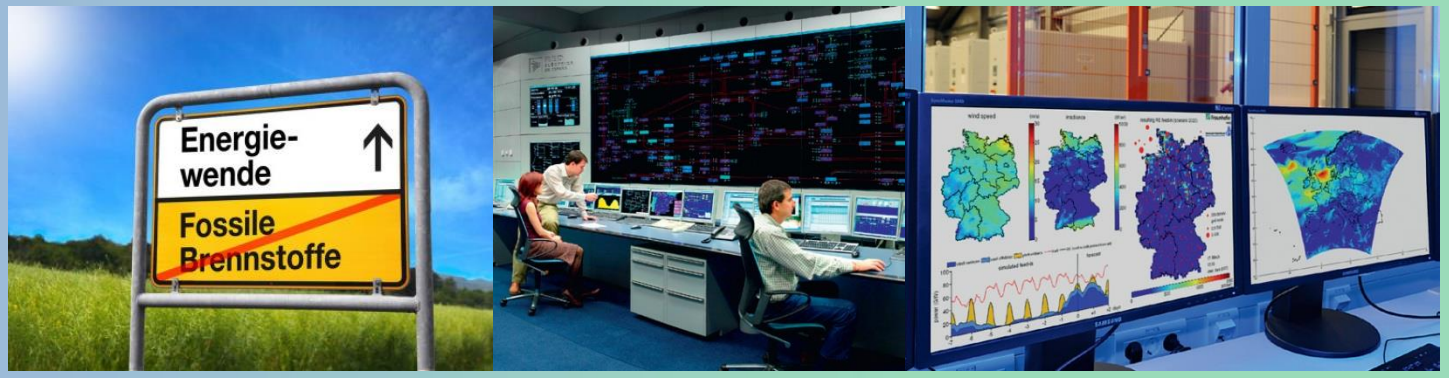
- Fraunhofer IWES Kassel, Königstor 59



Fraunhofer-Institut für Windenergie und Energiesystemtechnik
www.iwes.fraunhofer.de
www.herkulesprojekt.de

CIM Users Group Meeting 2017 – Europe / Germany / Herzogenaurach

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Overview

- Introduction
- Research Demonstrator
- IT Architecture of the Demonstrator
- Simulation
- Interaction with IEC 61850

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- **Introduction**
- CIM based Research Demonstrator
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Introduction

- Ancillary services generated from distribution grids become more important
- Need to coordinate and exchange large amounts of data
- Need scalable and transformable solutions => CIM/CGMES
- Field Test Demonstrator with CGMES data model

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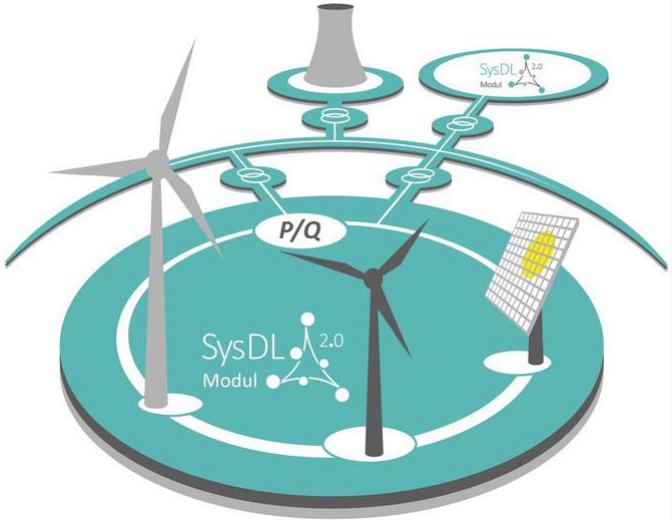
Research Project „SysDL2.0“

- Consortium of three DSO and one TSO as well as Research and Technology Institutes
- 3.5 Years Duration (2014 - 2018)
- Goals:
  - Ancillary Services from Distribution Grids
  - Development of Optimization Algorithms
  - New ways of using DER
  - Standardized System Architecture and Data models
  - Laboratory and Field Test Demonstrator



www.sysdl20.de

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Why we chose CIM CGMES

- We needed:
  - a way to export DSO data from operating system into demonstrator
  - one data model for all participating DSO
  - standardized data model (not propriety)
  - Interface support from manufacturers
  - continuity towards TSO

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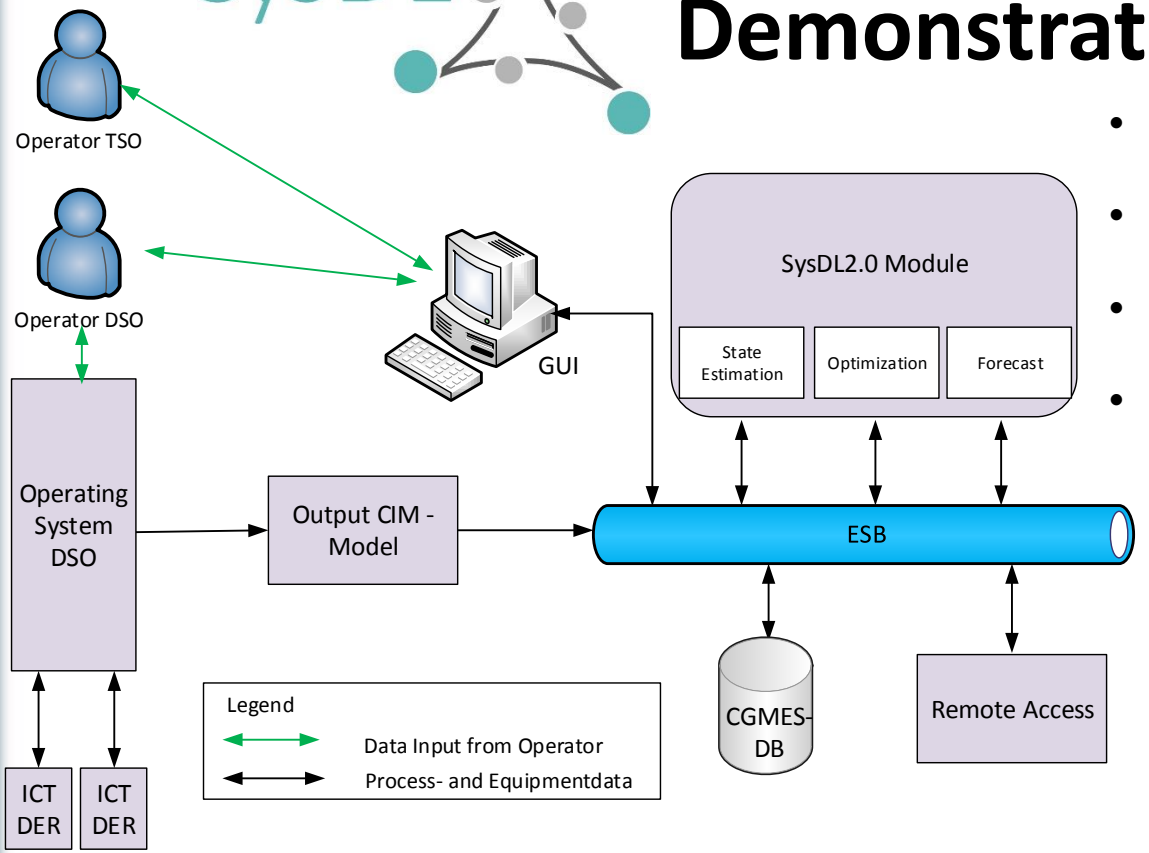
Why we chose CIM CGMES

- Synchronized data model between TSO-DSO and external modules as basis for visualization or consistency checks between topology and current network state
- Provision of equipment master data for the use in real-time OPF and planning issues
- Provision of online measurement data and topology changes for the use in visualization, load flow computations, OPF or State-Estimation
- Basis for unique identification of network elements in communication between network operators
- Basis for processing of scheduled switching operations and topology changes as well forecast data
- Various operating systems in various versions in use → common interface needed
- Data models often proprietary → misinterpretation of data
- Processing data and application of external additional functionalities (OPF, State Estimation, ...) → no conversion needed
- Common Information Model (CIM) leading data model for energy systems
- Provider and platform independent communication with system operation programs via CIM → no vendor lock
- Sustainable through easy extendable components at the interface
- ...

Demonstrator



- Parse CIM/CGMES files
- Store it into CGMES database
- Module have DB access via ESB
- Modules using CIM data are:
  - Topology Processing
  - State Estimation
  - Optimization (ancillary services)
  - Forecast Processing
  - GUI visualization (Web application)

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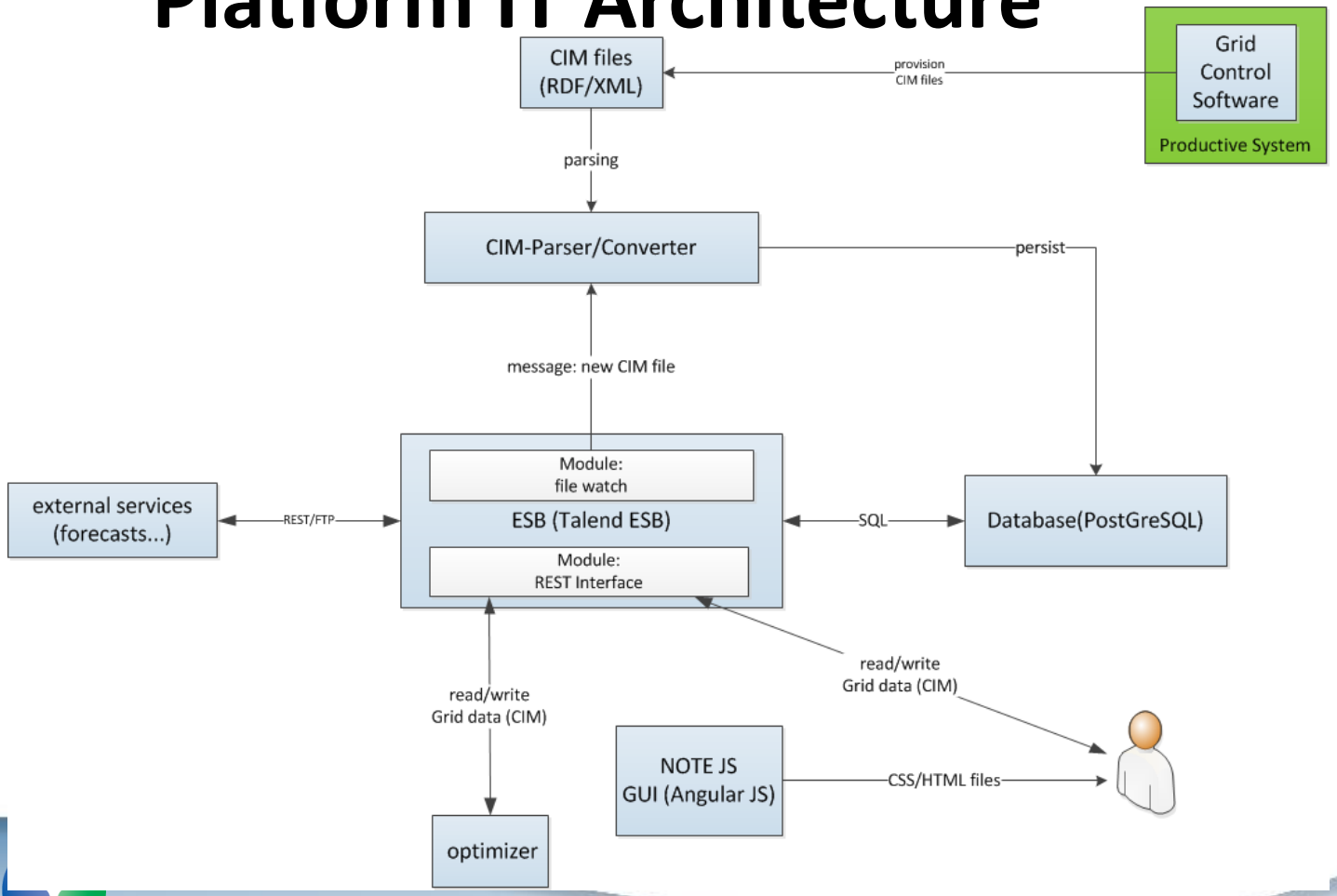
Platform IT Architecture



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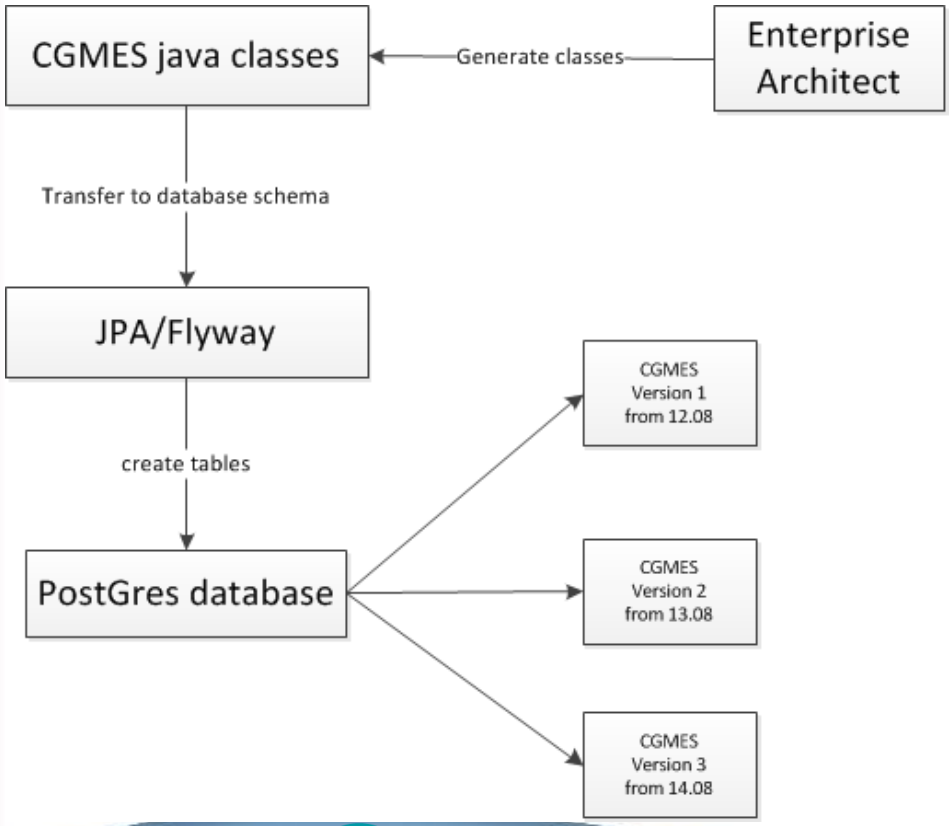
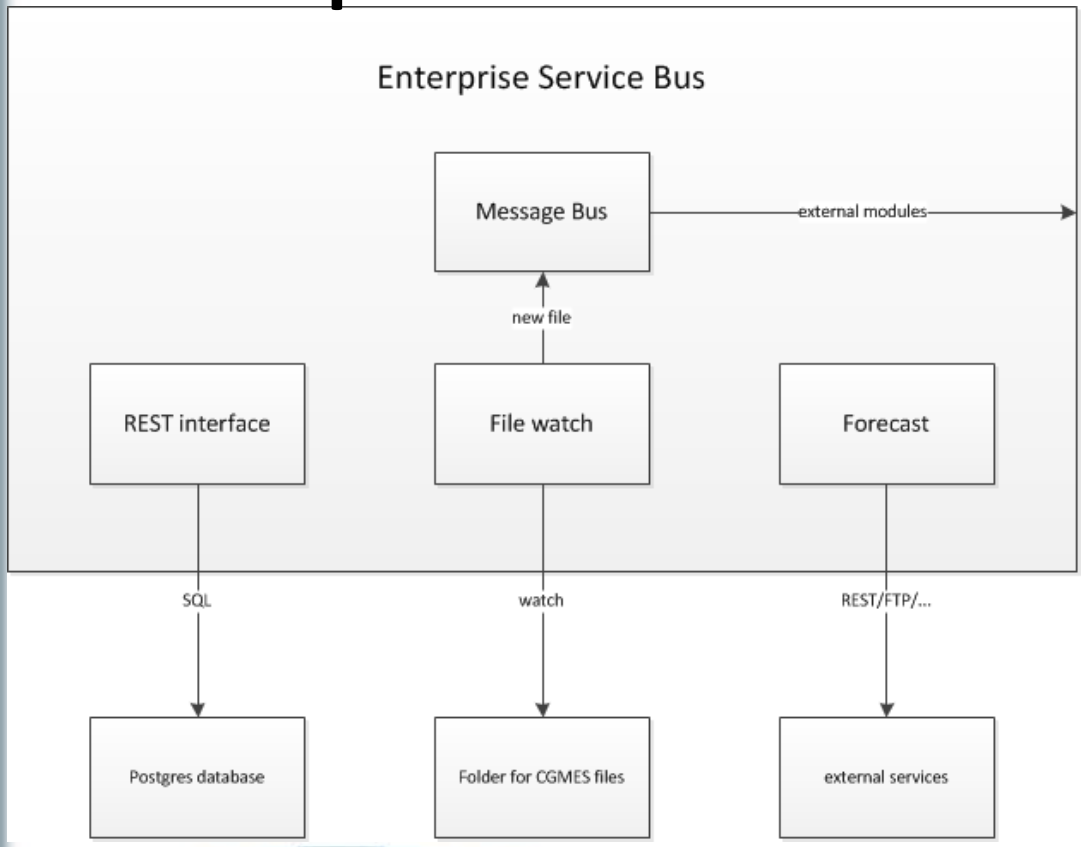
Component overview: Database



- EA generate java classes (manual)
- Flyway integrate data model to DB (automatic)
- User/module can extract CGMES versions

Component overview: Enterprise Service Bus



- Talend ESB
- Configuration via Talend ESB studio
- ESB modules deployed in OSGI framework (karaf)
- activemq as message bus

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“External / Additional” Modules

- Run standalone or as deploy in Liferay
- Not direct access to the database
- Read and Write over REST interface CGMES data
- Convert or extract CGMES data into own data model
- Write CGMES objects as output
- Modules are e.g. GUI, OPF, Forecast, ...

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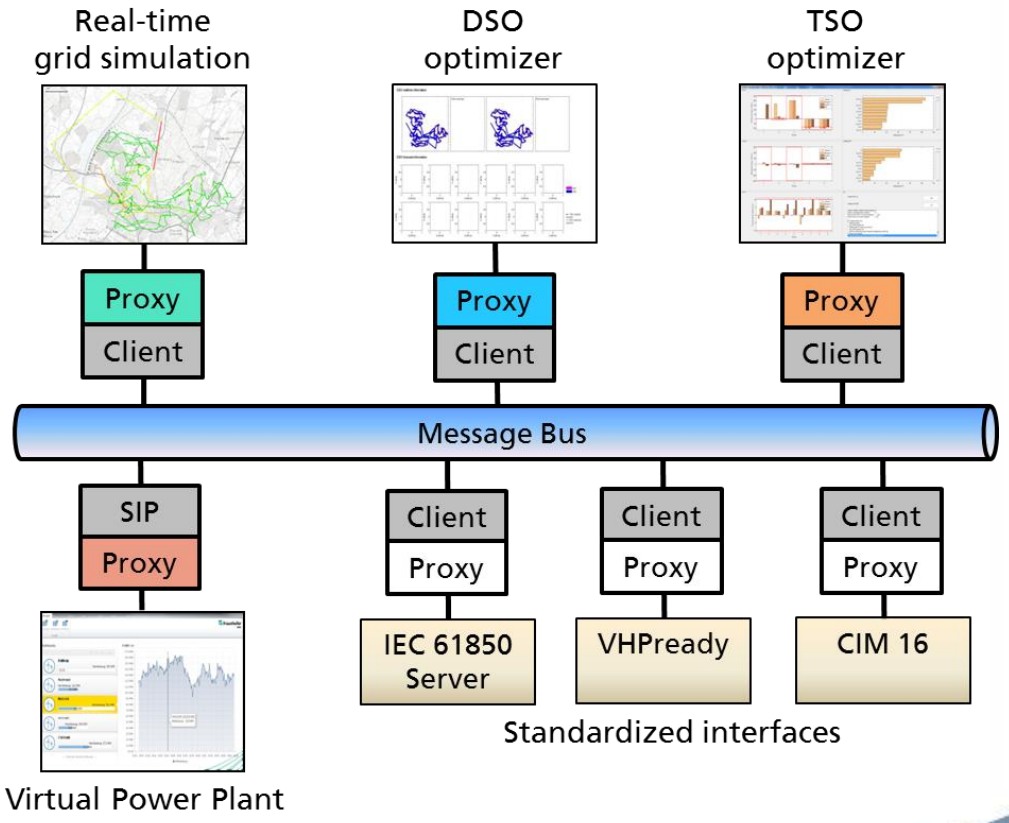
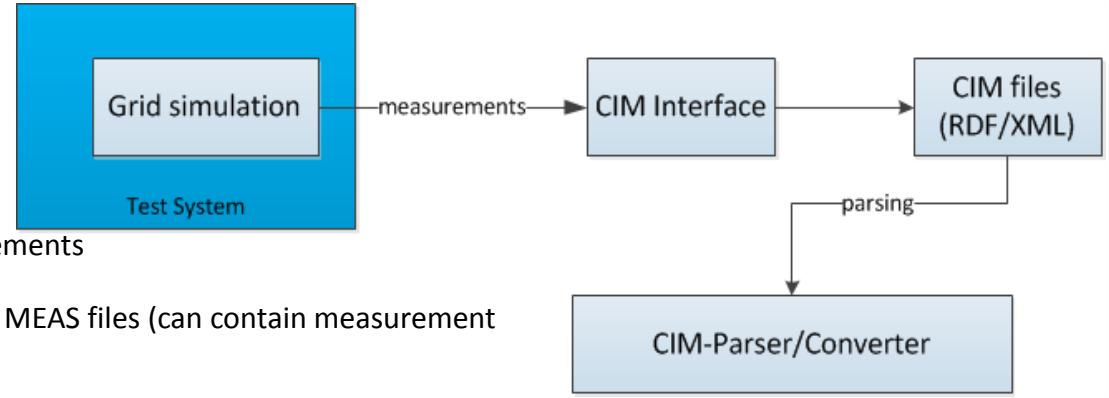
Simulation Environment OpSim

- Study interactions between multiple grid operation strategies (= optimizers)!
- **Test** of e.g. Q-management algorithms in real-time, prior to field testing!
- Using **standardized interfaces** (CIM, IEC61850, VHPready), one can connect **software from external partners** to OpSim!
- Accessible via **Webservice** from anywhere
- Test **interfaces** and communication protocols



Simulation sequence

1. CIM interface receives data (measurements) from grid simulator (OpSim)
2. CIM interface reads equipment and topology files for mapping the measurements onto CIM objects
3. CIM interface creates analog/analogvalues in own file and profile (Measurement profile)



4. CIM interface can add errors to the measurements
5. CIM interface creates SSH file (at beginning), MEAS files (can contain measurement errors), SV files (no simulated error)
6. Files will be parsed and stored to DB

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Interaction with IEC 61850

- Complete simulation of grid data exchange
  - CIM for talking over the grid
  - IEC 61850 for talking to the grid
- IEC 61850 interface for OpSim (grid simulation)
- Transform grid simulation data model into IEC 61850 data model
- Send and receive data over IEC 61850

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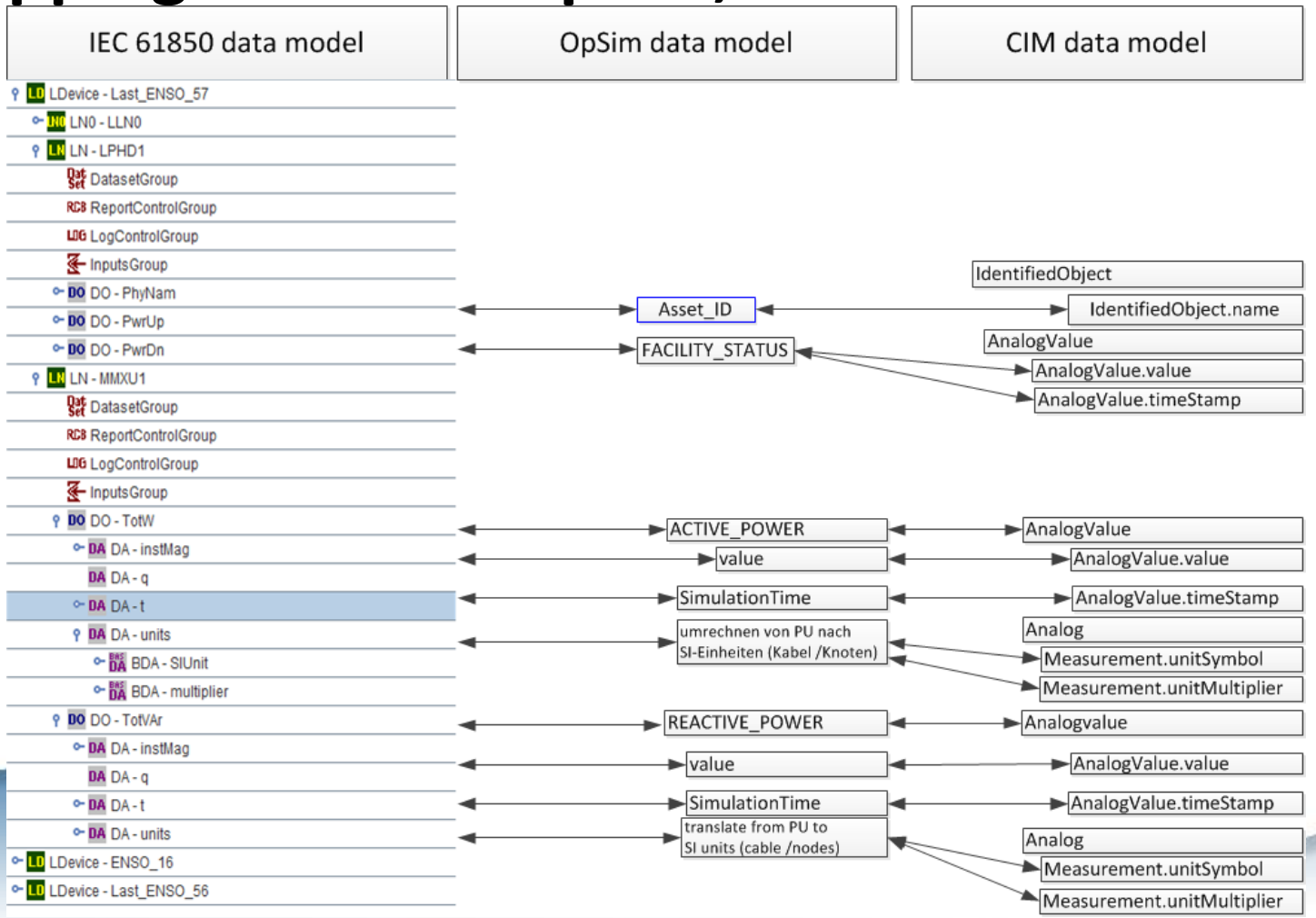
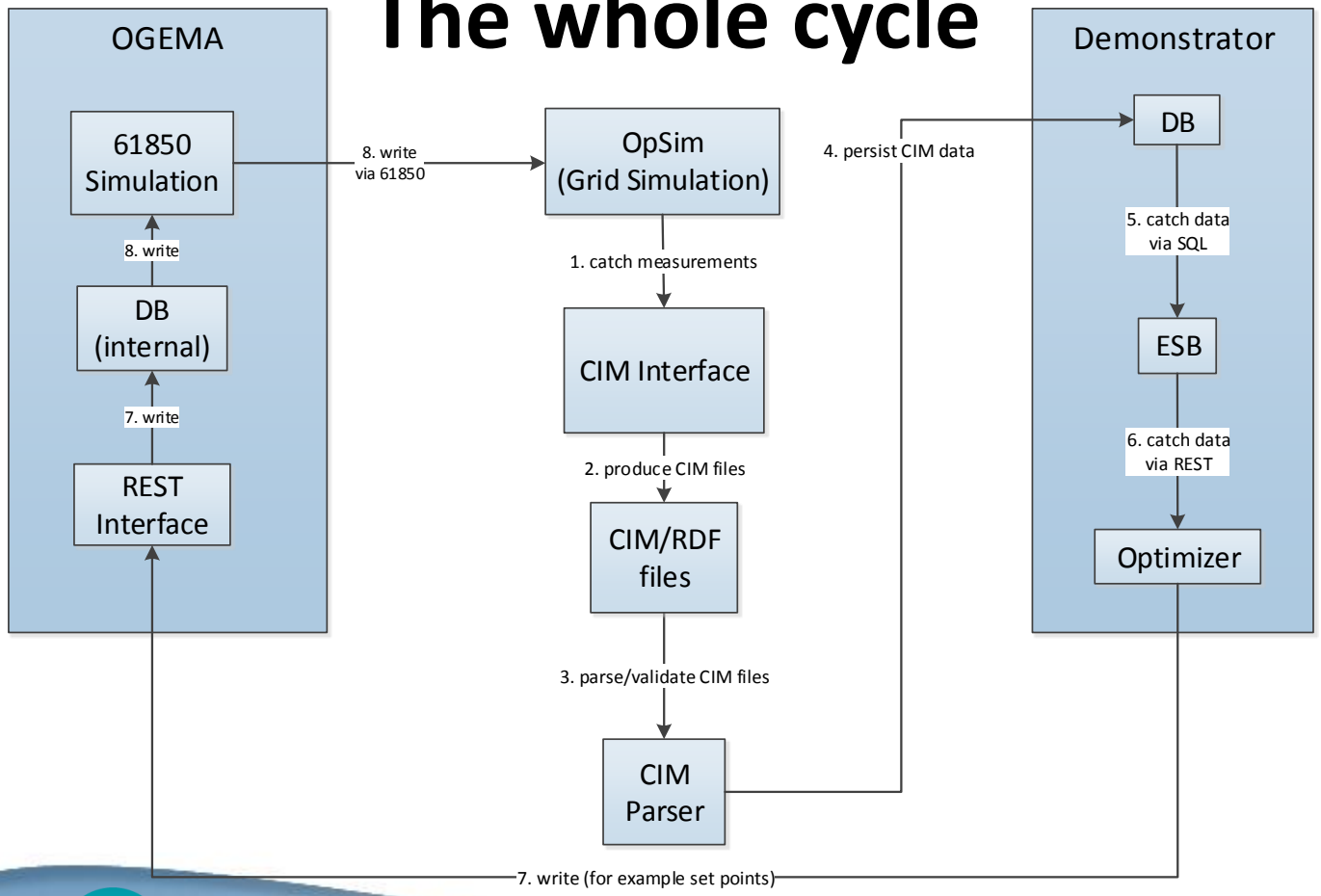
Mapping between Opsim, IEC 61850 and CIM



The whole cycle



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Summary and Future Prospects

- Using CIM CGMES as exchange model in research projects
- Using CIM CGMES for the description of distribution grid elements
- Simulation environment with standardized interfaces like CIM and IEC 61850
- Expand interfaces towards more CIM profiles
- Performing Interface verifications and interoperability tests
- Automatic IEC 61850 configuration

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Fraunhofer IWES – Abteilung Betrieb Verteilungsnetze

Research groups:

- Operation and Planning / Hybrid Grids
- Multi-Utility Storage Systems
- Aggregated System Operation

Research focus:

- Energy and ancillary services provided by DER (focus on PV systems, storage systems and E-mobility)
- Techno-economic approaches for planning and operation of active distribution systems
- Energy management in decentralised supply structures

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