FEASIBILITY STUDY FOR THE IMPLEMENTATION OF A DIGITAL TWIN IN A LOW-VOLTAGE GRID AREA

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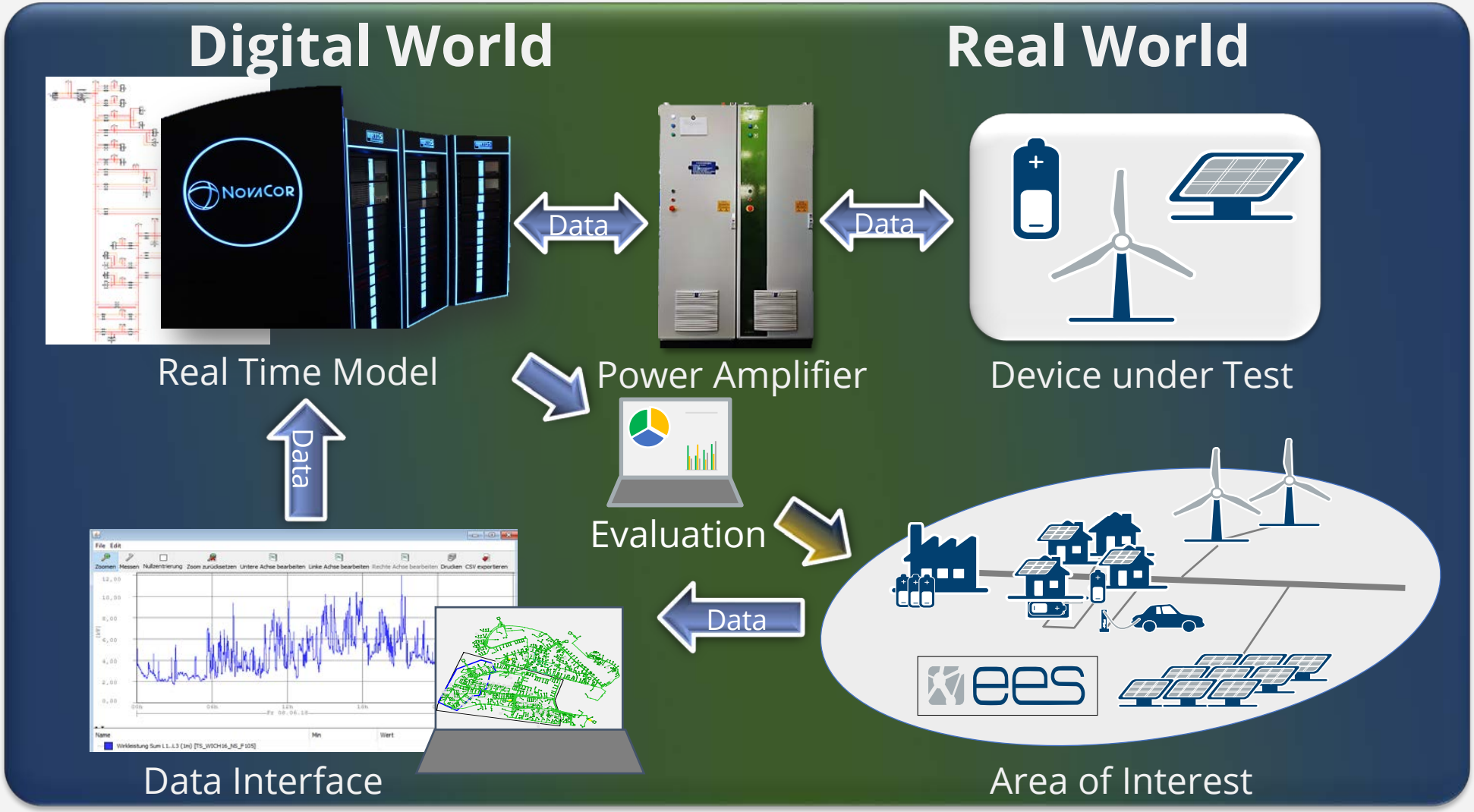
USER SPOTLIGHT SERIES BY RTDS Technologies

CONTENT

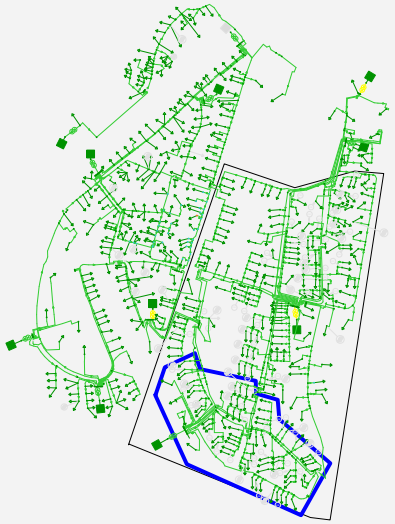
1. Concept of a digital twin
2. Aim of the project
3. Local grid area
4. Development of the RSCAD grid model
5. Data transfer via a Python interface
6. Outlook

CONCEPT OF A DIGITAL TWIN



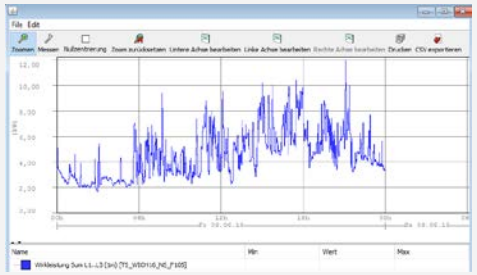
AIM: FEASIBILITY STUDY OF A DIGITAL TWIN IN THE RTDS SYSTEM OF A GRID SECTION

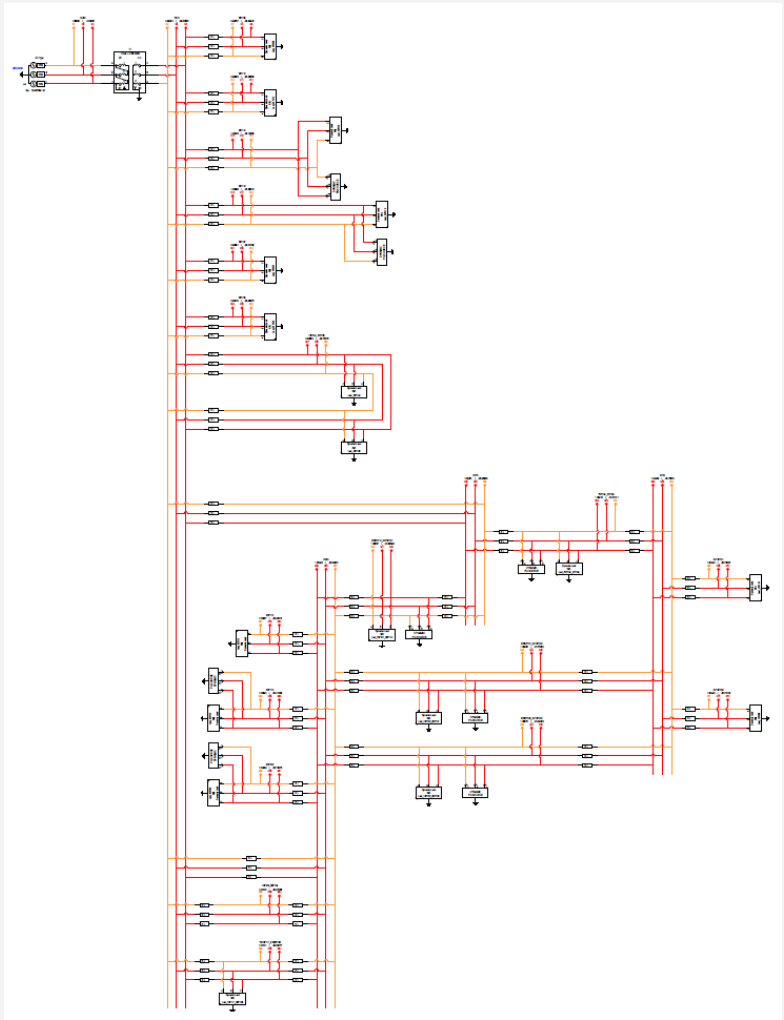
- Grid model in PSS®SINCAL



- PV measurement data

- Measurement data in GridVis



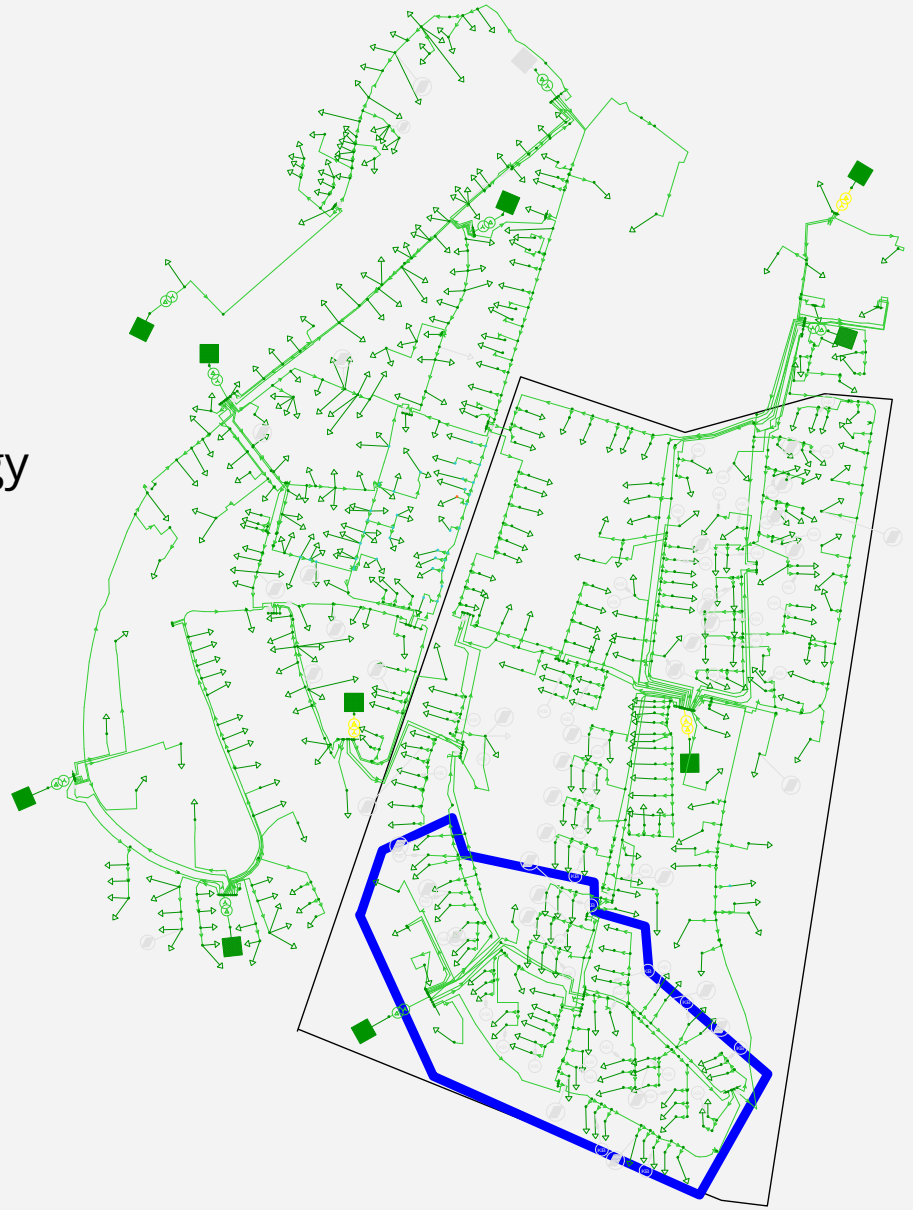


LOCAL GRID AREA

- Active distribution network
- Each feeder is equipped with measurement technology

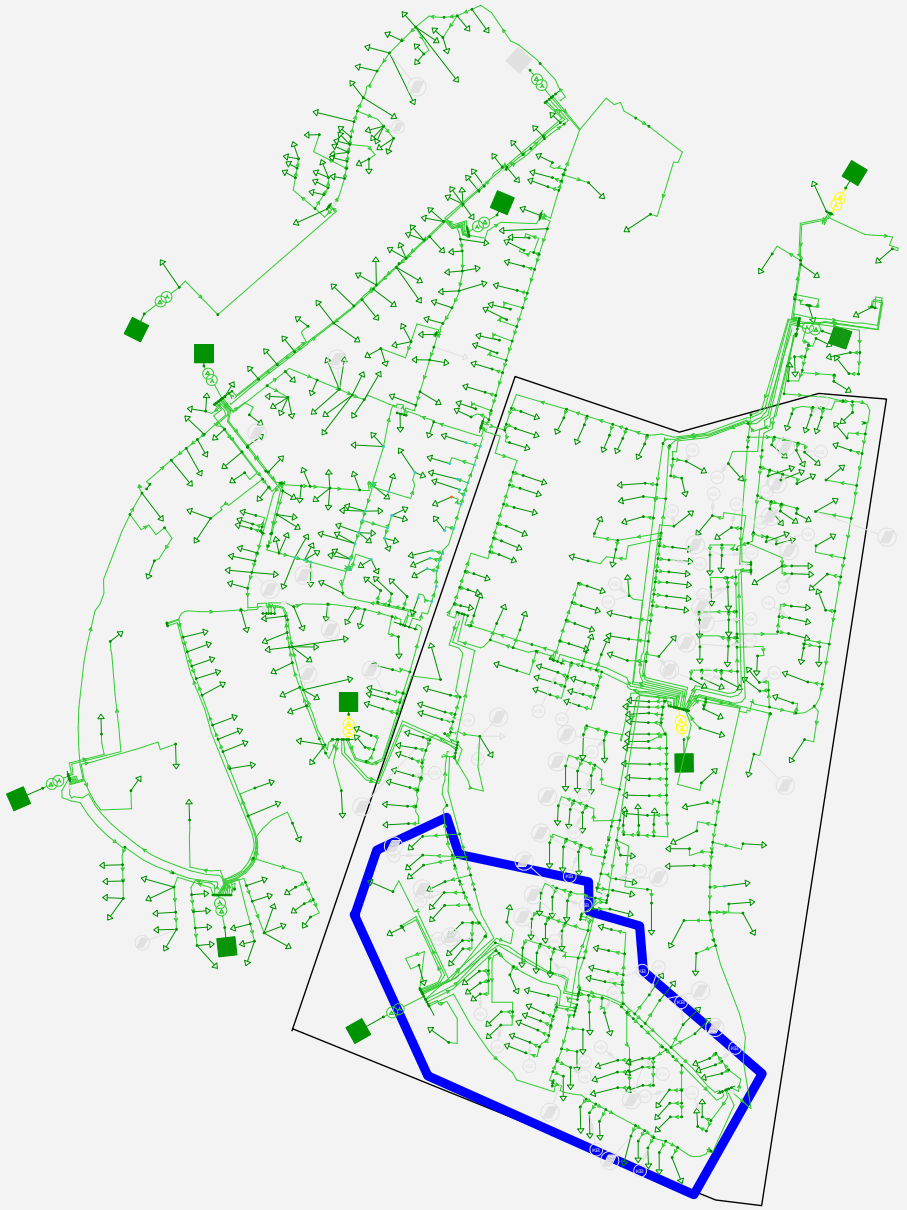
  → Measurement of different el. Parameters

  (P, Q, I, V, ∠, as sample per minute)
- Loads: households and businesses
- Installed PV capacity: 820 kWp
- Rated load: 834 kW
- Area total: 0,8 km^2



LOCAL GRID AREA

Area of Interest (AoI in blue):	0,1 km^2
Nodes:	appx. 150
Consumer:	68
PV systems:	11



DEVELOPMENT OF THE RSCAD GRID MODEL

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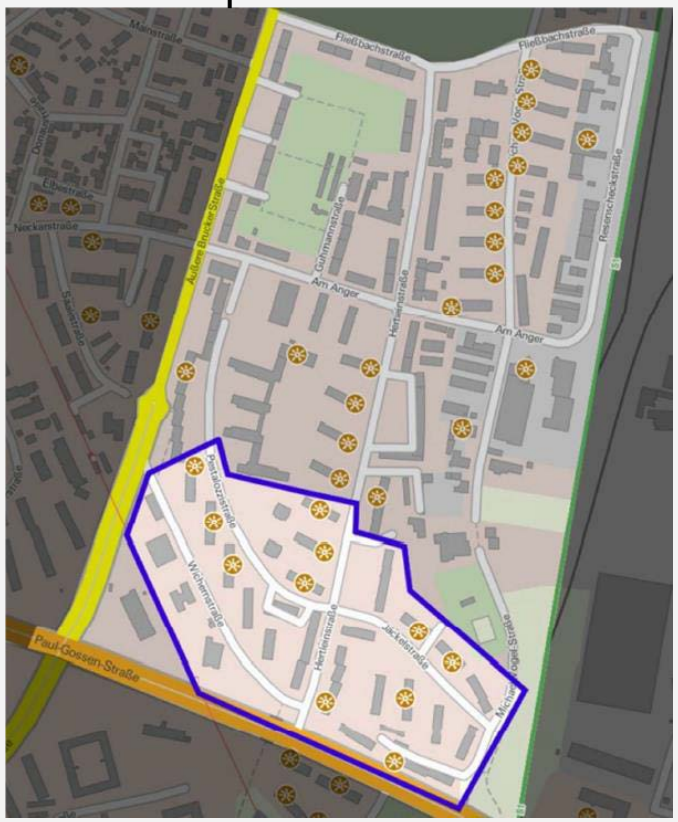
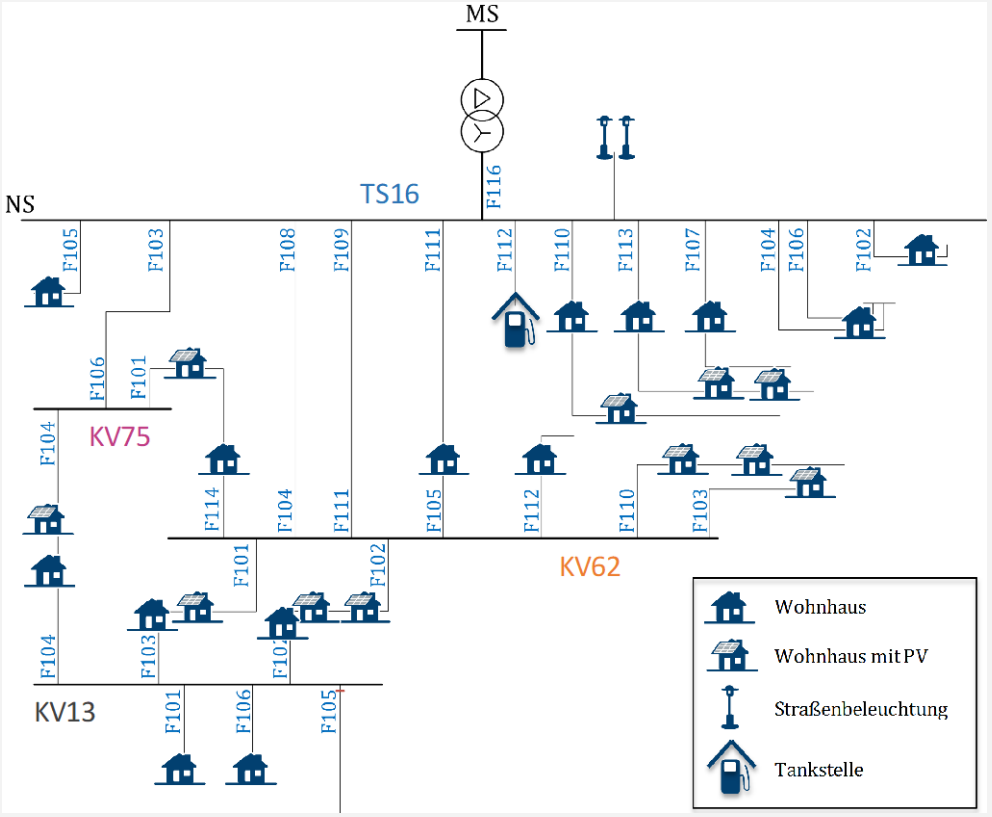
Land-use plan of AoI:



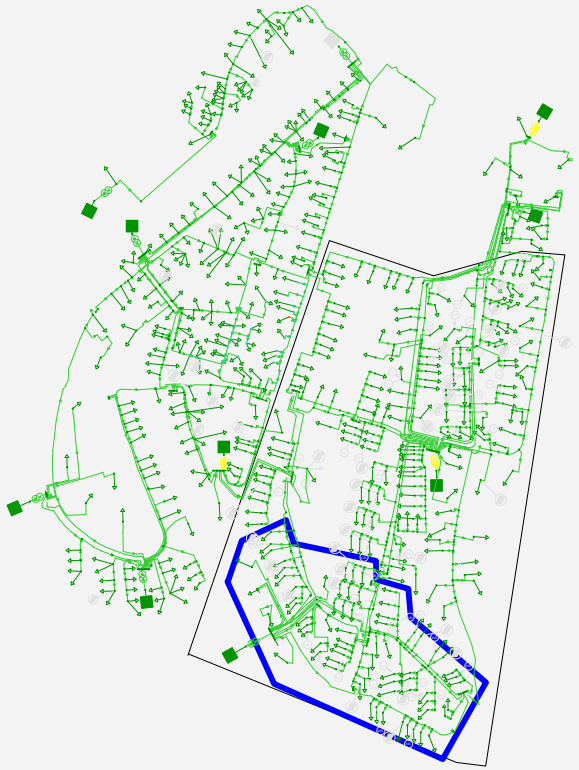
„Unsymmetrische dreiphasige Lastberechnung in einem städtischen Niederspannungsnetz mit hohen Photovoltaik-Anteil“, Julia Gutbrod

Electric schematic of AoI:

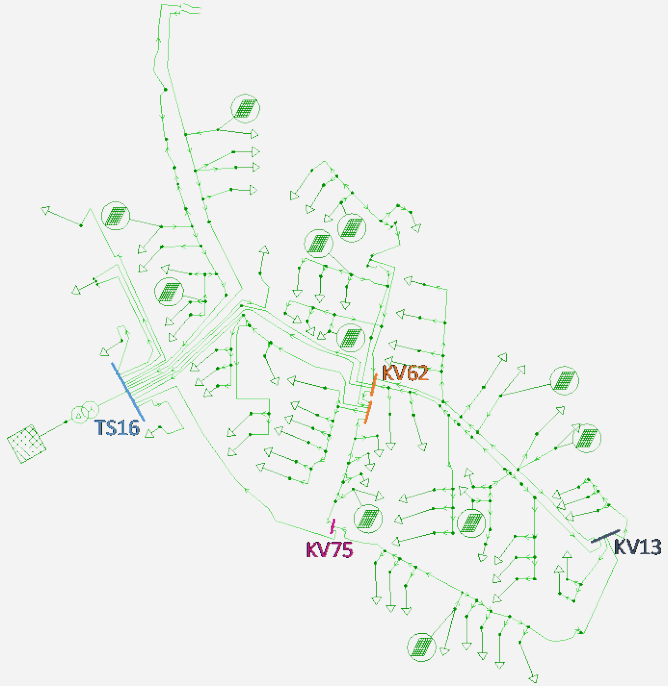


DEVELOPMENT OF THE RSCAD GRID MODEL

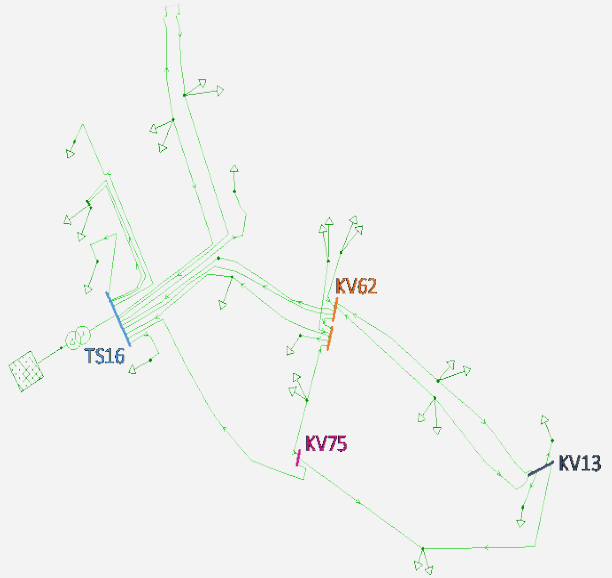
Entire grid area:



AoI:



AoI with load substitution:



- Transformer station (TS16)
- Cable Distribution Cabinets (KV62/75/13)

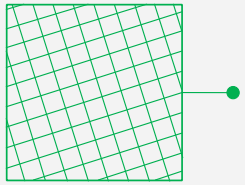
→ Installation of the measuring devices

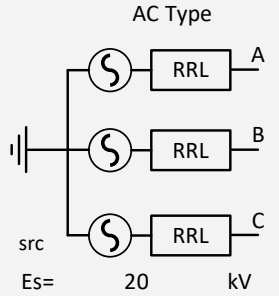
DEVELOPMENT OF THE RSCAD GRID MODEL

Components of PSS®SINCAL

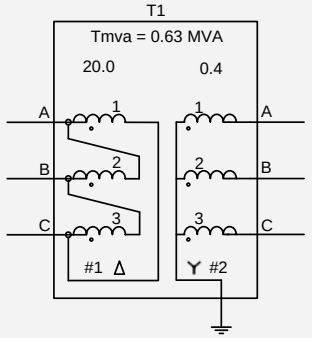
Components of RSCAD

MV-infeed

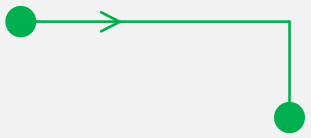


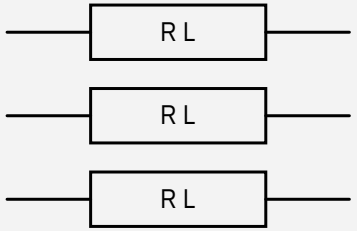


Transformer



Line



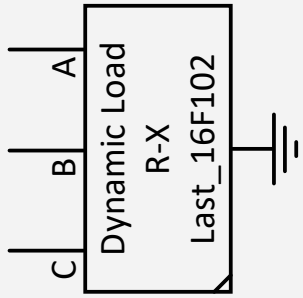


DEVELOPMENT OF THE RSCAD GRID MODEL

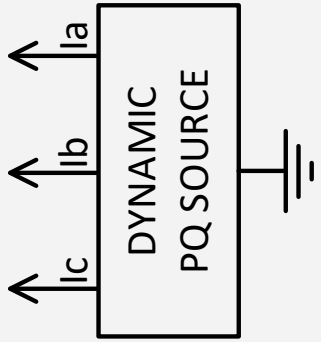
Components of PSS®SINCAL

Components of RSCAD

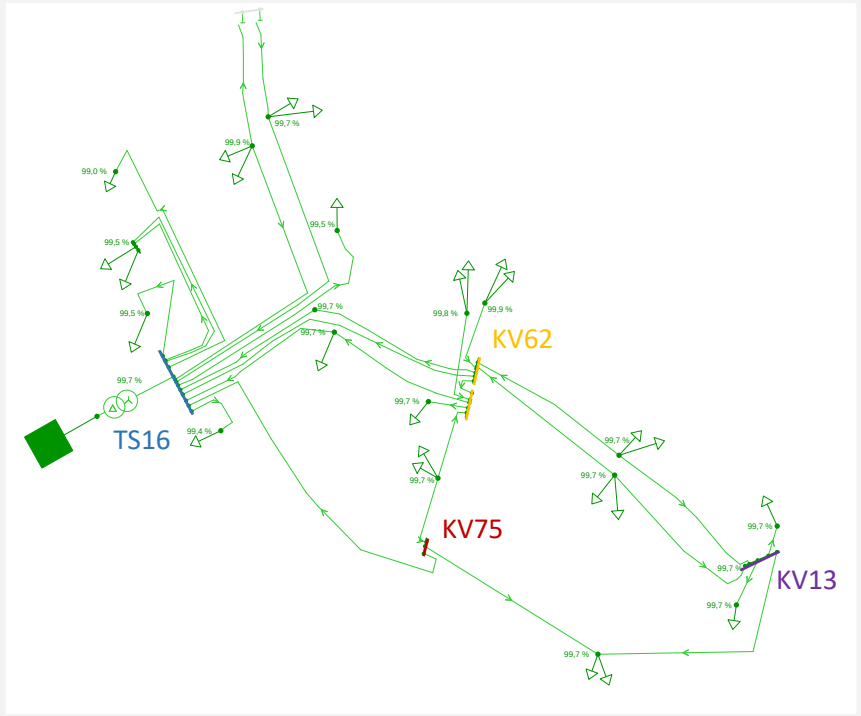
Consumer



PV-infeed



DEVELOPMENT OF THE RSCAD GRID MODEL



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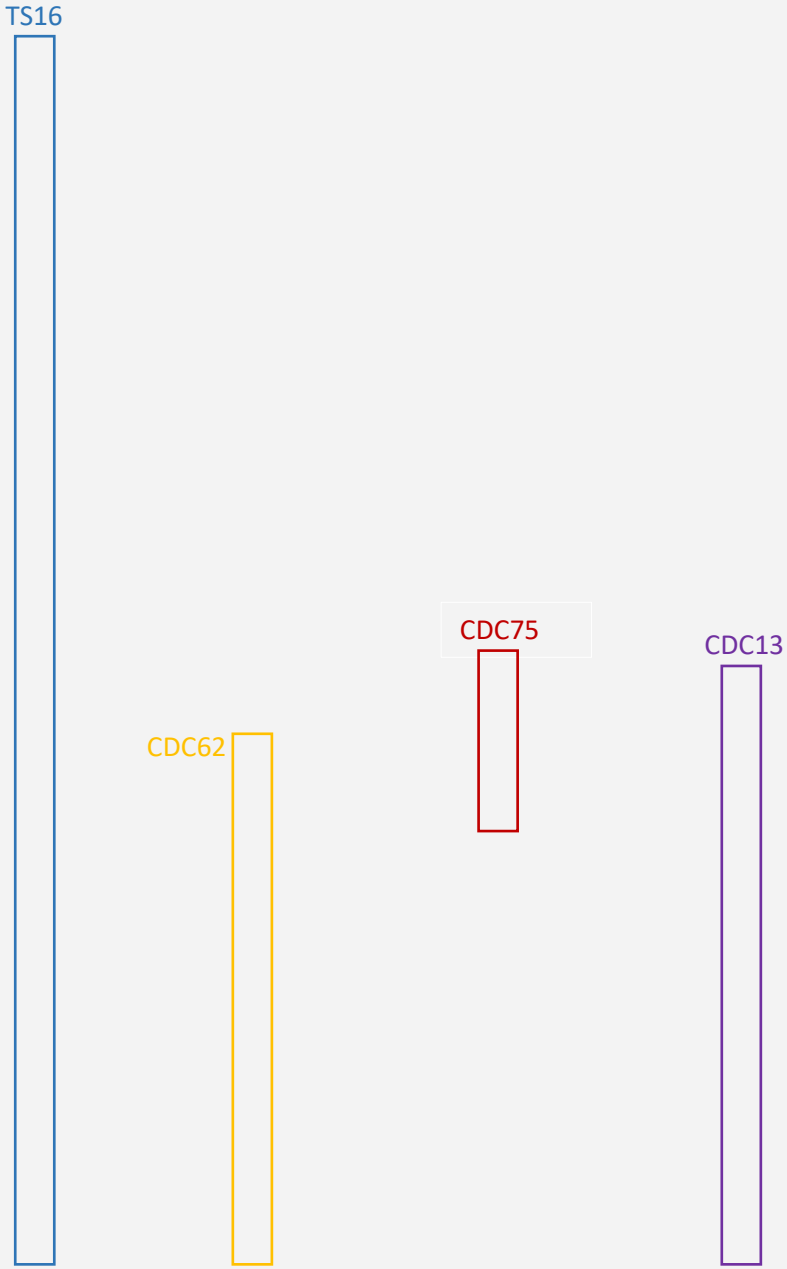
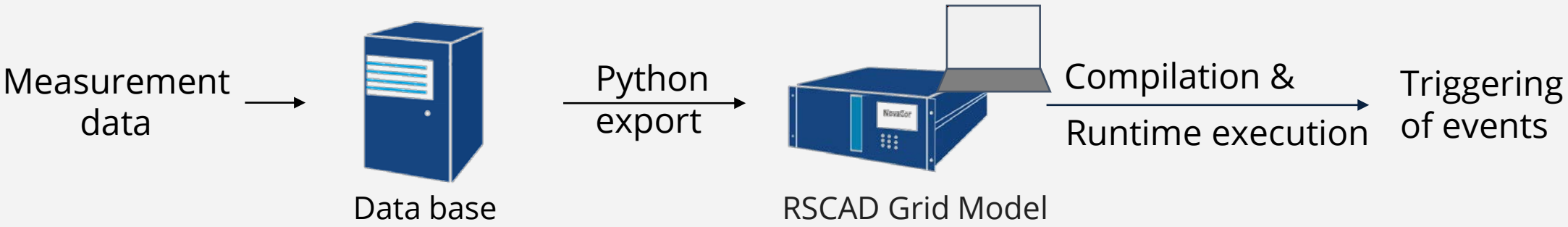


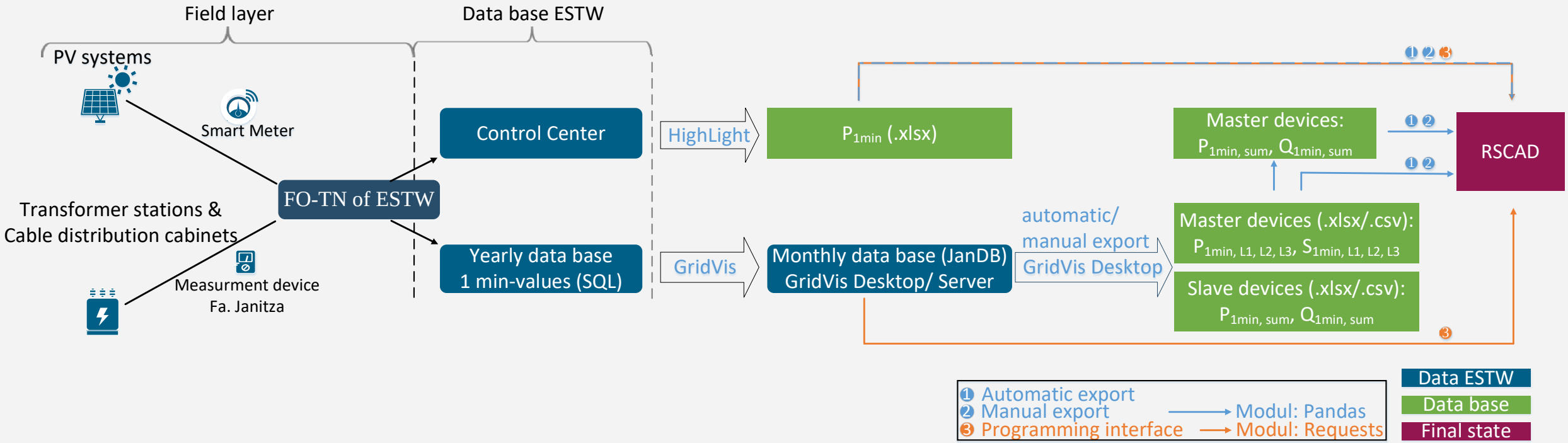
DATA TRANSFER VIA A PYTHON INTERFACE

DATA TRANSFER

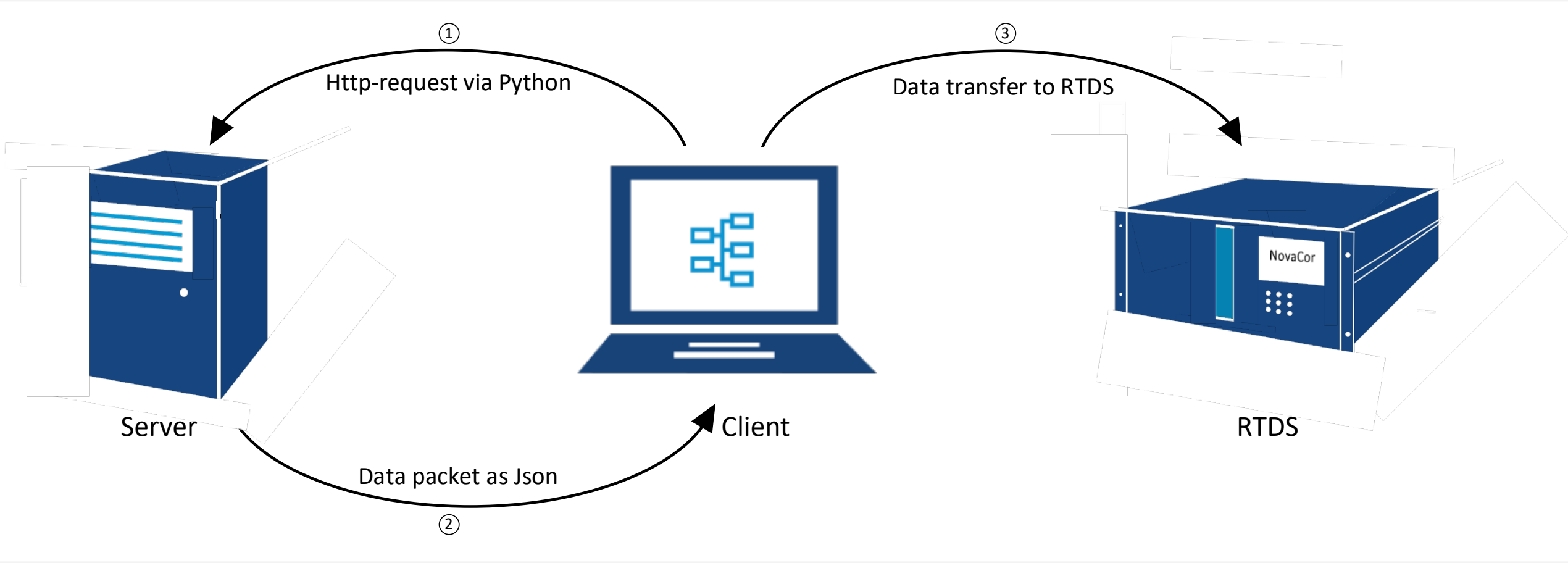
- Load flow initialization by import of measurement data in the previous developed RSCAD grid model (dft-file)
- No changes of the runtime file (sib-file)
- Triggering of events (sib-file) after import of data and compilation (dft-file)



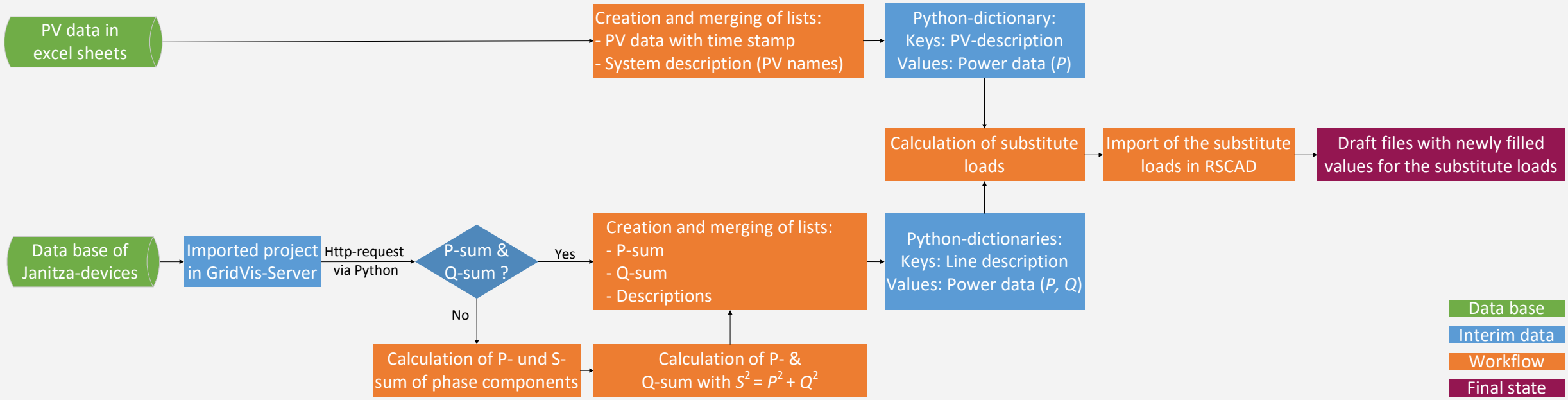
DATA TRANSFER



DATA TRANSFER

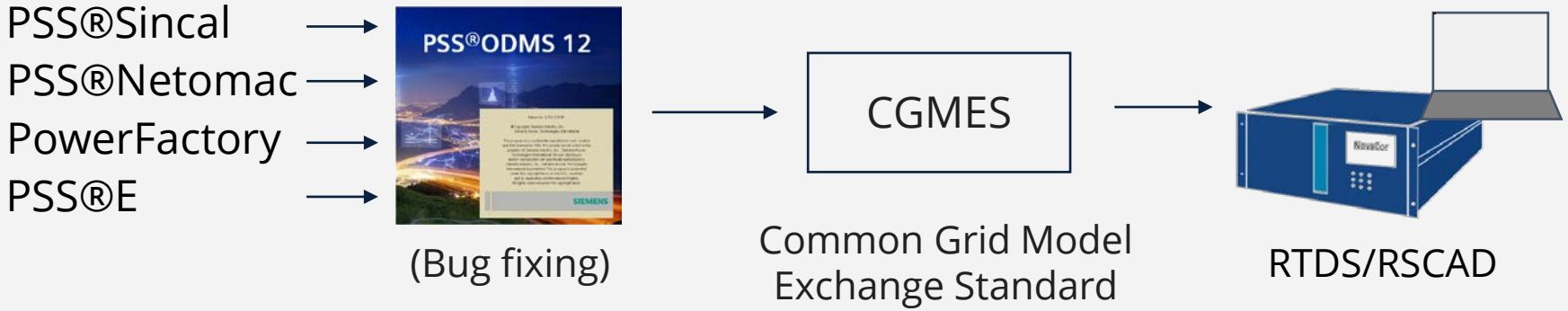


DATA TRANSFER



OUTLOOK

- Increase of the modeling depth with respect to grid dynamics (converter control, line models)
- Expansion of the grid area
- Import of load flow data and topology changes from several offline simulation tools (PSS®E, PSS®Sincal, PSS®ODMS , PowerFactory) to the RTDS system via Python



- Power Hardware-in-the-Loop analyzation in the low voltage grid section