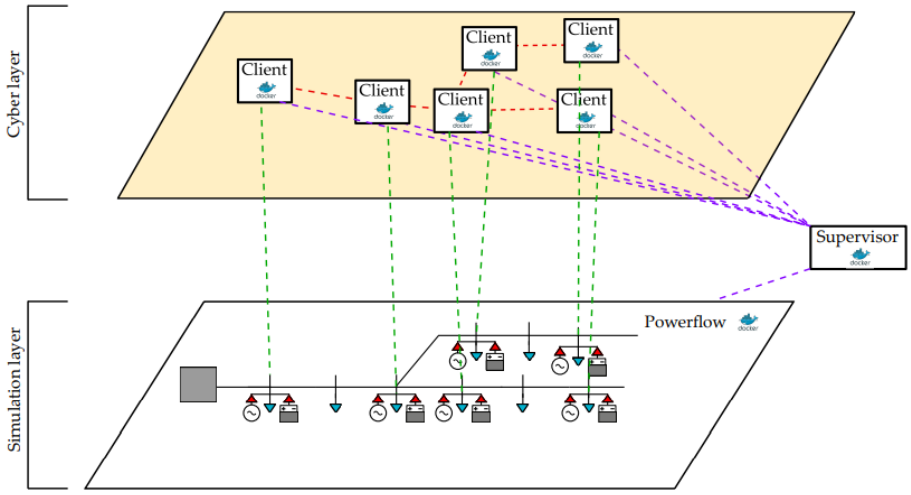
RWTH AACHEN UNIVERSITY

E.ON Energy Research Center
ACS | Institute for Automation of Complex Power Systems

Master-Thesis:

Implementation of a Distributed Model Predictive Voltage Control with Containers

Context:
The increasing installation of Distributed Generators (DG)s in medium voltage and low voltage distribution grid is introducing rapid fluctuations of load and generation profiles, affecting consequently the voltage. Recently, model predictive control (MPC) solutions have been developed to control (over a prediction horizon) the voltage within the operational limits defined by the grid standards.
Moreover, distributed control algorithms have been recently considered for the control of the voltage, where the calculation of the optimal solution is shared among several control units placed directly where the DGs are installed. With this approach each control unit communicate only with a subset of neighboring units.
In a distributed architecture the failure of a single node does not follow the loss of control of the whole system, which remains controlled by the remaining nodes, thus increasing the reliability. Moreover, some of the distributed control algorithms are based on the exchange of the lagrangian multipliers, which do not have a direct connection with the system data, excluding therefore issues linked with the privacy. This thesis proposal considers the implementation of a distributed algorithm for the model predictive control using docker containers. With this approach the algorithm is tested considering communication aspects and instantiation of the control nodes. In addition, scalability issues and possible solutions will be analyzed.



Your tasks:
The student will start the with a literature review on Distributed MPC for voltage control. At the same time, the student will get familiar with the distributed implementation based on docker containers. After that, the student will work on the implementation of the Distributed MPC, which will be interface with a grid simulator. After the implementation, tests with different forecast profiles and different grids will be performed to evaluate the performances of the proposed solution.

On this project, you expect to find:
- Python programming
- Distributed Model Predictive Control theory and algorithms
- Distribution grid modelling and simulation
- Docker containers

Requirements:
- Good knowledge of Python programming
- Knowledge of Control Theory (at least Systemtheorie II)

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