CINELDI

Centre for intelligent electricity distribution
- to empower the future Smart Grid

PhD: Distributed and centralized control to support smart grid operation with high quality in a cost-efficient way

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Challenge and objectives

The distribution grid is moving towards decentralization, both in power supply and control. Although this is expected to increase the reliability of the grid, it will put different requirements on communication and coordination between different actors in the grid. It might also introduce new threats to the grid, for example an inconsistent view of the state of the grid between different local controllers.

Research tasks

The main objective of this PhD project is to find methods and frameworks for assessing the reliability impact of different control and communication architectures in a smart distribution grid. In particular, the trade-off between centralized and decentralized control.

Approach

The approach is primarily based on modeling using formalisms like Stochastic Activity Nets and Markov models. Both power systems and ICT components are included in the same model to capture interdependencies. Results are obtained by discrete event simulation where an analytic approach is infeasible.

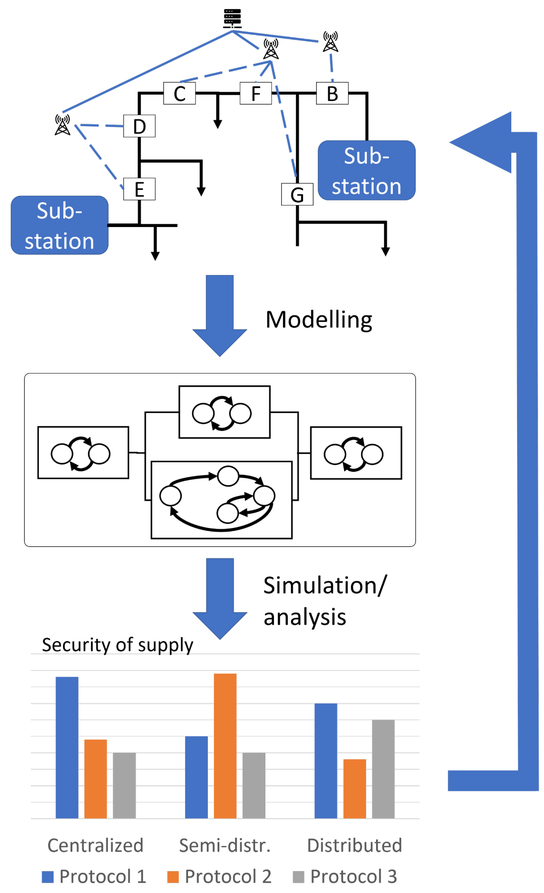
Significant results

The results so far have been towards investigating the consequences and effects of value failures in smart distribution grid controls. A model of a remote controlled disconnector was made and analysed in collaboration with Romina Muka, Poul Heegaard and Hanne Vefsnmo to look at inconsistencies between the real and observed state of a smart grid component [1].

A simulation framework for assessing the reliability of different services in a smart grid is being developed. It will allow for comparison between different possible service deployments and communication architectures.

Illustration

The figure illustrates the goal of having a tool for modeling both the power system and the ICT-portion of a smart grid, analyzing it based on relevant metrics and using the results from this to guide the design of the grid.



[1] R. Muka, F. B. Haugli, H. Vefsnmo and P. E. Heegaard, "Information Inconsistencies in Smart Distribution Grids under Different Failure Causes modelled by Stochastic Activity Networks," *2019 AEIT International Annual Conference (AEIT)*, Florence, Italy, 2019, pp. 1-6, doi: 10.23919/AEIT.2019.8893378.

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