



Application of New Sensors and Controllers for Distribution Grid Operation

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Challenge and objectives

- Real time operation and decision support; increasing need for pervasive monitoring, self-healing and automation.
- Increased decentralization due to DER with new flexibility options; changes in the Distribution Grid (DG) (prosumers, peak loads).
- Current communication solutions used by DSOs not prepared for real-time and reliability requirements; maintaining grid health and stability.

Research tasks

- Study system services of grid operations in the future DG; and investigate how the Security of Supply is improved by adding more sensors/controllers to enable e.g., advanced protection and self-healing, improve voltage control, reduce fault localization.
- Develop strategies for deployment of sensors and controllers in the DG, taking communication network constraints into account.
- Identify and analyze interdependencies and reliability in the combined ICT and Power Systems.

Approach

- Modelling with Stochastic Activity Networks. Software bugs, communication failures, wrong sensor readings and mechanical malfunction of disconnectors are included to assess the probability of information inconsistencies in the monitoring.
- Optimization Problem for placement of sensors/controllers in remotely controlled DG using Genetic Algorithm.

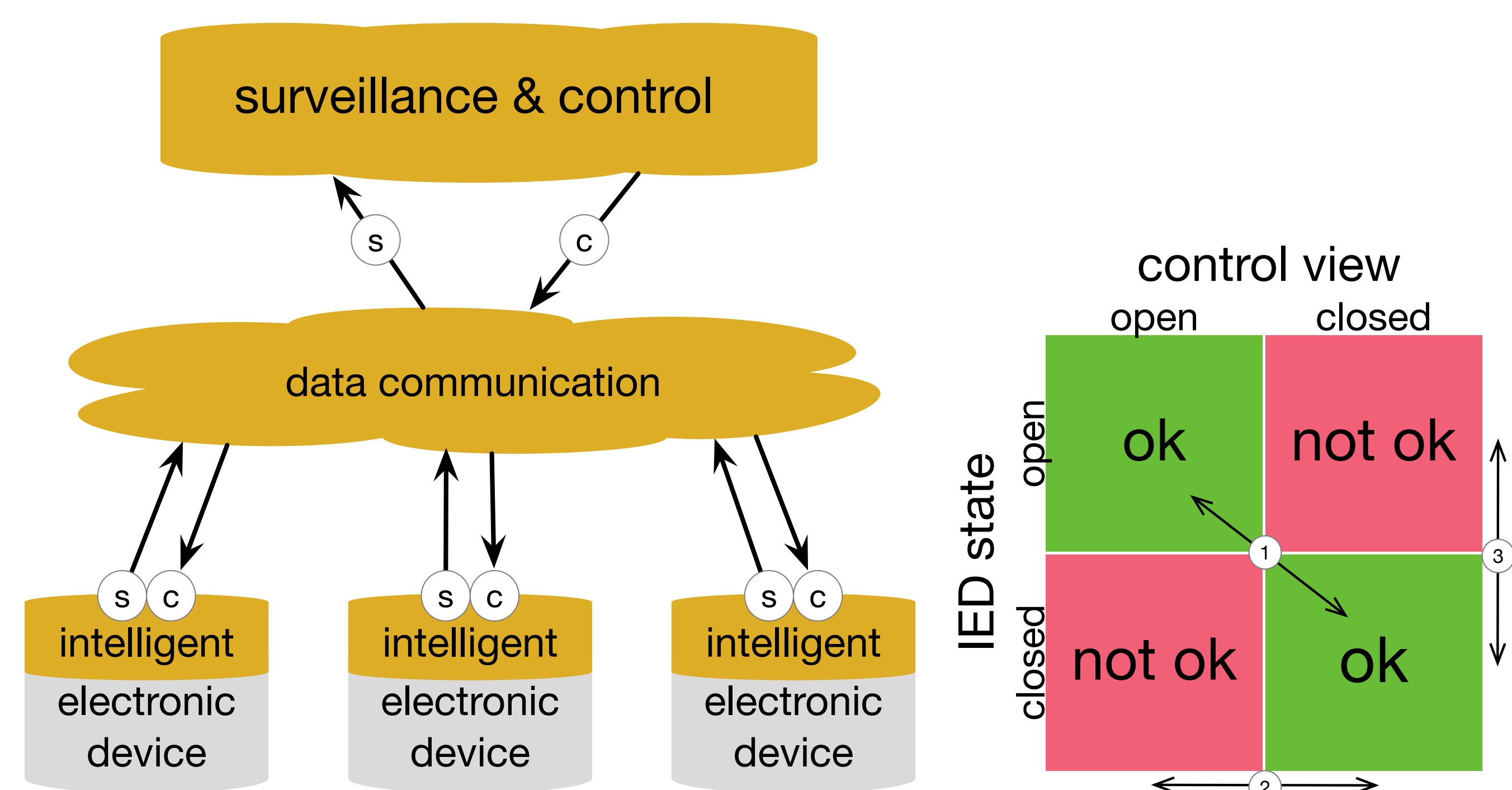
Significant results

Preliminary results from simulation studies show how the probability of information inconsistencies change under different conditions.

Conclusions

- Inconsistencies between the state of the grid reported in the Distribution Management System (DMS) and the real state of the grid is a relevant problem.
- As the DG becomes more dependent on computers and automation, it will become more important to understand the mechanisms behind these inconsistencies in order to assess the reliability of future power systems.
- Smart grid reliability will be improved by integrating the information collected from sensors and controllers into DMS and proposing a new algorithm for sensors' placement.

Illustration



Surveillance and control system with distributed sensors and controllers (IEDs).