Development of a Controller Hardware-in-the-Loop Platform for Microgrid Distributed Control Applications

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Overview

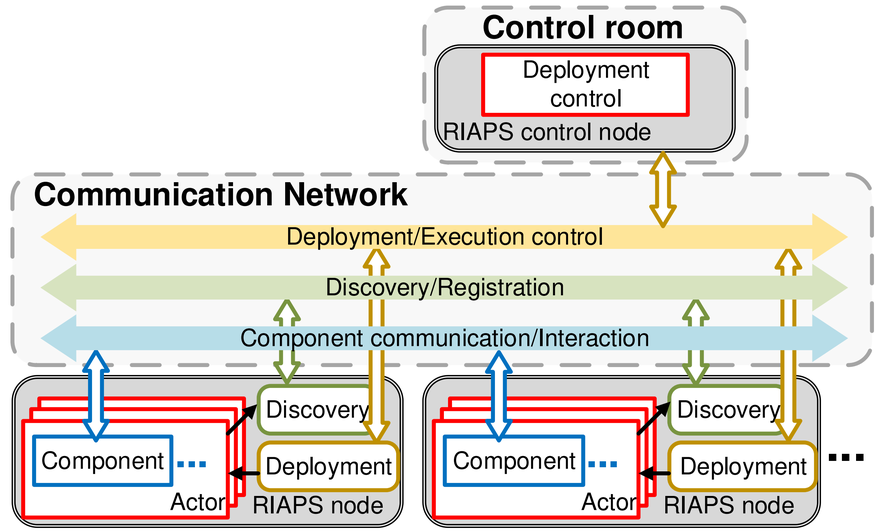
Microgrids (MGs) are ideally suited for distributed control solutions. However, implementation and validation of the developed distributed control algorithms are quite challenging:

- ✓ Sufficient computational capability to support small iterative time step;
- ✓ Time synchronization management of concurrency among all the nodes
- ✓ Exchange information in a fast and accurate manner;
- ✓ Scalable controller and hardware implementation;

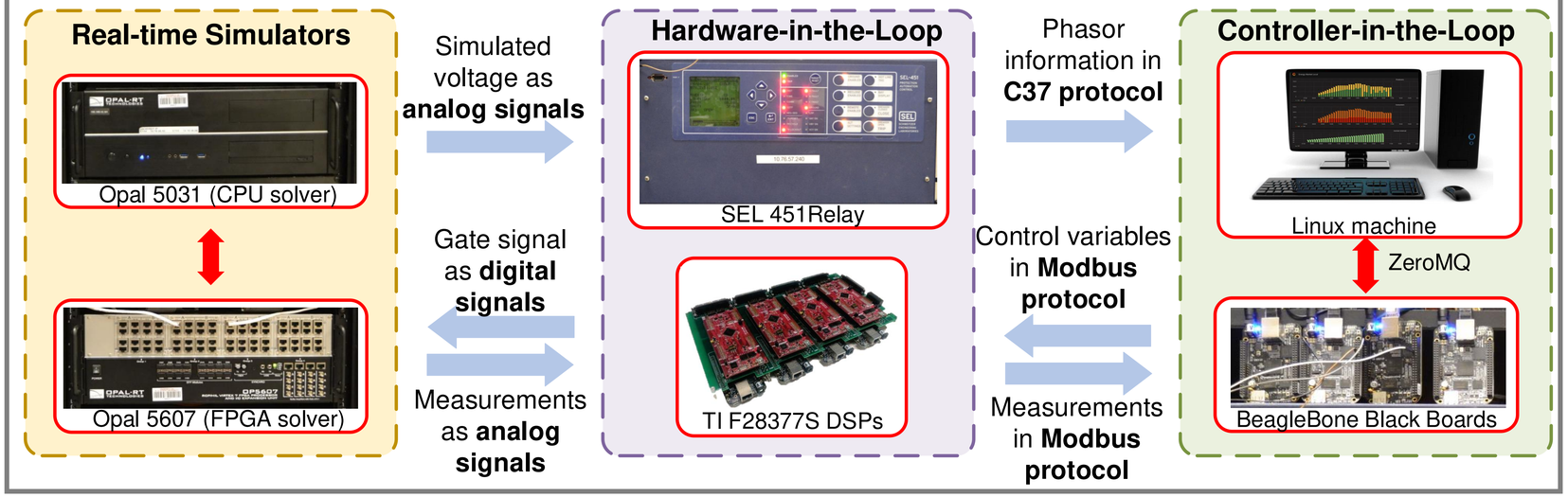
Motivations

Hardware testbeds	• Typically small-scale prototypes • Limited components and simple system topology
Software validations	• Easy and economic to researchers • Too ideal to provide convincing results and revealing implementation issues
Hardware-in-the-Loop (HIL) simulation	• Provides higher level of fidelity • Enable integration of actual equipment and communication links
Controller-in-the-Loop (CIL) simulation	• Provides validations over developed control algorithms under hardware level with practical communication/ execution delay

RIAPS System Architecture Overview



Controller Hardware-in-the-Loop Platform



Applications Developed

- Improved energy/power management with adaptive distributed control;
- Stable control for islanded mode, (un)intentional islanding, grid synchronization;
- Utilizes distributed computation and decision making platform;
- Distributed control for cascaded H-bridge converter with SOC equalization capability.

More Information

- https://riaps.isis.vanderbilt.edu/
- https://riaps.github.io/

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