Enabling Highly Resilient and Efficient Microgrids through Ultra-Fast Programmable Networks

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Motivation:

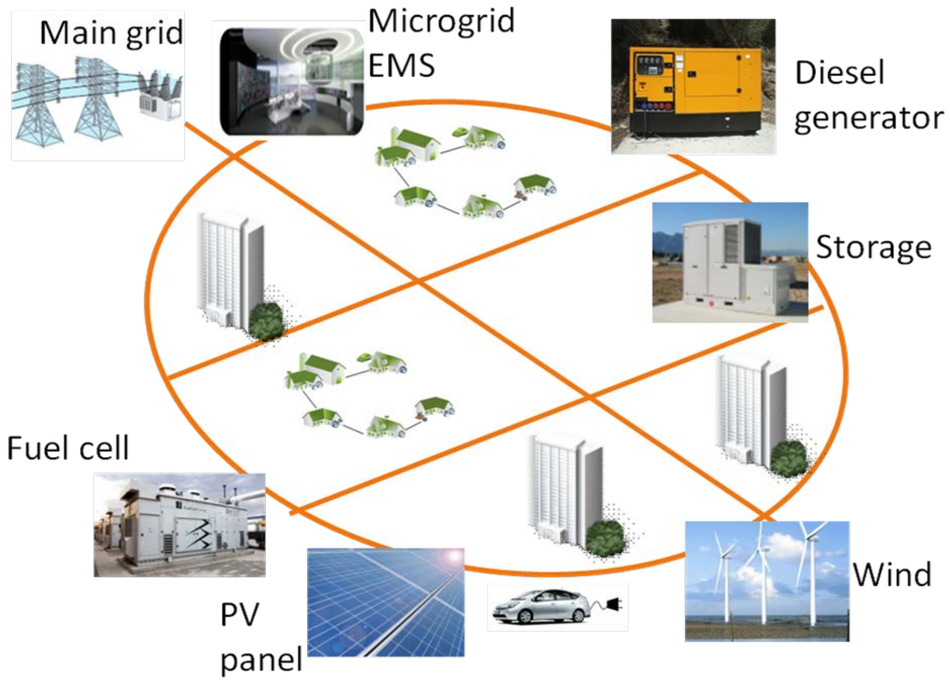
- Microgrid
  - Small-scale, low-voltage power network
  - Supply electricity and heat to a small community (industrial park, university, shopping center, etc.)
  - Use renewable energy sources
  - Connected to or isolated from main grid
- Emerging & promising paradigm for
  - improving resilience of electric distribution infrastructure
  - Enhance power supply quality
  - Example: statewide microgrids in Connecticut
- Communication infrastructure
  - Critical for microgrid with renewable energy sources
  - Challenges: renewable energy sources difficult to control, diverse QoS requirement, resilient to communication network failures

Contributions:

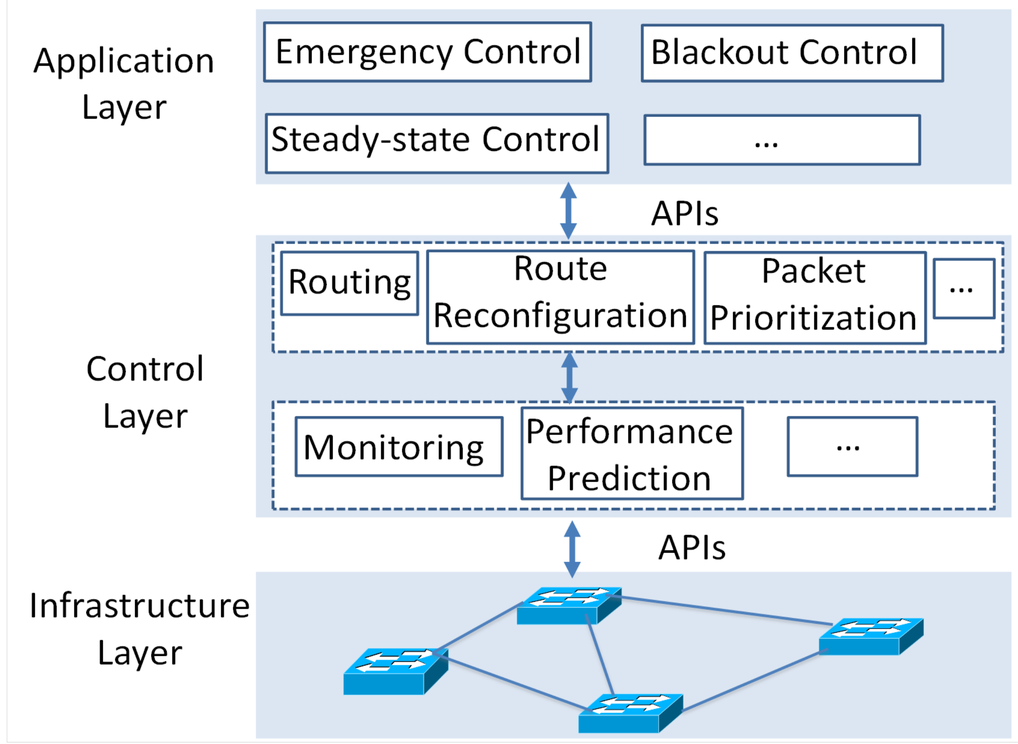
- Innovative SDN-based communication architecture for microgrid
- Ultra-fast-network enabled microgrid control
- Evaluation and demonstration in microgrid at UConn

Impact:

- Enable highly resilient operation of microgrid
- Lead to high penetration of microgrid in power grid
- Achieve nation's goal of generating 80% of electric energy using renewable energy sources

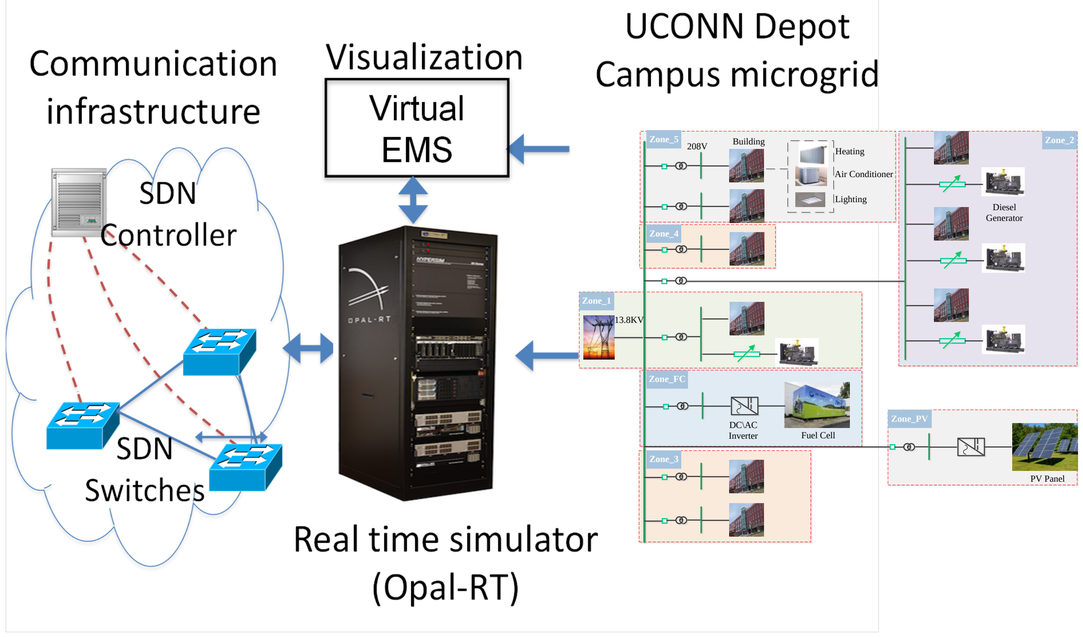


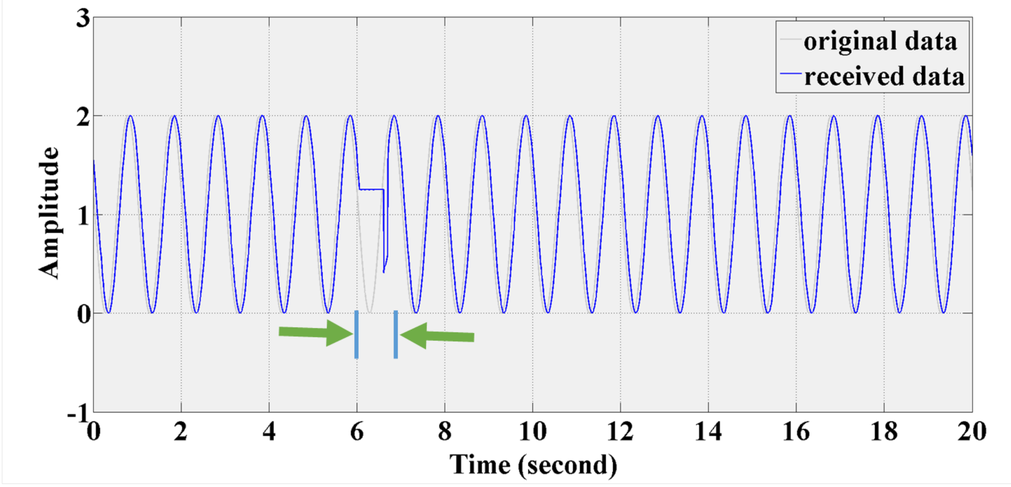
microgrid



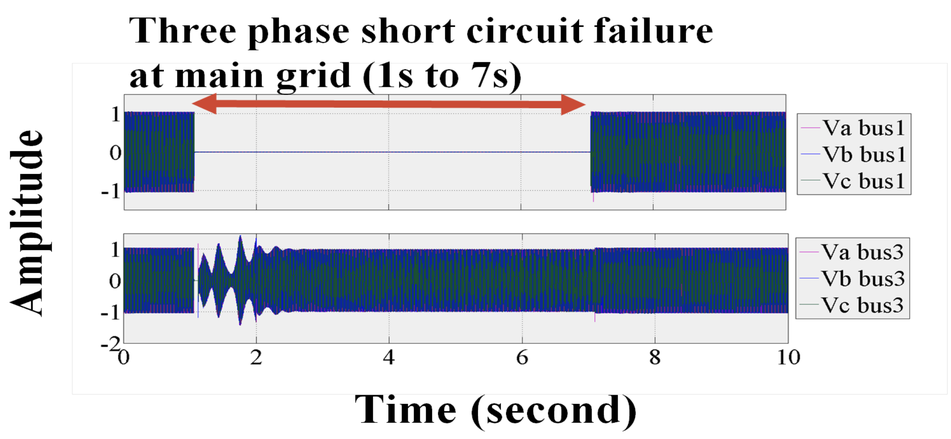
SDN-based communication architecture

Evaluation and demonstration:

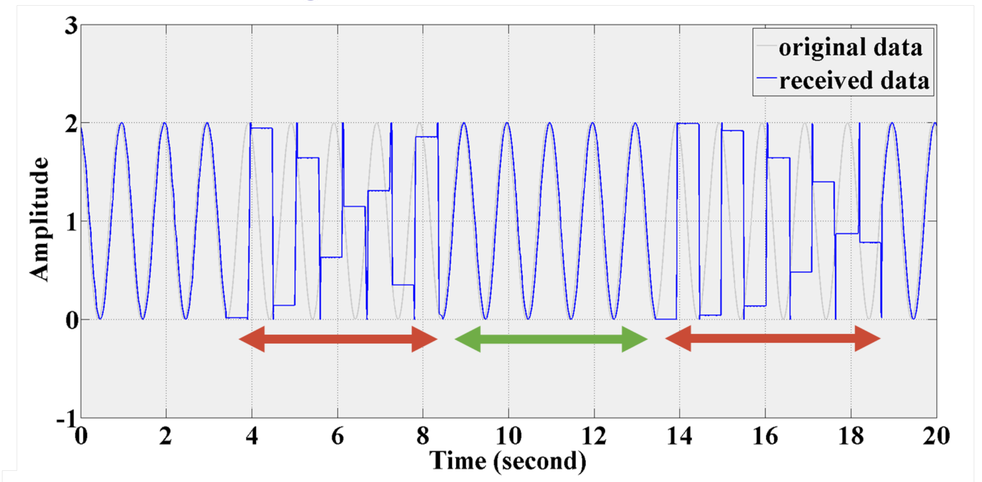




SDN controlled network path reconfiguration after link failure



Local generator switched on after microgrid islanding, controlled by ultra-fast network



SDN controlled rate limitation (marked as red) for non-critical traffic