

Cyber Physical Modeling of the Smart Grid

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Problem statement

Smart grids are susceptible to cyber attack as a result of new communication, control and computation techniques employed in the power grid. Our objective is to design a secure smart grid that is resilient to attack and failure. This objective requires a means to evaluate resiliency of the proposed design. We are developing a testbed that combines real, emulated and simulated models of smart grid components.

Objectives

1. Evaluate the cyber-physical security posture of the smart grid by emulate large-scale cyber-physical attack scenarios.
2. Deploy, study and validate different detection and mitigation mechanisms.
3. Demonstrate our cyber security mechanisms to DoE.

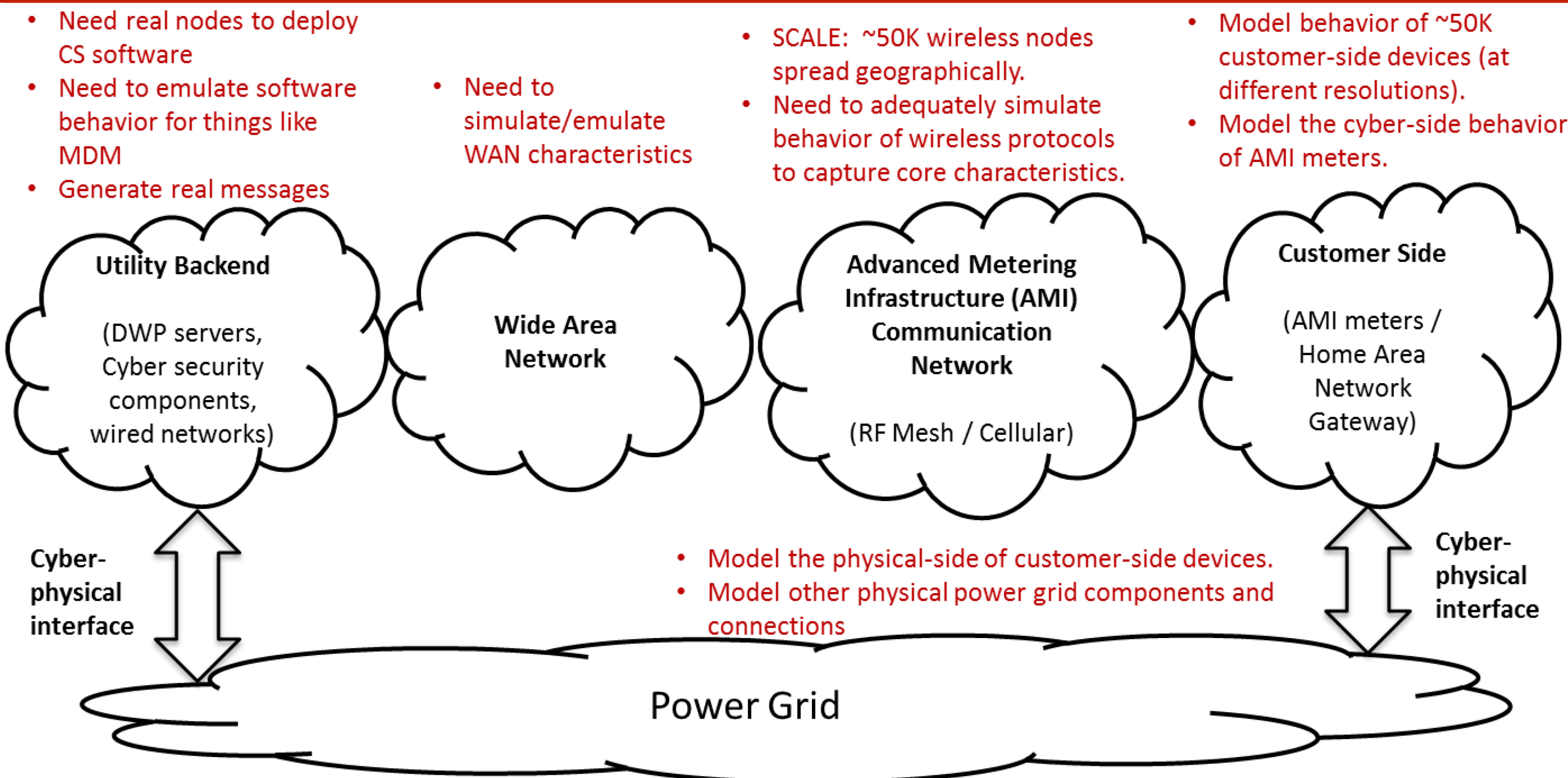
Example Cyber Physical Attack Scenario

Attack Objective: Create a fault condition (a large transient) on the physical power system from the cyber domain to create a cascading blackout.

Attack Vector: Attacker manipulates the load on the system by carefully controlling Demand Response (DR) load curtailment requests.

Smart Grid Conceptual Model and Modeling Requirements

- Conceptual model components derived from the NISTIR 7628 Smart Grid model.
- Modeling requirements (shown in **cardinal**) demonstrate the need for **multi-scale**, **multi-fidelity** modeling of smart grid.



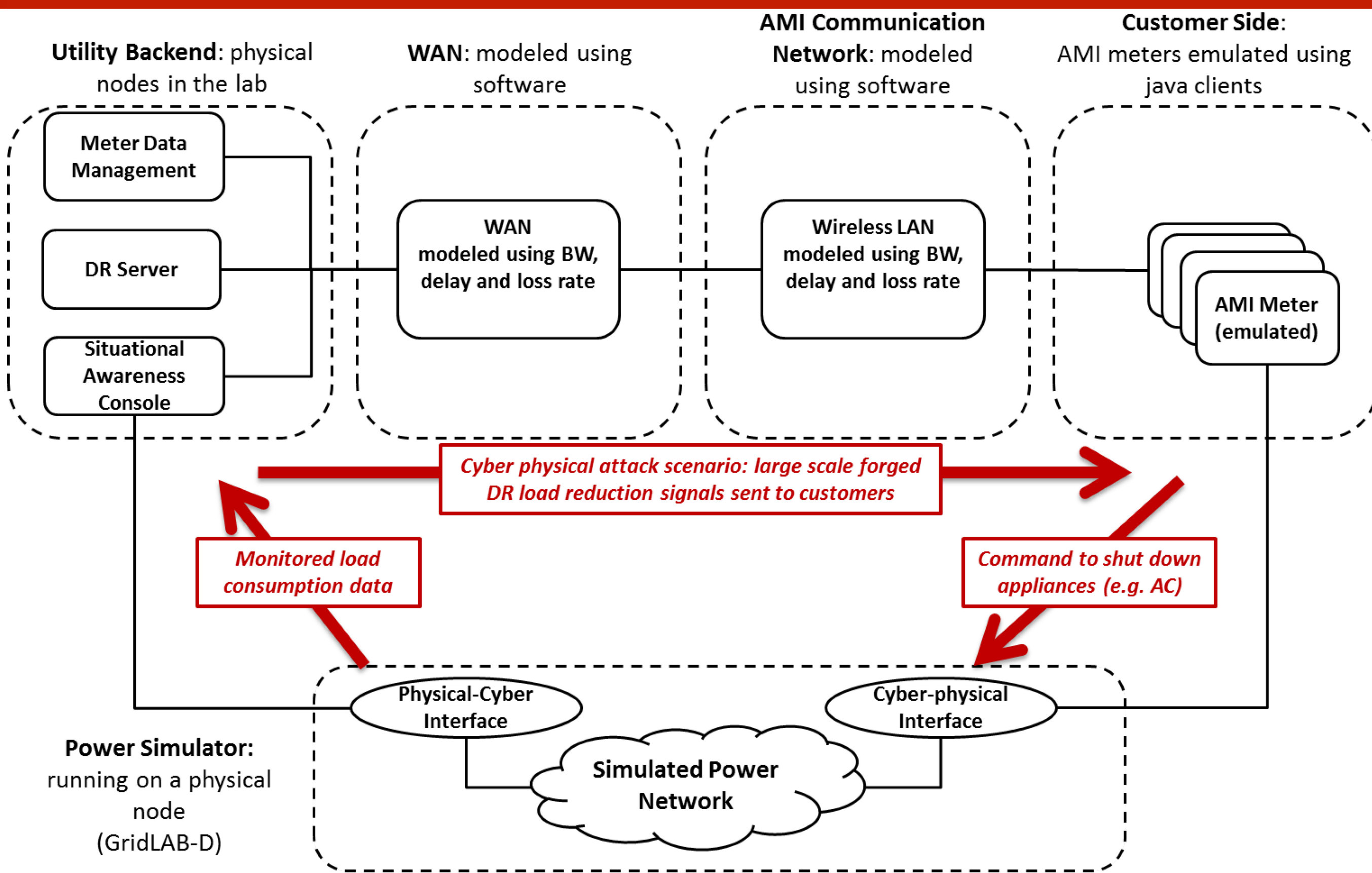
Model Instantiation

Current Status of Work

1. 1000 customers are connected to utility backend model of the system.
2. DR and AMI functionalities are modeled.
3. Currently used to study effect of DR on power grid.

Future Work

1. Scale the system to model large scale scenario.
2. Use more complex models of smart grid components (communication and power).



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