The successful operation of modern power grids is highly dependent on reliable and efficient underlying communication networks. Researchers and utilities have started to explore the opportunities and challenges of applying the emerging software-defined networking (SDN) technology to enhance efficiency and resilience of the Smart Grid. This trend calls for a simulation-based platform that provides sufficient flexibility and controllability for evaluating network application designs, and facilitating the transitions from inhouse research ideas to real productions.

**DSSnet: Smart Grid testbed**
- Power System Simulator
- Communication Network Emulator

**Combining Power and Communication Systems**
and the role of Software Defined Networking (SDN)

**DSSnet: A Smart Grid Modeling Platform**
Combining Electrical Power Distribution System Simulation and Software Defined Networking Emulation

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**Motivation and Challenges**
- How do communication delays affect power system operation?
- Identifying Cyber security solutions in Smart Grid infrastructure.
- How can we secure the Microgrid with the use of SDN?

**Future Works**
Advanced Synchronization:
- Dynamic synchronization window
- Application specific lookahead to improve parallelism between the systems.

Distributed Emulation: to achieve better scalability in the network emulator.

SDN Applications:
- Network-wide configuration verification
- Context-aware intrusion detection
- Self-healing network layer for power applicators
- QoS enforcing policies in microgrid
- Network Function Virtualization for control of distributed applications

**Microgrid Security and Resilience Evaluation and Modeling**

**Putting it All Together**
The Detailed architecture of DSSnet is shown below. The 5 main components are:

- Network Coordinator
- Power Simulator
- Virtual Time system

**OpenDSS** [2] - the power simulator used in DSSnet has the following capabilities:

- Snapshot Power Flow Studies
- Daily/Weekly Power Flows
- Harmonics
- Fault study
- Monte Carlo fault study

In simulation, continuous variables are modeled with differential equations supporting sequential-time simulation solved at discrete time intervals.

The time step used in the simulation depends on the nature of the request. For protection studies, time steps at the scale of milliseconds may be required while load and generation studies may be at large scales such as seconds or minutes.

**References:**