

Goals

- Provide provisioning for experimental support/integration of TCIPG projects
- Provide a simulation and emulation environment with real hardware and software used in the power grid
- Serve as national resource for experimental work in research and analysis of trustworthy power grid systems
- Span Transmission, Distribution & Metering, Distributed Generation, and Home Automation and Control – providing true end-to-end capabilities

Fundamental Questions/Challenges

- How does one provide a large-scale, realistic, end-to-end power grid experimentation platform that is both repeatable and flexible to cover both legacy and emerging research?
- How does one leverage real equipment, simulation, and emulation to provide the necessary capabilities?
- How does one programmatically integrate, control, and interact with power grid equipment that was not designed with that in mind?

Research Plan

- Develop new modeling and evaluation technologies to enhance evaluation capabilities of the testbed
- Continue to expand the equipment capabilities, features, and functionality through strategic integration of both software and hardware
- Develop integration glue to seamlessly integrate power grid equipment and software into the testbed by coupling simulation, emulation, and real equipment
- Leverage existing and emerging research from other areas where it can benefit the goals of the testbed effort

Impact and Interaction

- Enable advanced research for Smart Grid efforts throughout the world
- Flexible framework being implemented and advancing towards tailored operating constraints
- Will be open for collaborative research, facility-driven use, sponsored research, or technical testing

Research Results

- Realtime Immersive Network Simulation Environment (RINSE) – large scale network simulation
- Virtual Power System Testbed – Cyber/Physical coupling of simulation, emulation, and real equipment
- Network Access Policy Tool (NetAPT) – policy tool to evaluate network access paths and verify compliance with a global policy

Capabilities

- Full end-to-end “Smart Grid” capabilities
- Real, Emulated, and Simulated Hardware/Software
- Real data from the grid, Industry partners, etc.
- Power Simulation, Modeling, and Optimization
- Network Simulation and Modeling
- Visualization
- WAN/LAN/HAN integration and probes
- Security assessment tools (e.g. static analysis)
- Protocol assessment tools (e.g. harness’, fuzzing)

Hardware and Software

- RTDS, PowerWorld, PSSE, PSCAD, DSAtools Suite, DynRed
- RINSE, testBench, LabView, OSI PI, OSii Monarch, SEL Suites
- GPSs, Sub. Comps, Relays, Testing Equipment, PLCs, Security
- RTUs, F-Net, ICS Firewalls, Inverters, DAQs, Oscilloscopes, Multimeters, Gigabit Firewalls and Switches, Embedded devices
- Home EMS, Monitoring devices, Zigbee, Automation
- Display Wall, Visualization Platforms, Training
- Mu Dynamics, Fortify, Sec. Research tools
- DETER/Emulab integration and extension

Use Cases

- Provide a multi-faceted approach to security through testbeds, education and training, field testing, and tool creation
- Facilitate collaboration amongst researchers and industry to work towards creating more resilient critical infrastructure
- Facilitate rapid transition and adoption of research to industry
- Provide positive real-world impact through engagement

