Idaho National Laboratory National and Homeland Security

Protecting the Nation’s Infrastructure

- Power Grid Test Bed
- Physical Security Test Bed
- Contraband Test Bed
- Wireless Test Bed
- Training and Exercises
- UAV Test Bed
- Cyber Test Bed
- Power Grid Test Bed
- SCADA Test Bed

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National SCADA Test Bed

...established in 2003

DOE multi-laboratory program designed to:

Support industry and government efforts to enhance control systems cyber security across the energy infrastructure

Key Program Areas

- Assess and mitigate energy control systems vulnerabilities
- Develop advanced secure control systems technologies
- Support development of standards and best practices
- Conduct outreach and awareness
Critical Infrastructure Protection/Resilience Simulator

DoD-OSD sponsored: coordination of response and recovery efforts
Successful demonstration October 2007 and will be used in national exercises

Hazard Modeling and Damage Assessment

Power Grid Modeling

Situational Awareness and Decision Support

- Federated High Level Architecture
  Incorporates real-time fidelity models, running simultaneously with asynchronous intercommunication
  - Cross-sector interdependency analyses
- GIS-based user interface
  - Multi-resolution: view varying levels of detail
  - Display of asset information, model results, and real-time interactive control of models
  - Customizable via GIS editors
- Visualize events in temporal and spatial context
Technology Foundations

- DoD Sim Framework & Visualization
- Scene Generation
- Power Grid Modeling
- Wireless Communication Modeling
- Flight Planning & Restoration Analysis
- Wildfire models
- Disaster Models
- PC Tides
- IMOM Engineer
Customizable Interface
Physics Based Power Modeling
Real Time Digital Simulation

- Simulation hardware dedicated to solving complex power system electromagnetic transient equations
- Modeling software (RSCAD) installed on PC workstation able to accurately describe analog power components in a “digital” language and communicate with RTDS
- The RTDS “rack” contains the power processors and communication hardware necessary to solve the complex system of equations generated by RSCAD
- Real Time – simulation is fast and accurate enough for hardware-in-the-loop functionality
Underlying Hardware Architecture

- Power Grid Modeling
- Monitoring and Control of Physical Assets
- DNP3
- SCADA
- Test Bed
- PMUs
- Analog
- TCP/IP
- CIPR

Proposed Functionality

Existing Functionality

RTDS Technologies

Monitoring and Control of Physical Assets

SE/EMS

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PMU Integration Issues

- Identify data timing and network fidelity gaps
- Dynamic and static model benchmarking and validation
- Demonstrate optimal use of PMU data for applications
  - Wide Area Measurement Systems - network situational awareness
  - Real time control
  - SCADA/EMS: Determine optimal short term plan for operator awareness
    - Voltage, angle, frequency, thermal overload alarm
    - Improved restoration awareness

http://www.naspi.org/vision.stm

P. Overholt, *Wide Area Measurement Systems*, CMU 2007 Conference
Training Emulator

- System operators will be exposed to a vast number of complex training scenarios
  - Blackstart training
  - Low occurrence, high consequence scenarios
- Beyond event recording – offers dynamic human-system interaction
  - Testing and evaluation of switching orders
  - Heuristic event analysis
- Interface to existing operator training simulators
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