U.S. Department of Energy

Office of Electricity Delivery and Energy Reliability

Cybersecurity for Energy Delivery Systems

2010 Peer Review

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TCIPG Center Overview

TCIPG Summary

Extend and **integrate** previously developed TCIP technologies and to **develop new** ones that collectively provide resilience in the nation's electric grid cyber infrastructure that ensures

- Trustworthy and timely operations,
- Survives malicious attacks while ensuring **continuous delivery of services**, and is built on an
- **Intrusion tolerant**, survivable architecture

- Builds on NSF/DOE/DHS Effort from 2005-2010
- $15 M per over 5 years from DOE/DHS, starting Oct 1, 2009
- $3.75 M cost share from Universities
- Funded by Department of Energy, Office of Electricity
  - With support from Department of Homeland Security
- 5 Universities
  - University of Illinois at Urbana-Champaign
  - Washington State University
  - University of California at Davis
  - Dartmouth University
  - Cornell University

TCIPG Project Committees and Boards

- **External Advisory Board (EAB)**
  - Advises and provides recommendations for task plans and funding.
- **Industry Interaction Board (IIB)**
  - Expand existing Industry Advisory Board (50+ organizations attended meeting last fall) to form Industry Interaction Board.
  - IIB is a large community of stakeholders that interacts with TCIPG.
- **Executive Committee (EC)**
  - Provides day-to-day management of project.
  - Membership:
    - Cluster and Cross-Cutting Effort leads
    - Management: Bill Sanders (PI), Himanshu Khurana (Principal Scientist), Pete Sauer (Industry Lead)

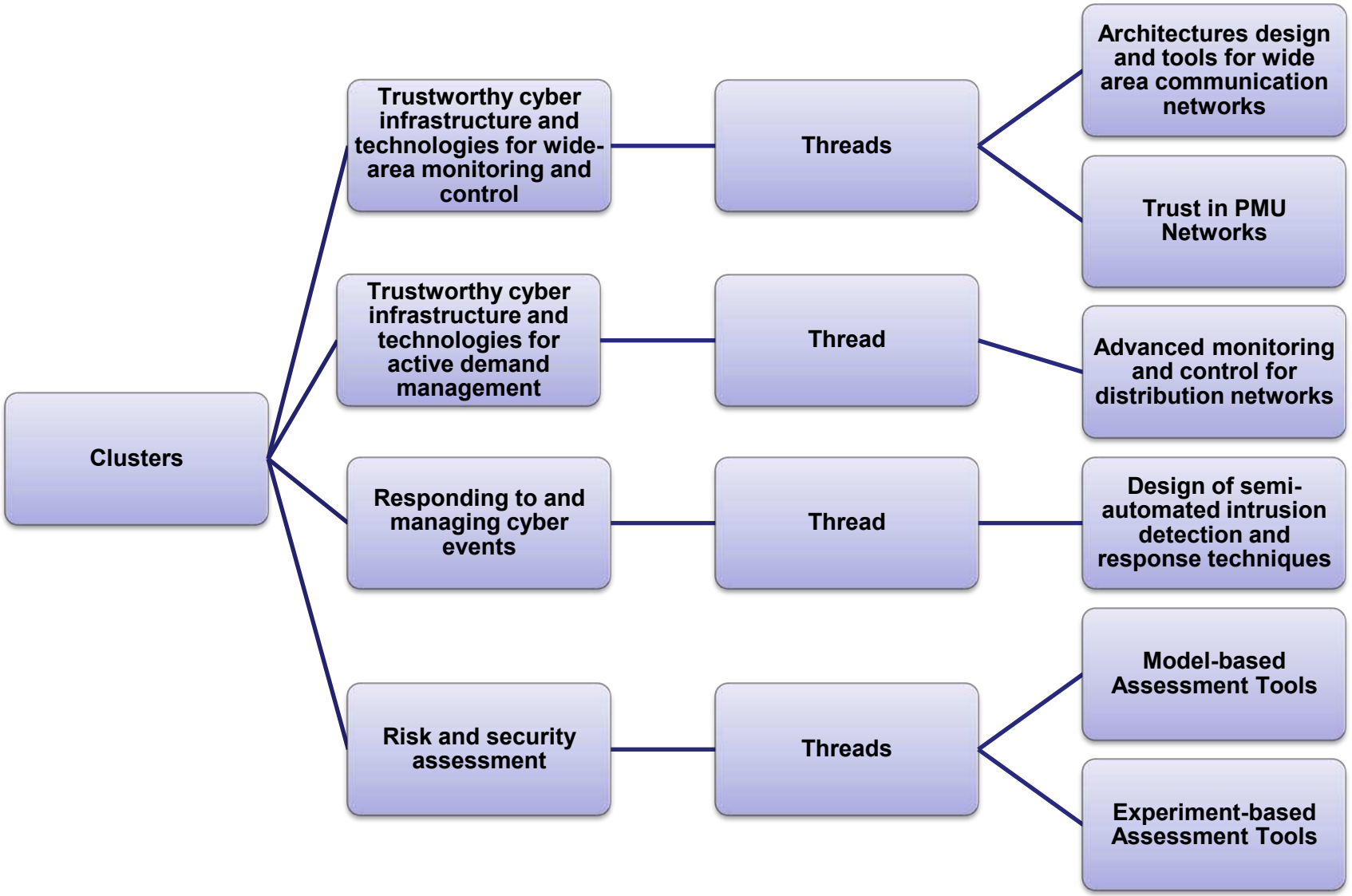
TCIPG Technical Organization

- **Technical Clusters** integrate work in specific technical areas over the life of the project
  - **Threads** connect work of various faculty to achieve specific goals within a technical area.
    - May come and go, based on needs, during lifetime of project
- **Cross-Cutting Efforts** address issues that cross technical clusters

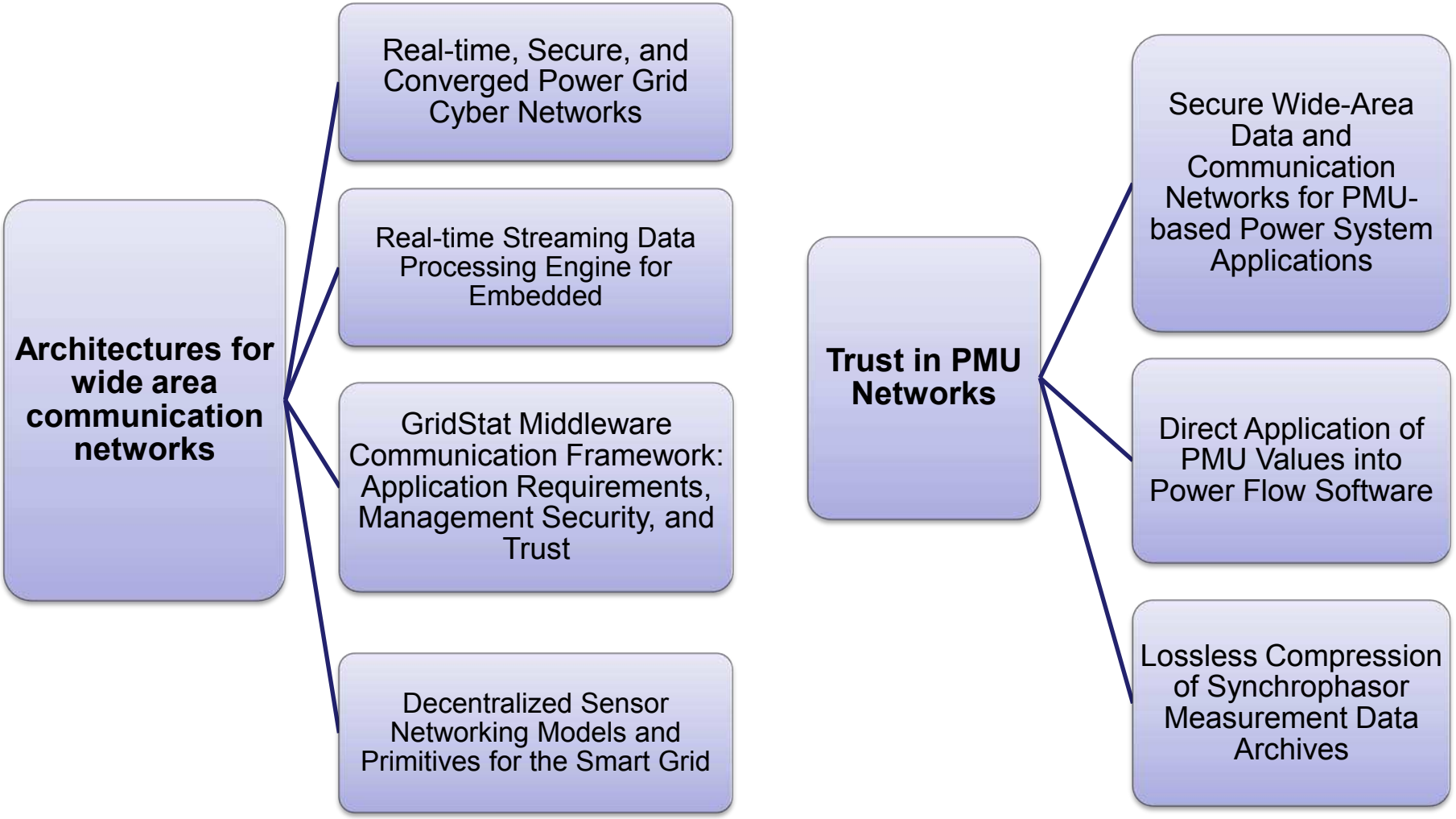
TCIPG Clusters and Cross Cutting Efforts

- **Technical Clusters**
  - *Trustworthy cyber infrastructure and technologies for wide-area monitoring and control*
  - *Trustworthy cyber infrastructure and technologies for active demand management*
  - *Responding to and Managing Cyber Events*
  - *Risk and Security Assessment*
- **Cross Cutting Efforts**
  - *Testbed theory, technologies, design and procurement*
  - *Technology transfer opportunities and challenges*
  - *Education and Workforce Development*

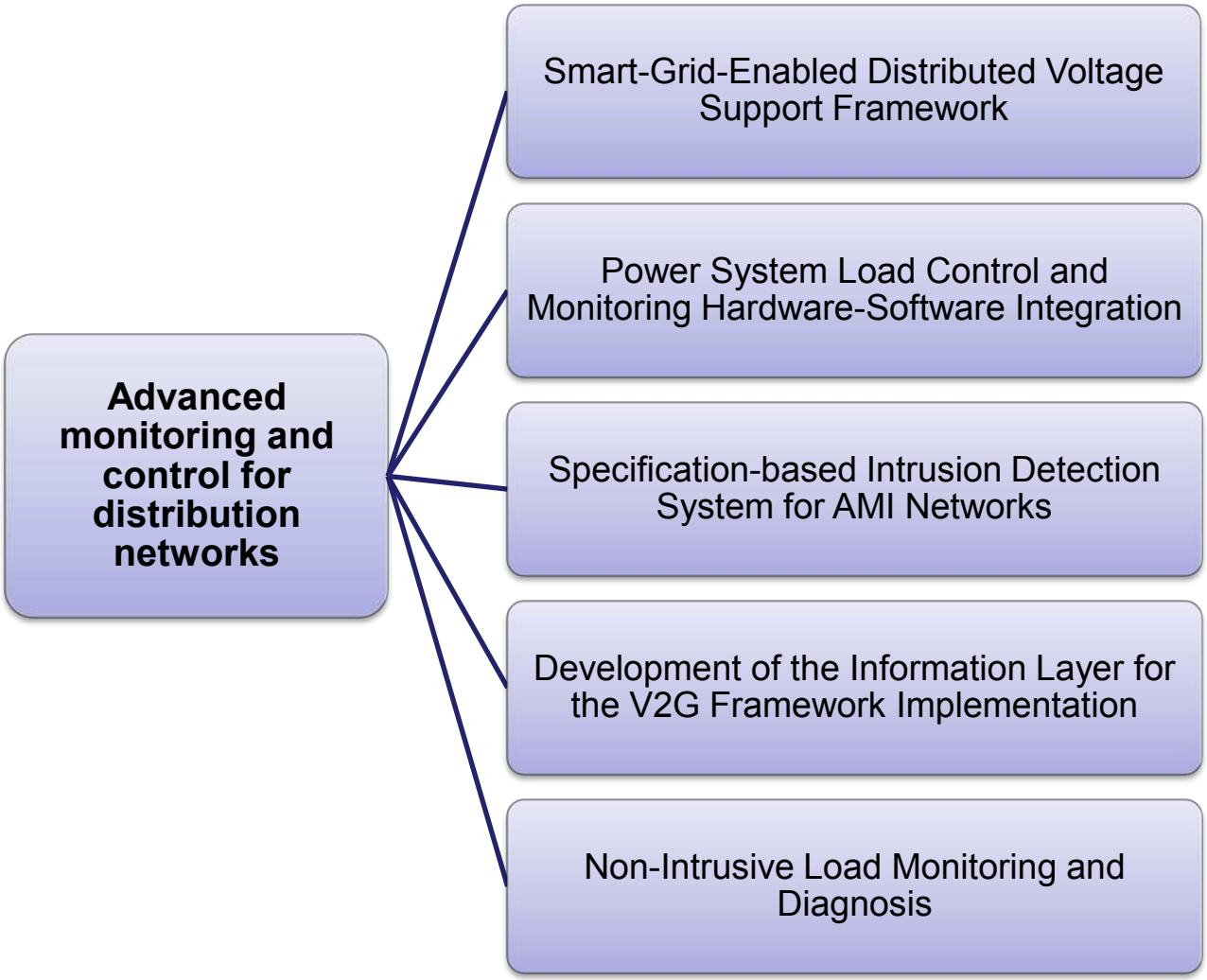
TCIPG Technical Clusters and Threads



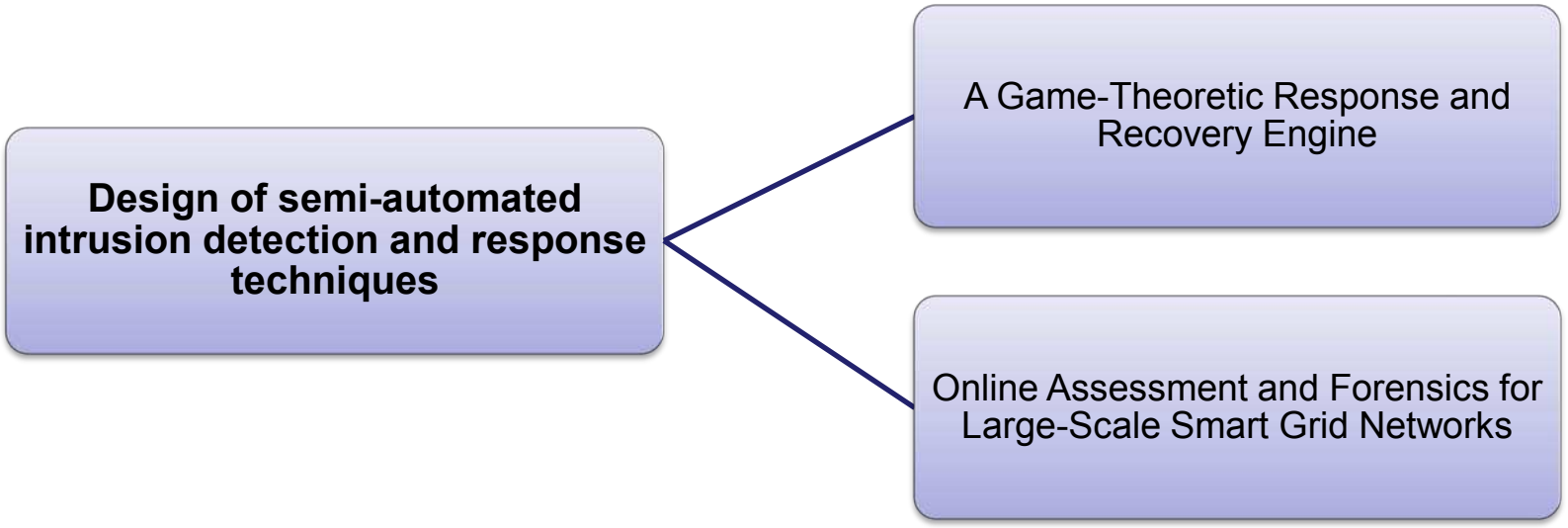
Cluster: Trustworthy cyber infrastructure and technologies for wide-area monitoring and control



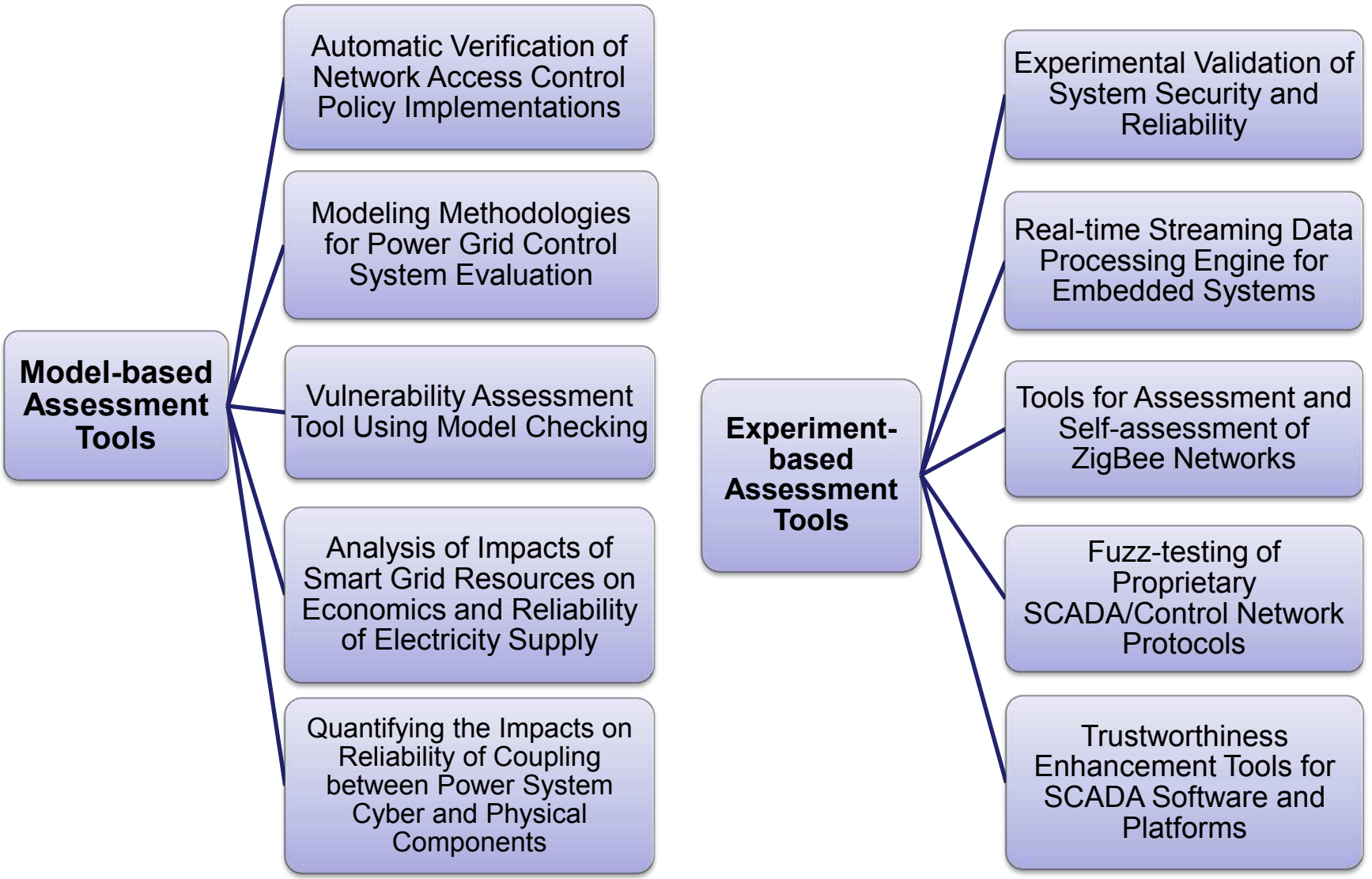
Cluster: Trustworthy cyber infrastructure and technologies for active demand management



Cluster: Responding to and managing cyber events



Cluster: Risk and security assessment



TCIPG Testbed Development

Objectives

- Develop capability of end-to-end testing.
- Develop proof-of-concept scenarios.
- Support researchers in evaluation of emerging smart grid research.

Achievements

- INL visit to coordinate related efforts.
- Attended DistribuTech 2010 and fostered vendor relationships for testbed expansion.
- Completed initial DNP3 protocol emulation work internal to RINSE.

Challenges/Problems Addressed

- Complex integration of cyber and physical domains.
- Design of experiments, output analysis.
- Appropriate equipment sourcing and build-out to provide maximum ROI with testbed resources.

Milestones/Plans for Remainder of Year

- Continue SCADA emulation work.
- Expand and integrate wireless model work.
- Create secure repository for industry PMU data.
- Expand data collection capability for non-intrusive load monitoring.
- Create plan for additional equipment and initiate execution.

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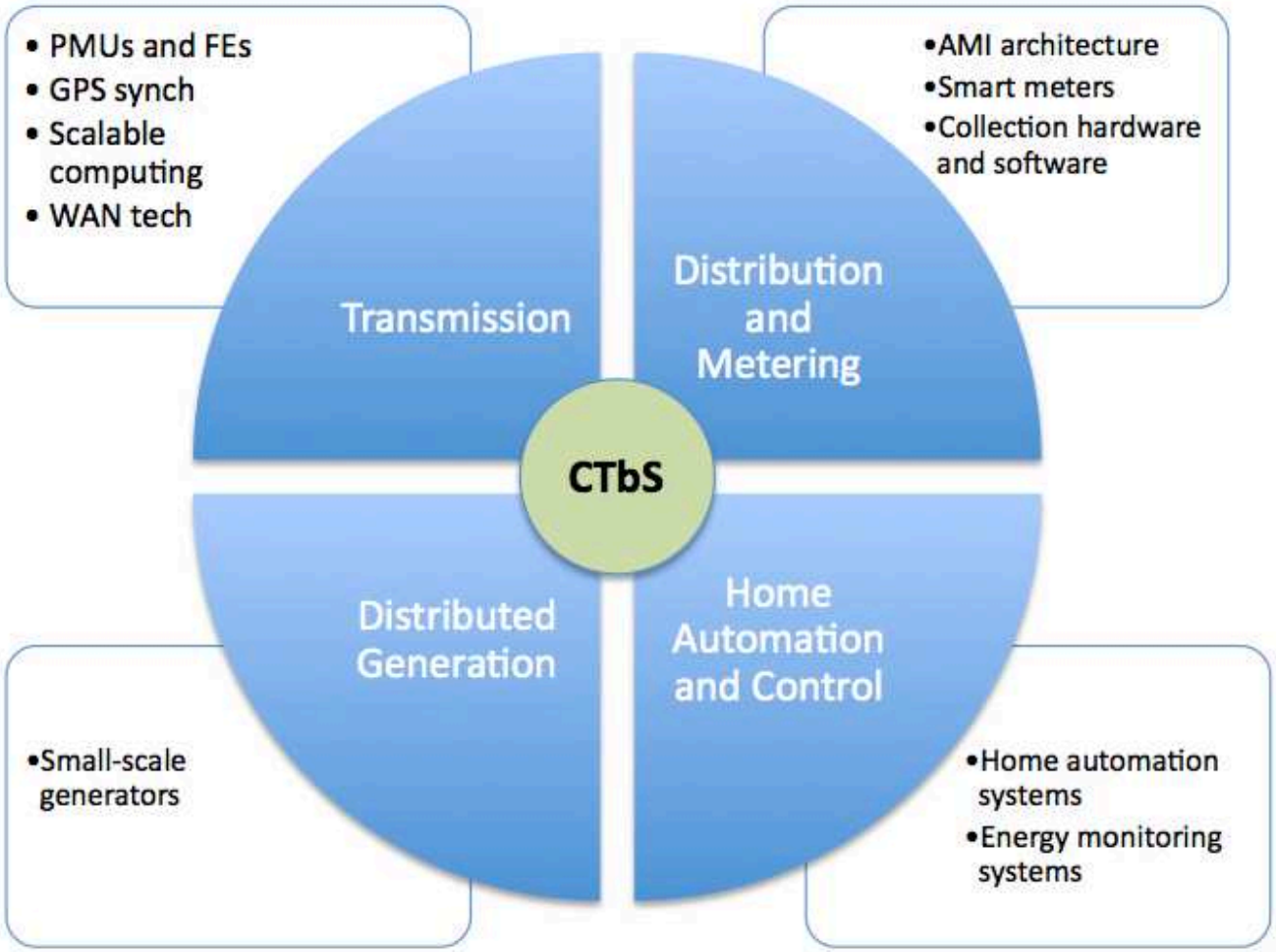
Logical Organization of TCIPG Testbed (Under Development)



CTbS: Core Test-bed Services

Example Industry Interactions and Technology Transfer – First Quarter 2010

- **Events and Other Activities**
  - Daniel Chen participated in the Smart Grid Virtual Summit 2010.
  - Tim Yardley attended DistribuTech 2010 and visited with vendors to build contacts for testbed augmentation.
  - TCIPG researchers participated in the February and March meetings of NASPI in Austin, TX, and discussed aspects of TCIPG and associated data-gathering.
  - TCIPG researchers have met and exchanged emails with some of the network operators in the power sector (Entergy, SISCO, and TVA) to gather information regarding traffic and network behavior.
  - TCIPG researchers are assisting the NERC Smart Grid Task Force in exploring R&D opportunities.
- **Upcoming Interactions**
  - A follow-up engagement with Ameren, May 2010.
  - Plans are being formulated for TCIPG researchers to visit the ComEd control center in Chicago.

TCIPG Upcoming Industry/Lab/Government Events

- TCIPG Seminar Series: Technologies for a Resilient Power Grid (Webinar Series)
- Industry Meeting / Annual Review, Urbana, IL – Nov. 3-4, 2010
- NIST Cyber Security NISTIR Presentation Day, Nov. 5, 2010
- TCIPG Summer School – Location TBD, Summer 2011

(Give any TCIP Member Business Card to get on our mailing list.)

CALL FOR SPEAKERS

TCIPG Seminar Series: Technologies for a Resilient Power Grid

beginning Fall 2010

The new TCIPG Seminar Series on Technologies for a Resilient Power Grid seeks speakers to present topics in the broad area of research, development, and design for secure and resilient systems related to the power grid. The scope includes all power grid systems, from traditional systems involved in generation, transmission, and distribution to emerging systems dealing with distributed generation, renewable integration, and demand-response. The seminars will be held on the campus of the University of Illinois at Urbana-Champaign, normally on the first Friday of every month at 1:00 p.m. Central Time, and streamed live on the Web. The seminars will be open to the public and are expected to attract a broad audience from industry, academia, and government. TCIPG will cover speakers' travel costs.

If you are interested in appearing as a speaker in the series, please contact TCIPG principal scientist Himanshu Khurana at hkhurana@iti.illinois.edu.

The new seminar series is presented by the TCIPG Center (Trustworthy Cyber Infrastructure for the Power Grid), whose partner institutions are the University of Illinois at Urbana-Champaign, Cornell University, Dartmouth College, the University of California at Davis, and Washington State University. The TCIPG Center, which is a successor to the earlier NSF-funded TCIP Center, was founded in 2009 by the U.S. Department of Energy with additional support from the U.S. Department of Homeland Security. It is housed in the University of Illinois Information Trust Institute.

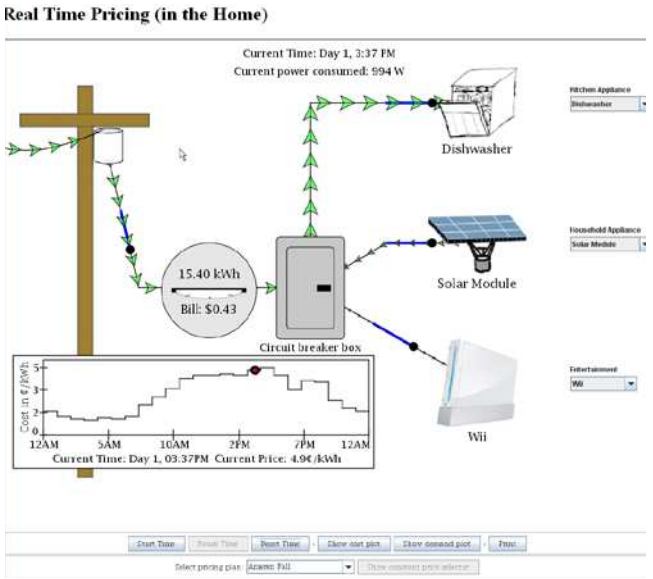
The TCIPG Center's work involves the development and integration of information technologies with the key properties of real-time availability, integrity, authentication, and confidentiality needed to build a more resilient power grid. Its objectives are to develop and evaluate technologies needed for realizing select Smart Grid applications, such as wide-area monitoring and control, demand response with controllable load, and plug-in hybrid electric vehicles. Ultimately, TCIPG research is expected to result in a secure and real-time communication system, an automated attack response system, and risk assessment and security validation techniques.

www.tcipg.org

Education and Workforce Development, p. 1

Objectives

- Link researchers, educators, consumers, and students.
- Develop pedagogically and technologically sound curriculum materials relating math and science to power, energy, and cyber communication issues and utilize these materials to connect with middle and high school teachers and students.
- Provide energy information for an informed public.
- Develop an exhibit at the Orpheum Children's Science Museum (OCSM).



Users can choose a three-tiered pricing option or seasonally adjusted hourly pricing.

Outreach Events

- University of Illinois Public Engagement Symposium, March 3, 2010.
- University of Toronto Sustainability Energy Fair, March 12, 2010.
- University of Illinois Engineering Open House, March 12-13, 2010.
- Kiosks established at the Orpheum Children's Science Museum, Champaign, IL.
- Renewable Energy and the Electrical Power Grid presented at the National Science Teachers Association (NSTA) national meeting in Philadelphia on March 20. Science teachers from the U.S. and Canada attended a presentation of the education materials.

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Education and Workforce Development, p. 2

Achievements

- The TCIP and TCIPG Education website, tcip.mste.illinois.edu, received 5,044 visits during the first quarter of 2010.
- Developed first prototype of Cyber Communication applet.
- Continued development and testing of Time-Sensitive Pricing applet and curriculum materials.

Expected Outcomes/Impacts

TCIPG Education strives to relate school math and science to power and energy issues, to create interest in STEM disciplines and careers, and to illustrate issues necessary for consumer acceptance and use of smart grid technologies.

Milestones/Plans for Remainder of Year

- Public access to Time-Sensitive Pricing applet and curriculum.
- Cyber Communication applet.
- Production of a power grid video in collaboration with Bill Hammack, www.engineerguy.com.
- Grand Opening for Children's Museum exhibit.
- Smart HVAC applet.
- Smart grid applet that integrates the concepts of communication, in-device intelligence, and the physical behavior of electrical systems.
- Begin planning for a second workshop for researchers and practitioners from industry, national laboratories, and academia to be held in the summer of 2011.

Personnel

Jana Sebestik, Himanshu Khurana, George Reese, Tom Overbye, Zeb Tate

Students: Kurchi Subhra Hazra, Steve Granda

TCIPG

Summary

- **Vision**
  - Design of an adaptive, resilient, trustworthy (and smart) infrastructure for electric power transmission and distribution
- **Approach**
  - Unique, holistic, technological approach
  - Academic, Government, Industry partnership
- **Execution**
  - Maintaining long term focus, but developing capabilities that can be used in today's grid
- **New Partnerships for Transition**
  - Engaging Industry and National Lab partners to take TCIP & TCIPG technologies to the next level

Questions?