TRANSFORMING GRID OPERATION AND PLANNING

Future Power Grid Initiative Newsletter

September 2015

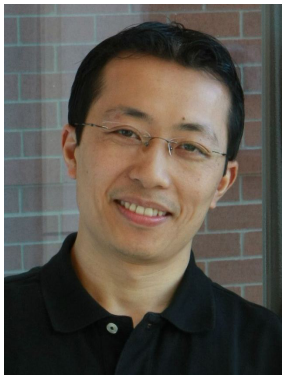
AS FPGI CONCLUDES, NEW CHAPTER BEGINS FOR GRIDOPTICS™

Pacific Northwest National Laboratory's Future Power Grid Initiative Comes to a Close on September 30, Marking Successful Completion of a Five-Year Effort

The first edition of the FPGI Newsletter, issued in September 2011, summed up the initiative's first full year:

"The Future Power Grid Initiative (FPGI) was approved in September 2010. By November 2010, nine projects started, focusing on research in the three focus areas: Networking and Data Management; Grid Modeling, Simulation, and Analysis; and Visualization and Decision Support. With its first birthday approaching, the FPGI can look back at a very successful year filled with a number of achievements."

The first year's progress became a common theme in the following four years, as FPGI moved from a concept to successfully developing a suite of tools--GridOPTICS™--designed to improve grid management and operations.



Henry Huang

"As we complete FPGI, the focus now shifts to advancing GridOPTICS™. This tool suite not only will benefit the grid, but national security, and potentially fields such as emergency response. The tools that have been developed through FPGI reflect visionary, innovative thinking of our research teams," says **Henry Huang**, who has served as FPGI co-lead with **Jeff Dagle** for the duration of the initiative.

The key focus going forward is the formation of a community of users and advocates to promote further development of GridOPTICS™ tools. Steps were taken toward this objective during annual workshops hosted the past four years by FPGI—the most recent was in September at PNNL. At that meeting, national experts continued to make progress toward creation of a multi-institute consortium that will advance GridOPTICS™ and related grid analytics tools developed by other organizations. The consortium, as currently envisioned, initially would include a core group of national laboratories, later expanding to involve industry stakeholders and other research organizations. In addition to organizing the next annual workshop, the consortium's first efforts will focus on development of a grid analytics roadmap and definition of common interfaces for software interoperability.

"Ultimately, we want to see GridOPTICS™ tools in broader use, improving power grid management and planning, and contributing to a future grid that will meet the nation's energy needs in the most cost-effective, reliable manner," Jeff says. "We also know the versatility of GridOPTICS™ can deliver solutions in other fields, which is an added benefit."

Jeff Dagle

PNNL's Laboratory Directed Research and Development (LDRD) program funded FPGI—approximately $16 million over the five-year lifetime.

"Investments in FPGI have already made tangible improvements in how the grid is operated. I have no doubt that this will continue—it's an honor to have been a small part of helping it succeed," says **Kelly Sullivan**, PNNL's interim director of Institutional Strategy and manager of the LDRD program.

Kelly Sullivan

EVENTS SHOWCASE FPGI DEVELOPMENT, GRIDOPTICS™ FUTURE

Initiative Hosts Annual Review, Energy Day @ PNNL and Grid Analytics Workshop

Three consecutive events at Pacific Northwest National Laboratory in late August and early September examined not only the Future Power Grid Initiative's development and impact, but also the future of FPGI's core product—the GridOPTICS™ capability suite.

The first event, FPGI's final Annual Review with its advisory committee, was held on August 31. FPGI leadership and research staff met with the advisors and provided updates, as well as final thoughts, on the five-year initiative and its projects. By design, the meeting was more conversational and less formal than past years. The advisors offered congratulations on the execution of the initiative and its accomplishments.

Energy Day @ PNNL, open to the public, was held on September 1 and was an opportunity for PNNL and FPGI to share information about GridOPTICS™ and other energy-related technologies. Representatives of government, industry and academia traveled to PNNL for the event, which included panel discussions, a keynote speech from the Bonneville Power Administration's Terry Oliver, technology demonstrations and a poster session. Energy Day also offered sessions on doing business and collaborating with PNNL, which received high marks from participants.

The 4th Workshop on Next-Generation Analytics for the Future Power Grid was held September 2-3. This event also featured participation from government, industry and academia, with a focus of moving the FPGI-developed GridOPTICS™ suite and similar tools to broader use and impact. The two-day event offered presentations on technology advances and other innovations, sessions to identify grid analytics challenges and solutions, and further discussion on establishing a consortium to support the ongoing use and development of GridOPTICS™ and other grid analytics tools.

Henry Huang opens Energy Day @ PNNL with a GridOPTICS™ overview presentation.

During Energy Day, PNNL's Brandon Carpenter (left) shares information about the VOLTTRON™ technology with a participant.

Gil Bindewald of the U.S. Department of Energy's Office of Electricity Delivery and Energy Reliability provided the plenary talk at the 4th Workshop on Next-Generation Analytics for the Future Power Grid on September 2.

Jianzhong Tong of PJM Interconnection fields questions during his presentation at the 4th Workshop on Next-Generation Analytics for the Future Power Grid on September 2. Tong provided industry insights on a GridOPTICS™ energy forecast tool.

FIVE YEARS OF ACCOMPLISHMENT

A Snapshot of FPGI and its Outcomes

During the past five years, the Future Power Grid Initiative conceptualized and developed the GridOPTICS™ capability suite. This process—and its outcomes—produced tools and resources designed to enhance operation and management of the nation's electric power grid.

Since the initiative's launch, FPGI has realized a number of significant milestones and achievements. A few highlights:

» FPGI formed multi-disciplinary research teams of PNNL staff from not only the power engineering discipline, but computing, mathematics, statistics, and visualization—This approach mirrored PNNL's hallmark method of marshalling multi-disciplinary teams to address research questions, and introduced a whole new group of staff to power grid research, strengthening PNNL capabilities overall.

» The initiative completed 18 projects that led to the development of GridOPTICS™ tools and capabilities, including:

- Four open-source technologies: **VOLTTRON™**, **GridPACK™**, the **GridOPTICS™ Software System (GOSS)**, and the **Framework for Network Co-Simulation**. VOLTTRON™ has been used in multiple grid- and buildings-related projects, including serving as the underlying platform for a transactive control node.
- The **powerNET testbed** for power system technologies, recipient of funding from the Department of Homeland Security (DHS) and other organizations over the past four years.
- **Decision Support** capabilities—which also have received funding from DHS.
- The **Power Model Integrator**—a tool that shows great promise as an efficient, cost-saving method to forecast electricity needs; PMI has been successfully tested in an electric transmission environment and recently was named a 2015 finalist for the prestigious R&D 100 Award.

» FPGI received, including funds mentioned above, a total of almost $16 million from the U.S. Department of Energy, DHS and other entities for use or further development of assorted GridOPTICS™ capabilities.

- More than $2 million was provided by DOE's Office of Electricity Delivery and Energy Reliability for GridPACK™'s development.
- $4.5 million was received from DOE's Advanced Scientific Computing Research program to support development of a math center for the power grid.

» The initiative achieved 17 invention disclosures, four copyrights and six patent applications, and built numerous collaborative relationships in government, industry and academia.

» FPGI communicated its research and associated advancements through more than 50 conference proceedings and other publications, as well as more than 110 presentations to regional, national and international audiences.

"This is just a sampling of FPGI accomplishments," says initiative co-lead Henry Huang, adding, "FPGI could not have done this without the support of PNNL's leadership, the LDRD program, the many staff who made outstanding contributions to the success of the initiative, DOE and other agencies, and external organizations that have collaborated with us. We're confident that GridOPTICS™ is positioned to bring solutions to national power grid needs."

STAFF VIEW FPGI AS AN ELECTRIC EXPERIENCE

Many staff across PNNL were involved in moving the Future Power Grid Initiative from concept to completion. Now that the five-year effort is concluding, they reflect on FPGI, their experiences, and the impact of the initiative on their careers.

"As the initiative's administrator for the past several years, much of my work with FPGI involved organizing the logistics of our mid-year and annual review meetings with the initiative's advisory committee. These events were challenging, as we were always trying to make sure that the meetings were as seamless as possible for our advisors and our staff, and that we were providing an atmosphere that allowed for effective communication and discussion of FPGI's projects. Beyond these meetings, my work often involved regular interactions with FPGI research and support staff. The team spirit was great, and I truly appreciated everyone's willingness to go above and beyond what was asked of them. By doing so, contributors to the initiative helped us achieve some terrific accomplishments. I'm excited to see where GridOPTICS™ goes from here, and its positive impacts on the power grid."

Tamica Dickenson
FPGI Project Administrator

"My research in FPGI involved several of the GridOPTICS™ technologies, including the GridOPTICS™ Software System (GOSS) and M-DART—which has a long name but essentially is a reasoning tool for smart grid integrated information systems. It was a pleasure to work with multi-disciplinary teams on these projects to create tools that have the potential to not only make the job of grid planning and operations easier, but will help the region and nation to maximize our electricity resources. I learned a lot from my involvement in FPGI, made contacts and met collaborators from other organizations who I hope to continue to work with in the future, and am hopeful that my research contributions will help achieve positive outcomes. I also hope that I will have continuing involvement in moving GridOPTICS™ tools to broader application."

Mark Rice
Power Engineer

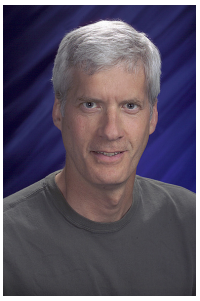
"The FPGI project that led to the creation of the Framework for Network Co-Simulation (FNCS) was the first time I had served in a principal investigator role. My area of expertise is high-performance computing, and it was a fantastic experience working with Jason Fuller from PNNL's grid team to integrate the computing aspects with the power domain's transmission, distribution and communications elements. I enjoyed working on the project and the initiative, learned a lot, and will be continuing to apply FNCS at PNNL through the Control of Complex Systems Initiative."

Jeff Daily
Computational Scientist

"A portion of my work in developing the GridOPTICS™ Software System (GOSS) involved interacting with other FPGI research teams to work with their project data and programming interface. This collaborative aspect of the project—particularly getting to know colleagues outside of my area of expertise (software engineering), was one of the highlights of my involvement. I'm looking forward to leveraging the new knowledge I've gained from FPGI in future projects."

Poorva Sharma
Software Engineer

"It has been gratifying to lead a multi-disciplinary team, develop a useful new capability (GridPACK™), and then position that capability for programmatic funding from DOE's Advanced Grid Modeling program. GridPACK™ already has gotten traction within PNNL for use in grid projects, and with it being open source, we're confident that this capability is going to achieve impact in improving modeling approaches in the broader grid community."



Bruce Palmer
Computational Scientist

Past Newsletters

For past newsletters, please see our news page here http://gridoptics.pnnl.gov/articles/i/n/i/Initiative_News_57ae.html#newsletters.

Contact

For more information, please visit the FPGI website gridoptics.pnnl.gov. or contact Initiative Leads

Henry Huang
Tel: (509) 372-6781
zhenyu.huang@pnnl.gov

Jeff Dagle
Tel: (509) 375-3629
jeff.dagle@pnnl.gov

Tim Ledbetter
Communication Lead
Tel: (509) 375-5953
tim.ledbetter@pnnl.gov

Pacific Northwest
National Laboratory
P.O. Box 999, K1-85
Richland, WA 99352

www.pnnl.gov

Pacific Northwest
NATIONAL LABORATORY

Proudly Operated by Battelle *Since 1965*