A Q&A with Henry . . .

GRID INITIATIVE CHARGES INTO FY14 WITH INCREASED ENERGY

Technical Advances and Teamwork Shine as Initiative Tackles New Challenges

Now in its fourth year, the Future Power Grid Initiative continues to make progress on its goal of developing a computing architecture, **GridOPTICS™**, to enable creation of next-generation tools and methods for power grid operation and planning.

Henry Huang

Initiative lead **Henry Huang** recently sat down for an interview to provide an FPGI update and share his views on the initiative's progress.

Is the Future Power Grid Initiative on track to achieve its objectives?

Yes, we are on track with the technical progress we have made in the last three years, and also in terms of our budget. We've achieved some notable technical accomplishments. A major part of the GridOPTICS computing architecture is a library, GridPACK™, that will enable advanced computing for power grid applications. GridPACK has been developed and released, and has gone from being a PNNL Laboratory Directed Research and Development investment to earning DOE Office of Electricity Delivery and Energy Reliability (OE) funding for future development (see related article in this newsletter). Other technical accomplishments include GOSS—or GridOPTICS Software System, which has served as the foundation for the development of several software tools; **VOLTTRON™**—a platform that deploys intelligent "agents" that help turn data from multiple sources into useful information for decision-making, which has been used in DOE-OE-funded projects; and **powerNET**, which is connected to the Electricity Infrastructure Operations Center and

serves as a testbed for power grid networking. This resource has been used by several internal and external projects.

These are just a few examples of FPGI technical progress.

What are key steps and challenges in the initiative's future?

One key step in our vision is that GridOPTICS will transition to an open-source platform, supported in its future development and use by a "community" including PNNL, other national labs, academia, vendors, and power companies. We realize GridOPTICS is a very aggressive objective and major endeavor, and going forward we need to leverage additional resources and expertise to ensure its benefit to the grid. There are a number of questions about forming a community, including its structure and the business model needed to sustain it. The initiative is working to resolve those questions.

Another key step in FY14 is our planned integrated demonstration of the GridOPTICS architecture. We're working with all of the projects within FPGI—and some projects outside of the initiative—to put together a demo that offers power grid scenarios. We'll then show how the GridOPTICS architecture and software tools would help mitigate or prevent any potential problems. The demonstration will be part of the FPGI annual review meeting in early summer.

How important have FPGI project teams been in achieving initiative progress?

Extremely important—I cannot emphasize enough how important they've been. We started as a multi-disciplinary effort, and from the very beginning we involved other PNNL domains, such as computer science, mathematics, statistics, visualization, and analytics, as well as power engineering. The teams have done outstanding work. We expected that staff from other disciplines would gain a long-lasting interest in the grid, and that they'd continue to work with power engineers even after FPGI ends. I think that's important—we're

team-building internally and it's a good thing for PNNL and the grid.

GridPACK™ TAKES NEXT STEP

Important New Resource for Model Development Released

A PNNL-developed toolkit that strengthens power grid modeling capabilities and is expected to be a key resource for building future power grid applications is now available publicly.

GridPACK™ was released for public use in November 2013. "Our initial focus was to make GridPACK work—we now are in the process of improving and fine-tuning it to enhance performance and reliability," explains **Bruce Palmer**, leader of the development team. The next step, he says, will be to build applications on top of the basic infrastructure.
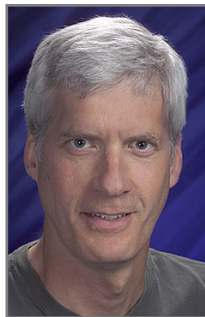
The toolkit's various modules help move model development from the workstation level to the

Bruce Palmer

Conceptual overview of GridPACK architecture

high-performance computing realm, while seeking to eliminate some of the lower-level details and complications typically involved in programming on parallel computers. "The idea is that people should spend a lot more time focusing on rapid development of their models and applications and not so much time trying to deal with data exchanges and partitions and similar issues pertinent to parallel computing," Bruce says.

GridPACK's development, initially supported by PNNL's Laboratory Directed Research and Development program, has garnered funding from the Department of Energy's Office of Electricity Delivery and Energy Reliability.

GridPACK is available at **https://www.gridpack.org/**.

Grid Analytics Workshop Explores Future of GridOPTICS™

Work Proceeds on Defining Business Model for "Community"

Software infrastructures such as the PNNL-developed GridOPTICS™ should transition to an open-source software, with further development entrusted to an open community of users and advocates—that was one of the key recommendations from the recent 2nd Workshop on Challenges in Next-Generation Analytics for the Future Power Grid. The workshop

was held September 19-20, 2013, in Seattle (**http://gridoptics.pnnl.gov/fpgws13/**). Participants included DOE's Gil Bindewald and 44 other power grid experts from government, industry and academia. The workshop expanded on findings from an initial workshop in November 2012.

"Participants concluded that a business model should be defined to underpin effective formation and operation of an open community, and that the members should include influential entities who have a vested interest in software infrastructure and who will serve as advocates in moving it forward," says **David Callahan**, FPGI Focus Area Two lead. Other recommendations from the meeting addressed issues related to GridOPTICS' interoperability, decision-support tools, predictive capabilities, and establishment of a testing facility to improve the tool suite's usability. A report that summarizes the workshop's outcomes is expected in January 2014.
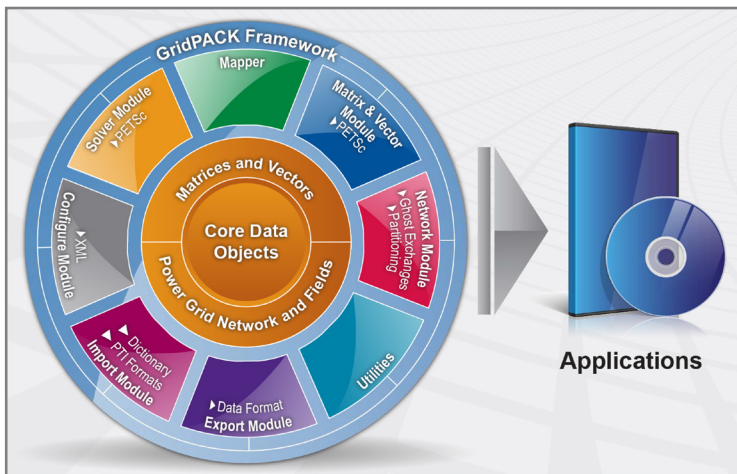
David Callahan

FPGI Sponsors Third Workshop at Supercomputing

Initiative Gains Visibility, Generates Interest

Representatives from national laboratories, universities and industry attended the Third International Workshop on High Performance Computing, Networking and Analytics for the Power Grid (**http://gridoptics.pnnl.gov/sc13/**), November 22, 2013, in Denver. The

session was part of Supercomputing 2013 and was sponsored and organized by the Future Power Grid Initiative in cooperation with SIGHPC.

The focus of the workshop was on promoting use of high-performance computing and networking for power grid applications. "The agenda included five presentations and a panel discussion, all of which generated considerable interest and productive conversations," says **Daniel Chavarria**, workshop chair.

Daniel Chavarria

Presenters in the session included four staff members from PNNL. Additional presenters were from Carnegie Mellon University, Argonne National Laboratory and Brookhaven National Laboratory.

FPGI has sponsored and organized the workshop each of the past three years.

ABOUT FPGI

The Future Power Grid Initiative (FPGI) will deliver next-generation concepts and tools for grid operation and planning and ensure a more secure, efficient and reliable future grid. Building on the Electricity Infrastructure Operations Center (EIOC), the Pacific Northwest National Laboratory's (PNNL) national electric grid research facility, the FPGI will advance the science and develop the technologies necessary for meeting the nation's expectations for a highly reliable and efficient electric grid, reducing carbon emissions and our dependence on foreign oil.

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FPGI FOCUS AREAS

Focus Area One addresses data networking and management issues, and enables the digital infrastructure for the future grid. This focus area will address the gaps in networking and real-time data management by developing advanced algorithms and software tools and techniques. **Focus Area Leads**: Bora Akyol (bora@pnnl.gov) and Harold Kirkham (harold.kirkham@pnnl.gov)

Focus Area Two targets research in the areas of advanced mathematical models, next-generation simulation and analytics capabilities for the power grid. Projects in Focus Area Two will use high-throughput data streams produced by projects in Focus Area One and integrate them with sophisticated mathematical models to conduct large-scale power grid simulation and analysis. Focus Area Two strives to advance the state-of-the-art in modeling and simulation in order to

achieve much higher fidelity situational awareness and global comprehension for power grid stability, efficiency and flexibility. **Focus Area Leads**: David Callahan (david.callahan@pnnl.gov), and Shuai Lu (shuai.lu@pnnl.gov)

Focus Area Three aims to convert large amounts of model and sensor data into information and knowledge to support decisions in grid operation, planning, and policymaking. This area concentrates on the development of coordinated visualization interfaces and decision support capabilities in a modular, extensible software environment that can be used for both real-time grid operations as well as long-term planning. **Focus Area Leads**: Paul Whitney (paul.whitney@pnnl.gov), and Jodi Obradovich (jodi.obradovich@pnnl.gov)

Future Power Grid Initiative
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