TRANSFORMING GRID OPERATION AND PLANNING

Future Power Grid Initiative Newsletter

September 2013

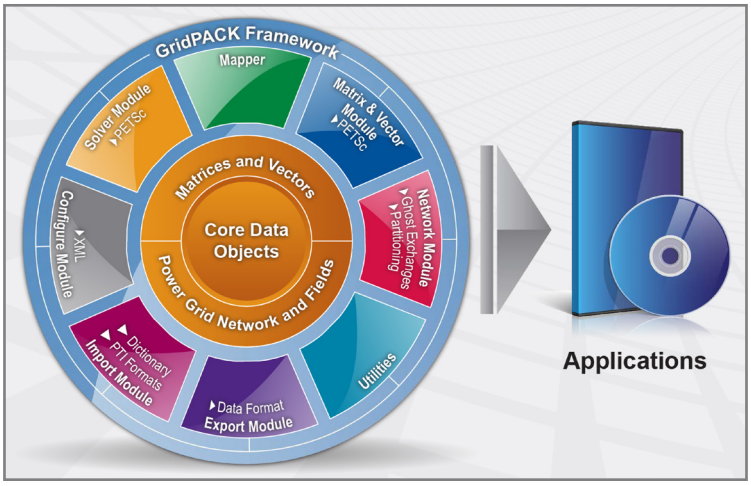
This month, FPGI features GridPACK, our scalable software framework for the development of power system simulation applications, and some recent funding news for two projects.

GridPACK™ – AN ADVANCED SOFTWARE SOLVER LIBRARY FOR THE POWER GRID

Computational analysis of the power grid is evolving to insure accurate and timely simulations. Yet the software tools available for power grid simulation today are primarily sequential single core programs. Depending on the specific applications, these simulations can take up to minutes, hours and days to complete – a timeframe far too long for today's ever more distributed and intermittent power grid. GridPACK, which stands for Grid Parallel Advanced Computational Kernels, is a new scalable software framework for the development of power system simulation applications which will contribute to shorter simulation times and increased productivity of power engineers.

How does it work? GridPACK builds on existing generic software libraries, such as PETSc and Hypre – mature linear algebra frameworks for high performance computing that can interface with many different solvers to create modules customized for the power grid domain. Linear solvers and associated matrix-vector kernels are keys to most power-grid simulations. For example, such solvers are needed when analyzing power flow and state estimates, predictive real-time Kalman filter analysis, and implicit time-integrators for real-time modeling.

GridPACK provides a scalable framework of modules that can enable power system domain experts to produce their own simulations for large and complex systems, eliminating the need for parallel implementation of the software. Users of GridPACK will be able to combine these modules to produce custom algorithms. FPGI will produce an open source GridPACK library that will benefit the modeling of both current power-grid networks and future power-grid networks that require fast solution procedures for larger systems of equations.



Conceptual overview of GridPACK architecture

PROJECT UPDATES

PowerNET

FPGI's **PowerNET lab** has secured $1m in follow on funding from the Department of Homeland Security. This funding will support research of federated power grid physics models between test beds- including the DEFT consortium, which includes University of Illinois Urbana Champagne, the Information Sciences Institute, and SRI)- as well as general capability improvements for powerNET.

VOLTTRON

FPGI's **VOLTTRON project** received an additional $200k in funding to support the Department of Energy's Transactional Network project. VOLLTRON will use the funding to build support for building controls protocols, such as BACNET.

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 Ning Zhou (ning.zhou@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 Lead**: Paul Whitney (paul.whitney@pnnl.gov), and Jodi Obradovich (jodi.obradovich@pnnl.gov)

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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