Pacific Northwest NATIONAL LABORATORY

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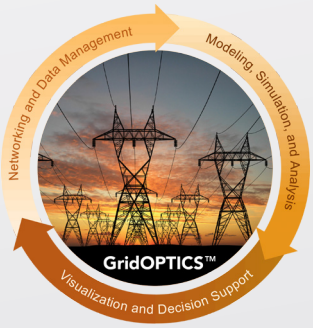


FUTURE POWER GRID INITIATIVE

GridPACK: Grid Parallel Advanced Computational Kernels

OBJECTIVE

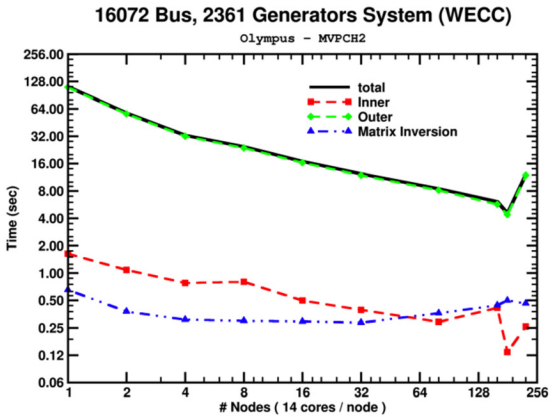
The U.S. power system is now more complex and contains far more elements than ever before. Computational analysis of the power grid will also have to evolve to insure accurate and timely simulations. On the other hand, the software tools available for power grid simulation today are primarily sequential single core programs. The productivity of power engineers that need the results of these simulations can be greatly enhanced when simulations take tens of minutes instead of days to complete by using large number of cores in parallel. In order to take advantage of such parallel systems, a new software paradigm is required. Our project proposes to develop a scalable software framework for the development of power system simulation applications that will be accessible to domain experts.

APPROACH

GridPACK will use PETSC, a MPI-based HPC parallel linear algebra framework that can interface with many different solvers, to create modules customized for the Power Grid domain. Users will be able to combine these modules to produce custom algorithms. In addition we will produce four technology demonstration programs to test the modules and provide guidance to others for building their own applications. We will also leverage the results of the FPGI GridOPTICS™ program and other tools developed at PNNL to provide synergistic tool development for power system domain experts.

IMPACT

We will provide a scalable framework of modules that can enable power system domain experts to produce their own simulations for systems that are larger and or more complex than what is possible today without the need to worry about the parallel implementation of the software. This framework will greatly increase productivity of expert in this field by reducing the time to solution for systems of interest. This framework will be put forth as an example of the practical application of HPC to critical Power Grid simulations and provide great benefits to PNNL, DOE, and industrial researchers.



Recent work done within the ARRA Parallelization project for Ensemble Kalman Filters.

U.S. DEPARTMENT OF ENERGY

FOCUS AREA 2 - MODELING AND SIMULATION

FOCUS AREA

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:** Ian Gorton (ian.gorton@ pnnl.gov), and Ning Zhou (ning.zhou@ 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.

ABOUT PNNL

Pacific Northwest National Laboratory is a Department of Energy Office of Science national laboratory where interdisciplinary teams advance science and technology and deliver solutions to America's most intractable problems in energy, the environment and national security. PNNL employs 4,900 staff, has an annual budget of nearly $1.1 billion, and has been managed by Ohio-based Battelle since the lab's inception in 1965.

For more information, please visit the FPGI website or contact:

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