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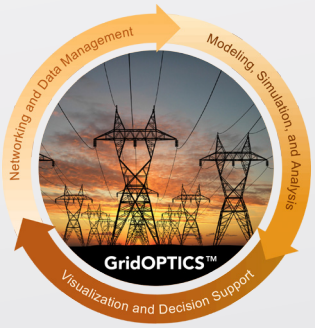
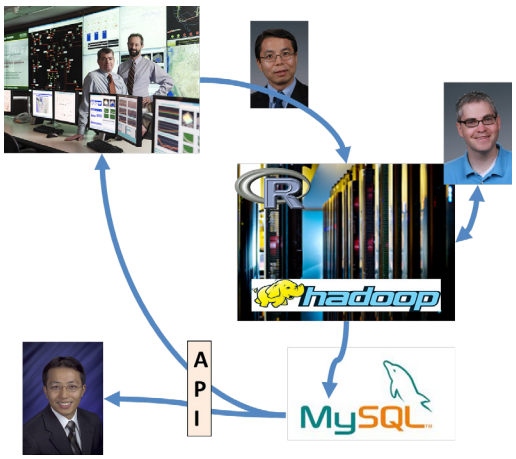


FUTURE POWER GRID INITIATIVE

Multi-Resolution Data Model and Directed Data Reduction, Reconstruction, and Aggregation

OBJECTIVE



Phasor Measurement units (PMUs) generate up to 30 observations per second. To develop a better understanding of the data it is necessary to develop tools for

- Exploratory analysis of historical PMU data
- Identification of events of interest
- Efficient access to events

We have obtained approximately 1.5 years' worth of PMU data and have developed several algorithms to identify erroneous records. These algorithms have been applied against our entire data generating a "cleaned" version of the data. We use this cleaned data as the basis for identifying events of interest.We have also developed an event repository where we record metadata about specific events for fast retrieval.

APPROACH

We are taking an exploratory analysis approach to defining data cleaning and event extraction algorithms. Specifically we

- analyze the entire data set to identify patterns of interest
- explore the patterns in more detail on a subset of the data
- develop an algorithm to extract the pattern
- apply the algorithm over the entire data set

We are using R over Hadoop on the PNNL Institutional Computers to enable this analysis, and have used 415k CPU hours. Once events are extracted, they are stored in a metadata repository for fast retrieval. A specialized API has been developed to support specific queries against the repository based on event type.

IMPACT

The algorithms that we develop as a result of our analysis can be applied to both historical data sets and streaming data.

We have developed data cleaning filters that

- eliminate a variety of erroneous types of data

U.S. DEPARTMENT OF ENERGY

FOCUS AREA 1 - NETWORK AND DATA MANAGEMENT

» provide a clean data set for additional analysis algorithms to utilize

Event extraction algorithms enable identifying multiple power types of power grid events such as generator trips. While our specific analyses are relatively simplistic, the scalable data analysis infrastructure has demonstrated the ability of this approach to analyze large-scale power data.

FOCUS AREA

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)

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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