Computational Science for Grid Management

CHALLENGE

Electric utilities and operators of the modern grid face complex challenges. For example, distributed energy leads to greater uncertainty of supply and demand due to the intermittent nature of alternative energy resources, such as wind and solar. As a result, safety margins must increase to maintain reliability, which increases costs. Electric utilities and grid operators need advanced computational planning tools to keep pace and operate economically in this complex environment.

APPROACH

In this project, six DOE national laboratories are working with industry stakeholders and academic partners on a framework to accelerate the capabilities of existing software to achieve grid modernization goals. They will develop new algorithms that predict the grid's status faster and more accurately. This new framework will provide better and more timely forecasts and analyses that reduce safety margins and require fewer costly standby power plants. Key activities of the project include:

- integration of prototype mathematical solvers for grid optimization, dynamics, and uncertainty for increased accuracy;
- development of an advanced framework that allows 10x faster prototyping of computationally intense analyses;
- development of open source optimization, dynamics, and uncertainty solvers that compute 100 times faster than current approaches by harnessing parallelism; and
- identification of high-value use cases for demonstrating the framework and solvers at scale.

EXPECTED OUTCOMES

These efforts will illuminate the effects of renewable energy, improve the planning and operation of the grid, and lower costs for electric utilities and grid operators. By accelerating data analytics, optimization, and dynamic simulations, the program will better manage the modern grid's uncertainty and increased data requirements. In turn, electric costs and emissions will decline and grid reliability will increase.

At-A-Glance

PROJECT LEADS

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PARTNERS

- PJM
- ISO New England

BUDGET

$1.18 million

DURATION

April 2016 – March 2019

TECHNICAL AREA

Design and Planning

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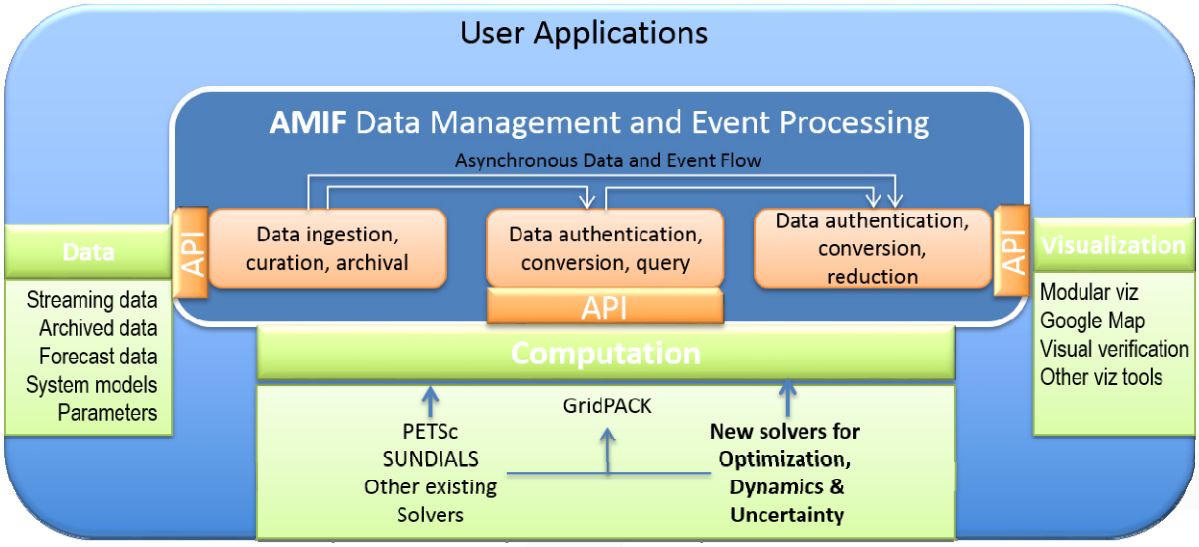

Architecture of the proposed computational framework for the grid.

LAB TEAM

Argonne NATIONAL LABORATORY

Lawrence Livermore National Laboratory

Los Alamos NATIONAL LABORATORY

NREL NATIONAL RENEWABLE ENERGY LABORATORY

Pacific Northwest NATIONAL LABORATORY

Sandia National Laboratories

Launched in November 2014 under the U.S. Department of Energy's Grid Modernization Initiative, the GMLC is a strategic partnership between DOE Headquarters and the national laboratories, bringing together leading experts and resources to collaborate on national grid modernization goals. The GMLC's work is focused in **six technical areas** viewed as essential to modernization efforts:

Devices and Testing | Sensing and Measurements | Systems Operations and Control
Design and Planning | Security and Resilience | Institutional Support