



# 2017 ADMS Program Steering Committee Meeting Project Summary

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**Project Title:** Development of an Open-Source Platform for Advanced Distribution System Management – GridAPPS-D™

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**Organization:** PNNL

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**Presenter:** Ron Melton

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**Project Year 2 Funding (\$K):** \$3,300K – PNNL; \$600K - NREL

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## Project Objectives and Outcomes

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This project has three primary objectives. First is to develop a standards based, open source, reference implementation of a platform supporting creation of advanced distribution system planning and operations applications. Second is to validate the benefits of advanced applications that take advantage of the data rich environment in a modernized distribution system through formal evaluation of example applications. Third is to transition the open source reference software to industry.

Through realizing these objectives, the project seeks to reduce the time and cost to integrate advanced application into distribution utility planning and operations and to enable small and medium sized utilities to be able to take advantage of such technologies. Realizing these objectives will also further the practical use of standards such as the Common Information Model.

## Significance and Impact

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GridAPPS-D provides a platform for development of new classes of distribution system planning and operations applications. It has been designed to support modernized distribution systems that include a diverse mix of customer and 3<sup>rd</sup> party owned

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distributed energy resources, an increasing number of “smart” devices and systems, market interactions and distributed control and coordination operations. These modernized systems have a data rich environment requiring distributed systems while still maintaining situational awareness, reliability and resiliency. GridAPPS-D enables cost-effective development and integration of applications meeting these future needs.

The architecture of GridAPPS-D provides the application developer with an abstract data model based on standards such as the Common Information Model (CIM). The use of a standards based data abstraction and a standardized data exchange mechanism enables the development of applications that can be executed in any system that supports the data abstraction and data exchange mechanism. This approach should help promote adoption of the related standards within the industry and provide a pathway for providing cost-effective applications to utilities. It also provides a common platform for research and development with the DOE labs and industry.

## Technical Approach

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GridAPPS-D development is being conducted using agile software development practices. A conceptual design and functional requirements specification were written and the outset. These requirements were partitioned into three segments to be implemented during three release cycles of software development. The first phase included the core functionality to integrate existing software including GridLAB-D, the Framework for Network Co-Simulation (FNCS), Open-DSS, and the Grid-Optics Software System (GOSS) provided starting points for GridAPPS-D. For the second release cycle the remaining basic functionality has been added to the core from release cycle 1. In release cycle 3 the remaining functionality will be completed and V1.0 released. A test harness has been created to test incremental additions to GridAPPS-D in addition to the unit testing included in the software development process. The use of agile software development release cycles helps manage the various risks associated with the software development process.

To demonstrate the benefit of advanced applications, a formal application validation methodology has been developed. This methodology is based on observations of distribution system operators during visits to utility control rooms. Project team members who are developing the example applications are designing the ability to support formal evaluation into each application. In the third year of the project formal evaluations will take place comparing the benefits of the advanced applications to conventional applications. Creation of the formal methodology and building in specific evaluation measures in each application helps assure the success of these tasks.

One risk that is being actively managed is the lack of published interfaces to commercial systems that will be used in the evaluation / validation activity. This risk is being mitigated by exploring alternative approaches to exchanging network models and updating them based on the active simulation and action of the application(s) being evaluated. Vendor training will be used to help manage this risk and for those vendors willing to do so, active involvement by the vendor in providing the necessary interfaces.

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Finally, GridAPPS-D will be transitioned to the industry for longer term maintenance and support. To this end work has begun on a transition plan. The initial step in this is to discuss what the different options are for long term maintenance and support and to identify stakeholder expectations through discussions with members of the Industrial Advisory board and other interested parties. A workshop is planned to gather further input for use in drafting the initial transition plan.

In addition, for each application the project is identifying one or more utility “host” to provide input on the development of the application. This raises awareness of the use of GridAPPS-D and provides valuable feedback to the application developers. In this way, we manage the risk that the applications will not be relevant to the industry.

# Project Summary (continued)

## Technical Progress and Results

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GridAPPS-D Implementation: Conceptual design and functional requirements completed and published (April 2017). Implementation release cycle 1 completed May 2017 including simple Volt VAR Optimization (VVO) app as an example for testing. Release cycle 2 completed October 2017 including basic functionality in all elements of GridAPPS-D and shift to use of triple-store database technology for increased performance and flexibility.

Software QA plan completed – Sept. 2016 and updated in Dec. 2016. Software Test Harness completed.

ADMS Gap Analysis completed – April 2017

GridAPPS-D Evaluation Framework completed – April 2017

Database Technology Alternatives Completed – March 2017

Application development workshops held at Southern California Edison and PNNL to select applications and discuss how to develop applications to be developed.

Industrial Advisory Board established with face-to-face meetings at DistribuTech in San Diego (Feb. 2017) and in Washington, DC (April 2017). Regular web meetings started in Sept. 2017.

GridLAB-D version 4.0 annual major release (April 2017)

GridAPPS-D transition plan informal discussions with stakeholders started in June 2017.

Presentations on GridAPPS-D at IEEE ISGT 2016 and 2017, and 2017 IEEE PES GM. Twelve other presentations to individual stakeholder organizations or in other conferences or meetings.

## Project Collaborations and Technology Transfer

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The joint Industrial Advisory Board for GridAPPS-D and the ADMS Hardware Testbed has 24 members from utilities, vendors and industry organizations. The project interacts with the IAB on a periodic basis to solicit feedback and to identify collaboration opportunities. From this more detailed collaboration discussions have taken place with Avista, SCE, NRECA, and EPRI and are planned with several others.

For each advanced application one of more utility “hosts” is being identified to ground the application development with guidance from the host.

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The project team has been expanded beyond PNNL, NREL, Washington State University, Modern Grid Solutions, and Incremental Systems to include the University of Alaska – Fairbanks.

The transition plan for GridAPPS-D will define a collaborative path for the industry to assume responsibility for the long-term support and maintenance of the reference implementation of the GridAPPS-D platform.