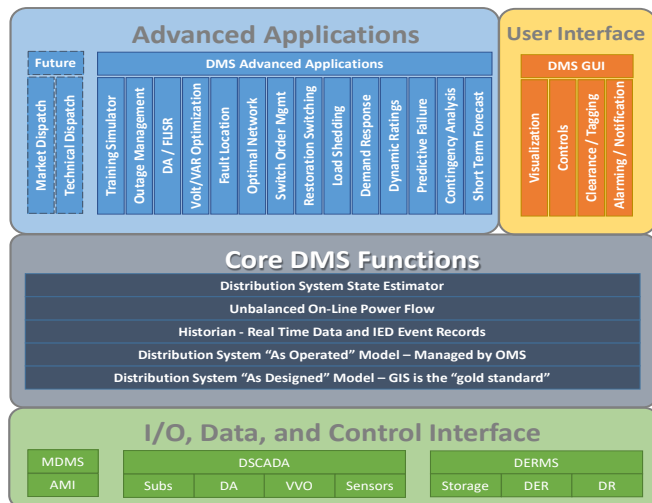


Distribution System State Estimation Test



Distribution Management System Functional Architecture

Background, Objectives, and New Learnings

Over the past few years, as distribution management systems (DMS) have evolved and become more widely deployed, the concept of distribution system state estimation (DSSE) has become deeply embedded in the core DMS architecture, as shown in the figure above. This core DMS function is intended to support key DMS use cases such as distribution automation, volt/var optimization, fault location, and situational awareness.

As utilities roll out their DMS deployments, the DSSE functionality, once configured, will begin to generate estimates of the state across an entire distribution system. However, estimates of the state of the distribution system generated by these DSSE implementations have not typically been put through rigorous evaluation. Assessments are needed to determine critical measurements and sensitivities to key inputs, such as topology, measurement accuracy, load models, and distributed energy resource (DER) production models. Methods for validating these estimates and testing their sensitivity to critical inputs have been lacking in the industry. Most utilities have simply spot- and sanity-checked the results during system acceptance testing.

EPRI and its members have taken a step to collaboratively address this gap by developing a DSSE Test Plan. This project will execute the Test Plan with utilities on utility-deployed DMS solutions.

Project Highlights:

- Evaluate DSSE results against system modelling sensitivities including topology accuracy, availability of medium-voltage measurements, customer load shapes, DER production curves.
- Evaluate DSSE results against temporal sensitivities such as season, day of week, hour of the day.
- Evaluate wisdom of utilizing DSSE results for critical DMS Advanced Applications.
- Provide data from which critical settings/configurations of DSSE can be established.

Benefits

Execution of the EPRI DSSE Test Plan is expected to:

- Quantify the accuracy of DSSE results across various operating, loading, and weather conditions.
- Quantify the sensitivity of DSSE results to system modelling variations, including topology accuracy, availability of medium voltage measurements, customer load shapes, and DER production curves.
- Quantify the accuracy of DSSE results to required accuracies of DSSE use cases.

Project Approach and Summary

The Test Plan identifies the necessary set of test variations with which a utility can create a custom test plan, balancing its specific requirements with the cost and complexity of the test. There is some latitude in customizing the specific test plan to meet a utility's needs. These variations will be evaluated during the first phase of the project. The most significant of these variations is whether the utility wants to conduct the test during one (peak), two (peak, off-peak), or three (summer peak, winter peak, off-peak) seasons. EPRI intends to work with participating utilities to apply the DSSE Test plan through the following tasks:

Task 1: Develop customized test plan.

Task 2: Develop test schedule.

Task 3: Conduct DSSE testing on up to five (5) representative distribution feeders.

Task 4: Collect test data for analysis.

Task 5: Conduct data analysis.

Task 6: Develop project report(s).

Deliverables

Each utility participating in this supplemental project will receive the following deliverables:

- Customized DSSE Test Plan
- Initial analysis report for each season of DSSE testing conducted
- Final report combining all testing, evaluating sensitivities, and critical measurements.

A Web workshop will be provided to funders, following the completion of two years of utility projects, summarizing the common results and findings of the projects.

The non-proprietary results of this research will be incorporated into EPRI Distribution Operations and Planning R&D Program and made available to the public for purchase or otherwise.

Price of Project

The price of the project is scope-based, depending on the number of test seasons desired.

- Level 1 – \$90,000 - For a single season of testing (peak)
- Level 2 – \$115,000 - For two seasons of testing (peak, off-peak)
- Level 3 – \$140,000 - For three seasons of testing (summer peak, winter peak, off-peak)

This project qualifies for Self-Directed Funding (SDF) or Tailored Collaboration (TC) funds. Funding can be split across two years.

Project Status and Schedule

This project is expected start in the first quarter of 2020 and run for 24 months with milestones for testing, analysis, and reporting throughout the project. Test schedules will be developed as each participant joins the project.

Who Should Join

Any distribution utility that has or is in the process of deploying a Distribution Management System with Distribution System State Estimation.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

Technical Contacts

Brian Deaver at 443.910.2553 (bdeaver@epri.com)

Nick Heine at 865.218.8157 (nheine@epri.com)

Alex Melhorn at 865.218.5911 (amelhorn@epri.com)

Member Support Contacts

Brian Dupin at 650.906.2936 (bdupin@epri.com)

Barry Batson at 704.905.2787 (bbatson@epri.com)

Chris Kotting at 614.468.3205 (ckotting@epri.com)

Annette Mosely at 972.556.6507 (amosley@epri.com)

Electric Power Research Institute

3420 Hillview Avenue, Palo Alto, California 94304-1338 • PO Box 10412, Palo Alto, California 94303-0813 USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com