Data Analytics and Applications Newsletter for EPRI's DMD/TMD Demo

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ABOUT THE NEWSLETTER

The EPRI *Data Analytics and Applications Demonstration* newsletter provides updates on EPRI's "Data Analytics" demonstrations—the Distribution Modernization Demonstration (DMD) and Transmission Modernization Demonstration (TMD). These initiatives identify and analyze data-oriented applications and support infrastructure through collaborative demonstrations around the world. Contact Doug Dorr (DMD) (ddorr@epri.com) or Alberto Del Rosso (TMD) (adelrosso@epri.com) with comments.

If you or a colleague would like to be added to or removed from the mail list, email Lori Warneke lwarneke@epri.com.

EPRI Perspective

Data and analytics are the new enablers for the smart grid. The electric power industry is progressing toward more diverse activities around data-driven decision making. Some consider this a disruptive change, while others embrace the change as the evolution of the smart grid. There are dozens of areas where improved grid visibility achieved through data analytics are going to re-script the way electric utilities view and manage their end product. This newsletter is designed to provide updates into a selection of interesting and evolving topics associated with analytics of the electric power system.

EPRI's (DMD/TMD) data analytics initiative is about getting more value from data and sharing the most beneficial examples. The work leverages EPRI and industry subject-matter experts, documents successful data-driven use cases, identifies new and innovative applications of data analytics, and develops frameworks customized for leading practices in utility analytics. The benefits will include more value from data sets such as better decision making and coordinated demonstrations on many types of data sources and applications with less duplication of efforts.

TECHNOLOGY TRANSFER AND INDUSTRY COORDINATION

Fall DMD/TMD Advisory Meeting

The EPRI "Data Analytics for Transmission and Distribution Applications" fall advisory meeting was held on October 29 and 30, 2014, at the EPRI Charlotte, North Carolina meeting facility. The general sessions included updates on research and development, presentations on technology transfer, updates on utility demonstration projects, and research prioritization.

The key focus of the DMD/TMD workshop was to review the plans and overall goals of each of the current demonstration projects and discuss how these demonstrations relate to core business decisions and value challenges. Current challenges include quickly gathering accurate data from disparate data sets, smarter sensors with less data movement, and minimization of data bottlenecks.

Presentations and key takeaways included:
- Modernizing the Grid with Analytics
  - A 2030 utility will be distinguished by how it uses and derives value from information.
- Preparing for Better Model Management
  - Data needs to be turned into actionable insights that operators and managers can use.
- Weather Predictive Modeling
  - There are several questions around the best ways to optimize the layers associated with storm data and analytics. When combined with system information, vegetation data, and historicals, some utilities may get adequate results with commodity data while others can benefit from strategic placement of supplemental weather sensors.
- Storm Recovery Visualization
  - Managers and dispatchers require fast answers to questions about system events. Access to the "what and why" data from a common interface is a key component.
- Fast, Accurate, and Accessible Smart Meter Analytics
  - This session demonstrated how big data technology and proper design - applied to billions of records of information with ultra-high-speed query results is feasible.
- Voltage and Current Sensor Data Mining for Fault Locating and Other Event Analytics
  - There are many valuable diagnostics afforded with data from smart grid sensors if the information can be leveraged quickly and efficiently.
- Transmission Monitoring, Diagnostics & Visualization Tool (TMDV)
  - This session discussed the requirements and an implementation roadmap for a tool to optimize data and analytics for transmission systems.
- Oil Circuit Recloser Update
  - Algorithms are being developed to move certain categories of distribution assets from calendar-based to performance-based maintenance.
- Demonstration on Synchrophasor Applications
  - This session overviewed examples of high-speed, real-time data streams with flexibility; time-synchronization and high-resolution/high-visibility.
- Network Model Management
  - A planned and well-constructed data-management process can result in labor savings, improved data quality, and better documentation/process management.
- Transformer Command and Control
  - This session described the capabilities of some advanced command and control systems that will be demonstrated as part of the TMD initiative.

Dealing with Data Silos: An Update

A special session during the DMD/TMD advisory meeting featured discussion of a proposed white paper on "Dealing with Data Silos." The planned content of the paper was reviewed in both the TMD and DMD tracks. The content proposed for the paper starts from the incontrovertible existence of data silos and how traditional mechanisms for addressing them will not adequately meet all of the requirements for data analytics of the modernized electrical grid. It was suggested that the concept of the traditional enterprise data warehouse be replaced with that of a "logical data warehouse" based on leveraging a common, standardized understanding of the meaning of the data being gathered from disparate systems.

As a means of accelerating the development of such a common semantic model, it was further proposed that the source of this understanding be based on the IEC Common Information Model (CIM) or similar models. This concept was greeted with considerable enthusiasm. The use of CIM as the basis for a semantic model is also attracting attention in other EPRI research areas and provides a useful template for describing how such models can help electric service providers with their data analytics activities.

An incremental approach to the extension of existing warehouses will therefore be emphasized in the paper, based on the idea that the logical data warehouse need not be viewed as a complete replacement of existing solutions, but rather as a managed extension of the concept of the warehouse to encompass both traditional and new semantic-based components.

Special thanks to all of our presenters and advisors for a very successful and insightful workshop. We look forward to seeing all of you again at the spring advisory meeting in May 2015.

DISTRIBUTION MODERNIZATION UPDATES

DMD Activities

The distribution modernization (data and analytics) research initiative presently has ten demonstrations in the initiation process. A current list of demonstrations is shown in Table 1. Although the types of projects are diverse—including such categories as outage awareness, asset optimization, system awareness, practice/technology, and load/AMI analytics—in general, each demonstration has three commonly important criteria:
1. The demonstration involves multiple data sources and defines the methodology applied toward integration of these sources.
2. The demonstration is of sufficient scale that it can be extrapolated to a full system deployment (and value assessment).
3. The demonstration is suitable for creation of a use case and a replicable methodology.

Table 1. Data-Oriented Demonstrations in the Kickoff Stage	
1	Data repository and mining initiative for DSCADA, AMI, and supporting data sets
2	Demonstration of integrated data sources for higher-resolution prediction of storm damage
3	Visualization of disparate data sets for improved event analytics with time replay and mapping
4	Improved understanding of solar impacts with high-resolution AMI and weather data
5	Theft-detection analytics using AMI—leading practices and innovative data-enrichment concepts
6	Leveraging integrated data sources for better fault locating, anticipation, and source identification
7	Using data analytics for condition-based maintenance of oil-filled circuit-reclosing devices
8	Demonstration of ten AMI analytics algorithms with various member data sets
9	Description of data and use cases and conceptual description of a near-real-time awareness tool
10	Applying EPRI's Smart Grid Use-Case Methodology for determining the value of data analytics

Highlighting item 1 in the prior table, the industry-wide data-repository seeks to demonstrate solutions to data challenges faced by the international electric utility industry by leveraging collaboration between EPRI, electric service providers, and providers of data solutions, including both academia and data analytics companies. The enhanced partnerships established as part of this initiative will foster a better understanding of industry needs, capture leading data analytic practices, transfer knowledge from industry experts, and accelerate ideas/solutions to the market. This work will:

- Develop and maintain a data repository where the analysts can get the data sets of interest.
- Prioritize a wide variety of data-driven value cases (or use cases) where the mining initiative would provide insight and/or benefits.
- Define the internal and external data sets necessary to populate the data repository and support each use case.
- Determine suitable ranges of data size to adequately evaluate emerging big data technologies.
- Document, to the extent practicable, any data ingestion, semantic, or other challenges associated with the data packages placed in the repository.
- Consolidate the most valuable use cases per utility business unit and describe the implementation requirements to accomplish the use cases.
- Estimate the application value of attaining insights regarding the various use cases.

Overall, the goal of this effort is to learn what can be done with existing data, identify insights from the data that were previously unknown or perhaps not even conceptualized, and to become more versatile with strategies and activities related to analyzing big data. Special thanks to Southern Company for identifying the topic as one of the important industry needs associated with data and analytics and for working toward getting the first data packages into the repository.

 TRANSMISSION MODERNIZATION UPDATES

TMD Activities – Welcome New TMD Members

The Bonneville Power Administration (BPA) is a new member of TMD. BPA sponsors research projects related to big data in the utility enterprise in excess of $1.6 million annually, excluding capital expenditures. As such, participation of BPA is mainly intended to bring the learnings and experiences of these projects to the EPRI portfolio, adding value to the research being developed in the TMD, for members as well as to the utility community in general. The main focus of the investigation will be in synchrophasor data validation and applications. Demonstrations of algorithms and software tools for PMU-based event detection, data mining, oscillation detection, and voltage stability assessment and control are expected to be conducted, including commercial, in-house, and researcher-developed software. Also, different techniques for PMU-data quality assessment will be tested. BPA's synchrophasor laboratory facilities and data repository are expected to be used for this purpose. Currently, the lab houses over ten servers, running a variety of applications, including event detection, data validation, and real-time trending displays. An OSIsoft PI system, similar to those installed at both BPA control centers, allows for improved development of the operational system in an offline, R&D environment.

Louisville Gas and Electric Company and Kentucky Utilities Company (LG&E and KU) have recently joined TMD. LG&E and KU together serve 940,000 electricity customers in Kentucky and Virginia. The company Research and Development team is devoted to investigating and evaluating new technology to find ways of improving system operations and efficiency in order to better serve customers. LG&E and

KU participate in several of EPRI's research programs and recognize the value of EPRI's collaborative model, which enables the company to leverage every dollar invested in R&D, receiving amplified research benefits. Currently, activities are in the project-initiation phase, which includes meetings and interviews to prioritize areas of interest, identify transmission applications and systems, and select high-priority candidate areas for demonstration.

TMD Application Highlights

American Electric Power (AEP) is embarking on an effort that will transform the way network models are managed. AEP is considering undertaking a major project to improve the management of transmission network models as its initial demonstration project under the EPRI Transmission Modernization Demonstration (TMD) initiative. A convergence of activities over the last two years has put AEP in a position where launching such an improvement project is a logical next step. Such a project at AEP has the potential for providing substantial benefit to the industry, particularly when it is done within the framework of the TMD, where lessons learned and benefits derived will be monitored and shared.
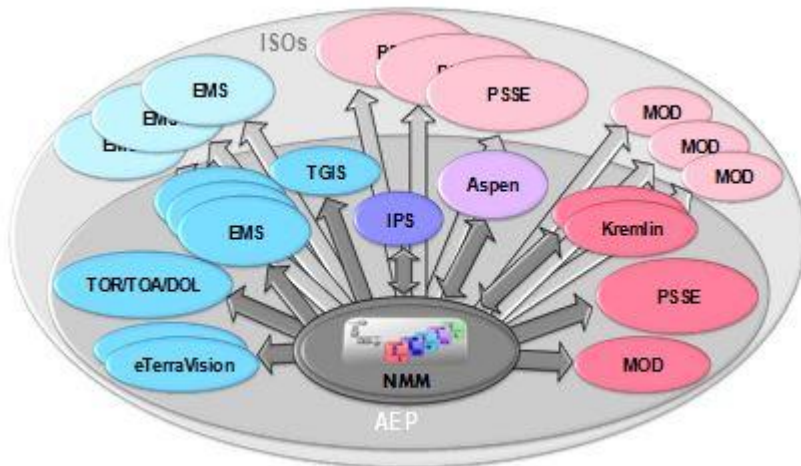

Existing model-management practices at AEP are typical of those found at large utilities throughout the United States. There are multiple applications with independently maintained data from transmission network models that do not talk to one another. An over-arching data-sharing architecture is lacking.

The purpose of the AEP TMD project is to streamline the processes that AEP uses to manage data from its network models by introducing a Network Model Management architecture, which will facilitate the organization and management of information from all of the network models. The idea is to update one record and have every database and application automatically receive the update. This architecture has been explored and defined through two recent EPRI supplemental projects in which AEP participated: Integrated Network Model Management and Network Model Manager Requirements Overview. The AEP TMD project is intended to implement a framework for managing full-scale production network models for sharing data among AEP transmission applications, which will form the foundation of a long-term AEP strategy for improving the quality of data from transmission networks, reducing the labor required to maintain network models and facilitating the addition of future transmission applications.

The work that AEP is considering represents an early production deployment that has been validated in other related industry implementations, without the internal model management goal focus as in the AEP TMD project and never to the scale proposed by AEP. Moving from the pilot test to full-scale integration will require a sizable AEP investment outside TMD.

EPRI's TMD resource team will assist AEP with initial project activities (development of a high-level project plan and overall integration design and identification of a set of initial targets). The TMD effort will then monitor and document accomplishments, challenges, and lessons learned.
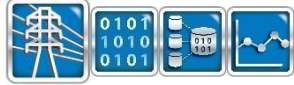
Two new deliverables are available for respective DMD-TMD member access:

- *Automated Waveform Analytics for Improved Reliability and Operational Support Demonstration of DFA Technology at Multiple Utility Companies* – 3002004136
- *Big Data and Analytics in the Utility Industry: Key Findings to Successfully Shift from Data Collection to Action* – 3002004716

Overall Deliverables Summary

All deliverables are available from the EPRI website by going to the **Program 180 Cockpits tab** and selecting Supplemental Project **S_DMD/TMD**. The newsletters and other public documents can be found on the Research tab at http://smartgrid.epri.com.

Table 2 shows the full set of DMD TMD deliverables for the respective research programs to date. For project member assistance with downloading, please contact askepri@epri.com.

Table 2. DMD/TMD Deliverables	Member Program	Orderable ID
The Electric Utility Industry's Cautious Move to the Cloud: An In-Depth Look at the Benefits and Risks	**DMD and TMD**	**3002003959**
IREQ Approach to Organizing Smart Grid Data – Case Study of Its AMI Data Organization Process	**DMD**	**3002004085**
Risk Assessment Methodology Applied to Data Analytics for Distribution and Transmission	**DMD and TMD**	**3002003171**
Data Governance and Utility Analytics Best Practices	**DMD and TMD**	**3002003006**
Application Readiness Guide: Assessment of AMI Applications with High Value	**DMD**	**3002003173**
Third-Party Applications for Data-Analytics Activities: Resources for Distribution Analytics	**DMD**	**3002002279**
Data – The Most Valuable Asset an Electric Service Provider Owns	**DMD and TMD**	**3002002820**
Catalog of Data Oriented Transmission Applications	**TMD**	**3002002236**
Big Data Survey Summary Report 2013	**DMD and TMD**	**3002002275**
Big Data and Analytics in the Utility Industry: Key Findings to Successfully Shift from Data Collection to Action	**DMD and TMD**	**3002004716**
Automated Waveform Analytics for Improved Reliability and Operational Support Demonstration of DFA Technology at Multiple Utility Companies	**DMD**	**3002004136**

DMD and TMD – Member/Advisor Updates

The Calendar for 2015 is shown in the following table. Content and agenda material will be supplied to each of the DMD and TMD technical contacts for dissemination to their respective teams. To be added to interest group/webcast invitation lists, contact Lori Warneke at lwarneke@epri.com.

Meeting/Webcast - 2015												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
DMD Update		●		●		●		●				●
TMD Update	●		●				●		●		●	
DMD/TMD Member Face-to-Face Meeting					●					●		

For a comprehensive list of calendar items related to EPRI's Smart Grid Demonstrations please visit www.smartgrid.epri.com.