Distribution GIS & Grid Model Data Management Project

Vendor Briefing Event

New Orleans
February 4, 2019
EPRI Distribution GIS & Grid Model Data Management

Housekeeping

- Exits are out door to the left and down stairs
- Restrooms are straight down on the left
- Presentation is vendor-focused but we’ve invited utilities (our participants and other interested utilities) to listen in
- We have remote attendees (from our participating utilities), so please use microphones for questions
- We are recording the session and will be posting the recording
After this session

One-on-one meetings with project team
- Vendors
- Utilities

Visit the EPRI Booth (#12743)
- GMDM ‘conversations’
  - Tuesday noon – 1 pm
  - Tuesday 5 - 6 pm
  - Wednesday 10 – 11 am
EPRI Distribution GIS & Grid Model Data Management Vendor Briefing Event Agenda

▪ 11:00 am to noon Project Presentation
  – Project background and drivers
  – Project vision and benefits
  – Project approach and activities
  – Status update
    ▪ Utility deep-dives
    ▪ Architecture development
  – The role of vendors

▪ Noon to 12:30 pm Lunch and Group Q&A Conversation

▪ 12:30 to 4:00 pm Individual Conversations
EPRI Distribution GIS & Grid Model Data Management

Introductions

- GMDM project team at DistribuTECH
  - Pat Brown, EPRI
  - Randy Rhodes, EPRI
  - John Simmins, EPRI
  - Jay Britton, Britton Consulting
  - Scott Coe, Grid Optimize
  - Jim Horstman, Strateture Solutions
  - Robert Sarfi, Boreas Consulting
  - Erik Shepard, Waterbridge Consulting
EPRI Distribution GIS & Grid Model Data Management Vendor Briefing Event Agenda

- **11:00 am to noon Project Presentation**
  - Project background and drivers
  - Project vision and benefits
  - Project approach and activities
  - Status update
    - Utility deep-dives
    - Architecture development
  - The role of vendors
- **Noon to 12:30 pm** Lunch and Group Q&A Conversation
- **12:30 to 4:00 pm** Individual Conversations
EPRI Distribution GIS & Grid Model Data Management

Project Background

- Grew from previous EPRI work
  - GIS in Distribution ICT program
  - Network model management in Transmission ICT program
- Officially launched in fall of 2017
- Utility-funded and collaborative

Ameren                Exelon
Arizona Public Service FirstEnergy
ConEd                  Great River Energy
Duke                   Pacific Gas & Electric
ESB (Ireland)          Salt River Project
EPRI Distribution GIS & Grid Model Data Management

Project Drivers

▪ Distributed Energy Resources!
▪ Challenges to grid reliability
▪ Increased need for network analysis in distribution planning and operations
▪ T vs D boundary is eroding (continuous modeling is inevitable)
▪ Distribution data needs improved accuracy to support the future
▪ Ad hoc approaches to integration are brittle and cost ineffective as they scale
An industry architecture that allows utilities and their vendors to implement enterprise-wide electric distribution grid model management
EPRI Distribution GIS & Grid Model Data Management
Project Vision

An industry architecture that allows utilities and their vendors to implement enterprise-wide electric distribution grid model management

(sounds simple, but it’s revolutionary...)
EPRI Distribution GIS & Grid Model Data Management

Benefits

New Capabilities  ➔  Optimized Performance  ➔  Utility Benefits

Implementing A Network Model Management Function Introduces New Capabilities

New Capabilities Lead To Optimized Utility Processes And Improved Performance

Optimized Processes Lead To Tangible Utility Benefits
EPRI Distribution GIS & Grid Model Data Management

Benefits

New Capabilities ➡ Optimized Performance ➡ Utility Benefits

- Standards-based data model
  - Industry-wide data definitions
  - Standardized data exchanges
EPRI Distribution GIS & Grid Model Data Management

**Benefits**

**New Capabilities**

- Standards-based data model
- Authority of all network model data
  - Manage history of changes
  - Proper authority granted to data providers
  - Manage model corrections
  - Manage multiple futures project options
  - Track and document changes

**Optimized Performance**

**Utility Benefits**
EPRI Distribution GIS & Grid Model Data Management

Benefits

**New Capabilities** ➡ Optimized Performance ➡ Utility Benefits

- Standards-based data model
- Authority of all network model data
- Enhanced model management
  - Complete set of model data in one place
  - Focused exclusively on electrical networks
  - View and edit graphically
  - Make changes and corrections centrally
  - Enables ‘detect and correct’ processes that continually improve data quality
  - Perform qualitative checks on model, for example standard power flow converges
  - Multiple concurrent users
  - Integrates across capital project lifecycles
EPRI Distribution GIS & Grid Model Data Management

**Benefits**

**New Capabilities** ➞ Optimized Performance ➞ Utility Benefits

- Standards-based data model
- Authority of all network model data
- Enhanced model management
- Sophisticated model scenario creation
  - Reconstruct a historical case for any point in time
  - Build a case dynamically from any set of projects from a central library
  - Export models tailored for each consumer, including equivalencing of details and external regions parts
EPRI Distribution GIS & Grid Model Data Management

Project Benefits

New Capabilities

- Standards-based data model
- Authority of all network model data
- Enhanced model management
- Sophisticated model scenario creation

Optimized Performance

- Reduced labor
  - Fewer manual processes
  - Minimized redundant tasks
  - Less design rework
  - Faster resolution to data questions

Utility Benefits
EPRI Distribution GIS & Grid Model Data Management

Project Benefits

New Capabilities ➞ Optimized Performance ➞ Utility Benefits

- Standards-based data model
- Authority of all network model data
- Enhanced model management
- Sophisticated model scenario creation

Optimized Performance:
- Reduced labor
- Improved data quality
  - Higher confidence in results
  - Fewer errors to chase and correct
  - More sophisticated analytics enabled
EPRI Distribution GIS & Grid Model Data Management

Project Benefits

**New Capabilities**
- Standards-based data model
- Authority of all network model data
- Enhanced model management
- Sophisticated model scenario creation

**Optimized Performance**
- Reduced labor
- Improved data quality
- More accurate study/analysis results
  - Better strategic planning decisions
  - Improved crew instructions
  - Reduced outage response times

**Utility Benefits**
EPRI Distribution GIS & Grid Model Data Management
Project Benefits

New Capabilities
- Standards-based data model
- Authority of all network model data
- Enhanced model management
- Sophisticated model scenario creation

Optimized Performance
- Reduced labor
- Improved data quality
- More accurate study/analysis results
- Faster, more effective studies
  - Process DER interconnections
  - Predict over-capacity scenarios

Utility Benefits
**EPRI Distribution GIS & Grid Model Data Management**

**Project Benefits**

### New Capabilities
- Standards-based data model
- Authority of all network model data
- Enhanced model management
- Sophisticated model scenario creation

### Optimized Performance
- Reduced labor
- Improved data quality
- More accurate study/analysis results
- Faster, more effective studies
- Improved operational efficiency
  - Improved situational awareness
  - Better communication of outages
  - Reduce SAIDI/SAIFI/CAIDI/MAIFI metrics

### Utility Benefits
EPRI Distribution GIS & Grid Model Data Management

Project Benefits

New Capabilities
- Standards-based data model
- Authority of all network model data
- Enhanced model management
- Sophisticated model scenario creation

Optimized Performance
- Reduced labor
- Improved data quality
- More accurate study/analysis results
- Faster, more effective studies
- Improved operational efficiency
- Streamlined technology
  - Consistent with enterprise data governance
  - Easier application deployment and maintenance
  - Fewer stand-alone software solutions
  - Provides a framework to support change

Utility Benefits
EPRI Distribution GIS & Grid Model Data Management

Project Benefits

- New Capabilities
  - Standards-based data model
  - Authority of all network model data
  - Enhanced model management
  - Sophisticated model scenario creation

- Optimized Performance
  - Reduced labor
  - Improved data quality
  - More accurate study/analysis results
  - Faster, more effective studies
  - Improved operational efficiency
  - Streamlined technology

- Utility Benefits
  - Reduce Costs
  - Improve Reliability
  - Increase Customer Satisfaction
  - Improve Safety
  - Enable Transition To “Grid Of The Future”
EPRI Distribution GIS & Grid Model Data Management
Project Overview - Approach

Two-minute Grid Model Data Management project video
EPRI Distribution GIS & Grid Model Data Management
Project Overview - Approach

- Leveraging earlier EPRI network model management work done in transmission domain
- Core team of passionate experts with wide variety of perspectives
- Real-world grounding from participating utilities
- Architecture development using EA philosophies and tools
- Vetting of architecture by vendors and utilities
- Incorporation of results into data exchange standards
EPRI Distribution GIS & Grid Model Data Management Project Overview – Activities

Year 1
- GIS Cleanup Technologies
- Exploration of GIS cleanup technologies, population practices

Year 2
- Utility Deep-Dive Part I
- Technology Demonstration

Year 3
- Utility Deep-Dive Part II

Architecture Development
- Data management architecture development

Field Activity Enablement
- Alternate solution architectures & tools
- Solution demonstration

Project Strategy
- Launch Meeting
- Monthly Webcasts
- Tech Transfer

Data Exchange Standards Contribution
- Data exchange standards development
- Distribution Grid Model Data Manager Requirements
EPRI Distribution GIS & Grid Model Data Management Project Status Update

- Utility Deep-Dives
- Architecture Development
  - Goal
  - Development Approach
  - Work To-Date
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Utility Deep-Dives

‘Part I’ complete with 3 utilities

Goals

- Understand/document ‘as is’
- Insight into trends/patterns
- Build foundation for utility shared understanding
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Utility Deep-Dives

- Sample ‘Part I’ data flow diagram
EPRI Distribution GIS & Grid Model Data Management Project Status Update – Architecture Development

- Goal

“A practical industry architecture for both product vendors and utilities that can guide the design and implementation of enterprise grid model management”
Goal

“A practical industry architecture for both product vendors and utilities that can guide the design and implementation of enterprise grid model management”

A reference design, not an implementation design
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

- Goal

“A practical industry architecture for both product vendors and utilities that can guide the design and implementation of enterprise grid model management”

A reference design, not an implementation design
Both are critical - vendors supply the building blocks that utilities deploy
Goal

“A practical industry architecture for both product vendors and utilities that can guide the design and implementation of enterprise grid model management”

A reference design, not an implementation design
Both are critical - vendors supply the building blocks that utilities deploy
Serve the needs of network analysis applications across the utility: planning, protection, operations
EPRI Distribution GIS & Grid Model Data Management

Project Status Update – Architecture Development

- Business function based
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

- Business function based
  - Allows essential understanding of the problem, requirements and solution approaches
  - Lets thinking be informed, but not dictated, by vendor products and utility usage
  - Vendors can map Business Processes to their products
  - Utilities can map Business Processes to their product use
EPRI Distribution GIS & Grid Model Data Management Project Status Update – Architecture Development

- **Work to-date**
  - High-level overview of business functions guides big picture thinking

functions consider the electrical system

functions deal with individual facilities
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

- Functional view of vision

EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

- Functional view of vision
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

• Functional view of vision

Existing as-built network model data flows
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

- Functional view of vision
  - Introduce a Network Model Management (NMM) function, that:
Functional view of vision
- Introduce a Network Model Management (NMM) function, that:
  - Combines facilities data into a system view
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

- Functional view of vision
  - Introduce a Network Model Management (NMM) function, that:
    - Combines facilities data into a system view
    - Supports future changes of many types

- Network Model Management
  - merge facilities data from multiple sources
  - manage future changes

- System Planning
  - Network Planning
  - Protection

- Substation
  - Facilities Design
  - Substation Facilities Design

- Feeder Facilities
  - Design
  - Facilities As-Built Records

- Facilities Record Management

- System Operations
  - Outage Management
  - State Estimation/Grid Optimization

- Work Management
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

- Functional view of vision
  - Introduce a Network Model Management (NMM) function, that:
    - Combines facilities data into a system view
    - Supports future changes of many types
    - Manages corrections

- Network Model Management
  - Merge facilities data from multiple sources
  - Manage future changes
  - Manage corrections

- System Planning
- Network Planning
- Protection

- System Operations
- Outage Management
- State Estimation/Grid Optimization

- Work Management

- Facilities Design
- Substation Facilities Design
- Feeder Facilities Design

- Facilities Record Management
- Substation Facilities As-Built Records
- Feeder Facilities As-Built Records
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

- Functional view of vision
  - Introduce a Network Model Management (NMM) function, that:
    - Combines facilities data into a system view
    - Supports future changes of many types
    - Manages corrections
    - Assembles models for any point in time for multiple consumers
**EPRI Distribution GIS & Grid Model Data Management**

**Project Status Update – Architecture Development**

- **Functional view of vision**
  - Introduce a Network Model Management (NMM) function, that:
    - Combines facilities data into a system view
    - Supports future changes of many types
    - Manages corrections
    - Assembles models for any point in time for multiple consumers
    - Defines standard data exchanges that tool vendors can implement
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

- Work to-date
  - Focus is on the interfaces around NMM function

Facility Engineering:
- As-built Records
- Facility Design

Design Standards

DER Connection Applications

Asset Mgmt

Work

Field Intelligence

The Power System

Network Planning

Network Model Management

Operations Planning

System Operations
Work to-date
- We’ve started here – the interface between facilities and NMM
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

- Introducing the notion of ‘fragments’ to bridge the gap between the facilities and system views

Facility Engineering:
- As-built Records
- Facility Design

Design Standards
DER Connection Applications
Asset Mgmnt
Field Intelligence
The Power System

Network Planning
Network Model Management
Operations Planning
System Operations
We believe the fragment approach
- Is implementable on both ‘sides’
- Would significantly reduce integration and data maintenance costs

Rationale for the fragment approach
- Source functions ‘live’ on the facilities side
- Source functions typically have
  - Specialized (specific) types of information
  - Limited (or no) ‘system’ view
- So sources can supply only ‘fragments’ of a system model
A fragment is
- A subset of network model information
- Expressed in terms of CIM 61970 classes

The fragment philosophy in action
- Source functions produce CIM 61970 fragments that reflect what they know
- Network model management (NMM) function synthesizes the fragments into a system view

Current project work focuses on validating the fragment approach
- Can sources can produce CIM 61970 fragments?
- Can NMM can synthesize fragments into models?
Can sources can produce CIM 61970 fragments?

- Data must be expressed in CIM 61970 classes and properties
- With object identifiers that are persistent
- And fragments must follow simple rules for versioning
Can NMM can synthesize fragments into models?
- Overlapping or incomplete information must be ‘fit’ together into a cohesive model
- In as automated a fashion as possible
- With support for manual guidance and override
We are exploring and documenting the fragment approach
- Specification for a ‘CIM 61970 Fragment’
We are exploring and documenting the fragment approach
- Specification for a ‘CIM 61970 Fragment’
- Use case for building feeder model
We are exploring and documenting the fragment approach
- Specification for a ‘CIM 61970 Fragment’
- Use case for building feeder model
- Use case for generic NMM fragment processing
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

- We are exploring and documenting the fragment approach
  - Specification for a ‘CIM 61970 Fragment’
  - Use case for building feeder model
  - Use case for generic NMM fragment processing
- We have introduced it into IEC TC57 WG13 (the CIM Working Group for network models)
- And we’d like vendor feedback from perspective of
  - fragment supplier products, like GISs, MDMSs, CISs
  - grid model data manager products
  - grid model consumer products, like network analysis applications
EPRI Distribution GIS & Grid Model Data Management
Project Status Update – Architecture Development

- Can we talk?
  - Our team is here in this room all afternoon
  - We are scheduling 30 to 60 minute one-on-ones anytime Tuesday or Wednesday, as well as Thursday morning
We believe:

- The industry has outgrown solutions based on collections of products hooked together with one-off interfaces
- Increasing distribution system complexity requires an intentional information strategy around grid model data management
- The strategy must
  - Include a network model management function
  - Be standards-based
  - Be supported by product-based interoperable interfaces
EPRI Distribution GIS & Grid Model Data Management
The Role of Vendors – Why Vendors Matter

- The success of this vision is dependent on vendor buy-in because....

Real improvement can be achieved only if utilities can implement products whose interfaces align with a standardized network model management architecture.
Network model management function
- A new area for product development
- An opportunity to position as an early adopter and leader in the market

Products providing other functions
- Being the vendor who improves utility data management
  - Up-front consulting
  - Discovery and implementation
  - Licenses
  - Services
EPRI Distribution GIS & Grid Model Data Management Vendor Briefing Event Agenda

- **11:00 am to noon** Project Presentation
  - Project background and drivers
  - Project vision and benefits
  - Project approach and activities
  - Status update
    - Utility deep-dives
    - Architecture development
  - The role of vendors

- **Noon to 12:30 pm** Lunch and Group Q&A Conversation

- **12:30 to 4:00 pm** Individual Conversations
EPRI Distribution GIS & Grid Model Data Management

Thank you

- Pat Brown, EPRI pbrown@epri.com
- Randy Rhodes, EPRI rrhodes@epri.com
- John Simmins, EPRI jsimmins@epri.com
- Jay Britton, Britton Consulting jpbritton@outlook.com
- Scott Coe, Grid Optimize scott.coe@gridoptimize.com
- Jim Horstman, Strateture Solutions jim.horstman@strateture.com
- Robert Sarfi, Boreas Consulting rsarfi@boreasgroup.us
- Erik Shepard, Waterbridge Consulting erik.shepard@outlook.com

To continue the conversation
- Visit the EPRI Booth (#12743)
  - Tuesday noon – 1 pm
  - Tuesday 5 - 6 pm
  - Wednesday 10 – 11 am
- Sign-up for one-on-one
  - Vendors – see Randy
  - Utilities – see Pat
Together...Shaping the Future of Electricity