Distribution Grid Model Data Management: EPRI Project & Methodology

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DistribuTECH

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EPRI GIS & Grid Model Data Management project

Topics

- **Why** EPRI believes a project around network model data management is so vitally important for the distribution world today

- **What** the EPRI project proposes to do to help the industry improve its ability to manage network model data

- **How** the EPRI project will approach the challenging work of creating an industry data management architecture
EPRI GIS & Grid Model Data Management project

Topics

- **Why** EPRI believes a project around network model data management is so vitally important for the distribution world today
EPRI GIS & Grid Model Data Management project
Why? It’s not your grandfathers grid.

- The Distribution grid is changing

- Grid planning & operation requires new analytics & simulations

New Grid-Connected Equipment

Networked Transmission

Markets

Radial Distribution

New Players

New Expectations

New Technologies
Many, many of which execute power flow-based simulations (network analysis functions)
Which require network (grid) models as input
Grid Model Data Management
Why? Analytics and simulations need network models.

- Network (grid) model data is

“Data representing a simplified view of the electrical grid, including equipment, its electrical behavior and its connectivity, as well as its operating state at a moment in time, that is sufficient to describe a starting point for network analysis.”
Grid model data is complex to manage because it:

- There’s lots of it
- Is made up of different types of data with different update cycles
- Is used to represent one grid past & multiple grid futures
- Has different parts from different sources
- Different studies need different parts
- Typically has a primary source:
  - With major consistency / completeness issues
  - That serves primary purposes other than providing grid model data
- Must be assembled into internally consistent, ‘electrically logical’ cases

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Why? Managing grid model data is challenging.
To summarize

- Distribution utilities will deploy new analytics and simulations
- Many of which require accurate grid model data
- That is difficult to manage
- And we have a messy starting point…
EPRI GIS & Grid Model Data Management project
Why? A messy application eco-system.

- Targets & Cases

- Protection Case
  - Protection Tool

- Planning Case
  - Planning Tool

- (A)DMS As-Built Case
  - (A)DMS

- OMS As-Built Case
  - OMS
EPRI GIS & Grid Model Data Management project
Why? A messy application eco-system.

- Targets & Cases
- Sources
EPRI GIS & Grid Model Data Management project
Why? A messy application eco-system.

- Targets & Cases
- Sources
- Physical Network Model Data

- Equipment & line connectivity
- Normal operating assumption
- Equipment & line steady state parameters
- Measurement locations
- EPRI GIS & Grid Model Data Management project
- Why? A messy application eco-system.
EPRI GIS & Grid Model Data Management project

Why? A messy application eco-system.

- Targets & Cases
- Sources
- Physical Network Model Data
- Case Assumptions
EPRI GIS & Grid Model Data Management project
Why? A messy application eco-system.

- Targets & Cases
- Sources
- Physical Network Model Data
- Case Assumptions
- Engineering Design

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Why? A messy application eco-system.

- Targets & Cases
- Sources
- Physical Network Model Data
- Case Assumptions
- Engineering Design
- Data Flows
- NO Data Management Strategy

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Why?

▪ To summarize
  – Distribution utilities will deploy new analytics and simulations
  – Many of which require accurate grid model data
  – That is difficult to manage
  – And we have a messy starting point…
  – And drivers that are increasing and increasingly urgent

▪ That’s why EPRI believes a project around network model data management is so vitally important for the distribution world today
EPRI GIS & Grid Model Data Management project

Topics

- Why EPRI believes a project around network model data management is so vitally important for the distribution world today

- What the EPRI project proposes to do to help the industry improve its ability to manage network model data
EPRI GIS & Grid Model Data Management project
What? A collaborative project.

Distribution GIS & Grid Model Data Management project

Goal:
Distribution industry grid model data management architecture
- vendors to implement reusable product interfaces and
- utilities to implement effective data management solutions
EPRI GIS & Grid Model Data Management project
What? A collaborative project.

Distribution GIS & Grid Model Data Management project

- **Collaborative** – utilities, vendors, consultants

- **Comprehensive** – 3-pronged approach

- **Considered** – 30 months
EPRI GIS & Grid Model Data Management project
What? Collaborative.

- Participating utilities include
  - Arizona Public Service
  - Consolidated Edison
  - Duke
  - ESB (Ireland)
  - FirstEnergy
  - Great River Energy
  - Salt River Project

- Approach to vendors
  - Don’t look to them for funding
  - Engage them as much as possible
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What? A comprehensive 3-pronged approach.

- 1 - Data management architecture
EPRI GIS & Grid Model Data Management project
What? A comprehensive 3-pronged approach.

- 1 - Data management architecture
- 2 - Improving GIS as a data source
EPRI GIS & Grid Model Data Management project
What? A comprehensive 3-pronged approach.

- 1 - Data management architecture
- 2 - Improving GIS as a data source
- 3 - Enabling data capture and use in the field
EPRI GIS & Grid Model Data Management project

What? Considered.

- 30-month project, coordinated activities

**Year 1**
- GIS Cleanup Technologies
  - Exploration of GIS cleanup technologies, population practices
  - Data management architecture development
  - Data exchange standards development
  - Distribution Grid Model Data Manager Requirements

**Year 2**
- Grid Model Data Management Architecture
  - Utility deep-dive
  - Alternate solution architectures & tools
  - Solution demonstration

**Year 3**
- Field Activity Enablement
  - Launch Meeting
  - Monthly Webcasts
  - Tech Transfer

**Project Strategy**
To summarize
- A collaborative project
- Including utilities, vendors and consultants
- Taking a 3-pronged approach:
  - Data management architecture
  - Improving GIS as a data source
  - Enabling data capture and use in the field
- Over the course of 30 months

That’s **what** the EPRI proposes to do to help the industry improve its ability to manage network model data
EPRI GIS & Grid Model Data Management project

Topics

- **Why** EPRI believes a project around network model data management is so vitally important for the distribution world today

- **What** the EPRI project proposes to do to help the industry improve its ability to manage network model data

- **How** the EPRI project will approach the challenging work of creating and industry data management architecture
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How?

GIS Cleanup Technologies
- Exploration of GIS cleanup technologies, population practices
- Technology demonstration

Year 1

Grid Model Data Management Architecture
- Utility deep-dive
- Data management architecture development
- Data exchange standards development
- Distribution Grid Model Data Manager Requirements

Year 2

Year 3

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

Project Strategy
- Launch Meeting
- Monthly Webcasts
- Tech Transfer
EPRI GIS & Grid Model Data Management project
How? An amazing & diverse project team.

Steph Amsbary, EPRI
Integration architect
“TOGAF & Archimate devotee”

Jay Britton, Britton Consulting
Software and integration designer
“grandpa of network analysis data modeling”

Pat Brown, EPRI
Solution designer & data modeler
“irrepressible idealist”

Scott Coe, GridOptimize
Solution designer & implementer
“hammering square DERs into round markets”

Karen George, EPRI
Organizer, project manager & technical writer
“Smart Grid veteran”

Randy Rhodes, EPRI
Solution designer & implementer
“distribution application & tool expert”

Robert Sarfi, Boreas Group
Solution designer & implementer
“distribution utility junkie”

John Simmins, EPRI
Integration manager & GIS pundit
“paradigm shifter”
EPRI GIS & Grid Model Data Management project
How? An amazing & diverse project team.

- Among us we have
  - over 150 years experience designing or implementing integration solutions
  - degrees in electrical engineering, physics, linguistics, computer engineering, ceramic science and architecture
  - membership in all IEC CIM Common Information Model Working Groups (WG13 – network models, WG14 – assets, meters, work, WG16 – markets)
  - been employed at 4 utilities and worked for 9 consulting firms
  - a significant incidence of missing or greying hair

- With bench depth from the EPRI Distribution Grid Ops & Planning (P220) program
  - Brian Deaver – Operations
  - Jason Taylor – Planning
  - Sean McGuinness - Protection
EPRI GIS & Grid Model Data Management project
How? Start with real-world understanding.

- Real-world grounding from deep-dives
EPRI GIS & Grid Model Data Management project
How? Start with real-world understanding.

- Real-world grounding from deep-dives

- 5 utilities
  - Learn about existing practice
  - Test drive the proposed data management architecture
  - Provide strategic direction guidance to deep-dive utility

- Major two-way benefit
  - Project gains broad reality-based understanding
  - Utility gets solid start on its data management work
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Data Architecture Approach

- Grounded in real-world understanding from deep-dives
- Keeping the goal in mind
  - Define common, appropriately granular data exchanges

- Standard data exchange definitions on which local implementations can be based - Not a local solution
- Reduce, not eliminate, the ‘distance to integrate’
EPRI GIS & Grid Model Data Management project
How? Leverage the CIM’s data organization.

- Real-world grounding from deep-dives
- Keeping the goal in mind
- Informed by the IEC CIM
EPRI GIS & Grid Model Data Management project
How? Capture insights from previous work.

- Real-world grounding from deep-dives
- Keeping the goal in mind
- Informed by the IEC CIM
- With insight from previous work

Network Model Manager Technical Market Requirements: The Transmission Perspective
(Product ID 3002003053)
No Cost to Public

Using the Common Information Model for Network Analysis Data Management: A CIM Primer Series Guide
(Product ID 3002002587)
No Cost to Public
EPRI GIS & Grid Model Data Management project
Data Architecture Approach

- Grounded in real-world understanding from deep-dives
- Keeping the goal in mind
- Informed by the IEC CIM
- With insight from previous work

Identification of GIS Data Dependencies
(Product ID 3002001042)
No Cost to Public
EPRI GIS & Grid Model Data Management project
How? Capture insights from previous work.

- Real-world grounding from deep-dives
- Keeping the goal in mind
- Informed by the IEC CIM
- With insight from previous work

From EPRI
From DOE DSPx

Modern Distribution Grid – Decision Guide Volume III
EPRI GIS & Grid Model Data Management project

How? Capture insights from previous work.

- Real-world grounding from deep-dives
- Keeping the goal in mind
- Informed by the IEC CIM
- With insight from previous work

Grid Modernization Initiative – Grid Management System Architecture

February 1, 2016
EPRI GIS & Grid Model Data Management project
How? Capture insights from previous work.

- Real-world grounding from deep-dives
- Keeping the goal in mind
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Summary of Electric Distribution System Analyses with a Focus on DERs

From EPRI
From DOE DSPx
From SCE
From GMLC
EPRI GIS & Grid Model Data Management project
How? Capture insights from previous work.

- Real-world grounding from deep-dives
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- With insight from previous work

From
- From DOE DSPx
- From SCE
- From GMLC
- From the CIM Interface Reference Model
EPRI GIS & Grid Model Data Management project
How? Leverage enterprise architecture wisdom.

- Real-world grounding from deep-dives
- Keeping the goal in mind
- Informed by the IEC CIM
- With insight from previous work
- Leverage enterprise architecture
  - for context
  - for expression of design
EPRI GIS & Grid Model Data Management project
How? Leverage enterprise architecture wisdom.

- Real-world grounding from deep-dives
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EPRI GIS & Grid Model Data Management project
How? Leverage enterprise architecture wisdom.

- Our project focus is here
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How? Leverage enterprise architecture wisdom.

- Real-world grounding from deep-dives
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EPRI GIS & Grid Model Data Management project
How? Leverage enterprise architecture wisdom.

- Design to be expressed in Archimate® (loosely)

Diagram credit: *Mastering ArchiMate Edition III. TCI*, © Gerben Wierda 2017
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How?

- Real-world grounding from deep-dives
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How?

Electric distribution industry grid model data architecture that enables
  • vendors to implement reusable product interfaces and
  • utilities to implement effective data management solutions

- Simple to describe
- Hard to figure out how to get from here to there
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How?

- Complexity comes from
  - Viewing interfaces in isolation
Complexity comes from:
- Viewing interfaces in isolation

How? Use a semantic model solution approach.

**Semantic Model**
- describes organization of shared data

**Shared data**
- Application A
- Interface
- Interface
- Shared data
- Interface
- Application C
- Application B
- Interface
- Interface
EPRI GIS & Grid Model Data Management project
How?

- Complexity comes from
  - Viewing interfaces in isolation
  - Vendor product overlap

Network model data

Network Model Data Source A

Application A

Application C

Application Z
Network Model Data Source A

Network model data

Network Analysis Application B

Network model data

Network Analysis Application C

interface

interface

interface

How? Use a ‘building block’ design approach.

- Complexity comes from
  - Viewing interfaces in isolation
  - Vendor product overlap
  - Complexity & variety of network model data

permanent grid changes OR temporary fixes?
load curves OR point history?
line detail OR electrical behavior?
Talk in terms of **business processes** not applications
- For example, not CYME or Synergi, but Expansion Planning, Reliability Planning or Interconnect Evaluation

**Decompose business processes** to the right level of granularity, where
- They approach being universal
  - Most utilities could assemble them to reflect how they use tools
  - Most vendors could identify which processes their tools support
- They allow unambiguous identification of **type of data** being exchanged

**Type of data** can be **mapped to CIM** for further detail
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How? Use a ‘building block’ design approach.
EPRI GIS & Grid Model Data Management project
How? Use a ‘building block’ design approach.
EPRI GIS & Grid Model Data Management project

How?

▪ Real-world grounding from deep-dives
▪ Keeping the goal in mind
▪ Informed by the IEC CIM
▪ With insight from previous work
▪ Leverage enterprise architecture
  – for context
  – for expression of design
    ▪ semantic model approach
    ▪ business process decomposition
EPRI GIS & Grid Model Data Management project

How?

▪ Real-world grounding from deep-dives
▪ Keeping the goal in mind
▪ Informed by the IEC CIM
▪ With insight from previous work
▪ Leverage enterprise architecture
  – for context
  – for expression of design
    ▪ semantic model approach
    ▪ business process decomposition
▪ Vetting by utilities and vendors
EPRI GIS & Grid Model Data Management project

How?

- Real-world grounding from deep-dives
- Keeping the goal in mind
- Informed by the IEC CIM
- With insight from previous work
- Leverage enterprise architecture
  - for context
  - for expression of design
    - semantic model approach
    - business process decomposition
- Vetting by utilities and vendors
- Results into IEC CIM
To summarize
- Real-world grounding from deep-dives
- Keeping the goal in mind
- Informed by the IEC CIM
- With insight from previous work
- Leverage enterprise architecture
  - for context
  - for expression of design
    - semantic model approach
    - business process decomposition
- Vetting by utilities and vendors
- Results into IEC CIM

That’s how the EPRI project will approach the challenging work of creating an industry data management architecture
Why EPRI believes a project around network model data management is so vitally important for the distribution world today

What the EPRI project proposes to do to help the industry improve its ability to manage network model data

How the EPRI project will approach the challenging work of creating an industry data management architecture that enables

- vendors to implement reusable product interfaces and
- utilities to implement effective data management solutions
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- Extraordinarily valuable.
- Entirely possible…
  …if we work together.

“It does not make sense that everybody should duplicate efforts when we could be working together.”
Theresa May

“If you want to go fast, go alone. If you want to go far, go together.”
African proverb

“The power of one, if fearless and focused, is formidable, but the power of many working together is better.”
Gloria Macapagagal Arroyo

“Growth is never by mere chance; it is the result of forces working together.”
James Cash Penney

“None of us is as smart as all of us.”
Ken Blanchard

“Alone we can do so little; together we can do so much.”
Helen Keller
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- This sessions slides available at:
Together…Shaping the Future of Electricity