Effective Management of Distribution Grid Model Data

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EPRI

CIGRE Grid of the Future Symposium
October 23, 2017
Effective Grid Model Data Management
A Changing Distribution Grid

- The Distribution grid is changing

- Grid planning & operation requires new analytics & simulations
- Effective data management is an enabling foundation
Effective Grid Model Data Management
New Analytics and Simulations

Planning
- Hosting Capacity Analysis
- Expansion Planning
- Interconnection Evaluation
- Non-Wires Solution Evaluation
- T & D Reliability Planning
- Protection Design
- DER & Load Forecasting

Operations
- DER Monitoring/Control
- Situational Awareness
- Outage Management & Scheduling
- Adaptive Settings
- Load Shedding
- FLISR
- Volt-VAr Control
- Training Simulator
- Demand Response
- Short-term DER & Load Forecasting

Supporting Technologies
- Communications
- Data Management
- Cyber Security
- Field Devices
- Effective Grid Model Data Management
- New Analytics and Simulations
Effective Grid Model Data Management
New Analytics and Simulations

- What do those ‘future applications’ do?
  - Execute power flow-based simulations (network analysis functions)

- What do those ‘future applications’ need?
  - Network (grid) model data:
    
    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.
Effective Grid Model Data Management
Challenges to Managing Grid Model Data

- Grid model data is complex to manage because it:
  - Is big
  - Is made up of different types of data with different update cycles
  - Represents one grid past & multiple grid futures
  - Has different parts from different sources
  - 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
Effective Grid Model Data Management

In Summary

- Distribution utilities will deploy new analytics and simulations
- Many of which require accurate grid model data
- That is difficult to manage

- Can we head the problem off at the pass?
Effective Grid Model Data Management
Network Model Data Management in Transmission
“Learning from Older Brother’s Mistakes”

- Consistently across industry
- In well-established silos
  - Every tool requires its own network model, in its own format
  - Every tool has its own users and maintainers
- Silos are both technical and organizational
Effective Grid Model Data Management
Network Model Data Management in Transmission
"Learning from Older Brother’s Mistakes"

- Consistently across industry
- In well-established silos
No overarching data management strategy
Effective Grid Model Data Management

Network Model Data Management in Transmission

"Learning from Older Brother’s Mistakes"

- EPRI work in Transmission

The Network Model Manager (NMM) Vision:
One Source for Each Piece of Data

Enterprise Data Sources
- Plans
- Substation As-Built
- Line Impedance Calculation
- Line Rating Calculation
- Circuit Description
- Transformer Data
- Generator data
- GIS
- Outages
- Substation Load History

Network Model Manager
- PNM
  - As-Built Internal
  - As-Built External
- Plans Internal
- Plans External
- Object Registry
  - CM

Network Cases
- Validation Cases
- Import/Export Cases
- EMS Network Model
- Outage Studies
- Planning Base Cases
- Protection Model
Effective Grid Model Data Management

Network Model Data Management in Transmission

In Transmission, EPRI

- Outlined the strategy in reports
  - Network Model Manager Technical Market Requirements
    (Product ID 3002003053)
  - Using the Common Information Model for Network Analysis Data Management: A CIM Primer Series Guide
    (Product ID 3002002587)
    (Product ID 3002000609)

- Socialized the strategy via multiple presentations, articles
- Is seeing increased utility and vendor interest
Effective Grid Model Data Management
In the Distribution Domain

- A data management foundation for GIS/grid model data would:
  - Reduce risk of bad data causing errors in
    - operations decisions
    - study results
    - capital planning decisions
    - maintenance decisions
  - Save labor wasted in duplicate entry, chasing bad data
  - Improve timeliness of results, decisions and actions
  - Provide a platform for deploying as-yet-unthought-of future applications
Effective Grid Model Data Management
Meeting the Challenge

- Develop an industry vision for grid model data management
  - Based on requirements synthesized from many utilities
  - That recognizes and supports the unique role of field activity
  - Expressed in terms of business functions and supporting software services
  - That allows the definition of industry standard data exchanges
Planning

- Hosting Capacity Analysis
  - Steady-State Power Flow
  - Short Circuit Power Flow
- Long-Term Forecasting
  - Load Forecasting
  - DER Forecasting
- Protection Design
  - Short Circuit Power Flow

Operations

- Work Management
  - Crew Management
- Planned Outage Management
  - Outage Request Management
  - Contingency Analysis
- Unplanned Outage Management
  - Unplanned Outage Detection
- Operational Forecasting
  - Load Forecasting
  - DER Forecasting

Supporting Technologies

- Business functions
- Software services
- Standard data exchanges
Effective Grid Model Data Management
Meeting the Challenge

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- Enhance the CIM standard

- Functional requirements for distribution grid model data management tool

- Socialize the vision
  - Utility understanding
  - Vendor interfaces on products – both data producers and consumers
  - Enable utilities to implement product-based solutions which reinforce good data management
Distribution GIS & Grid Model Data Management Project

- EPRI has launched multi-year, multi-utility collaborative supplemental project
  - GIS data cleanup
    - ‘Technologies of Promise’ exploration
    - Geo-spatial modeling best practices
  - Field crew enablement
    - Solution architecture evaluation & demonstration
  - Distribution enterprise grid model data management
    - Utility deep dives (up to 5)
    - Define grid model management architecture
    - CIM standard advancement

- More information
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Together…Shaping the Future of Electricity