Managing Power Grid Modeling with CIM

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Integrating Electric Utility Computing

- Around 30 years ago, most utility departments had stand-alone departmental applications.
- It was clear that the next major phase of automation involved connecting these islands of automation.
- 30 years later, we have learned one thing:

Integration is difficult and expensive!

- Individual connections vary in difficulty, but it is extremely hard to organize and maintain many connections over time.
- While integration will never be easy, it is necessary and we are learning better ways to do it …

There are large cost and productivity differences between well organized integration and *ad hoc* integration.

Why is integration difficult?

Technical Obstacles

- Departmental products were not designed to talk.
  - Internal data structures are different.
  - A common exchange structure is required.
- Patchwork bilateral data exchanges are a trap:
  - Individually simpler.
  - In sum, they create a disorganized and expensive overall solution.
- Sophisticated design is required to minimize overall life-cycle costs:
  - Identity mapping strategy.
  - Enterprise information architecture that coordinates exchange designs.
  - Interface architecture that facilitates update to new versions of products and standards.

Organizational Obstacles

- Integration requires interdepartmental agreement.
  - The more parties are involved, the more difficult is the discussion.
- High-level sponsorship is required.
- Costs are easier to see than benefits.
- Management can understand and plan patchwork solutions more easily than a comprehensive integration architecture.

Grid Model Management

- Electric utilities have a uniquely challenging problem:

  Accurate analytical modeling of the power grid electrical behavior is required to plan and operate the grid.

- The impact on overall grid behavior of every new construction or operating plan must be modeled and studied.
  - Grid models are complex and large.
  - Grid models are required for both present and future states.
  - The grid is continually changing as new projects are planned and new construction occurs.
  - There are many different analytical applications that require representations of the grid.
- Information of analytical significance comes from multiple sources:
  - Different departments within the utility.
  - Different operating divisions.
  - Other utilities operating in the grid.

Grid modeling is vital to the smart future grid.

- Analysis originally was a planning activity with relaxed time constraints and often relaxed accuracy criteria as well.
- Beginning in the 1980s, transmission operations became increasingly dependent on analytical functions like state estimation and contingency analysis to achieve grid reliability.
- With the advent of smart grid goals, analysis is rapidly becoming essential to the distribution grid as well.
- When operations depends on analysis,
  - Grid modeling is a critical business process.
  - Grid modeling detail increases.
  - Accurate grid modeling must be produced in real-time as changes occur.
- Automation of grid data management processes is required to meet requirements for timeliness and accuracy.
  - These processes span departments and are integration-based processes.

The grid modeling problem is an integration problem.

- Grid modeling must integrate source data systems with consuming applications.
- Sources of analytical modeling data:
  - Substation design
  - Transmission line design
  - Distribution feeder design
  - New project planning
  - Load forecasting
  - Smart customer or independent generator design
  - Neighboring division or utility modeling
  - Etc.
- Grid modeling must consolidate source information into analytical models.
- Consumer functions for analytical models:
  - All types of planning analysis
  - Transmission control centers
  - Distribution control centers
  - Customer outage management
  - Etc.

- Sources and consumers are from different vendors.
- Processes span participants and must support logic to coordinate the flow of information.

CIM is the best solution option!

- 25 years of collaborative engineering from vendors, utilities and consultants.
  - Most major vendor applications now support CIM.
  - New applications are increasingly adopting CIM engineering.
- The information model addresses the union of all analytical requirements.
- The CIM methodology for data exchange standards provides a consistent architecture for organizing grid data integration.
- CIM work is ongoing.
  - As the industry moves forward, so do the CIM standards.

The EPRI PEA CIM Project

- The EPRI team working with PEA has reviewed the current state of PEA grid management.
- The EPRI team believes that PEA will benefit from adopting CIM as the ‘canonical’ form of grid data exchange among analytical applications.
- More importantly, the EPRI team recommends that PEA should establish a CIM-based Grid Model Management function with responsibility for analytical model data.
- The mission for analytical data is to consolidate a single source of truth for modeling the electrical behavior of the grid (as opposed to the design of grid facilities).
  - Those responsible for analytical data must understand the grid electrical behavior and the needs of the analytical applications using the data.
  - Those responsible for the grid facilities must understand the requirements for supporting work and new facility design.
  - It is difficult to combine these two objectives, either from the skills required or from the underlying data modeling.

What about Thailand as a whole?

- The grid is not limited to PEA.
- It is not even limited to Thailand.
- Each analysis requires data representing all parts of the grid that are significant to that analysis, regardless of who owns that part of the grid.
- As time goes on, it will be more and more important for each entity that is responsible for part of the grid to share modeling information with other utilities in the grid.

  CIM includes a formal method for integrating multiple responsible parties into a data sharing framework for grid data.

- Europe has adopted this feature of CIM to organize cooperative modeling among its many TSOs and DSOs.

  Thailand (and perhaps also Southeast Asia) should consider moving toward this kind of grid modeling cooperation.

CIM is not the easiest way to do anything. It is the easiest way to everything!