Information Management and Visualization

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As the electricity industry becomes increasingly competitive, knowledge concerning the capacity, constraints and reliability of the electric system will become a commodity of great value. Electricity markets can be fast changing; understanding the implications of these changes before others can give an important competitive advantage. Power systems, however, are characterized by extremely large sets of data that cover spatial, temporal and contingent dimensions. Therefore the focus of this mini-track is on the management and visualization of the information associated with power markets and power systems. This year there were four accepted papers.

The first paper, "Visualization for Shipboard Power Systems" addresses power system visualization as applied to naval ships. The relatively smaller size of the ship power system, as compared to large land-based grids, allows for a detailed and geographical display of the individual power system components, such as generators, cables, switchboards, circuit-breakers, bus transfer switches, and loads. Geographical information provided for these components could be quite useful to assess the impact of faults due to either battle damage or material casualties. The paper presents the details of the visualization and information retrieval tools needed to provide this display.

The second paper, "Animation and Visualization of Spot Prices via Quadratized Power Flow Analysis," moves from displaying detailed device information for a small system to providing techniques for visualizing information about the prices in a large power system. The paper presents a new model for efficient calculation of spot prices, and then presents techniques for the animation and visualization of spot price evolution as the system operating point is changing. The computational method is based on the quadratized power flow approach, which casts the power flow problem as a set of quadratic equations. Once the power flow problem is solved to determine the operating point the spot prices are computed by a linear programming approach. The results are then visualized in a three-dimensional OpenGL display.

The third paper in the mini-track, "Displaying Aggregate Data, Interrelated Quantities, and Data Trends in Electric Power Systems," presents visualization techniques that have actually been implemented in the Tennessee Valley Authority control center to display SCADA information. The paper describes how advanced visualization techniques such as historical trend animations and three-dimensional displays can be used to clarify the complex relationships, aggregate subsystem characteristics, and emerging trends that describe the current state of the TVA system and help predict its future evolution.

The last paper in the mini-track, "Data Integrations and Information Exchange for Enhanced Control and Protection of Power Systems," looks at the important issue of data integration and exchange of power system information. Traditionally, the different power system functions such as protection, control, monitoring and maintenance have been supported by a separate infrastructure of recording instruments and/or controllers for obtaining the processing data. With the introduction of new computer-based equipment for control and protection in the mid eighties, the integration of data and information exchange were possible but not explored. This paper explores the benefits by doing such an information exchange and integration.

Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS'03)
0-7695-1874-5/03 $17.00 © 2002 IEEE