Smart Grid and IDMS

IEEE PES 2009 General Meeting – Calgary, Alberta, Canada
Distribution Subcommittee

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July 29, 2009
Presentation Agenda

• Progression of Distribution Operations
  – Past
  – Present
  – Future

• Integrated Distribution Management System (IDMS) facilitates the Smart Grid

• Examples of AMI integration value
The Southern Company

Serve 4.4 Million Retail Customers
Generating Capacity: 42,000 MW
120,000 Square Miles
Alabama Power Company

- APC serves 1,403,203 customers
- 10,163 Miles Transmission
- 76,137 Miles Distribution
- 44,500 Square Mile Service Territory
Past Distribution Operations

Prior to 1988

- Less than 5% of Distribution Substations were automated
- No devices on the Distribution Feeder were automated
- Distribution System was operated manually with AutoCAD wall-mounted switching diagrams from 55 locations
- No OMS / WFMS in place to support operations
Present Distribution Operations

* Distribution Automation program initiated at Alabama Power Company in 1991
  * 98% of substations automated
  * 3600 RTU sites
  * 230,000 points scanned (6s status / 12s analog)

**Automation Technologies**

- Substation
- Line Monitoring
- Line Recloser
- Sectionalizing Switch
- Automatic Transfer Switchgear
- UG Network Relay
- Standby Generators
- Switched Capacitors

- Power Measurements
  - Per Phase basis
  - MW, MVAR, volts, amps
  - Calculate MVA, pf

- Remote control
- Fault Detection
- Power Quality
  - Harmonics to 15th
  - % THD
Present Distribution Operations

Applications integration by operator

• Distribution SCADA
• Switching Management
• Outage Management
• Crew Call Out System
• Work Force Management
Why Change?

Improve distribution operation capabilities to address:

- System loading, maximize assets utilizing connected model
- Predicting, locating, isolating, and analyzing faults with or without operator intervention – self healing systems
- Autonomous application systems
- Reliability and asset maintenance – Condition Based
- Demand Management – system losses and demand reduction programs
- Distributed generation
- Operator Training
- Enable active customer participation through AMI
Future Distribution Operations

Integrated Distribution Management System (IDMS) Project

**SCOPE of IDMS PROJECT**

- AREVA T&D product that achieves seamless integration of operating applications – combines OMS, SCADA, AMI, and Distribution Management into a single user interface for operator efficiency gains
- Utilizes ESRI GIS as the source for a connected and “intelligent” model
- GIS topology and attribution facilitates the use of advanced network analysis applications to enhance operational decisions
- Improve distribution system efficiency and expand demand management programs
- Distribution Operator Training Simulator
IDMS Facilitates Smart Grid Operations

Advanced IDMS Applications Enabled from GIS

- Unbalanced load flow analysis
- AFISR (Automatic Fault Isolation and Service Restoration)
  - De-centralized
  - Centralized
- Fault detection and location
- Volt/Var control / minimize distribution losses / demand management
- System coordination and protection analysis
- Contingency analysis
- Switching Management
- Advanced Crew Management
- Dynamic Deration of Power Equipment (Harmonic loading)
IDMS Facilitates Smart Grid Operations

DOE and EPRI Support

• IDMS project being co-funded by US Department of Energy’s GridWise Program and the Electric Power Research Institute (EPRI)
• Demonstration project completed in June 2008
• Implementation at Alabama Power Company in 2010
IDMS Facilitates Smart Grid Operations

IDMS and AMI Integration

- AMI Project completion in 2010
- Full Two-Way Network (By Definition)
  - ✓ Read Any Meter anytime
- All reading Types
  - ✓ KWh Readings; TOU Readings; Demand Readings (including Resets); Load Profile
- Voltage Information
- Active Power Outage, Power Restoration, and Tamper Detection
- Support Multiple Meter Vendors
Distribution Network Management of the Future

• Further demand for distribution network situational awareness and improved performance indices
  – Visualization of automation!
  – More severe penalties for reliability transgressions
  – More physical network reconfiguration capability
  – Dynamic model always showing current state of network

• Progression towards AMI becoming the primary tool for observation and a key component of supervisory control of the distribution network including the consumer premises -> real-time state observation and demand response enabler

• Complementary interaction with, and supervisory control of, field deployed automation (automated feeder/substation reconfiguration schemes like IntelliTeam)
  – closed loop reconfiguration – this is a key part of the “self-healing” bit in Smart Grid
  – implies providing broader, and dynamic, network connectivity knowledge to fast field deployed automation schemes
Distribution Network Management of the Future (cont.)

- Further requirements for automated loss minimization, reliability, and demand management means increased control at the distribution level
- Utility interface to Distributed Generation (monitor and control)
- Precise fault location determination to speed dispatch/repair
- Predictive and pro-active reconfiguration plans
- Analytical predictions of network tampering/power theft
Pre-fault View of Overhead Circuits
Dispatcher Training Simulator with 3 lateral faults
OMS Incident Summary
Smart Meter Responses to Feeder-wide Ping
Confirm Fused Lateral Outage
Feeder Outage Refined to Multiple Lateral Incidents
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