Evolution of ADMS

OMS solutions integrating with DMS solutions

OMS solutions expanding to include DMS

SCADA solutions integrating with DMS solutions

SCADA solutions expanding to include DMS

Re-architecture to support requirements of comprehensive DMS solution
Modern Architecture
Requirements as basis for unified, modular platform

- **High performance** – in-memory database, parallel processing
- **High availability** – no single point of failure, seamless failover
- **Modern technology** – 64-bit, .NET, centralized data management
- **Integration** – standards-based web services (i.e. CIM)
- **Scalability** – small to extra large utilities (millions of data points)
- **Security** – infrastructure, replication, integration, etc.
- **Flexibility** – multi-site, multi-zone and phased deployments
- **Versioning** – real-time, planning, simulation, training, etc.
- **Multi-display** – geographic, schematic, station one-lines
- **Thin client** – web (outside control room) and mobile (field client)
Technology Trends

● **Consolidation** of technology
  ➢ DMS -> SCADA -> OMS -> EMS

● **Convergence of IT & OT**
  ➢ Corporate IT and Network Management

● **Enterprise integration and Mobility**
  ➢ Industry standards to sharing data throughout the enterprise and the field

● **Big data** (from several new sources) and analytics
  ➢ Intelligent devices, smart meters, data warehouse

● **Operational asset management**
  ➢ Leveraging new data for efficient use of assets

● **Energy efficiency** throughout the value chain
  ➢ Network optimization, generation/load control, demand response

● Managing distributed renewable energy (**DER**)
  ➢ Increase in wind and solar with high intermittency
IT/OT Integration

Feeder Automation

Substation Automation

Realtime Bus

Advanced Distribution Management System

SCADA

DMS

OMS

EMS

MWFM

OAM

DERMS

Common Platform

UI

Data

Model

History

Security

Enterprise Bus

CIS

EAM

AMI

GIS

Weather

DRMS

Energy Market

Historian
Enabling IT/OT Convergence

- Geospatial Asset Management
- Weather Services
- ADMS Realtime Operations and Planning
- Scheduling & Dispatch
- Enterprise Resource Planning
- Enterprise Data Infrastructure
- Dashboards
- Materials Warehouse
- Mutual Aid
- Government First Responders
- Customers / The Public
- Field Devices
- Field Crews
Situational Awareness

- Multiple map views
- Topology analysis
- Smart alarming
- Event filtering
- Load forecasting
- Simulations
- Historical analysis

Geographic View  Schematic View  Station View
ADMS over Legacy OMS
The Key to Improved Reliability & Resiliency

• Awareness of complete, real-time state of the network
• Geographic and schematic views
• Deployment as mission critical system
• Reduced total cost of ownership
  • Infrastructure, maintenance, support, training
• Embedded advanced analysis engine
  • Automatic creation of switching steps (safety, efficiency)
  • Validation of network operations (check before operate)
  • Reduce outage time (work prioritization)
  • Optimal use of existing equipment
  • Analysis of dynamic equipment rating
  • FLISR and Large Area Restoration (crew efficiency)
  • Modeling of “cold load pickup”
ADMS Functionality Examples

- **Train**
  - Real-time Simulation
  - Off-line Simulation
  - What-if Analysis
  - Historical Playback

- **Plan**
  - Medium & Long-term Load Forecasting
  - Network Reinforcement
  - Optimal Device Placement
  - DER Planning

- **Optimize**
  - Volt/VAR Optimization
  - Network Reconfig
  - Near & Short-term Load Forecasting
  - Demand Response
  - Distributed Energy

- **Operate**
  - Fault Management
  - Switch Management
  - Crew Management
  - Under-load Switching
  - Large Area Restoration
  - Load Shedding

- **Analyze**
  - Load Flow
  - State Estimation
  - Fault Analysis
  - Reliability Analysis
  - Relay Protection
  - Energy Losses
  - Historical Analysis

- **Monitor**
  - Telemetry
  - Alarming
  - Tagging
  - Trending
  - Reporting
Demand Management Scenario

P [MW]

Energy storage discharging

Peak shaving threshold

Energy storage threshold

Demand reduction threshold

Efficiency threshold

Base generation

Energy storage charging

Standard Operation  Efficiency  Demand reduction  Peak shaving  Demand reduction  Efficiency

0:00  2:00  4:00  6:00  8:00  10:00  12:00  14:00  16:00  18:00  20:00  22:00  24:00

Time [h]
Renewable Resource Variability

Milford, UT (Milford Phase I) December 2009 Daily Wind Profile

- 185 MW
- 170 MW
- 10 MW
- 20 MW

Forecasted Dec 09 Generation: 39,886 MWh
Actual Dec 09 Generation: 23,692 MWh

Percent Monthly Capacity Factor: 19.74%
Optimizing the Grid with DER Management

- **Modeling and Monitoring**
  - Beyond the metering modeling
  - Realtime awareness of DER activity
  - Alerting and reporting

- **Reliability analysis and Network planning**
  - Near-term, short-term load/power forecasting
  - Integrated weather data
  - What-if analysis in simulation mode

- **Operations and Optimization**
  - Reliability and economic dispatch
  - Shaping the daily load curve
  - VVO and FLISR
  - Microgrid control
Advancement of the DR Model

Reactive Demand Response ➔ Active & Integrated Demand Management

- Deep customer **engagement**
- "**Prosumer**": adaptive customer facilities, generation, and storage
- Realtime load **connectivity**
- **Fast-acting** signaling and load response
- **Economic** dispatch
- Customer loads managed as a **dependable resource** by grid operations
Integrated Demand Management

Model and Optimize the Network (VVO, Switching, DER Mgmt)

Forecast Load, Determine Location, Initiate DR & DER event

Monitor Grid Performance, DR & DER Response

Use Feedback to Close Loop

Homes

Buildings

Plants

Factories
Distributed Architecture
Advanced Distribution Management
From Situational Awareness to Automated Control

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