Industry Data Model Solution for Smart Grid Data Management Challenges

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Topics

• Utility Data Management Challenges
• Data Management Best Practices
• Utility Data Model Solution
• Open Discussions
Some sectors are positioned for greater gains from the use of big data

Historical productivity growth in the United States, 2000–08

Source: Big data: the next frontier for innovation, competition and productivity - McKinsey
Data Growth of a Typical Large Utility

- Mobile data goes live
- RTU upgrade
- Substation automation system
- Workforce management project
- GIS system deployment
- OMS upgrade
- AMI deployment
- PCTs come on-line
- New HAN devices
- Distribution management rollout
- Advanced distribution automation
- Substation automation system
- Mobile data goes live

Source: EPRI
Asset Management Requires Quality Information

- Effectively allocates scarce resources to provide higher levels of customer service and reliability while balancing financial objectives
- Communicates return on asset investment in terms of customer value and risk avoidance
- Balances conflicting objectives:
The Real-Time and Proactive Utility

Transactional to real-time:
Leveraging information to act faster and smarter

- Historical Assessment
- Reactive Decision Making
- Proactive Decision Making
- Predictive Assessment

- Past Time
- t = 0
- Future Time

Products

Analysis & Decisions

Timeframe

Outages

Current Conditions

Peak Conditions
What-If Scenarios
Defining “Analytics” as a Driver of Efficiency

Analytics is the process of using quantitative methods to derive predictive insights and drive successful outcomes from data.

Maturity in use and analysis of information

Maturity of Information infrastructure and technology

Analytic Obsession
Silos of applications and expertise

Information Anarchy
Spreadsheets

Predictive Analytics
(the “so what”...and the “now what”)
Future oriented and is the source of competitive advantage if deployed pervasively

Descriptive Analytics
(the “what”)
“Rearview mirror” - provides necessary foundation and insight, but does not capture full value on its own

Information Apathy:
Big investments — not much use

What will happen next?
What if these trends continue?
Why is this happening?
What actions are needed?
Where exactly is the problem?
How many, how often, where?
What happened?
What’s the best that can happen?

Derived From: Competing on Analytics: The New Science of Winning (Davenport / Harris), Accenture, and Gartner
Unleashing Your Data: Leveraging Standards, Tools and Industry Best Practices

Standardized Business Intelligence Metadata Layer

- Customer Analytics
- Revenue Analytics
- Credit and Collections Analytics
- Mobile Workforce Analytics
- Outage Analytics
- Operational Performance Analytics

Discovery | Ad-Hoc Queries | Data Mining | Statistical Analysis

- Customer
- Meter Data
- Work and Asset
- Failure

- Analytics
- Analytics
- Analytics

- CIS, CSS, CRM, DSM
- MDMS, CMMS, AMFM, GIS
- OMS, DMS, SCADA, MWMS

Unleashing Your Data: Leveraging Standards, Tools and Industry Best Practices

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Potential Analytics Use Cases

- Load Balancing
  - Phase based on Load
- Regulated Standards on Power Quality – Voltage Standards
- Premise Vacancy – Retail Driven
  - Must disconnect after 6 months
  - People in properties and don’t know why
- Appliance Reliability
  - Based on usage changes and signatures
  - Thermostat on Water Heater
  - Pool Pump
  - Ag Pumps
  - Sprinklers
- Predictive Churn Models
- Pricing Elasticity
- Modeling of Tariffs
  - Optimal
  - Winners and Losers

- Predictive Maintenance
  - Load/Temperature
  - Failure Rates
  - SCADA
  - Pri(?) Fault
- Pole Failure Rates
- Underground Cables
  - Faults
  - Loads
- Faults
  - Special Events
  - Real-time Rating
- Credit Strategy
- Libraries of Signatures
- Targeted Vegetation Management
  - Tree Profiles
  - Momentary Outages
- Load Control
  - Control failures
- Batch Analysis
  - Fault Detection
- Lifecycle
  - 3-4 years out
  - Common Mode Failures
- Water Quality
  - Meter Failure
- Technical and Non-Technical Losses
- Asset Risk
  - Replacement Strategies
- Correlation of Revenue to Assets
Example: Improving Short-Term Forecasting

“Top Down”
Traditional generation demand forecasting typically examines historical generation output and transmission loads using sophisticated models, but only macro-level data sources can be used to calibrate it.

“Bottom Up”
Forecasting from AMI data can leverage far more granular data sources:
- Local weather conditions
- Individual customer load shapes
- Distribution losses
- Demand response/price signals
- Distributed generation
Example: Predictive Analytics for Electric Vehicles

Planning and Operational Tools to Manage Network Capacity Constraints

Pattern recognition identifies EV charging loads

Available Energy for EVs

Forecast EV Adoption, Design EV Rates, and Provide Billing Options

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**Example: Transformer Load Management**

- Single largest T&D asset class by investment
- Uneconomical to monitor
- Recent smart grid investments (AMI, MDM, OMS/DMS) can provide detailed insight into performance
Smart Grid Data Management Challenges

• **Multiple communications technologies**
  – No one size fit all due to utility customer segmentation and geographical variations.
  – Likely to drive up network management apps integration needs.

• **Explosion of field and customer devices that will be attached to the energy delivery network.**
  – Exponential growth of frequency and volume of data from field and customers devices
  – Security, reliability and liability of data and communication

• **Real time processing of events with automation and visualization**
  – Ability to process and react to events in real time
  – Humans will need HELP to operate the grid of the future

• **Tighter integration between operational systems and enterprise systems to drive business performance (productivity and financial)**
  – Grid operational decision will have much more impact on the top and bottom line of the utility business. Demand response to affect revenue, outage detection to affect cost, etc.

• **Tighter integration with other businesses and customers – third party access, customer participation, distributed energy resources, PHEV, etc.**
  – Provide access to data/information to third parties (retailers, value-added service providers, etc.)
  – Provide more real time data access to customers
DATA MANAGEMENT

• Biggest area of focus for CIOs, CTOs.
• 50 -80% of resources and time spent in data sourcing and Data quality
• Data layer is the most strategic component of enterprise analytics architecture.
• Reporting is only as complete, timely and accurate as the data.
• Bad data means bad decisions
• Reference data and reporting dimensions should be used across all lines of business.

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Integrated Information Architecture

Enterprise Semantics for Utility Data Management Needs

Utility and Smart Grid Data Models & Standards

Identity Management Service

Process Integration (Quality & Security)

Data Integration (Quality and Security)

Master Data Management Service

Utility Enterprise Semantic Models

End Users

3rd Parties

Customers

BI

B2B

Portals

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The Industry Data Model – The Common Semantics
Why Do We Need Industry Data Model?

• Comprehensive
  – Industry Domain experience captured in one model

• Standards-based
  – Leverage the best practices of open standard models, such as CIM, MultiSpeak, etc.

• Flexible/Extensible
  – Built with the future in mind – relevant (up-to-date)
  – Saves time on initial development with improved precision due to common definition
  – Prevents re-architecting the DW
  – Quicker to gain industry specific insight

• Cross Industry Expertise and Compatibility – applied to a given industry yet reuse common definitions
  – Shared concepts and structures across industry models allow for cohabitation and future expansion.

• Convergence to a large scale ‘open’ data model
  – Can be used for SOA, ODS or other data integration effort
Implementing Utility Data Model for Advanced Analytics

Data Integration Platforms
- Message/Service Models
  - ESB
- ETL Transformation
  - ETL
- Event Models
  - CEP
- NoSQL Model
  - Hadoop/MapReduce

EDW Base
Base Tables Model (3NF)

Analytics
Analytical Model

BI
Business Metadata
Key Takeaways

• Data is Not Just Data
  – Data about data is key to manage data.

• Think Enterprise – Act Domain Specific
  – Infrastructure, Models, Tools, Standards, Competency Centers
  – Focus on specific business and domain requirements, solve real world problems

• Advanced Analytics is not just IT.
  – Business, IT and Statisticians must come together.
  – It is about the solution, not just tools for analysis and dashboards.
  – It is about building long lasting competencies.
Thank You

• For further information and/or collaboration, please contact:

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