Data Analytics in the Digital Utility

Arnie de Castro, SAS
Analytics

Descriptive
Discovery and communication of meaningful patterns in data

Predictive
Modeling and machine learning to make predictions about the future or otherwise unknown events

Prescriptive
Suggests decision options to take advantage of predictions
How Are They Used?

In Health: Wake County EMS -
100 people survived cardiac arrest without brain damage because they continued chest compressions after 30-minutes.

In Banking and Credit: A credit card company that I use –
“We use industry leading fraud detection capabilities that help us recognize when our Card Members are traveling, so you do not need to notify us before you travel.”

In Sports: Oakland Athletics -
In 2012 was ranked 28th in revenue, but 5th in operating income. They used analytics in assembling the team.
Analytics Technologies for the Digital Grid

Customer

Enterprise Data

Operations

Optimization
Technologies for the Smart Grid

• Enterprise Analytics
  • Situational awareness, One source of truth, Visualization

• Grid Operations Analytics
  • Stability, Security, Reliability and Resilience

• Consumer Analytics
  • Energy Forecasting, Consumption Analysis

• Cost Optimization
  • Generation Scheduling, Distribution Dispatch, Revenue Protection
Big Data

Big Data is Relative, not Absolute

When volume, velocity and variety of data exceeds an organization’s storage or compute capacity for accurate and timely decision-making

<table>
<thead>
<tr>
<th>Meter</th>
<th>Traditional</th>
<th>AMI Meter</th>
<th>SCADA</th>
<th>PMU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reads/Month</td>
<td>1</td>
<td>2880</td>
<td>1296000</td>
<td>77760000</td>
</tr>
</tbody>
</table>
Analytics Server Architecture

Massively Parallel Processing (‘MPP’)

CAS Controller
- Server Monitor
- SAS Data Connector
- SAS Data Connect Accelerator

CAS Secondary Controller
- Server Monitor
- SAS Data Connector
- SAS Data Connect Accelerator

CAS Worker

CAS Worker

CAS Worker

MEMORY
STORAGE
PROCESSING
DATA SOURCES

RODBMS
Nonrelational
ERP
Hadoop
unstructured
PC Files
Analytics Server Architecture
Operations Analytics
Stability, Security, Reliability and Resilience

Reliability
The probability of its satisfactory operation over the long run.

Security
The degree of risk in its ability to survive imminent disturbances (contingencies) without interruption of customer service.

Stability
The continuance of intact operation following a disturbance.
Security

**Electric grid security** refers to the activities that utilities, regulators, and other stakeholders play in securing the national electricity grid.
Operations Analytics
Stability, Security, Reliability and Resilience

Business Disruptions
$100B yearly

Health Problems
1000
2015

Outages
2X every 5

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Operations Analytics
Stability, Security, Reliability and Resilience

Microgrids and storage
Planning for disturbances

Techniques for detecting effects of malware
Customer Analytics

Graphs and data illustrating the electrical grid load in California throughout the day, with projections for 2012, 2013, and 2014, and actual data for 2015. The graph also shows the percentage load on March 31st of each year.

Another graph illustrates the MAPE (%) and savings per year for specific models and methods, with a focus on 29GW Annual Peak.
Energy Forecasting
Customer Analytics

Load Profile Comparisons via Segmentation
Optimization

Non-Technical Losses
$100,000,000 pa

Coincident peak credits for average distribution utility (1M kW) - $75,000/mo.

Optimal unit commitment and economic dispatch can save utilities up to 3% of costs
Distribution Optimization

GIS, OMS

Distribution Network Model
- Tap Changing Transformers
- Capacitors
- Regulators

SCADA/DMS, Meter Data, Sensor/Data

Network Operations Model
- Load Forecasts
- Load Models
- Load Analytics
- Measurement and Verification

Operational (Dynamic) Data

Optimization Software

Distribution Optimization
- Conservation Voltage Reduction
- Loss Minimization
- Direct Load Control
- Cost Optimization
- Distributed Intelligence

Connectivity (Static) Data

Distributed Generation
- Energy Storage
Analytics Technologies for the Digital Grid

Customer

Enterprise Data

Operations

Optimization
Thank you