Managing the Power Grid using Maps, Real-time Data and Rosetta Stones

Using ESRI technology and real-time data to visualize and manage the Power Grid

Presented by Dayna Aronson
Dayna Aronson
Enterprise Solutions Architect
Peak is registered in the NERC Compliance Registry to perform the Reliability Coordinator (RC) function as a statutory activity. Peak performs this function for most of the Balancing Authorities and Transmission Operators in the Western Interconnection which includes all or parts of 14 western states, British Columbia, and the northern portion of Baja California, Mexico.
Peak Visualization Platform (PVP)

ProcessBook Display

95.69

Areas

- BPA
  - Generation: 13,897.00 (15,773.68)
  - Load: 6,053.00 (6,053.00)
- NEVP
  - Generation: 1,912.13 (1,621.57)
  - Load: 2,384.59 (2,384.59)

IROLs Details

- SDGE_Import_Non_Summer
- SDGE_Import_Summer
- NW_Wash_Load_Area

IROLs-Dynamic: SDGE_Import_Non_Summer

- IROL_Status: Normal
  - callingUnit: 3803
  - callingMargin: 2349
  - callingPercent

Path: INTWMS

- WSMPathName: INTWMS
  - scheduleflow: 0.00
  - percentageLimit: 5.05
  - pathloss: 0.00
  - pathline2: 0.00
  - pathlinek: 0.00
  - pathTableView: 0.00
  - pathlinem: 0.00
  - pathlinem2: 0.00
  - area: BPA
  - actualflow: 0.00
  - loca: 20.122

Substations Under 230 kV

- Substations Under 230 kV Details
  - 230kV: false
  - unacknowledgedAlarm: false
  - totalflow: 0.00
  - totalflow: 0.00
  - totalflow: 0.00

- Substations 230 kV and Over
  - Substations 230 kV and Over Details
    - 26: false
      - unacknowledgedAlarm: false
      - totalflow: 0.00
      - totalflow: 0.00
      - totalflow: 0.00

230kV and Under 230kV Selected

- MW: 507.64
  - MVAR: 12,325.14
- MW: 104.37
  - MVAR: 6,213.77

Substations Selected

- 22
  - 30

PEAKRELIABILITY
PVP Solution Summary

- New ESRI Customer in 2015
- OSIsoft Customer since 2008
- Total number of SCADA tags we get via ICCP: 160k
  Updating every 10 seconds
- Total number of tags in EMS OSIsoft PI System: 1.1m
- All real-time data comes from OSIsoft PI System
- Number of GeoEvent services: 50
  Polling frequency 30 seconds
- Events per second 350-550
- Current visualization client: Operations Dashboard
- Currently ArcGIS 10.4.1 moving to 10.5
- Will be implementing the Spatiotemporal Big Data Store
Same Problem – Different Control Room

• More and more data coming into the control centers responsible for larger areas than ever before

• Addition of PMU and other high definition data sources (even more data)

• Need to make it comprehensible by humans – turning data into information
  – allow the most important data to rise to the top and be understood by operations staff
  – Show how one set of data impacts another

• MUST be maintainable

• Alarms
• IROL
• Flow gate / Paths
• ACE
• PMU and wide area Voltage Angle
• Load
• Ace
• AGC
• RAS
• Systems / IT
Options Evaluated

- eTV
- WAV
- STI
- Macomber Map
- PowerWorld
- ESRI

Lots of solutions available – about best match
“...Failure to Communicate”

- Systems that need to communicate with each other about the same Equipment / Grid speak different languages. They have different models, units, nomenclature, process and terminology.
Model Consolidation & Normalization

Performed every five weeks

- Physical network topology: ETS (EMS vendor Tool)
- SCADA: In-house databases and scripts
- ICCP: In-house databases and scripts
- RTCA Contingencies: Home-grown CSV file and scripts
- Alarms: EMS vendor UI and scripts
- RAS: In-house databases and scripts
- Outages: 3rd party proprietary software

Peak RC spends significant resources to maintain models (meta-data)
Building the Rosetta Stone

Habitat EMS runtime databases

Outage Management System

Other Systems

SQL Server

AF

Model & Meta-Data Consolidation & Normalization
Collaboration Kudos

- Three versions over two years of development, with at least 4-5 days/month dedicated to it.
- Over 15,000 lines of code

- Jeffrey Parker
- Tim Van Prooyen
- Cody Parker
- Brian Caserta
- Ryan Schoppe
- Michael Nuget
- Todd Chumley
Grid Reliability

- Reducing the amount of time it takes an RC to comprehend actionable information.

- 11:44 Loss of first 500kV line
- Over next 4 hours additional facilities are impacted as fire grows
- RC calls fire bosses to try and determine location and direction of fire growth and what additional facilities are about to be impacted
- It takes up to 1 hour for this information to get back to the RC
- No current method for analytic tools to geographically map

- Sub optimal gen dispatch
- Extended load shed exposure
Real-time Fire Visualization

Fire location, size and spatial geometry boundaries updating every 5 minutes from USGS along side of transmission assets
**Dashboard**

![Dashboard Image](image-url)

### ProcessBook Display

**Sum of ACEs**

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>95.69</td>
<td>Sum of ACEs</td>
</tr>
</tbody>
</table>

### Areas Details

- **BPA**
  - Generation: 13,897.00 (13,753.60)
  - Load: 6,055.00 (6,053.00)
- **WAOM**
  - Generation: 2,991.75 (1,004.30)
  - Load: 2,500.00 (2,500.00)
- **NEVP**
  - Generation: 1,912.13 (1,621.57)
  - Load: 2,134.33 (2,134.53)

### Operating Areas: BPA

- **agadisplay:** [http://...] (0.00)
- **requiredtolaserves:** 0.00
- **requiredspinin preserving reserves:** 0.00
- **mus:** 798.00

### IROLS Details

- **IROLS-Dynamic:**
  - **SDGE_Import_Non_Summer**
  - **SDGE_Import_Summer**
  - **NW_Wash_Load_Area**

- **IROLS**
  - **Normal**
  - **Path18**
  - **Path19**
  - **Path16**
  - **Path17**
  - **Path58**

### Paths Details

- **INTWMS Normal**
  - **Path INTWMS**
  - **Path INTWMS-Normal**
  - **Path INTWMS-Normal**

### Substations Under 230 kV

- **230 kV and Over Selected**
  - **230 kV Selected**
  - **Under 230 kV**

- **MW**
  - **507.64**
  - **104.37**

- **MVAR**
  - **12,325.14**
  - **-29.22**

- **Subtrans Selected**
  - **22**
  - **30**

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**PEAKRELIABILITY**
Navigation
**Context specific App launch**

- Any URL
Technical details

- **Operation Dashboard**
  - Manages GIS assets and user security
- **Portal**
- **GeoEvent Processor**
  - Real time data feeds
- **Geo Database**
- **PI Integrator**
  - Substations
  - Paths (Flowgates)
  - IROLs
  - Lines
  - BA / TOP
- **SQL Sources**
  - Alarms
  - RTCA
- **CoreSight**
- **.context**
- **Launching**
- **ArcGIS**
- **Historian**
- **AF**
- **ArcGIS Desktop**
- **Model**
Decision Drivers

- ESRI and OSIsoft are the “best in class” in their core technologies
- Leverage Peak Investment in OSIsoft PI
  - Staff Knowledge and Comfort
  - Relationship
  - Infrastructure
- Data driven solution
Solution Highlights

- Easy display creation and modification with Operations Dashboard
- Rosetta Stone Data Philosophy
- Whiteboard philosophy (can build anything – not limited)
- EMS vendor Agnostic
- Eye toward secure external tablet and mobile use
- Quickly reconfigure based on input from users
- 6 months from vendor selection of ESRI to available in the control room as a “Pilot” solution
What value was achieved

• Organization of data to the operation staff
• Empowered operations staff to control their environment
• IT focuses on making data available
• Better decisions in less time
Dayna Aronson
Enterprise Solutions Architect - Peak RC

daronson@peakrc.com
360-448-2655