PowerRunner on the AVEVA™ PI System™ - Extending the value of the PI Data infrastructure for real-time grid analytics

Jason Iacobucci - PowerRunner
Kevin Walsh - AVEVA
An industry in transition

**Structural Transformation**

**Global/Societal Trends**
- Decarbonization & Electrification,
- Net-Zero Targets for 205

**Regulatory Compliance**
- State renewable Mandates,
- FERC Order 2222,
- US Infrastructure Bill,
- DNO to DSO in Europe/Global

**Prosumer**
- New consumer technologies are changing the physics of the electric distribution grid (Solar, wind, electric vehicles, energy storage)

**Digital Transformation**

**Streaming “big data” – OT/IT convergence**
- 1M Meters with 7 tags, read at 15-minute intervals = 1B measurement reads/day
- Joined with disparate OT and IT data sources

**Data Management**
- Alignment, normalization, asset relationships, etc..

**Data Governance**
- Versioning, role-based security, traceability, etc.

**Real-time Actionable Information**
- Enterprise-wide single source of truth containing the best available data with configurable business analytics to support in-game operational decisions
AVEVA’s Power & Utilities footprint

**AVEVA Data Hub**

**Enterprise Level Monitoring**
Engineering & Planning

**PI Systems**

**Generation**
- Fossil
- Hydro
- Renewable
  - Solar
  - Wind
- Biomass
- Thermal
- Storage

**Transmission EMS**

**Substation Data Integration** (non SCADA)

**Distribution Automation Devices** (non SCADA)

**Distribution DMS**

**Distribution Energy Resources**

**AMI Meter Data**

**Prosumer**

**Control Center (ESP)**

**Reporting Applications**
- KPIs, Dashboards
- Benchmarking, Mobility

**Business Applications**
- ERP, Outage Management, GIS, Work & Asset Management

**AMI Data at Scale**

**Distribution Grid Analytics**

**Energy Storage**
- Batteries
- EV

**Microgrids**

**Grid sensors**

**At-the-meter**
- Load
- Generation
- Voltage
- Etc.

**Behind-the-meter**
- Load
- Generation
- Sensor data
- EV
- Thermostats

**Community**

**Enterprise Operations Infrastructure**

**Enterprise Level Monitoring**

**Control Center (ESP)**

**Engineering & Planning**

**Grid Application**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection and Control</td>
<td>Line Protection Relay, Transformer Protection Relay, Bus Protection Relay, Circuit Breaker Protection Relay</td>
</tr>
<tr>
<td>Monitoring &amp; Control</td>
<td>Smart Recloser, Recloser Control, Voltage Regulator Control, Capacitor Bank Control, PDQ Monitor, Smart Switch</td>
</tr>
<tr>
<td>Asset Condition Monitoring</td>
<td>Dissolved Gas Monitor, Moisture Monitor, Circuit Breaker Condition Monitor, Load Tap Changer Monitor</td>
</tr>
<tr>
<td>Fault Indicators and Sensors</td>
<td>Overhead Fault Indicator, Underground Fault Indicator</td>
</tr>
<tr>
<td>Metering</td>
<td>Smart Meter, Power Quality Meter, Revenue Meter</td>
</tr>
</tbody>
</table>

© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.
Overview

PowerRunner is a software and consulting solution provider - solutions address the unique and dynamic capabilities of the energy industry created by Variable Renewable Generation and Smart Meter investments needed to manage to the Whole Power System.

- PowerRunner’s analytical solutions govern, analyze and predict granular and disparate streams of data for actionable, real-time decision management support.

- PowerRunner has been implemented in other commodities and industries, like natural gas and water, proving its core platform’s economies of scope for multiple industries.
Distribution grid analytics

**Power and Utilities**

**Challenge**

- Grid Fidelity is now dependent upon real-time awareness of Distribution Grid:
  - Thousands of network model asset relationships changes (intra) daily cross millions of assets
  - Near Real Time asset availability for operator (DG/DR/sectionalizers/ reclosers)
  - What thermal/voltage issues are present/predicted due to outages, weather etc.

**Solution**

- **PowerRunner on the PI System**

**Results**

- **Asset Data Governance and Automated Network Model Validation for Connectivity Updates**
  - 90% Accuracy out of the box identification of meter → xfmr mismatches, xfmr shorts
  - **DA Teaming Availability for Grid Reconfiguration and Segmentation**
  - Reduced 2-3 FTE manual process over 2-3 days → near Real-Time display for Operators
  - **Automated Fault Detection and Location using SCADA and AMI for Affected Line Segments**
  - Reduction in fault identification time and automated WAM ticket creation
Asset governance

PI Asset Framework

High Cardinality Asset Hierarchy
Meter data quality and exceptions

- Digital (Meter Events) and Analog Data Analysis
- SAIFI/ SAIDI calculations using AMI

![Image of PowerRunner software interface with various sections labeled: Date Range, Summary of Key Meter & Interval Statistics, Meter Quality Table, Interval Quality Table, Multi-day Meter Summary View.]

- **Date Range**
- **Summary of Key Meter & Interval Statistics**
- **Meter Quality Table**
- **Interval Quality Table**
- **Multi-day Meter Summary View**
Network model validation and voltage analytics

- Full Network Model View
- Phase connection analysis
- Model connectivity evaluation and recommendation
- Recommended transformer voltage analysis/validation
- Broken Neutral and Shorted-Coil Detection
Near real-time distribution automation analysis and exceptions

- DA Network Configuration
- Availability
- Line Fault Locator
  - Work Request Automation
- Last Asset Operation
- Asset Failure Risk Analysis
  - Current Teaming Status
- Cap Bank Monitoring
Look-ahead analysis with Predictive Analytics

- Asset-Level Gen/Load Forecasts
- Constraint Analysis
- DER Performance and Impacts
Benefits- Automated DA monitoring with sectionalizer and autorecloser teams

Commonwealth Edison Company (ComEd, an Exelon Company) provides electric service to approximately 3.8M customers across northern Illinois, or 70% of the state’s population. Distribution teaming schemes are becoming more advanced and the challenge is how do you monitor team status in near real-time, incorporate design changes, and keep a record of the type of event happening to the team. ComEd is using the PI System with their partner, PowerRunner, to monitor and automate team updates in an automated fashion.
Value approach of operational analytics

### Prescriptive Analytics
- Load curtailment program dispatch
- Battery discharge strategy
- Locational incentives for price responsive load and generation

### Predictive Analytics
- Locational resource planning - hosting capacity
- DER valuation & integration to support state estimation and contingency analysis
- Predictive loading on critical system assets

### Exception Analytics
- Multi asset smart alarming
- Threshold alarming, notification and workflow
- Event/alarm analysis – frequency, prioritization

### Available Asset Analytics
- Aggregation and segmentation of load and generation by system asset or customer attribute
- DER, EV and customer program segmentation
- Transformer Load Management

### Aggregate Asset Analytics
- Meters reporting vs. meters installed
- Missing interval analysis
- Configurable asset hierarchy
- Asset drill-thru up & down the hierarchy

### Network Model Validation
- Meter to transformer analysis to find mis-mapped meters
- Validate Meter -> Transformer -> Feeder -> Substation relationships
- Automated workflow into WMS/GIS

### Asset Governance & Data Quality
- PowerRunner on PI
PowerRunner on the AVEVA PI System solution

Data Volume and Variety

- Disparate Data
  - PI System Operational Data Store
  - Data Lake
  - Cloud Data
  - Data Warehouse

Data Velocity and Veracity

- Data Virtualization
  - Creating order from chaos to support business with actionable information.

- Extract Transform & Load
  - Streaming I/O Engine
  - PowerRunner-PI Gateway
  - Mature API Layer

- Data Management
  - Data Normalization
  - Temporal Alignment
  - Attribute Definitions and Parameters
  - Asset Relationships

- Data Governance
  - Role Based Security
  - Effective Dating
  - Version Control
  - Version Hierarchy
  - Auditability and Traceability

Value

- Actionable Information
  - PowerRunner Business Processes
    - Calculation Engine
    - Forecasting Engine
    - Rules-base Data Algorithms
    - Configurable Workflow

- In-line Processes
  - AI on streaming data to support other in-line operational processes

- Signal from the noise
  - Exception analytics to identify and warn of pending operational limit

- System Planning
  - Bottom-up analysis of current and future locational resource requirements

- Configurable Analytics
  - Self-service analytics with inherent reporting and visualization tools or export to BI tools
Jason Iacobucci
President
- PowerRunner
- Jason.Iacobucci@powerrunner.com

Kevin P Walsh
Industry Principal
- AVEVA
- kevin.walsh@aveva.com
Questions?
Please wait for the microphone.
State your name and company.

Please remember to...
Navigate to this session in the mobile app to complete the survey.

Thank you!
This presentation may include predictions, estimates, intentions, beliefs and other statements that are or may be construed as being forward-looking. While these forward-looking statements represent our current judgment on what the future holds, they are subject to risks and uncertainties that could result in actual outcomes differing materially from those projected in these statements. No statement contained herein constitutes a commitment by AVEVA to perform any particular action or to deliver any particular product or product features. Readers are cautioned not to place undue reliance on these forward-looking statements, which reflect our opinions only as of the date of this presentation.

The Company shall not be obliged to disclose any revision to these forward-looking statements to reflect events or circumstances occurring after the date on which they are made or to reflect the occurrence of future events.
ABOUT AVEVA

AVEVA is a world leader in industrial software, providing engineering and operational solutions across multiple industries, including oil and gas, chemical, pharmaceutical, power and utilities, marine, renewables, and food and beverage. Our agnostic and open architecture helps organizations design, build, operate, maintain and optimize the complete lifecycle of complex industrial assets, from production plants and offshore platforms to manufactured consumer goods.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life’s essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world’s most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

Learn more at www.aveva.com

© 2023 AVEVA Group plc and its subsidiaries. All rights reserved.