Bridge IT and OT with a process data warehouse

Presented by Matt Ziegler, OSIsoft
Problem Complexity Drives the Need for Integrators

Disparate assets or interacting one-by-one

Real-time visibility

- HMI

Process Optimization

- Real-time & historical view across any plant asset

- PI ProcessBook
- PI Coresight
- PI Datalink

Benchmarking

- Fleet-wide performance comparison

- BI App (i.e. Tableau, Spotfire, Lumira)
- PI Integrator for Business Analytics
- PI Integrator for SAP HANA

System Optimization

- Large scale multi-variate analysis

- Machine Learning (Azure ML, R)
- PI Integrator for Business Analytics
- PI Integrator for SAP HANA
Recipe for PI Integrator for Business Analytics

1. **Start with business need**
   - Don’t Start with technology
   - Example use cases to follow

2. **Assess internal readiness**
   - PI System Maturity
   - Data Flows, Systems Involved
   - Ownership, Skills, and People Boundaries

3. **Implement and iterate**
   - Incorporate results
   - Have a plan to operationalize

4. **Ask for Help**
Use Cases

• Production Reporting
  – More detailed view into energy, oil, metals
Drilling Phase Performance Comparison

More Responsive Business Tools

Existing Concepts

Executed with:
More Speed & Larger Scale
**Renewables**
Energy Production
7 wind farms
Outlier Analysis

**Oil and Gas**
Drilling and production comparisons
Information Distribution

**Mining**
Route optimization
Energy Reduction
300 haul trucks

**Life Sciences**
Reactor Comparison
Process Scale Up
1L, 3L, 10L, 1kL, 10kL

**Food and Beverage**
Utility Usage
Process Analytics

**PI Integrator for Business Analytics 2015**
usage today

- IT/OT Integration
- Business Intelligence and Reporting
- Data Warehouse Integration
- Broad Platform Support
Use Cases

• Production Reporting
  – More detailed view into energy, oil, metals

• Alerting and Customer Intimacy
  – Integrate detailed production data with CRM data to alert on outages and meet customized SLA requirements

• Regulatory Compliance
  – Keep product genealogy data on hand for products to deal with regulatory requests

• Root Cause Analysis
  – Discover patterns related to equipment failure or low quality product
I want to analyze operations data stored in the PI System using modern BI tools.
Enterprise Data Warehouse Architecture

Visualization & Analytics
- Tableau
- Spotfire
- SAS
- MSFT BI
- Custom Applications

Enterprise Data Warehouse / Data Mart / Data Lake
- Oracle DW, SQL Server, Teradata
- Hadoop

Data Preparation and Integration Layer
- PI Integrator for Business Analytics
- Custom or 3rd Party Data Management and ETL

System of Record
- PI Server
- CRM
- Sales
- EAM
- ERP
- HR
- ...
Prepare Your Data Model

Show me the total energy cost
For the first shift
During Peak Status

Time-series data stored in PI System

Context stored in PI System

Weather
- Temperature
- Wind Speed
- Heat Index
- Cooling Degree Days

Date & Time
- Month
- Day
- Hour
- Shift

Off-Peak Partial Peak Peak Status
- Peak

Prepare Your Data Model
Project Summary

1. Ask some good business questions
2. Build a dataset using PI Integrator for Business Analytics
3. Publish data to SQL Azure
4. Use Power BI to analyze and explore the data
5. Discuss Best Practices
Questions

• Where is the most energy consumed in the building?

• What effect does weather have on energy consumption?

• Are there any unexpected patterns or anomalies?
Analyzing Fleets with PI Asset Framework

Temperature Zones

- Sub Panels
- 3 Floors
- 2 AC Units
- 1 Roof
- 1 Commercial Kitchen
Other considerations

• Build a business case first. Evaluate technology second.

• Establish trust between data providers and data users
  – Governance, security, sign off
  – Data lifecycle management

• Know your end to end data flows
  – Use process to supplement technology

• Utilize OSIsoft and partners. We’re here to make your first project successful.
Scalability – Scales via Quantity of Assets

No Guidance Required
- < 10,000 Assets with 10 tags each (100,000 output streams)
- < 1,000 Assets with 100 tags each
- < 100 Assets with 1000 tags each

Seek Guidance (Multiple Instances)
- > 10,000 Assets
- > 100,000 Output Streams
Roadmap
Problem Complexity Drives the Need for Integrators

Disparate assets or interacting one-by-one

Interacting with common assets as a fleet

Monitoring
- Real-time visibility
  - HMI

Process Optimization
- Real-time & historical view across any plant asset
  - PI ProcessBook
  - PI Coresight
  - PI Datalink

Benchmarking
- Fleet-wide performance comparison
  - BI App (i.e. Tableau, Spotfire, Lumira)
  - PI Integrator for Business Analytics
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System Optimization
- Large scale multi-variate analysis
  - Machine Learning (Azure ML, R)
  - PI Integrator for Business Analytics
  - PI Integrator for SAP HANA
Full platform coverage for all data integration scenarios
Progression

2015
- Visibility / Slice and Dice / Model Training Data

2016
- Prediction / Run Models / Stream Data
- Standardize / Enhance Models /

2017
- Operations / Application Integration

Get Started

Derive More Value
More systems, less systems management

### Business Intelligence & Data Warehouses

<table>
<thead>
<tr>
<th>Available Today</th>
<th>Planned</th>
<th>Planned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalable BI for the PI System</td>
<td>Expanded Systems and Events</td>
<td>Scale</td>
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<tr>
<td>Initial Release</td>
<td>May 2016</td>
<td>High Availability</td>
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<tr>
<td>Fleet Asset Reporting</td>
<td>Oracle</td>
<td>Backfill and OOO data</td>
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<tr>
<td>Reduce Reporting Time</td>
<td>Hadoop (HIVE &amp; HDFS)</td>
<td></td>
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<tr>
<td>Integrate w/ Data Warehouse</td>
<td>Event Frames</td>
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</table>

### Streaming Systems

<table>
<thead>
<tr>
<th>Research</th>
<th>Planned</th>
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</thead>
<tbody>
<tr>
<td>Streaming Pattern</td>
<td>Stream Systems</td>
</tr>
<tr>
<td>Market Problems</td>
<td>Initial Release</td>
</tr>
<tr>
<td>• External Computing and Event Platforms</td>
<td>• Azure Event &amp; IoT Hub</td>
</tr>
<tr>
<td>• App Specific Data Shapes (JSON/XML)</td>
<td>• Kafka</td>
</tr>
<tr>
<td></td>
<td>• Custom Data Output</td>
</tr>
</tbody>
</table>

2015 - 1H-2016 - 2H-2016
Streaming Lighthouse Program

Problems

- Real-time predictions and models
- Alerting and pushing data out
- Feeding a data lake with streams
- Real-time GIS visualization

Platforms

- Kafka
- SAP Smart Data Streaming
- Azure Event Hub / Azure IoT Hub
- JSON, XML, PMML, XSD

- Leave Contact Info
  - Card
  - E-mail
- Engage in late Q2 and early Q3
- Urgency Required
Contact Information

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Questions

Please wait for the **microphone** before asking your questions

State your name & company

Please remember to...

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Thank You

감사합니다

Тяньге

Merci

Danke

Gracias

Spasibo

Obrigado

ありがとう
Federated Data Model

Virtual Tables
- Data stays in source by default
- Balance Performance / Storage

Best For
- Maximum control over data
- Limiting HANA Memory Usage
- Smaller Datasets
PI Views (ODBC Access)

Virtual Tables
- Data managed by PI System
- Balance Performance / Storage

Best For
- Workgroup level BI and Reports
- Smaller Datasets
Direct Data Model (On premises)

HANA Tables

- Data is materialized in memory

Best For

- Highest Performance
- Large Datasets
Direct Data Model (Cloud)

Virtual Tables
- Data stays in source by default
- Balance Performance / Storage

Best For
- Maximum control over data
- Limiting HANA Memory Usage
Agenda

• Why Are We Here?
  – IT OT Challenges
  – Common Use Cases
  – Product Demo
• Scenarios
  – Best Practices
  – Organizational Challenges
• Roadmap
• Q&A
Simplify

Eliminate Custom Code

Transcend Organizational Data Problems

Accelerate Insights and Cost Savings
FAQs

• How do I size?
  – Method 1: # of Assets * # of Tags for analysis
  – Method 2: 20-50% of PI Data Archive Size

• How do I track?
  – Binary Restricted
  – Measured in product in Administration → Licensing

• Can I re-use or recover streams?
  – Once a stream is in a view it is counted against license
  – It can be used in multiple views
  – If a stream is not used in any views for 90 days, it may be recovered manually.
Self Service Access for operational data

Decision Ready Data for Business Intelligence and Data Warehouses

Broad Platform Support and Scale

PI Integrator for Business Analytics
Save Time, Handle Complexity

Turbine 1
- Speed
- Torque
- Bearing Temp
- Oil Temp
- Manufacturer
- Last Service
- Additional Measure
- Different Archive Time
  - Vestas
  - June 20, 2013
- Comm Failure
- Spike / Out of Range
- Uneven Spacing

Turbine 2
- Speed
- Torque
- Bearing Temp
- Oil Temp
- Wear Factor
- Manufacturer
- Last Service Date
- Bad Sensor
- Different Archive Time
  - Siemens
  - February 5, 2015
- Comm Failure
- Spike / Out of Range
- Uneven Spacing
Consumption Reporting

Business Driver

Deliver 5 minute data directly from the field to the Enterprise Data Warehouse so that it can be used for:

1) Detailed Consumption Reporting so that the business can close the books 5 days earlier.
2) Asset optimization.
Detailed Technical Requirements

✔ Send data to SQL Server and Hadoop (Hive)
✔ Handle late arriving data
✔ Deliver one version of the truth (same data)
  • Performance and data validation
  • Handle diverse equipment across sites
  • Federated and Centralized PI Servers
  • Merge and join data with other sources
Switch to Demo
SAP HANA - Less management, streaming, predictions

Available Today
- Initial Release
- Fleet Asset Reporting
- Reduce Reporting Time
- Federated Data

Planned
- Expanded Systems and Events
  - May 2016
    - Direct Writes to HANA
    - Event Frames
    - Asset Updates

Planned
- Smart Data Streaming
People