Intelligent Liquid Pipelines & Terminal Operations

Attaining synergy value from the Integration of AVEVA Enterprise SCADA and the AVEVA™ PI System™

Steven Textor
Process Engineer, Enbridge Liquid Pipelines
Enbridge at-a-Glance

The Evolution of the PI System & Enterprise SCADA Integration

Intelligent Pipeline Use Cases:

- Use of PI AF Templates & PI Vision for Enhanced Visualization
- Flow path Analytics

Perspectives on best practices & Lessons learned
Enbridge at-a-Glance

Enbridge is North America’s leading energy infrastructure company

<table>
<thead>
<tr>
<th>Liquids Pipelines</th>
<th>Natural Gas Pipelines</th>
<th>Natural Gas Utilities</th>
<th>Renewable Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>~28,661 km/17,809 mi of pipe</td>
<td>118,763* km/73,796* mi of pipe</td>
<td>3.9 million retail customers</td>
<td>45+ renewable power facilities</td>
</tr>
<tr>
<td>Moving 3 million barrels/day</td>
<td>Moving 25.7 Bcf/day</td>
<td>Serving 670+ communities</td>
<td>2,174 MW generating capacity</td>
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</tbody>
</table>

- 30% of crude oil produced in North America
- 20% of the natural gas consumed in the U.S.
- 75% of Ontario residents’ energy needs delivered
- 966,000 homes powered by our assets

* Includes DCP Midstream assets
The Base - 2018 / 2019 +

A System Built for Security
PI System & Enterprise SCADA Details
Heavy use of PI AF & PI Vision Templates with Enterprise SCADA Integration

Enterprise SCADA

• Consoles:
  • 37
• Telemetered Points:
  • 440,000+
• Field Devices:
  • 3,000+
• Poll Cycle:
  • 5 seconds
• Pipeline Operations Liquids
  • Pipeline Objects: 54,000+
  • Automation Objects: 83,000+

PI System

• # Servers:
  • 14 servers in Production
  • (4 archive servers, 2 AF servers, 5 interface servers, 3 PI Vision servers)
• # PI Tags:
  • 700,000 and growing fast
• # AF Elements:
  • 96K Elements,
  • 550K Attributes,
  • 125K Analyses
• # of AF Templates:
  • 8 Event Frame templates,
  • 50 Element templates
Configuring PI AF Strategically

Pipeline and Terminal Hierarchies

Traditional Asset Hierarchy

- Based on Corporate Maintenance System Hierarchy for location and equipment type
Use of PI AF Templates & PI Vision Linked to Enterprise SCADA for Enhanced Visualization
The Basics - Pipelines

Easy access even if you don’t know the tag name!
The Base - Terminals

PI Vision allows System Insights

Cushing

- 85 Tanks
- 24 Valve Manifolds
- 10 Booster Pump Manifolds
- 100s of Valves
The Base - Terminals

Equipment Templates are Embedded in every Display
The Base - Terminals
Equipment Templates are Embedded in every Display

61-THS-5
Current  34.2 deg C
Reset    39.0 C
Warning  40.6 C
High     41.79 C
High-High 41.8 C
Dynamic Temperature Limits
Integration with the AVEVA Enterprise SCADA provides access to more advance control parameters in the PI System
Flow Path Analytics
Flowpath Analytics
A System View in PI Vision makes initial evaluation quick and easy
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A System View in PI Vision makes initial evaluation quick and easy
Flowpath Analytics – Seeq

- **Flowing & Open**
- **Valve Open**
- **Pressure**
- **TK-15 Valve**
- **Flow Rate**
- **Flowing**
System View

• quick understanding of the operational data available and
• the flow path during the event

Has this happened before?

• PI Vision
  • Adhoc
  • Trending

• Using Seeq to identify other occurrences in the past.

Flowpath Analytics – Seeq Extended

View as if the only path!

Using Chain

Pressure

TK-15 Valve

Flow Rate
Flowpath Analytics

Asset Hierarchy – Based on Injection and Delivery Flow Paths

- Based on approved flow Paths through a terminal
- Provides a filter for Operating Data
- Works well with Seeq Functionality
• Instant Flow Path Knowledge
• Quick Operational Evaluations
• Longer term efficiency monitoring
• Knowing how much equipment is being used:
  • Facility Integrity
  • Asset Monitoring
But What If? – Flow Paths!

Tank 15 to Spearhead/FSP BU Discharge Pressure

- Pressure, psi
- Flowrate, m3/hr

Legend:
- Spear
- FSP
Conclusion
Best Practices and Lessons Learned
Imparting Wisdom

Best Practices
• Get the Base Correct
  o Good PI AF Structure
  o Consistent Tagging & Governance
  o Proper Engineering Units

• Plan out PI AF Templates as early as possible

• Make it easy to find the information

• Integrate AVEVA eSCADA & the PI System – significant synergy value

Lessons learned
• Visualization need to be simple but include all the appropriate info.

• Maintenance of PI Vision Screens is not as onerous as you would think.

• Engineers want different information than a control room.
Intelligent Liquid Pipeline & Terminal Operations

Challenge

• Finding information
• Seeing the pipeline and terminal systems as a whole – many SCADA screens to navigate
• Reactive & cumbersome troubleshooting
• Seeing flow paths in real time & retroactively to troubleshooting
• Reactive vs proactive, exception-based operations
• Enabling remote SME support

Solution

• Integrated the AVEVA eSCADA and PI System to capture synergy value
• Configured PI AF in both a standards and linear hierarchy using templates
• Configured PI Vision displays to provide system views and to easily find information
• Configured PI Event Frames for proactive identification of issues & enhanced troubleshooting
• Started the journey to developing overlay PI System based applications like pump efficiency, cavitation avoidance, etc.

Benefits

• Significant improvement in SME effectiveness and efficiency
• Improved flow path visibility and associated analytics in support of FBI
• Move to proactive, exception based intelligent liquid pipeline & terminal operations
• Ability to capture and share knowledge and best practices
The Result of Easy to Find Process Information!

- **700+ PI Vision Monthly Users**
- **200+ PI Vision Daily Users**
- PI Process Book Removed
Steven Textor

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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.

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