Expanding the value of AVEVA™ PI System™ with online process simulation & predictive analytics

Unlocking additional value from your operations data through predictive asset optimization

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Agenda

- AVEVA PI System as operational data infrastructure
- AVEVA PI System with process simulation
- AVEVA PI System with predictive analytics
- Predictive Asset Optimization (PAO)
- Customer success story
- How AVEVA accelerates data potential journey
- Call to action
AVEVA™ PI System™ as operational data infrastructure
AVEVA™ PI System™
Industrial data backbone for digital transformation

40% market share
2.0B+ data streams
30,000+ sites
130+ countries
1500+ case studies
68% of Industrial Fortune 500

INDUSTRIAL DATA INFRASTRUCTURE BACKBONE

Oil & Gas
95% of top 60 companies

Power & Utilities
1000+ of the world’s leading companies

Chemicals
38/50 of the world’s largest companies

Metals & Mining
100% of Fortune 500 companies

Life Sciences
9/10 of top pharma companies

Pulp & Paper
400+ Sites

Infra-structure
600+ Sites
Turning data into decision-ready information

Add structure and meaningful context to your operations data

Automatically pinpoint important events in your operations

Optimized storage & access to massive volumes of operational data

Transform raw data into actionable KPIs using streaming calculations

Send automatic alerts to the right people with the right information

How can you keep expanding your data potential?
Turning data into decision-ready information

Data Archive
Optimized storage & access to massive volumes of operational data

Asset Framework
Add structure and meaningful context to your operations data

Asset Analytics
Transform raw data into actionable KPIs using streaming calculations

Event Frames
Automatically pinpoint important events in your operations

Notifications
Send automatic alerts to the right people with the right information

Expand the data potential with additional capabilities

Cloud-based collaboration
Advanced visualization
AI and ML models
Immersive environments
Risk assessment tools
Optimization models
Automated procedures
Mobile operator tools
Execution management
Digital twins

Turning data into decision-ready information
Integration readiness by PI maturity levels

Level 1
- Data directory (tag mapping)
- Abstraction (std. Lexicon)
- Normalization (UOM, time zones)
- Organization (Dynamic hierarchy)

Level 2
- Metadata integration - add context via data references and linked tables
- Simple calculations (data quality, totals, averages)

Level 3
- Complex calculations (CBM, OEE, rollups)
- Use of Event Frames (downtime, startups, shifts tracking)
- Notifications (emails, work order generation via web service)

Level 4
- Advanced analytics (predictive, equation-based)
- Forecasting & actual vs predicted comparisons

AVEVA PI System Data Archive
- Tag-based, high fidelity historical data ingress/egress
- “Rich” time-series data created by PI AF analytics & calculations (health index, efficiency etc.)
- Future data (forecasts, projections etc.)
How to get new value from integration of your data infrastructure with process simulation?
Process Simulation 101

Model-based representation of simultaneous chemical, physical, hydraulic & other technical processes

Unit operations & equipment
- Distillation
- Reactor
- Vessel
- Pump
- Heat exchanger
- Compressors

Steady state & dynamic

Thermodynamic models
- VLLE
- Van der Walls
- Soave Redlich-Kwong
- Peng-Robinson

First principles model

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Process Simulation 101
Delivering the process digital twin with a first principles platform
The case for AVEVA™ PI System™ and process simulation

Real-time data + asset analytics

- Create asset templates to calculate and monitor simple KPIs for equipment
- Easily scale and deploy asset templates across your enterprise
- No insight beyond measured mechanical and process data
- Difficult to quantify asset impact on upstream & downstream processes

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Deploy models online for real-time optimization and performance monitoring.

**AVEVA™ PI System™ integration with process simulation**

- **Process simulation**
- **Live / archived process data**

- **Operating digital twin**
  - Troubleshoot past & real-time operations
  - Provide soft sensors
  - Improve operation & efficiency
  - Testing platform

First principles physics, chemical & hydraulic models
How to get new value from integration of your data infrastructure with predictive analytics?
Optimize your asset reliability, maintenance and performance

A journey in operational reliability with AVEVA PI System and AVEVA Predictive Analytics

### Failure patterns

- **Age-related failure**
- **Random failure**

- **Predictive technology** for early warnings: 82%
- **Reactive and preventive programs**: 18%

### It’s a journey

- **Strategic, proactive, optimized**
  - AVEVA™ Asset Strategy Optimization
  - AVEVA Predictive Analytics
  - AVEVA PI System
- **EAM/CMMS**
- **Run to failure**

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^ARC studies show only 18% of asset failure is age-related. Based on these data, preventive maintenance provides a benefit for just 18 percent of assets, and monitoring for predictive maintenance is a recommended option for the rest.


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Monitoring with predictive analytics

The approach

- Historical data: Application learns normal operation from historical data.
- Machine learning: Advanced algorithms create and organize operational profiles.
- Early warning: Deviations from normal operation are identified and displayed.

The advantage

- Machine learning continuously monitors behavior in real time 24/7.
- Alerts when operation differs from historical norm.
- Early warning detection of equipment problems.
- Advanced analysis capabilities including problem identification & root cause analysis.
Automated model building

Deployment at scale for fast time to value

• PI Asset Framework templates integrate with AVEVA Predictive Analytics templates
• Minimize manual work with template integration
• Automatically include filters, alert thresholds, and fault diagnostics
• Automatic cleansing of training data

Minimize errors
Ensure consistency
Improve productivity

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How to get additional value from integration of data infrastructure with BOTH process simulation & predictive analytics?

A: Predictive asset optimization (PAO)
What is PAO? Real-time data + artificial intelligence + simulation + optimization

**Historical behavior**
What happened in the past?

**Current behavior**
What is happening now?

**First principles simulation**
What should be happening now?

**High dynamic range (HDR) analytics**
Increase the range of anomaly detection to enable earlier intervention and greater risk mitigation

**Prognostics**
What might happen next?

**Optimization**
How can I improve the outcome?

**Learning**
When should I act?
The case for AVEVA™ PI System™ and predictive analytics

Real-time data + predictive analytics

- ✔ AI and condition-based multivariate analysis of process deviations
- ✔ Early warning notifications, time-to-failure, and remaining useful life estimates
- ✗ No insight beyond measured mechanical and process data
- ✗ Difficult to quantify asset impact on upstream & downstream processes

Overall Model Residual (OMR)

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The case for AVEVA™ PI System™, predictive analytics, and process simulation

Real-time data + predictive analytics + simulation

- Quantify the impact of a single deviation on upstream & downstream assets
- Leverage rigorous equipment models for advanced KPI calculations
- Simplify deployment with easy drag-and-drop model building
- Test recommended actions in the digital twin before rollout
Scalability of predictive asset optimization

**Asset framework**
- Templates
  - Centrifugal Pump
    - Flow Rate
    - Pressure
    - Manufacturer
    - Service Date

**Simulation**
- P-XXXX
  - Diagram showing pump and flow

**Predictive analytics**
- Graphs showing data analysis

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Customer success story

How Saudi Aramco is using PAO to improve their operations
Please join Aramco’s AWC Presentation on Wed, Oct 25 from 11:40-12:10 in Oil, Gas & Energy Track

Challenge

• How to manage & improve asset reliability & major equipment performance across dozens of distributed sites?
• How to predict asset failure in advance to optimize resource planning & maintenance schedules?

Solution

• AVEVA™ Process Simulation (APS) and AVEVA Predictive Analytics connected to AVEVA PI System

Results

• Applied process simulation (APS) for real-time performance monitoring
• Online fault monitoring (OFM) solution being scaled & deployed
• OFM solution provides asset failure prediction & operational support for critical assets
• Reduced maintenance costs and improved asset reliability, availability & performance

“We have used technology as an enabler to be more responsive, more adaptive, and more intelligent.”

Abdulaziz Alzahrany – IT System Analyst, Aramco

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How AVEVA accelerates your data potential journey with process simulation & predictive analytics
Stop thinking tags, start thinking assets

Build once, deploy many!

- Better alignment with Engineering, Operations & Maintenance
- Scalable & consistent
- Less time to develop & deploy
- Safer, fewer errors
- => Structure & context for enterprise analytics

Metadata
Sensor ‘tag’ data
Calculations, analytics & workflows

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# PI Digital Twin Library

*(Please join AWC Presentation on Wed, Oct 25 from 16:30-17:00 in PI System User track for more information)*

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Call to action

Step 1
Identify a test case
Consider relevant use cases & identify one use case. Consider equipment with high criticality or problems

Outcome
Mutual understanding of model to build & evaluate

Step 2
Build and deploy model
During AVEVA PI Digital Twin Workshop, define success criteria & work together to develop & deploy initial integrated model

Outcome
Model built with AVEVA support & success criteria understood

Step 3
Confirm value
Evaluate model against defined success criteria to confirm value of solution

Outcome
Potential value identified & agreed upon. Model utilized as example for future rollouts

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Q&A
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