AVEVA

AVEVA and OSIsoft have come together to elevate industries through Performance Intelligence

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aveva.com/performance-intelligence

The PI System and Seeq

Integration Considerations, Methods and Best Practices

The PI System and Seeq – Better Together

Your Speakers Today

Craig Harclerode
O&G Industry Principal

Sasha Krivonosova
Sr Pre-Sales Engineer

Ales Soudek
Principal Pre-Sales Engineer

OSIsoft
is now part of AVEVA

Ted Gorrie
VP Sales

Kris Wiggins
Analytics Engineer

Seeq

Hello, thanks for joining us today!

A few housekeeping notes:

- This webinar is being recorded! We will be providing the recording and slides after the webinar. You can expect an email within a few days.

- Have a question? Use the ON24 Q&A box.

- Reference material available in on-demand sign up

Agenda

- **The PI System and Seeq**
  - *Overview and Positioning*
  - *Why better together perspectives*

- **Recommended Practices**
  - *Defining "Operationalization"*
  - *Integration Methodology and Considerations*

- **Demo**

- **Perspectives from Experience**

- **Key Takeaways**

- **Q&A**

The PI System and Seeq

Overview and Positioning

The PI System
Edge-to-cloud operational data management for your distributed enterprise
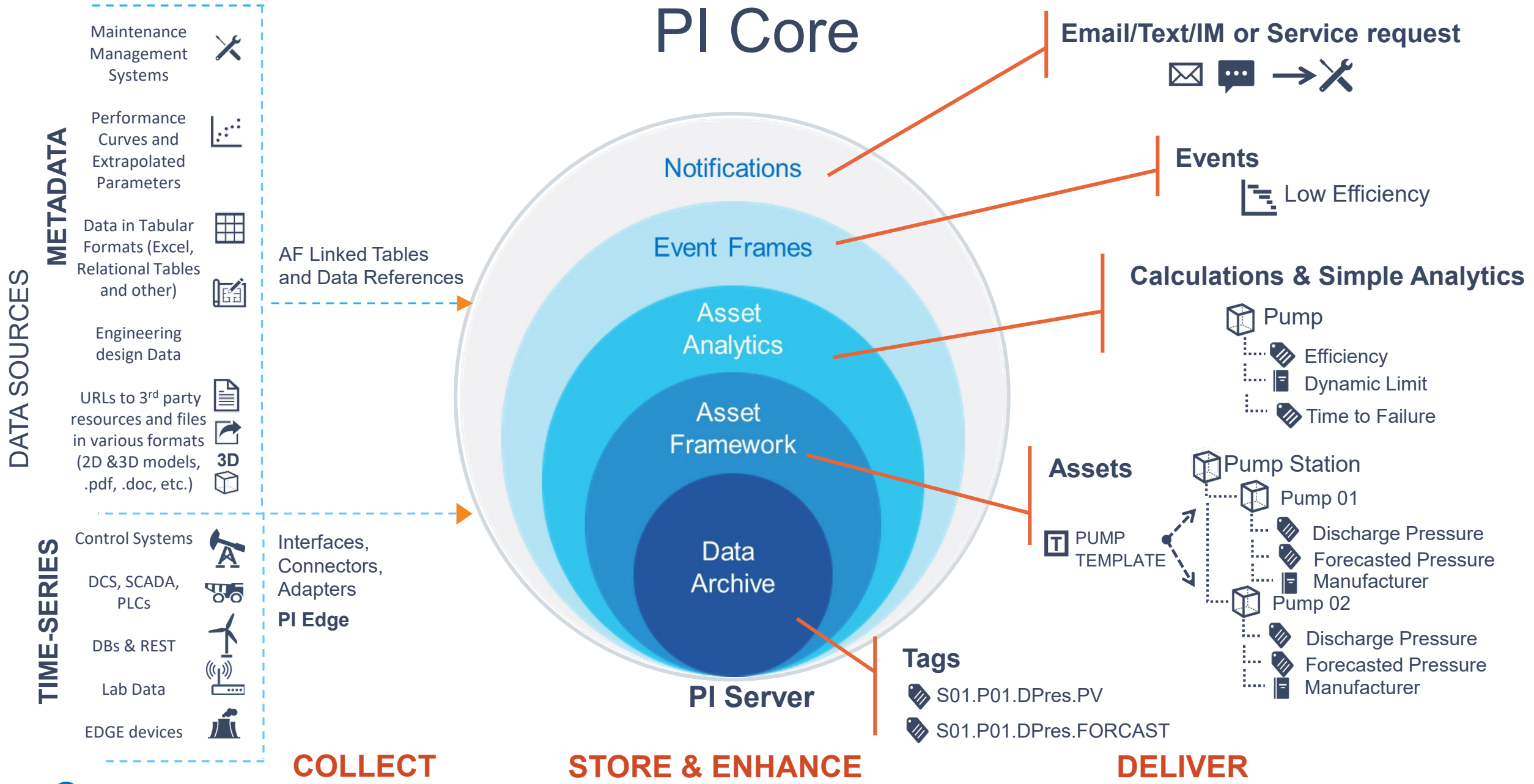

PI Cloud

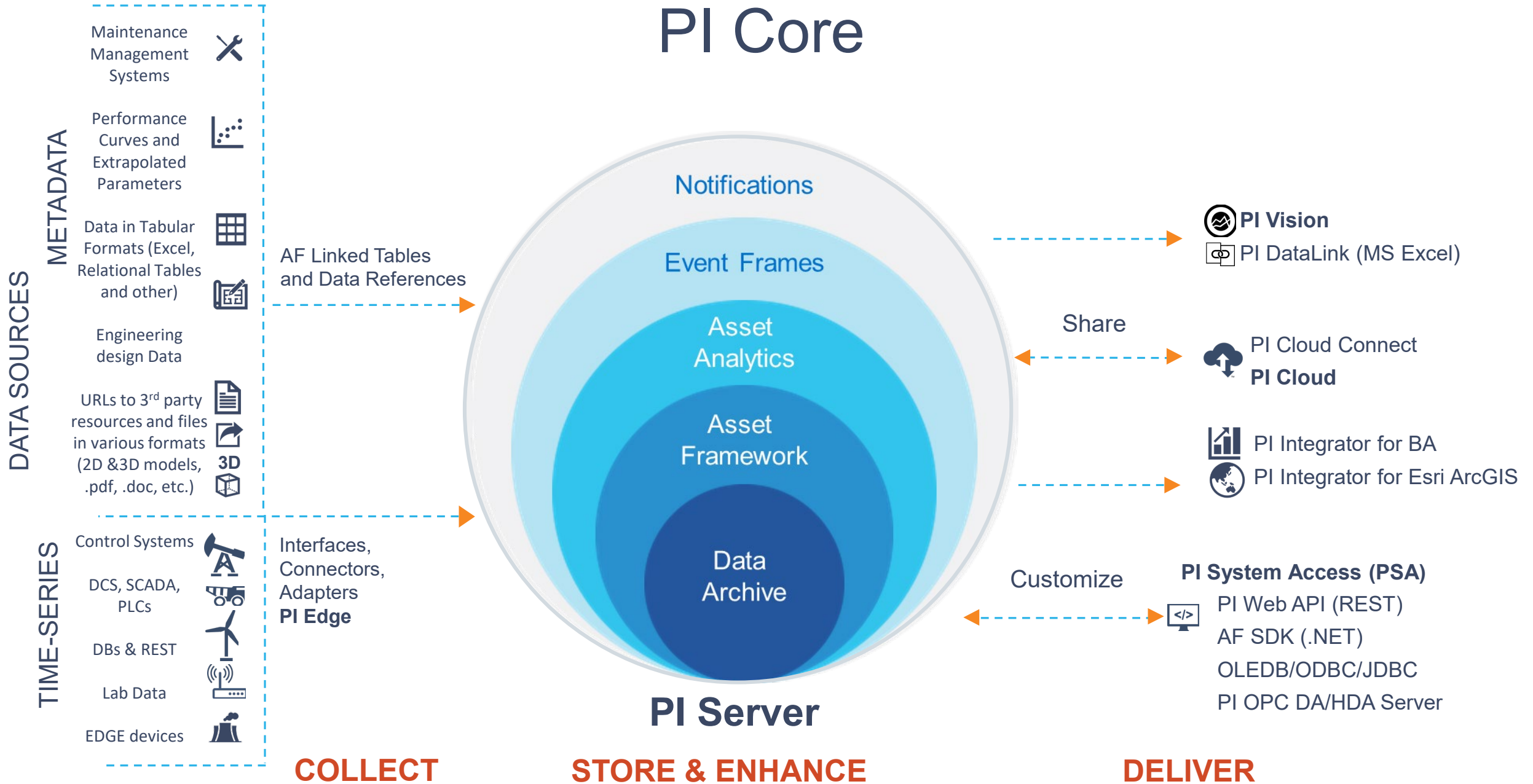Scalable, integrated data services for advanced analytics

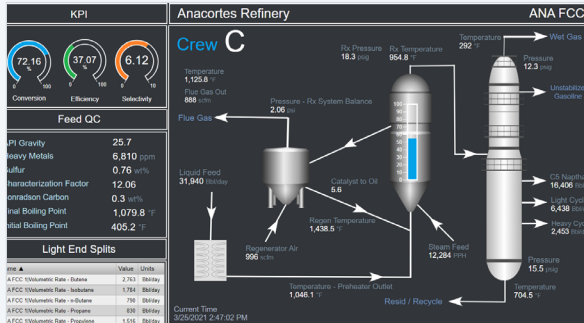**PI Core**

On-premises for 24/7 critical operations

PI Edge

Pervasive, real-time data collection for remote environments

PI Core

DATA SOURCES
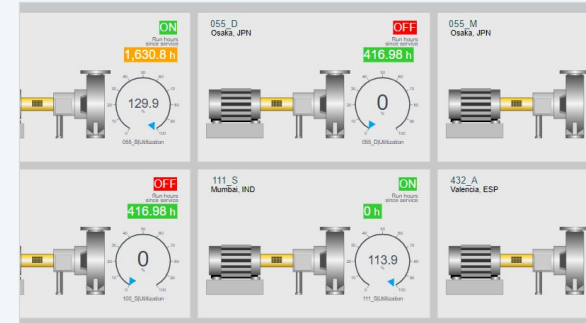
METADATA

- Maintenance Management Systems
- Performance Curves and Extrapolated Parameters
- Data in Tabular Formats (Excel, Relational Tables and other)
- Engineering design Data
- URLs to 3rd party resources and files in various formats (2D & 3D models, .pdf, .doc, etc.)

TIME-SERIES

- Control Systems
- DCS, SCADA, PLCs
- DBs & REST
- Lab Data
- EDGE devices

AF Linked Tables and Data References

Interfaces, Connectors, Adapters

PI Edge

PI Core (circles)

- Notifications
- Event Frames
- Asset Analytics
- Asset Framework
- Data Archive

PI Server

Deliver side

Email/Text/IM or Service request

Events
- Low Efficiency

Calculations & Simple Analytics
- Pump
  - Efficiency
  - Dynamic Limit
  - Time to Failure

Assets

PUMP TEMPLATE

- Pump Station
  - Pump 01
    - Discharge Pressure
    - Forecasted Pressure
    - Manufacturer
  - Pump 02
    - Discharge Pressure
    - Forecasted Pressure
    - Manufacturer

Tags
- S01.P01.DPres.PV
- S01.P01.DPres.FORCAST

COLLECT   STORE & ENHANCE   DELIVER

PI Core

DATA SOURCES

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Interfaces, Connectors, Adapters
PI Edge

PI Server

- Notifications
- Event Frames
- Asset Analytics
- Asset Framework
- Data Archive

Share

⦿ **PI Vision**
⊕ PI DataLink (MS Excel)

☁ PI Cloud Connect
PI Cloud

📊 PI Integrator for BA
🌐 PI Integrator for Esri ArcGIS

Customize

PI System Access (PSA)
PI Web API (REST)
AF SDK (.NET)
OLEDB/ODBC/JDBC
PI OPC DA/HDA Server

COLLECT   **STORE & ENHANCE**   **DELIVER**

PI Vision: Real-time, Self-Serve, Scalable, Actionable Intelligence

Real-time operational dashboarding
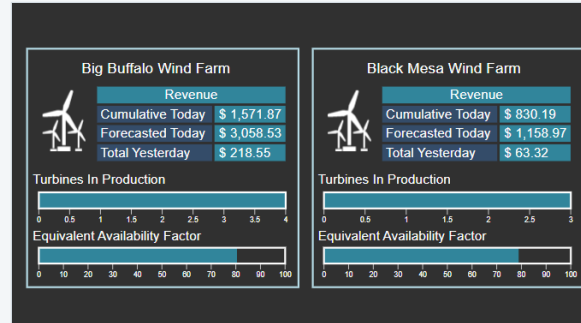
Enterprise level dashboarding

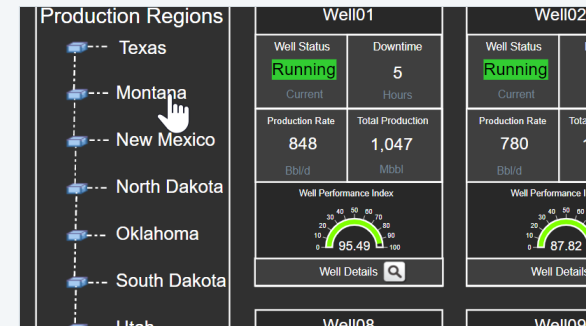

Dynamic templatized asset representation
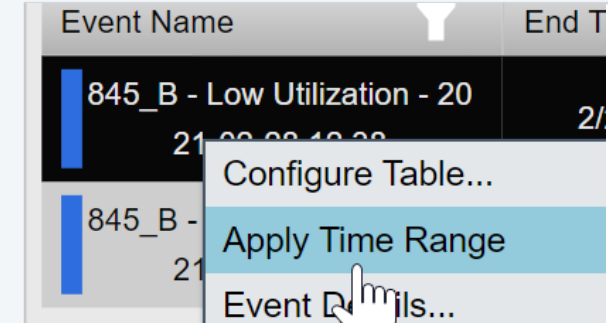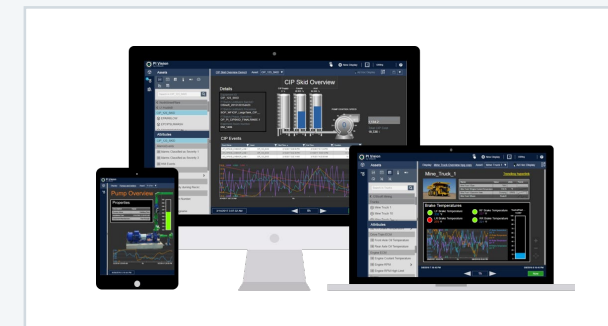

Event-contextualized Visualization
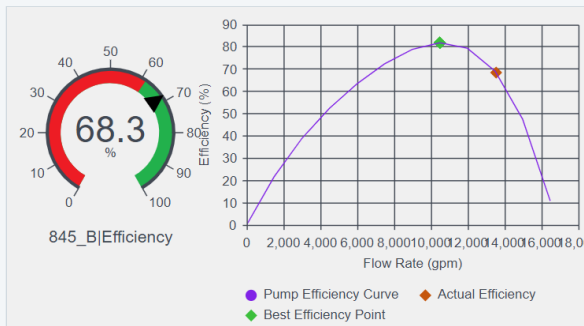
Integration point for real-time KPIs and engineering/meta data

Native visualization platform for Notifications

Smart drill-in navigation driven by AF Hierarchy

Mobile-friendly

Layers of Analytics and No-Code Operational Digital Twins with the PI System

Operational Data Management & System of Record

Enrique Herrera, Industry Principal at OSIsoft
Craig Harclerode, O&G/HPI Industry Principal at OSIsoft
Steve Edwards, Sr. Systems Engineer at OSIsoft
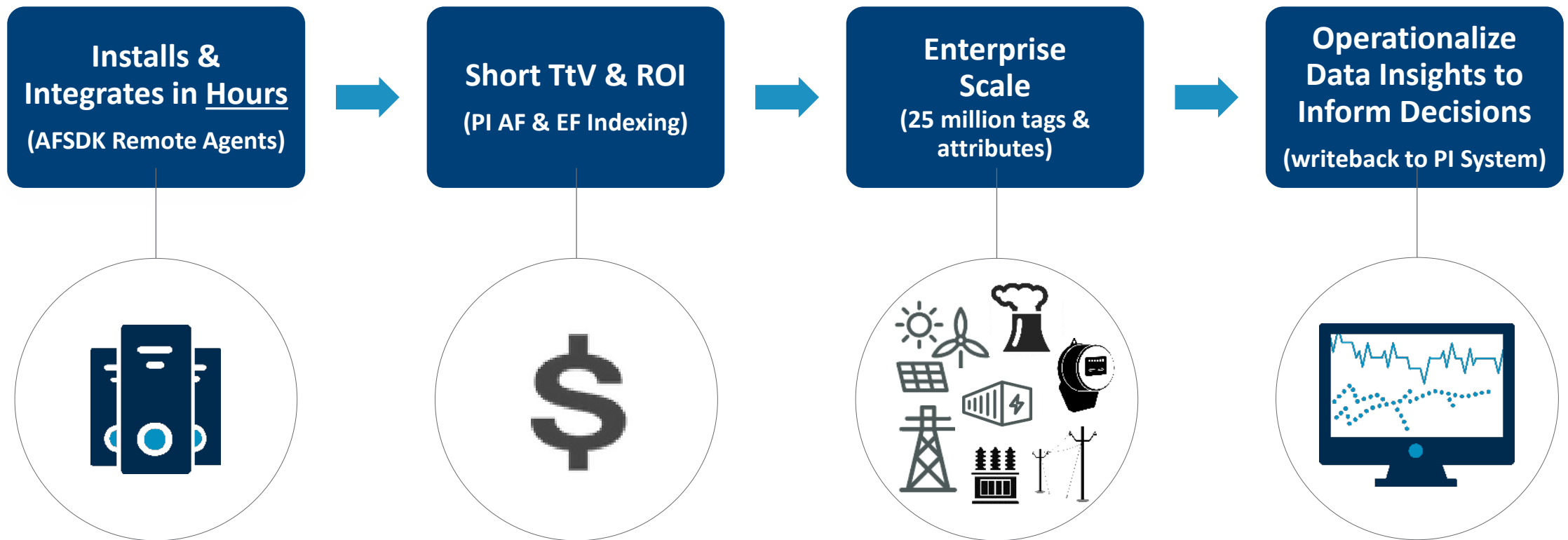Sasha Krivonosova, Sr. Pre-Sales Engineer at OSIsoft

November 5th, 2020 – On Demand link in the Resource Section

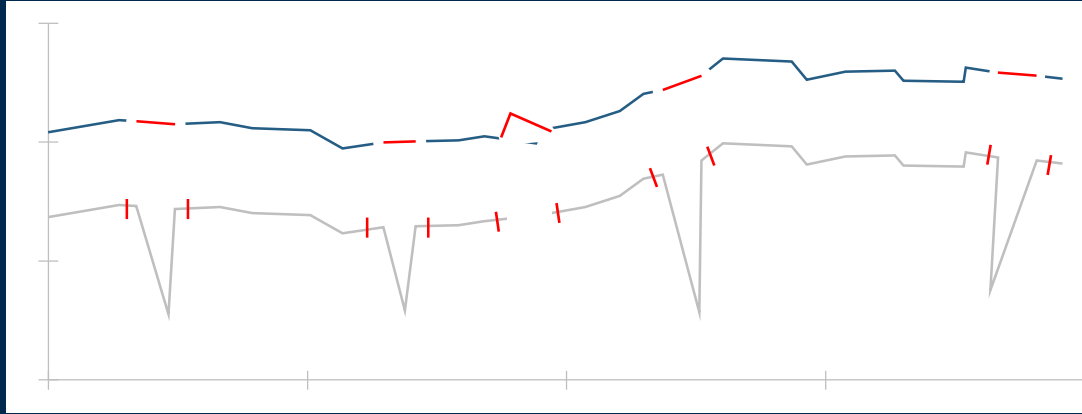# Edge-to-Cloud Operational Data Management at Enterprise Scale

Seeq ORGANIZER

Seeq WORKBENCH

Seeq DATA LAB

Seeq CORTEX
SaaS or in your Cloud

OSIsoft.
is now part of AVEVA

PI Cloud

PI Core

PI Edge

MySQL ORACLE

PostgreSQL Microsoft SQL Server

SQL Sources

EAM Forecast

Packaging Lab Instruments

Custom Sources

Integration Options
tableau PowerPoint
Spotfire Excel
Power BI R
PI Vision by OSIsoft
python Java MATLAB
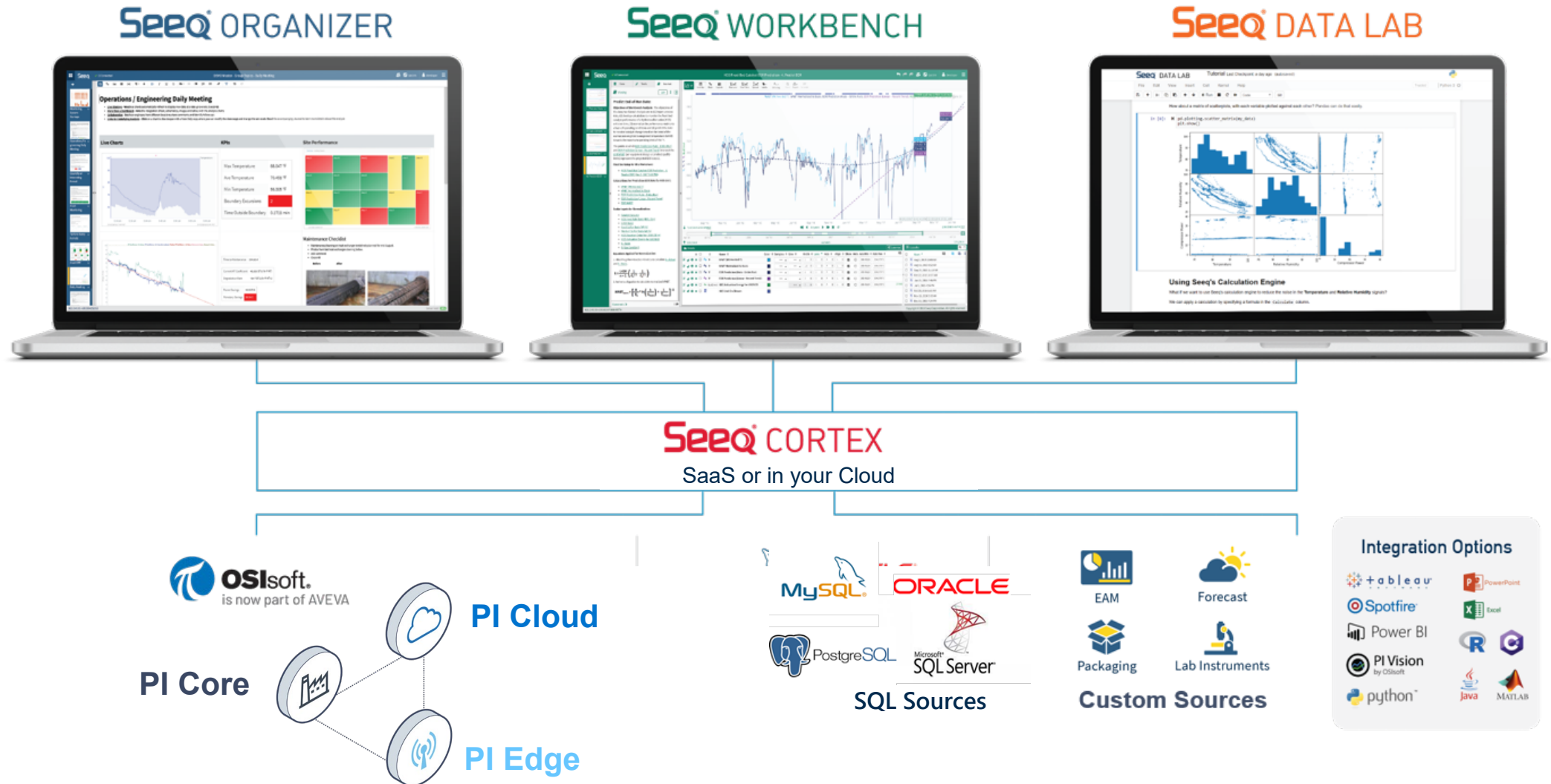
Utilizing Seeq with your PI System Infrastructure

Seeq is an advanced analytics application purpose-built for time-series data that empowers engineers and SMEs with self-service tools to collaborate & improve operational performance
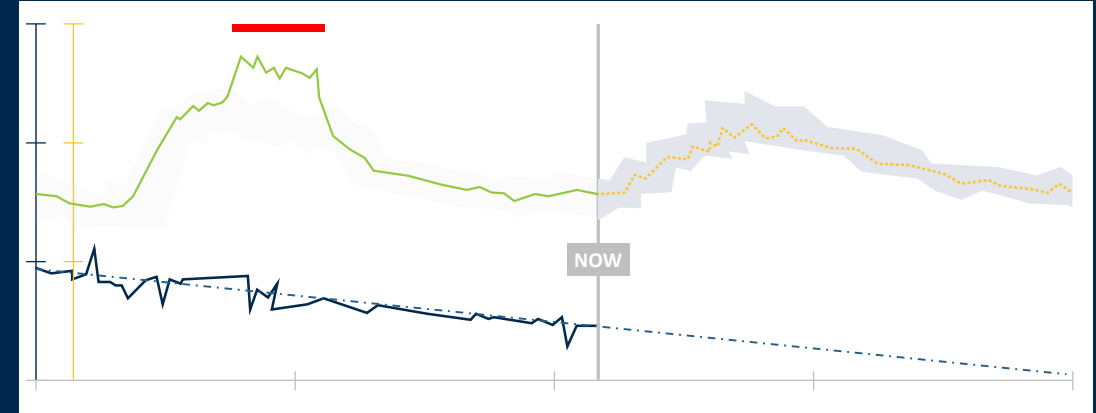
Installs & Integrates in <u>Hours</u>
(AFSDK Remote Agents)

Short TtV & ROI
(PI AF & EF Indexing)

Enterprise Scale
(25 million tags & attributes)

Operationalize Data Insights to Inform Decisions
(writeback to PI System)

Seeq's Complement of Ad-hoc Capabilities for the PI System

Data Cleansing

Advanced Analytics

NOW

Reports & Dashboards

Analytics Workflows

Sharing workbooks

Real-time collaboration

Annotations

Knowledge capture
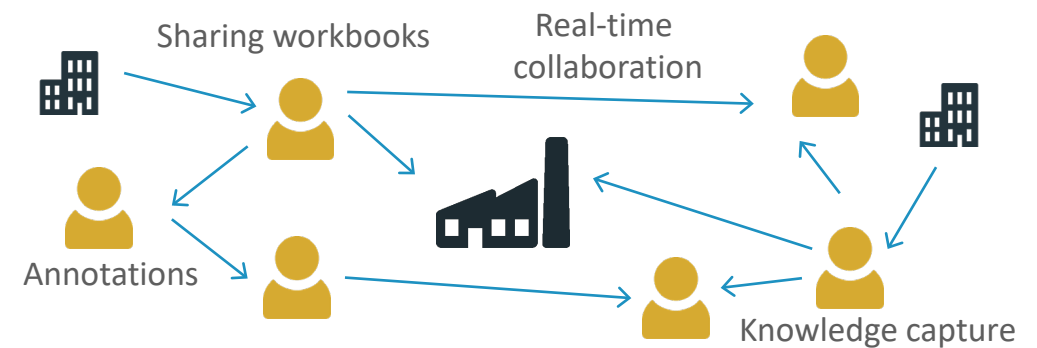
OSIsoft PI System integration with Seeq
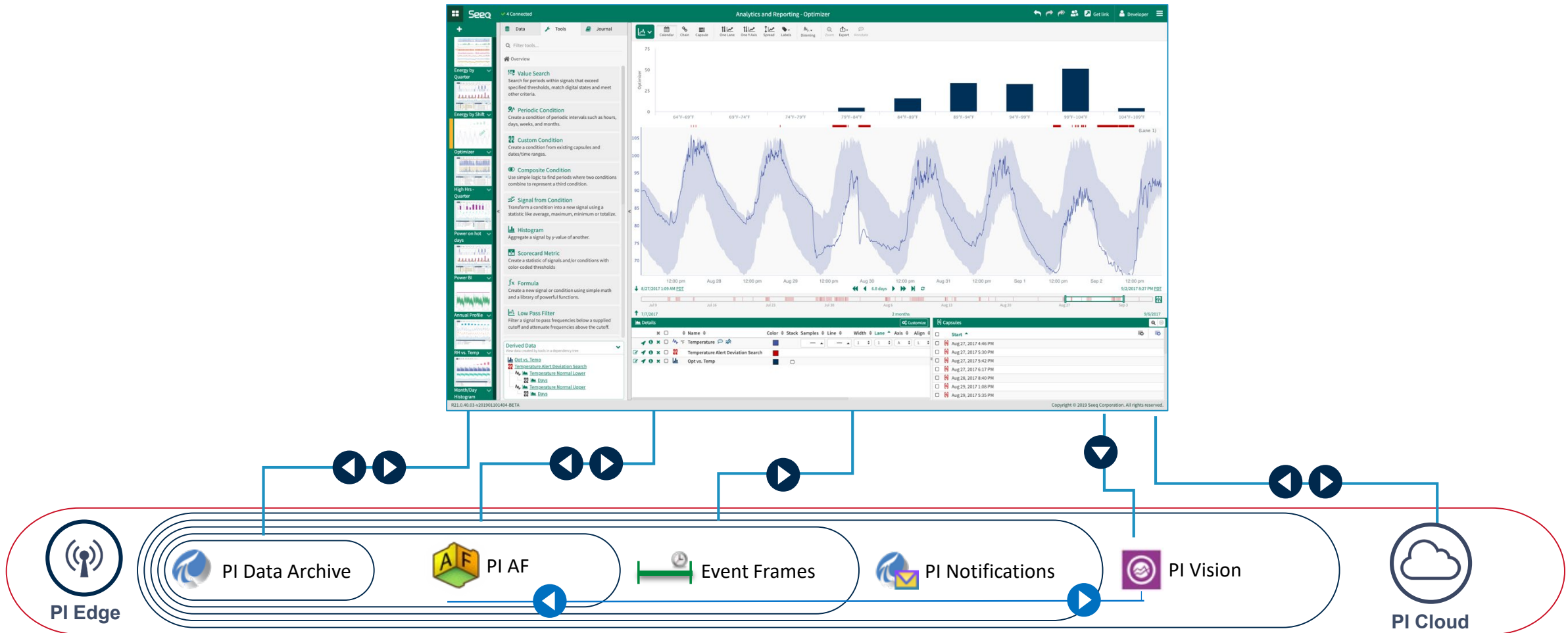
What Makes 'Seeq + the PI System' So Special?

Federation

Seeq connects to all of a company's plants and locations through the PI System

Scalability

10+ million PI tags, PI Asset Framework templates, elements & attributes, and Event Frames

SaaS

Available through AWS and Azure Marketplace and Integrates with PI Cloud

Self-Serve

Engineers and SMEs have immediate access to all the operational data, in context. The marginal cost of curiosity is zero

Collaborate

Knowledge workers collaborate on Operational Excellence in the cloud, eliminating all time and distance barriers between assets and people

Operationalize

As best practices are identified in Seeq, they can be quickly adopted at scale in the PI System

The PI System and SEEQ

Why Better Together Perspectives

Synergy

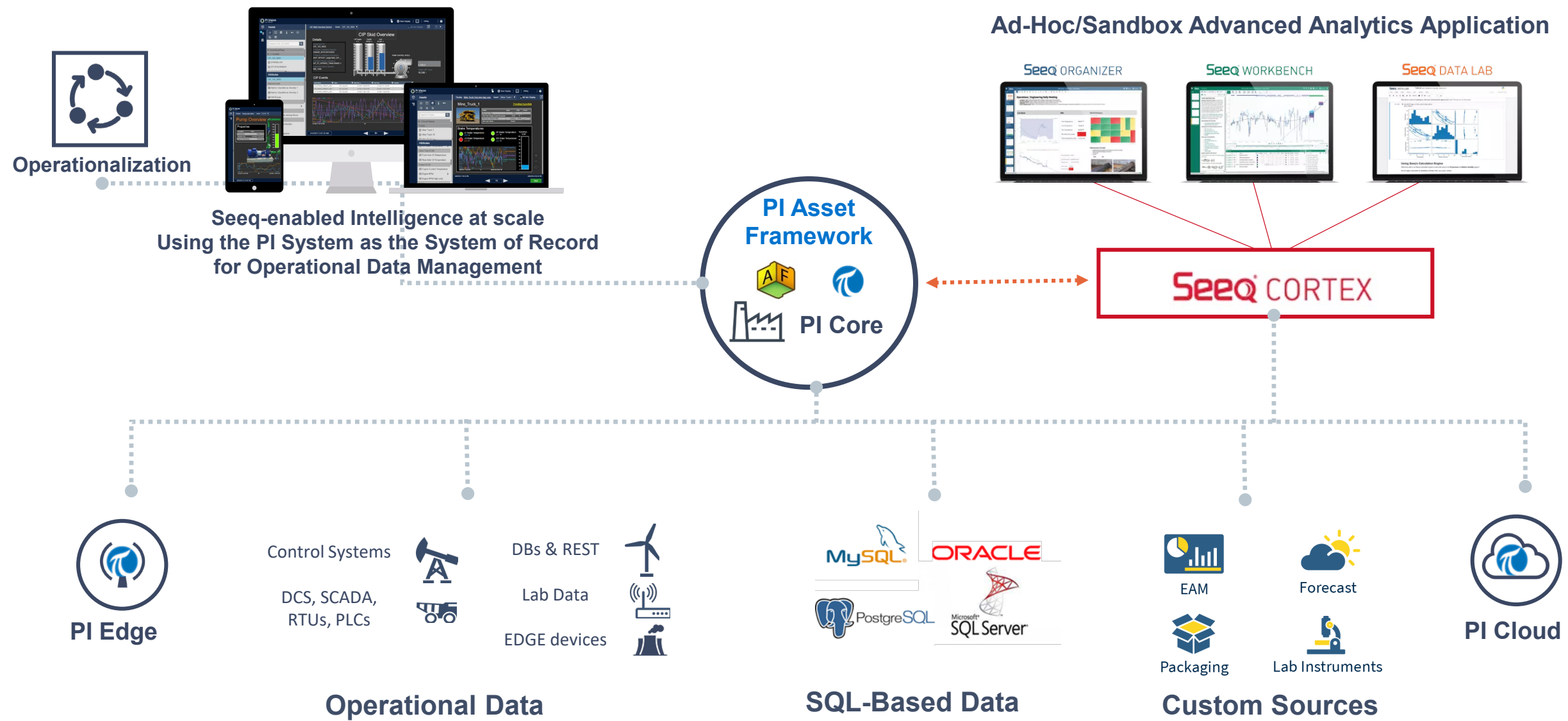OSIsoft is now part of AVEVA **+** Seeq **=** VALUE

Integration, applications and streaming analytics **infrastructure** enabling the **operationalization** of SME-enabled Seeq insight at scale

System of Record for Operational Data

Expressions	Formulas
Event Frames	Capsules
AF Hierarchy	Asset Tree
Asset Context Switch	Asset Swap

On demand, self-serve **advanced analytics application** for manufacturing data

Flexible Complementary Capabilities – PI AF as the integration point

Operationalization

Seeq-enabled Intelligence at scale
Using the PI System as the System of Record
for Operational Data Management

Ad-Hoc/Sandbox Advanced Analytics Application

Seeq ORGANIZER | Seeq WORKBENCH | Seeq DATA LAB

PI Asset Framework

AF | PI Core

Seeq CORTEX

PI Edge

Control Systems

DCS, SCADA, RTUs, PLCs

DBs & REST

Lab Data

EDGE devices

Operational Data

MySQL | ORACLE

PostgreSQL | Microsoft SQL Server

SQL-Based Data

EAM | Forecast

Packaging | Lab Instruments

Custom Sources

PI Cloud

Recommended Practices

Defining Operationalization
Integration Methodology and Considerations

Operationalization

*Moving **from offline** or on-demand **to enhanced real-time decision support** by leveraging the PI System's streaming capabilities and making **advanced analytics results accessible to operations***
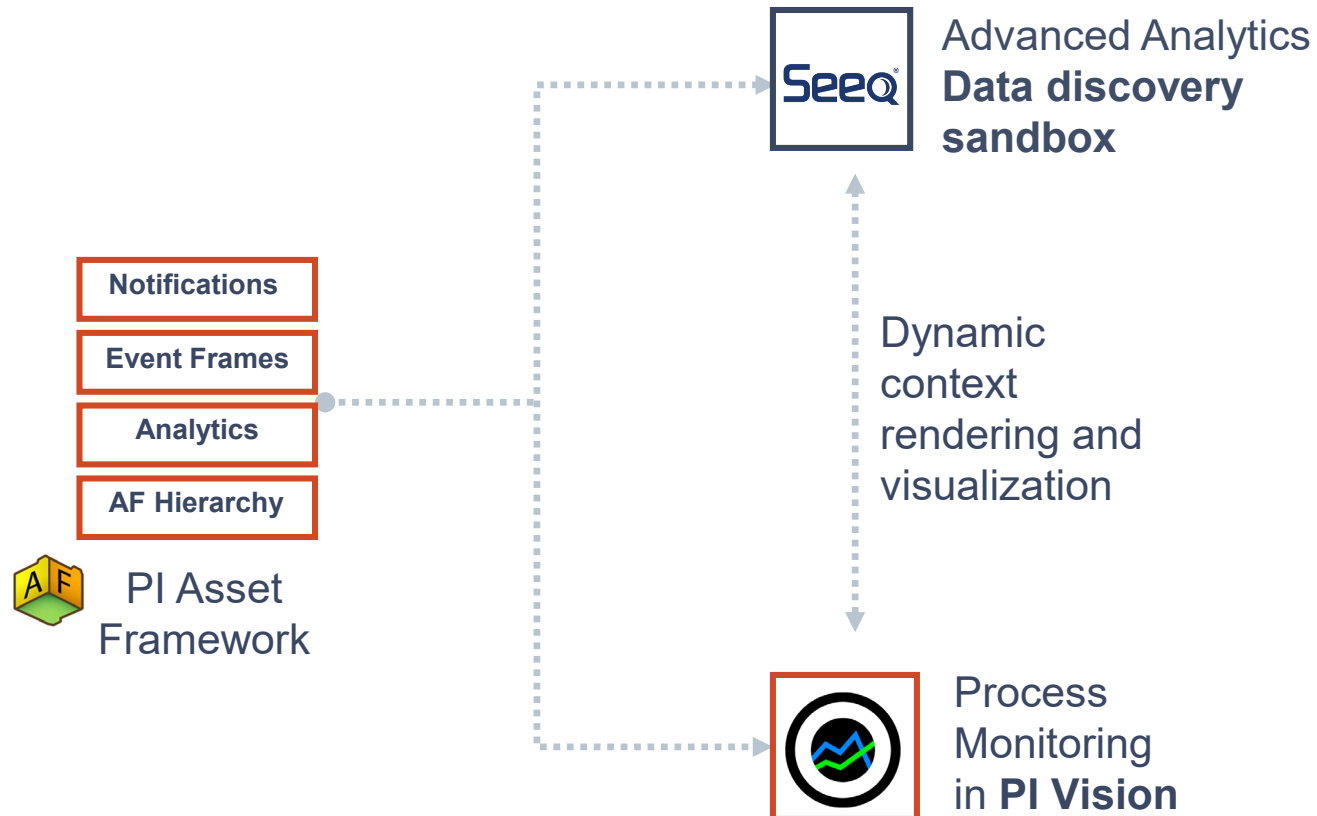
*Key is the enablement and **empowerment of engineers** and **subject matter experts (SMEs)** with a **self serve**, **agile development** of the **layers of analytics** in a **hybrid cloud environment***

Recommended Integration method between the PI System and Seeq

Remote assets

IoT gateways

PI Edge

PI Cloud

Advanced Analytics
Data Science

Control Systems

DCS, SCADA, RTUs, PLCs DBs, REST, etc.

PI Data Archive

Notifications

Event Frames

Analytics

AF Hierarchy

PI Asset Framework

Advanced Analytics
Data discovery sandbox

Process Monitoring in **PI Vision**

Metadata
Maintenance Management
Engineering
Other

Operationalization Methods

Advanced Analytics
Data discovery sandbox

Dynamic context rendering and visualization

Notifications

Event Frames

Analytics

AF Hierarchy

PI Asset Framework

Process Monitoring in **PI Vision**

Visual Web Integration

- **In PI Vision:** Embed Seeq webpage within PI Vision screen (via extensibility framework)

- **In Seeq:** Open corresponding PI Vision screen based on selected context in Seeq

- Dynamic *asset-context-driven* URL generation via URI Builder data reference in PI AF

Operationalization Methods

Notifications

Event Frames

Analytics

AF Hierarchy

AF Attributes and Events

Advanced Analytics
Data discovery sandbox

PI Asset Framework

Seeq AF Data Reference
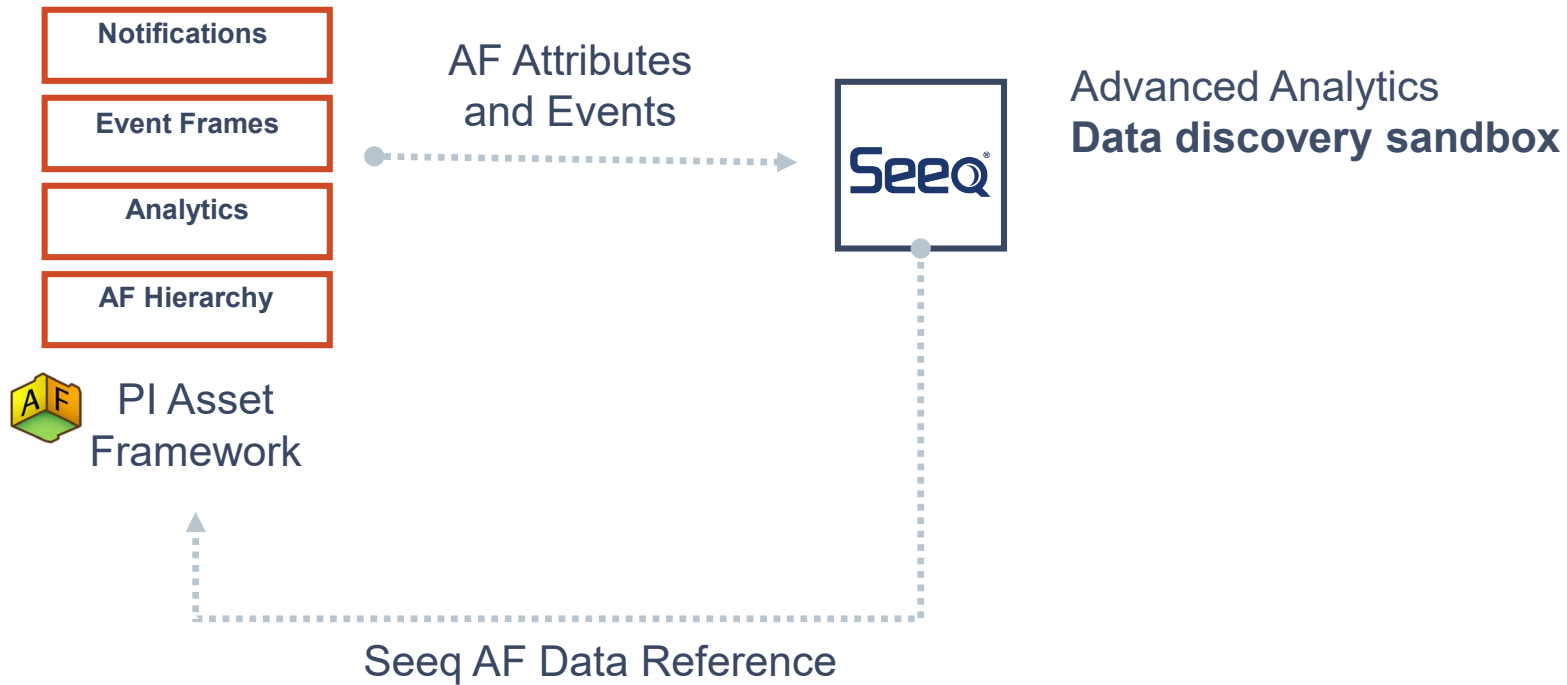
Seeq Data Reference

- Ad-hoc data query from PI AF to Seeq

- Great for checking single value output

- Developed by Seeq using AF SDK

Operationalization Methods

Notifications

Event Frames

Analytics

AF Hierarchy

PI Data Archive

PI Asset Framework

System of Record

PI AF Attributes and Events

Advanced Analytics
Data discovery sandbox

Seeq AF Data Reference
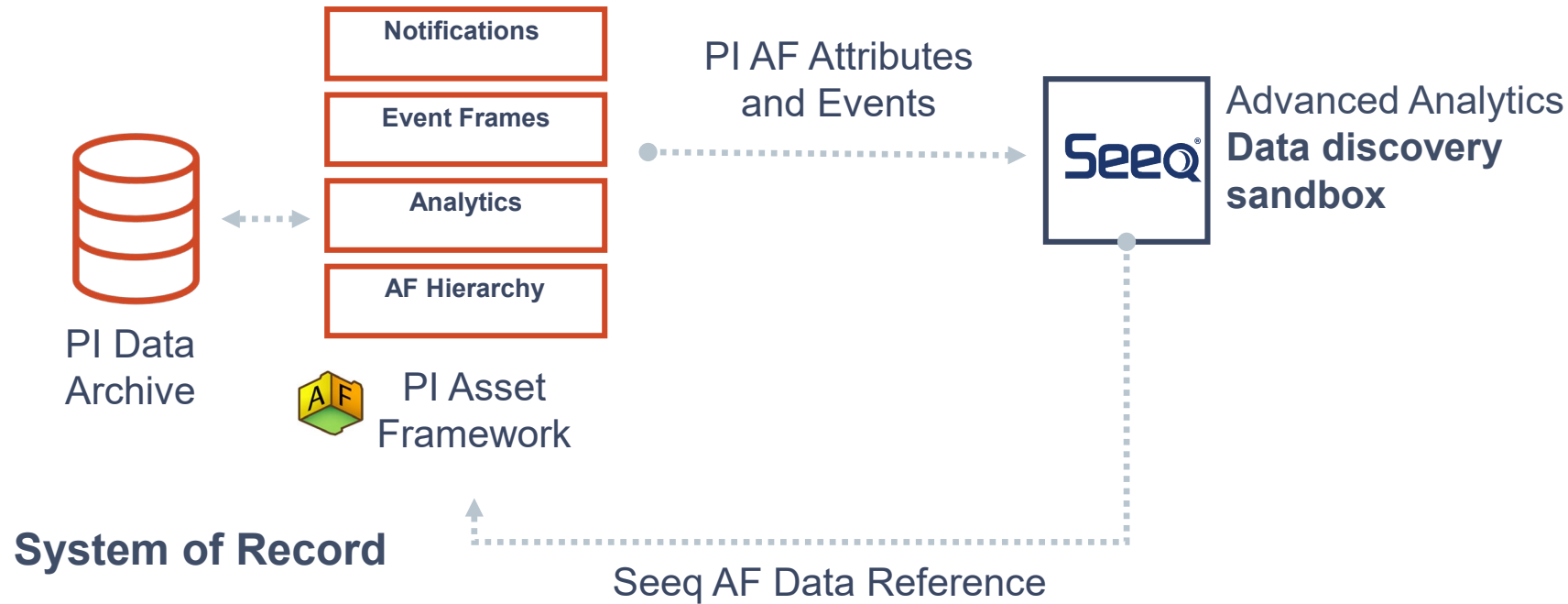
Seeq Data Reference
+
PI AF Analytics

- AF Analysis reads input value from Seeq by data reference and historizes in a PI tag through a PI AF attribute output

- Great for historical data retrieval and comparisons

- Leverages PI AF templates for quick deployment and scalability

Operationalization Methods

AF Analysis:

AF Attribute output

| vForecastPolyTwoInputs | (-1e-5)*(vRnHrs^3)+(| | | Production - Polynomial Forecast (Flow and RunH) |

(-1e-5)*(vRnHrs^3)+0.0013*(vRnHrs^2)-0.2425*vRnHrs+(3.0e-7)*(vFlowRate^3)+(-1e-4)*(vFlowRate^2)
+0.0127*vFlowRate

Seeq Workbench:

— Prediction model

Legend

Variable	Name
$a	Days Running
$b	Flow_Rate

Coefficients

Name	Coeffici...	Std. Err...	P-Value...
$a	0.2425	0.0009	0
$b	0.0127	0.0007	4e-81
$a^2	0.0013	3.1e-5	2e-314
$b^2	-1e-4	6.2e-6	2e-87
$a^3	-1e-5	2.9e-7	0
$b^3	3.0e-7	1.4e-8	3e-90

Statistics

Name	Value
intercept	0
interceptStandardError	0
adjustedRSquared	0.9999
rSquared	0.9999

Polynomial expression
created using
Seeq-generated coefficients

Advanced Analytics logic recreation using PI AF Analytics

- Allows to run the Analytic close the data source

- Allows to historize, backfill and recalculate the result

- Great for historical and real-time comparisons (Actual vs Predicted analytics)

- Applies to different types of Analytics (**Expressions, Event Frames**)

Demo

Story board and context
Demo

PI Asset Framework and Seeq Integration Example

Asset Hierarchy
(can have multiple structures for context)

Category: Seeq Integration

Treat Seeq generated data as any other attribute to trigger notifications, access in PI Vision and other tools

Category: Visualization Metadata

Dynamic asset-context-driven URLs generated by URI Builder data reference

Categories of Attributes
Used for Grouping, Navigation and Integration
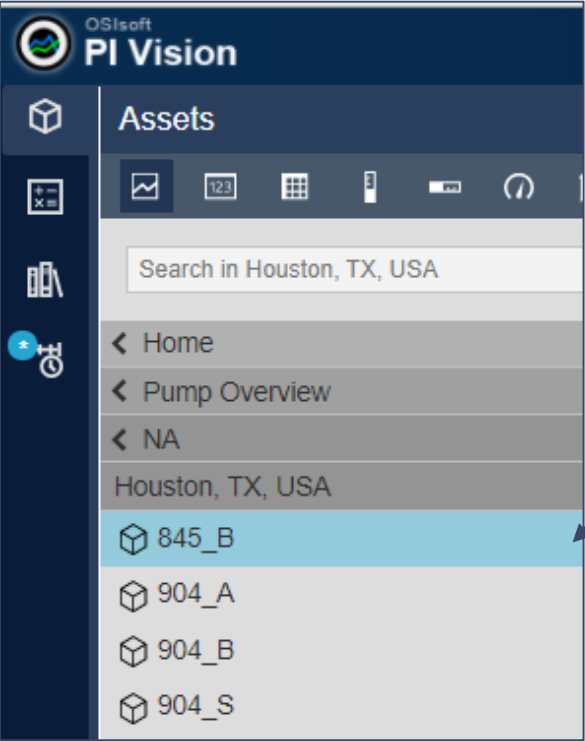
Attributes – Descriptors with Abstraction

- static data
- real-time data
- linked tables
- string builder
- URLs
- custom data references
- etc.

Category: Seeq Scalar

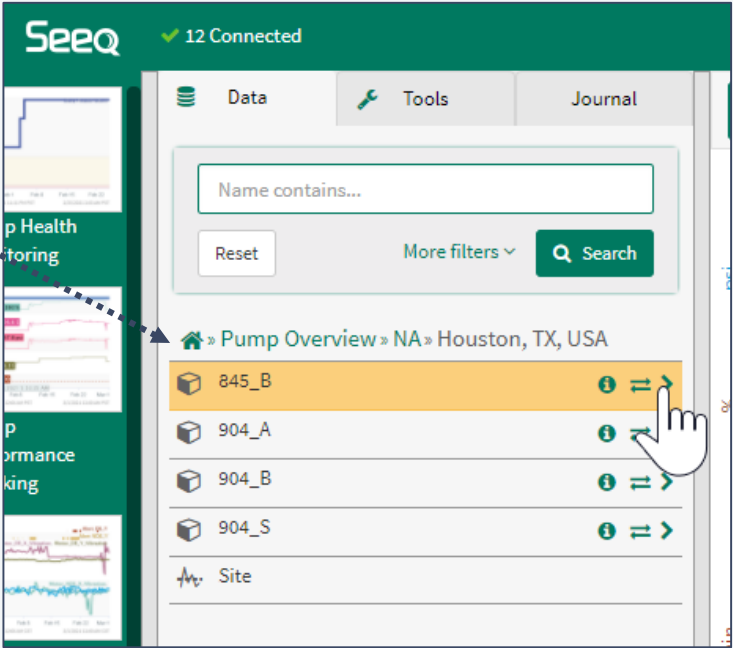Use to make non-time series data visible in Seeq
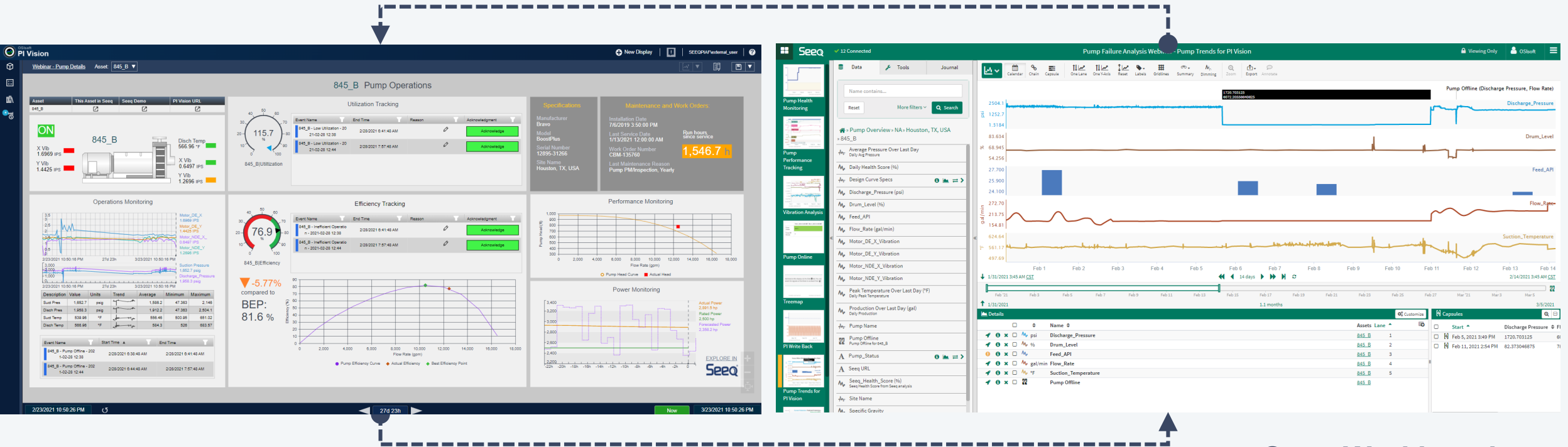
PI AF-Powered Visualization

PI Vision

Seeq Workbench

PI Asset Framework

PI Core
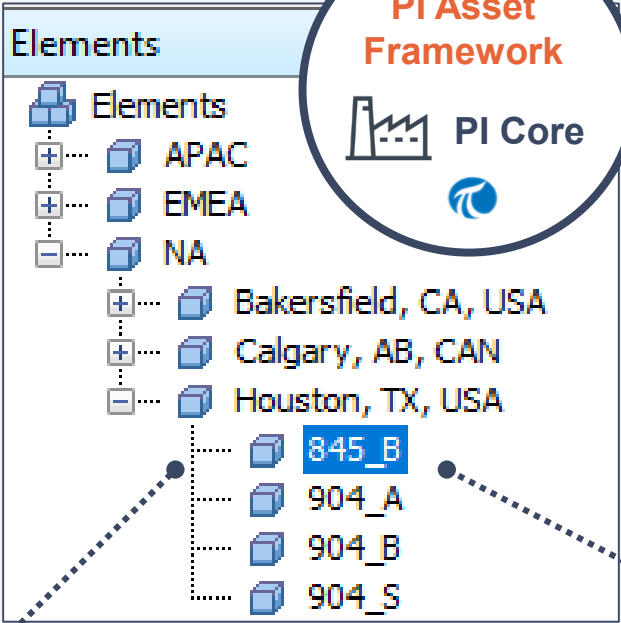
Dynamic Integration

User Experience: complementary tools

PI Vision
Process Monitoring
Operationalized results
Refined knowledge:
Event Frames, KPIs, Performance Curves

Seeq Workbench
Ad-Hoc/Sandbox
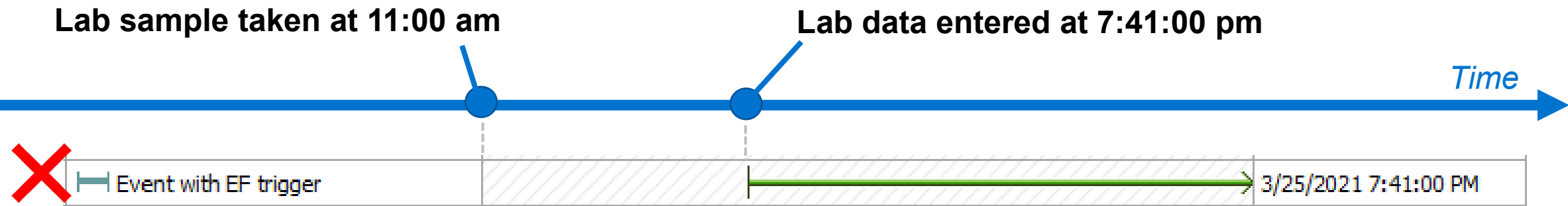Adjust Capsules
Generate Predictions

Perspectives from Experience

Perspectives from Experience

- **PI AF brings the power of Units of Measure (UOM) and conversion from Source UOMs**

- **Backfilling of Seeq-discovered logic in PI AF can lead to additional discoveries**

- **A Self-serve, agile approach leads to faster time to value and sustainability**

- **Segregate Event Frame trigger and logic into separate Analysis of Expression type**
  - *Simplifies Event Frame trigger logic*
  - *Allows preview of results*
  - *Allows automatic recalculation of the trigger and handles late arriving data*

Challenge of Late Arriving Data

Lab sample taken at 11:00 am

Lab data entered at 7:41:00 pm

Time

❌ | Event with EF trigger | | 3/25/2021 7:41:00 PM

Analysis Type: ⊙ Event Frame Generation

Generation Mode: Explicit Trigger ▾   Event Frame Template: EventFame Triggered

Add... ▾

Name	Expression
⊟ Variables	
vDens	'Density'
vTemp	TagVal('Temperature',PrevEvent(vDens,'*+1s'))
vFlow	TagAvg('Flow Rate',PrevEvent(vDens,'*+1s')-300,PrevEvent(vDens,'*+1s'))
⊟ Start triggers	
StartTrigger1	('Status' = "ON" and vFlow > 0 and vTemp < 280)

Challenge of Late Arriving Data

Lab sample taken at 11:00 am

Lab data entered at 7:41:00 pm

Time

Name	3/25/2021 11:00:00 AM	[1.01:16:53.3170802]	3/26/2021 12:16:53 PM	Start Time
⊢ Event with Expression Trigger				3/25/2021 11:00:00 AM
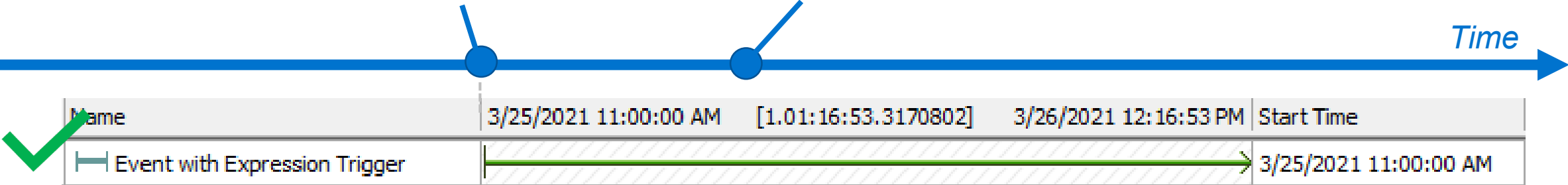
Analysis Type: ◉ Expression

Analysis Type: ◉ Event Frame Generation

Write output result to calculated time

Advanced options ✕

Output Time Stamp
- ◯ Trigger Time
- ◯ Execution Time
- ◯ Relative to Trigger Time: [   ]
- ◉ Variable: [vTime ▼]

Automatic Recalculation
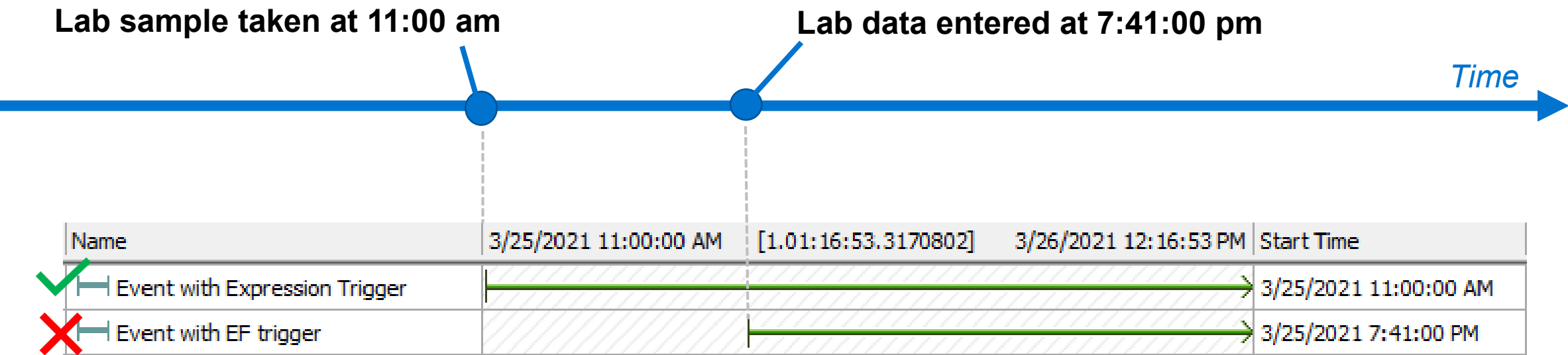- ☐ Recalculate analysis for out-of-order input events

[OK] [Cancel]

Add a new variable

Name	Expression	Output A...
vDens	'Density'	Map
vTime	PrevEvent(vDens,'*+1s')	Map
vStartTime	vTime - 300	Map
vTemp	TagVal('Temperature',vTime)	Map
vFlow	TagAvg('Flow Rate',vStartTime,vTime)	Map
vTrigger	If 'Status' = "ON" and vFlow > 0 and vTemp < 280 Then 1 Else NoOutput()	Event Trigger

Generation Mode: [Explicit Trigger ▼]

Add... ▼

Name	Expression
⊟ Start triggers	
StartTrigger1	'Event Trigger' = "TRUE"

Create Output tag and use as Event Trigger

OSIsoft
is now part of AVEVA

Challenge of Late Arriving Data

Lab sample taken at 11:00 am

Lab data entered at 7:41:00 pm

Time

Name	3/25/2021 11:00:00 AM	[1.01:16:53.3170802]	3/26/2021 12:16:53 PM	Start Time
✔ ├─ Event with Expression Trigger				3/25/2021 11:00:00 AM
✘ ├─ Event with EF trigger				3/25/2021 7:41:00 PM

Trigger from **Event Frame Analysis** – Event starts at the wrong time

Trigger from **Expression Analysis** – Event starts at the correct time

Final Architecture

Decision trees can be easily understood and implemented
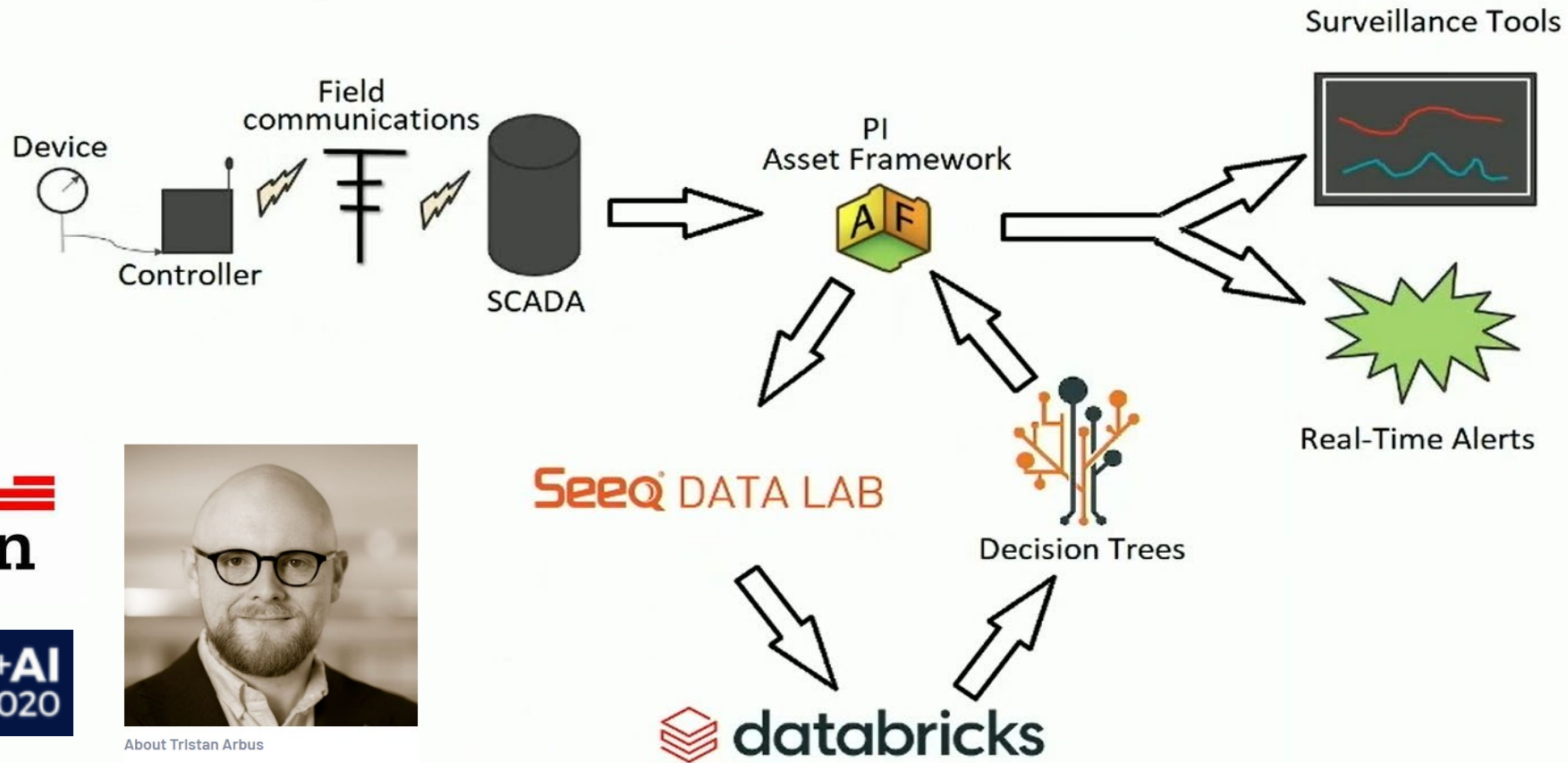
About Tristan Arbus
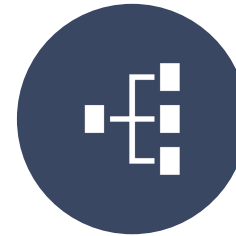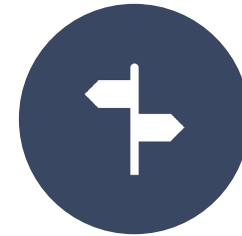Devon Energy

#Datateams #SparkAISummit

Key Takeaways

Flexible & Complementary Capabilities

Self-serve Enablement of the SMEs is Foundational for Trusted, Actionable Performance Intelligence

PI AF should be the Primary Integration Point with PI Core

Understand the capabilities of both the PI System and Seeq

Use the Right Tool for the Right Task