AVEVA PI System Presales Training for SI's

V1 - 2023

David Ariens, Manager Project Support & Analytics

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Practical Stuff

- You will receive these slides after the presentation
- Feel free to distribute the slides and recording within your organisation

- Questions?

  Raise hand  or ask via the chat! 

- Please **mute** yourself

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Hi !

David Ariens
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Past at **BASF Antwerp**:

- I have 12y+ experience in MOM projects as Manager Industrial Digitalization at BASF Antwerp, including the introduction of PI
- Introduced BASF's global Cyber Security program
- Responsible for all of BASF's Industry 4.0 activities in Europe.

Now at **AVEVA Select Benelux**

- Leading all data platform related projects
- Manager Project Support
- Manager Manufacturing Analytics
- A passion for AI

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Agenda

- The Data Journey: A generic approach towards a data driven organization
- The AVEVA Data Proposition
- AVEVA PI: The Basics
- Positioning PI within the AVEVA Portfolio
- Can PI replace MES? (No)
- System Architectures: The Basics
- AVEVA Datahub
- Use Cases
- Training Paths

The Data Journey

A generic approach towards a data driven organization

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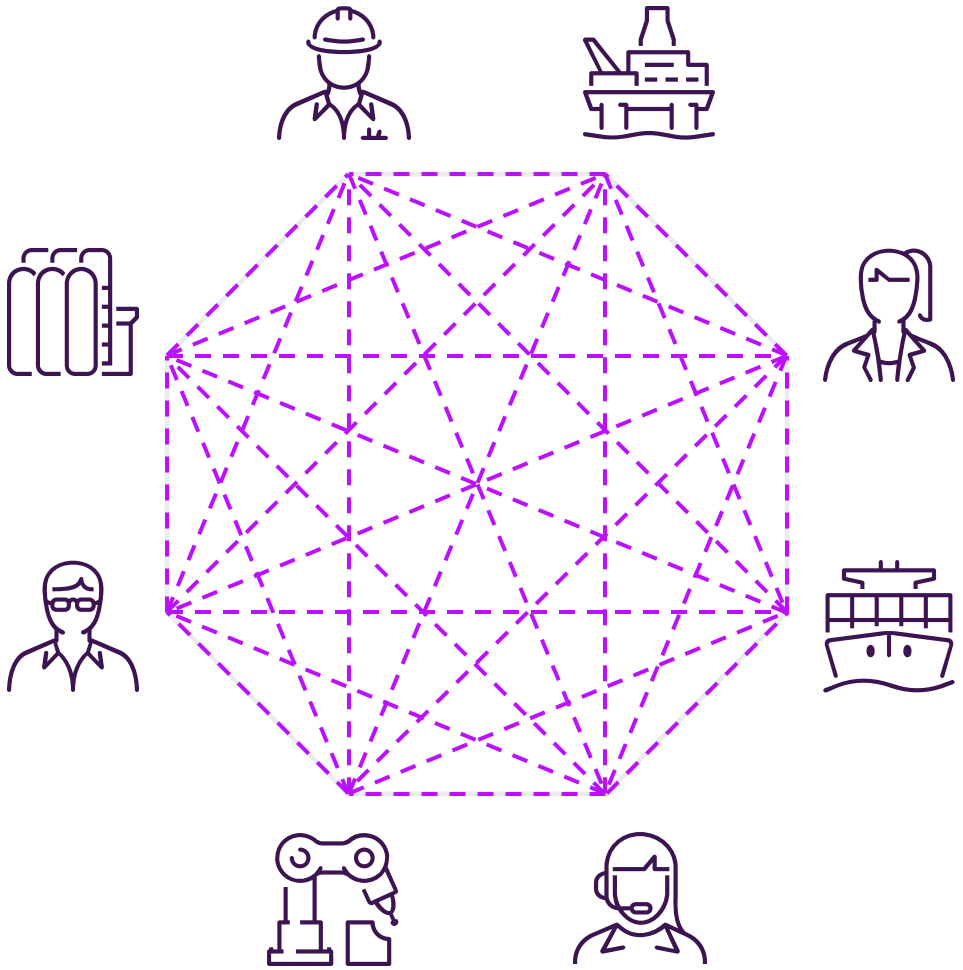
Data can be the **accelerator** of your **connected** business.



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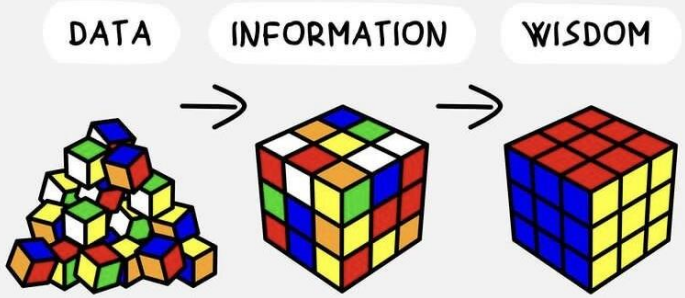

Capturing data is where we **start.**
Creating **value** is our mission.

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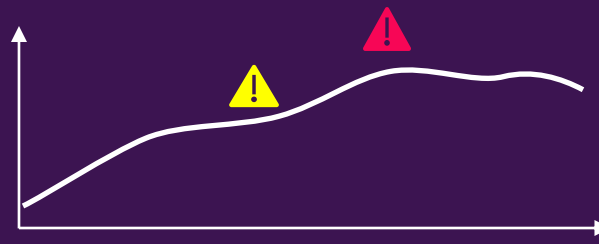
0 This Pump (and 100 more) are controlled by your SCADA. The operators react on alarms.

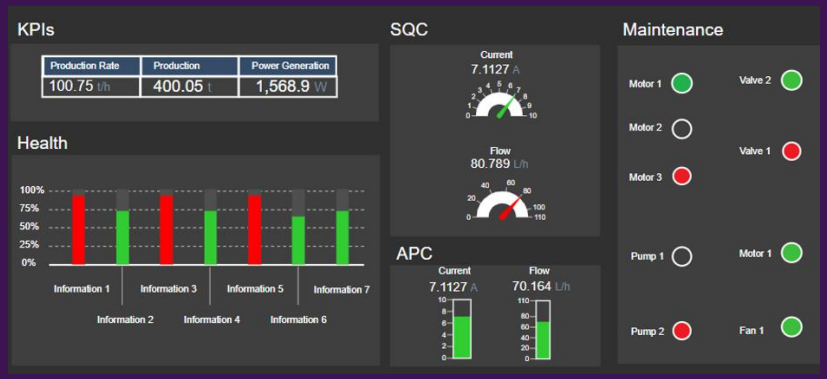


Pump: Bearing Temperature

1 You start building nice Excel type reports for your maintenance staff to review on a regular basis

Pump	Max Temp	#Alerts	Last Oil Change
P101A	85°	1	10/10/22
P101B	99°	12	20/02/23
P56895	79°	0	null
P555z_1	n/a	n/a	28/02/20

2 You start focusing on what your staff needs to act upon, given the operational circumstances, with integrated Maintenance Data



3 You start moving towards a Digital Twin: by providing structure, meta data and context you predict the next failure days in advance

High Energy Alert

Pump Efficiency

Pump Station

Pump 01

Flow Rate

Pressure

Manufacturer

Pump 02

etc...

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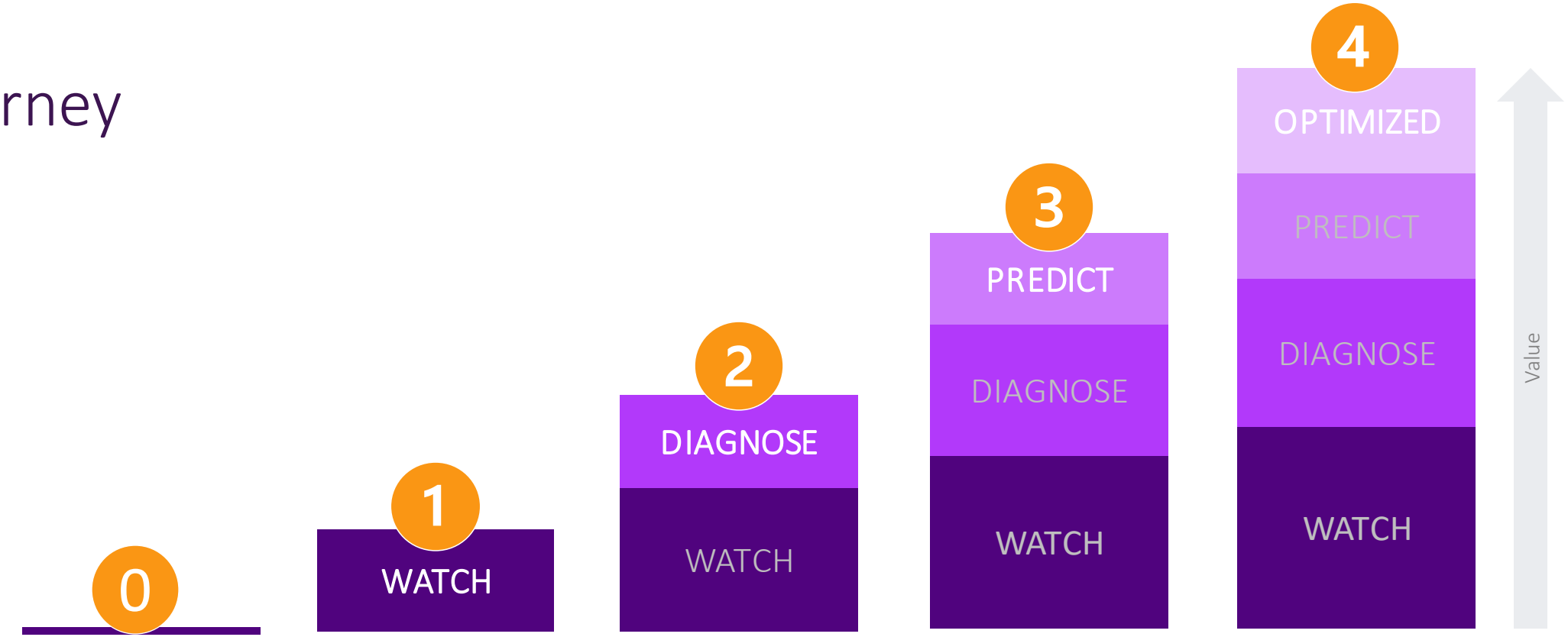
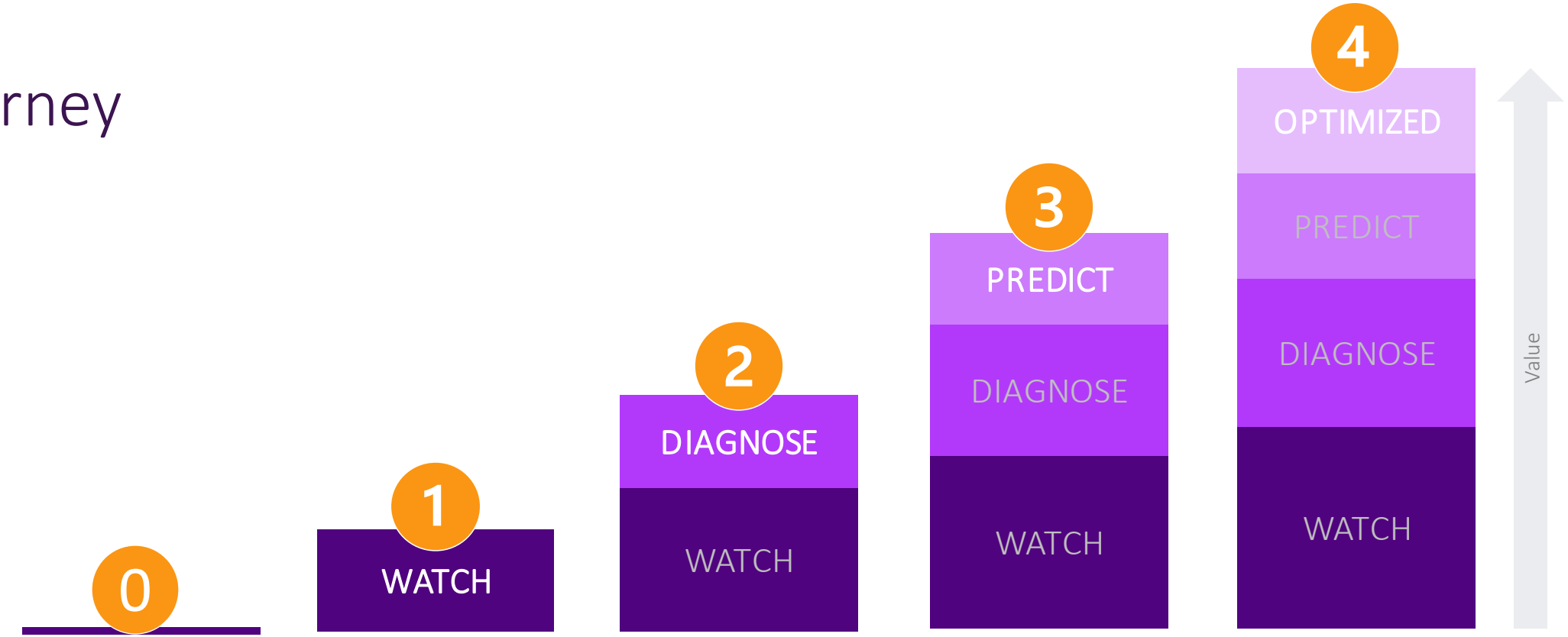
Data journey



	The Dark Ages of Data	Initial visibility	Discover	Get informed	Get guided
Example	SCADA only, paper	Excel export, Trends	Smart dashboards	Smart (AI) Models	Real time optimizer
*Business **Value***	-	€€	€€€	€€€€	€€€€€
***Cost** to implement*	-	€	€	€€	€€€
Data Challenge		Availability	Integration & Structure	Process Context & Quality	Business Context

Time & Maturity

Data journey



	0	1	2	3	4
	The Dark Ages	Initial visibility	Discover	Get informed	Get guided
Example	SCADA only, paper	Excel export, Trends	Smart dashboards	AI Models	Real time optimizer

? Where are you now?

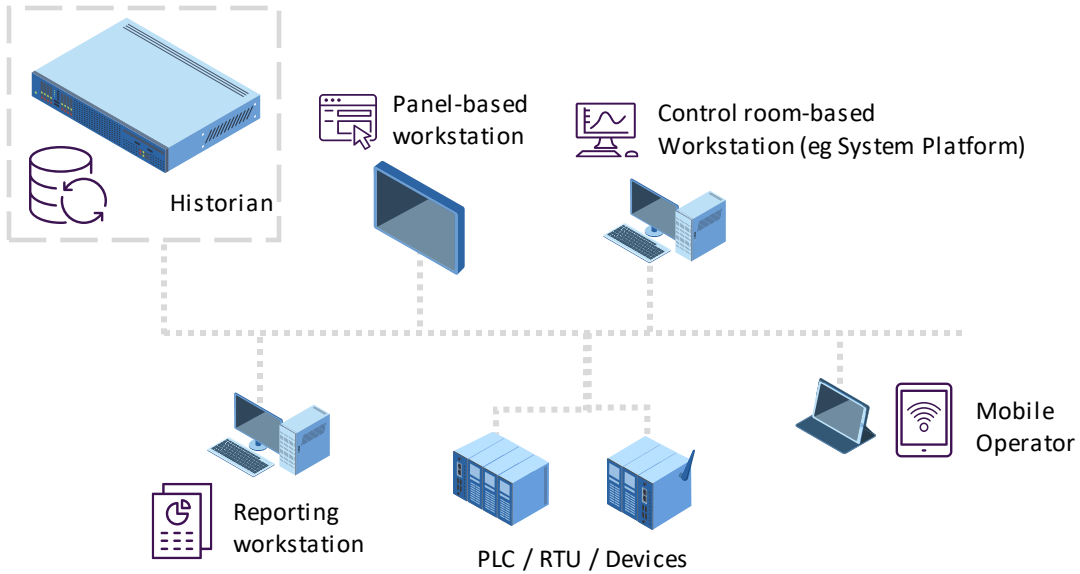
? What is your dream?

? What is your next step?

Challenge 1: Data availability

Install an Historian per site or plant

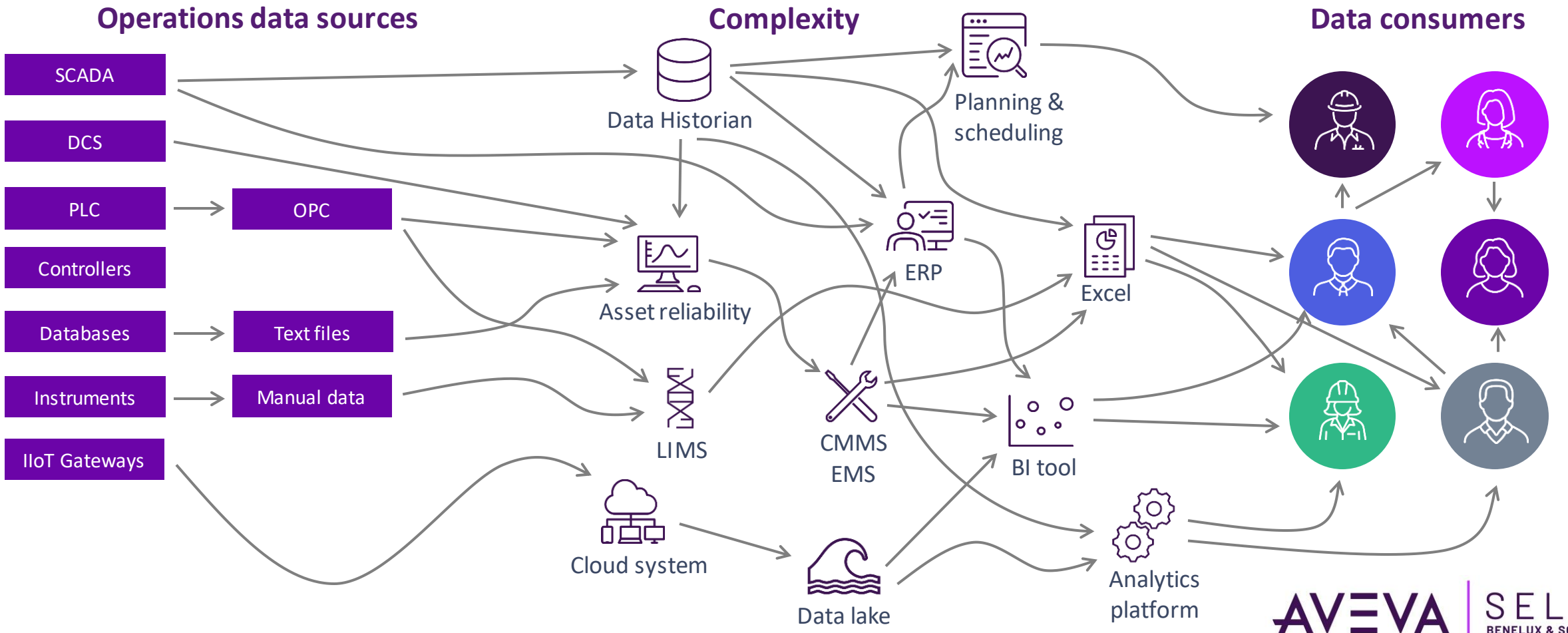
- Collect & Store your process values (time series)
- Purpose-built for speed, reliability and security
- Data analysis tools for trending, querying and reporting provide comprehensive diagnostics and troubleshooting of process anomalies
- On premise (local) server
  Optionally combined with Cloud connectivity



- Examples: AVEVA Historian, AVEVA PI System

Challenge 2: Data Integration

Integrating relational data (e.g. ERP) and time series data is difficult



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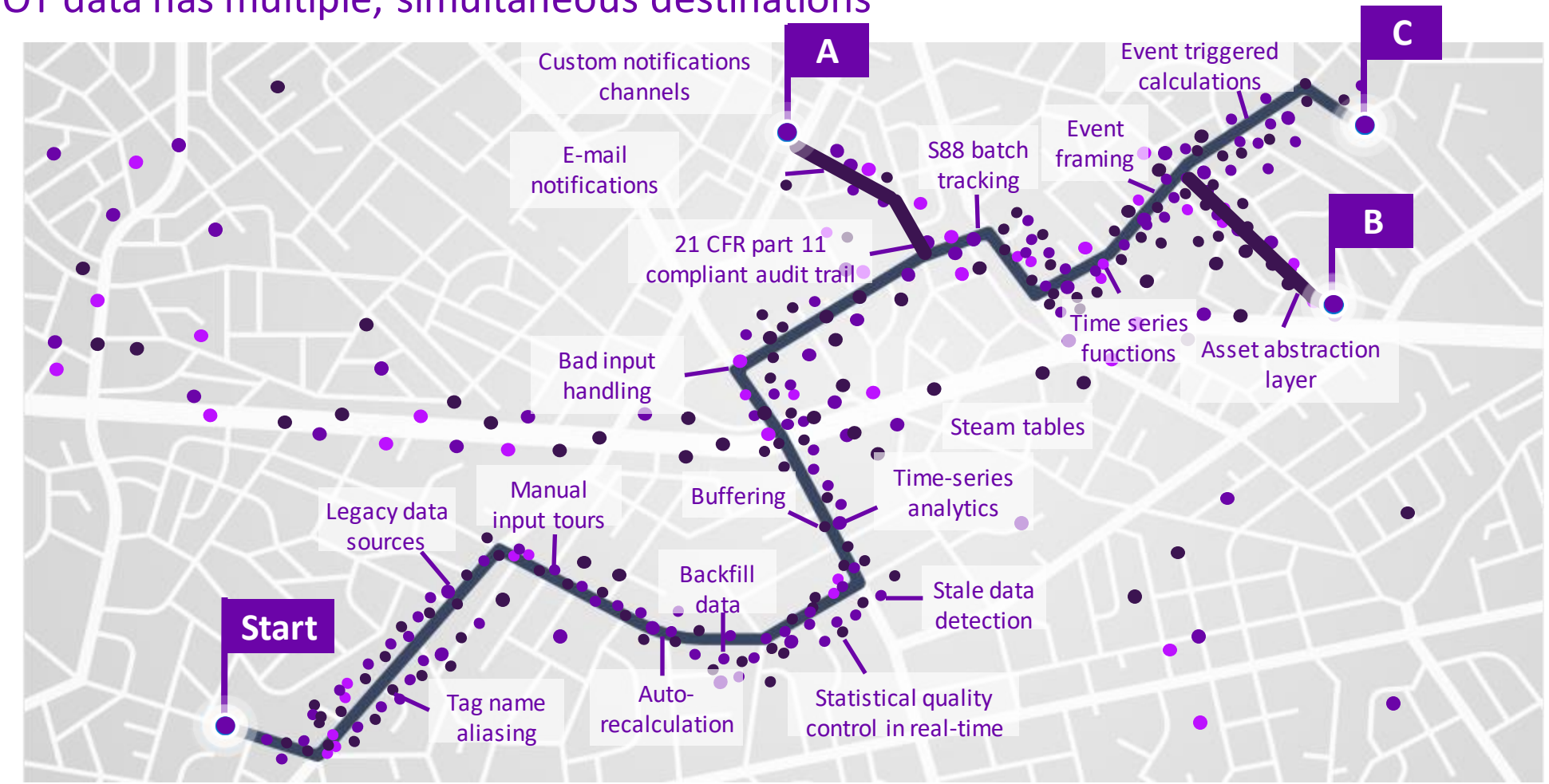
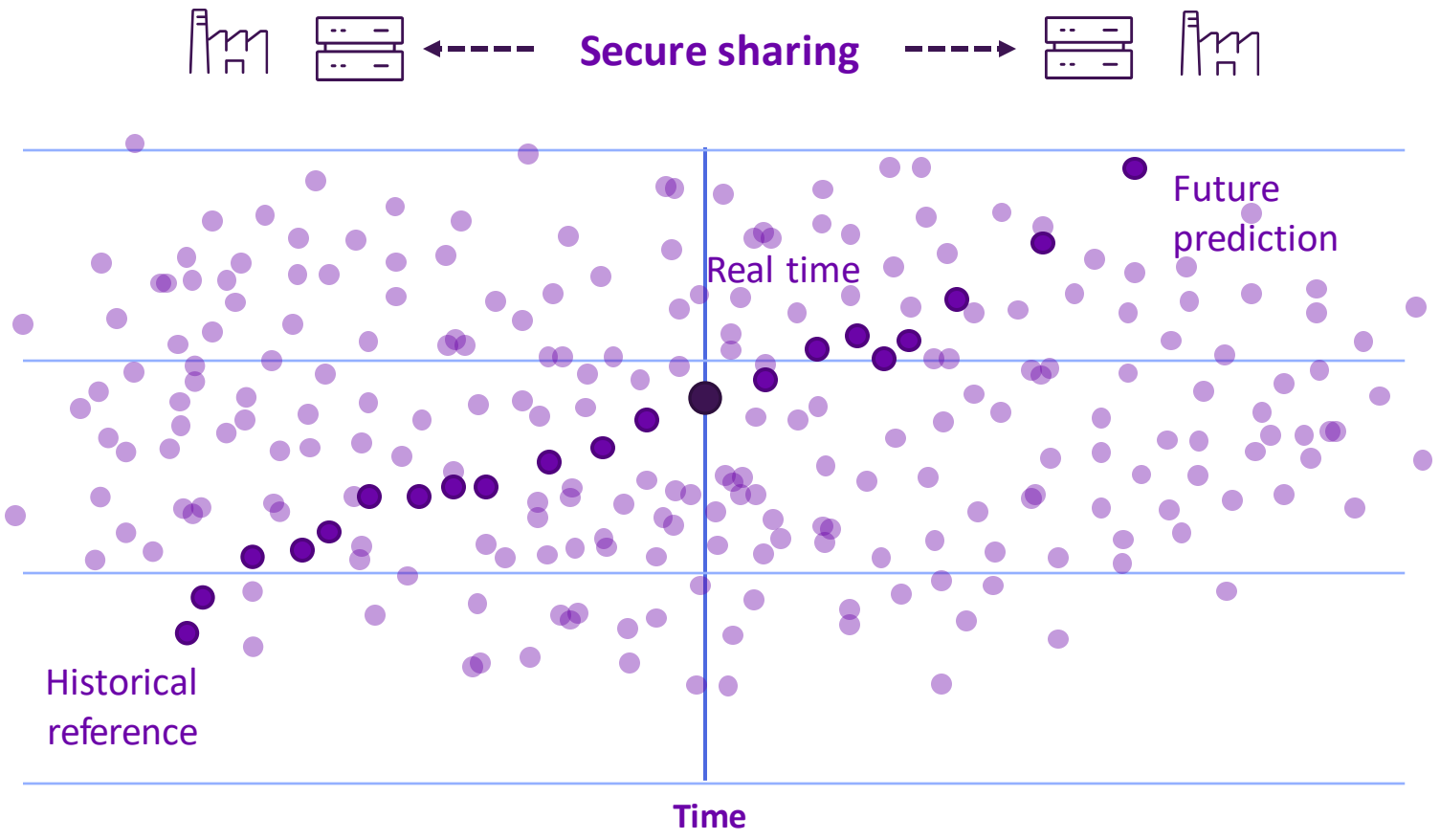
Managing operations data is complex

OT data has multiple, simultaneous destinations



An operations information management solution must ensure…

Scope, scale, and secure sharing



SCOPE
Collect data

- Legacy and new
- High fidelity
- Real time and historical

SCALE
Manage data

- Store for rapid retrieval
- Self-service and AI-ready
- Clean, transformed, and contextualized

SECURITY
Use data

- Secure across OT, ET, IT, and business domains
- Secure at rest and in motion
- Share across business and ecosystem

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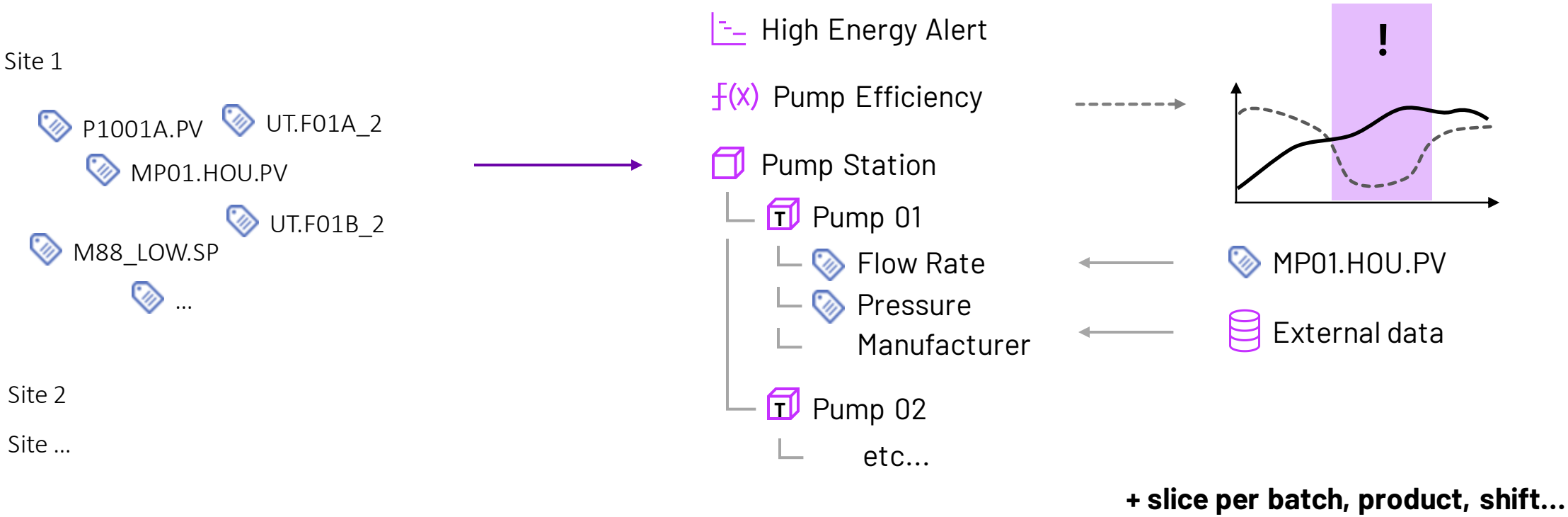
Challenge 3: Structuring data is key

Structure & Context is a key differentiator in your data journey



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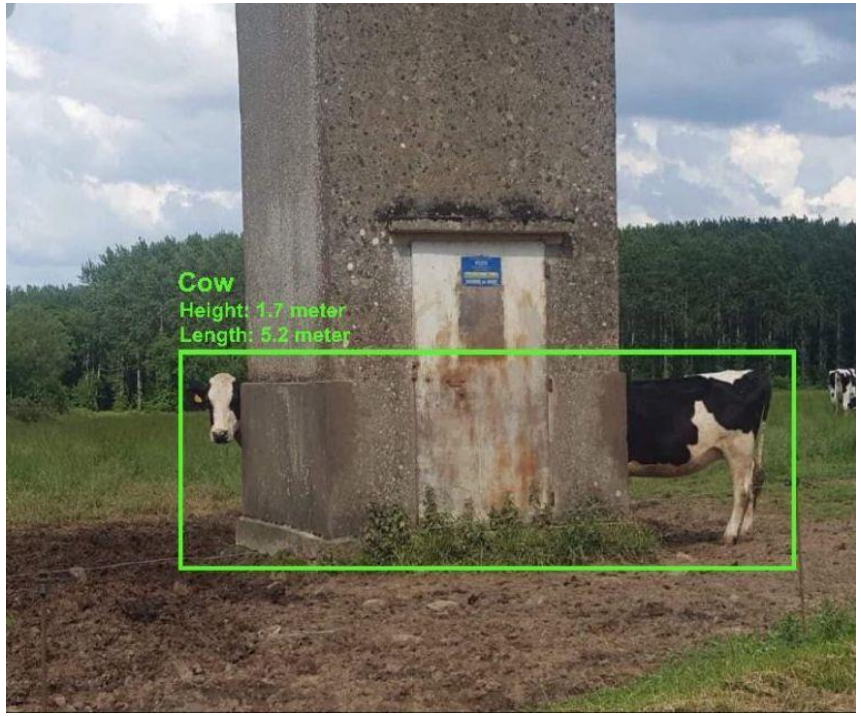
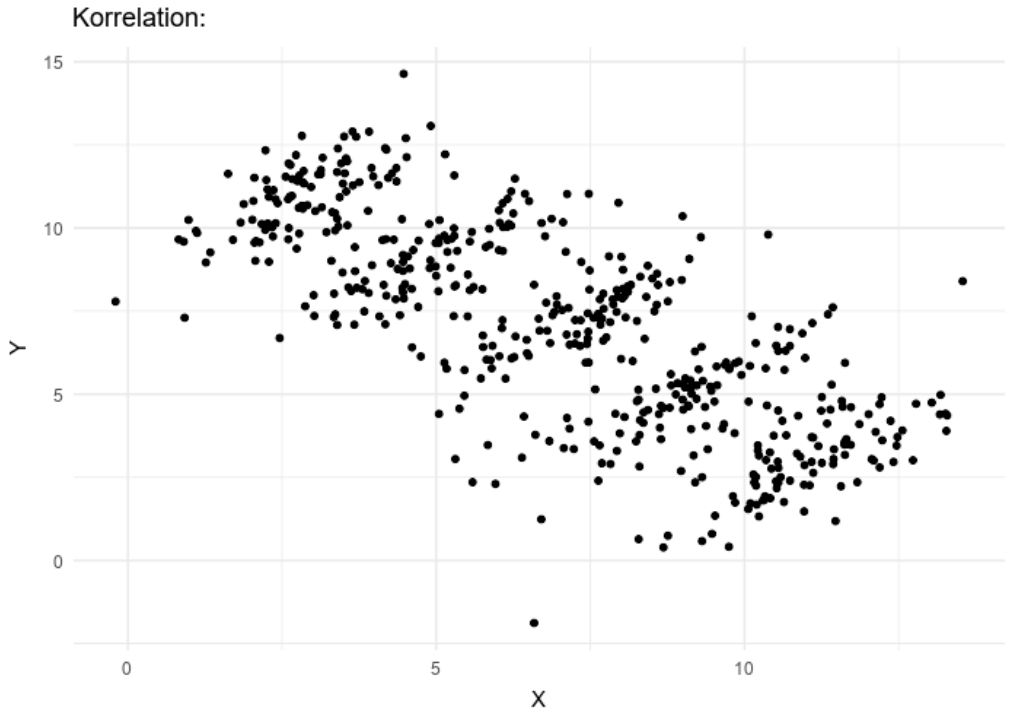
Challenge 4: Data context





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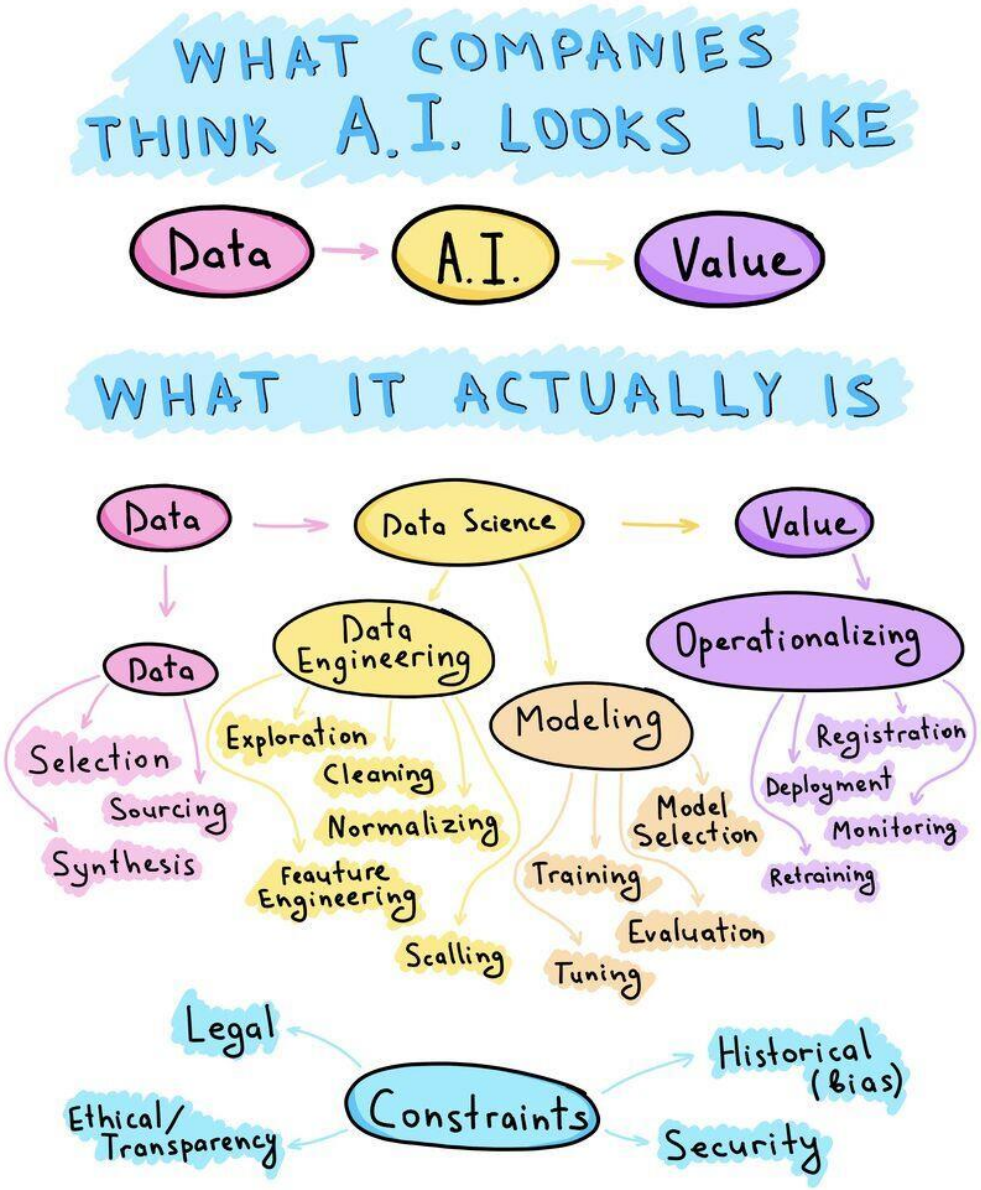
Challenge 4: Data context

- Examples of Context
  - Relation between equipment and location in the plant
    Eg: Pump A2 is the redundant for Pump A1
    Pump A1 and A2 feed into Tank Z
  - Normal (expected) working conditions
  - Mathematical model describing the equipment
  - Maintenance history
  - …



The AVEVA Data Proposition

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Our Portfolio – Product view

Simulation and Learning

AVEVA Process Simulation
AVEVA Dynamic Simulation
AVEVA PRO/II Simulation
AVEVA Pipeline Integrity Monitor
AVEVA Unified Learning
- AVEVA XR for Training
- AVEVA Operator Training Simulator
- AVEVA Pipeline Training Simulator

AVEVA Teamwork

Engineering & Execution

AVEVA Unified Engineering
AVEVA Engineering
AVEVA P&ID
AVEVA Diagrams
AVEVA Electrical and Instrumentation
AVEVA E3D Design
- AVEVA Plant Design
- AVEVA Marine Design
  - AVEVA Hull Design
  - AVEVA Outfitting Design
  - AVEVA Initial Design
  - AVEVA Assembly Planning

AVEVA Enterprise Resource Management

Industrial Information

Engineering Information Management
AVEVA Asset Information Management
AVEVA 3D Asset Visualization
AVEVA Information Standards Manager
AVEVA Point Cloud Manager
Operations Information Management
AVEVA PI System
- AVEVA PI Server
- AVEVA PI Vision
- AVEVA PI DataLink
- AVEVA PI Integrator for Business Analytics
- Edge Data Store

AVEVA Data Hub
AVEVA Historian
AVEVA Insight
AVEVA Unified Operations Center

Operations Control

AVEVA Operations Control (Edge to Enterprise)
AVEVA Edge
AVEVA InTouch HMI
AVEVA Plant SCADA
AVEVA System Platform
AVEVA Historian
AVEVA Unified Operations Center
AVEVA Development Studio / Integration Studio
AVEVA Teamwork
AVEVA Reports for Operations
AVEVA Enterprise SCADA
- Liquid Applications
- Gas Applications

Asset Performance

AVEVA APM Assessment
AVEVA Asset Strategy Optimization
AVEVA Predictive Analytics
AVEVA Insight
AVEVA Mobile Operator
AVEVA Operational Safety Management
Safety Management from Prometheus Group

Production Optimization

AVEVA Manufacturing Execution System
- AVEVA Enterprise Integration

AVEVA Recipe Management
AVEVA Batch Management
AVEVA Work Tasks
AVEVA Discrete Lean Management
AVEVA Production Management
AVEVA Off-sites Management
AVEVA Production Accounting
AVEVA Insight
AVEVA APC
AVEVA Process Optimization

Planning and Scheduling

AVEVA Crude Assay Management
AVEVA Unified Supply Chain
Advanced Planning and Scheduling (from PlanetTogether)

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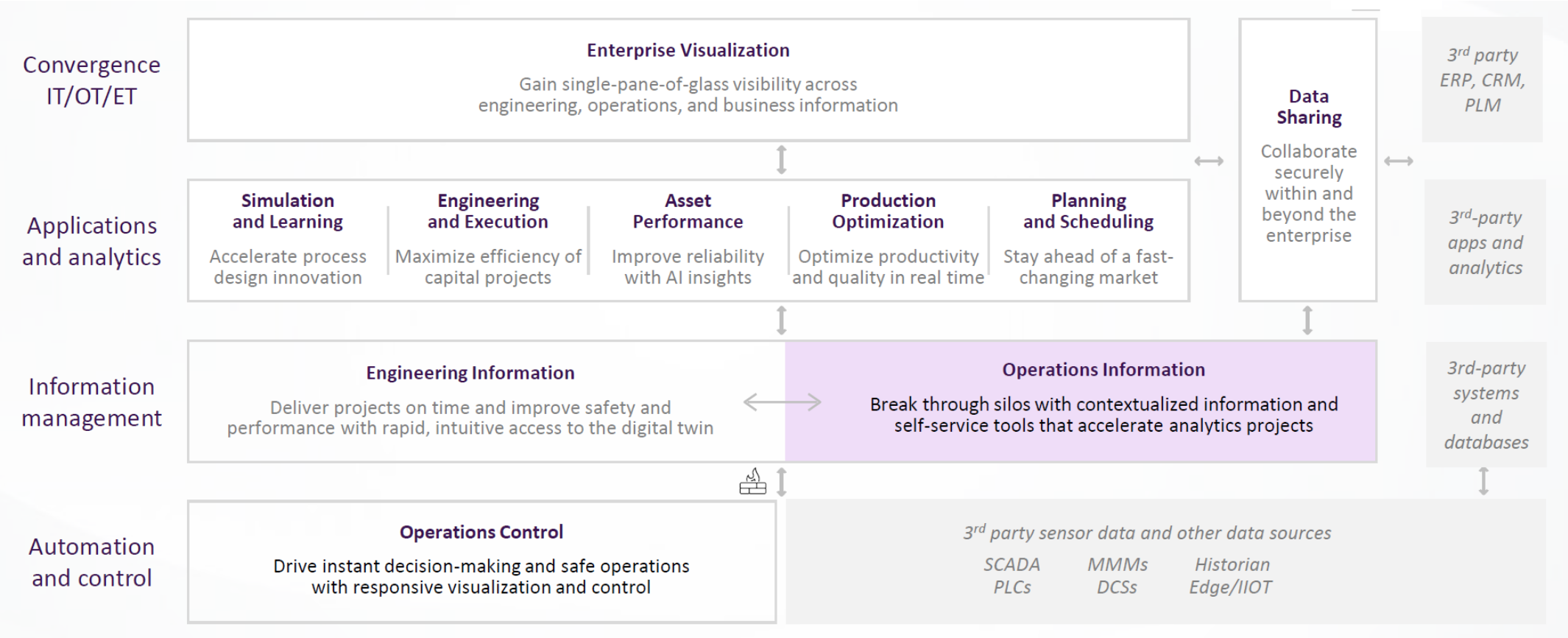
Our Portfolio – Use case view



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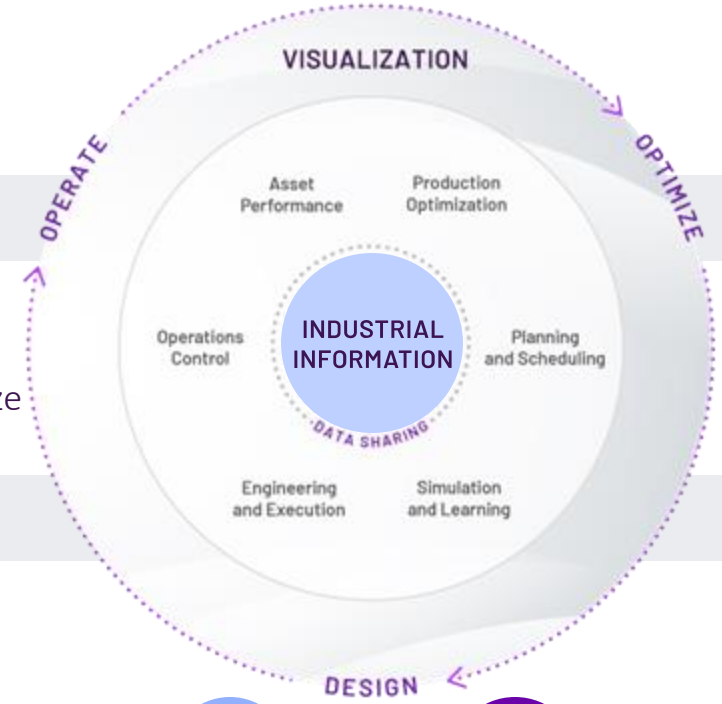
Bringing together two world-class software experts

Delivering end-to-end customer value with best of breed industrial software

AVEVA Connect cloud services platform and AVEVA Flex subscription program

AVEVA

Industrial software to optimize engineering and operations



PI System

Industry-standard for industrial information management

1 **Better data**
Accuracy, reliability, context, scope and scale

2 **Smarter solutions**
With better integration, while maintaining neutrality

3 **Proven results**
Efficiency, agility, reliability, sustainability

Big Data | Industrial IoT/Edge | Cloud | Artificial Intelligence | Digital Twin | Connected Worker

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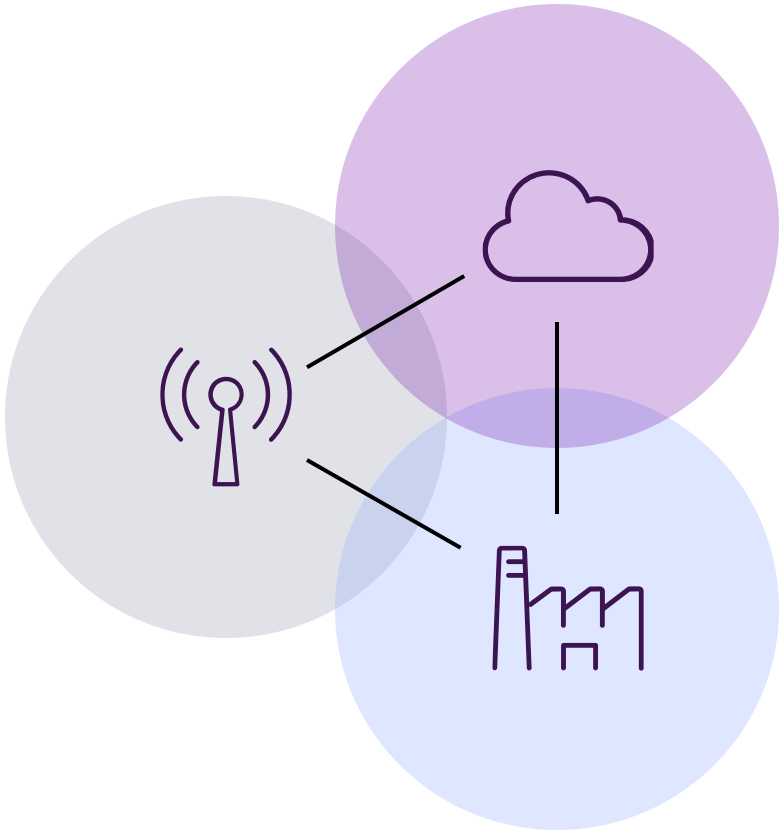
An architecture that supports OT, IT and IIoT use cases

AVEVA PI System and AVEVA Data Hub spans from edge to plant to cloud

At the edge

Pervasive, real-time data collection from sensors, IIoT devices and remote assets



In the cloud

Scalable data services available for a wider array of users, tools and applications

On-premises

Enriched industrial data available 24/7 for critical operations

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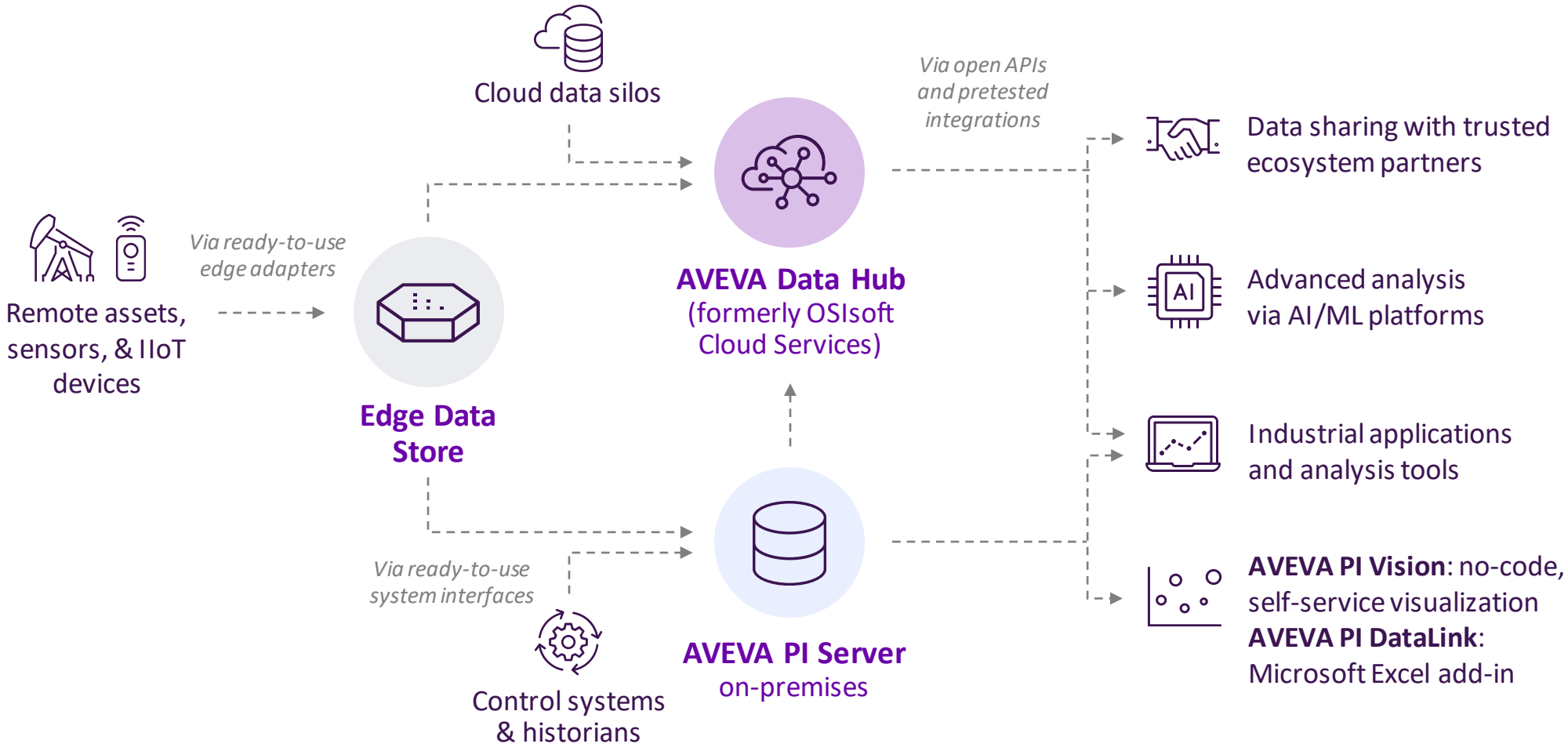
Proven components accelerate time-to-value



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Better data. Better business outcomes.

Asset health

DCP Midstream saved

$20-25 million

in first year

Energy efficiency

Air Liquide achieved

10x ROI

in operational savings in first 8 months

Process optimization

ArcelorMittal shipped

26M additional tons

for $120M in added revenue

Quality tracking

Deschutes postponed

$8 million

capital upgrade

Compliance & sustainability

TasWater sped up response time by

13 hours

and saved the local oysters

Safety & resilience

Qatar Power operated over

3,452 days

without lost-time accidents

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PI System: trusted by essential industries for over 40 years

Oil & Gas

85%

of the top oil and gas companies

Power & Utilities

1,000+

utilities worldwide

Mining & Metals

9

of the top 10 Mining companies

Pharma & Life Sciences

24

of the top 25 Pharmaceutical companies

Chemicals

9

of the top 10 Chemical companies

Manufacturing

6

of the World Economic Forum's Factories of the Future

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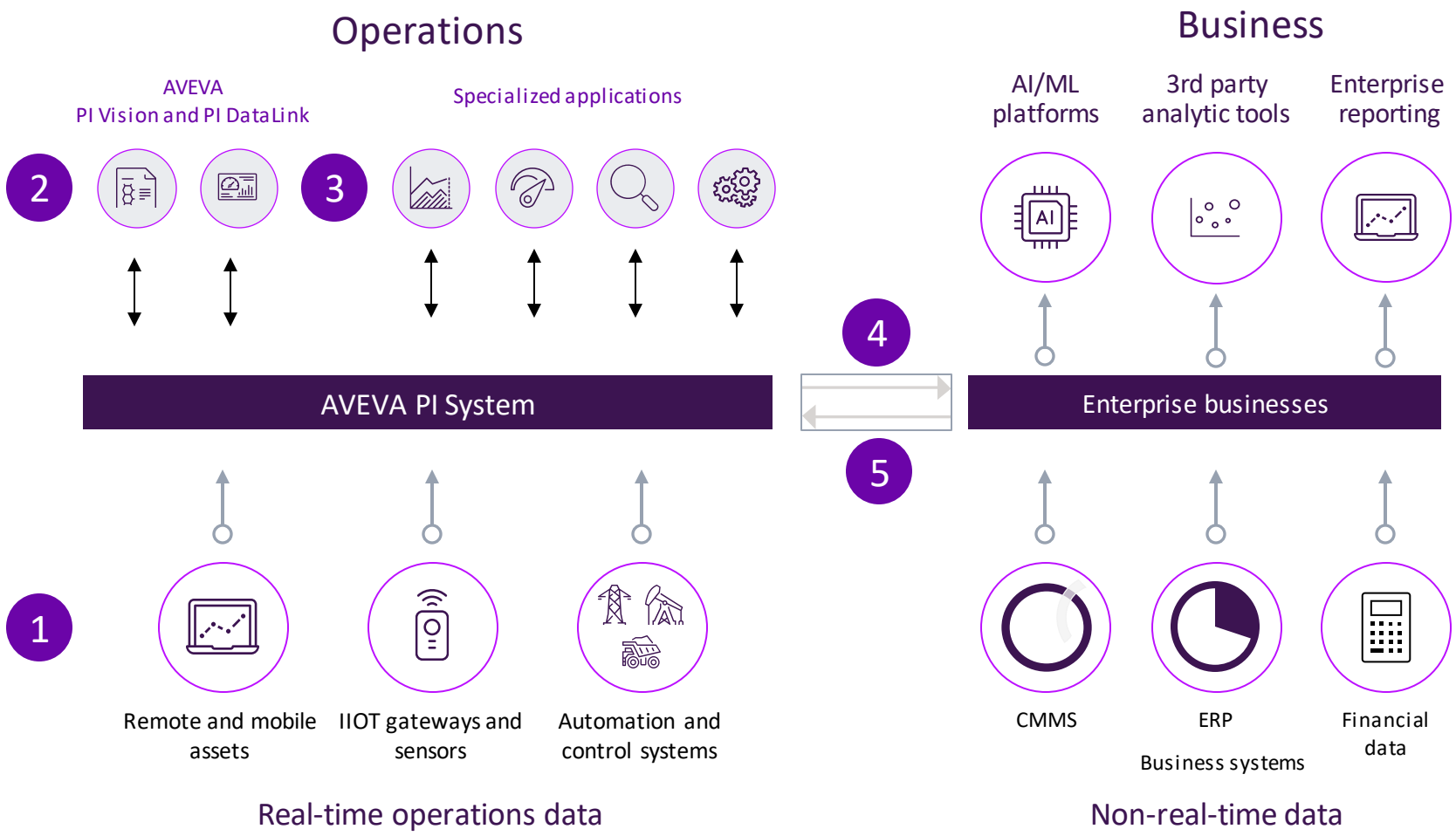
Value of AVEVA PI System in the modern enterprise

1. Consolidate operations data
2. Create real-time dashboards and reports
3. Layer specialized applications
4. Integrate OT data to enterprise
5. Validate & operationalize insights



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AVEVA PI: The Basics

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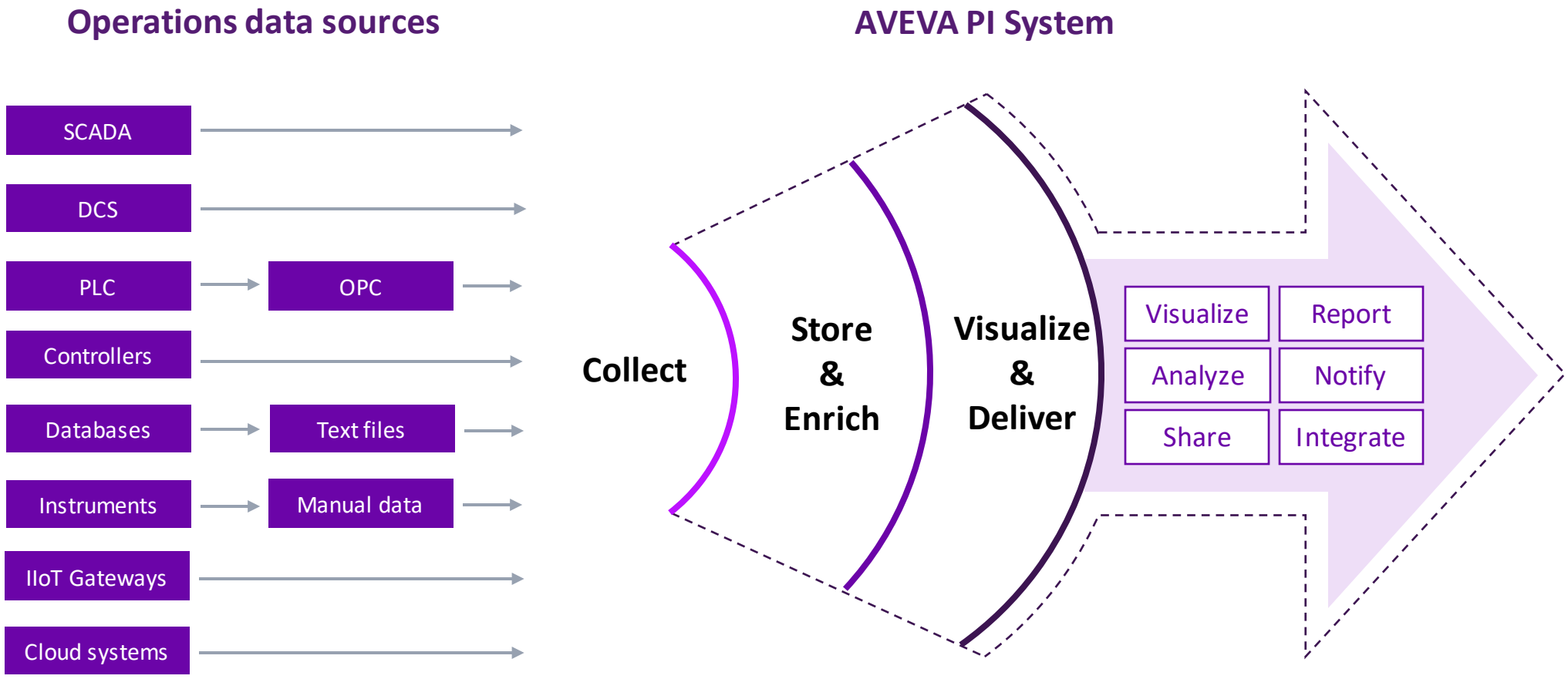
AVEVA PI System connects people to data with an infrastructure approach



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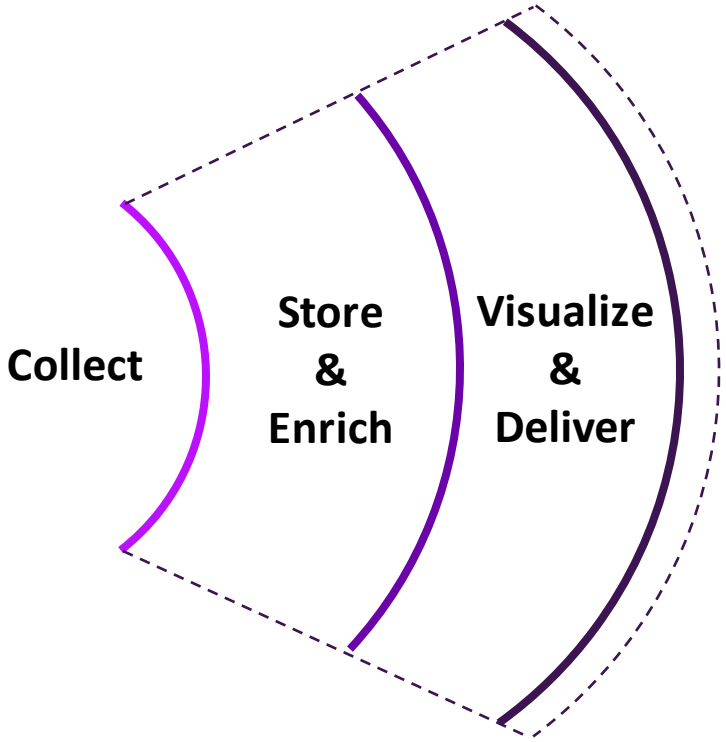
How AVEVA PI System technology helps our users



- It can **collect** the data that you need to make decisions
- It can **enrich** that raw data to turn it into actionable information
- And it can **deliver** it where and when you need it

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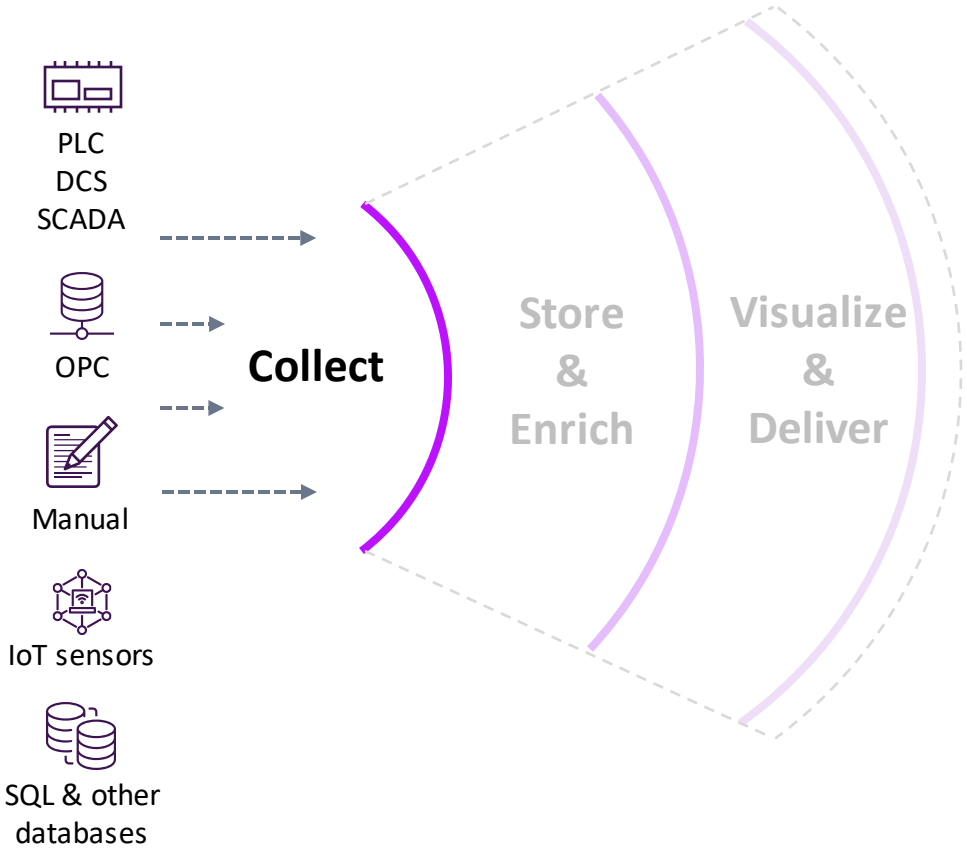
Gather past, present, & forecasted data from hundreds of sources



- Connect to any asset regardless of vendor, location or environment
- Supports 225+ industrial protocols
- Developed and maintained by us
- Configuration only. No programming required

See https://techsupport.osisoft.com/Products/PI-Interfaces-and-PI-Connectors

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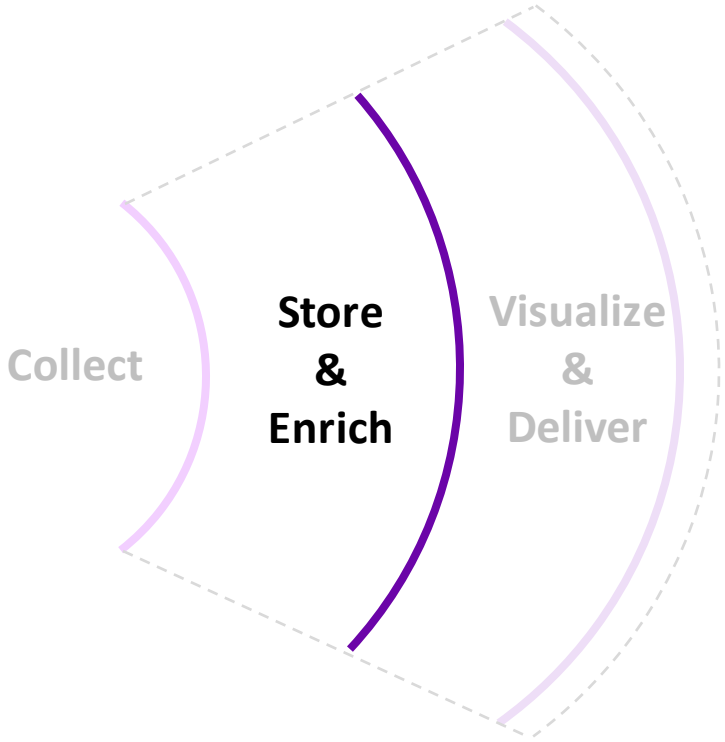
Turn raw data into actionable information



- Store high-frequency and large volumes of data
- Provide context to your data
- Run real-time analytics on your raw data
- Bookmark & notify on key events and batches in your data

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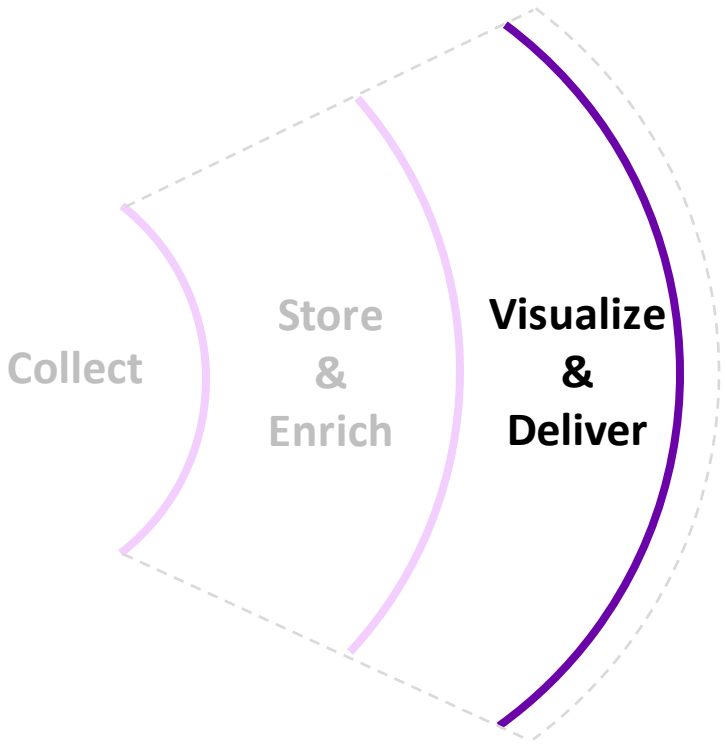
Deliver operations insights in real-time to anyone, anywhere



- Dynamic, real-time displays that update in seconds, not minutes
- View KPI's in Microsoft Excel or on any web-browser enabled device
- Build self-service dashboards or reports without requiring assistance from IT
- Publish large-scale real-time exports and streams of data and metadata to third-party geospatial, big data, or business analysis platforms
- Rich programmatic access to build anything on AVEVA PI System

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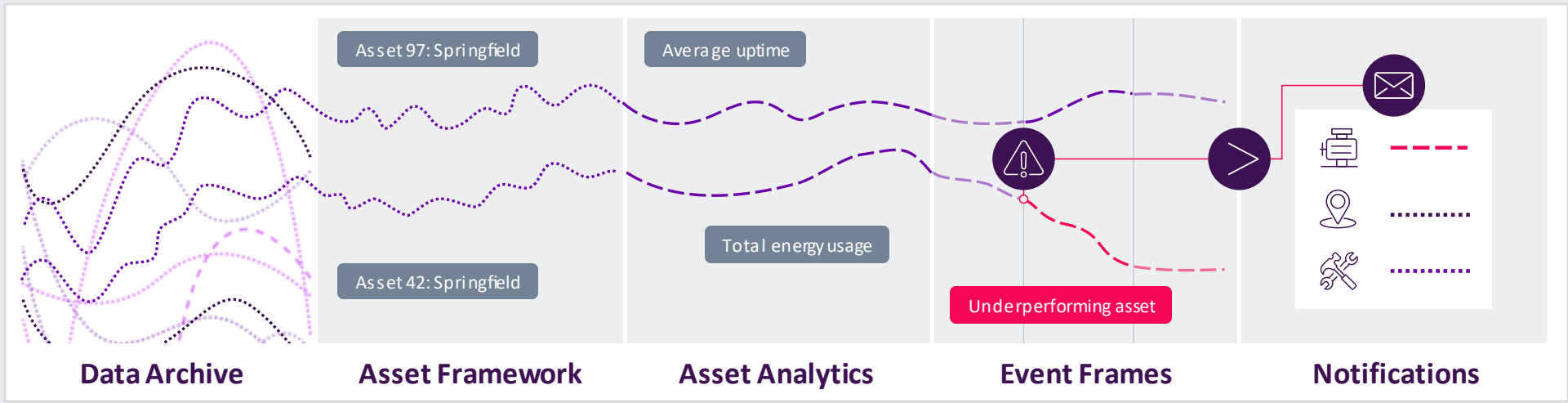
Enrichment features turn data into decision-ready information

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

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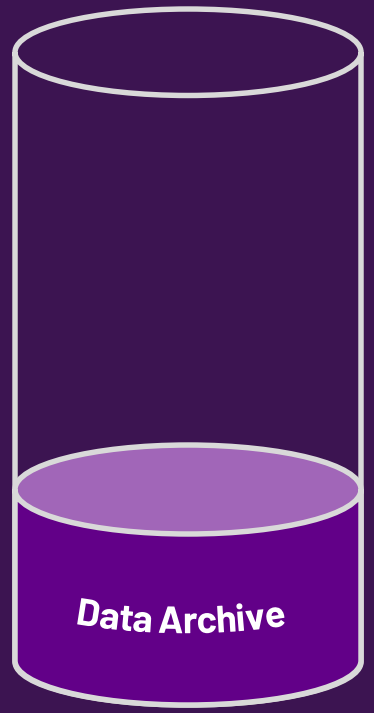
PI Server: Data Archive

Similar to **Historian**
PI: No alarms

Optimized storage & access to massive volumes of operational data

- Store millions of data streams and thousands of values per second over multiple decades
- Maintain the original fidelity of your data
- Keep your data online for immediate, real-time retrieval
- Store future data from predictive models and other sources



PI Server

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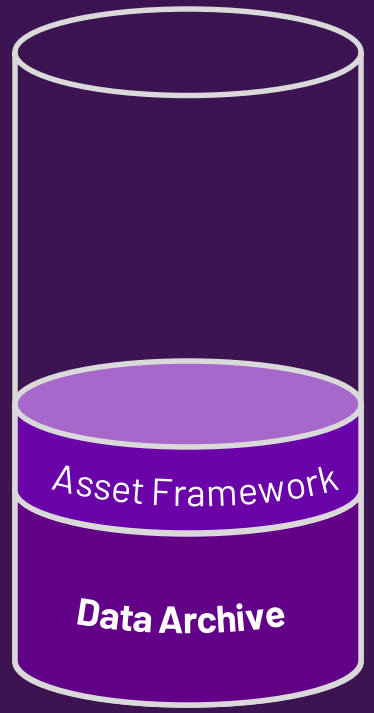
PI Server: Asset Framework

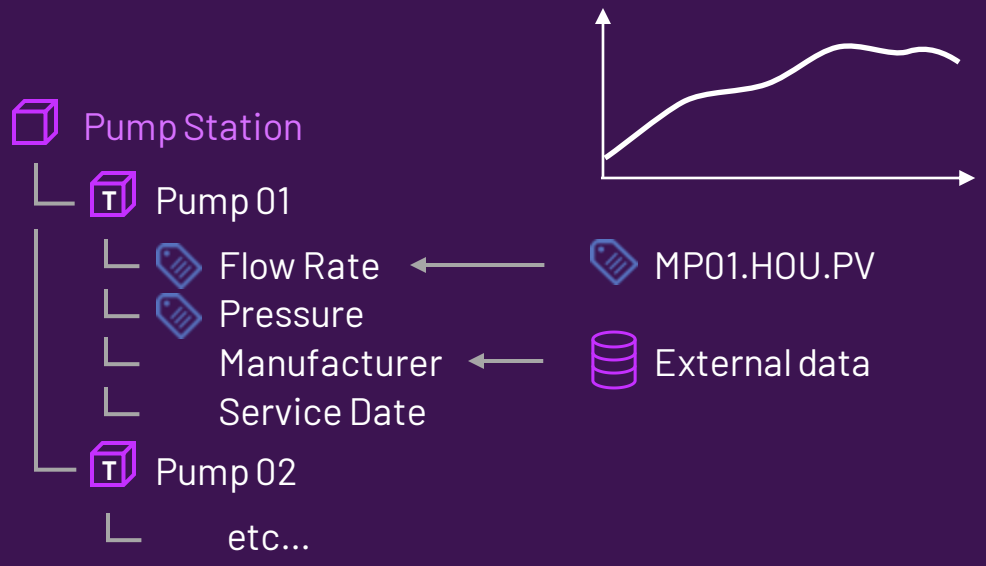
Similar to **Asset Model in SP**

Organize and contextualize your operational data in a way that makes sense to users across your enterprise — not just SCADA experts

- Label data with human-friendly names
- Group related data into assets
- Add metadata and context manually or from external systems
- Standardize groupings, labels, and units with templates



PI Server



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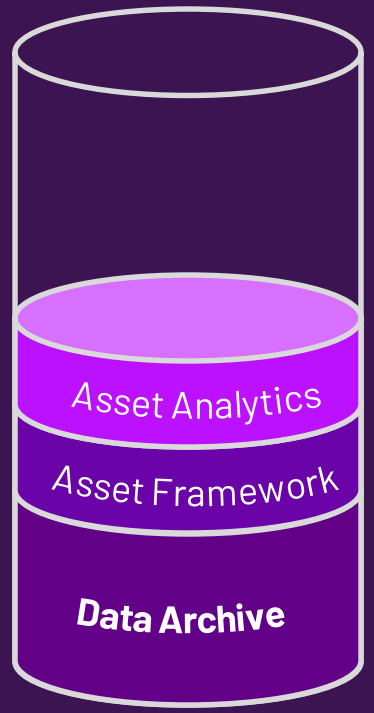
PI Server: Asset Analytics

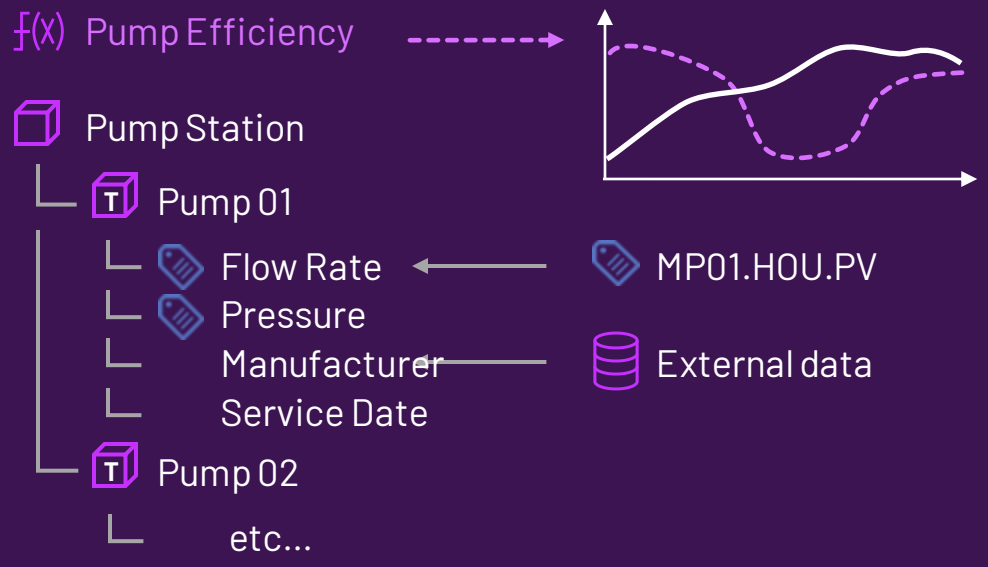
Standardize and centralize your operations calculations and KPIs with continuous real-time results

- Easy-to-use interface and a rich set of built-in functions
- Migrate equations from Excel or other tools
- Templatize and roll out calculations across multiple assets in bulk
- Backfill calculation results as far back as you have source data



PI Server

Calculations not possible in Historian (could be done in SP)



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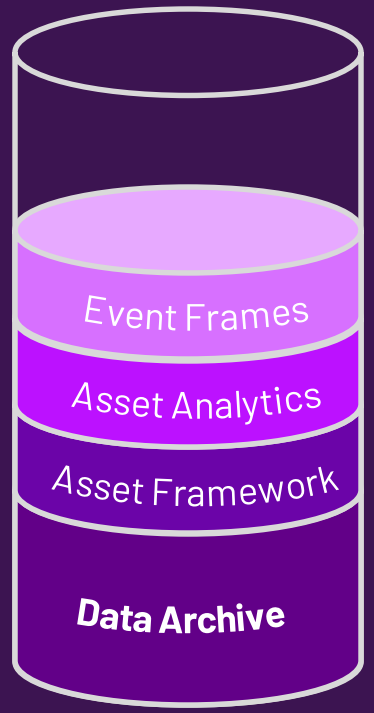
PI Server: Event Frames

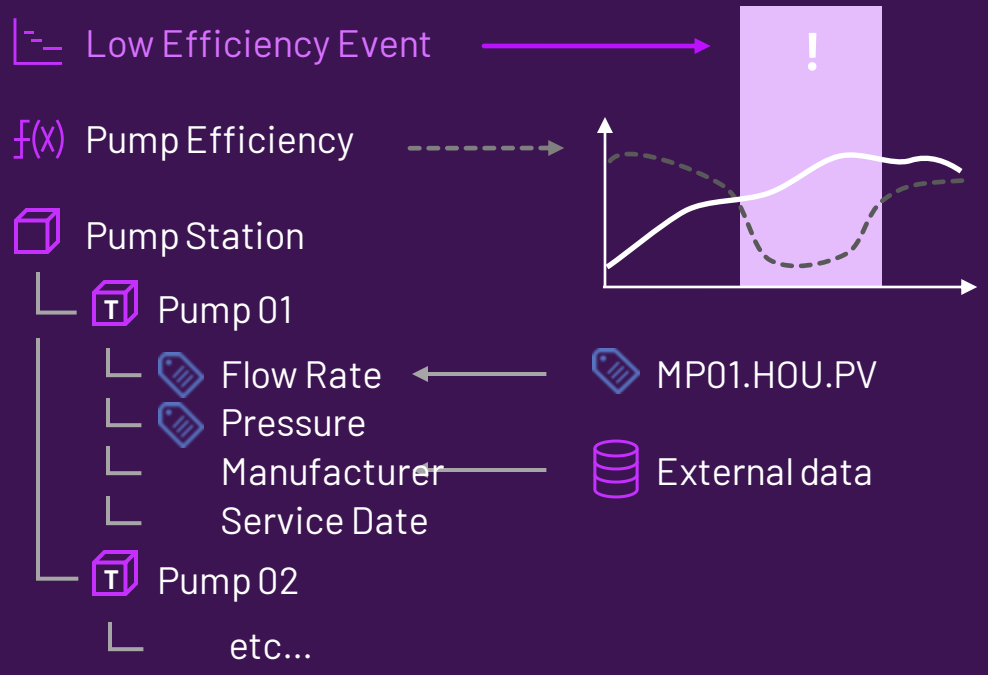
Automatically **bookmark important events** in your operations

- Find the minute that matters in a decade's worth of data
- Capture events based on user-defined process thresholds or other KPI triggers
- Store related context and calculations within Event Frames
- Easily analyze and compare these events in bulk



PI Server

Events - no alarms
Historian equivalent:
"SliceBy" / BIG



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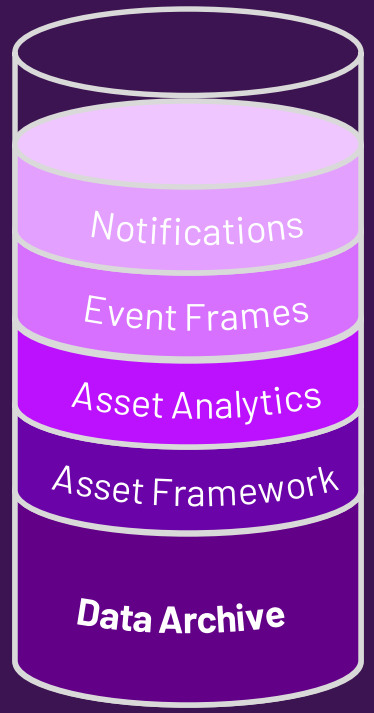
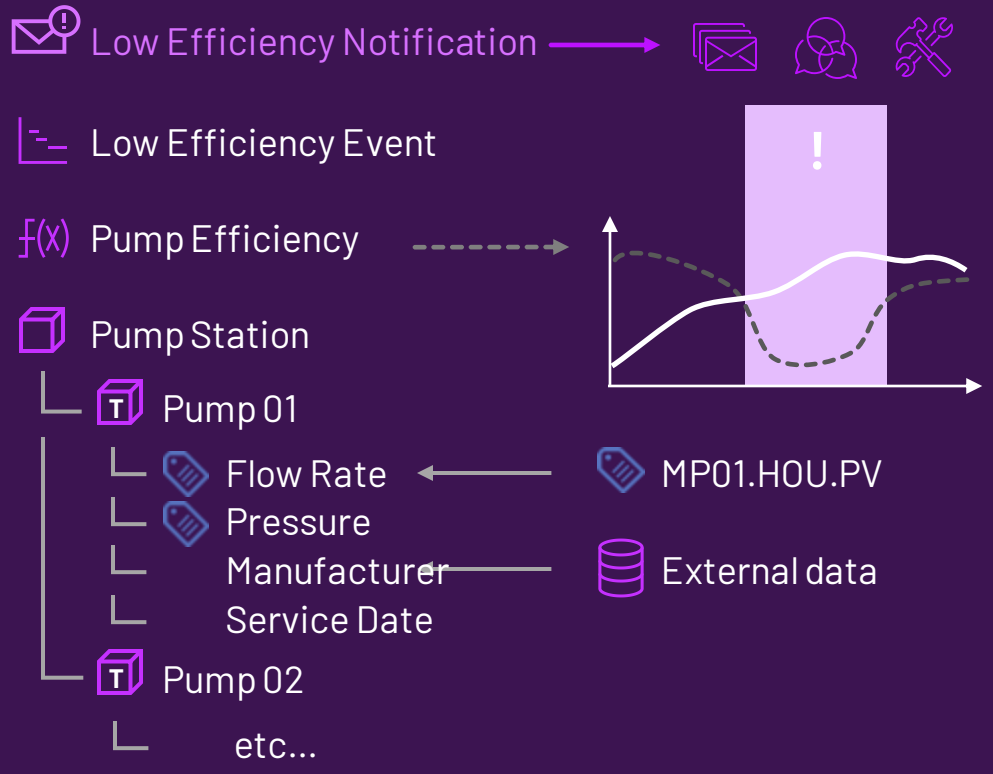
PI Server: Notifications

Automatically send alerts to the right people with the right information

- Configure notification emails to contain values, trends, links, and attachments
- Design specific email formats for different recipients
- Send to individuals or groups, and automatically escalate if unacknowledged
- Send directly to web services for integrating with 3rd-party systems



PI Server



AVEVA | SELECT BENELUX & SCANDINAVIA

Advanced Analytics
AVEVA Predictive Analytics
Custom Models & Tools

Dashboarding
PI Vision
PowerBI / (Excel)

Trending
Excel / PI Vision
3th Party tools
(eg Trendminer, Seeq...)

Applications
Lab, ERP, Logistics, Energy,
Planning, Environment...

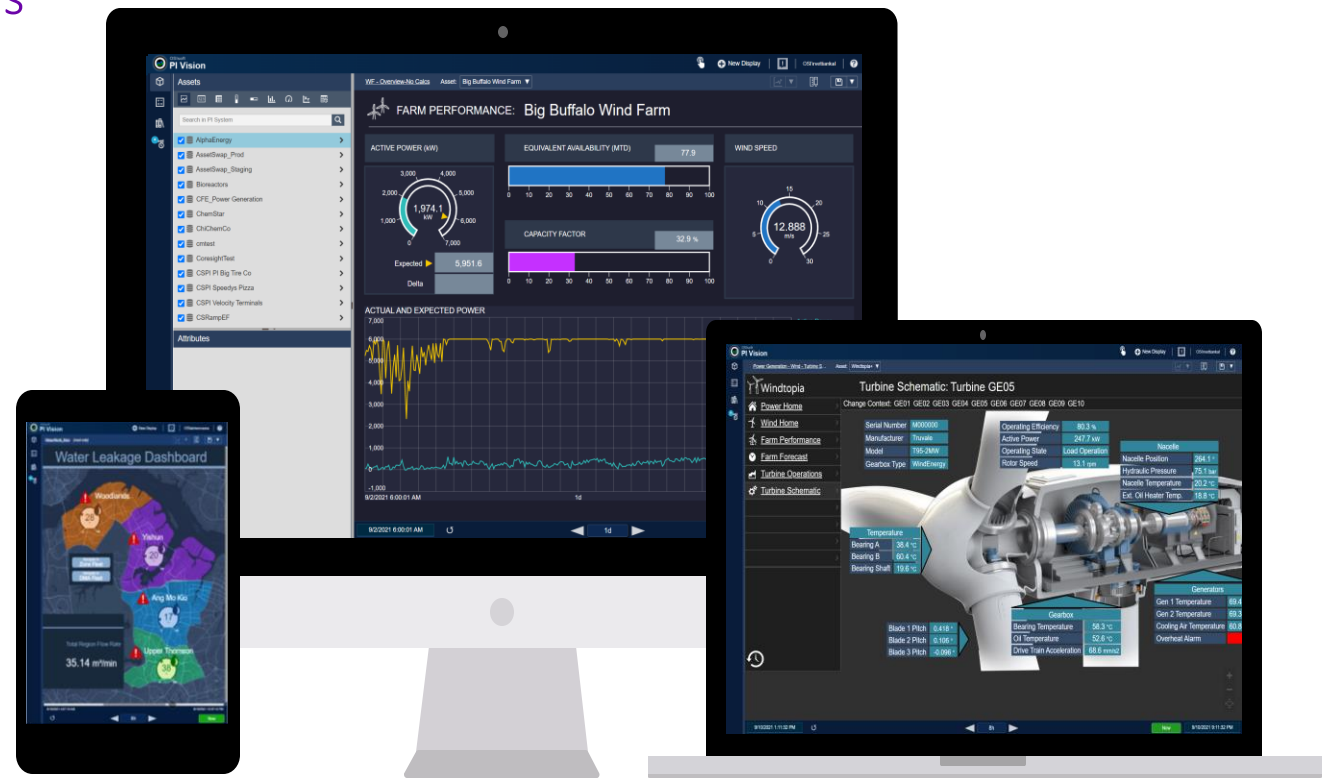
Operator Interaction
AVEVA Mobile Operator
AVEVA Worktasks

Cloud
IIoT Platforms
Azure Datalake

AVEVA PI Vision

Real-time data visualization for decision makers

- An **easy-to-use, self-service, scalable** visualization solution
- Dynamic displays
- Access real-time data from **any device** – phone, tablet, laptop, desktop
- **Share real-time displays** across your organization



AVEVA | SELECT BENELUX & SCANDINAVIA

PI Vision - MB Pumps

OSIsoft PI Vision

New Display | OSI\dlopez

MB Pumps (read-only) (explorer-mode) Asset: ANA FCC Pump 1+

Export

Anacortes

ANA FCC Pump 1	ANA FCC Pump 2	ANA FCC Pump 3	ANA FCC Pump 4
2,006 rpm	1,972 rpm	1,972 rpm	2,026 rpm

Baton Rouge

BAT FCC Pump 1	BAT FCC Pump 2	BAT FCC Pump 3	BAT FCC Pump 4
3,017 rpm	1,982 rpm	2,028 rpm	3,026 rpm

Houston

HOU FCC Pump 1	HOU FCC Pump 2	HOU FCC Pump 3	HOU FCC Pump 4
2,018 rpm	1,996 rpm	1,999 rpm	1,985 rpm

Martinez

MAR FCC Pump 1	MAR FCC Pump 2	MAR FCC Pump 3	MAR FCC Pump 4
2,028 rpm	1,980 rpm	2,022 rpm	1,975 rpm

Sarnia

SAR FCC Pump 1	SAR FCC Pump 2	SAR FCC Pump 3	SAR FCC Pump 4
1,980 rpm	1,971 rpm	1,977 rpm	1,975 rpm

Data Entry | Home

ANA FCC Pump 1

Name	Value
ANA FCC Pump 1|Manufacturer	Federation Pumps
ANA FCC Pump 1|Serial Number	NCC1701A
ANA FCC Pump 1|Asset	ANA FCC Pump 1
ANA FCC Pump 1|FCC	ANA FCC 1
ANA FCC Pump 1|Refinery	Anacortes Refinery
ANA FCC Pump 1|Date - Installed	1/1/2017 12:00:00 AM
ANA FCC Pump 1|Date - Last Service	12/26/2019 8:30:00 AM

Temp 140.3 °F

2.1854 mils

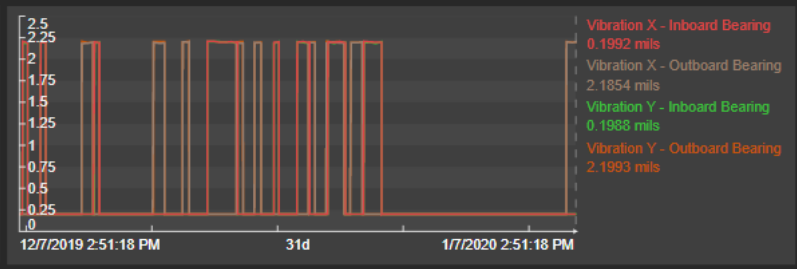
Y 2.1993 mils

Temp 84.9 °F

X 0.1992 mils

Y 0.1988 mils

Motor Vibration



Run Hours

Since Installed 26,438 h

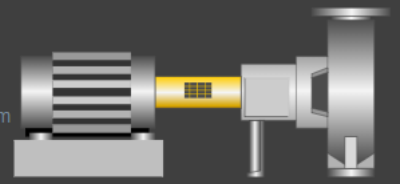
Since Last Service 293.5 h

Pump Operations

748.4 °F 75.4 psi

100 A

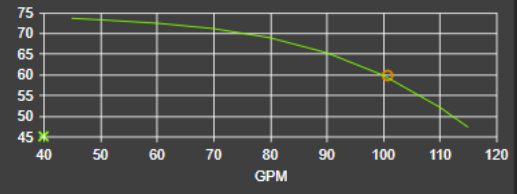
2,006 rpm



100.8 US gal/min

Troubleshooting Checklist

Pump Performance Curve (PSI vs GPM)



High Vibration Events

Event Name	Start Time	End Time	Reason	Acknowledged By
ANA FCC Pump 1 Pump Upset 2020-01-07 00:17:07	1/7/2020 2:17:07 AM	In Progress		
ANA FCC Pump 1 Pump Upset 2019-12-26 21:07:07	12/26/2019 11:07:07 PM	12/27/2019 7:00:07 PM		
ANA FCC Pump 1 Pump Upset 2019-12-08 17:17:07	12/8/2019 7:17:07 PM	12/9/2019 2:00:07 AM		

Bearing Temperature Events

Event Name	Start Time	End Time	Reason	Acknowledged By
ANA FCC Pump 1 Pump Upset 2020-01-07 01:49:07	1/7/2020 3:49:07 AM	In Progress		
ANA FCC Pump 1 Pump Upset 2019-12-26 21:07:07	12/26/2019 11:07:07 PM	1/6/2020 2:09:46 PM		

Cavitation Events

Event Name	Start Time	End Time	Reason	Acknowledged By
ANA FCC Pump 1 Pump Upset 2019-12-09 11:43:07	12/9/2019 1:43:07 PM	1/6/2020 2:09:46 PM		
ANA FCC Pump 1 Pump Upset 2019-11-18 11:46:07	11/18/2019 1:46:07 PM	1/6/2020 2:09:46 PM		

12/7/2019 2:51:18 PM | 31d | Now | 1/7/2020 2:51:18 PM

PI Vision - Petrolux - Upstream

OSIsoft PI Vision

New Display | OSI\dlopez

Petrolux - Upstream - Drilling - Offsho... (read-only) (explorer-mode) Asset: DrillingRig1

Export

Petrolux Upstream

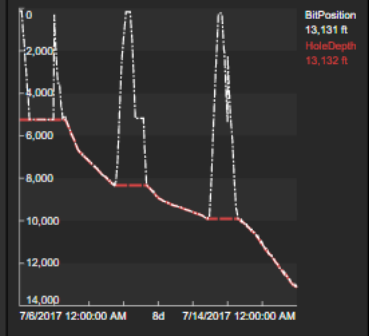
DrillingRig1 - Offshore Rig Overview

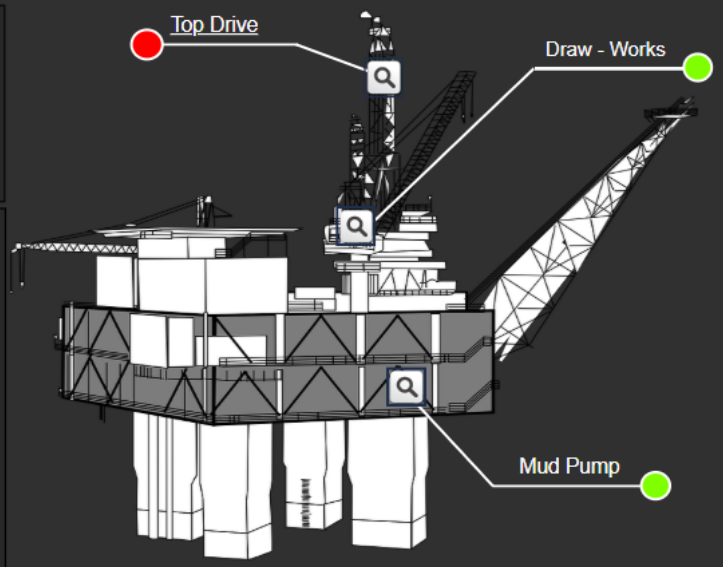
- Home
- Reports
- Offshore Rigs
- Land Rigs
- Mud Motor Performance
- Drilling Efficiency Dashboard
- RealTime Drilling

Well

Description	Value
Rig State	InSlips
Phase of Current Hole Section	Drilling
Hole Section	Lateral
Current Well ID	Well ID-105

Depth Profile



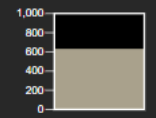


Current Drilling Parameters

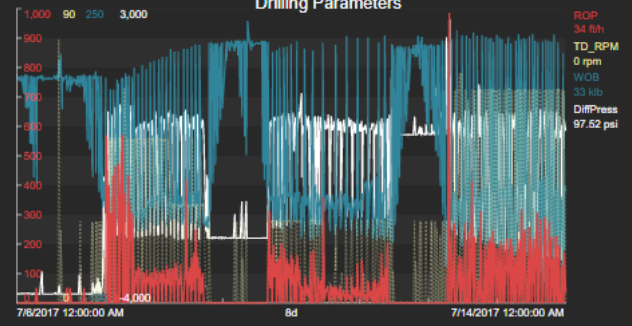
Description	Value	Units
WOB	33	klb
Top Drive RPMs	0	rpm
ROP	34	ft/h
Hole Depth	13,132	ft
Differential Pressure	97.52	psi

Mud Volume

631.6 bbl



Drilling Parameters

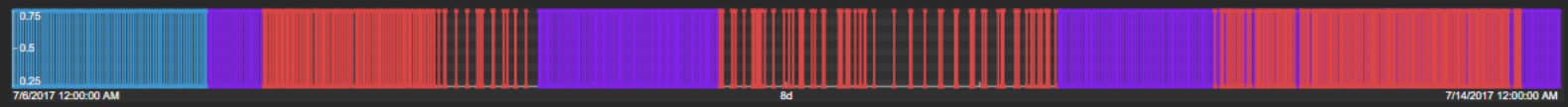


Event Name	Event Type	Start Time	End Time	Severity	Duration	Acknowledged By
DrillingRig1.Crew B Events	Drilling Crew	10/31/2019 6:00:00 AM	11/16/2019 11:46:52 PM	None	16d 18h	
DrillingRig1.Crew A Events	Drilling Crew	10/31/2019 6:00:00 PM	11/1/2019 6:00:00 AM	None	12h	
DrillingRig1.Crew B Events	Drilling Crew	11/1/2019 6:00:00 AM	11/1/2019 6:00:00 PM	None	12h	
DrillingRig1.Crew A Events	Drilling Crew	11/1/2019 6:00:00 PM	11/2/2019 6:00:00 AM	None	12h	

Crew A

Shift Night

Operational Timeline



7/6/2017 12:00:00 AM | 8d | Now | 7/14/2017 12:00:00 AM

PI Vision

OSIsoft
PI Vision

New Display | OSI\dlopez

(read-only) (explorer-mode)

Export

Events

Automatically refresh the list

Pinned

Tableting Cycle 2020-01-07 09:50:45.000
1/7/2020 11:50:45 AM - 1/7/2020 12:08:45 PM

Search Results

Tableting Cycle 2020-01-07 12:22:45.000
Tableting Cycle 2020-01-07 12:03:45.000
Tableting Cycle 2020-01-07 11:44:45.000
Tableting Cycle 2020-01-07 11:25:45.000
Tableting Cycle 2020-01-07 11:06:45.000
Tableting Cycle 2020-01-07 10:47:45.000
Tableting Cycle 2020-01-07 10:28:45.000

Edit Search Criteria

Attributes

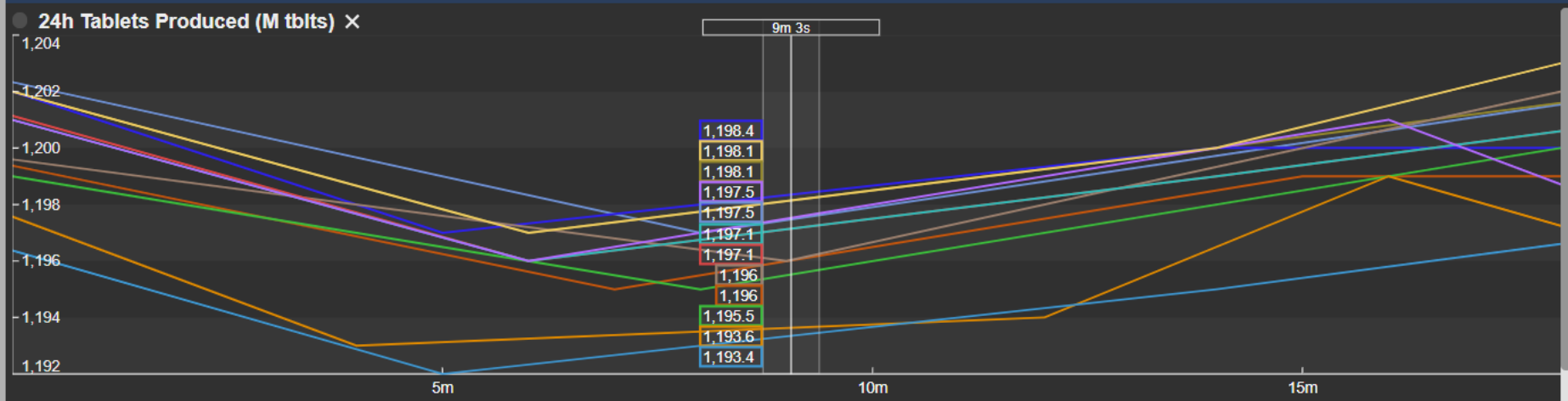
Plant: Plant1
Site: Charlotte, NC

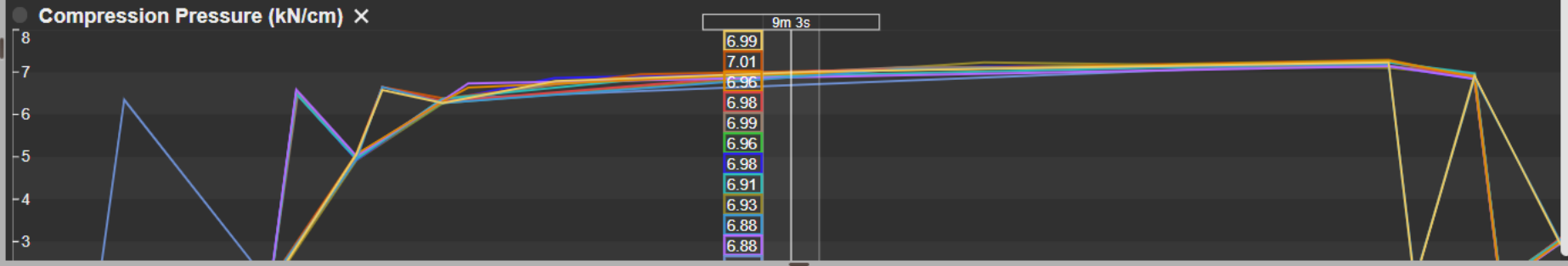
KPIs

24h Tablets Produced: 1,196.6 M tblts
Compression pressure - 7-Day Average: 5.46 kN/cm
Hourly Tablets Produced: 50,230 tblts
Production Rate - Hourly Avg: 12.83 tblts/s
Tablets Produced Today: 645.15 M tblts

Parameters

Compression Pressure: 2.98 kN/cm



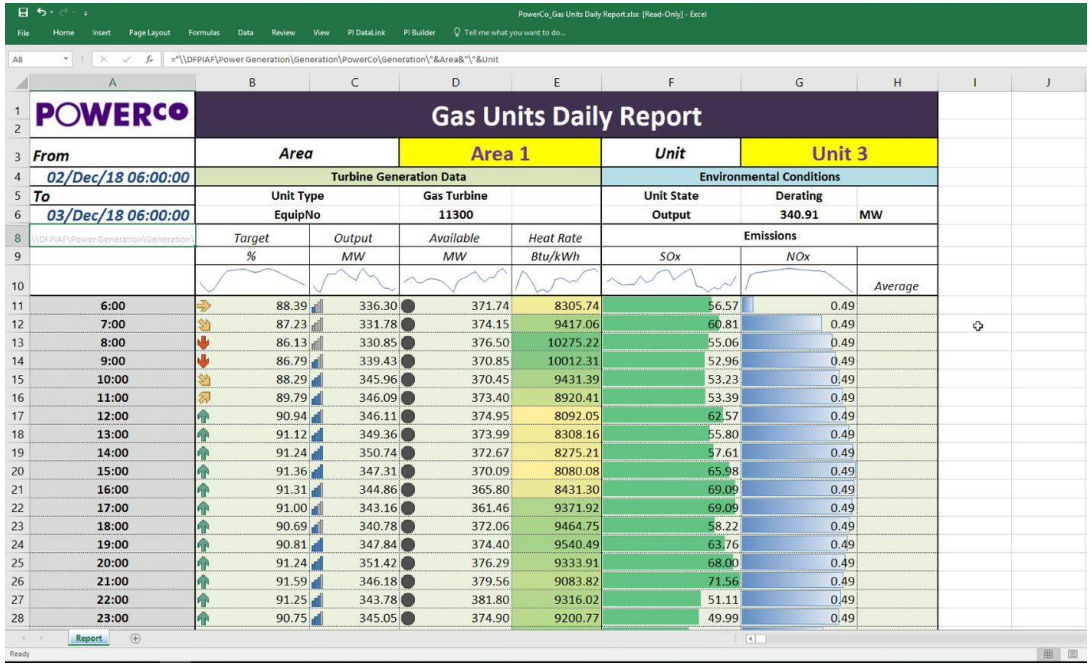


Tableting Cycle 2020-01-07 09:50:45.000
Tableting Cycle 2020-01-07 12:41:45.000
Tableting Cycle 2020-01-07 12:22:45.000
Tableting Cycle 2020-01-07 12:03:45.000
Tableting Cycle 2020-01-07 11:44:45.000
Tableting Cycle 2020-01-07 11:25:45.000

AVEVA PI DataLink

Deliver formatted data directly to Excel

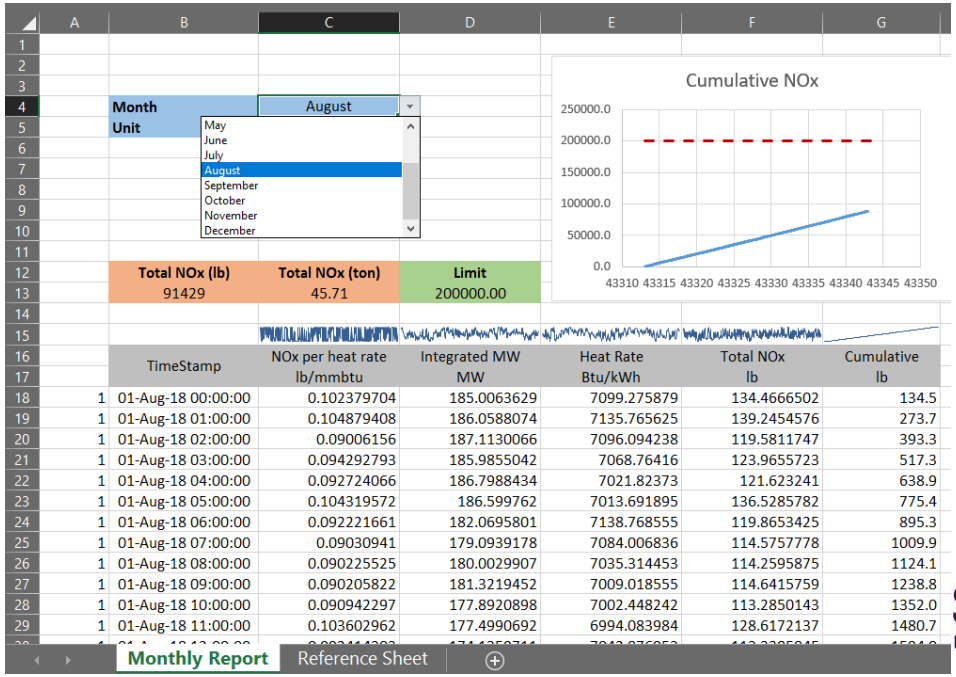
- Create **live, interactive, spreadsheet reports** that easily compare and analyze assets in context
- Summarize **years of historical data** and view it alongside **real-time data**
- Make **summary calculations** and **filter** data



POWERCO — Gas Units Daily Report

From	Area	Area 1	Unit	Unit 3
02/Dec/18 06:00:00	Turbine Generation Data		Environmental Conditions	
To	Unit Type	Gas Turbine	Unit State	Derating
03/Dec/18 06:00:00	EquipNo	11300	Output	340.91 MW

	Target	Output	Available	Heat Rate	Emissions	
	%	MW	MW	Btu/kWh	SOx	NOx
						Average
6:00	88.39	336.30	371.74	8305.74	56.57	0.49
7:00	87.23	331.78	374.15	9417.06	60.81	0.49
8:00	86.13	330.85	376.50	10275.22	55.06	0.49
9:00	86.79	339.43	370.85	10012.31	52.96	0.49
10:00	88.29	345.96	370.45	9431.39	53.23	0.49
11:00	89.79	346.09	373.40	8920.41	53.39	0.49
12:00	90.94	346.11	374.95	8092.05	62.57	0.49
13:00	91.12	349.36	373.99	8308.16	55.80	0.49
14:00	91.24	350.74	372.67	8275.21	57.61	0.49
15:00	91.36	347.31	370.09	8080.08	65.98	0.49
16:00	91.31	344.86	365.80	8431.30	69.09	0.49
17:00	91.00	343.16	361.46	9371.92	69.09	0.49
18:00	90.69	340.78	372.06	9464.75	58.22	0.49
19:00	90.81	347.84	374.40	9540.49	63.76	0.49
20:00	91.24	351.42	376.29	9333.91	68.00	0.49
21:00	91.59	346.18	379.56	9083.82	71.56	0.49
22:00	91.25	343.78	381.80	9316.02	51.11	0.49
23:00	90.75	345.05	374.90	9200.77	49.99	0.49



Month: August
Unit:
May, June, July, August, September, October, November, December

Cumulative NOx

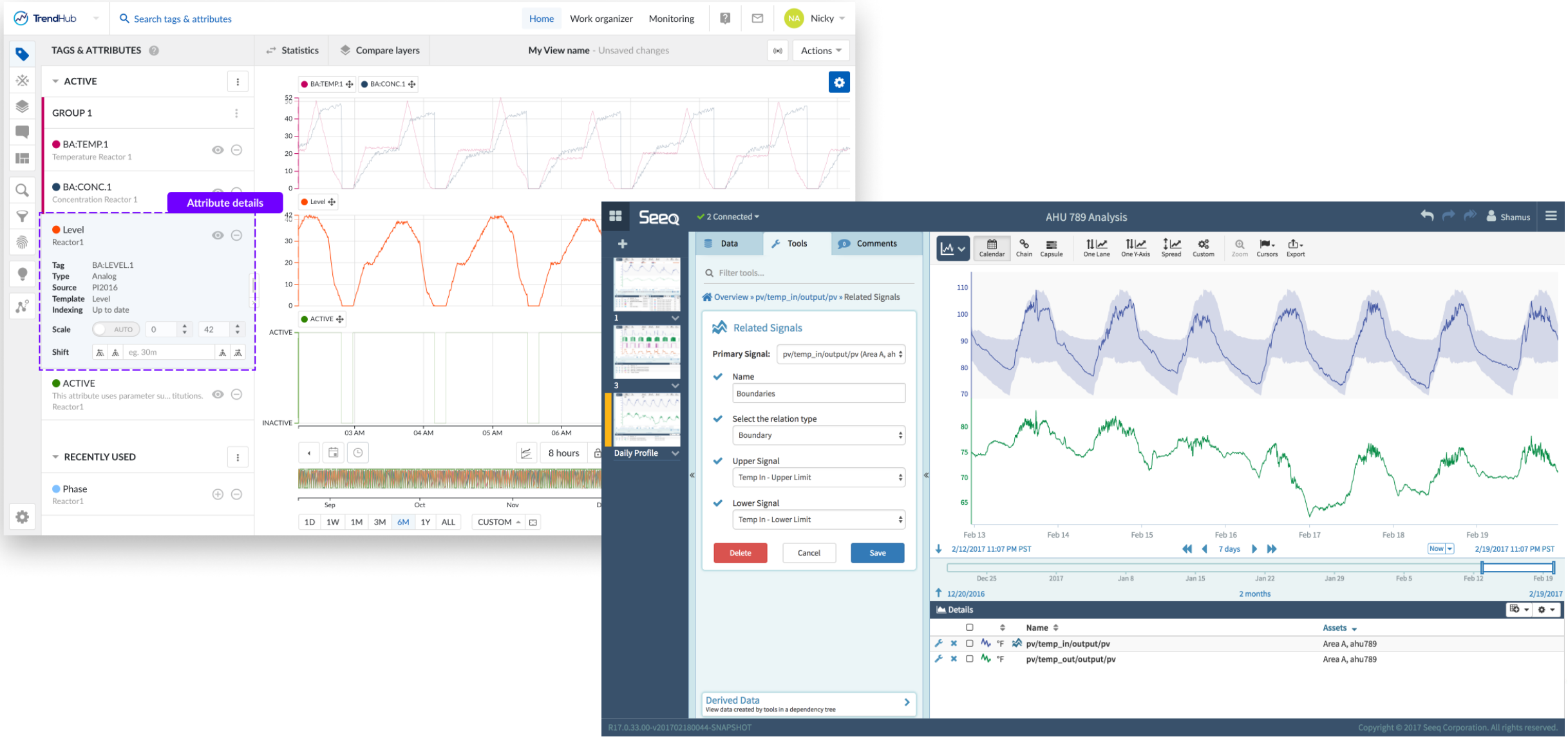
Total NOx (lb)	Total NOx (ton)	Limit
91429	45.71	200000.00

	TimeStamp	NOx per heat rate lb/mmbtu	Integrated MW MW	Heat Rate Btu/kWh	Total NOx lb	Cumulative lb
1	01-Aug-18 00:00:00	0.102379704	185.0063629	7099.275879	134.4666502	134.5
1	01-Aug-18 01:00:00	0.104879408	186.0588074	7135.765625	139.2454576	273.7
1	01-Aug-18 02:00:00	0.09006156	187.1130066	7096.094238	119.5811747	393.3
1	01-Aug-18 03:00:00	0.094292793	185.9855042	7068.76416	123.9655723	517.3
1	01-Aug-18 04:00:00	0.092724066	186.7988434	7021.82373	121.623241	638.9
1	01-Aug-18 05:00:00	0.104319572	186.599762	7013.691895	136.5285782	775.4
1	01-Aug-18 06:00:00	0.092221661	182.0695801	7138.768555	119.8653425	895.3
1	01-Aug-18 07:00:00	0.09030941	179.0939178	7084.006836	114.5757778	1009.9
1	01-Aug-18 08:00:00	0.090225525	180.0029907	7035.314453	114.2595875	1124.1
1	01-Aug-18 09:00:00	0.090205822	181.3219452	7009.018555	114.6415759	1238.8
1	01-Aug-18 10:00:00	0.090942297	177.8920898	7002.448242	113.2850143	1352.0
1	01-Aug-18 11:00:00	0.103602962	177.4990692	6994.083984	128.6172137	1480.7

Monthly Report | Reference Sheet

SELECT BENELUX & SCANDINAVIA

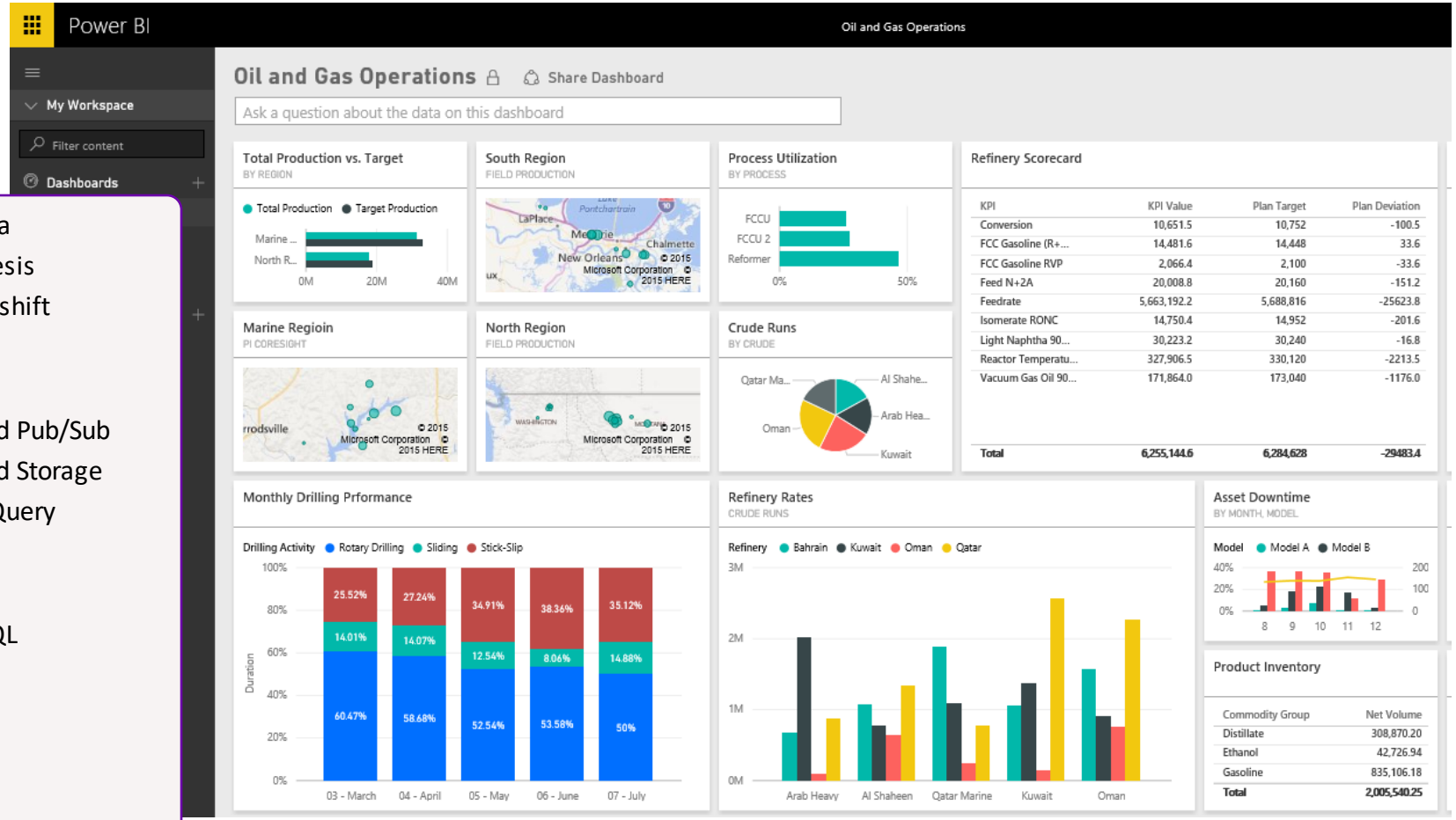
3th Party landscape (Trending / Search / Discover)



3th Party landscape (Data Science / Dashboarding)

- Transform & Augment
  - PI Integrator For Business Analytics
  - AVEVA BI Gateway

- Apache Kafka
- Amazon Kinesis
- Amazon Redshift
- Amazon S3
- Cognos
- Google Cloud Pub/Sub
- Google Cloud Storage
- Google Big Query
- Hadoop
- Hive
- Microsoft SQL
- MS Azure
- Oracle
- PowerBI
- SAP HANA
- Spotfire
- SAS
- Tableau



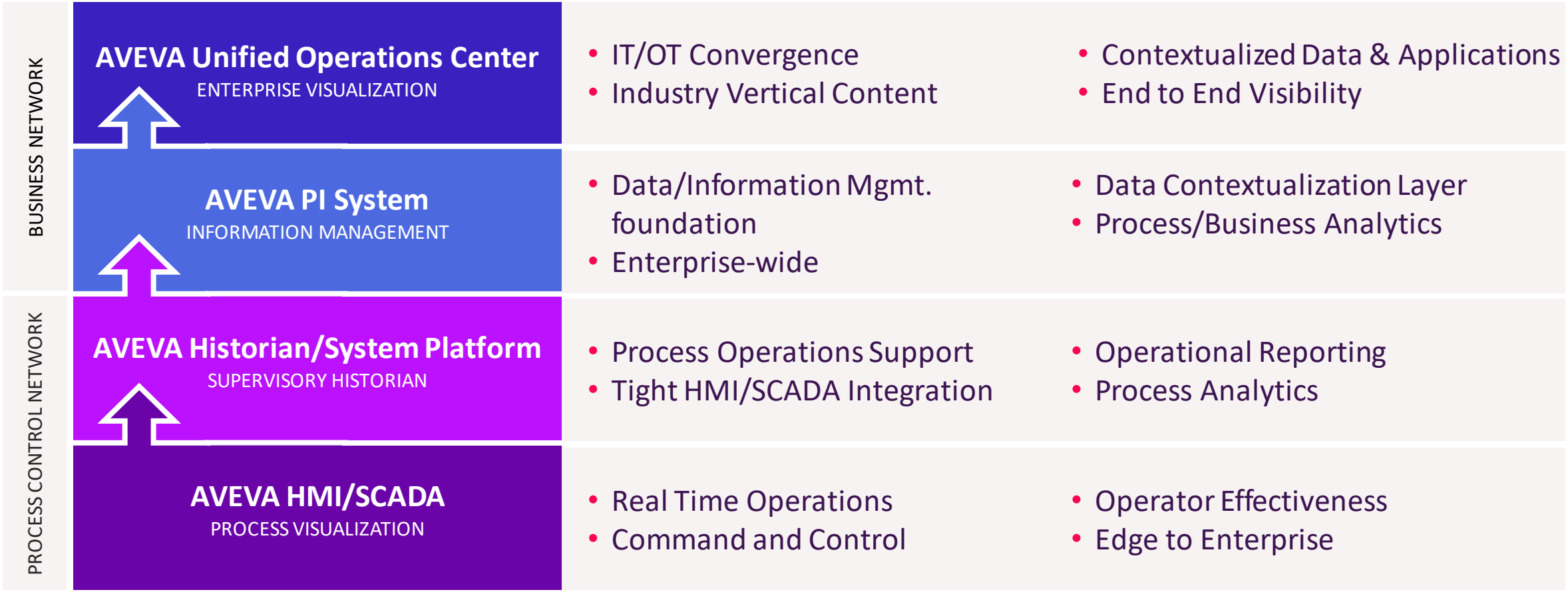
AVEVA | SELECT
BENELUX & SCANDINAVIA

Positioning PI within the AVEVA Portfolio

AVEVA SELECT
BENELUX & SCANDINAVIA

Better together: AVEVA PI Server & AVEVA Operations Control

Distinct Operational Roles



AVEVA | SELECT BENELUX & SCANDINAVIA

AVEVA Historian

High performance industrial database

Easier discovery of high value process improvements

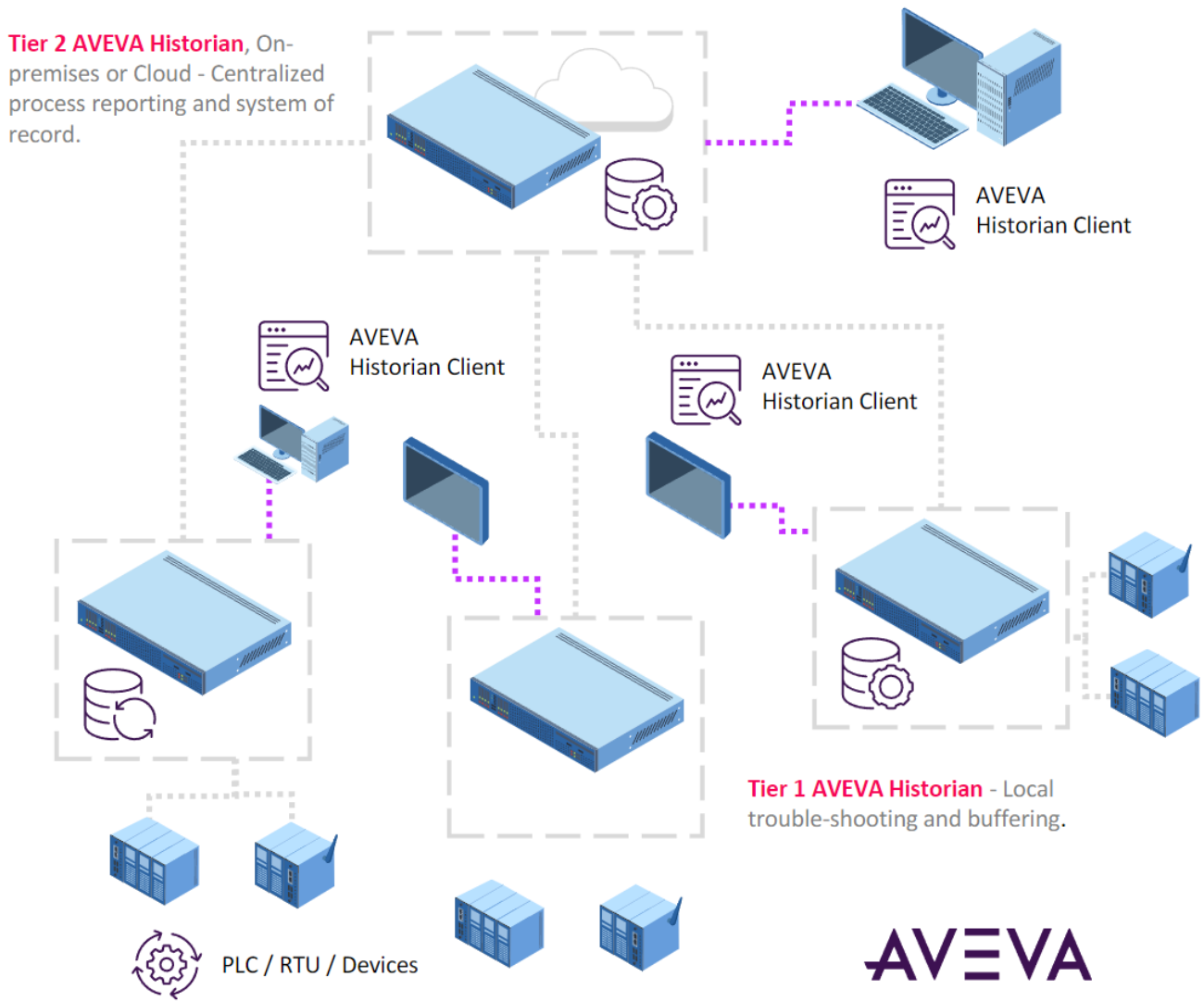
- Collect and store all vital data – Process / Alarm / Event
- Securely monitor a single area or an entire facility
- Provides a complete and accurate operational history
- Foundation for faster troubleshooting
- Integrated alarms & events
- Capture complete data records, including from slow or intermittent networks

Empower team collaboration with a shared Digital Thread

- Comprehensive reporting and data analysis
- Share data between teams and applications for better business decisions
- Extensive internationalization

Reduce IT costs and accelerate system ROI

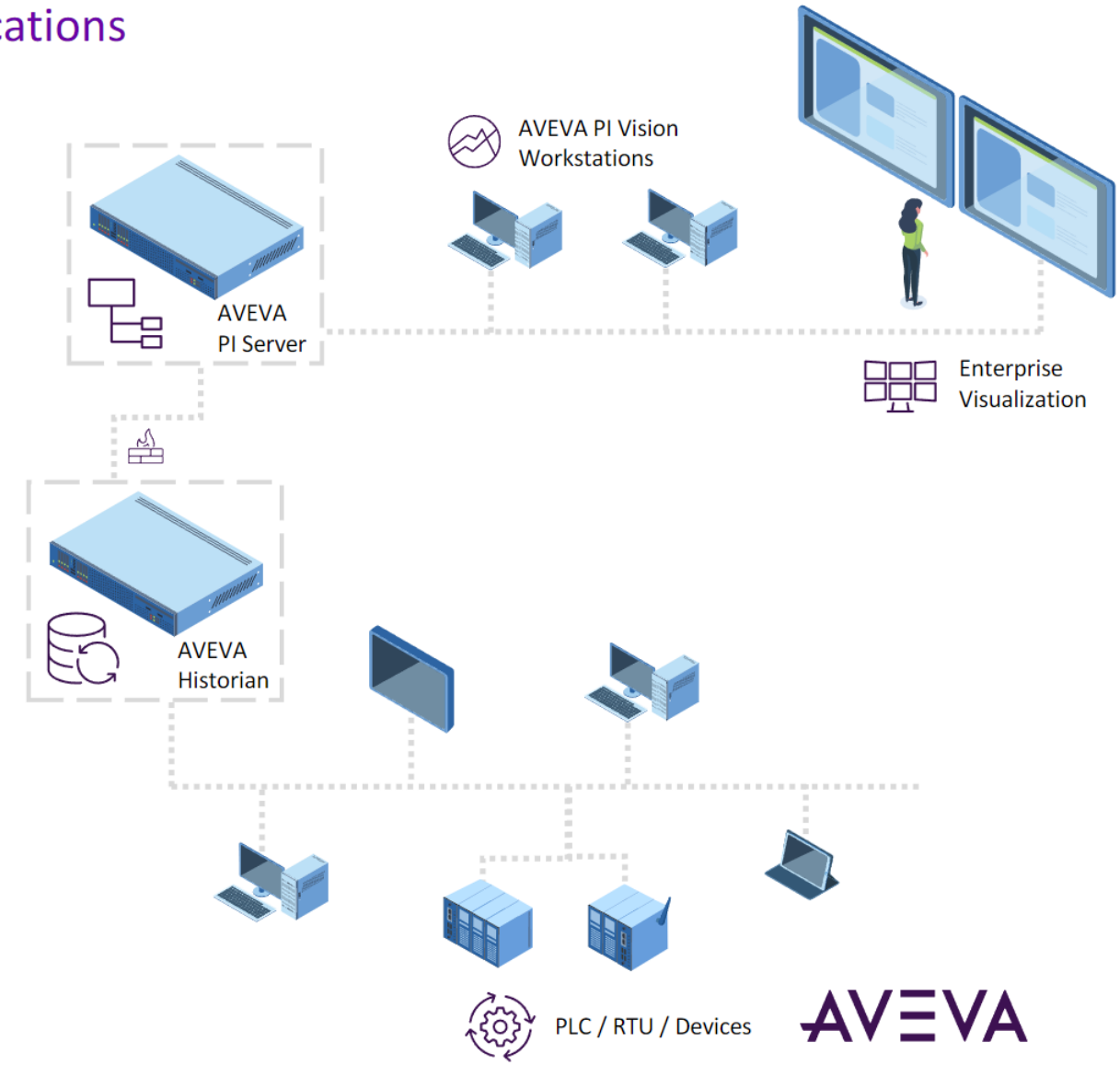
- Flexible, scalable implementation options – featuring Tiering
- High availability and disaster recovery help ensure business continuity



Historian integration with AVEVA PI System

Push data to higher-level consuming services and applications

- **AVEVA PI System**
  - Enterprise-class data management system for aggregating, enriching, analyzing, and using operations data
  - Ensures operations and business decision makers have a single, trusted source of industrial data.
  - Data democratization: make industrial data easily understood and available to non-experts so more employees can play a role in identifying value and efficiency gains
  - Receives data forwarded from AVEVA Historian on the process network
  - Accelerates operational insight by delivering aggregated data from multiple AVEVA Historians cleansed and formatted for broad analysis tools and advanced AI
  - Gives users code-free access to relevant data and asset analytics outside of the process control network without waiting for IT assistance



Historian <> PI

	HMI/ SCADA specific features	Low-cost solution	Alarm history	Proven in essential industries	COTS, no ongoing dev costs	IIoT, edge data sources	Wider ops data focus	Enterprise scale data mgmt	Built for millions of tags	No-code data access	Ability to view data in context	App/tool integra-tion	Secure, online data sharing
AVEVA PI System	◗	◗	◗	●	●	◕	●	●	●	●	●	●	●
AVEVA Historian	●	●	●	●	●	◗	○	◗	◕	●	◗	◗	●

Historian caters to the demands of real-time processes on the control network, aligned with HMI/SCADA, to aid optimization and troubleshooting activities.

PI System is an enterprise-wide information management solution. It's ability to collect & enrich data from edge, plant, cloud is unmatched.

PI Server includes context, calculation, event tracking, and notification capabilities at no additional cost.

Primarily for HMI/SCADA

Lead with AVEVA Historian

Broader Information Management play

Lead with AVEVA PI Server

AVEVA | SELECT BENELUX & SCANDINAVIA

FLEX Model

Basic Model

PI Server & Interfaces
Tag based

- AVEVA PI Server 1K
- AVEVA PI Server 2K
- AVEVA PI Server 3K
- AVEVA PI Server 5K
- AVEVA PI Server 10K
- AVEVA PI Server 15K
- AVEVA PI Server 20K
- AVEVA PI Server 25K
- AVEVA PI Server 30K
- AVEVA PI Server 40K
- ...

+

Client Software
Named User based

- AVEVA PI Client Pack 5
- AVEVA PI Client Pack 10
- AVEVA PI Client Pack 25
- AVEVA PI Client Pack 50
- AVEVA PI Client Pack 100
- AVEVA PI Client Pack 200

+

System Access
Tag based

Business Integrator
Stream based (opt.)

High Availability Nodes
Tag based (opt.)

AVEVA | SELECT
BENELUX & SCANDINAVIA

FLEX Model – Example Smallest Config

Basic Model

PI Server & Interfaces
Tag based

PI Server 1K Tags
396 Credits

Connectivity Pack
Included

+

Client Software
Named User based

PI Client Pack 5 Users
240 Credits

+

System Access
Tag based

PI System Access 1K
180 Credits
(optional but recommended)

= 816 Credits

AVEVA | SELECT
BENELUX & SCANDINAVIA

FLEX Model – Example Medium Config

Basic Model

PI Server & Interfaces
Tag based

PI Server 25K Tags
4908 Credits

Connectivity Pack
Included

+

Client Software
Named User based

PI Client Pack 25 Users
1116 Credits

+

System Access
Tag based

PI System Access 25K
1368 Credits
(optional but recommended)

= 7392 Credits

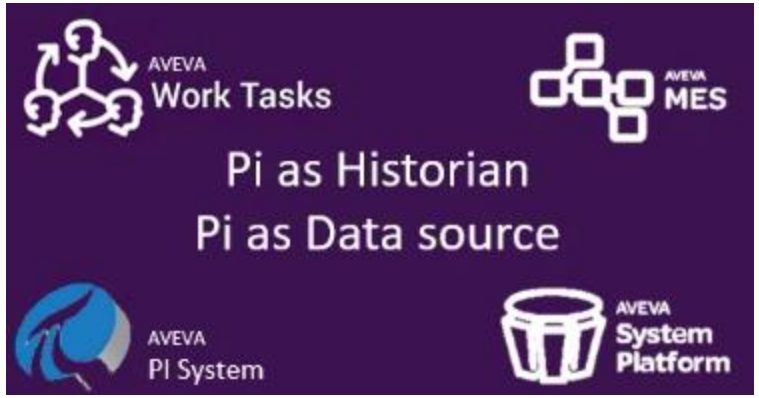
AVEVA | SELECT
BENELUX & SCANDINAVIA

Can PI replace MES? (No)

AVEVA SELECT
BENELUX & SCANDINAVIA

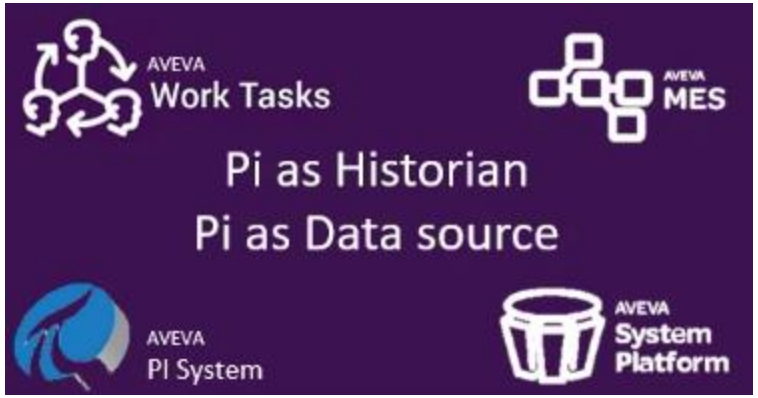
AVEVA MES and AVEVA PI System

Possible PI Roles in combination with MES



AVEVA | SELECT
BENELUX & SCANDINAVIA

AVEVA MES and AVEVA PI MIS



PI roles for Historian and Data Source

- PI Role 1: overall Historian for MES Projects
  - ASP 2023 use Historian replicate to PI
  - Use of OPC Server or OPC UA Server as Data Source for PI
  - PI Adapter for MQTT
  - Client session based SQL Data Queries
  - Client session based REST WebAPI Interface
  - PI Asset Framework afSDK integration
- PI Role 2: Data Platform and Data Source for MES (and system platform)
  - PI has an OPC DA and OPC HDA server to connect to System Platform.
  - PI Asset Framework afSDK integration for subscription of data points(PI Points, Asset Attributes, Event Frames)

AVEVA MES and AVEVA PI MIS

PI Role for Analytics

- MES Reporting via KPI's
  - PI has the capability to create custom Key Performance Indicators KPI's.
    - Example analyses:
      - Additional OEE calculations, when the OEE is not order based, or used on machines where the standard OEE formula is not appropriate/difficult to use,
      - OEE including labour management [OEE = Availability X Performance X Quality X Labour Usage]
      - View Analysis result on User Interface such as PI Vision
      - Add new analyses on data and use Backfill to make PI recalculate.

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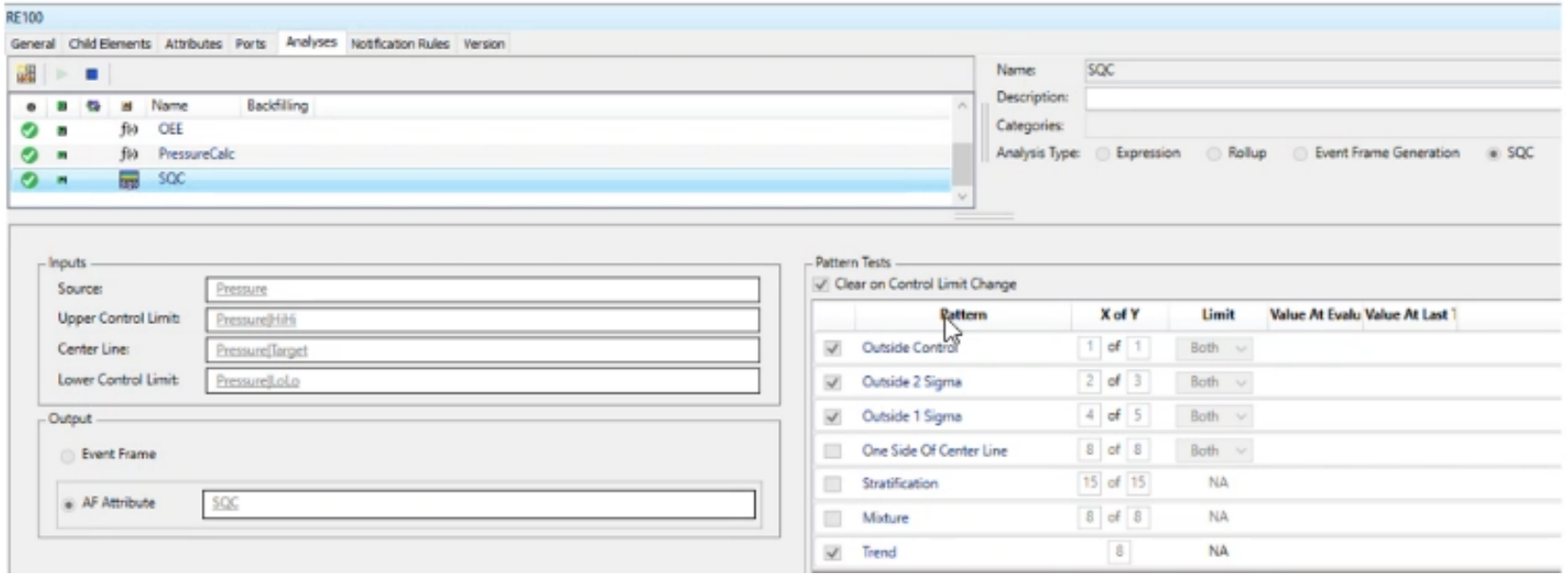
AVEVA MES and AVEVA PI MIS

PI Role for Analytics

- MES Reporting via KPI's
  - PI has the capability to create custom Key Performance Indicators KPI's.
    - Example analyses:
      - Log data in PI, make Statistical Quality Control SQC analysis and feed the results back to MES



AVEVA SELECT
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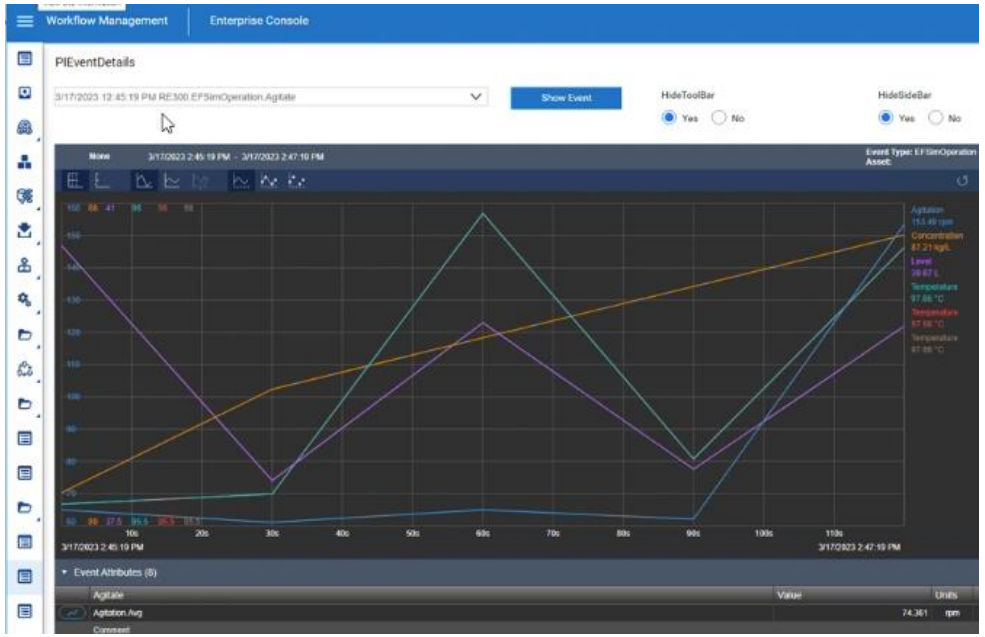
AVEVA MES and AVEVA PI MIS

PI Role for Analytics

- PI Analytics in PI Vision
  - Example analyses:
    - Add new Event Frames which are triggered (transactional !) from MES or by MES data.
    - Add MES context data via PI Points, Asset Framework attributes or Event Frame attributes



AVEVA SELECT
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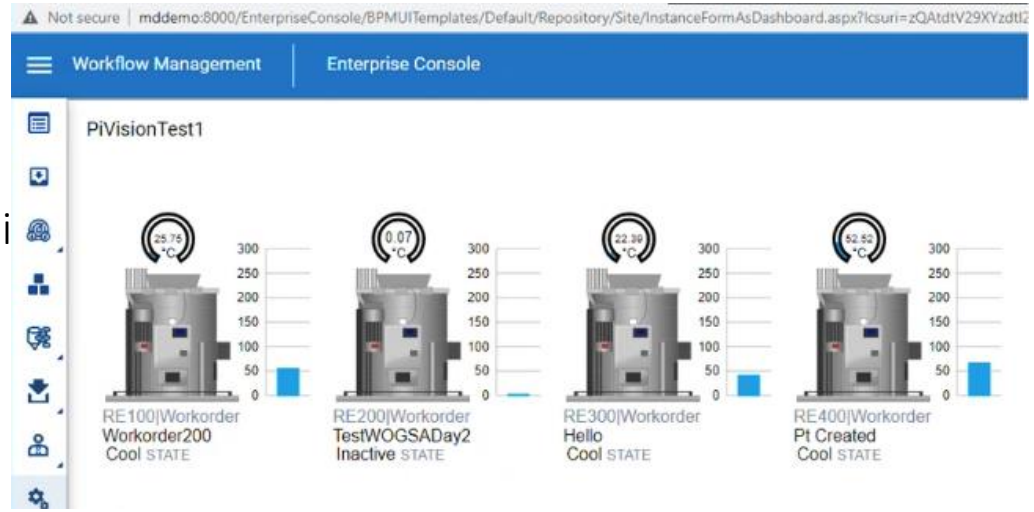
AVEVA MES and AVEVA PI MIS

PI role for Self-service Dashboards

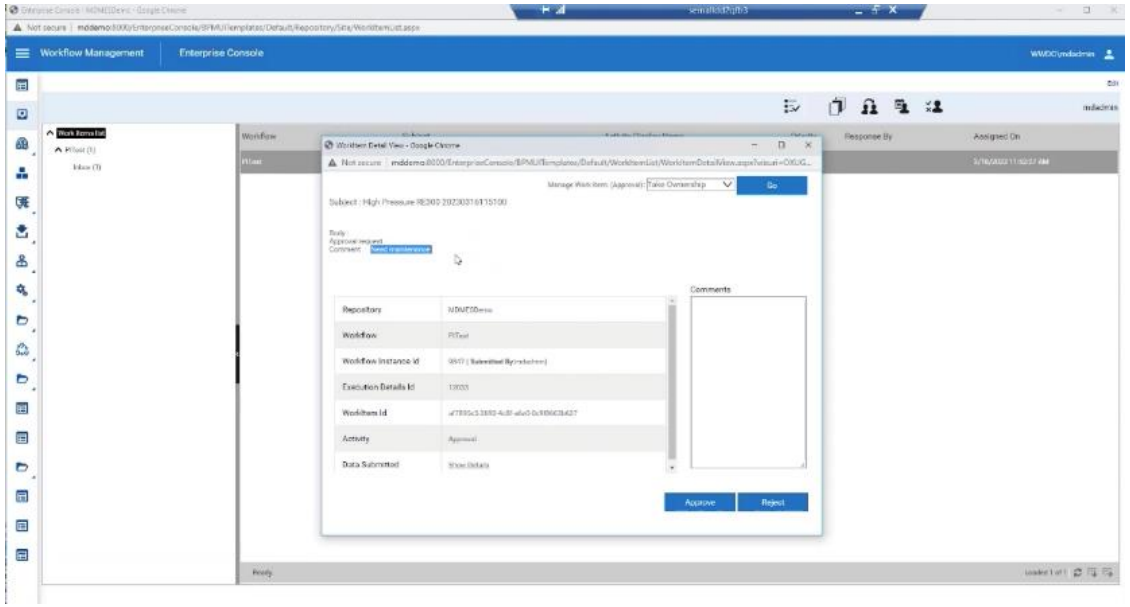
- PI Vision has a self-service dashboard environment to create custom displays
  - Standalone Web Portals, embed in another portal,
  - Embedded in MES screens
    - MES controls the look-and-feel
    - MES controls if menus are shown and what asset is shown
    - MES embeds Event Detail View from event data collected vi



AVEVA MES and AVEVA PI MIS

PI Role for Integrated Business Logic with Work Tasks

- PI allows to add business logic which includes:
  - PI, PI Events, System Platform, MES, Work Tasks
  - Examples:
    1. High Pressure Event raised in PI
    2. Event detected in Work Tasks and workflow is started with Event data
    3. In Work Tasks data from event is analyzed and depending on the result
       1. Data can be sent back to PI, with Event Frame Ack, End Time an attribute data
       2. Work Tasks can connect to other system before returning result to PI.



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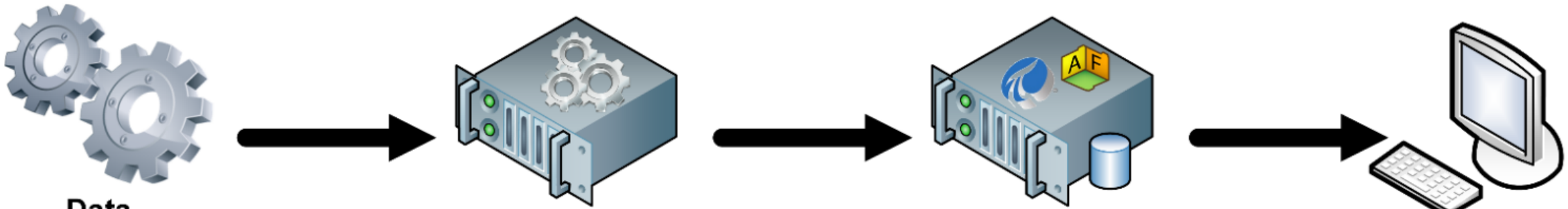
AVEVA MES and AVEVA PI MIS

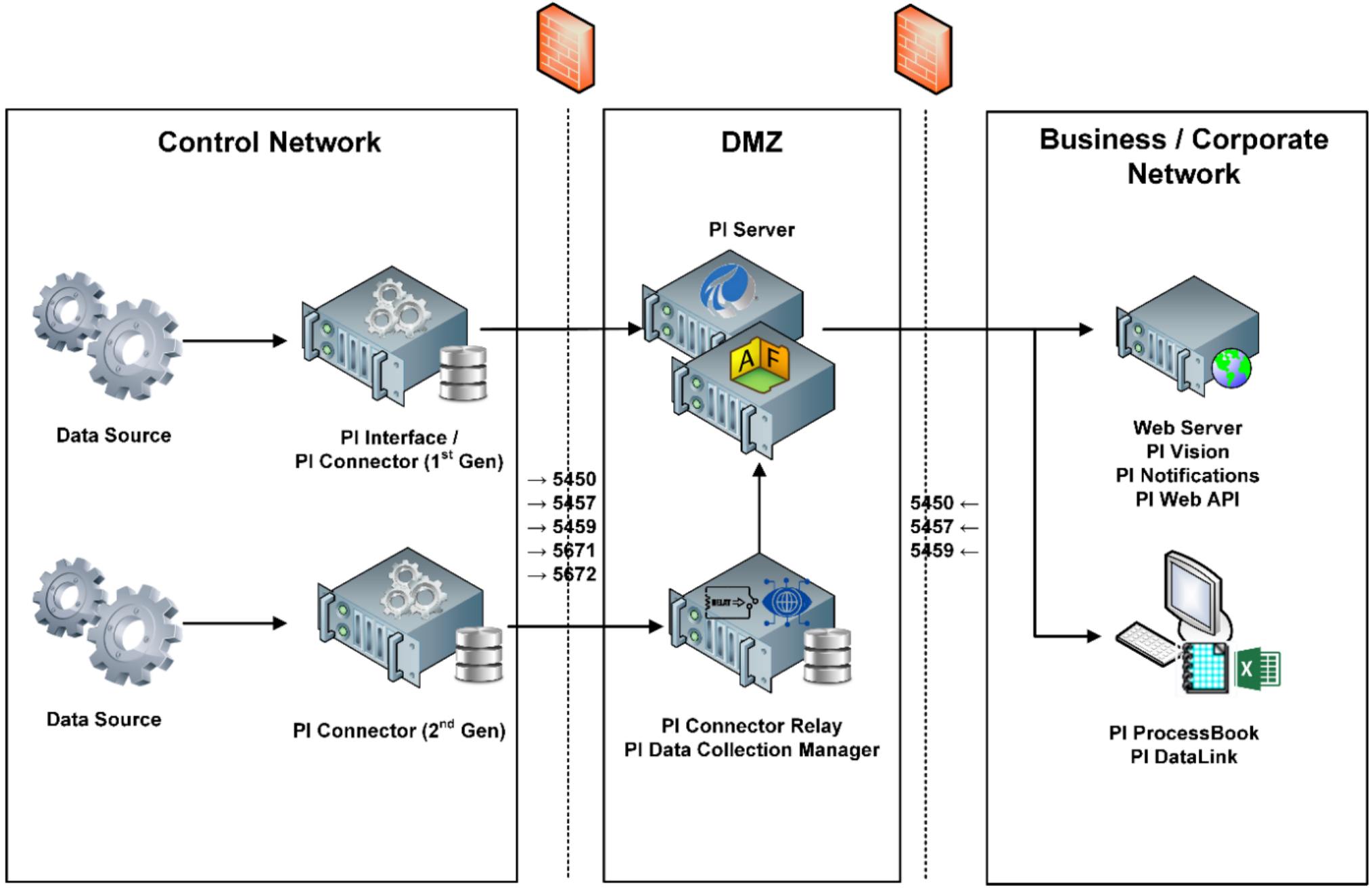
PI Role in other situations in combination with MES

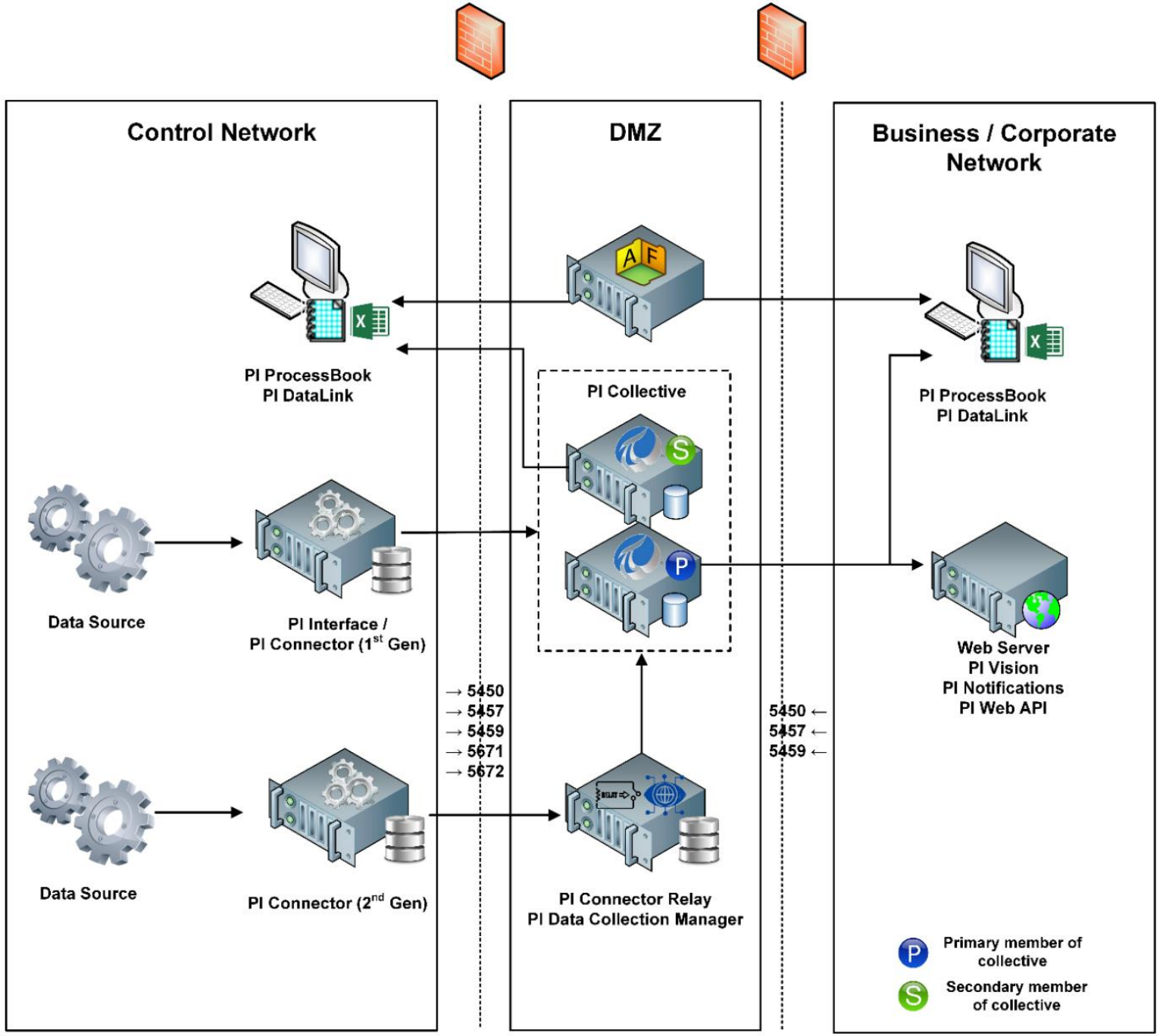
- Use MES or Work Tasks based User Interface for manual data entry to PI
  - Mobile client, tablet or desktop, scanning, etc.
- Use Outlook add in for Work Tasks to react and/or approve/acknowledge Events from PI
- Use the capabilities of System Platform to write to PLC's, .NET applications, etc.
- Use System Platform .NET capabilities to get data from other sources
- Use System Platform capabilities to add calculation or logic from .NET libraries
- Etc.

System Architectures (High Level)

AVEVA SELECT
BENELUX & SCANDINAVIA


Data Source
Data Collection Node:
• PI Interface
• PI Connector (1st Gen)
• PI Connector (2nd Gen) with PI Connector Relay
PI Server (PI Data Archive / PI AF)
Client PC

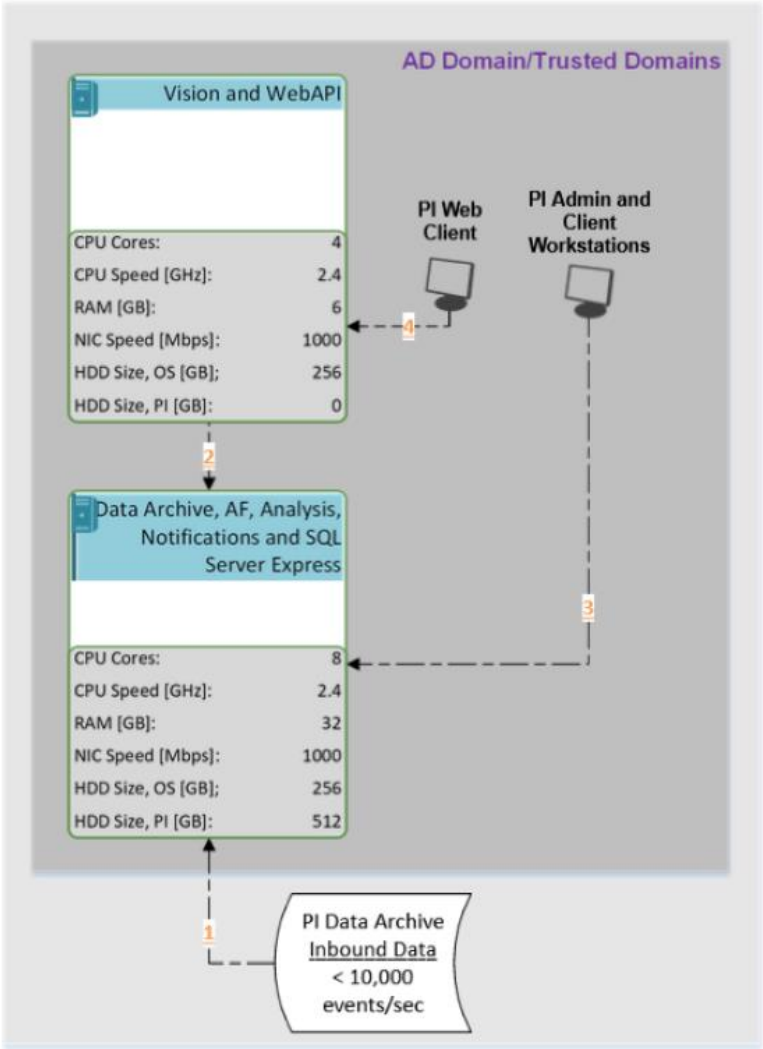

Control Network
DMZ
Business / Corporate Network
PI Server
Data Source
PI Interface / PI Connector (1st Gen)
→ 5450
→ 5457
→ 5459
→ 5671
→ 5672
5450 ←
5457 ←
5459 ←
Web Server
PI Vision
PI Notifications
PI Web API
Data Source
PI Connector (2nd Gen)
PI Connector Relay
PI Data Collection Manager
PI ProcessBook
PI DataLink



EVA SELECT BENELUX & SCANDINAVIA

PI Architecture (I)

Simplest architecture – <10000 Events/s



PI Data Flows

1 Inbound Data Flowing to PI Data Archive
- TCP port 5450 (PINET-Data Archive)
- Authentication method depends on type of connection (PI Interface, PI Connector, SQL, etc.)

2 PI Vision Requests Flowing to PI Server
- TCP ports 1433 (SQL), 5457 (AF-SDK)
- Recommended authentication method is Kerberos

3 PI Client Requests Flowing to PI Server
- TCP ports 5450 (PINET-Data Archive), 5457 (PINET-AF), 5463 (PINET-Analysis), 5468 (PINET-Notifications)
- Recommended authentication method is WIS

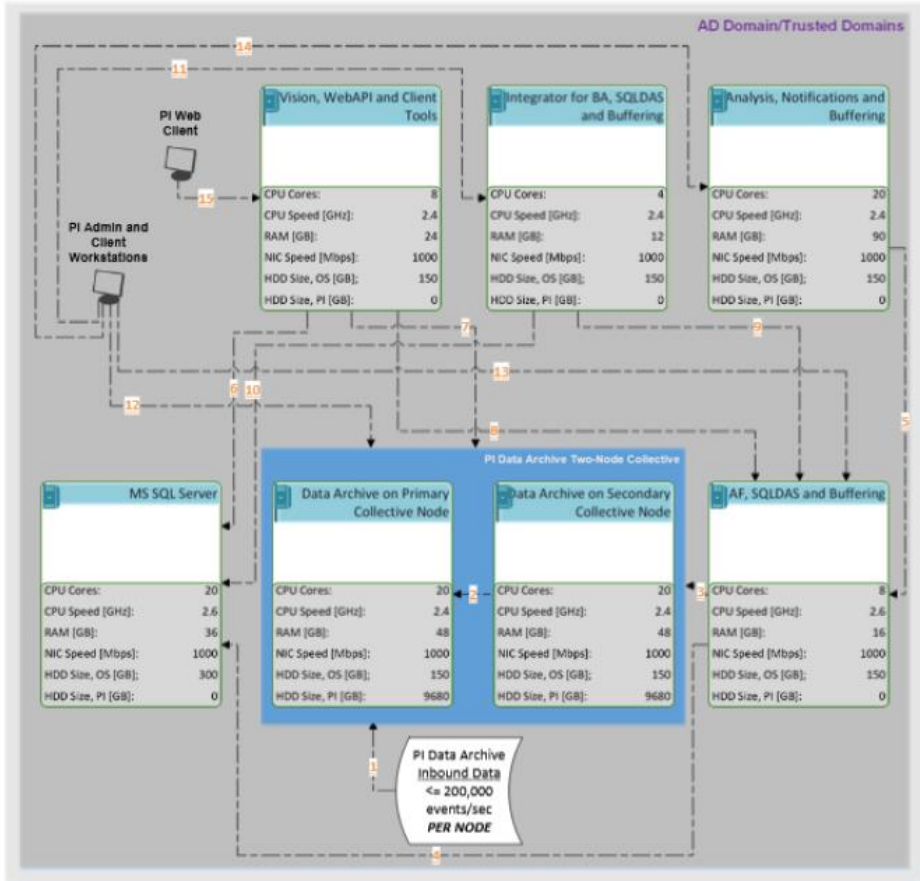
4 PI Web Clients Requests Flowing to PI Vision Server
- TCP ports 80 (HTTP), 443 (HTTPS)
- Recommended authentication method is SSL certificate

Topology Performance Envelope

Inbound Data Rate [Events/Sec]	10,000
Archive Data Rate [Events/Sec]	3,000
Analysis Evaluation Rate [Eval's/Sec]	3,000
Event Frame Generation Rate [EF's/Day]	250
Notifications Generation Rate [Notif's/Min]	60
Outbound Data Rate [Events/Sec]	500,000

PI Architecture (II)

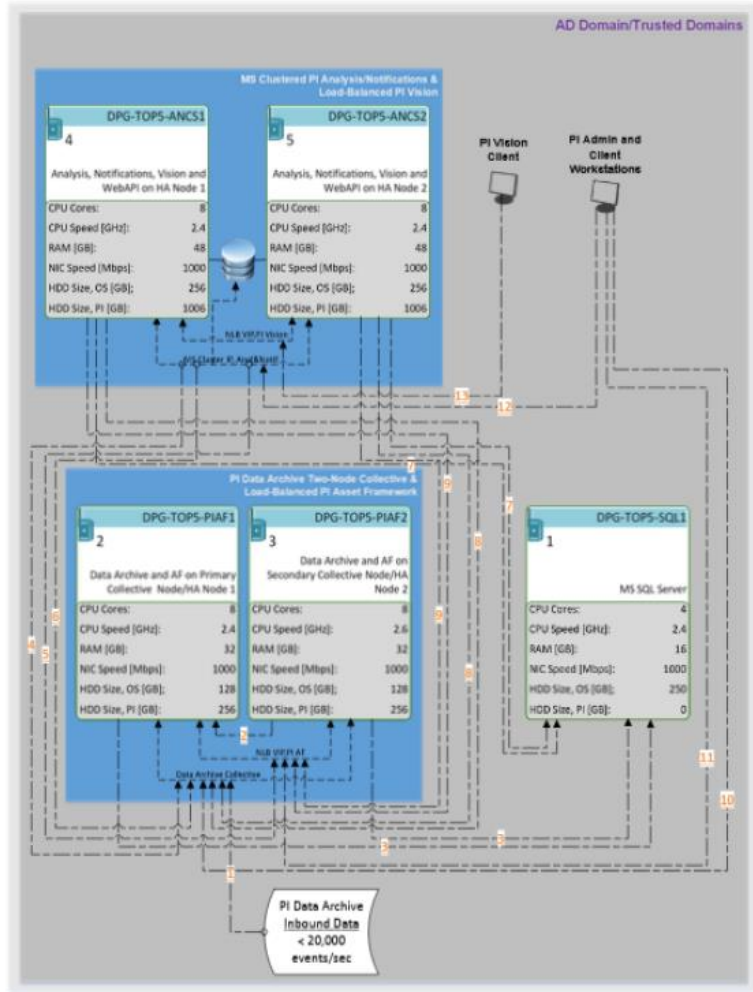
Bigger architecture < 200000 Events/s



Topology Performance Envelope Rates, Max	
Inbound Data Rate [Events/Sec]	200,000
Archive Data Rate [Events/Sec]	100,000
Analysis Evaluation Rate [Eval's/Sec]	30,000
Event Frame Generation Rate [EF's/Day]	10,000
Notifications Generation Rate [Notif's/Min]	120
Outbound Data Rate [Events/Sec]	2,000,000

PI Architecture (III)

Adding High Availability into the equation



PI Data Flows

1. Inbound Data Flowing to PI Data Archive
   - TCP port 5450 (PINET-Data Archive)
   - Authentication method depends on type of connection (PI Interface, PI Connector, BGL, etc.)
2. PI Data Archive Collective Secondary to PI Data Archive Collective Primary Node
   - TCP port 5450 (PINET-Data Archive)
   - Recommended authentication method is WIG
3. PI AF to MS SQL Server
   - TCP port 1433 (SQL), UDP port 1434 (SQL)
   - Recommended authentication method is WIG
4. PI Analysis Service to PI Data Archive
   - TCP port 5450 (PINET-Data Archive)
   - Recommended authentication method is WIG
5. PI Analysis Service Flowing to MS Asset Framework
   - TCP port 5457 (PINET-AF)
   - Recommended authentication method is Kerberos
6. PI Notifications Requests Flowing to Data Archive
   - TCP port 5450 (PINET-Data Archive)
   - Recommended authentication method is WIG
7. PI Vision Requests Flowing to MS SQL Server
   - TCP port 1433 (SQL), UDP port 1434 (SQL)
   - Recommended authentication method is WIG
8. [OPTIONAL]: PI Vision Requests Flowing to PI Data Archive
   - TCP ports 5450 (PINET-Data Archive)
   - Recommended authentication method is Kerberos
   - Optional because depends on PI Vision version and features used
9. PI Vision Requests Flowing to PI Asset Framework
   - TCP ports 5457 (PINET-AF)
   - Recommended authentication method is Kerberos
10. PI Client Requests Flowing to PI Data Archive
    - TCP ports 5450 (PINET-Data Archive), 5459 (PINET-SQL)
    - Recommended authentication method is WIG
11. PI Client Requests Flowing to PI Asset Framework
    - TCP ports 5457 (PINET-AF)
    - Recommended authentication method is WIG
12. PI Client Requests Flowing to PI Analysis and Notifications Services
    - TCP port 5463 (PINET-Analysis), TCP port 5468 (PINET-Notifications)
    - Recommended authentication method is WIG
13. PI Web Clients Requests Flowing to PI Vision Server
    - TCP ports 80 (HTTP), 443 (HTTPS)
    - Recommended authentication method is SSL certificate

Topology Performance Envelope

Inbound Data Rate [Events/Sec]	20,000
Archive Data Rate [Events/Sec]	7,500
Analysis Evaluation Rate [Eval's/Sec]	7,000
Event Frame Generation Rate [EF's/Day]	1,500
Notifications Generation Rate [Notif's/Min]	60
Outbound Data Rate [Events/Sec]	2,000,000

OSIsoft.	OSIsoft, LLC Topology 5				Deployment & Performance Guild
	M Taylor	Ver 1.0	12-Nov-2020	Internal Use Only	

AVEVA Datahub

AVEVA SELECT
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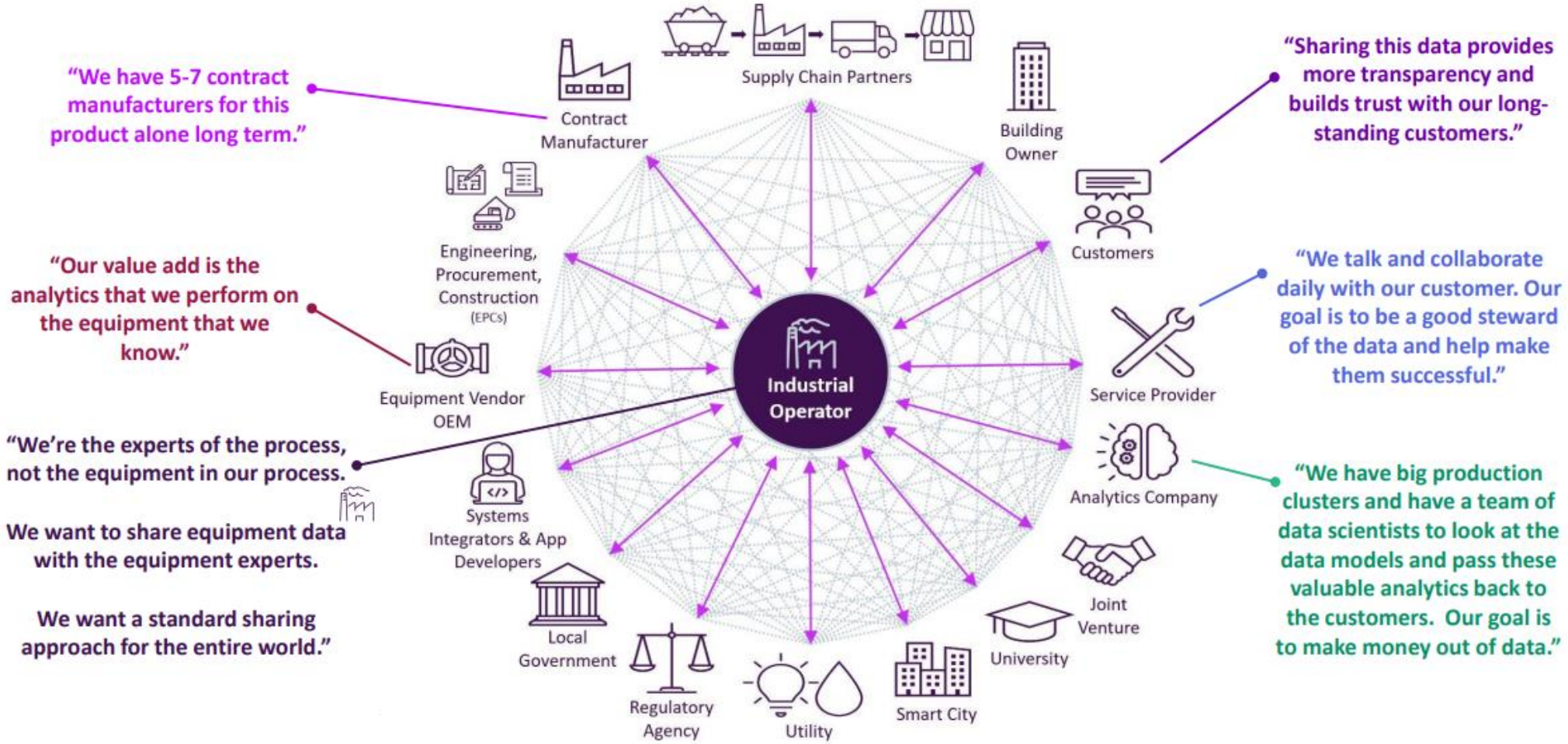
Connected Community

Enables simple & secure operational data sharing across organizations



AVEVA | SELECT BENELUX & SCANDINAVIA

From data source to AVEVA Data Hub

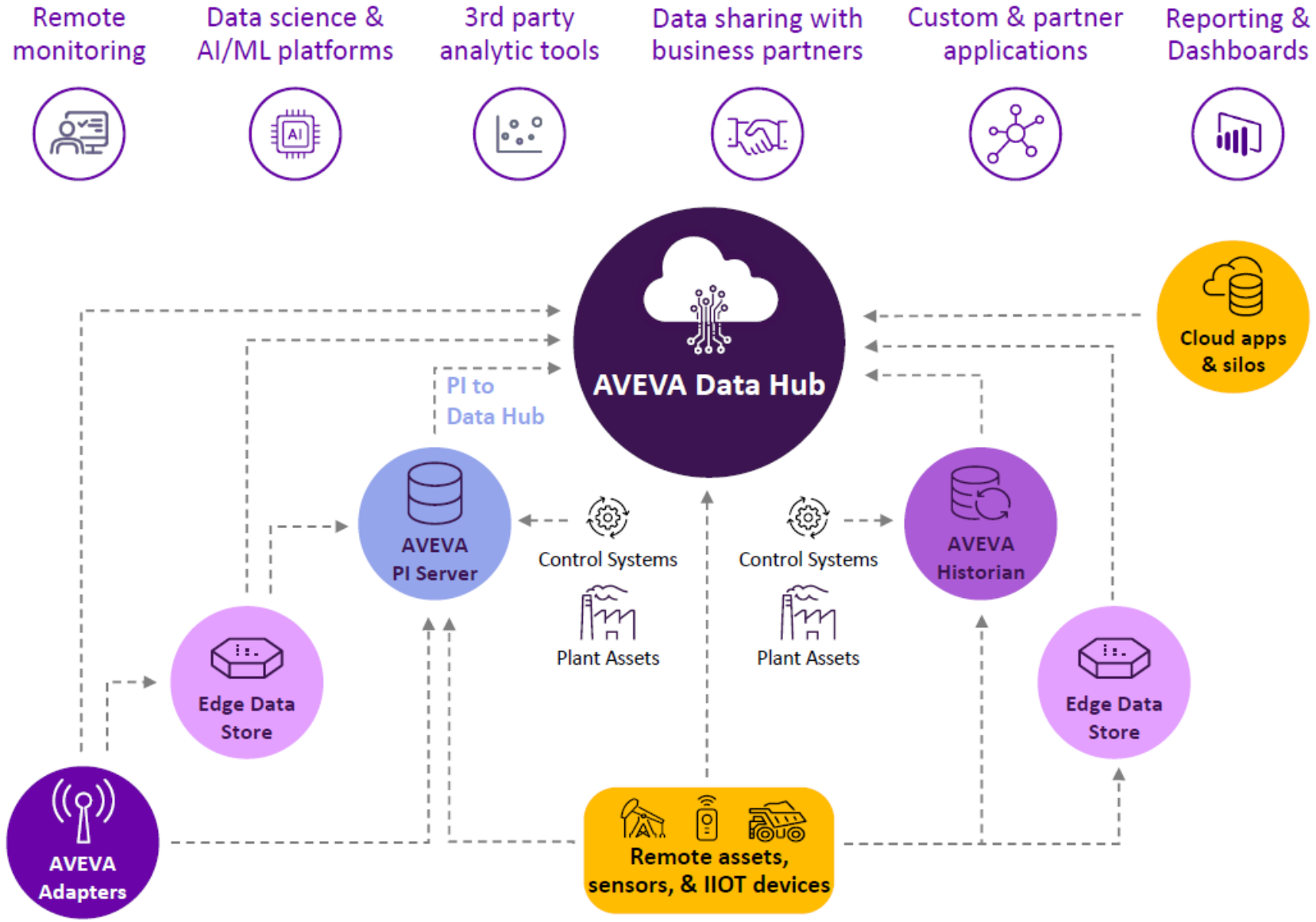
Supporting hybrid industrial architectures from the edge to on-premises to the cloud

Custom edge & cloud apps
- OMF – Open Message Format spec
- Maximum flexibility for developers
- Supported on any HW & OS
- REST API available as well

PI to Data Hub
- Native connectivity
- Support for PI points & AF Elements
- Current data & Historical data
- Simple, easy, & centralized config

Edge Data Store
- Persistent storage at the edge
- Cross platform & self-healing
- Flexible egress filtering config
- Same REST API as AVEVA Data Hub

AVEVA Adapters
- Ready off-the-shelf connectivity
- Cross platform (Windows & Linux)
- Lightweight footprint
- Client & Server level failover



Adapters available for: Azure Event Hubs, BACnet, DNP3, Modbus TCP, MQTT, OPC UA, RDBMS, Structured Data Files

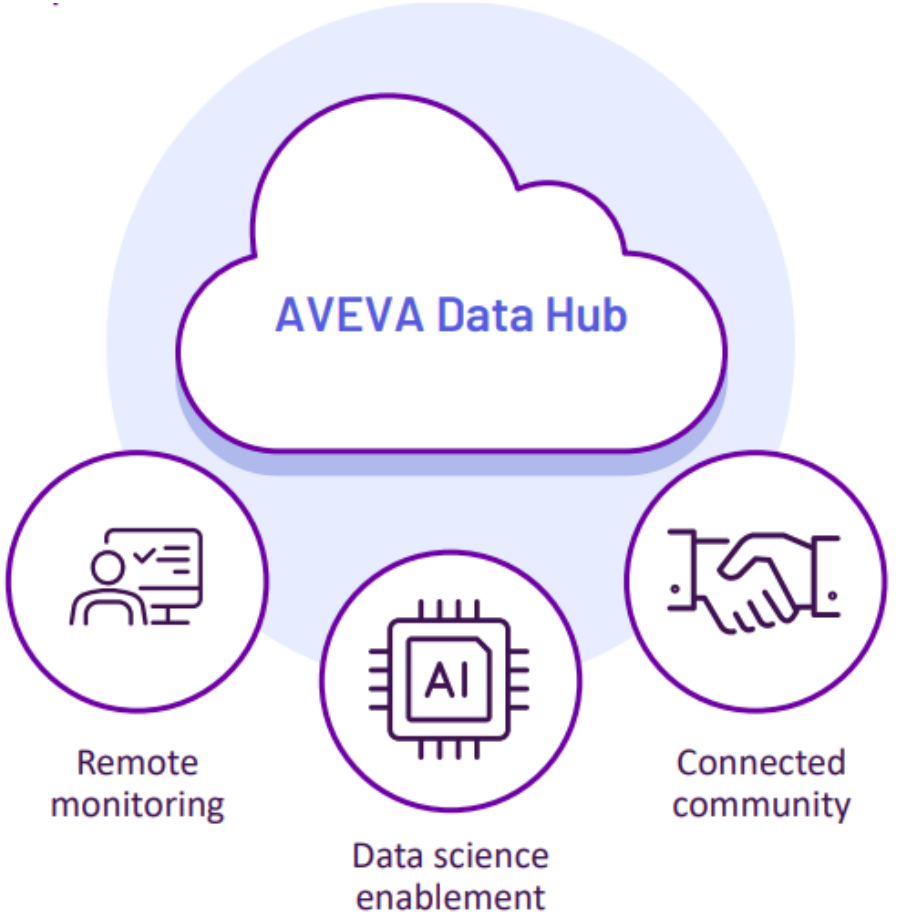
All connections shown are based on OMF unless noted

AVEVA

What is AVEVA Data Hub today?

Positioning the product

- A **cloud-native platform** where a customer can…
  - **Store** (scalable & centralized cloud storage)
  - **Prepare** (basic contextualization & aggregations)
  - **Share** (REST API & community's)
  - **Monitor** (basic trending & investigations)
- …**operations data** from
  - *Historians*
  - *Edge devices*
  - *Remote assets*
  - *Cloud applications*
- Data Hub is built, deployed and secured on Microsoft Azure and operated & maintained by AVEVA



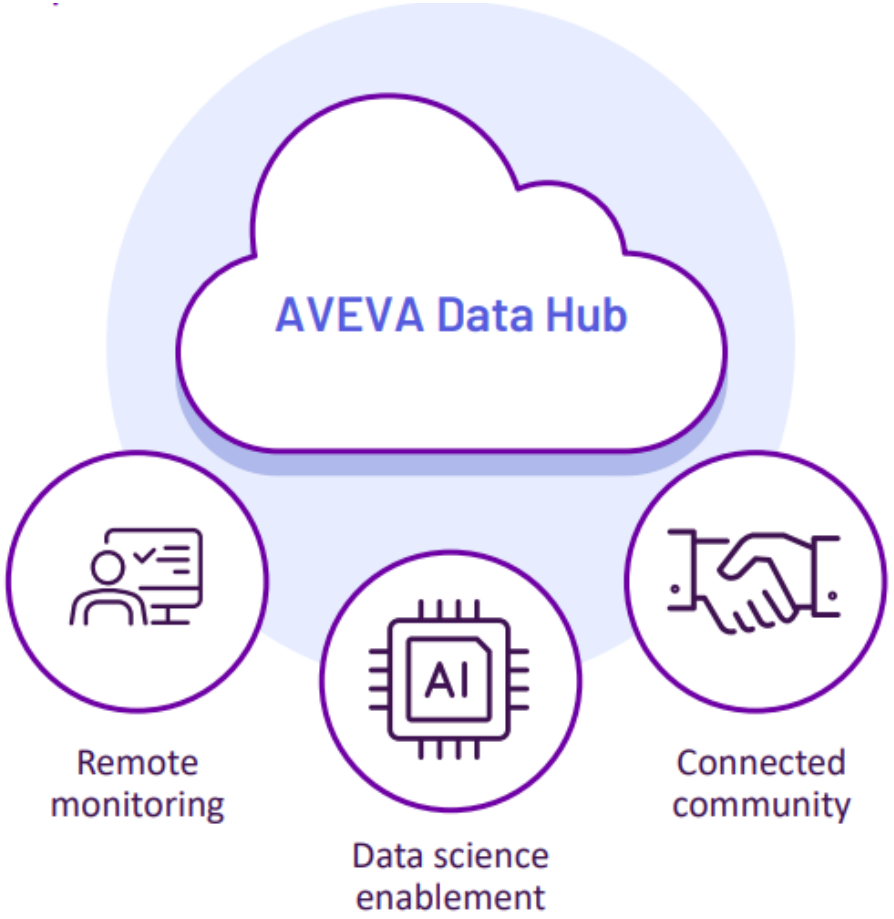
What AVEVA Data Hub is NOT

Positioning the product

- The magical answer to all your cloud or analytics questions
- The same as AVEVA Insight
- A Data Science or Machine Learning platform
- A Data Analytics solution (like PowerBI or Tableau)

Our best explanation on what Data Hub is:

- The future data storage backbone that is to be used for all applications within the AVEVA Connect environment
  - Data Hub should almost always be used in combination with other software products or solutions. This can be both AVEVA or Third-Party software.
  - At the moment AVEVA works on the integration with the existing SaaS products like AVEVA Insight and Advanced Analytics.



When to advise AVEVA Data Hub?

5 Examples of customer requests where Data Hub can be advised

Example 1	*"We want to bring all our operational data into a centralized Data Lake / Data Warehouse!"*
Example 2	*"We want to do Data Science and Machine Learning on our OT data!"*
Example 3	*"We want to share (subsets of) our OT data with internal or external partners!"*
Example 4	*"We need a centralized data platform for storing and making available multi-site data!"*
Example 5	*"Our IT department wants to have access to specific operations data, how can we do this?"*

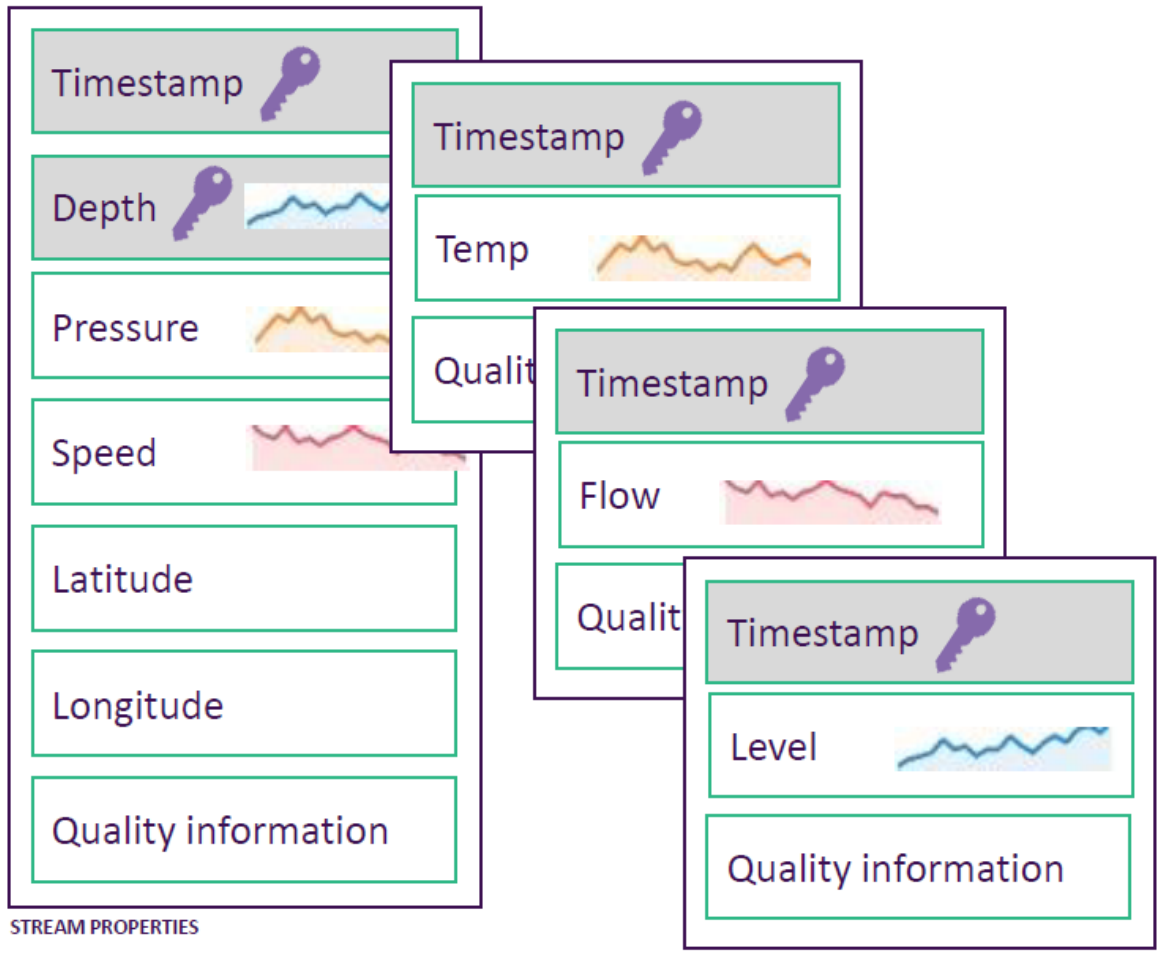
AVEVA Data Hub vs. AVEVA Insight

Comparison according to current situation

Capability	AVEVA Data Hub	AVEVA Insight
Focus	Data Storage and Data Sharing	Data Storage and Data Visualization
Storage	Sequential Data Storage	Time Series Data Storage
Connectivity	Extensive (AVEVA, PI, Edge & Enterprise)	Extensive (AVEVA, Edge & Enterprise)
Visualization	Limited to only trend analysis	Basic analytics: graphs, dashboards & alarms
Data Sharing / API	Extensive API + Integrated Data Views	Basic API + optional add-ons (BI-Gateway)
Asset Modelling	AF (Asset Framework) based	CIMv3 asset model
Scalability	Easily scalable (tags, assets and sites)	Easily scalable (tags, assets and sites)
End-users	Data Consumers (Data Scientists) + other applications	Operators and Data Analysts

Flexible Sequential Data Store that keeps related data together

Stream types & Streams: Define simple or complex schemas



STREAM PROPERTIES

HOUS.SensorUnit9.PM25 (*HOUS.SensorUnit9.PM25*)

+ Add Event

Timestamp	ParticleCount0.3	ParticleCount0.5	ParticleCount1.0
Feb 1, 2022, 6:18:12 PM	24	6	0
Feb 1, 2022, 6:18:18 PM	18	4	0
Feb 1, 2022, 6:18:25 PM	18	4	0
Feb 1, 2022, 6:18:31 PM	24	6	0
Feb 1, 2022, 6:18:37 PM	18	6	0
Feb 1, 2022, 6:18:43 PM	45	15	0
Feb 1, 2022, 6:18:49 PM	45	15	0
Feb 1, 2022, 6:18:54 PM	57	19	0
Feb 1, 2022, 6:19:00 PM	18	6	0
Feb 1, 2022, 6:19:06 PM	33	11	0
Feb 1, 2022, 6:19:13 PM	42	14	0
Feb 1, 2022, 6:19:19 PM	27	9	0

Showing 1 - 50 of 100 Items per page: 50 1

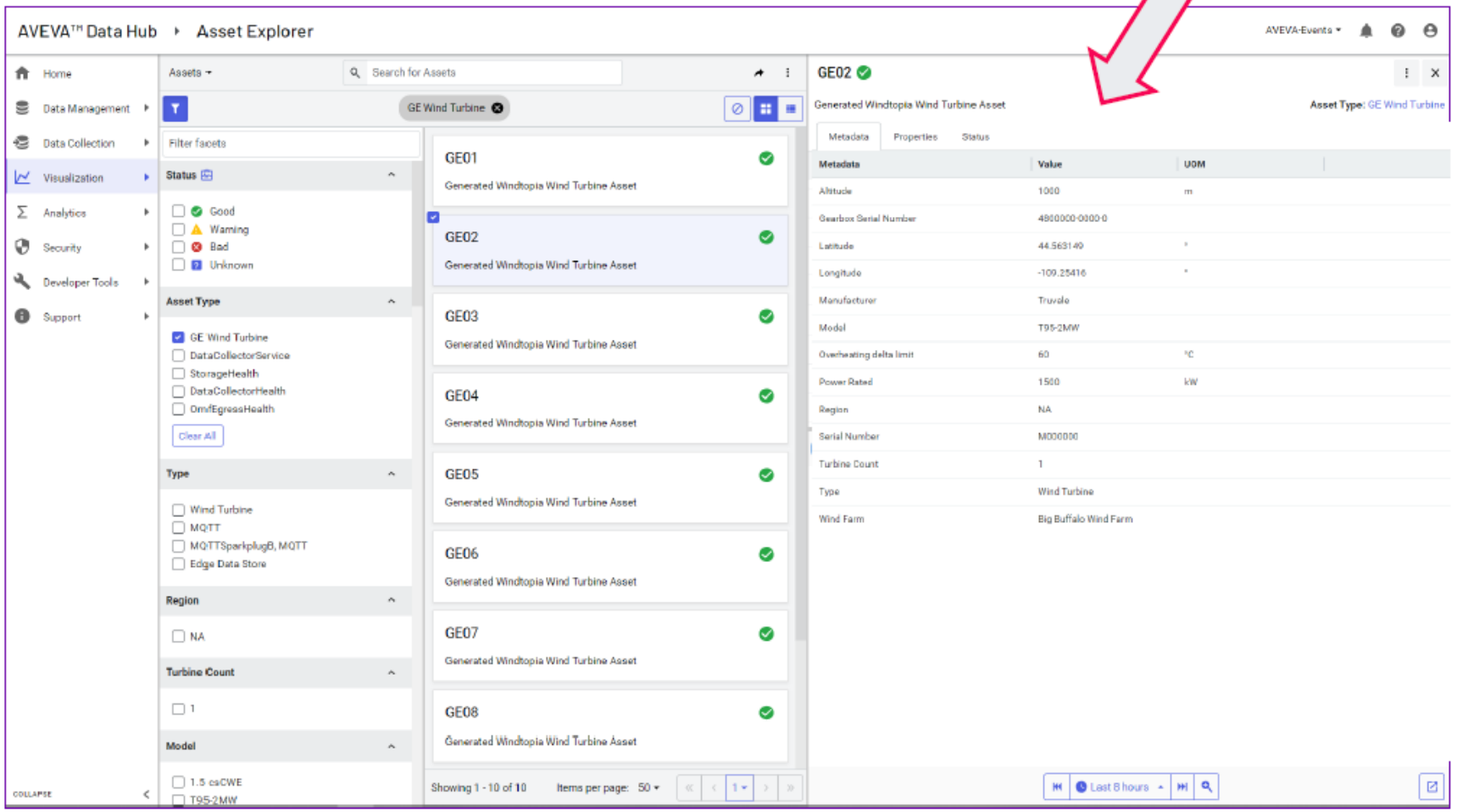
COMPLEX STREAM EXAMPLE

AVEVA

Assets

Meta Data (static attributes)

Asset types & Assets

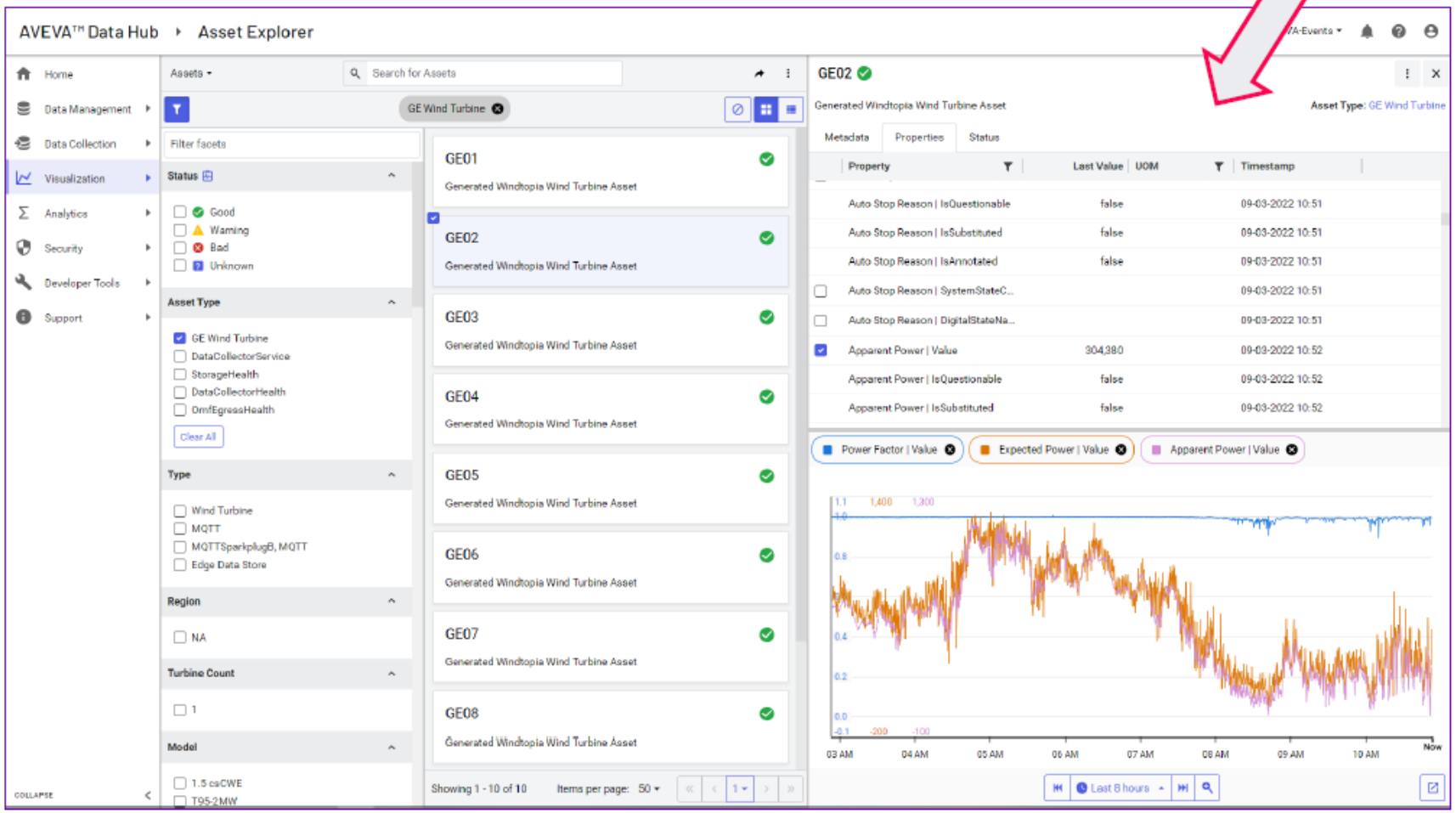


- **Static metadata** (Region: North America, Wind farm: Big Buffalo Wind Farm, Asset Type: GE Wind Turbine, Manufacturer: Truvale, Model: T95-2MW, …)

Assets

Properties (streaming data attributes)

Asset types & Assets

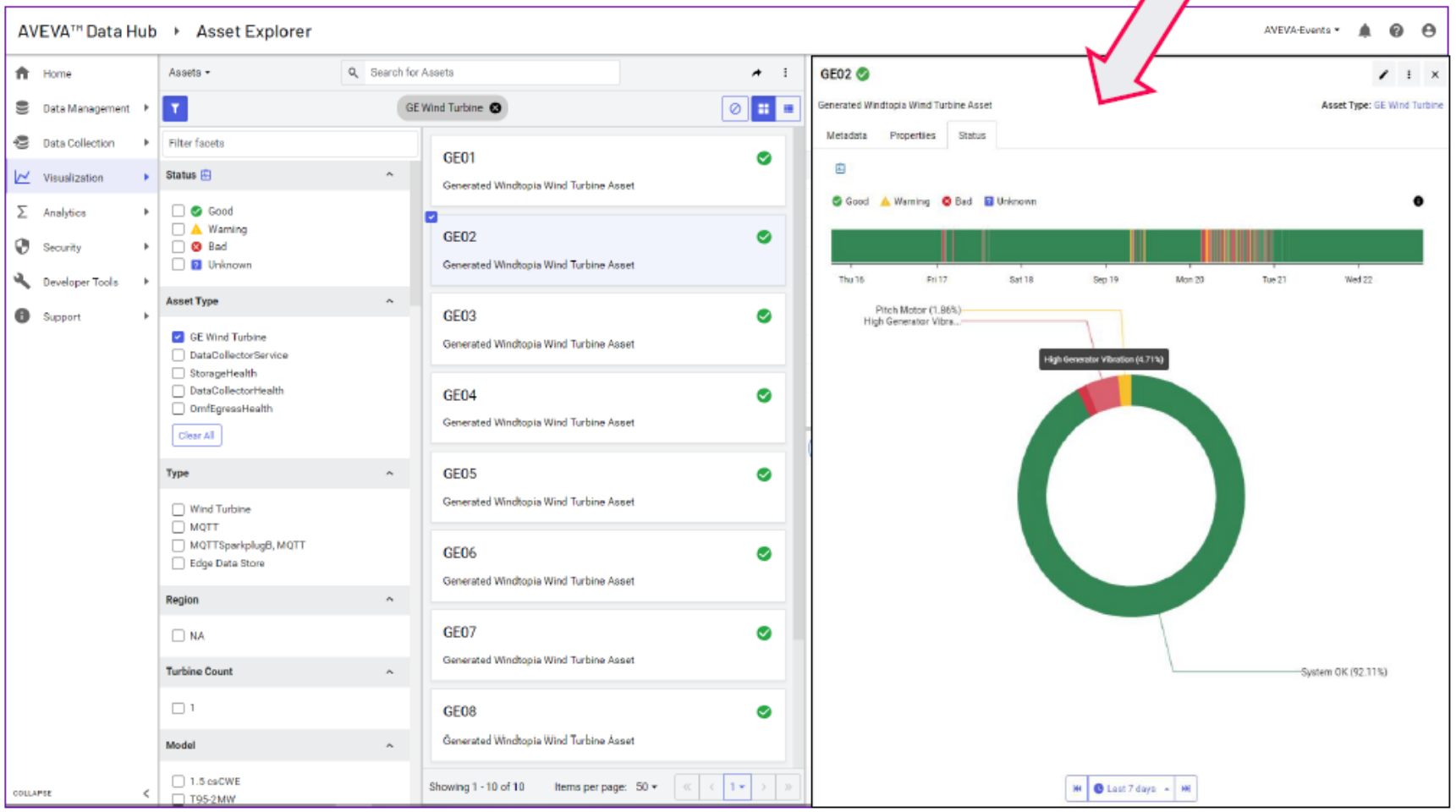


- **Stream reference properties** (Active power, expected power, operating state, etc.)

Assets

Asset Status (current + history)

Asset types & Assets



- **Asset status** (stream property values mapped to status: good, warning, bad)

Use Cases

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AVEVA (PI) World Presentations

- Find 100’s of public use cases here: https://resources.osisoft.com/presentations/

Start Small:
PoC first

Work Use
Case Driven

Happy users
Create Pull

Forget about
the initial ROI

Use cases

PI is the **enabler** not the business case

- Important to understand: **PI is a data platform,** but the value is somewhere else.
  It's the enabler of other Business Cases.
- **Trending & analysis** Eg: Help during startup, batch optimization (golden batch), fouling detection, impact analysis…
- **Predictive Maintenance** can reduce or avoid downtime and associated costs (lost production + cost to repair)
- As input for **Optimizers** can reduce energy costs, financially optimize, etc…
- **Vertical integration** can automate and optimize logistic processes, production planning…

Training Paths

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E-Learning: PI System Infrastructure Specialist training

Class	Link	Comments
PI System: Basics	PI System Basics	Free - 1h
PI Vision: Basics	PI Vision: Basics	5h
PI Vision: Beyond the basics	PI Vision: Beyond the Basics	10h
PI DataLink: Basics	PI DataLink: Basics	4h
Asset Framework: Basics	Asset Framework: Basics	12h
Asset Framework: Beyond the Basics	Asset Framework: Beyond the Basics	6h
PI System Administration: Basics	PI System Administration: Basics	16h
Event Frames and Notifications	Event Frames and Notifications	6h
Introduction to developing with the PI System	Introduction to Developing with the PI System	Free - 2h

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E-Learning: PI System Installation Specialist Training

Class	Link	Comments
PI System Initiation and Planning	PI System - Initiation and Planning	Free - Online - 2h
PI System Implementation and Adoption	PI System - Implementation and Adoption	Free - Online - 2h
PI System Administration: Beyond the Basics	PI System Administration: Beyond the Basics	12h
PI Vision Installation and Migration from PI ProcessBook	PI Vision Installation and Migration from PI ProcessBook	8h
Trouble Shooting Basics for Administrators	Troubleshooting Basics for Administrators	3h
PI System Topologies	?	?
Configuring PI Data Archive Security	Configuring PI Data Archive Security	12h

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Instructor Led Courses

Class	Link	Advised Order	Comments
PI System Administration	PI System Administration - Europe	1	4d Required Starting point
Building PI System Assets and Analytics with AF	Building PI System Assets and Analytics with AF - Europe	2	4d Requires knowledge of the PI system
Visualizing PI System Data (Clients)	Visualizing PI System Data (Clients) - Europe	3	3d No real requirements, but advised to know the PI system before taking this class
PI System Architecture, Planning and Implementation	PI System Architecture, Planning and Implementation - Europe	(optional)	4d Requires knowledge of the PI system (at least the PI System Admin course) Handles: •PI System architecture •PI Interfaces & PI Connector (1st Gen) •Failover •Security •Installing PI Data Archive •Using PI Interface Configuration Utility •Pi Buffering Mechanism •High Availability •Etc…..

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Thank You

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dariens@benelux.avevaselect.com

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Extra Customer Cases

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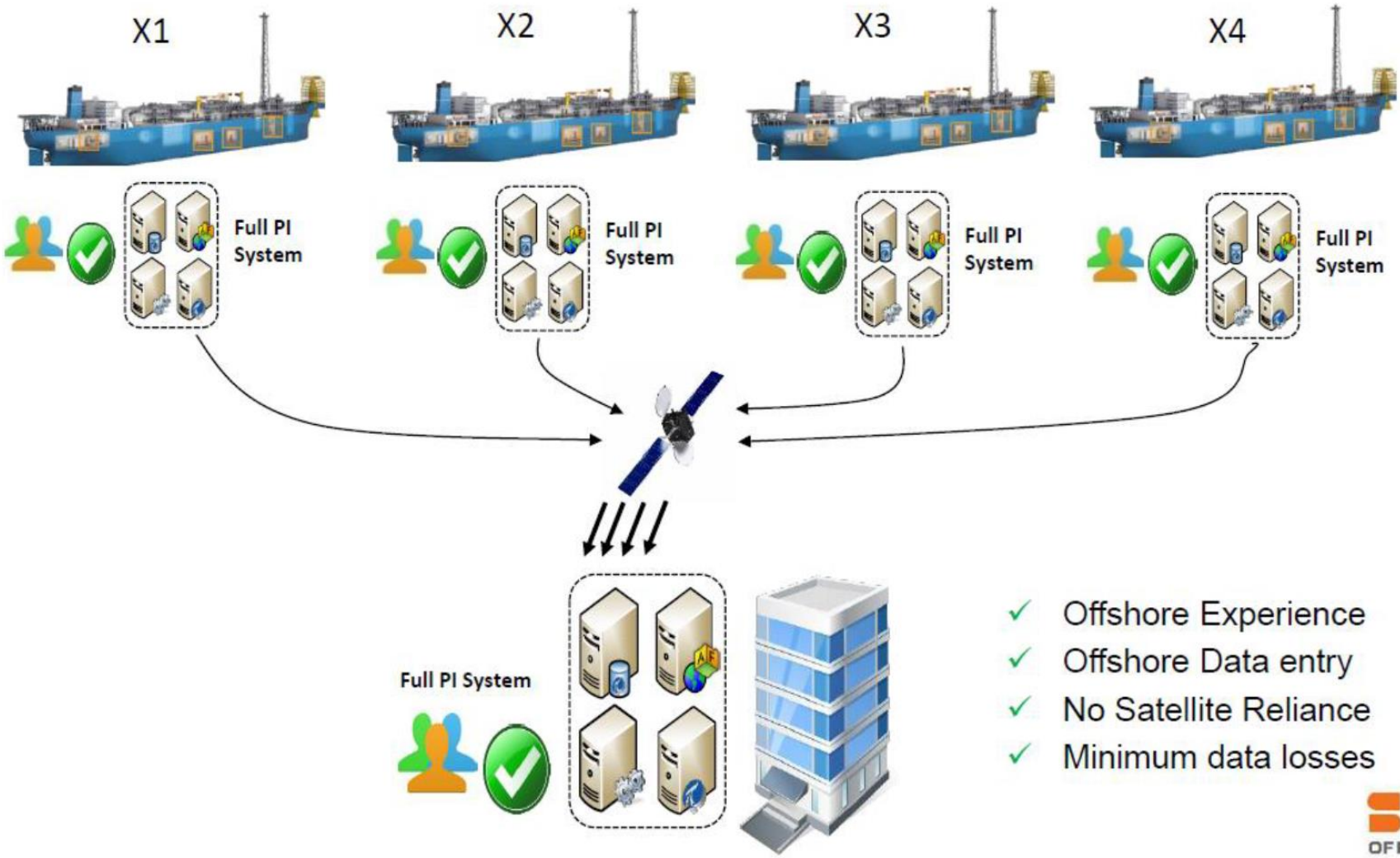
SBM Offshore



- ✓ Offshore Experience
- ✓ Offshore Data entry
- ✓ No Satellite Reliance
- ✓ Minimum data losses

SBM OFFSHORE

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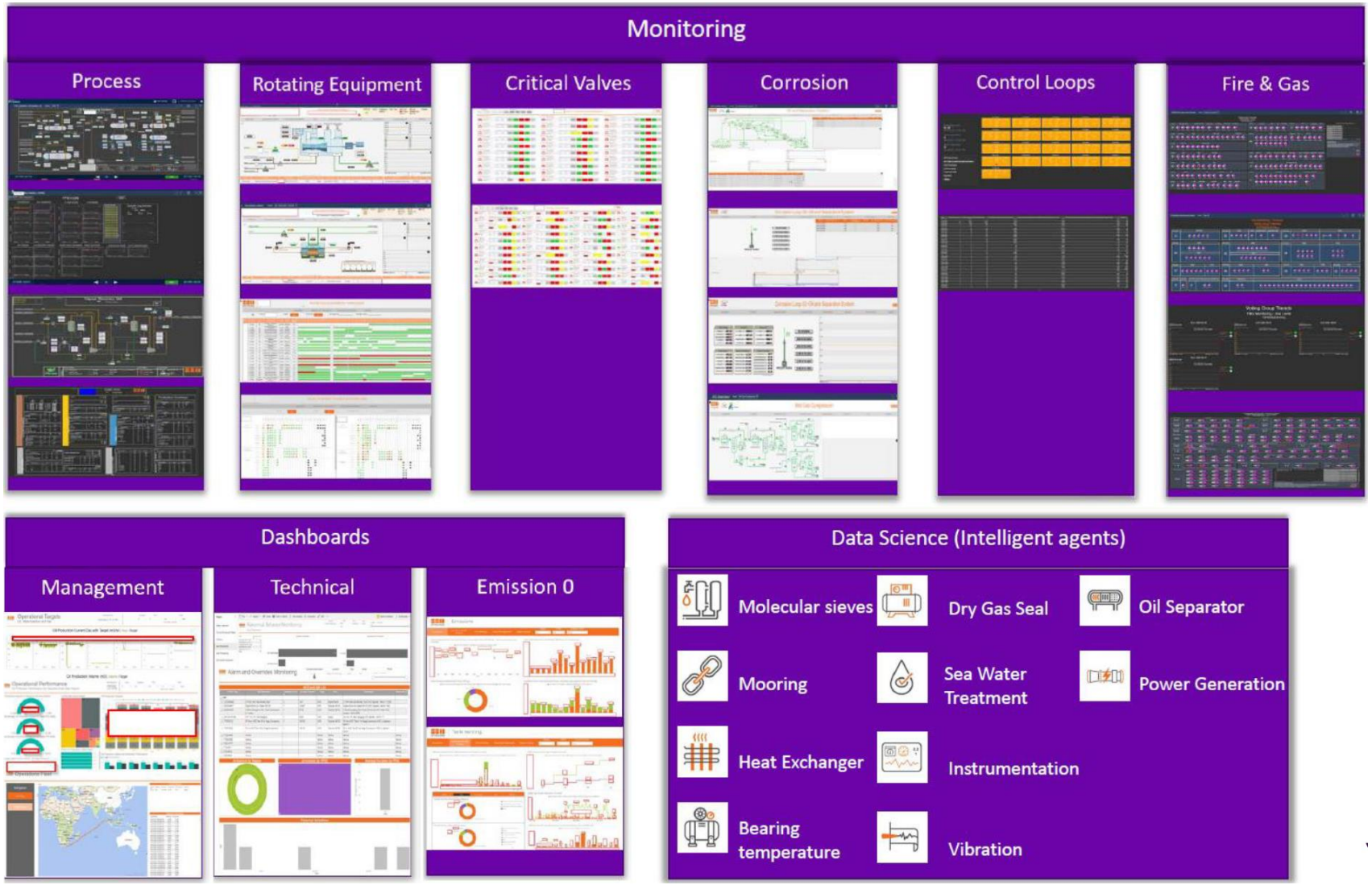
SBM Offshore



AVEVA | SELECT
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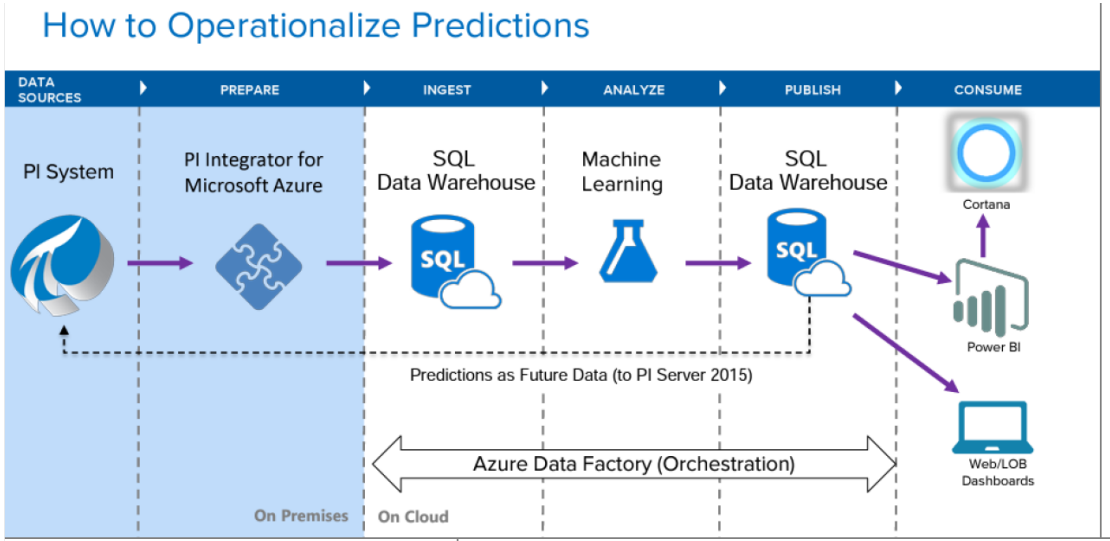
Deschutes Brewery: Reducing Beer Production Time with Predictions



Machine Learning Model

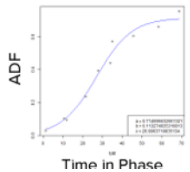
Proposal

Early Density Readings → Transition Time

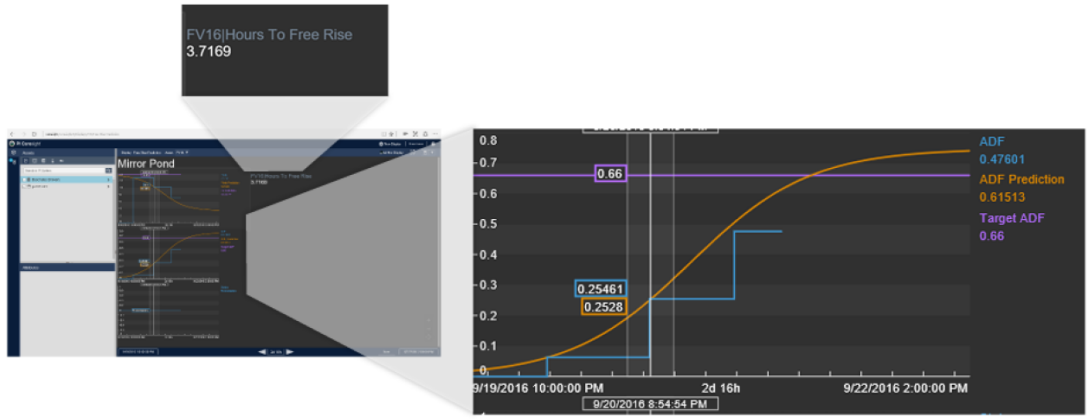
Hypothesis

Transition time influenced by

- Brand of beer
- Fermentation dynamics (temperatures, pressures,..)
- Vessel's dimensions & volume



Operationalizing Predictions on When the Transition Occurs



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DCP Midstream

North America

DCP Midstream, one of the largest midstream services companies in North America, selected the PI System as their strategic enterprise OT infrastructure.

Goals

- Begin digital transformation
- Employee empowerment
- Operational excellence

Challenges

- Existing systems disaggregated, siloed and geared toward control & operations, NOT reporting and analytics.
- Crews lacked any real-time insights, and needed a single, contextualized view of all operations

Results

- Saved $25 million in fiscal year 2017 alone thanks to improved plant operations
- Reduced operations and maintenance costs in 60 gas plants, 11 fractionation plants, and 80 booster stations
- A culture shift from reactive to proactive/predictive and innovative
- Improved customer service and satisfaction

Industry: Oil & gas

Solution: AVEVA™ PI System

"In that first 2017, which in my mind is the ramp up year where we still have a lot of heavy investment…we're starting to see that return. We've already captured that payback"

Kevin Milliman, Director Capital Projects, DCP Midstream

ENI S.A

Italy

Headquartered in Rome, Eni S.p.A. identifies and extracts oil and gas across 79 countries. AVEVA PI System optimizes asset performance and production through real-time on-line modeling.

Goals

- Build a digital twin of oil field assets to run advanced algorithms and production simulations

Challenges

Lack of a real-time data infrastructure resulted in dated simulation models, which led to:

- Poor diagnosing / monitoring of production system
- Bottlenecking and production inefficiencies in new field operating conditions/constraints

Results

- Optimized processes and assets, enabling new production opportunities, early detection of issues, and optimal parameter settings
- Model helped obtain an increase of 60% in oil rate
- Real-time data integration resulted in models updating 2-3 days faster

Industry: Oil & gas

Solution: AVEVA™ PI System

"We can build a model, but we need the PI System"

"If we are not able to visualize what we are building or trending, it's useless… And PI Vision gives us big help for building this type of dashboards"

Luca Cadei, Chairman, SPE YP Italian Section, Eni

EDF

North America

EDF runs fleet-wide monitoring of solar, wind and energy storage using AVEVA Predictive Analytics combined with PI System operational data management. The solution saved £1.5 million in a single early-warning catch.

Goals

- Combine the PI System™ operations data with AVEVA™ Predictive Analytics to mitigate major asset failures and optimize call-out decisions for maintenance crews.

Challenges

- With 39.1 million customers globally, EDF Group's brand image is closely linked to continuity of service
- Major failures could have been avoided before becoming severe, but the company did not have the capability to detect the early warning signs of future asset failures
- They resolved to create five monitoring centers in order to monitor over 300 fossil, nuclear and hydro plants

Results

- Avoidance of downtime resulting from equipment failure
- £1.5 million saved from a single early warning catch

Industry: Power generation

Solution: AVEVA™ PI System and AVEVA™, Predictive Analytics (formerly PRiSM)

"The PI System is designed to support our goals of operational intelligence. The idea is you build systems that take raw data and turn it into actionable information so you can make smarter decisions"

David Rodriguez Sr., Analytics and Intelligence Engineer, EDF Renewables

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Qatar Power and Water

Qatar, UAE

Qatar Power is an independent power and water producer in the State of Qatar. It seeks to reduce costs and improve plant efficiency and safety while meeting an unprecedented demand for water in an extreme climate. The PI System helps Qatar Power to reduce costs and improve safety

Goals

- To provide reliable energy and water under all conditions
- To improve plant efficiency and worker safety

Challenges

- Exponential growth in water demand driven by changing social conditions
- High fluctuations in load demand due to extreme climate.
- High heat and humidity endangers workers

Results

- Seawater margins increased $1.3 million (USD) in the last two years
- $1.4 million (USD) saved in fuel efficiency per year
- No heat-stress related worker incident in the last three years

Industry: Power Generation and Water Utilities

Products: AVEVA™ PI System

"At Qatar Power, we are using this PI System not only for operations, but for maintenance and for the well-being of people who are working in extreme conditions."

Parshu Borkar, Senior Engineer in Commercial and Performance

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AGL Energy

Australia

AGL manages a third of the energy generated for Australia's eastern seaboard. AGL Energy generates energy from thermal power, natural gas, wind power, hydroelectricity, solar energy, gas storage and coal.

AVEVA PI System has helped the company with real-time data and predictive modeling in its growth.

Goals

- Give everyone in the organization access to real-time data to empower employees, expand from real-time awareness to predictive modeling.

Challenges

- Company growth presented challenges in managing data systems. Legacy systems couldn't access real-time data or support predictive analysis.

Results

- Saved Australian A$18.5M in one year
- Avoided a catastrophic shutdown that would have cost A$50-$70M.
- Enabled $18.7 million AUD in avoided losses in three years

Industry: Transmission and Distribution

Products: AVEVA™ PI System

"What came along was a solution that really fit what we needed, and that was the PI System. It could connect to any one of our controllers. We could harvest every piece of real-time data and make it available to every person at AGL"

David Bartolo, Head of Asset Performance, AGL

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UC Davis

University of California, Davis

Growing green: UC Davis, one of the University of California's premier research institutions, is using operational data to reach net-zero emissions goals by 2025.

Challenges

- 1,000 buildings with diverse energy needs
- Self-sustaining budget
- Aging facilities infrastructure

Solution

- AVEVA PI System integrates data from multiple campus systems, AVEVA PI Vision displays it clearly and securely, and AVEVA™ System Platform lets engineers easily adjust control algorithms so utilities run at maximum efficiency.
- Three main sustainability initiatives benefited from real-time data in the AVEVA PI System—optimizing the chilled water system, improving HVAC scheduling, and switching from steam to a low-temperature hot water heating system—have led to massive energy and monetary savings and have ensured UC Davis is on track to meet its net-zero emissions goal.

Results

- Expected annual savings of $150,000 from chilled water optimization and 62% reduction in gas usage from heating system retrofit
- 46% reduction in energy-use intensity since 2009, a cost savings of $15 million
- Projected savings of $197M over 60 years from shift to low-temperature hot water heating

Industry: Facilities

Products: AVEVA™ PI System, AVEVA System Platform

"We've achieved some of the more obvious efficiencies, but to reach our 2025 goal we need to go deeper. That increasingly requires things like user engagement, campus engagement, and optimization. In the last five years, the use of real-time data and the AVEVA PI System has become increasingly integral to our operations and our goals."

David Trombly, Senior Engineer Supervisor, UC Davis

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Covestro

Germany

How process simulation is driving deeper insights with less effort, delivering greater accuracy and driving operational improvements and profitability for global chemicals giant

Goals

- Replace existing, limited online process simulation with a more efficient approach to improve tracking of so-called “non-measurable phenomena” and optimize performance throughout the value chain

Challenges

- Maintenance and replication of simulation models required significant time and effort, which outweighed the value delivered
- Required set-up was tedious and complex
- Lack of graphical user interface hampered troubleshooting and forced reliance on time-based maintenance processes
- Lack of transparency made data interpretation difficult

Results

- Simplified set-up and interpretation of data in real-time enabled more accurate diagnostics and more agile decision-making
- Anticipated reduction in model maintenance effort of 20%
- Ability to easily scale up to use in many more plants, driving comparative value and economies of scale across the business

Industry: Chemicals

Solution: AVEVA™ Process Simulation, AVEVA PI System

“We see opportunities in using PI Asset Framework for easier maintenance of our online models because of the template design, using PI Vision to simplify set-up of the visualizations and reduce maintenance. We plan to use AVEVA Process Simulation which should reduce our maintenance effort of the models by roughly 20%.”

Christian Bratfisch, Computer Aided Process Engineering Software & Modeling Expert, Covestro

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Newcrest Mining

Australia

Newcrest Mining is an Australian-based corporation which engages in the exploration, development, mining and sale of gold and gold-copper concentrate.

Challenges

- 80+ hours of mine downtime due to crushed ore bin sensor failure, and no ability to run models continuously.

Solution

- Real-time data available 24/7 thanks to PI System architecture enabling the use of virtual sensors running ML models to overcome sensor failure.
- Using the PI System as a framework, this data is also used to decide when to retrain and recalibrate the models, so they can constantly improve.
- With the PI System, automations were also set up to notify support when the virtual sensor's confidence in the readings became too low, and to let operators know when it was ready to run again

Results

- Increased throughput by 650 thousand tons in the first six months.
- Decreased crushing circuit downtime by over 50%.
- Enable faster delivery by fostering trust between the Site and IT teams, owing to more responsive and reliable process

Industry: Mining and Metals

Solution: AVEVA™ PI System

For Newcrest, the answer was "a scalable modern platform for collection and mobilization of data to produce digital outcomes for our company, as well as advanced analytics, such as AI and data science."

Nevena Andric, IT Solutions Lead at Newcrest Mining

Kellogg’s

USA

Kellogg’s is an American multinational manufacturer of cereal and convenience foods. Kellogg’s uses the PI System to set and reach 10-year energy targets

Challenges

- Meet aggressive energy targets and reduce overall energy consumption.
- Reduce energy consumption of 44 HVAC units
- Building pressure problems led to using poor quality air from outside that introduced food safety risks

Solution

- Installed gas, air, and voltage meters
- Used AVEVA PI System to create a data-driven ecosystem that benchmarked usage and identified inefficiencies. Uncover more energy efficient process solutions
- Discovered that they were heating, then cooling the air flow for 44 HVAC units

Results

- Saved $350k/year on HVAC units alone
- Saved $3.3 million annually
- Claimed an additional $1.8 million in rebates

Industry: Consumer packaged goods

Solution: AVEVA PI System

“Our plant is saving $3.3M annually and we’ve claimed $1.8M in rebates – and those rebate unlocks don’t come without data.”

John Gothberg, Engineering & Facilities Manager

Dominion Energy

USA

Providing real-time renewables data to customers across 16 states and supporting ESG pledges for customers across the USA

Goals

- Collate data streams from multi-sourced and distributed power generation units and provide integrated data and metrics to be used for ESG reporting by Dominion themselves, and also by Dominion's customers, through their cloud-based data platform.
- Enhance visibility and efficiency with secure shared insight into energy and power generation and asset utilization, enabling efficient energy use and mitigating costs and potential critical outages.

Results

- Secure wind and solar generation data visualization successfully deployed to data platform, via the AVEVA Data Hub cloud.
- Real-time and dynamic cloud-based data is gathered from the power-generation network and made available to its residential, commercial and wholesale customers, enabling companies to validate their renewable energy commitments and ESG reporting requirements.
- Secure real-time access to data provides ESG assurance for Dominion, ending the need for static reporting of renewable energy resources.

Industry: Power

Solution: PI System ™ and AVEVA™ Data Hub

"Working with PI System has definitely opened our team's ability to get access to data quickly and be able to share and dive into insights more readily, so we can quickly diagnose and return units to service. PI System also gives us the ability to pool different data sources together to make those decisions."

Mike Timmons, Power Generation Excellence Manager, Dominion Energy

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AVEVA

DCP Midstream

DCP Midstream selected the PI System as their strategic enterprise OT infrastructure

Model helped reduce the lower operating limit from 70% to 30%

Saved $25 million in fiscal year 2017 alone due to improved plant efficiencies

The PI System provided immediate, self-service value and improved customer satisfaction

ENI S.A.

AVEVA PI System optimizes asset performance and production through real-time on-line modeling

Model helped obtain an increase of 60% in oil rate

Real-time data integration resulted in models updating 2-3 days faster

Kellogg’s

Kellogg’s uses the PI System to set and reach 10-year energy targets

“Our plant is saving $3.3M annually and we’ve claimed $1.8M in rebates – and those rebate unlocks don’t come without data.”

John Gothberg
Engineering & Facilities Manager

PETRONAS

PETRONAS increased operational efficiency and output at its brownfield refinery at Mekala.

Petronas deployed the complete suite of AVEVA asset performance management software, built on PI System.

Uptime improved by 5% and maintenance costs reduced by >10%

“We want to make the [PI System-based] solution more integrated and more embedded to the engineers that really need to use it…because we know it's simple, and because we know it works.” **Khairil Azwan Khabri, Head Reliability Manager, PETRONAS**

UCDAVIS

On track to be carbon-neutral by 2025

Using AVEVA System Platform and AVEVA PI System to control and assess sustainability performance across its multiple campuses

Expected annual savings of $150,000 from chilled water optimization, and 62% reduction in gas usage from heating system retrofit

46% reduction in energy-use intensity since 2009, a cost saving of $15 million

AVEVA

EDF runs fleet-wide monitoring of solar, wind and energy storage using AVEVA Predictive Analytics combined with PI System operational data management. The system saved £1.5 million in a single early-warning catch.

"The PI System is designed to support our goals of operational intelligence. The idea is you build systems that take raw data and turn it into actionable information so you can make smarter decisions."
David Rodriguez, Sr. Analytics & Intelligence Engineer, EDF Renewables

Newcrest Mining

Australia-based mining company, Newcrest Mining, crushes its goals with the PI System

Model helped reduce the lower operating limit from 70% to 30%

Increased throughput by 650 thousand tons in the first six months

Enable faster delivery by fostering trust between the Site and IT teams, owing to more responsive and reliable process.

Xcel Energy uses the PI System to improve wind forecasting

Xcel provides power for 3 million electric customers & 1.9 million natural gas customers across 8 US states

A reduction in the need to quickly shift to coal and gas plants, resulting in savings of more than $7 million per year

Extra Information

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BENELUX & SCANDINAVIA

AVEVA Edge Data Store and AVEVA Adapters

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PI Interfaces, PI Connectors, AVEVA Adapters

Comparison Table

	Remote management capabilities	Auto-discovery on data sources	Supports Linux, ARM Linux, and Windows	Deployable using Docker containers	Includes buffering	Client- and server-side failover	Encrypts egressed data	Can write to AVEVA PI Server	Can write to AVEVA Data Hub	Can write to Edge Data Store	Can be remotely installed as modules	Offers multiple authentication methods
PI Interfaces	✗	✗	✗	✗	✓	✓	✓	✓	✗	✗	✗	✗
PI Connectors	✓	✓	✗	✗	✓	✓	✓	✓	✗	✗	✗	✗
AVEVA Adapters	✓ (module versions only)	✓	✓	✓	✓	✓*	✓	✓	✓	✓	✓	✓

*Currently available in the downloadable install kit for direct installation for AVEVA Adapter for OPC UA and the AVEVA Adapter for MQTT (Generic and SparkplugB). It will be available for more AVEVA <data sources> and Docker container module versions of the software later this year.

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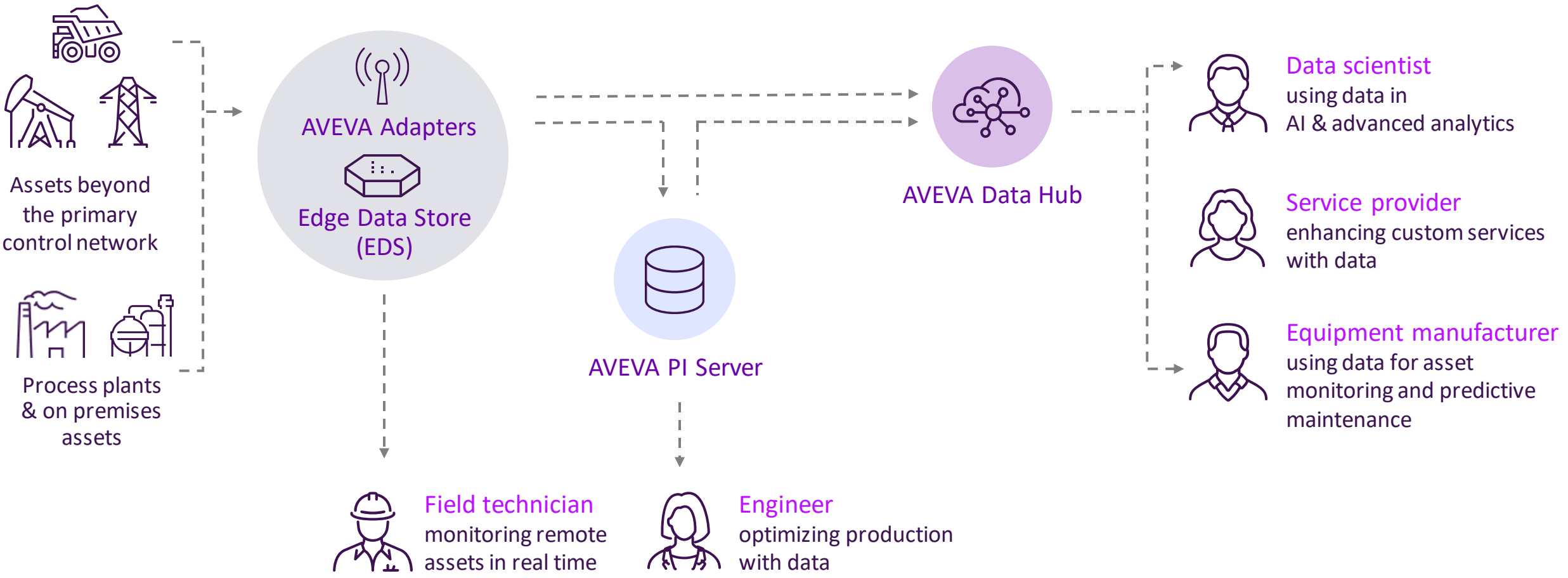
Edge Data Store brings remote data out of the shadows

Where AVEVA PI Server is not practical or cost effective

- **Lightweight data management software** for cost-effective data collection from thousands of remote assets
- **Out-of-the-box connectivity** via common industrial protocols **requires no local IT support**
- Give local technicians in remote locations **access to real-time performance data and edge analytics**
- **Native transfer** to AVEVA PI Server and/or AVEVA Data Hub

Pervasive data connectivity for your business



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AVEVA Adapters

Add real-time data from additional critical sources. Ready off-the-shelf, lightweight, flexible end-points

- **Cross-platform** (Windows, Linux, Docker)
- **Resilient,** suitable for **harsh, remote and/or uncrewed environments**
- **Multiple, flexible end-points,** send data to Edge Data Store, AVEVA PI Server and AVEVA Data Hub
- Out-the-box connectivity to standard industrial protocols:
  - OPC UA
  - Modbus TCP
  - DNP3
  - BACnet
  - MQTT
  - RDBMS
  - Structured Data Files
  - Azure Event Hubs

AVEVA PI Integrator for Business Analytics

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AVEVA PI Integrator for Business Analytics

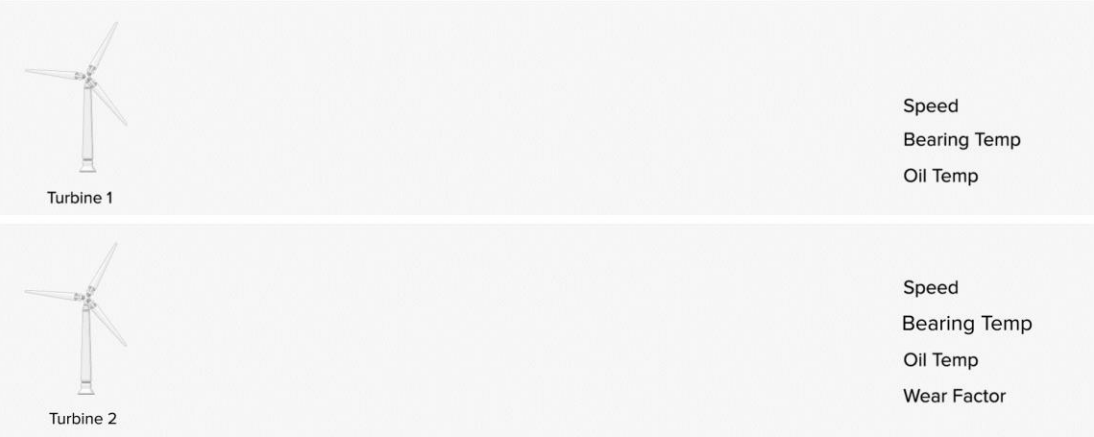
Less time wrangling, more time analyzing

- **Format complex datasets** you've targeted for analysis.
- **Cleanse** outliers and **uneven data** points.
- **Shape** and **augment** raw sensor data.
- **Transmit your analysis-ready data** to BI tools and machine learning algorithms.

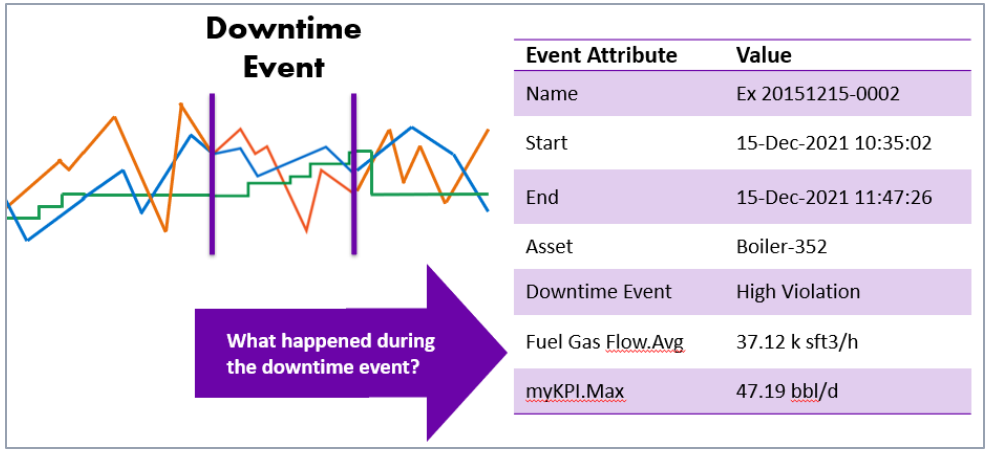
Operational data is not like other data

In raw form, it's virtually useless for analysis and cannot be combined with business data

Time-series data is not naturally aligned



One data stream can represent many discrete events or products



Event Attribute	Value
Name	Ex 20151215-0002
Start	15-Dec-2021 10:35:02
End	15-Dec-2021 11:47:26
Asset	Boiler-352
Downtime Event	High Violation
Fuel Gas Flow.Avg	37.12 k sft3/h
myKPI.Max	47.19 bbl/d

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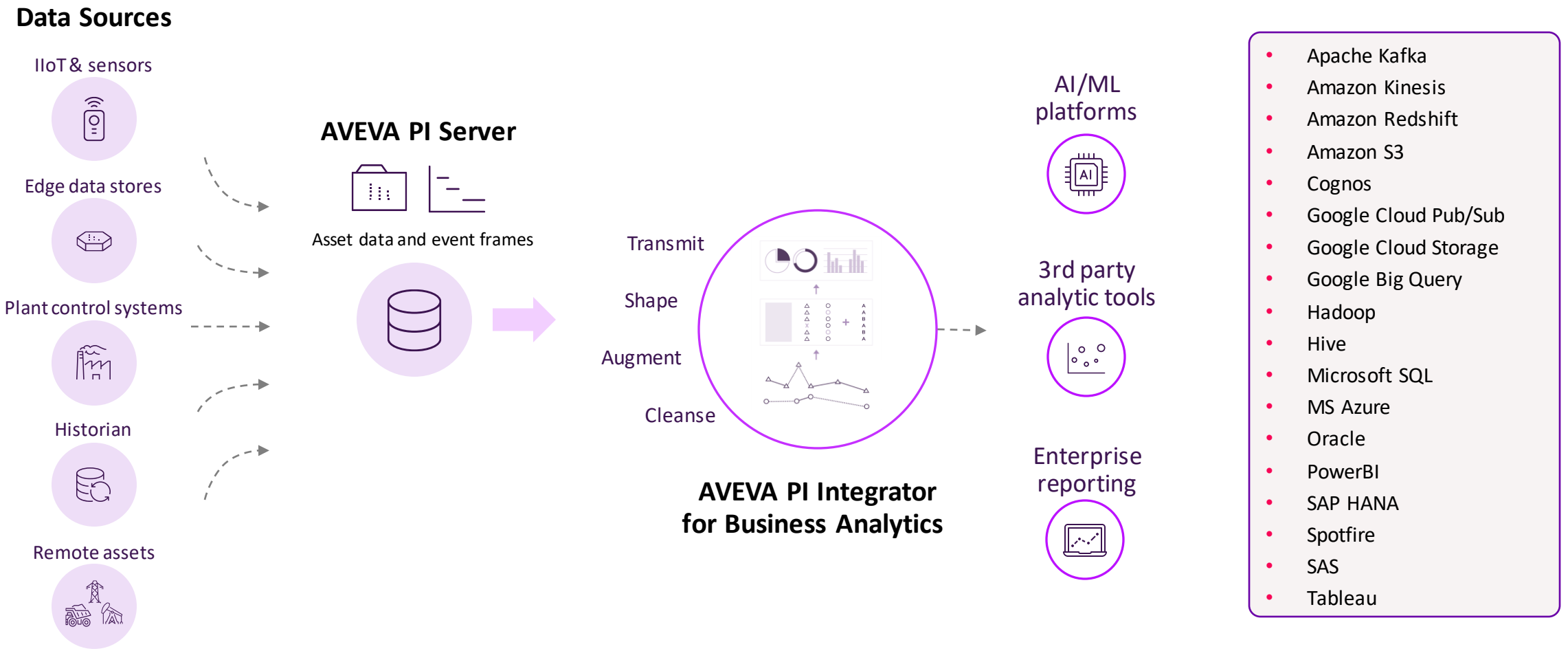
AVEVA PI Integrator for Business Analytics sets foundation to accelerate advanced analytics and business intelligence



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AVEVA PI Integrator for Business Analytics is your solution if you need to

Identify opportunities to increase production and reduce operating costs

Prepare compliance and regulatory reports

Run predictive analytics, AI, ML, business intelligence and data science applications

Integrate operations data with other business data with zero custom code

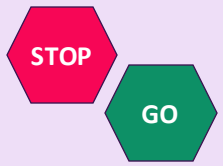
Or export data to perform analyses that are NOT available with AVEVA PI Server's Asset Analytics

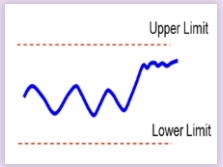
AVEVA | SELECT BENELUX & SCANDINAVIA

Operational

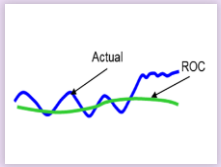
Calculations & analytics with AVEVA PI Server's Asset Analytics

Equipment status





Equipment usage



Timers & counters

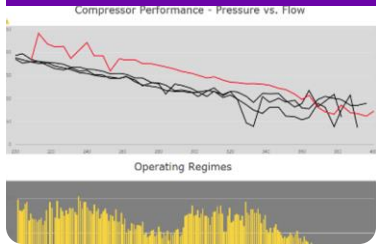
LOGIC

Operating envelopes

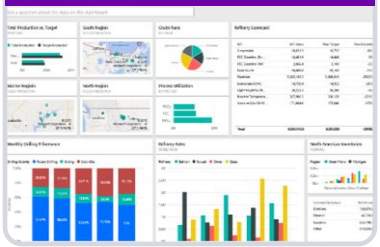
Enterprise

AVEVA PI Integrator for Business Analytics provides data in context for advanced analytics

Multi dimensional analysis



Complex statistical analysis



Complex statistical analysis

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My Workspace

Filter content

Dashboards

Oil and Gas Operations

Reports

You have no reports

Datasets

No datasets found

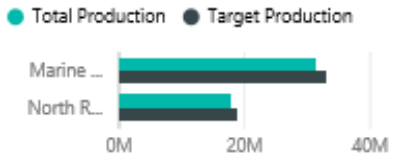
Oil and Gas Operations

Share Dashboard

Ask a question about the data on this dashboard

Total Production vs. Target

BY REGION



South Region

FIELD PRODUCTION

Process Utilization

BY PROCESS

Refinery Scorecard

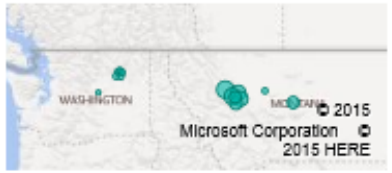
KPI	KPI Value	Plan Target	Plan Deviation
Conversion	10,651.5	10,752	-100.5
FCC Gasoline (R+...	14,481.6	14,448	33.6
FCC Gasoline RVP	2,066.4	2,100	-33.6
Feed N+2A	20,008.8	20,160	-151.2
Feedrate	5,663,192.2	5,688,816	-25623.8
Isomerate RONC	14,750.4	14,952	-201.6
Light Naphtha 90...	30,223.2	30,240	-16.8
Reactor Temperatu...	327,906.5	330,120	-2213.5
Vacuum Gas Oil 90...	171,864.0	173,040	-1176.0
Total	**6,255,144.6**	**6,284,628**	**-29483.4**

Marine Regioin

PI CORESIGHT

North Region

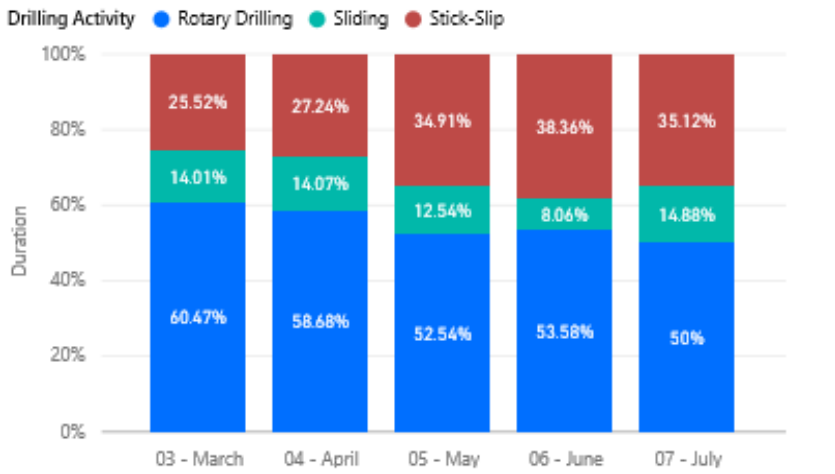
FIELD PRODUCTION



Crude Runs

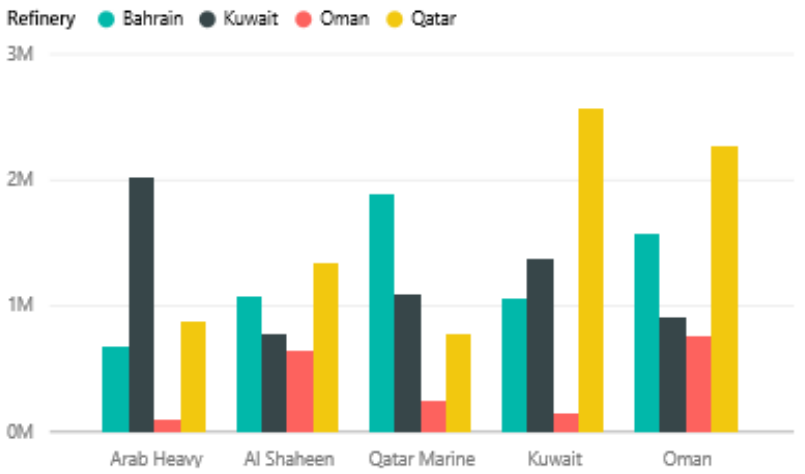
BY CRUDE

Monthly Drilling Prformance



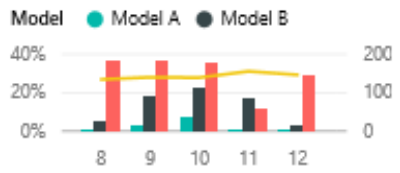
Refinery Rates

CRUDE RUNS



Asset Downtime

BY MONTH, MODEL



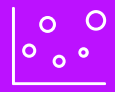
Product Inventory

Commodity Group	Net Volume
Distillate	308,870.20
Ethanol	42,726.94
Gasoline	835,106.18
Total	**2,005,540.25**

In a nutshell

Time-series

There is no better tool than the **AVEVA PI System to handle time-series data**



Analytics

When speaking about analytics, there are **so many things which can been done** with simple **calculations within AVEVA PI Server**

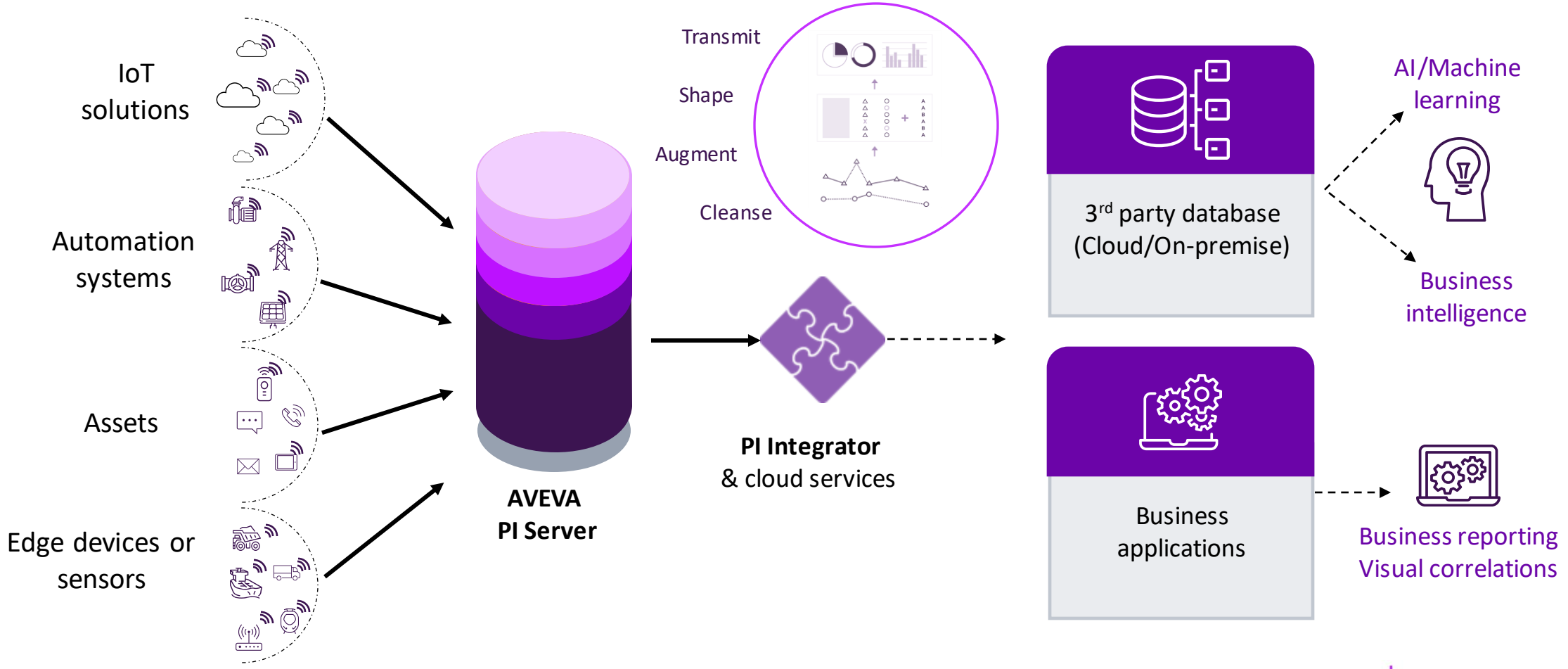
Operational data

AVEVA PI Integrator for Business Analytics tremendously **reduces the data prep time** required by time-series data before it can be integrated into Your business analytics projects

AVEVA | SELECT BENELUX & SCANDINAVIA

Advanced analytics with industrial real-time data

How AVEVA PI System sets foundation?



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AVEVA PI Integrator for Business Analytics

One product, multiple integrations, with zero custom code

List of supported 3rd party applications

- Apache Kafka
- Amazon Kinesis
- Amazon Redshift
- Amazon S3
- Cognos
- Google Cloud Pub/Sub
- Google Cloud Storage
- Google Big Query
- Hadoop
- Hive
- Microsoft SQL
- MS Azure
- Oracle
- PowerBI
- SAP HANA
- Spotfire
- SAS
- Tableau

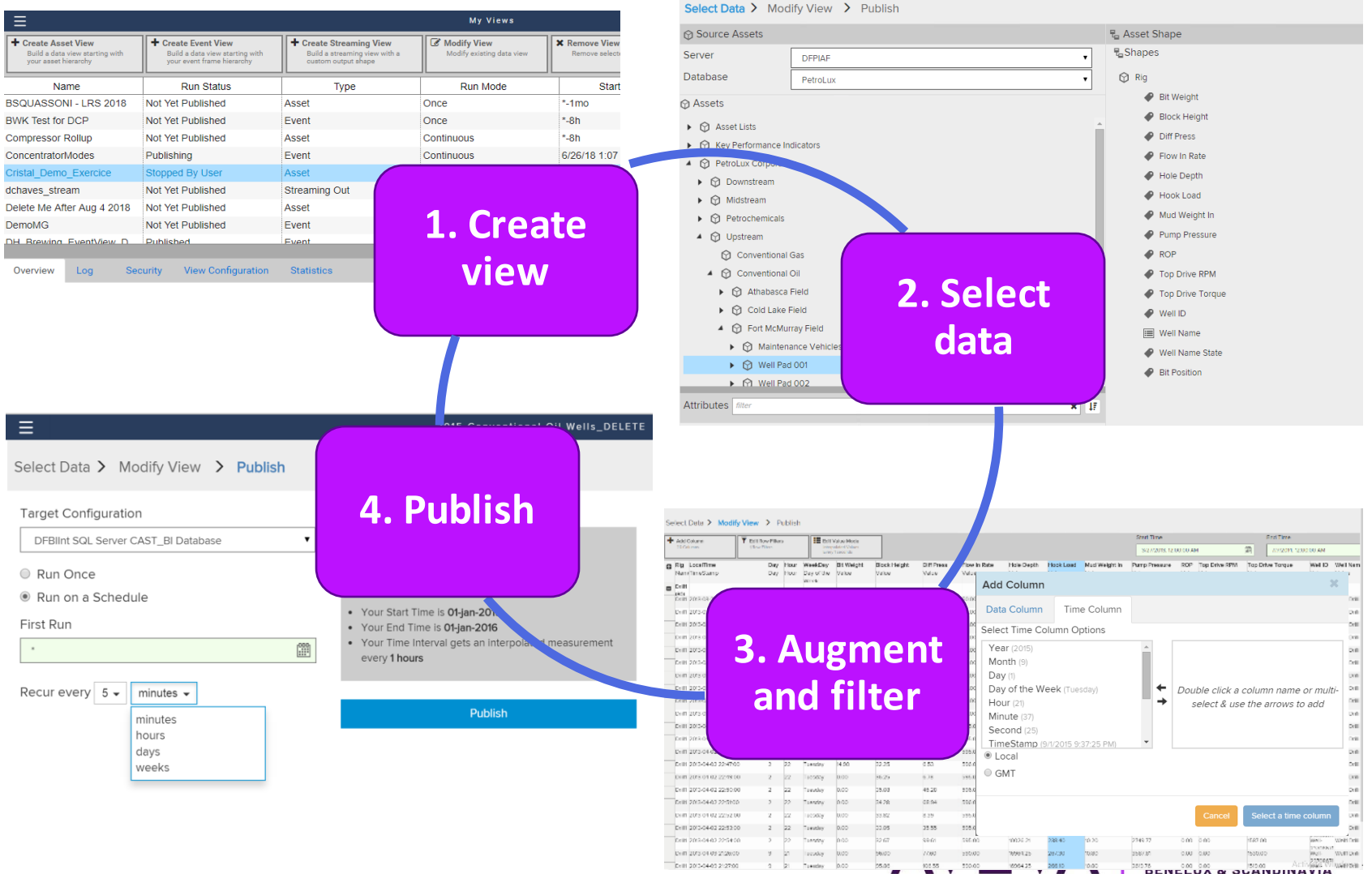
AVEVA | SELECT BENELUX & SCANDINAVIA

AVEVA PI Integrator for Business Analytics - 4 simple steps

Collect

Store and enhance

Deliver



Capabilities enabled by AVEVA PI Integrator for Business Analytics

Standard edition

- Enterprise reporting
- Visual business intelligence
- Combine operations and business data

Scheduled, bulk data updates

Advanced edition

- Train a new predictive algorithm
- Continuously retrain a predictive algorithm
- Operationalize models using most recent data

Continuously streaming data

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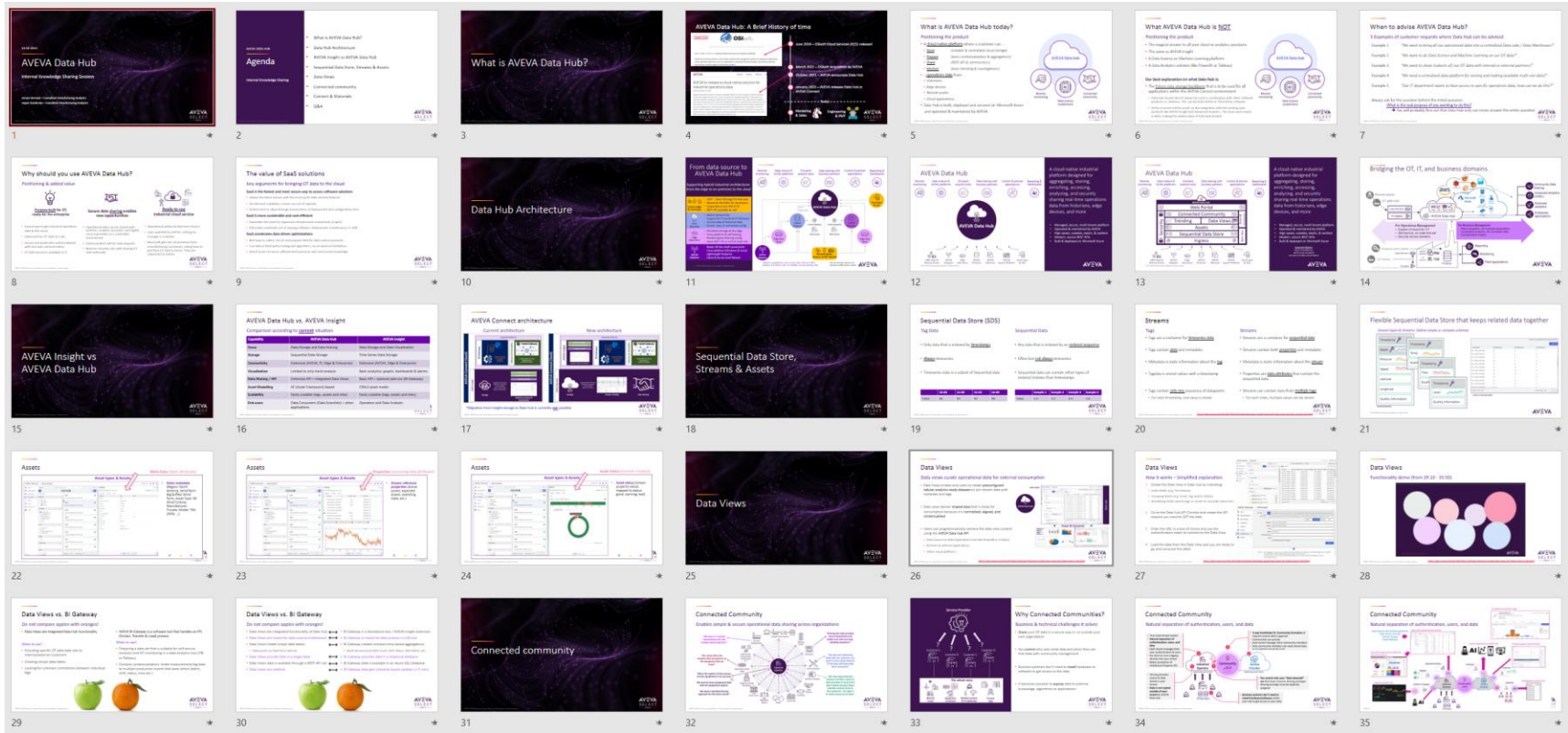
AVEVA Data Hub

AVEVA | SELECT BENELUX & SCANDINAVIA

ZIE Presentatie Jasper/Jeroen

...\Eight Lakes\AVEVA Select Benelux - Documents\AVEVA Portfolio explained\AVEVA_Data_Hub

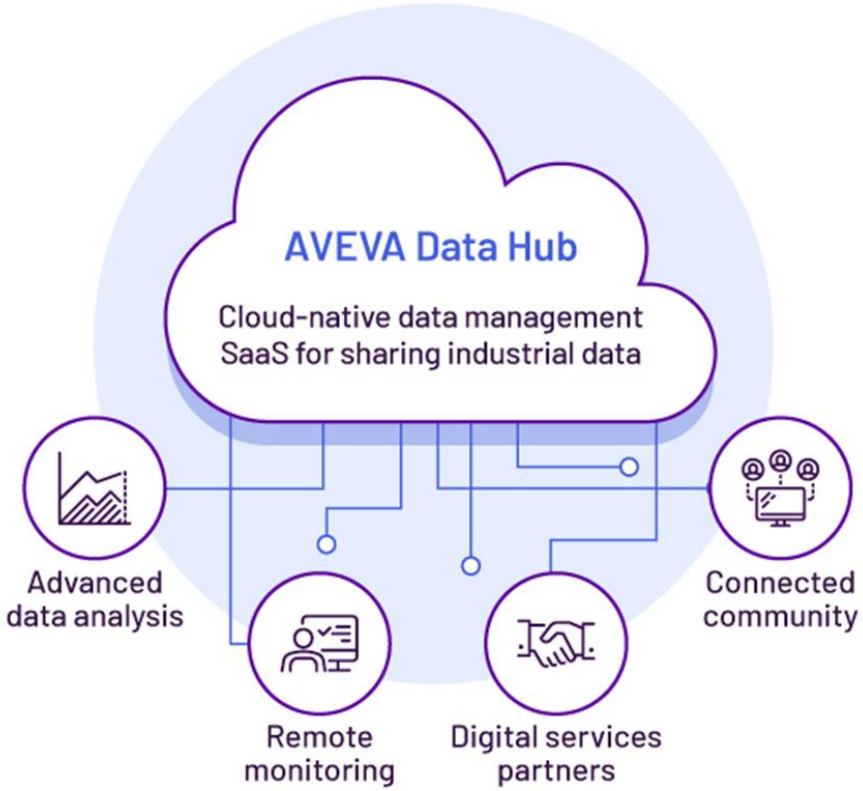


AVEVA | SELECT BENELUX & SCANDINAVIA

Extend the value of AVEVA PI System via the cloud

Engage new personas, enable new use cases, expand value of industrial data

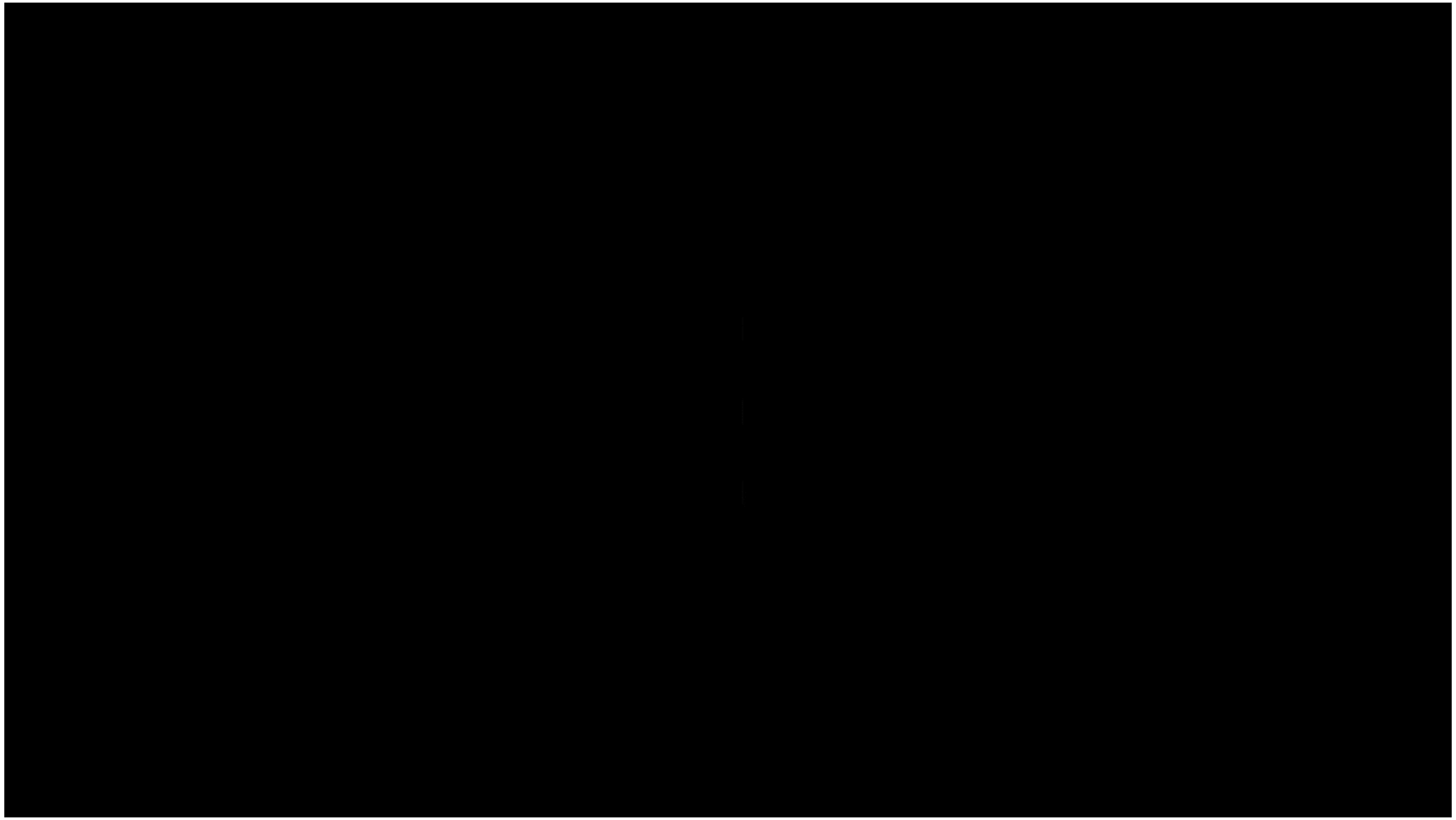
- **Purpose built,** to meet the demands and challenges of industrial information
- Simple, **secure data sharing** with trusted partners and experts
- Rapid time-to-value with **native integration** to AVEVA PI Server and Edge Data Store
- Scalable foundation for new digital service business. Get up and running in **minutes, not months**



AVEVA | SELECT BENELUX & SCANDINAVIA

AVEVA Data Hub gives users inside and outside the organization the information they need to make meaningful change

Reduce the time, effort and resources to collect, centralize and securely share operations data



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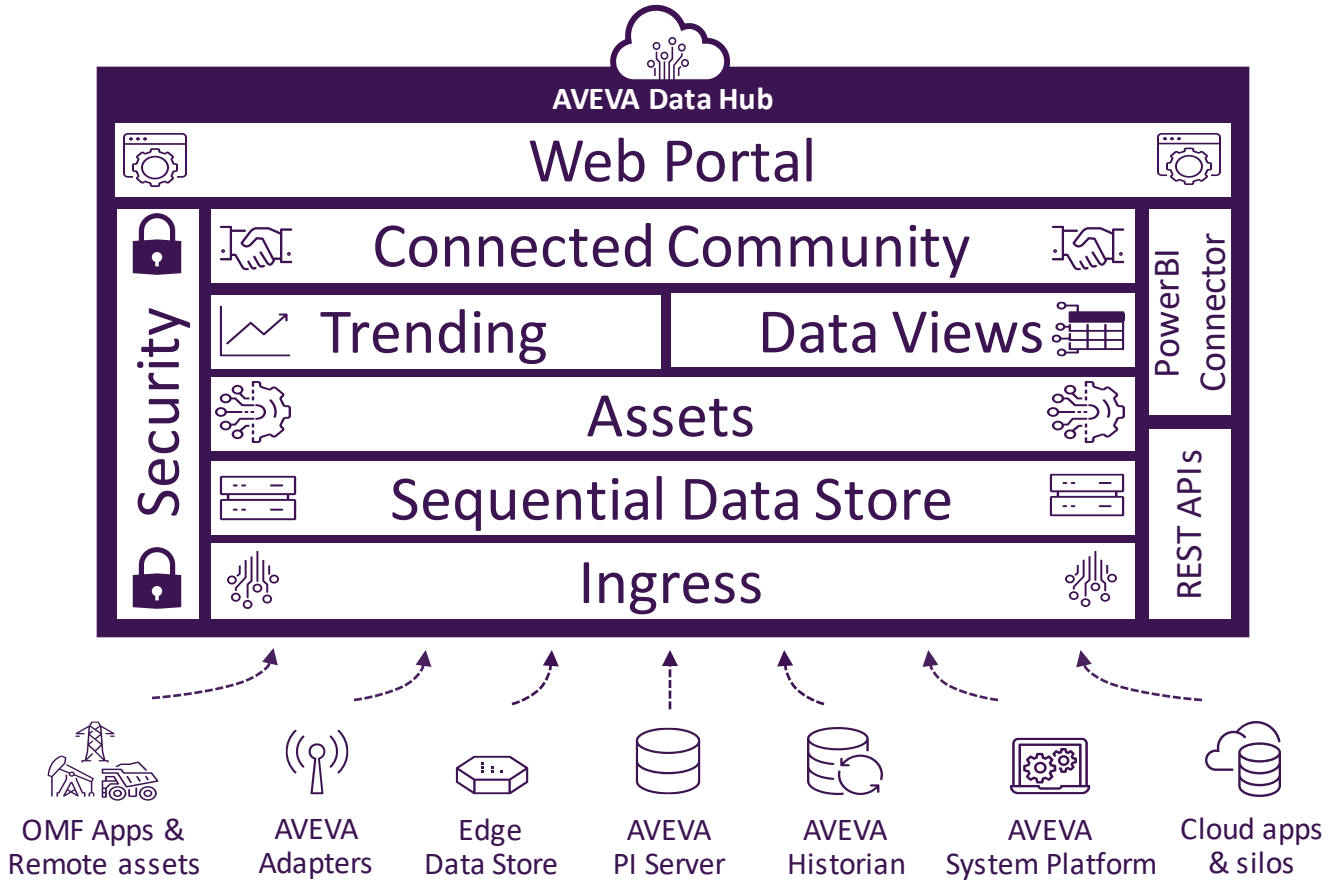
AVEVA Data Hub



A cloud-native industrial platform designed for aggregating, storing, enriching, accessing, analyzing, and securely sharing real-time operations data from historians, edge devices, and more

- Managed, secure, multi-tenant platform
- Operated & maintained by AVEVA
- High speed, scalable, elastic, & resilient
- Modern, secure REST APIs
- Built & deployed on Microsoft Azure

Supported Regions
West US (California)
North Europe (Ireland)
Australia East (New South Wales)

AVEVA Data Hub connected community

Enables simple & secure operational data sharing across organizations

Achieve a more secure way of sharing your data

Manage users in your AVEVA Connect account

Easily connect to your trusted business partners in an AVEVA Data Hub community

Gain control and transparency over your shared data

Works great with AVEVA PI Server & other AVEVA historians

(but not required)

Scale your sharing to many business partners

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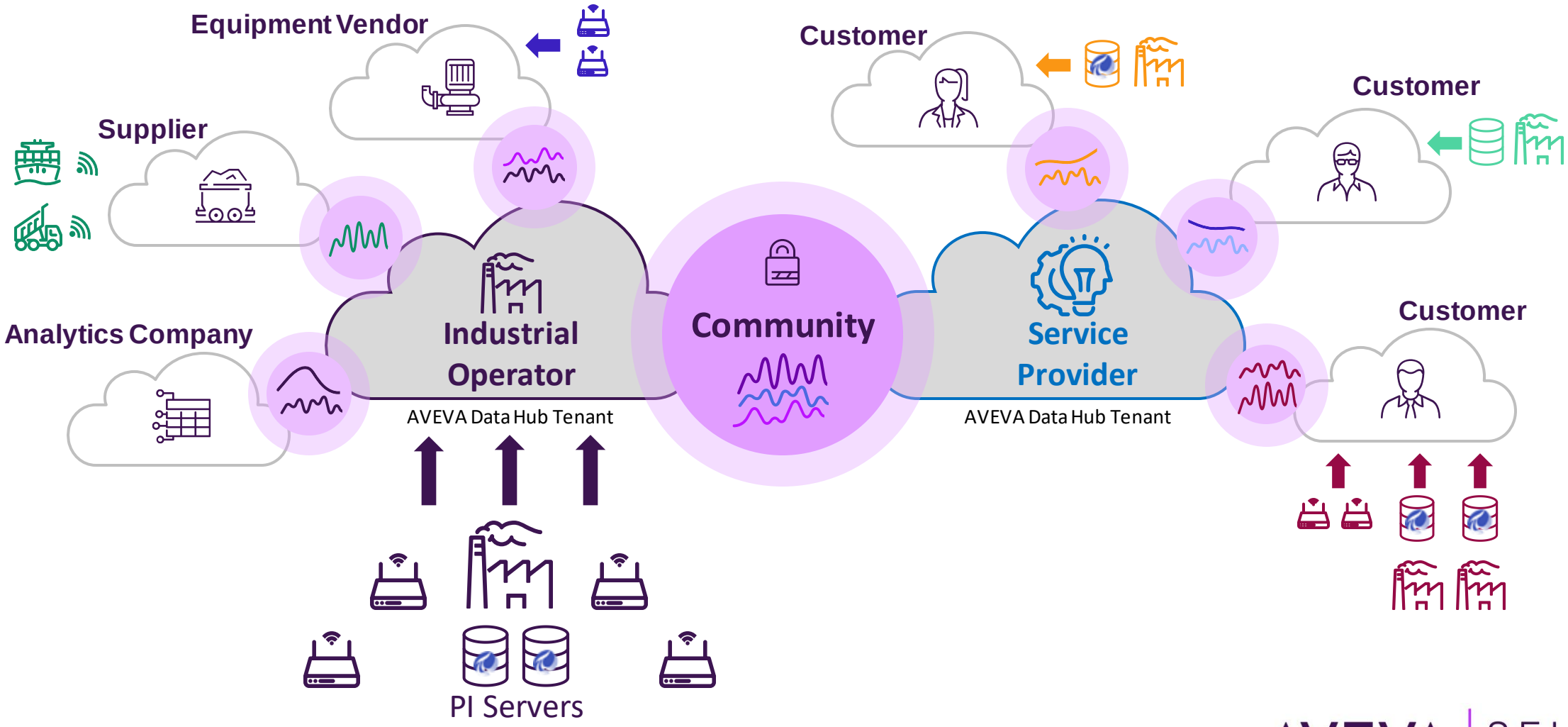
Connected community: Powering your industrial ecosystem



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What’s next for AVEVA Data Hub?

Recently released

Seamless infrastructure

Community Data Sharing (Streams)

Enable cross-tenant data sharing of streams with your business partners, service providers, and analytics providers

PI to AVEVA Data Hub enhancements

Adding support to edit an existing transfer; Replication of data changes in PI Server to AVEVA Data Hub

Manageable software

OCS to AVEVA Data Hub migration

Support for migration from existing OCS tenants to AVEVA Data Hub tenants

Increased value and scope

AF in PI to AVEVA Data Hub

Leverage your existing AF context by transferring AF representation to AVEVA Data Hub Assets

Data Views from shared data

Ability to create a curated data view from Community shared streams

In development

Seamless infrastructure

Event Broker

Ability to sign up for and query changes to stream data

Increased value and scope

Event Data Store

Ability to store event data in AVEVA Data Hub and provide a rich contextual search API for retrieving the information

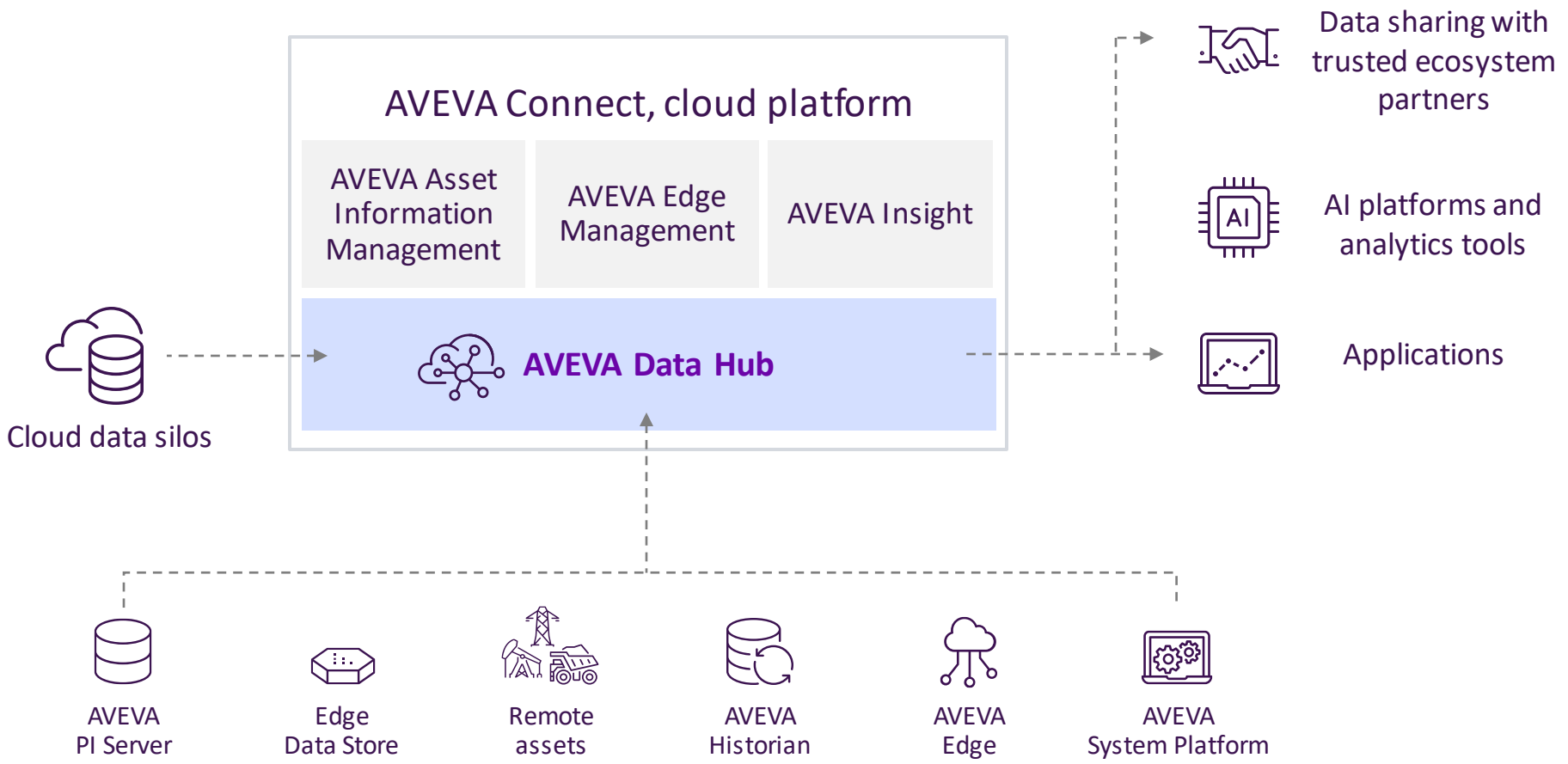
Collecting feedback

Seamless infrastructure

Community Data Sharing (Assets)

Enable cross-tenant data sharing of assets

Better together: AVEVA Data Hub is available on AVEVA Connect



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