

AVEVA Advanced Analytics

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AVEVA



According to Seagate,
only **32%** of the data available
to enterprises was put to work

56%
of data is
captured through
operations

44%
of data goes
uncaptured

57%
of captured
data is **used**

43%
remains
largely **unused**

68%
of data goes
unleveraged

Source: The Seagate Rethink Data Survey, IDC, 2020



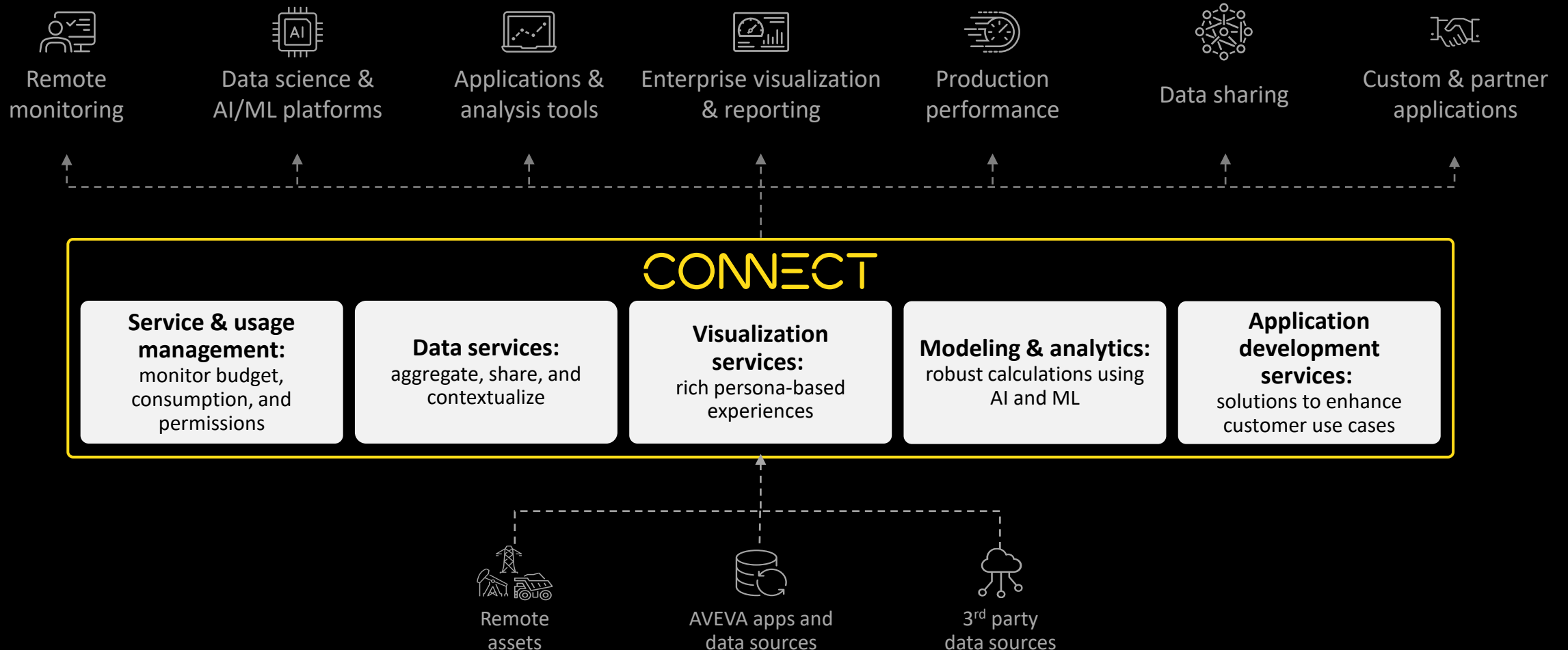
38%

of new operational data
will be stored and
processed in the cloud.
This is an increase of 16%
since just two years ago.

Source: IDC, "Worldwide IT/OT Convergence Survey, 2022", Jonathan Lang, Sept 2022.

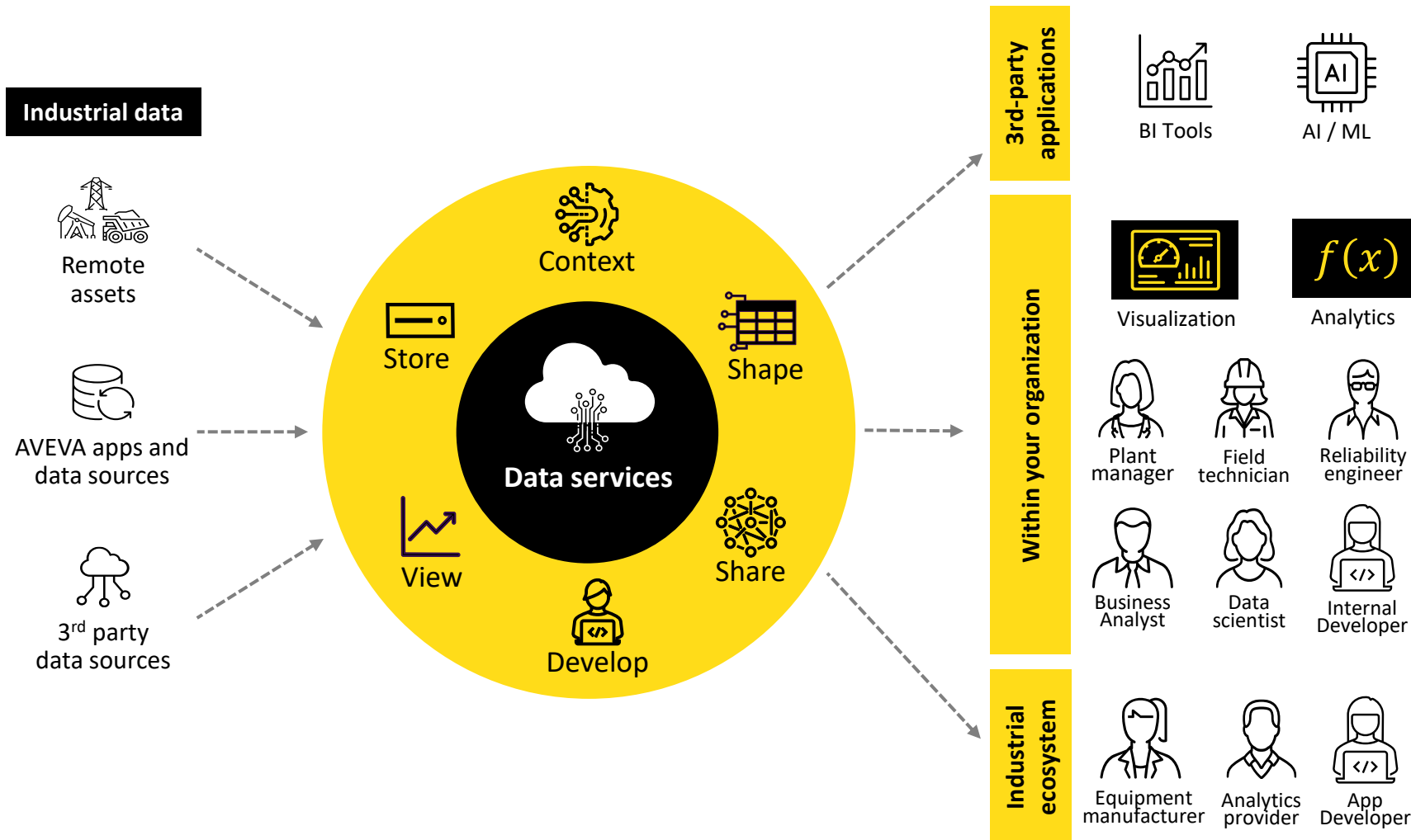
CONNECT, our industrial intelligence platform

Open and neutral, providing rich data insights for your unified industrial ecosystem



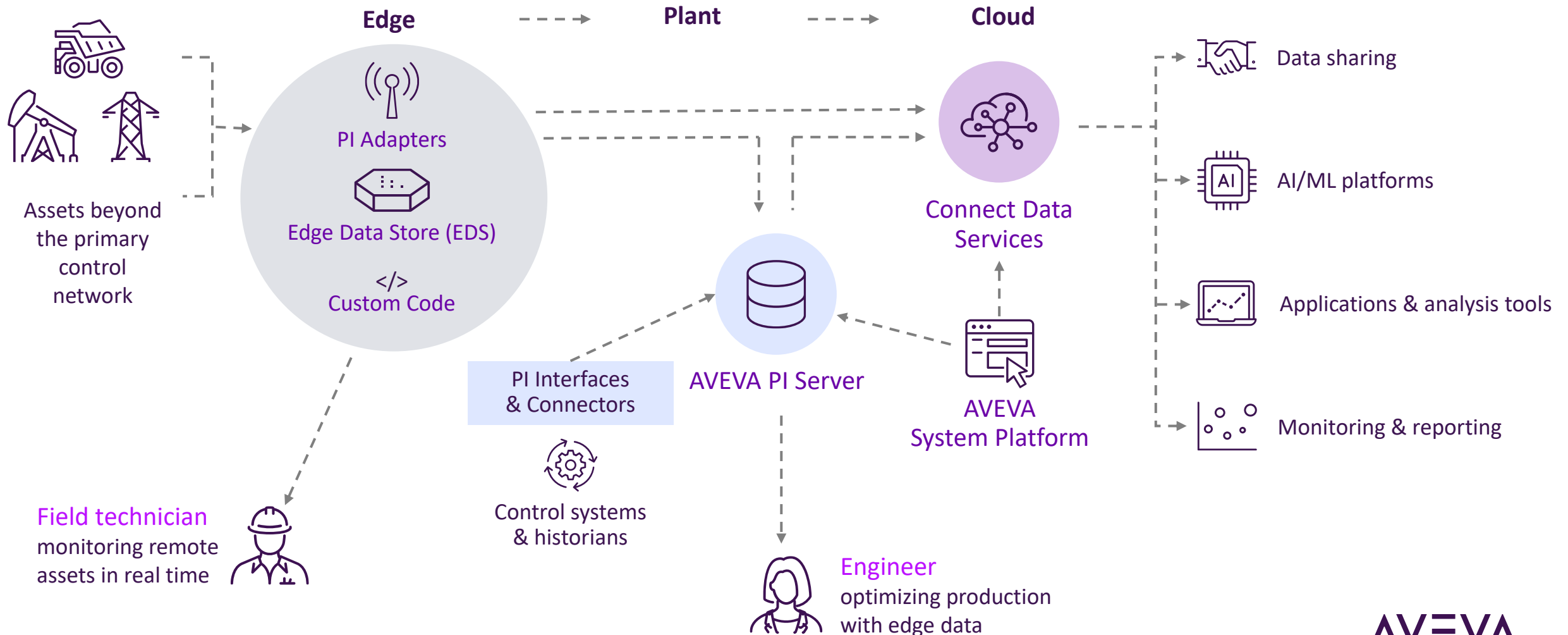
CONNECT data services (AVEVA Data Hub)

Aggregate, contextualize, and share real-time industrial data

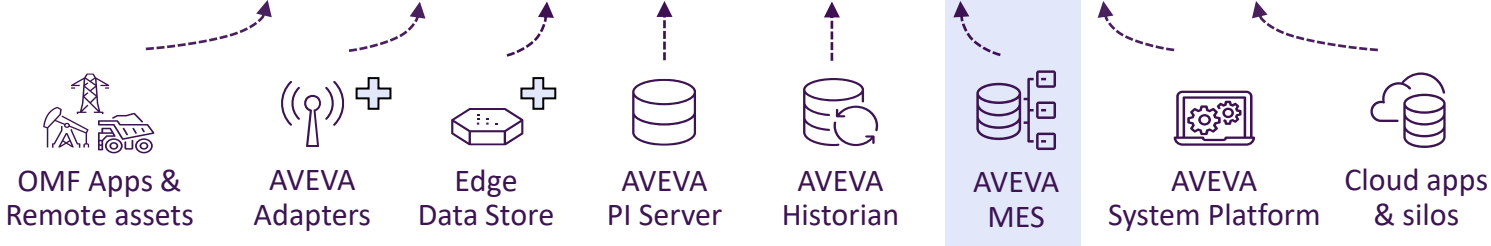
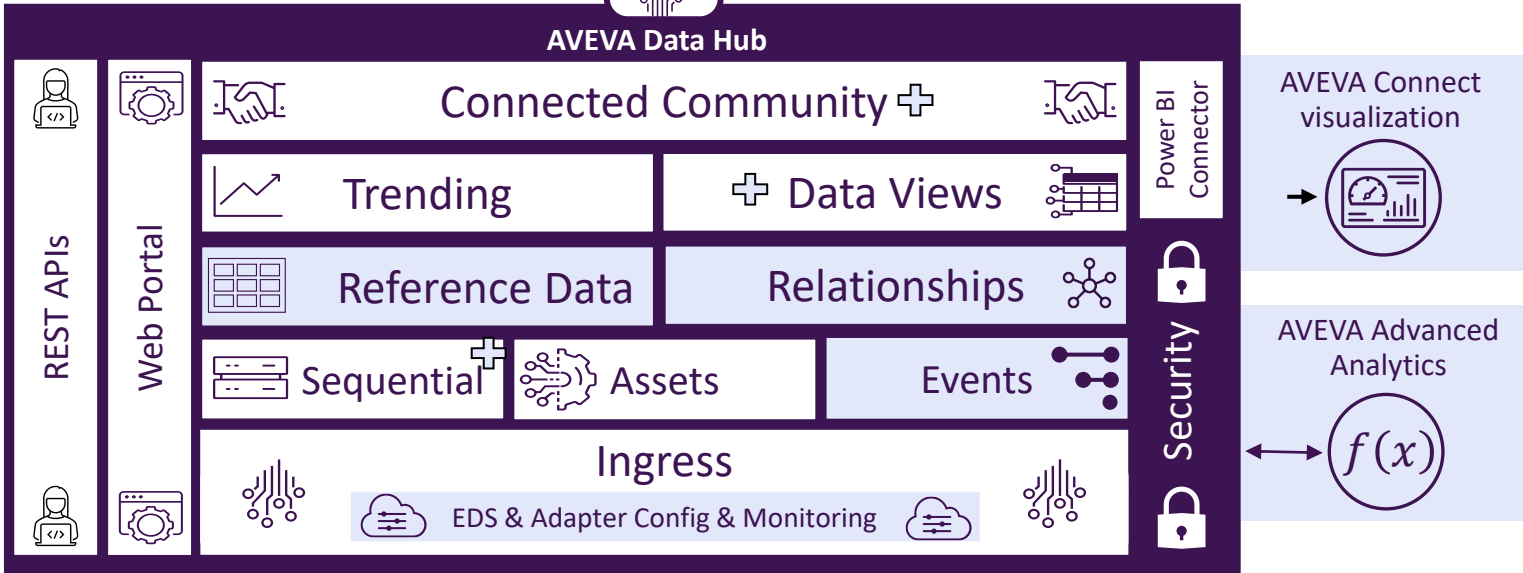


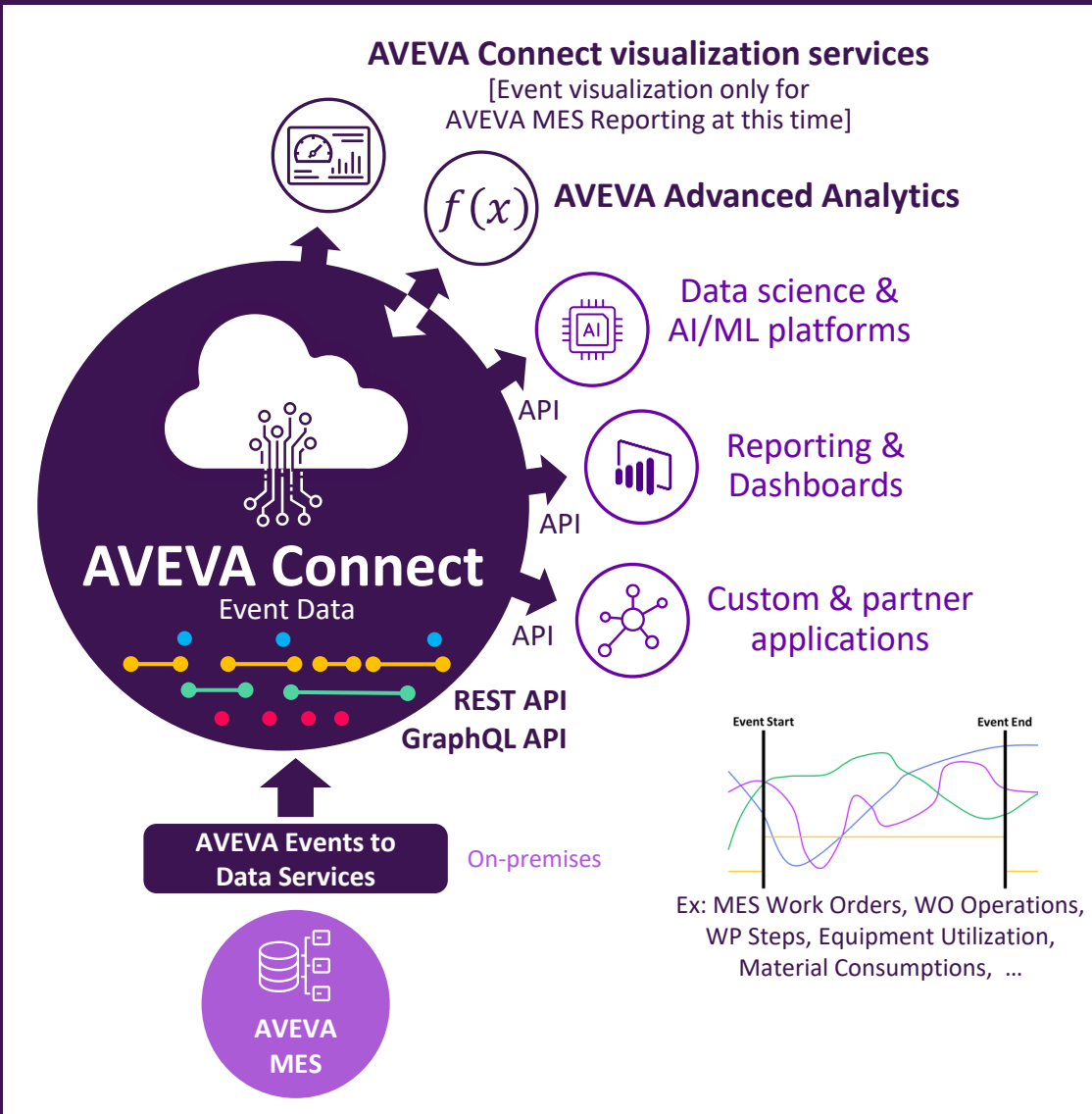
- Build and manage a central data repository for BI, AI and ML tools
- Securely share your industrial information with authorized users, extending the use of your existing data beyond your organization's four walls
- Enable 3rd-party providers to access real-time industrial data for customized services and applications

Edge data expands operational insights and creates new opportunities



Connect Data Services in 2024





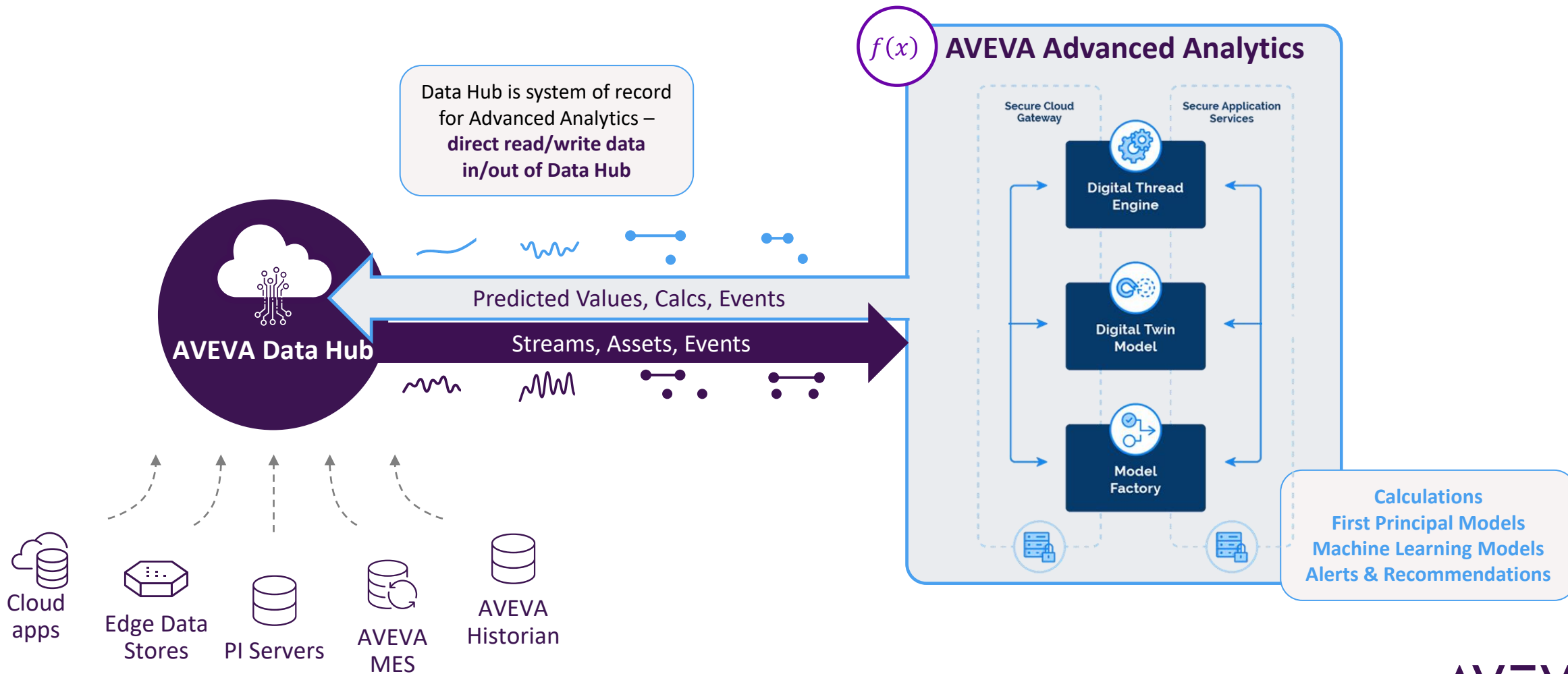
New: Event Data Store

Store event data in AVEVA Data Hub and provide a rich contextual search GraphQL API for retrieving the information

- New data historization and retrieval for industrial *events*
- Flexible schema for event and reference data storage
- Native AVEVA MES integration
 - Enhances enterprise data management across plants
 - Connects manufacturing operations data to cloud analytics
 - Enables enterprise-wide visibility for manufacturing operations & production performance reporting

AVEVA Advanced Analytics

Combine your existing data with AI-enabled applications for faster and smarter decisions



AVEVA ADVANCED ANALYTICS

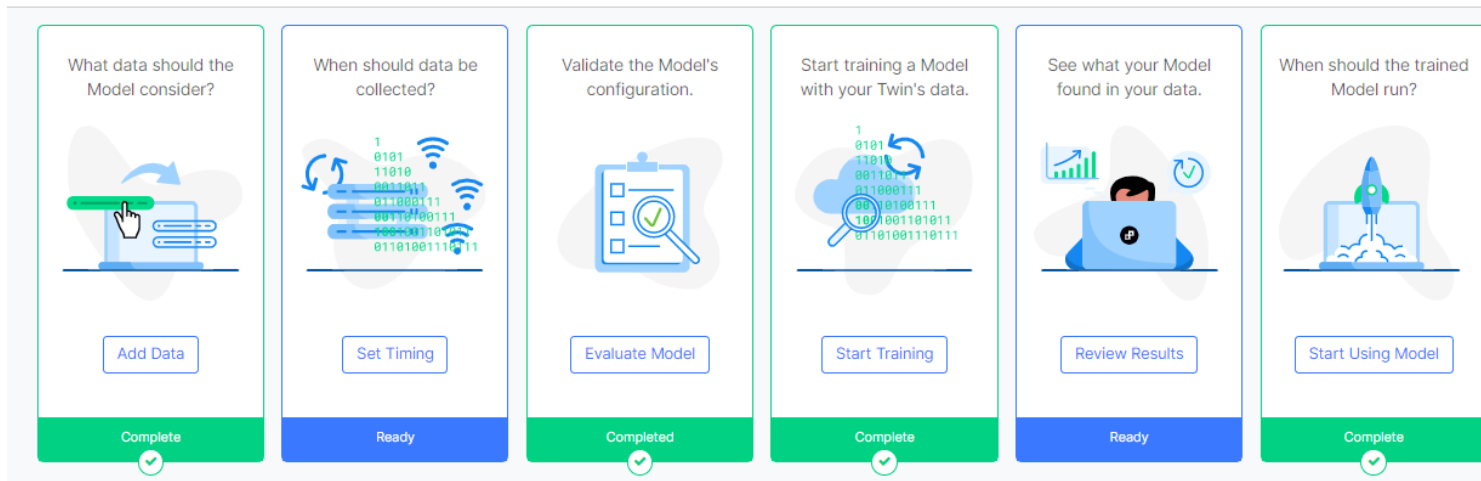
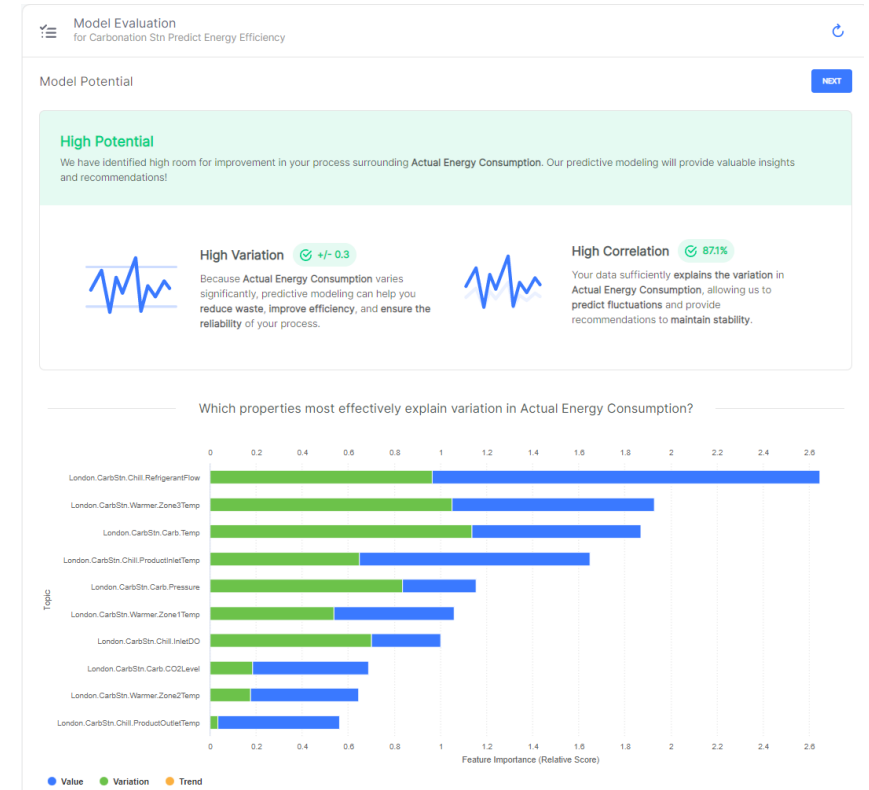
Solution overview



AVEVA Advanced Analytics

Guided model configuration

- No Code/Low Code Platform
- Leveraging data from Aveva Data Hub
- Automated evaluation of model potential and top model drivers
- Automated training data clean-up
- Best algorithm selection by the model for outcome optimization
- Results analysis by production segment to drive best recipes and automation opportunities



Advanced Analytics applications

Key application details



Predictive Quality

Predicts a quality parameter

Some use cases:

- Reduce frequency of quality measurements
- Offline measurement with delayed lab results
- Get an early indication of quality in production line

Application provides:

- Predicted Quality value
- Ideal operating conditions
- Anomaly timeline and breakdown
- Recommendations on controllable parameters



Predictive Throughput

Computes measures of production rate

Some use cases:

- Identify optimum operating conditions to maximize production
- Identify measures of production by product or rate

Application provides:

- Predicted production rate
- Ideal operating conditions
- Anomaly timeline and breakdown
- Recommendations on controllable parameters



Predictive Energy Efficiency

Provides normalized measures of energy consumption

Some use cases:

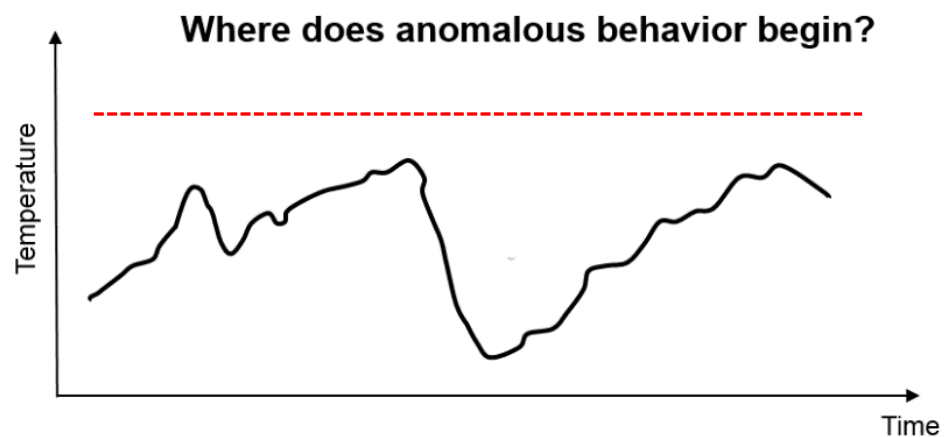
- There is no overall measure of energy consumption
- Normalized measures of energy use by product
- Identify optimum operating conditions to minimize energy consumption

Application provides:

- Normalized energy use
- Predicted total energy consumption
- Ideal operating conditions
- Anomaly timeline and breakdown
- Recommendations on controllable parameters

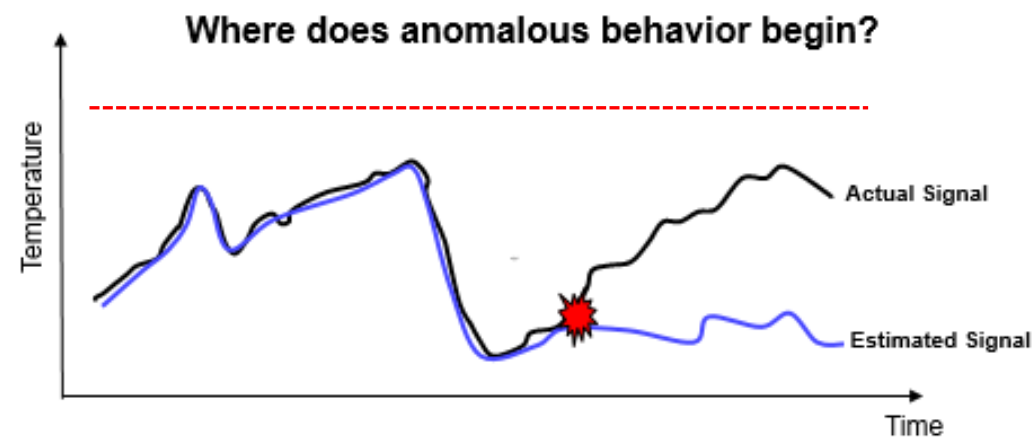
Monitoring Approach

Traditional Monitoring



- Constant alert/alarm limits are typical
- Damage accumulates prior to reaching limit

Predictive Asset Monitoring

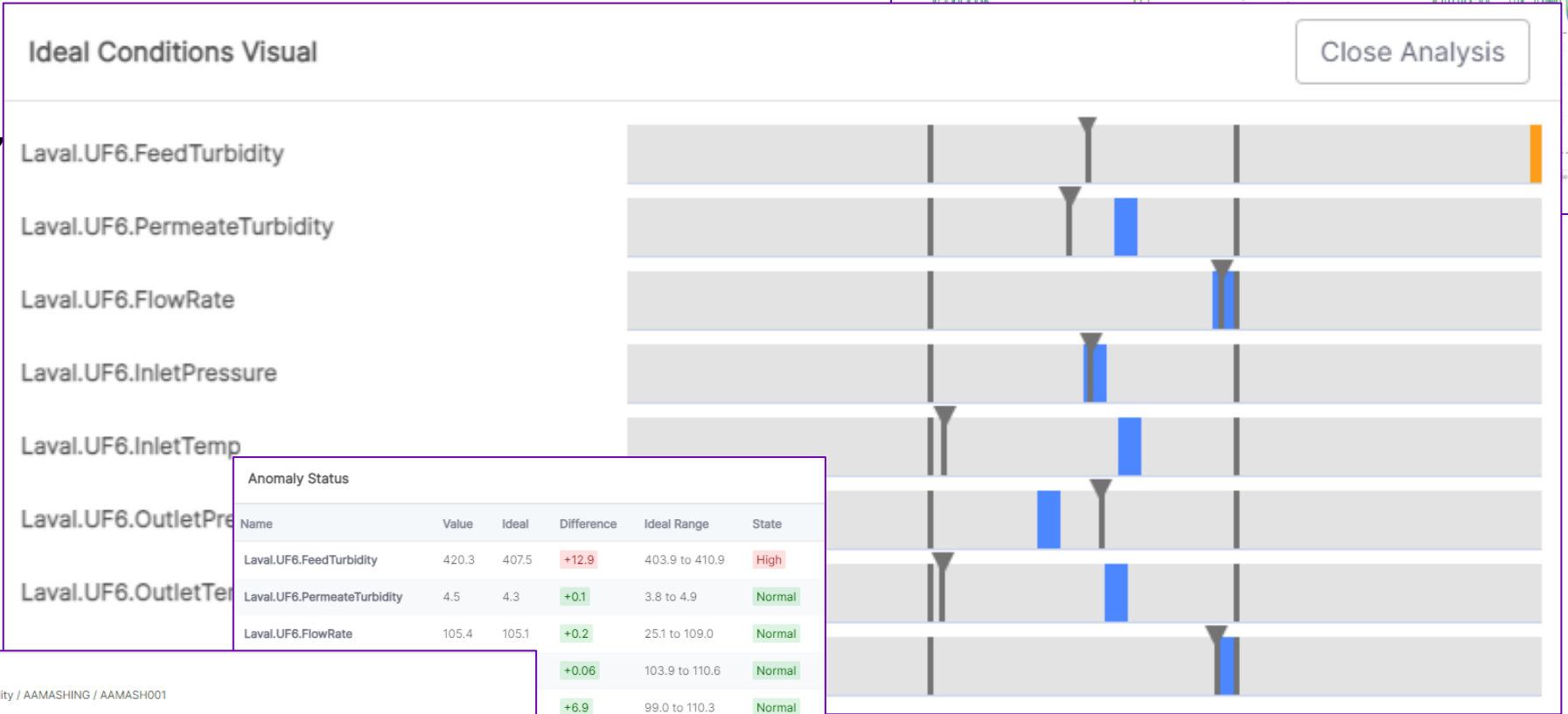
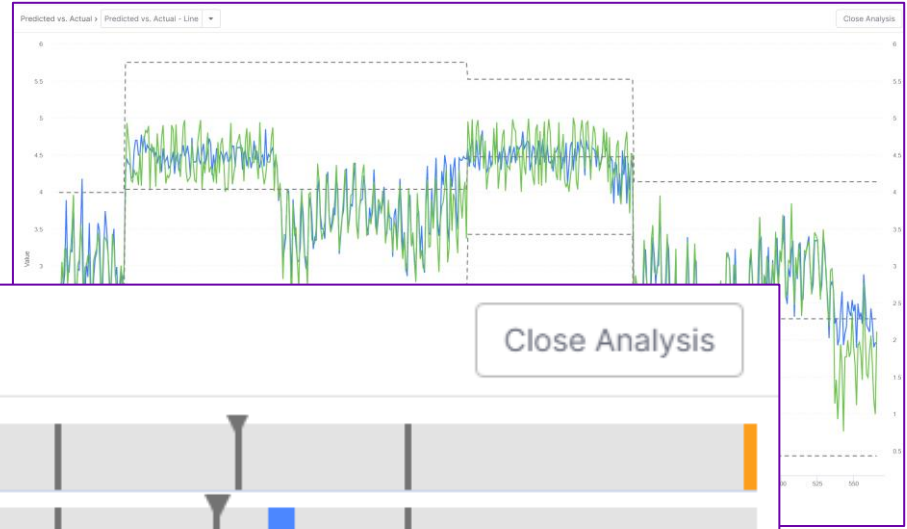


- Actual minus estimated (residual) signal detects anomaly as-soon-as-possible

AVEVA Advanced Analytics

Advanced training and

- “Predicted Quality Value”
- “Top Model Drivers”
- “Ideal Conditions Visual”
- “Anomaly Status”
- “Anomaly Timeline”
- Recommendations



Anomaly Status					
Name	Value	Ideal	Difference	Ideal Range	State
Laval.UF6.FeedTurbidity	420.3	407.5	+12.9	403.9 to 410.9	High
Laval.UF6.PermeateTurbidity	4.5	4.3	+0.1	3.8 to 4.9	Normal
Laval.UF6.FlowRate	105.4	105.1	+0.2	25.1 to 109.0	Normal
			+0.06	103.9 to 110.6	Normal
			+6.9	99.0 to 110.3	Normal
			-1.2	102.1 to 109.1	Normal
			+6.2	102.1 to 113.0	Normal
			+4.7	190.8 to 325.2	Normal

Recommendation Analysis							
Recommendation Analysis / Execute Predict Property Model for Predict Quality / AAMASHING / AAMASH001							
Product	Time	Type	Property	Recommended	Value	+30min	+60min
Pale Ale-Emptying	Mar 8th, 2022 at 15:06	Run Start	London.aaMash001.WaterTemp	26.0	26.0 (+0.1%)	26.0 (+0.1%)	21.1 (-18.7%)
Pale Ale-Emptying	Mar 8th, 2022 at 15:06	Run Start	London.aaMash001.AgitatorSpeed	1030.0	1030.3 (+0.0%)	1030.0 (-0.0%)	21.1 (-98.0%)
Pale Ale-Emptying	Mar 8th, 2022 at 15:06	Run Start	London.aaMash001.LastMaltFlow	32.0	30.3 (-5.5%)	30.3 (-5.5%)	30.3 (-5.5%)
Pale Ale-Emptying	Mar 8th, 2022 at 15:06	Run Start	London.aaMash001.WaterTemp	26.0	26.0 (+0.1%)	26.0 (+0.1%)	21.1 (-18.7%)
Pale Ale-Mixing	Mar 8th, 2022 at 11:56	Run Start	London.aaMash001.AgitatorSpeed	1030.1	1029.7 (-0.0%)	1029.9 (-0.0%)	1029.7 (-0.0%)

Industry, Asset and metric candidates for Advanced Analytics



Oil and Gas Chemicals

- Reciprocating and centrifugal compressors
- Pumps
- Expanders
- Turbines
- Heat recovery steam generators
- Energy Efficiency
- Reliability
- Uptime
- Asset Life
- Yield management



Food, Beverage, CPG

- Agitators
- Blender
- Mixer
- Fans
- Blowers
- Boiler
- Oven
- Pumps
- Air heaters
- Quality
- Asset Reliability
- Uptime
- Asset Life
- Throughput



Mining

- Emission systems
- Pulveriser
- Crusher
- Gearbox
- Kiln
- Asset Reliability
- Uptime
- Asset Life



Infrastructure

- Pumps
- Variable Frequency Drives (VFD)
- Heat exchanger
- Chillers
- Reliability
- Uptime
- Asset Life
- Energy efficiency



Water & Waste Water

- Pumps
- Motors
- Blowers
- Reliability
- Uptime
- Asset Life
- Energy efficiency



Power

- Steam and gas turbines
- Generators
- Fans
- Mills
- Boilers
- Feedwater pumps and heaters
- Condensers
- Circulating water pumps
- Emissions systems
- Transformers
- Breakers
- Capacitors
- Asset Reliability
- Uptime
- Asset Life
- Energy efficiency

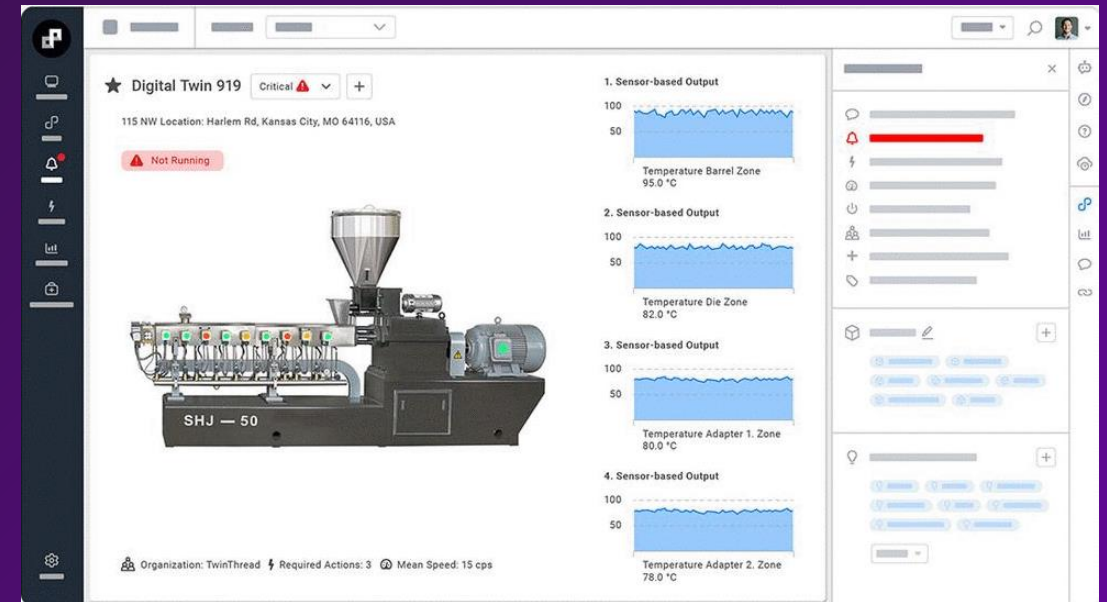
Digital Twin

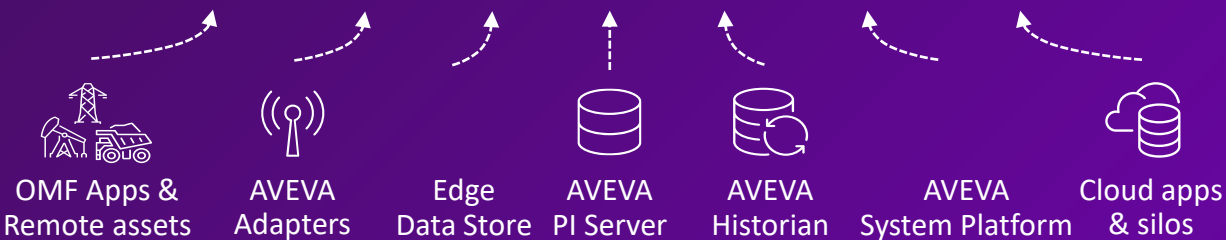
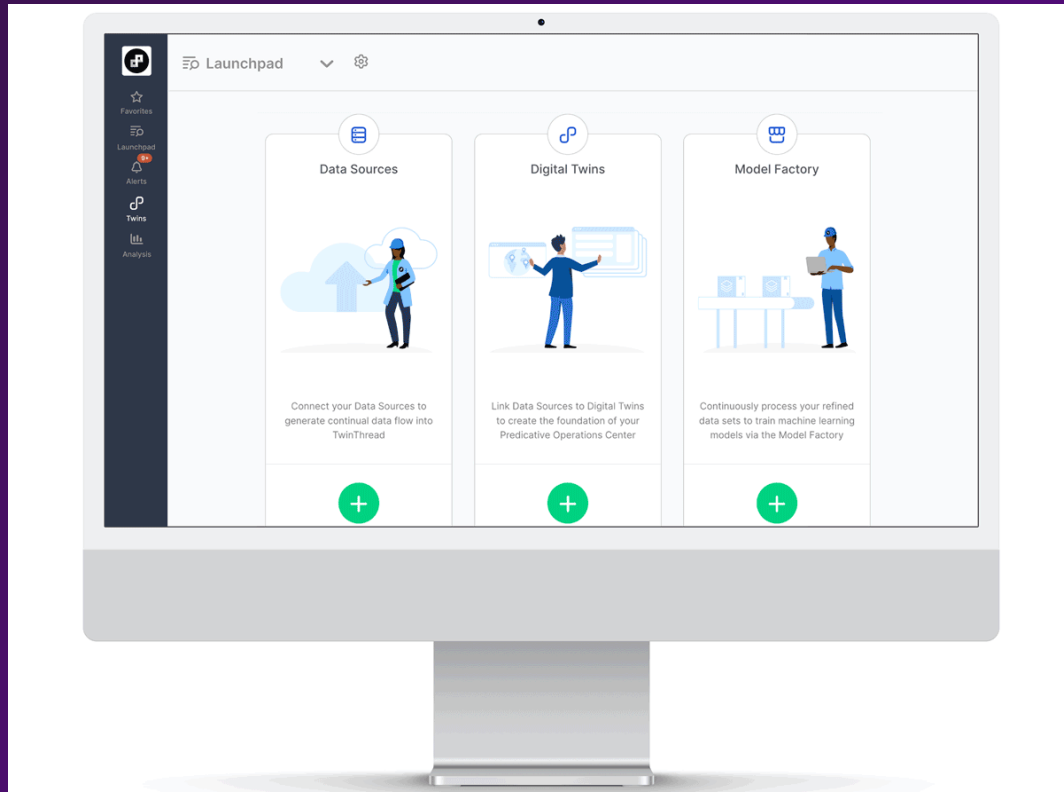
Visibility into all aspects of industrial assets and operations

- Classes for scaling twins
- Parent-children hierarchy
 - *Site, Plant, Department, Line, Machine*
- Linked Sensors for receiving data
- Timeline of key twin properties
- Visual Dashboard with key information
- Opportunities - possible issues to be addressed



Provides the structure and context to automate insights across all assets, production lines, and plants





Data collection

Use data from various data sources

- PI to Data Hub architecture
- Edge data store & adapters
- Open Message Format (OMF) connections



AVEVA Data Hub is system of record for Advanced Analytics provides a number of methods for collecting data from external sources

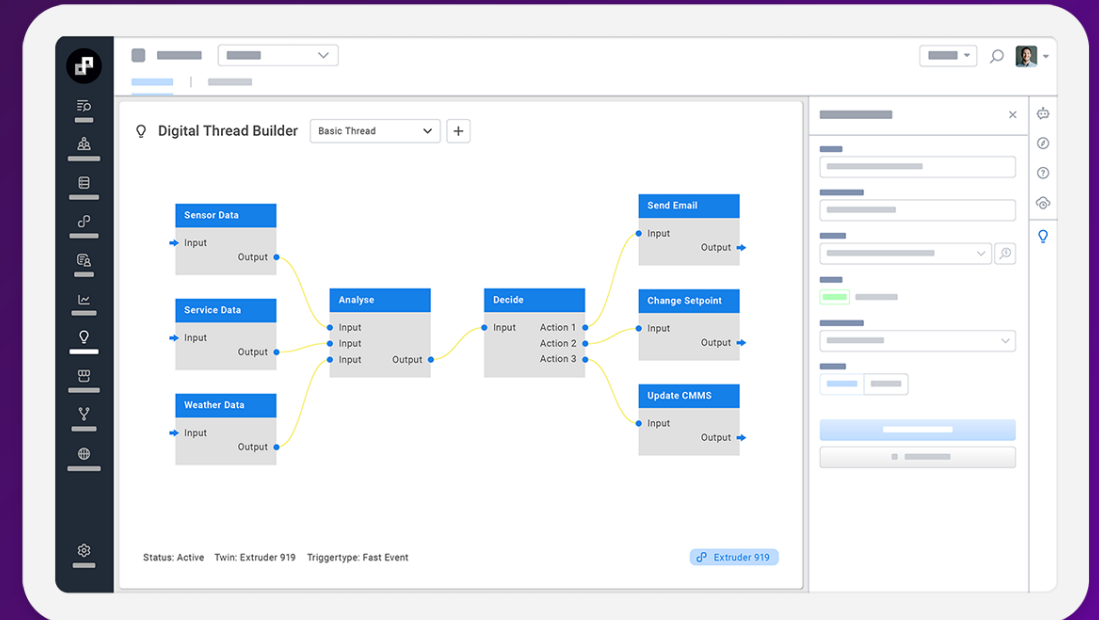
Digital threads

Logical workflow to support operations

- No-code logical workflows
- Automate calculations
- Operationalize actions
- Trigger specific actions or activities
- Sending notification via email/SMS
- Automatically and continuously running



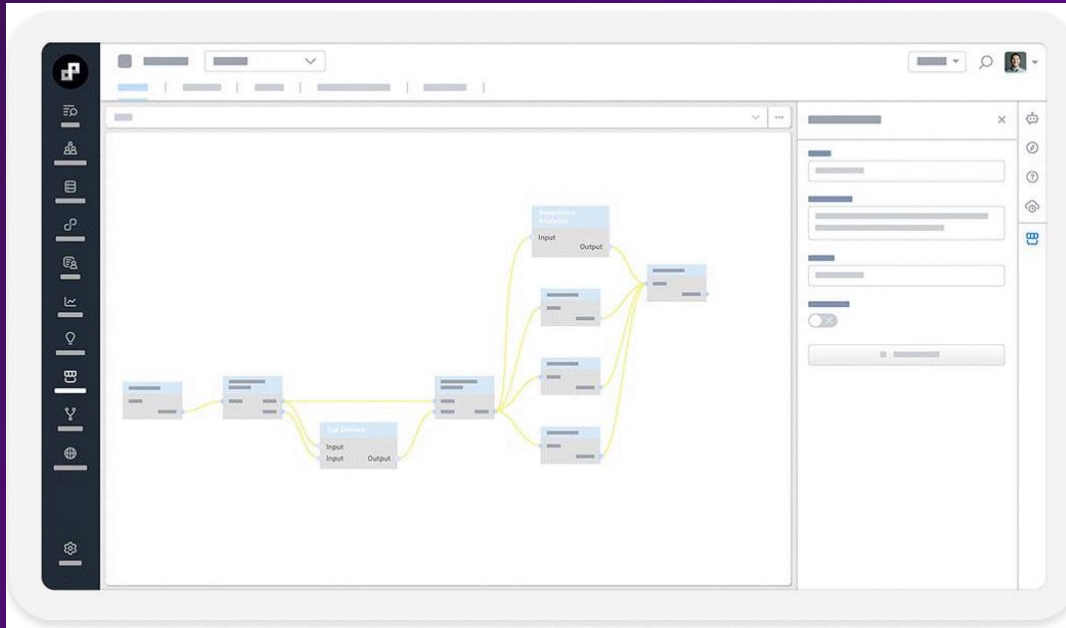
The actions represented by a digital thread could trigger specific actions or activities



Model factory

Templates to solve fundamental manufacturing problems

- Use cases templated model selection
- Automate Machine Learning (ML) model creation
- Easy-guided twin configuration steps - product segmentation, operational state, rate
- Automatically evaluates and selects the best performing algorithm
- Visualized model creation process



A digital assembly line for automating machine learning (ML) model creation and deployment

Model customization

Logical workflow to support operations

- User defined tasks to extend out of the box model tasks:
 - Verification of model task output
 - Custom visualization
 - Python code
- User defined train blocks:
 - Add custom algorithm to train data
 - Choose specific columns to train
 - Add "derived" columns to the train input dataset



Flexibility with User Defined algorithms and transforms

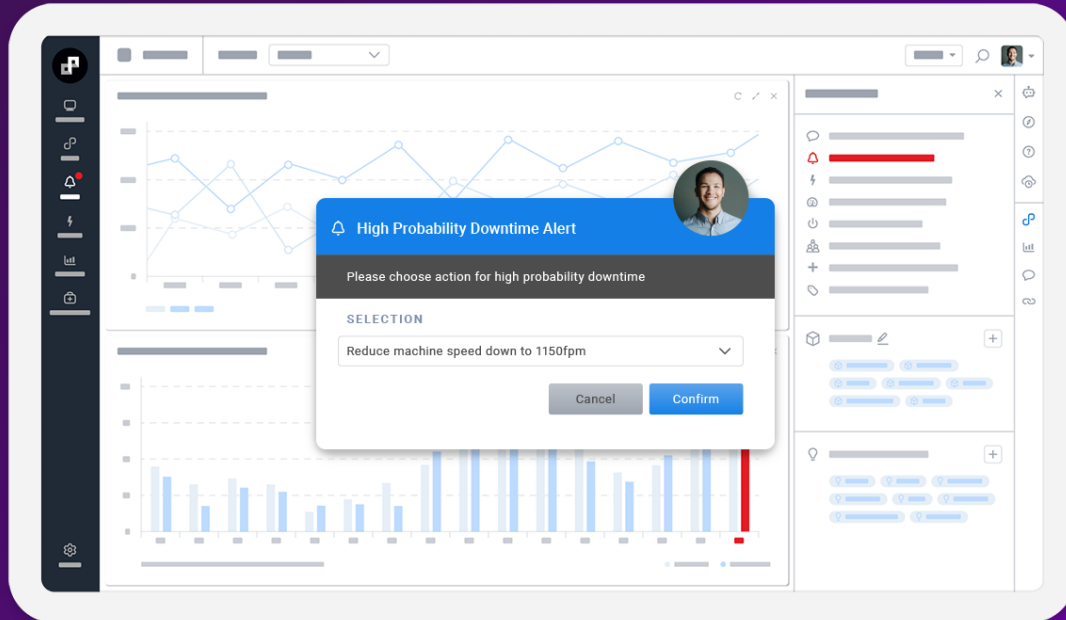
The screenshot displays the 'User Defined Task' configuration window. The left side shows a workflow diagram with a blue 'User Defined Task' block. Two 'dataset' nodes are connected to the block, one on the left and one on the right. The right side of the window is a configuration panel with the following elements:

- Name:** User Defined Task
- Description:** User Defined Task
- Publish Output through BI Connector:** A toggle switch that is currently turned on.
- Access This Data In Jupyter:** A 'Download notebook' button.
- Python Task Code:** A text area containing the number '1' and a line number indicator '1'. An 'Edit' button is located to the right of the text area.
- Buttons:** A green play button, a button with three dots, and a blue 'Save changes' button.

Intelligent alerts & actions

Notify when condition is abnormal

- Create intelligent alerts
- Create logical workflows
- Automate actions
- Action awareness views



Intelligent alerts and automated actions each time a process is operating outside of normal conditions.

Dashboard monitoring

Analyze the key information about your asset and process

- Out-of-the-box visualizations and graphs
- No-code workflow tools

“Predicted Quality Value”

“Top Model Drivers”

“Ideal Conditions Visual”

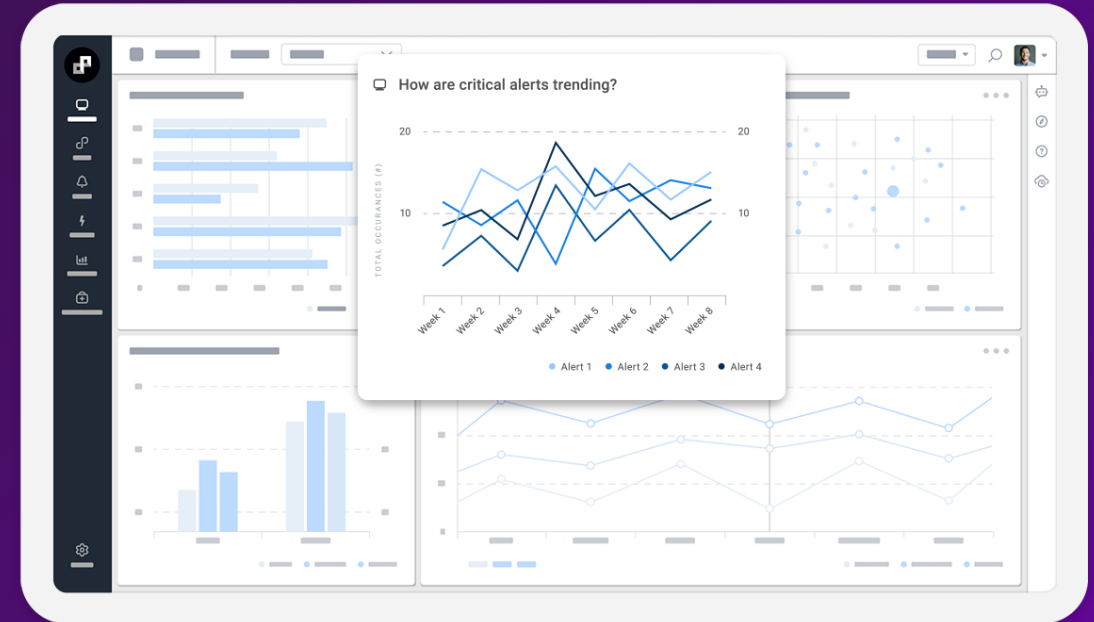
“Anomaly Status”

“Anomaly Timeline”

“Recommendations”



Powerful dashboard creation tools to distil complex data into simple, easily readable views



Anomaly Score detected

N no-reply@twinthread.com
To: Charles Navarrete

Mon 8/21/2023 9:19 AM

CAUTION - This message originated outside AVEVA



Anomaly Score detected on Mixer1Demo.

AgitatorSpeed.Value Normal	1030 rpm 1029 rpm	1030 1029	FillingFlow.Value Unprecedented High	10.1 210.1	10.1 210.1
LastSyrupFlow.Value Normal	26.4 26.9	26.4 26.9	MixVolume.Value Unprecedented High	7996.2 8000.6	7996.2 8000.6
ProductTemp.Value Normal	26.0 26.0	26.0 26.0	SyrupFlow.Value High	1.3 26.5	1.3 26.5

Case study: Predictive quality

Problem

Premium Pet Food Manufacturer wanted to reduce scrap from frequent line startups / formulation changes and reduce reliance on in-process testing. Due to 30-60min process lag times between key unit operations and finished product quality tests, the potential for scrap from off-quality product was very high.

Solution

Implement predictive models for “middle of line” quality for finished product Density, Moisture, Fat, and Protein content. Monitor more than 75 process variables from across the production process to make accurate predictions for all four quality parameters in real-time, plus provide recommendations to operators to keep quality on-target.

Payback

Payback periods between 15-60 days (implementation + 1yr subscription).

Innovation and Value Streams

CONTINUOUS LEARNING



Connect Digital Twins



Train Models



Analyze Models

- Top quality drivers
- Best recipe / centerlines
- Automation opportunities
- Recipe simulation



Deploy Models



Monitor Twins



Analyze & Act

- Soft Sensor / Real-time Prediction
- Real-time Anomalies
- Real-time Recommendations

Multi-Verticals Company improves frozen food quality with cloud-based data and analytics

Challenge

- Needed to reduce shift variations on frozen food product quality
- Wanted to predict and understand QA parameters to optimize production process; thereby reducing waste, overprocessing and energy costs
- Lack of no code (low code) data science and machine learning in Customer's existing platform

Solution

- Deployed AVEVA™ Data Hub and AVEVA™ Advanced Analytics to complement existing AVEVA™ PI System usage, supporting process operators with prediction-based setpoint recommendations

Results

- **Ideal startup and run conditions plus automated operator recommendations are shared to operators in real-time with dashboards and alerts**
- **Customer's people now have real-time access to live and historical asset data, with out-of-the box predictive analytics options, easy and secure data sharing, and other innovative capabilities**



“ Having a real-time data flow from PI System into the cloud with AVEVA™ Data Hub, enabled us to provide enhanced product quality to our customer. The user-friendly analytics and machine learning tools supported us with product predictions and will enable us to take on new use cases, which we are very excited about!”

Production Subject Matter Expert, Customer

Case Study: Predictive Energy Efficiency

- **Challenge**
 - Large consumer products manufacturer committed to reducing global manufacturing energy footprint by 5% across all utilities including Water, Air, Gas, Electricity, and Steam.
- **Solution**
 - Implement predictive energy models for each “process type” across making, converting, and packaging. The goal of the predictive models are to find best operating conditions / centerlines that minimize energy while running plus identify procedures to minimize energy while not running.
- **Result**
 - Payback periods between 60 days (implementation + 1yr subscription).

“Committed to reduce energy footprint”



ROI
60 days



consistent set of
measures



Scalability

ACCIONA reduces environmental impact and increases supply of treated water

Challenge

- Improve the performance of all water treatment facilities with minimum impact to the environment.
- Needed a digital solution to collect, contextualize, and analyze data to anticipate equipment behavior deviations and find the optimum operating point in real-time.
- Increase water production capacity and reduce energy use.

Solution

- Acciona uses AVEVA™ Data Hub to manage and contextualize historical and streaming data collected by AVEVA™ System Platform. AVEVA™ Advanced Analytics adds rich machine learning-based analytics and provides easy access to monitor critical KPIs.

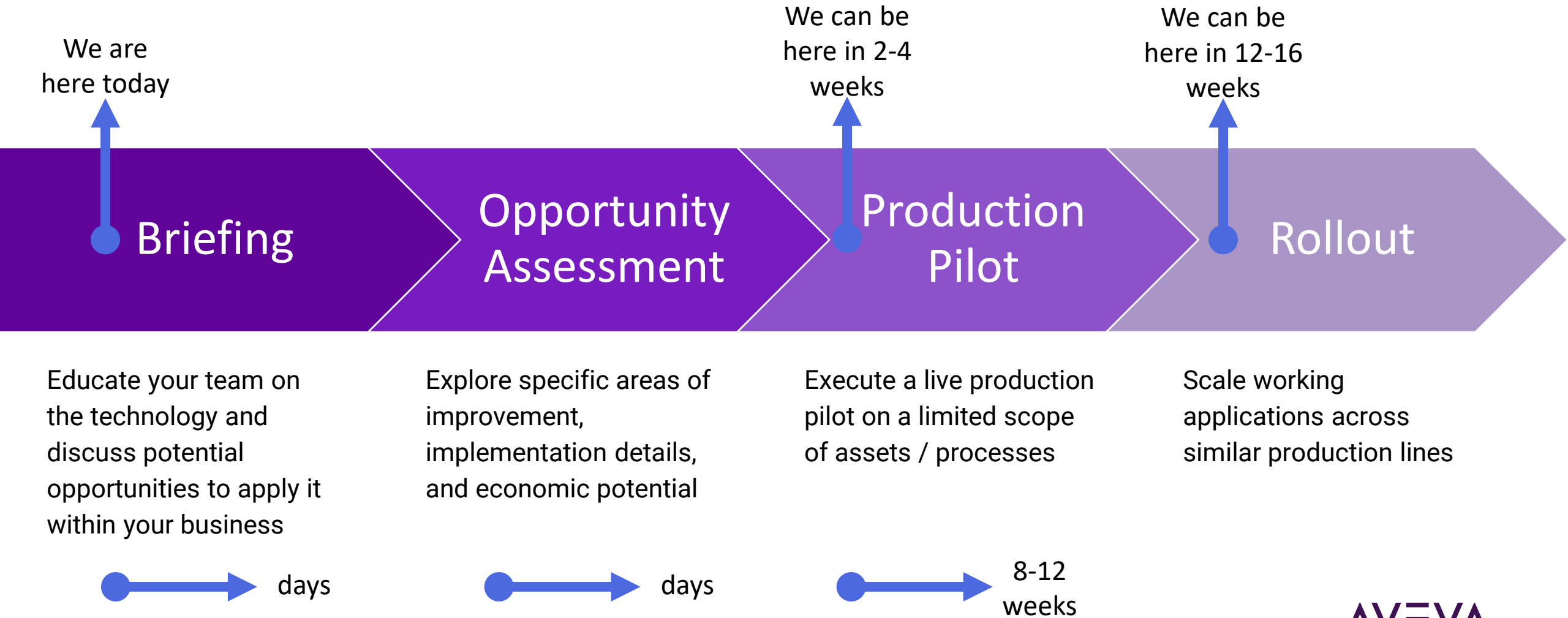
Results

- **Prediction model enabled optimization of energy recovery systems resulting in 4.6% reduction in energy consumption of the high-pressure pump, and increased production capacity of the rack by 16 m³/h.**
- **Increased efficiency in O&M teams thanks to readily available information.**
- **Improved confidence from clients due to transparency of operations.**

[Learn more](#)



The Journey to ROI



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