



AVEVAWORLD
PARIS

OCTOBER 2024

Operations data analytics at cloud scale

Seamless integration of AVEVA™ PI System™ data with CONNECT data services

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AVEVA WORLD 2024

Agenda

Operations data
analytics at cloud scale

- Review the use of **AVEVA™ PI Data Infrastructure** as the integrated, hybrid solution for **industrial data management**
- Understand the **multiple routes** for **performing advanced analytics** with cloud-native **CONNECT data services**
- **Transferring data** between **AVEVA™ PI Server and CONNECT**
- Final thoughts

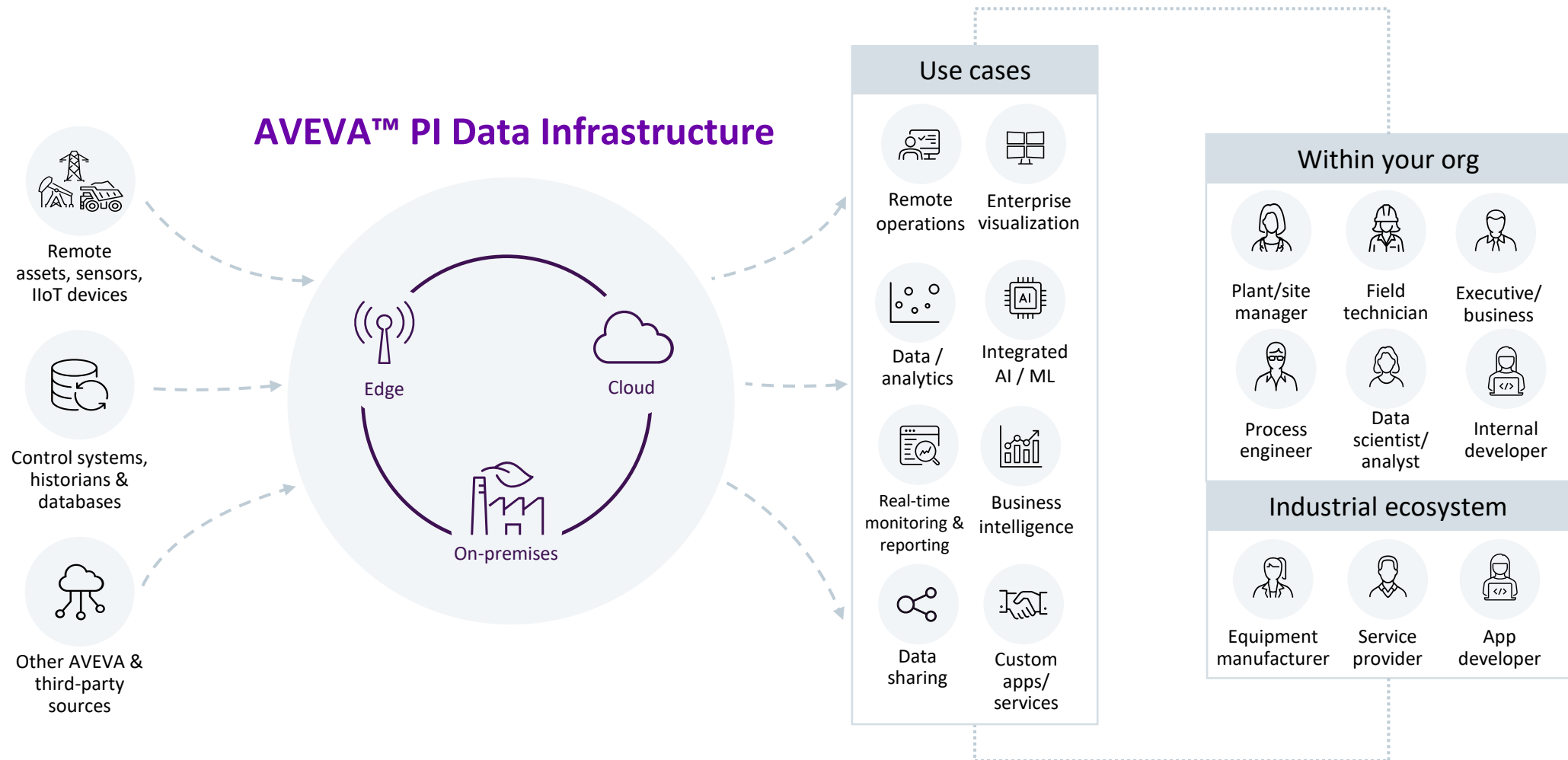
OPERATIONS DATA ANALYTICS AT CLOUD SCALE

AVEVA PI Data Infrastructure for industrial data management

AVEVA

Hybrid data infrastructure

From edge to plant to community



Windtopia's data management journey with AVEVA

What is Windtopia doing today?

Monitoring wind farms

- On-premises AVEVA PI Server with data archive and asset framework
- PI connectors for data collection
- AVEVA™ PI Vision™ dashboards
- Increasing scale and scope over time



Windtopia's continued journey

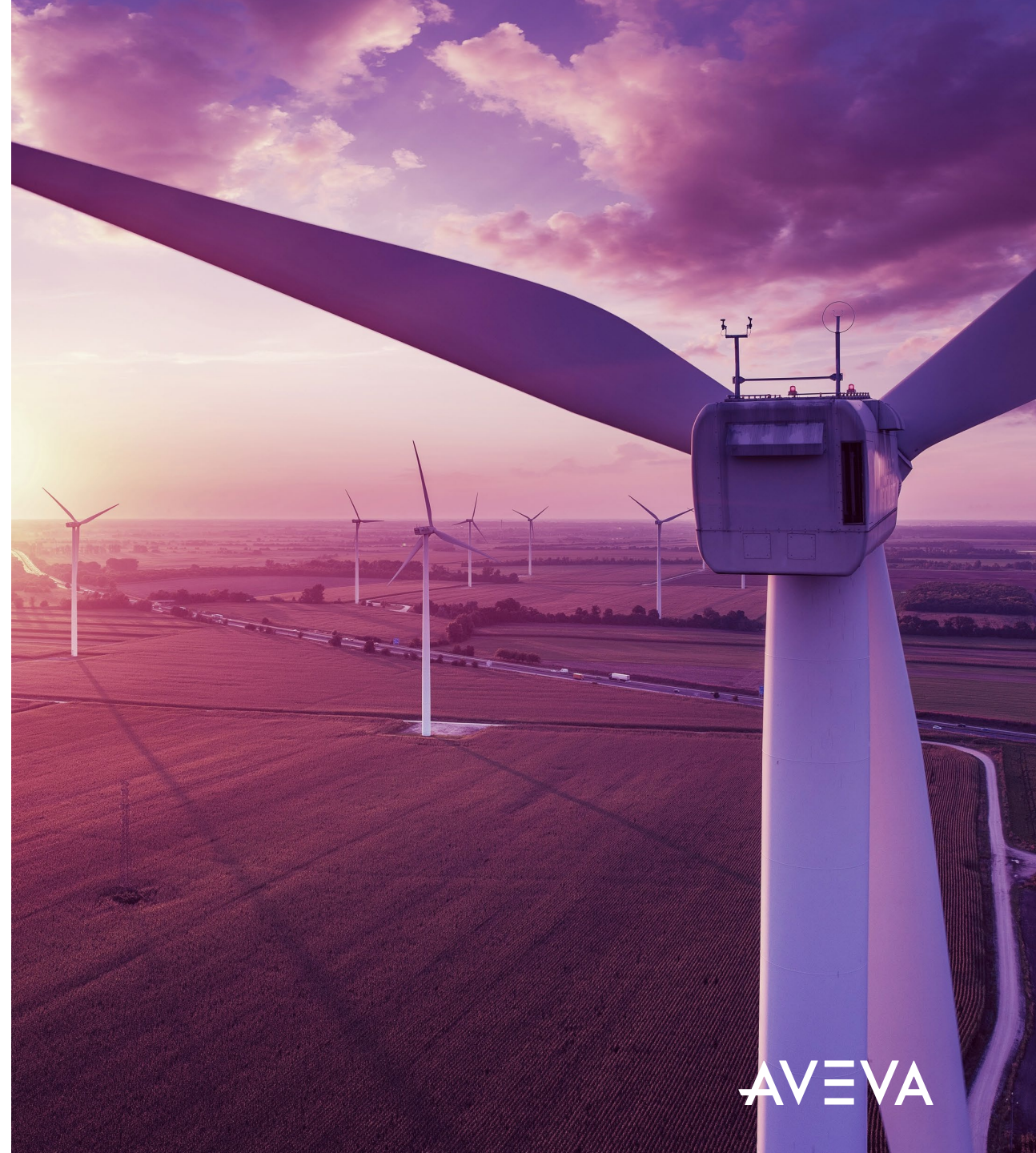
How can Windtopia prepare for the future?

Keep up with the industry trends
(ML, AI, Analytics, Cloud)

Increase data-driven decisions

Create analytics to predict potential problems

How can Windtopia leverage
AVEVA PI System to meet its goals?



AVEVA PI Data Infrastructure has become more flexible

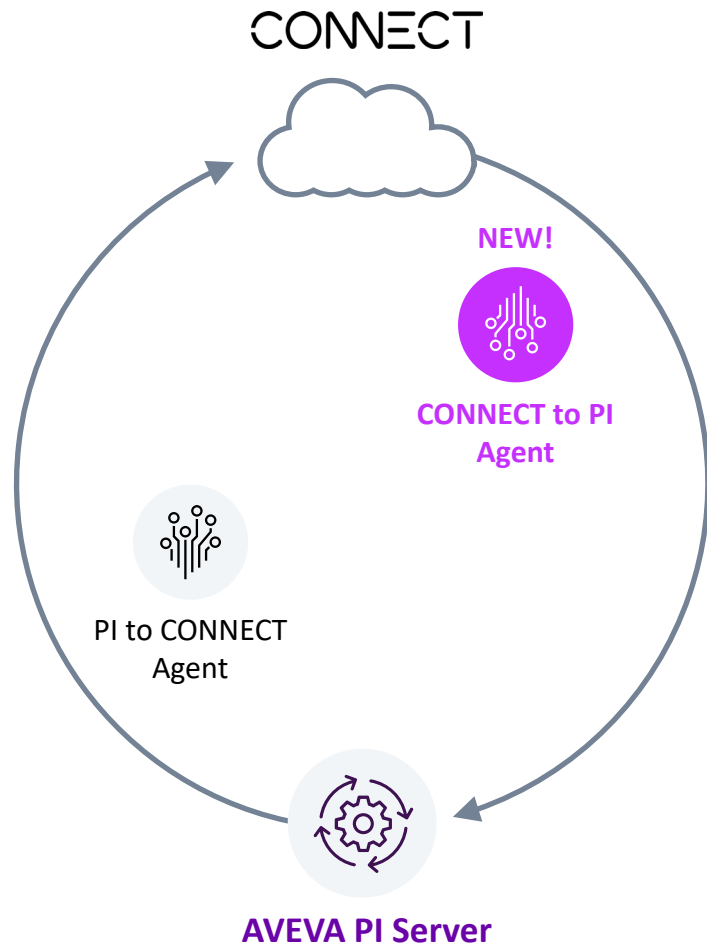
Over the past year...

- In October 2023, AVEVA PI Data Infrastructure—an integrated hybrid solution—was introduced.
- This hybrid solution allows companies to easily move data from AVEVA PI Server on-premises to CONNECT in the cloud:
 - Aggregate data from smart IIoT assets and multiple sites in a central location
 - Make aggregated data available for advanced analysis
 - Provide data access to authorized users in any location via the internet
 - Share real-time data with business partners and service providers
- But... how to bring cloud data into AVEVA PI Server ?



CONNECT to PI Agent is now available

Replicate data streams from CONNECT in AVEVA PI Server, serving advanced analytics scenarios



- Why go from PI Server to CONNECT ?
- Why go back from CONNECT to PI Server ?
- How to use CONNECT-to-PI Agent ?
- Demo

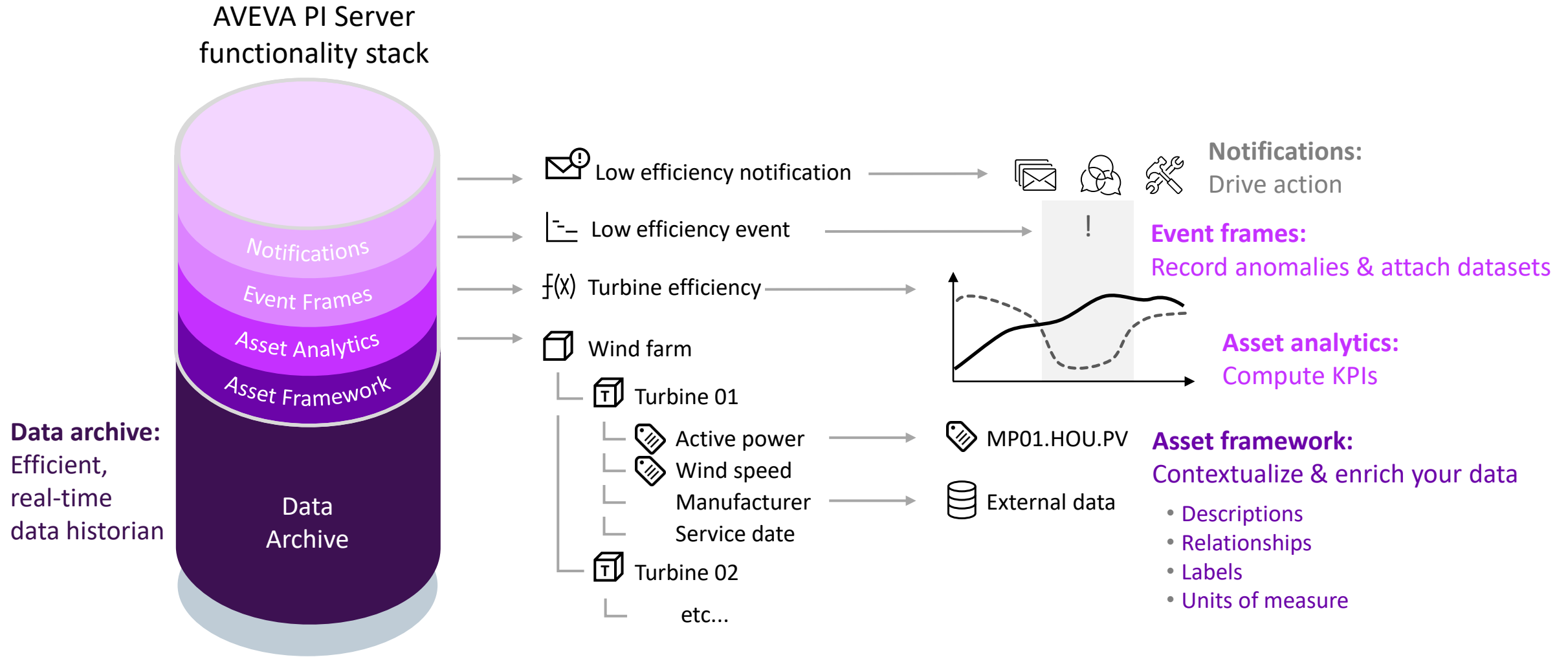
AVEVA PI System is vendor neutral

Can acquire data from almost any industrial vendor or protocol, including at the edge

- Hundreds of PI Interfaces, PI Connectors and AVEVA Adapters are available.
- Here are a few standard ones:

PI Interface for ABB 800xA Batch	PI Interface for Rockwell Factory Talk Batch	PI Connector for OPC UA Gen 1
PI Interface for ABB 800xA Production Response Batch	PI Interface for Rockwell PharmaSuite	PI Connector for OPC UA Gen 2
PI Interface for AVEVA Batch Management	PI Interface for Siemens SIMATIC Batch	PI Connector for Ping
PI Interface for DNP3	PI Interface for SNMP	PI Connector for Siemens SIMATIC PCS 7
PI Interface for Emerson DeltaV Batch	PI Interface for TCP Response	PI Connector for UFL
PI Interface for Emerson Syncade Batch	PI Interface for Universal File and Stream Loading (UFL)	PI Connector for Wonderware Historian
PI Interface for Modbus Ethernet PLC	PI Interface for Werum Pas-X Batch	AVEVA Adapter for BACnet
PI Interface for OPC DA	PI Connector for BACnet	AVEVA Adapter for DNP3
PI Interface for OPC HDA	PI Connector for CygNet	AVEVA Adapter for Modbus TCP
PI Interface for Performance Monitor	PI Connector for Ethernet IP	AVEVA Adapter for MQTT
PI Interface for Ping	PI Connector for FANUC Focas	AVEVA Adapter for OPC UA
PI Interface for Ramp Soak Simulator Data	PI Connector for HART-IP	AVEVA Adapter for RDBMS
PI Interface for Random Simulator Data	PI Connector for IEC 61850	AVEVA Adapter for Structured Data Files
PI Interface for Relational Database (RDBMS via ODBC)	PI Connector for MQTT Sparkplug	AVEVA Adapter for Azure Event Hubs

AVEVA PI Server has powerful data transformation features



Configured with no-code tools, all based on templates

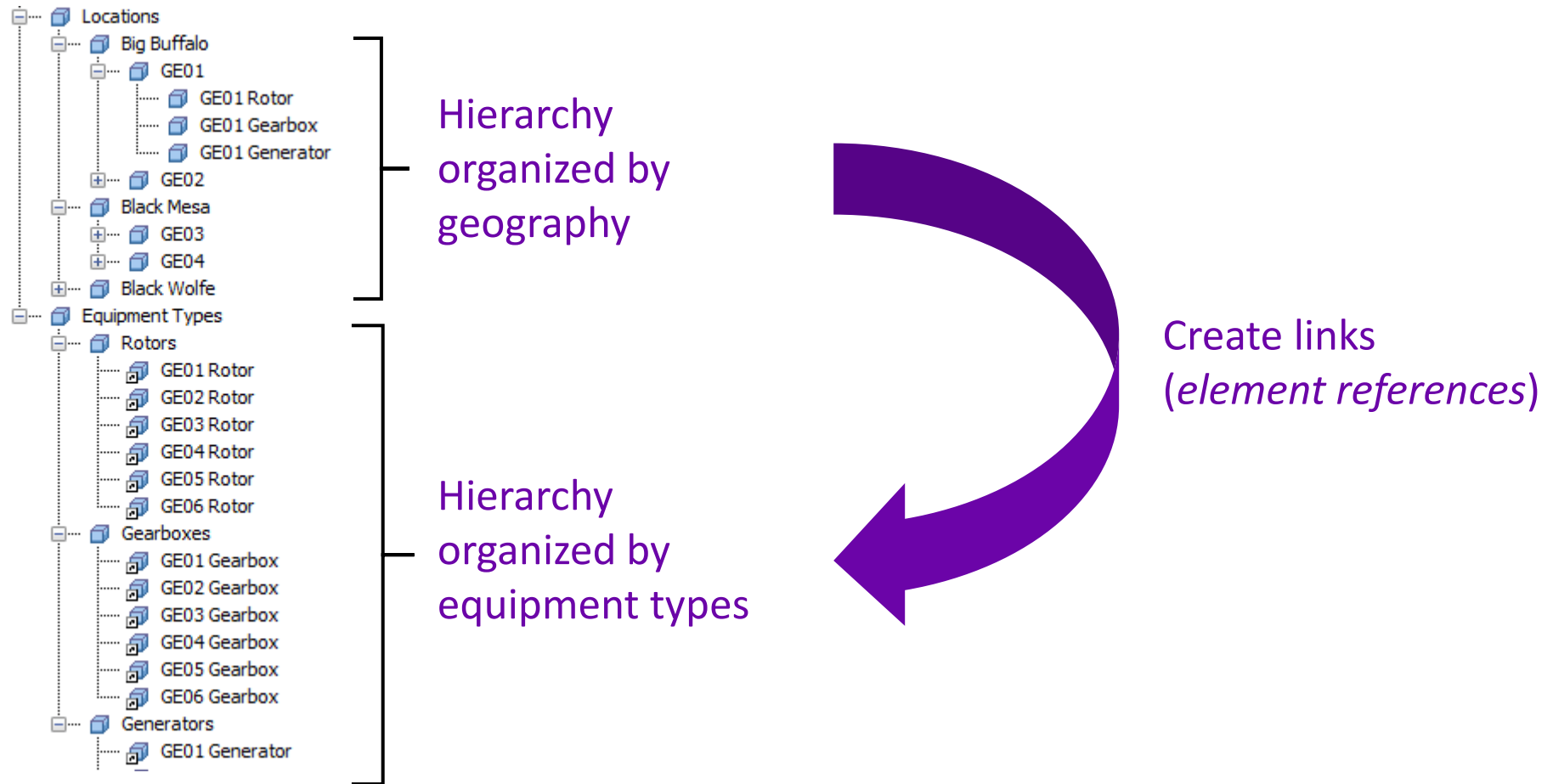
Data management at scale with AVEVA PI AF templates

True object-oriented programming... without writing any code

Object-oriented programming concept	PI AF equivalent
Classes	Element & event frame templates
Properties	Attributes
Methods	Analyses & notification rules
Inheritance	Derived template
Polymorphism	Attribute & analysis & analysis configuration overrides
Encapsulation	Hidden attributes

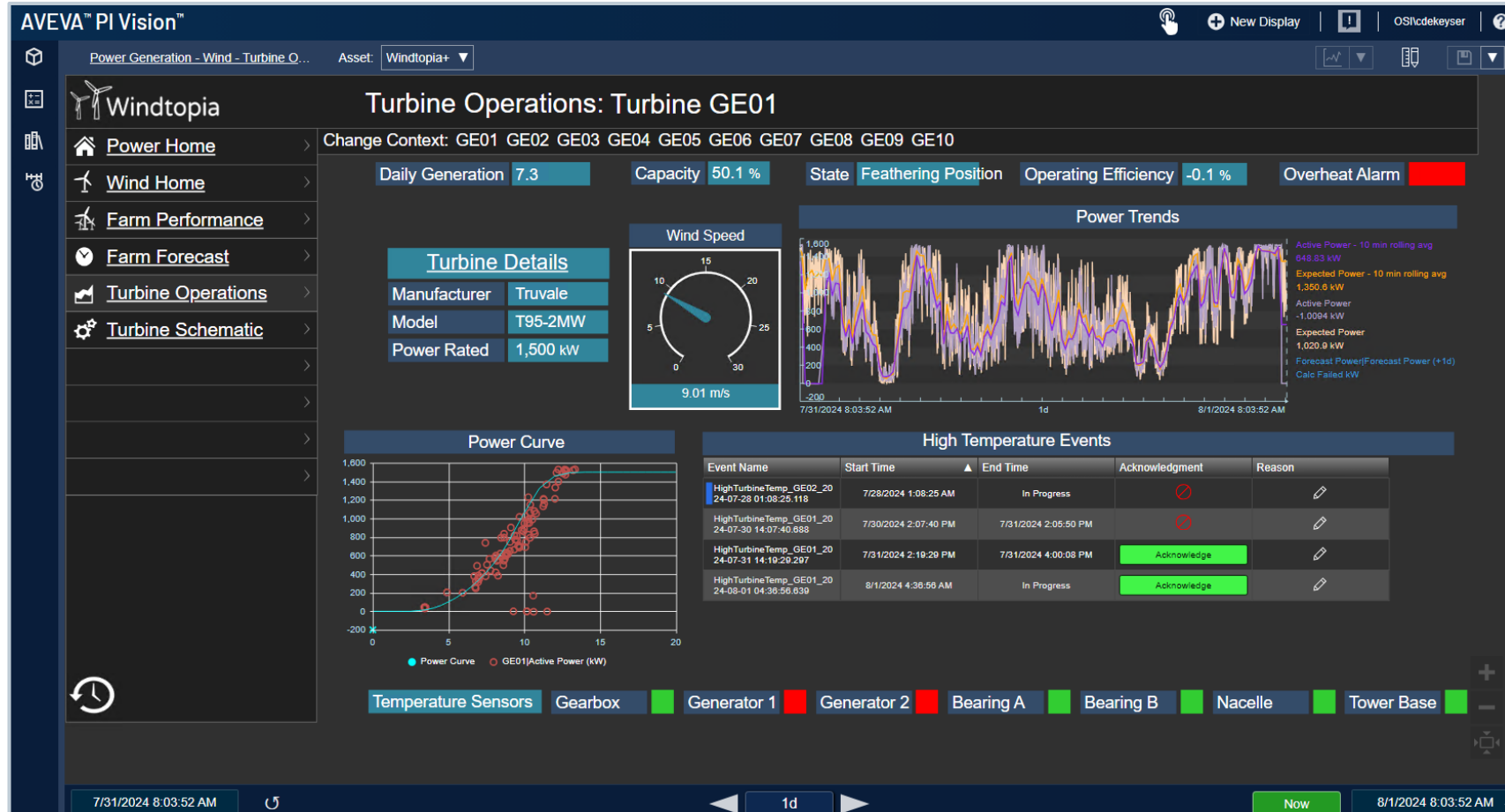
AVEVA PI Server can combine multiple types of asset hierarchy

Reuse assets in multiple hierarchies with *element references*



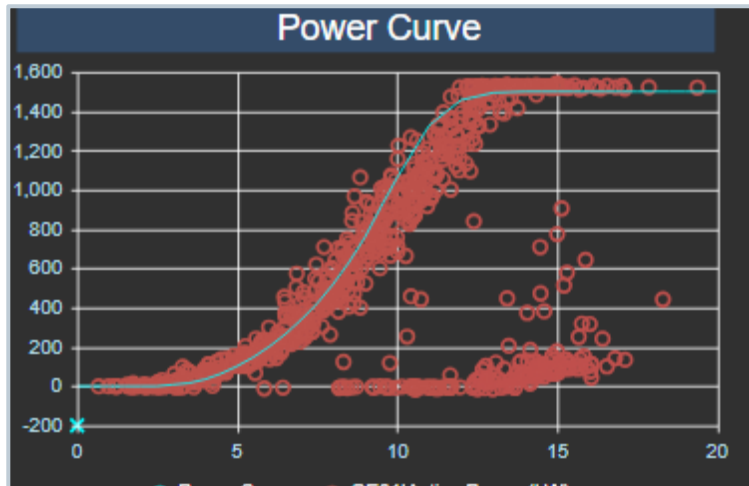
Self-service visualization with AVEVA PI Vision

The fastest, easiest way to visualize AVEVA PI Server data



Supporting analytics needs at different levels

Visual correlations & ad-hoc calculations



Compare wind-power relationship with reference curves

Simple or more advanced streaming analytics

Name	Expression
BOW	IF Weekday('*') = 1 THEN 't' ELSE 't' - 86400 *
AvgWTD	TagAvg('Feed Rate', BOW, '*')
MaxDif	IF Weekday('*') = 1 AND '*' = Bod('*') THEN 0 E
TarWTD	Roundfrac(Convert(Convert('Daily Target' * Week
ActWTD	Roundfrac(Convert(Convert(Int(TagTot('Feed Rate
CurDif	Abs(TarWTD-ActWTD)

Turbine efficiency during medium-wind phases

Data science & advanced analytics

The screenshot shows the AVEVA Data Hub interface with a table of data views. The table has columns for Timestamp, Name, Turbine Name, and Rotor Speed Value. The data rows show hourly records for Wind Turbine 01 on October 18, 2022.

Timestamp	Name	Turbine Name	Rotor Speed Value
Oct 18, 2022, 12:00:00 AM	Wind Turbine 01	WTG	12.065339694521
Oct 18, 2022, 1:00:00 AM	Wind Turbine 01	WTG	12.1737352656388
Oct 18, 2022, 2:00:00 AM	Wind Turbine 01	WTG	12.6155541437183
Oct 18, 2022, 3:00:00 AM	Wind Turbine 01	WTG	8.11173770355818
Oct 18, 2022, 4:00:00 AM	Wind Turbine 01	WTG	13.2228791411514
Oct 18, 2022, 5:00:00 AM	Wind Turbine 01	WTG	12.0253646491773
Oct 18, 2022, 6:00:00 AM	Wind Turbine 01	WTG	11.5812083027400
Oct 18, 2022, 7:00:00 AM	Wind Turbine 01	WTG	13.1888600614061
Oct 18, 2022, 8:00:00 AM	Wind Turbine 01	WTG	13.4219184096655
Oct 18, 2022, 9:00:00 AM	Wind Turbine 01	WTG	13.3892396397786
Oct 18, 2022, 10:00:00 AM	Wind Turbine 01	WTG	12.0966064425502

Early detection of turbine anomalies
Forecast power generation / demand

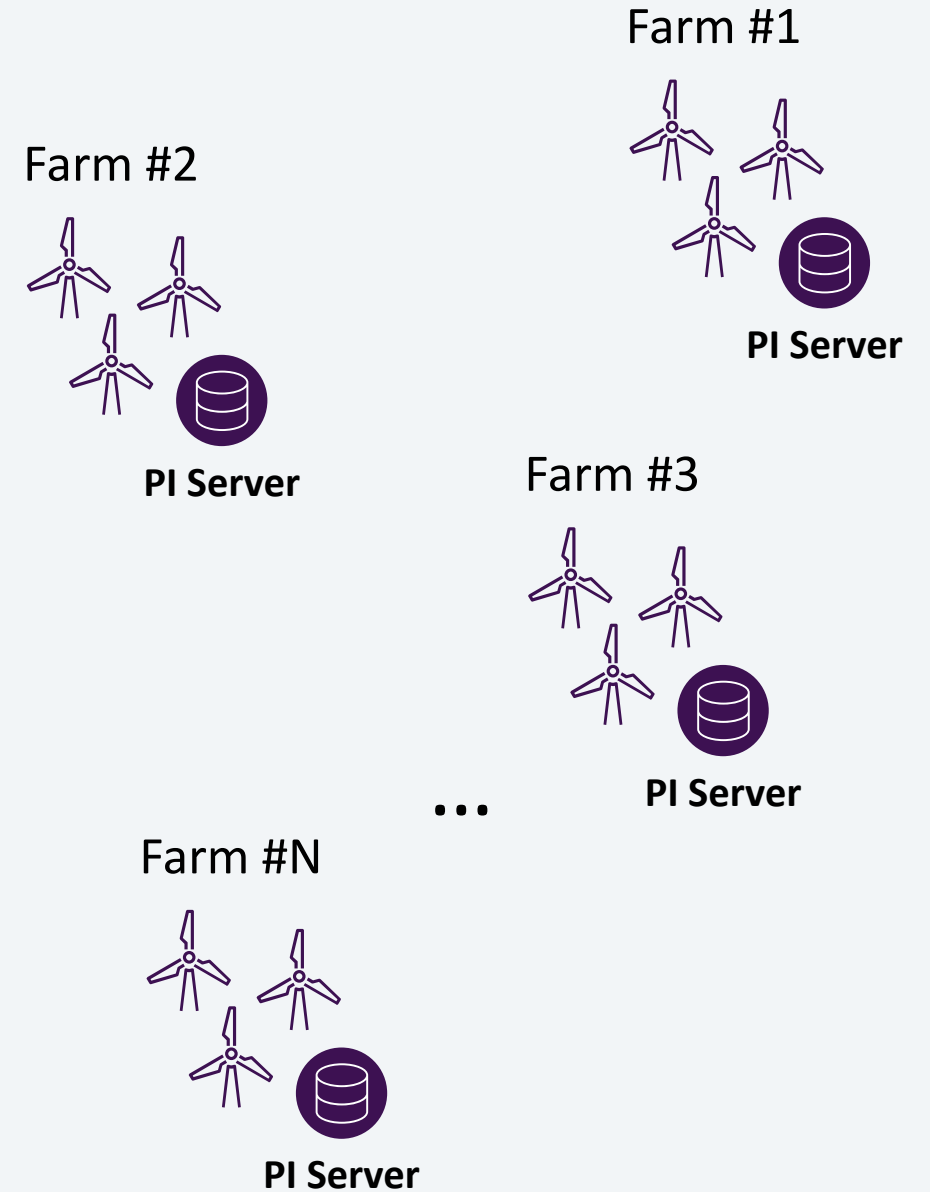
AVEVA PI System

Choice of AVEVA or third-party solution

Advanced analytics at scale

Windtopia's challenges

- No built-in advanced analytic tools in PI
- Windtopia has dozens of AVEVA PI Servers across the world
 - How can they give access to data scientists?
- Very large volumes of data to query
 - Horizontal scalability required



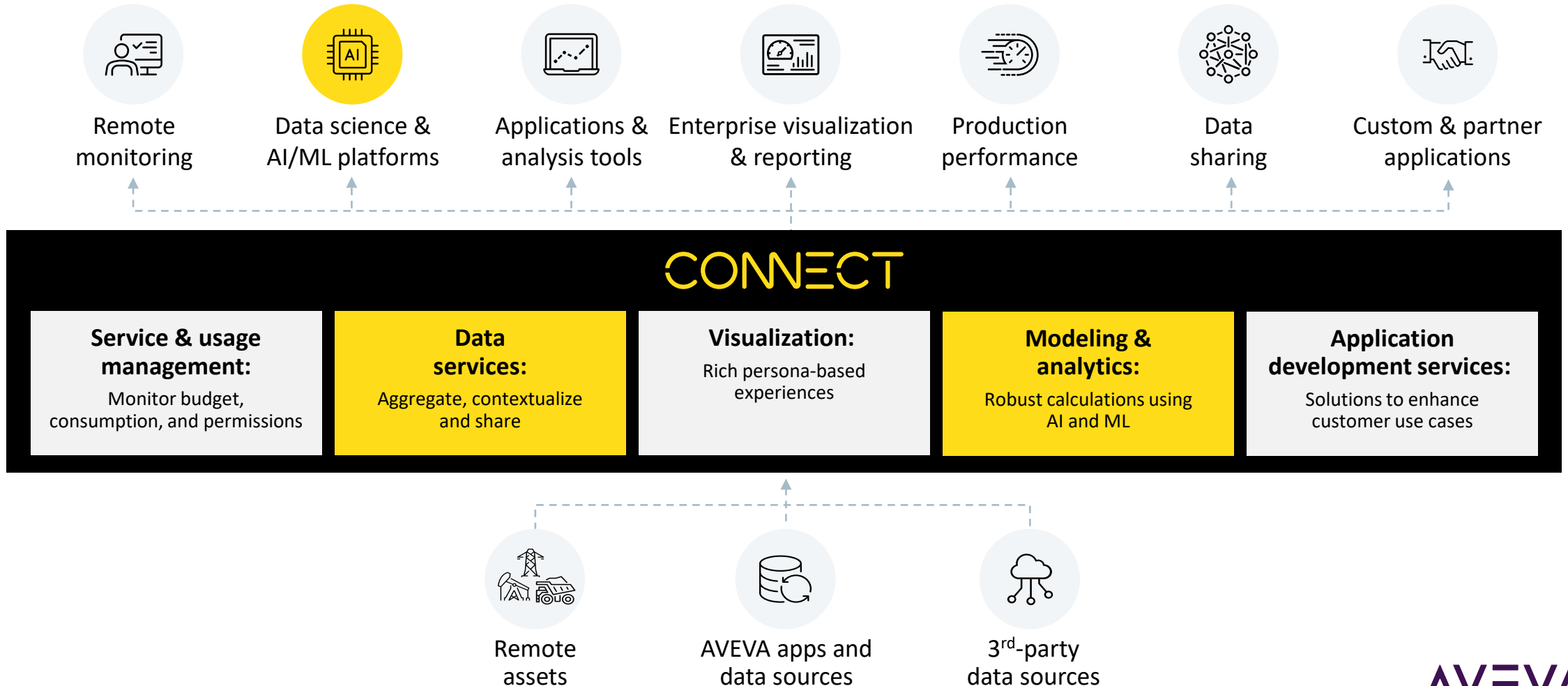
OPERATIONS DATA ANALYTICS AT CLOUD SCALE

CONNECT provides multiple routes
for performing advanced analytics

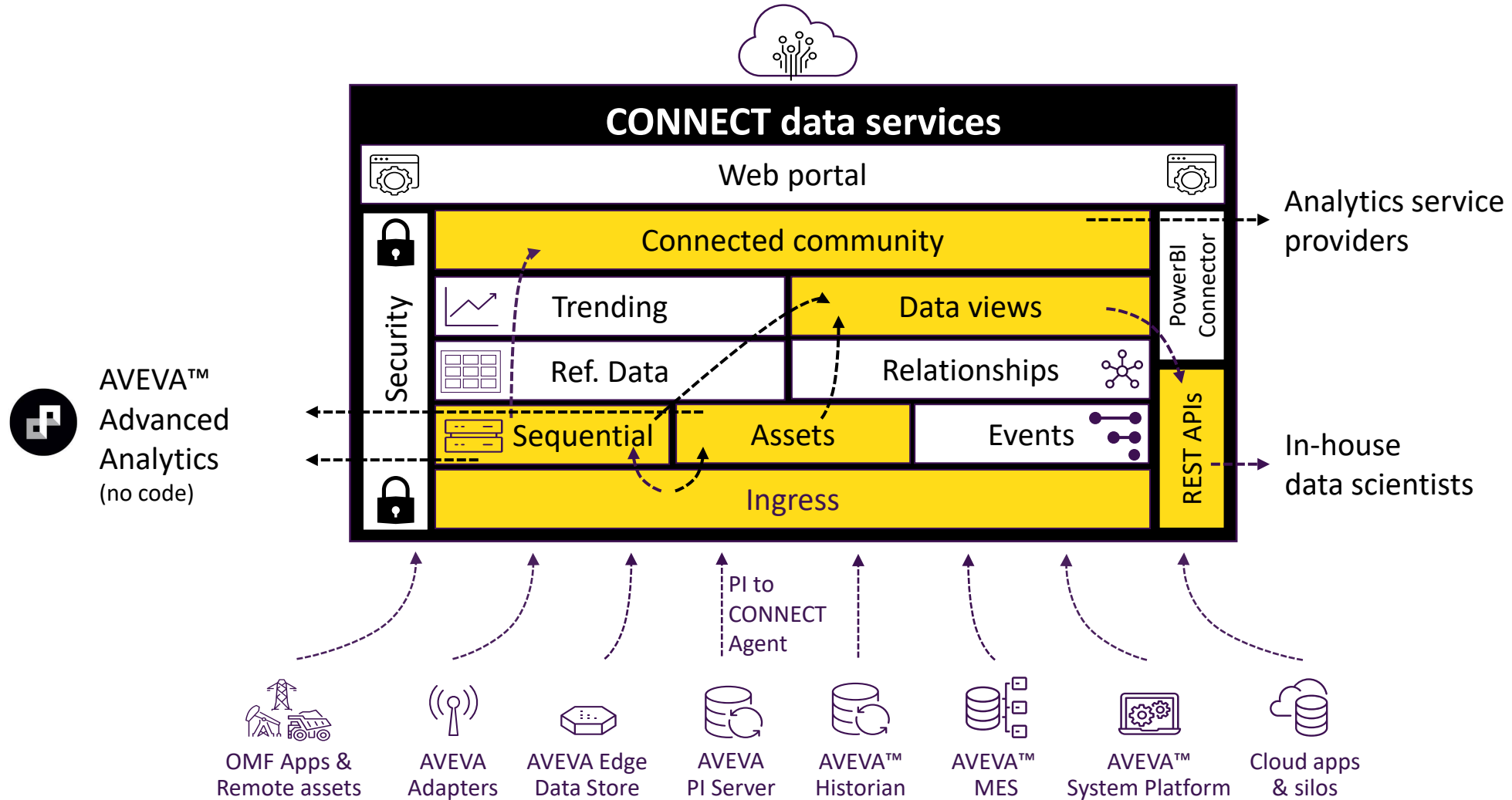
AVEVA

Leveraging CONNECT, the industrial intelligence platform

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



Multiple routes for advanced analytics



AVEVA Advanced Analytics

Overview

What data does this model use? 13 TOPICS

Name	Description
Wind Turbine 1 Anomaly	AWC24 talk by Clément Dekeyser

Problem To Solve
Detect Anomaly - Asset

Twin
[Wind Farm / Wind Turbine 1](#)

Active? Last Training: **Sep 12th, 2024 at 17:33** Data collected every: **0:15** Executes every: **0:15** Retraining every: **N/A** Model is executing

What data should the Model consider?

Add Data

Complete

When should data be collected?

Set Timing

Complete

Validate the Model's configuration.

Evaluate Model

Complete

Start training a Model with your Twin's data.

Start Training

Complete

See what your Model found in your data.

Review Results

Ready

When should the trained Model run?

Operationalize Model

Complete

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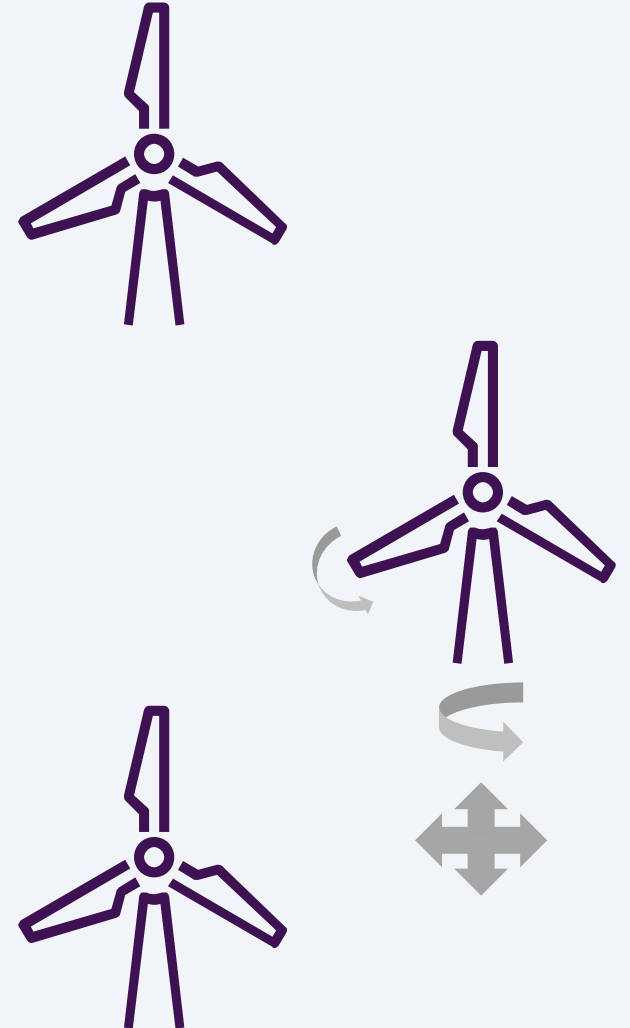
OPERATIONS DATA ANALYTICS AT CLOUD SCALE

Transferring data between AVEVA™ PI Server and CONNECT

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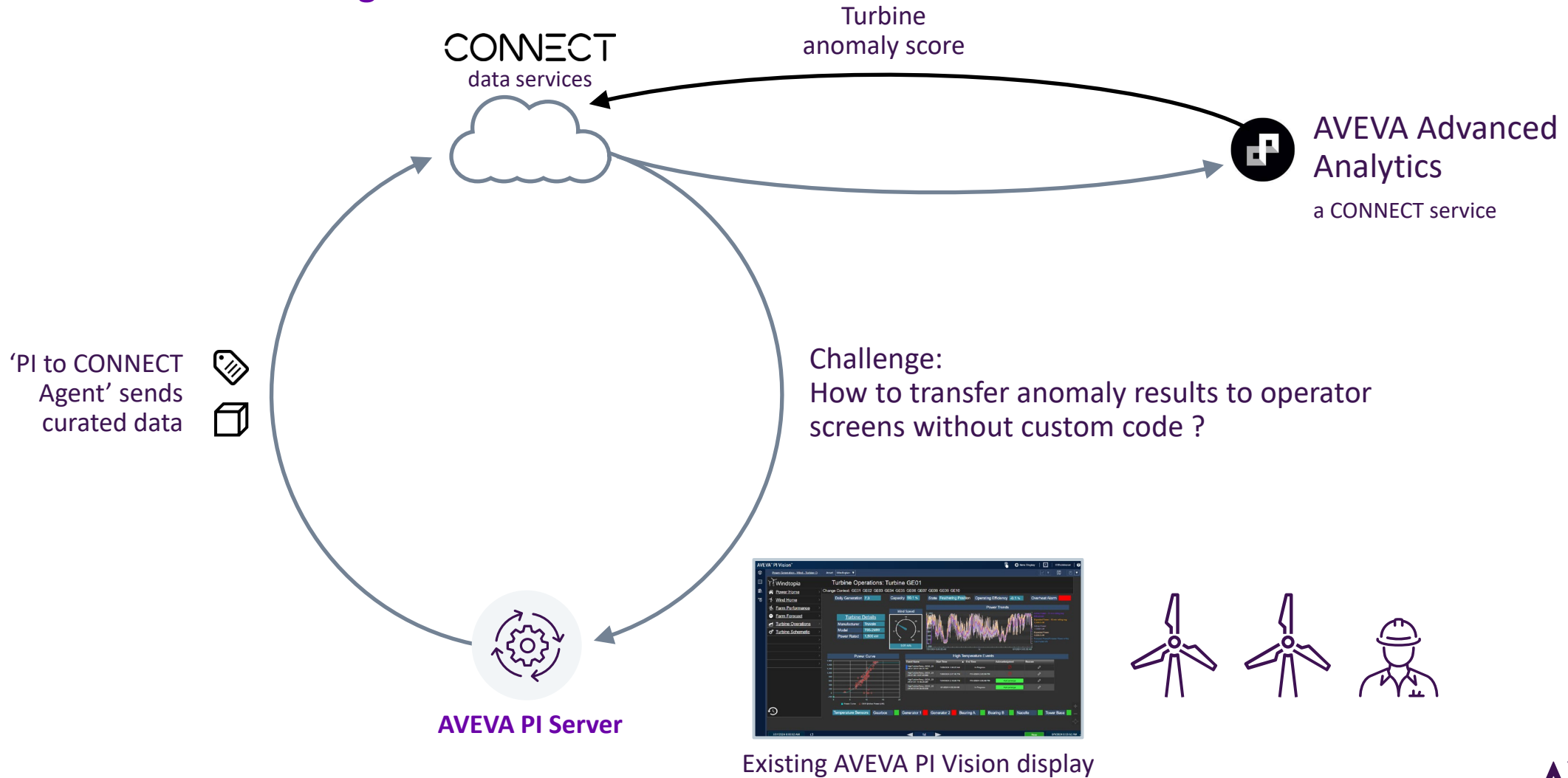
Windtopia's maintenance challenges

- Monitor not only the wind turbines, but also the accessories
- Additional motors move the turbines and blades
 - Important for windfarm performance optimization
 - Not enough monitoring
- How to detect potential anomalies as early as possible ?
 - More time to plan and optimize maintenance visits
 - More time to book spare parts



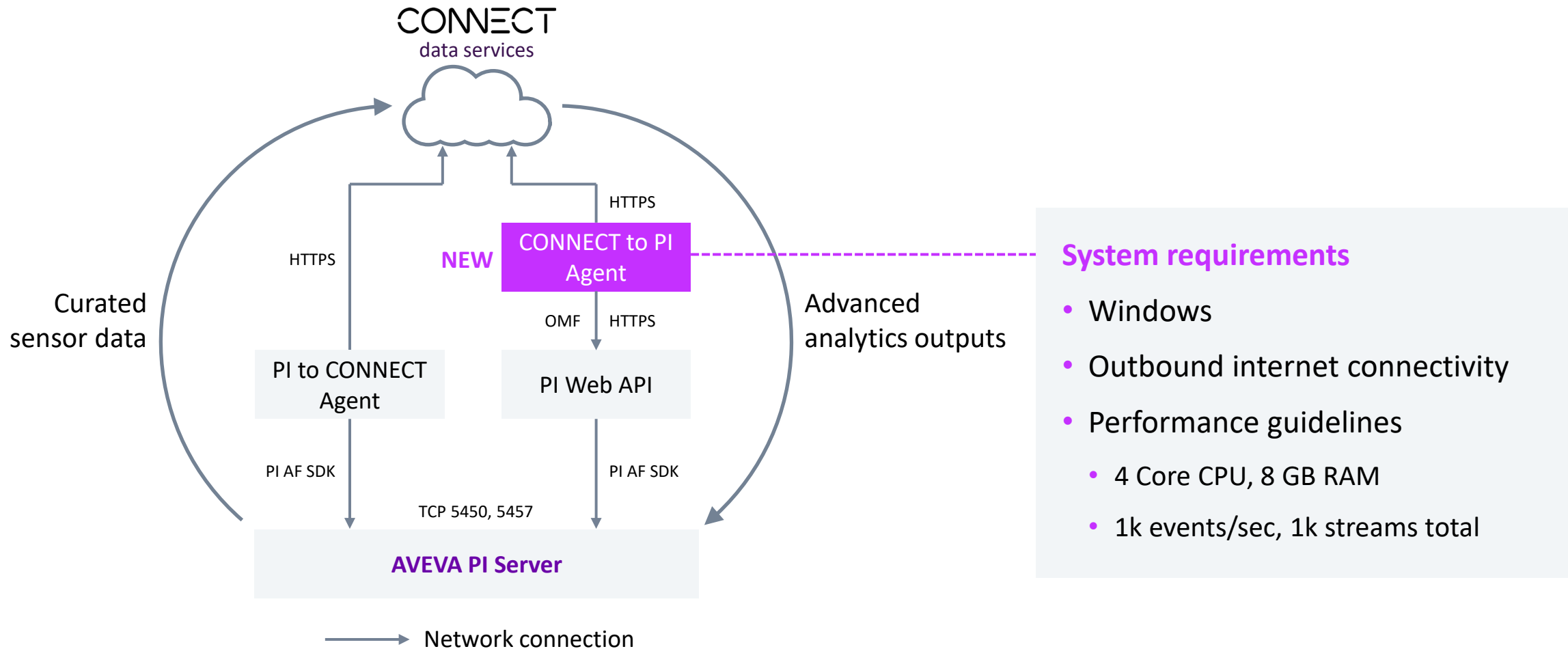
Wind turbine anomaly score from AVEVA™ Advanced Analytics

Use case: maintaining asset health

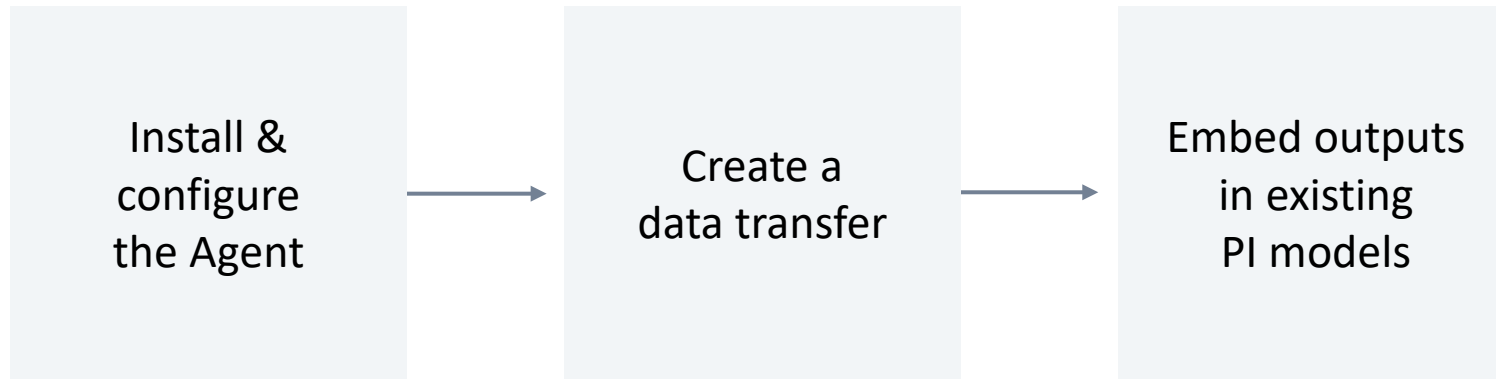


Deploying CONNECT to PI Agent

Based on the AVEVA Adapter framework and Open Message Format (OMF)



Steps to deploy the Agent



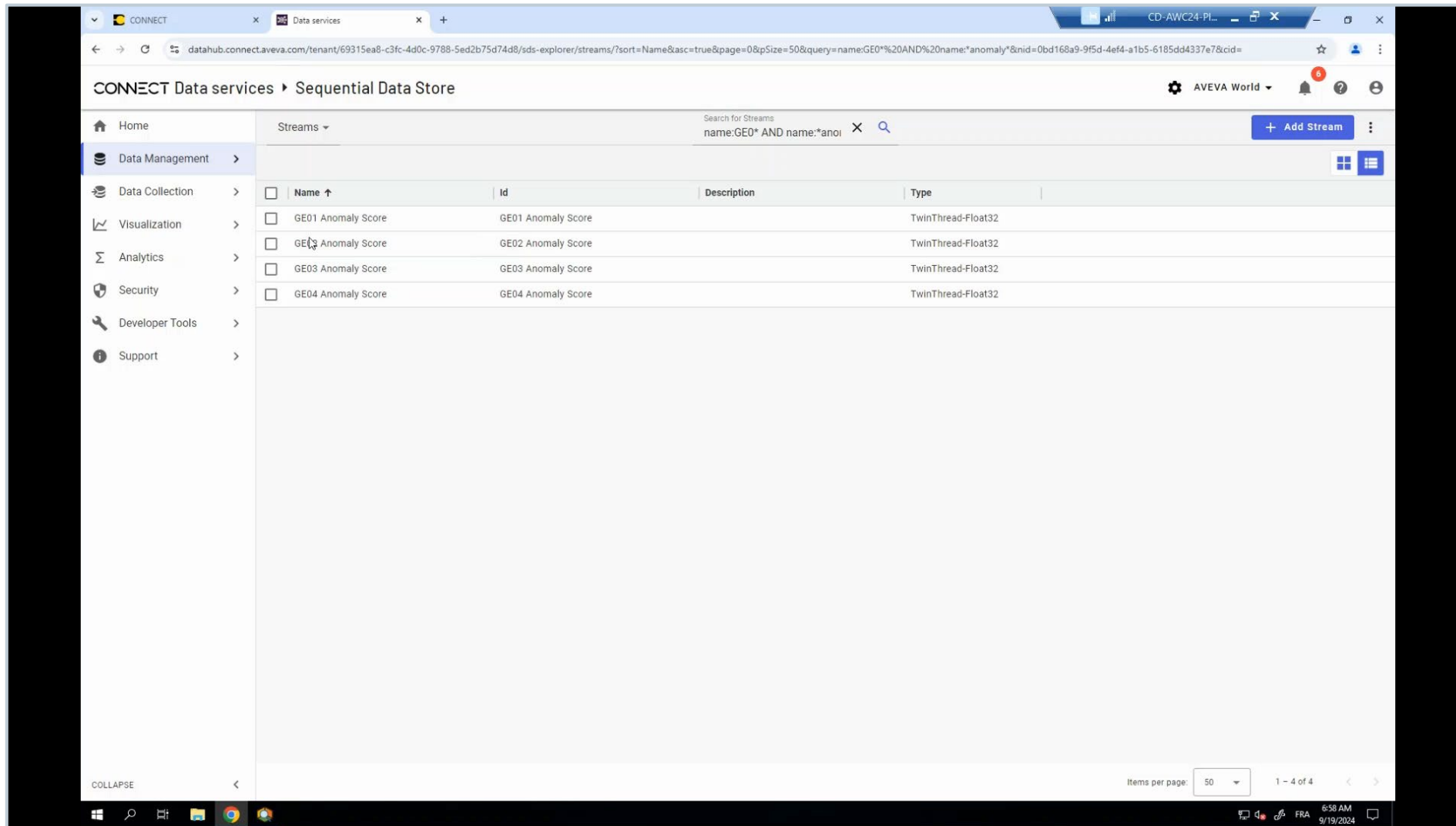
1. Install & configure the 'CONNECT to PI Agent'

The screenshot displays the 'CONNECT Data services' dashboard. The left sidebar contains navigation options: Home, Data Management, Data Collection, Visualization, Analytics, Security, Developer Tools, and Support. The main content area features several widgets:

- Latest Service Updates:** An announcement for 'CONNECT to PI Agent 1.0.1523 is released!' dated August 26, 2024. The text describes a new hybrid data connectivity software for managing data transfer from streams to tags in AVEVA PI Server.
- Quick Links:** A list of five links: View API documentation, Explore working code samples, View service blog, Manage Users And User Access For Your Organization, and Manage clients and secrets for securely accessing your data.
- Yesterday's Resource Usage:** A table for September 8, 2024, showing 65 Streams Stored, 0 Streams Accessed, and 0 Shared Streams Accessed.
- System Health:** A green heart icon with a pulse line and the text 'Ok'.
- PI to CONNECT Agents:** A green checkmark icon and the text 'All agents in good health'.
- Systems:** A circular progress indicator showing '5 Total Systems'. Below it, a bar chart shows 0 Good, 3 Warning, 2 Bad, and 0 Stopped.
- CONNECT to PI Agents:** A box stating 'No Agents Found'.

The bottom of the dashboard includes a 'COLLAPSE' button and a Windows taskbar with system icons and the date/time (ENG FR 12:37 AM 9/9/2024).

2. Create a 'CONNECT to PI Agent' data transfer



The screenshot displays the AVEVA CONNECT Data services interface, specifically the Sequential Data Store. The page title is "CONNECT Data services > Sequential Data Store". A search bar at the top right contains the query "name:GE0* AND name:*anoi". Below the search bar is a table listing streams. The table has columns for Name, Id, Description, and Type. There are four rows of data, each representing an anomaly score stream. The interface includes a left-hand navigation menu with options like Home, Data Management, Data Collection, Visualization, Analytics, Security, Developer Tools, and Support. At the bottom right, there are controls for "Items per page" (set to 50) and "1 - 4 of 4".

<input type="checkbox"/>	Name ↑	Id	Description	Type
<input type="checkbox"/>	GE01 Anomaly Score	GE01 Anomaly Score		TwinThread-Float32
<input type="checkbox"/>	GE02 Anomaly Score	GE02 Anomaly Score		TwinThread-Float32
<input type="checkbox"/>	GE03 Anomaly Score	GE03 Anomaly Score		TwinThread-Float32
<input type="checkbox"/>	GE04 Anomaly Score	GE04 Anomaly Score		TwinThread-Float32

3. Results: Enriched AVEVA PI Vision display with greater insight

The screenshot displays the AVEVA PI System Explorer interface. On the left, a tree view shows the hierarchy: Elements > Generation > Windtopia > Big Buffalo Wind Farm > GE01. The main pane shows a table of data for GE01, with the 'Anomaly Score' row highlighted. The table has columns for Name, Value, and Time Stamp. The 'Anomaly Score' row shows a value of 0.6 at 10/9/2024 1:08:30.163 PM. Below the table, a list of categories is visible, including Advanced Analytics, Current Conditions, Data Management, Energy&Power, Events, Financial, Forecast, Gearbox, General, Generator, Location, Nacelle, Navigation, Other, Stats, Temperature, and Tower. On the right, a properties panel for 'Anomaly Score' is shown, with fields for Name, Description, Properties, Categories, Default UOM, Value Type, Value, Display Digits, and Data Reference. The Value field is set to 0.6 and the Data Reference is PI Point. At the bottom, a status bar indicates 'GE01 Modified:10/12/2024 12:25:13 AM Owner:OSI\cdekeyser Version: 1/1/1970 12:00:00 AM, Revision 12'.

Name	Value	Time Stamp
AAA Anomaly Model Analysis Link	https://aponeu.advancedanalytics.connect.aveva.com:443/models/172/analysis	1/1/1970 12:00:00 AM
AAA Current Anomaly Status Link	https://aponeu.advancedanalytics.connect.aveva.com:443/analyze/7135?returnUrl...	1/1/1970 12:00:00 AM
AAA Model Id	172	1/1/1970 12:00:00 AM
Anomaly Score	0.6	10/9/2024 1:08:30.163 PM
HI	90	1/1/1970 12:00:00 AM

ADVANCED ANALYTICS WITH BI-DIRECTIONAL DATA TRANSFER

Final thoughts

Final thoughts

- AVEVA PI Data Infrastructure, featuring **AVEVA PI Server + CONNECT data services**, delivers advanced analytics faster based on curated data.
- Put analytic results back into the hands of your operations engineers.
 - Ops team knows how to interpret and act on PI data
 - Ops team will welcome new insights in their existing visualizations
- With the 'CONNECT to PI Agent', you can easily complete the roundtrip.



AVEVA

The Windtopia story continues

Watch Windtopia transform its data infrastructure over the course of AVEVA World

This Session: Operations data analytics at cloud scale:

Seamless integration of PI System data with CONNECT data services

Room: Ternes Hall | 16 October, 14:45 – 15:15

Later: Easily deploy AVEVA Adapters to remotely collection operations data at scale

Room: #251 | 16 October, 15:30 – 16:00

Later: Hosting PI Asset Framework's SQL database in the cloud with Azure SQL DB

Room: #252A+B | 16 October, 16:15 – 16:45

Later: Support expanding needs with AVEVA PI Vision 2024

Room: #241 | 16 October, 17:00 – 17:30

Questions?

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