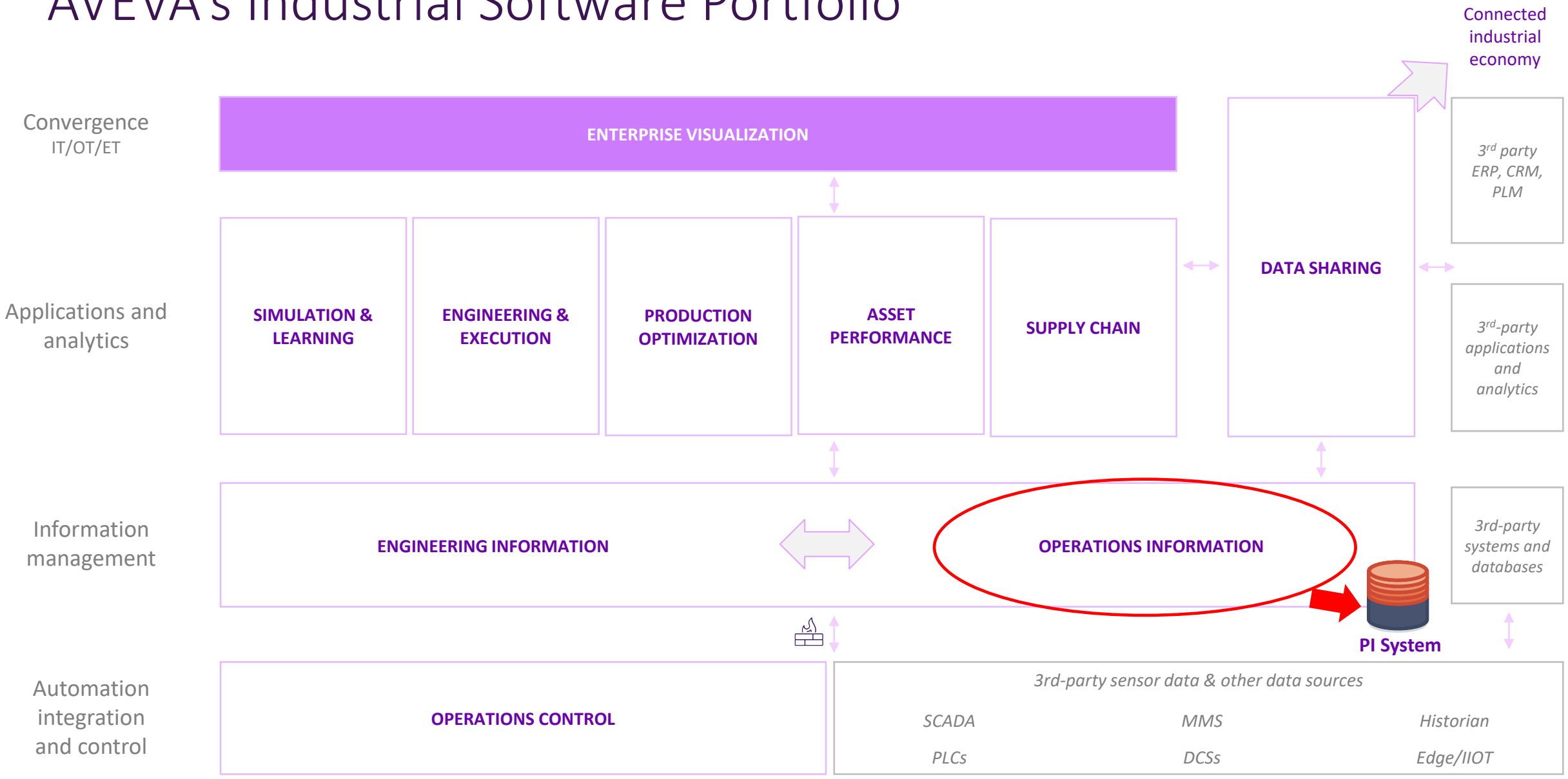
SEPTEMBER 2022

PI System – Operations Data Management

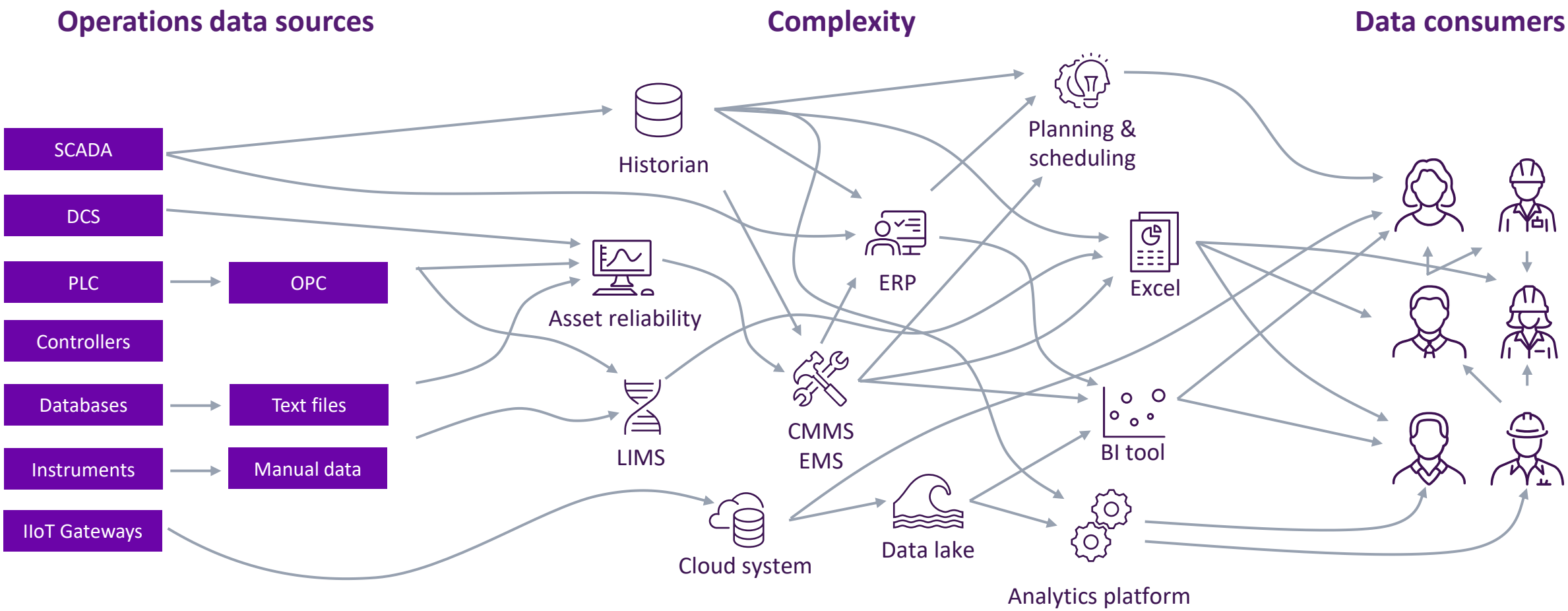
AVEVA Select California Roadshow 2022

Andrew Nathan

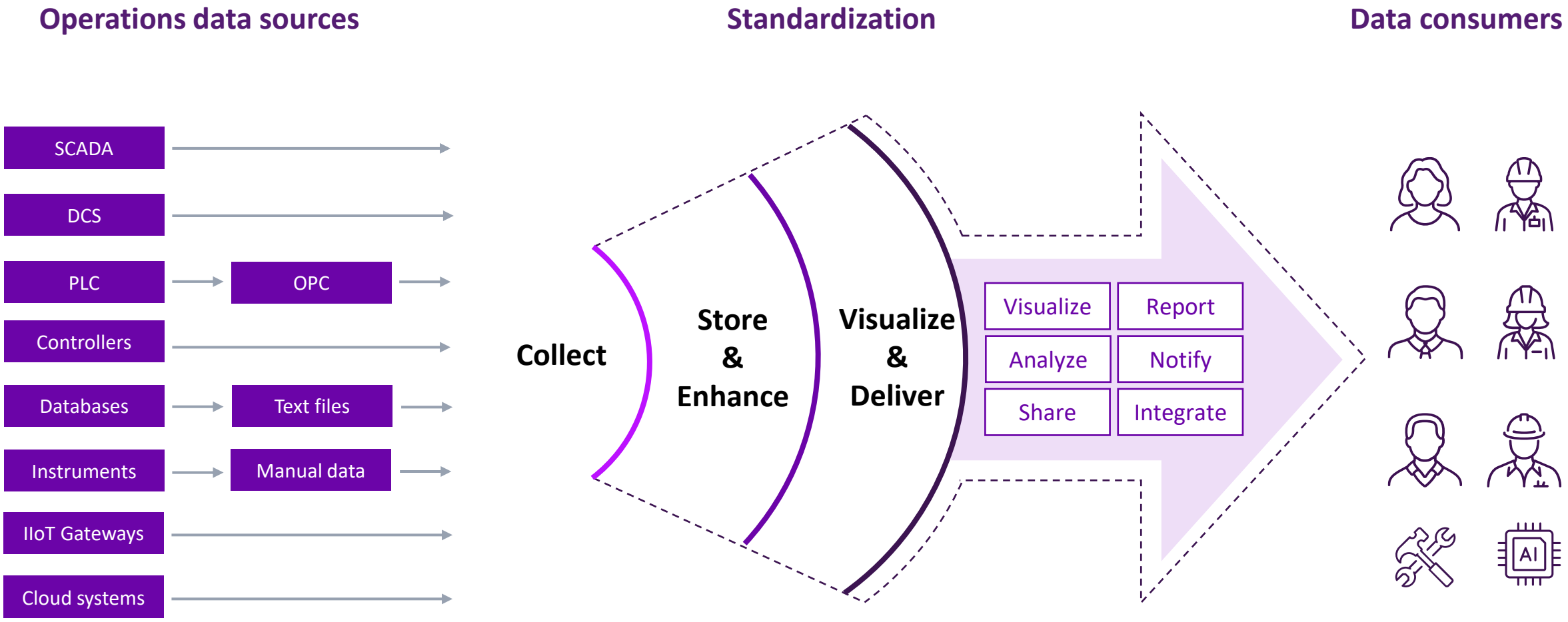
AVEVA's Industrial Software Portfolio



Managing operations data is complex



Connect people to data with an infrastructure approach

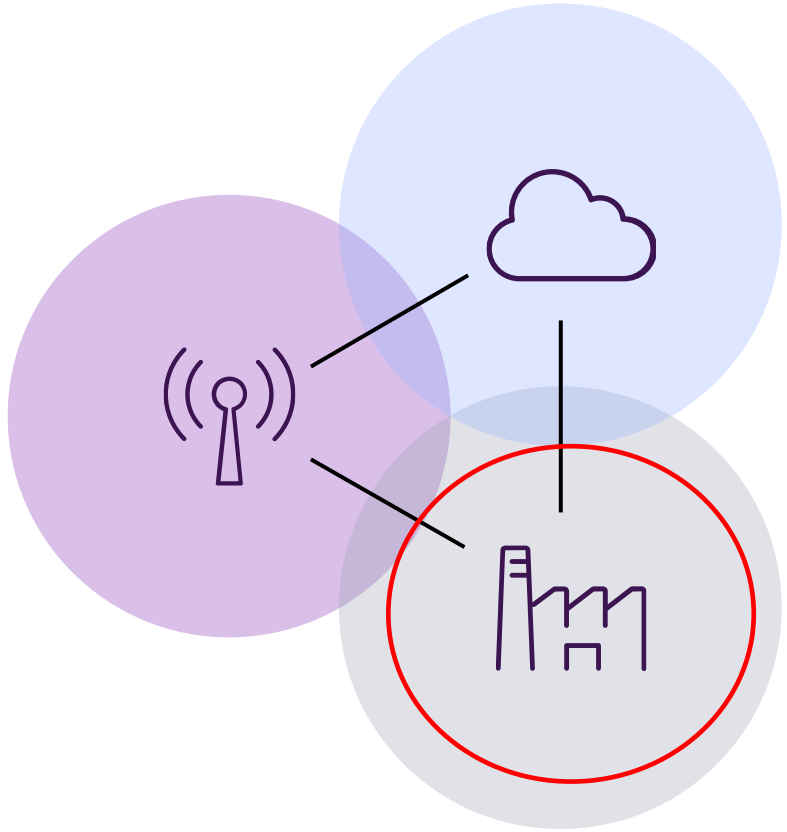


AVEVA PI System’s edge to plant to cloud data management

An integrated, edge-plant-cloud architecture supports OT, IT and IIoT use cases

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

The Modern On-prem PI System

DATA SOURCES

METADATA

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

AF Linked Tables and Data References

TIME-SERIES

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

Interfaces, Connectors, Adapters

PI Edge

COLLECT

PI SERVER

Notifications

Event Frames

Asset Analytics

Asset Framework

High Fidelity Historian with Future Data

STORE & ENHANCE

Email/Text/IM or Service request

Events

Low Efficiency

Calculations & Simple Analytics

Pump

- Efficiency
- Dynamic Limit
- Time to Failure

Assets

PUMP TEMPLATE

Pump Station

Pump 01

- Discharge Pressure
- Forecasted Pressure
- Manufacturer

Pump 02

- Discharge Pressure
- Forecasted Pressure
- Manufacturer

Tags

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

PERFORMANCE INTELLEGENCE

AVEVA

The Modern On-prem PI System

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TIME-SERIES

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

COLLECT

AF Linked Tables
PI System Access Methods and Data References

Interfaces, Connectors, Adapters
PI Edge

PI SERVER

- Notifications
- Event Frames
- Asset Analytics
- Asset Framework

High Fidelity Historian with Future Data

STORE & ENHANCE

DELIVER

Predict → AVEVA Predictive Analytics

Visualize → PI Vision, PI DataLink (Excel)

Share → AVEVA™ Data Hub

Integrate →
Business Intelligence Tools
Amazon Web Services
Esri ArcGIS
Microsoft Azure
SAP HANA

Customize →
Custom Applications
Business Systems
Programmatic Access

PERFORMANCE INTELLEGENCE

AVEVA

Pump Optimization: An Application of the AVEVA PI System

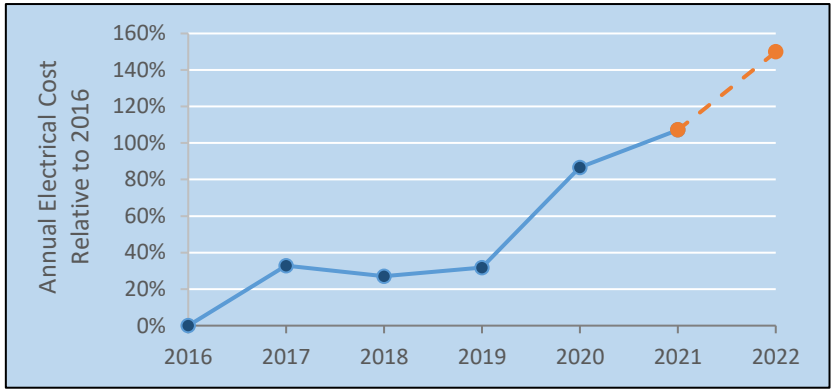
Ethan Smith, E.I.T

SAN JOSE WATER

AVEVA

The Problem

Costs of Pumping

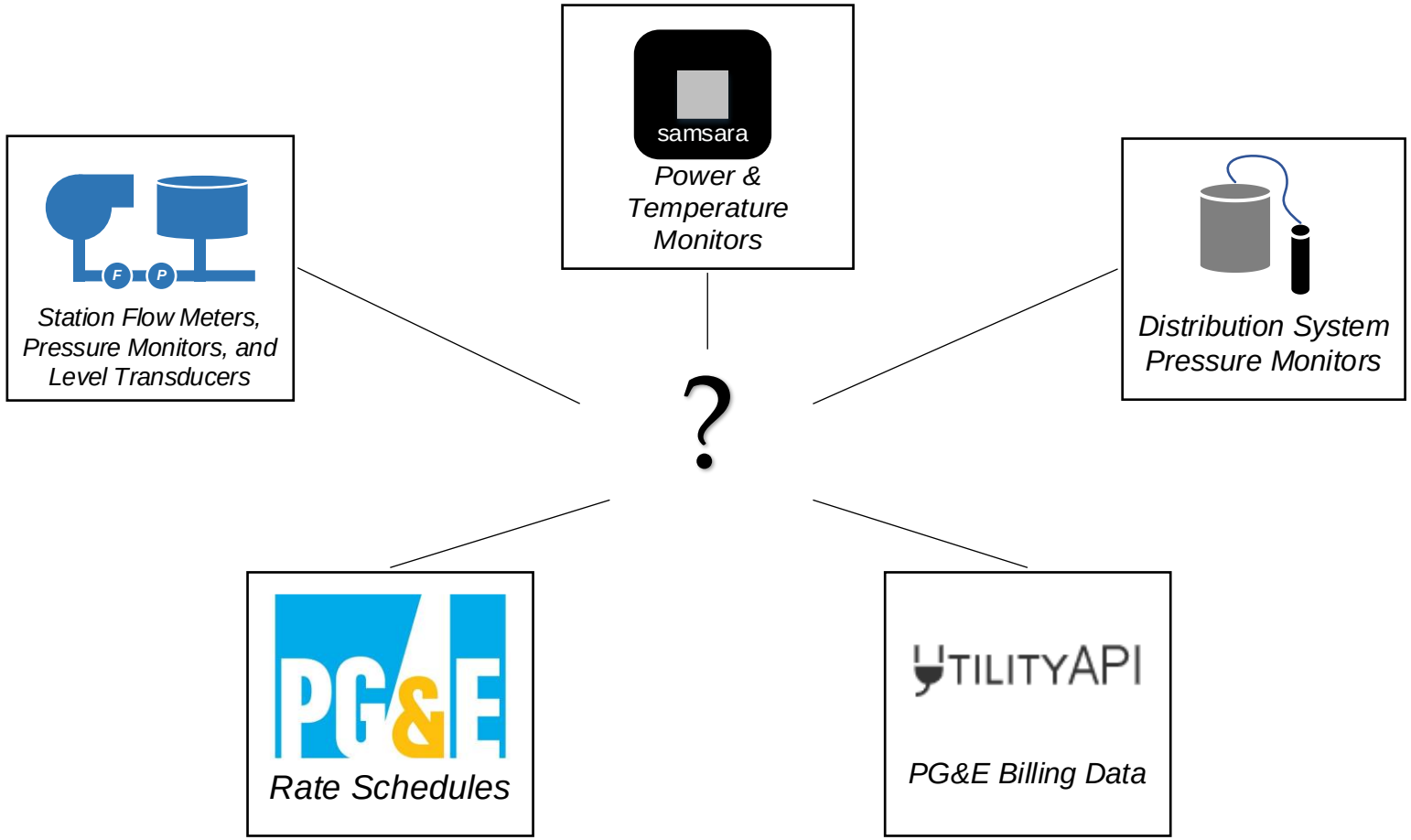


- 92% of Energy Use
  - ~40,000,000 kWh

- Limited Monitoring = Reactive Maintenance
  - System Strain
  - Service Interruption
  - More Costly Repair/Replacement

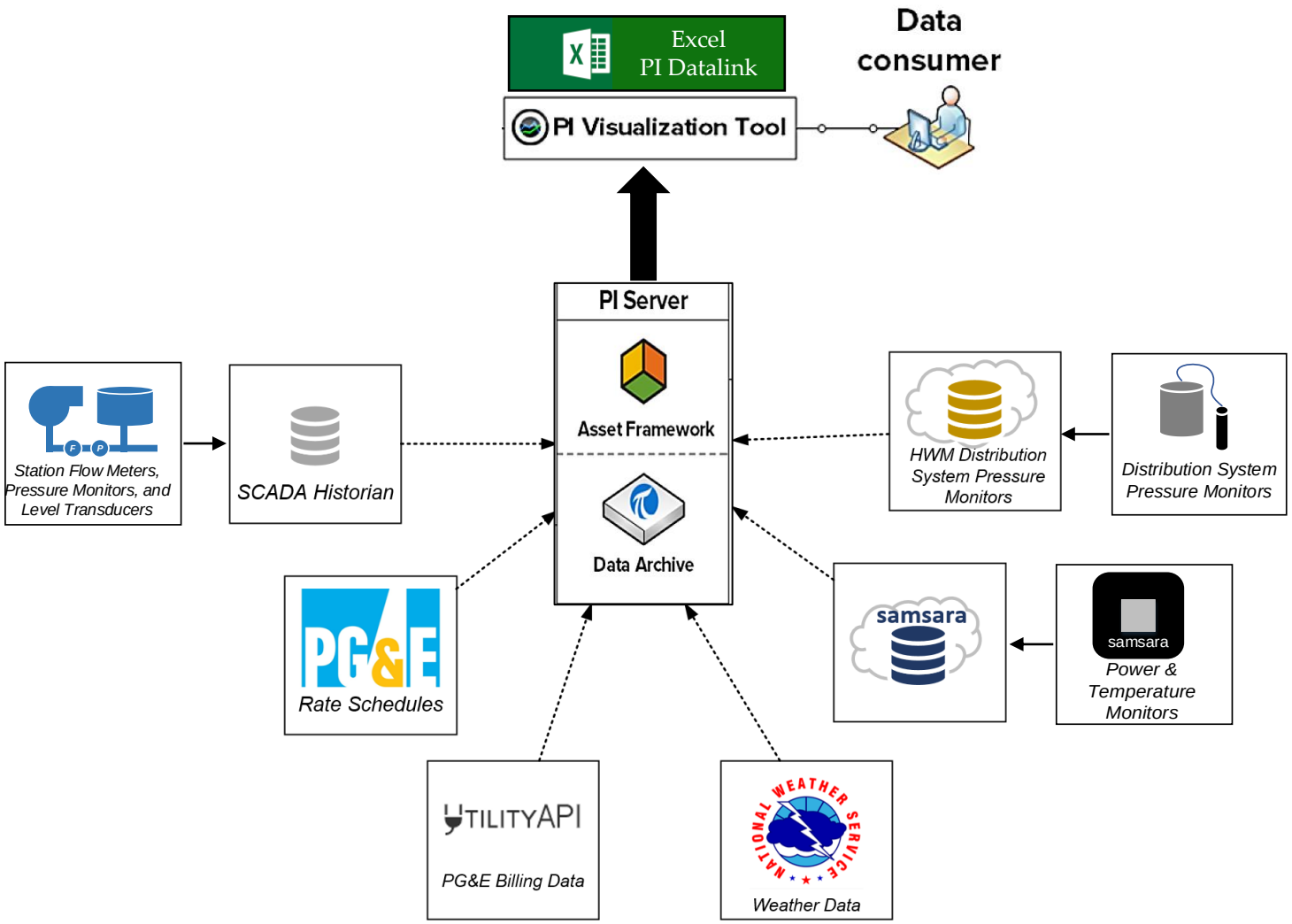
- Pump Prioritization Reliant on Field Efficiency Tests
  - Resource demanding
  - Infrequent
    - Data is Often 2-5 Years Old

Independent Data Sources

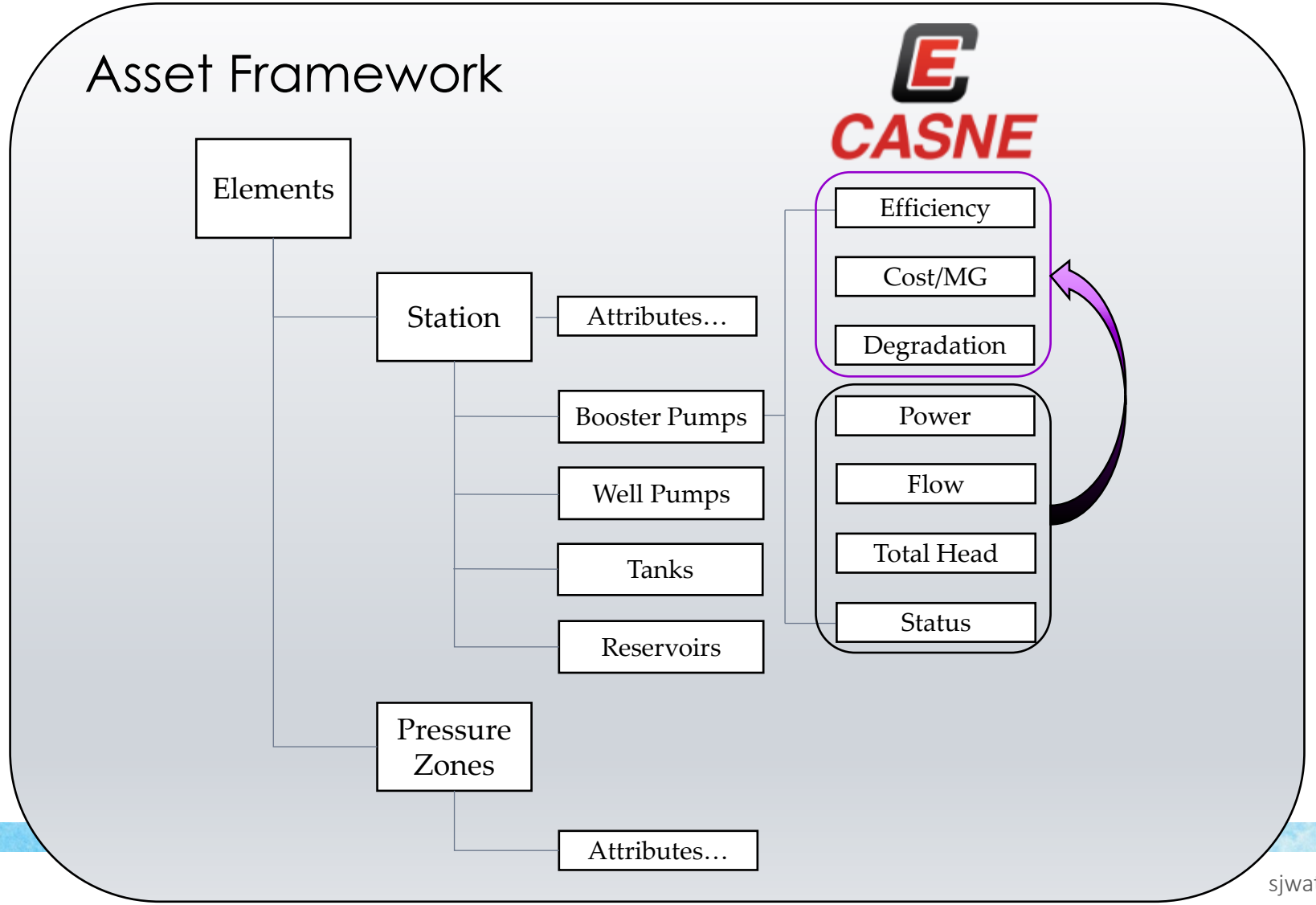


The Solution

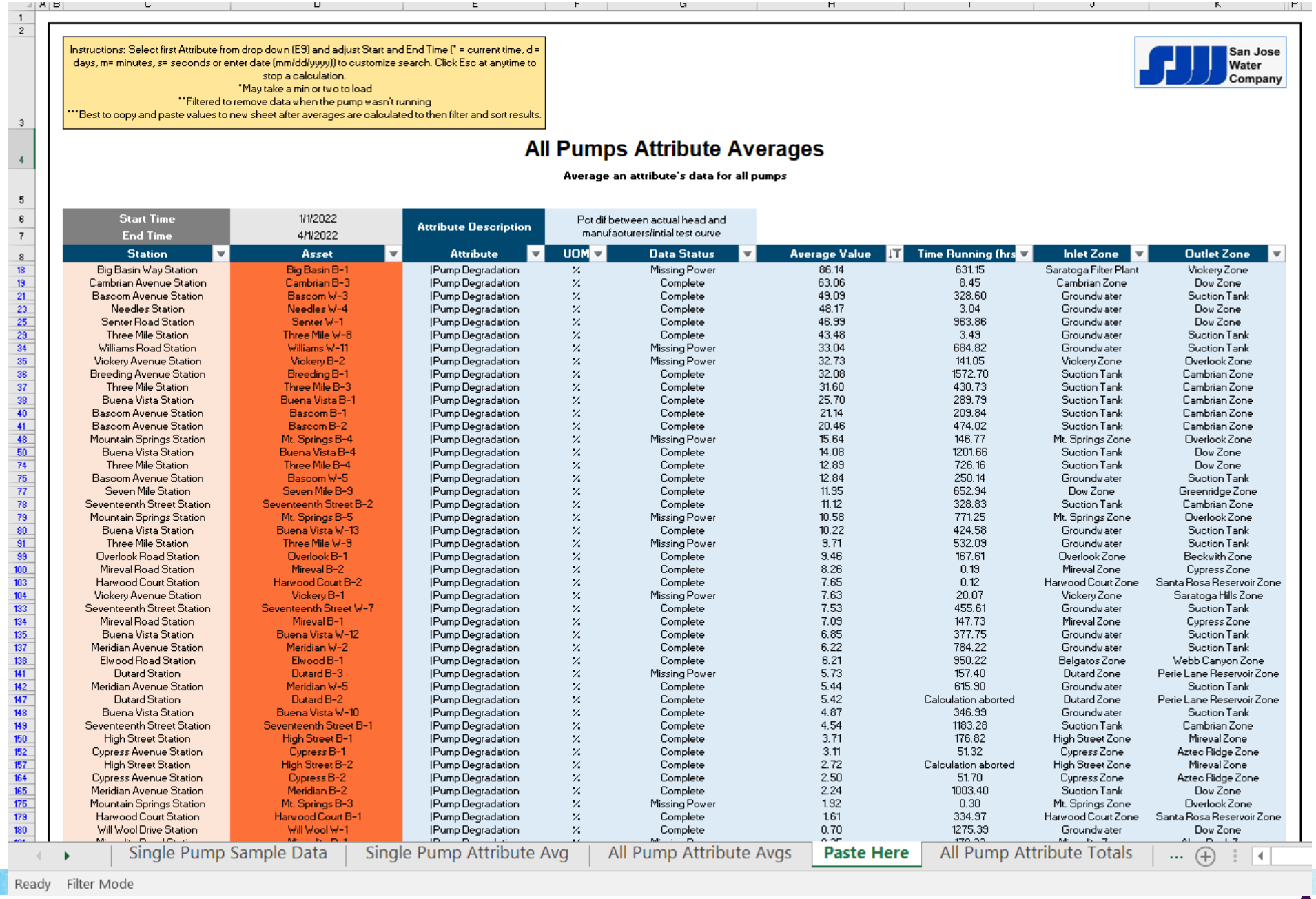
PI System


Excel
PI Datalink
Data consumer
PI Visualization Tool
PI Server
Asset Framework
Data Archive
Station Flow Meters, Pressure Monitors, and Level Transducers
SCADA Historian
HWM Distribution System Pressure Monitors
Distribution System Pressure Monitors
PG&E
Rate Schedules
samsara
samsara
Power & Temperature Monitors
UTILITYAPI
PG&E Billing Data
NATIONAL WEATHER SERVICE
Weather Data

Implementation



Application: Visualization



Instructions: Select first Attribute from drop down (E9) and adjust Start and End Time (* = current time, d = days, m= minutes, s= seconds or enter date (mm/dd/yyyy)) to customize search. Click Esc at anytime to stop a calculation.
*May take a min or two to load
**Filtered to remove data when the pump wasn't running
***Best to copy and paste values to new sheet after averages are calculated to then filter and sort results.

San Jose Water Company

All Pumps Attribute Averages

Average an attribute's data for all pumps

Start Time	1/1/2022	Attribute Description	Pct dif between actual head and manufacturers/intial test curve					
End Time	4/1/2022							
Station	Asset	Attribute	UOM	Data Status	Average Value	Time Running (hrs	Inlet Zone	Outlet Zone
Big Basin Way Station	Big Basin B-1	Pump Degradation	%	Missing Power	86.14	631.15	Saratoga Filter Plant	Vickery Zone
Cambrian Avenue Station	Cambrian B-3	Pump Degradation	%	Complete	63.06	8.45	Cambrian Zone	Dow Zone
Bascom Avenue Station	Bascom W-3	Pump Degradation	%	Complete	49.09	328.60	Groundwater	Suction Tank
Needles Station	Needles W-4	Pump Degradation	%	Complete	48.17	3.04	Groundwater	Dow Zone
Senter Road Station	Senter W-1	Pump Degradation	%	Complete	46.99	963.86	Groundwater	Dow Zone
Three Mile Station	Three Mile W-8	Pump Degradation	%	Complete	43.48	3.49	Groundwater	Suction Tank
Williams Road Station	Williams W-11	Pump Degradation	%	Missing Power	33.04	684.82	Groundwater	Suction Tank
Vickery Avenue Station	Vickery B-2	Pump Degradation	%	Missing Power	32.73	141.05	Vickery Zone	Overlook Zone
Breeding Avenue Station	Breeding B-1	Pump Degradation	%	Complete	32.08	1572.70	Suction Tank	Cambrian Zone
Three Mile Station	Three Mile B-3	Pump Degradation	%	Complete	31.60	430.73	Suction Tank	Cambrian Zone
Buena Vista Station	Buena Vista B-1	Pump Degradation	%	Complete	25.70	289.79	Suction Tank	Cambrian Zone
Bascom Avenue Station	Bascom B-1	Pump Degradation	%	Complete	21.14	209.84	Suction Tank	Cambrian Zone
Bascom Avenue Station	Bascom B-2	Pump Degradation	%	Complete	20.46	474.02	Suction Tank	Cambrian Zone
Mountain Springs Station	Mt. Springs B-4	Pump Degradation	%	Missing Power	15.64	146.77	Mt. Springs Zone	Overlook Zone
Buena Vista Station	Buena Vista B-4	Pump Degradation	%	Complete	14.08	1201.66	Suction Tank	Dow Zone
Three Mile Station	Three Mile B-4	Pump Degradation	%	Complete	12.89	726.16	Suction Tank	Dow Zone
Bascom Avenue Station	Bascom W-5	Pump Degradation	%	Complete	12.84	250.14	Groundwater	Suction Tank
Seven Mile Station	Seven Mile B-3	Pump Degradation	%	Complete	11.95	652.94	Dow Zone	Greenridge Zone
Seventeenth Street Station	Seventeenth Street B-2	Pump Degradation	%	Complete	11.12	328.83	Suction Tank	Cambrian Zone
Mountain Springs Station	Mt. Springs B-5	Pump Degradation	%	Missing Power	10.58	771.25	Mt. Springs Zone	Overlook Zone
Buena Vista Station	Buena Vista W-13	Pump Degradation	%	Complete	10.22	424.58	Groundwater	Suction Tank
Three Mile Station	Three Mile W-9	Pump Degradation	%	Missing Power	9.71	532.09	Groundwater	Suction Tank
Overlook Road Station	Overlook B-1	Pump Degradation	%	Complete	9.46	167.61	Overlook Zone	Beckwith Zone
Mireval Road Station	Mireval B-2	Pump Degradation	%	Complete	8.26	0.19	Mireval Zone	Cypress Zone
Harwood Court Station	Harwood Court B-2	Pump Degradation	%	Complete	7.65	0.12	Harwood Court Zone	Santa Rosa Reservoir Zone
Vickery Avenue Station	Vickery B-1	Pump Degradation	%	Missing Power	7.63	20.07	Vickery Zone	Saratoga Hills Zone
Seventeenth Street Station	Seventeenth Street W-7	Pump Degradation	%	Complete	7.53	455.61	Groundwater	Suction Tank
Mireval Road Station	Mireval B-1	Pump Degradation	%	Complete	7.09	147.73	Mireval Zone	Cypress Zone
Buena Vista Station	Buena Vista W-12	Pump Degradation	%	Complete	6.85	377.75	Groundwater	Suction Tank
Meridian Avenue Station	Meridian W-2	Pump Degradation	%	Complete	6.22	784.22	Groundwater	Suction Tank
Elwood Road Station	Elwood B-1	Pump Degradation	%	Complete	6.21	950.22	Belgatos Zone	Webb Canyon Zone
Dutard Station	Dutard B-3	Pump Degradation	%	Missing Power	5.73	157.40	Dutard Zone	Perie Lane Reservoir Zone
Meridian Avenue Station	Meridian W-5	Pump Degradation	%	Complete	5.44	615.90	Groundwater	Suction Tank
Dutard Station	Dutard B-2	Pump Degradation	%	Complete	5.42	Calculation aborted	Dutard Zone	Perie Lane Reservoir Zone
Buena Vista Station	Buena Vista W-10	Pump Degradation	%	Complete	4.87	346.99	Groundwater	Suction Tank
Seventeenth Street Station	Seventeenth Street B-1	Pump Degradation	%	Complete	4.54	1183.28	Suction Tank	Cambrian Zone
High Street Station	High Street B-1	Pump Degradation	%	Complete	3.71	176.82	High Street Zone	Mireval Zone
Cypress Avenue Station	Cypress B-1	Pump Degradation	%	Complete	3.11	51.32	Cypress Zone	Aztec Ridge Zone
High Street Station	High Street B-2	Pump Degradation	%	Complete	2.72	Calculation aborted	High Street Zone	Mireval Zone
Cypress Avenue Station	Cypress B-2	Pump Degradation	%	Complete	2.50	51.70	Cypress Zone	Aztec Ridge Zone
Meridian Avenue Station	Meridian B-2	Pump Degradation	%	Complete	2.24	1003.40	Suction Tank	Dow Zone
Mountain Springs Station	Mt. Springs B-3	Pump Degradation	%	Missing Power	1.92	0.30	Mt. Springs Zone	Overlook Zone
Harwood Court Station	Harwood Court B-1	Pump Degradation	%	Complete	1.61	334.97	Harwood Court Zone	Santa Rosa Reservoir Zone
Will Wool Drive Station	Will Wool W-1	Pump Degradation	%	Complete	0.70	1275.39	Groundwater	Dow Zone

Single Pump Sample Data | Single Pump Attribute Avg | All Pump Attribute Avgs | Paste Here | All Pump Attribute Totals

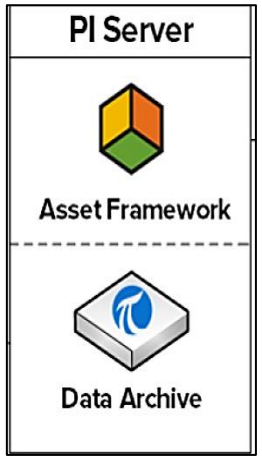
Ready Filter Mode

Next Steps/Expected Results

Expanding & Improving Coverage

- Calibration
- Replacement
- New Installation

Automated Pump Ranking



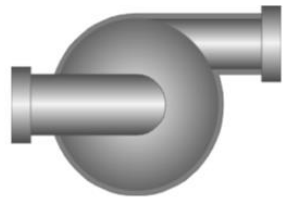
$/MG

API

SCADA

a) Control Variable A
   1. Pump B
   2. Pump A
   3. Pump C

b) …



Estimated Savings

- Peak ⇨ Off Peak = $540,000 / Year
  - 30 Pumps/Month Unintentionally On During Peak
- Prioritizing Most Efficient Pumps 2% Eff. = ⇧
- 2% Efficiency
  - i.e., 800,000 kWh Reduction ⇧ = $210,000 / Year

= 564 metric tons of CO_2