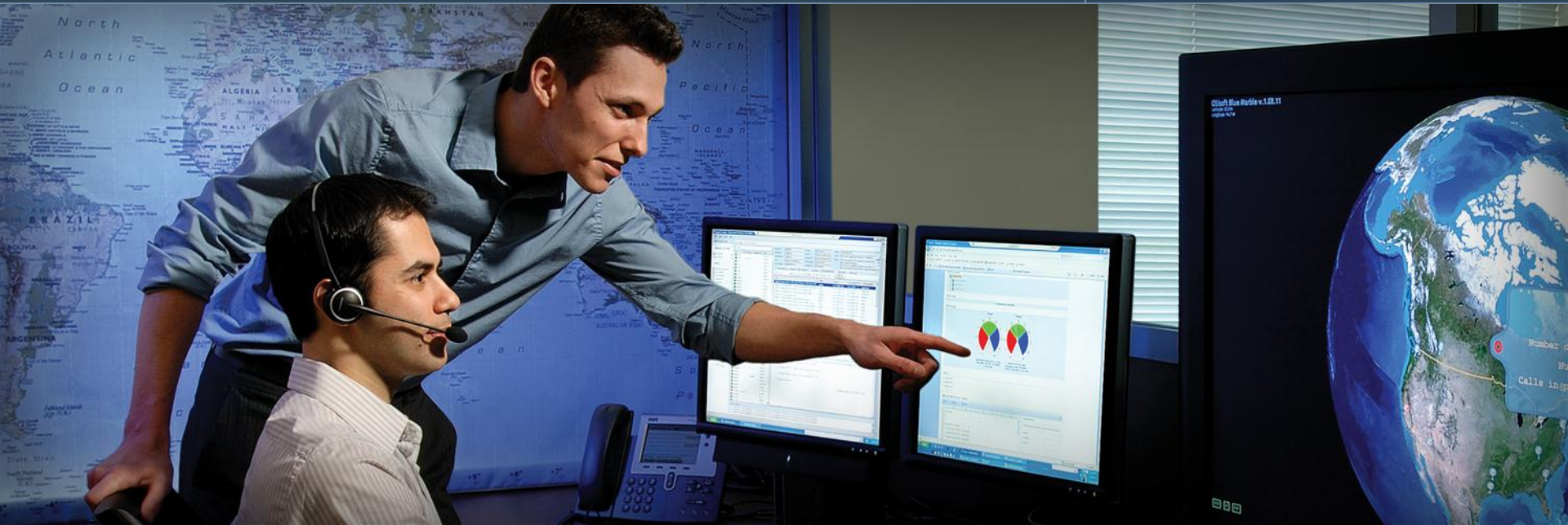




## Regional Seminar Series Boston



### PI Asset Framework (AF)

Stephen Kwan  
Product Manager  
OSIsoft, LLC

3 November 2010

Empowering Business in Real Time.

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- Overwhelming amount of data from disparate sources
  - Multiple interfaces
  - Multiple PI Servers
  - Non time series data - relational databases, design data, tables, etc.
  - Difficult to find the exception rather than the norm
- Complicated, inconsistent naming, definition and structure
- Difficult if not impossible to find all the data you need to make business decisions
- No single version of the truth - lacks consistency, difficult to communicate

## PI Asset Framework (AF)



*“An information model to organize and structure all your data with context”*

# Add Context to Your Data



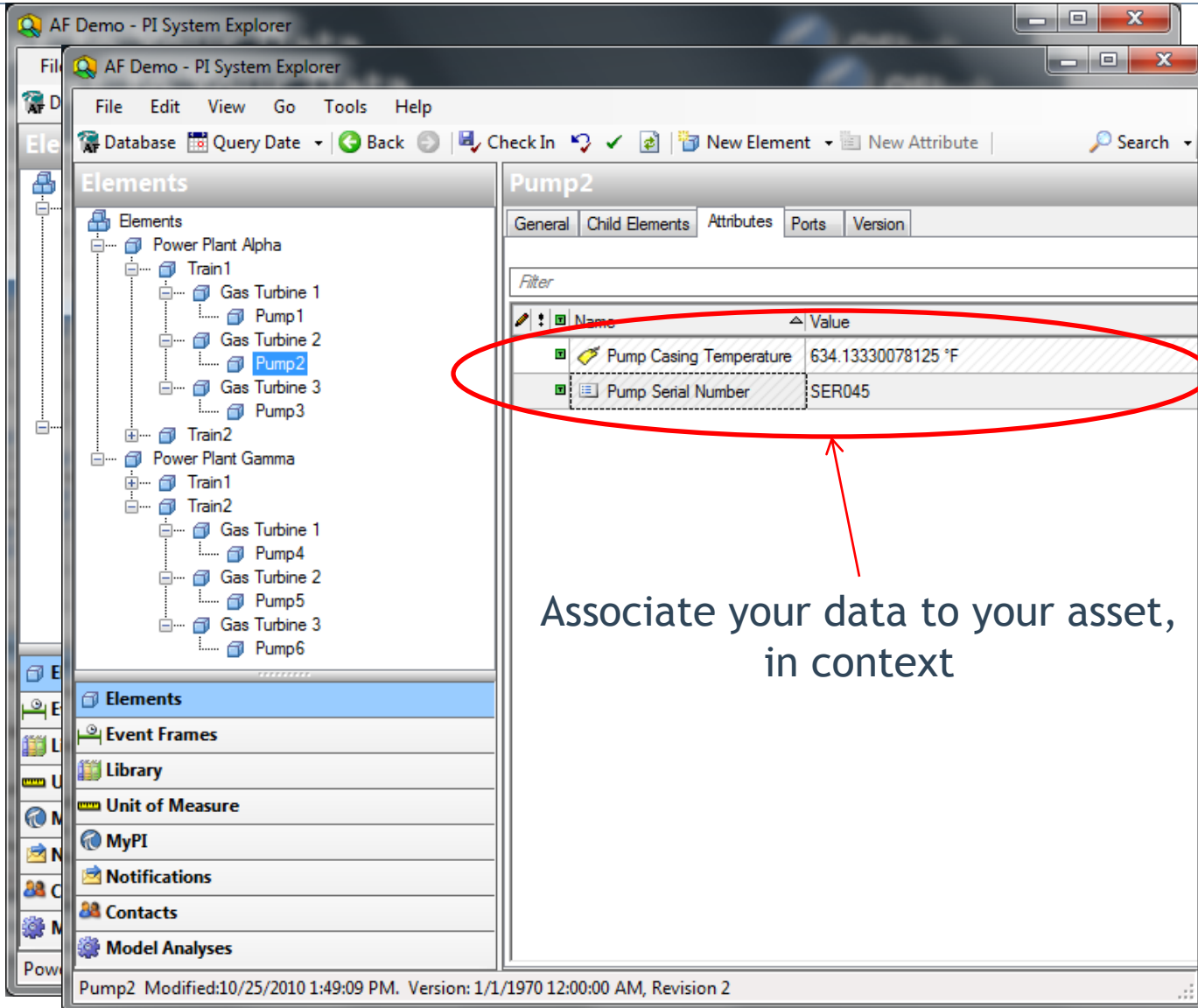
Difficult to decipher tag names

PI TAG	ENG UNITS	DESCRIPTION	MIN	MAX
ESFI21A2	KPPH	STEAM TURBINE UNCONTROLLED (IND FLOW)		0 100
TMT1132A	DEGF	ST-100 METAL TEMP (BEARING2)		0 400
TI99047	??	??		
G1:DWATT		Generator MW Output		
TMZ120A1	%	ST-100 AXIAL POSITION (PROBE #1)	-100	100
TMZ120A2	%	ST-100 AXIAL POSITION (PROBE #2)	-100	100
GT2PEAK.PV		GT2 Peakload Signal	0	1
FE_PUMP		Fire Extinguisher Pump Status		
ESFI33A	KPPH		0	425
ESTI34A	DEGF	LETDOWN TEMP TYPE E (HP STEAM)	0	1000
HPPI30B1	PSI	HP STEAM PRESSURE 1 (HP-STMP)	-1	1550
ESFI21A1	KPPH	STEAM TURBINE UNCONTROLLED (EXTR FLO)	0	210

Data

Missing or incomplete data - difficult to find what you need  
P&ID

# Add Context to Your Data



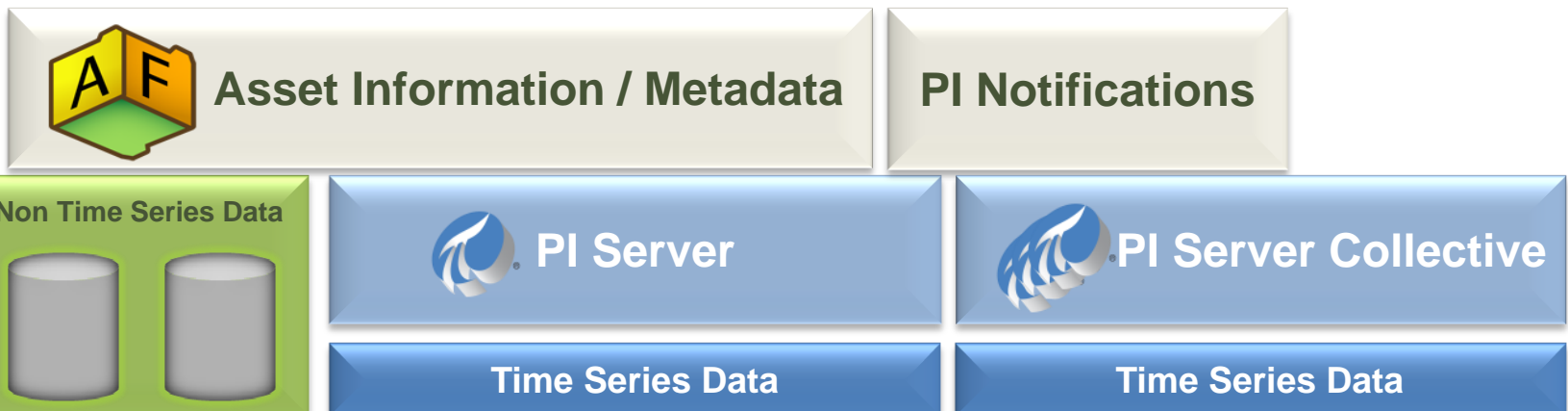
The screenshot displays the 'AF Demo - PI System Explorer' application. On the left, a hierarchical tree shows the structure of the system, including 'Power Plant Alpha', 'Train1', 'Gas Turbine 1', 'Pump1', 'Gas Turbine 2', 'Pump2', 'Gas Turbine 3', 'Pump3', 'Train2', 'Power Plant Gamma', 'Train1', 'Train2', 'Gas Turbine 1', 'Pump4', 'Gas Turbine 2', 'Pump5', 'Gas Turbine 3', and 'Pump6'. The 'Pump2' element is selected. The right pane shows the 'Pump2' details, with tabs for 'General', 'Child Elements', 'Attributes', 'Ports', and 'Version'. The 'Attributes' tab is active, displaying a table of attributes for Pump2. A red oval highlights the 'Pump Casing Temperature' and 'Pump Serial Number' attributes, with a red arrow pointing to them from the text 'Associate your data to your asset, in context'.

Name	Value
Pump Casing Temperature	634.13330078125 °F
Pump Serial Number	SER045

Associate your data to your asset,  
in context

Pump2 Modified:10/25/2010 1:49:09 PM. Version: 1/1/1970 12:00:00 AM, Revision 2

- Asset centric view of your plant via elements and attributes - templates for standardization and reuse
- Build hierarchy, categories and connectivity models
- Data references to time series (PI Points) and other data
- Search across multiple PI Servers to find information
- Leverage PI Notifications
- Rich set of AF SDK functions to customize your applications
- Access your data via PI WebServices and PI OLEDB Enterprise

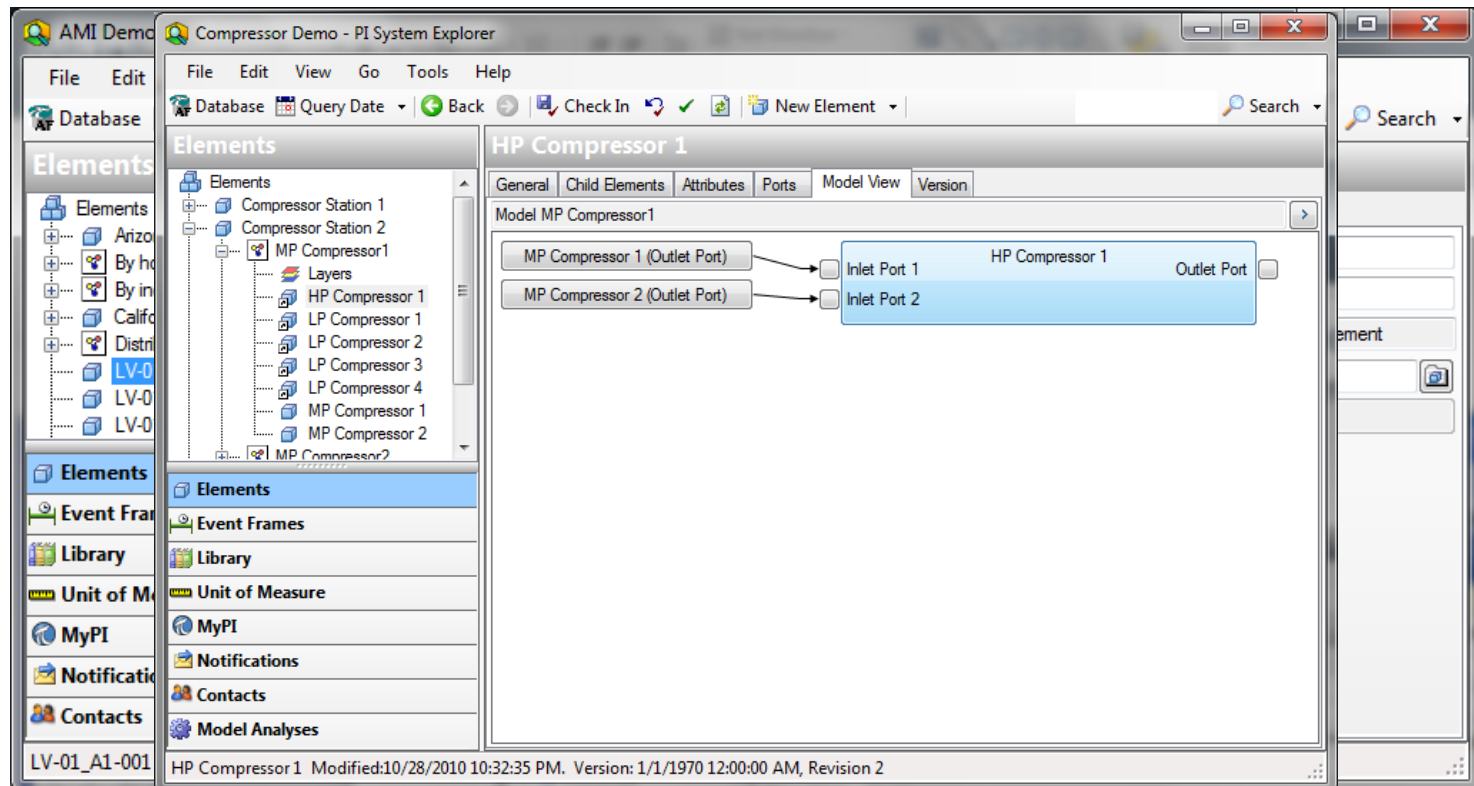


## PI AF Tools

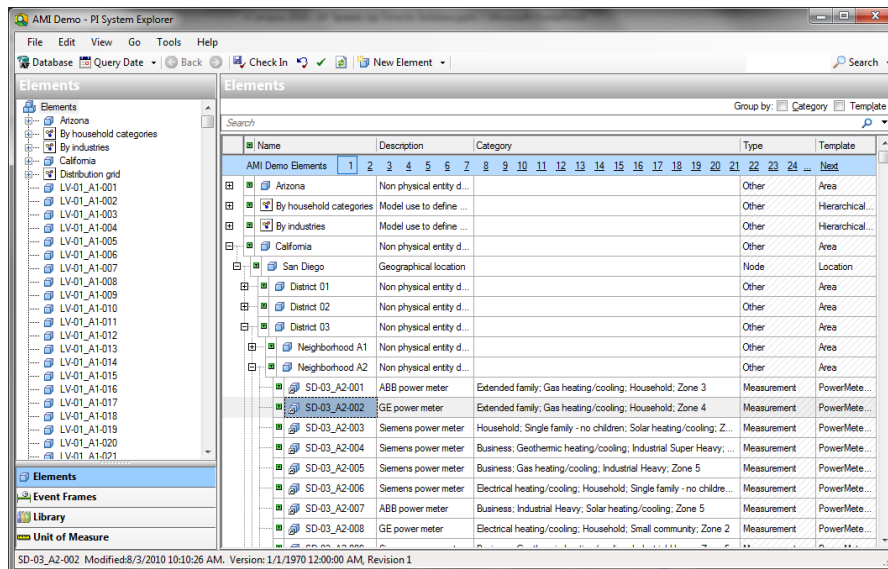


*PI AF Concepts and Interaction*

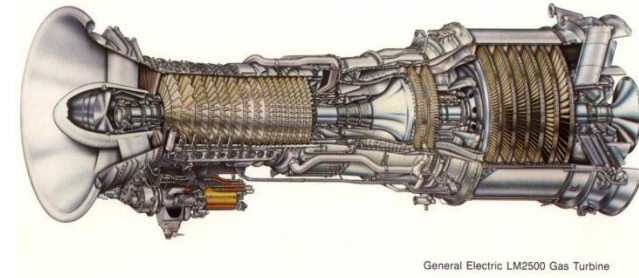
- Create and manage the asset hierarchy and models
  - Templates, elements, Data References, Notifications, etc.
  - Structure and relationships
- Visualization of the asset hierarchy and models



- Elements represent physical or logical entities
  - Attributes and attribute templates define properties
  - Categories for classifications
  - References to define relationship between Elements/Attributes
- Can be organized in hierarchical structure or connectivity models



- AF Element Attributes:
  - Static Values
    - Name plate information
    - Operating limits
  - Data References
    - Time series data - PI Tags and PI Tag Arrays
    - Relational data
    - Tables
    - Formulas/Calculations
  - Supports Units of Measure (UOM)
    - Unit conversions within the same class

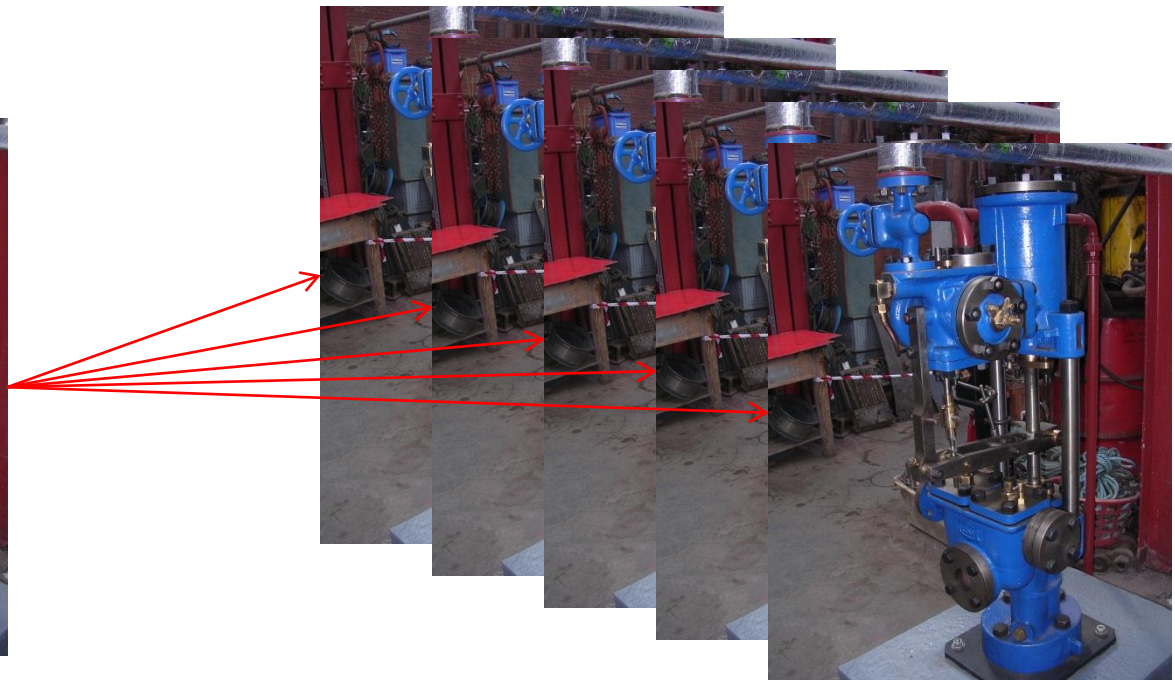


General Electric LM2500 Gas Turbine

- Element Templates can be created and reused for consistency - changes are propagated to each instance
- Elements can also be created without an Element Template for flexibility



Pump Template

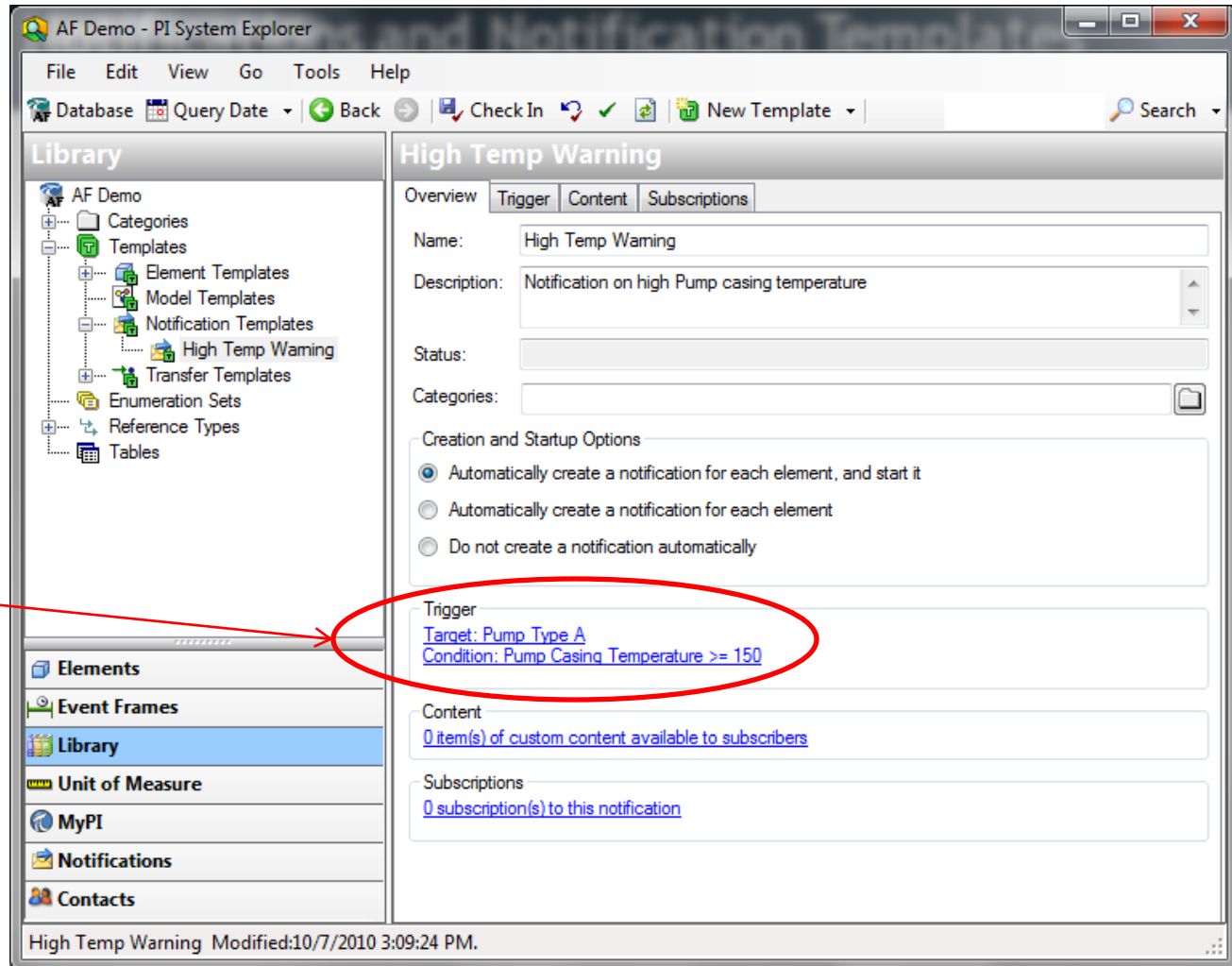


Instances

# Notifications and Notification Templates



Associate a PI Notification template to an AF Element template





## Natural Gas Compressor

- RPM
- Fuel consumption rate
- Exhaust temperature
- Oxygen sensor

PI Tags

- Flow in
- Flow out
- Pressure differential

Calculations  
Different Measurement Units

- Last service date
- Service type
- Mfr documentation

External Database



- Build compressor template
- Create attribute templates
- Set default values
- Create instances of template
  - Compressor1
  - Compressor2
  - ...
  - CompressorN
- Associate attributes to your data streams





- Locate data without needing tag names
- Search between multiple data sources
- Build just one display and show each compressor
- Include non-PI data in reports
- Estimate next maintenance
- Calculate fuel consumed
- Calculate losses to help find leaks
- Find which compressors have low pressure differentials.
- And so on...



# AFBuilder - Configure AF Attributes in Bulk



Book2 - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Add-Ins PI PI AF Builder Team

Current AF Connection  
 PISystem: SKWANE6400  
 Database: AF Demo  
 Connection

Database  
 Headers  
 (x) Select All  
 ( ) Deselect All  
 Export to AF

Delete Export  
 Library Elements  
 Import from AF

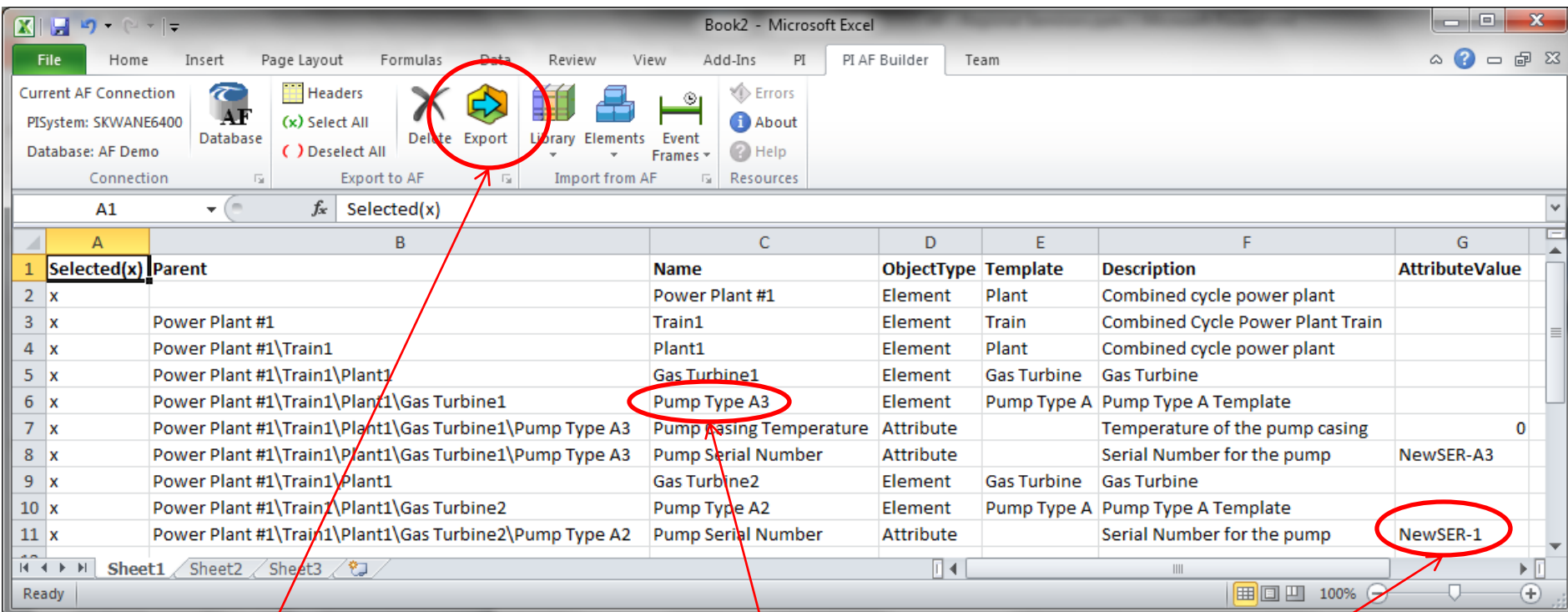
Event Frames  
 Errors  
 About  
 Help  
 Resources

	A	B	C	D	E	F	G	H	I
	Selected(x)	Parent	Name	ObjectType	Template	Description	Categories	Serial Number	Pump Serial Number
2	x		Power Plant #1	Element	Plant	Combined cycle power plant			
3	x	Power Plant #1	Train1	Element	Train	Combined Cycle Power Plant Train			
4	x	Power Plant #1\Train1	Plant1	Element	Plant	Combined cycle power plant			
5	x	Power Plant #1\Train1\Plant1	Gas Turbine1	Element	Gas Turbine	Gas Turbine		GT505-A	
6	x	Power Plant #1\Train1\Plant1\Gas Turbine1	Pump Type A1	Element	Pump Type A	Pump Type A Template	Pumps;		T1-197
7	x	Power Plant #1\Train1\Plant1\Gas Turbine1	Pump Type A2	Element	Pump Type A	Pump Type A Template	Pumps;		T1-198
8	x	Power Plant #1\Train1\Plant1	Gas Turbine2	Element	Gas Turbine	Gas Turbine		GT505-B	
9	x	Power Plant #1\Train1\Plant1\Gas Turbine2	Pump Type A1	Element	Pump Type A	Pump Type A Template	Pumps;		T1-199
10	x	Power Plant #1\Train1\Plant1\Gas Turbine2	Pump Type A2	Element	Pump Type A	Pump Type A Template	Pumps;		T1-200

Sheet1 Sheet2 Sheet3

Ready 100%

- Do you need to add an asset to PI AF?
- Did you replace an asset due to maintenance?



Book2 - Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Add-Ins PI AF Builder Team

Current AF Connection  
PISystem: SKWANE6400  
Database: AF Demo

Database AF

Headers  
(x) Select All  
( ) Deselect All

Delete Export Library Elements Event Frames

Export to AF Import from AF

Errors  
About  
Help  
Resources

A1	Selected(x)	Name	ObjectType	Template	Description	AttributeValue
1	Selected(x) Parent	Power Plant #1	Element	Plant	Combined cycle power plant	
2	x	Train1	Element	Train	Combined Cycle Power Plant Train	
3	x	Power Plant #1\Train1	Element	Plant	Combined cycle power plant	
4	x	Power Plant #1\Train1\Plant1	Element	Gas Turbine	Gas Turbine	
5	x	Power Plant #1\Train1\Plant1\Gas Turbine1	Element	Pump Type A	Pump Type A Template	
6	x	Power Plant #1\Train1\Plant1\Gas Turbine1\Pump Type A3	Attribute		Temperature of the pump casing	0
7	x	Power Plant #1\Train1\Plant1\Gas Turbine1\Pump Type A3	Attribute		Serial Number for the pump	NewSER-A3
8	x	Power Plant #1\Train1\Plant1\Gas Turbine2	Element	Gas Turbine	Gas Turbine	
9	x	Power Plant #1\Train1\Plant1\Gas Turbine2	Element	Pump Type A	Pump Type A Template	
10	x	Power Plant #1\Train1\Plant1\Gas Turbine2\Pump Type A2	Attribute		Serial Number for the pump	NewSER-1

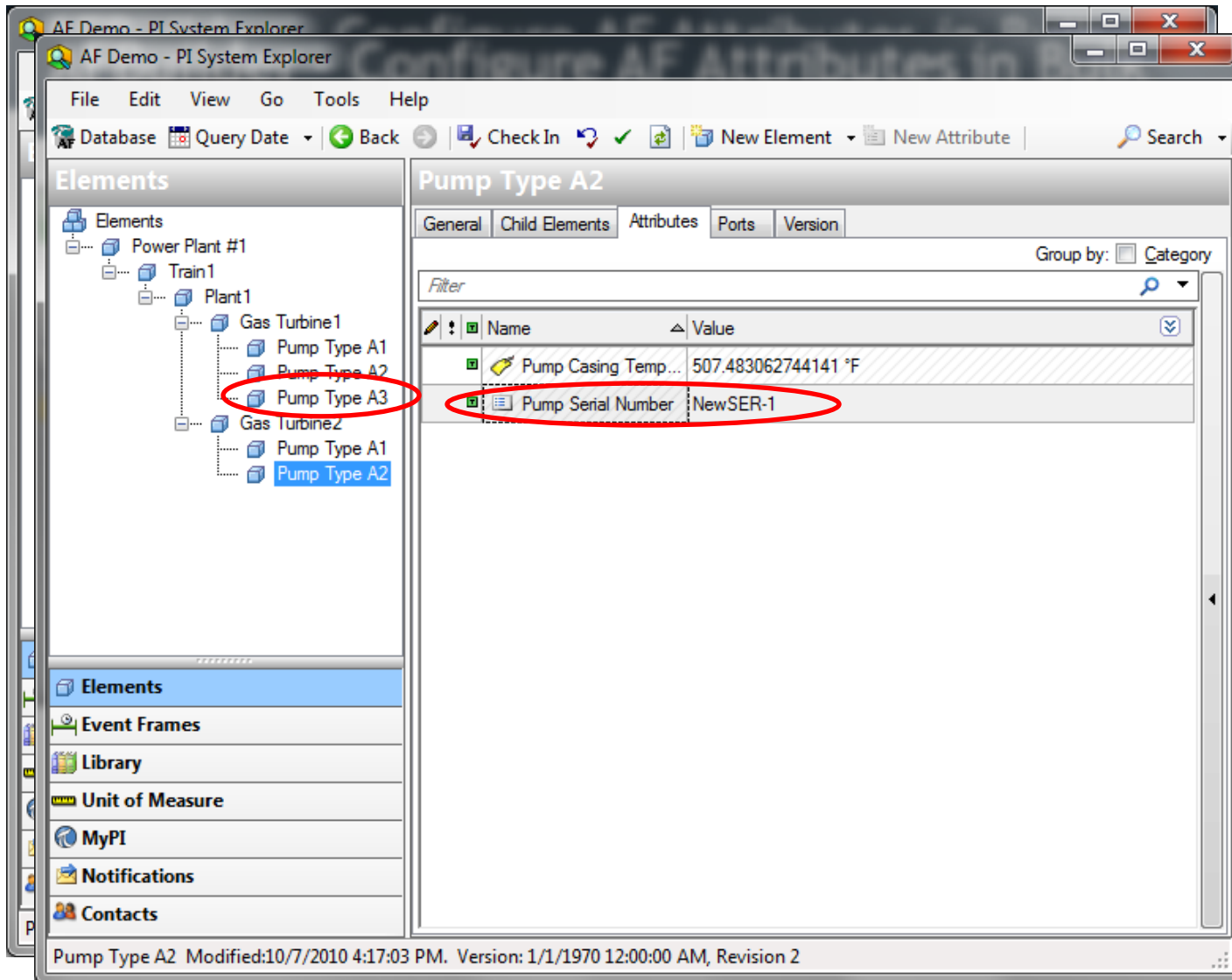
Sheet1 Sheet2 Sheet3

Ready

Export your changes

Add a new asset

Change an attribute value



AF Demo - PI System Explorer

File Edit View Go Tools Help

Database Query Date Back Check In New Element New Attribute Search

**Elements**

- Elements
  - Power Plant #1
    - Train 1
      - Plant 1
        - Gas Turbine 1
          - Pump Type A1
          - Pump Type A2
          - Pump Type A3
        - Gas Turbine 2
          - Pump Type A1
          - Pump Type A2

**Pump Type A2**

General Child Elements Attributes Ports Version

Filter

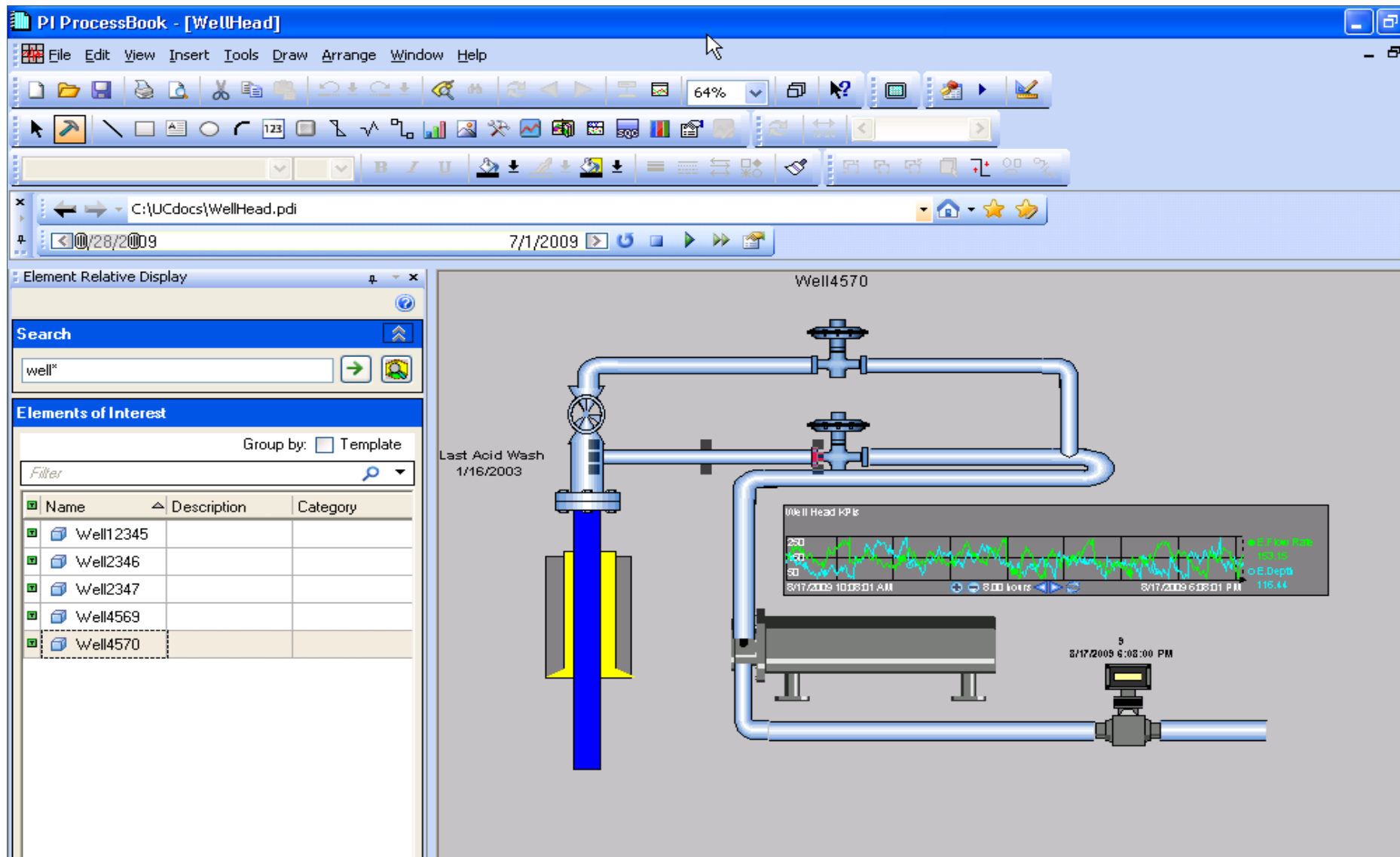
Name	Value
Pump Casing Temp...	507.483062744141 °F
Pump Serial Number	NewSER-1

Group by: Category

Elements Event Frames Library Unit of Measure MyPI Notifications Contacts

Pump Type A2 Modified:10/7/2010 4:17:03 PM. Version: 1/1/1970 12:00:00 AM, Revision 2

# PI AF Element Relative Display in PI ProcessBook



## PI AF and your Data



*Associate your data to PI AF*

# PI Point Data Reference



- Associate an AF attribute to a PI point or a PI point array
- Substitution parameters to generically map PI tags
- Retrieve snapshot & archive values as well as summaries
- Can auto-create PI tag with full access to configuration
- UOM conversion as needed

A screenshot of the "PI Point Data Reference" dialog box. The dialog has a title bar with a close button (X). It contains several sections: "PI Server:" with a dropdown menu showing "SKWANE6400"; "Tag name:" with a text field containing "%Element%.PV" and a small icon; "Attribute:" with a dropdown menu; "Unit of Measure" section with "UOM:" and a dropdown menu showing "Wh"; "Value retrieval methods" section with "By Time:" (Time Range), "Relative Time:" (\*-1h), "By Time Range:" (Average), "Calculation basis:" (Time Weighted), "Min percent good:" (50), and "By Case:" (Automatic); and a "Read only" checkbox which is checked. At the bottom are "OK" and "Cancel" buttons.

PI Point Data Reference

PI Server: SKWANE6400

Tag name: %Element%.PV

Attribute:

Unit of Measure

UOM: Wh

Value retrieval methods

By Time: Time Range

Relative Time: \*-1h

By Time Range: Average

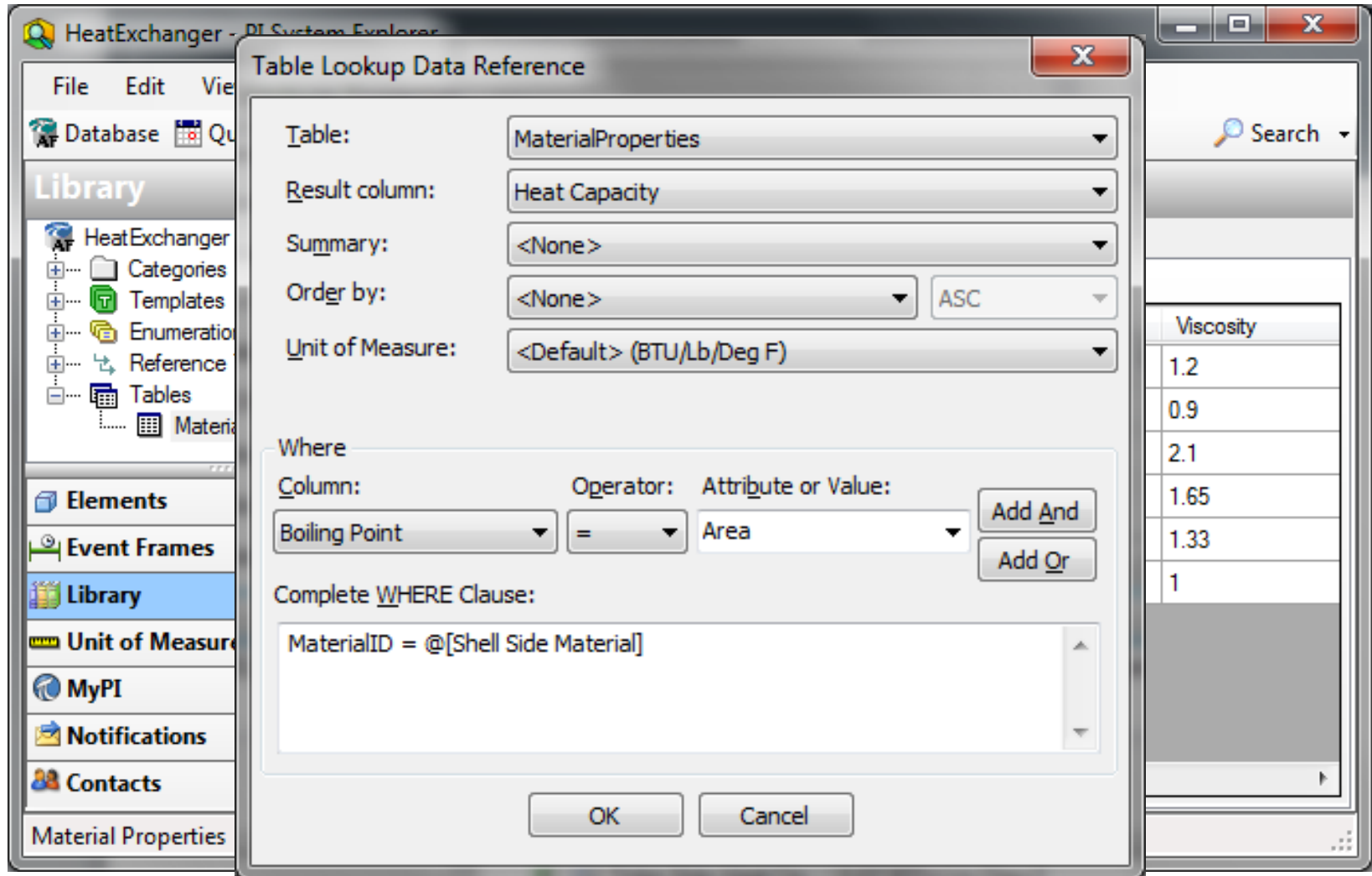
Calculation basis: Time Weighted

Min percent good: 50

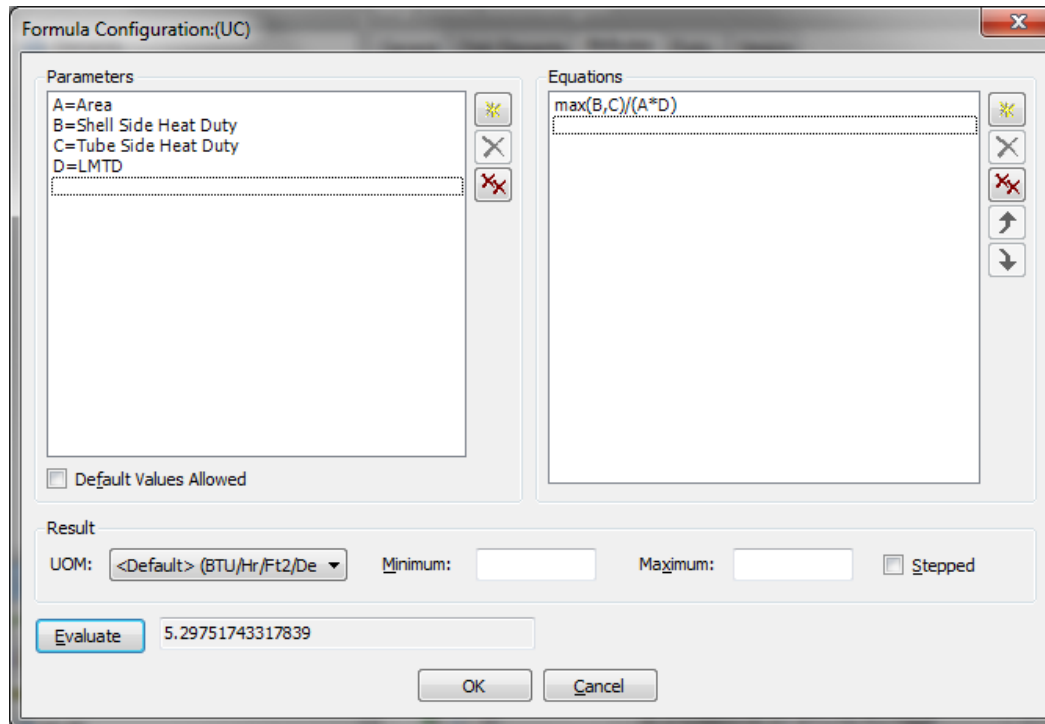
By Case: Automatic

☒ Read only

OK Cancel



- Define a calculation within PI AF acting on PI AF attributes
- Formula calculations are done on demand
- Build once, apply many times via templates to all similar assets



The image shows a 'Formula Configuration' dialog box with the following components:

- Parameters:** A list of variables: A=Area, B=Shell Side Heat Duty, C=Tube Side Heat Duty, D=LMTD. To the right are icons for adding, deleting, and clearing parameters.
- Equations:** A text area containing the formula  $\max(B,C)/(A*D)$ . To the right are icons for adding, deleting, and clearing equations, as well as up and down arrow icons.
- Default Values Allowed:** A checkbox that is currently unchecked.
- Result:** A section containing:
  - UOM:** A dropdown menu showing '<Default> (BTU/Hr/Ft2/De)'.
  - Minimum:** An empty text input field.
  - Maximum:** An empty text input field.
  - Stepped:** An unchecked checkbox.
- Evaluate:** A button that, when clicked, updates the result value.
- Result Value:** A text field displaying the calculated value '5.29751743317839'.
- Buttons:** 'OK' and 'Cancel' buttons at the bottom.

# Units of Measure (UOM) Templates and Library



- Each attribute can have a specific UOM
- PI AF is shipped with UOM library with conversion factors
- Automatic conversions between UOMs of the same class
- UOMs are fully extensible and customizable

AF Demo - PI System Explorer

File Edit View Go Tools Help

Database Query Date Back Check In New Class New UOM Search

### Unit of Measure

Filter

Class

- Angular Velocity
- Area
- Density
- Dynamic Viscosity
- Electric Charge
- Electric Current
- Electric Potential
- Energy**
- Energy Cost
- FOE Mass
- FOE Volume
- Force
- Frequency
- Heat Capacity
- Heat Transfer Coefficient
- Length
- Luminous Intensity
- Mass
- Mass Flow Rate
- Molar Flow Rate
- Molar Volume (Normal)

### Energy

Filter

Name	Abbrev...	Class	Canonical	Reference
British thermal u...	Btu	Energy	1055.05585262 J	1055.05585262 J
calorie	cal	Energy	4.1868 J	4.1868 J
gigajoule	GJ	Energy	1000000000 J	1000000000 J
joule	J	Energy	1 J	
kilocalorie	kcal	Energy	4186.8 J	1000 cal
kilojoule	kJ	Energy	1000 J	1000 J
kilowatt hour	kWh	Energy	3600000 J	3600000 J
mega watts hour	MWh	Energy	360 J	0.0001 kWh
megajoule	MJ	Energy	1000000 J	1000000 J
MegaWatts	MW	Energy	3600 J	0.001 kWh
million British th...	MM Btu	Energy	1055055852.62 J	1000000 Btu
million calorie	MMcal	Energy	4186800 J	1000000 cal
Tons	Tons	Energy	0.0878861525232...	8.33E-05 Btu
watt hour	Wh	Energy	3600 J	0.001 kWh
watt second	Ws	Energy	1 J	1 J

Unit-of-Measure Database on SKWANE6400 (48 Classes, 270 UOMs) Modified:10/7/2010 2:47:23 PM.

# Protect Your Investment



- PI System tags can still be searched and used to create displays, reports and applications
- Existing PI Module Database applications will continue to work seamlessly
  - PI DataLink
  - PI ACE
  - PI Batch
  - Custom applications
- New subsystem to sync MDB with AF



# Protect Your Investment



## MDB-based Products



RtWebParts  
ProcessBook  
DataLink  
BatchView  
RtReports

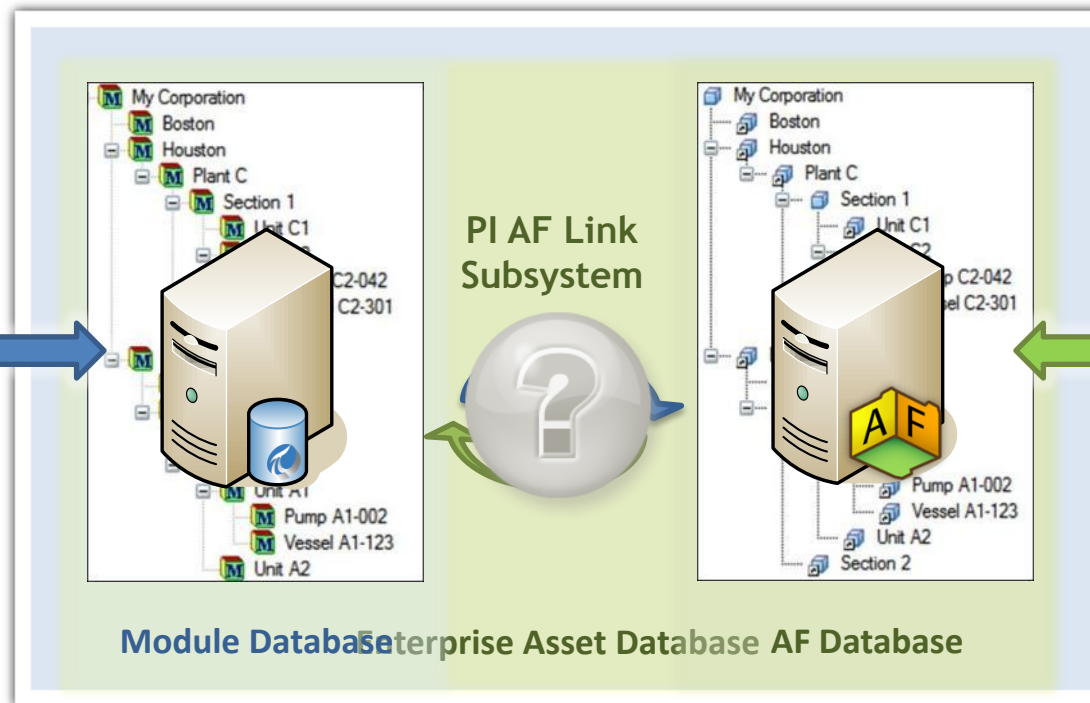


PI OLEDB  
PI JDBC  
PI OPC Server  
PI SDK



PI ACE

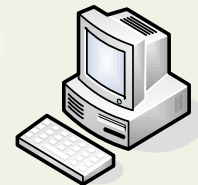
*Continue using your existing MDB-based products*



## AF-based Products



PI WebParts  
ProcessBook  
DataLink (future)



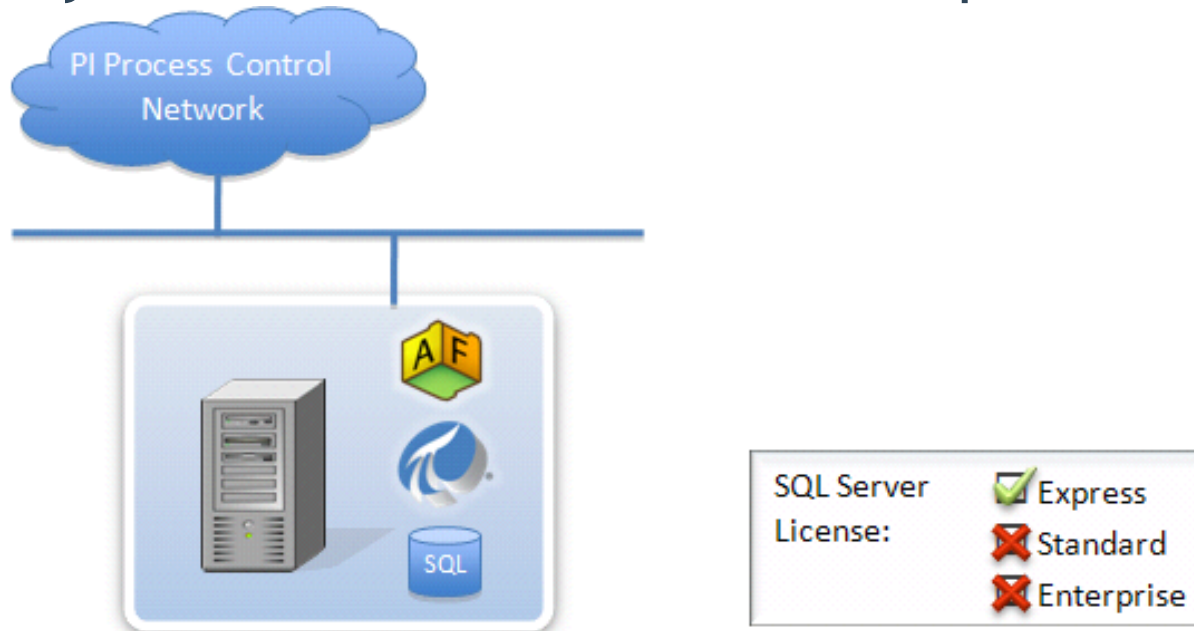
OLEDB Enterprise  
PI JDBC (future)  
PI Web Services  
AF SDK



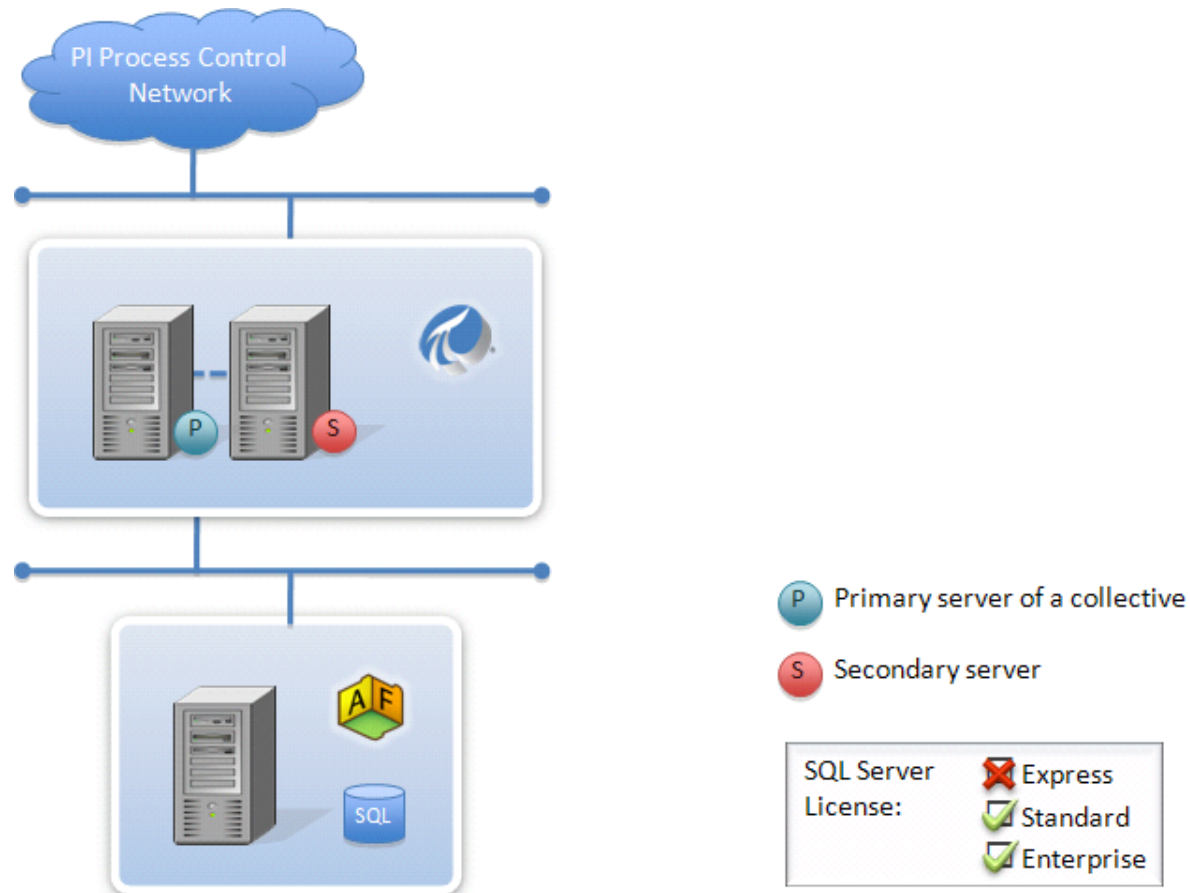
PI Notifications

*Upgrade to AF-based products when you are ready*

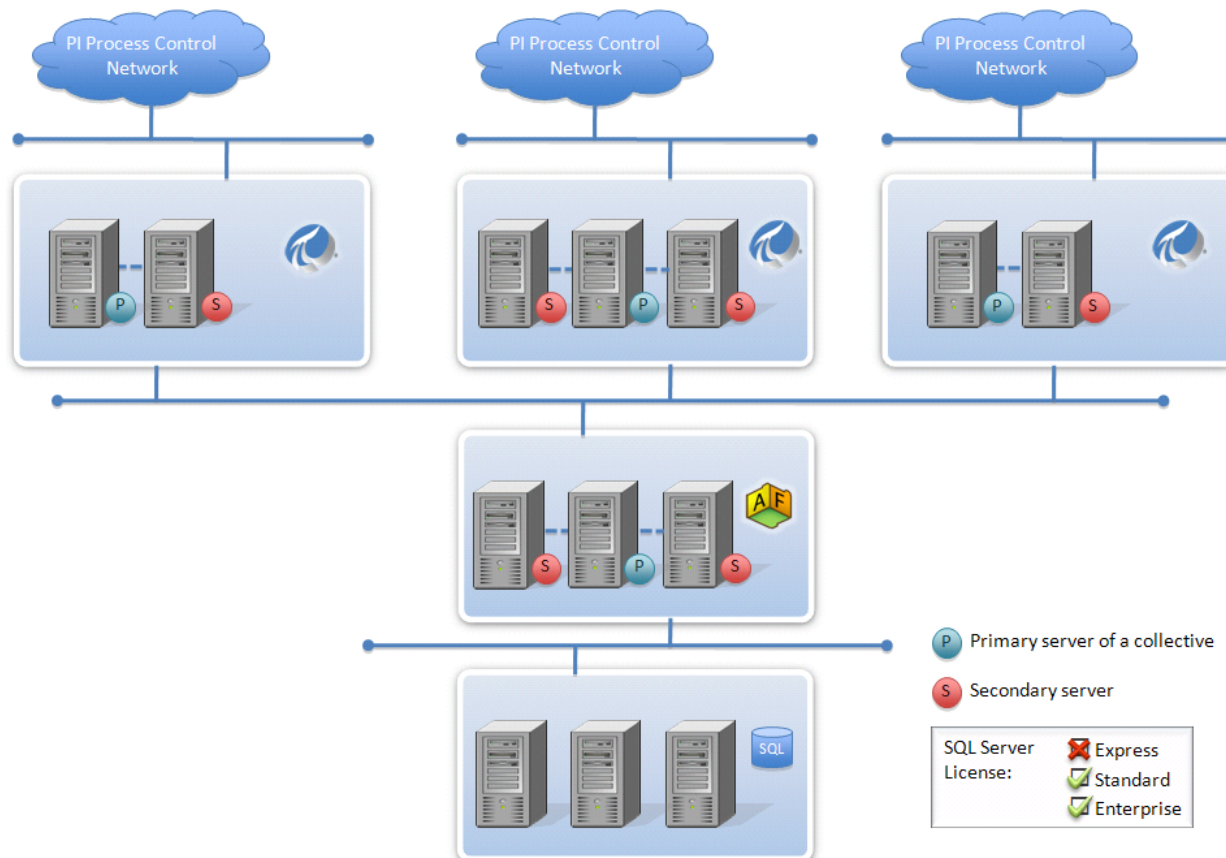
- PI AF is included with PI Server 2010
- PI AF requires Microsoft SQL Server 2005 or above
- PI AF supports High Availability (HA) configuration
- With smaller systems, PI Server, PI AF Server and MS SQL Server may be installed on the same computer



- With larger systems, PI Server, PI AF Server and MS SQL may be distributed between several computers



- With extremely large systems, or HA systems, PI Server, PI AF server and MS SQL Server may be installed in a highly redundant and distributed fashion



- PI AF Client and Server support 32 or 64 bits Microsoft operating systems
- Supports 32 or 64 bits Microsoft SQL Server (2005 and greater)
- Scale to millions of Elements having dozens of attributes each
- PI AF security model is integrated with Windows Integrated Security

- Intuitive, asset centric view of your data for everyone to consume
  - Common asset models and relationships
    - Standardize on a single definition of your assets across your enterprise
  - Connect assets to data references, apply formulas for basic analyses
  - No need to memorize point/tag names
  - Search and find information across all your data sources
  - Leverages other PI System components
    - PI Notifications
    - Element Relative Displays in PI ProcessBook and PI Web Parts
- Build your solution (i.e. display, model, analysis) ONCE and reuse on all similar assets



# Thank you

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