Asset Framework Template-Based Deployment

Presented by **Robert Raesemann**

Raesemann ENTERPRISES

Agenda

- A little motivation. Why user PI Asset Framework Templates?
- A concrete example of a Pre- PI AF solution redesigned to use PI AF
  - Discussion of the benefits
- Tips from the trenches to help get you started

My Background

- Installed my first PI server shortly after PI 3 for Windows NT around 1996
- One of the first to implement an “Enterprise” PI system for JEA in Jacksonville, FL.
  - Several UC Presentations about deploying and managing a distributed PI architecture
  - UC Presentation about using ODBC, Active Server Pages, and JPG generating components to display and trend PI data

My Background Continued

- Founded Raesemann Enterprises in 1999
- Deployed PI in many different industries including
  - Power Generation, Transmission and Distribution
  - Water/Wastewater
  - Pharmaceutical
  - Specialty Chemicals
  - Marine
  - Various Manufacturing
  - Education and Research

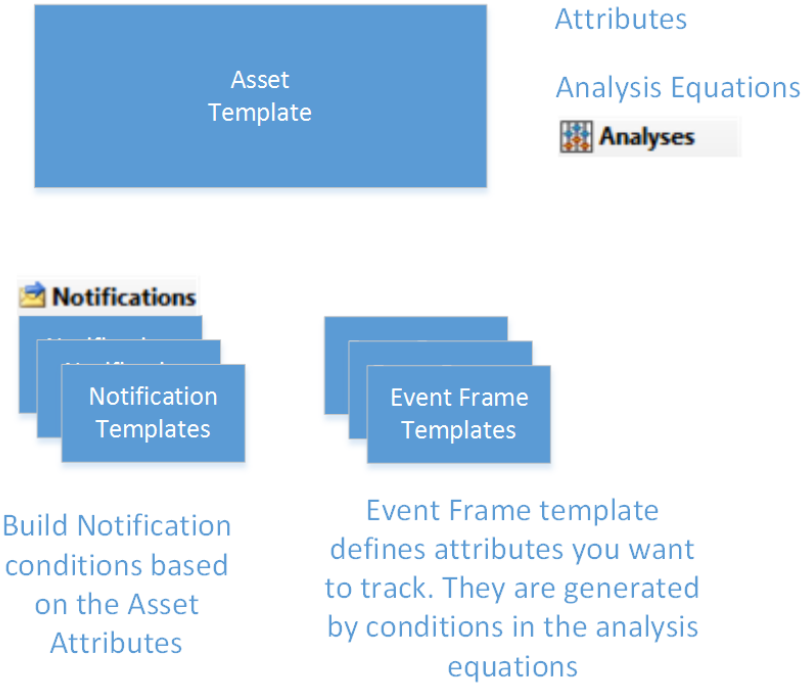
Motivation

“Try not to use PI Coresight in Hindsight”

Avoid The Post Mortem In The First Place

Most users find that PI is an valuable tool for determining the cause of a failure or undesired event. It is important to take the next step and implement systems for detecting and preventing the occurrence in the future. The PI Asset Framework suite of tools provides you with a systematic way of doing this.

PI Asset Framework Encourages You You To Be Proactive



- Think about how to define your assets
- Determine measurements and data you can collect about that asset
- Develop analytics to determine the performance of that asset and detect problems
- Determine what time-based events you want to catalog
- Determine the conditions that warrant a notification

A Concrete Example

- We'll explore the Template-Based approach to the PI Asset Framework using a real-world example
- We'll discuss the client needs and the pre-AF solution implementation and its limitations
- Then we'll discuss this system converted to an AF template model with Real-Time Analytics, PI Notifications, and Event Frames

The Motor Exception Report

The Problem

- Client has over 700 hundred motors to manage ranging from 1 HP to 1500 HP
- Motors are being over-driven, exceeding their Amperage rating. At best this shortens the life of the motor, at worst it leads to spectacular failure resulting in expensive down time and lost production.
- Motors are rated for a limited number of starts a day, but this limit is often exceeded.

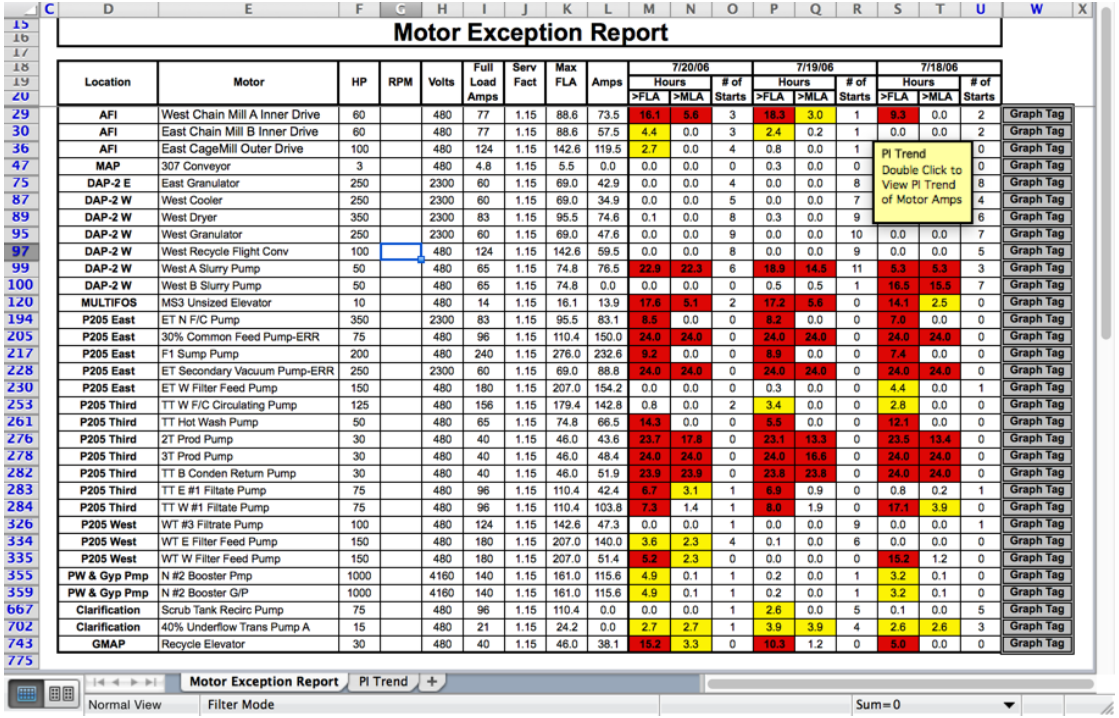
Managing their Motors

- Motors have ratings and characteristics
  - HP rating
  - Voltage rating
  - Full Load Amps (FLA) – based on HP and Voltage using look up table
  - Service Factor – user determined
  - Max Full Load Amps – Calculated from FLA and Service Factor. Measured Amps should not be above this limit.
  - Amps – instrumented and recorded in PI
  - Maximum starts per day – calculated through AMPS

Tools Available at the Time

- PI Server
- Performance Equations – client decided not to use because they did not have enough extra tags.
- PI ProcessBook
- PI DataLink
- VBA Code

Decided to Use PI DataLink and VBA



Motor Exception Report

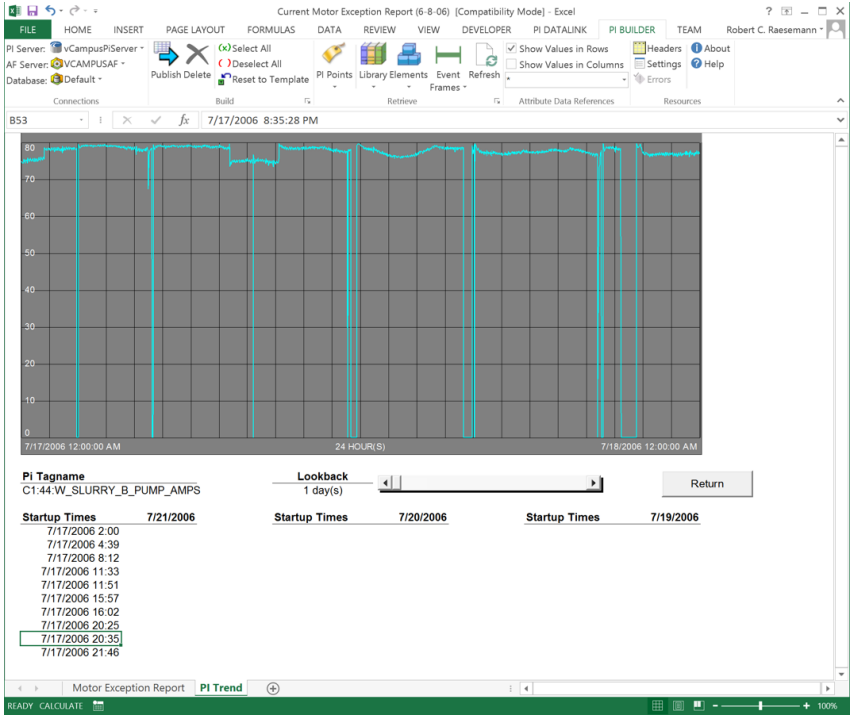
Location	Motor	HP	RPM	Volts	Full Load Amps	Serv Fact	Max FLA	Amps	7/20/06 Hours >FLA	7/20/06 Hours >MLA	7/20/06 # of Starts	7/19/06 Hours >FLA	7/19/06 Hours >MLA	7/19/06 # of Starts	7/18/06 Hours >FLA	7/18/06 Hours >MLA	7/18/06 # of Starts	
AFI	West Chain Mill A Inner Drive	60		480	77	1.15	88.6	73.5	16.1	5.6	3	18.3	3.0	1	9.3	0.0	2	Graph Tag
AFI	East Chain Mill B Inner Drive	60		480	77	1.15	88.6	57.5	4.4	0.0	3	2.4	0.2	1	0.0	0.0	2	Graph Tag
AFI	East CageMill Outer Drive	100		480	124	1.15	142.6	119.5	2.7	0.0	4	0.8	0.0	1			0	Graph Tag
MAP	307 Conveyor	3		480	4.8	1.15	5.5	0.0	0.0	0.0	0	0.3	0.0	0			0	Graph Tag
DAP-2 E	East Granulator	250		2300	60	1.15	69.0	42.9	0.0	0.0	4	0.0	0.0	8			8	Graph Tag
DAP-2 W	West Cooler	250		2300	60	1.15	69.0	34.9	0.0	0.0	5	0.0	0.0	7			4	Graph Tag
DAP-2 W	West Dryer	350		2300	83	1.15	95.5	74.6	0.1	0.0	8	0.3	0.0	9			6	Graph Tag
DAP-2 W	West Granulator	250		2300	60	1.15	69.0	47.6	0.0	0.0	9	0.0	0.0	10	0.0	0.0	7	Graph Tag
DAP-2 W	West Recycle Flight Conv	100		480	124	1.15	142.6	59.5	0.0	0.0	8	0.0	0.0	9	0.0	0.0	5	Graph Tag
DAP-2 W	West A Slurry Pump	50		480	65	1.15	74.8	76.5	22.9	22.3	6	18.9	14.5	11	5.3	5.3	3	Graph Tag
DAP-2 W	West B Slurry Pump	50		480	65	1.15	74.8	0.0	0.0	0.0	0	0.5	0.5	1	16.5	15.5	7	Graph Tag
MULTIFOS	MS3 Unsized Elevator	10		480	14	1.15	16.1	13.9	17.6	5.1	2	17.2	5.8	0	14.1	2.5	0	Graph Tag
P205 East	ET N F/C Pump	350		2300	83	1.15	95.5	83.1	8.5	0.0	0	8.2	0.0	0	7.0	0.0	0	Graph Tag
P205 East	30% Common Feed Pump-ERR	75		480	96	1.15	110.4	150.0	24.0	24.0	0	24.0	24.0	0	24.0	24.0	0	Graph Tag
P205 East	F1 Sump Pump	200		480	240	1.15	276.0	232.6	9.2	0.0	0	8.9	0.0	0	7.4	0.0	0	Graph Tag
P205 East	ET Secondary Vacuum Pump-ERR	250		2300	60	1.15	69.0	88.8	24.0	24.0	0	24.0	24.0	0	24.0	24.0	0	Graph Tag
P205 East	ET W Filter Feed Pump	150		480	180	1.15	207.0	154.2	0.0	0.0	0	0.3	0.0	0	4.4	0.0	1	Graph Tag
P205 Third	TT W F/C Circulating Pump	125		480	156	1.15	179.4	142.8	0.8	0.0	2	3.4	0.0	0	2.8	0.0	0	Graph Tag
P205 Third	TT Hot Wash Pump	50		480	65	1.15	74.8	66.5	14.3	0.0	0	5.5	0.0	0	12.1	0.0	0	Graph Tag
P205 Third	2T Prod Pump	30		480	40	1.15	46.0	43.6	23.7	17.8	0	23.1	13.3	0	23.5	13.4	0	Graph Tag
P205 Third	3T Prod Pump	30		480	40	1.15	46.0	48.4	24.0	24.0	0	24.0	16.6	0	24.0	24.0	0	Graph Tag
P205 Third	TT B Conden Return Pump	30		480	40	1.15	46.0	51.9	23.9	23.9	0	23.8	23.8	0	24.0	24.0	0	Graph Tag
P205 Third	TT E #1 Filtate Pump	75		480	96	1.15	110.4	42.4	6.7	3.1	1	6.9	0.9	0	0.8	0.2	1	Graph Tag
P205 Third	TT W #1 Filtate Pump	75		480	96	1.15	110.4	103.8	7.3	1.4	1	8.0	1.9	0	17.1	3.9	0	Graph Tag
P205 West	WT #3 Filtrate Pump	100		480	124	1.15	142.6	47.3	0.0	0.0	1	0.0	0.0	9	0.0	0.0	1	Graph Tag
P205 West	WT E Filter Feed Pump	150		480	180	1.15	207.0	140.0	3.6	2.3	4	0.1	0.0	6	0.0	0.0	0	Graph Tag
P205 West	WT W Filter Feed Pump	150		480	180	1.15	207.0	51.4	5.2	2.3	0	0.0	0.0	0	15.2	1.2	0	Graph Tag
PW & Gyp Pmp	N #2 Booster Pmp	1000		4160	140	1.15	161.0	115.6	4.9	0.1	1	0.2	0.0	1	3.2	0.1	0	Graph Tag
PW & Gyp Pmp	N #2 Booster G/P	1000		4160	140	1.15	161.0	115.6	4.9	0.1	1	0.2	0.0	1	3.2	0.1	0	Graph Tag
Clarification	Scrub Tank Recirc Pump	75		480	96	1.15	110.4	0.0	0.0	0.0	1	2.6	0.0	5	0.1	0.0	5	Graph Tag
Clarification	40% Underflow Trans Pump A	15		480	21	1.15	24.2	0.0	2.7	2.7	1	3.9	3.9	4	2.6	2.6	3	Graph Tag
GMAP	Recycle Elevator	30		480	40	1.15	46.0	38.1	15.2	3.3	0	10.3	1.2	0	5.0	0.0	0	Graph Tag

PI Trend
Double Click to View PI Trend of Motor Amps

Motor Exception Report | PI Trend | +

Normal View | Filter Mode | Sum=0

PI DataLink Solution - Trend



How it Worked

- Client would open the spreadsheet
- It would run all of the needed calculations and highlight motors exceeding their FLA rating or with too many starts
- Excel filtered rows to only show motors that were exceeding specifications

It was a Success

- Client was able to monitor motor usage and address operating problems
  - Equipment maintenance to address overloading motors
  - Addressed system issues that required multiple starts and stops
  - Expensive equipment downtime was prevented
  - Fewer motors failed
  - Downtime reduced

Room for Improvement

- Lots of data calls for each of the 700+ motors each time spreadsheet was run
- Occasional glitches in VBA code
- Office updates would sometimes break the whole thing
- Occasionally, while updating motors and tags, the spreadsheet would be broken and I would have to debug it

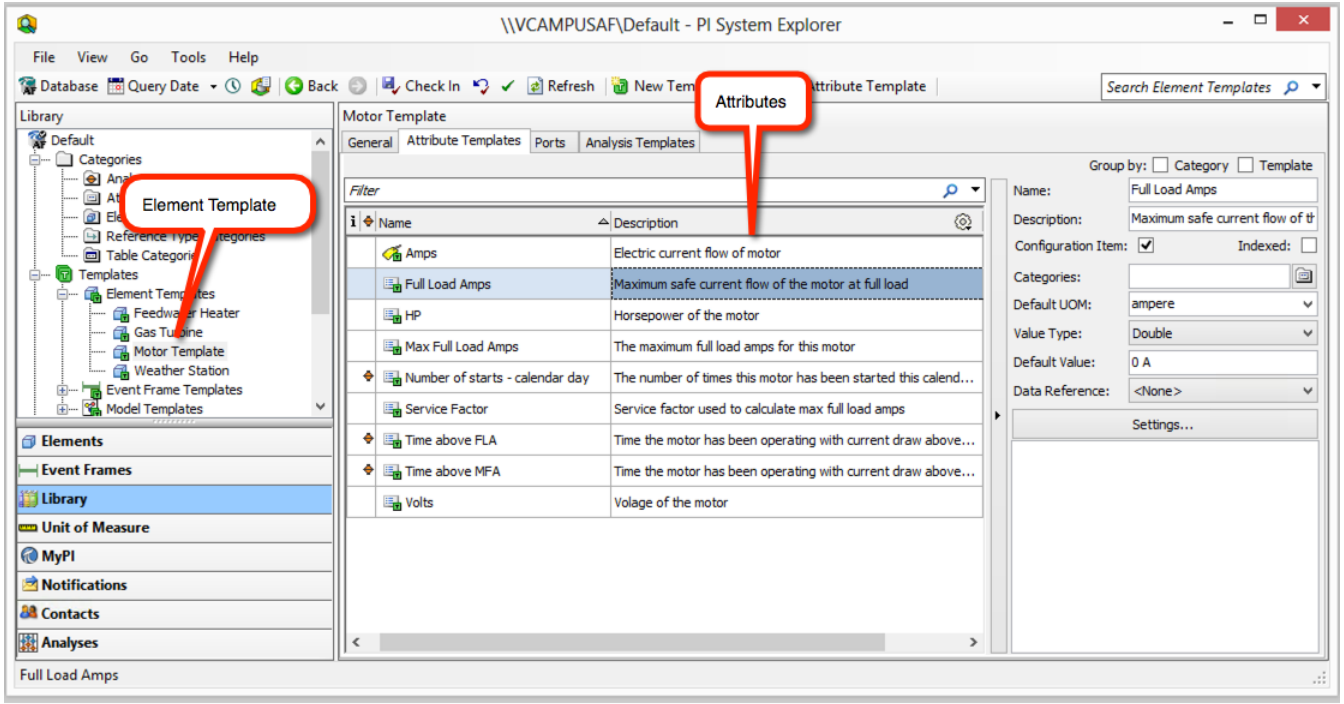
Drawbacks

- The spreadsheet and code were pretty involved, even for this simple case.
- We could not easily add new parameters
  - What if we wanted to start monitoring vibration and temperature?
  - This solution could not easily handle added parameters

Drawbacks

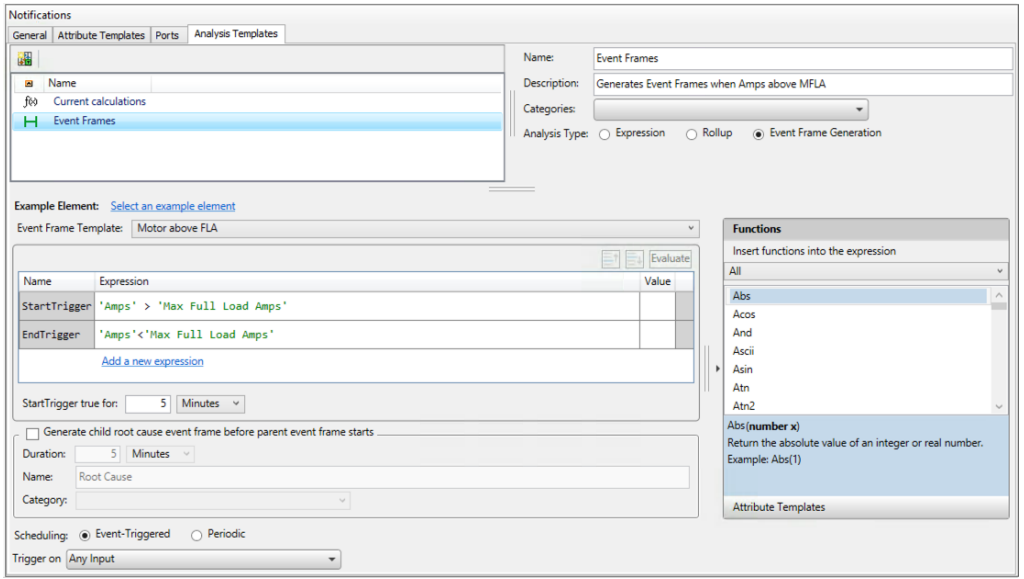
- All of the logic and configuration was contained in the spreadsheet
  - If you wanted to create displays in ProcessBook, it did not have any easy way to access that information
- No proactive notifications
  - User had to manually run the report and look at the information to see if any motors were having a problem
- No easy way to trend the problem times – everything in Excel

New Solution Using AF – Motor Template

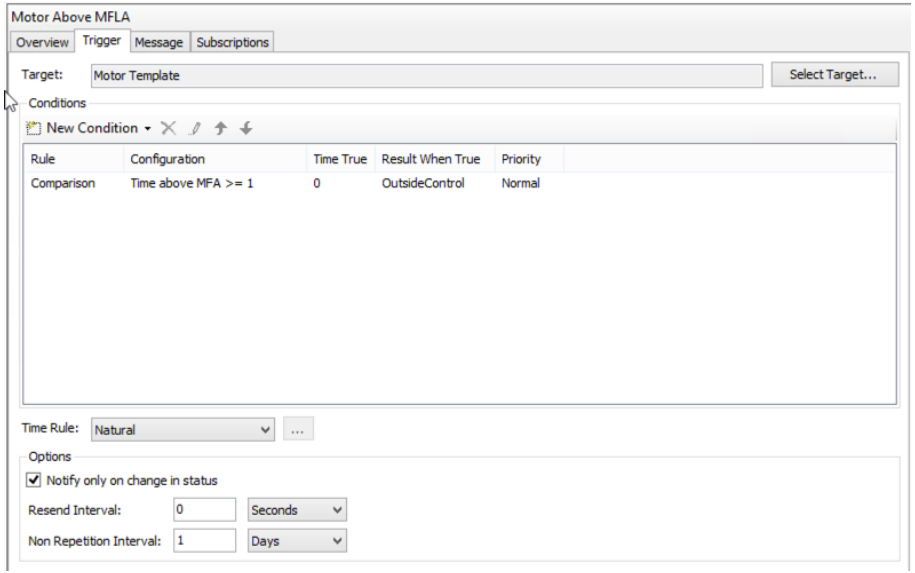


New Solution Using AF – Event Frames

An event frame is automatically generated for each timeframe that the measured Amps exceed the Max Full Load Amps (MFLA)



New Solution Using AF – Notifications



- Proactive Notifications sent for times when Amps exceed Max Full Load Amps
- Proactive Notifications sent when too many starts detected in a day

New Solution Using AF – Motor Definition

- Configuration items are entered for the HP, Voltage, and Service Factor of the motor
- Full Load Amps looked up in table using the HP and Voltage
- Max Full Load Amps calculated = FLA * Service Factor
- Measured Amps points to the appropriate PI tag for that motor

New Solution Using AF – Benefits of the Template

- Once motor is defined, you automatically get
  - The needed calculations and analytics are created from the template automatically
  - Event Frame generation occurs automatically for the new motor
  - Notifications are automatically created for the new motor

New Solution Using AF – Benefits of the Template

- All PI Clients are AF aware
  - ProcessBook trends and displays are build to reference the template
  - DataLink reports are build to reference the template
  - Coresight displays reference the template

No need to modify any displays or reports. Just configure the motors and point to the one you want to investigate.

New Solution Using AF - Benefits

- Easier to maintain
- All clients aware of what a motor is through my template
- Motors are attached to different control systems using different tag naming conventions. That no longer matters to users. They can find the motor in the hierarchy and all attributes look the same for any motor no matter where it is.

Some Practical Benefits

- Versioning allows me to document when a motor is changed out, or an attribute is edited.
- Extensible. I can now easily add new attributes like vibration or temperature and add new Event Frame Templates to capture times of excursions.

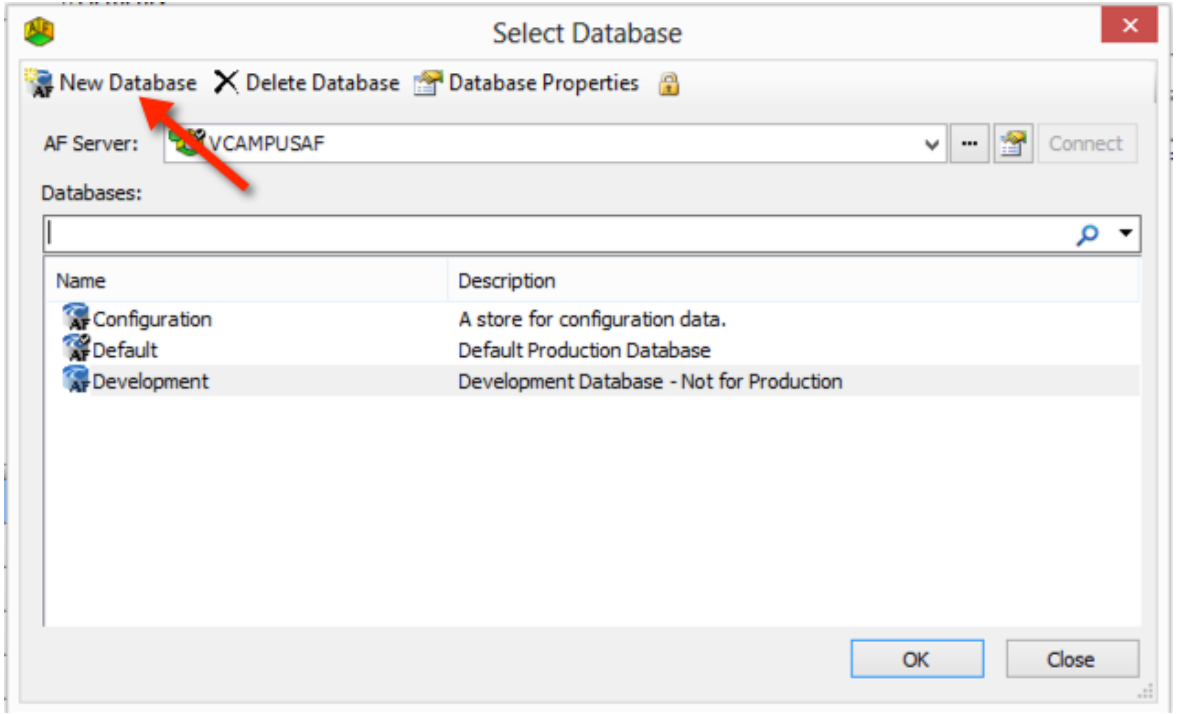
Changes to Template Immediately Propagate to all Elements

- Make one change to the motor model and all of the hundreds of motors are automatically updated to reflect that change.
- Much easier to maintain.
- This is good design. PI AF acts as the Business Logic Layer.

Tips from the Trenches

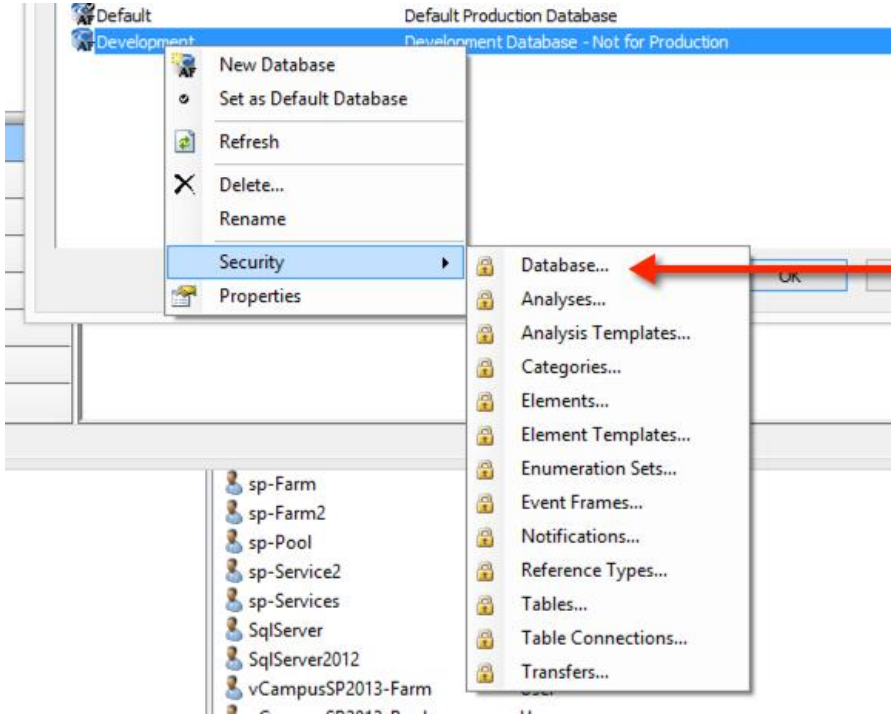
Here are a few suggestions to help get you started with the Asset-Based Approach

Create a Development Database



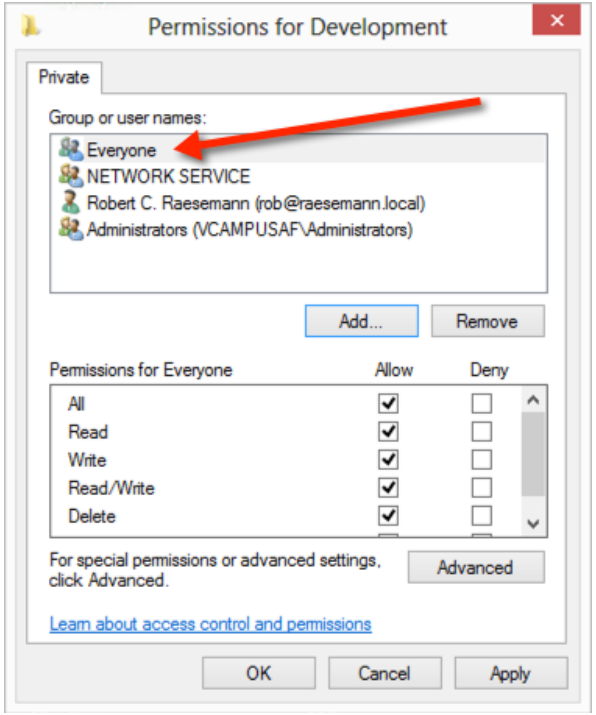
You can create more than one database on your AF server. Create one called “Development” to give you a place to learn and experiment without worrying about affecting your production environment

Hide Your Development Database



You can hide your development database so that it does not confuse your users. If you remove the everyone group from the Database Security, you can explicitly add a group of developers or individuals who can see and use the database

Hide Your Development Database

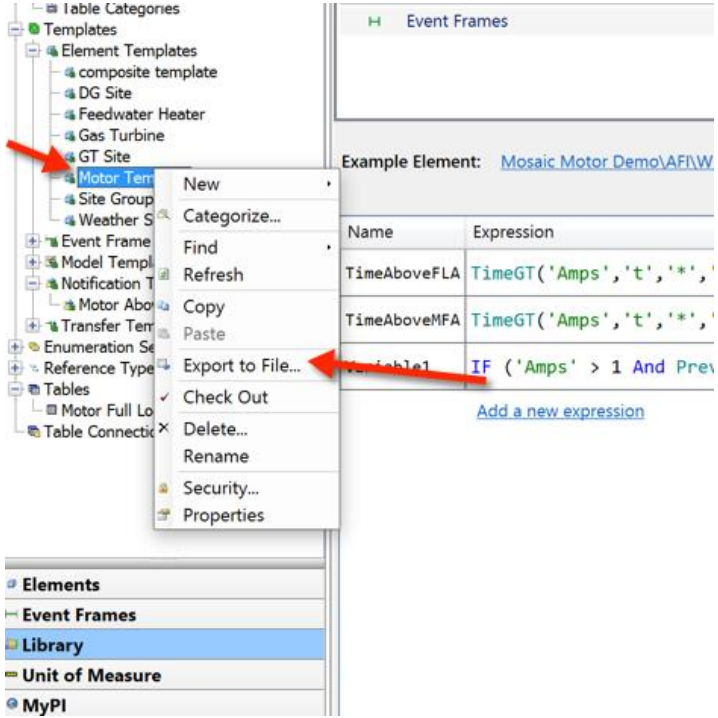


Remove the Everyone group and make sure that only groups and individuals that you want to see and use the Development database are listed

Easily Deploy Templates from Development to Production

Once you create and test a template in your Development environment, you can easily deploy it to Production by exporting it from Development and Importing it into Production

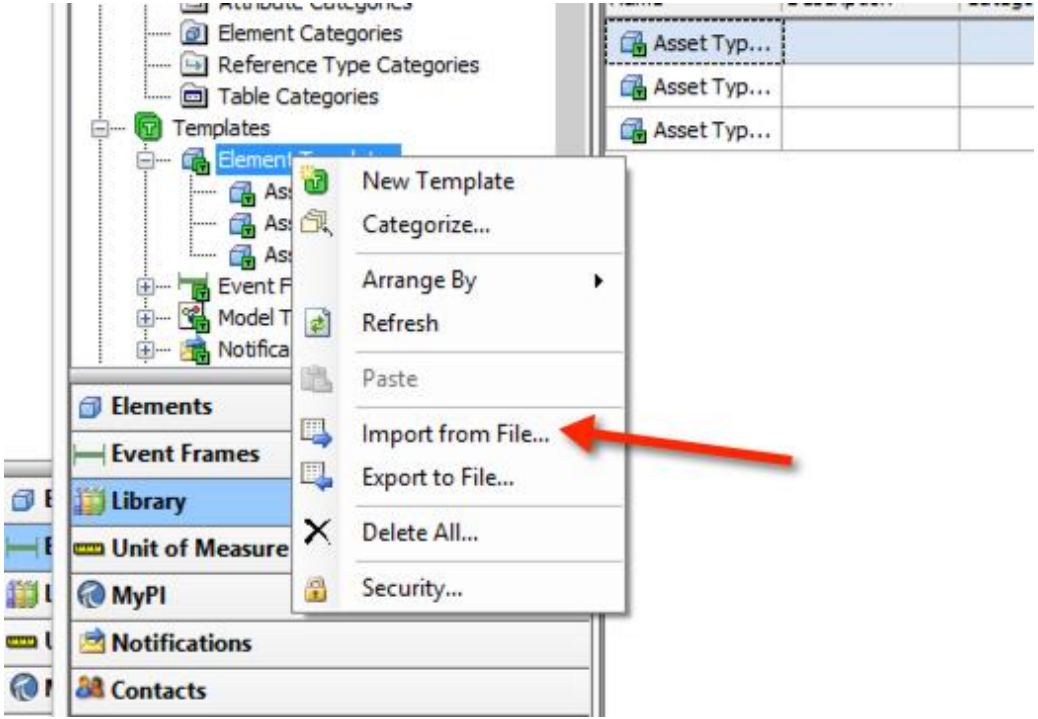
Export and Import



Once you are happy with your template, you can easily export it to an XML file and then import it to your production system.

This is not limited to a single template, you can also export multiple items, entire hierarchies, or anything else.

Export and Import

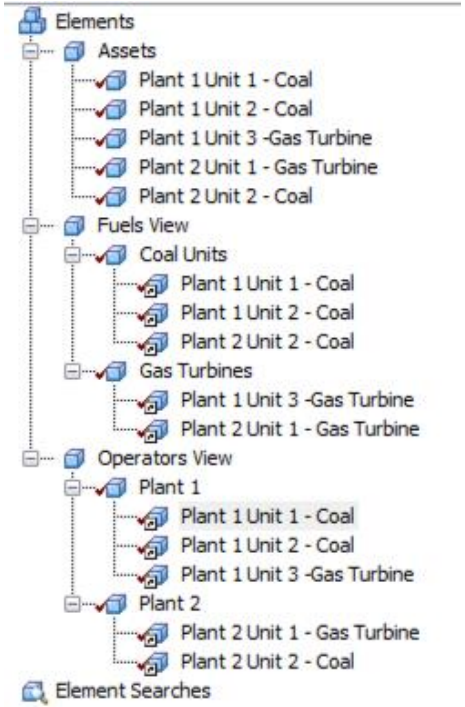


Switch to Production Database and import the XML file to import the templates or any other item

No Analysis Paralysis

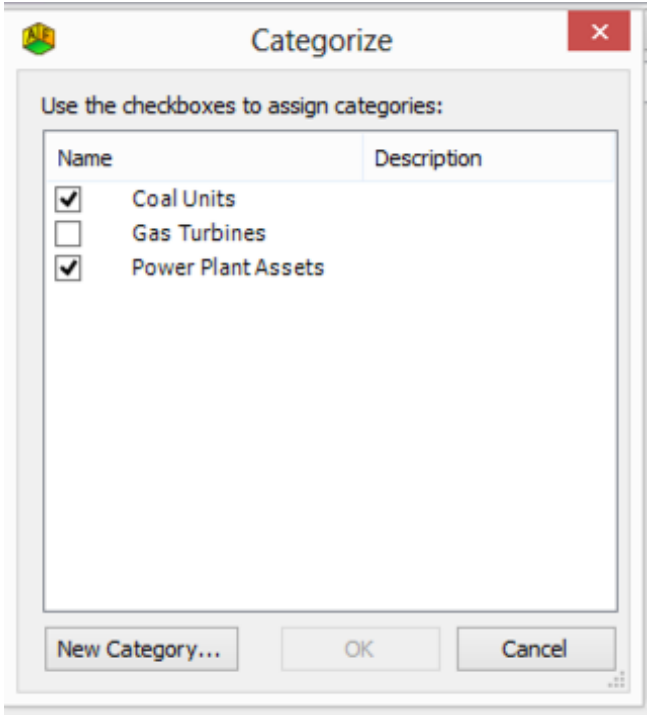
- Don’t feel like you must have a grand hierarchy scheme. You can start little and move things around as your hierarchy develops and grows. You won’t lose your data.
- Client side displays and reports adapt to rearranged hierarchies.
- Remember that you can create the asset elements in one place and then provide a link to it in other hierarchies

Use Links to Create Different Views



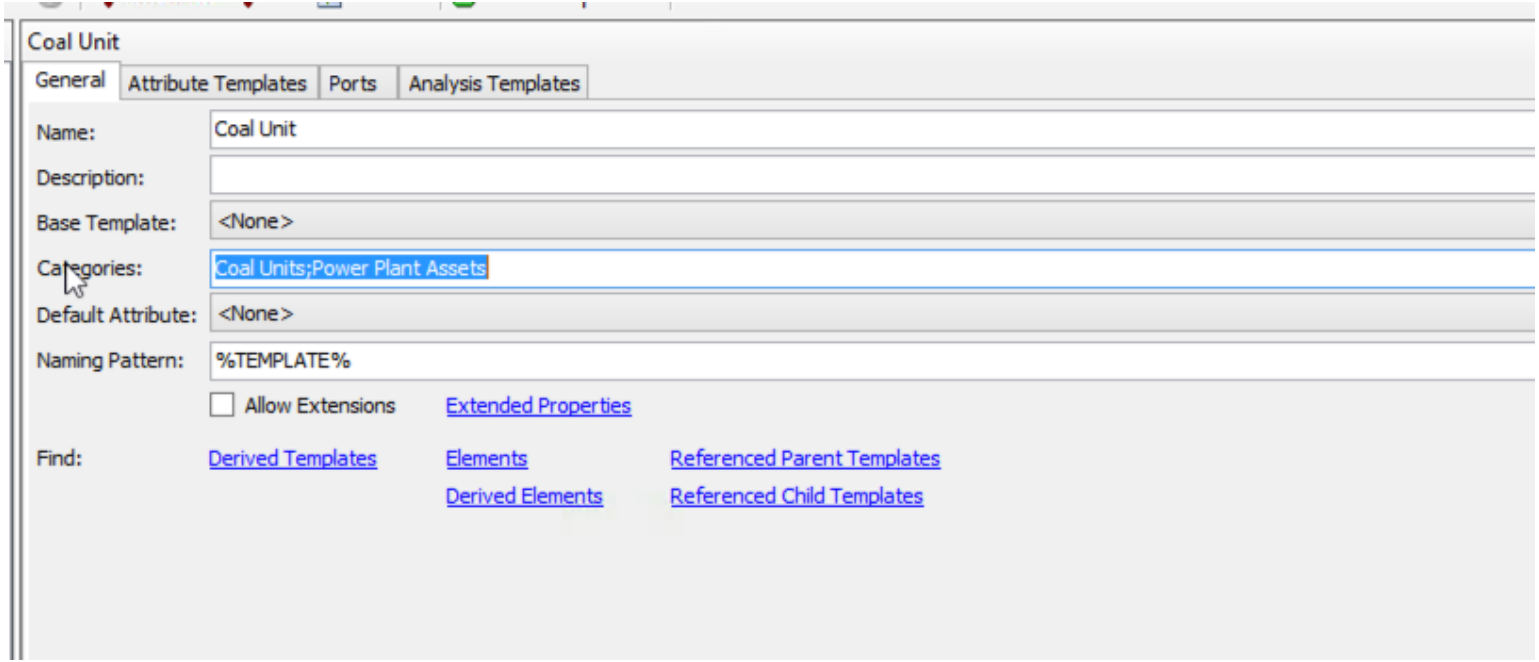
- Realize that you do not have to create one hierarchy to rule them all
- You can create different nodes in your hierarchy that arrange data in different groups for different users
- Also realize that when searching, the hierarchy is not that important.
  - I usually end up searching by template

Create Categories to Organize your Assets and Templates

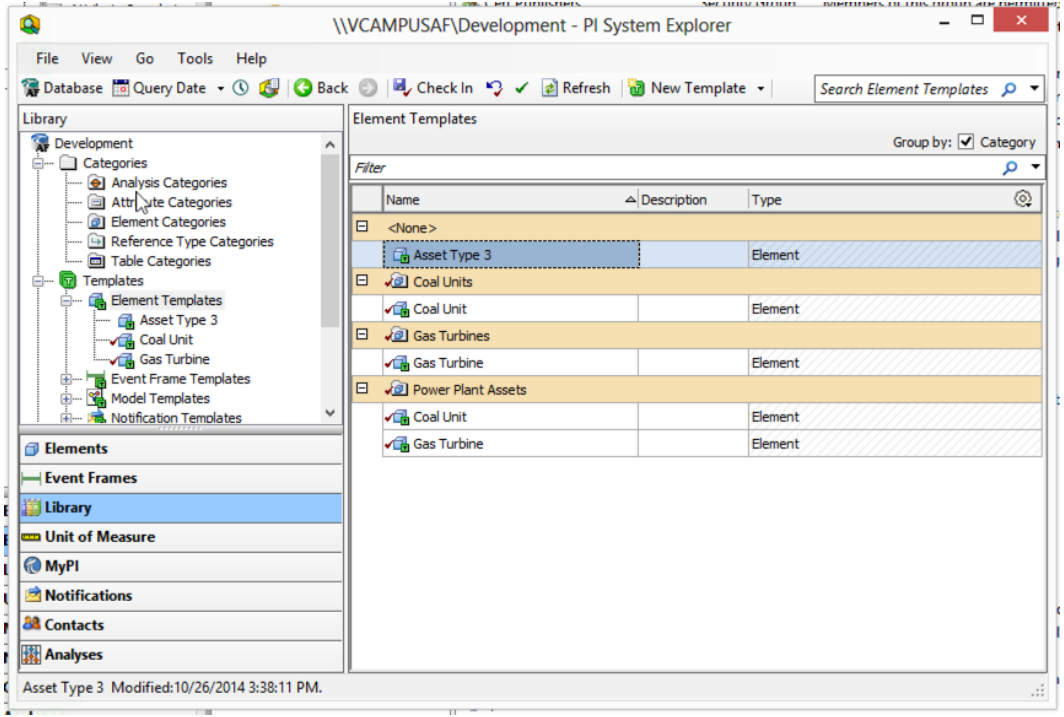


- Things will start to get crowded as you develop more in your database
- Categories will help you to organize everything and are a valuable tool helping users find items in AF
- You can create as many different categories as you need
- Items may belong to more than one category

Create Categories to Organize your Assets and Templates



Create Categories to Organize your Assets and Templates



Multiple Ways To Find Data

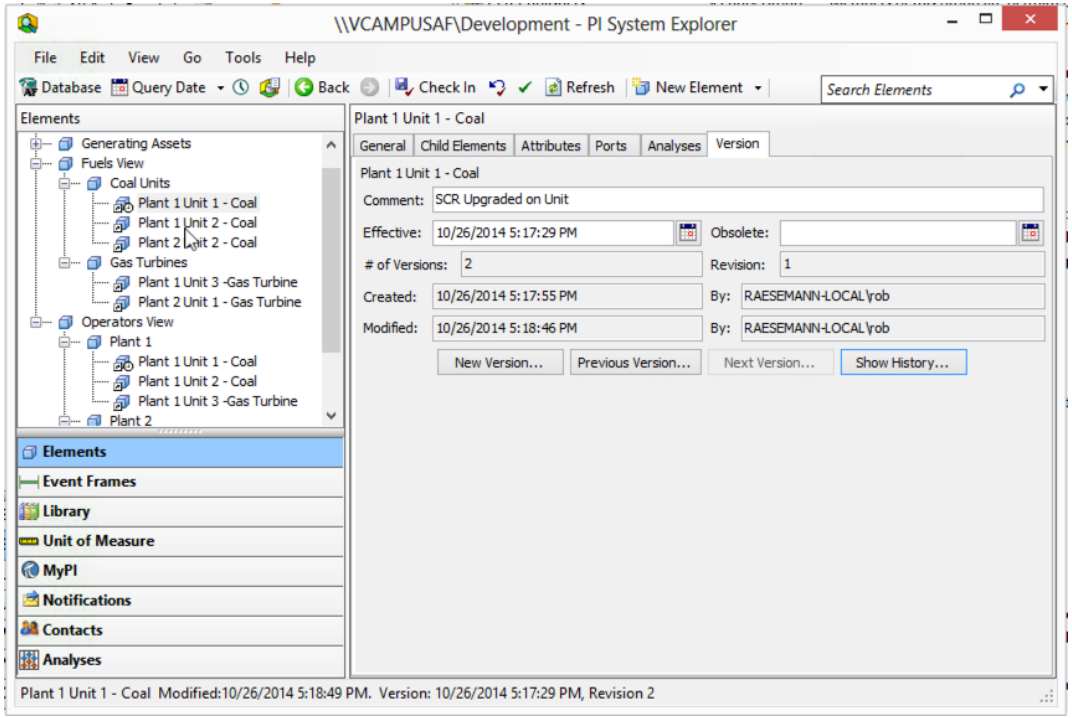
- Search for items based on Template
- Search for items based on Category
- Search for items based on Description

Enter the data with as many details as possible to make items easy to find from multiple angles

Consider Adding Attributes Providing Metadata About The Asset

- AF is not just for tag-related data
- A good example would be to add attributes for Model and Install Date to the Motor Template
  - Now I can search for all motors of a certain model
  - Find all motors installed in the last 6 months

Use Versioning



Now Just Go And Do It

- Remember the motor model was a relatively simple but high value solution
- It is easy to create a PI AF Database and get started

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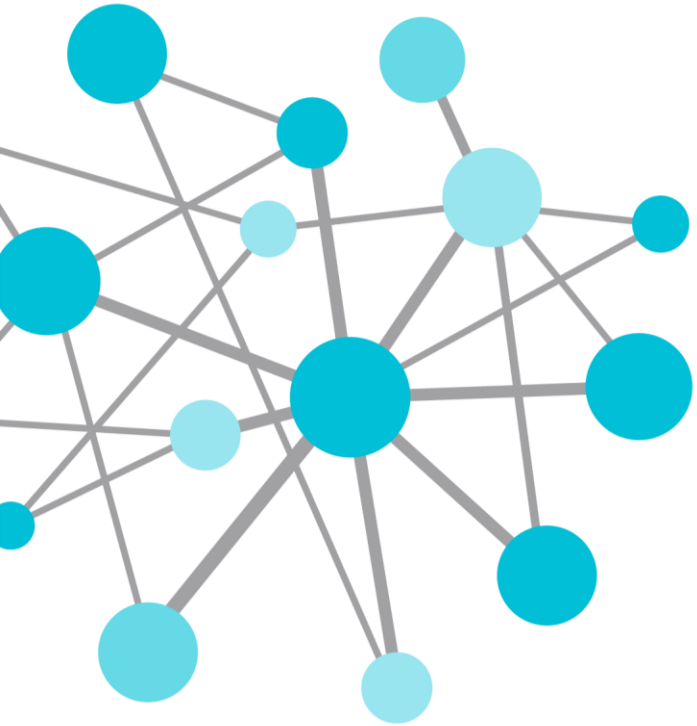

THANK YOU

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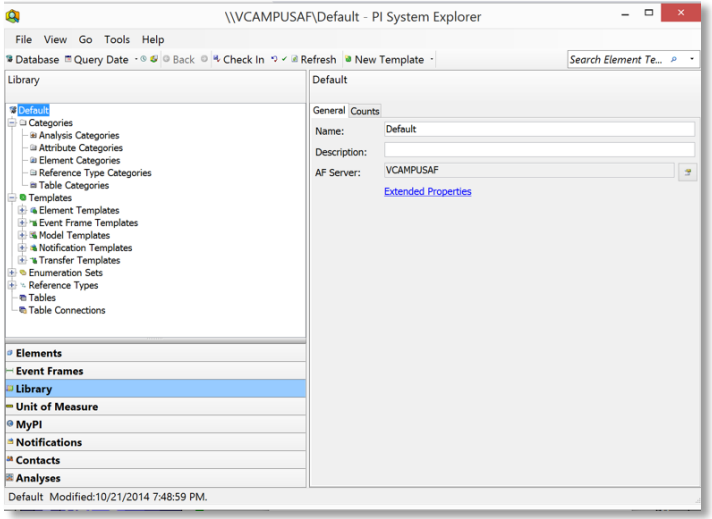
Asset Framework Template-Based Deployment

I've had great success with template-based deployment with some of my clients, but I find that many PI System users do not really understand the how the pieces fit together. I'll present a couple of use cases demonstrating the approach and highlighting the advantages of using a template-base AF approach.

Raesemann ENTERPRISES



Business Challenge

- New tools allow users to more easily tackle challenges, but many users are not familiar with the tools and don't understand how to effectively use them.

Solution

- A template-based package of AF model, event frames, notifications, and calculations makes managing your assets in PI much easier.

Results and Benefits

- Faster deployment
- Easier to maintain
- More powerful