Simplifying Complexities of Power Distribution by Implementing PI Asset Framework

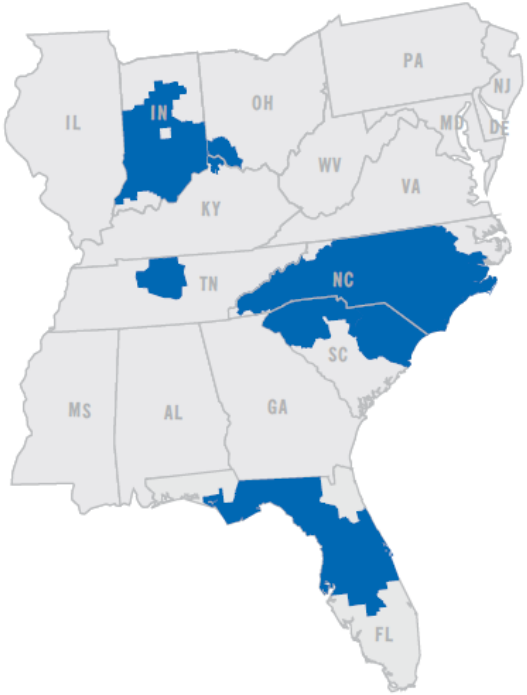
OSIsoft.

DUKE ENERGY®

energy & MORE
PRODUCTS & SERVICES

- 150+ years of service
- Electric retail customers – 7.5 million
- Gas customers – 1.5 million
- 49,300 MW of owned generation capacity
- Transmission lines – 32,200 miles
- Distribution lines – 261,700 miles
- Duke Energy Renewables
  - More than 2.9 GW of wind and solar projects operating in 14 states

Electric and Gas Utilities Service Area



Company Initiative

- Duke Energy has deployed a new SCADA system in our Florida region for Distribution Management
  - This system will integrate with our OSIsoft PI System
  - Scheduled go-live date is November 7, 2017.

Company Initiative

- A **Distribution Management System (DMS)** is a collection of applications designed to monitor & control the entire distribution network efficiently and reliably

Electric Substation

Opportunity of Data Accessibility

Make Distribution Substation data available to the enterprise

- Quality Reporting
- Technicians, Outage Reduction
- External Applications (i.e. Outage Information)
- Business Analysis

Make data easy to find

- Standardize names & attributes for ALL data
- Provide the ability to quickly & easily visualize equipment in a standard and consistent manner

OSIsoft PI is a corporate standard – Corporate EA Agreement

Challenge of Large Data Volumes

Organization & Visualization

- Millions of data points over time
- > 1,300,000 Transformers
- > 645,000 Protective Devices and Switches
- > 7,300 Circuits
- > 2,000 Total Stations

PI Data Archive  PI Asset Framework  PI ProcessBook

Core PI System Components

- PI Data Archive
  - Standardization of PI Tag Nomenclature
- PI Asset Framework
  - Consistent modeling of equipment
- PI ProcessBook
  - Element Relative Displays for THOUSANDS of Units
- Scripting Tools for the PI System

PI Data Archive 

PI Asset Framework 

PI ProcessBook

PI Data Archive Tag Standards

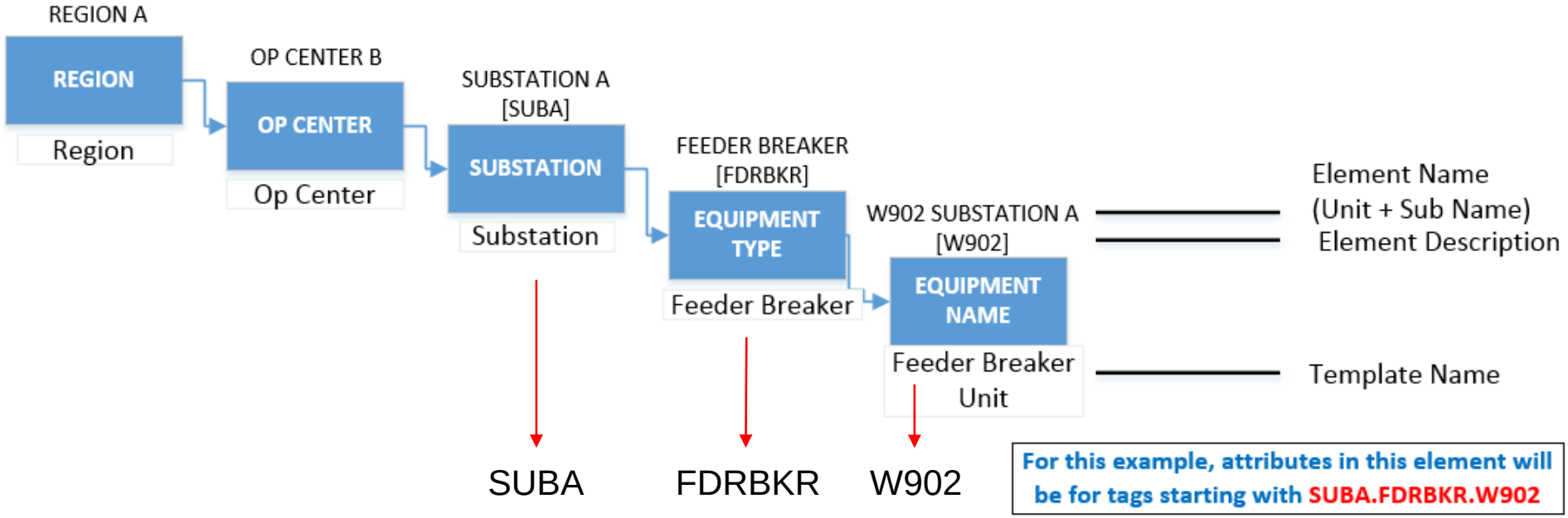
The most critical component of standardization starts with your PI Tag Names

[SUBSTATIONCODE].[EQUIPTYPE].[EQUIPNUM].[UNIT]

- SUBSTATIONCODE = SUBA (Substation A)
- EQUIPTYPE = FDRBKR (Feeder Breaker)
- EQUIPNUM = W902 (Unique Identifier)
- UNIT = MWA (Phase A Megawatts)
  - **Tag Example:** SUBA.FDRBKR.W902.MWA

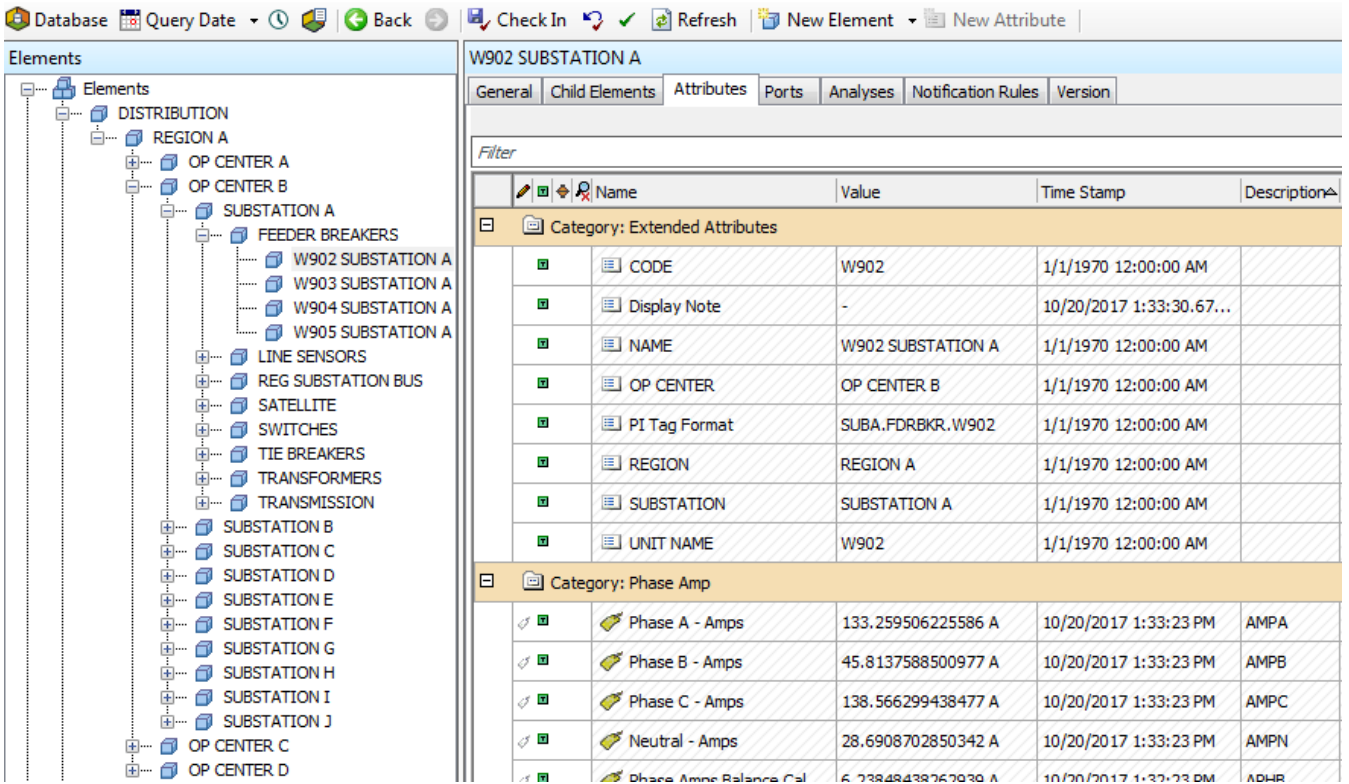
PI Asset Framework

A geographical process layout that utilizes the PI Tag standardization to easily and quickly deploy a structure:



PI Asset Framework Structure

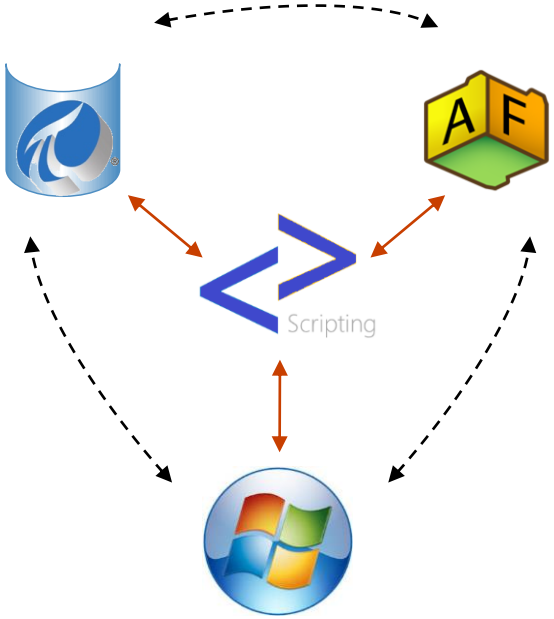
- ✓ Use templates for **everything**
- ✓ Plan ahead
- ✓ Understand the business needs
- ✓ Include as much meta-data as possible



Bringing systems together with scripting

Scripting tools for the PI System

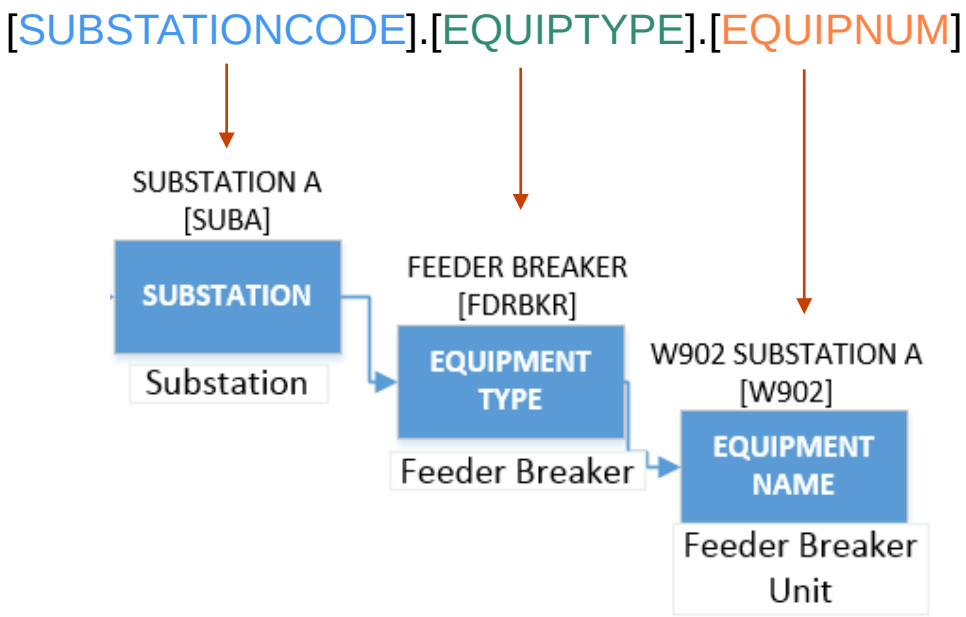
- Scripting language, similar to batch
- Fast & efficient
- Provides access to the PI Data Archive
- Provides access to PI Asset Framework
- Provides access to the Windows System



Brings all the pieces together!

PI Asset Framework Automation

Keeping PI Asset Framework up to date with the PI Data Archive using Scripting



A = Retrieve a list of all unique PI Tags from the Substation code to Equipment Number

B = Retrieve a list of all unique Elements in PI Asset Framework

Compare

- ✓ If A is not found in B: **Add It**
- ✓ If B is not found in A: **Remove It**

PI ProcessBook needs and concerns

To Do:

- Create standard displays for thousands of pieces of equipment that exist in PI Asset Framework

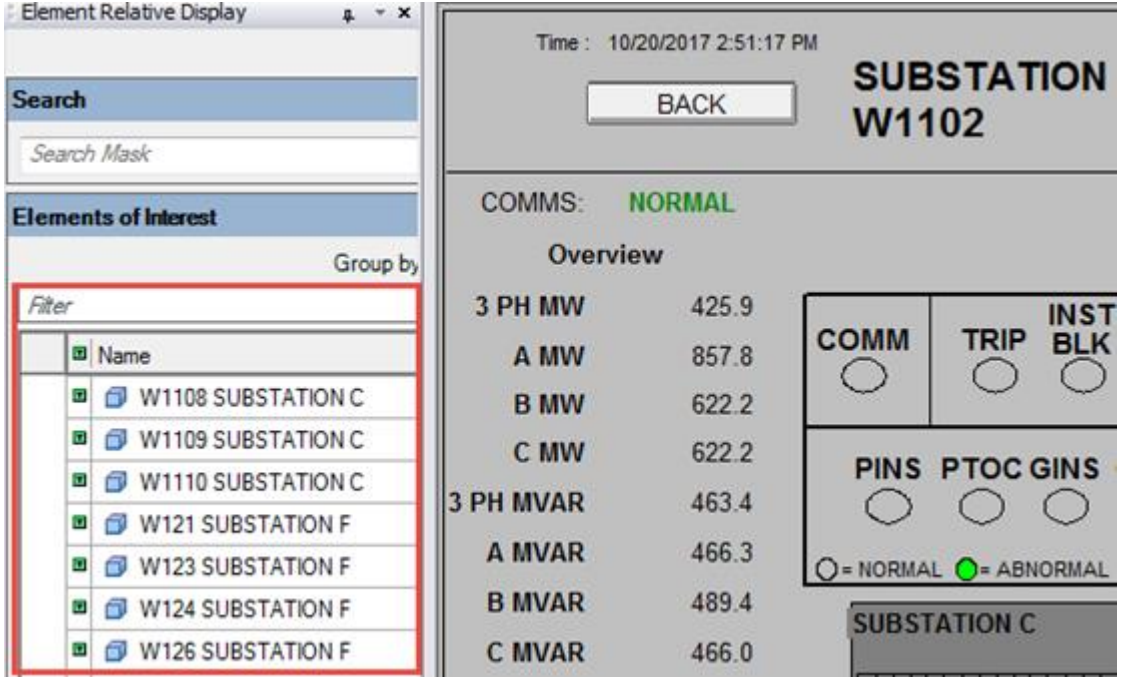
Obstacles:

- Having too many Elements of Interest for an Element Relative Display makes it difficult to quickly locate what you need
- Previous efforts in the company have resulted in the creation of over 150,000 separate PI ProcessBook Displays, a lot to support
- Leveraging VBA can limit the use of a PI ProcessBook Display

Elements of interest filtering

Elements of Interest

- Filtering requires the user to know the name of the Element



* For this reason, consider naming your Elements with key information users are familiar with, like Substation names

PI ProcessBook needs

Each Substation will have it's own set of displays

- One per template
- Limit the Elements of Interest list to just the equipment in that substation

- Build one set of displays to be used for all substations, including navigation
- Create navigation directly based on the AF Hierarchy

PI ProcessBook SVG files to the rescue

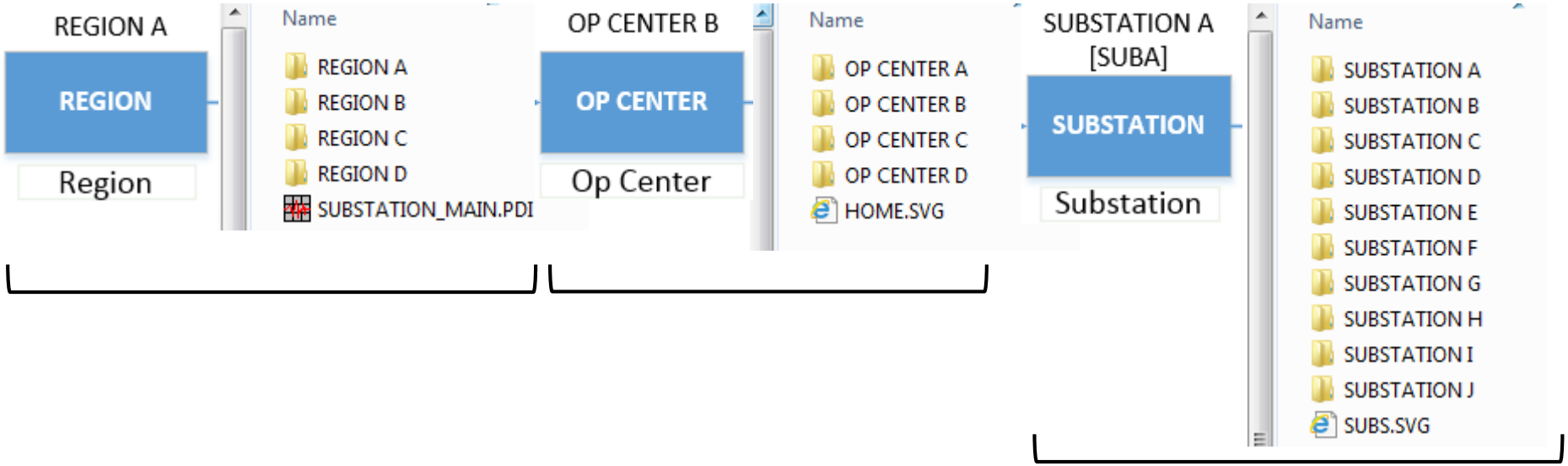
Build a single set of displays:

- Only include AF Attributes from a template (must be Element Relative)
- Save your displays as SVG files from PI ProcessBook
  - ✓ SVG, or Scalable Vector Graphic, files **can be modified with a plain text editor** and use XML formatting

```
1  <?xml version="1.0" encoding="UTF-8"?>
2  <svg height="100%" viewBox="0 1 4120 2199" width="100%" fill="#C0C0C0" image-rendering="optimizeSpeed" onload=
   "SVG_doc_loaded(evt);" PB:pid="" xlink:xid="" xmlns:svg="OSI_SVG_20090601" xmlns:xlink="
   http://www.w3.org/1999/xlink" xmlns:PB="urn:osisoft-com-pb" xmlns:PBI="urn:osisoft-com-interface" xmlns:PBD=
   "urn:osisoft-com-data" xmlns:xsi="http://www.w3.org/1999/XMLSchema/instance">
3     <defs><PBD:TagUses tag="\\piserver\sinusoid" PB:BO="PWSPIEventsBO.cBOEvents">
4           <PBI:Symbol name="Value18" PB:Type="7"/>
```

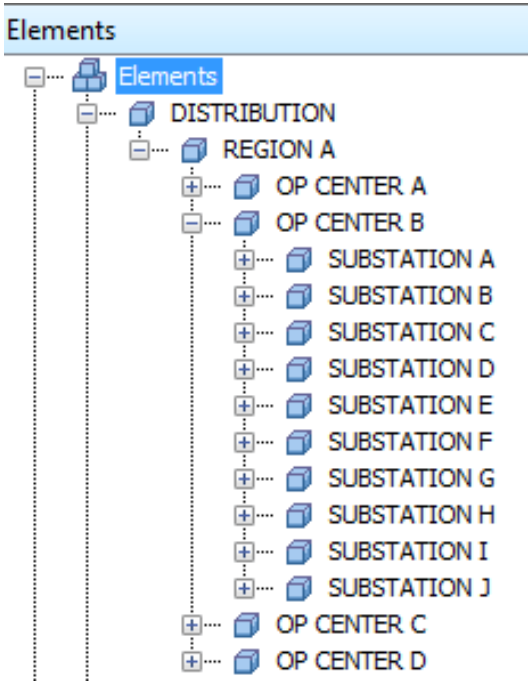
Display navigation building

Using scripting to access your PI Asset Framework structure, you are able to retrieve each level of the hierarchy using template names and create a folder structure in Windows for your navigation:



PI ProcessBook navigation

PI Asset Framework



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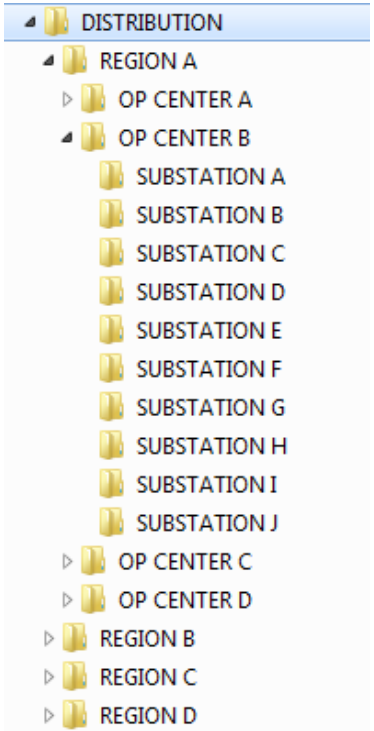
Windows Folder Structure



Retrieving Elements of Interest

Use scripting to retrieve all Elements using your Equipment Template Name:

- Get Element Name of the Equipment & the Name of its Parents
  - Region -> Op Center -> Substation [+ Element Name]
- Using a combination of all 4 of the Element Names, you now have the paths for your “Elements of Interest”
- This is also the Windows Path created earlier

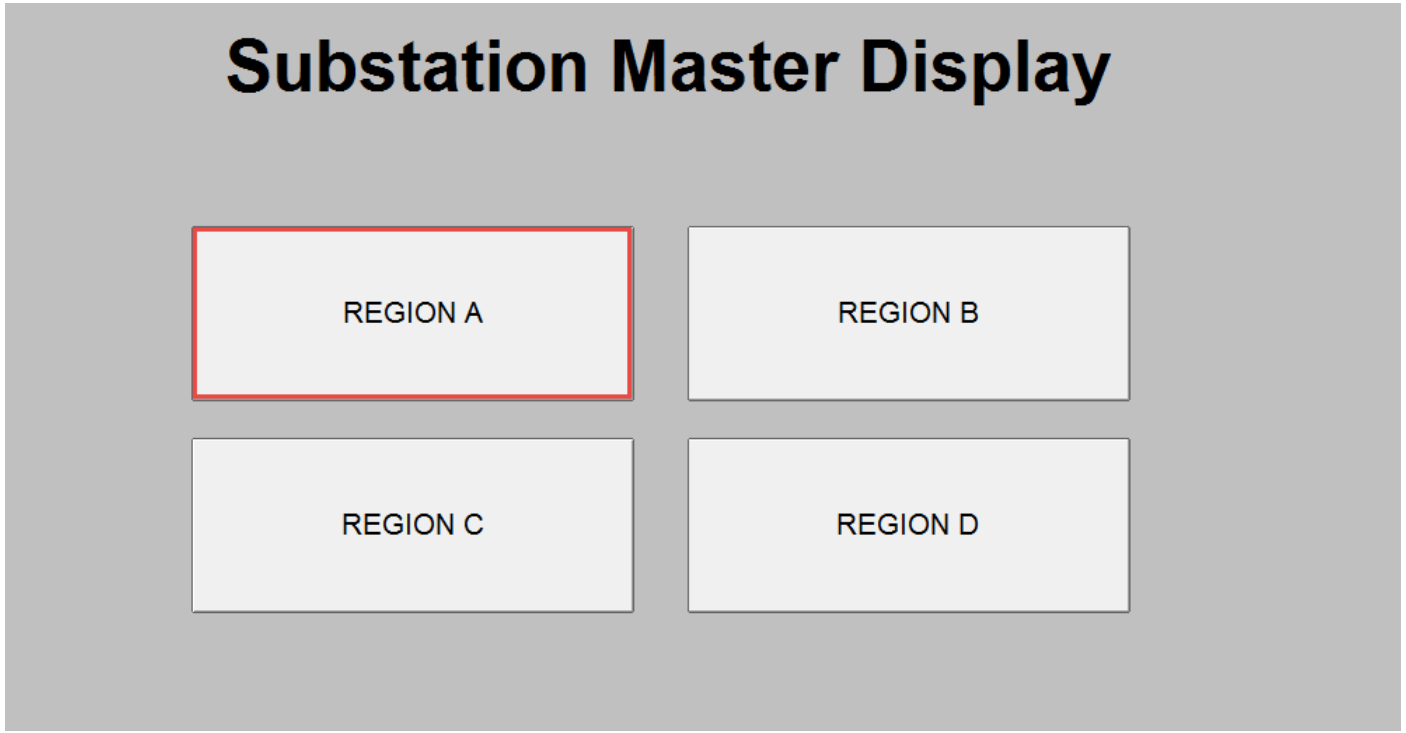
REGION A\OP CENTER B\SUBSTATION A\W902 SUBSTATION A

Display auto-creation

- Use scripting to import the SVG Display made for that template
- Replace the Elements of Interest from your standard display with the paths you retrieved from PI Asset Framework
- Export the SVG Display to the ‘Region\Op Center\Substation’ path in Windows
  - ✓ Do this for every piece of equipment for your template displays and you have just automated screen replication using AF

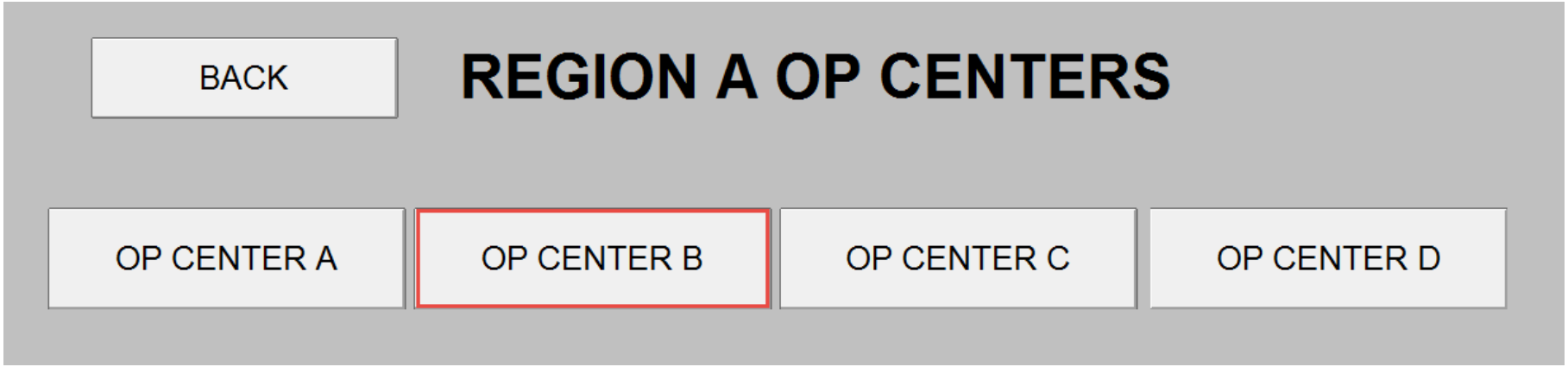
- Use the same method to retrieve your Op Center & Substation names to create the navigation pages

PI ProcessBook - Results



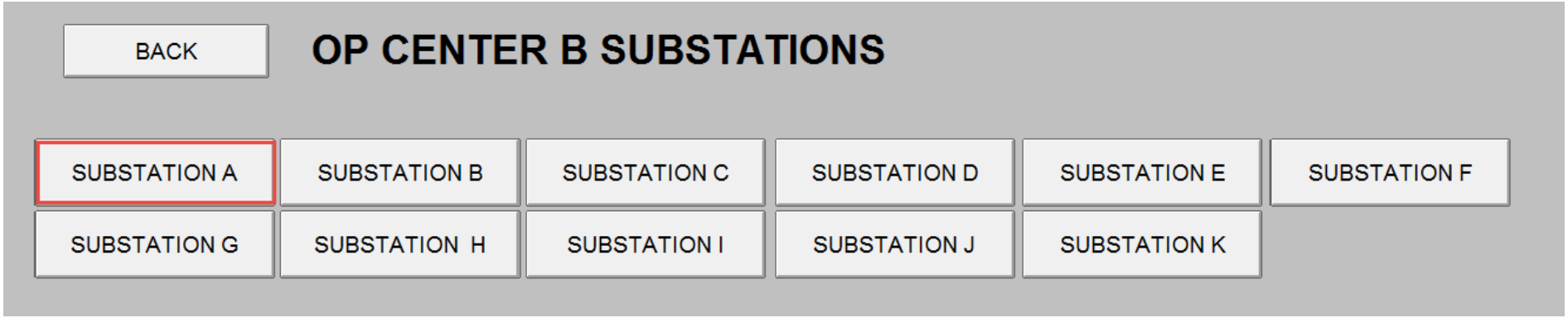
* Built using Region Template

PI ProcessBook - Results



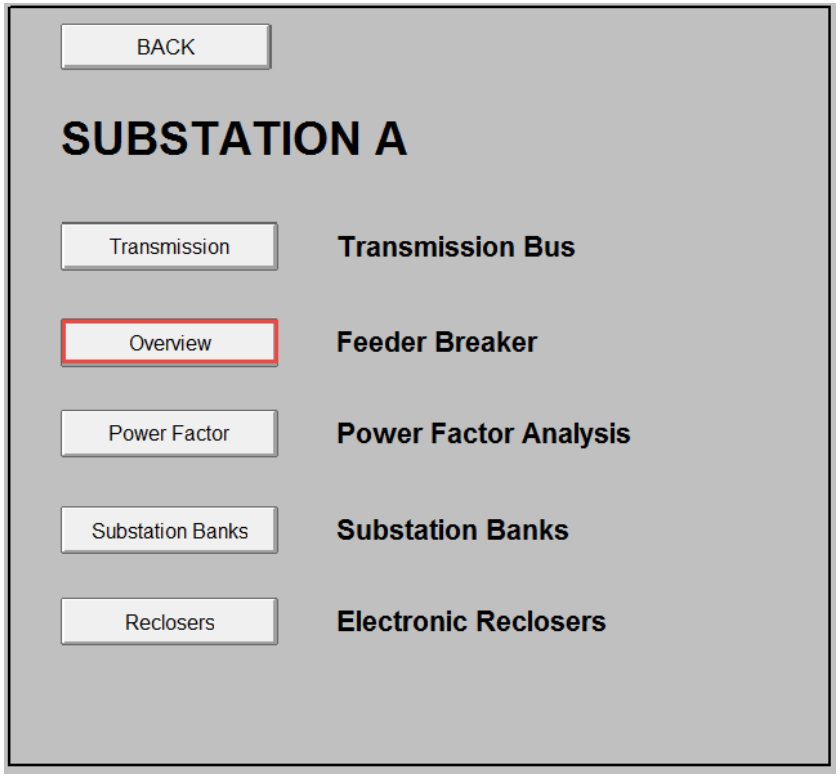
* Built using Op Center Template

PI ProcessBook - Results



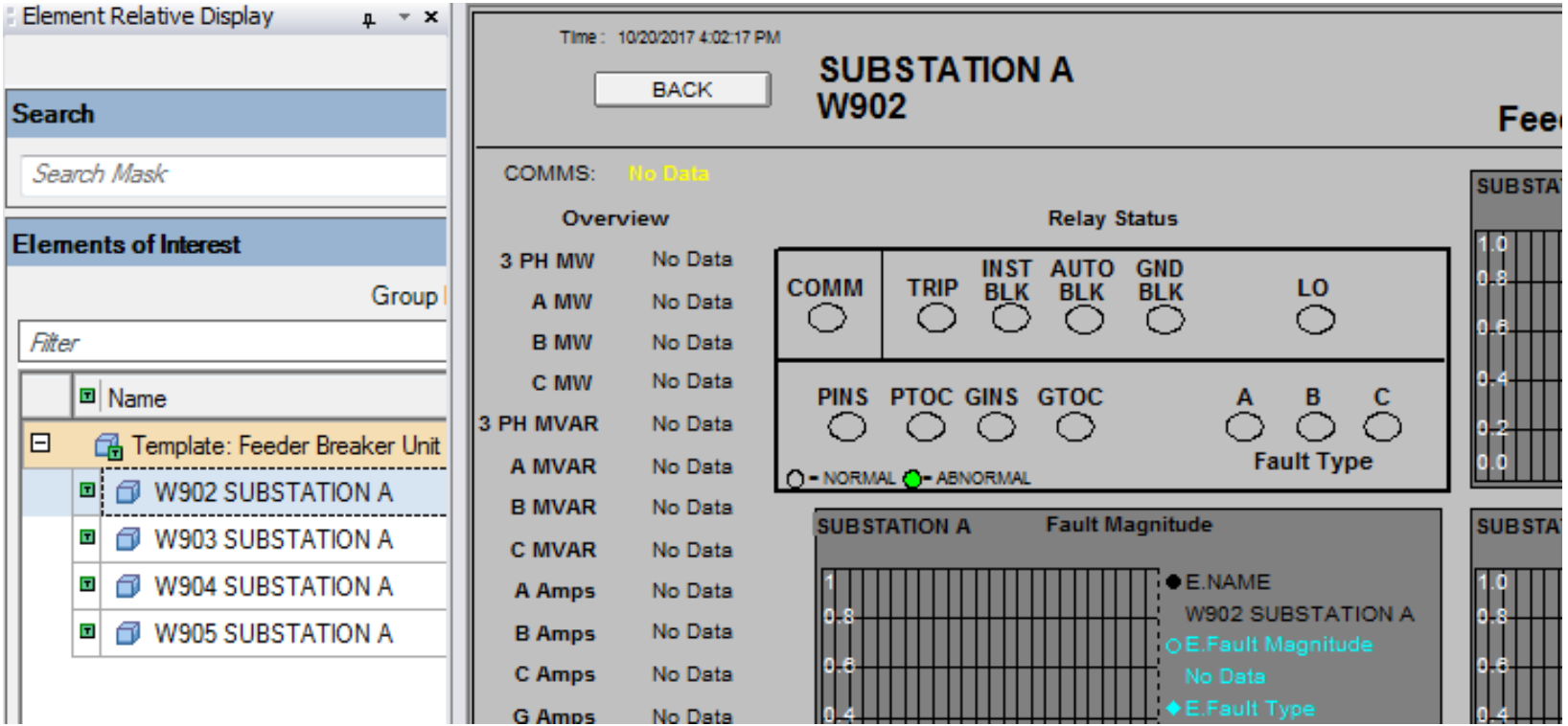
* Built using Substation Template

PI ProcessBook - Results



- 5 displays created for each substation
- Buttons only show up if the substation has that template assigned to it
- Adding and removing from the SVG's XML as needed

PI ProcessBook - Results



Results

- ✓ Creating or removing PI Tags for equipment will automatically be added or removed in PI Asset Framework
- ✓ Additions or removal of Elements in PI Asset Framework will automatically rebuild the displays and pick up the changes
- ✓ Consistency across ALL displays. Updating the base SVG file will replicate across all displays
- ✓ Able to create approximately 4,000 displays in 60 seconds

Critical components for success

- Coordinated efforts between the business, IT, SCADA, and key stakeholders
  - Clearly communicate expectations and needs

- Standards committees for equipment and data modeling, including tag naming standards

- Plan out your PI System design from the very beginning!

Takeaways

- **Standard tag naming** enables rapid implementation of your PI Asset Framework system and deployment of visualization solutions and reports
- Minimizes the need for unnecessary maintenance from a support perspective
- Increases the users ability to quickly and easily find the data they need
- Provides visibility into the operation of thousands of substations from Day 1 of system Go-Live

Lessons Learned

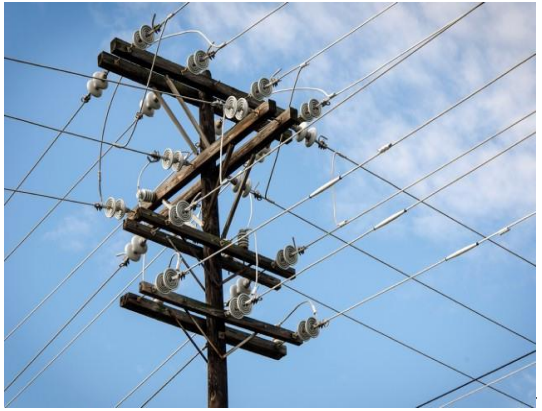
Next Steps

- System Go-Live on November 7th
  - UAT has been completed successfully and signed off by the business
- Leverage standardization and functionality across the rest of the enterprise
- Explore additional use cases that can be leveraged by Analytics and PI Notifications
- Training workshops for control operators and users
- Integration of PI Vision for displays

Leveraging the PI System for Power Distribution Monitoring

COMPANY and GOAL

Duke Energy is a leading energy company focused on electric power and gas operations and will Improve these operations through our commitment to innovation and standardization



CHALLENGE

Integrate with a new SCADA system and provide enterprise visibility to operations

- Large amount of data collected
- Meaningful visual solutions
- Verify data from old SCADA system matches the new SCADA system

SOLUTION

Integrate with the OSIsoft PI System leveraging standardization

- Committee established to define standardization
- Enterprise wide monitoring of operations with real-time displays
- Advanced reporting with Analytics

RESULTS

Improved operational visibility through verified and trusted data

- Monitor and trend new SCADA system state and performance
- Increased reporting accuracy
- Decreased support needs

Contact Information

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Questions

Please wait for the **microphone** before asking your questions

State your **name & company**

Please don't forget to…

complete the Post Event Survey

감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado

Engage, Plan, Standardize, then Deploy