Building User-specific Dashboards from Legacy Views with AVEVA™ PI Vision

Dave Johnson

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• Intro
• Challenge: Migrate thousands of displays from a legacy system quickly to PI Vision
• Solution: Use the PI Vision API to programmatically build PI Vision displays
• Benefits
• **PI Vision API Bonus tips**
• Questions
I serve in a technical advisory role for all Chevron refineries and liaison with our central PI team.
Legacy Visualization = “LVIZ”
LVIZ = Elvis
Elvis Deployments

Challenge: Migrate thousands of displays from a legacy system fraught with security vulnerabilities to PI Vision
PI Vision API to the rescue!

Client Machine

AVEVA PI Vision Server

AVEVA PI Vision API
displays (JSON)
Nota Bene

PI Vision API \neq PI Web API
Important Note

With experienced PI administrators and internal development resources, Chevron was able to go beyond the supported capabilities of AVEVA™ PI Vision and create a customized solution to meet their specific needs. This presentation celebrates Chevron’s achievement in going beyond what is available out-of-the-box and is not intended to imply or warrant the functionality they describe for general usage of AVEVA™ PI Vision.
PI Vision API Client Options

- C#
- cURL
- Golang
- PowerShell
- Python
- Rust

- Many other options – just need to be able to consume (and publish) JSON data from an HTTP-based endpoint.

- The PI Vision API opens many new doors of possibility in the realm of PI Vision!
Phase 1: **Pure PI tag-based conversion** rather than leveraging PI AF capabilities
Key Python Packages Used

• pythonnet (Python/C# interop) to invoke .NET libraries
  • PI AF SDK
  • .NET WebClient to get and post JSON data (could not use the Python `requests` module due to authentication challenges)
• BeautifulSoup4 (bs4)
• cssutils
• pyautogui
• Pillow
High Level Architecture Overview

Elvis 5 Exported View (HTML) → Elvis 5 View Extractor (eve.py) → Elvis 5 Extracted CSV → PI View Builder (pvb.py) → AVEVA PI Vision Display

Elvis 6 View → Screenshot Creator (screenshot.py) → Screenshot image file → HTTP PUT request → tags, x, y
### Elvis 5 Exported View (Fragment)

<table>
<thead>
<tr>
<th>Component</th>
<th>View</th>
<th>Drillable</th>
<th>Template Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller_TS</td>
<td>Name: HorizValve</td>
<td>Use View Properties</td>
<td>Component View List</td>
</tr>
<tr>
<td></td>
<td>Device: Desktop</td>
<td></td>
<td>Member</td>
</tr>
<tr>
<td></td>
<td>Orientation: Landscape</td>
<td></td>
<td>Expression</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BaseTag &quot;22FC101&quot;</td>
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<td></td>
<td>Expression</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BaseTag &quot;22FC105&quot;</td>
</tr>
</tbody>
</table>
Elvis 5 Exported HTML (Fragment)

BeautifulSoup web scraping saves the day!
Elvis View Extractor (eve.py)

C\..> python eve.py -h
usage: eve.py [-h] [-p] [-n] site html_file_or_directory

Extract PI tags and their X/Y coordinates into a CSV file from the HTML files created during the Elvis 5 view export process.

Positional arguments:
  site: Name of the site. Sites are retrieved from the sites.csv config file. Valid options include: ese, pas, ric, slc
  html_file_or_directory: HTML file to process or directory of HTML files to process all at once

Options:
  -h, --help: show this help message and exit
  -p, --prod: use the prod PI server rather than the dev PI server to fetch PI tag values
  -n, --nopi: bypass fetching PI metadata from server
| A | Display Name | B | Row | C | X | D | Y | E | Symbol | F | Tag Name | G | Description | H | UOM | I | PointType | J | Extended Props |
|---|--------------|---|-----|---|---|---|---|---|---|--------|---|----------|---|-----------|---|------|---|-----------|---|----------------|
| 1 | FCC          |   | 18  |   | 677| 554|   |   | HorizValve |   | 22FC101  |   | Description 1 |   | MBPD       |   | Float32 |   | BaseTag:22FC101 |
| 2 | FCC          |   | 19  |   | 44 | 511|   |   | HorizValve |   | 22FC105  |   | Description 2 |   | LB/HR      |   | Float32 |   | BaseTag:22FC105 |
| 3 | FCC          |   | 20  |   | 207| 215|   |   | HorizValve |   | 22LC450  |   | Description 3 |   | PCT        |   | Float32 |   | BaseTag:22LC450 |
| 4 | FCC          |   | 24  |   | 359| 393|   |   | VertBar30_PV|   | 22LC460  |   | Description 4 |   | PCT        |   | Float32 |   | BaseTag:22LC460 |
| 5 | FCC          |   | 27  |   | 391| 240|   |   | Description_11pt|   | 22TI4614 |   | Description 5 |   | DEGF       |   | Float32 |   |                     |
| 6 | FCC          |   | 28  |   | 455| 237|   |   | TagUnit |   | 22TI4614 |   | Description 6 |   | DEGF       |   | Float32 |   |                     |
| 7 | FCC          |   | 29  |   | 391| 261|   |   | Description_11pt|   | 22TI4609 |   | Description 7 |   | DEGF       |   | Float32 |   |                     |
| 8 | FCC          |   | 30  |   | 455| 258|   |   | TagUnit |   | 22TI4609 |   | Description 8 |   | DEGF       |   | Float32 |   |                     |
| 9 | FCC          |   | 31  |   | 353| 191|   |   | TagUnit |   | 22TI460  |   | Description 9 |   |           |   | Float32 |   |                     |
| 10 | FCC |   | 32  |   | 391| 282|   |   | Description_11pt|   | 22TI4615 |   | Description 10 |   | DEGF       |   | Float32 |   |                     |
| 11 | FCC |   | 33  |   | 455| 279|   |   | TagUnit |   | 22TI4615 |   | Description 11 |   | DEGF       |   | Float32 |   |                     |
| 12 | FCC |   | 34  |   | 391| 302|   |   | Description_11pt|   | 22TI4616 |   | Description 12 |   | DEGF       |   | Float32 |   |                     |
| 13 | FCC |   | 35  |   | 391| 322|   |   | Description_11pt|   | 22TI4617 |   | Description 13 |   | DEGF       |   | Float32 |   |                     |
| 14 | FCC |   | 36  |   | 455| 300|   |   | TagUnit |   | 22TI4616 |   | Description 14 |   | DEGF       |   | Float32 |   |                     |
Screenshot element zapping
Screenshot Creator (screenshot.py)

Result: Image without live elements

C:\...>python screenshot.py -h
usage: screenshot.py [-h] [-f] [-z] site group

Create background images for PI Vision displays from Elvis 6 HTML5 views

positional arguments:
  site
  group
    Name of the site. Sites are retrieved from the sites.csv config file. Valid options include: ese,pas,ric,slc
    Group to process. Separate multiple groups with commas and no spaces. Example: fcc1,fcc2

options:
  -h, --help
  -f, --force-elvis6
  -z, --zap
    show this help message and exit
    Force an update of the offline files from the Elvis 6 server even if the files already exist
    Zap elements manually from the display before saving a screenshot
High Level Architecture Overview

Elvis 5 Exported View (HTML) → Elvis 5 View Extractor (eve.py) → Elvis 5 Extracted CSV → PI View Builder (pvb.py) → HTTP PUT request → AVEVA PI Vision Display

Elvis 6 View → Screenshot Creator (screenshot.py) → Screenshot image file
## Elvis 5 Exported View CSV result

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Display Name</td>
<td>Row</td>
<td>X</td>
<td>Y</td>
<td>Symbol</td>
<td>Tag Name</td>
<td>Description</td>
<td>UOM</td>
<td>PointType</td>
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<tr>
<td>2</td>
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<td>18</td>
<td>677</td>
<td>554</td>
<td>HorizValve</td>
<td>22FC101</td>
<td>Description 1</td>
<td>MBPD</td>
<td>Float32</td>
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<td>FCC</td>
<td>19</td>
<td>44</td>
<td>511</td>
<td>HorizValve</td>
<td>22FC105</td>
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<td>359</td>
<td>393</td>
<td>VertBar30_PV</td>
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PI Vision JSON
symbol templates

Mapped to symbols defined in the CSV
PI Vision JSON
symbol templates

Dynamic Expression Syntax
PI View Builder (pvb.py)

Result: PI Vision Display of legacy converted display including background screenshot

C\...>python pvb.py -h

Build PI Vision displays using CSV files and screenshots created using eve.py and screenshot.py respectively

Positional arguments:
- site: Name of the site. Sites are retrieved from the sites.csv config file. Valid options include: ese, pas, ric, slc
- group: Group to process. Separate multiple groups with commas and no spaces. Example: fcc1, fcc2

Options:
- -h, --help: show this help message and exit
- -u, --update: update the display on the PI Vision web server in addition to writing the results to a JSON file
- -p, --prod: use the prod environment rather than the dev environment
- -b, --browser: launch web browser after display is updated on the PI Vision web server (must be used with --update to work)

Note: The PI Vision API officially supports just the import and export of displays. We created symbols and exported displays as a starting point to ensure the JSON conformed to standards before programmatically building the PI Vision displays.
Final Result: Elvis graphic
Final Result: AVEVA PI Vision Graphic
Surgeon (surgeon.py)

Perform surgery on an existing PI Vision display rather than regenerating it completely

```
C\...>python surgeon.py -h

positional arguments:
  site          Name of the site. Sites are retrieved from the sites.csv config file. Valid options include: ese,pas,ric,slc
  group         Group to process. Separate multiple groups with commas and no spaces. Example: fcc1,fcc2

options:
  -h, --help    show this help message and exit
  -u, --update  update the display on the PI Vision web server in addition to writing the results to a JSON file
  -p, --prod    use the prod environment rather than the dev environment
  -b, --browser launch web browser after display is updated on the PI Vision web server (must be used with --update to work)
```
Chevron saves money and increases reliability using the PI Vision API to convert legacy displays

**Challenge**

- We (Chevron) were faced with a situation in our domestic refineries where we needed to convert hundreds of complex legacy data visualization views built over 20 years residing in a non-AVEVA PI system to AVEVA PI Vision—and we needed to do it expeditiously.

**Solution**

- We leveraged the AVEVA PI Vision API in conjunction with Python to programmatically build the PI Vision displays rather than creating each new PI Vision display manually.

**Results**

- Hundreds of hours saved building new PI Vision displays manually.
- Increased accuracy and reliability since the human element of transcribing PI tags (i.e., swivel chair interface) was removed.
- We grew our capabilities to use the PI Vision API in other future contexts beyond legacy display conversion.
PI Vision API Bonus tips

We have just scratched the surface in terms of the flexibility and power the PI Vision API provides.

- Create trends or tabular displays automatically from a spreadsheet or simple markdown document
- Find PI tag dependencies
- Count equipment such as pumps, etc. based on symbols present in the views
- Search/replace symbols made across many displays in your solution
- Adjust links in displays after the fact due to a new URL
- The PI Vision API opens many new doors of possibility in the realm of PI Vision
Special thanks

• Billy Crosby
• Tom Hosea
• Bryan Klosiewicz
• Brent Bregenzer
• James Owens
• The entire Chevron PI team
Dave Johnson
Senior Software Engineer
• Chevron
• dave.johnson@chevron.com
Questions?

Please wait for the microphone. State your name and company.

Please remember to...

Navigate to this session in the mobile app to complete the survey.

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