How to take advantage of the PI WEB API in your organization

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EDPR

Assets to date: August 2019

- 12,185 MW
- 292 WPPs
- 14 PVPPs
- 6,958 WTGs
- 152 INVs
- 13 OEMs
- 37 Models
Business Needs

Machine Learning Predictive Maintenance

Advanced Historical Calculations & KPIs

Performance of Wind Turbines

Wind Turbine Life Extension
Challenge

Requirements of EDPR’s External Data use in Relational Databases and Real Time Applications

Architecture design and PI Calculations Capabilities

Create an Interface Between PI and External Consumers

Scope: How to extract amount of historical Data and Streaming data using PIWEB API
Requirements in Numbers

- Extract Data in Streaming
- Currently difficulties for information processing
- Refresh every 15 seconds
- Arround 500,000 Analog Tags
- Scope Calculations: RT, 1min, 10min…

2 Million of Tags

Currently, difficulties for information processing...
Reasons to use PI WEB API

- **Why Use PIWEB API**
- PI Integrator Restriction
- Test with 2M Tags
- PI Integrator difficulties In Config
- Scalable Solution
- Open Source Access to Data
- Flexibility to Design your own Engine
- A Web Service to Access to Data
AF Configuration v1

Organization by:
- Platform
- Country
- Zone
- Node
- WPP
- WTG

~7000 Assets
(WTGs & INVs)

~300 Tags per Asset

Total: ~2,000,000 Tags
Types of Reading used with PIWEB API

Get Point by path
https://localhost/piwebapi/points?path={path}  Webid of Tag

Get Element by path
https://localhost/piwebapi/elements?path={path}  Webid of Element

Current Value for a Tag or Attribute
https://localhost/piwebapi/streams/{webId}/value  Return One Value

Current Value for All Attributes of Element
https://localhost/piwebapi/streamsets/{webid}/value  Return One Value per each Attr of Element

Get all the Archive Values for All attributes of an element for 30 minute
https://localhost/piwebapi/streamsets/{webid}/recorded?starttime=*-1h&endtime=*-30m  Return Multiples Values per each Attr of Element

Get Streaming Data for All attributes of an element continuously
https://localhost/piwebapi/streamsets/{webid}/channel  Return Continuously incoming data of each Attr of Element
First Test

Default Configuration & AF, Using 1 PIWEB API

- Default Configuration PIWEB API
- Access to AF Default Configuration Element by WTG
- Run with 100 Elements without constrictions
- Total Tags Streaming: ~30,000

Tags Read in Streaming

<table>
<thead>
<tr>
<th>TEST 1</th>
<th>TEST 2</th>
<th>TEST 3</th>
<th>TEST 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>280000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AuthenticationMethods</td>
<td>String Array</td>
</tr>
<tr>
<td>CorsExposedHeaders</td>
<td>Allow, Content-Encoding, Content-Length, Date,</td>
</tr>
</tbody>
</table>
Second Test

Default Configuration, New AF Model, Using 1 PIWEB API

- Default Configuration PIWEB API
- New Model by Groups of ~50,000 Tags each one (39) in Heterogeneous distribution
- Run with 3 Elements without constrictions
- Total Tags Streaming: ~150,000
Third Test

New Configuration, New AF Model, Using 1 PIWEB API

- New Configuration PIWEB API
- (Probably requires New Conf in PI Archive)
- New Model by Groups of ~50.000 Tags each one (39) in Heterogeneous distribution
- Run with 10 Elements without constrictions

- Total Tags Streaming: ~500.000

Tags Read in Streaming

<table>
<thead>
<tr>
<th>TEST</th>
<th>Tags Read</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST 4</td>
<td>507700</td>
</tr>
<tr>
<td>TEST 3</td>
<td>152310</td>
</tr>
<tr>
<td>TEST 2</td>
<td>28000</td>
</tr>
<tr>
<td>TEST 1</td>
<td></td>
</tr>
</tbody>
</table>
Fourth Test

New Configuration, New AF Model, Using 4 PIWEB API

- New Configuration PIWEB API
- New Model by Groups of ~50,000 Tags each one (39) in Heterogeneous distribution
- Run with 39 Elements without constrictions
- Total Tags Streaming: ~2,000,000

- Use 4 PIWEB API

Tags Read in Streaming

<table>
<thead>
<tr>
<th>TEST 4</th>
<th>TEST 3</th>
<th>TEST 2</th>
<th>TEST 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>507700</td>
<td>152310</td>
<td>28000</td>
<td>0</td>
</tr>
</tbody>
</table>
Lesson Learned

- Use AF Model Ad-Hoc to the type of Reading
- Adapt the Configuration of PIWEB API in order to the Project
- Using Streamsets Recorded or Streamsets Channel depending on Purpose
- Use more PIWEB API if you need transfer more tags
DEMO

View Streaming Updating of 39 Channels
Enterprise Agreement = Partnership

• A collaborative path towards customer success with OSIsoft products
• Extends across an entire portfolio of assets as opposed to a “buy as you go” plan
• The focus of the enterprise agreement is returning value to EDP
  • Customer Success Managers (CSMs)
  • Technical Advisors
  • Workshops (AF, Architecture, etc.) and training plan
    • Analysis Configuration Engine
    • AF Analytics Recommendations
  • Field Service Activities
  • Asset Monitoring
  • Audit Plans
<table>
<thead>
<tr>
<th>CHALLENGES</th>
<th>SOLUTION</th>
<th>BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve Key Processes of the Company extracting 2M of Tags:</td>
<td>Using PIWEB API with Streamsets – Channel and:</td>
<td>Include 100% of the Assets in our Key Processes</td>
</tr>
<tr>
<td>▪ Machine Learning Predictive Maintenance</td>
<td>▪ Adapt AF Structure</td>
<td>Reduce between 97.0%-99.9% the execution time of processes</td>
</tr>
<tr>
<td>▪ Advanced Historical Calculations &amp; KPIs</td>
<td>▪ Change Configuration in PIWEB API</td>
<td>Increase the analytic tools to improve our processes</td>
</tr>
<tr>
<td>▪ Performance of Wind Turbines</td>
<td>▪ Use Multiples PIWEB API</td>
<td></td>
</tr>
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<td>▪ Wind Turbine Life Extension</td>
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</table>
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• EDP Renewables
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