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AVEVA™ PI Server Analysis: Expression Tips and Tricks

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Agenda

- Intros
- Tips and Tricks for expression analyses
  - Use Variables
  - Data Density and Data Pattern
  - Input Attributes
  - Scheduling
- Monitoring the PI Analysis Service and analyses
  - Identifying trouble analyses/PI Analysis Service
  - New tools to identify poorly performing analyses
- Questions

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PI Analytics: Expression Analysis Best Practices

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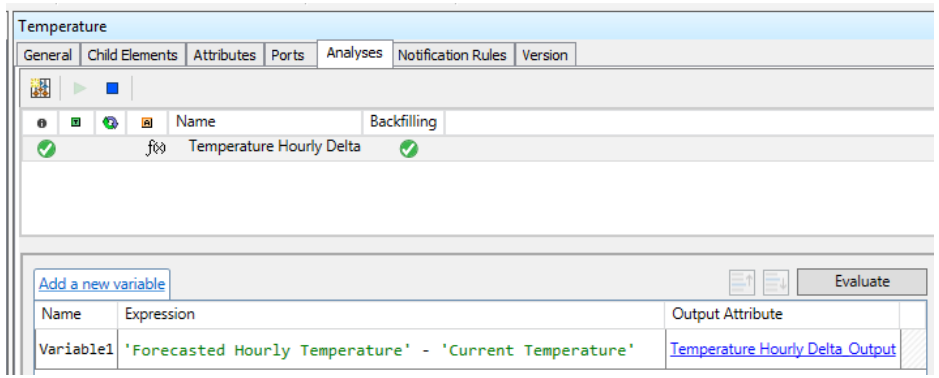
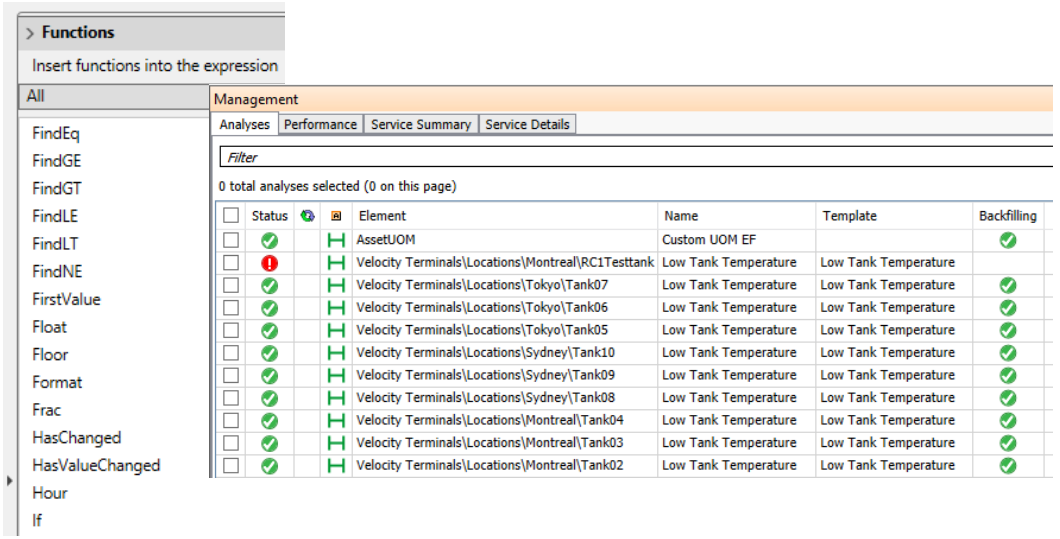
Asset Analytics – An Introduction

- Analytics are part of the PI Asset Framework (PI AF)
- Allow you to generate new streams of information, written back to PI
  - **Expression** – Perform calculations on existing data points
  - **Rollup** – Aggregate several AF attributes
  - **Event-based** – Generate event frames based on user-defined triggers
- Build analyses via PI System Explorer
- Use the PSE Management plugin to manage your analytics





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Tip #1: Use Variables

What is easier to calculate if we need to do several tasks in parallel?

- $X = (V_1 * T^{V_2} + V_3) * He * \frac{\frac{\overline{M}*p}{\mathbb{R}*T}}{\frac{\overline{M}*611.2*\exp\left(\frac{17.62*T}{243.12+T}\right)}{\mathbb{R}*T}}$

- $p_{sat} = 611.2 * \exp\left(\frac{17.62*T}{243.12+T}\right)$
- $f = \frac{\overline{M}*p}{\mathbb{R}*T}$
- $f_{Sat} = \frac{\overline{M}*p_{Sat}}{\mathbb{R}*T}$
- $\rho = \frac{f}{f_{Sat}}$
- $V = (V_1 * T^{V_2} + V_3) * He$
- $X = V * \rho$

- where
  - T, p are measurement data
  - $V_1, V_2, V_3, He, \overline{M}, \mathbb{R}$ are (material-specific) constants

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Use Variables

What is easier to calculate if we need to do several tasks in parallel?

- Keep analysis from doing identical tasks multiple times
- Avoid multiple calls for the same data
- Simplify scheduling
- More readable for users
- Keep syntax simple
  - Speeds up evaluation

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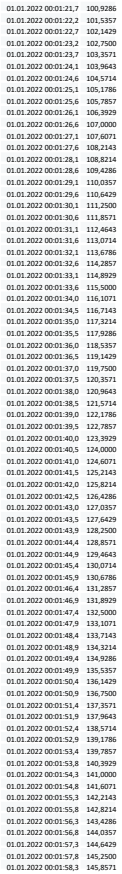
Tip #2: Data Density and Data Patterns

Do we really need this many events to be stored?



01.01.2022	00:01:21,7	100,9286
01.01.2022	00:01:27,6	108,2143
01.01.2022	00:01:28,1	108,8214
01.01.2022	00:01:30,6	111,8571
01.01.2022	00:01:31,1	112,4643
01.01.2022	00:01:42,0	125,8214
01.01.2022	00:01:43,0	127,0357
01.01.2022	00:01:47,4	132,5000
01.01.2022	00:01:48,4	133,7143
01.01.2022	00:01:50,9	136,7500
01.01.2022	00:01:51,4	137,3571
01.01.2022	00:01:52,4	138,5714

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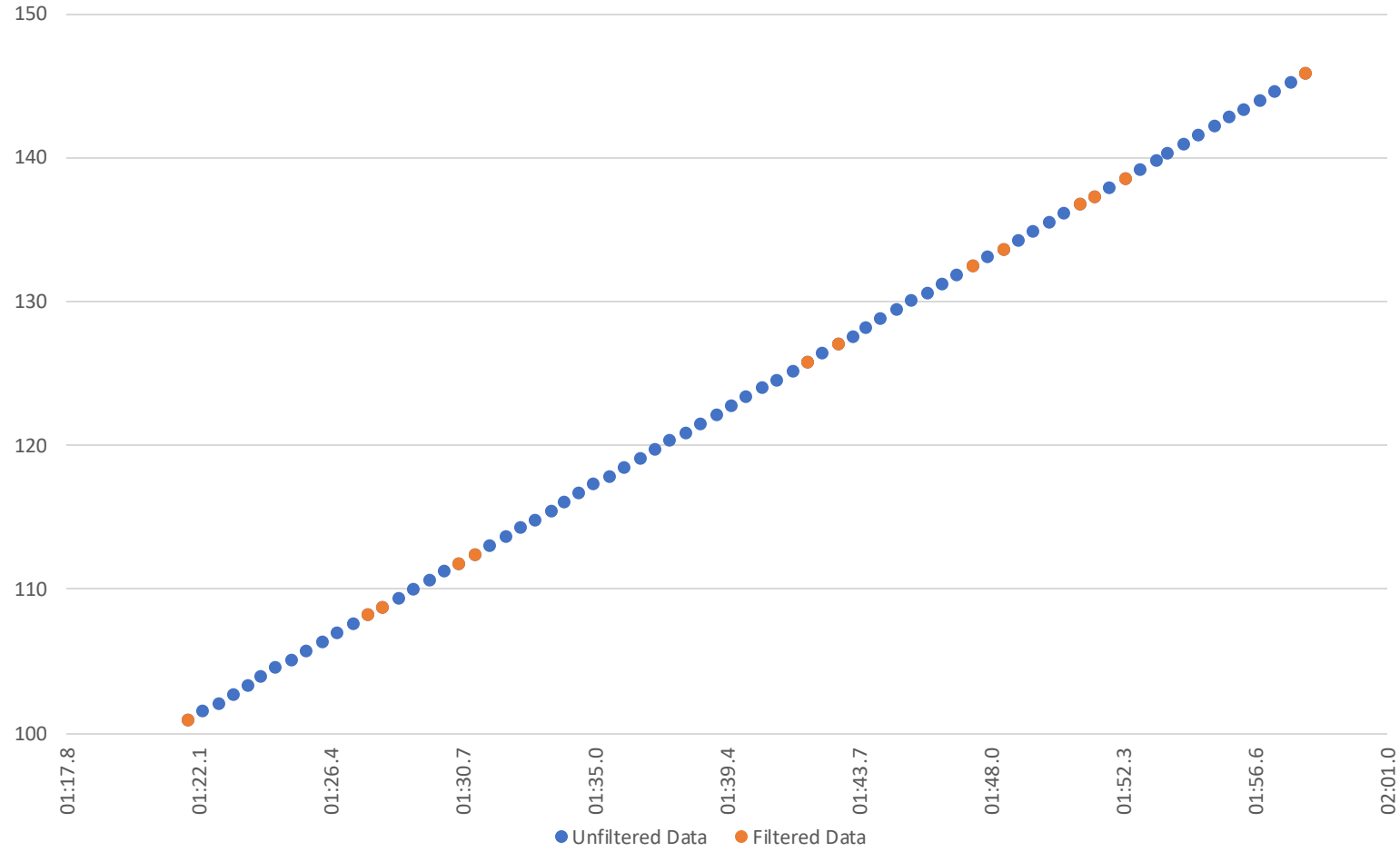
Tip #2: Data Density and Data Patterns

Do we really need this many events to be stored?



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Tip #2: Data Density and Data Patterns

Do we really need this many events to be stored?

- Do not send more data to AVEVA PI Server than needed
  - Review Exception and Compression settings
  - Review Data Source

- Use periodic scheduling to control data density

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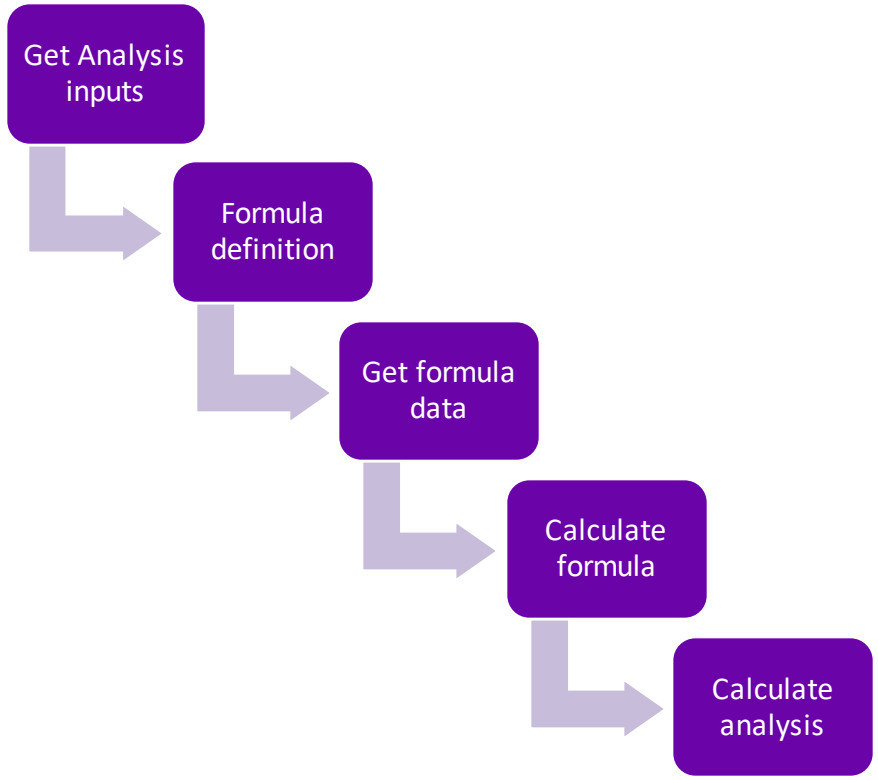
Tip #3: Input Attributes

Where does our data come from?

- Use PI Points wherever possible
- For Table Lookups
  - Use Parametrized Queries
  - Keep Tables as small as possible
- Try to avoid Formula Data References
- Try to avoid extensive Analysis Data References



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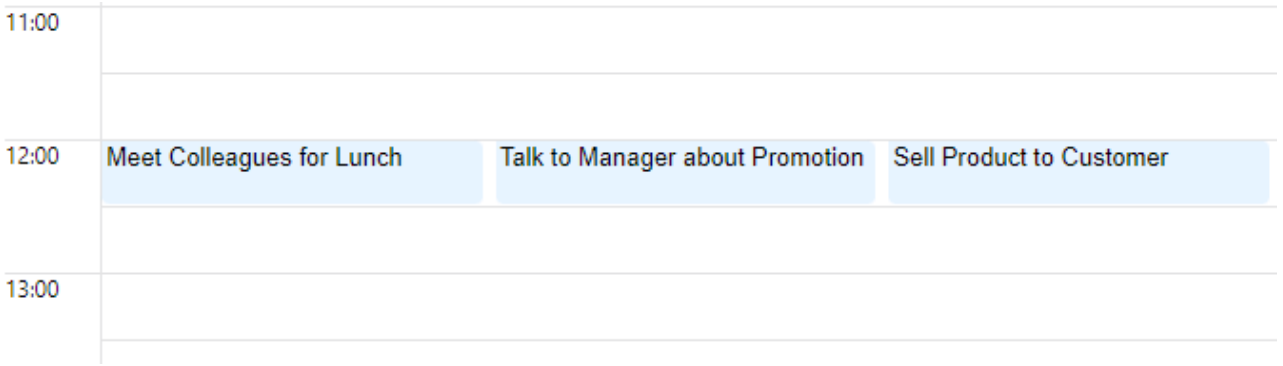
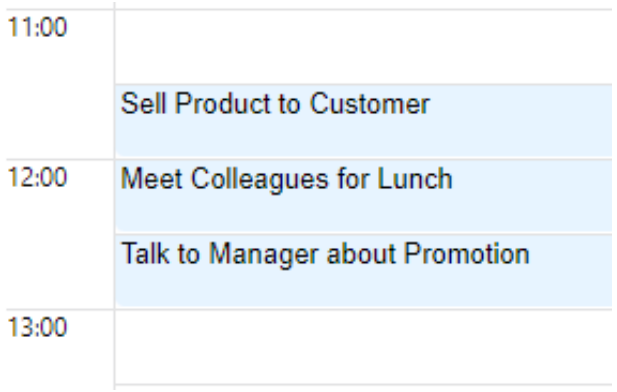
Tip #4: Scheduling

How can we help planning an execution?





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Tip #4: Scheduling

How can we help planning an execution?

- Use templates
- Periodic scheduling gives you control
  - Use offsets
- Natural scheduling is controlled by the data source

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Monitoring PI Analysis Performance

a.k.a. Finding the ~~needle~~ in the haystack

elephant

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What does a struggling PI Analysis Service look like?

- **Evaluation Skipped Count** keeps increasing
- **Maximum Latency** is high
- **Evaluation Count** has reached max capacity

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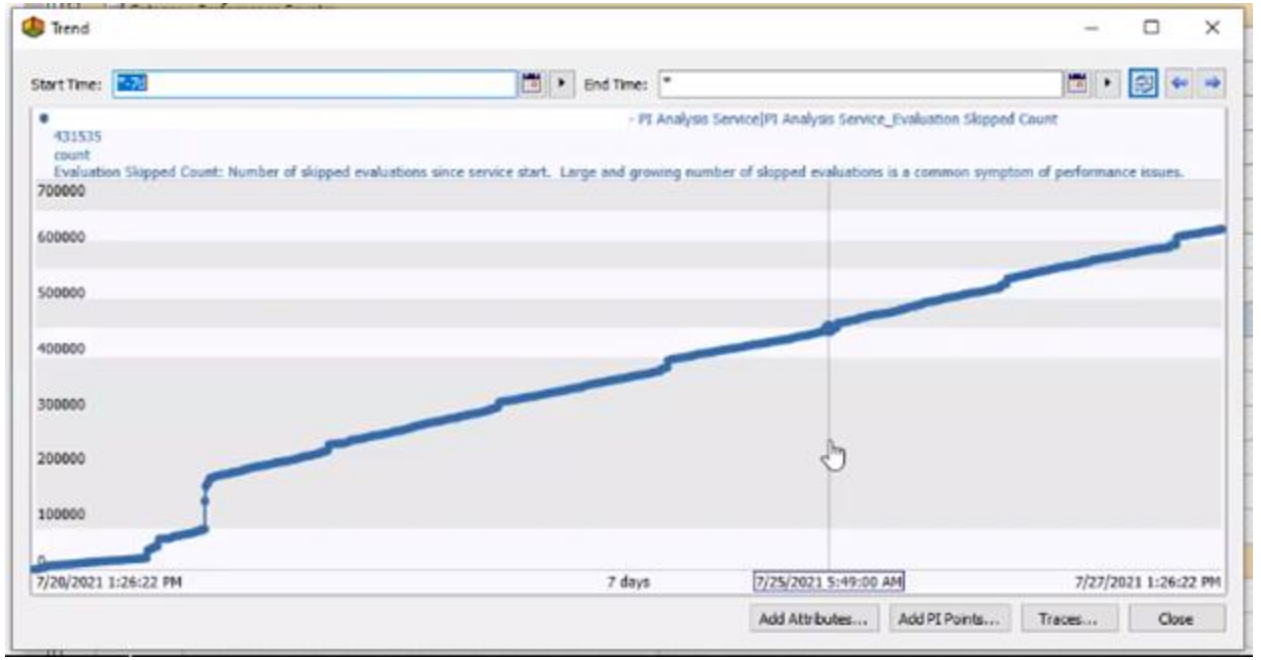
Proactive monitoring

- Use PI Interface for Performance Monitor
- Build logic to alert for issues
- Services engagement available to assist



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Trademarks of a bad analysis

- Long-running
- Calculated too often
- Long dependency chain

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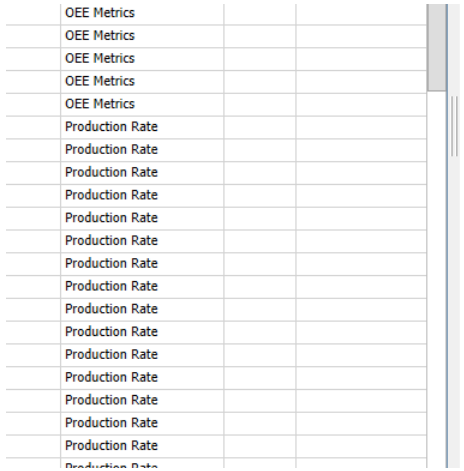
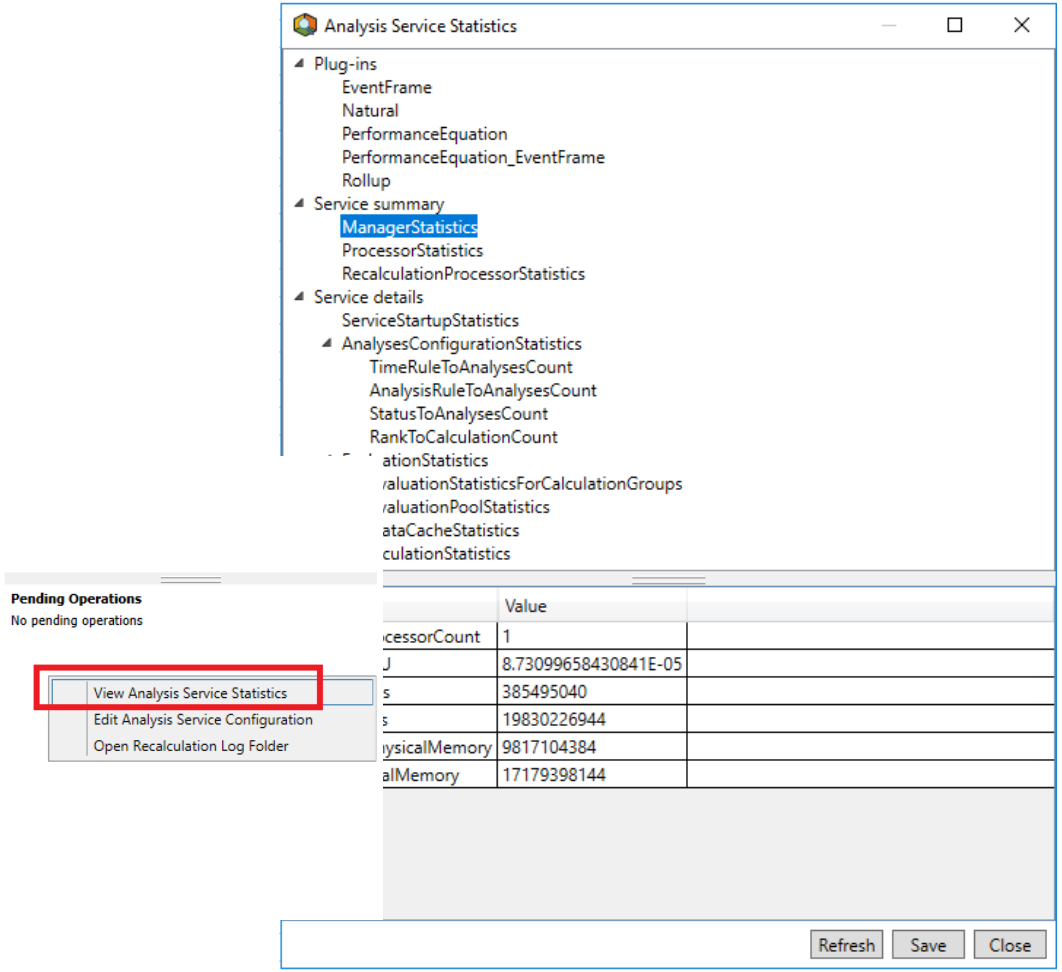
How can I tell which analyses are misconfigured?

(We are already in a bad state…)

- The Past
  - Analysis performance metrics were hidden and difficult to understand
  - Not organized in a way to compare one analysis template to another
  - Required customers to contact support or schedule a Service engagement





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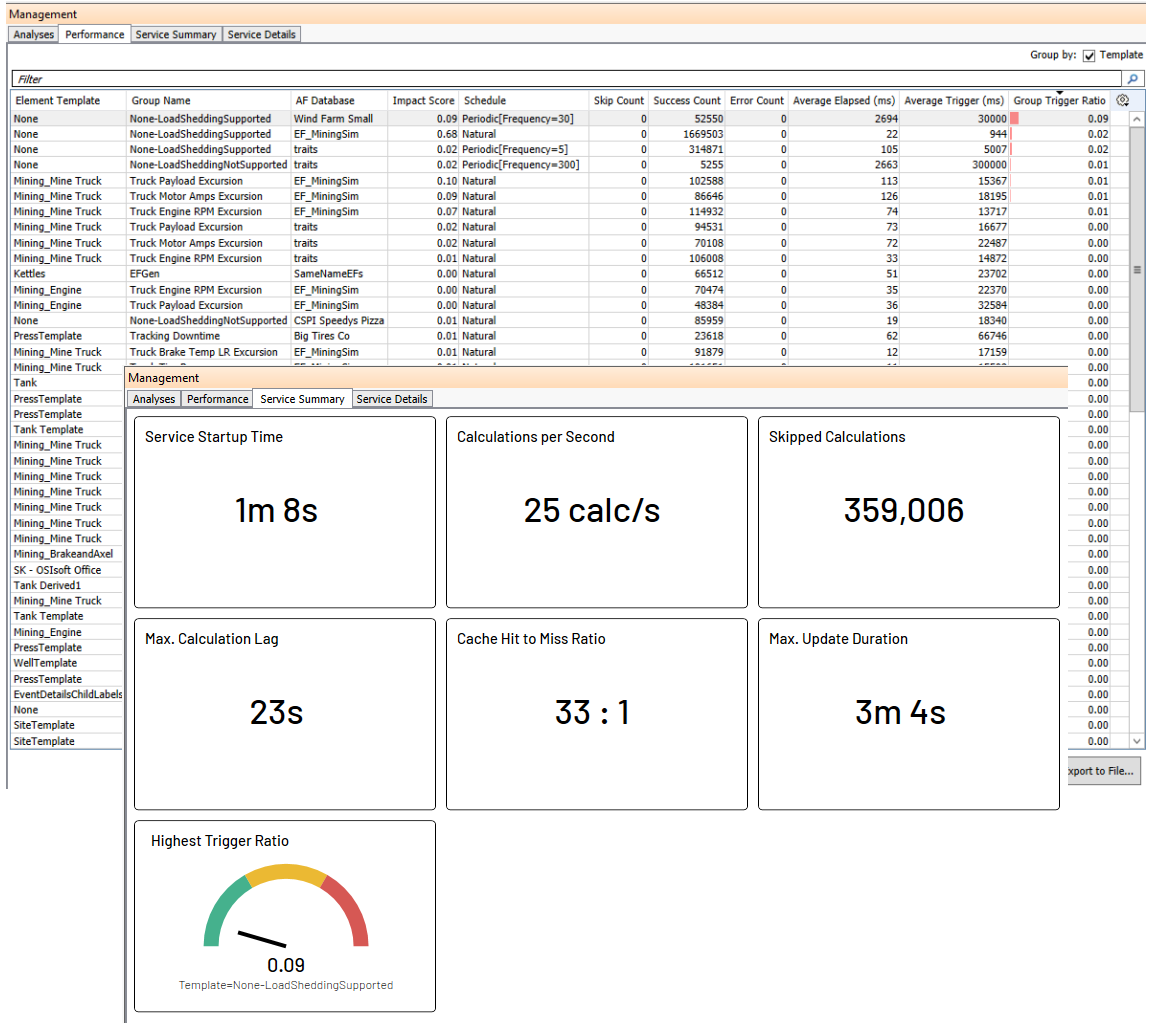
How can I tell which analyses are misconfigured?

- The Future – PI AF Client 2018 SP3 Patch 4
  - Enhancements and usability improvements in PI System Explorer Management plug-in
  - Additional analysis views for analysis and service performance
  - Easily identify expensive analytics/analysis templates
  - Visually represent Analysis service health



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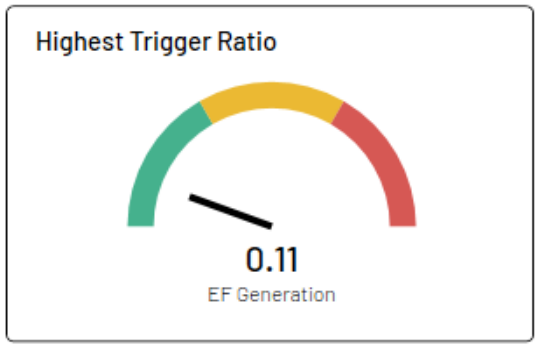
New Analysis Performance Metrics

- **(Group) Trigger Ratio**
  - Measures efficiency of analysis template
  - Average Elapsed ÷ Average Trigger
  - Keep it under 1!

Average Elapsed (ms)	Average Trigger (ms)	Group Trigger Ratio
221	2000	0.11
415	15000	0.03
414	15000	0.03
87	5004	0.02
99	10007	0.01
27	3003	0.01
27	3003	0.01
24	3003	0.01
24	3003	0.01
24	3003	0.01
24	3003	0.01



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New Analysis Performance Metrics

- **Impact Score**
  - Overall impact the template's instances have on the server
  - Combines efficiency of Trigger Ratio with number of instances of analysis template

Average Analysis Count	Group Trigger Ratio	Impact Score
4000	0.11	441.79
6000	0.03	165.96
6000	0.03	165.72
5000	0.02	87.33
7500	0.01	67.03
7500	0.01	66.55
7500	0.01	60.34
7500	0.01	57.76
7500	0.01	57.02
7500	0.01	57.00
7500	0.01	56.96

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Demo

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Summary

- Follow best practices to avoid issues
  - Best practices for analyses
    - Use Variables
    - Data Density and Data Pattern
    - Input Attributes
    - Scheduling
  - Monitoring the Analysis Service and AF Analytics
    - Identify strugging Analysis Services
    - Proactive monitoring
    - Leverage PI AF Client 2018 SP3 Patch 4 for monitoring analysis performance

If you run into issues today, contact us!

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Questions?

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