

AVEVA PI WORLD

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# Monitoring PI Systems

Improving reliability and availability at Xcel Energy Services

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**AVEVA**



## About Xcel Energy Services

- Eight states served via 3 companies
  - Southwestern Public Service, Amarillo TX
  - Public Service Company of Colorado, Denver CO
  - Northern States Power, Minneapolis MN
- Customer Base
  - Approximately 3.5 million electric and
  - 2.0 million natural gas customers
- Strong centralized PI System delivery with an enterprise focus
- Business customers who are committed to the journey

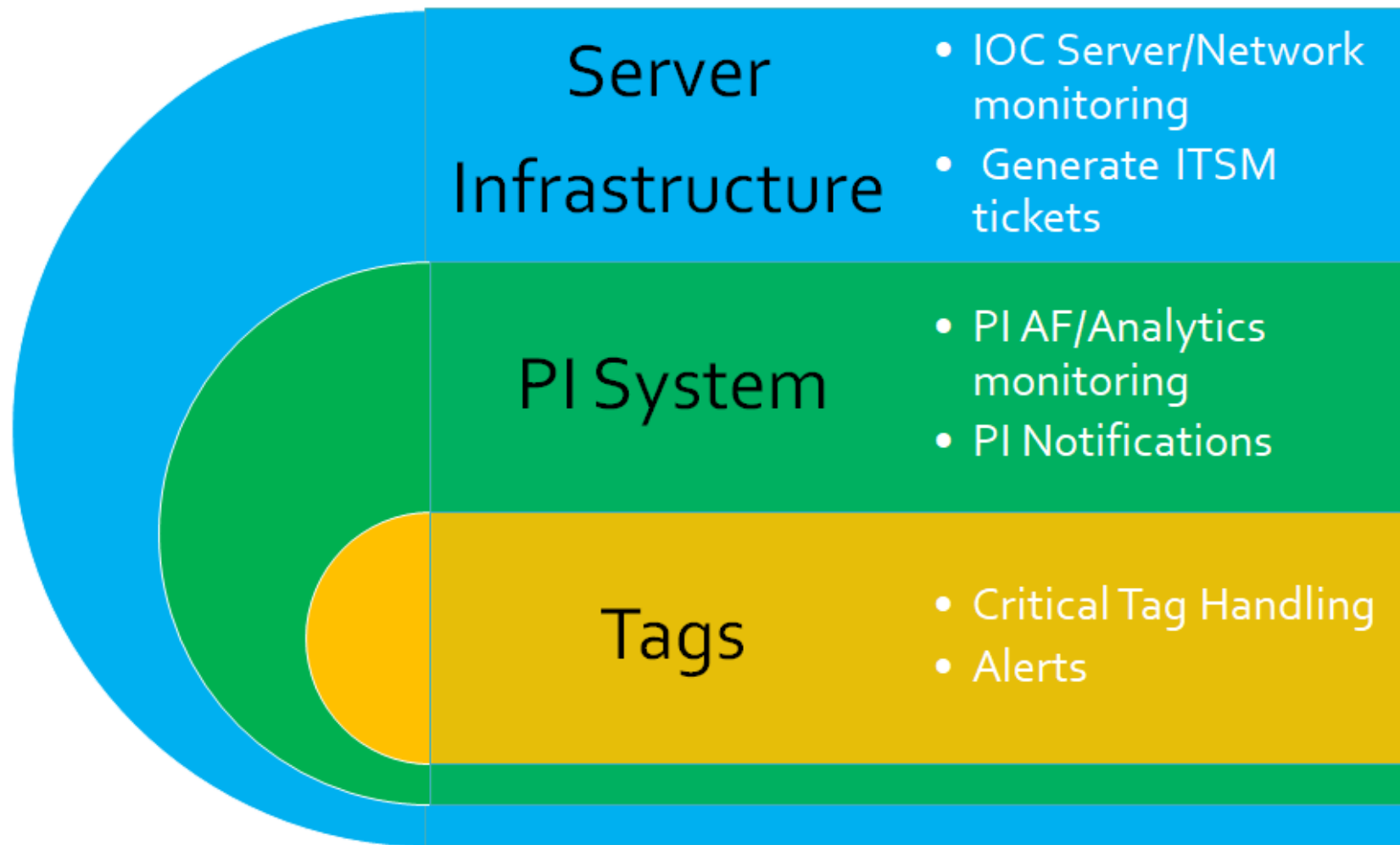


# Reliability & Availability

## Challenges

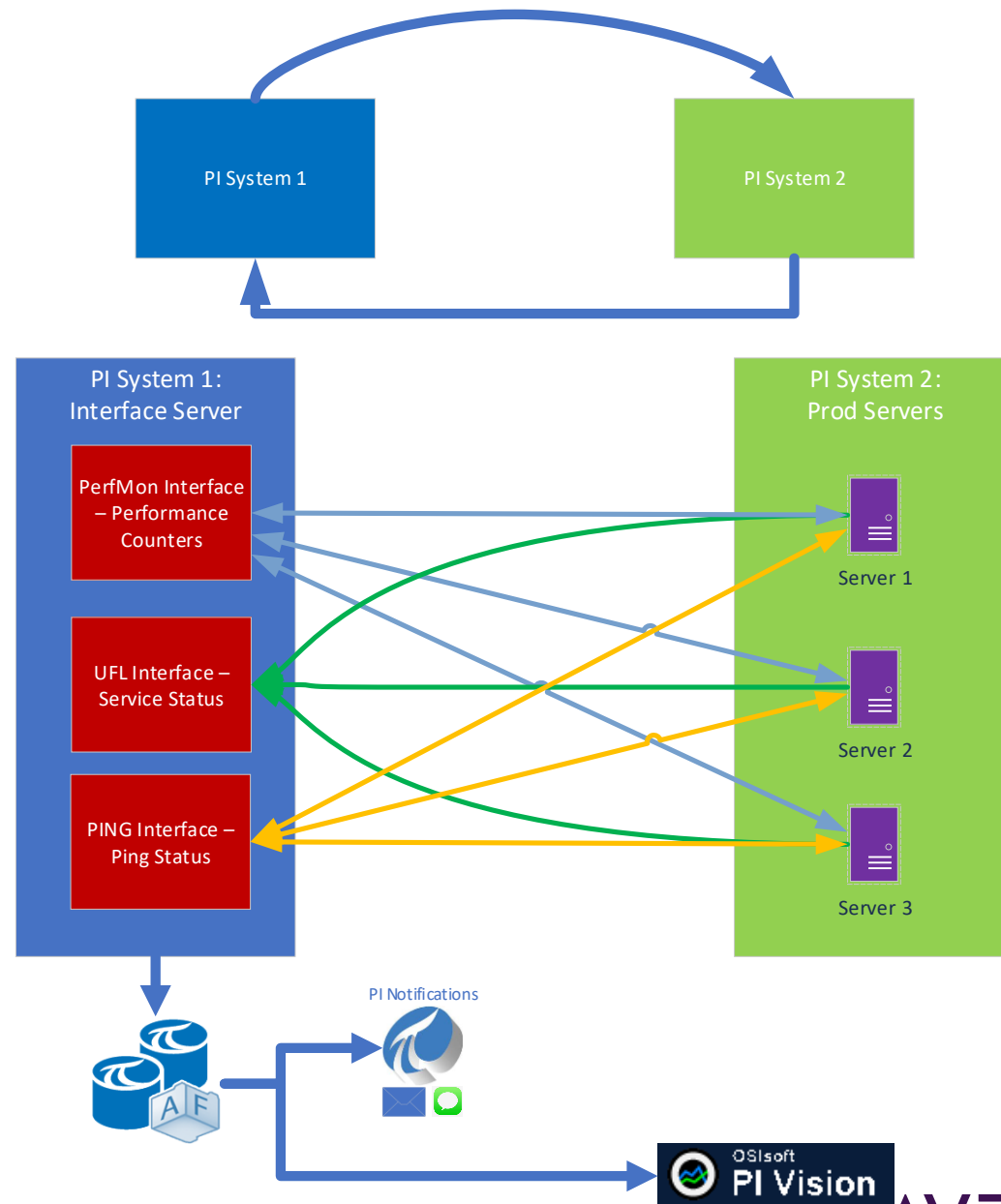
- Small team, expected to monitor many instances of PI servers across the enterprise
- Monitor PI Servers with hardware already on hand
- 5+ Million Points of high-speed data (4-10 sec updates)
- Mission Critical Requirements
- Diagnose Missing Data Flow
  - User Perception
  - Numerous servers to monitor and maintain in multiple locations
  - Resolution could take hours to identify and sort out
- Need to establish meaningful performance monitoring metrics that allows a small team to nimbly maintain large PI Systems

## Cross Monitoring Process Flow



# Cross Monitoring Process Flow

## Cross Monitor PI Systems



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# Monitoring

PI Vision Monitoring Screens

Monitoring PI  
Systems

EnterprisePI

eLogPI

Analytical PI

Region 1 PI

Region 2 PI

Region 3 PI

# EnterprisePI



## EnterprisePI Archive Servers

Server 1 Server 2 Server 3

## Analytical Servers

Server 1 Server 2

## AF Enterprise Servers

Server 1 Server 2

## Interface Servers

Server 1 Server 2 Server 3 Server 4 Server 5  
Server 6 Server 7 Server 8 Server 9 Server 10

## General Servers

Server 1 Server 2 Server 3

## Vision Servers

Server 1 Server 2

## Database Servers

Server 1 Server 2

## Business Integrator Servers

Server 1 Server 2

### States

Bad Data

In Maintenance

Critical

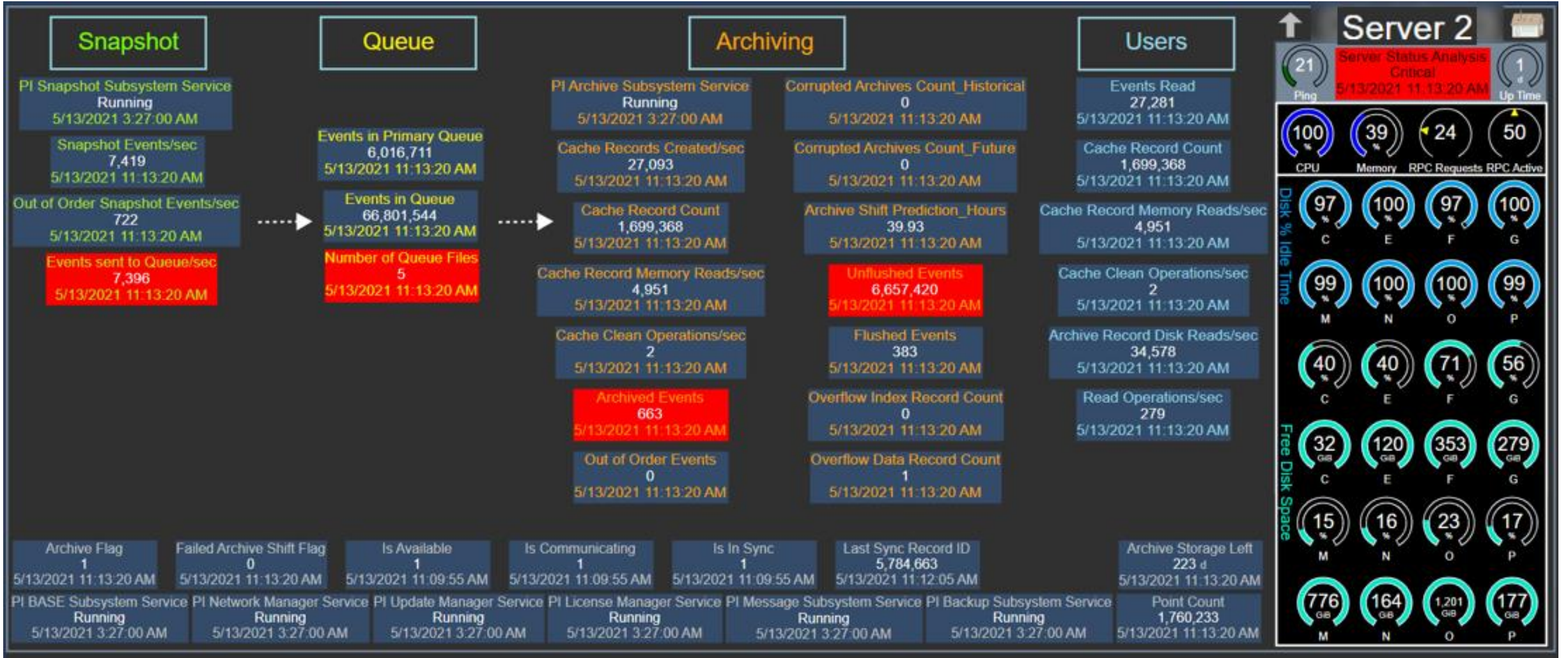
Alert

Warning

Running



# EnterprisePI Primary Archive Server Detail View



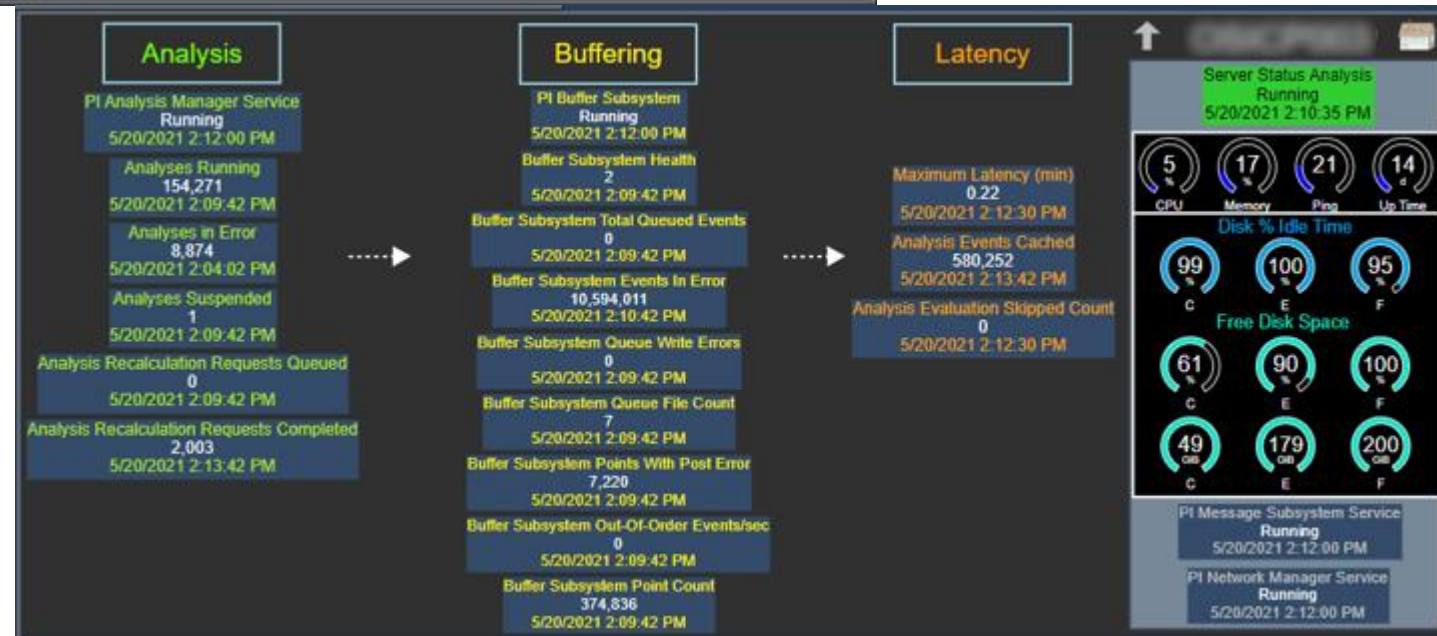
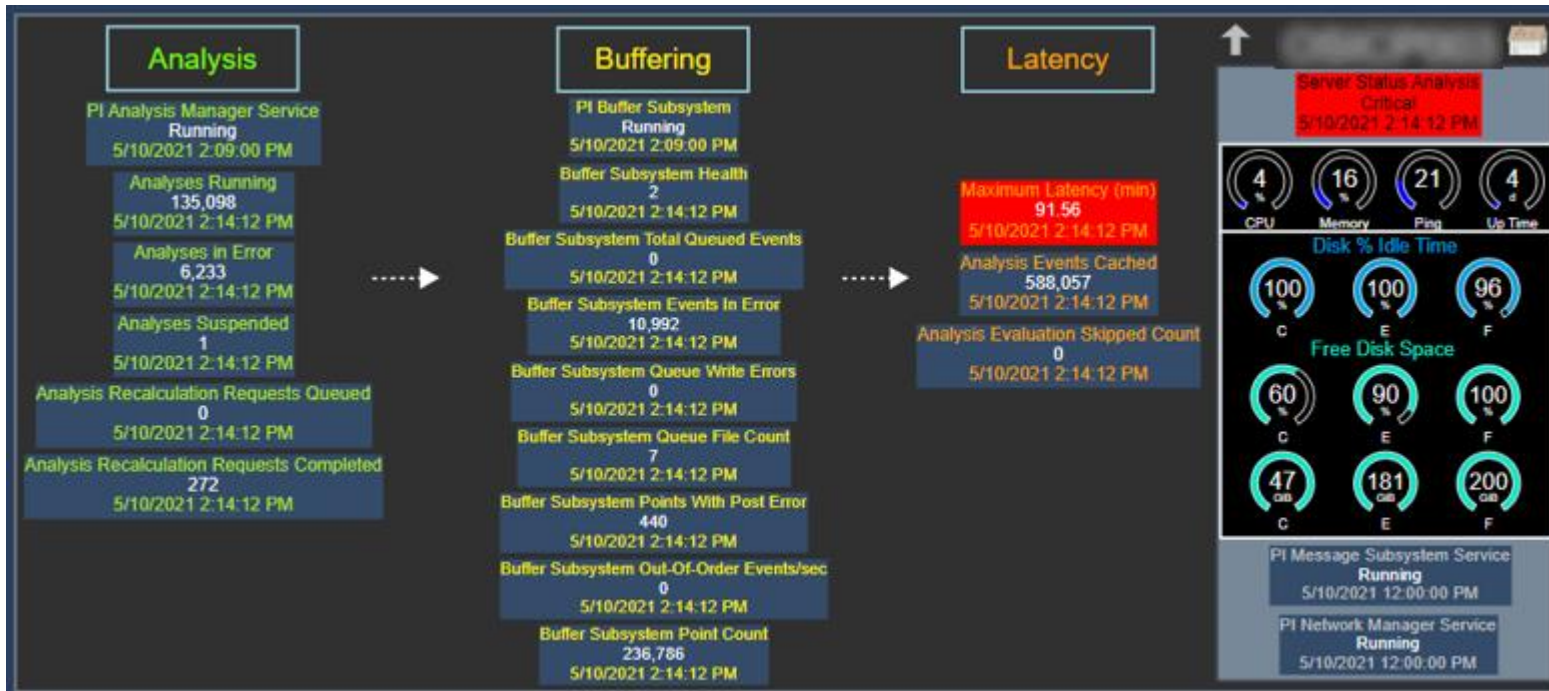


# EnterprisePI Archive Collective View





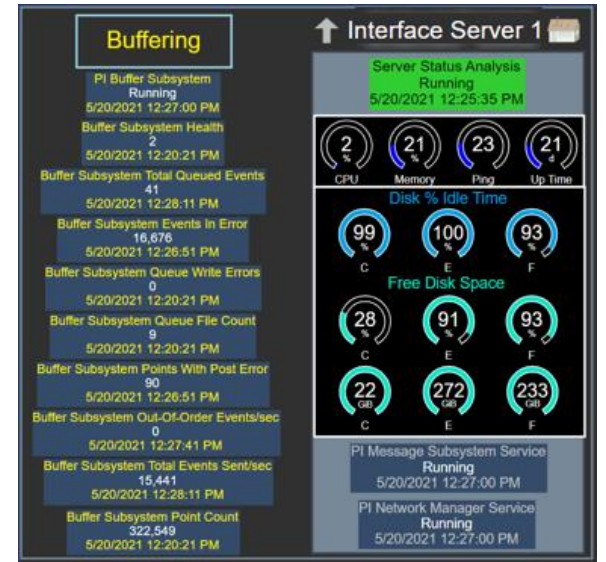
# Analytical Server



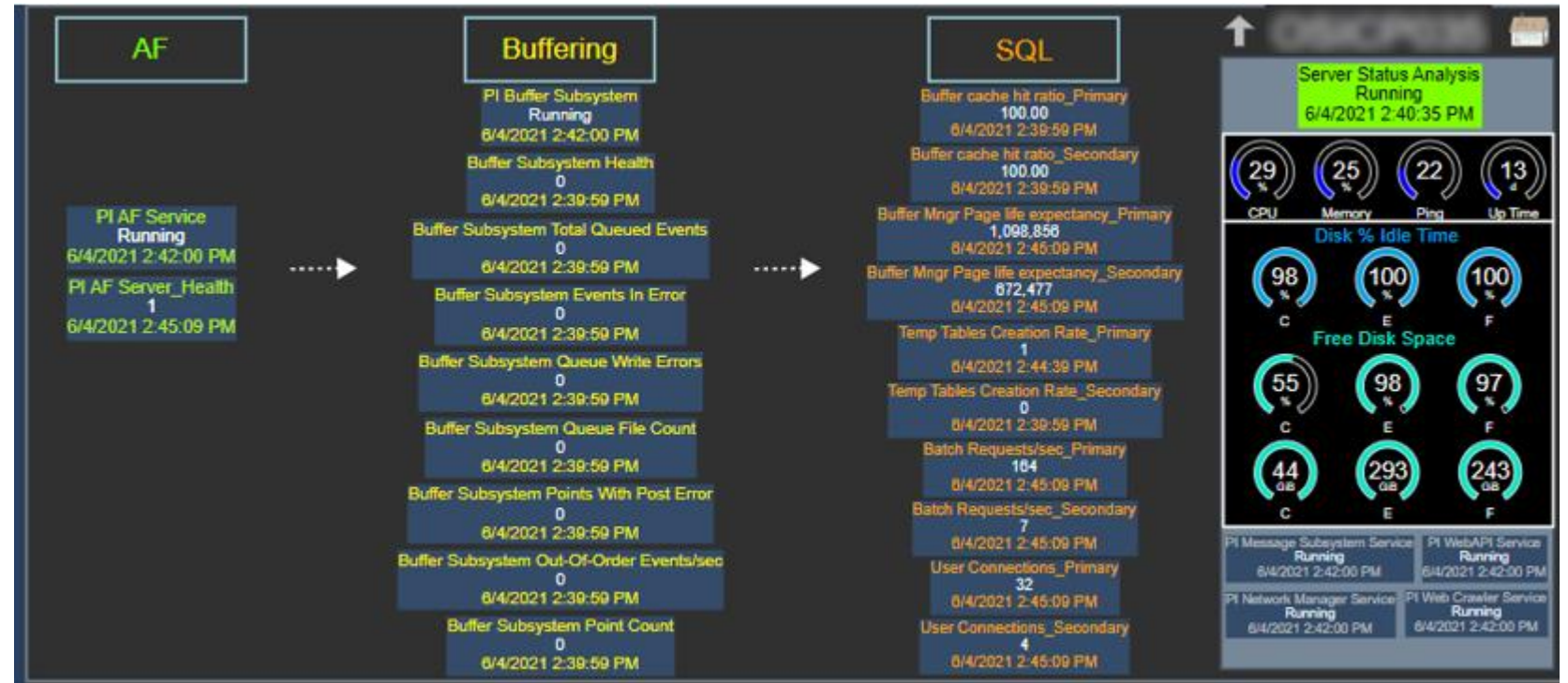
# Notification Server



# Interface Server



# AF Server





# Hale 1 OPC Interface

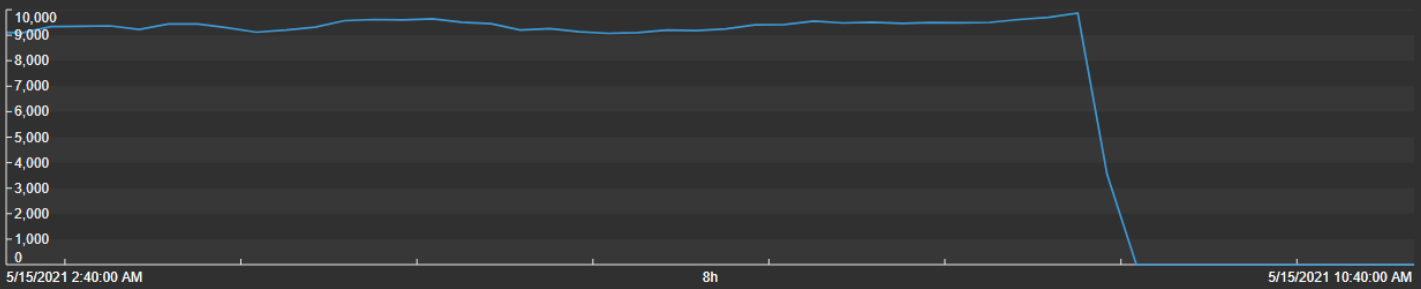
Interface Status  
**Critical**  
5/15/2021 10:40:00 AM

[Back to Main](#)

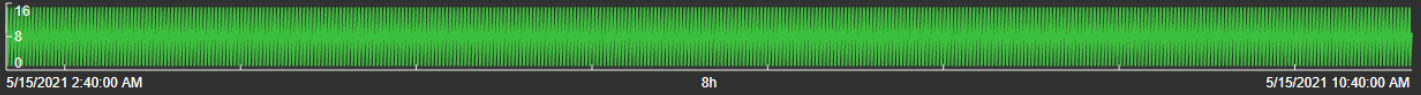
## Hale 1 OPC Interface

IO Rate <b>0.099998</b> 5/15/2021 10:40:00 AM	IORateThreshold <b>2,000</b> 5/15/2021 10:40:00 AM	Device Status <b>Good</b> 5/15/2021 2:43:12 AM	Heartbeat <b>9</b> 5/15/2021 10:40:00 AM	Message Count <b>3,927</b> 5/15/2021 10:40:00 AM	Interface Point Count <b>6,168</b> 5/15/2021 10:40:00 AM
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IORateAnalysisOutputAF <b>1</b> 5/15/2021 10:40:00 AM	DeviceStatusAnalysisOutputAF <b>0</b> 5/15/2021 10:40:00 AM	HeartbeatAnalysisOutputAF <b>0</b> 5/15/2021 10:40:00 AM	KeyTagsAnalysisAnalysisOutputAF <b>2</b> 5/15/2021 10:40:00 AM	FailoverIORateAnalysisOutputAF <b>No Data</b> ...	FailoverHeartBeatAnalysisOutputAF <b>No Data</b> ...
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IO Rate  
0.099998



Heartbeat  
9 seconds

KeyTag1 <b>8.5336</b> 5/15/2021 10:40:00 AM	KeyTag2 <b>7.2695</b> 5/15/2021 10:40:00 AM	KeyTag3 <b>9.3592</b> 5/15/2021 10:40:00 AM
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# Hale 1 OPC Interface

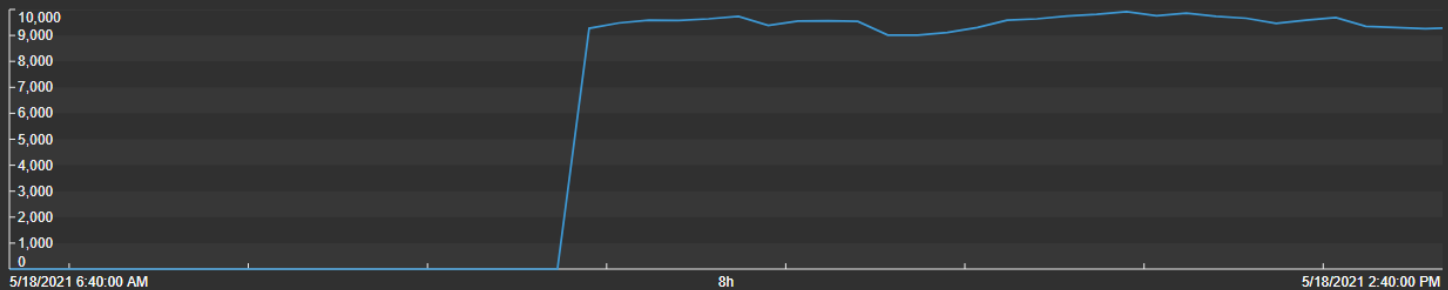
Interface Status  
**Running**  
5/18/2021 2:40:00 PM

[Back to Main](#)

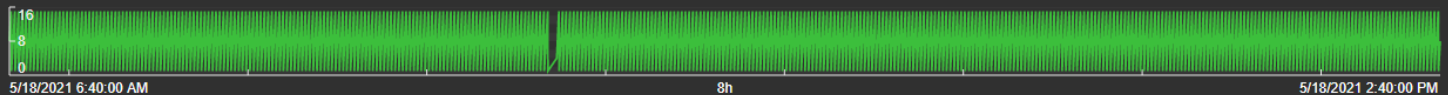
## Hale 1 OPC Interface

IO Rate <b>9,282.3</b> 5/18/2021 2:40:00 PM	IORateThreshold <b>2,000</b> 5/18/2021 2:40:00 PM	Device Status <b>Good</b> 5/18/2021 9:43:41 AM	Heartbeat <b>8</b> 5/18/2021 2:40:00 PM	Message Count <b>3,531</b> 5/18/2021 2:40:00 PM	Interface Point Count <b>6,168</b> 5/18/2021 2:40:00 PM
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IORateAnalysisOutputAF <b>0</b> 5/18/2021 2:40:00 PM	DeviceStatusAnalysisOutputAF <b>0</b> 5/18/2021 2:40:00 PM	HeartbeatAnalysisOutputAF <b>0</b> 5/18/2021 2:40:00 PM	KeyTagsAnalysisAnalysisOutputAF <b>0</b> 5/18/2021 2:40:00 PM	FailoverIORateAnalysisOutputAF <b>No Data</b> ...	FailoverHeartBeatAnalysisOutputAF <b>No Data</b> ...
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IO Rate  
9,282.3



Heartbeat  
8 seconds

KeyTag1 <b>6.2211</b> 5/18/2021 2:40:00 PM	KeyTag2 <b>7.2</b> 5/18/2021 2:40:00 PM	KeyTag3 <b>5.5955</b> 5/18/2021 2:40:00 PM
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# Notifications

# PI Alert: Hale 1 OPC Interface - Critical - notification event.



Retention Policy Xcel 90 Days Delete (90 days)

Expires 8/13/2021

Reply Reply All Forward ...

Sat 5/15/2021 9:41 AM

<b>Name:</b>	Hale 1 OPC Interface
<b>Description:</b>	Hale 1 OPC Interface
<b>Start Status:</b>	<b>Alert</b>
<b>Start Timestamp:</b>	5/15/2021 10:10:30 AM Central Daylight Time (GMT-05:00:00)
<b>Send Status:</b>	<b>Critical</b>
<b>Send Timestamp:</b>	5/15/2021 10:40:30 AM Central Daylight Time (GMT-05:00:00)

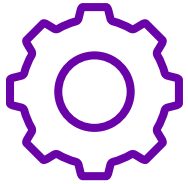
Analysis:		
<b>IO Rate Analysis:</b>	1	5/15/2021 10:40:00 AM Central Daylight Time (GMT-05:00:00)
<b>Heartbeat Analysis:</b>	0	5/15/2021 10:40:00 AM Central Daylight Time (GMT-05:00:00)
<b>Device Status Analysis:</b>	0	5/15/2021 10:40:00 AM Central Daylight Time (GMT-05:00:00)
<b>Key Tags Analysis:</b>	2	5/15/2021 10:40:00 AM Central Daylight Time (GMT-05:00:00)

Tags:		
<b>IO Rate:</b>	0.099998	5/15/2021 10:35:19 AM Central Daylight Time (GMT-05:00:00)
<b>IO Rate Threshold:</b>	2000	1/1/1970 12:00:00 AM Central Standard Time (GMT-06:00:00)
<b>Heartbeat:</b>	1	5/15/2021 10:40:33 AM Central Daylight Time (GMT-05:00:00)
<b>Device Status:</b>	Good	5/15/2021 3:43:12 AM Central Daylight Time (GMT-05:00:00)
<b>Key Tag1:</b>	8.6	5/15/2021 9:48:11 AM Central Daylight Time (GMT-05:00:00)
<b>Key Tag2:</b>	7.3	5/15/2021 9:48:46 AM Central Daylight Time (GMT-05:00:00)
<b>Key Tag3:</b>	9.4	5/15/2021 9:48:25 AM Central Daylight Time (GMT-05:00:00)

### Troubleshooting steps if [Analysis](#) triggered a "1" or "2" above:

- Device Status - look at Device Status tag to see when it last updated or if it has a message in there that tells you the problem.
- Heartbeat - look at Heartbeat tag to see when it has last updated.
- IO Rate - look at IO Rate tag to see when it has last updated, then look to see if value has not changed, also take a look if the value is below IORateThreshold, then if it has any other message in there that tells you the problem.
- Key Tags - Check if any of the key tags have "bad" value or check to see if the data is stale or see when was the value last updated.

# Increased PI System Availability and Reliability



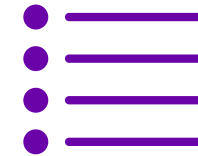
## Challenge

- Diagnosing and resolving issues with PI System Data Flow and System Resources was laborious and time consuming.
- System outages decreased user perception and perceived value of Xcel's mission critical operation



## Solution

- Deployed PI System Monitoring infrastructure, dashboards, and notifications to allow much more rapid resolution
- Solution is templated to enable rapid deployment to other environments.



## Benefits

- Reduced outages by as much as 40 to 50%. Reduced outages from multiple large weekly problems to close to a single problem per month.



“If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle.”  
— Sun Tzu, The Art of War



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THANK YOU

謝謝

DZIĘKUJĘ CI

NGIYABONGA

TEŞEKKÜR EDERİM

DANKIE

TERIMA KASIH

GRACIES

WHAKAWHETAI KOE

DANKON

TANK

TAPADH LEAT

SALAMAT

SPASIBO

GRAZIE

MATUR NUWUN

ХВАЛА ВАМ

MULTUMESC

PAKMET CIZGE

고맙습니다

GRAZIE

شكرا

FAAFETAI

ESKERRIK ASKO

GO RAIBH MAITH AGAT

HVALA

HVALA

БЛАГОДАРЯ

GRACIAS

MAHADSANID

TI БЛАГОДАРАМ

TEŞEKKÜR EDERİM

DANKJE

EΥΧΑΡΙΣΤΩ

GRATIAS TIBI

OBRIGADO

TAK

DANKE

MAHADSANID

AČIŪ

SALAMAT

MAHALO IĀ 'ŌE

TAKK SKALDU HA

МЕРЦИ

RAHMAT

MERCI

GRAZZI

PAKKA PÉR

ありがとうございました

DI OU MÈSI

ĐAKUJEM

HATUR NUHUN

PAXMAT CAĠA

SIPAS JI WERE

TERIMA KASIH

CẢM ƠN BẠN

UA TSAUG RAU KOJ

TI БЛАГОДАРАМ

СИПОС


WAZVIITA


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