

# The PI System – Leveraging the IT/OT Relationship to Identify Optimization Opportunities

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Heather Quale - Mera

# Conference Theme & Keywords



# Agenda



**Bob McIntyre**  
Sr. Process Control Eng., Nutrien



**Heather Quale**  
President, Mera

- Introduction
- Why Enterprise PI System
- Evolution of PI System
- Best Practices
- Wrap-up and Q&A



- Nutrien is the world's largest provider of crop inputs and services (potash, nitrogen, phosphate, retail).
- Formed Jan 1, 2018 as a “merger of equals” between PotashCorp and Agrium.
- Nutrien plays a critical role in **Feeding the Future** by helping growers to increase food production in a sustainable manner.



- Mera is a team of engineers, economists and IT specialists with diverse experience providing services primarily to the oil and gas, mining and pipeline industries
- Our clients vary from innovative start-ups to some of the largest corporations in the world with the goal of using OT data as a competitive advantage

# Why Do We Need an Enterprise PI System?

## Our Vision:

- **Current Practice:** Decisions based primarily on historical metrics and reports.
- **Goal:** Enhance decision making with real-time operational data by implementing an Enterprise PI System.
- **Approach:** Collaborate with Nutrien business systems to provide timely information to the user community.




# Why Implement an Enterprise PI System

- A single data point can have far reaching uses in an organization – pressure used for process, rotating equipment, throughput, safety considerations, sales, etc.
- Consolidated operational data enables companies to share best practices across the organization while maintaining local and regional needs
- Integrating operational data with other business data allows organizations to address much more complex challenges

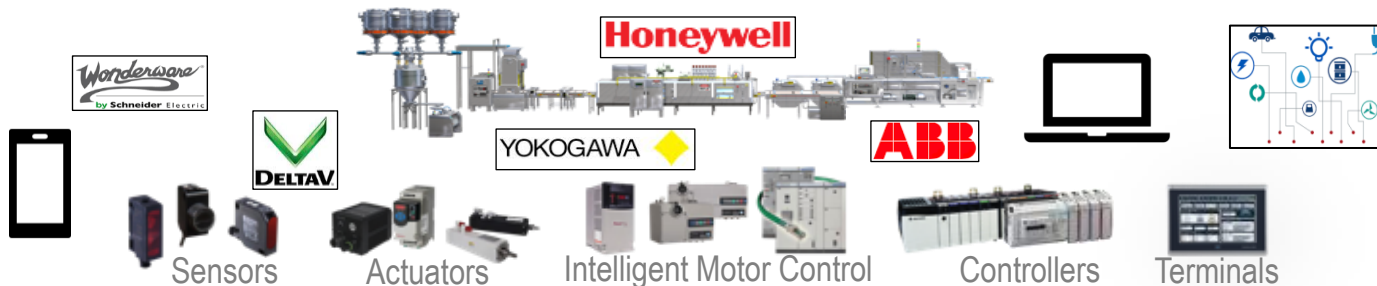
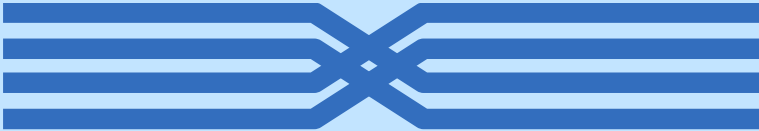


PI System Enables Easy Access to Structured Operational Data

# OT Data Collection

 PI Data Archive

*Storing Millions of Tags for the “life of the assets”*



Wonderware by Schneider Electric

Honeywell

YOKOGAWA

ABB

DELTA V

Sensors

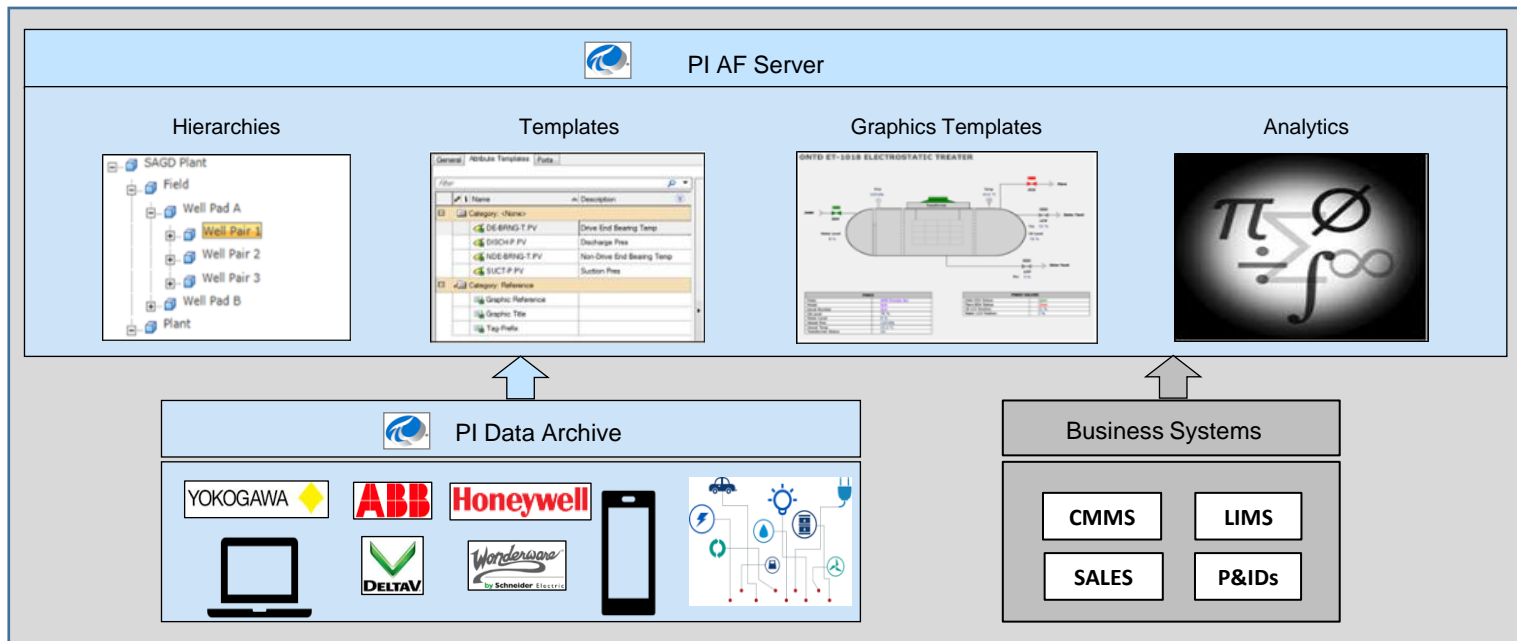
Actuators

Intelligent Motor Control

Controllers

Terminals

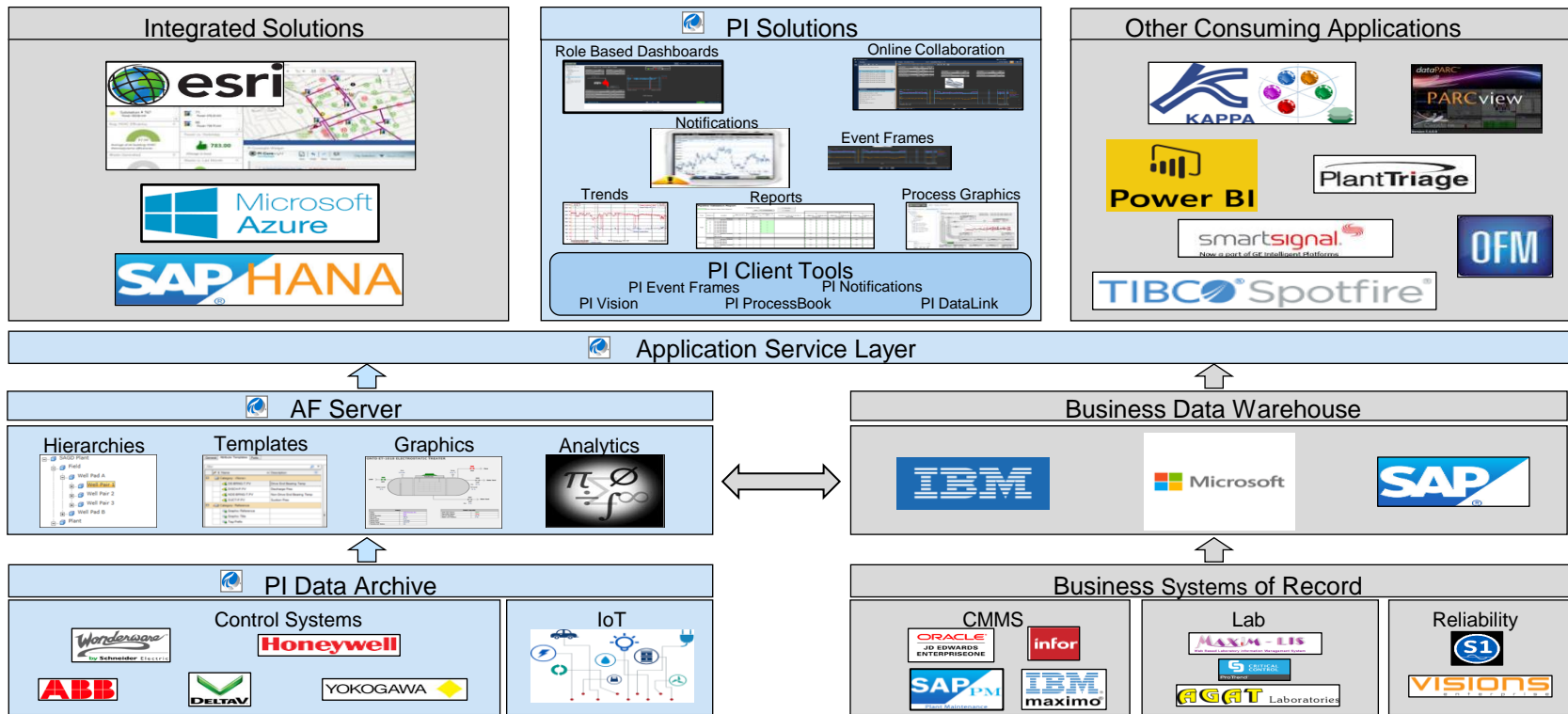
# PI System Asset Framework – OT Data “Game Changer”



Use AF to Provide Structure, Organization and Context to OT Data



# Enterprise PI System – OT Data Warehouse



# Our Path to Enterprise PI System

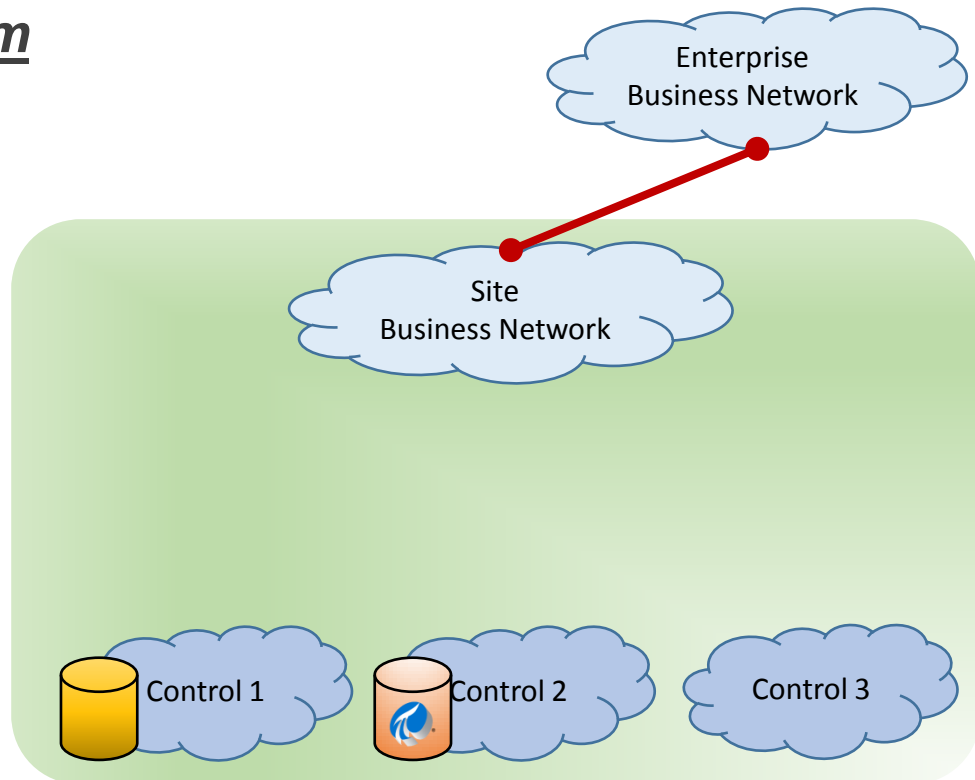
- 1 Architecture
  - The evolving role of the PI System
- 2 Context
  - Standards
  - AF structure and templates
  - Event Frames
- 3 Integration
  - Reconciliation and integration
- 4 Governance
  - OT working *with* IT
  - PI Steering Committee
  - Data Governance Board



# Architecture: Evolving Role of the PI System

## Stage 1: In the Control System

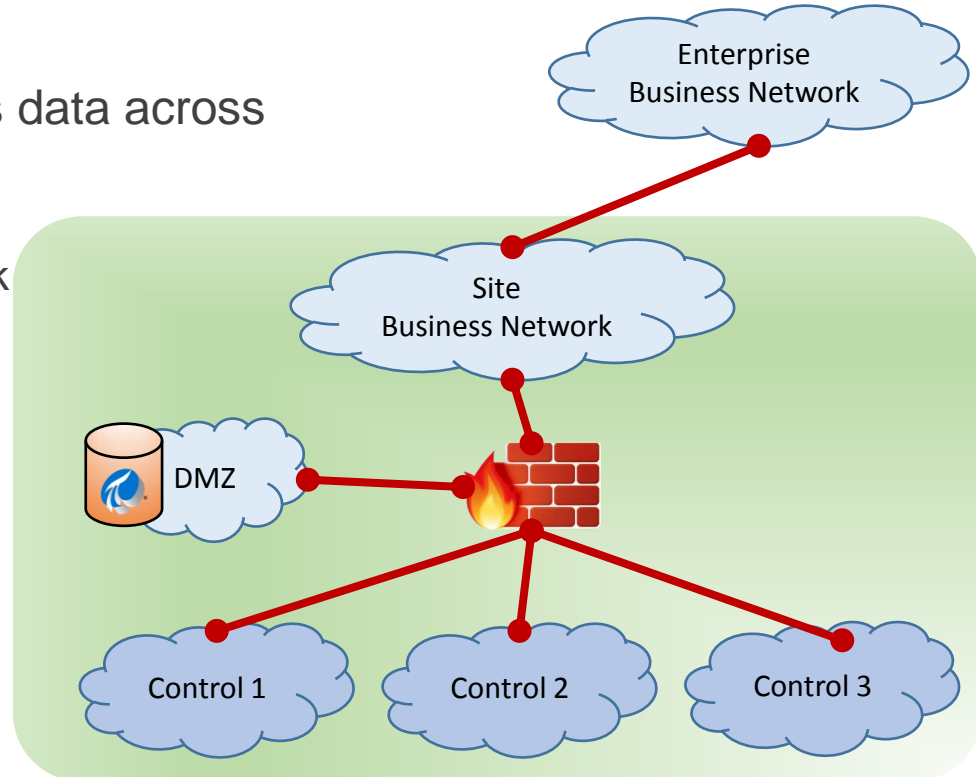
- Only stores data for one system
- Short term, ultra-high frequency
- Not visible outside that control system
- Vendor specific



# Architecture: Evolving Role of the PI System

## Stage 2: Site PI System

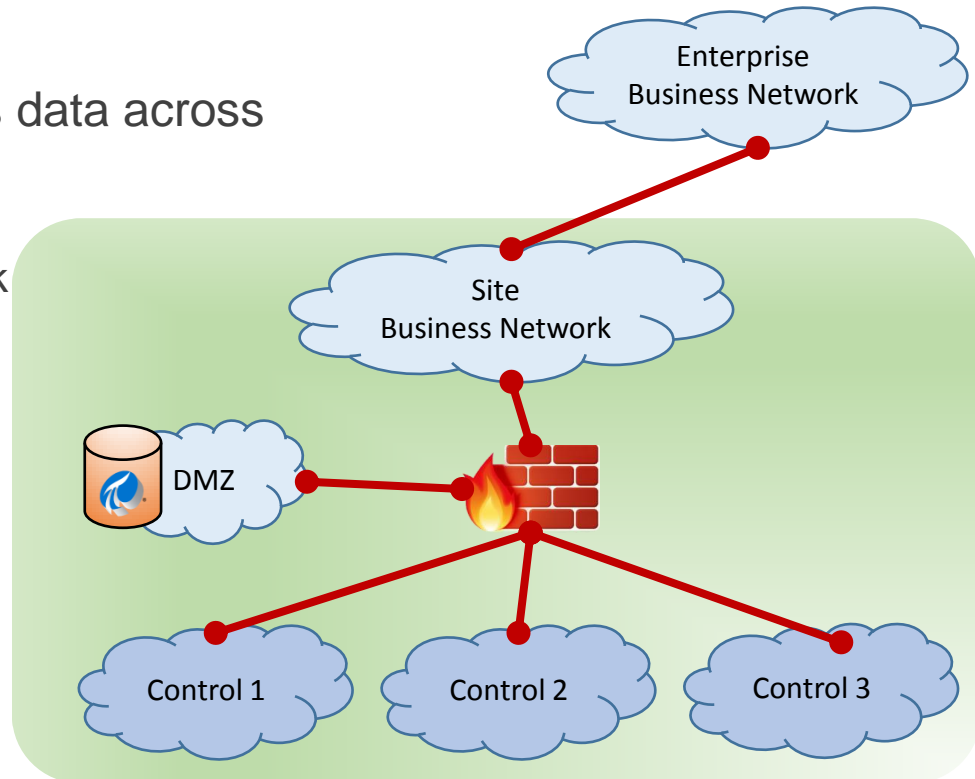
- ✓ One PI System for all operations data across the entire site
  - DMZ or Business network
  - Do not put in Control network
- ✓ Business users have access



# Architecture: Evolving Role of the PI System

## Stage 2: Site PI System

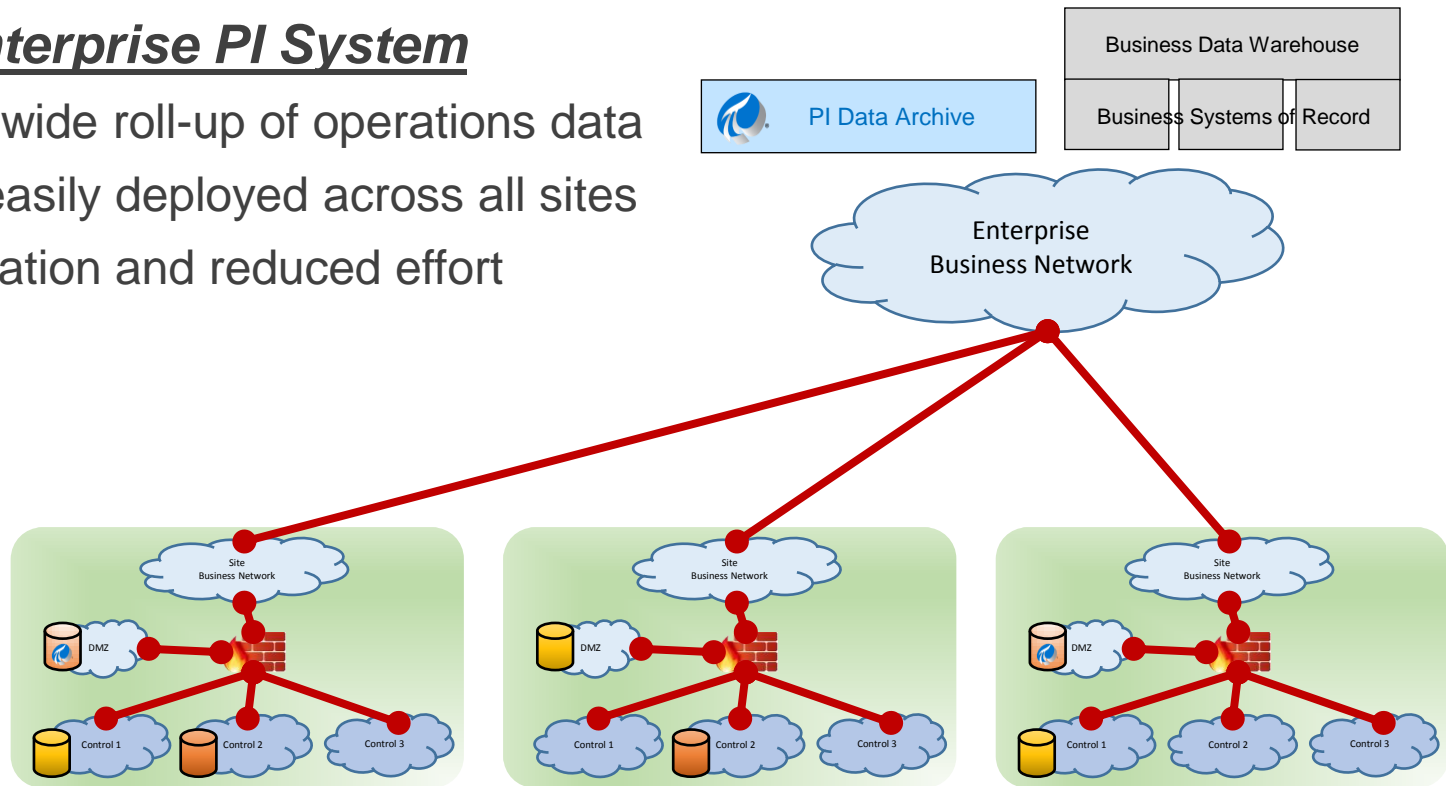
- ✓ One PI System for all operations data across the entire site
  - DMZ or Business network
  - Do not put in Control network
- ✓ Business users have access
  - No Enterprise view
  - Multiple interfaces to business systems
  - Solutions not easily redeployed to other sites



# Architecture: Evolving Role of the PI System

## Stage 3: Enterprise PI System

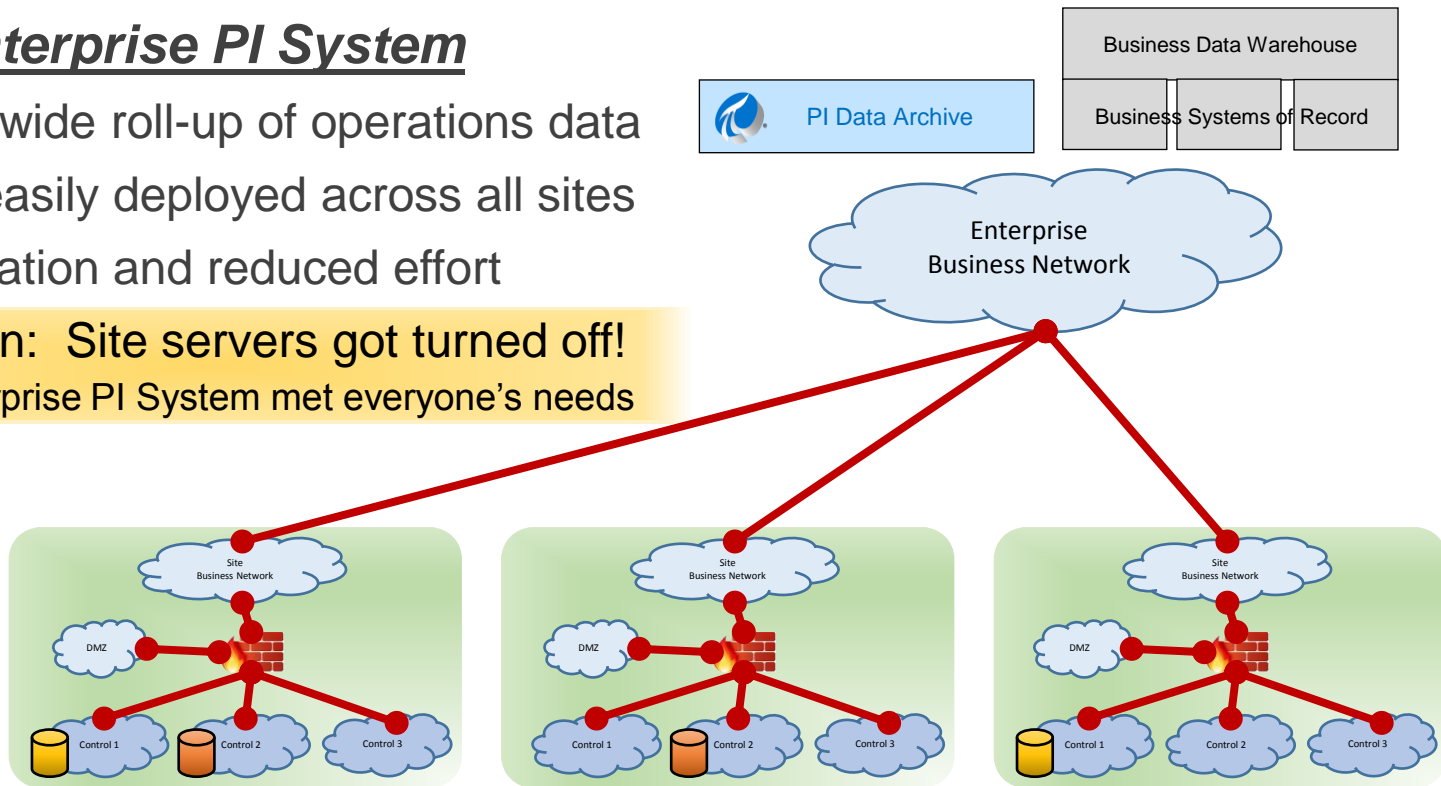
- ✓ Enterprise wide roll-up of operations data
- ✓ Solutions easily deployed across all sites
- ✓ Standardization and reduced effort



# Architecture: Evolving Role of the PI System

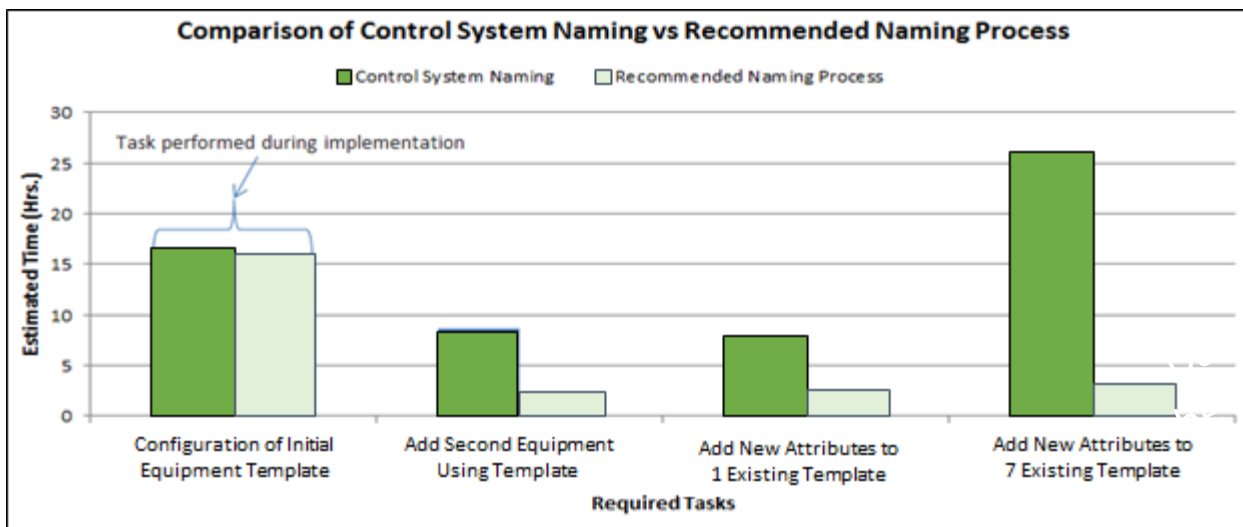
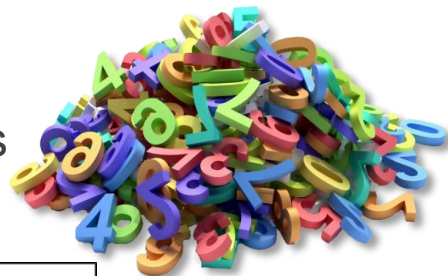
## Stage 3: Enterprise PI System

- ✓ Enterprise wide roll-up of operations data
- ✓ Solutions easily deployed across all sites
- ✓ Standardization and reduced effort
- Observation: Site servers got turned off!
  - Enterprise PI System met everyone's needs



# Context: Standards and Validation

- Without AF, a PI Data Archive is basically a “pile of tags”
- Only context comes from tag naming standard and displays
- Implemented common tag naming standard for all sites

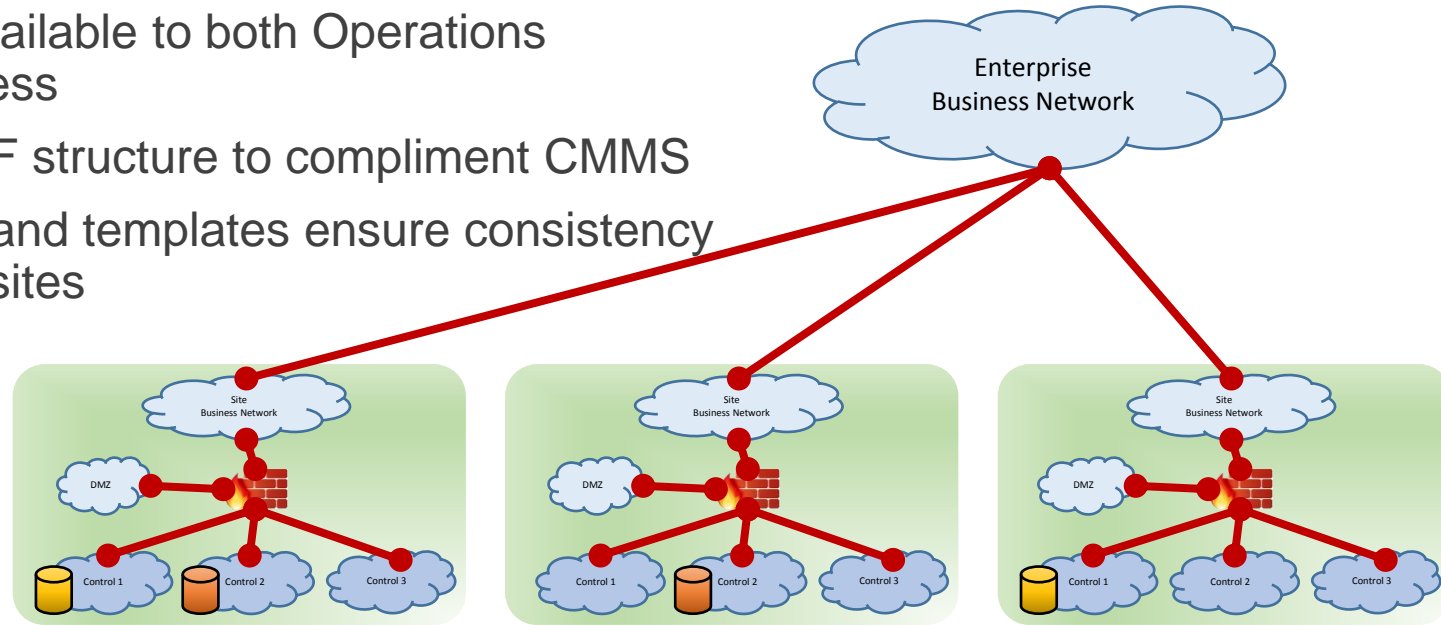
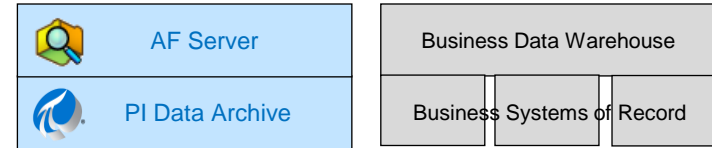




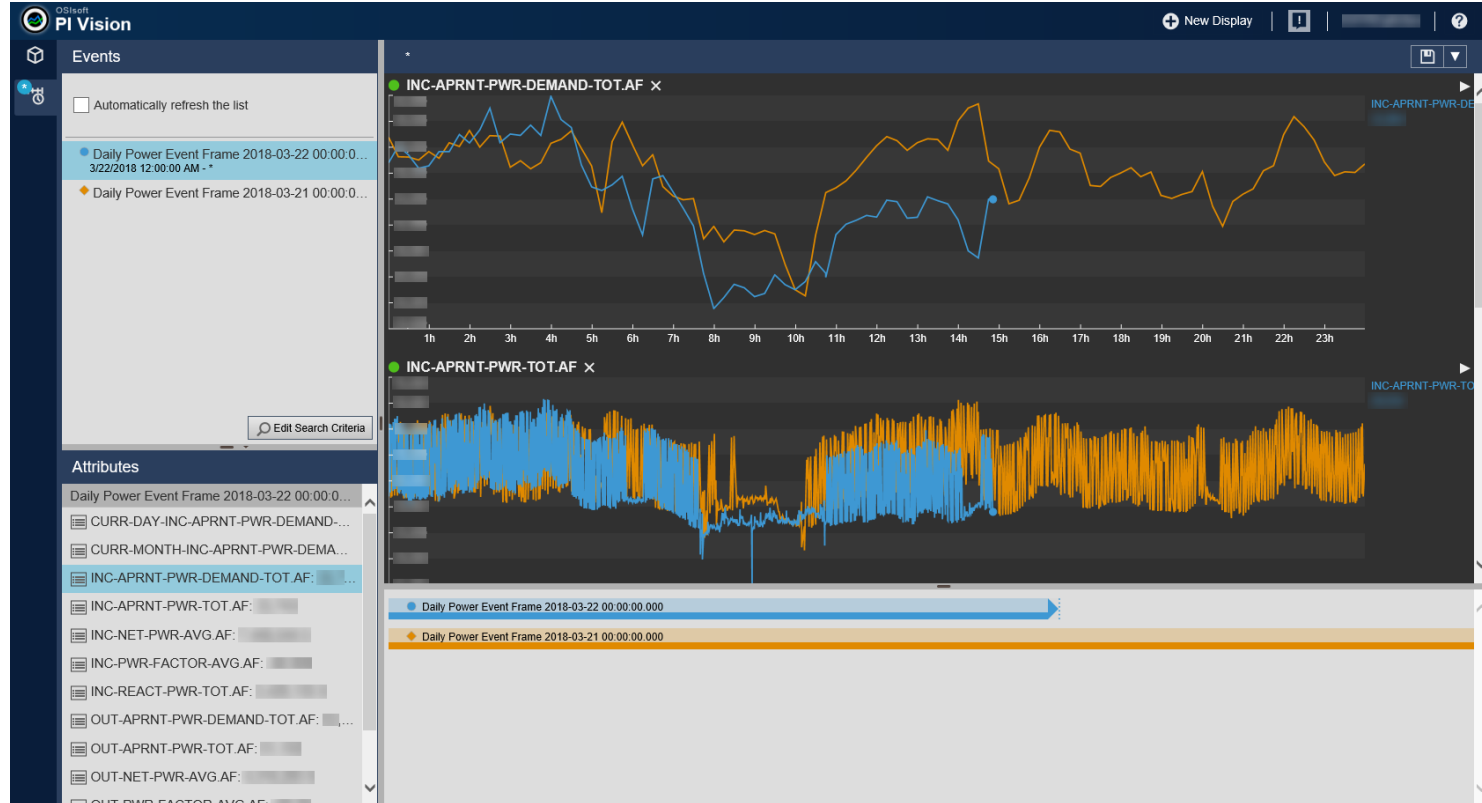
# Context: Evolving Role of the PI System

## Stage 4: Enterprise PI AF

- Adds context and analytics at the source
- Context available to both Operations and Business
- Develop AF structure to compliment CMMS
- Hierarchy and templates ensure consistency across all sites

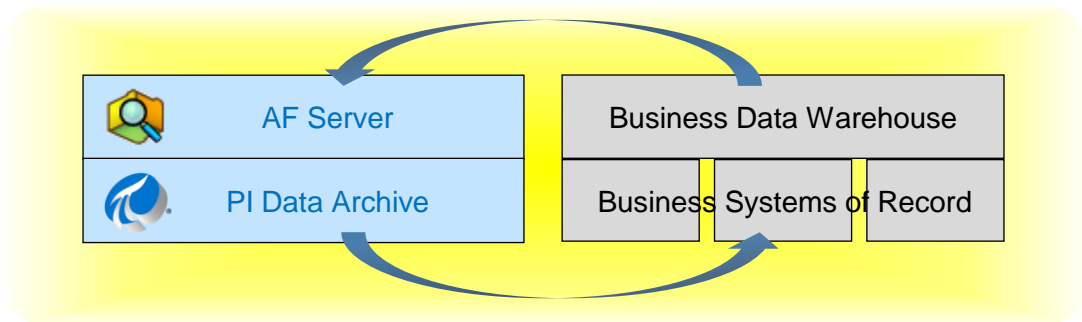


# Context: Event Frames

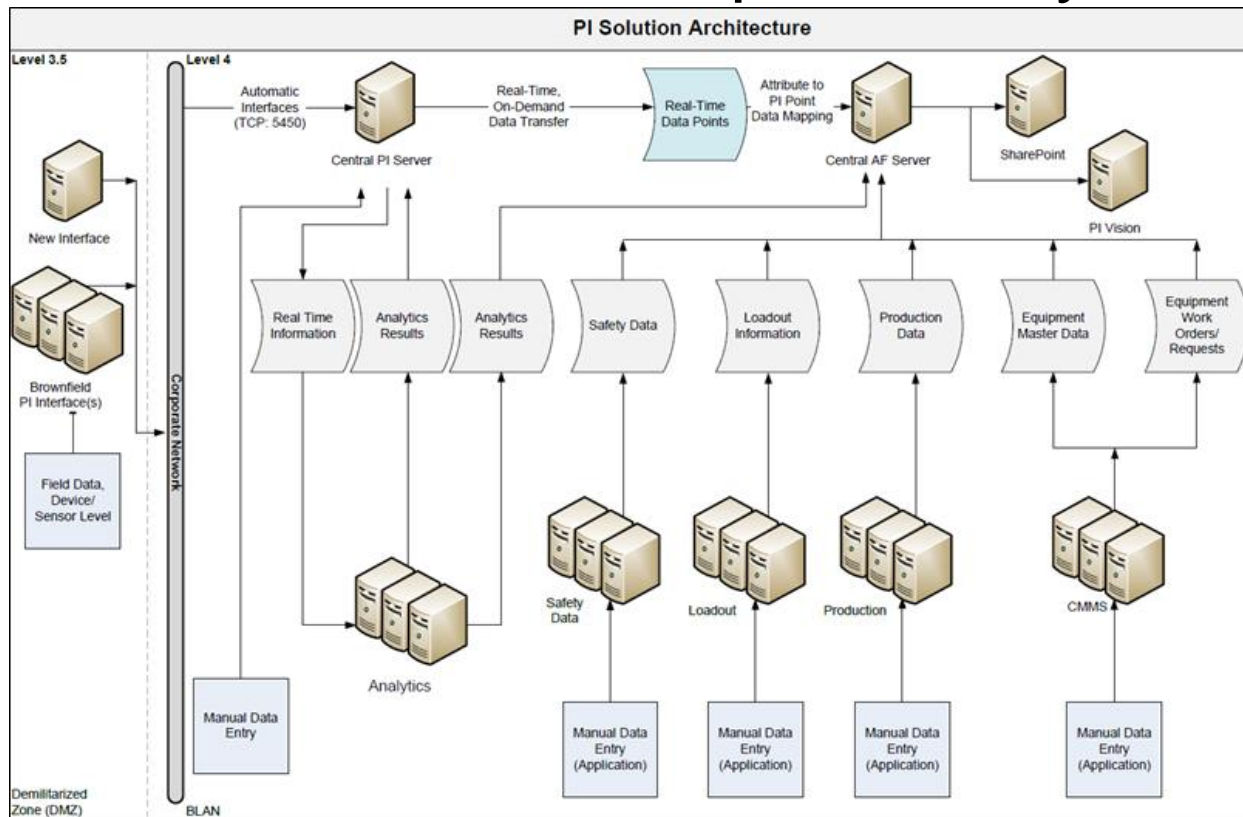


# Integration: From Ops to Business and Back

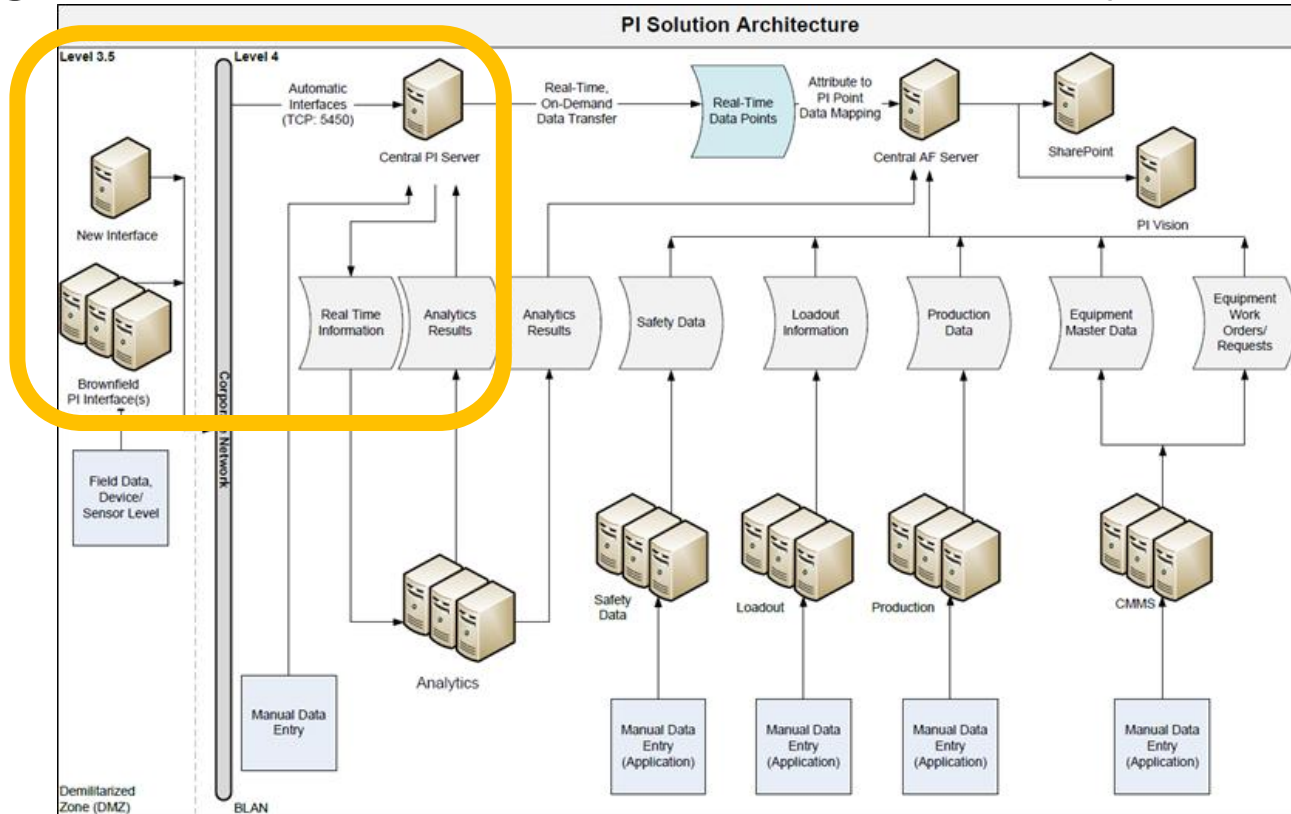
- Operations data must be reconciled before use in Business Systems
  - Values transferred to Business Systems (system of record)
- What is AF Integration?
  - Select data from other systems is shown in AF for added context
  - Data not stored in the PI System, just referenced
  - Integrated data looks and feels like a PI System tag
- “Single source of the truth”



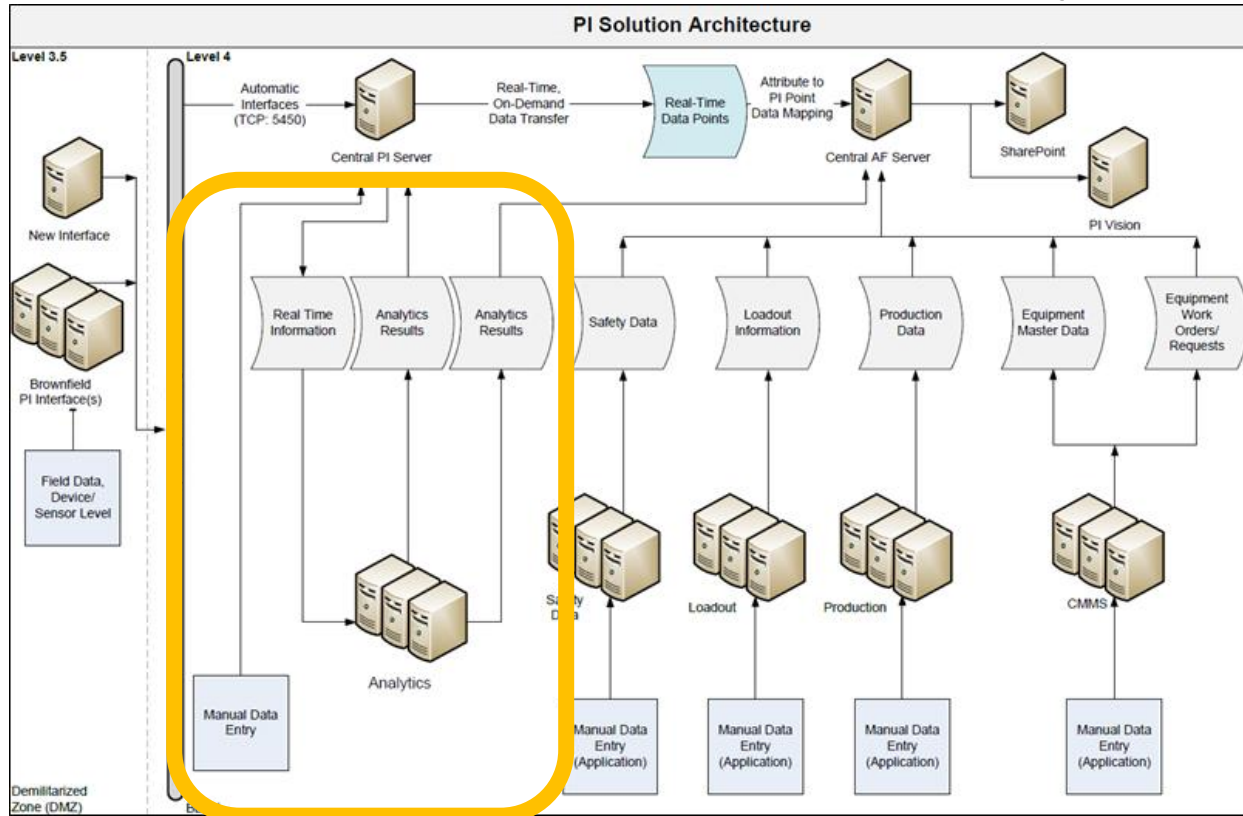
# Integration: Nutrien's Enterprise PI System



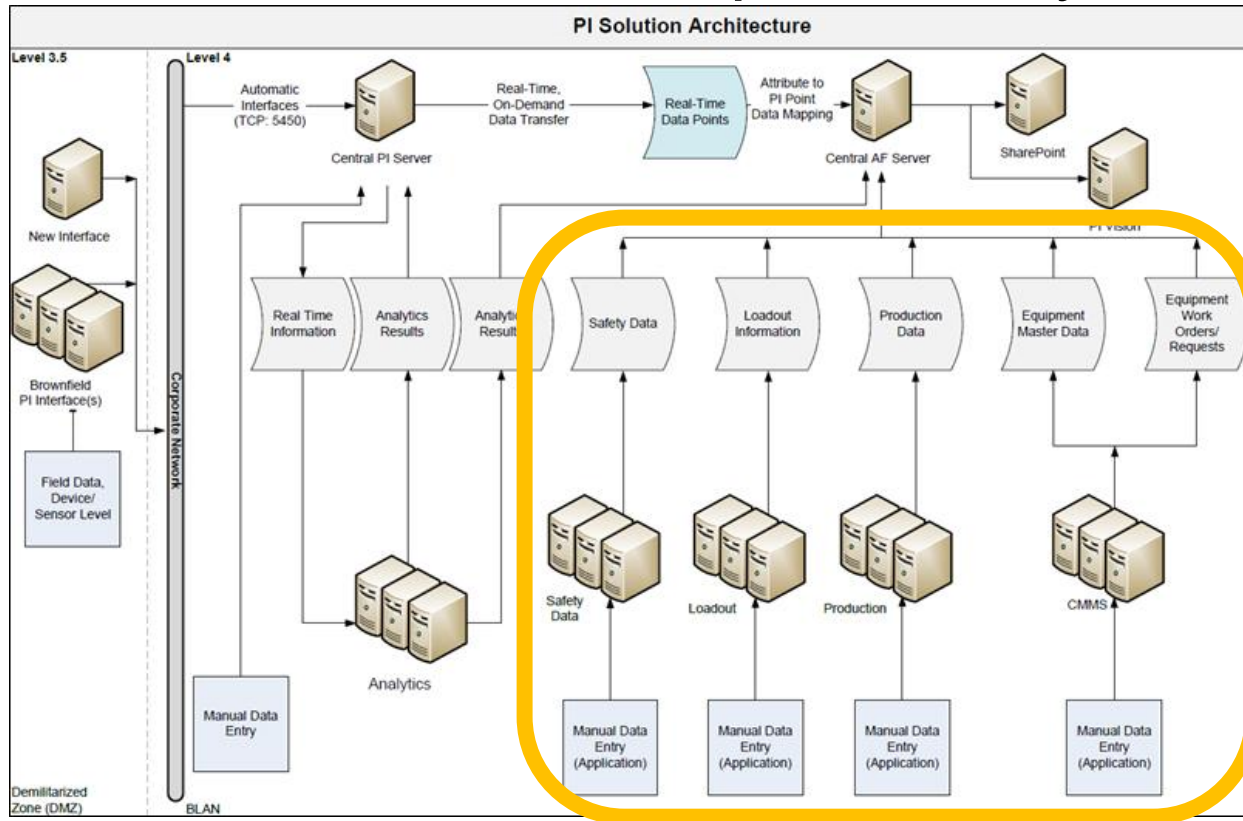
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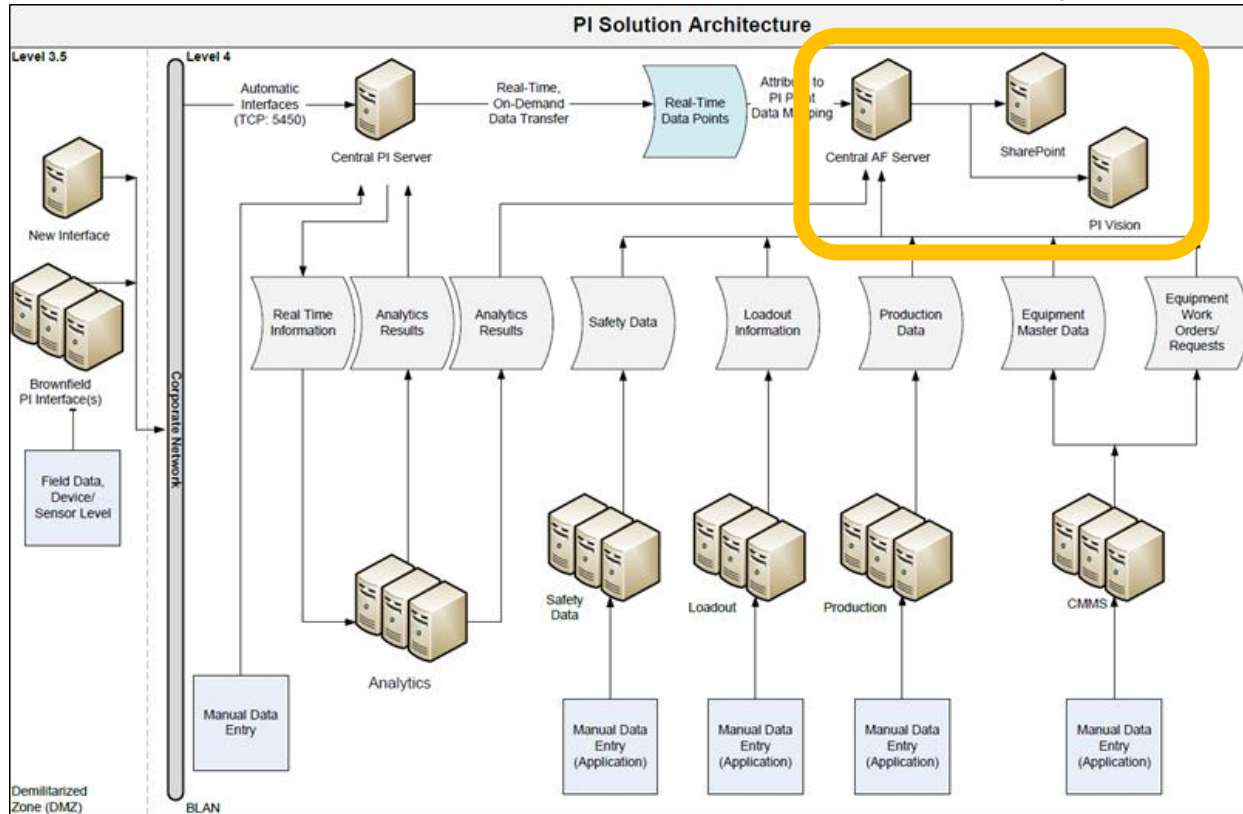
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# Integration: Nutrien's Enterprise PI System

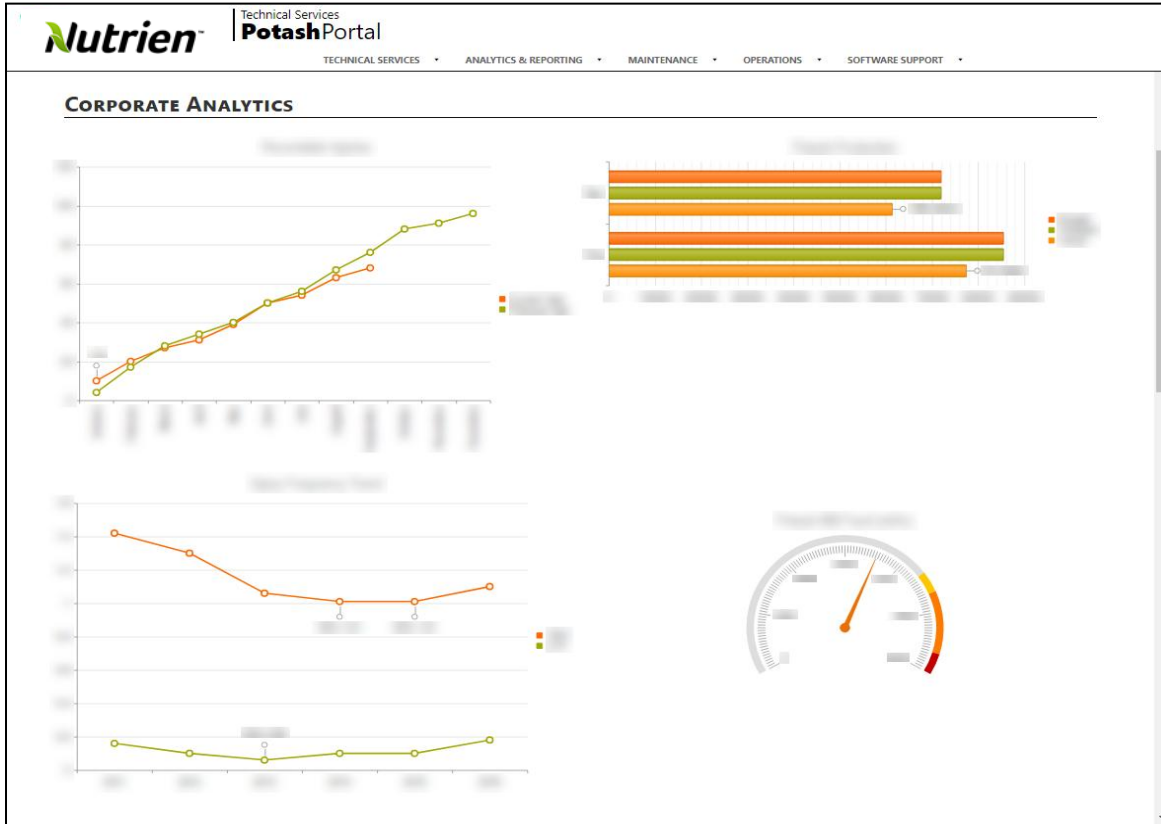


# Integration: Nutrien's Enterprise PI System





# Example: Potash Portal



# Example: Equipment Dashboard



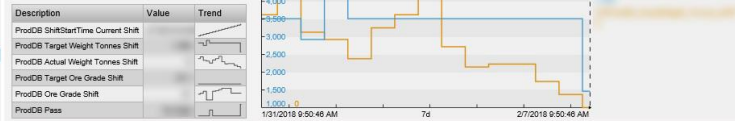
Equipment Information Dashboard

- Copy
- Borers
  - Rocanville
    - Borers
      - Grizzly Borer
      - Jaguar Borer
      - Koala Borer**
      - Kodiak Borer
      - Leopard Borer
      - Lion Borer
      - Panda Borer
      - Panther Borer
      - Polar Borer
      - Puma Borer
      - Tiger Borer
    - Compactors
    - Separators

## ROCANVILLE KOALA BORER

MARIETTA MINER, 780 AW4, MINER, ROTOR, FOUR

### Production Data



### K40 Probe Data

Description	Value	Units
Probe 1 Ore Grade		PERCENT
Probe 2 Ore Grade		PERCENT
Probe 3 Ore Grade		PERCENT
Probe 4 Ore Grade		PERCENT
Probe 5 Ore Grade		PERCENT
Probe 6 Ore Grade		PERCENT
Probe 7 Ore Grade		PERCENT

### Borer Motor Data

Description	Value	Units
Motor 1 Current		AMPS
Motor 1 Drive End Temp		DEGREES
Motor 1 Opposite Drive End Temp		DEGREES
Motor 2 Current		AMPS
Motor 2 Drive End Temp		DEGREES
Motor 2 Opposite Drive End Temp		DEGREES
Motor 3 Current		AMPS
Motor 3 Drive End Temp		DEGREES
Motor 3 Opposite Drive End Temp		DEGREES
Motor 4 Current		AMPS
Motor 4 Drive End Temp		DEGREES
Motor 4 Opposite Drive End Temp		DEGREES

### Borer Data

Description	Value	Units
Head Motor Current Setpoint		AMPS
Head Motor Current Max		AMPS
Hydraulic Pressure		PSI
Hydraulic Pump Motor Drive End Temp		DEGREES
Hydraulic Pump Motor Current		AMPS
Hydraulic Pump Motor Opposite Drive End Temp		DEGREES
Left Belt Pressure		PSI
Left Gearbox Oil Temp		DEGREES
Left Train Pressure		PSI
Right Belt Pressure		PSI
Right Gearbox Oil Temp		DEGREES
Right Train Pressure		PSI

1/31/2018 9:50:46 AM 7d Now 2/7/2018 9:50:46 AM

### Underground Production

Borer Name	Shift Start	Shift Type	Target Ore Grade	Ore Grade	Target Tonnes	Actual Tonnes	Pass
50706 Koala		DS					
50706 Koala		NS					
50706 Koala		DS					
50706 Koala		NS					
50706 Koala		DS					

### Equipment Work Order

Work Order Number	Description	Work Order Type	Activity Type	Cause	Shutdown Type	Material Shortage	Asset Number	Asset Description	Activity Source	Scheduled Start Date	Scheduled Completion Date	Priority	Status
1141411	REBUILD FRONT IDLERS	CORRECTIVE	NORMAL	NORMAL	Not Required	No		MINER, MARIETTA, FOUR ROTOR, KOALA	PRODUCTION				Complete
712278	PM: DAILY MINER PM	PREVENTIVE	NORMAL REPAIR	NORMAL	Not Required	No		MINER, MARIETTA, FOUR ROTOR, KOALA	PRODUCTION				Complete

# Solving Operational Challenges

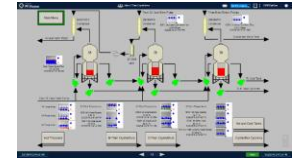


• **PI System Event Frames**

Leverage Event Frames and Notifications to Identify Emerging Issues

• **PI Vision**

Implement PI Vision Dashboards to Monitor Equipment



Integrate OT Data with Context into Predictive Analytics

• **Predictive Analytics**

Pass OT Data with Context to Specialized Analytics Applications

• **Specialized Analytics**



# Best Practices IT and OT Teams

- PI AF organizes and structures Operation Data to enable integration with business systems
  - PI System becomes the warehouse for all required operational data
  - Multiple interface options to share data – OLEDB, ODBC, WebAPI
  - Customized Integrators built to share data directly
- Governance Programs encourage sharing of data between the PI System and Business Systems and Applications
- Subject Matter Experts from IT and OT can work together to determine the best tool to address the business community's needs

Technology Exists – Now Building Teams to Leverage  
Best Tool for Any Business Requirement

# Leveraging PI AF in Nutrien



Nutrien, the world's largest fertilizer company, **is leveraging operational data** to help feed the world.



## CHALLENGE

Require consistent operational data that users can trust and easily access to make informed decisions

- Operational data differs site to site
- Users could not locate data easily and had issues trusting the data
- PI AF was not deployed

## SOLUTION

Implemented PI AF and expanded client tools allowing access to operational data

- PI AF leveraged the corporate MMS hierarchy
- Validated and standardized all data in the PI System
- Integrated key business systems
- Deployed PI client tools

## RESULTS

Created a trusted source of operational data to be readily leveraged for business solutions

- Implemented Potash Portal for management reporting
- Deployed reconciliation engine to simplify daily production reporting
- Leveraging structured OT data in PI System to rapidly deploy new functionality across the sites

# Contact Information



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- Mera



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- Sr. Process Control Engineer
- Nutrien



# Questions

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



State your **name & company**

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Merci

谢谢

**Nutrien**  
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Спасибо

Danke

Gracias

Thank You

감사합니다

ありがとう

Grazie

Obrigado