IIoT Data Readiness with the PI System

Martin Bryant

October 10, 2017

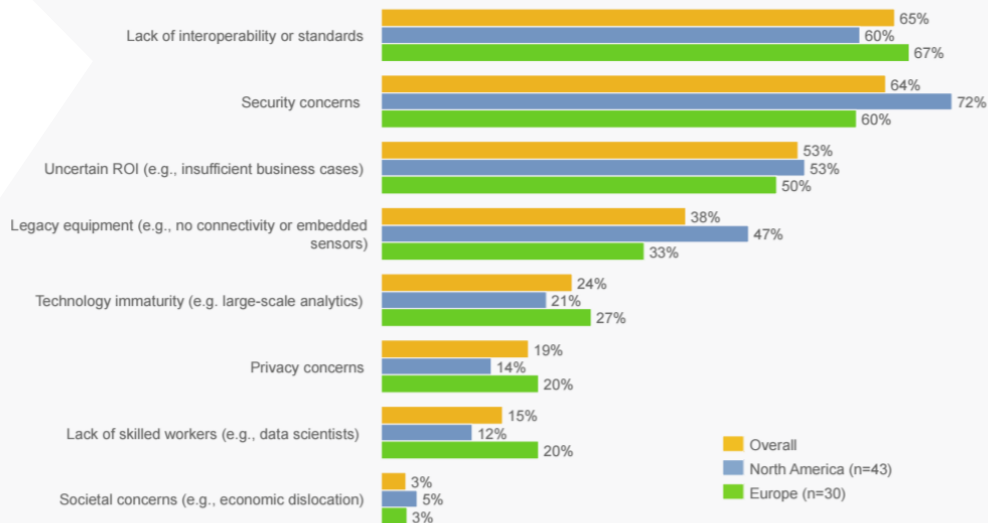# You've Collected All That IIoT Data…

…*Now What?*

The Three Biggest Barriers to Adopting IoT

1. Lack of interoperability or standards

2. Security concerns

3. Uncertain ROI

Q: What are the greatest barriers inhibiting business from adopting the industrial Internet?

Barrier	Overall	North America (n=43)	Europe (n=30)
Lack of interoperability or standards	65%	60%	67%
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Uncertain ROI (e.g., insufficient business cases)	53%	53%	50%
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Societal concerns (e.g., economic dislocation)	3%	5%	3%

10   Industrial Internet of Things

Source: World Economic Forum Industrial Internet Survey, 2014

In This Talk, We Will Show How to Overcome Those Barriers

1. Lack of interoperability or standards
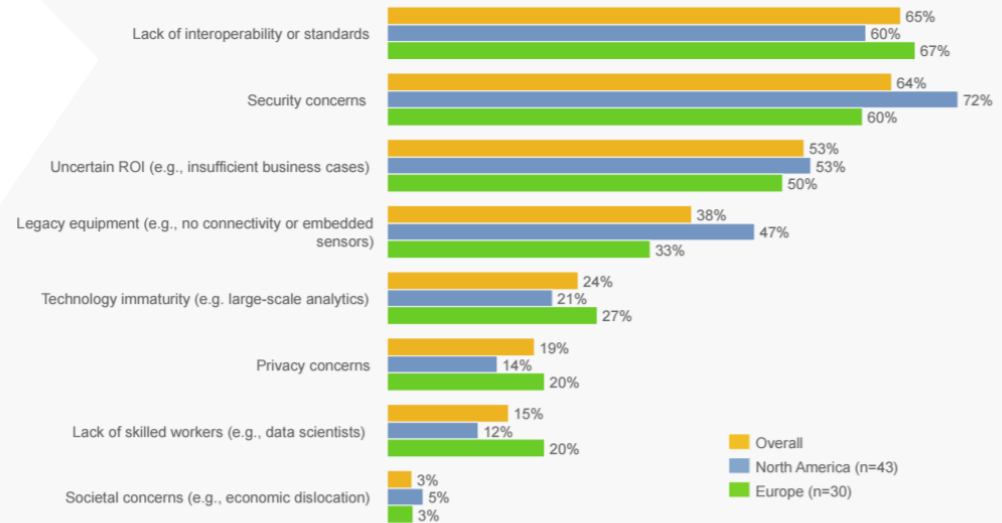- Asset Framework

2. Security concerns
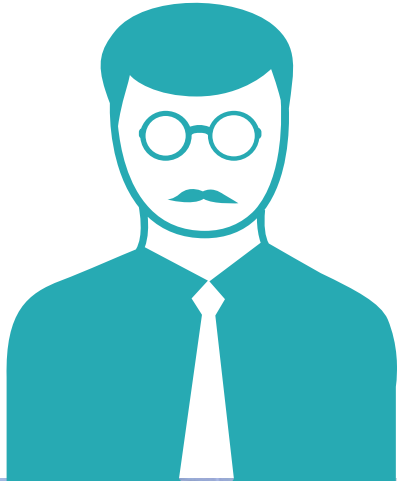- Mitigation and best practices

3. Uncertain ROI
- Asset analytics, event frames, infrastructure approach

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Asset Framework: Bridge the Physical & Digital World
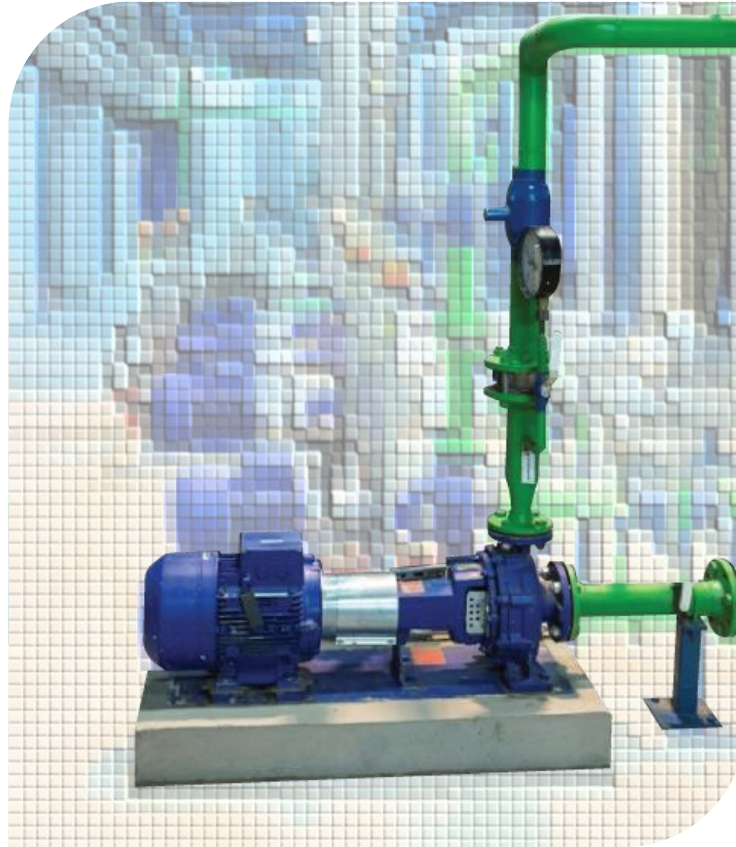
Time series data
- Pressure data
- Vibration data
- Pulse counters

Asset details
- Name
- Model
- Manufacturer

External data
- Performance curves
- Maintenance records

Analyses
- Efficiency analyses
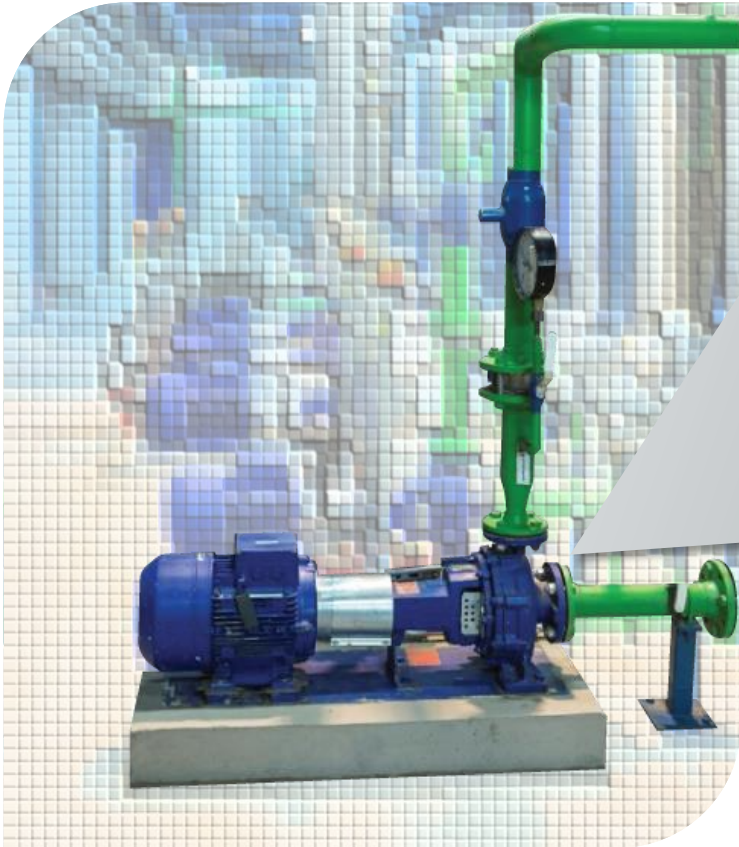- Key Performance Indicators (KPIs)

Events
- Downtimes
- Startups
- Failures

**Notifications**
- High torque alerts
- Rotor failure alerts

Capture Asset Information in Configurable Templates

Discharge Pressure	539.342651367188 psi
Electricity Cost Factor	0.162879550235334 US$
Flow Rate	141.52 gpm
Impeler Size	3
LCL	92.5
Liquid Gravity	1 SG
Minimum Efficiency	90 %
Model Number	G11
Pump Curve Head	0.616988159999998 psi
Pump Downtime During Last Shift %	0.346886343426175 %

- Reference data (without replicating it) from **external databases** with **AF linked tables**
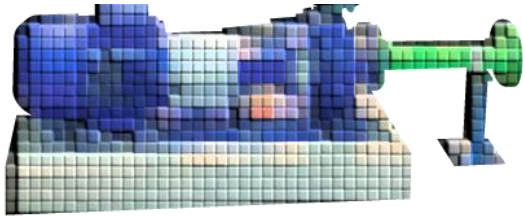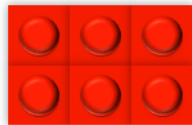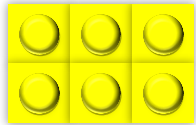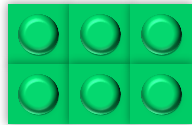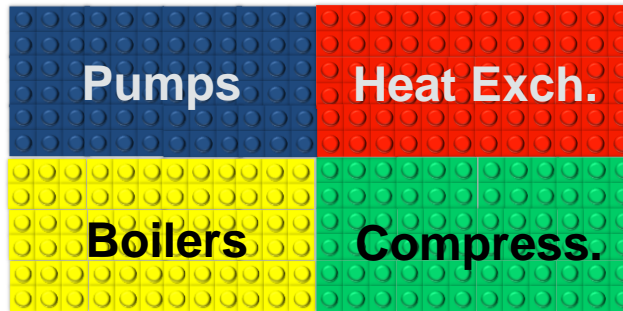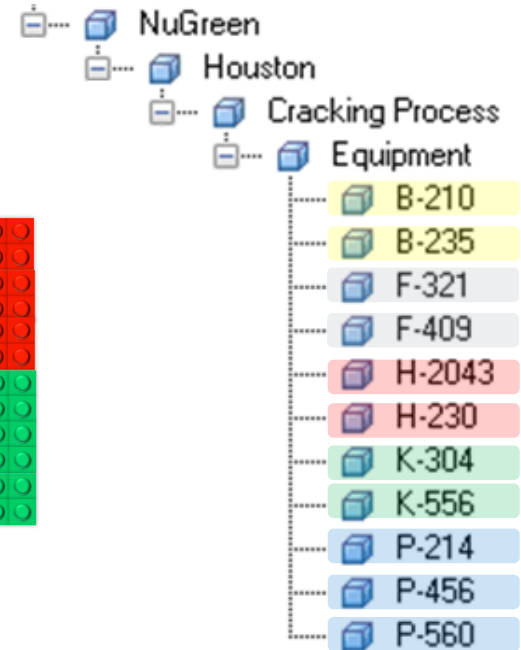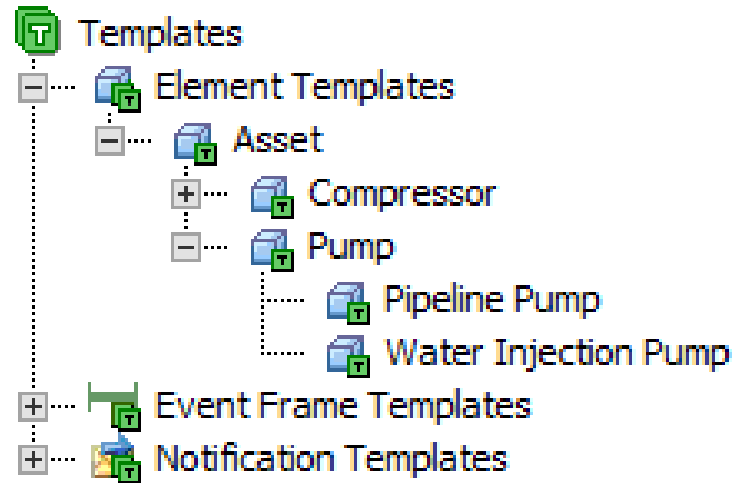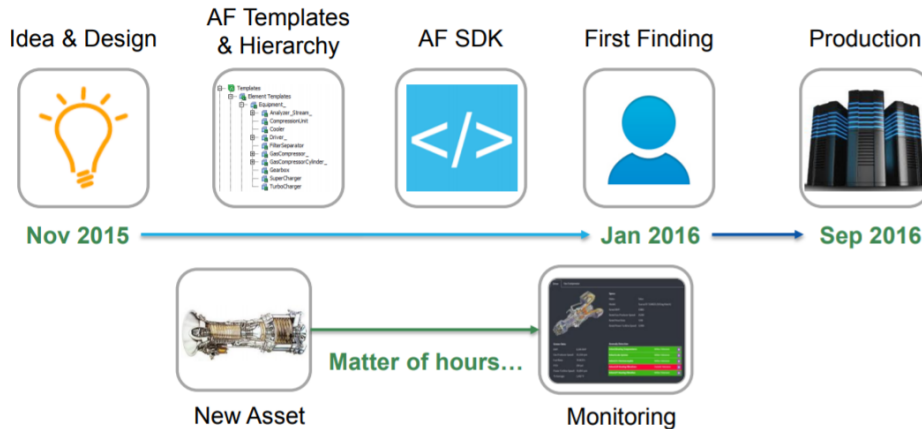
Support Ongoing Standardization with Asset Framework

- **Update** templates over time
  - Start simple, add attributes as needed

- **Facilitate** asset management
  - Centrally push updates to all assets

- **Available** to visualization tools
  - Consistent displays for similar assets

TransCanada uses AF to Achieve 98% Availability of their Compression Assets

Results - Implementation Time & Scalability

Idea & Design | AF Templates & Hierarchy | AF SDK | First Finding | Production

Nov 2015 → Jan 2016 → Sep 2016

New Asset → Matter of hours... → Monitoring

"We were able to **build out our entire AF hierarchy** and we had our **first finding within a couple months**.

As [new assets] come online, they get **built in AF in a matter of hours** and **automatically go into monitoring**."

Brendan Bell, TransCanada

In This Talk, We Will Show How to Overcome Those Barriers

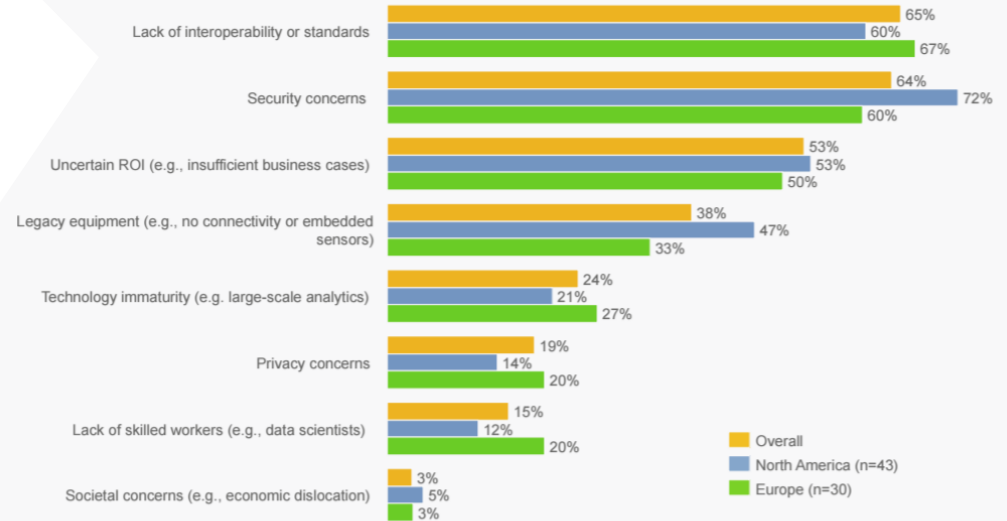**1. Lack of interoperability or standards**
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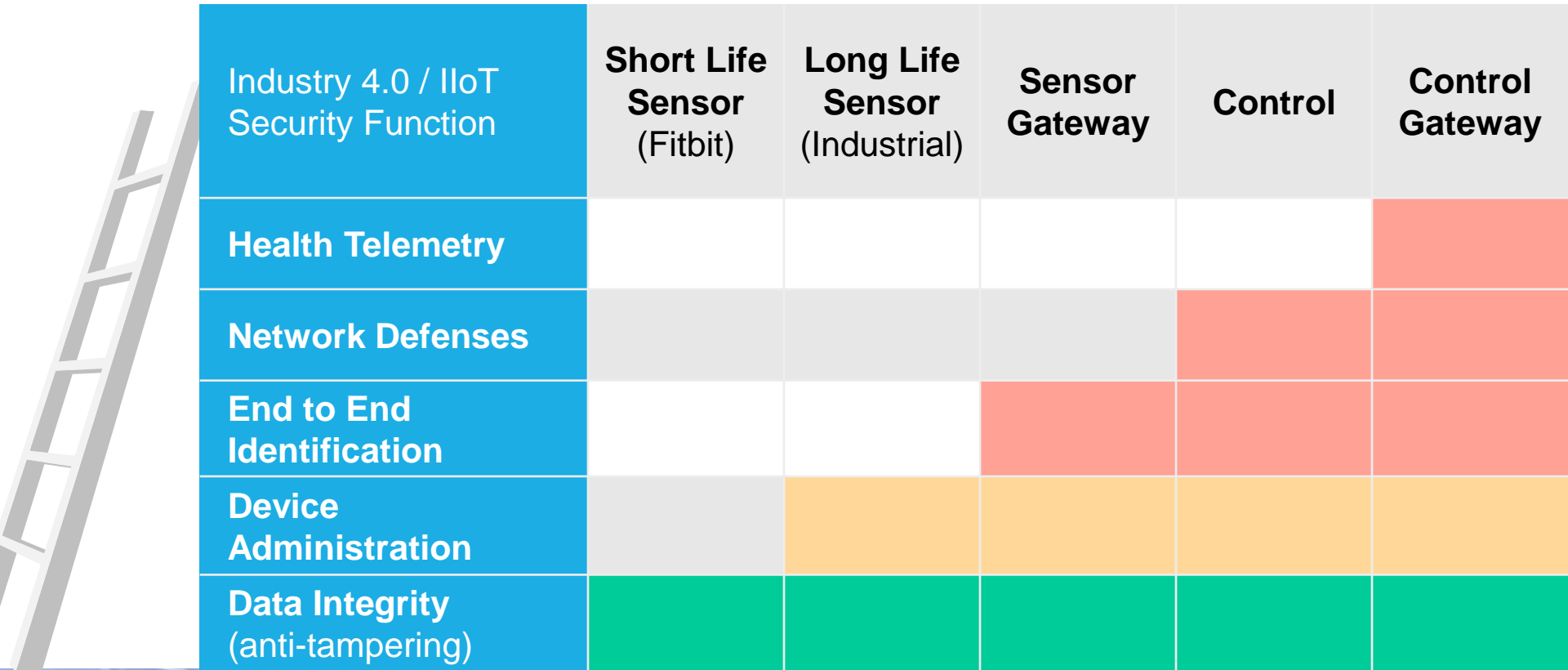- Mitigation and best practices
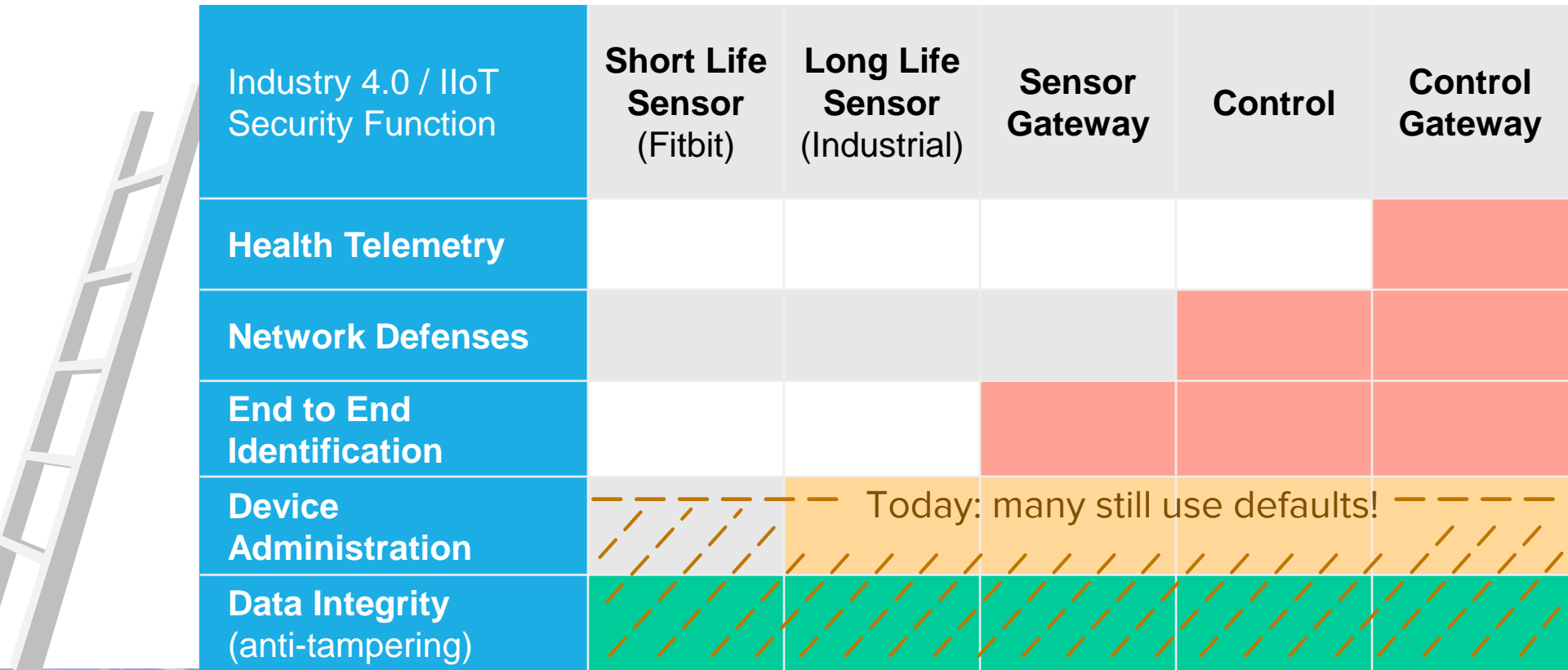
3. Uncertain ROI
- AF, event frames, infrastructure

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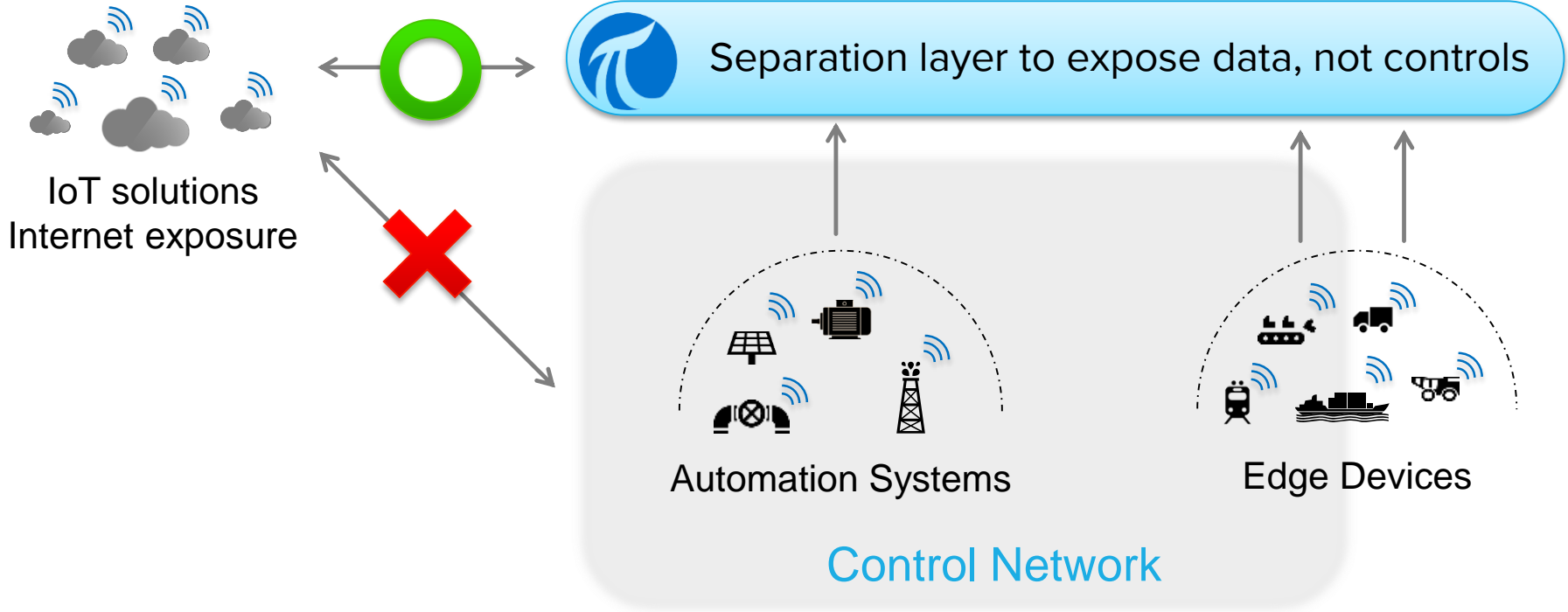
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Legend: ■ Overall ■ North America (n=43) ■ Europe (n=30)

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Internet of Things… Or Threats?

- Example: Mirai malware looks for IP addresses that use default login names and passwords
- Controlled remotely
- High-profile 2016 attacks:

  Twitter, Netflix, Reddit & others

Many IIoT Devices Are Still Climbing the Internet Security Ladder

Industry 4.0 / IIoT Security Function	Short Life Sensor (Fitbit)	Long Life Sensor (Industrial)	Sensor Gateway	Control	Control Gateway
Health Telemetry					🟥
Network Defenses				🟥	🟥
End to End Identification			🟥	🟥	🟥
Device Administration		🟧	🟧	🟧	🟧
Data Integrity (anti-tampering)	🟩	🟩	🟩	🟩	🟩

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End to End Identification			🟥	🟥	🟥
Device Administration		Today: many still use defaults!			
Data Integrity (anti-tampering)					

Protecting the Control Network is More Important Than Ever

IoT solutions
Internet exposure

Separation layer to expose data, not controls

Automation Systems

Edge Devices
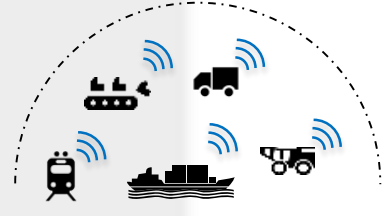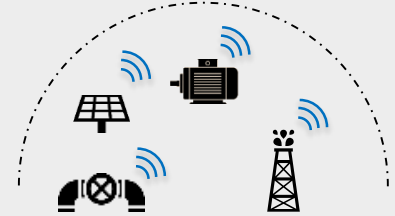
Control Network

The Modern PI System is More Secure than Ever

Pure-WIS-only authentication (using PI Mappings) via PI API 2016

Granular security access for each data item leveraging AD groups and users

Backing by 24/7 technical support and a dedicated security champions team

Compatibility with disk-level encryption (e.g. BitLocker)

Windows Server Active Directory

Support for low-attack-surface server core installations

Transport-level encryption throughout the PI System architecture

Full support for DMZs and secure distributed architectures

FIDUCIA CERTITUDO SECURITAS

Secured SSL/HTTPS transport for PI Vision, PI Web API, and PI Cloud Connect

Disable API trust
Disable SDK trust
Disable explicit login
Disable explicit login
Disable blank pa

To learn more, see https://techsupport.osisoft.com/Troubleshooting/PI-System-Cyber-Security

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- Asset Framework

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80% of the investment lost
to data-prep **can be automated**

3% Build training set

4% Refine

9% Patterns

20% Collecting data sets

60% Organizing & enriching data

5% Other

Forbes, March 23, 2016
"Cleaning Big Data"

80% of the investment lost
to data-prep **can be automated**

3% Build
training set

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PI Connectors

- **AF templates, analytics**
- **Event frames**

20%
Collecting
data sets

60%
Organizing &
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5%
Other

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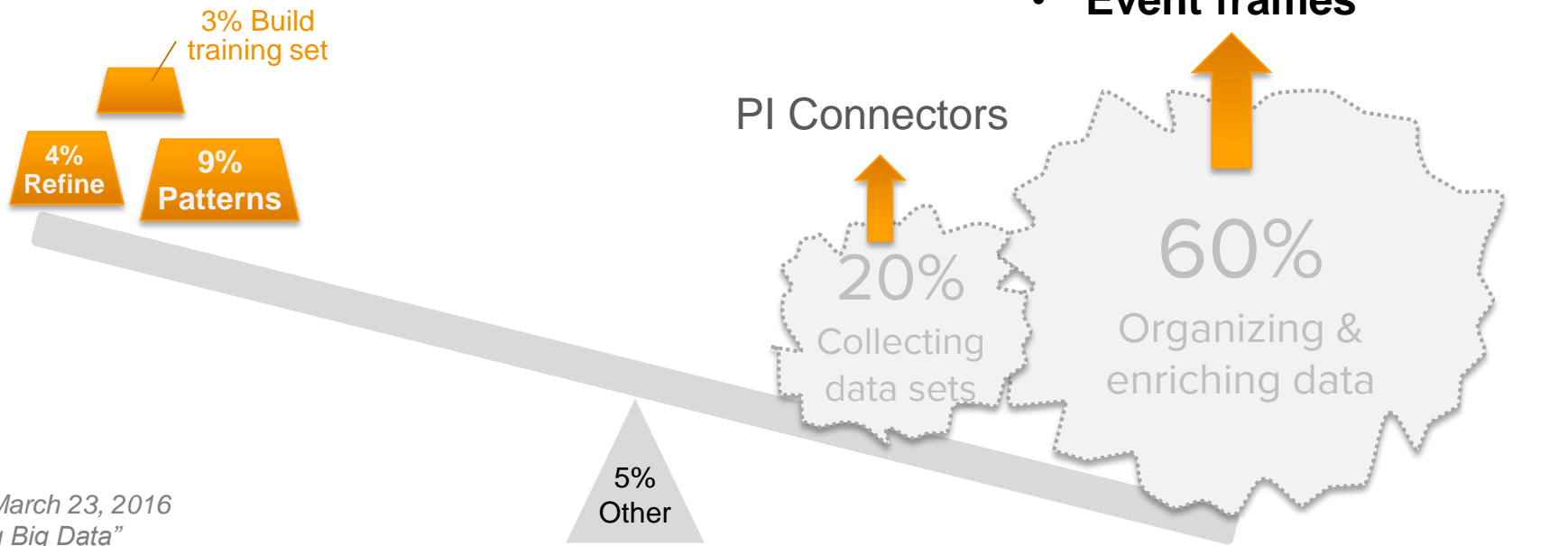
AF **Templates** Put Data Into a Standard, **Consistent** Format

Asset Analytics Turn Data into **KPIs**
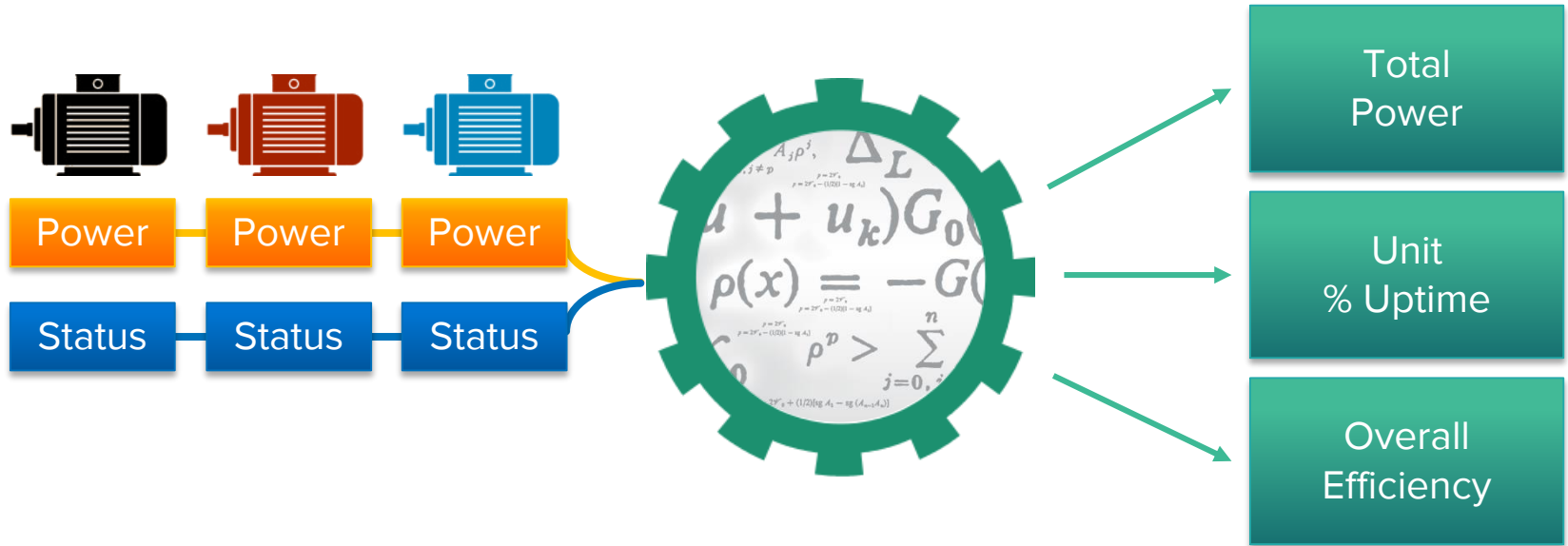
Easily Track Site-level Metrics with Rollup Capabilities

NASA Monitors Real-Time Facility Power Demand and Consumption
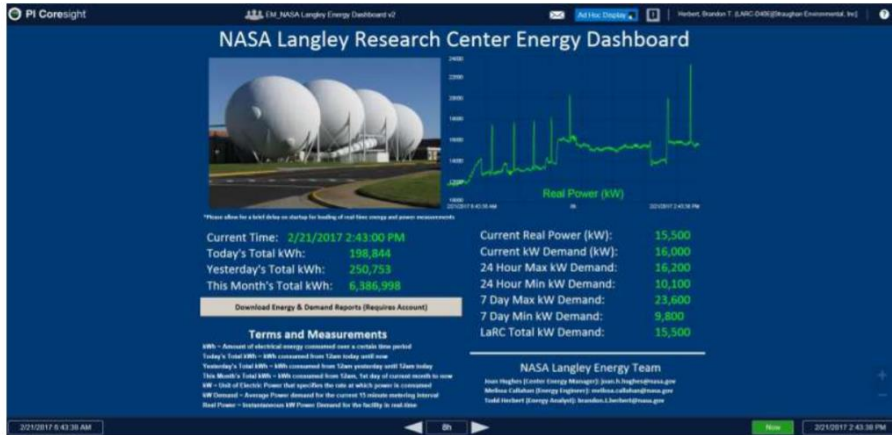
> "I'm able to go into AF and make a bunch of calculated attributes.
>
> 24 hour max demand, 7 day max demand, they are meaningful to us because at a glance, we can see how that building is doing."

Todd Herbert, NASA

Event Frames: Out of Years of Data, Bookmark the One Minute that Matters

Downtime
Excursion
Batch
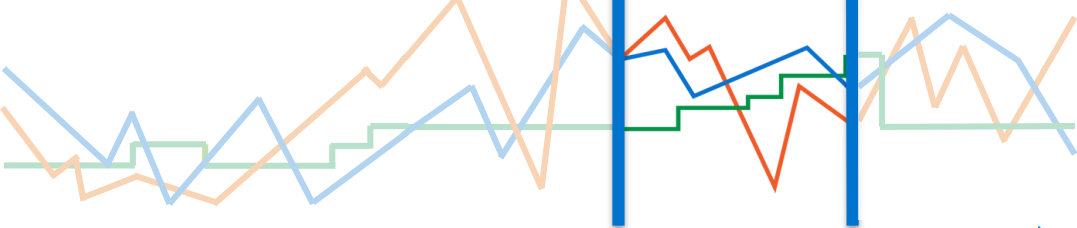
Auto event summary

Event Attribute	Value
Name	Excur. 1215-002
Start	15-Dec-2013 10:35:02
End	15-Dec-2015 10:47:26
Asset	Boiler-352
Excursion Type	High Violation
Fuel Gas Flow.Avg	37.12 k sft3/h
myKPI.Max	47.19 bbl/d

# Simplify Data Analysis
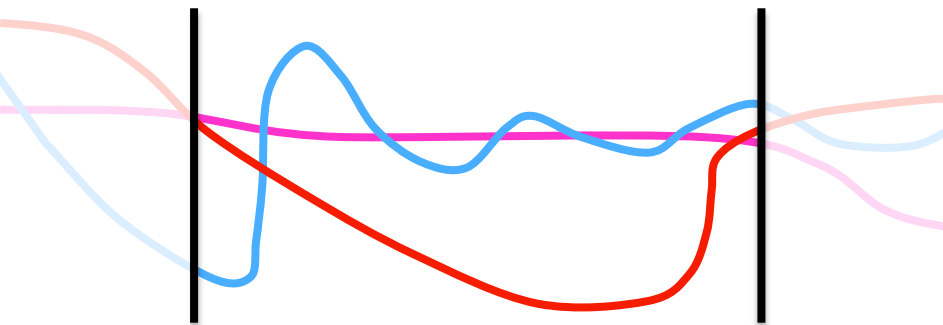
Compare Assets

Next: an example!

Weekly Downtime (Instances)

DT101	DT102	DT103
15	4	7

Weekly Cumulative Downtime (hrs)

DT101	DT102	DT103
84	117.6	42

Compare Events

Name	Max
EF1	122.47
EF2	112.73
EF3	98.61
EF4	125.24
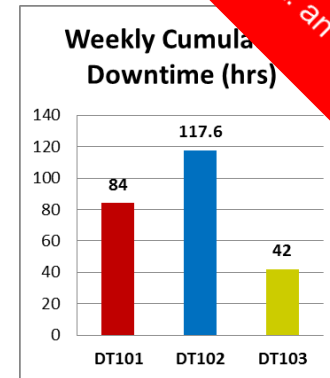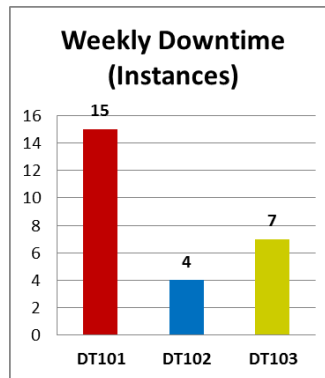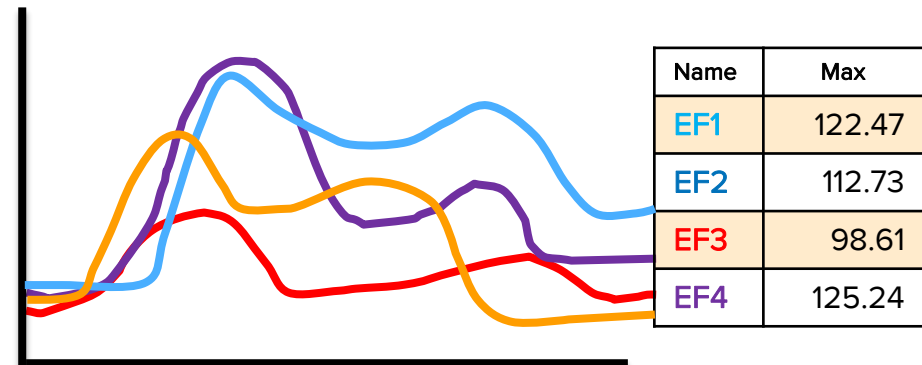
Discover Event Interrelationships

Running XYZ   Downtime
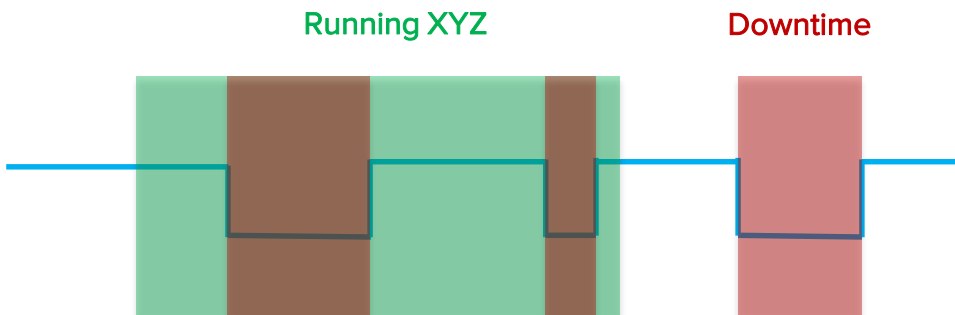
What Can This Look Like?

Example application:
Investigating electricity
usage anomalies
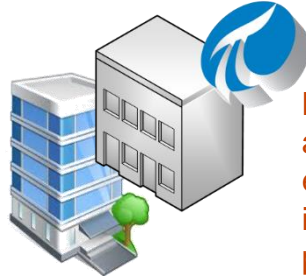
Multiple buildings at a site all use electricity, ideally in a similar pattern
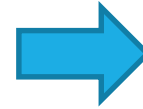
Meter readings are streamed in real-time to an OSIsoft PI System and compared with utility bills

1. Each week, buildings should consume electricity in a fairly consistent pattern

2. The PI System collects, manages, and enhances that data

3. Our goal: discover why electricity costs were so high in a given week

Solution: PI Event Frames allows easily investigating a particular week's data!

EF Templates Automatically Populate Consistent Summaries

Text entries for filtering or grouping

Fields for **comments**

Calculated summaries like average, max, min

Infrastructure Improves ROI
by Making Data Available for Multiple Projects

ENTERPRISE
ANALYTICS AND
APPLICATIONS

esri ArcGIS

Microsoft Azure

Cortana Intelligence Suite

MAINTENANCE

Docum. Mgmt. System

ANALYTICS-READY DATA

ERP

ENGINEERING

ENTERPRISE OPERATIONS DATA INFRASTRUCTURE

ASSET DATA

SMART
MACHINES & PLANTS

SMART
DEVICES

Sensors   Actuators   Intelligent Motor Control   Controllers   Terminals

Overcome Barriers Using the OSIsoft PI System

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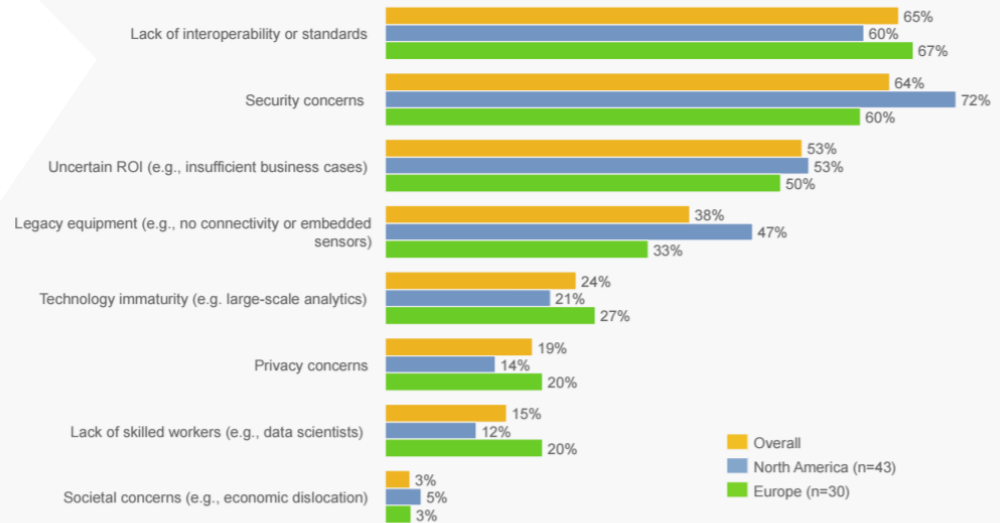
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Contact Information

Martin Bryant

MBryant@osisoft.com

Services Delivery

OSIsoft

Questions

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

State your **name & company**

Please remember to…

Complete the
Post-Event Survey

감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado