Firsthand experience of OSIsoft Product Roadmap

From the OSIsoft Team

Chris Nelson, VP Software Development

What to expect for Day 3

Day 3: Analytics Track Room 114, P1 Level	Day 3: Developer Track Room 116, P1 Level	Day 3: Marketplace Partner Showcase Room 115, P1 Level	Day 3: PI Admin Track Room 117, P1 Level	Day 3: Product Track Room 113, P1 Level
10:40 - 11:20	10:40 - 11:20	10:40 - 11:20	10:40 - 11:20	10:40 - 11:20
Introduction to Time-Series Analysis with PI System Data	PI Developers Club Community - Developer Technologies Roadmap	Extending the Power of your PI System with Seeq Analytics	Hardcore PI System Hardening	OSIsoft Cloud Services
11:30 - 12:10	11:30 - 13:00	11:30 - 12:10	11:30 - 13:00	11:30 - 12:10
Introduction to Data Science for PI Data for PI Professionals	LiveCoding: Writing Highly Performant PI Web API Applications	Data Diode Cybersecurity for PI System	LiveCoding: Getting the Most Out of the New AFSearch	PI System 2018
12:20 - 13:00	14:30 - 16:15	12:20 - 13:00	14:30 - 16:15	12:20 - 13:00
Advances in PI System Streaming Analytics with MATLAB and Other External Calculation Engines	HowTo: Writing applications at the Edge with OSIsoft Edge Data Store	Plantweb IIoT Solutions on PI System as an Infrastructure	HowTo: Streaming Calculations with the PI System and MATLAB and other Computation Engines	PI Vision: Enabling Real-Time Monitoring and Analysis for the Enterprise
14:30 - 15:15		14:30 - 15:15		14:30 - 15:15
Data Science with R and the PI System		FactoryTalk Analytics Platform and MES integration with the PI System Infrastructure		Pervasive Data Collection - Connectivity from A to Z
15:30 - 16:15				15:30 - 16:15
PI System Analytics, Fit for Purpose				Actionable Insights with PI Integrators

OSIsoft Headquarters

- Leverage PI System to support the facility
- Collect data from Building Management System (BMS)
- Operational excellence
- Single pane of glass
- Energy management
- Optimize energy usage
  - HVAC performance
- Anomaly detection

OSIsoft's new Headquarters, the SLTC story

Gregg Le Blanc – VP Product

Agenda for the next 82 minutes

- SLTC Business Challenges and Product Roadmap
- Pervasive Data Collection
- Data Storage and Management
- Analytics
- Visualization
- OSIsoft Cloud Services
- Dev Con Kickoff
- Summary

← Future will extend in all directions →

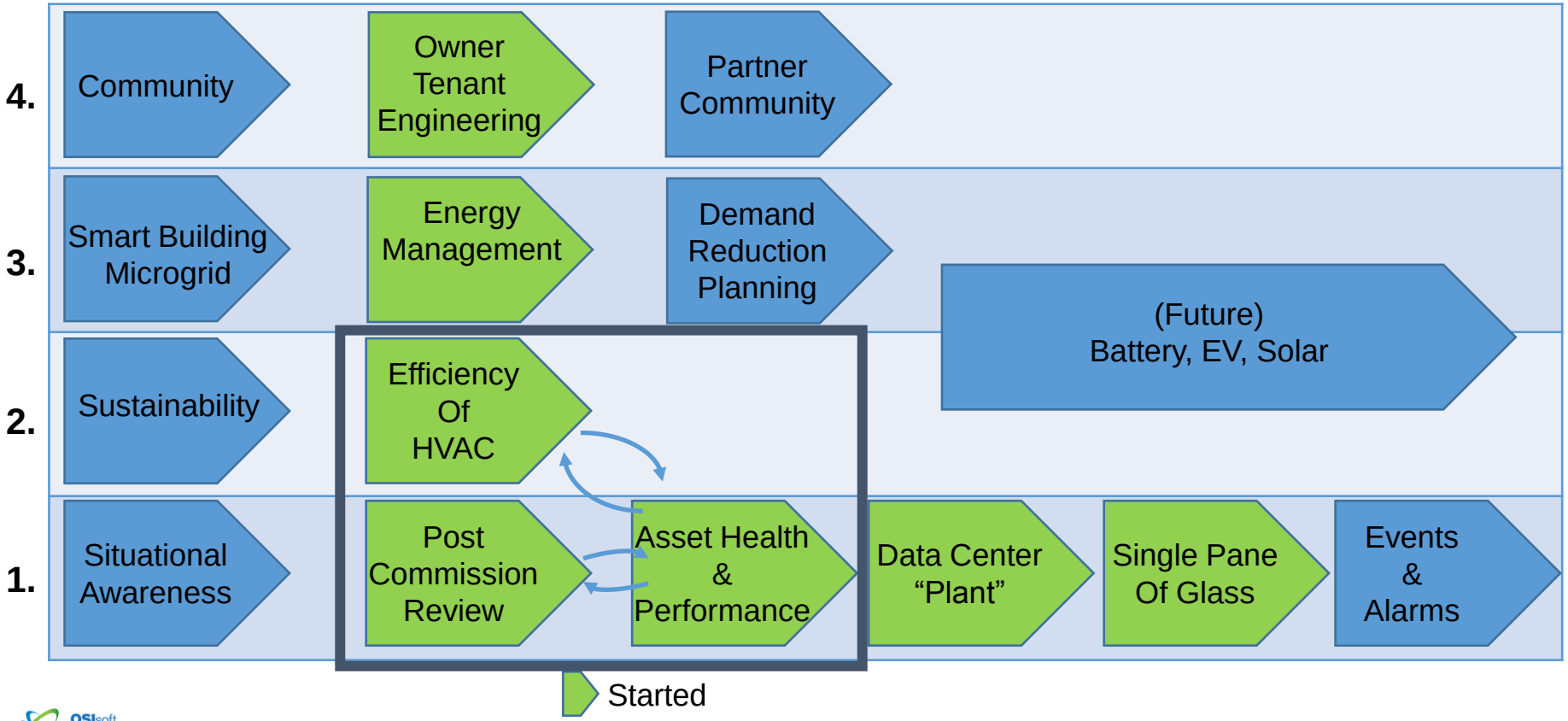
Pervasive Data Collection (PDC)

OSIsoft Cloud Services

Industrial IoT	Assets	Plant	Enterprise	Community
Millions of **Smart Devices**	Multiple **Sensors**	Multiple **Assets**	Multiple **Plants**	Multiple **Enterprises**

PI System

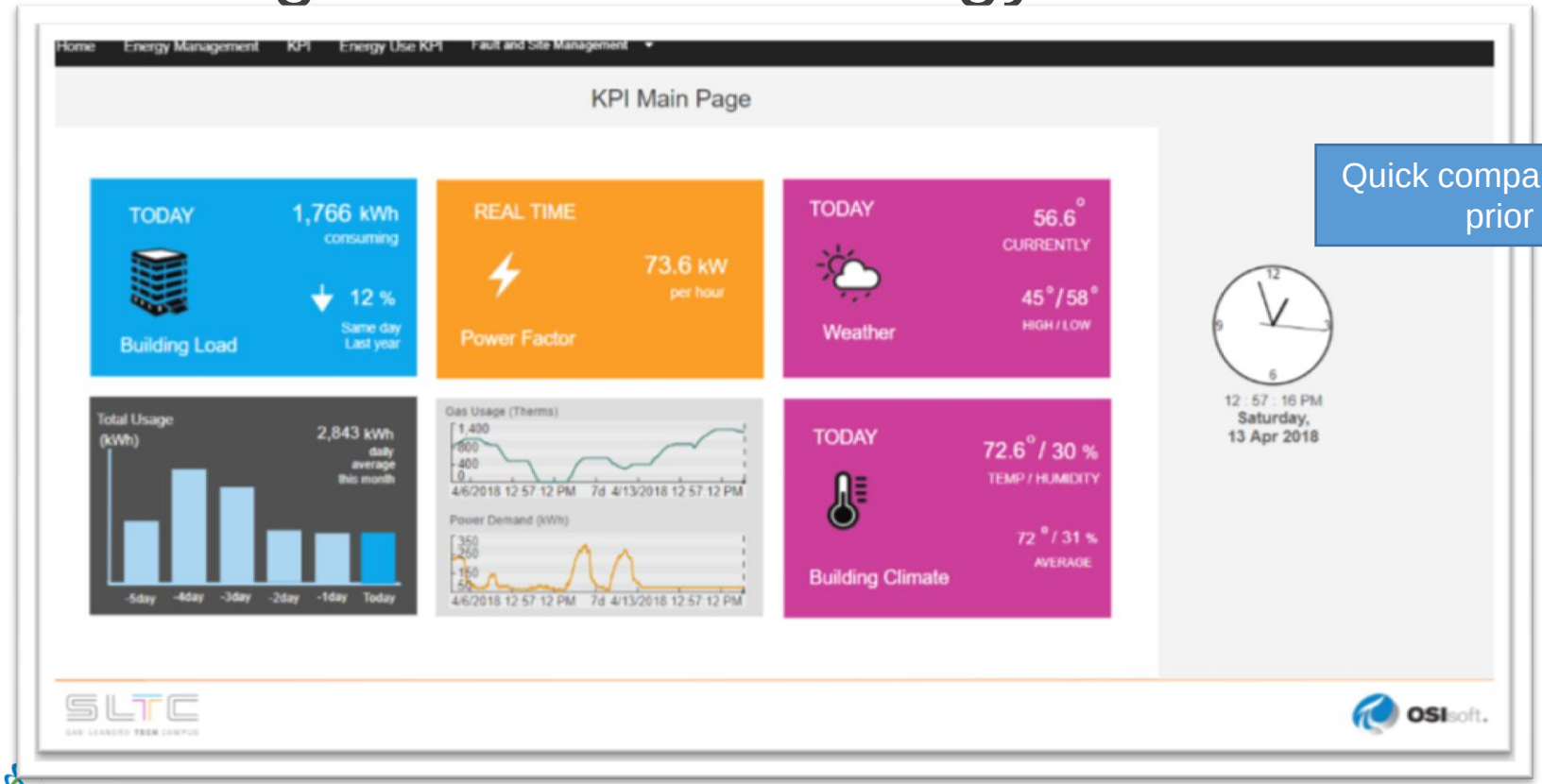
OSIsoft – as a Customer



Rollout and Development Themes

- Manageability
  - Using PI Vision to centralize UI work
  - Using OSIsoft Cloud Services to aggregate data
- Seamless infrastructure
  - Using Connectors to collect our data
  - Deploying IoT and Edge devices
  - Using new analytics features of PI System 2018
  - Connecting PI System to OSIsoft Cloud Services

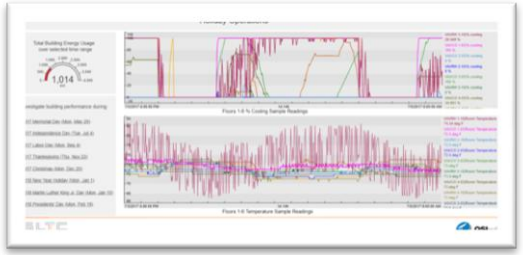
Management KPI - Energy Dashboard



Quick comparison against prior year

Post Commission Review (Visualization, Data Baseline Trend Analysis)

The target for the building was an improvement from 26 kWh/sf (old building) to 8.5 kWh/sf (new building) how to validate design and evaluate the commission process for errors.



CHALLENGE

The commission process is only as good as the design specifications

- Design vs. actual performance
- Failed equipment
- Inadequate or missing specifications

SOLUTION

Implement PI for benchmarking the HVAC, hot water and window tinting system.

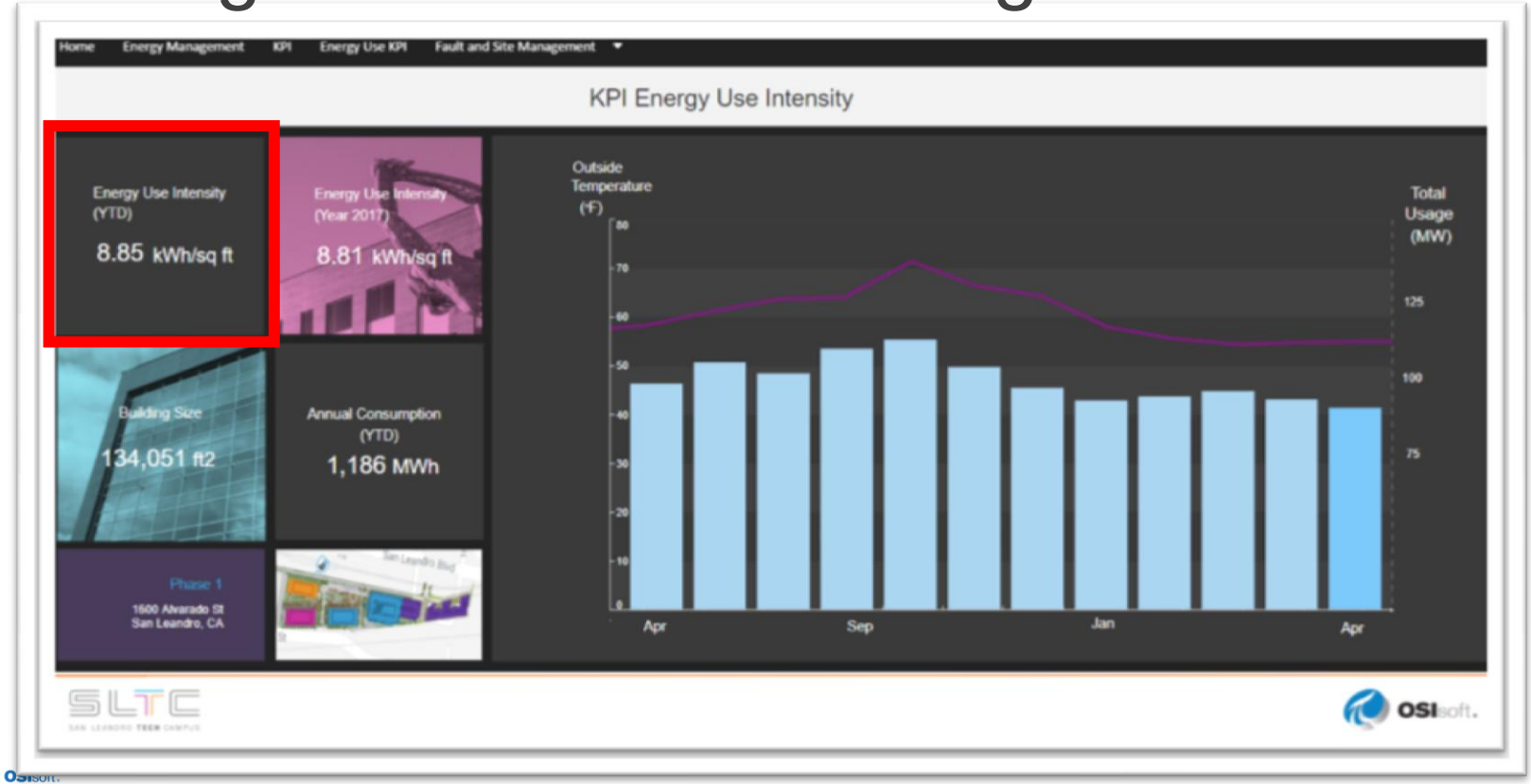
- BACnet Connector
- PI Vision
- PI UFL for Energy Data

RESULTS

Found numerous gaps between the design specification and the actual system requirements.

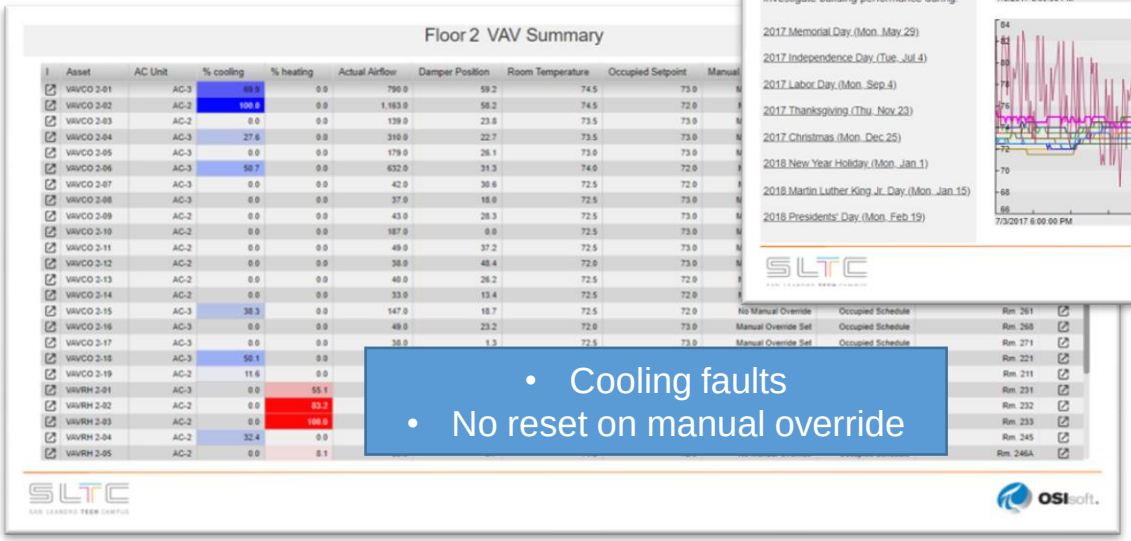
- Failed or poorly installed equipment
- Lack of BMS required features
- Programming errors
- Building design issues

Management KPI – Building Benchmark



Problems with the real world

Issues they didn't see



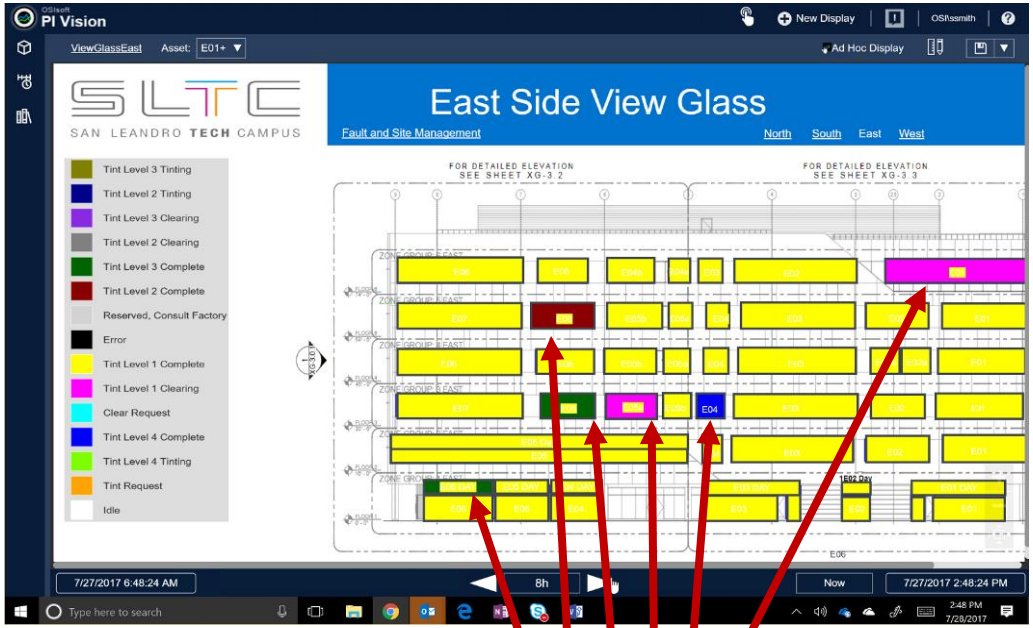
- Cooling faults
- No reset on manual override

- 4am start on a holiday
- One unit hunting despite vacant

Problems with the real world

Commissioning of specialized systems

How it should work



Reality = hidden faults

Single Pane of Glass (Visualization)

We installed new technologies that provided no management console and additional building systems were not connected to Building Management System.

CHALLENGE

We lacked completed system visibility

- ViewGlass window tinting system had no HMI.
- Lighting & ViewGlass not in BMS
- BMS lacked ability to share data with multiple participants

SOLUTION

Leverage PI Vision for dashboards, troubleshooting and root cause analysis

- Dashboards for the current status of the system
- Integrate trending
- Troubleshooting Analytics

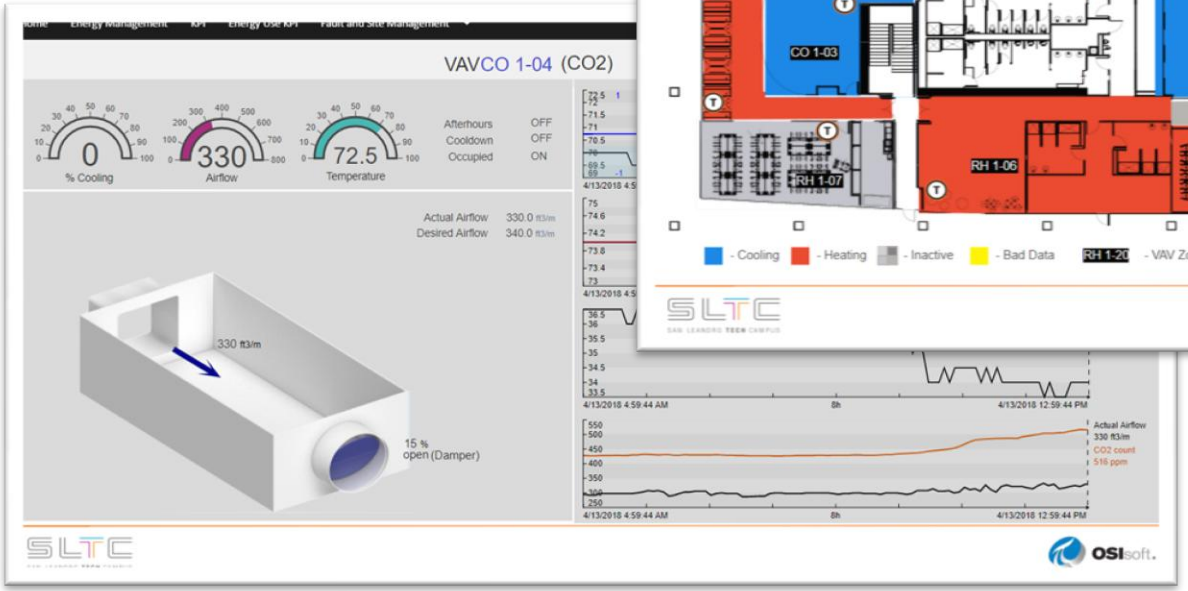
RESULTS

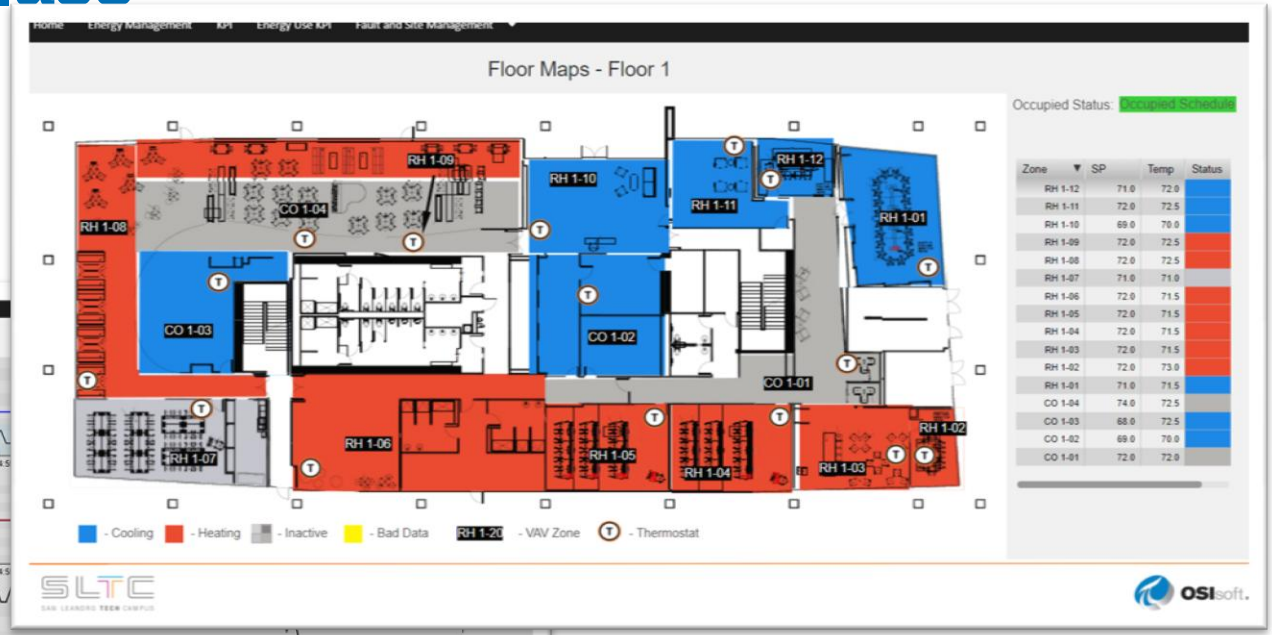
Real Time Reporting for multiple stakeholders and missing HMI system

- ViewGlass Displays (Vendor Now Interested in using PI)
- 3 Stakeholders Access – engineering, landlord, tenant
- Internal Customer Screens

Single Pane of Glass

Asset View

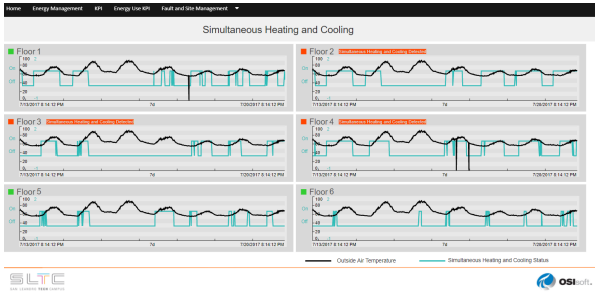




Floor View

HVAC Performance (Trend Analysis and Machine Learning)

The BMS system included it's own algorithm on the optimization of the start-up process. Plus the amount of manual temperature overrides we needed to understand system performance tied to comfort for employees.



CHALLENGE

We monitored inefficient use of the HVAC system and need to understand performance.

- Start-up 4 hour duration but units achieving set point temperature in as little as 30 minutes
- Significant manual overrides causing simultaneous heating and cooling in contiguous zones

SOLUTION

Analyze system performance with Machine Learning and analyze trends of manual overrides

- Integrator for Business Intelligence
- Power BI, R, Orange
- PI Vision Adhoc Trending
- PI Vision Dashboards

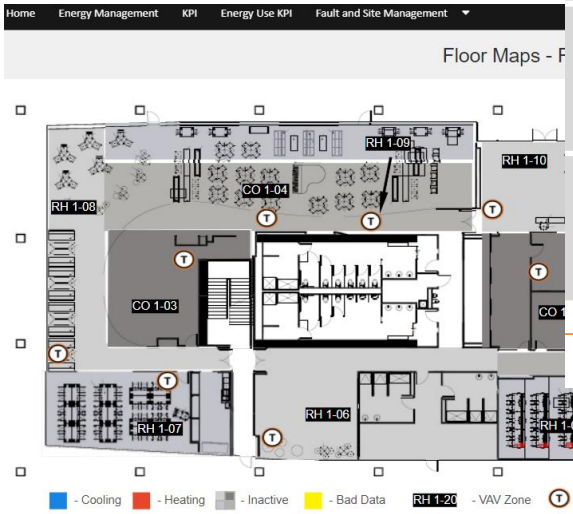
RESULTS

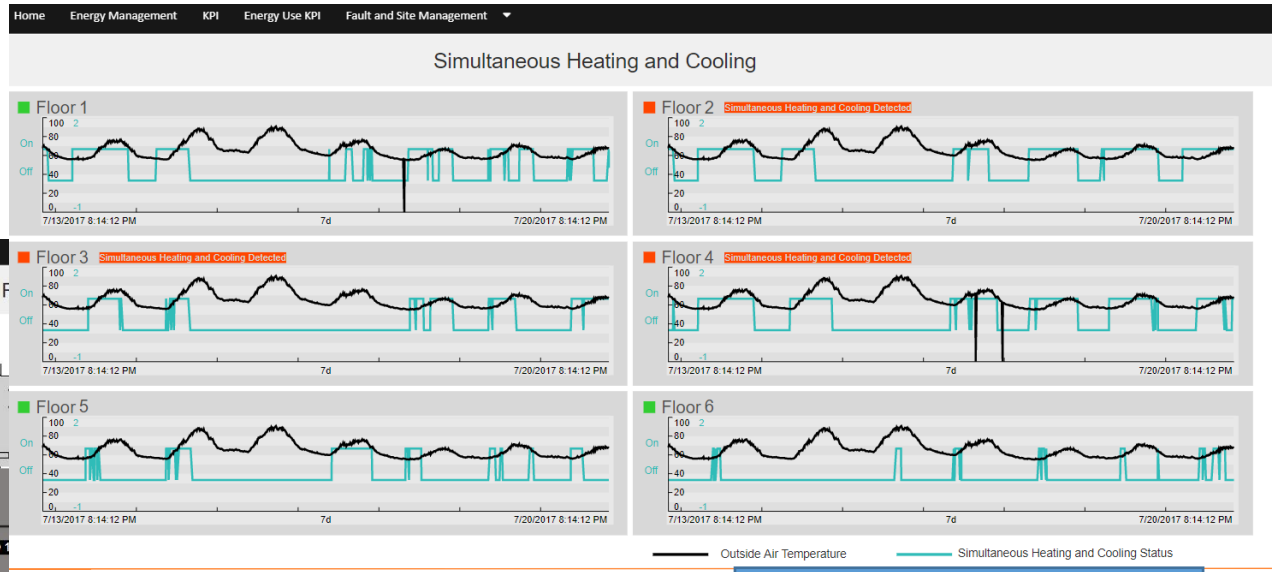
Identified multiple contributing issues contributing to a minimum of 5% energy consumption

- BMS Software Bugs
- BMS Configuration Issues
- HVAC Design Issue
- BMS optimization algorithm not optimized for energy conservation

Problems with the real world

First Floor Failed Pre-Conditioning Prior to





Manual Overrides created extensive heating and cooling issues

Machine Learning Insights

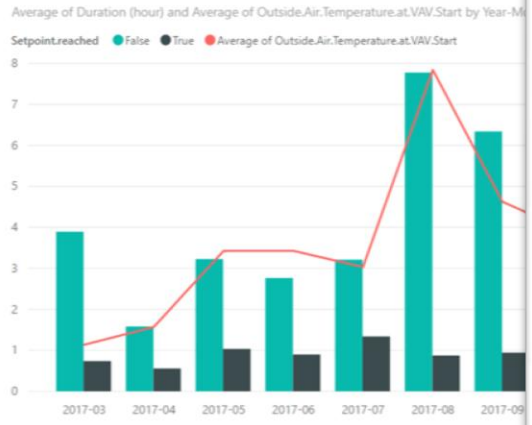
How long is startup taking?

1.84

Average of Duration (hour)

0.97

Average Duration (setpoint reached)



Are the VAV Units reaching setpoint? At what time?

72%

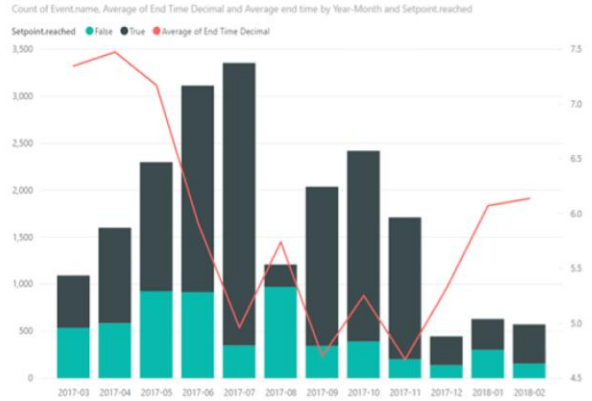
% Setpoint reached

5:38:08

Average end time

Side	Number of Events	% Setpoint reached	Average end time
East	7623	68%	5:48:06
NA	2056	53%	6:45:09
West	10809	78%	5:23:26
Total	**20488**	**72%**	**5:38:08**

Floor	Number of Events	% Setpoint reached	Average end time
1	2056	53%	6:45:09
2	3064	74%	5:13:56
3	3825	71%	5:20:35
4	3720	77%	5:43:27
5	2963	74%	5:44:50
6	4860	73%	5:38:09
Total	**20488**	**72%**	**5:38:08**



Energy Management (Visualizations, PI AF/Analysis Server & PXiSE)

While the building is energy efficient we lacked visibility of energy consumption by system and for building two the need for multi-tenant billing support. Plus we want to plan for a 25% reduction in demand charges.

CHALLENGE

We had no real time view of energy data.

- 48 Hour delayed utility data
- Building only

SOLUTION

PXiSE solution for 10 hertz data for real time and high frequency data to determine system demand.

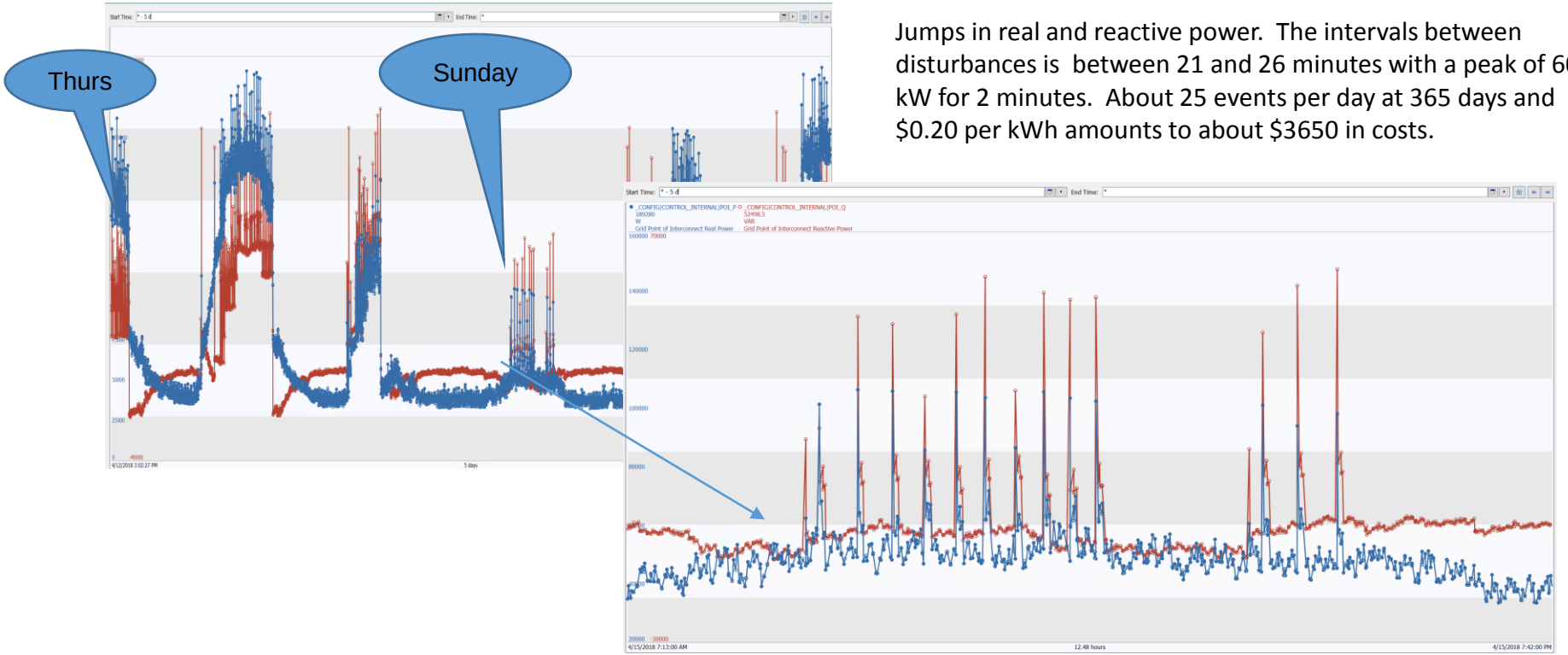
- PXiSE Microgrid Controller with embedded PI
- PI UFL Connector
- PI Vision & AF Analytics
- Future – Sub Metering

RESULTS

Identified building base load, 25% potential demand reduction, individual systems impact on energy.

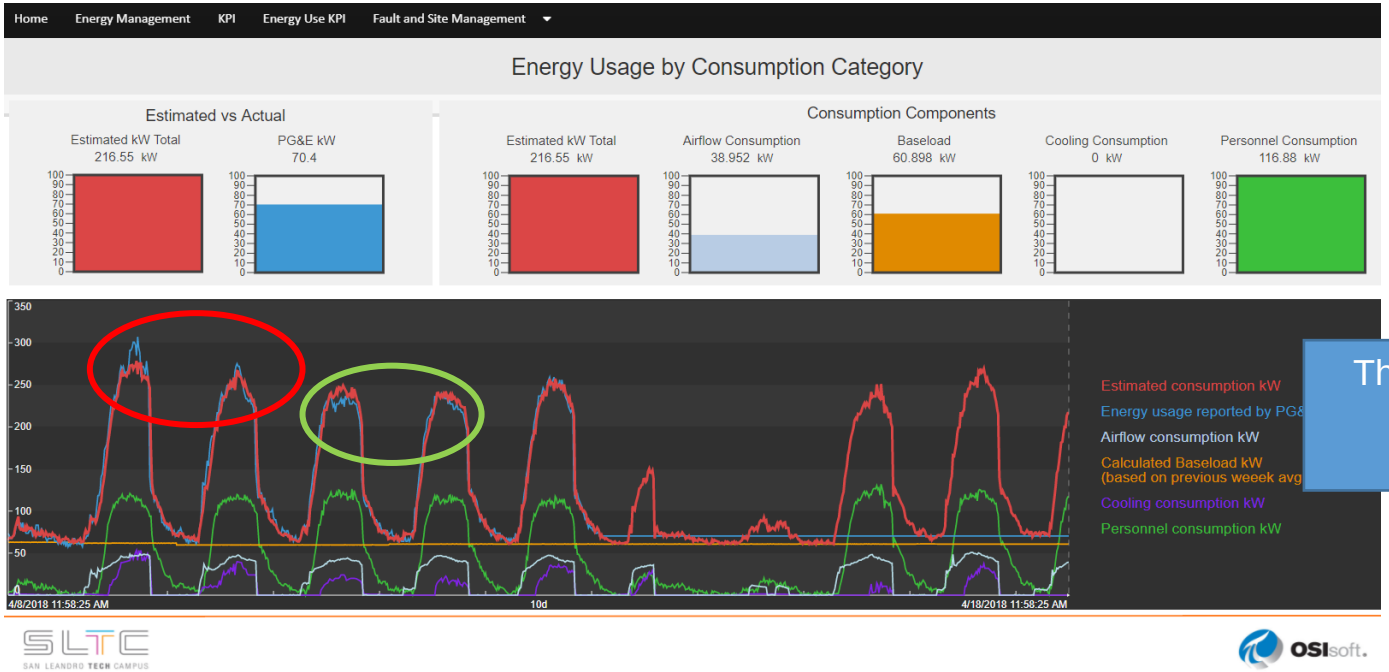
- Full PG&E Bill Audit Analytics
- Battery Sizing Calculated
- Energy Impact of Window Tinting (Future)
- Energy Impact of Demand Reduction Lighting System (Future)

PXiSE – High Fidelity Energy Data



Jumps in real and reactive power. The intervals between disturbances is between 21 and 26 minutes with a peak of 60 kW for 2 minutes. About 25 events per day at 365 days and $0.20 per kWh amounts to about $3650 in costs.

Energy Consumption



The data now tells us a story on where we consume energy

Community (PI Cloud Connect, PI System Connector, PI System Integrator)

We are part of an ecosystem as a customer and as a manufacturer of the solution. We need to share our data with the landlord, building engineering, Microgrid provider, independent software vendors, system integrators and building technology vendors.

CHALLENGE

A disparate group of community members with different requirements.

- Building engineering wanted real time access
- ISV and SI wanted streaming data to build market solutions
- Technology providers was point in time snapshots

SOLUTION

Leverage the toolkit for an appropriate solution for each customer with no additional overhead.

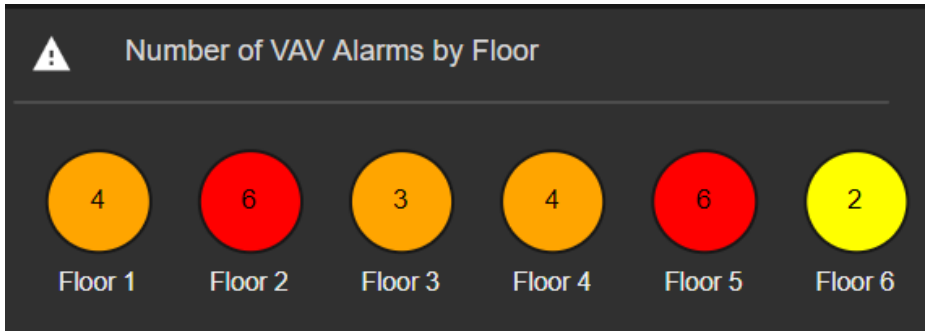
- PI Cloud Connect
- PI System Connector
- PI Datalink
- PI Vision Dashboards
- PI System Integrator

RESULTS

A subscriber menu based on requirements we can provide quick and easy access with history.

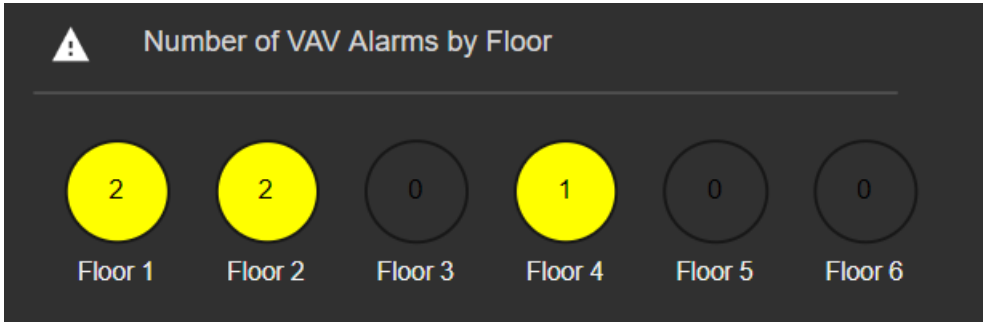
- 3rd party companies with PI who want streaming data took PI Cloud Connect
- Internal we used all of the options based on use cases (ML, Training, Demo)
- Building engineering just want pre-built displays

Building Performance – Out of Spec

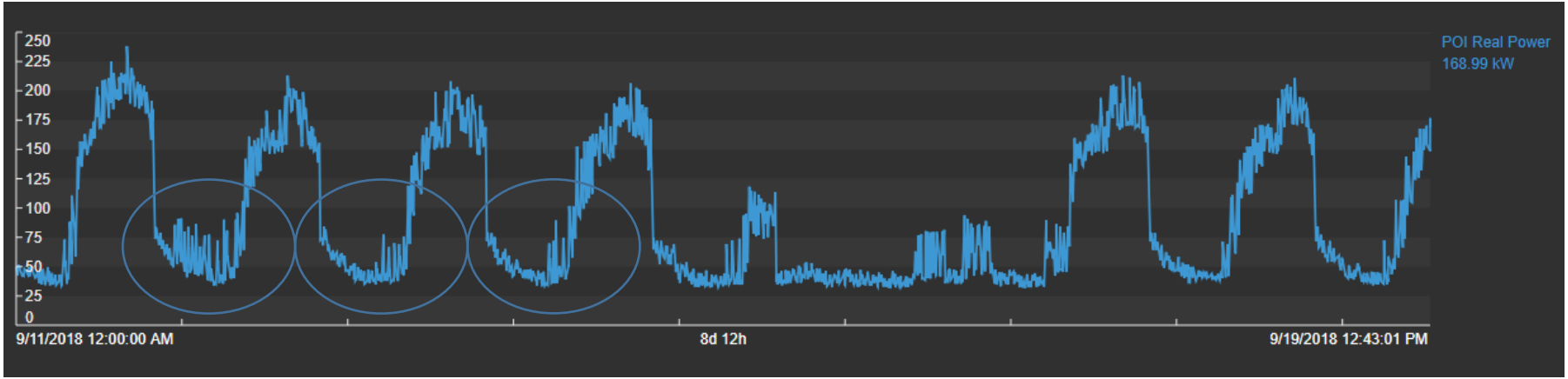


Running Out Building Spec –
Failed Temperature Alarms

Running In Building Spec –
Failed Temperature Alarms

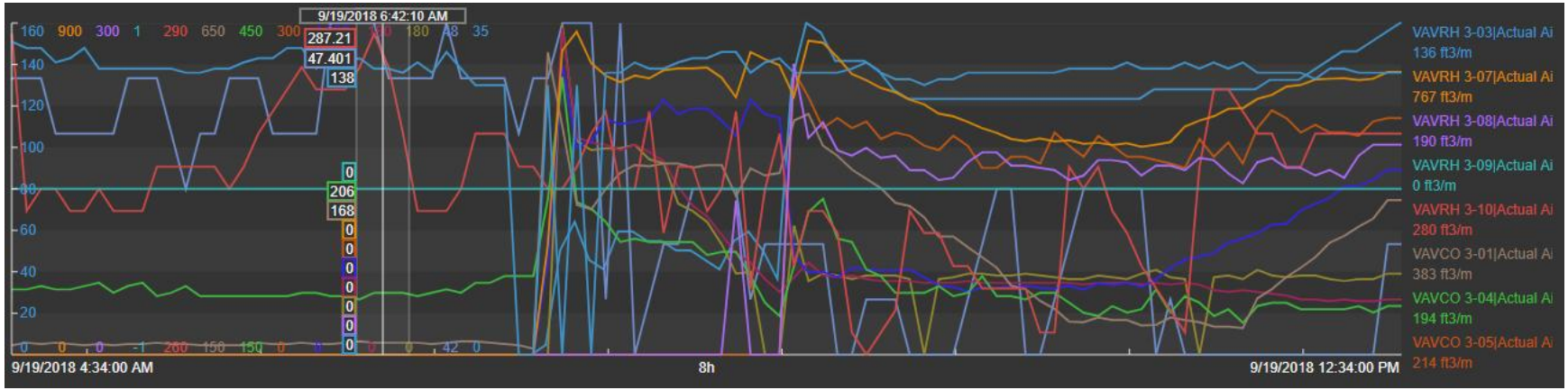


Real Power Impacts



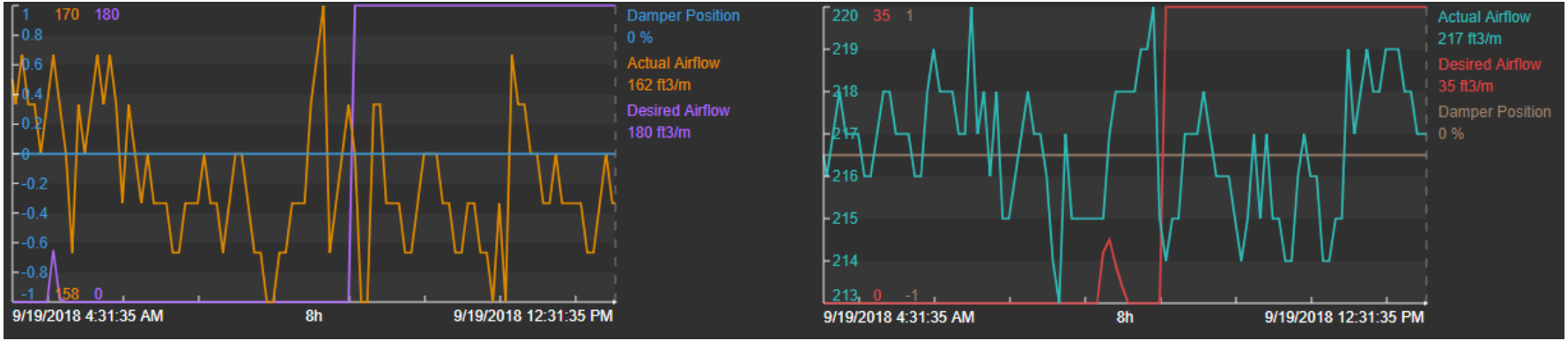
1. 15 Minute Utility Meter is like driving at midnight with sunglasses on
2. High Velocity data shows the impact of poor performance and improvements from tuning
3. See the change in fan usage by changing set points to within building design specifications

Facility Analytics – Multiple Issues



No Supply Air Fan, Dampers Open or Closed
Several VAV Systems with significant airflow

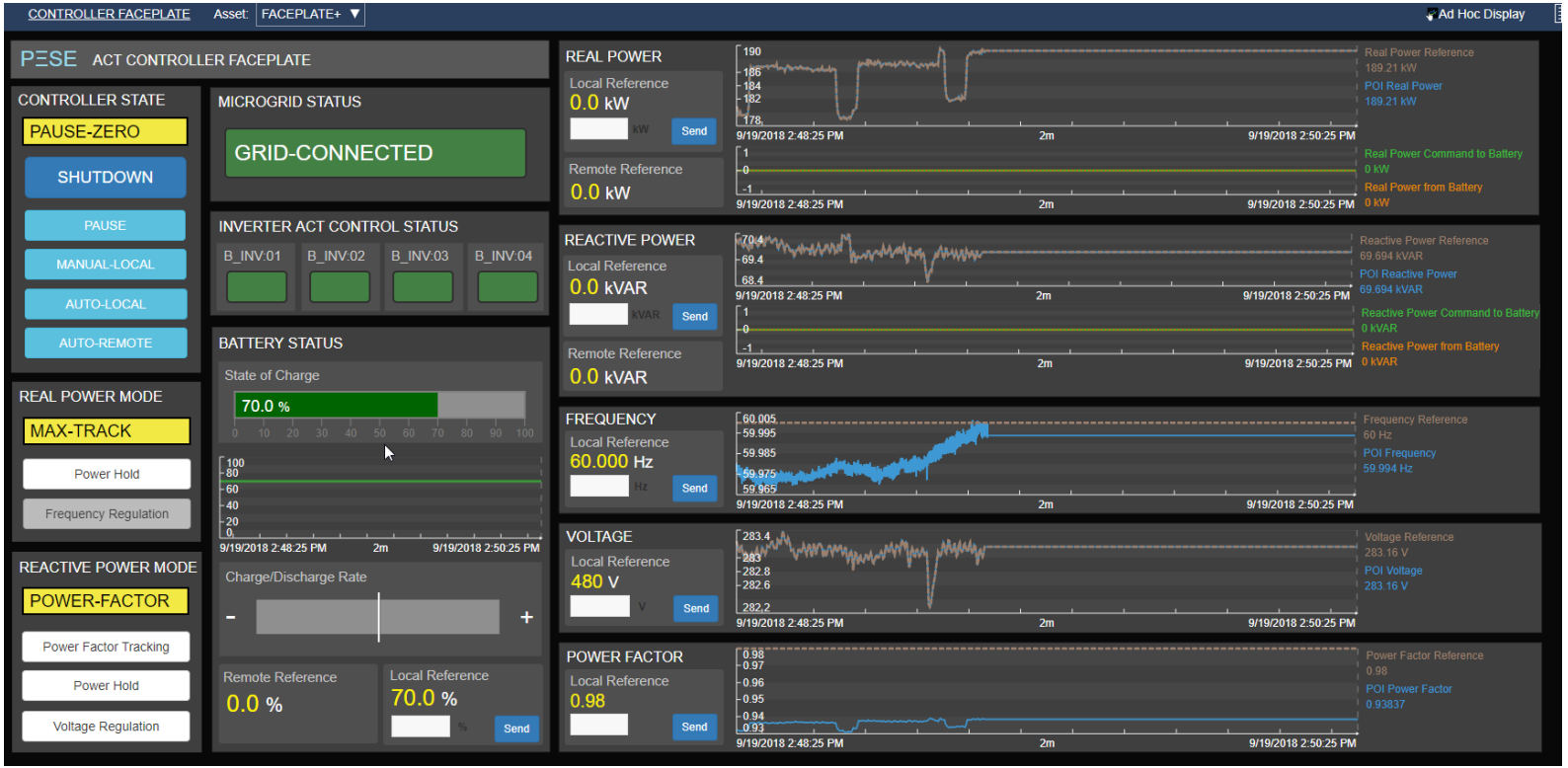
Facility Analytics & FDD (or Lack Of)



We found several VAV boxes with either poor calibration or broken dampers

Airflow
With Damper Closed Examples

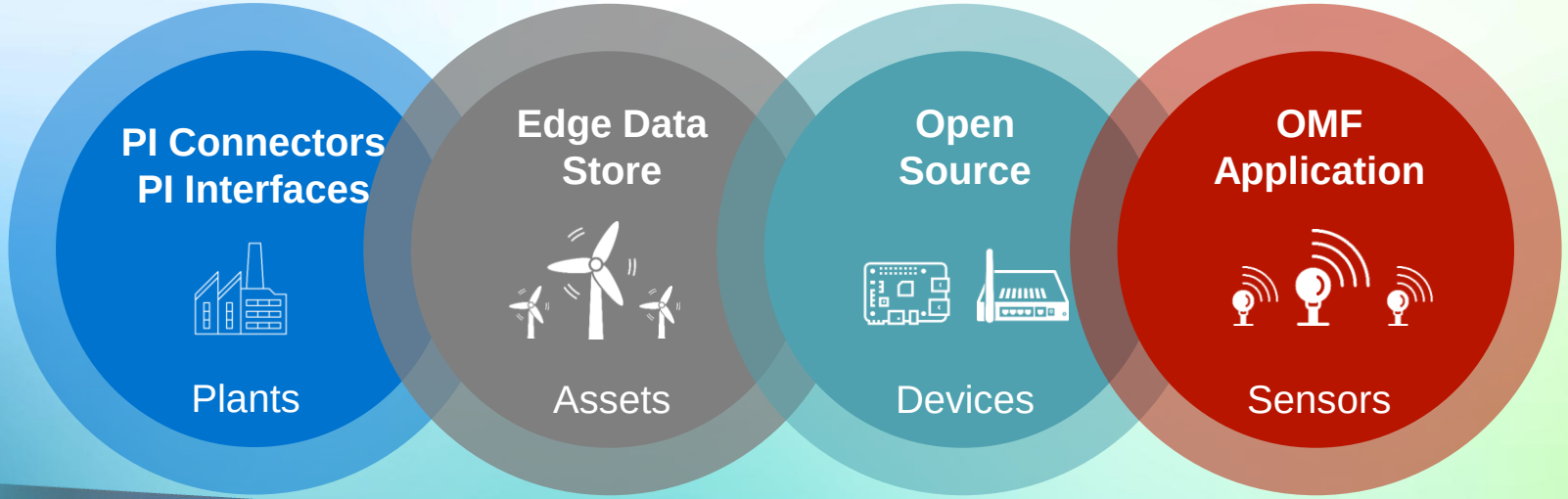
Real Power in Real Time



Pervasive Data Collection

Chris Felts – Product Manager
Abbas Saboowala – Product Manager

Pervasive Data Collection



10,000's	⟵	Data Streams	⟶	10's
High	⟵	Compute Resources	⟶	Low

MESSI AND NOT A MESS

PI Connectors help you be strategic

Streamlined Configuration

Auto create PI Points and AF reference model with rules-based data selection.

Auto discover data, now and later

PI Connectors monitor the source so you don't have to.

Unified Admin Experience

A one-stop shop to manage data collection across your sources.

Secure & Flexible Architectures

Send data securely across diverse networks to multiple destinations.

What do we collect

BACnet

UFL

Redfish

Collect Building Management Data

Parse Energy Data

Server monitoring for IT Operations

OSIsoft Cloud Services

PI Server

Edge Data Store

What do you see here?

Edge Data Store Built for Purpose

Persistent Data Storage

Collect and store thousands of data streams easily and securely.

Self-Healing

Designed from the ground up for unmanned, remote operation.

Upload to PI and OCS

Automatic data transfer for advanced viewing, analytics, data sharing and long term storage.

Application & Analytics Ready

Modern, RESTful APIs for local and remote data access for application and analytics integration.

OMF Expands Data Connectivity

Maximum Flexibility

Application developer is only required to adhere to the specification, otherwise is free to develop any required features and functions.

Lightweight Footprint

Targeting the smallest device and sensor data sources.

Any Environment

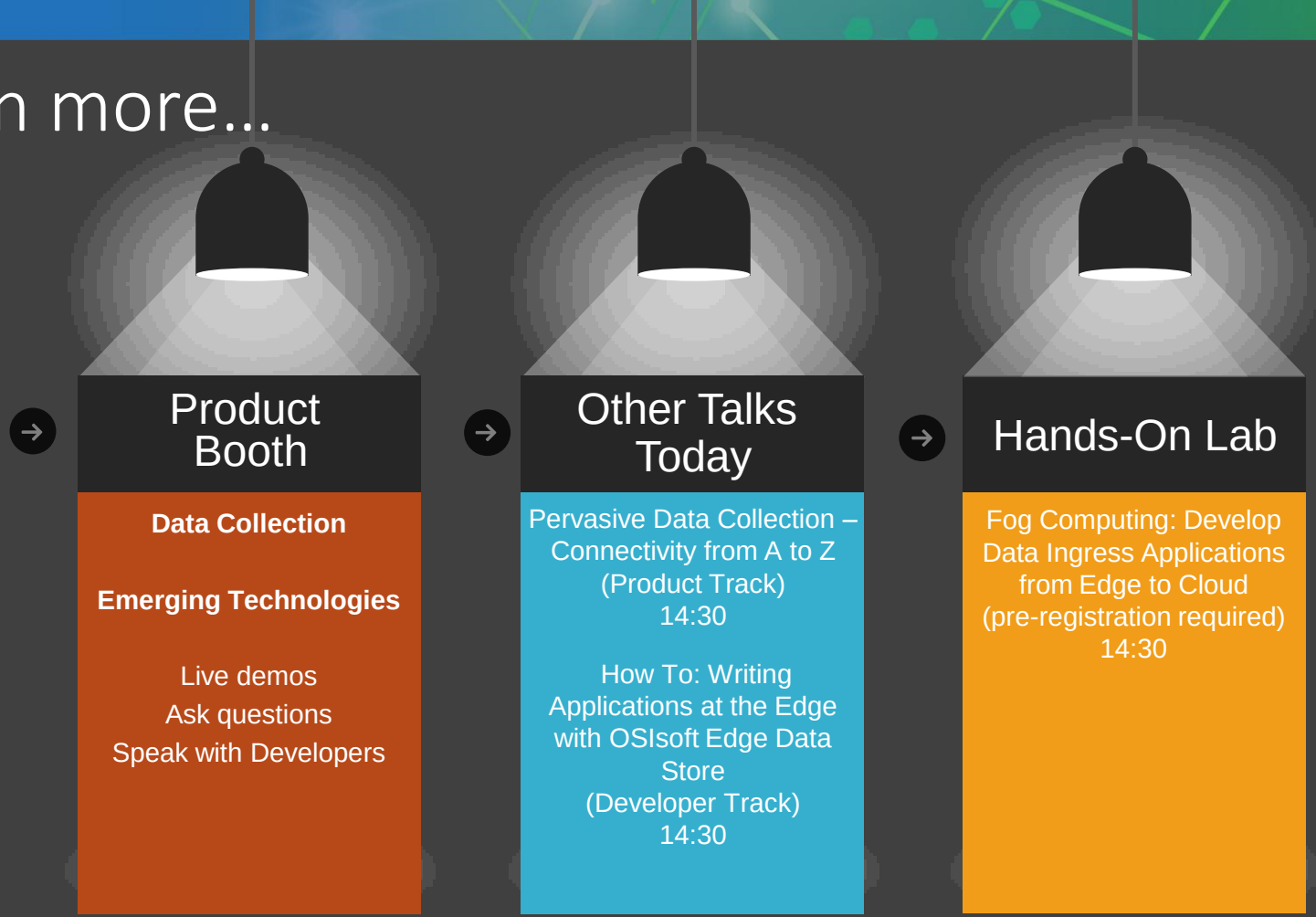
Any hardware, any operating system, any development tools.

Partner Enablement

Message structure abstracts the backend OSIsoft storage technology, easing the application development effort.

Rooftop Solar – Parking Garage

Learn more…



Product Booth

Data Collection

Emerging Technologies

Live demos
Ask questions
Speak with Developers

Other Talks Today

Pervasive Data Collection – Connectivity from A to Z
(Product Track)
14:30

How To: Writing Applications at the Edge with OSIsoft Edge Data Store
(Developer Track)
14:30

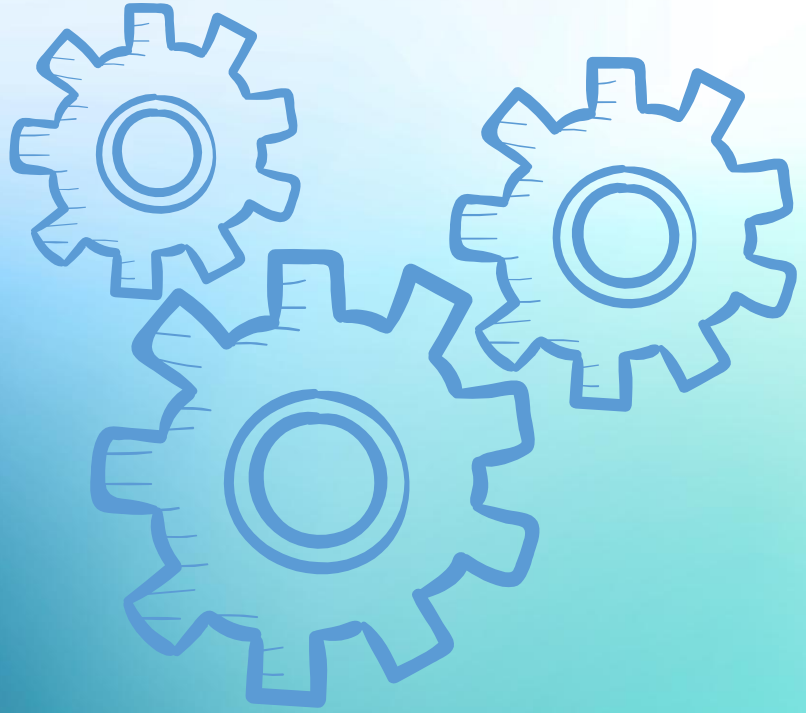
Hands-On Lab

Fog Computing: Develop Data Ingress Applications from Edge to Cloud
(pre-registration required)
14:30

Data Storage and Management Calculations and Events

Stephen Kwan – Product Manager

What are customers telling us?



Make it easy

Make it work

Make it fast

Make it scale

Help me manage it

Tell me when something is wrong

Fix it for me

I want to do more with my data

……

Make it easy and make it work

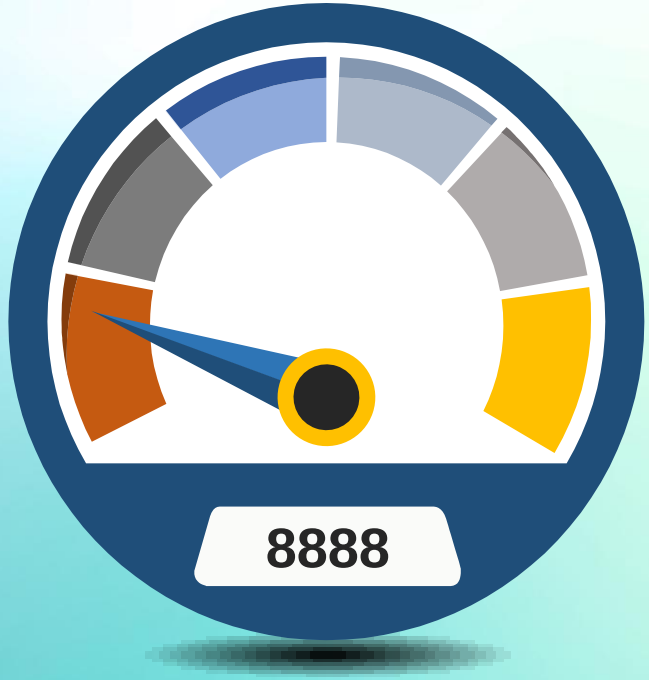
- Attribute display digits
- Arrays in asset analytics
- Dynamic output timestamps
- Recalculate dependent analyses
- Notify at end of event
- Implicit event frame generation

Make it fast and make it scale

Improved AF searches

Improved event frame searches

Bulk event frames checkout and deletes



Improved data archive reads in some situations

Improved handling of dependent analyses

Better handle missing or un-configured PI Points

Help me manage it

Easier to migrate AF DBs

Improved AF audit trails

AF connections history

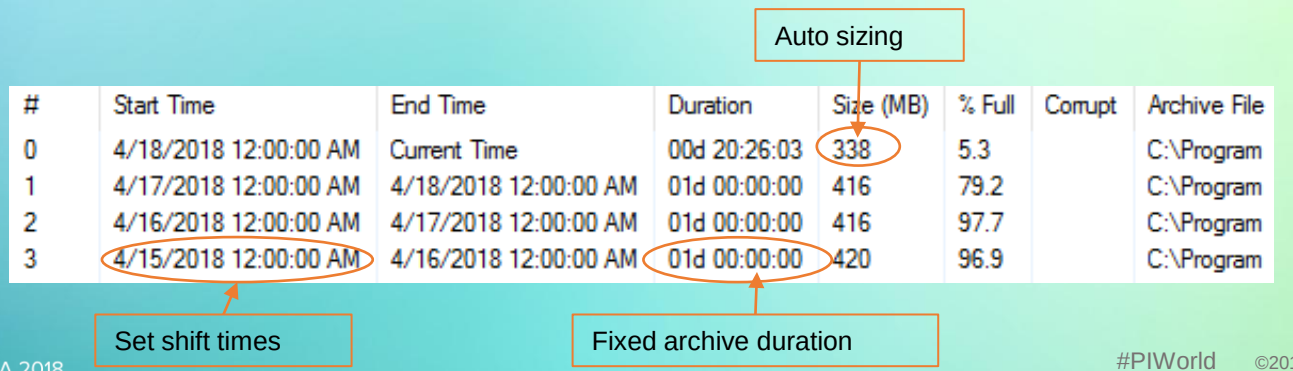
Analyses status via AF SDK

Single PI Server setup kit

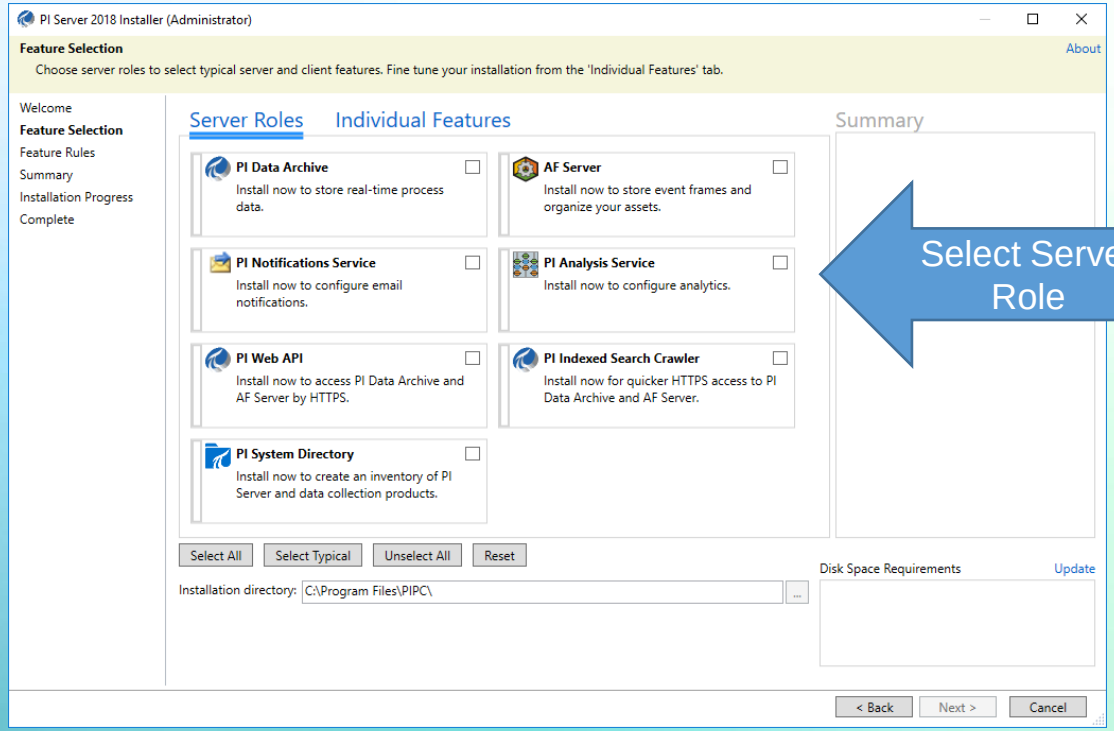
Scheduled archive shifts

Improved Archive Management

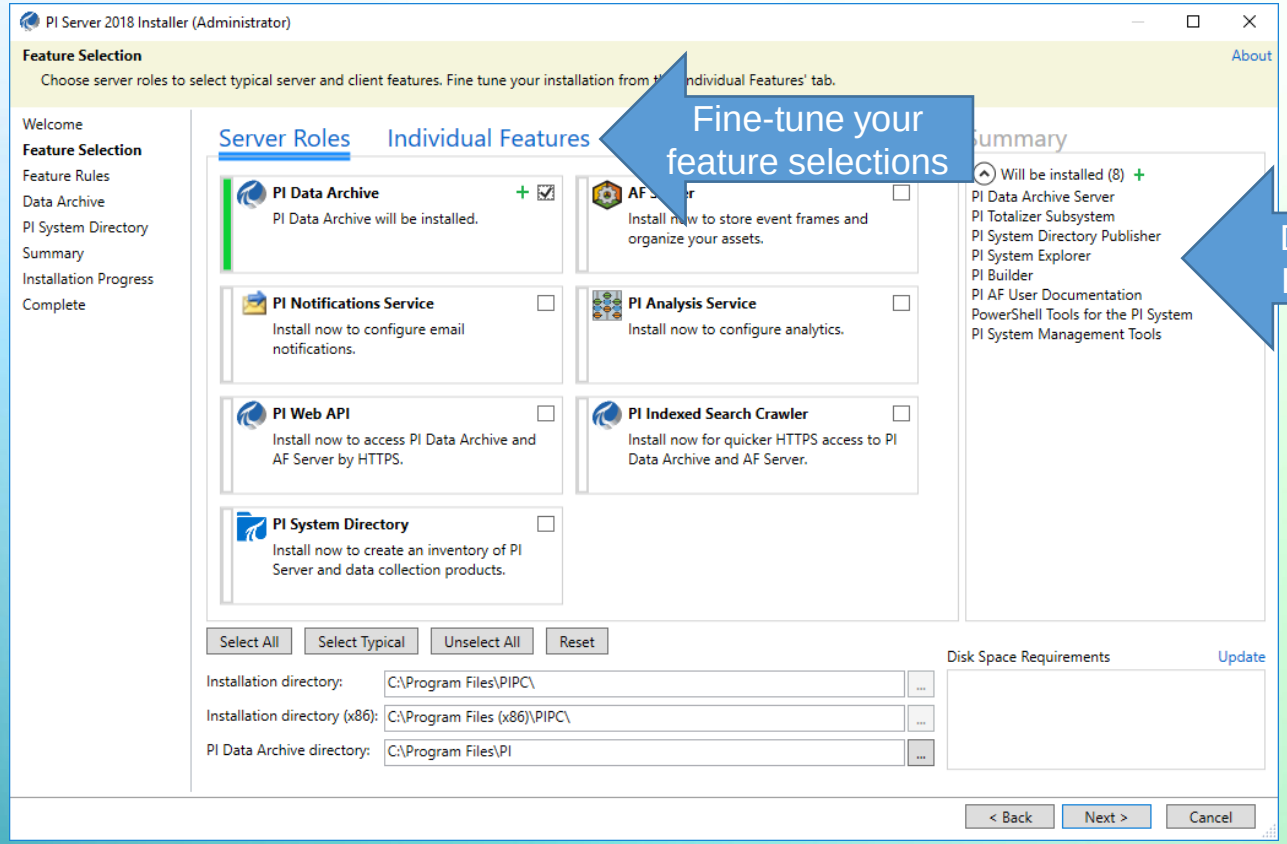
- Archive shifts at fixed duration – daily, weekly, monthly
- Auto archive sizing
  - Based on data rate and expected archive duration
- Align archives amongst collective members
  - Handles time zone differences



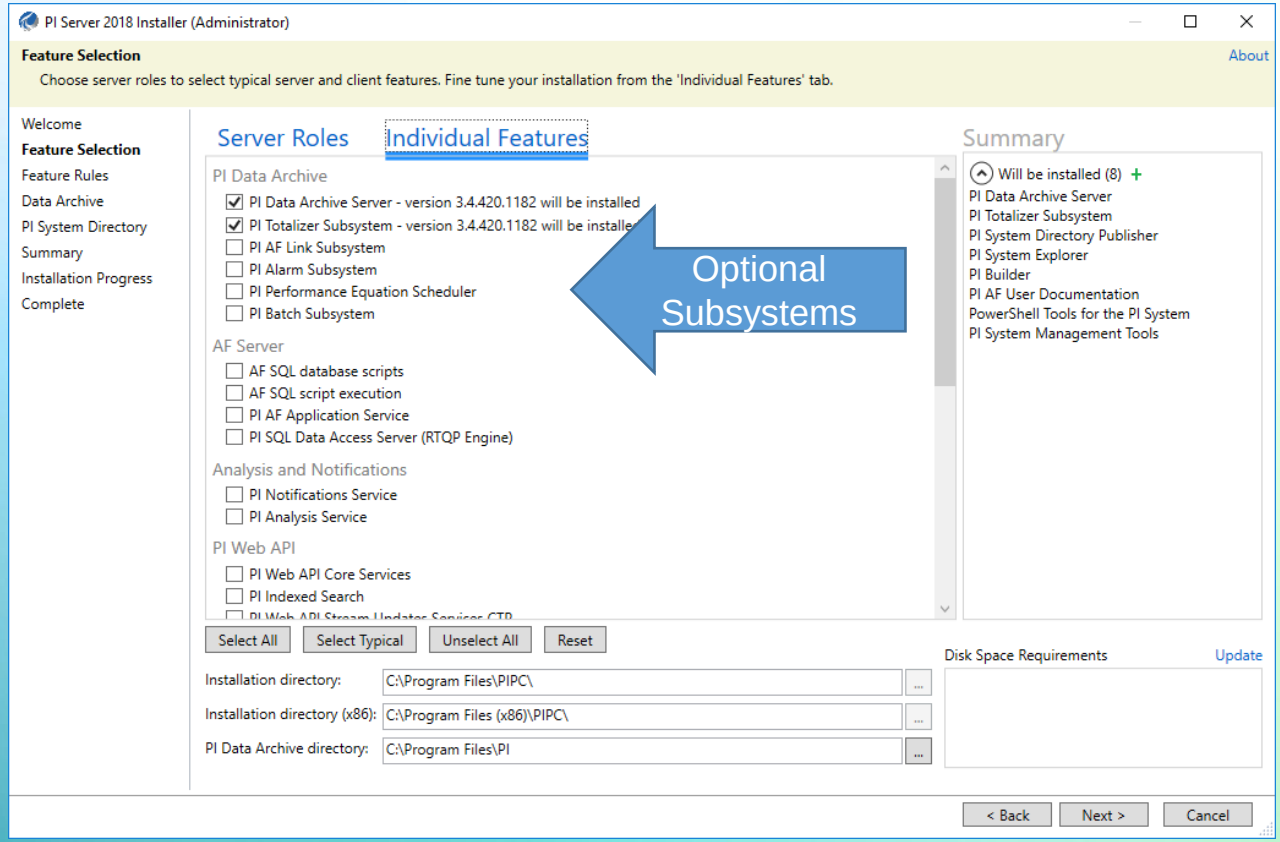
Improved Installation Experience



Improved Installation Experience



Improved Installation Experience



Analytics

Stephen Kwan – Product Manager
Joy Wang – Product Manager

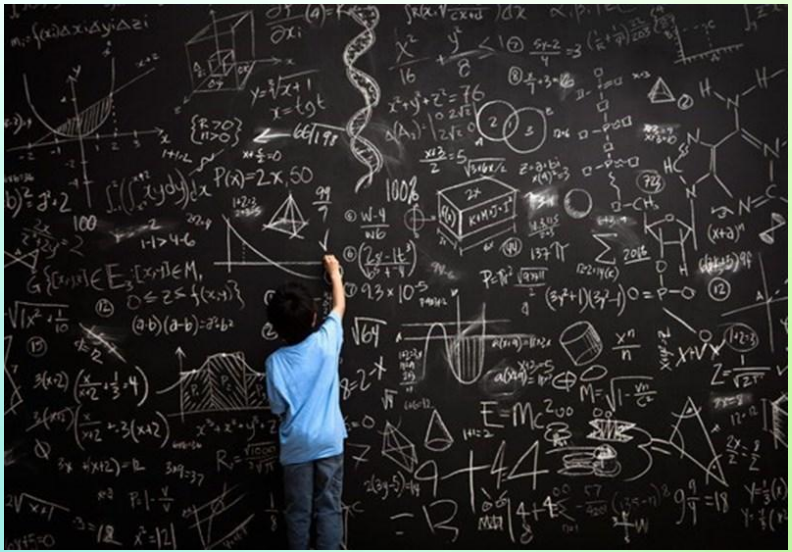
OSIsoft Headquarters

- Leverage PI System to support the facility
- Collect data from Building Management System (BMS)
- Operational excellence
- Single pane of glass
- Energy management
- Optimize energy usage
  - HVAC performance
- Anomaly detection

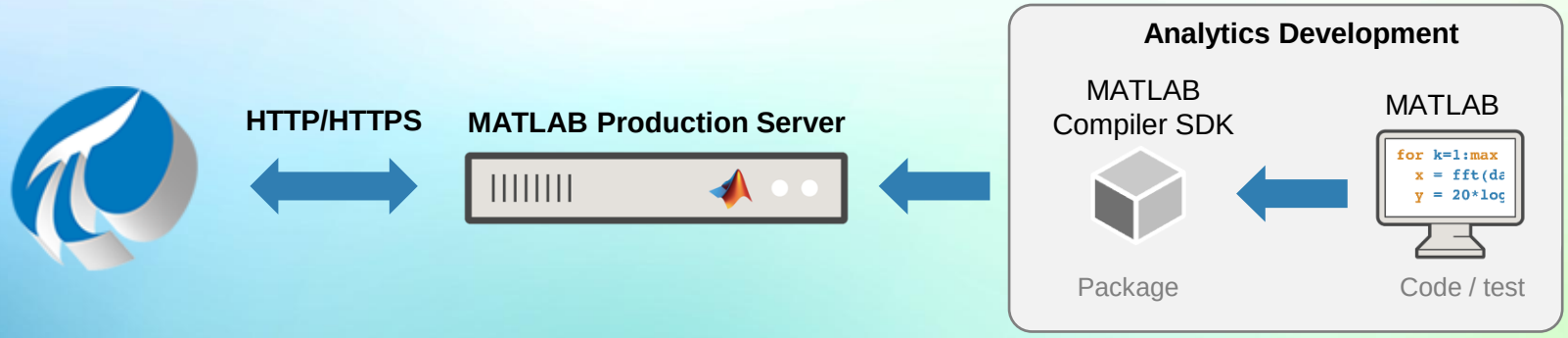
How can we predict Energy Usage?

Advanced Streaming Calculations

- Asset Analytics released in 2014
- PE replacement
- Leverages AF and PI System
- Configuration experience
- Robust engine with scheduler
- Widely used, but users want more
  - Advanced calculations
  - More flexibility
  - Retain “ease of use”

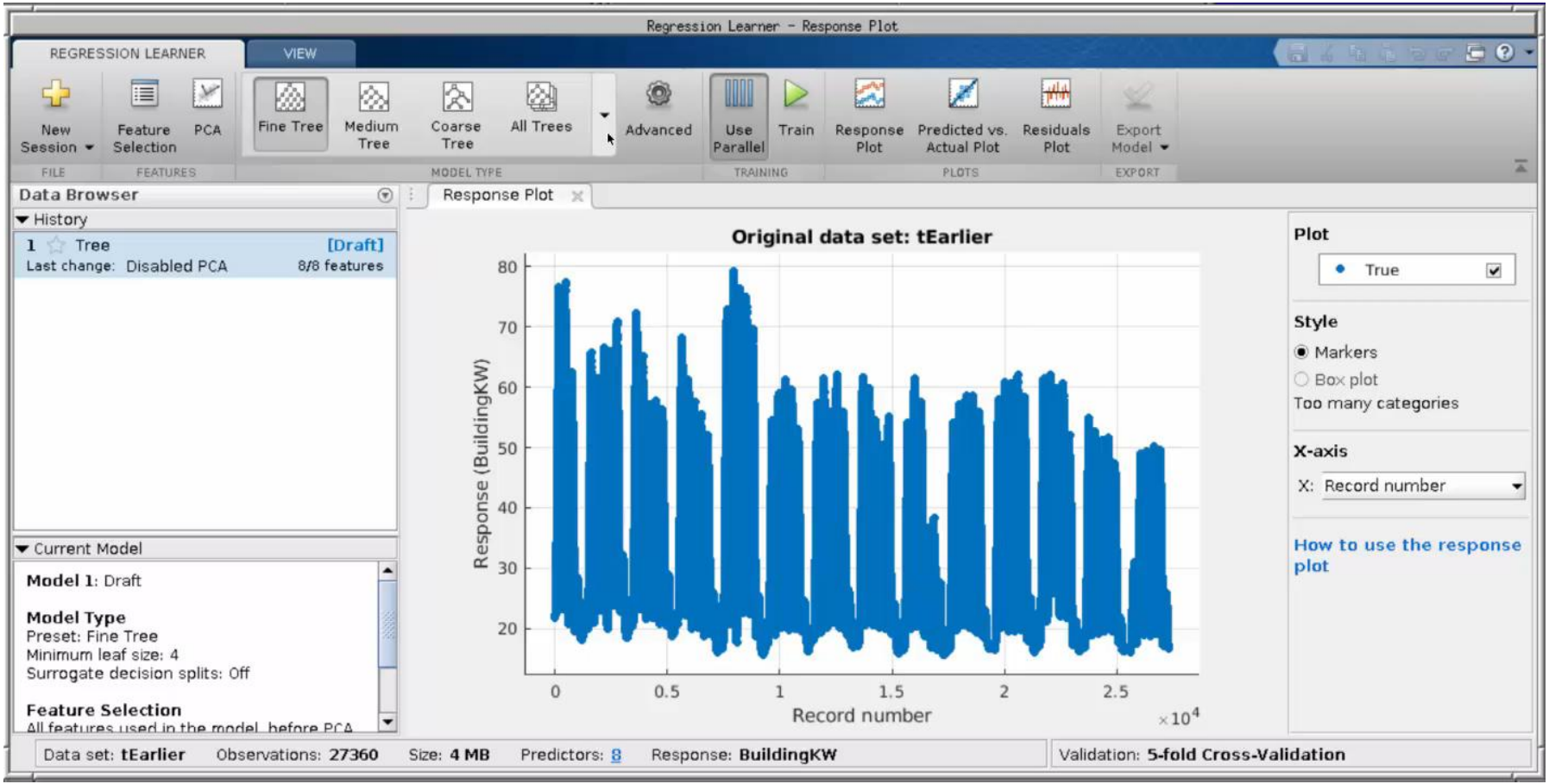


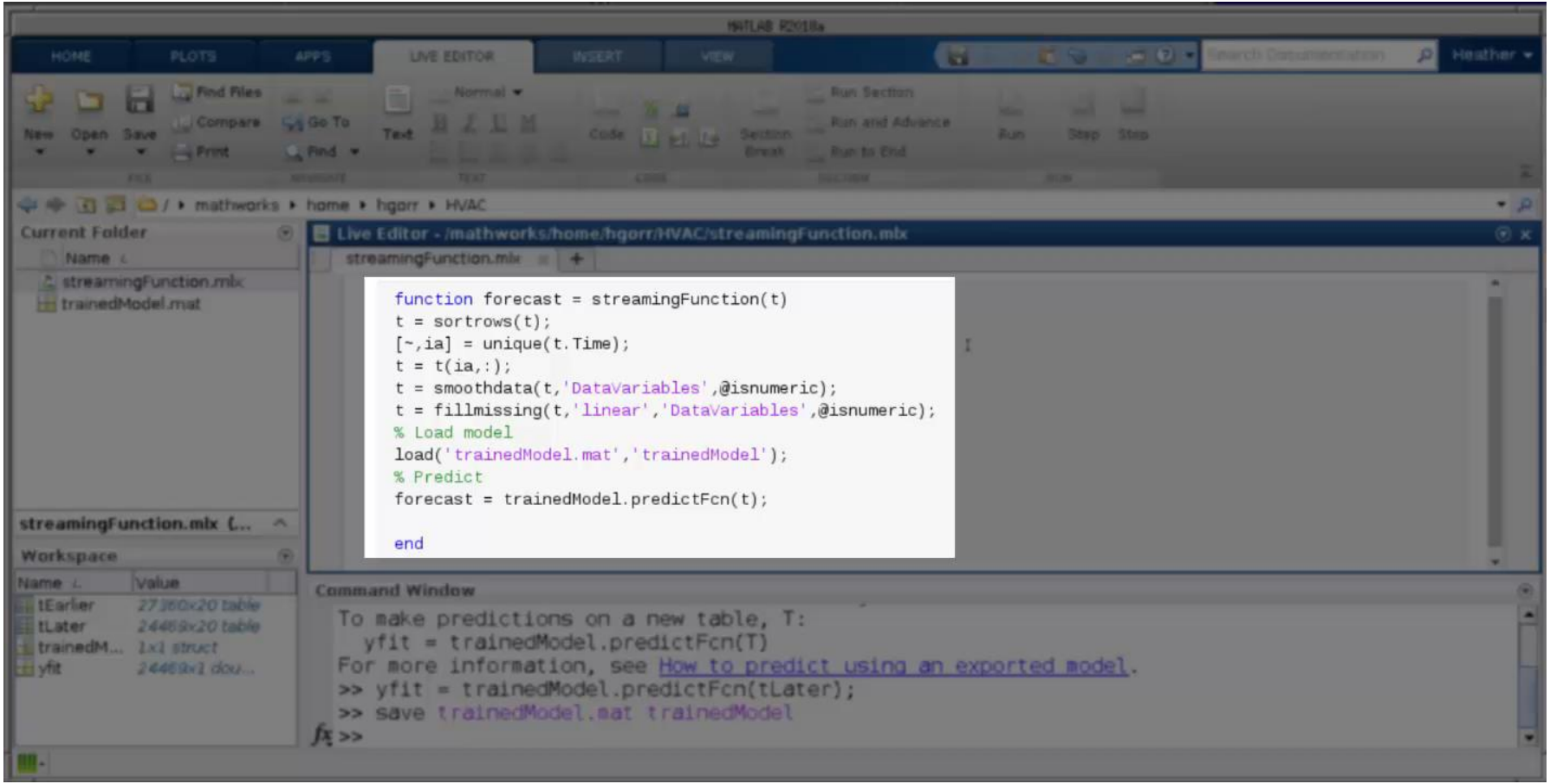
Integration with MATLAB Production Server

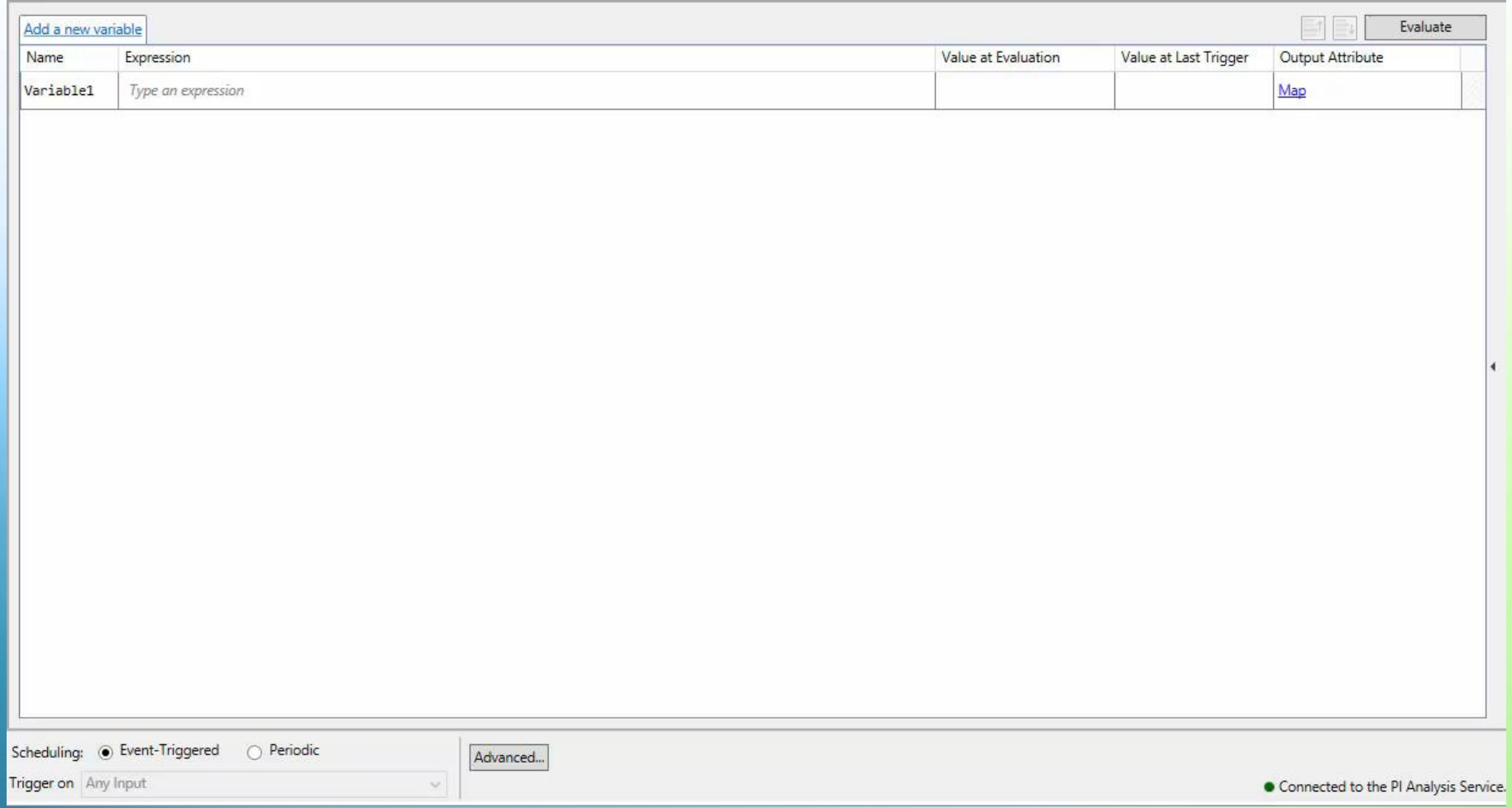


- Requirements
  - PI Asset Framework 2018
  - MATLAB Production Server 2018a
  - MATLAB, MATLAB Compiler and MATLAB Compiler SDK

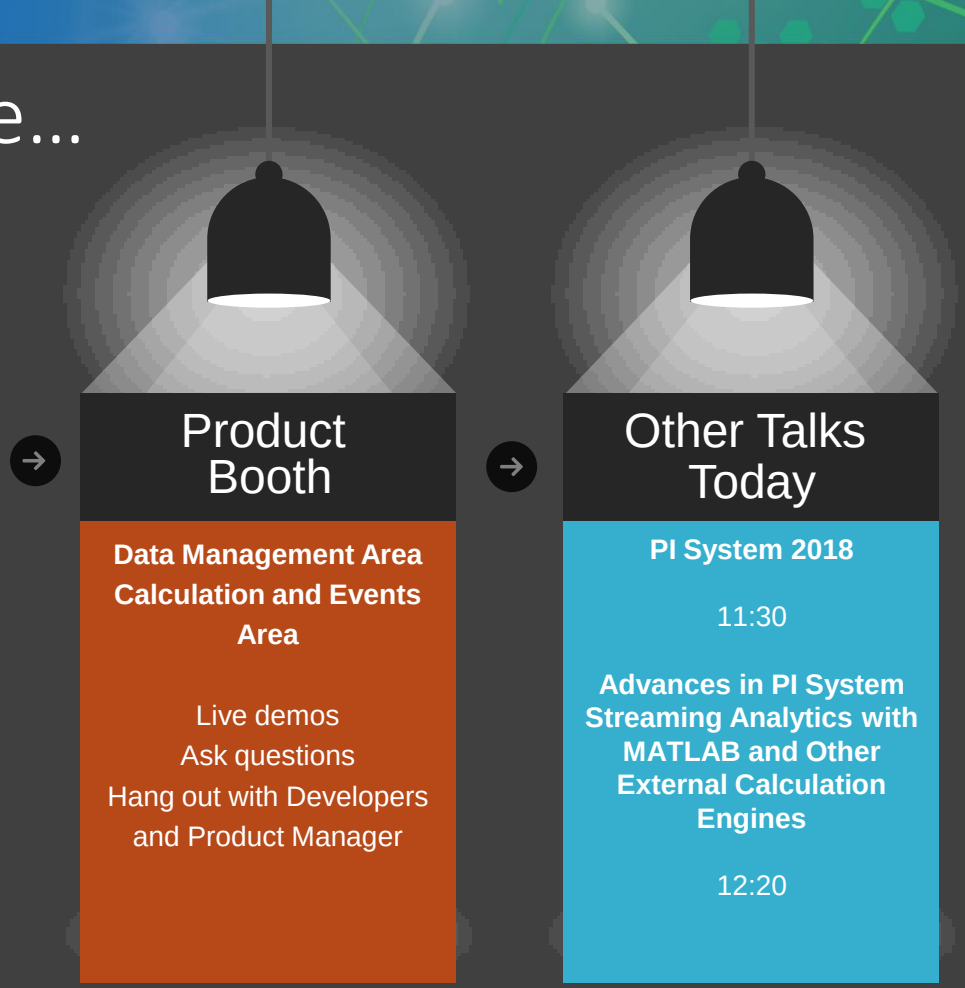
DEMO






Add a new variable
Evaluate
Name
Expression
Value at Evaluation
Value at Last Trigger
Output Attribute
Variable1
Type an expression
Map
Scheduling:
Event-Triggered
Periodic
Trigger on
Any Input
Advanced...
Connected to the PI Analysis Service.

Learn more…



Product Booth

Data Management Area
Calculation and Events Area

Live demos
Ask questions
Hang out with Developers and Product Manager

Other Talks Today

PI System 2018

11:30

Advances in PI System Streaming Analytics with MATLAB and Other External Calculation Engines

12:20

***PI Integrators speed the process** that **brings trustworthy data** to many unique analytical tools*

SAP HANA

PI Integrators 2018

Refined user experience for effortless data preparation

Distributed processing to parallelize jobs in queue

Live streaming updates for evergreen algorithms

Recall…

Are the VAV Units reaching setpoint? At what time?

72%
% Setpoint reached

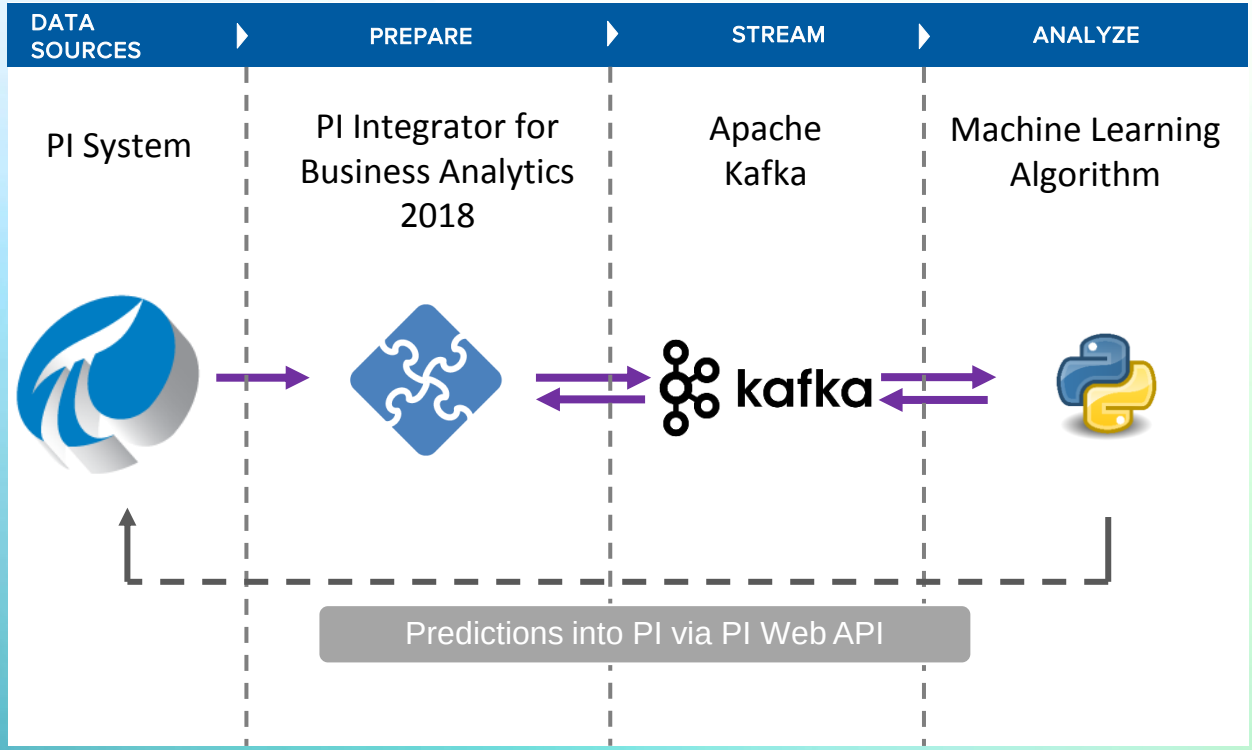
5:38:08
Average end time

Side	Number of Events	% Setpoint reached	Average end time
East	7623	68%	5:48:06
NA	2056	53%	6:45:09
West	10809	78%	5:23:26
Total	**20488**	**72%**	**5:38:08**

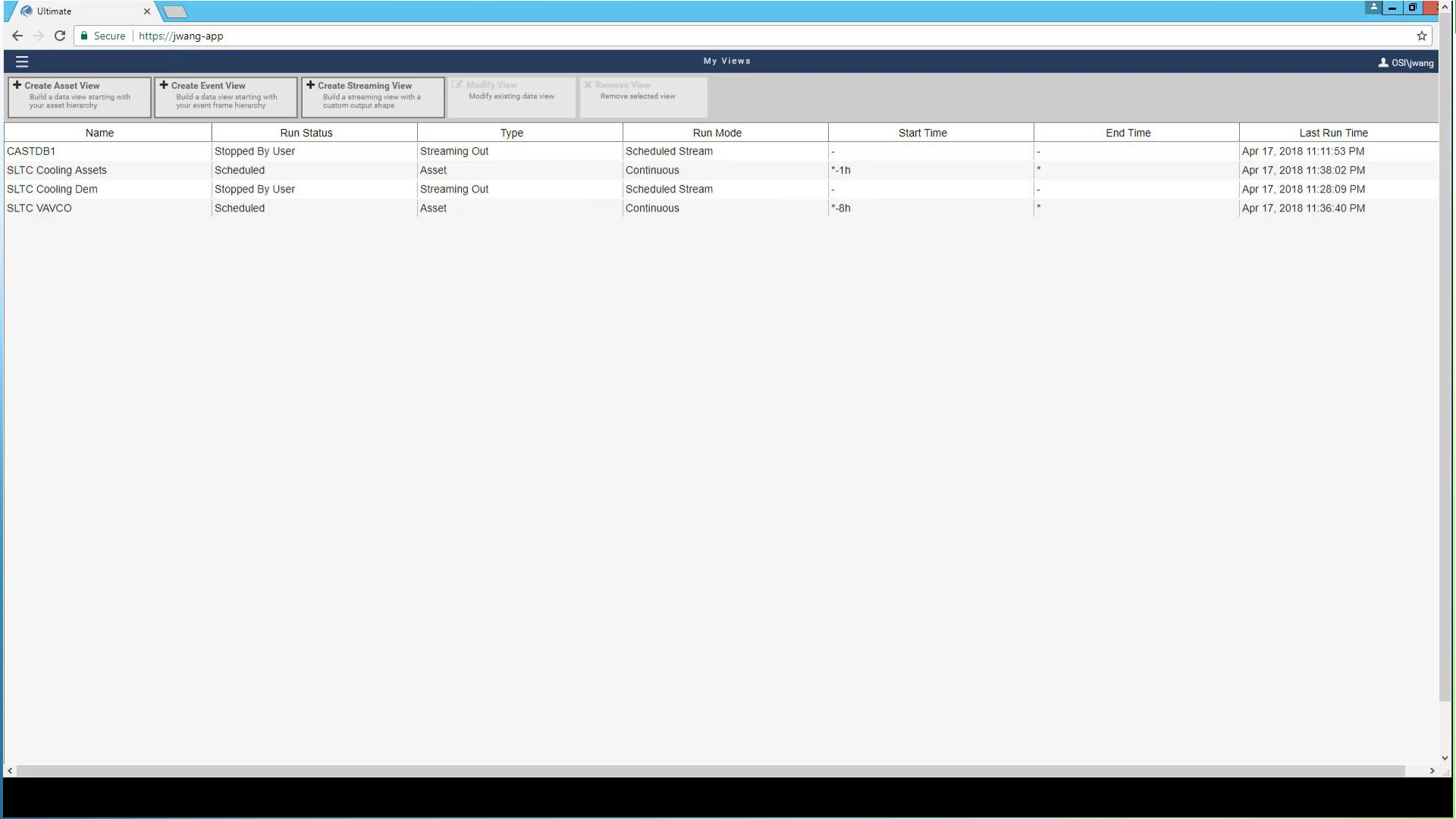
Floor	Number of Events	% Setpoint reached	Average end time
1	2056	53%	6:45:09
2	3[illegible]	74%	5:13:56
3	[illegible]	71%	5:20:35
4	3720	77%	5:43:27
5	2963	74%	5:44:50
6	4860	73%	5:38:09
Total	**20488**	**72%**	**5:38:08**

Can we optimize our current energy usage?

Data Science Enablement with PI Integrators

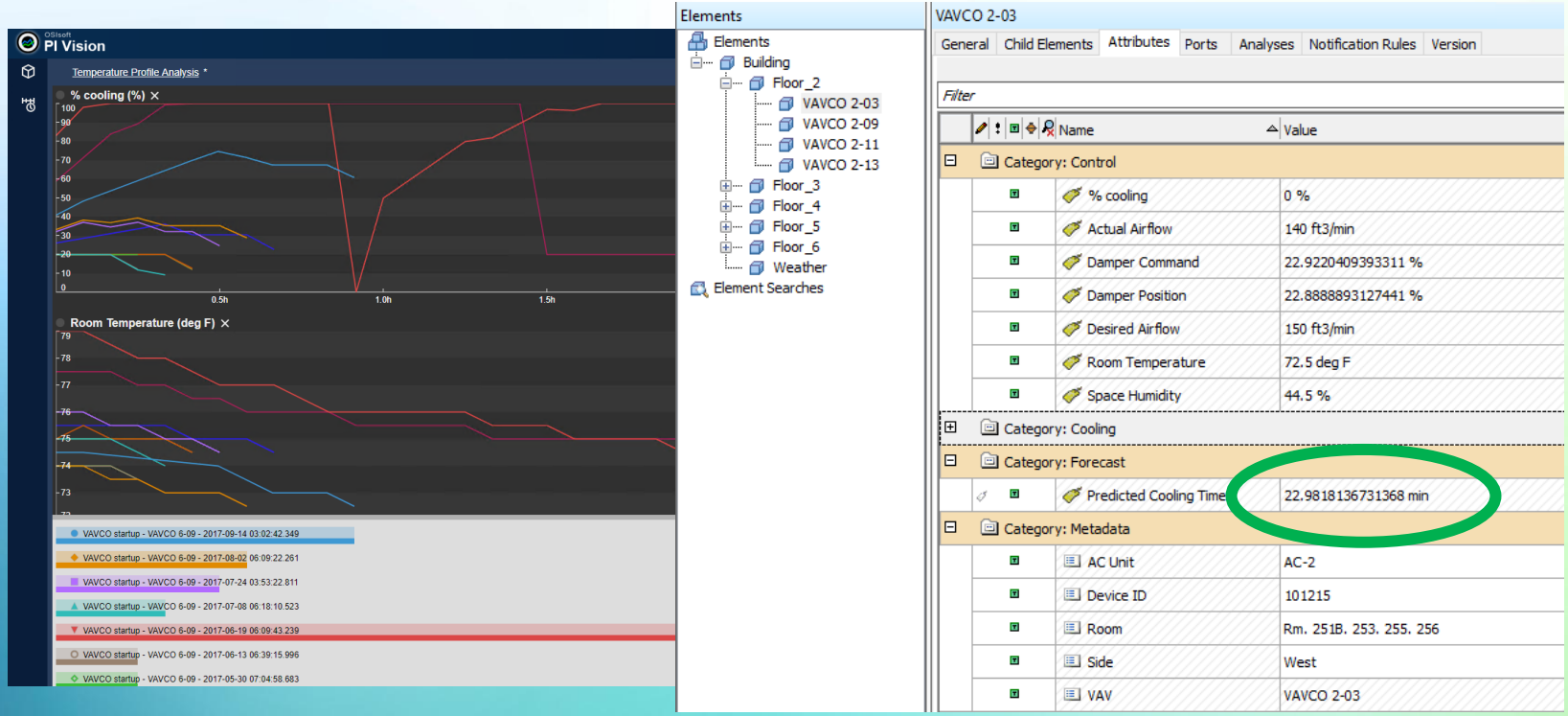


DEMO

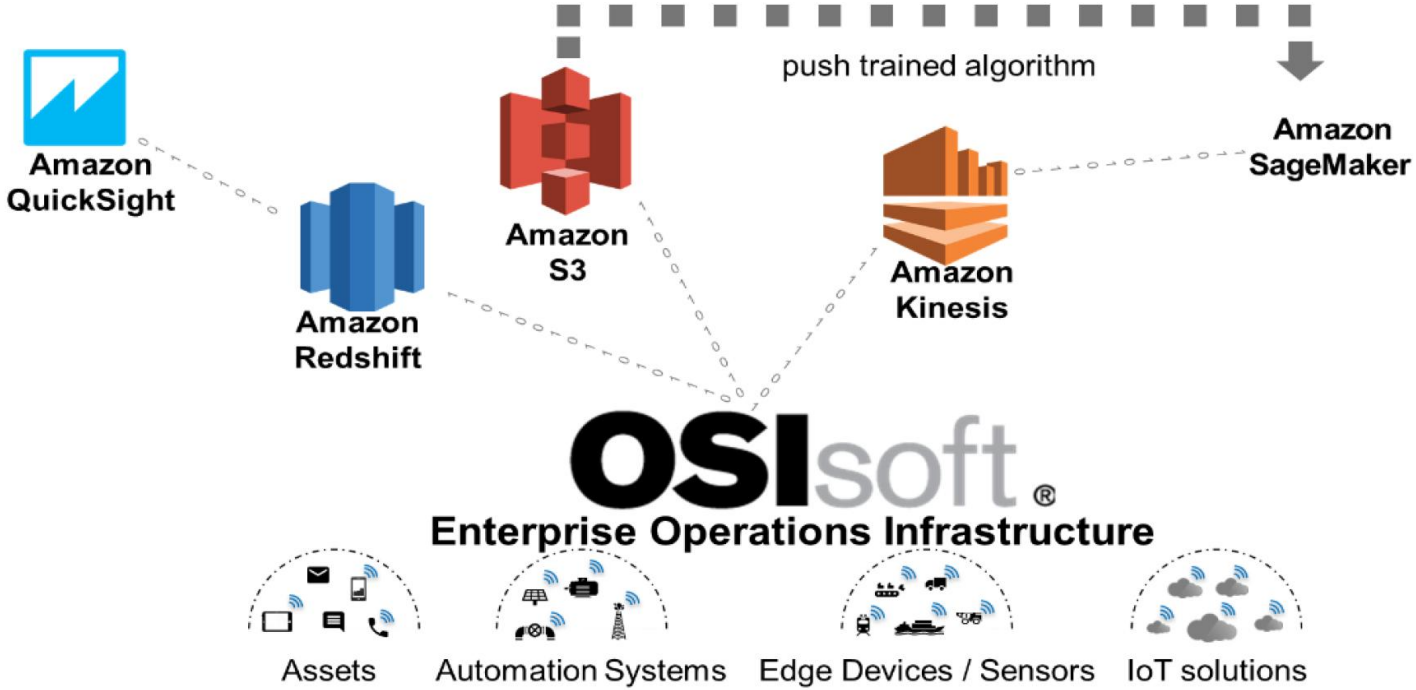


Name	Run Status	Type	Run Mode	Start Time	End Time	Last Run Time
CASTDB1	Stopped By User	Streaming Out	Scheduled Stream	-	-	Apr 17, 2018 11:11:53 PM
SLTC Cooling Assets	Scheduled	Asset	Continuous	*-1h	*	Apr 17, 2018 11:38:02 PM
SLTC Cooling Dem	Stopped By User	Streaming Out	Scheduled Stream	-	-	Apr 17, 2018 11:28:09 PM
SLTC VAVCO	Scheduled	Asset	Continuous	*-8h	*	Apr 17, 2018 11:36:40 PM

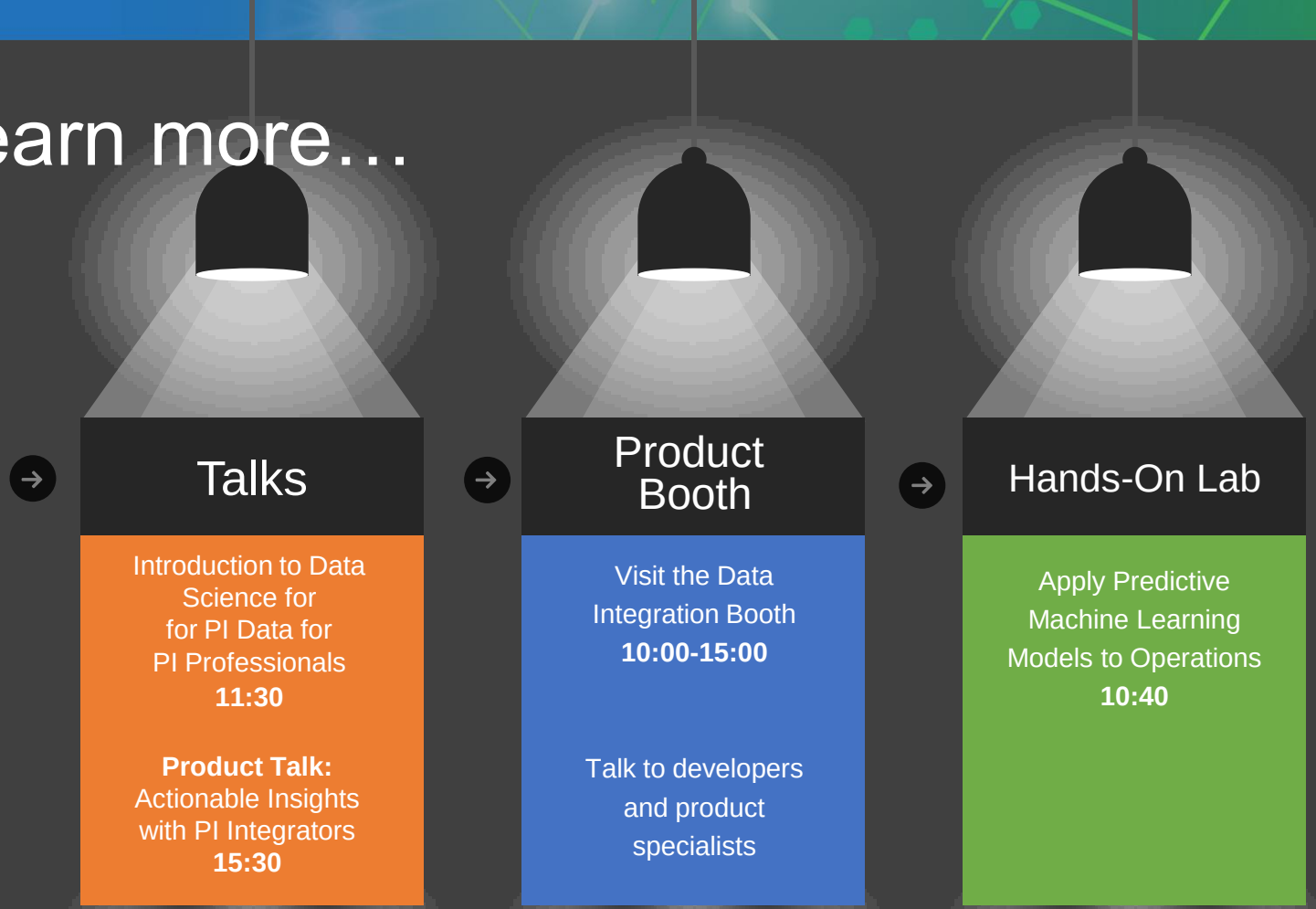
Next Steps for Building Management



PII4BA 2018 R2 – Amazon Web Services



Learn more…



Talks

Introduction to Data Science for for PI Data for PI Professionals
11:30

Product Talk:
Actionable Insights with PI Integrators
15:30

Product Booth

Visit the Data Integration Booth
10:00-15:00

Talk to developers and product specialists

Hands-On Lab

Apply Predictive Machine Learning Models to Operations
10:40

Visualization

Alicia Coppock – Product Manager

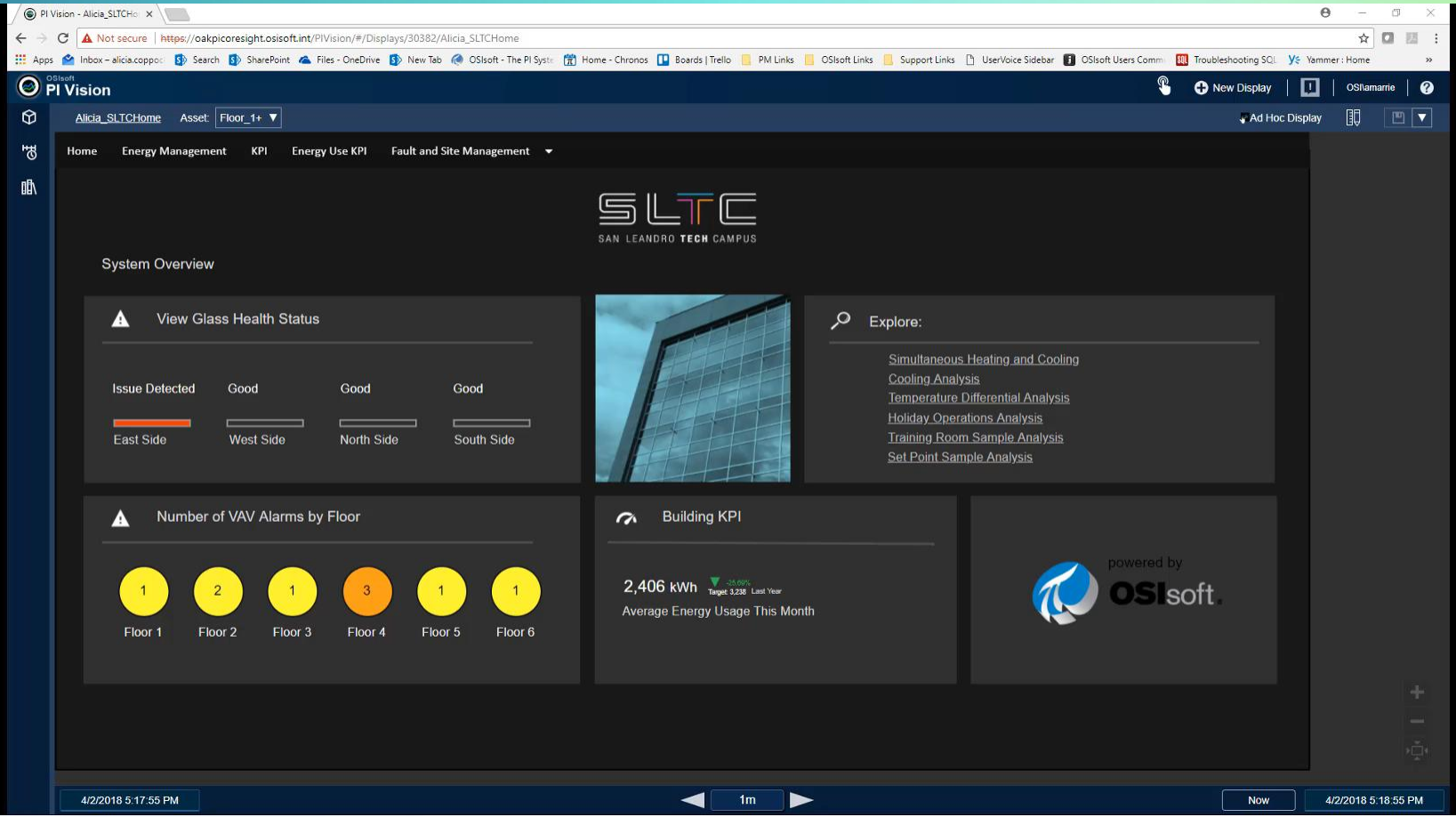
What is PI Vision?

The fastest, easiest way to visualize PI System data

- Access data from any web browser, including mobile device browsers
- Collaborate and share comments across the company
- Deploy and roll-out rapidly

PI Vision

We are embarking on a **unified visualization infrastructure** to deliver a seamless, powerful, extensible experience.



PI Vision 2019

PI ProcessBook Migration Tool

New Ad-hoc Experience

Streamlined security for XY plot and Events Table

Learn more…

Talk

PI Vision: Real-time Monitoring and Analysis for the Enterprise

TODAY
12:20

Product Expo

Talk to developers and PMs

Ask questions

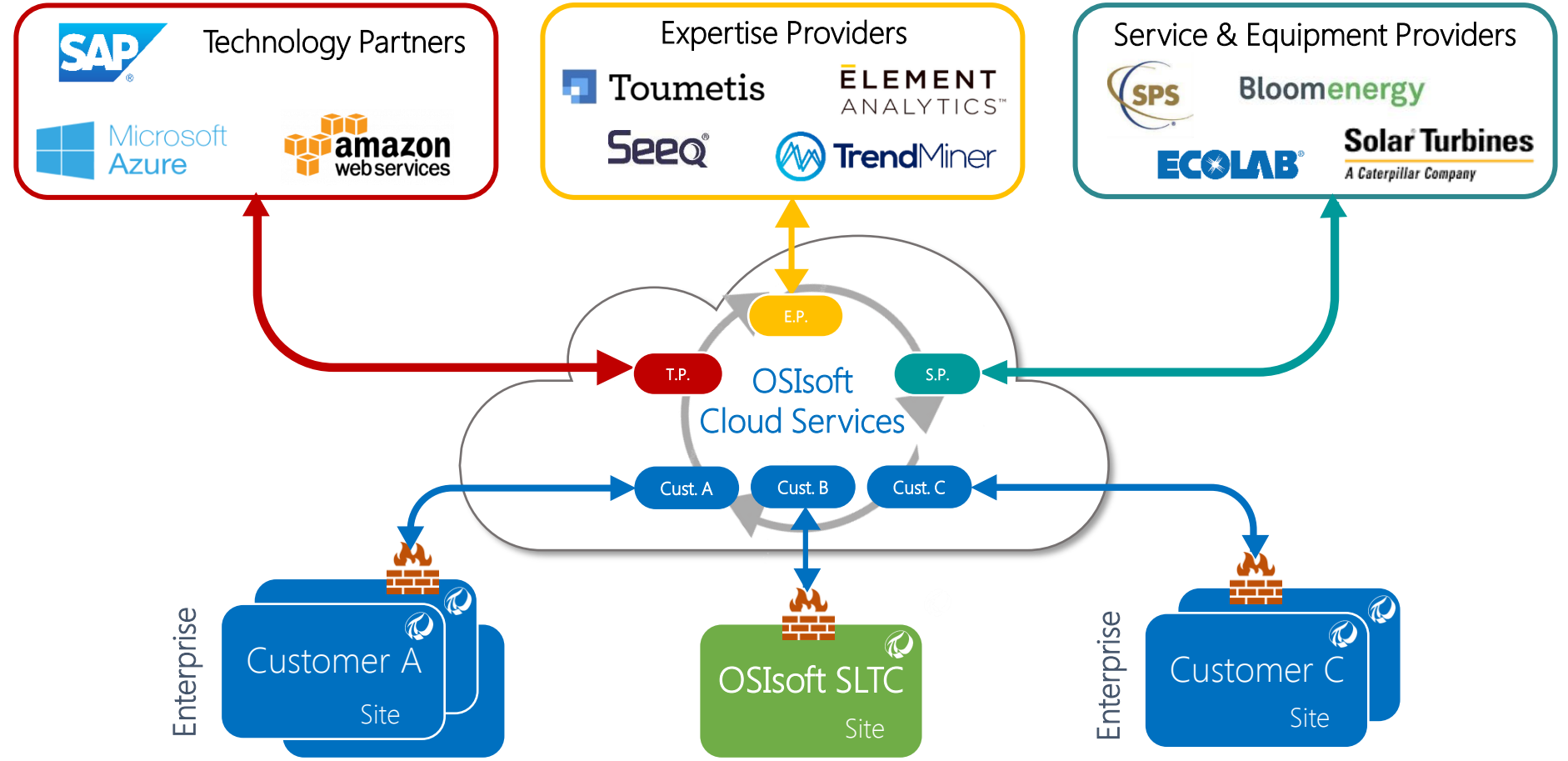
Demos

OSIsoft Cloud Services (OCS)

Laurent Garrigues – Product Manager
Michael Saucier – CEO, Transpara

OSIsoft Cloud Services Vision

Develop & maintain an
operational data ecosystem
that connects **you** (the customer)
with best-in-class Analytics and
your community of vendors & partners.



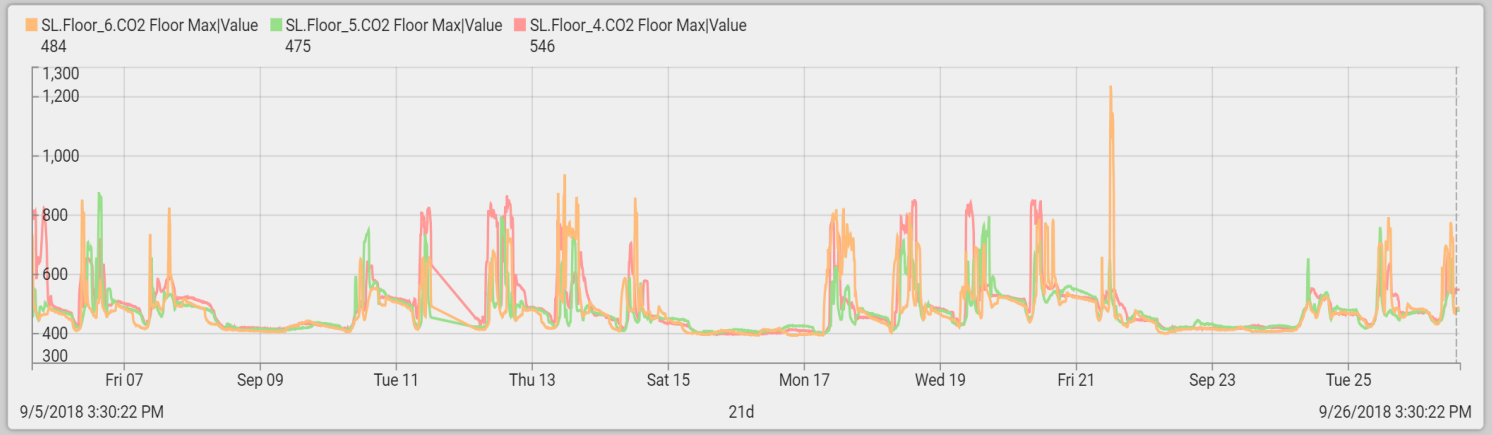
OCS Partner Preview Participants

OCS Partner Preview Participants

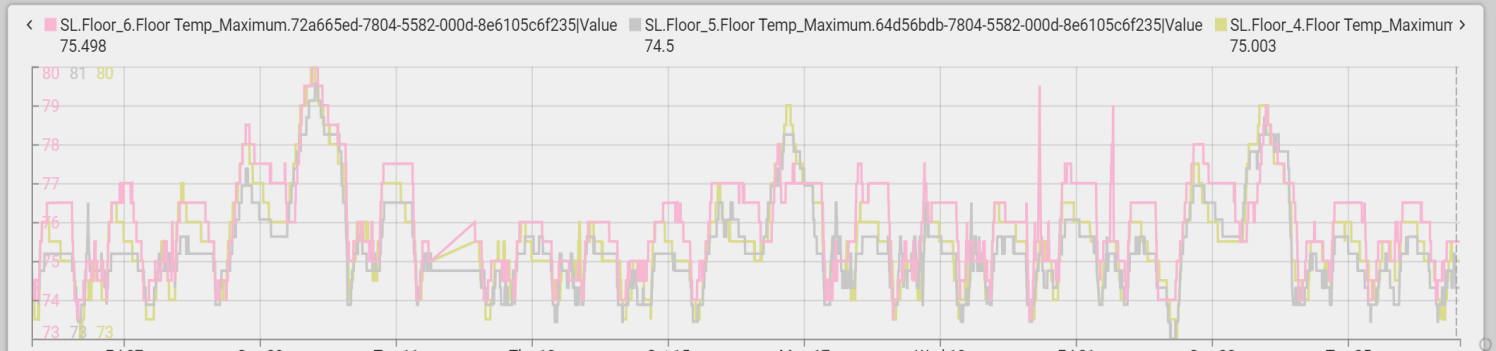
Navigation

- Home
- Learn & Explore
  - API Documentation
  - Code Samples
  - Security
  - API Console
  - OMF Editor
- Data Services
  - Namespaces
  - Ingress
  - Storage
  - Displays
  - Communities
- Access
  - Data
  - Client Keys
  - Users & Roles
- Support
  - Logs
  - Services Blog

CO2 Levels in SLTC



Temperature in SLTC

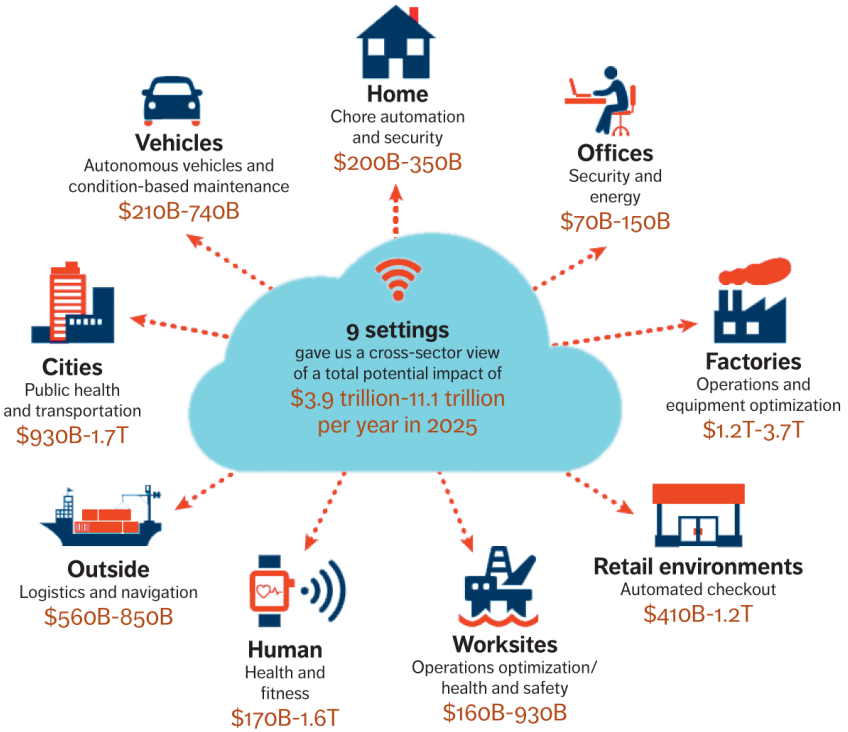


New Possibilities

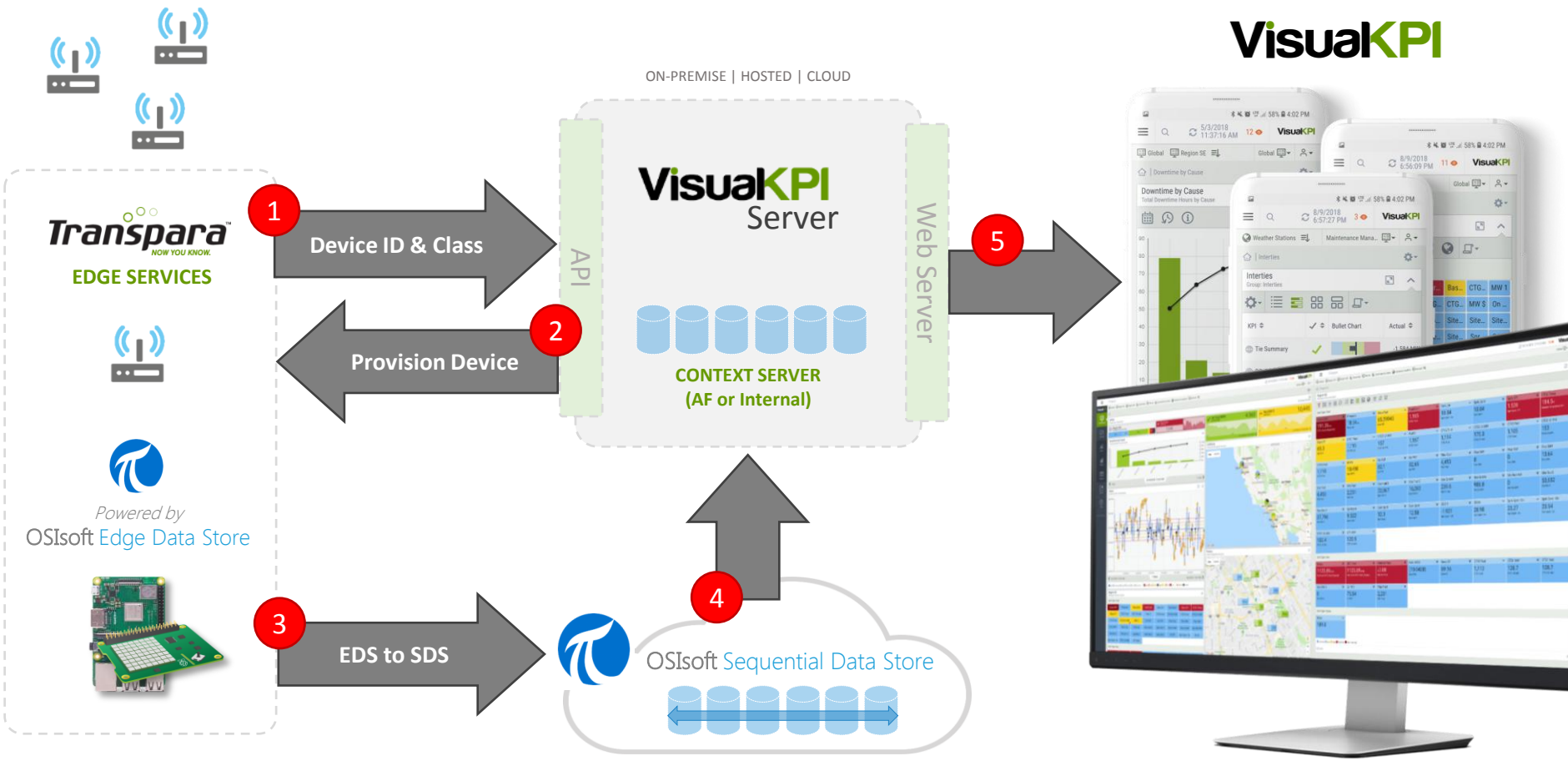
- Low cost, commodity sensors
- Low power, small footprint, high volume, no touch
- Occasionally connected, wireless-ready
- Remote and/or mobile assets
- Outside the DCS or PLC (due to age, cost, effort)
- Benchmarking / compositing

New Opportunities

- Industrie 4.0 & Brownfield modernization
- New applications (e.g. vertical farming, drones)
- Smart cities / infrastructure as a service
- Autonomous vehicles
- Data as a business (e.g. Streamr, Quandl, PJM, National Grid)
- Uptime as a service



Source: McKinsey Global Institute, June 2015



DEMO

Edge Data Store with Transpara Visual KPI

Try it yourself on any device:

http://dev.transpara.com/demo

Learn more…

PI World Day 3 Summary

Chris Nelson, OSIsoft, VP Engineering
Gregg Le Blanc, OSIsoft, VP Product

Day 3 Highlights

Product Track

- PI System 2018 & OSIsoft Cloud Services
- Pervasive Data Collection
- Visualization
- Integrators and Integration

Day 3: Analytics Track Room 114, P1 Level	Day 3: Developer Track Room 116, P1 Level	Day 3: PI Admin Track Room 117, P1 Level	Day 3: Product Track Room 113, P1 Level
10:40 - 11:20	10:40 - 11:20	10:40 - 11:20	10:40 - 11:20
Introduction to Time-Series Analysis with PI System Data	PI Developers Club Community - Developer Technologies Roadmap	Hardcore PI System Hardening	OSIsoft Cloud Services
11:30 - 12:10	11:30 - 13:00	11:30 - 13:00	11:30 - 12:10
Introduction to Data Science for PI Data for PI Professionals	LiveCoding: Writing Highly Performant PI Web API Applications	LiveCoding: Getting the Most Out of the New AFSearch	PI System 2018
12:20 - 13:00	14:30 - 16:15	14:30 - 16:15	12:20 - 13:00
Advances in PI System Streaming Analytics with MATLAB and Other External Calculation Engines	HowTo: Writing applications at the Edge with OSIsoft Edge Data Store	HowTo: Streaming Calculations with the PI System and MATLAB and other Computation Engines	PI Vision: Enabling Real-Time Monitoring and Analysis for the Enterprise
14:30 - 15:15			14:30 - 15:15
Data Science with R and the PI System			Pervasive Data Collection - Connectivity from A to Z
15:30 - 16:15			15:30 - 16:15
PI System Analytics, Fit for Purpose			Actionable Insights with PI Integrators

Welcome to PI World 2018
Dev Con

Mike Sloves, OSIsoft, Director Technology Enablement

A Dedicated Time for PI Geeks

- Day 3 AND Day 1!
- Talks
- Hands-On Labs
- Exciting new changes
- Hackathon Awards Tonight

Who should attend?

- If you are…
  - A Developer
  - A Data Scientist
  - A Business Analyst
  - A Security Professional
  - A PI System Administrator
  - Someone that LOVES being a GEEK!

What's going on at Dev Con

- Talks and a Roadmap Discussion
  - Customer or Partner interested in upcoming features
  - Extreme PI System Hardening
  - Streaming Calculations using MATLAB and PI
  - Fog Computing
  - Writing Highly Performant Web API Code
- Hands-On Labs
  - Building Symbols in PI Vision 2018 Extensibility
  - Advanced Analytics for PI Data for Data Scientists
  - Introduction to PI Developer Technologies
- And A LOT MORE!

What's Changed This Year

- Live-Coding
- How-To's
- The "PI Geek" Track on Day 1
  - **YOU** provide the content!
  - DataOps toolchain for Continuous Control Monitoring
  - Migrating Performance Equations to AF Analytics
  - Accelerate PI AF with Cognitive Computing
  - Monitoring Data Quality with Asset Analytics

Hackathon Changes

- Programming Hackathon is now the *Innovation Hackathon!*
  - Solution to Challenges are more Data Science than Programming
  - All skillsets are welcome to participate
  - Bring your own tools or use ours
- Special Thanks to DEME for being Data Sponsor
- 70 People Registered!

Awards

- At the Closing Fiesta this evening @ 4:30
- Hackathon Winners
  - 1st Place – Intel NUC, Free Registration
  - 2nd Place – BOSE SoundLink Wireless Headphones, 50% Registration
  - 3rd Place – Raspberry PI Retro Gaming Kit

Final Words of Wisdom

```
// How real programmers play Russian Roulette
$bash-4.4 [$[$RANDOM % 6]==0] && rm -rf /* || echo *Click*
```

Questions?

Please wait for the **microphone**

State your **name & company**

Please rate this session in the mobile app!

Thank you!

Chris Nelson
cnelson@osisoft.com
VP, Engineering
OSIsoft, LLC

Gregg Le Blanc
gleblanc@OSIsoft.com
VP, Product
OSIsoft, LLC