Enterprise IIoT and Analytics in the Process Industries

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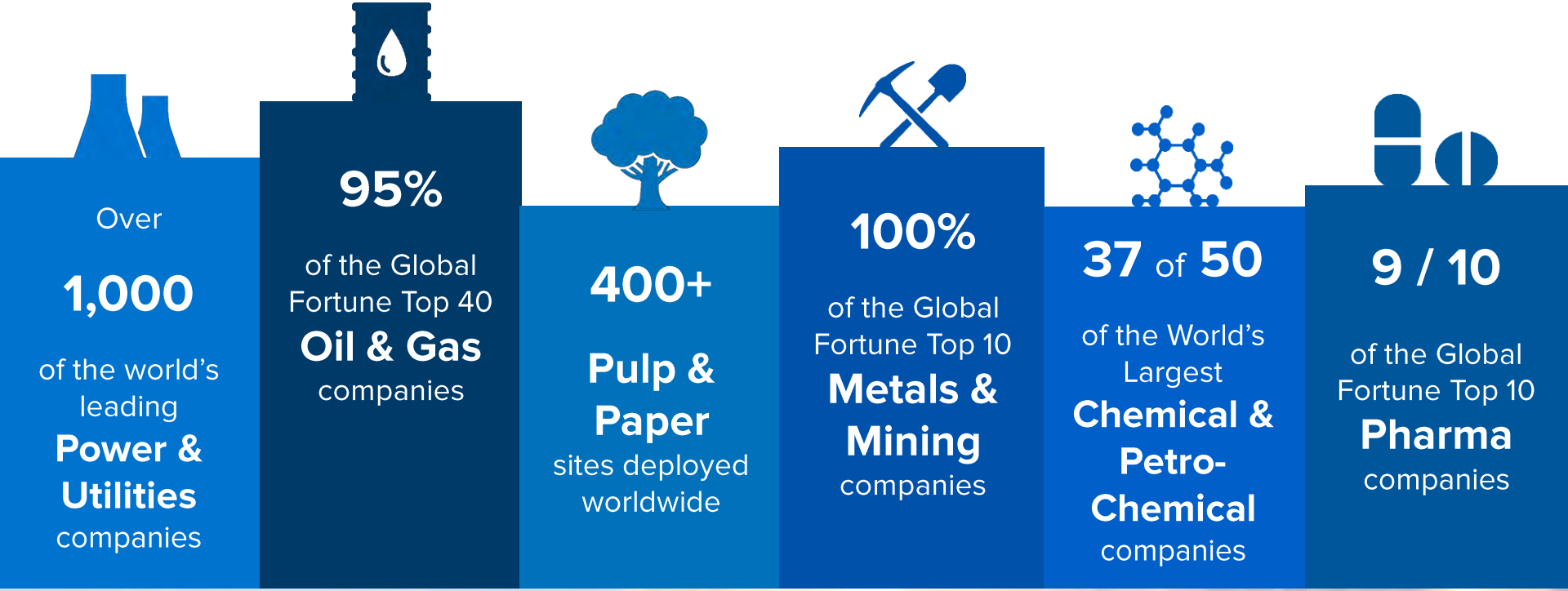
John Matranga, Director of Customer Innovation and Academia, OSIsoft
Ahmad Fattahi, Manager of Data Science Enablement, OSIsoft

OSIsoft

Stanford


We believe People with Data
can Transform their world

OSIsoft is Trusted by the World's Leading Companies



38+
years as a leader

140+
countries installed in

20,800+
sites deployed

2B+
licensed sensor-based data streams

65%
of the Industrial Fortune 500 use us

Top 5 priorities when buying industrial IoT products

Priorities have changed over time; Cybersecurity has come to the top

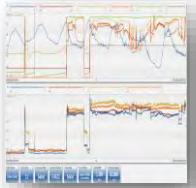
Most important IoT product purchase factors besides basic function
Top 3 of 12 analysis

Note: Total respondents = 1161

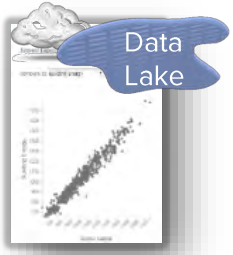
Data Infrastructure Approach to Digital Transformation

Operations
Real-time Monitoring

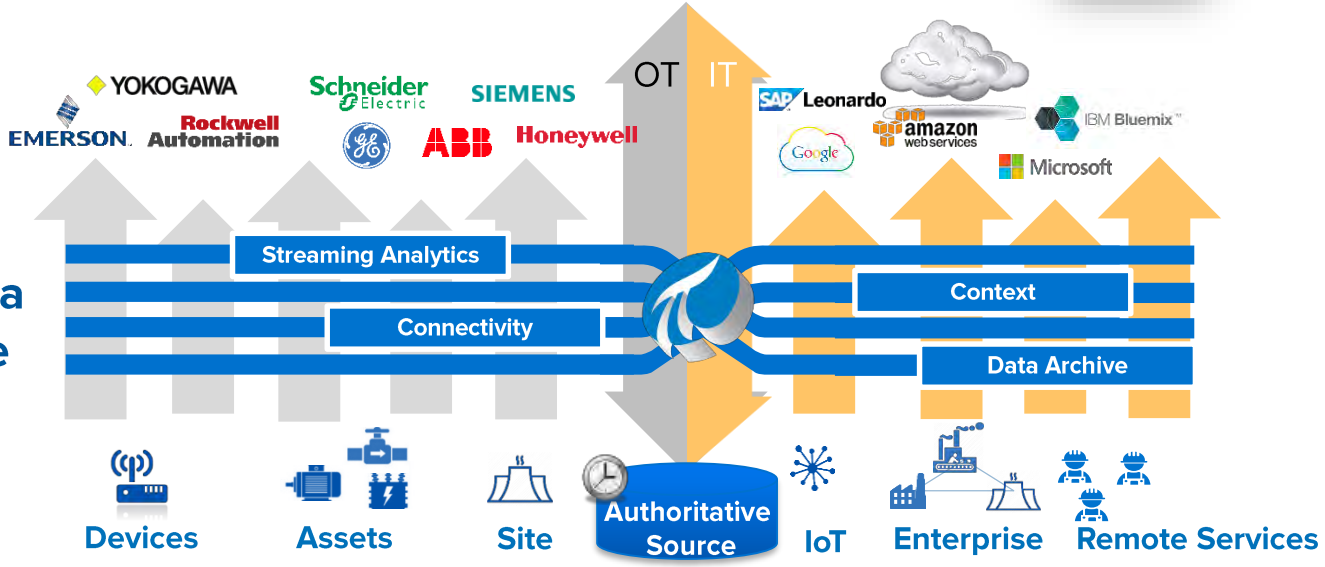
Operations
Self-service Access



Analytics



Enterprise Data Infrastructure



The PI System Allows You To Securely, Automatically...

Collect

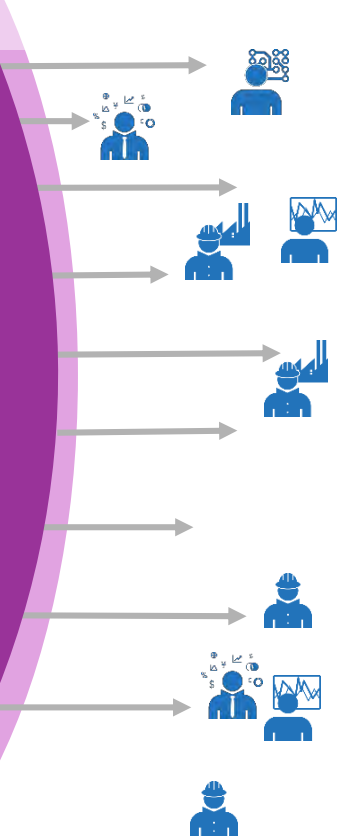
data using
PI Interfaces and PI Connectors

Manage & Enhance

data within the
PI Data Archive and PI Asset Framework

Deliver

data via
PI Client Tools and PI Integrators



Early Control Room – Circa 1960's

- Central Control Room
- Hundreds of sensors
- Silos of Signals
- Analog Readouts
- Home Runs Needed for Piping and Wires
- Integration at the Human
- Simple Control

Picture Source: en.wikipedia.org/wiki/Distributed_control_system

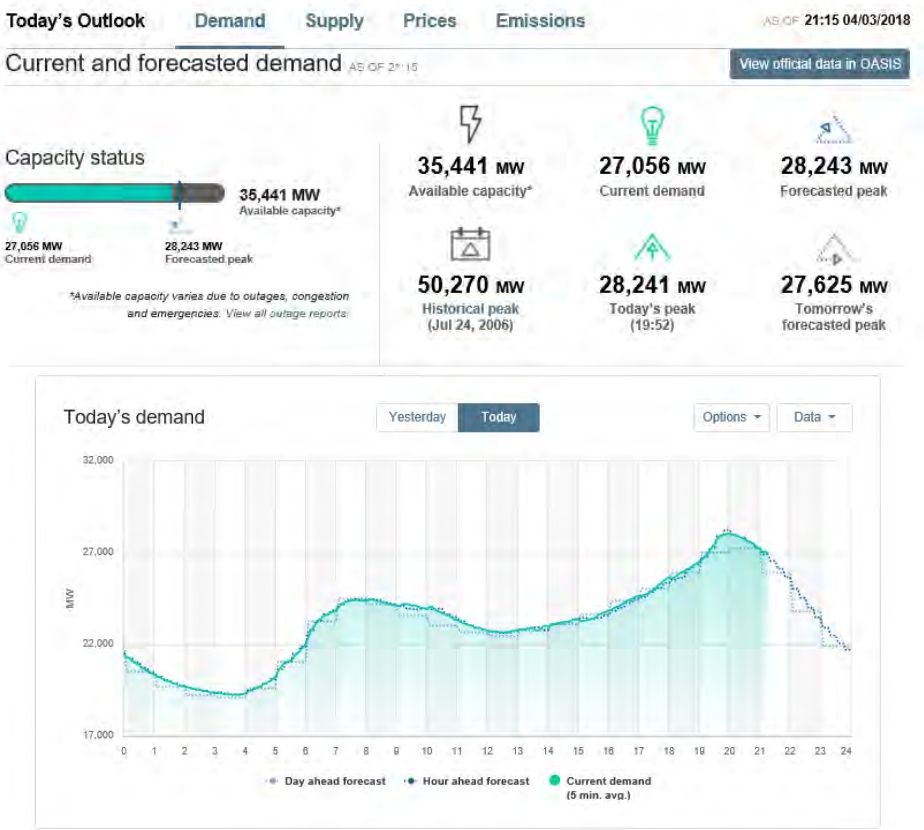
Distributed Control System (DCS)

- Introduced Late 70’s
- Thousands of sensors
- Rolled Out In the 80’s/90’s
- Updated Slightly Over Time
- DSC Allows for Plant-wide Control
- Advanced, Multivariable Control
- Typically multiple DCS in a plant (7 in HI Independent)
- VAX >> Unix >> Windows

Picture Source: en.wikipedia.org/wiki/Distributed_control_system

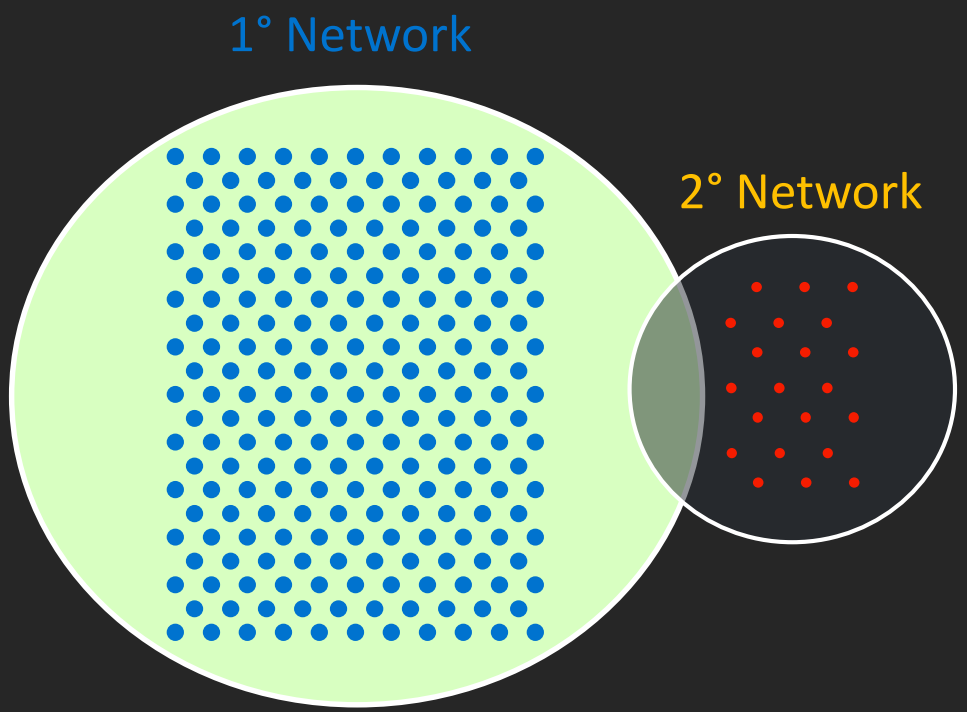
Electrical Infrastructure Supply Chain - Today

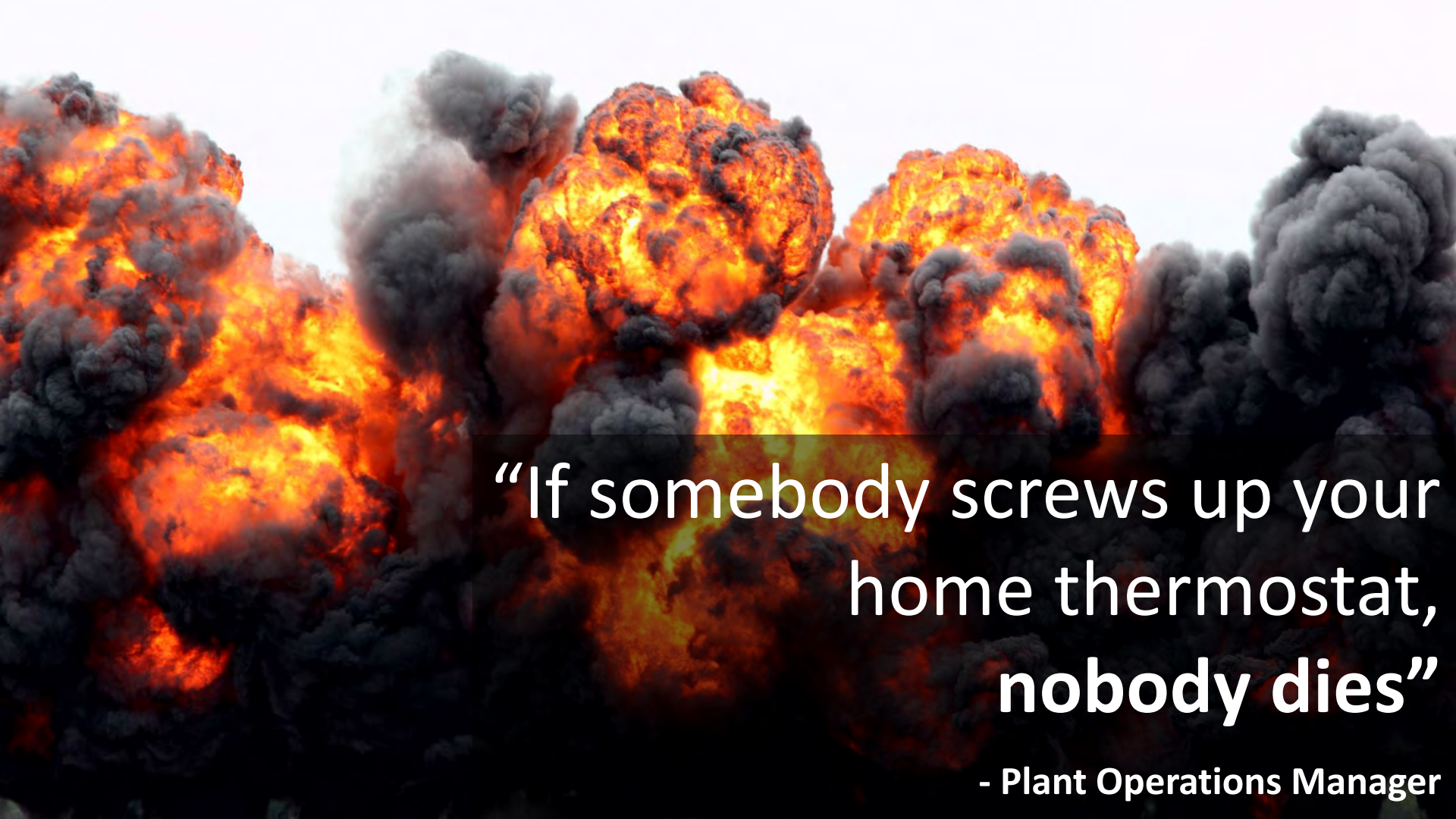
Redundant, Distributed Control Center
Geography Dispersed/Diverse Control
Cross Company Business Control
(Circa 1990's - Today)



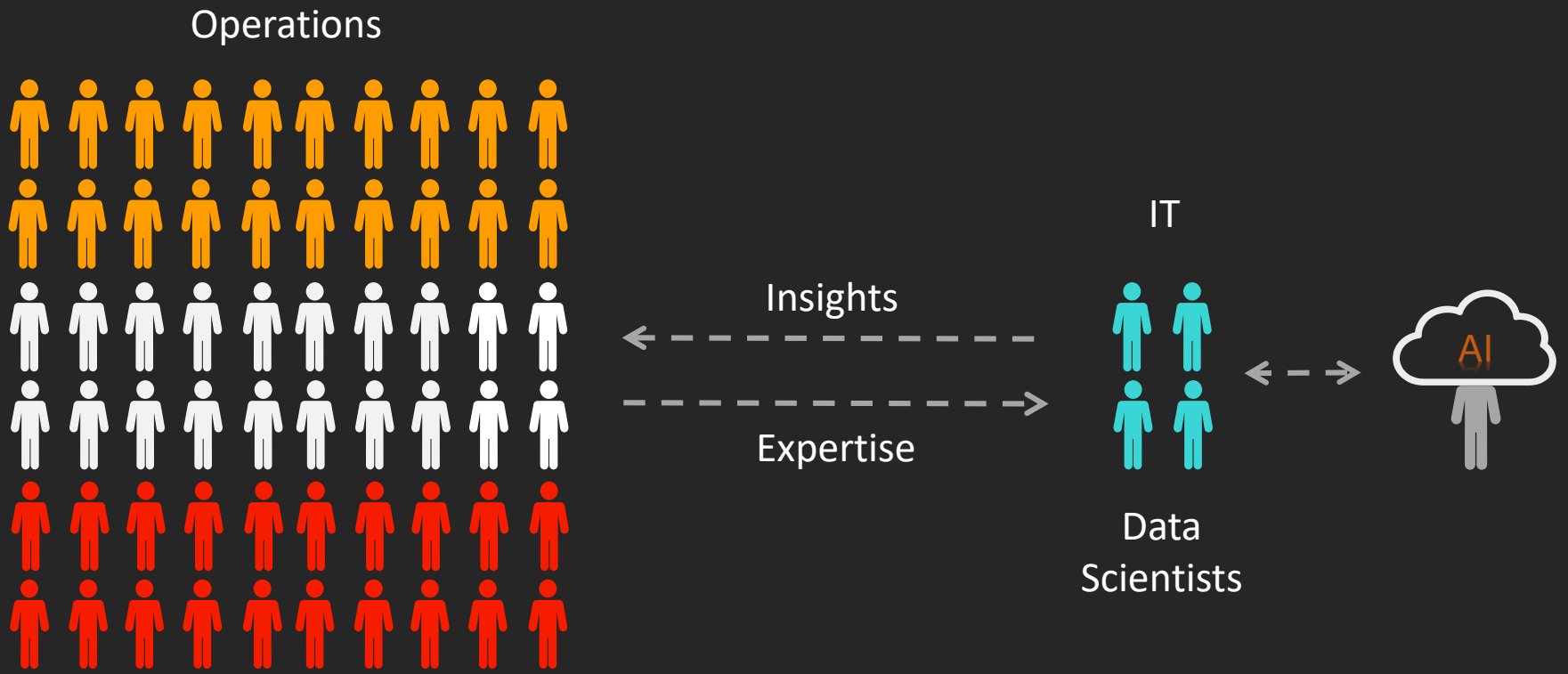
Source: California Independent System Operator (CALISO)

The **reality** of **new sensors today**

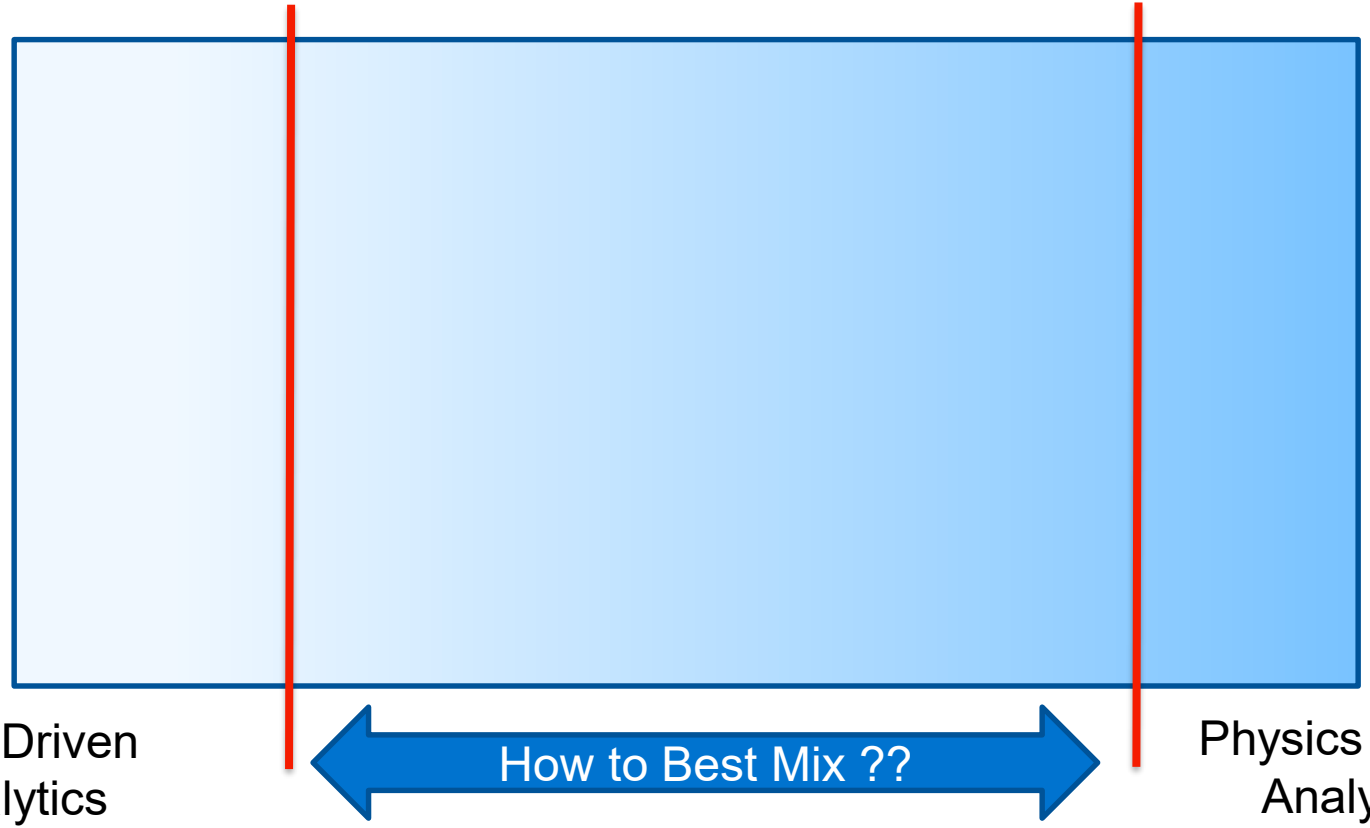



“If somebody screws up your home thermostat, **nobody dies**”
- Plant Operations Manager

Reality of data science today



Data and 1st Principles Physics



Real-World Examples from Process Industries

Oil and Gas

Real-time Estimations and Online Learning for Industrial Assets at Total - Total

TOTAL: Committed to Better Energy

[1] Based on market capitalization in U.S. dollars at December 31, 2015

Oil and Gas

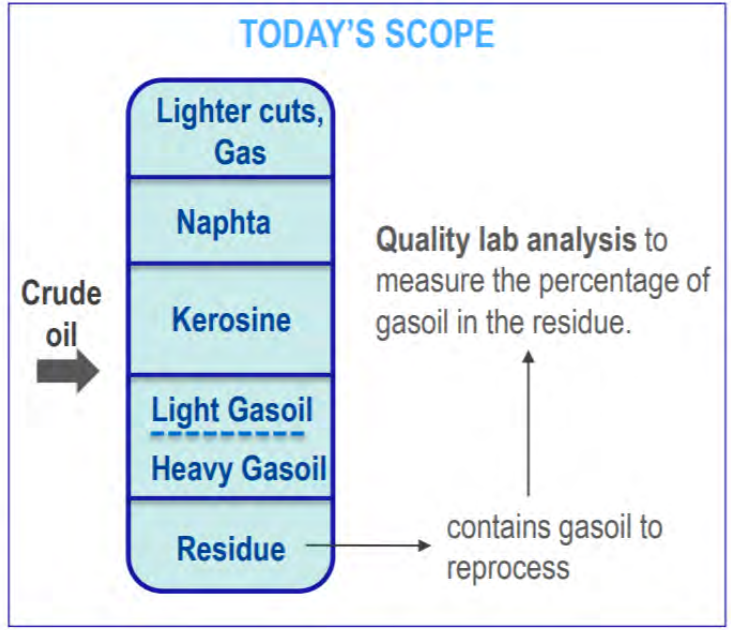
USE CASE

BUSINESS OBJECTIVE

Increase lab & units efficiency using advanced analytics

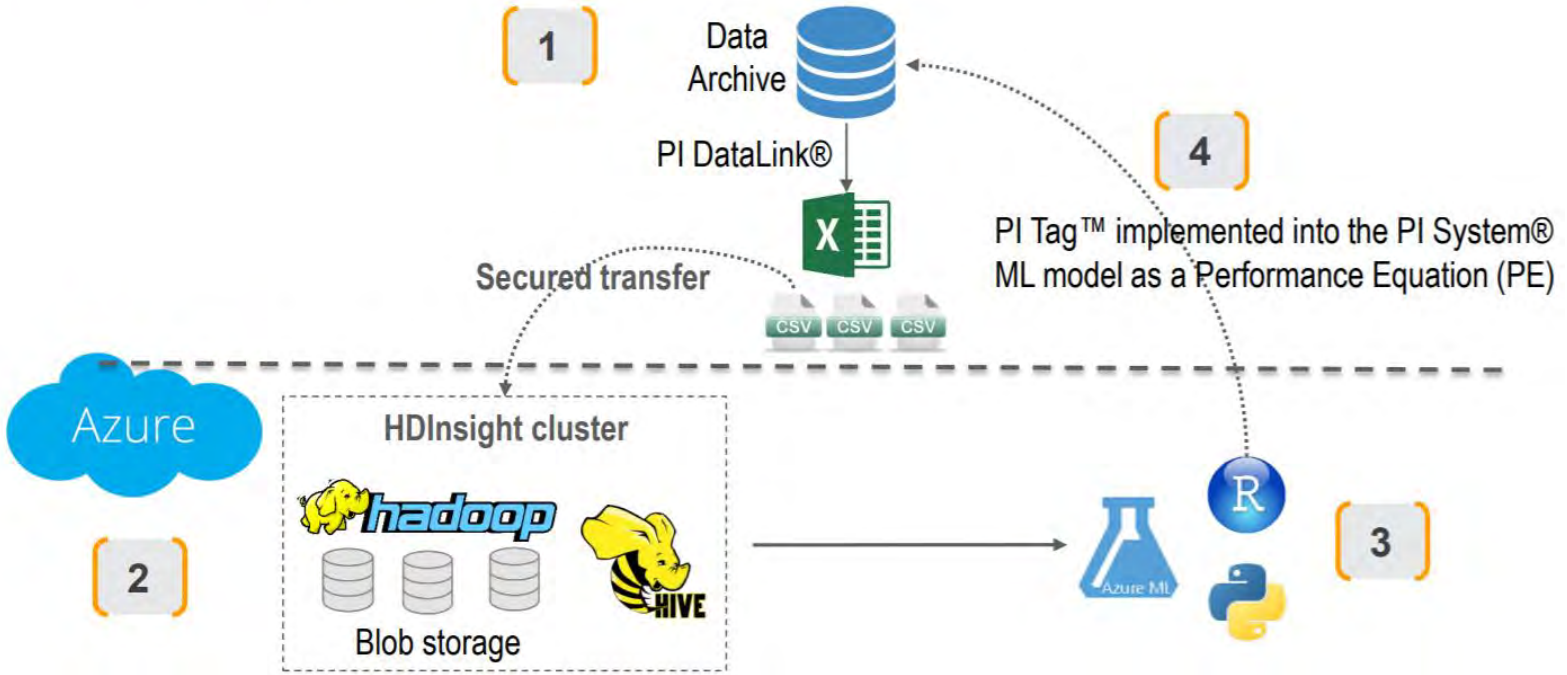
- **To reduce the amount of samples** processed that bring little or no added value
- To help the process experts **to improve units outputs**

A proof of concept: estimating crude distillation quality for Antwerp refinery



Oil and Gas

ARCHITECTURE & WORKFLOW



Oil and Gas

CONCLUSIONS

BUSINESS OBJECTIVE

Increase lab & units efficiency using advanced analytics

DATA SCIENCE SOLUTION

Online learning to estimate the % of gasoil remaining in the residue of a distillation unit

- **An automated workflow** to extract data, compute several models and provide data scientists and Business experts with an updated dashboard

ADDED VALUE

Short term impact

- The proposed workflow is **easy to both install and generalize many ML models** for quality estimation
- **Provide a clear and updated view of unit's quality** to the Business at any time

Long term impact

- Important **reduction of processed samples** that bring little or no added value

Food and Beverage

Brewing Beer the Smart Way – Deschutes Brewery

About the Brewery

- Pub in Bend, Oregon est. 1988 – Brew 1
- Production facility in Bend, Oregon est. 1993 - Brew 2
- Pub in Portland, Oregon est. 2008 – Brew 3
- 8th largest craft brewery in the US in 2017.
- Distribution in 28 states and District of Columbia.
- Produced over 300k bbl (9.5M gal) in 2017.
- Began using the PI System in 2015.

Food and Beverage

Challenges Prior to the PI System

- Missing, late, or inaccurate data entries.
- Inefficient process historian.
  - Large amounts of time spent searching for data.
  - Difficult to compare batch data.
  - Limited licensing.
- Large amounts of time spent on building spreadsheets.
- Late action on yeast disposal or harvest.
- Lack of real-time data between manual sample collection.

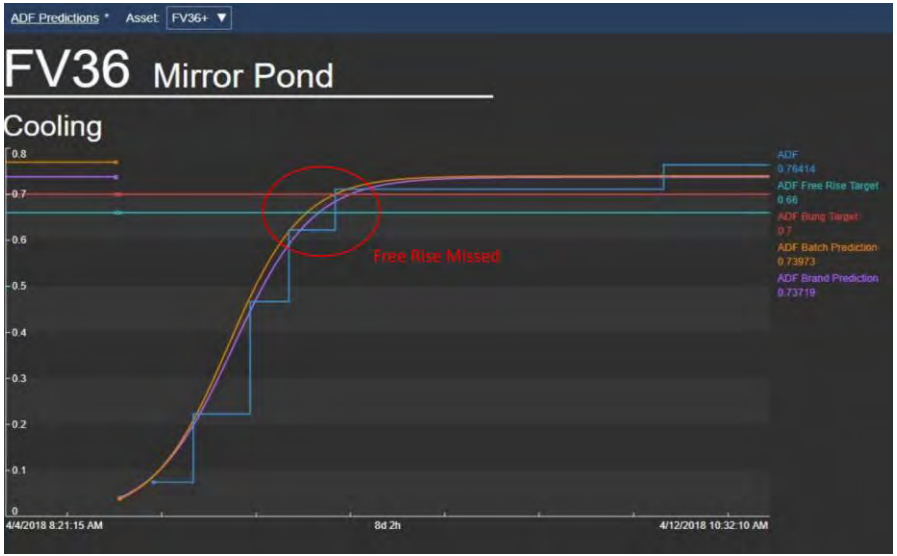
Solution: Leverage Asset Framework, Asset Analytics, and PI Vision.

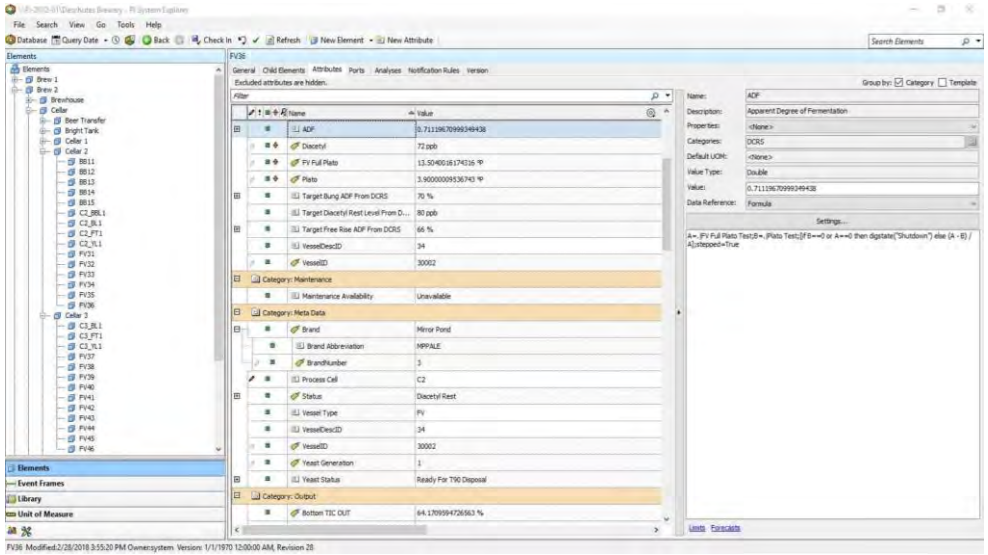
Food and Beverage

Old School Data Management

Food and Beverage

Modernized Data Management – Historical, Real-Time, and Predictive





Food and Beverage

Brewing with the PI System

Deschutes Brewery wanted to provide **Real-Time** data and analytics to Brewers and Quality Technicians in order to increase efficiency and improve the quality of beer for our fans.

CHALLENGE

Reduce spreadsheets, product non-conformities, decreased yield, and lost time associated with delays in data.

- Manual data entry in complicated spreadsheets could result in miscommunication across shifts.
- Biological processes are difficult, costly, or impossible, to track in real-time.

SOLUTION

Create dynamic, real-time displays for operators that leverage a variety of PI System tools.

- Asset Framework
- Asset Analytics
- PI Integrator for Microsoft Azure
- PI Vision

RESULTS

Reduction of time spent on generating spreadsheets, lost time, and non-conformities associated with bad or missing data leads to increased cellar capacity.

- 4% decrease in total fermentation time.
- 2% decrease in diacetyl rest time.

Power Generation

Optimizing Predictive Maintenance by Integrating Vibration Data and Process Data
Silicon Valley Power

Donald Von Raesfeld (DVR) Power Plant

Santa Clara, CA - Operating since 2005

148 MW Combined-Cycle Plant

2 LM6000 gas turbines

1 steam turbine

150+ balance-of-plant assets (BOP)

90% of sales come from commercial customers

Commercial: 9,000 customers

Residential: 45,000 customers

Power Generation

Unplanned Downtime of BOP still a big problem

Comes with significant repair costs and reduced capacity

Ex 1: Gas turbine shutdown
For 4 weeks after generator fan failed

Ex 2: Reduced overall capacity
Due to condensate pump downtime

Power Generation

IIoT Advantage: More simple, more affordable

No wiring costs

No PLCs required

No dedicated server hardware

No systems admin needed

Power Generation

IIoT system prevented unplanned downtime

Principles of Analytics for Process Industries

You need a Solid Business Question

Focus on **Business Value**

- Sharp
- Supported by existing or feasible data

Then start brainstorming ideas

- Open to a large volume of ideas

Narrow down

- Include SMEs and data professionals

Start building

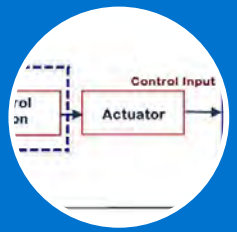
- Build KPI measurements in the process

Constantly validate with SMEs

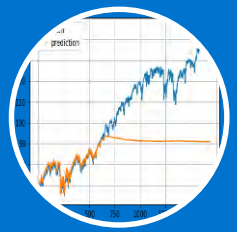
Different Personas Have Different Goals

Business Goal	Analytics Goal
Reduce the cost of production	Identify what variable contributes most to scrap material
Increase profit margin from Unit A	Optimize the choice input material based on market price/demand
Improve the quality of our hires	Identify success measures and translate into indicators on resumes
Make us safer against cyber attacks	Identify anomalies in our network traffic beyond significance threshold

Is the goal of the project to…



control?

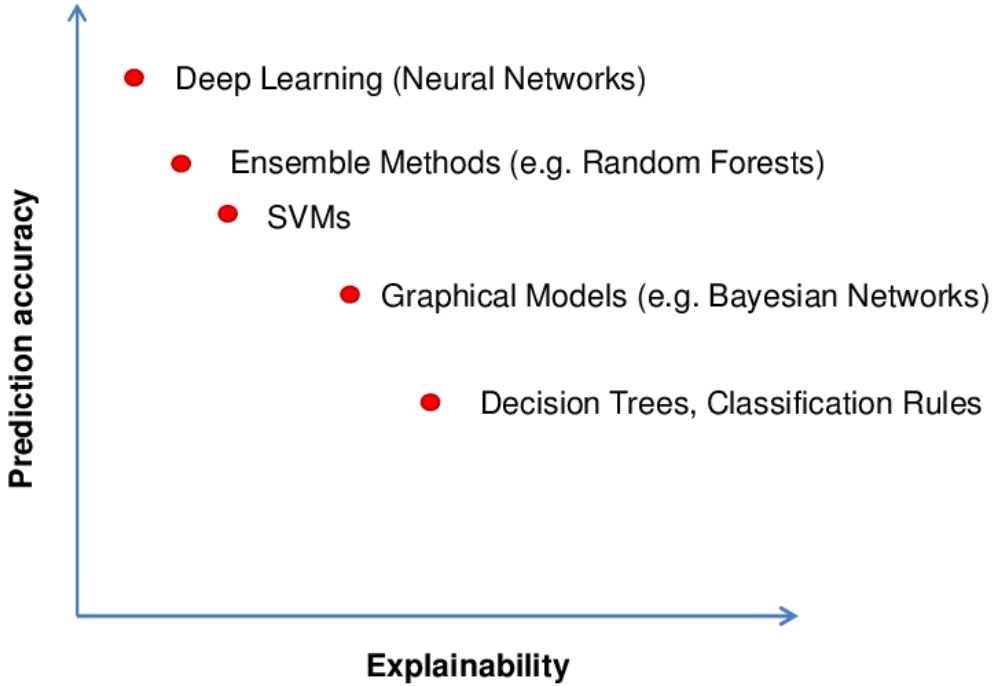


predict?

Why Model Explainability Matters?

- Winning trust for a critical system
- Regulatory reasons
- Improve chances of approval
- Post-mortem analysis in case of failure is crucial

The Explainability Tradeoff



Source: ResearchGate GmbH

Computational Complexity Is Important

Data Engineering as Important as Data Science

- Development is different from Production
- Data Governance challenges
- Latency
- Regulatory considerations
- Engineering cost matters

Some Soft Factors

Balancing doubters and overly-zealous personas can be tricky

You need Subject Matter Experts

- Features often need to be engineered from raw data

Fundamental challenges in mature companies

- Eric Colson of Stitch Fix's opinion
- Focus on value - even incremental change can be very valuable
- Look for the real problems and solve them
- Look for (powerful) allies

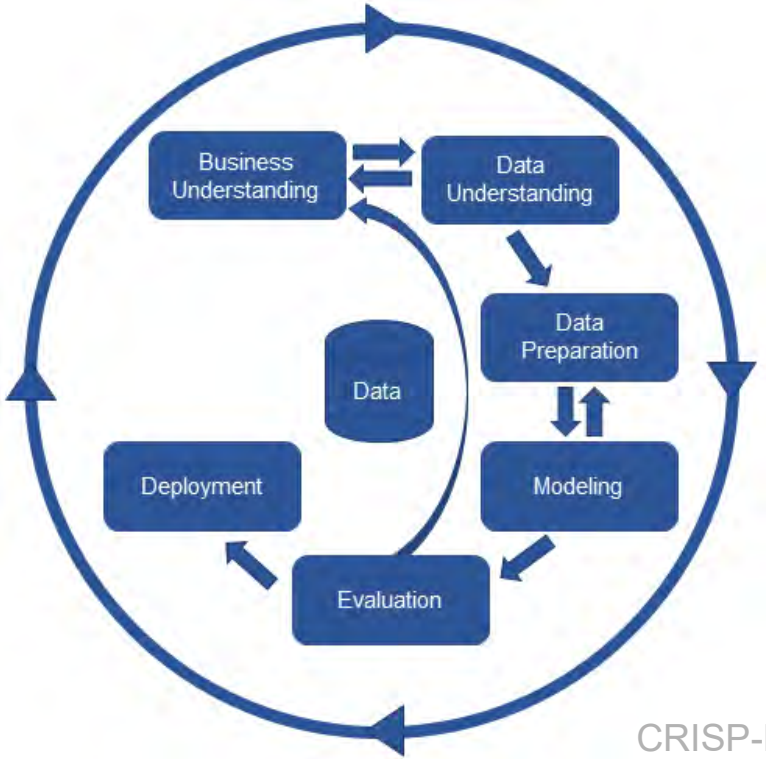
Tell Stories!

“Data makes people think, emotions make them act.”

- Antonio Damasio

Image credit: www.mycustomer.com

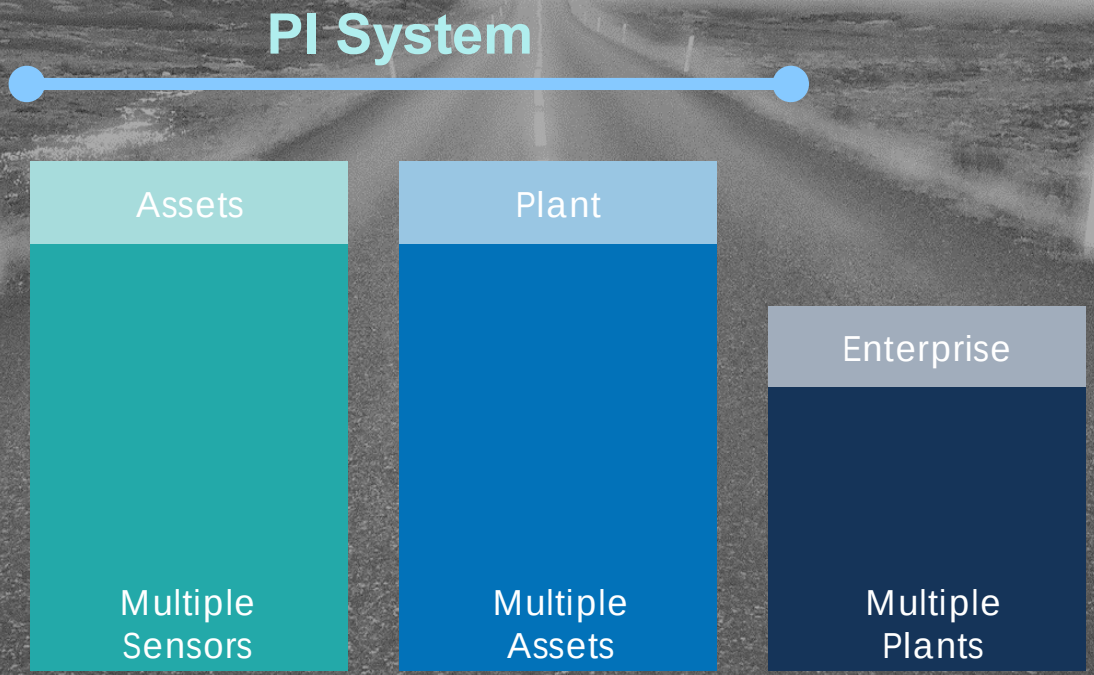
Make the Process Reproducible



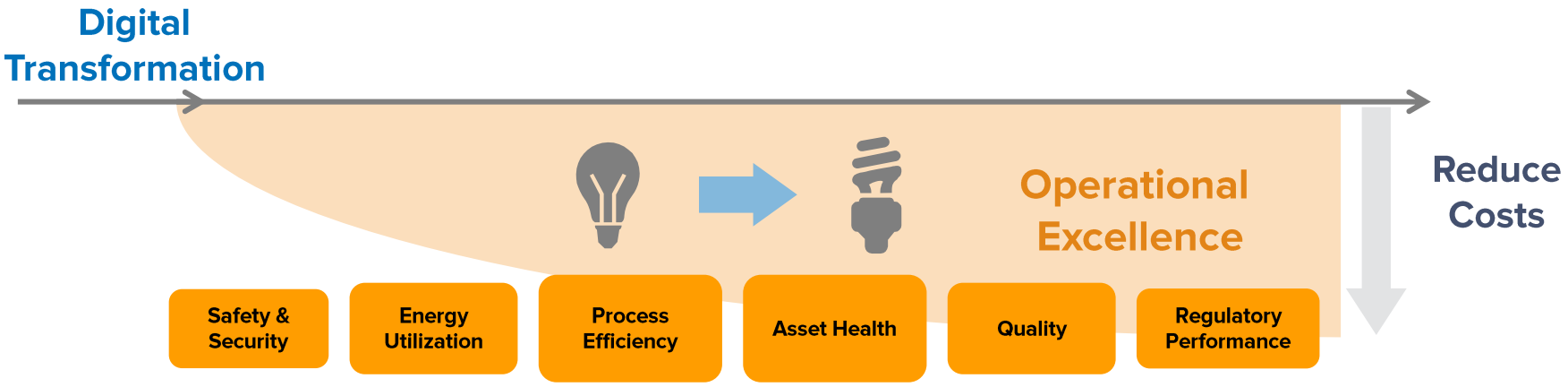
CRISP-DM


We believe People with Data
can Transform their world

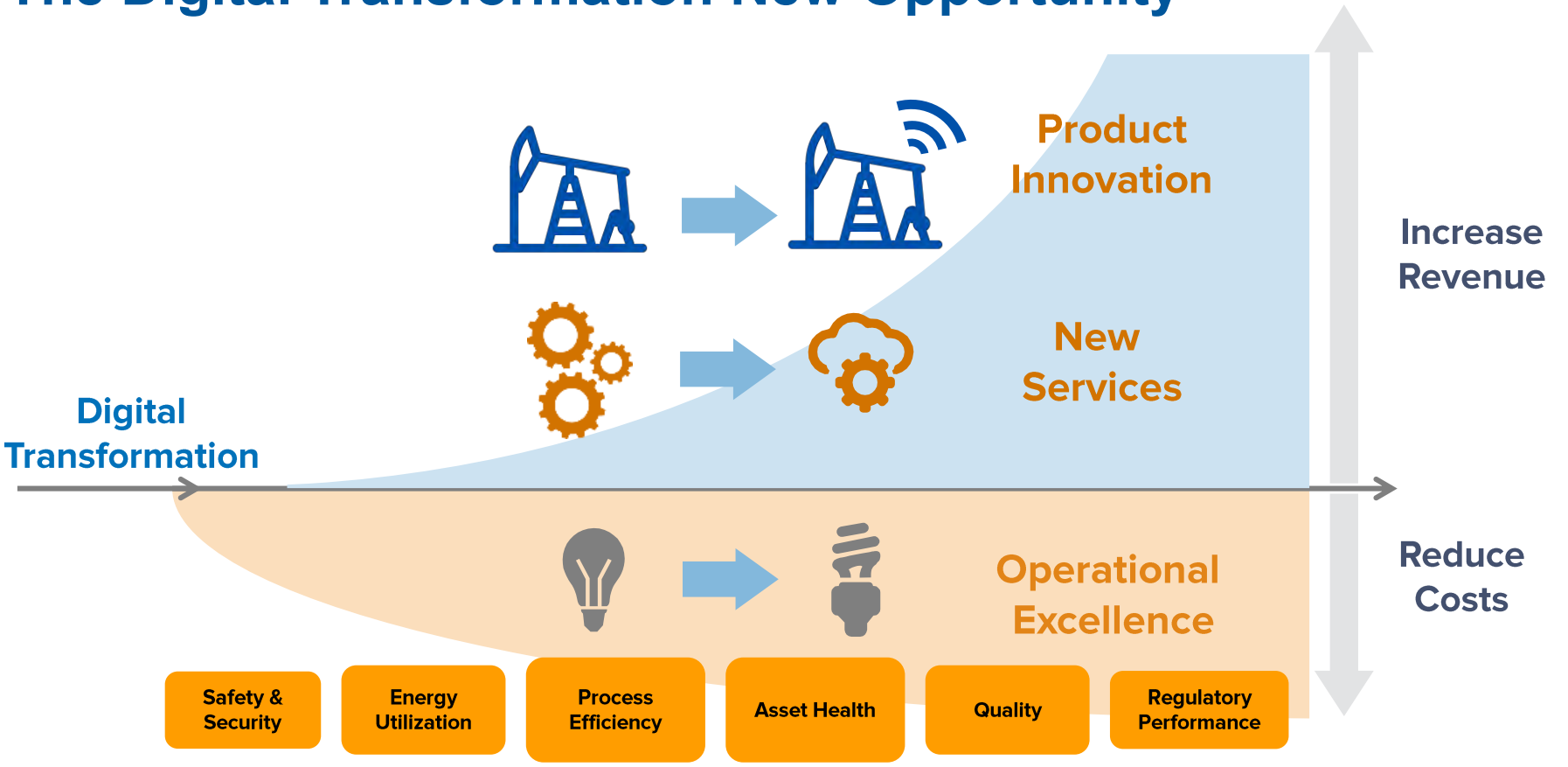
Plant & Enterprise



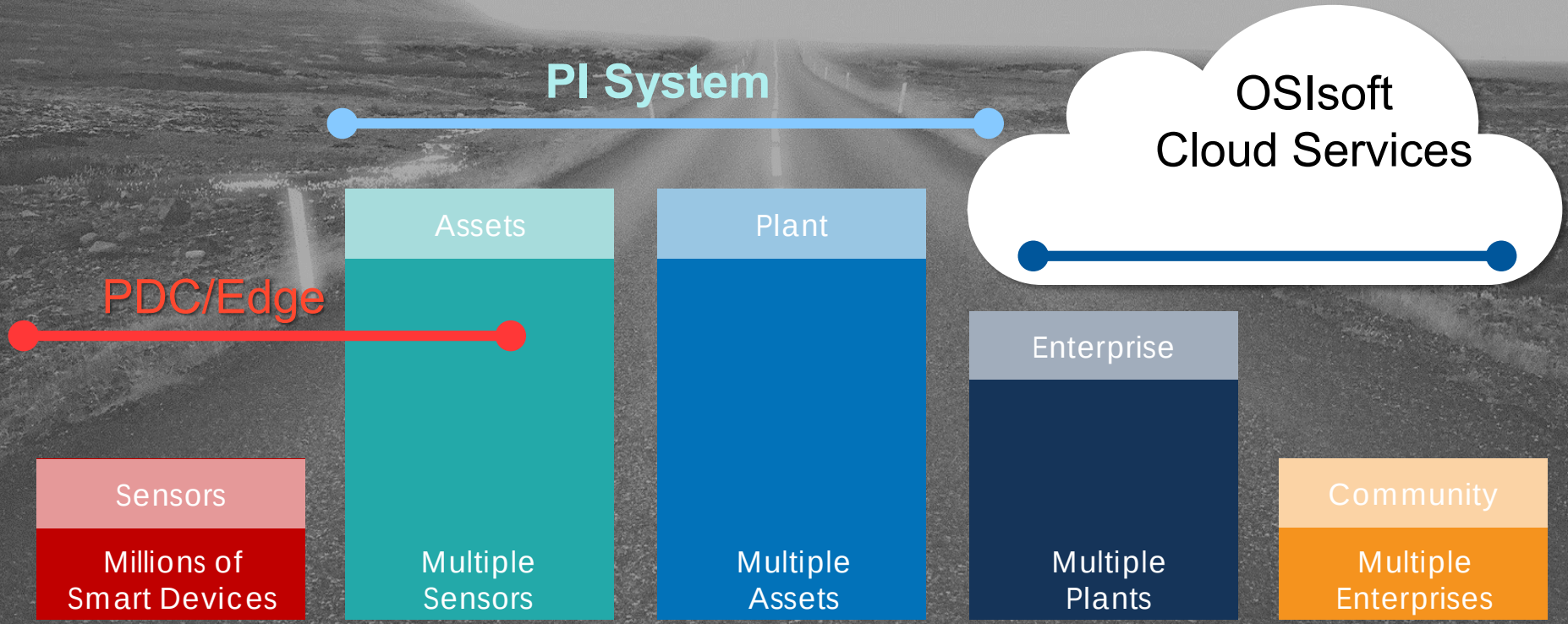
The Digital Transformation



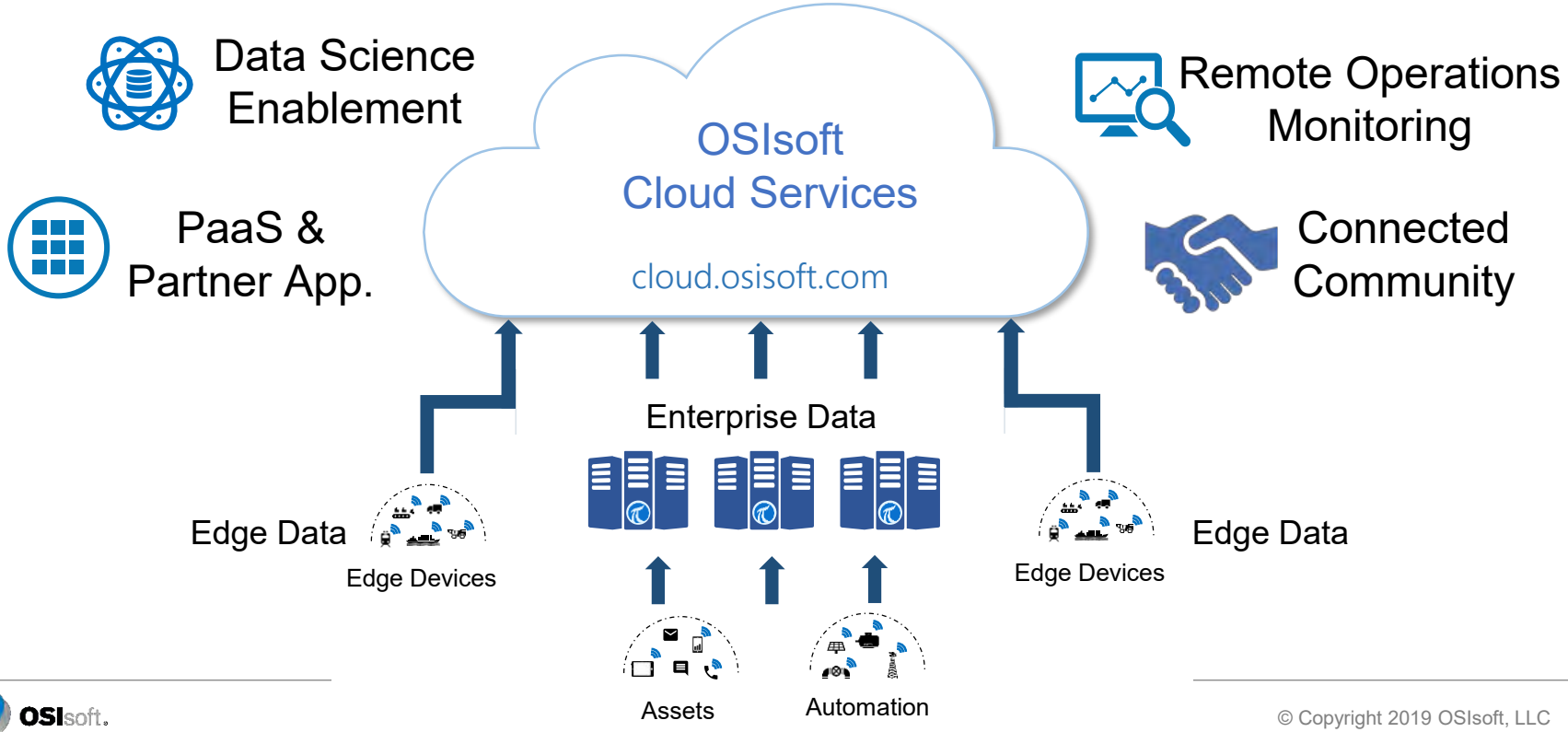
The Digital Transformation New Opportunity



Enterprise and Community scenarios have unique opportunities and challenges

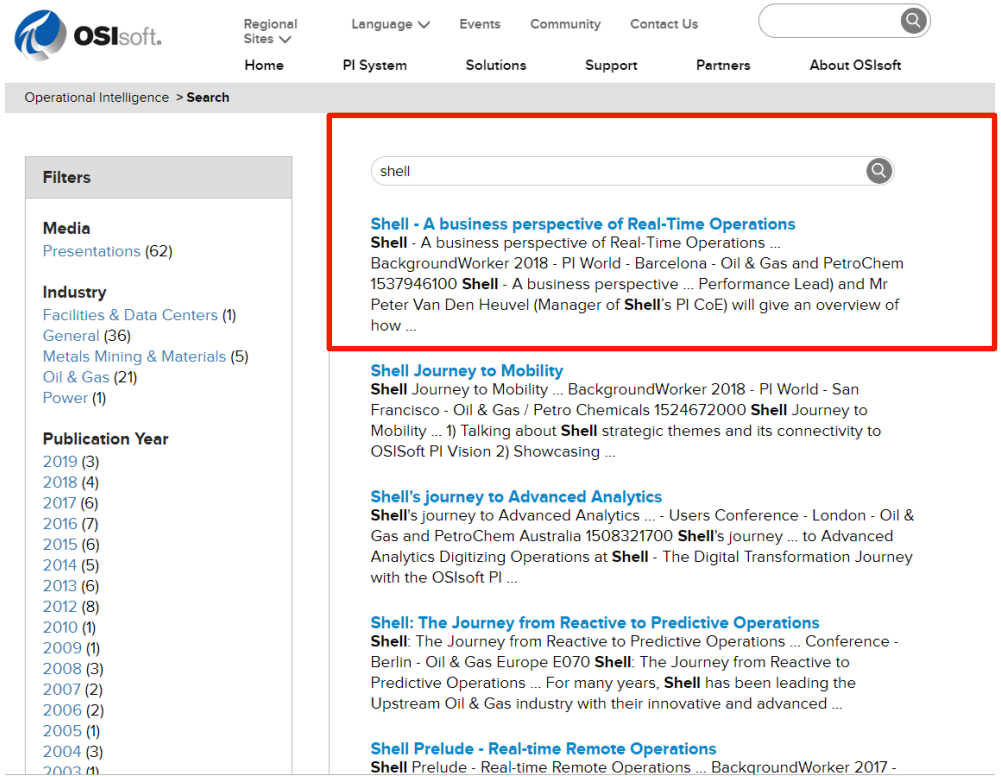


OCS: Complementing the PI System



Resources – www.OSIsoft.com

- Over 1,200 Customer Talks
  - Video and Slides
  - Company and Industry Issues



John Matranga

John@osisoft.com

Director of Customer Innovation and Academia

OSIsoft, LLC

Ahmad Fattahi

afattahi@osisoft.com

Manager of Data Science Enablement

OSIsoft, LLC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