

Enterprise IIoT and Analytics in the Process Industries

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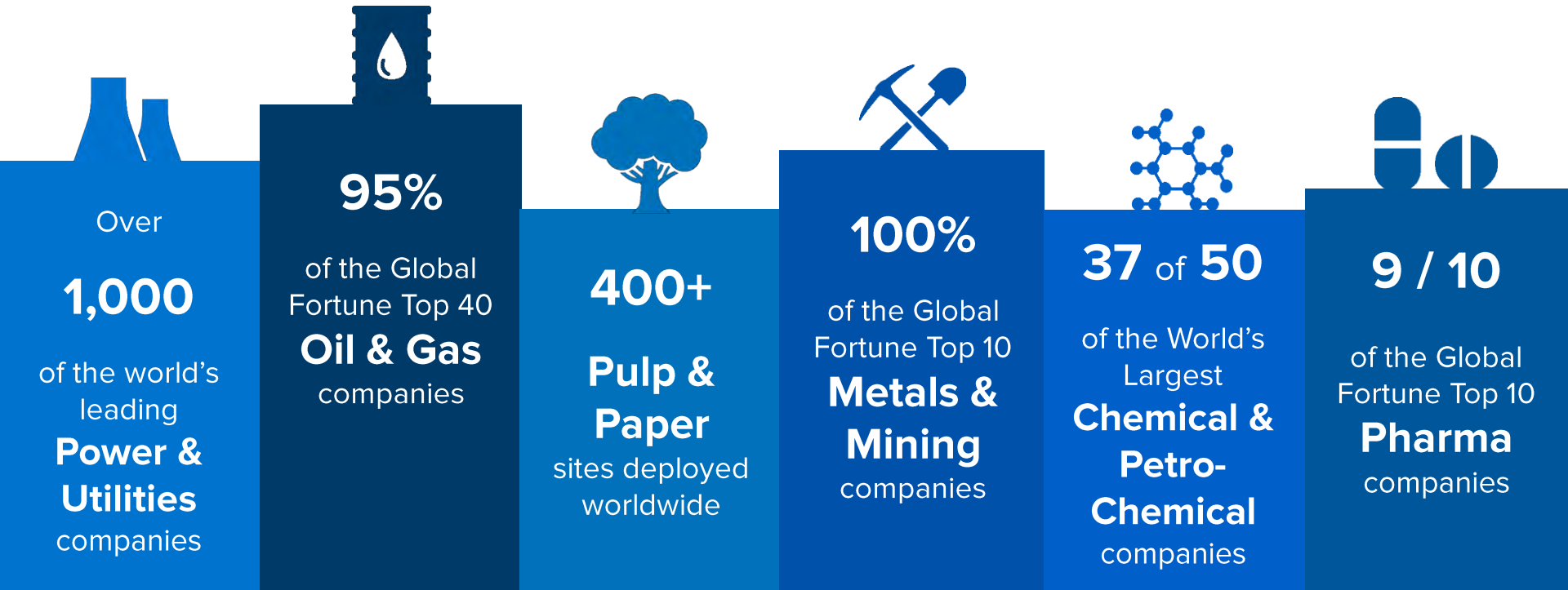


Stanford

**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

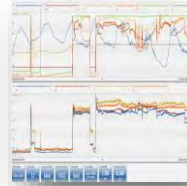
Data Infrastructure Approach to Digital Transformation



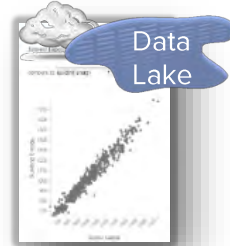
Operations
Real-time Monitoring



Operations
Self-service Access

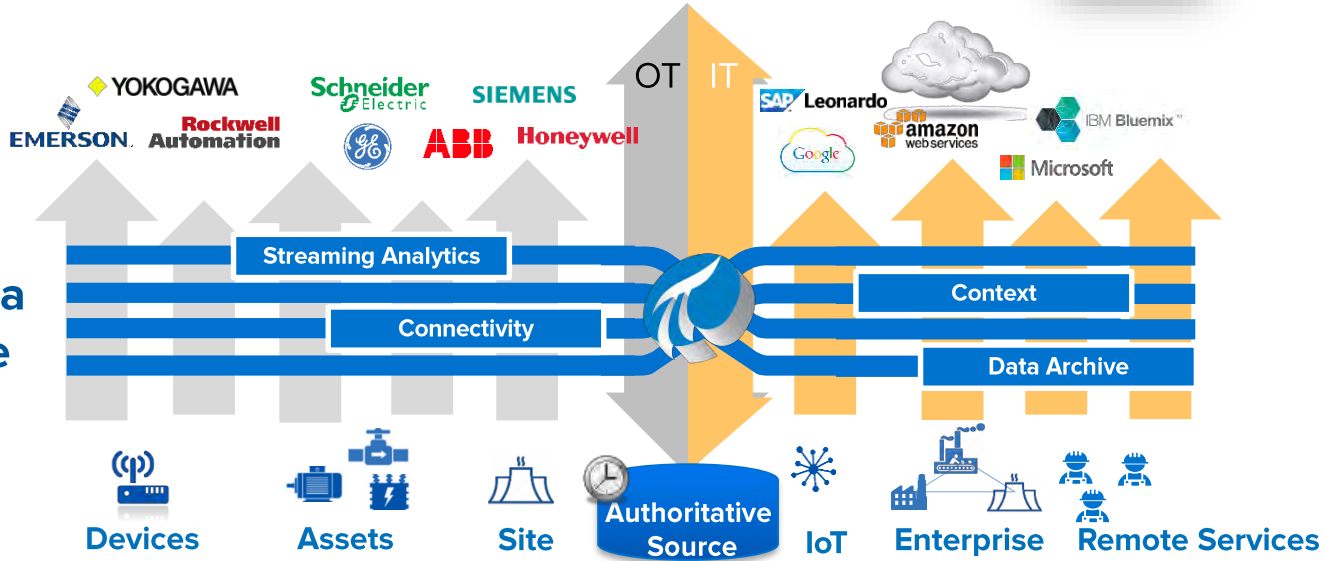


Analytics



Data Lake

Enterprise Data Infrastructure



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

Collect

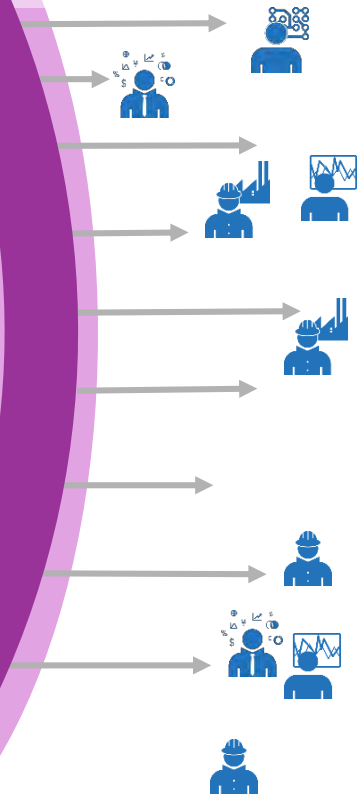
data using
**PI Interfaces
and PI
Connectors**

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



Distributed Control System (DCS)



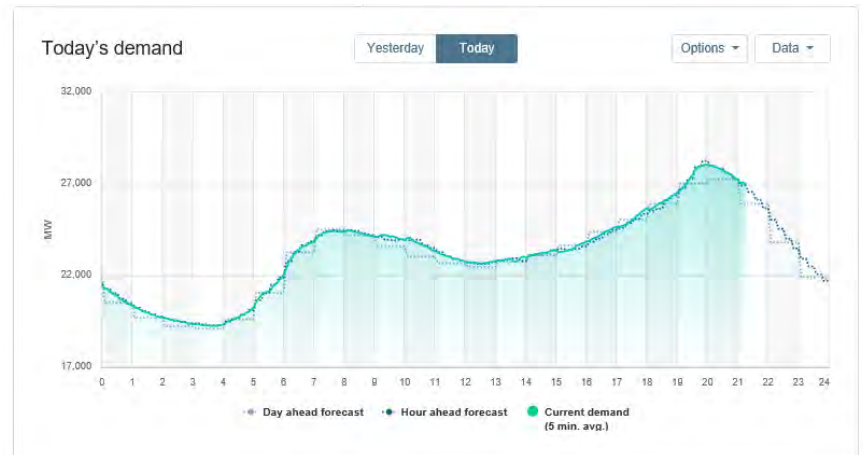
- Introduced Late 70's
- Thousands of sensors
- Rolled Out In the 80's/90's
- Updated Slightly Over Time
- DSC Allows for Plant-wide Control
- Advanced, Multivariable Control
- Typically multiple DCS in a plant (7 in HI Independent)
- VAX >> Unix >> Windows



Electrical Infrastructure Supply Chain - Today

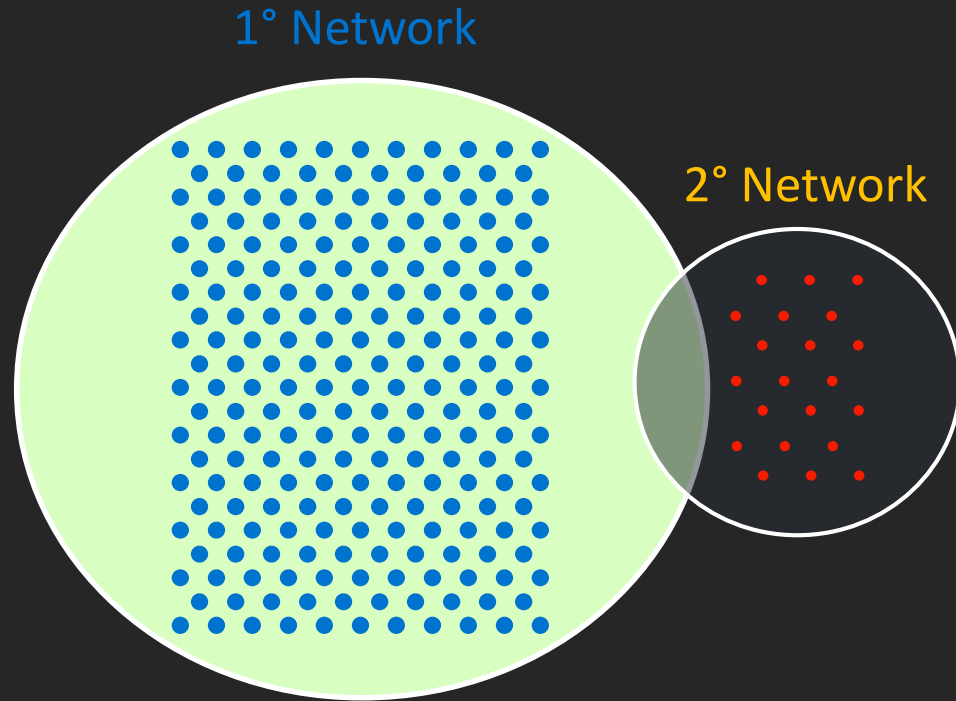


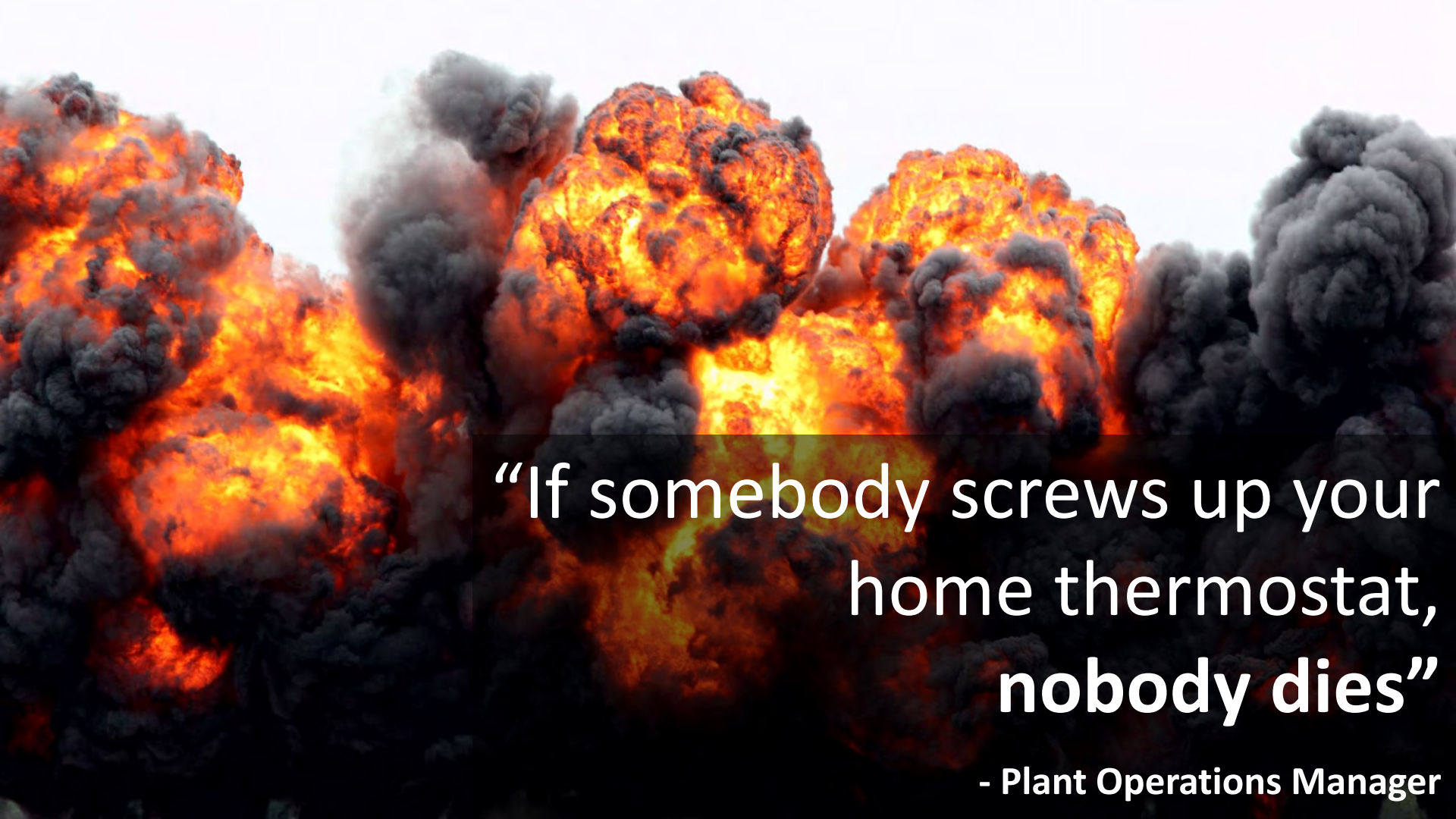
Redundant, Distributed Control Center
Geography Dispersed/Diverse Control
Cross Company Business Control
(Circa 1990's - Today)





The reality of new sensors today





“If somebody screws up your
home thermostat,
nobody dies”

- Plant Operations Manager

Reality of data science today

Operations



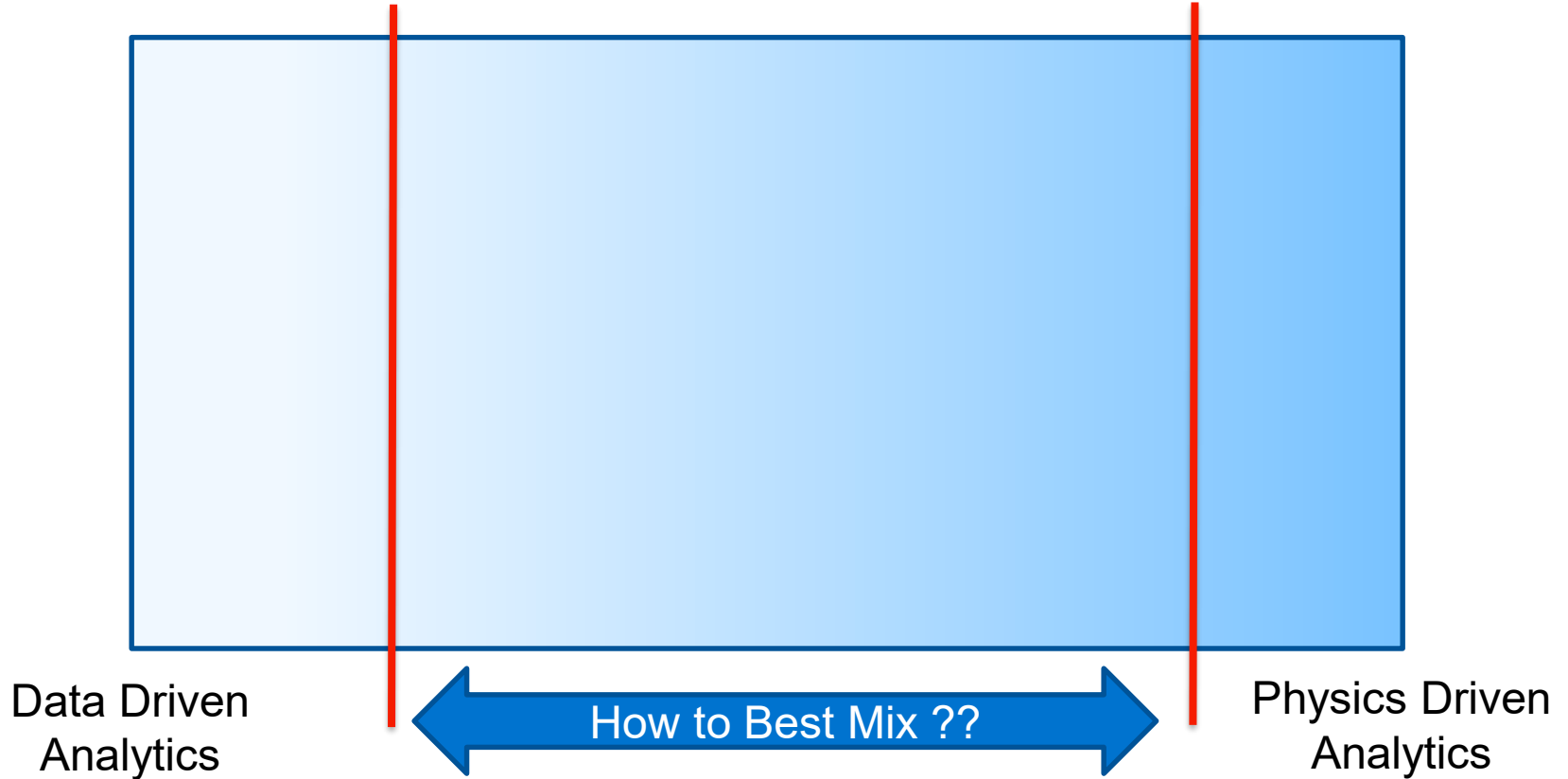
IT



Data
Scientists



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

Total is the world's **4th**-ranked oil
and gas company¹

and a global **leader** in solar energy
with SunPower.

WITH OPERATIONS IN MORE THAN

130 COUNTRIES,

we have over **96,000 employees**
who are fully committed to better energy.

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

Oil and Gas

USE CASE



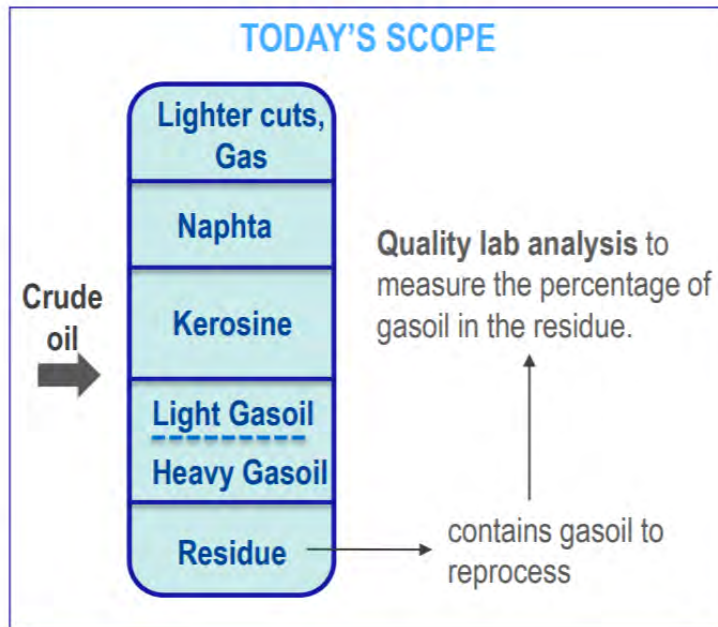
BUSINESS OBJECTIVE

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

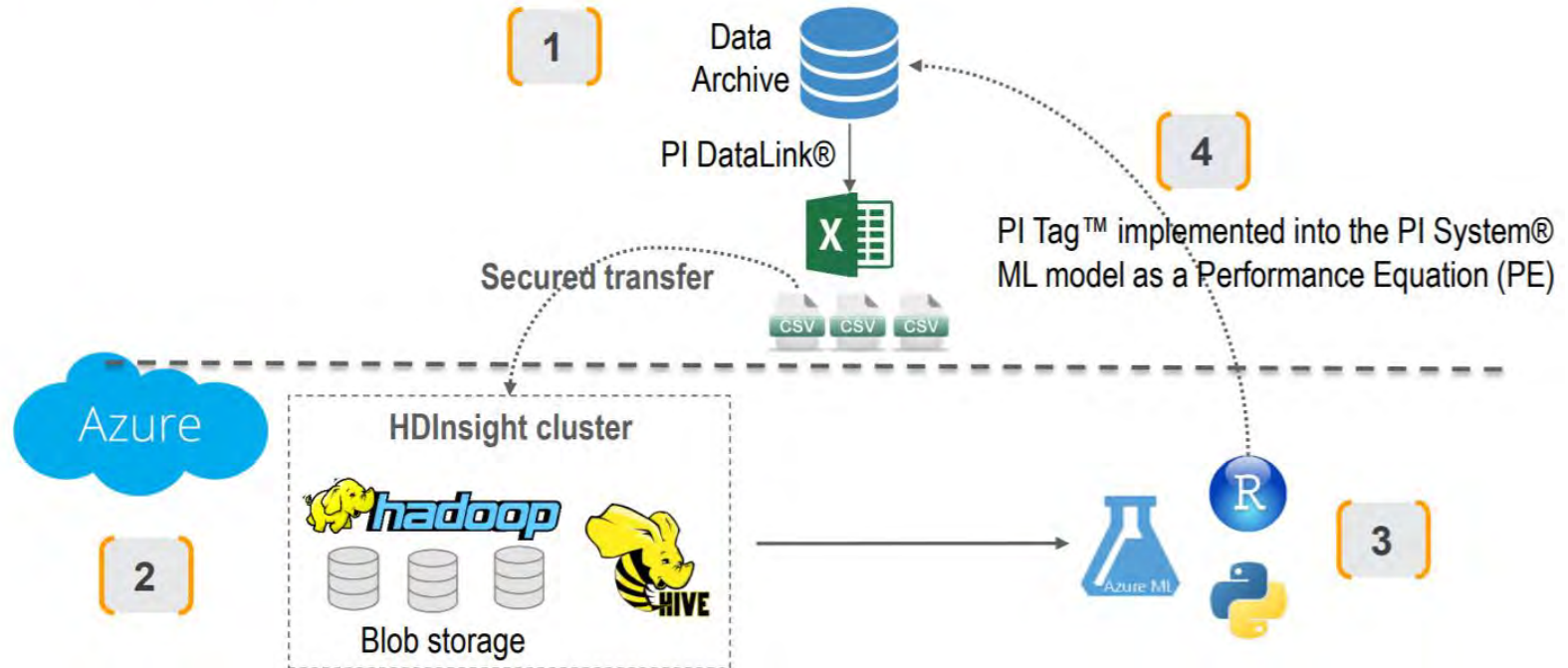


A proof of concept: estimating crude distillation quality for Antwerp refinery



Oil and Gas

ARCHITECTURE & WORKFLOW



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.



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

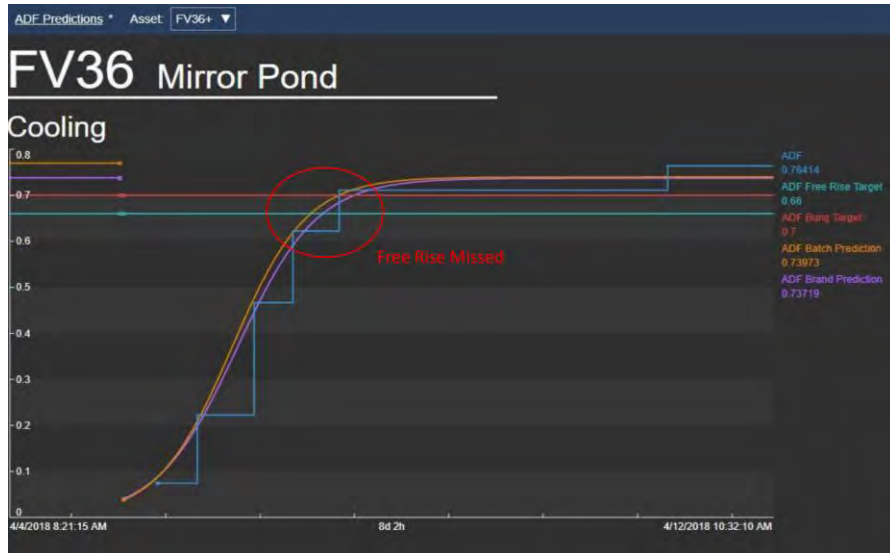
Old School Data Management

DATE	2-28	TIME	0430 AM	68	PM	JH
TANK	BRAND	PLATO	TEMP	BH	ADF	NOTES
45	P+r	(B)				
39	Twigh	(B)				
42	PSg	(B)				FR
22	Heage	(B)				
46	FC	(B)				T90 Not Disposed
40	PSi	5.2	67.7	4.98	68.12	
38	PS	6.0	65.3	4.74	63.21	
75	Pw	8.9	56	5.08	28.46	
41	P+r	9.2	65	4.74	32.16	
32	P+e	11.2	63	5.22	16.9	
~ JV BROWN HOUSE ~						
~ BRAZZ ~						
~ PLOW BROWN HOUSE ~						
EU-F12	40 P+g	(B)				
EU-F13	40 P+g	(B)				FR
EU-F14	70 P+g	3.7	60	4.74	167.59	
EU-F15	70 P+g	3.5	60	4.94	167.59	FR
EU-F16	70 P+g	11.8	67	4.81	40.70	FR

Yeast Pulling Log						
C1 FY UM UP: Set UP013 (harvest complete), UP014 (POC complete), UP015 (PCD complete) as applicable						
Task ID	Task Name	Start	End	Status	Notes	Comments
101	Set UP013	10:00	10:00	OK		
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Food and Beverage

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



The screenshot shows the configuration interface for FV36. The left pane lists various elements like Brew 1, Brew 2, Beer Transfer, Bright Tank, Celer 1, Celer 2, and various vessels (BV11-BV16, C2_BV1, C2_BV1, C2_F11, C2_F11, FV31-FV36). The main pane shows the configuration for FV36, including a table of parameters and their values.

Name	Value
ADF	0.711267099949438
Diactyl	72.0ppb
FV Full Plato	13.5040048174216 °P
Plato	3.6000009538743 °P
Target Bung ADF From DCS	70 %
Target Diactyl Rest Level From D...	80.0ppb
Target Free Rise ADF From DCS	66 %
VesselDescID	34
VesselID	30002

Additional configuration details on the right include:

- Name: ADF
- Description: Apparent Degree of Fermentation
- Properties: Volume
- Categories: DCS
- Default LDC: Volume
- Value Type: Double
- Value: 0.711267099949438
- Data Reference: Formula
- Settings: A ~ FV Full Plato TestID ~ Plato TestID [0=0 or A=0 then Update("Window") else (A - B) / A] stepped=True

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

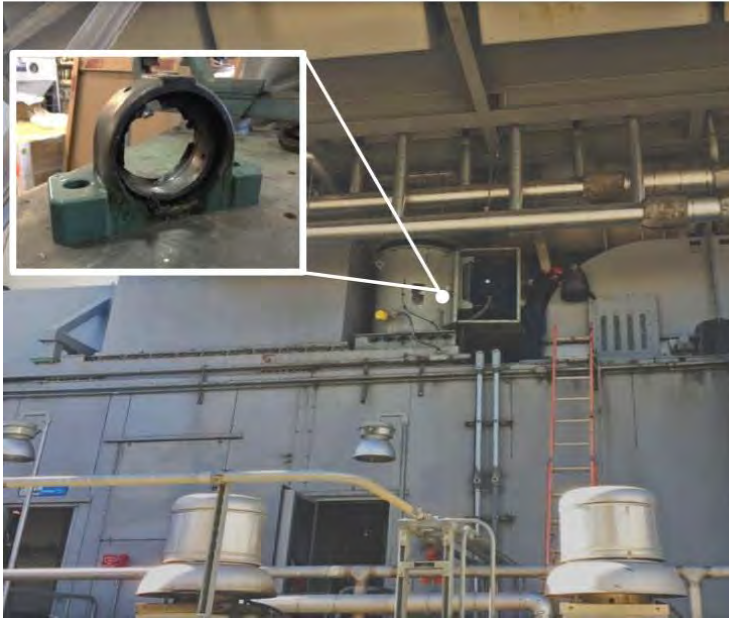
150+ balance-of-plant assets (BOP)

90% of sales come from commercial customers

Commercial: 9,000 customers

Residential: 45,000 customers

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

IloT 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

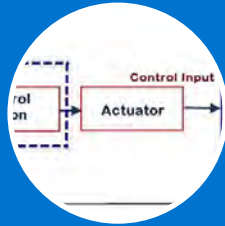
- Build KPI measurements in the process

Constantly validate with SMEs

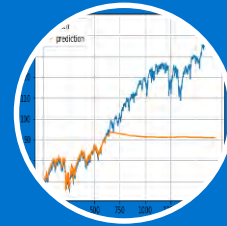
Different Personas Have Different Goals

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?

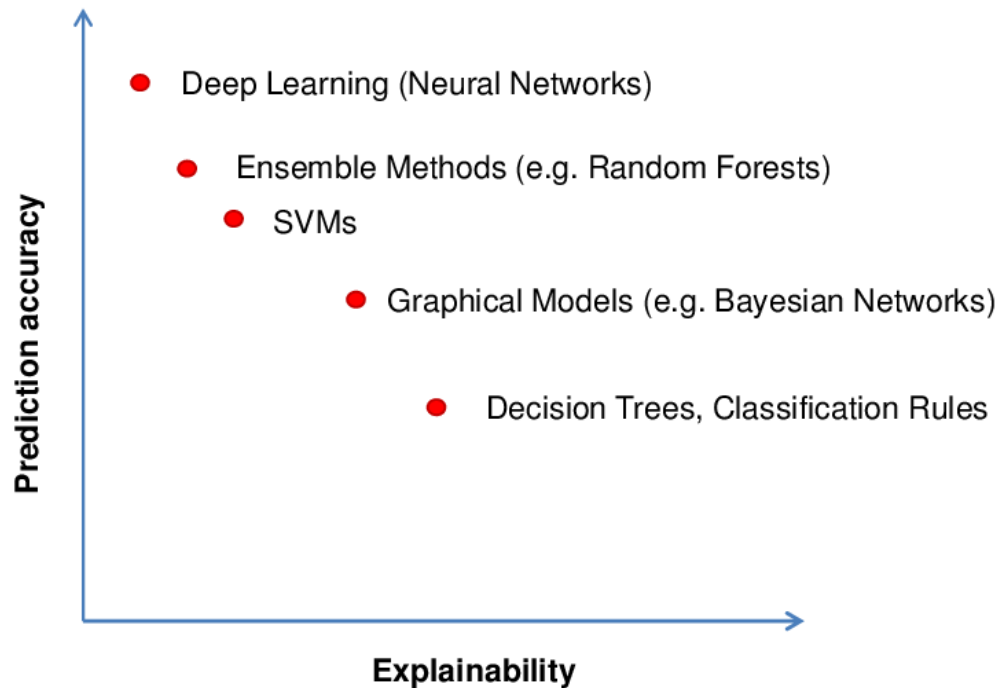
Winning trust for a critical system

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!

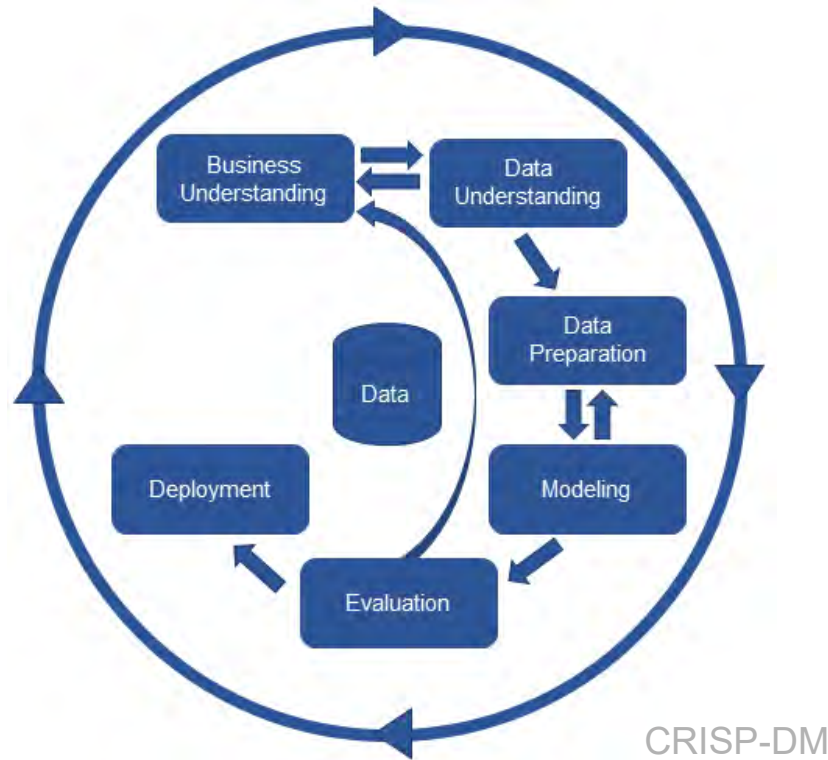
“Data makes people think, emotions make them act.”

- Antonio Damasio



Image credit: www.mycustomer.com

Make the Process Reproducible



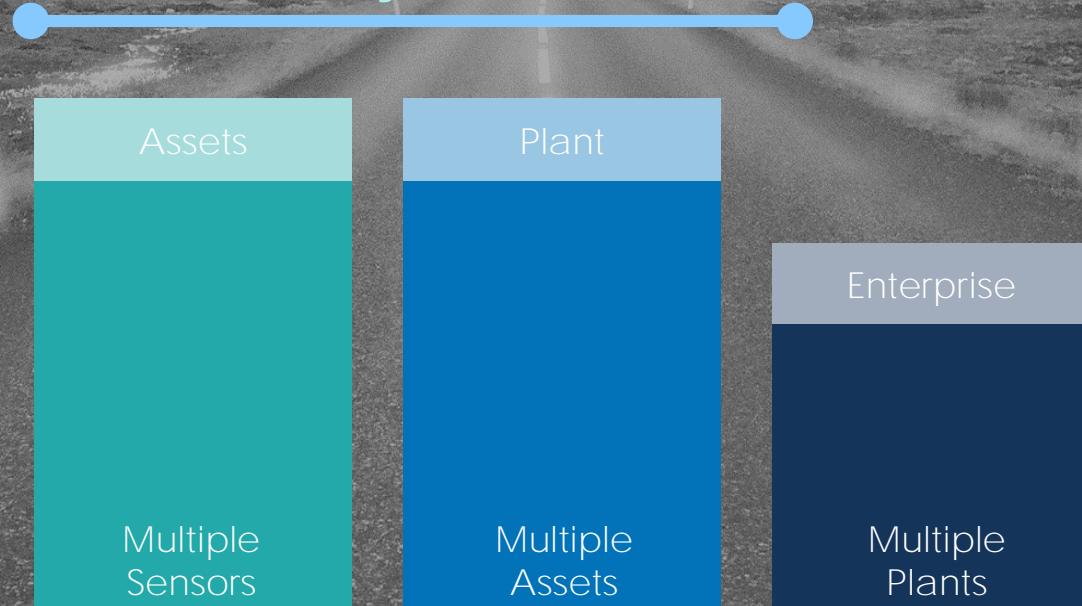
CRISP-DM

**We believe People with Data
can Transform their world**

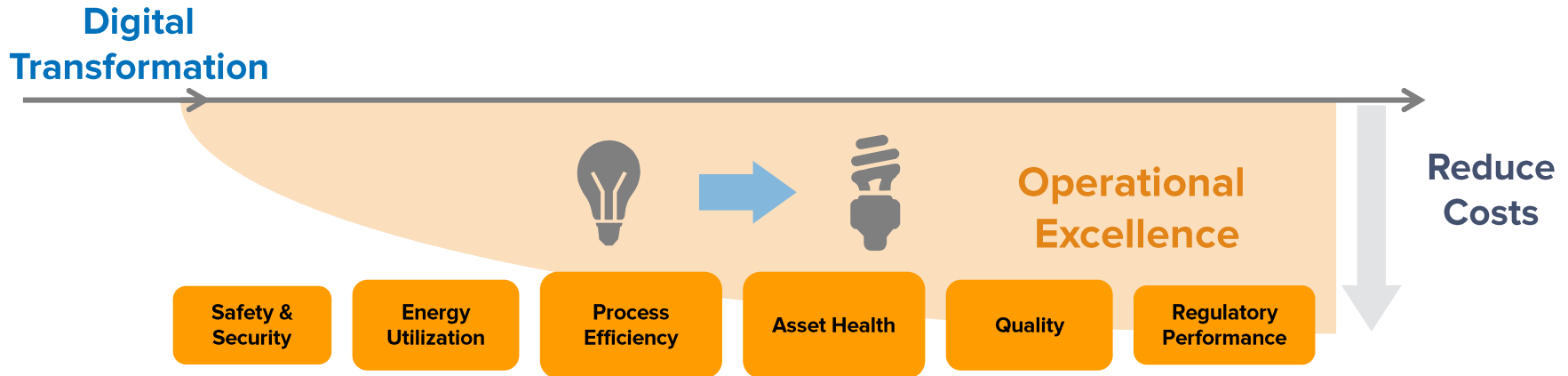


Plant & Enterprise

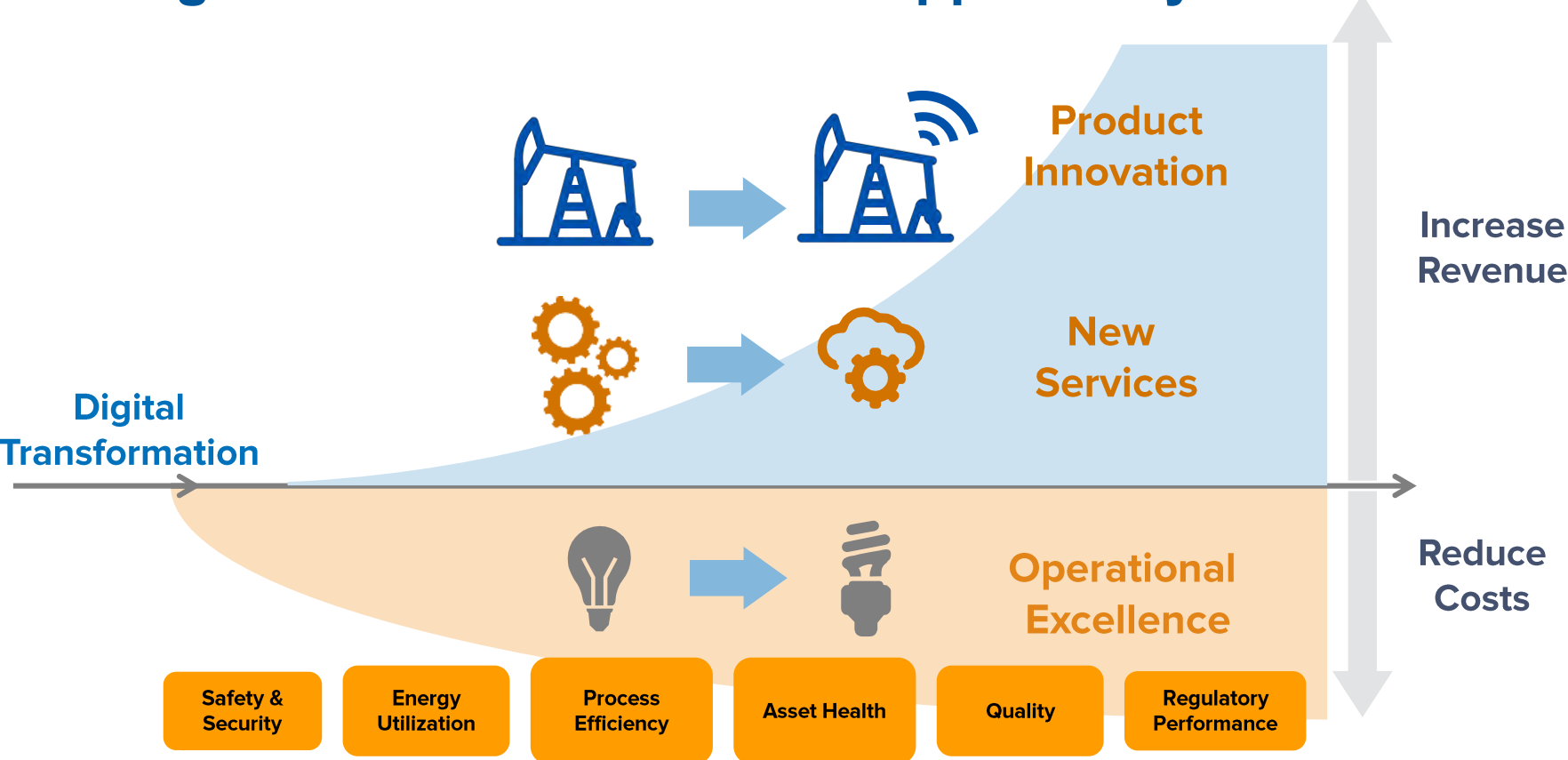
PI System



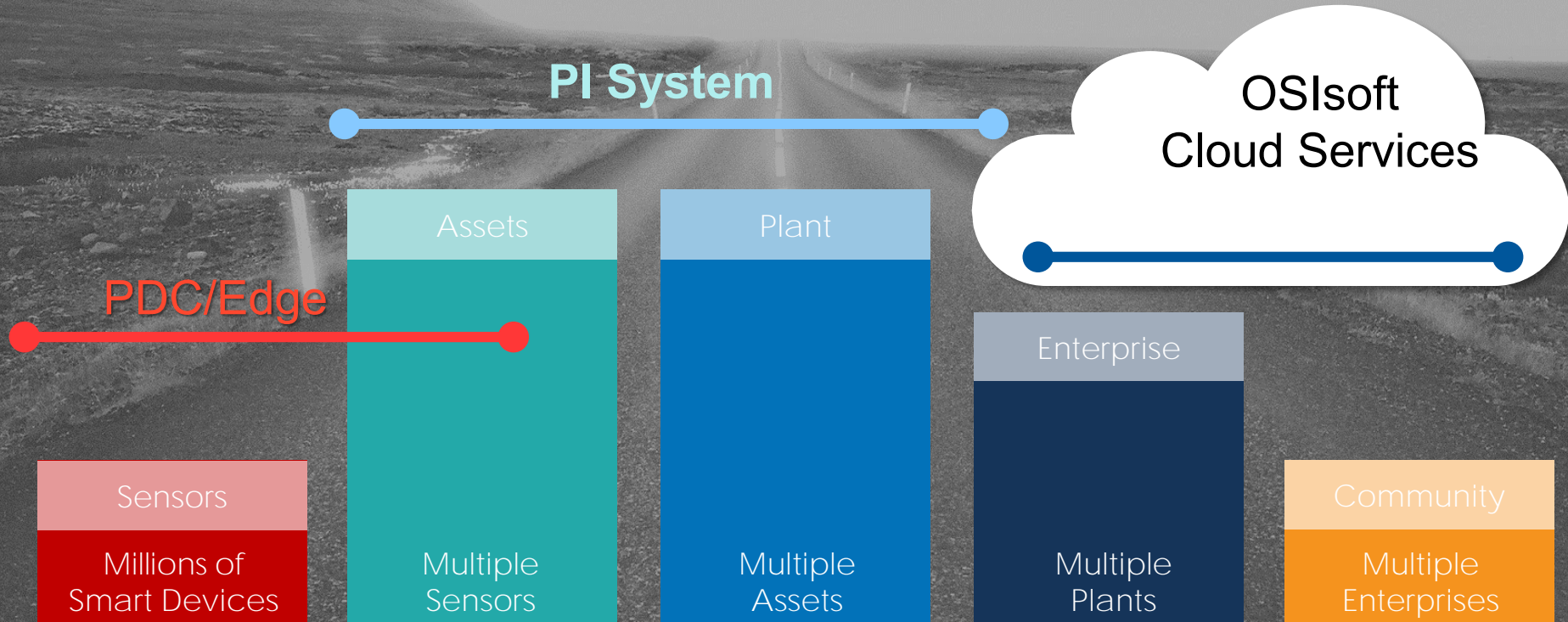
The Digital Transformation



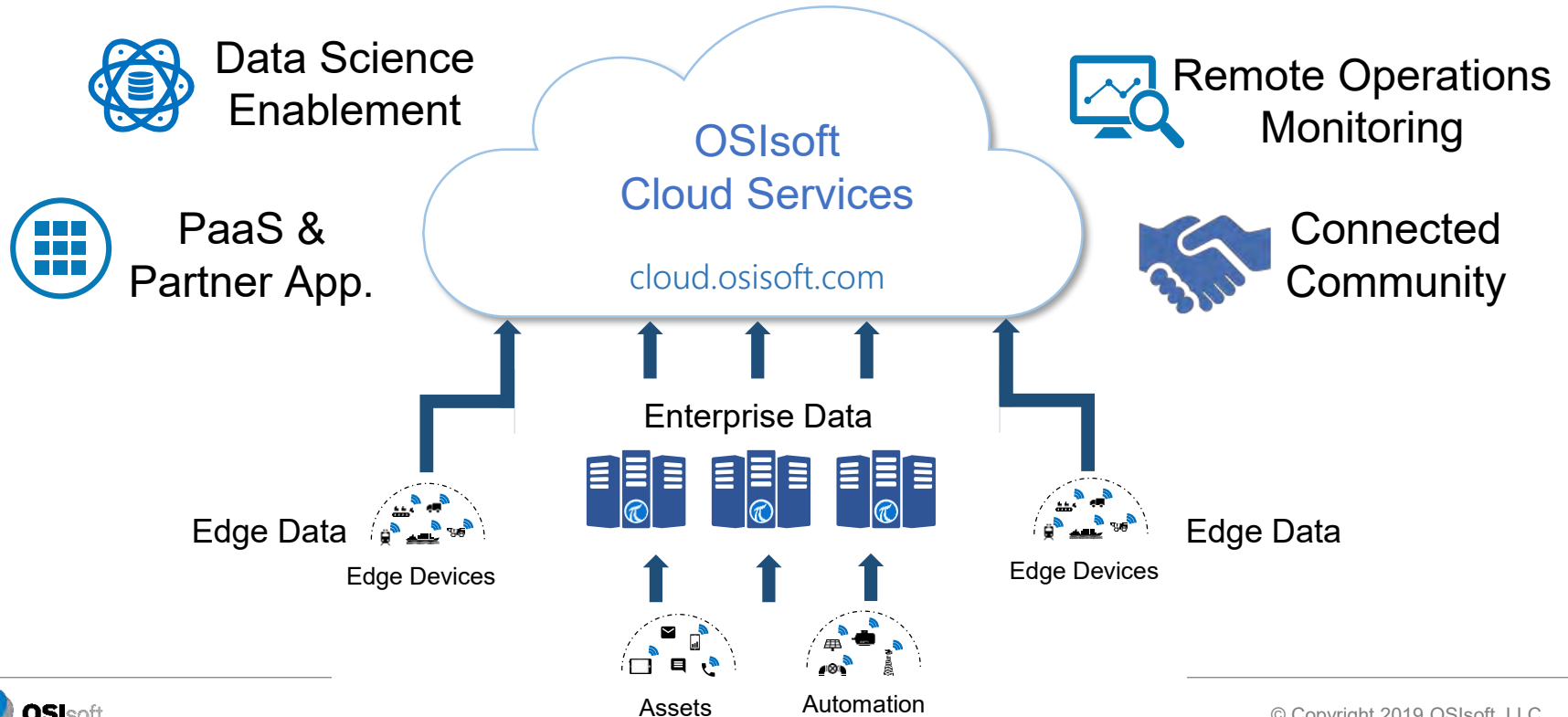
The Digital Transformation New Opportunity



Enterprise and Community scenarios have unique opportunities and challenges

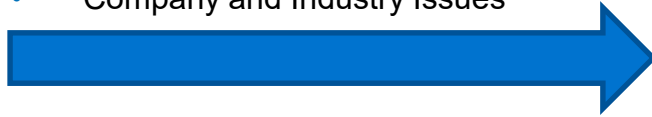


OCS: Complementing the PI System



Resources – www.OSIsoft.com

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



The screenshot displays the OSIsoft website interface. At the top, there is a navigation bar with the OSIsoft logo, a search bar, and links for Regional Sites, Language, Events, Community, and Contact Us. Below this is a secondary navigation bar with links for Home, PI System, Solutions, Support, Partners, and About OSIsoft. The main content area is titled 'Operational Intelligence > Search'. On the left, there is a 'Filters' sidebar with categories: Media (Presentations (62)), Industry (Facilities & Data Centers (1), General (36), Metals Mining & Materials (5), Oil & Gas (21), Power (1)), and Publication Year (2019 (3), 2018 (4), 2017 (6), 2016 (7), 2015 (6), 2014 (5), 2013 (6), 2012 (8), 2010 (1), 2009 (1), 2008 (3), 2007 (2), 2006 (2), 2005 (1), 2004 (3), 2003 (1)). The main search results area shows a search bar with 'shell' entered. Below the search bar, there are three search results, each with a title and a brief description. The first result is 'Shell - A business perspective of Real-Time Operations', the second is 'Shell Journey to Mobility', and the third is 'Shell's journey to Advanced Analytics'. The fourth result is 'Shell: The Journey from Reactive to Predictive Operations'. The fifth result is 'Shell Prelude - Real-time Remote Operations'.

Filters

Media
Presentations (62)

Industry
Facilities & Data Centers (1)
General (36)
Metals Mining & Materials (5)
Oil & Gas (21)
Power (1)

Publication Year
2019 (3)
2018 (4)
2017 (6)
2016 (7)
2015 (6)
2014 (5)
2013 (6)
2012 (8)
2010 (1)
2009 (1)
2008 (3)
2007 (2)
2006 (2)
2005 (1)
2004 (3)
2003 (1)

shell

Shell - A business perspective of Real-Time Operations
Shell - A business perspective of Real-Time Operations ...
BackgroundWorker 2018 - PI World - Barcelona - Oil & Gas and PetroChem 1537946100 Shell - A business perspective ... Performance Lead) and Mr Peter Van Den Heuvel (Manager of Shell's PI CoE) will give an overview of how ...

Shell Journey to Mobility
Shell Journey to Mobility ... BackgroundWorker 2018 - PI World - San Francisco - Oil & Gas / Petro Chemicals 1524672000 Shell Journey to Mobility ... 1) Talking about Shell strategic themes and its connectivity to OSIsoft PI Vision 2) Showcasing ...

Shell's journey to Advanced Analytics
Shell's journey to Advanced Analytics ... - Users Conference - London - Oil & Gas and PetroChem Australia 1508321700 Shell's journey ... to Advanced Analytics Digitizing Operations at Shell - The Digital Transformation Journey with the OSIsoft PI ...

Shell: The Journey from Reactive to Predictive Operations
Shell: The Journey from Reactive to Predictive Operations ... Conference - Berlin - Oil & Gas Europe E070 Shell: The Journey from Reactive to Predictive Operations ... For many years, Shell has been leading the Upstream Oil & Gas industry with their innovative and advanced ...

Shell Prelude - Real-time Remote Operations
Shell Prelude - Real-time Remote Operations ... BackgroundWorker 2017 -

John Matranga

John@osisoft.com

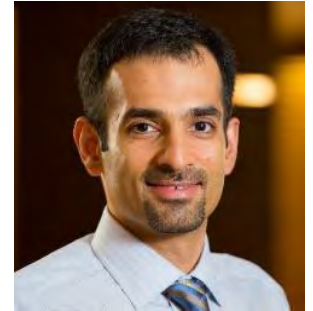
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謝謝

KEA LEBONA

DZIĘKUJĘ CI
NGIYABONGA

TAPADH LEIBH

고맙습니다

БАЯРЛАЛАА

MISAOTRA ANAO

OBRIGADO شڪرا

TEŞEKKÜR EDERİM

DANKON TANK TAPADH LEAT

SALAMAT

KÖSZÖNÖM

DANKIE

TERIMA KASIH

GRACIES

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GO RAIBH MAITH AGAT

БЛАГОДАРЯ GRACIAS

ТИ БЛАГОДАРАМ

TAK DANKE

MAHADSANID

THANKYOU

DANK JE

ΕΥΧΑΡΙΣΤΩ GRATIAS TIBI

AČIŮ

SALAMAT

MAHALO IĀ 'ŌE

TAKK SKALDU HA

ДЗЯКУЙ

GRAZIE

RAHMAT

MERCI

GRAZZI

PAKKA PÉR

ありがとうございました

DI OU MÈSI

ĎAKUJEM

HATUR NUHUN

PAHMAT CAĜA

SIPAS JI WERE

TERIMA KASIH

MATUR NUWUN

CẢM ƠN BẠN

FALEMINDERIT

UA TSAUG RAU KOJ

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СИПОС

WAZVIITA