Delivering Transformative Business Value in O&G with the PI System

7 Key Differentiators

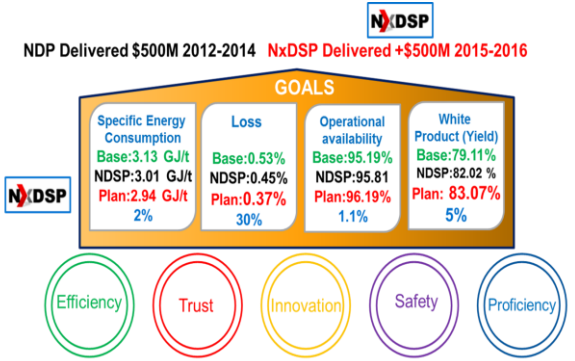
Presented by: Craig Harclerode - O&G Industry Principal

Key Differentiator #1

They recognize the focus is delivering **business value** defined by a **business case and the time value of money, not technology** or necessarily the **cost of the technology** …..**they are guided by the "4M" strategy**

Make Me More Money!

Delivering $1B Business Value from Digital Transformation in ~5 years



COMPANY and GOAL

Deliver $1B in EBITDA by a business transformation enabled by a digital transformation leveraging the PI System as a strategic OT data infrastructure for advanced predictive and proactive analytics

[Presentation]

2016 Analytics, IOT, Big Data

CHALLENGE

Deliver strategic business value to respond to increasing competitive threats; **Change a diverse culture** to **"act as one"** with Operational Excellence & continuous improvement enablement.

- Increasing competitive environment in Eastern Europe
- Variable cracked spread
- Diverse culture across 8 countries
- Low use of data and analytics
- Poor business performance 4th Qtle

SOLUTION

Evolved the use of the PI System as a tag based historian to an asset based infrastructure to **support cultural change** and **data based decision making and support** with advanced predictive and proactive analytics.

- Evolved from Tag to PI AF based infrastructure across the MOL fuels value chain
- Normalized tag, asset, UOM, and time using PI AF as an abstraction layer
- Used data and information to support business transformation

RESULTS

Delivering on the MOL Downstream business transformation goal of $1B and more importantly, a sustainable **cultural change based on data and information** to drive **operational excellence** going forward into he 21st century.

- *Leading Process Safety Management*
- *1st Quartile in energy, yields, loss, and utilization*
- *OT infrastructure enabling time to value and value momentum with advanced analytics including machine learning*

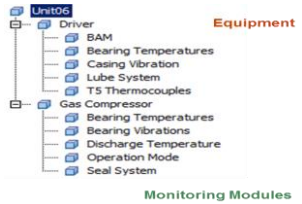
Key Differentiator #2

They **leverage PI AF element templates** like lego blocks **owned by SMEs** and in doing so, **redefined the roles between OT and IT and** enabled OT/IT collaboration via a common language **– "the language of the PI System"**

TransCanada Anomaly Detection & Predictive Analytics

Centrifugal Compressor Templates

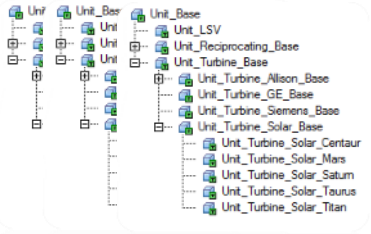
Health Index Templates



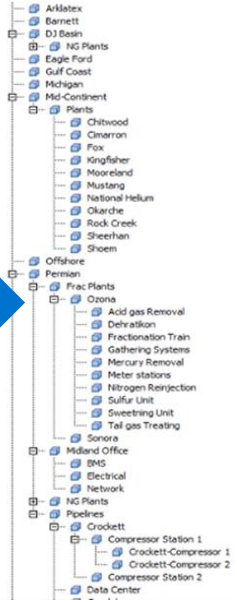
Anomaly Detection Templates

TransCanada
In business to deliver

Physical Compressor Stations



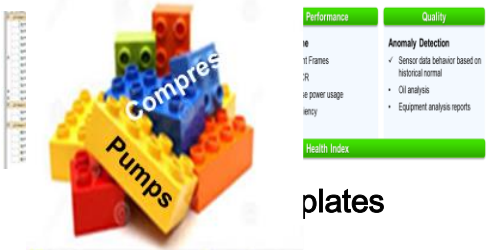
Digital Compressor Stations



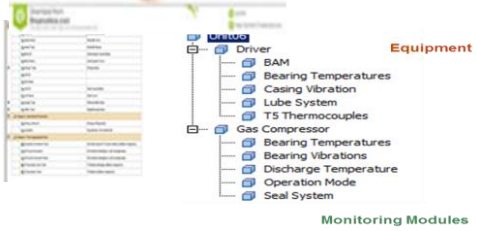
TransCanada Smart OT Infrastructure

TransCanada Anomaly Detection & Predictive Analytics

Centrifugal Compressor Templates



plates



Anomaly Detection Templates

TransCanada
In business to deliver

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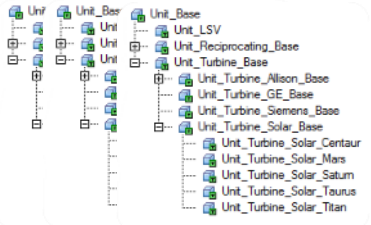

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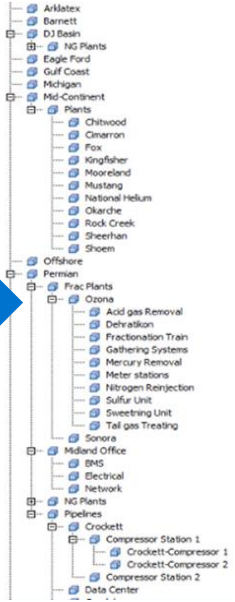
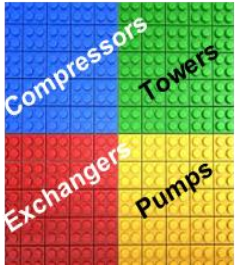


TransCanada Smart
OT Infrastructure



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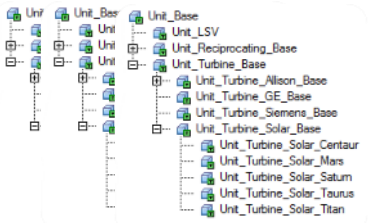

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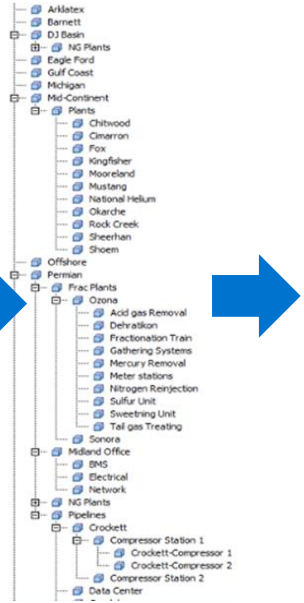
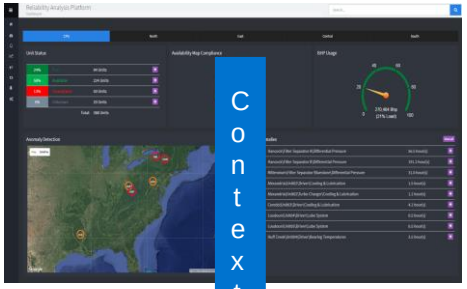


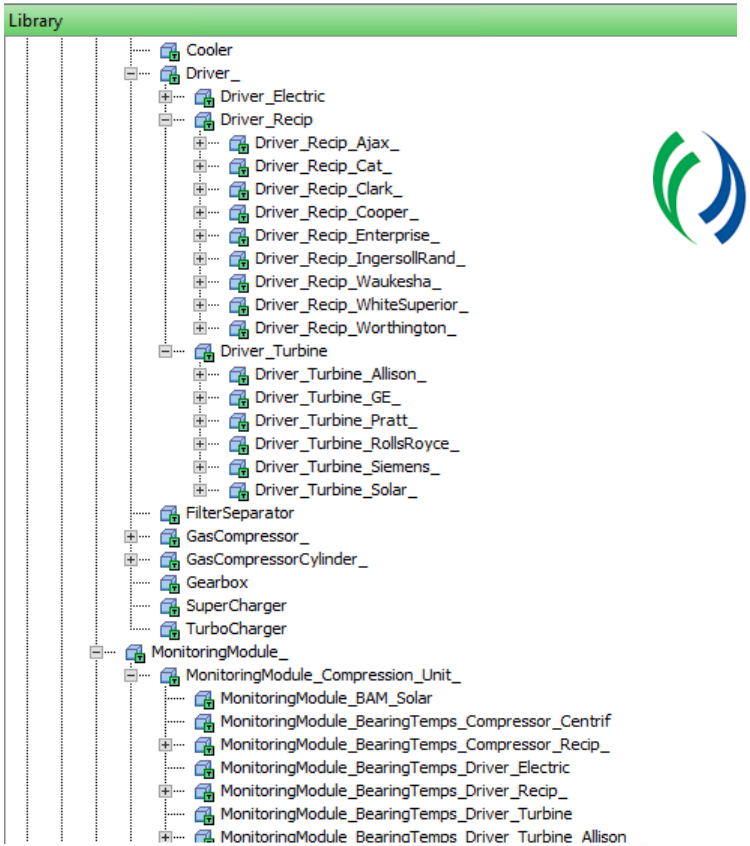
TransCanada Smart OT Infrastructure

Exception based KPI Dashboard system

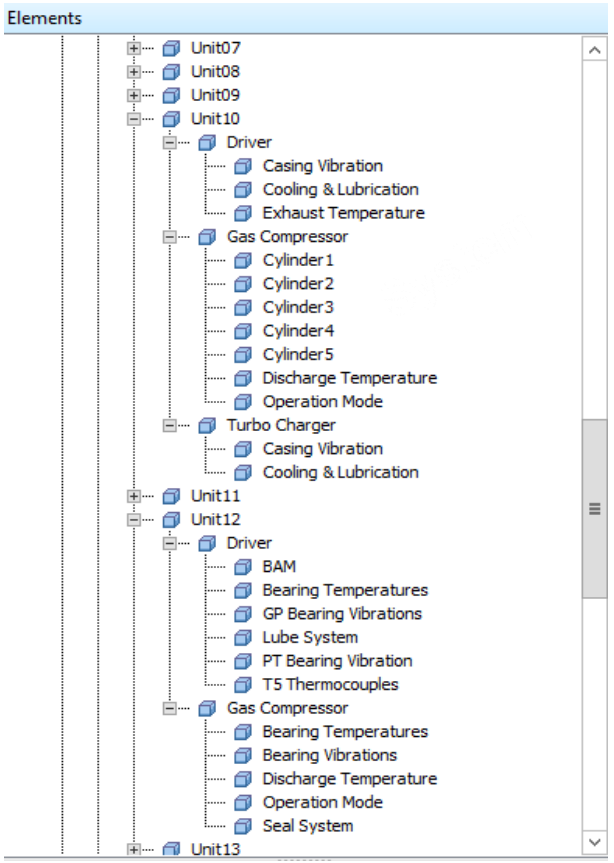


Contextual Drill Down

Portfolio of Templates for Drivers & Compressors

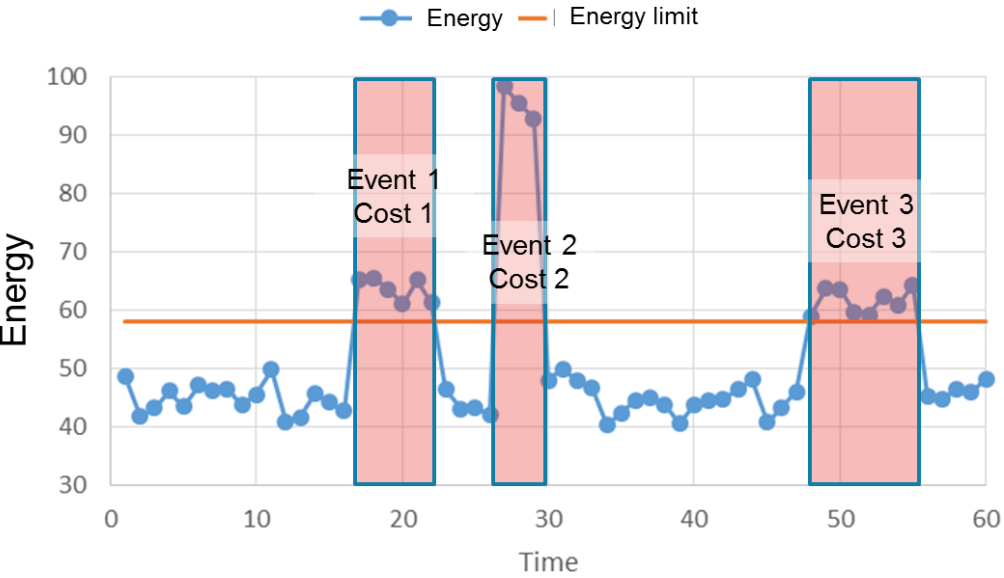


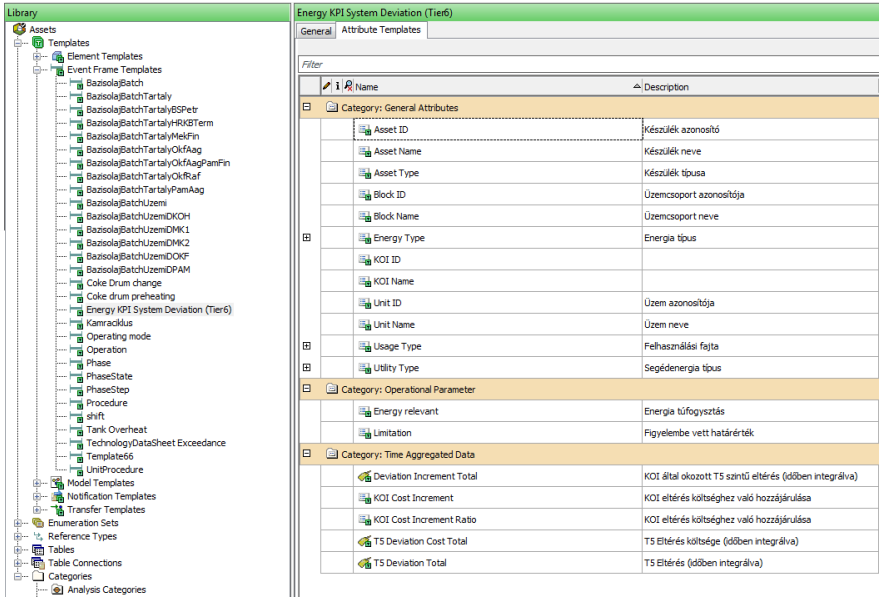
TransCanada
In business to deliver



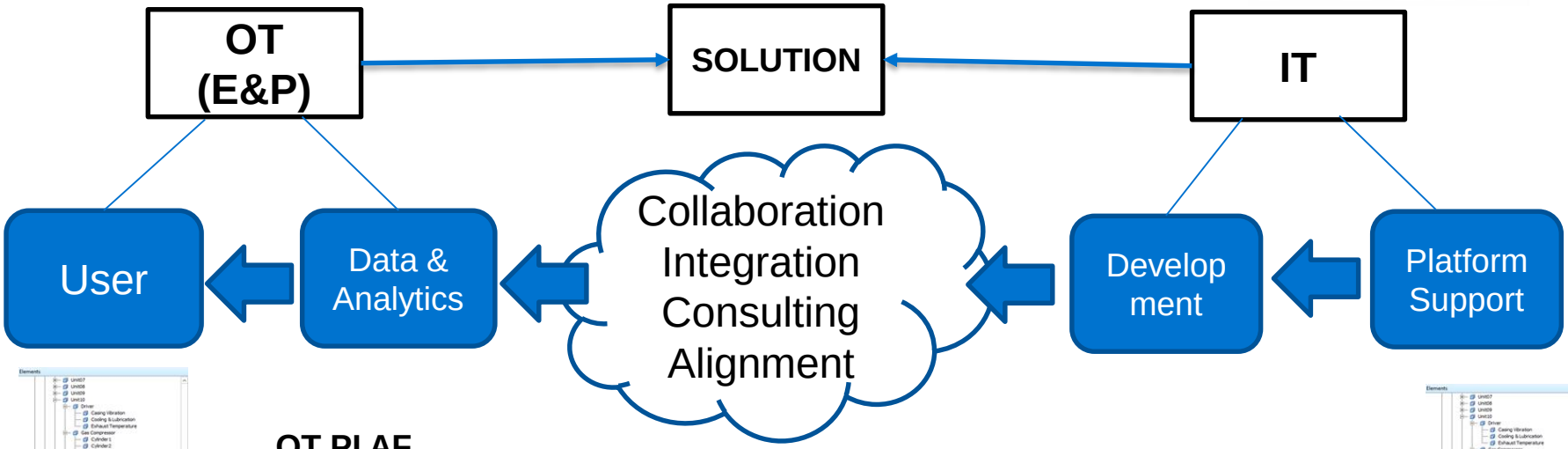
PI Event Frames – Energy Over consumption events

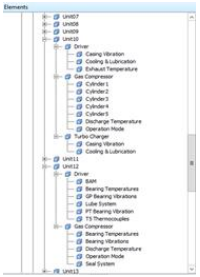
Ability to create Event Frame Templates and apply retroactively..ie – “IF I have this event definition, how many times in the past would I have seen it?





Devon's Digitally Enhanced Business Transformation- "Our Secret Sause"

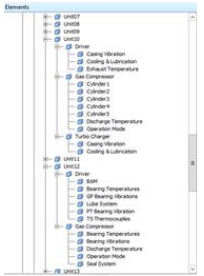




OT PI AF
OT Infrastructure

"The Language of PI"

IT PI AF
(IT Infrastructure)



Rick Howell - IIOT, Analytics, and Big Data Conference, Houston, October 12, 2016

Key Differentiator #3

They leverage a **“hybrid data lake strategy”** and the ability to **leverage cleansed, augmented, and shaped high fidelity historical and future data** to improve their “big data” applications with **“self service” capabilities**

Hybrid “Data Lake”- Leveraging Fit for Design Technologies

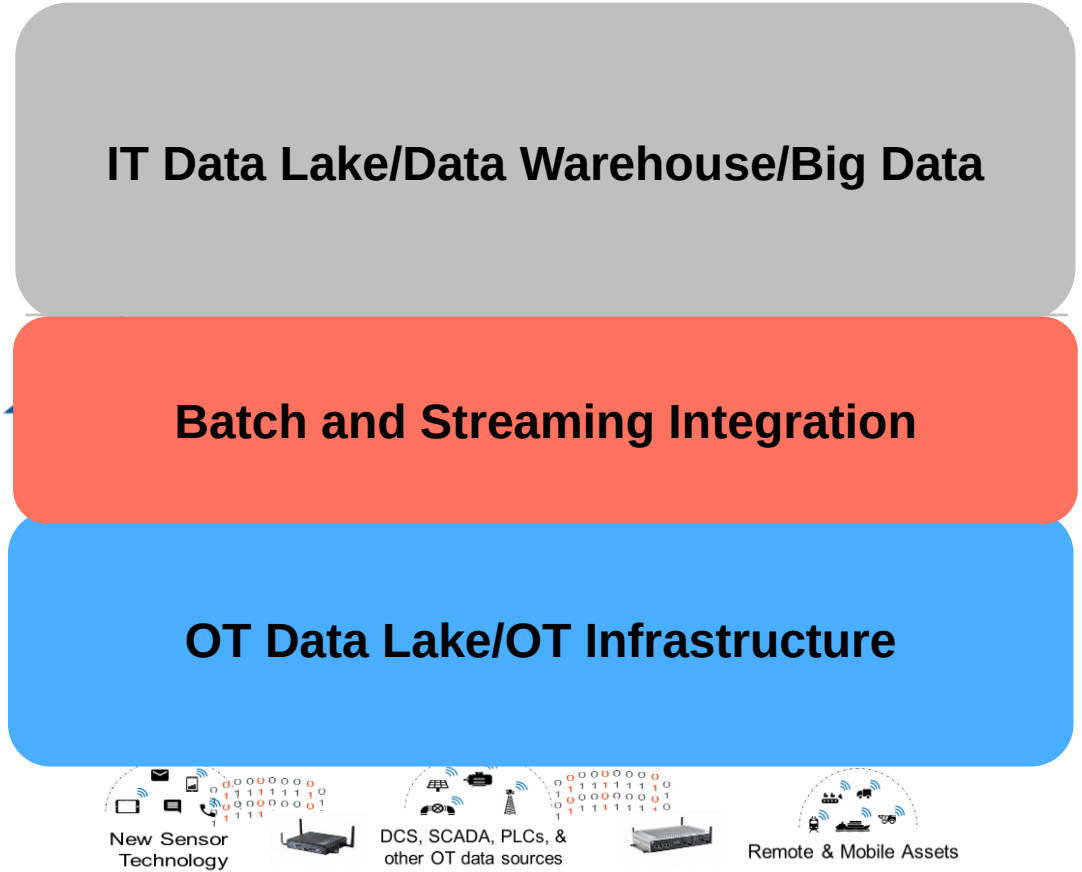
“Data Lake”

“Data Warehouse”

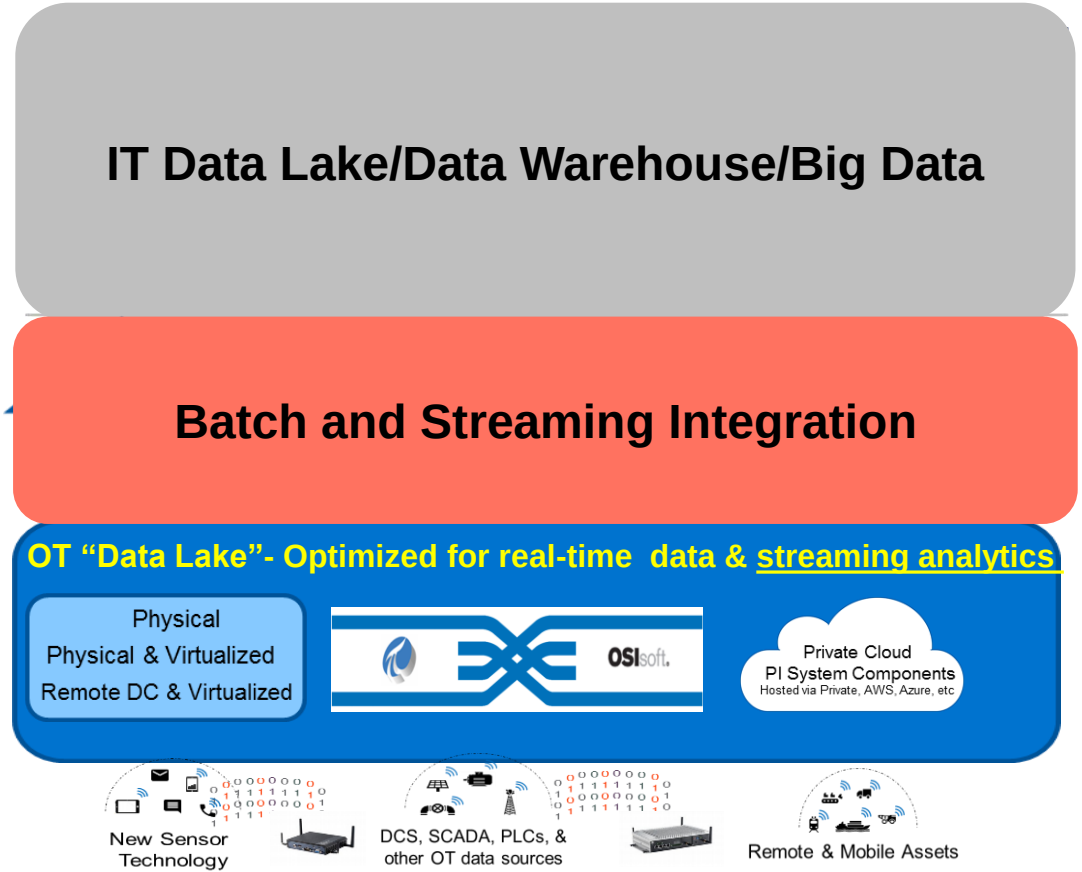
“Big Data”

“Cloud”

Hybrid “Data Lake”- Leveraging Fit for Design Technologies



Hybrid “Data Lake”- Leveraging Fit for Design Technologies



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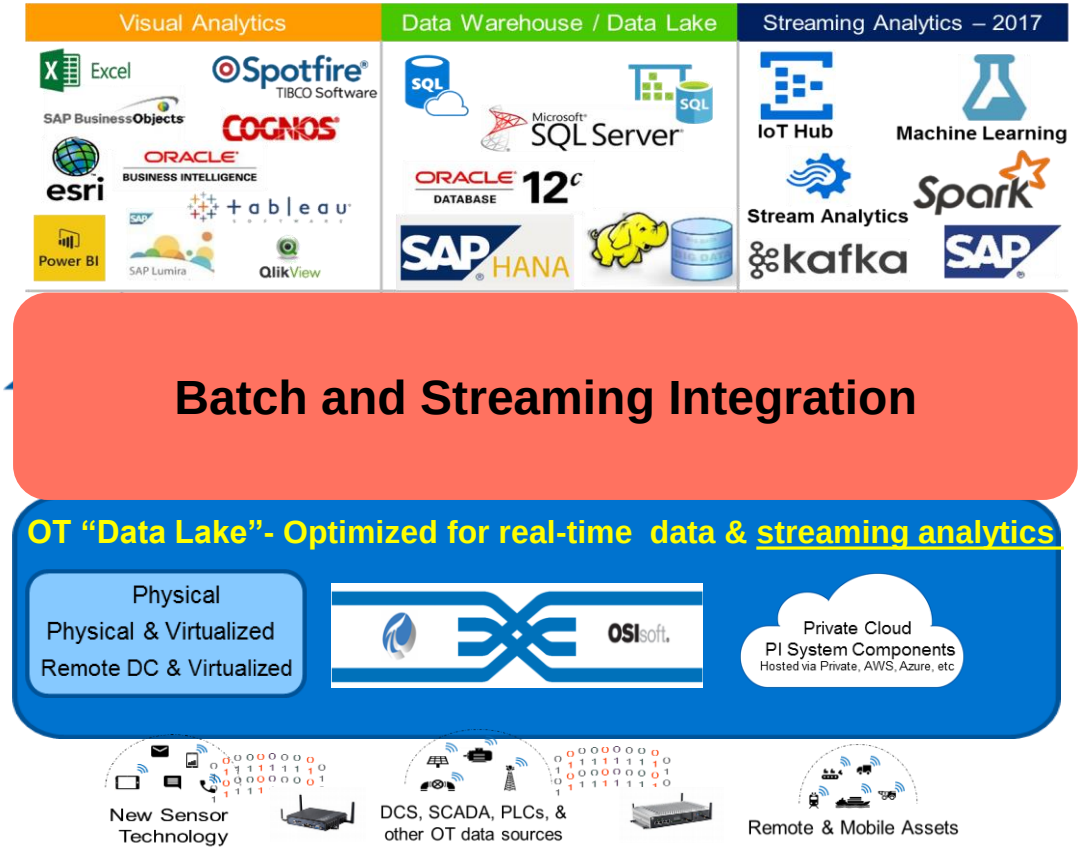

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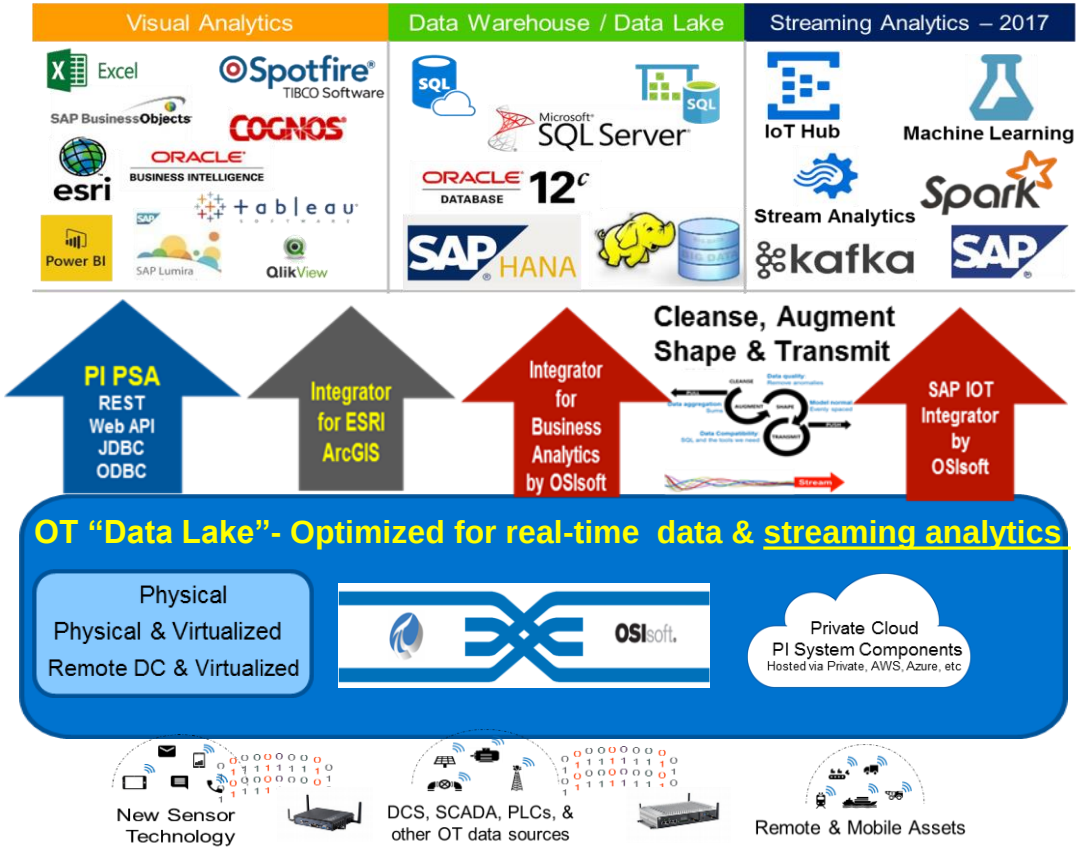
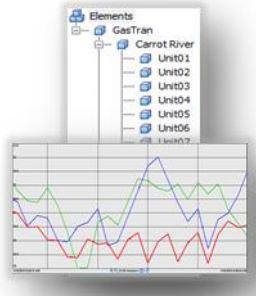
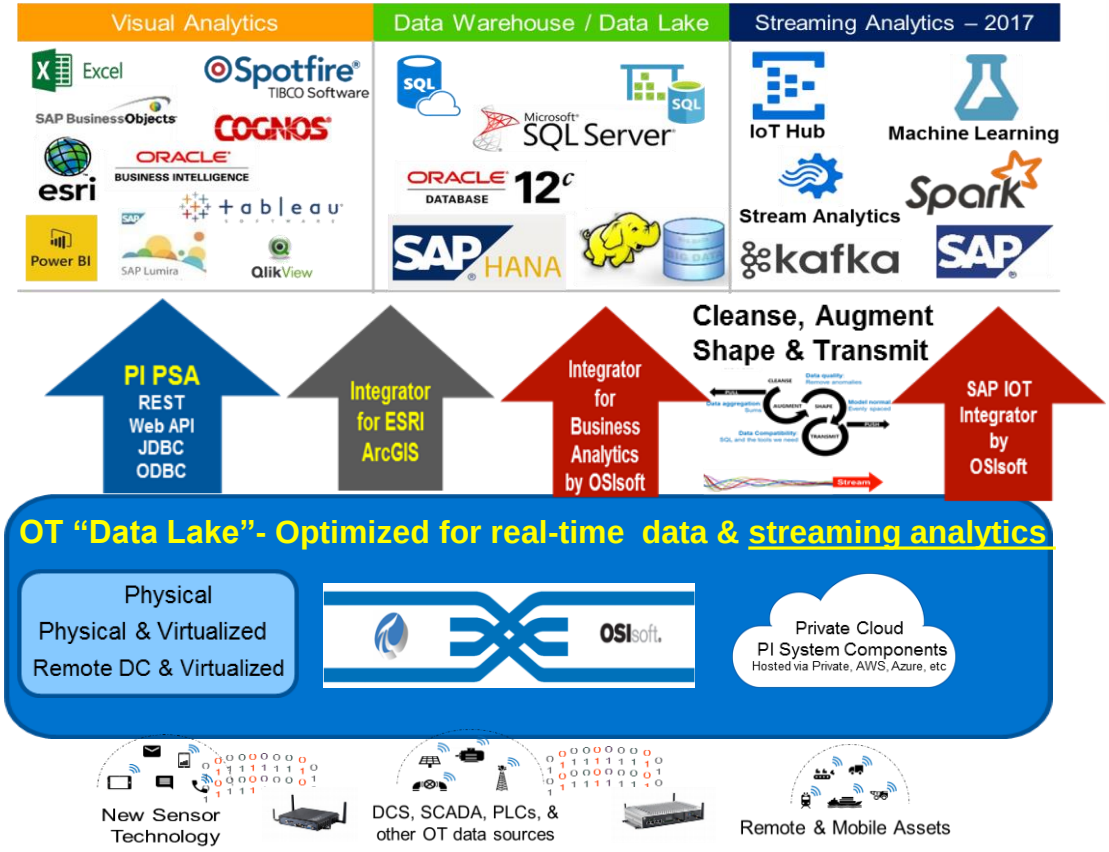


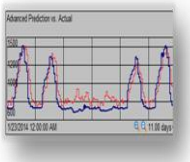
Hybrid “Data Lake”- Leveraging Fit for Design Technologies

Tabular & Unstructured +



Linear/Time, Event, Asset Context Structured

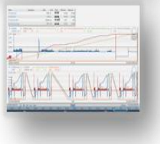




Predictive Statistical Modeling ML/AI

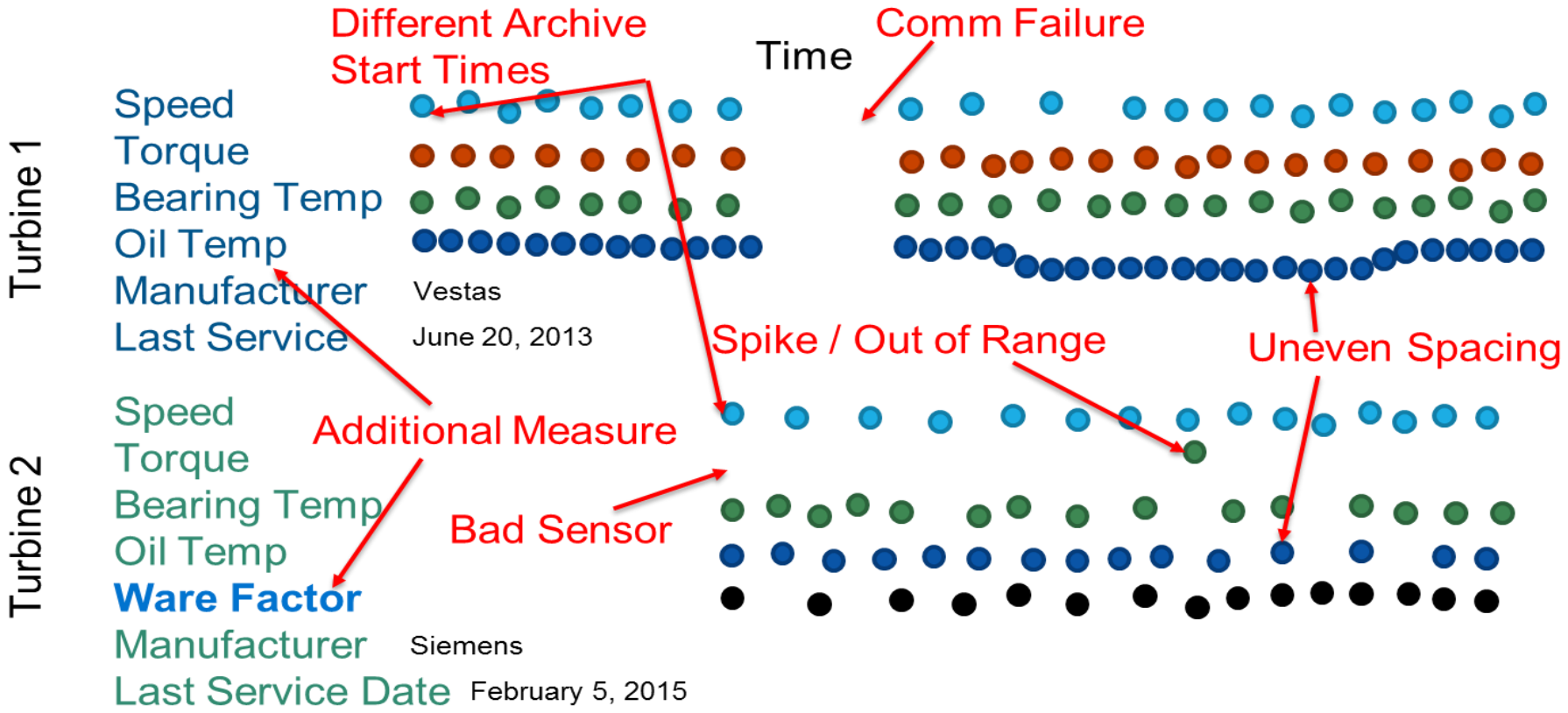
Dashboards Geospatial & multi-dimensional assessment

$$Q = \frac{\Delta P_{DD} * kh}{141.2 \mu B_0 \left\{ ln \frac{r_e}{r_w} - \frac{3}{4} + S \right\}}$$



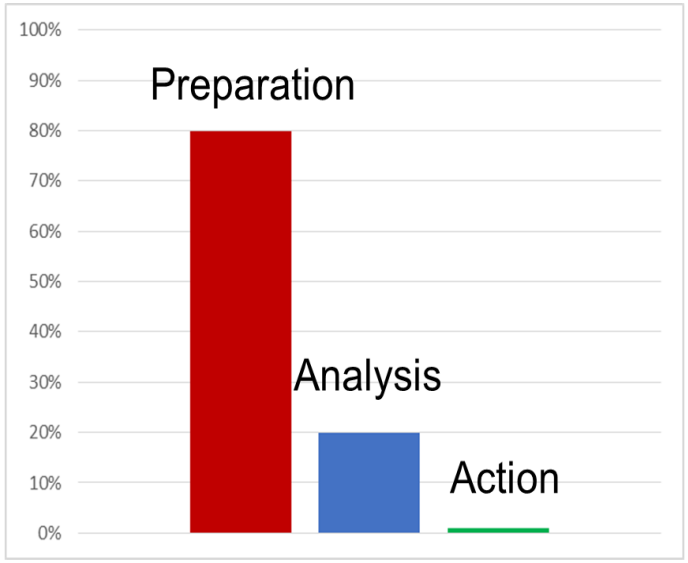
Prescriptive, Empirical, & Physics based Streaming Analytics

The Smart OT Infrastructure is Designed to Deal with the Unique Characteristics of Time Series data and Metadata

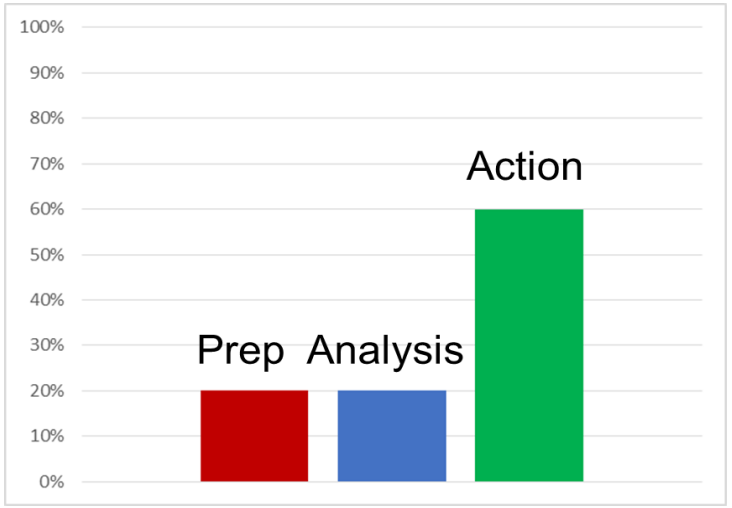


Refocusing on Data Use vs Cleansing and Preparation

Hybrid "Data Lake" Approach vs a pure RDB "Data Lake" Approach

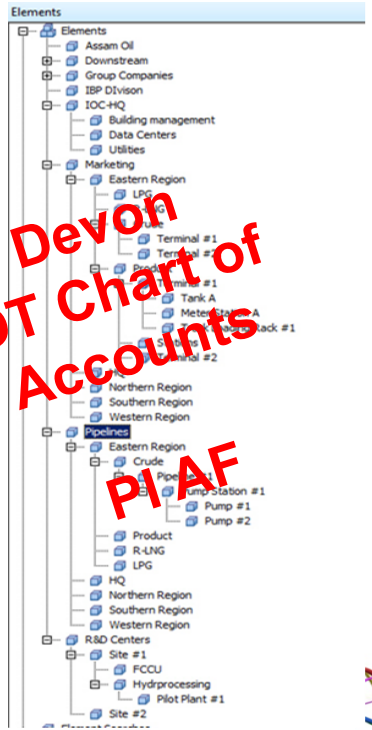


Data cleansing and preparation tasks can take 50-80% of the development time and cost



Spending more time getting new, actionable insights from existing data sets….minimizing the "lost opportunity costs"

The OT Data Model(PI AF) is Foundational for Higher Level Analytics & The Power of Choice and Self-Serve BI



Devon OT Chart of Accounts

PI AF

devon

On Demand/Scheduled

CLEANSE

Data quality: Remove anomalies

PULL

Data aggregation: Sums

AUGMENT

SHAPE

Model normalization: Evenly spaced

PUSH

Data Compatibility: SQL and the tools we need

TRANSMIT

Stream

sas

esri

TIBCO Spotfire

Microsoft SQL Server Reporting Services

hadoop

MEMSQL

Microsoft Azure

Streaming Analytics

Event Hubs | Stream Analytics | Machine Learning

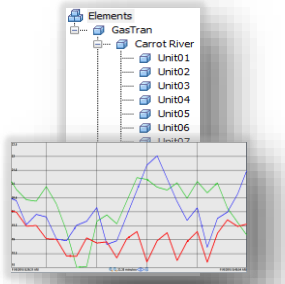
kafka | STORM | Spark

Key Differentiator #4

They **define "analytics"** and **"Layers of analytics**" as a framework for their **analytical journey** with a mapping of examples and use an **infrastructure approach leveraging the OT Infrastructure**

An Evolutionary Approach to Analytics

Laying the Analytical Foundation with PI AF



Time, Event and Asset Context

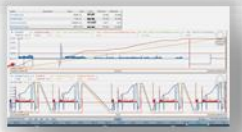
Real-time Streaming Analytics

Human Analytics

Descriptive & Prescriptive
Level 1 Predictive

$$Q = \frac{\Delta P_{DD} * kh}{141.2 \mu B_0 \left\{ ln \frac{r_e}{r_w} - \frac{3}{4} + S \right\}}$$

Real-time, contextual, exception based decision support



Evolutionary Approach to Analytics- Moving up the Ladder

Tabular Context

Community ML/AI

Strategic ML/AI

Tactical ML/AI

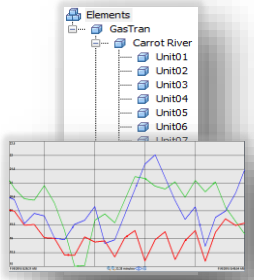
PI PSA REST Web API JDBC ODBC

Integrator for Business Analytics by OSIsoft

SAP IOT Integrator by OSIsoft

Real-time Streaming Analytics

Human Analytics



Time, Event and Asset Context

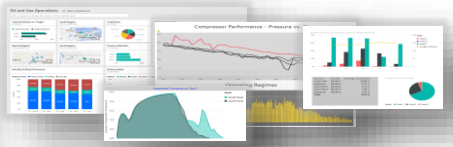
Predictive

Statistical Modelling & Machine Learning/AI (Pattern Recognition)

Level 2+ Predictive

Visual

Dashboards & Multidimensional Assessment



Descriptive & Prescriptive

Level 1 Predictive

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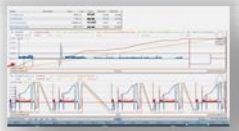
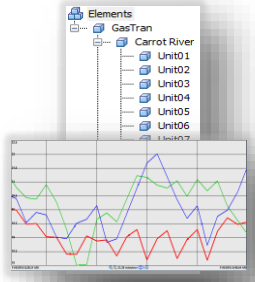


An Evolutionary Approach to Analytics- Moving to the Edge

Tabular Context



Time, Event and Asset Context

Community ML/AI

Strategic ML/AI

Tactical ML/AI

PI PSA
REST
Web API
JDBC
ODBC

Integrator for Business Analytics by OSIsoft

SAP IOT Integrator by OSIsoft

Real-time Streaming Analytics

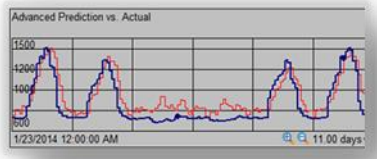
Human Analytics

Edge Analytics

Predictive

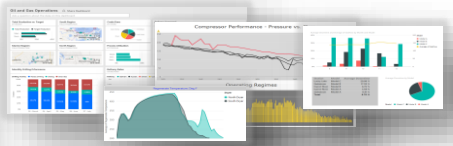
Statistical Modelling & Machine Learning/AI (Pattern Recognition)

Level 2+ Predictive



Visual

Dashboards & Multidimensional Assessment



Descriptive & Prescriptive

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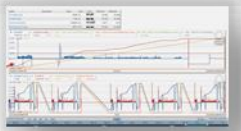

Descriptive & Prescriptive

Level 1 Predictive

Machine Learning/AI/M2M

An Evolutionary Approach to Analytics- Enabled by PI AF

Tabular Context

Community ML/AI

Strategic ML/AI

Tactical ML/AI

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JDBC
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Integrator for Business Analytics by OSIsoft

SAP IOT Integrator by OSIsoft

Real-tim Analytics

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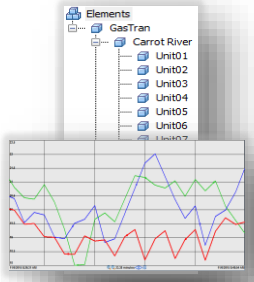
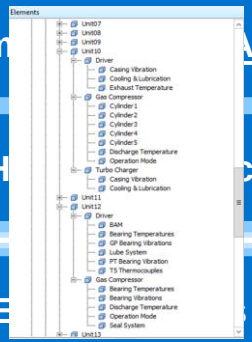


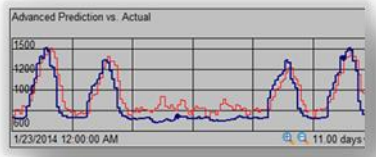
Time, Event and Asset Context



Predictive

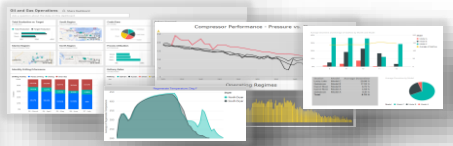
Statistical Modelling & Machine Learning/AI (Pattern Recognition)

Level 2+ Predictive



Visual

Dashboards & Multidimensional Assessment



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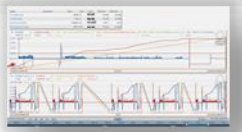


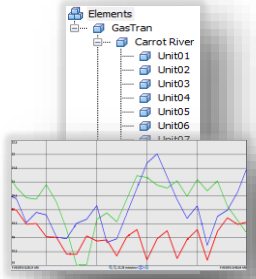
Descriptive & Prescriptive

Level 1 Predictive

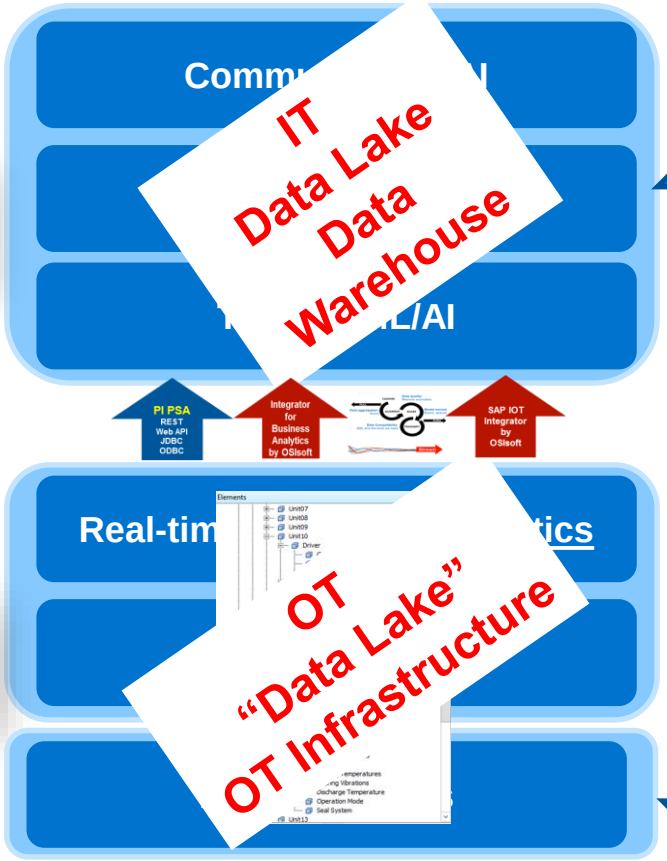
Machine Learning/AI/M2M

Evolutionary Approach to Analytics- The Hybrid Data Lake

Tabular Context



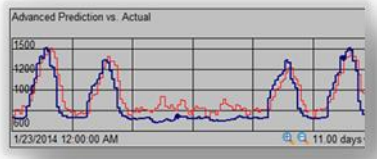
Time, Event and Asset Context



Predictive

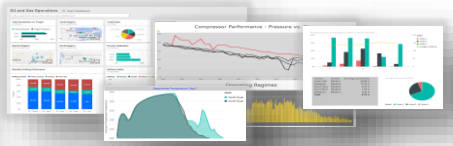
Statistical Modelling & Machine Learning/AI (Pattern Recognition)

Level 2+ Predictive



Visual

Dashboards & Multidimensional Assessment

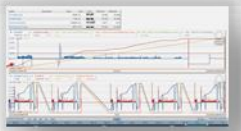


Descriptive & Prescriptive

Level 1 Predictive

$$Q = \frac{\Delta P_{DD} * kh}{141.2 \mu B_0 \left\{ ln \frac{r_e}{r_w} - \frac{3}{4} + S \right\}}$$

Real-time, contextual, exception based decision support



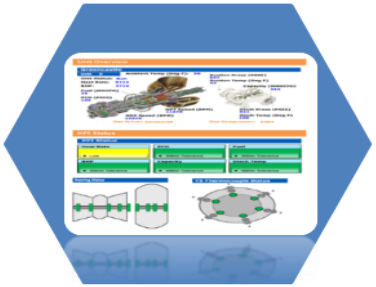
Descriptive & Prescriptive

Level 1 Predictive

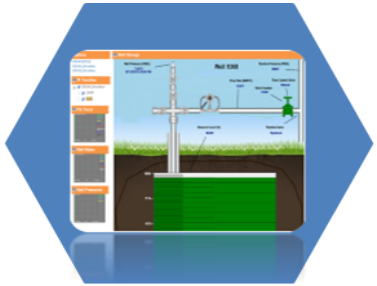
Machine Learning/AI/M2M

Our Focus Over Time

TransCanada
In business to deliver



Compression Reliability



Storage Analytics

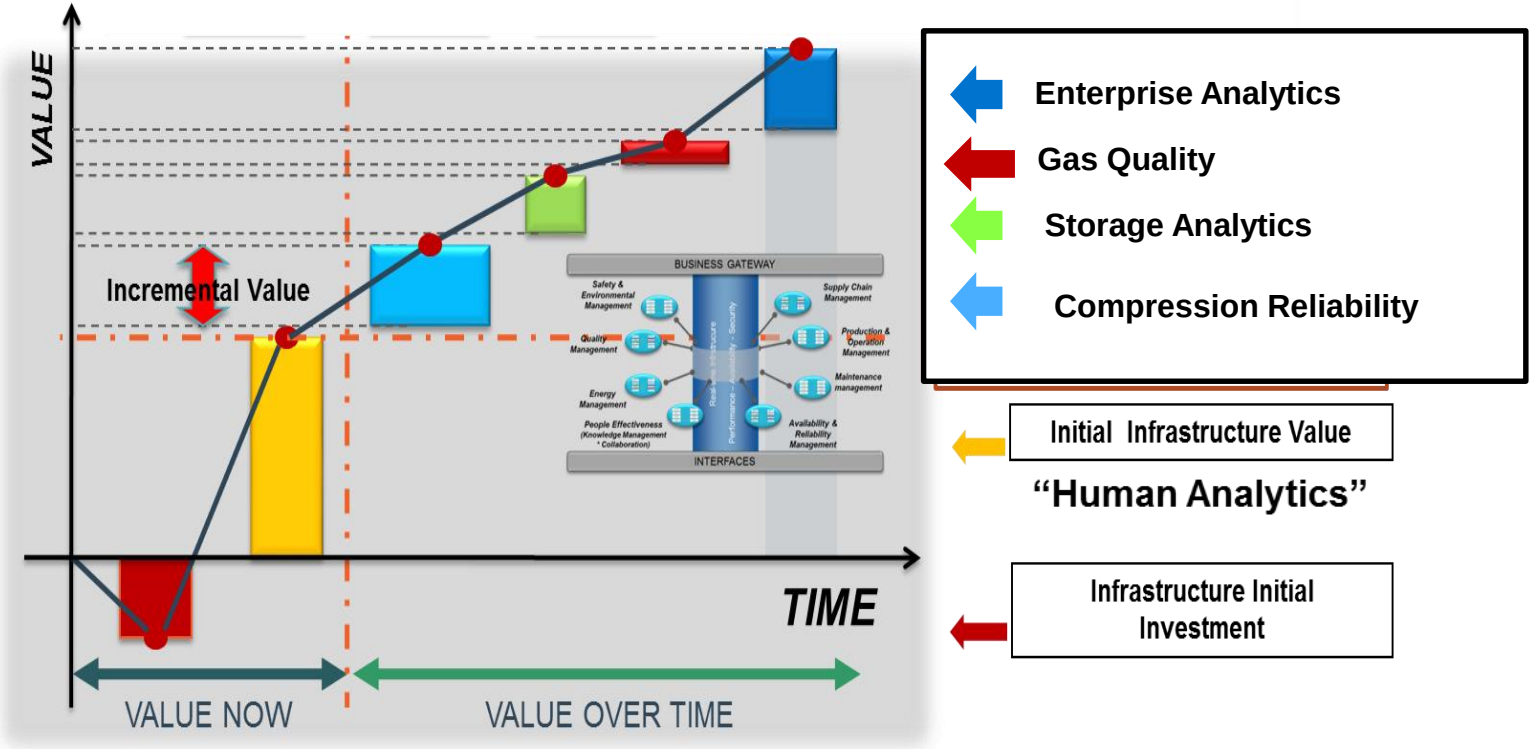
Gas Quality

Enterprise Analytics

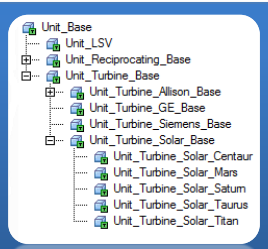
Executive Dashboards

2012 - 2013 | 2013 - 2014 | 2015 - 2016

An Infrastructure Investment Approach - “OT Data Utility”

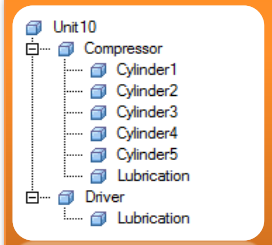


Why Leverage the Smart OT Infrastructure?



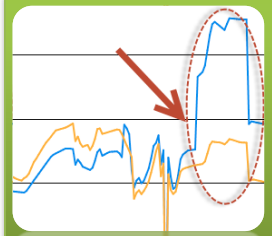
Scalability

- Highly Scalable
- Smart Asset Objects (Element Templates)
- Inheritance – Ability to modularize and shape



Dynamic, Logical Asset Structure

- Model our equipment fleet using a logical structure that is familiar to our engineers and analysts – “in context”
- Bring operational time-series data and relational asset data together to implement complex calculations & analytics



Test and Validate- Ability to Evolve Over Time

- Develop hypophysis for anomaly and modify analytics
- Run the analytics back in time to test and validate the revised algorithms
- Once validated in template, rapidly propagate to all instances

Calculating Expected Heat Rate

TransCanada
In business to deliver

	_CoeffType	ECMax
	A	3.01916
	B	0
	C	-140.82336
	D	0
	E	3431.05804
	F	0
	G	-39811.23565
	H	0
	I	226037.87046
	J	0
	K	-524290.83316
	L	0
	M	0
	N	0
	O	0
	P	0
	Q	0

Lookup curve-fit coefficients from SQL Table (Manufacturer Performance Curves)

Data Reference: Table Lookup

Settings...

SELECT CoefficientValue FROM PerformanceCentrifEff WHERE PerformanceModelID = @[PerformanceModelID] AND CoefficientType = @[_CoeffType] AND CoefficientOrder = 1

Category: Nominal Values	
BHP_Nominal	8710.27322604474 BHP
FuelRate_Nominal	71.1036975854648 MCFH
HeatRate_Nominal	8163.19944739005 BTU(LHV)/BHP-hr
PCD_Nominal	205.15303353481 psi
T5_Nominal	1394.59524035539 °F
T7_Nominal	925.386891989674 °F

Apply curve-fit to calculate Nominal Heat Rate

Data Reference: Formula

Settings...

S=..\Driver|Steady Speed;A=.|A;B=.|B;C=.|C;D=.|D;E=.|E;F=.|F;G=.|G;H=.|H;I=.|I;J=.|J;K=.|K;L=.|L;M=.|M;N=.|N;O=.|O;P=.|P;Q=.|Q;X=FC_MaxSpeed;[if not(S) then 0 else (A + C*X + E*X^2 + G*X^3 + I*X^4 + K*X^5 + M*X^6 + O*X^7 + Q*X^8)/(1 + B*X + D*X^2 + F*X^3 + H*X^4 + J*X^5 + L*X^6 + N*X^7 + P*X^8)]

	Unit_Heat_Rate_Actual	9843.68334570345 BTU(LHV)/BHP-hr

Calculate Actual Heat Rate

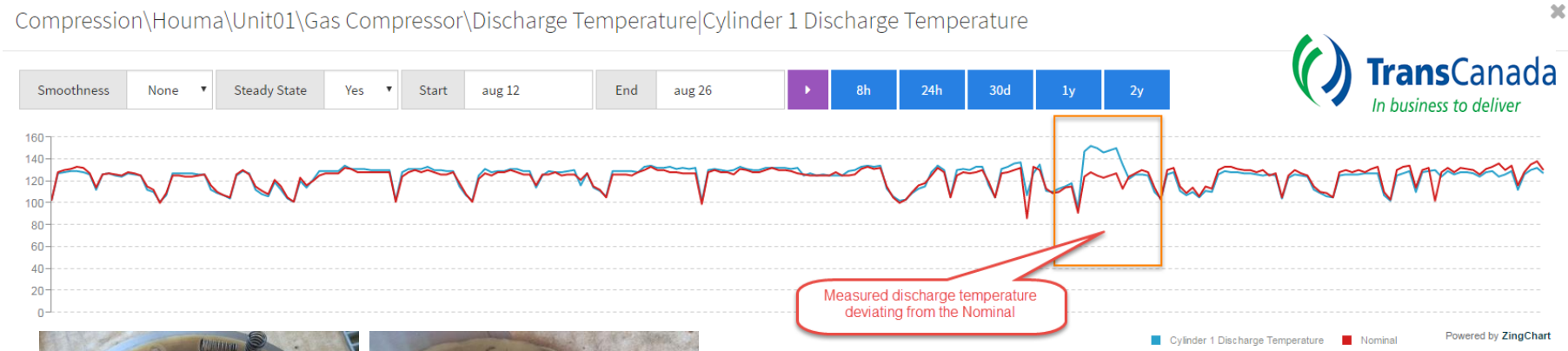
Data Reference: Formula

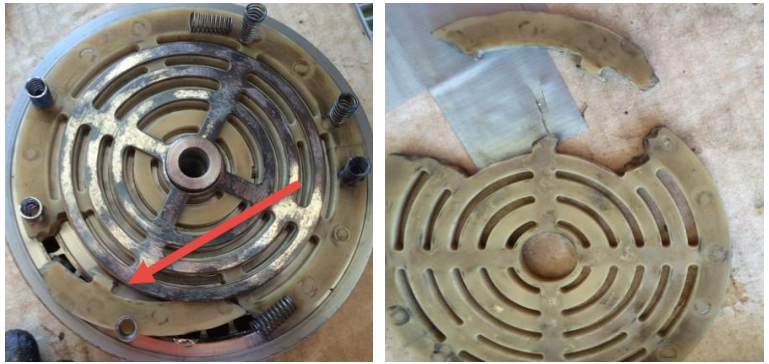
Settings...

A=Unit_BHP;B=Unit_Fuel;C=Unit BTU;[if badval(A) or badval(B) then 0 else if A<=30 then 0 else (B*(1000*C*0.915))/A]

Example of Predictive Analytics in PI AF – Expected vs Actual

EA Finding using KPI Strategy

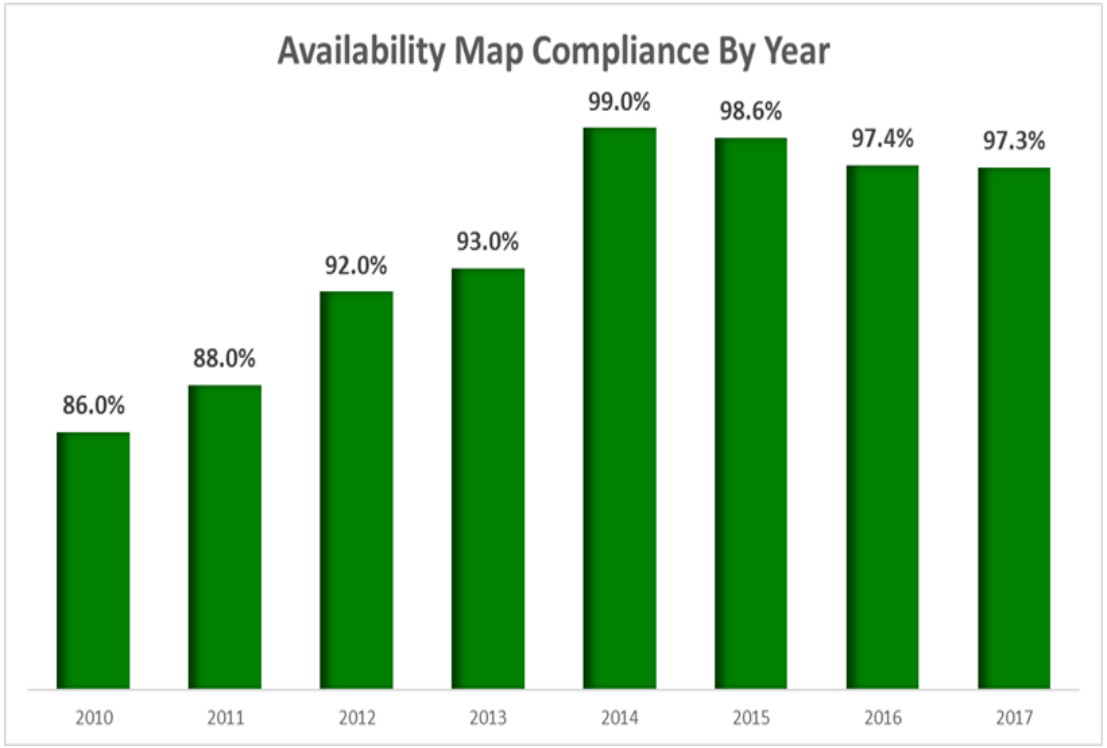




Found partially damaged compressor valve.
The valve was replaced in a planned & controlled manner.

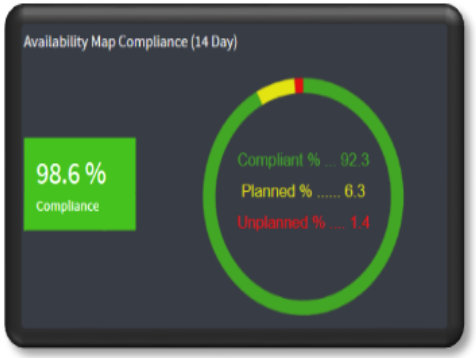
Compression Availability Compliance

TransCanada
In business to deliver



Visibility

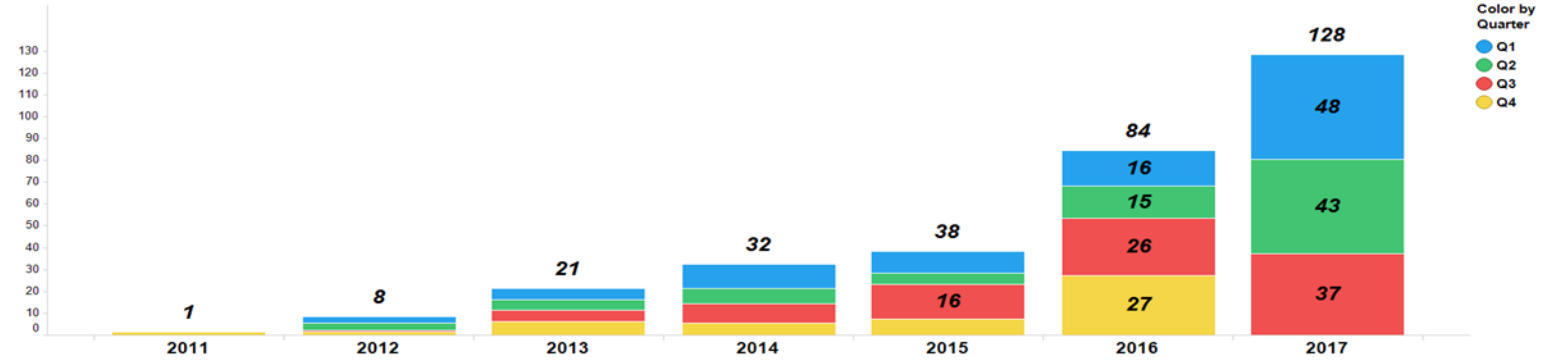
- Real-time dashboard

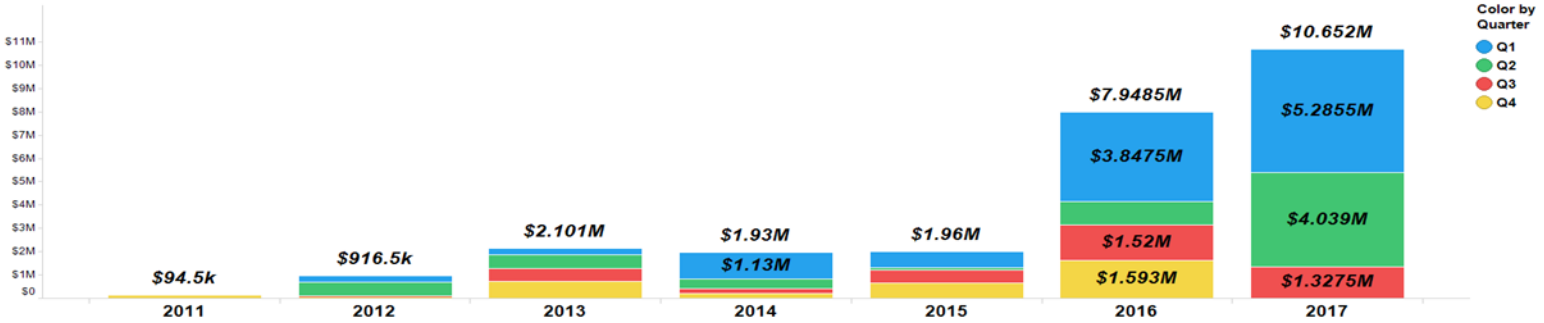


- Monthly scorecard reporting to president

Delivering ~$25M since EA in 2012 from Anomaly Detection

TransCanada
In business to deliver





PI Vision - Petrolux Land

https://picsprevieww.osisoft.com/PIVision/#/Displays/261051/Petrolux-Land-Rig-Overview?asset=%5C%5CDFPIAF%5CPetroLux%5CPetroLux%20Corporation%5CUpstream%5CDrilling%20Operations%202%5CDrillingRig1

OSIsoft PI Vision | New Display | OSI\bharclerode

Petrolux Land Rig Overview | Asset: DrillingRig1+ | Ad Hoc Display

Petrolux Upstream

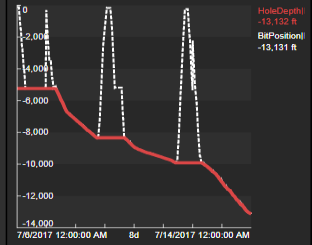
DrillingRig1 - Rig Overview

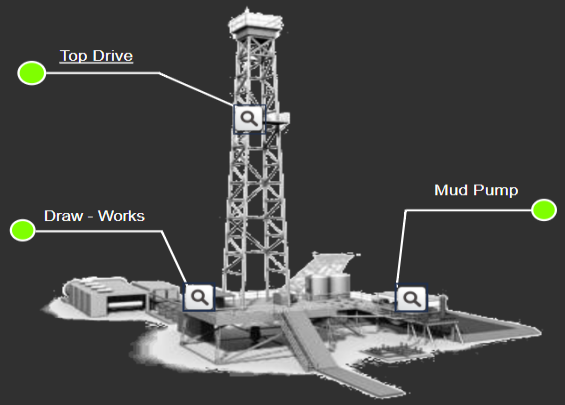
- Home
- Reports
- Land Rigs
  - Rig Overview
  - Mud Motor Performance
  - Drilling Efficiency Dashboard

Well

Description	Value
Current Well ID	Well ID-105
Hole Section	Lateral
Phase of Current Hole Section	Drilling
Rig State	InSlips

Depth Profile



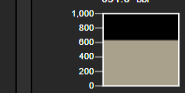


Current Drilling Parameters

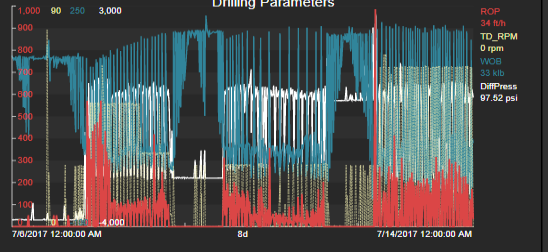
Description	Value	Units
WOB	33	klb
Top Drive RPMs	0	rpm
ROP	34	ft/h
Hole Depth	13132	ft
	97.52	psi

Mud Volume

631.6 bbl



Drilling Parameters

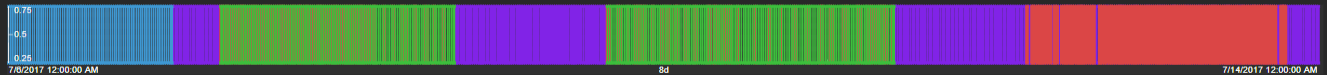


Event Name	Event Type	Start Time	End Time	Duration
DrillingRig1.Crew C Events	Drilling Crew	1/1/2017 12:00:00 AM	1/1/2017 6:00:00 AM	6h
DrillingRig1.Crew D Events	Drilling Crew	1/1/2017 6:00:00 AM	1/1/2017 6:00:00 PM	12h
DrillingRig1.Crew C Events	Drilling Crew	1/1/2017 6:00:00 PM	1/2/2017 6:00:00 AM	12h

Crew A

Shift Night

Operational Timeline



7/6/2017 12:00:00 AM | ◀ 8d ▶ | Now | 7/14/2017 12:00:00 AM

Name	Expression
DSSlope	(TagVal('Drill Strength','*')-PrevVal('Drill Strength','*-1m'))/('*'-PrevEvent('Drill Strength','*-1m'))
DSSlopeCheck	BadVal('Drill Strength Slope') or 'Drill Strength Slope'=0
MSESlope	If MSECheck=True Then NoOutput() Else (TagVal('MSE','*')-PrevVal('MSE','*-1m'))/('*'-PrevEvent('MSE','*-1m'))
MSESlopeCheck	BadVal('MSE Slope') or 'MSE Slope'=0
MSEDS	If DSSlopeCheck=True or MSESlopeCheck=True Then NoOutput() Else MSESlope/DSSlope
RatioSlope	If RatioCheck=True Then NoOutput() Else ('MSE_DS_Slope'-PrevVal('MSE_DS_Slope','*-1m'))/('*'-PrevEvent('MSE_DS_Slope','*-1m'))
UCS	If MSECheck=True or DSCheck=True or RatioCheck=True Then NoOutput() Else If MSESlope>0 and DSslope>0 and RatioSlope<0 Then 0 Else If MSESlope<0 and DSSlope<0 and RatioSlope>0 Then 1 Else NoOutput()
BitBalling	If MSECheck=True or DSCheck=True or RatioCheck=True Then NoOutput() Else If MSESlope>0 and DSSlope>0 and RatioSlope<0 Then 1 Else NoOutput()
Vibration	If MSECheck=True or DSCheck=True or RatioCheck=True Then NoOutput() Else If MSESlope>0 and DSSlope>0 and RatioSlope>0 Then 1 Else NoOutput()
Wear	If MSECheck=True or DSCheck=True or RatioCheck=True Then NoOutput() Else If MSESlope>0 and DSSlope>0 and RatioSlope<0 Then 1 Else NoOutput()
DrillingDysfunction	If UCS=0 Then 0 Else If UCS=1 Then 1 Else If BitBalling=1 Then 2 Else If Vibration=1 Then 3 Else If Wear=1 Then 4 Else NoOutput()

PI Vision - RealTime Land

https://picspreview.osisoft.com/PIVision/#/Displays/261056/RealTime-Land-Drilling-Dashboard?asset=%5C%5CDFPIAF%5CPetroLux%5CPetroLux%20Corporation%5CUpstream%5CDrilling%20Operations%202%5CDrillingRig1

OSIsoft PI Vision

New Display | OSI\bharclerode

RealTime Land Drilling Dashboard Asset: DrillingRig1

Ad Hoc Display

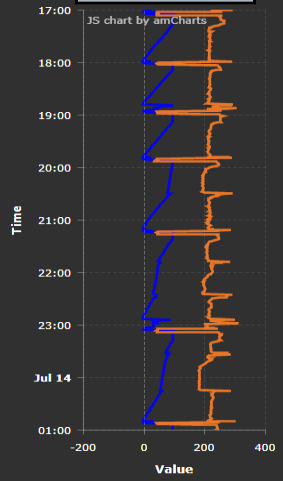
Hole Depth 13196 feet	Block Height 92.165 feet	Rotary RPMs 65 rpm	WOB 12 klbs	SPP 2,362.7 psi
Bit Depth 13196 feet	Hookload 231.79 klbs	Rotary Torque 16,431 ft-lbs	ROP 58 ft/hr	Diff 68.896 psi

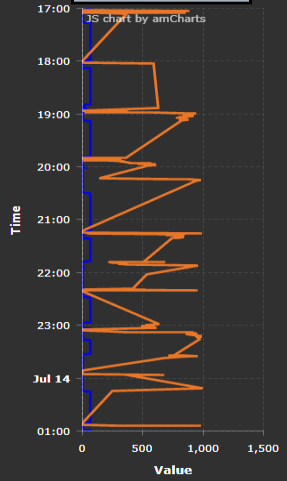
Rig State: Rotary Drilling

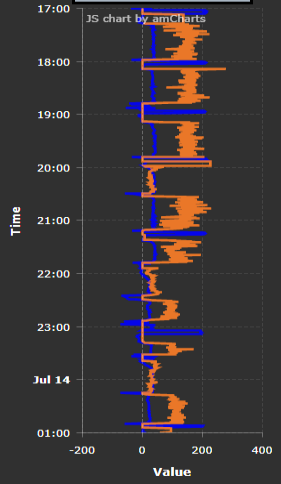
Hole Section: Lateral

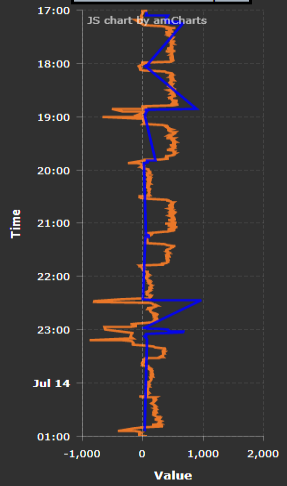
Hole Section Phase: Drilling

Back





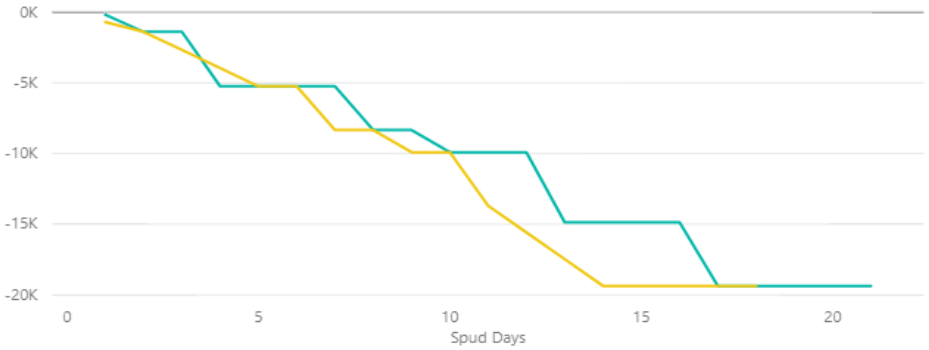




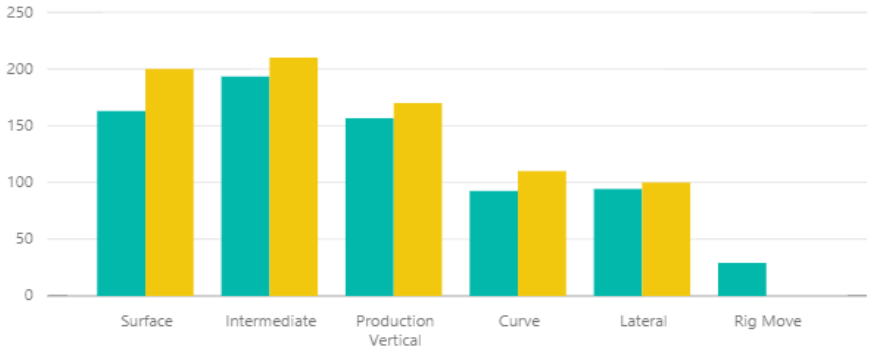
7/13/2017 5:00:00 PM 8h Now 7/14/2017 1:00:00 AM

Well Phase Analysis

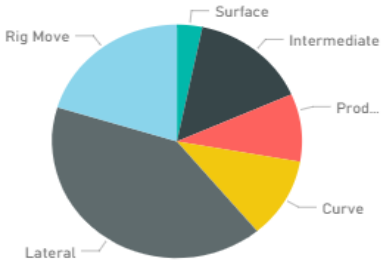
Days vs Depth with Composite Best



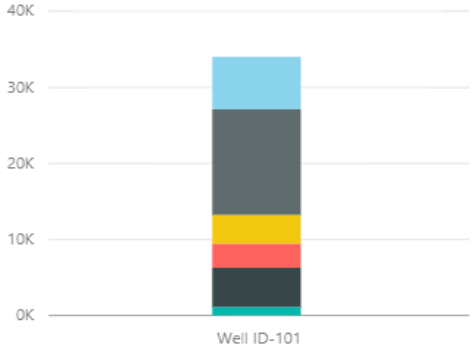
Hole Section ROP vs Composite Best



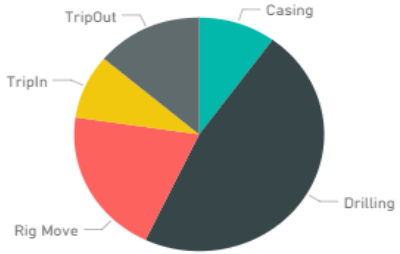
Hole Section Percentage



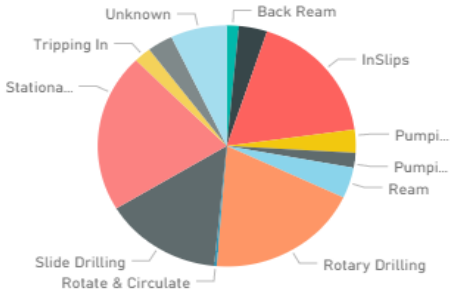
Hole Section Duration By Well

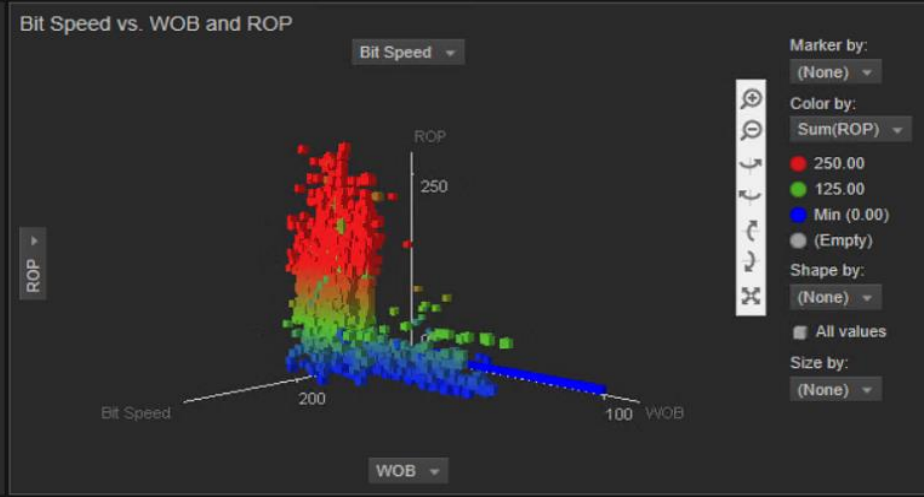


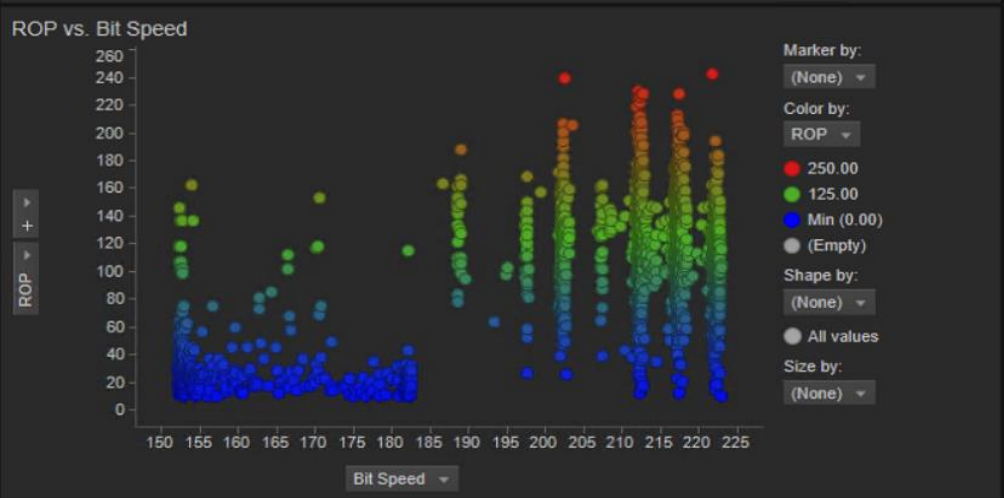
Hole Section Phase Percentage

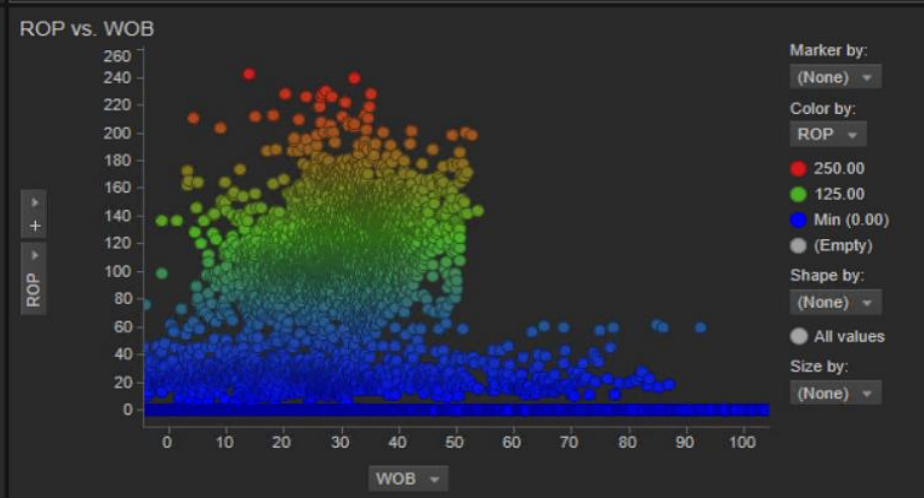


Rig State Percentage





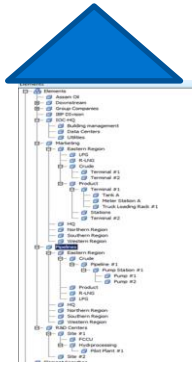




Defining, Rationalization & Distribution of "Analytics" ……"Layers of Analytics"

SAP HANA

Microsoft Azure



Integrated Control & Safety Systems Excel Files

Strategic Machine Learning/Big Data/Advanced Analytics
Enabled by the OT Infrastructure

Analytics and Predictions for :
- Dynamic or "smart" IOW/targets/APM/PSM
- "How do you "smooth" operations?
- How do you optimize the yields?
- How do we optimize the fuels value chain?

Tactical Machine Learning/Big Data/Advanced Analytics
Enabled by the OT Infrastructure

Analytics & Predictions for :
- Coker Hotspot
- Hydro treater sulfur in product
- Hydro treater cloud point
- Bromine Index Benzene
- Coke drum filling & removal

27+ Tactical ML Apps in production

Real-time Analytics –
In the OT Infrastructure

Analytics and Predictions for:
- Corrosion analytics (HTHA, chlorides, etc.)
- Natural gas & electrical peak exceedances
- CBM – exchangers, rotating equipment, etc.
- Environmental Limit predictions.

Human Analytics
Enabled By *and* In the OT Infrastructure

Enablement of:
- Data Based Decisions
- Real-time situational awareness
- Management by exception

61,000 Event frames across 6 plants

Natural Gas Consumption Prediction

BackGround

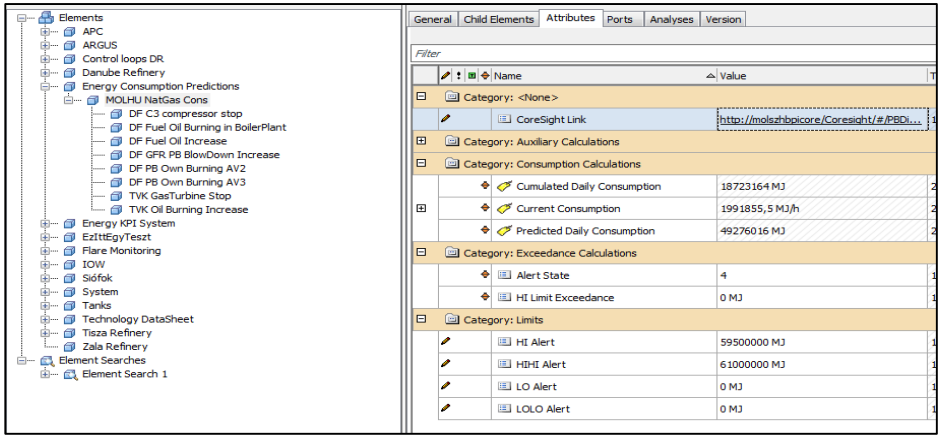
- Huge saving possibilities in the decrease of contracted natural gas daily maximum amount

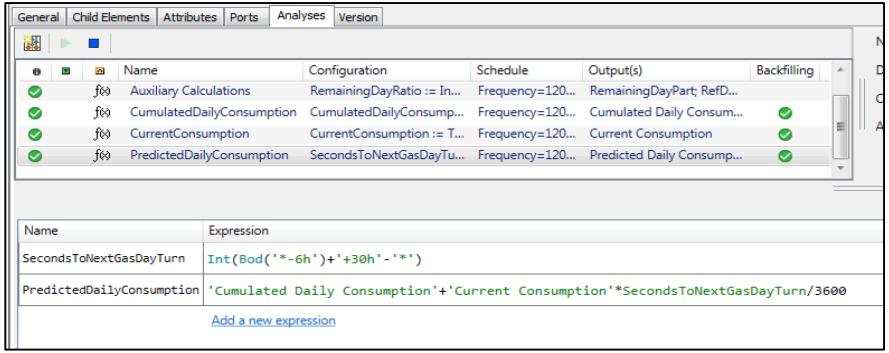
Problem

- High penalty on daily amount exceedance
- Alerting system was needed

Solution

- Consumption prediction calculations in PI Analysis
- Detailed information on PI Vision display (about consumption, prediction, contacts of decision makers)
- E-mail alerting system in Notifications





Integration of the OT Infrastructure & SAP PM

Smart OT Infrastructure

- Process database
- Online analysis of process information
- Calculation of asset health
  - Asset condition
  - Number of Cycles
  - Running hours
  - Performance
- User Interface
  - PI Coresight
  - PI DataLink

Connection
(WebLogic)

Calculated asset health →

← Maintenance related information

SAP PM

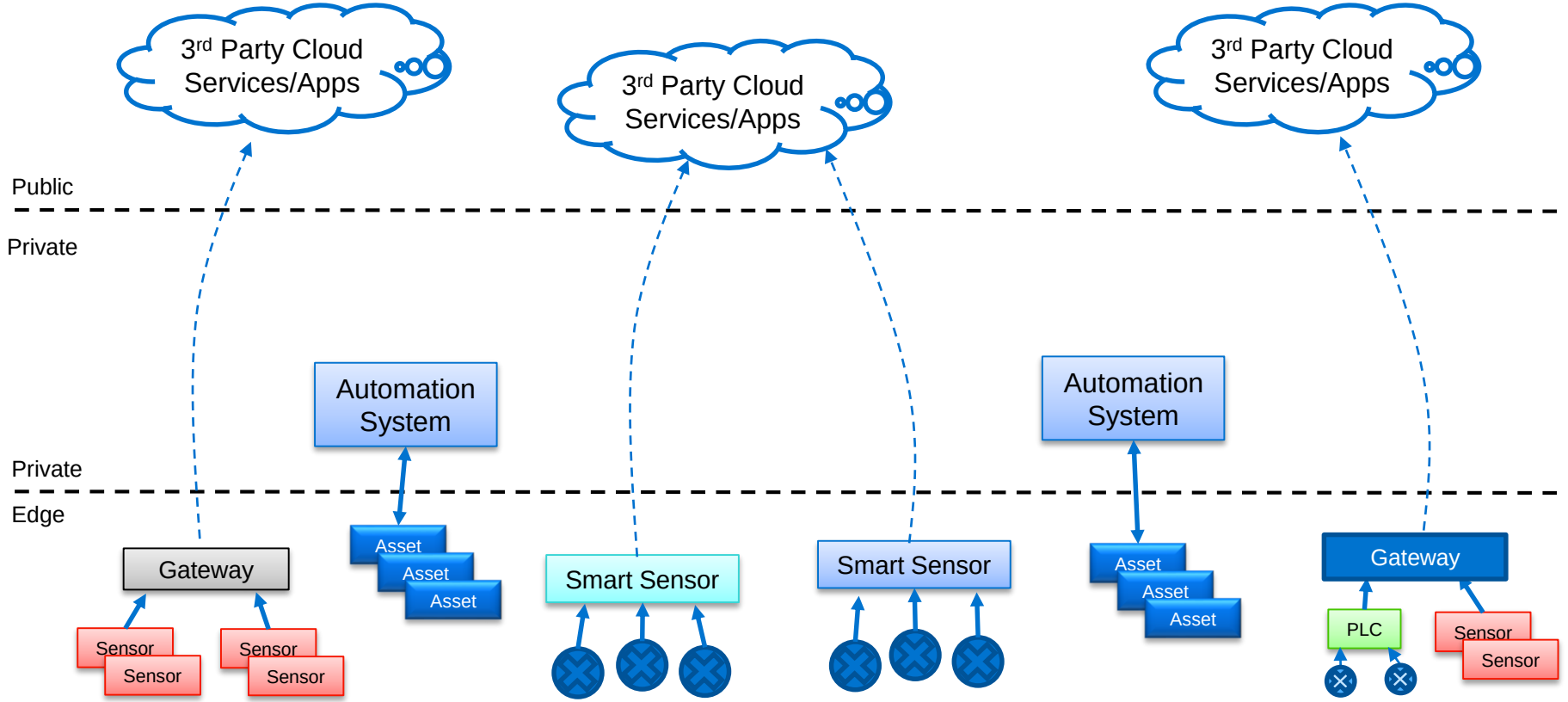
- Technical database
- Management of maintenance processes
- Creation of work orders or notifications
- Trigger maintenance strategies based on asset health

All Rotating Equipment, Exchangers, Critical Valves, critical equipment etc. are now on CBM vs Time Based and use a Heath Index that MOL Subject Matter Experts Maintain in the asset template – Changes propagate across the MOL Enterprise

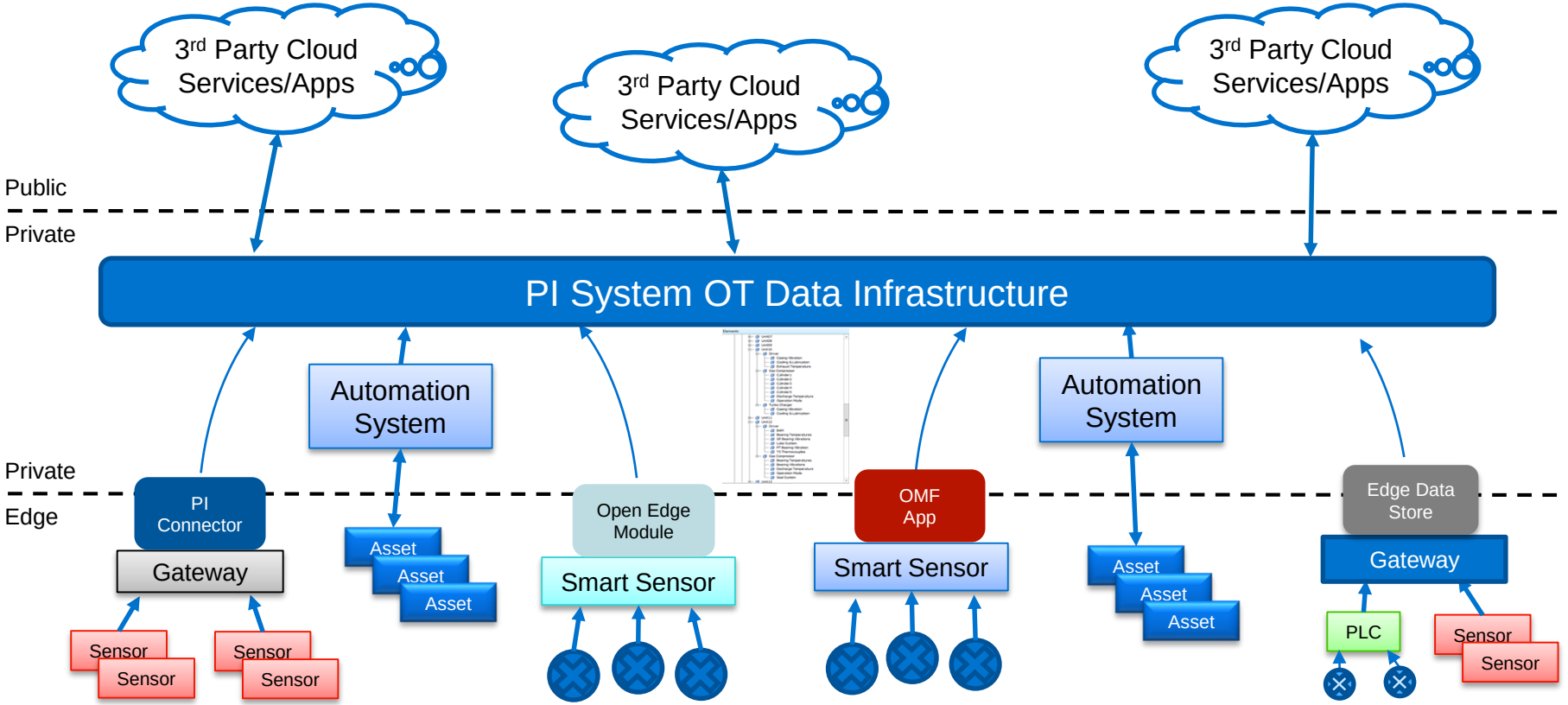
Key Differentiator #5

They see **IOT as an extension of the PI System Infrastructure** via IOT connectors as required to **mesh IOT data with the wired sensory data..not a rush to "the cloud"**

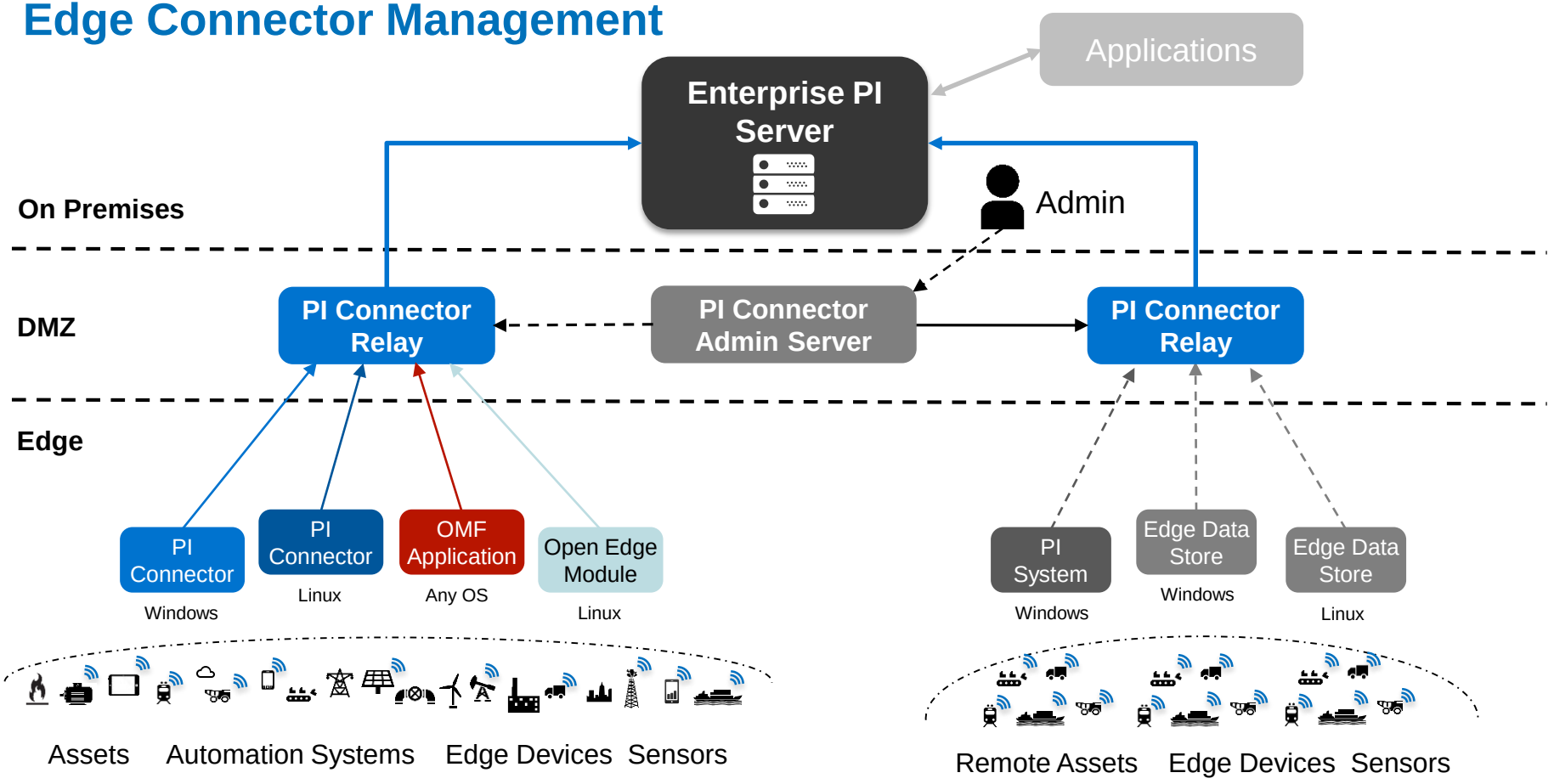
Typical Industrial IoT Architecture



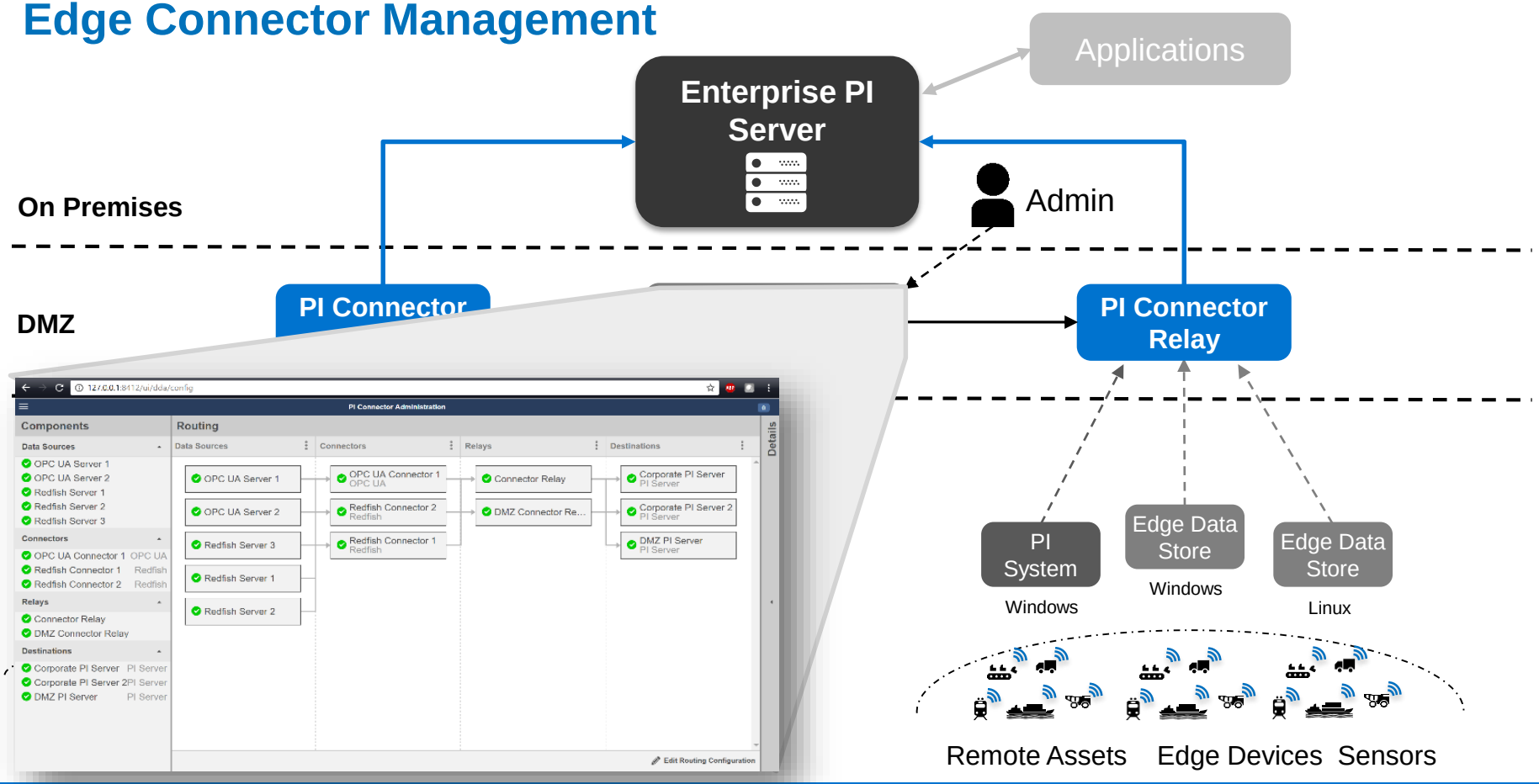
Brining DCS/SCADA and IOT/Edge Data together in Context



Edge Connector Management



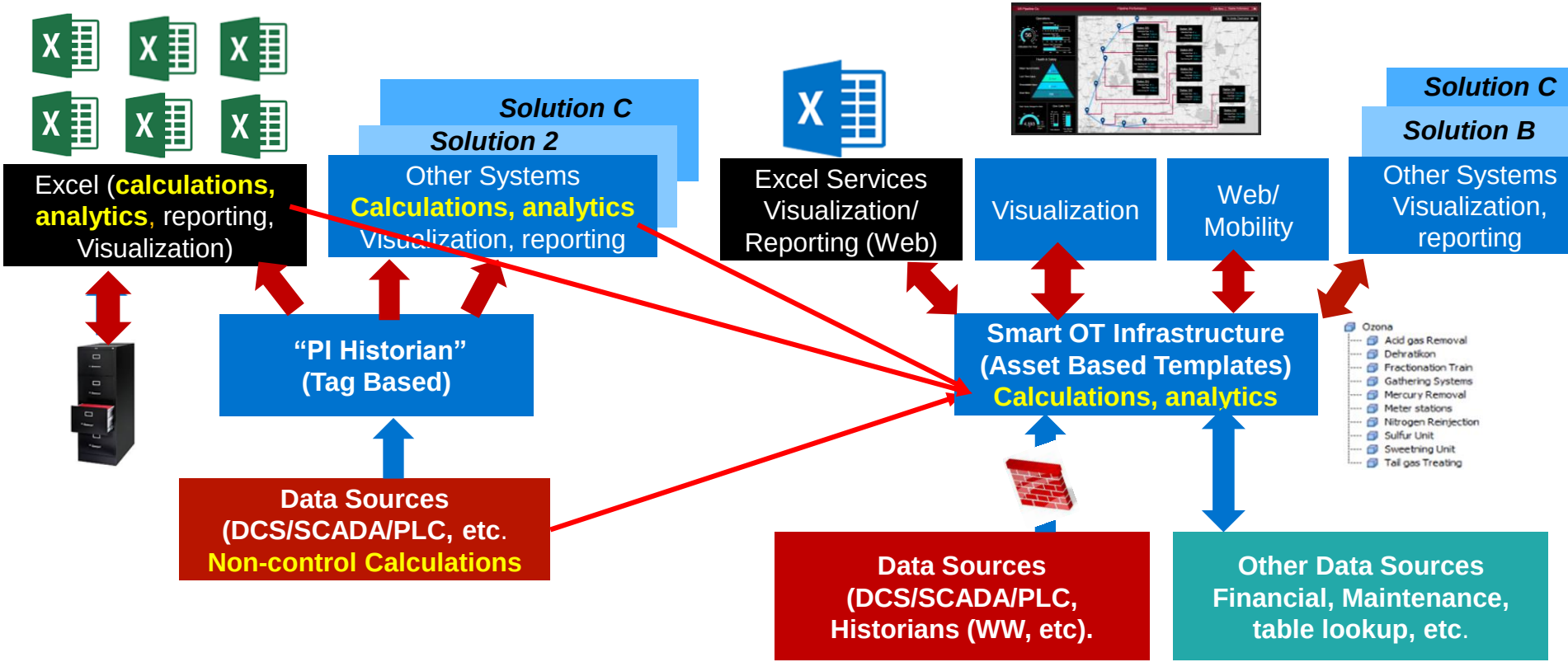
Edge Connector Management



Key Differentiator #6

They **simplified and standardized calculations** and analytics by **migrating to the PI System OT infrastructure**

Standardizing Calculations & Analytics

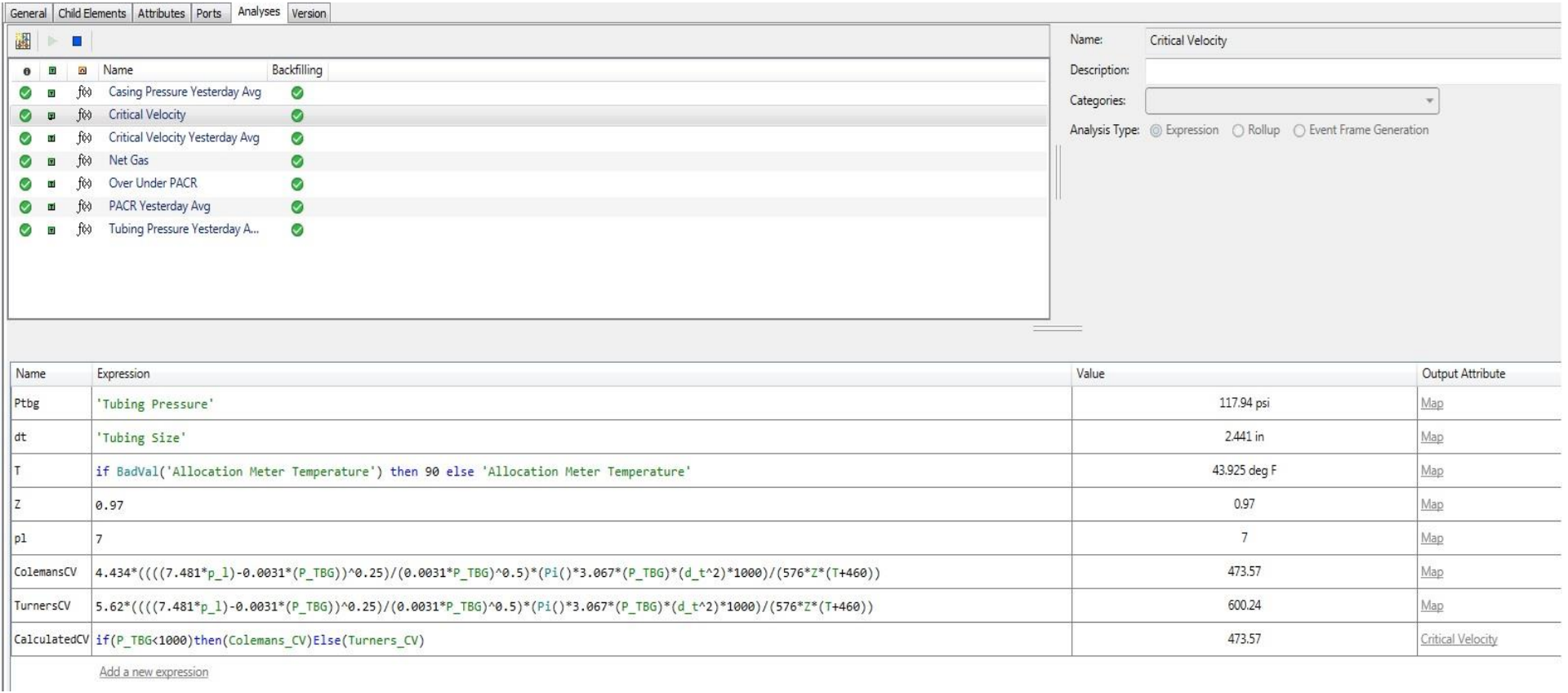


PI System Used for Eliminating Spreadsheets (cont'd.)

Using PI Vision to ELIMINATE Excel all together from the equation

	Above Critical?	Over Under Critical	Allocation Meter Cu	Critical Velocity	Gas Lift Injection	Injection Set Point
Timbro LC13-73HN	No	-159.75 mcfd	520.83 mcfd	486.35 mcfd	301.78 mcfd	400 mcfd
Timbro L...74-1HN	Yes	-42.592 mcfd	846.58 mcfd	516.08 mcfd	291.43 mcfd	400 mcfd
Timbro LC13-74HN	Yes	-170.67 mcfd	332.12 mcfd	471.5 mcfd	182.03 mcfd	400 mcfd
Timbro L...75-1HN	No	-147.54 mcfd	458.79 mcfd	482.43 mcfd	282.8 mcfd	400 mcfd
Timbro LC13-75HN	No	-63.856 mcfd	0 mcfd	65.622 mcfd	0 mcfd	0 mcfd
Timbro L...76-1HN	Yes	44.696 mcfd	705.1 mcfd	504.19 mcfd	261.42 mcfd	400 mcfd
Timbro LC13-76HN	No	-92.636 mcfd	0 mcfd	99.572 mcfd	0 mcfd	0 mcfd
Timbro L...77-1HN	No	-977.98 mcfd	0 mcfd	977.98 mcfd	0 mcfd	0 mcfd

PI Asset Analytics for Well Performance Calculations



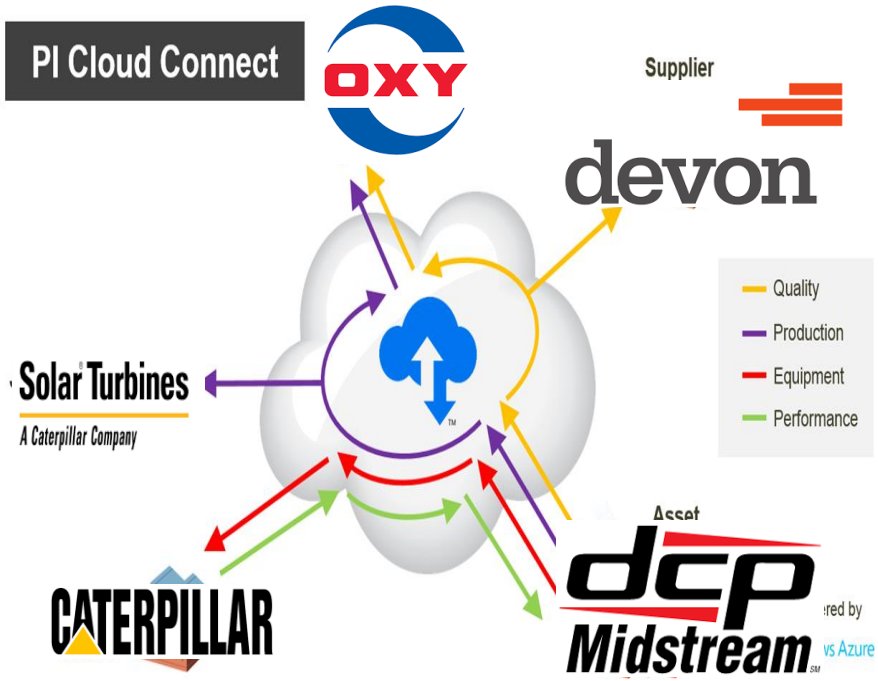
Name	Expression	Value	Output Attribute
Ptbg	'Tubing Pressure'	117.94 psi	Map
dt	'Tubing Size'	2.441 in	Map
T	if BadVal('Allocation Meter Temperature') then 90 else 'Allocation Meter Temperature'	43.925 deg F	Map
Z	0.97	0.97	Map
pl	7	7	Map
ColemansCV	4.434*((((7.481*p_l)-0.0031*(P_TBG))^0.25)/(0.0031*P_TBG)^0.5)*(Pi()*3.067*(P_TBG)*(d_t^2)*1000)/(576*Z*(T+460))	473.57	Map
TurnersCV	5.62*((((7.481*p_l)-0.0031*(P_TBG))^0.25)/(0.0031*P_TBG)^0.5)*(Pi()*3.067*(P_TBG)*(d_t^2)*1000)/(576*Z*(T+460))	600.24	Map
CalculatedCV	if(P_TBG<1000)then(Colemans_CV)Else(Turners_CV)	473.57	Critical Velocity

Add a new expression

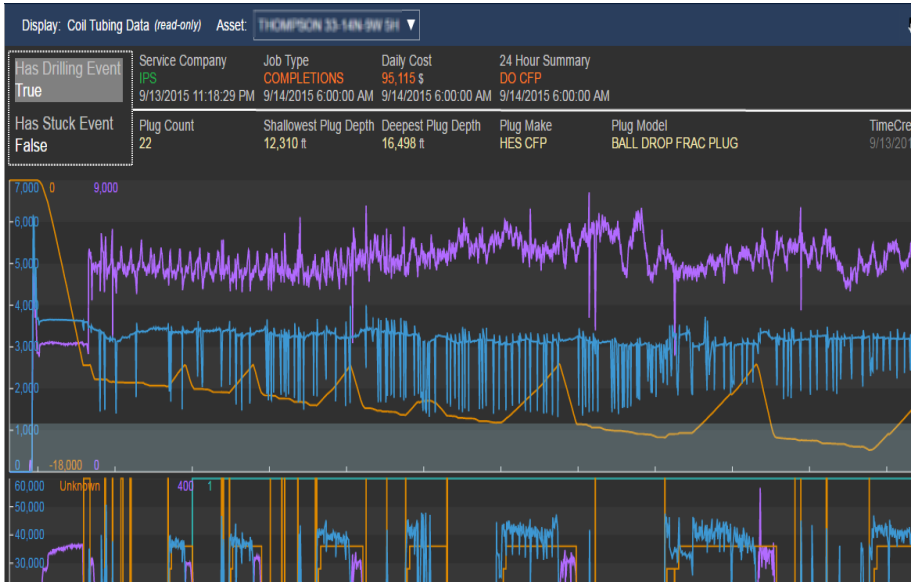
Key Differentiator #7

They see new value from applying **analytics** and **outsourcing** via the **digital value chain** – the community model

Integrating the Digital Value Chain with PI Cloud Connect



Coiled Tubing Analytics NOV & devon



Community Model

Summary - Key Differentiators

1. Guided by the 4M Strategy – “Make Me More Money”
2. Leverage PI AF element templates…. owned by SMEs
3. Use a “hybrid data lake strategy”
4. Define and leverage “Layers of analytics”..and work up and down
5. See IOT as an extension of the PI System Infrastructure
6. Simplified and standardized calculations and analytics in PI AF
7. Moving to analytics on the digital value chain – the community model

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