

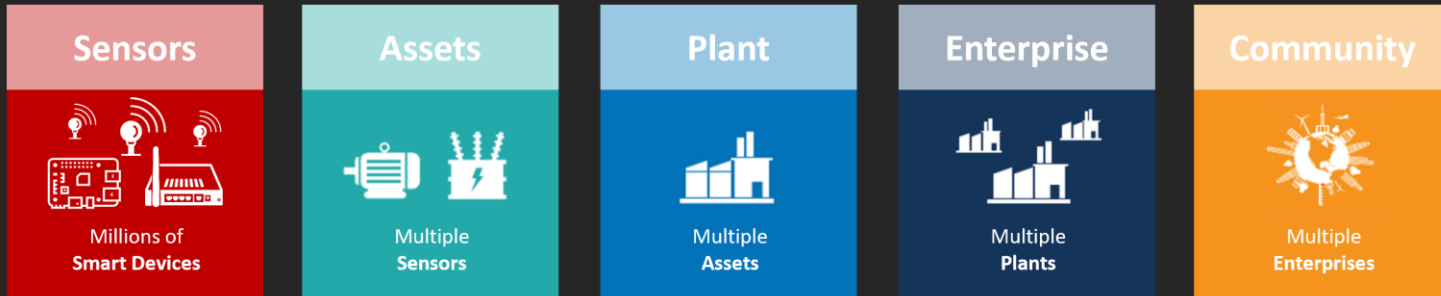
Centralised Data Strategies for Modern Oil & Gas Operations



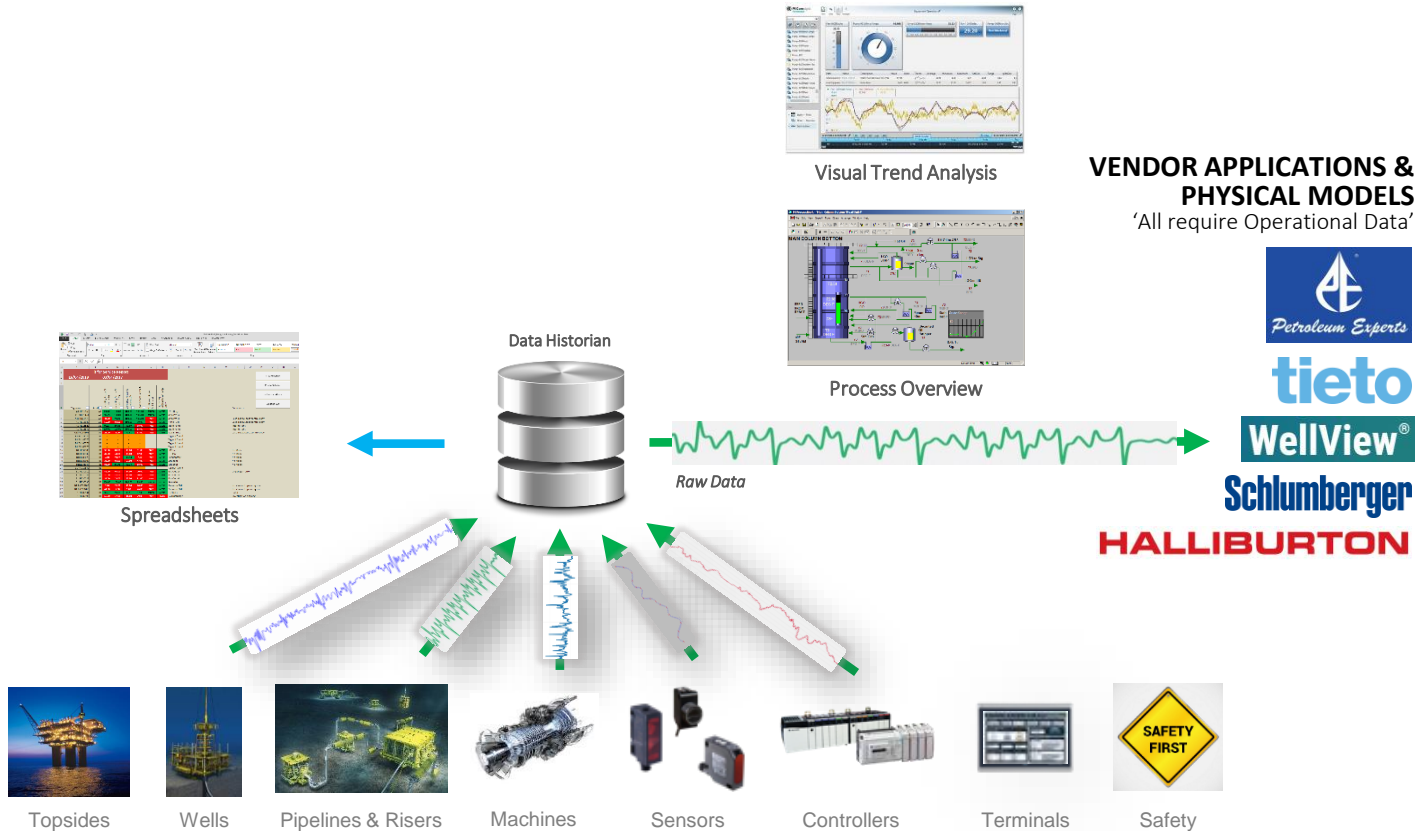
Russell Herbert (rherbert@osisoft.com)
Industry Principal – Oil & Gas



Data Infrastructure?



A Typical 'Real-Time' Digital Oilfield



Production Surveillance
Field, Platform, Well Reporting
Virtual Metering
Operating Envelopes
Deferment

Production Allocation
Well Test Validation
Production Reconciliation

Production Optimisation
Artificial Lift Optimisation
Routing Optimisation

Flow Assurance
Transient Simulations
Detection of Deposits & Blockages

Production Forecasting
Integrated Forecasts
Data Driven Forecasts

A Typical 'Real-Time' Digital Oilfield

Issues & Short Comings Of This Approach

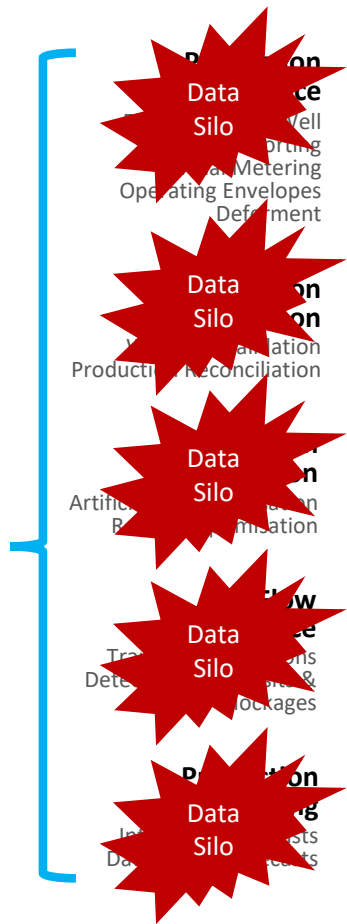
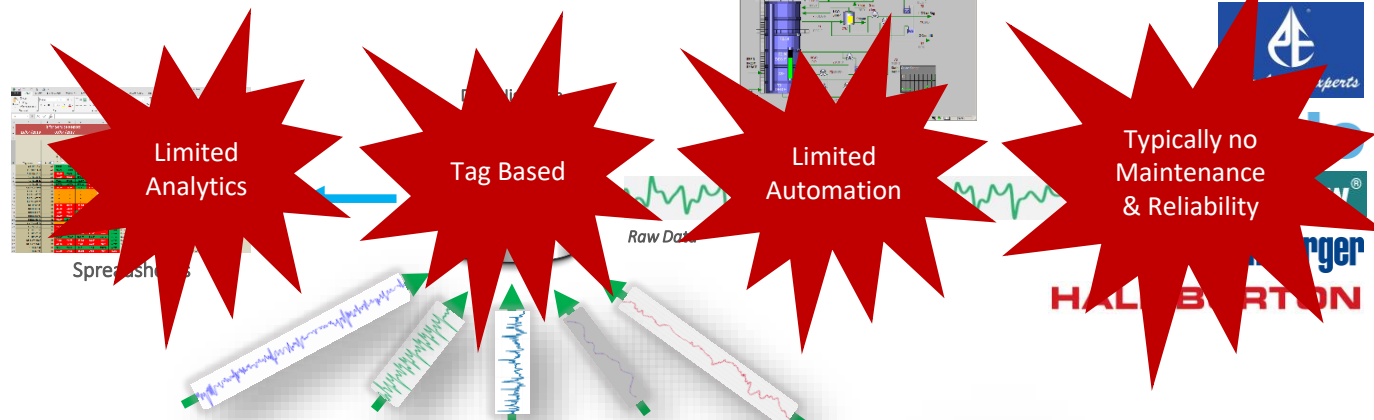
- Data Silos
- Dependency on users bringing everything together
- Doesn't scale well & requires heavy maintenance
- 'Tag Based', enterprise data access a real problem
- Little use of automated analytics & data driven workflows



Visual Trend Analysis



VENDOR APPLICATIONS & PHYSICAL MODELS
'All require Operational Data'



Topside



Wells



Pipelines & Risers



Machines



Sensors



Controllers



Terminals



Safety

Where is the industry trying to get to?

Real-Time Operations



- Selective access to **real-time asset performance data** largely through 3rd party vendor applications
- High quality **operation-to-office communication & collaboration**
- **Model guided operations**

Data-driven Analytics



Industrial IoT



Exception Based Surveillance

exception

Integrated Operations



Automation



Mobility & Advanced Visualisations



Robots, Drones,
Autonomous Vehicles



Fully Digitalised Operations

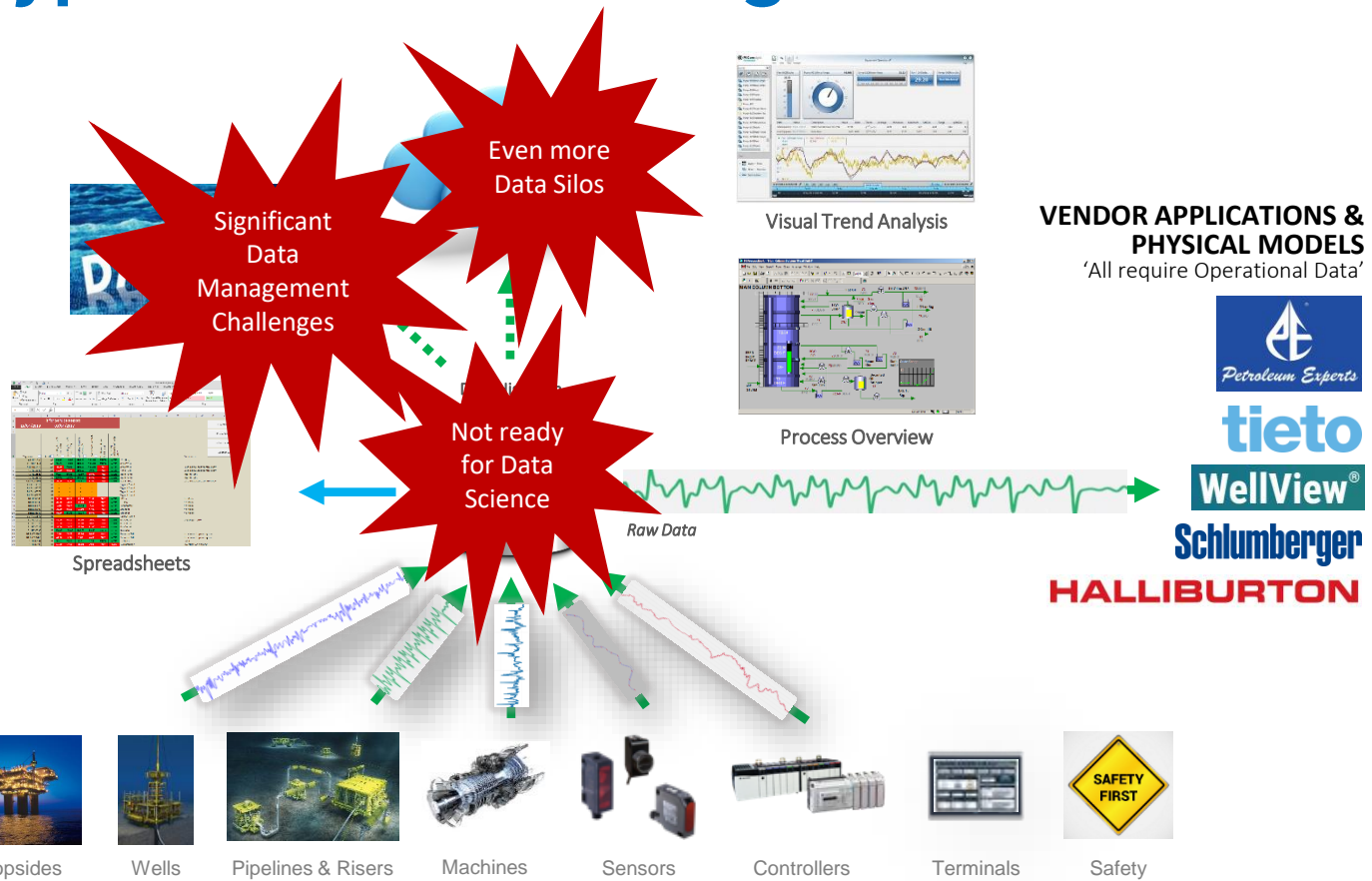


- **Organisation-wide access to meaningful real-time operational information**
- Less uncertain, **more predictive**
- More **focused** with **faster responses**
- More **automated & autonomous**
- **More productive, Lower cost**

Past

The Future

A Typical 'Real-Time' Digital Oilfield



Production Surveillance
 Field, Platform, Well Reporting
 Virtual Metering
 Operating Envelopes
 Deferment

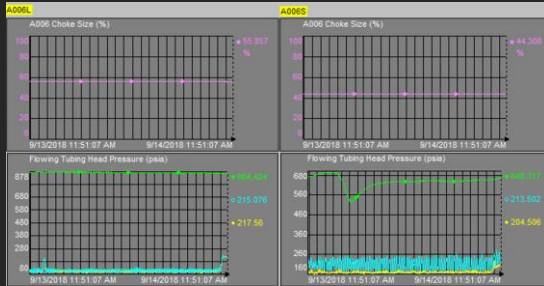
Production Allocation
 Well Test Validation
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Production Optimisation
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Flow Assurance
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 Detection of Deposits & Blockages

Production Forecasting
 Integrated Forecasts
 Data Driven Forecasts

Historian



'Source of Data'



Data Infrastructure



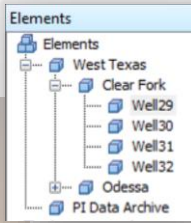
'System of Insight'



1.) Operational Data Model



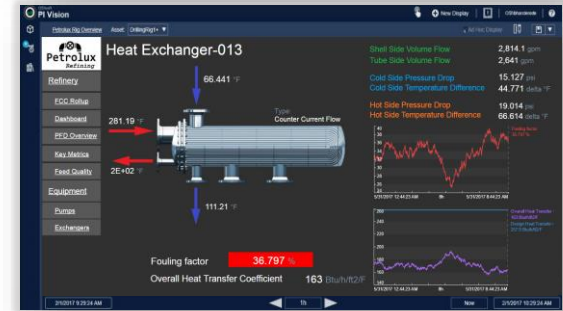
Child Elements	Attributes	Ports	Analyses	Notification Rules	Version
Excluded attributes are hidden.					
Filter					
Name	Value				
Category: Calculation					
Load Ratio	0 %				
Category: Location					
Latitude	0				
Longitude	0				
Category: Power Consumption					
Power Consumption	76.6881035951376 kW				
Category: Pressure					
Bottom hole pressure	8632.93014263405 psia				
Casing pressure	9.54536437988281 psia				
Line Pressure	1455.05201744617 psia				
Tubing pressure	1462.57281045549 psia				
Category: Production					
Category: Property					
Bore Head	0 in				
Gas Gravity	1.1098313858560761				
Tubing Diameter	0 in				
Well Type	Gas				
Category: Real-time data					
Category: Specification					
Category: Target					
Category: Temperature					
Casing temperature	78.272367947861724				
Tubing temperature	99.338721930672747				
Category: Time tracking					
Avg 30d Downtime	719.959447542832 h				
Status Message	Running				
Total Downtime	42574.85 h				
Total Runtime	0.999305555555556 d				



- Measured Data
- Meta Data
- Calculated Data
- Data Analysis
- Predicted Data
- Geospatial Data
- Referenced Data

Meaningful, Consistent, Assessable, Structured Data for Everyone!

2.) Advanced Real-Time Visualisation



Applications & Real-Time Tools for Monitoring & Analysis

3.) Real-Time 'Streaming' Calcs & Analytics



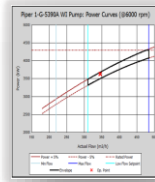
Equipment Status



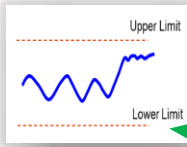
Equipment Usage



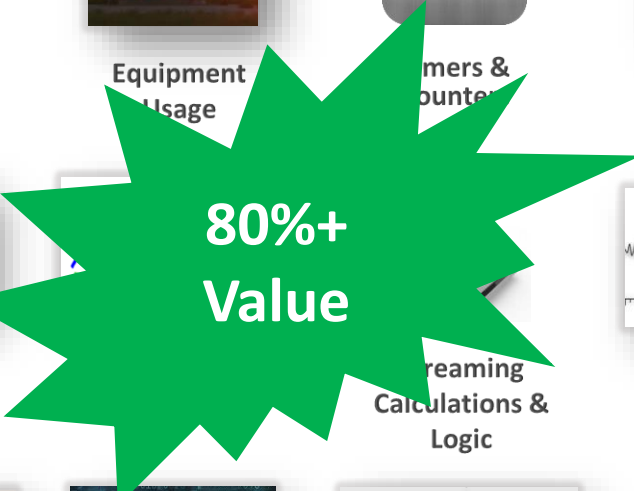
Counters & Timers



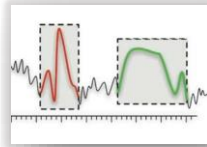
Operating Envelopes



Engineering Limits



Streaming Calculations & Logic



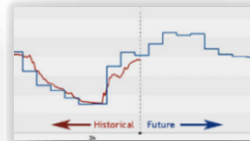
Pattern Recognition

ID	Duration	Start Time	End Time
4_00-01:52	...	4/5/2015 5:57:03 PM	4/5/2015 5:58...
0:01:52	4/5/2015 5:57:03 PM	4/5/2015 5:58...	
0:01:38	4/5/2015 5:57:07 PM	4/5/2015 5:58...	
0:01:17	4/5/2015 5:57:10 PM	4/5/2015 5:58...	
0:00:33	4/5/2015 5:57:13 PM	4/5/2015 5:57...	
0:00:33	4/5/2015 5:57:50 PM	4/5/2015 5:58...	
0:00:14	4/5/2015 5:58:03 PM	4/5/2015 5:58...	
0:00:09	4/5/2015 5:58:36 PM	4/5/2015 5:58...	

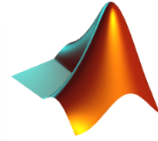
Operational Events



Data Quality

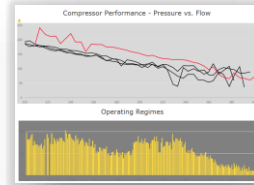


Predictions vs Actual



3rd Party Processing

4.) Data Science & Advanced Analytics



Multi Dimensional Analysis



Machine Learning



Complex Statistical Analysis



Artificial Intelligence

5.) Event/Exception Based Surveillance

Event Frame Search 1

Name	Duration	Start Time	End Time
TopLevel_EventFrame	0:01:52	4/5/2015 5:57:03 PM	4/5/2015 5:58...
UnitProcedure_EventFrame	0:01:38	4/5/2015 5:57:07 PM	4/5/2015 5:58...
Operation_EventFrame	0:01:17	4/5/2015 5:57:10 PM	4/5/2015 5:58...
Phase_EventFrame	0:00:33	4/5/2015 5:57:13 PM	4/5/2015 5:57...
Phase_EventFrame	0:00:33	4/5/2015 5:57:50 PM	4/5/2015 5:58...
Operation_EventFrame	0:00:14	4/5/2015 5:58:31 PM	4/5/2015 5:58...
Phase_EventFrame	0:00:09	4/5/2015 5:58:36 PM	4/5/2015 5:58...

EVENT FRAMES



NOTIFICATIONS & ALERTS

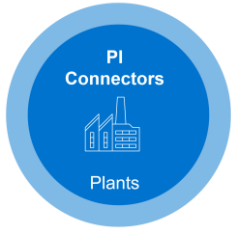


- ← Operational events
- ← Erroneous conditions
- ← Predefined patterns
- ← Impossible combinations of data
- ← Event prioritisation

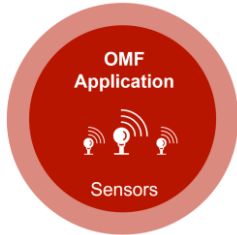
- ← Notifications & Alerts
- ← Event Analytics
- ← Automated Workflows

6.) Edge & IoT

Pervasive Data Collection



- Ready Off-The-Shelf
- High Performance
- Auto-Discovery



- Developer Flexibility
- Lightweight Footprint
- Agnostic to Environment



- Persistent Storage
- Self-Healing Capabilities
- Analytics & Application Ready

7.) 3rd Party Data Sharing



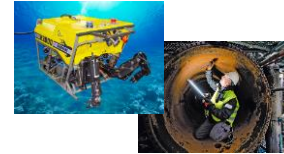
**Equipment
Manufacturers**



**Engineering
Companies**



**Maintenance
Contractors**



**Support &
Inspection**



**Analytics
Specialists**



Material Suppliers



Oil & Gas Services



Real-Time Drilling



Logistics

3rd PARTY REAL-TIME SERVICES

Equipment Specific Monitoring & Condition Based Maintenance
Specialist Data Driven Services



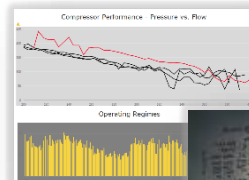
ENTERPRISE REPORTING

'Live' Management Dashboards & Reports
Business Analytics
Business Process Management



DATA SCIENCE

Advanced Analytics
Data Driven Analytics & Models
Machine Learning & A.I.
Predictive & Prescriptive Analytics



REAL-TIME APPLICATIONS & ANALYTICS 'BUILT BY YOU'

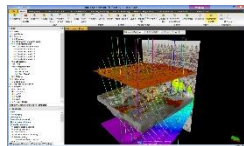
Real-Time Monitoring & Optimisation
Condition Based Maintenance
'Live' Operational Integrated Dashboards & Reports
Exception Based Surveillance
Alerts & Alarms



OTHER CRITICAL BUSINESS SYSTEMS

SPECIALIST APPLICATIONS 'PURCHASED'

Production Surveillance
Production Allocation
Production Optimisation
Flow Assurance
Production Forecasting



Topsides



Wells



Pipelines & Risers



Sensors



Controllers



Safety



Edge



Customer Case Studies



www.osisoft.com



7.5 million+ connected devices, 20 years+ data, 15,000+ user

100,000's real-time calculations & automated workflows per minute

10 trillion PI read/writes per month!



PI World EMEA 2018

A business perspective of Real-Time Operations [↗](#)



PI World SFO 2018

Shell Journey to Mobility [↗](#)



PI Users Conference EMEA 2017

Shell's journey to Advanced Analytics [↗](#)



PI Users Conference SFO 2017

Prelude FLNG - Real-time Remote Operations [↗](#)



PI Users Conference EMEA 2016

The Journey from Reactive to Predictive Operations [↗](#)



Acknowledged benefits by supporting Shell applications

\$200 Million



Smart Digital Oilfields & Smart Subsea, CBM, Real-Time Drilling, Emissions, LNG, FLNG, Rotating Equipment, Gas Storage, Refining

...and investigating Shipping & Retail



1998



2018

Digital Oilfield

Smart Foundation, Super Collectives & PI AF

Huge Centralised PI Archives & Company-wide push to put PI AF into the hands of operations

Advanced Analytics & IoT

In house team of more than 80 data scientists working on PI Data through PI AF

PI Vision & Mobility

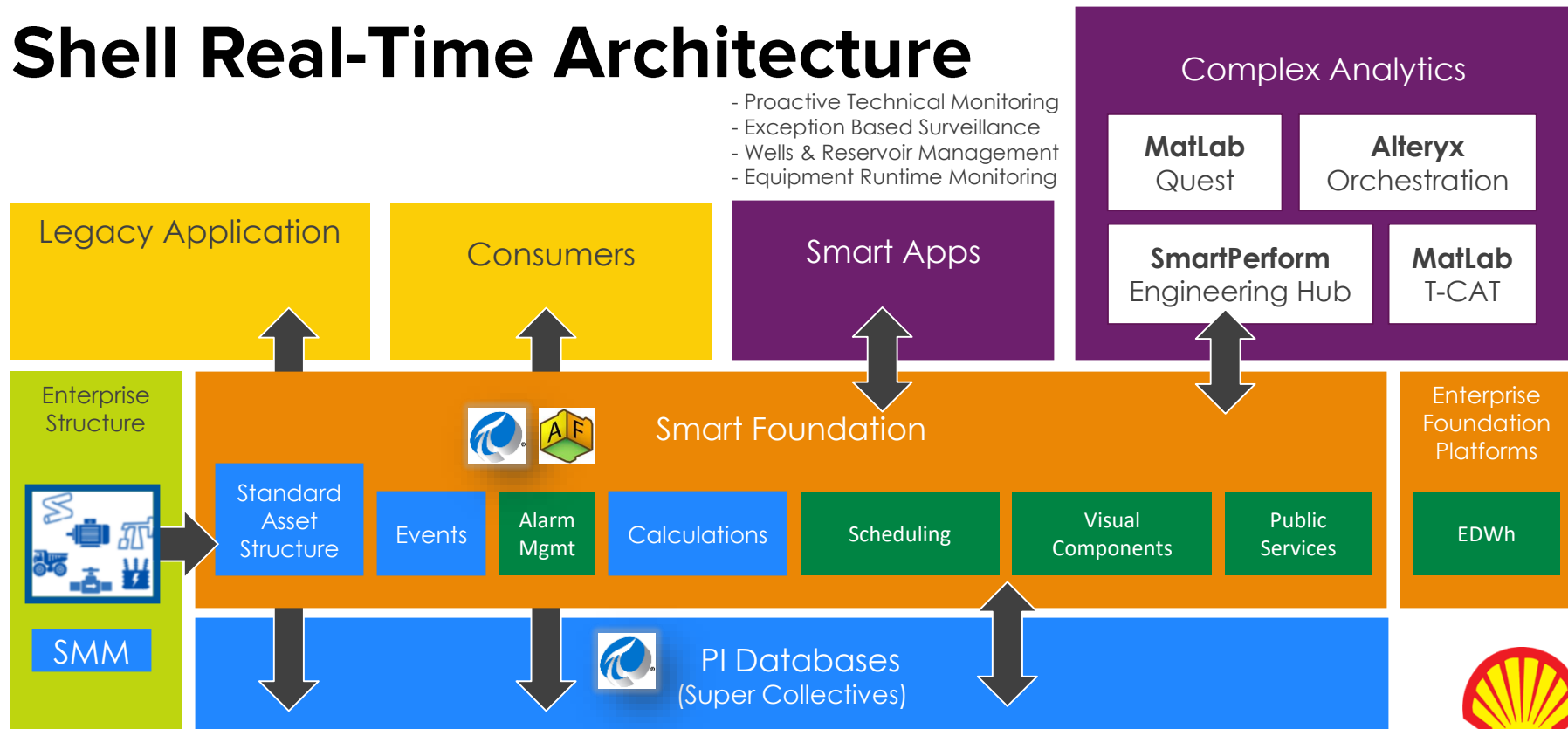
2000+ mobile users of PI Vision & 300+ of PI Manual Logger

Prelude FLNG



Shell Real-Time Architecture

- Proactive Technical Monitoring
- Exception Based Surveillance
- Wells & Reservoir Management
- Equipment Runtime Monitoring



Shell PI Priorities



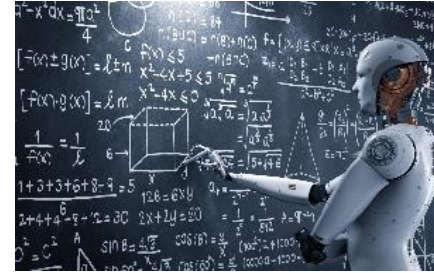
1.) Digital Oilfield

More integration between Shell's core Digital Oilfield tools (PETEX, EC, etc) and the PI System



2.) PI AF

Leverage the real-time analytics and automation capabilities from within the PI System



3.) Advanced Analytics

Explore Opportunities for Machine Learning, AI & Advanced Analytics sitting on top of the PI System





47 Operated Upstream Assets
11 Refineries
15 Petrochemical Plants
15,000km Pipelines



PI World SFO 2019

The Digital Transformation Journey in BP Upstream [↗](#)



Steve Beamer

VP Continuous Improvement,
Transformation, System
BP



PI World EMEA 2018

Using Analytics in PI AF to Improve Operating Performance [↗](#)

The BP Journey with PI



Data access via historians is now considered to be **“business critical”**



Migration of data to data lake to facilitate **“Big Data”** projects



1996

First use of OSIsoft PI

2005*

‘Field of the Future’



2014

2016



“Plant Operations Advisor”

Problem – align Real Time (PI) tags to common hierarchy to feed to BP Data Lake

Completed first asset ~17,000 tags, fed from our PI Historians took 6+ months to map and align with 5 FTE resources including documenting the process

2017

PI AF Data Model

2019

PI Vision Tools

55 assets on line, taking 4 – 6 weeks per asset with 1 FTE

Federal Data Structure in PI AF

PI becomes a ‘System of Insight’

9 PI Vision Analytics Globally Deployed

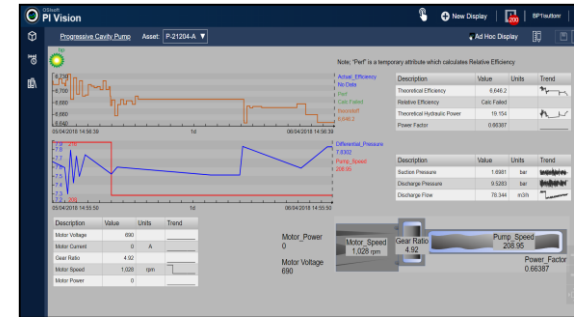
Availability of data, combined with live analysis to assist decision making is now tangible.

Remote Operations Pump Analytic delivered to Glen Lyon for Critical Pump Start-Up



PI AF Vision – One Team delivers solution in 3 days!

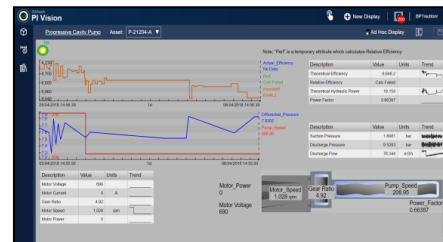
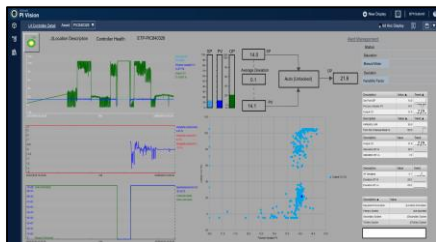
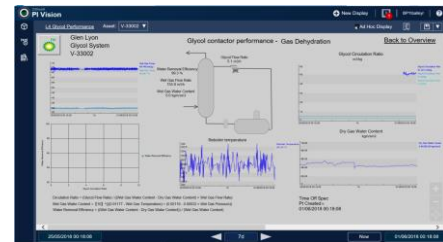
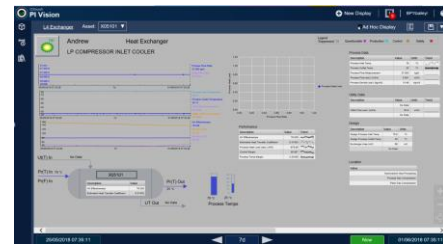
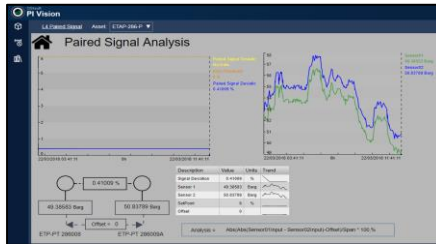
- During the PI AF roll out workshop in the North Sea, the Glen Lyon(GL) Team presented a business problem with produced water Progressive Cavity Pumps which were significantly impacting production. The pumps supported a 20,000 boed production improvement opportunity. (**Approx \$400m/yr**)
- The PI Analytic provides absolute and theoretical values of motor and hydraulic power and efficiency and is in the process of being extended to show leakage flows and power offset relative to the Manufacturer's curves for the pumps. The data is visualised in PI Vision to create a clear insights into any potential deteriorating performance.
- By bringing information together the engineers are able to get a better picture of the cause of pump failures/trips, enabling them to better avoid these in the future.



Global Templates for PI Vision Analytics

Requested Analytic	Hopper	Backlog/Dev	Deployed
Paired Signal			X
Heat Exchanger			X
Controller Health			X
Glycol System Performance			X
Filter DP			X
Dry Gas Seal			X
Operating Envelopes			X
Pump Performance Monitoring			X
Progressive Cavity Pump Monitoring			X
Compressor Performance	X		
Controller Valve Position	X		
Deviation Indicator Analytics - Normalisation		X	
Predictive analysis – future tags		X	
Gas Flow Analytics		X	
Level Inventory Monitoring Analytics	X		
Nitrogen system Analytics – Yevgeniy & Team	X		
Predictive facility trouble-shooter	X		
Produced water monitoring Analytics		X	
Product Quality Analytics	X		
Production Chemistry - Excursion Analytics		X	
Production Chemistry limit / like SDL, SOL	X		
Seperator - Density profiler Analytics		X	
Water injection system Analytics - Yevgeniy & Team	X		
Pipeline Stability	X		
Gas Turbines	X		
Lube oil & Utilities	X		
Choke Monitoring	X		

Evolving list – user input growing





**4 Refineries and 2 Petrochemicals
Plants**

Refining capacity of >415,000bpd

**400,000 PI Data Points, 20,000 Asset
Analytic Formulas, 8,000 PI System
Notifications**



PI World SFO 2019

Re-architecting the Advanced Analytics
Strategy at MOL [↗](#)



PI World SFO 2017

Leveraging the PI System in the Processing
of Opportunity Crudes [↗](#)



PI Users Conference EMEA 2016

Delivering Business Value in Downstream
Oil & Gas with Predictive Analytics and
Machine Learning [↗](#)



Solutions in PI AF

- Yield Optimisation
- Crude Blending Control
- Product Quality Monitoring
- Operating Envelopes
- Control Loops
- Advanced Process Control Monitoring
- Alarm Management
- Flare Monitoring
- Material Movement & Mass Balance
- Energy Monitoring and Management
- Natural Gas & Fuel Demand Forecasting
- Peak Electrical Forecasting

Advanced Refinery Analytics



High Temperature Corrosion Analysis

Including PI Integration with SAP PM



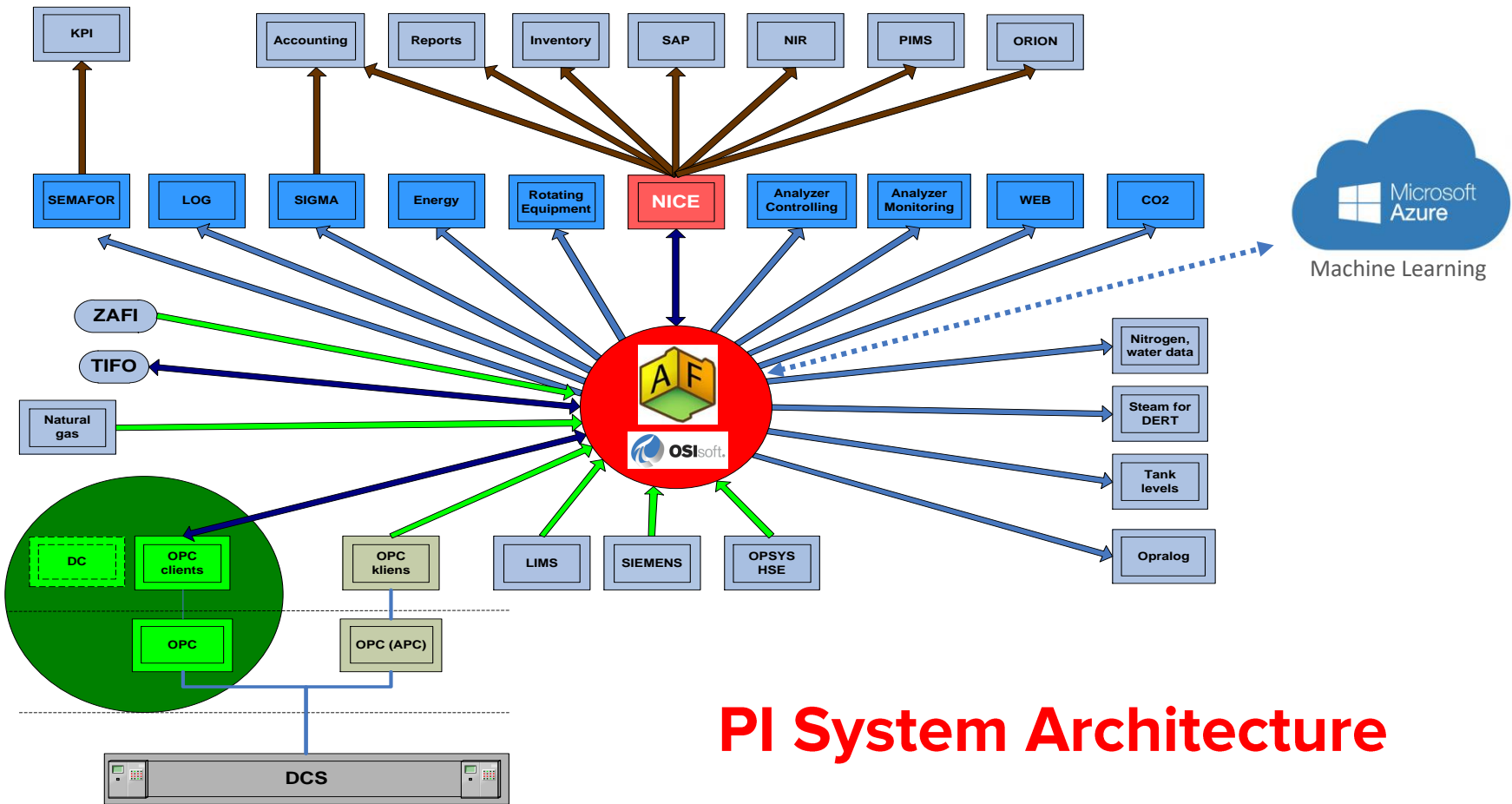
DCU Optimisation

using PI AF and MS Azure Machine Learning
\$12million saving per coker per year!!!

Desulphurization Optimisation

using PI AF and MS Azure Machine Learning
\$600K+ saving





PI System Architecture

MOL GROUP – Danube Refinery Awards

Petroleum Economist Award 2016 for Best Downstream Company of the Year

The Petroleum Economist Awards aim to celebrate the people, companies and projects which epitomize the best of the energy industry and to identify and reward examples of innovation and excellence.

In 2015 MOL Group's Downstream delivered its strongest ever performance with a Clean CCS EBITDA of USD 1.65bn alongside with strong free cash flow generation of more than USD 1bn.

The New Downstream Program (2012-2014), which targeted USD 500mn EBITDA was successfully complemented, MOL Group decided to react to further boost its profitability and competitiveness by launching the Next Downstream Program 2015-2017 (Nx DSP).

The significant incremental improvement of the Nx DSP may realize a 3 USD/bbl profitability boost by 2017.



FieldComm Group's Plant of the Year

FieldComm Group's Plant of the Year award is given annually to recognize the people, companies and plant sites around the world using the advanced capabilities of FOUNDATION Fieldbus, HART Communication and/or FDI technologies, IOT, IIOT, ML in real-time applications to improve operations, lower costs and increase availability.

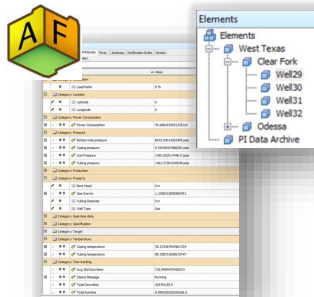
This is a supplier and industry independent awards program.

To qualify, nominees must be able to supply documented examples of real-time integration of device diagnostics and multi-variable implementations with control, safety and plant information / asset management systems that have delivered significant benefits to the operation.



Closing Thoughts...

1. The modern Oil & Gas Operation is generating **more Real-Time Data than ever before**
2. There is a growing need to **embrace Emerging Technology Trends** and **Digital Transformation**
3. There is **significant value** that can be realised by widely **embracing a centralised real-time data strategy** within your organisation. **Legacy historians are no longer enough!**
4. Across the Oil & Gas Industry **80%+ of the value of analytics** is coming today from the application of **real-time 'streaming' analytics** and **automated workflows** within a data infrastructure
5. Structured and contextualised data is a **foundational and critical building block** to successfully implementing Advanced 'Big Data' Analytics, Machine Learning & A.I.



THANK YOU

