Centralised Data Strategies for Modern Oil & Gas Operations

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Industry Principal – Oil & Gas
Data Infrastructure?

- Sensors: Millions of Smart Devices
- Assets: Multiple Sensors
- Plant: Multiple Assets
- Enterprise: Multiple Plants
- Community: Multiple Enterprises
A Typical ‘Real-Time’ Digital Oilfield

**Data Historian**

**Visual Trend Analysis**

**Process Overview**

**Raw Data**

**VENDOR APPLICATIONS & PHYSICAL MODELS**

‘All require Operational Data’

**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

**Spreadsheets**

**Topsides**

**Wells**

**Pipelines & Risers**

**Machines**

**Sensors**

**Controllers**

**Terminals**

**Safety**

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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

VENDOR APPLICATIONS & PHYSICAL MODELS

‘All require Operational Data’

Limited Automation
Typically no Maintenance & Reliability
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

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

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A Typical ‘Real-Time’ Digital Oilfield

Significant Data Management Challenges

Even more Data Silos

Not ready for Data Science

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Historian

‘Source of Data’

Data Infrastructure

‘System of Insight’

Petronas
1.) Operational Data Model

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

Meaningful, Consistent, Assessible, Structured Data for Everyone!

2.) Advanced Real-Time Visualisation

Applications & Real-Time Tools for Monitoring & Analysis
3.) Real-Time ‘Streaming’ Calcs & Analytics

80%+ Value

- Equipment Status
- Equipment Usage
- Operating Envelopes
- Pattern Recognition
- Streaming Calculations & Logic
- Engineering Limits
- Quality
- Predictions vs Actual
- 3rd Party Processing

4.) Data Science & Advanced Analytics

- Multi Dimensional Analysis
- Complex Statistical Analysis
- Machine Learning
- Artificial Intelligence
5.) Event/Exception Based Surveillance

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

EVENT FRAMES

NOTIFICATIONS & ALERTS

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

Specialist Applications
‘Purchased’
Production Surveillance
Production Allocation
Production Optimisation
Flow Assurance
Production Forecasting

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

Other Critical Business Systems

3rd Party Real-Time Services
Equipment Specific Monitoring & Condition Based Maintenance
Specialist Data Driven Services

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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
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

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

...and investigating Shipping & Retail

$200 Million
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
Data access via historians is now considered to be “business critical”

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

“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

PI AF Data Model

PI Vision Tools

33 assets complete, 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.

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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

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

*Evolving list – user input growing*
4 Refineries and 2 Petrochemical 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
**Advanced Refinery Analytics**

- High Temperature Corrosion Analysis
  - Including PI Integration with SAP PM
  
  ![Image of refinery equipment]

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

- Desulphurization Optimisation
  - using PI AF and MS Azure Machine Learning
  - $600K+ saving

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**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
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 (NxDSP).

The significant incremental improvement of the NxDSP 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