Digital Oilfield

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Industrial Revolutions

1784
- Industrial Revolution 1
- Mechanization
- Steam Power
- Weaving Loom

1870
- Industrial Revolution 2
- Mass Production
- Assembly Line
- Electrical Energy

1969
- Industrial Revolution 3
- Automation
- Computers
- Electronics

Today
- Industrial Revolution 4
- Big Data
- Robotics
- Artificial Intelligence
Technology Buzzwords

• **Cloud** – “Cloud computing is a style of computing in which scalable and elastic IT-enabled capabilities are delivered as a service using internet technologies. Cloud infrastructure as a service (IaaS) is a type of cloud computing service; it parallels the infrastructure and data center initiatives of IT.” - Gartner

• **Edge** – Edge computing is a system which brings computation and data storage closer to the location where it is generated, to improve response times and save bandwidth.

• **Digital Twin** - is a mathematical model of a process, equipment or service.

• **Artificial Intelligence** - system which is able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.

• **Machine Learning** - is the learning in which an algorithm can learn by its own without being explicitly programmed.
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| **Volume**     | Quantity of data/information | • Seismic Data Acquisitions for 2D and 3D images  
• Accelerometers | • Storage  
• Bandwidth |
| **Variety**    | Differences in data formats | • Text, image, audio, video  
• Transactional vs time series  
• Structured, semi-structured, and unstructured data | • Data storage methodologies  
• Data mining  
• Transmission protocol |
| **Velocity**   | Speed of data collection, transmission and processing | • Diagnostics/Prognostics Systems  
• Real Time Monitoring Systems | • Processors  
• Transmission protocol/medium (acoustic)  
• Connectivity (Satellite, etc) |
Value In Data

- Maximizing recovery
- Optimizing production
- Reducing NPT
- Improving safety
- Enabling enterprise-wide digital transformation

The P-F Curve

- Point of failure start
- P-F Interval
- Point at which failure can be detected
- Point of full functional failure

Asset Performance vs. Time
Data Stream

- **Sense**
  - Pressures
  - Temperatures
  - Vibrations

- **Acquire**
  - Control Systems
  - Manual Entry

- **Transmit**
  - Satellite
  - WIFI
  - LAN

- **Store**
  - SQL DB
  - NoSQL DB
  - Graph DB

- **Process**
  - Machine Learning
  - Visualizations

- **Action**
  - Insights
Oil & Gas Examples
Blowout Preventer (BOP) – Digital Oilfield Example

Can be up to ~2 Miles

~100 tags

BOP: ~1k tags

DrillShip: ~100k tags
Real-time monitoring

- BSEE RTM compliant (GoM)
- Wurldtech™ Cyber Secure
- BHGE WellLink™ WITSML connected
Regulator Lifting

After upper annular was found to be leaking for an extended time, the regulator lifting metric indicated that it was past its recommended useful life.

- A life cycle metric for the regulator was calculated based on the pressure sensor data collected.
- Metric indicated that regulator was beyond its recommended life.

Decision was made to replace regulator prior to deployment of stack again.

Potentially prevented an unplanned stack pull saving a minimum of 2 days of non productive time.
Blind Shear Rams

- Blind shear rams were unable to pass a pressure test
- Rubber seals parts were found in the flow line

Based on analysis, it was found the sequence of events led to opening rams under differential pressure

Video generated to replay the sequence of events

Recommended operations to change their pressure testing sequence and documentation to prevent issue in the future

- Eliminated extensive engineering RCA
- Allowed operator, contractor, and OEM to quickly agree on root cause preventing down time of 5-10 days
Where to learn about Data Science...

1. Pluralsight.com
2. Datacamp.com
3. Udacity.com
4. Coursera.com
5. edx.org