Future 2025: Internet of Things and the Upstream Oil and Gas Industry

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What does the Internet of Things mean?
Defining the Internet of Things

Multiple Terms – Same Meaning: Devices or things with sensors or local processing connected to a Wi-Fi, cellular or closed network.

- Internet of Things (“IoT”)
- Industrial Internet of Things (“IIoT”)
- Machine-to-Machine (“M2M”)

Mesh Networks v. Telemetry Networks

- Mesh: closed system with protocols defined for group of connected machines
- Telemetry: uses existing telecom infrastructure to send information back to central location
IoT in Operations
Key Drivers of Today’s IoT Adoption

Cheaper Technology
- Sensors
- Processors

Better Infrastructure
- Cellular technology
- Mesh networks

Inexpensive Storage
- Cloud data storage
- Hardware costs

Big Data Analytics
- Hadoop, etc.
- 3rd party analytics
Why the **Upstream Oil and Gas Industry**?
Think About Key Drivers in O&G

- **Lower for Longer**
  - **Crude Oil:**
    - Further signs of weakening prices in futures market
    - New well development break-even: $65/barrel
    - Significant CAPEX reductions
  - **Natural Gas:**
    - $4.75 Mmbtu (Henry Hub, Sept 2015) down from $8 MMBtu in July 2014
    - No significant increase in demand expected

- **Difficult Regulatory Environment**
  - Increasing Compliance Costs
    - Worker safety / environmental / new standards
  - New Partial Bans and Restrictions
    - Marcellus Shale, Arctic drilling, etc.
    - State restrictions and groundwater concerns
  - Greenhouse Gas / Methane Reports
    - Methane and CO$_2$ leaks from well heads
IoT in Oil and Gas Industry

Value Chain of Upstream Oil and Gas Industry

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<th>Exploration</th>
<th>Production</th>
<th>Transmission</th>
<th>Distribution</th>
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- **Oil & Gas well / Gas only well**
- **Separation**
- **Oil**
- **Water**
- **Venting and Flaring**
- **Gas**
- **Processing**
- **Compressor Station for Transport**

**Value Chain of Upstream Oil and Gas Industry**

**Midstream Oil and Gas**

- **IoT offers the ability to help companies compete on cost by improving productivity:**
  - Enable predictive maintenance vs. preventative maintenance
  - Improve process flow achieved by monitoring changes in operating conditions
  - Increase productivity and reduce accident frequency with real time monitoring of assets
This year, the Executive Branch and EPA announced plans to reduce methane emissions by 40-45% in 2025. This means that significant pressure will be placed on the upstream oil and gas industry to reduce methane leaks.

- EPA estimates that **29% of methane emissions** come from the oil and gas sector (agriculture and landfills produce 26% and 18% respectively).
- Environmental groups believe that methane emissions should be at least **50% higher** than previously estimated in the Barnett Shale region.
- The greenhouse effect of methane is **86x higher** than CO₂.
FUTURE OF UPSTREAM OIL AND GAS INDUSTRY

Projecting to 2025 and Beyond
Early Multinational and Startup IoT Success

• Predix PaaS offering designed to capture, store and analyze industrial scale machine data
• Already running and servicing GE Jet Engine Business to analyze 340TB for 3.4 million flights on 25 airlines to improve asset performance (with stated performance increase of 287X, and costs lowered by 7X)
• BP engaged in pilot project to connect 650 wells this year to monitor well performance. Increasing to 4,000 wells next year

• Sensor and analytic platform targeted at Oil and Gas performance optimization
• Have a number of specific solutions for Artificial Lift which is integral to 60% of total oil production. Extending ESP performance from the average life span of 1.2 years to the designed for 5 years could be a $10B opportunity
• Their solution addresses the management of Iron Sulphate build up in the tubing string, Gas Lock and Sand Erosion in ESP impellors
Early JV IoT Success

- In 2014, ExxonMobil Upstream Research Company issued a license to Providence Photonics to produce a leak detection system.
- The system involves software to analyze infrared camera images. It provides an early warning alert, even for small amounts of leaks.
- Utilizing optical gas imagers and advanced computer vision algorithms to enable remote autonomous hydrocarbon leak detection.
Future 2025: How O&G Will Get There

1. Get IoT sensors widely deployed
   – Deployment on existing wells will likely be driven by Oilfield Service providers
     • OFS: Highly technical
     • Key value propositions to customers: up-time and understanding complexity
   – Large OEMs will drive the next wave

2. Make the data useful
   – Usefulness of data depends on new services / entrants
     • E&P companies conduct complicated analysis – but real-time, continuous analysis of large volumes of data is relatively new
     • Requires combination of data analytics, engineering, network infrastructure, storage capabilities and access to underlying data
The Challenges Ahead
The Challenges Ahead

There are a number of key challenges that remain in achieving widespread IoT adoption, including the following:

• **Data Standardization**
  – Value lies in the interoperability between systems

• **Investing in Capital and Equipment**
  – Allocation of existing CAPEX budget to support adoption in existing and new operations will be difficult

• **Adoption by the Larger Industry**
  – Network effect required

• **Cyber Security Concerns**
  – Risk from piece-meal, non-integrated systems
Takeaways from Today’s Presentation

• Tipping point of IoT adoption is around the corner, benefits may take years to realize due to:
  - Upfront investment in a down market

• Key benefits and value proposition, include:
  - Production Optimization
  - Risk Reduction (especially regulatory)

• These key challenges need to be addressed:
  - Data Standardization
  - Wide scale industry adoption (network effect)
  - Cyber Security Concerns
We are attuned to the challenges facing organizations in a variety of industries and understand the constant pressure to improve business processes and make better decisions. But beyond that, we have a passion for technology. Using that passion, we help our clients use proven technology coupled with our real-world knowledge to accelerate and improve the flow of data and information and improve productivity. The technical improvements we provide equip our customers to make the best business decisions possible. Helping our clients unleash the power of their data is our focus.