



## Overview

The advent of Internet of Things (IoT) technology in the petroleum industry enables operators to harness, analyze and act on large data sets from the myriad physical assets employed for the extraction and transportation of fossil fuels. By unlocking and aggregating previously disparate data from the modern oil field, operators can leverage the information now available to identify patterns indicative of a potential mechanical failure or safety hazard via predictive analytics and employ proactive measures (preventative maintenance, initiate supply chain, early warning system, etc.) to alleviate a Tier 1 Process Safety Event or costly unplanned downtime before a negative situation ever occurs, much less escalates. In order to improve financial performance while also maintaining critical uptime, petroleum industry operators are turning to IoT technology as a means to improve business outcomes.

Mechanical failure in the transportation and extraction of fossil fuels is one of the leading causes of unplanned downtime and Loss of Primary Containment (LOPC),

presenting hazards of almost unrivaled scale in terms of cost and negative publicity annually for the petroleum industry. Reducing the occurrence of mechanical failure and prolonging equipment lifecycles becomes an increasingly critical factor in the efficient management of the modern data-driven oil field. Visibility into and optimization of equipment parameters are paramount to ensuring proper working conditions and healthy long-term asset utilization. The inability to analyze and act on data related to settings, environmental conditions and any other parameter that factors into mechanical failure exposes the operation to limitless vulnerabilities.

Many petroleum operations have already embedded sensor technology enabling the collection of operating data from a range of critical points within their operating environments. To date, the primary purpose of this data collection system has been to feed real-time and historic data to the equipment operator so that they can make more informed decisions concerning maintenance requirements.

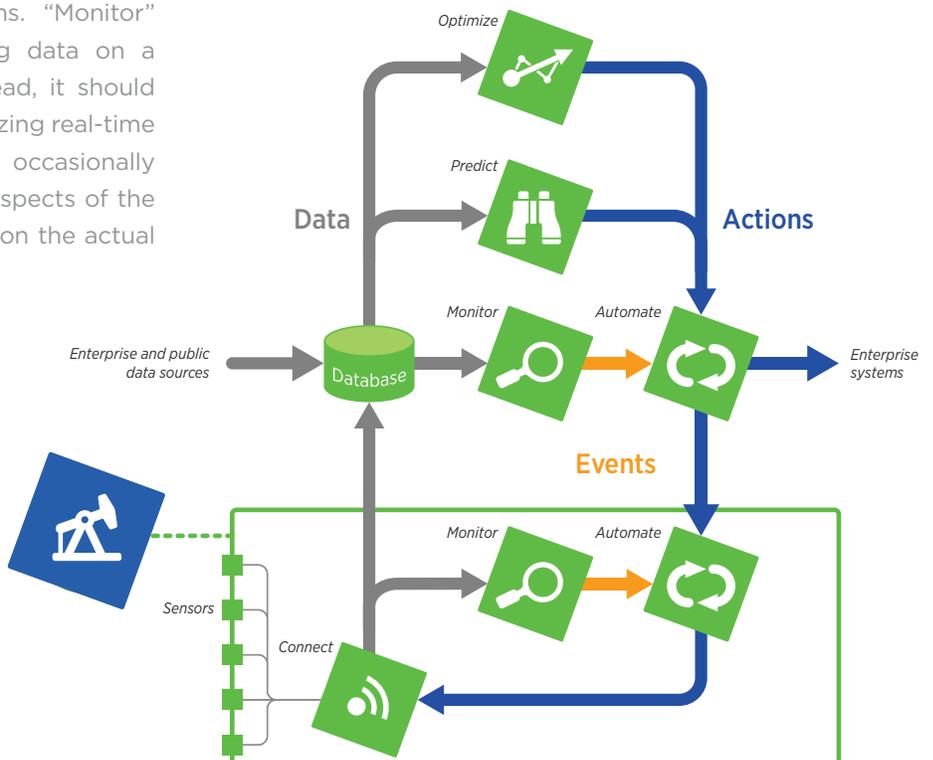
## IoT: The Future of Smart Petroleum Operations

The primary function of IoT technology is to collect data from a broad variety of physical assets over an extended period of time and deliver that data to cloud-based (public or private) databases so that rules and analytics can be applied to the data. The end goal is to improve business outcomes but a variety of complementary technologies are required in order to properly implement through IoT systems.

- Connect.** The primary foundation of IoT is to connect via the most suitable technology, physical assets to networks, cloud-based databases and applications (the cloud can be public or private, on-premise or off-premise). A core function of the connect process is to intelligently filter, compress, or combine data sets to best reduce network costs. In many IoT scenarios, sometimes nearly half the cost of the overall system is comprised of network transport costs. In taking steps to reduce the volume of upstream data, costs can be substantially reduced.
- Monitor.** The information generated by physical assets is monitored in real-time to identify anomalous conditions that may warrant a response. There are two critical factors to the monitor function which are typically overlooked in IoT systems. “Monitor” transcends more than simply displaying data on a dashboard for operators to digest. Instead, it should translate to software intelligently by analyzing real-time data feeds and applying heuristics (and occasionally dynamic) rule sets. Additionally, certain aspects of the monitoring function should ideally occur on the actual device itself. This functionality is critical to provide faster responses to essential conditions and also facilitate key IoT operations in off-line scenarios.
- Automate.** A vast assortment of actions are typically essential in response to anomalous conditions detected by the monitor function. For instance, commands to the physical asset itself (e.g., reduce drill bit torque or RPM to prevent strain or overheating), preventative maintenance alerts to operations and

support teams, and sometimes instructions to external enterprise applications (e.g., inventory, support and trouble-ticketing systems). It is critical that a portion of this core functionality reside on the physical asset in order to permit an environment where corrective actions can be automatically implemented even when the asset is disconnected from the network itself.

- Predict.** Essentially one of the primary functions of an IoT system is to predict failures before they occur and take corrective action-be it automatically dispatched or manual intervention from maintenance or engineering personnel- so that unplanned downtime is minimized or even eliminated. This core ability is primarily a function



of data analytics—surveying very large data sets over an extended period of time in order to best identify conditions that frequently precede failures. By virtue of this functionality, petroleum industry operators can more easily determine that a failure is about to occur, identify what corrective measure, tools and personnel are required to prevent the specific failure, and schedule preventative maintenance measures at the optimal interval so that unplanned downtime is eliminated.

- **Optimize.** Ultimately the final key in attaining better business outcomes from asset data is to modify the operational parameters of the specified assets to best optimize efficiency. Not unlike predictive failure, this is achieved through the examination of large data sets across the entire operational scope, to determine and benchmark the operational parameters of the best performing equipment, and apply those parameters to other tools and equipment throughout the operation.

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## How IoT Benefits the Oil and Gas Industry

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There are several ways in which IoT systems benefit not only the equipment manufacturer but also rental equipment business and, ultimately, end users.

### Increased Uptime

Unplanned downtime represents a significant productivity drain for petroleum industry operations. In many instances, petroleum extraction facilities are located in remote regions and any factor that impedes or extends the supply chain presents a serious roadblock to productivity. Unplanned downtime is one of the leading detriments to revenue and causes of increased operational costs. In terms of the petroleum industry, IoT systems can significantly reduce unplanned downtime through enhanced visibility into operations by providing better foresight and more detailed real-time analysis of extraction activities and transportation processes. Indirectly and less tangible, benefits also accrue through heightened safety and enhanced oversight to ensure regulatory compliance.

### Predictive Failure

Correctly designed IoT systems can reduce operational costs related to tools, mechanics and facilities in a number of ways. Through improved monitoring of physical asset data and advanced data analytics, costly maintenance deployments can be reduced by proactively identifying probable failures and taking corrective action before they occur. By aggregating and analyzing large data sets, operators can identify patterns and anomalies and benchmark those against historical trends to inform smarter decisions that can predict issues before it is too late. Proactive measures can be initiated by virtue of insights gleaned from predictive analytics to inform progressive preventative maintenance protocols before failing equipment reaches a critical mass. Therefore predictive failure capabilities from IoT help extend the lifecycle of equipment, reduce unplanned downtime, inefficient maintenance deployments and ultimately minimize unexpected costs.

### **Automated Workflows**

Real-time monitoring of equipment health instantly detects faults as they occur. Depending on severity, continued use of the equipment can lead to additional damage, increasing parts and labor costs. IoT can take immediate action by sending commands to the equipment in order to minimize further impact. Ideally the IoT system should have the ability to analyze equipment error codes and operating parameters along with historical repair information to create an optimized repair plan. The plan assigns probabilities to potential fixes, eliminating guesswork and reducing repair times. This information allows service managers to assign a technician with the correct skills and ensures that only necessary parts are used and keep track of what work was actually performed.

Furthermore, insights from physical asset data analytics can inform rules to trigger the automation of maintenance workflows and better focus diagnostic processes through enhanced troubleshooting. This intelligent utilization of field data translated into actionable logic enables an agile supply chain so parts, tools and specifically skilled personnel can be quickly aligned and deployed to significantly boost the Mean Time to Recovery (MTTR) rate, therefore reducing unplanned downtime.

### **Device Optimization**

Petroleum industry field operators strive to maximize the performance of their products, whether to improve output or increase efficiency. IoT systems can aggregate information from the entire fleet of equipment, identifying those that are underperforming and providing prescriptive, corrective actions. This information can be used to modify calibration or configuration settings immediately, and can serve as input to the R&D process.

### **What is DataV?**

For more than two decades, Bsquare has helped its customers extract business value from a broad array of physical assets by making them intelligent, connecting them, and using the data they generate to optimize business processes. Bsquare DataV software solutions can be deployed by a wide variety of enterprises to create business-focused Internet of Things (IoT) systems that more effectively monitor device data, automate processes, predict events and produce better business outcomes. Bsquare goes a step further by coupling its purpose-built DataV software with comprehensive analytic and engineering services that help organizations of all types make IoT a business reality.

### **Asset Utilization**

Petroleum field operators, as well as those transporting petroleum products, are often challenged with locating assets in the field and understanding how effectively they are being used. Ensuring the right settings on a downhole drill bit is critical for both productivity and safety. IoT systems can track and analyze equipment settings and cross reference those with environmental conditions to ensure that tools are properly utilized with the optimal settings given the conditions. IoT systems can also create geo-fence zones and apply unique logic per zone or asset. This can be used to reallocate underused assets or enforce regulatory compliance to ensure safety.

## Monetizing IoT

Apart from benefits, the petroleum industry is capable of monetizing their investment in IoT systems. The enhanced visibility into operational and geospatial data offers operators a more transparent view of a region's productive potential to better inform subleasing and commitments to extraction activities in a certain region.

## The Bottom Line

The emergence of IoT technology in industrial applications is transforming operational efficiency, bottom line productivity and safety around the world. Through the establishment of comprehensive, data-driven predictive insights, operators can employ sophisticated rules and machine learning to constantly adapt and tune expensive assets. For large-scale extraction industries like petroleum operations, IoT has been proven to provide tangible financial benefits while at the same time delivering superior products with greater uptime characteristics to their customers.

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or email us at [sales@bsquare.com](mailto:sales@bsquare.com)



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For over two decades, Bsquare has helped its customers extract business value from a broad array of assets by making them intelligent, connecting them, and using data collected from them to improve business outcomes. Bsquare software solutions have been deployed by a wide variety of enterprises to create business-focused Internet of Things (IoT) systems that can more effectively monitor assets, analyze data, predict events, automate processes and, in general, optimize business outcomes. Bsquare couples innovative software with advanced professional services that help organizations of all types make IoT a business reality.