Overview

USE CASE
Water and Power

Operators of power and water utilities, including generation and distribution, are seeking ways to improve reliability while also enhancing safety, minimizing costs, and maintaining regulatory compliance. A fully integrated Internet of Things (IoT) system is central to this effort. From aging infrastructure and new power sources to water scarcity concerns and stricter compliance mandates, unconnected autonomous systems simply cannot scale with the evolving demands placed upon this portion of the energy sector.

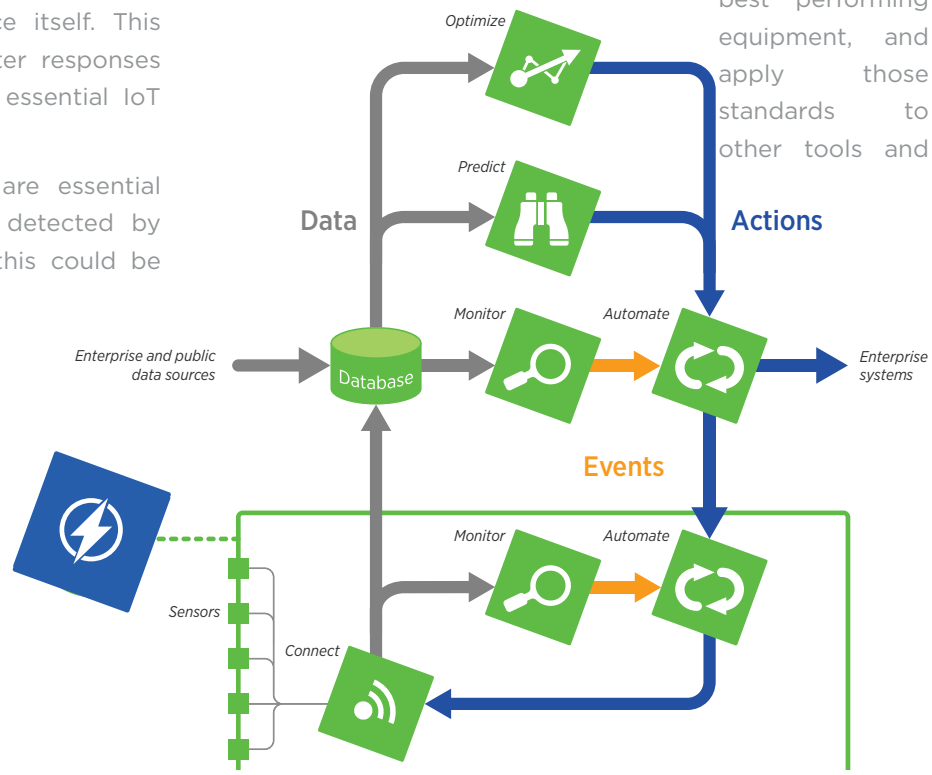
Through the deployment of smart sensors in monitoring and automating the myriad devices essential to running large facilities and remote installations, operators can better understand in real time how their assets are performing and have complete control over their network and device resources. Operators can leverage this intelligence to strengthen business processes by reducing production costs, improving reliability and optimizing overall performance to ensure better Power Usage Effectiveness (PUE). A properly utilized IoT system allows operators to proactively manage their core assets via predictive failure warnings by identifying potential mechanical issues before they become serious. This level of amplified asset monitoring allows operators to optimize device settings, modify calibration and gain better visibility into the utilization of assets informing smarter management that ensures regulatory guidelines are followed.

These capabilities not only extend the lifecycle of equipment and identify potential mechanical failures before they occur but can produce significant productivity gains with limited natural resources. The predictive capability of IoT informs a smarter, safer power grid that is better equipped to adapt to the constantly evolving demands and shifting environmental realities of the modern utility landscape.

IoT: The Future of Efficient Resource Management

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. Ultimately the goal is to improve business outcomes but a variety of complementary technologies are required in order to properly implement thorough IoT systems.

- **Connect.** Connecting via the most suitable technology, physical assets like turbines, valves and pumps to networks, cloud-based databases and applications (the cloud can be public or private, on-premise or off-premise) is the foundation of an IoT system. At its core, the 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.** Physical asset information is generated and monitored in real-time to identify anomalous conditions that should require a response. There are two critical factors to the monitor function which are typically overlooked in IoT systems. The function of "monitoring" transcends more than solely displaying data on a dashboard for operators to interpret and act upon. Ideally, it should translate to software intelligently analyzing real-time data feeds and applying heuristics (and occasionally dynamic) rule sets. Furthermore, certain aspects of the monitoring function should generally occur on the physical device itself. This functionality is critical to enabling faster responses to key conditions and also facilitating essential IoT operations in off-line scenarios.
- **Automate.** A wide range of actions are essential in response to anomalous conditions detected by the monitor function. An example of this could be dictating commands to the physical asset itself (e.g., reduce intake valve flow or turbine RPM to prevent strain or excessive output), issuing preventative maintenance alerts to operations and support teams, and sometimes dictating instructions to external enterprise applications (e.g., support and trouble-ticketing systems). It is essential that some degree 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 and the network are disconnected.
- **Predict.** Ultimately, one of the most valuable functions of any IoT system is to predict failures before they occur and take corrective action so that downtime is minimized or even eliminated. This is primarily a data analytics function—looking across very large data sets and extended time periods in order to determine conditions that frequently precede failures. By this means, operators of power and water utilities can determine that a failure is about to occur, what service action and parts are required to prevent the failure, and schedule remedial actions off hours so that downtime is eliminated.
- **Optimize.** The final step to ensuring better business outcomes from asset data is to modify the operational parameters of the specified assets to imprive efficiency or output. Similar to predictive failure, this is driven through the analysis of large data sets across the entire infrastructure to determine and benchmark the parameters of the best performing equipment, and apply those standards to other tools and



equipment throughout the operation. This degree of operational insight enables operators to draw correlations between performance metrics like output and productivity with other benchmarks like equipment health, usage trends and emissions measurements. By aggregating these variables on a continuous basis, comprehensive insights can inform significant business outcomes like benchmarking asset performance to gain an objective view of how efficient or clean facility emissions actually are.

How IoT Benefits the Power and Water Industry

There are several ways in which IoT systems benefit power and water utilities.

Predictive Failure

Properly designed IoT systems can reduce operational costs related to efficient resource management, mechanics and facilities through a myriad of avenues. 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 trigger preventative maintenance protocols through predictive insights to inform corrective actions be taken to ensure failing equipment is remedied before operations are negatively impacted.

Increased Uptime

Unplanned downtime represents a significant productivity drain for power and water operators. In many instances, power generation facilities are located near constantly shifting water sources like rivers in remote regions and any factor that impedes the ability to maintain output presents a serious roadblock to productivity. Unplanned downtime is one of the leading detriments to productivity and efficient operations. In terms of water and power generation facilities, IoT systems can significantly reduce unplanned downtime through enhanced visibility into operations by providing better foresight and more detailed real-time analysis of natural resource activities, patterns and processing capabilities. Indirectly and less tangible, benefits also accrue through heightened safety

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.

and enhanced oversight to ensure regulatory compliance.

Automated Workflows

Real-time monitoring of equipment health instantly detects faults as they occur. Depending on severity, continued use of equipment can lead to additional damage, increasing part demand 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

Power and water operators strive to maximize the performance of the resources they manage, 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. Implemented throughout a population of devices and assets, operators can gain visibility into how each individual component is competing against the many to objectively benchmark performance and inform optimization techniques. This enables a strategy of scale, where a prescriptive plan can be employed to offer the best parameters for an overall population of devices, yet still deliver the necessary visibility and flexibility to isolate recommendations for a singular device that isn't performing optimally.

Asset Utilization

Power and water operators are often challenged with locating assets in the field and under¬standing how effectively power output is being distributed. With the emergence of non-traditional domestic electricity applications like electric cars, historical analysis of PUE patterns are shifting, requiring better visibility into actual end use to ensure output is efficiently utilized. Ensuring the proper level of energy output to the power grid is critical for both productivity and regulatory compliance. IoT systems can track and analyze equipment settings and power distribution to ensure that assets are properly utilized with the optimal settings given the conditions and end use. IoT systems can also create geo-fence zones and apply unique logic per zone or asset. This can be leveraged to reallocate underused assets or enforce regulatory compliance.

Maintain Regulatory Compliance

Currently, fossil-fueled power plants are the largest source of U.S. carbon dioxide (CO2) emissions, accounting for 31 percent of U.S. total greenhouse gas emissions according to the EPA. The recent Clean Power Plan mandates that carbon dioxide emission reductions must be achieved through application of the "best system of emission reduction" (BSER) possible at existing power

plants or the "best available control technology" (BACT) for major new or modified sources in attainment areas per the Clean Air Act. IoT technology enables operators to meet the heightened BSER standard laid out by the federal government by having deeper visibility into the monitoring of emissions output and enhanced control over the optimization of power generation systems to more easily meet elevated compliance standards.

Additionally, the federal government hopes that by 2050, water withdrawals (water used by a power plant for cooling prior to release) will decline by over 80 percent while water consumption (water used by power plants but not returned) will decrease by over 40 percent. With government regulations both domestically and abroad requiring a significant increase in the production of renewable energies, the onus to implement and maintain a cleaner power grid will rely on the utilization of emerging technologies like IoT platforms that can meet and adapt to future operational, regulatory and environmental challenges.

The Bottom Line

Bsquare DataV, a complete IoT software stack, extracts business value from physical assets by making them intelligent, connecting them, and using the data they generate to automate and optimize operational processes. DataV transcends predictive analytic insights to inform smarter decisions and quickly automate workflow distribution to better optimize resource management and quality control processes. This helps the utility sector achieve greater asset utilization, maintain regulatory compliance and optimize production activity while avoiding costly, possibly catastrophic impacts on mission critical systems and infrastructure through enhanced monitoring and automation.

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updated-10/2015