



IoT in Manufacturing and Industrial Settings

Manufacturing and other industrial environments have many opportunities to leverage Internet of Things (IoT) technology to improve their operations. Factory visibility is a key benefit for plant managers, who require instant access to the operational parameters of mission-critical equipment.

Industry analysts such as Gartner and IDC forecast that by 2020 there will be 30 billion connected devices in use by consumers and businesses. For manufacturers and industrial suppliers these smart devices enable a connected supply chain and more transparent business operations.

Industrial IoT can automate decision making by applying rules-based logic to the real-time data stream. This can be used to synchronize machinery on the assembly line and adjust machine configuration or calibration in response to current operating conditions.

Data analytics also have a place in the IoT strategy of a manufacturing operation. Predictive analytics can identify the leading indicators to a failure, reducing the business impact of downtime. Maintenance and repair of equipment programs shift from reactive to proactive,

enabling the plant to schedule the work a time that is best for the business.

Advanced analytics can also be used to optimize machine output or to reduce defects. By establishing a data model based on desired machine performance, IoT technology can not only identify underperforming equipment assets but also provide prescriptive remediation steps.

All of this has the potential to improve businesses outcomes for manufacturers, but how does one go about architecting and deploying a complete IoT solution?

The first step is to clearly identify the business use case that the solution is targeted to address. For the situations described above, this could be smart diagnostics, condition-based maintenance, predictive failure or asset optimization.

Next, keep in mind that IoT projects are mainly focused on the value of data and by nature require the involvement of many disciplines within a business. In manufacturing environments, this translates into more cooperation between those who manage Information Technology (IT) and Operational Technology (OT) systems.

2 **INDUSTRY USE CASE**
Manufacturing

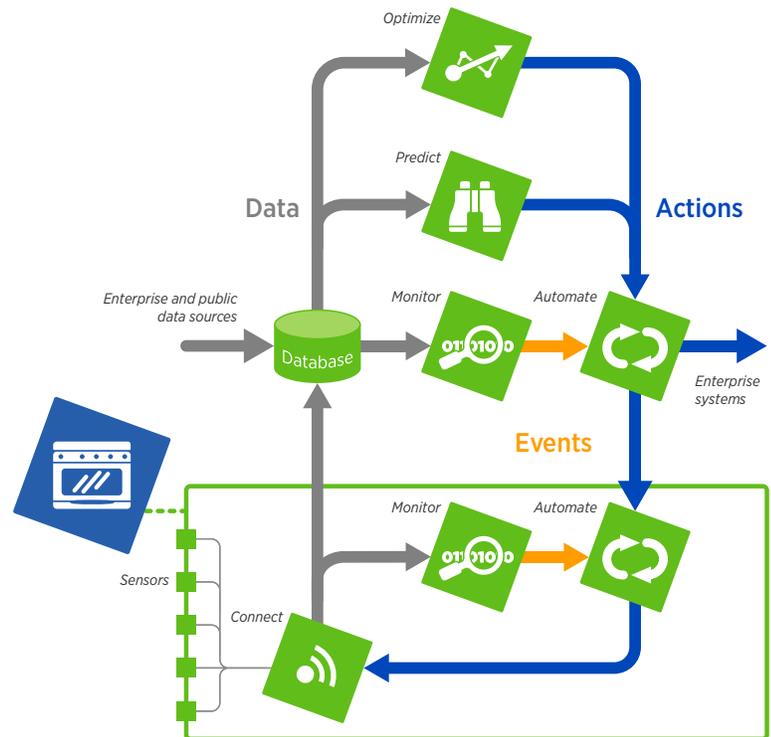
IoT: Optimizing machine performance

The primary function of IoT technology is to collect data from a broad variety of 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.

Bsquare DataV™ is a complete end-to-end IoT solution, enabling businesses to maximize operational performance by combining traditional enterprise data with new data generated by smart, connected devices and then automating decision-making by apply rules-based logic to the real-time data stream.

DataV consists of five components designed to bridge the gap between data-generating sensors and the business: Connect, Monitor, Automate, Predict and Optimize.

- Connect.** The foundation of IoT is to connect, through the most appropriate technology, physical assets and applications to networks, cloud-based databases and applications (the cloud may 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 as much as half the cost of the overall system is comprised of network transport costs. By taking steps to reduce the volume of upstream data, costs can be substantially reduced.
- Monitor.** The information generated by physical assets and applications 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” goes beyond the basic display of operational data on a dashboard. Instead, it should involve software intelligently analyzing realtime data feeds and applying heuristics (and occasionally dynamic) rule sets. Second, 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 set of actions may be relevant in response to anomalous conditions detected by the monitor function. For instance, commands to the physical asset itself (e.g., initiate a local device restart), 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.** 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

INDUSTRY USE CASE

Manufacturing

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, manufacturers 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.

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.

How IoT Delivers Business Benefits for Plant Operations

According to IDC, 65% of manufacturers with more than ten plants will make IoT investments that increase their operational intelligence. These investments align with three key themes: increased uptime, predictive failure and improved asset utilization:

Increased Uptime

Unplanned downtime results in operational disruption and increase costs for manufacturing operations. Manufacturing equipment can be expensive, revenue-generating corporate assets. In addition, machinery can be remotely located so any incident that slows or extends the supply chain presents a serious barrier to optimal operations. In an IoT-enabled environment, diagnostic processes are automated, identifying possible root causes through data validation and probability ranking before a repair technician arrives.

DataV Connect is integrated into smart sensors for manufacturing equipment and intelligently collects and processes available data. The software can scale from large devices down to small controller boards. Logic running locally on the equipment can be configured to define data collection rules, including which data to transmit and how often. All communication is secured using industry standard encryption and data integrity is enforced.

Under normal connections, this data is sent to DataV Monitor, which provides real-time visibility into the health of the entire plant. For larger operations, dashboards can enable an operations manager to view multiple locations in a consolidated, easy to use format. This information can be tailored based on user profiles and accessed with a web browser or mobile app.

4 INDUSTRY USE CASE

Manufacturing

Predictive Failure Analytics

Correctly designed IoT systems can reduce maintenance costs in a number of ways. Through the monitoring of physical asset data, the Remote Diagnostic Service (RDS) rate can be enhanced to reduce costly maintenance deployments. 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 extending the lifecycle of equipment and minimizing unexpected costs.

DataV Predict can identify problems before they occur. Powerful data analytics can find leading indicators to a failure event and monitor for those conditions proactively. For example, an oven that takes an increasing amount of time to reach the proper temperature not only wastes energy but is typically a sign of a part that is about to fail. DataV enables the ability to proactively schedule the maintenance or repair at a time that is best for the business.

Asset Utilization

Manufacturing plant operators that leverage technology advances to improve asset utilization, especially regarding energy consumption can reduce costs and improve profitability. Critical infrastructure such as CNC/milling machines are already instrumented for properties such

as chatter, vibration, thermal stability, hydraulic pump flow rate etc so as to minimize the power consumption for spindles and peripheral equipment. IoT software can collect machine data and establish patterns and trends that will help the operators to identify usage behavior and settings for highest throughput at lowest cost.

DataV Optimize can be used to understand how well a piece of equipment is operating and compare machine behavior across an entire population of devices. The ability to aggregate data from disparate machines, normalize and interpret this data with transactional business intelligence enables better alignment of shop-floor decisions with corporate business objectives.

By running the data through machine learning and data analytics algorithms, an operator can determine the best calibration settings for a particular piece of equipment, which may vary based on environmental conditions. Data analytics can also uncover correlations in areas such as energy consumption and product waste, which can be used to reduce overall operating costs.

The Bottom Line

DataV is designed as a modular, scalable solution that easily integrates into existing infrastructure, making it an ideal choice for mixed environments. The architecture enables the business to install only the components needed to achieve the desired business outcomes. Whether on-premise or in the cloud, DataV represents a complete IoT solution for maximizing the performance of manufacturing operations in industrial settings.

For more information, please visit bsquare.com or email us at sales@bsquare.com



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