



IoT in the Transportation Industry

USE CASE Transportation

In the world of fleet management, uptime is a key business success metric. Unscheduled downtime disrupts the supply chain, resulting in lost revenue and other negative business impacts. To make matters worse, truck repair times are often measured in weeks due to the time it takes to diagnose a problem and obtain the needed parts. Not only does this affect the fleet owner, but truck manufacturers must manage growing warranty costs due to these inefficiencies.

When a truck encounters a mechanical problem, it is difficult for the driver to know the severity of the problem and the best course of action. A wrong decision can jeopardize safety or risk additional damage. At the same time, a minor problem can unnecessarily take a truck off

the road. Those who manage service centers also need ways of maximizing the productivity of their technicians in response to the increasing complexity of modern engines and truck manufacturers need better methods of validating warranty compliance.

This is a market where smart management through an Internet of Things (IoT) strategy holds great promise for maximizing uptime and keeping trucks in service. A combination of remote diagnostics, an optimized repair process and advanced data analytics can virtually eliminate unscheduled downtime by proactively monitoring sensors on the truck, automating the diagnostic process, and identifying service facilities best equipped to solve the problem quickly.

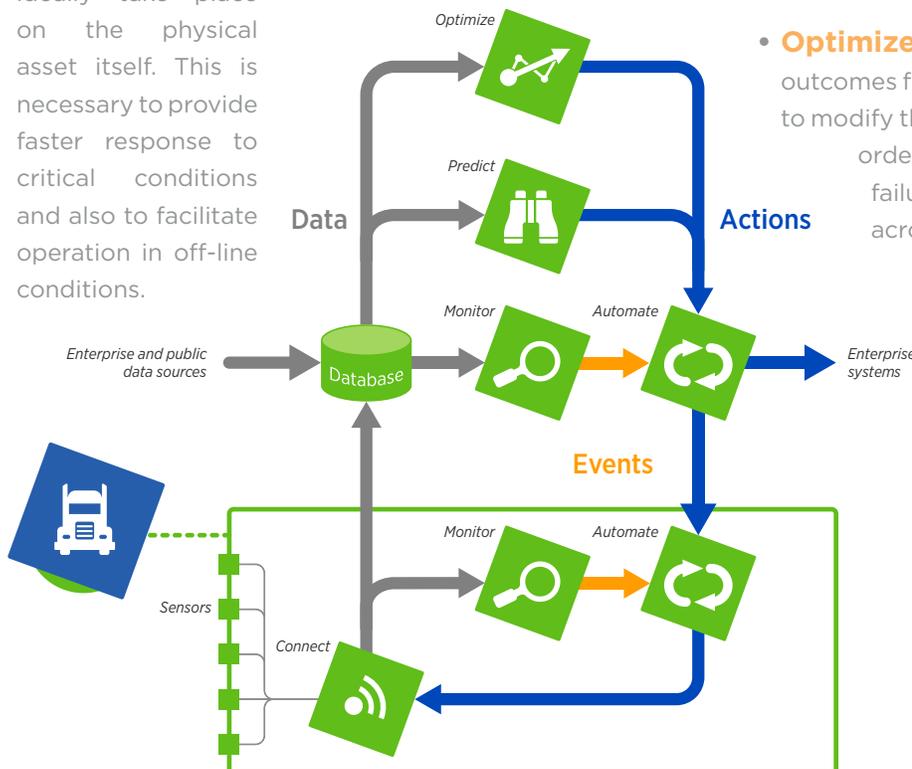
IoT: Providing Real-Time Visibility into Fleet Operations

The principle 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. While the end goal is to improve business outcomes, a complementary set of technologies is required to implement and integrate IoT systems into business operations. These include:

USE CASE Transportation

- Connect.** The most foundational aspect of IoT is to connect, through whatever technology is most appropriate, physical assets to networks, cloud-based databases and applications (the cloud may be public or private, on-prem or off-prem). A key function of the connect process is to intelligently filter, compress, or combine data sets in order to reduce network costs. In many IoT implementations, 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 data stream generated by physical assets is monitored in real-time in order to look for anomalous conditions. There are two important aspects to the monitor function which are often overlooked in IoT implementations. First, “monitor” does not mean to display data on a dashboard for human consumption. Rather, it means software intelligence examining real-time data feeds and applying heuristically derived (and possibly changing) rule sets. Second, aspects of the monitoring function ideally take place on the physical asset itself. This is necessary to provide faster response to critical conditions and also to facilitate operation in off-line conditions.

- Automate.** A broad array of actions may be required in response to anomalous conditions detected by the monitor function. These include commands to the physical asset itself (e.g., reduce engine RPM to prevent overheating), notifications to operations and support personnel, and even commands to other enterprise applications (e.g., inventory, support and trouble-ticketing systems). Here also, it is important that a portion of this functionality reside on the physical asset in order to allow actions to be taken even when the asset is disconnected from the network.
- 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 period in order to determine conditions that frequently precede failures. By this means, fleet managers 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 in driving better business outcomes from the data generated by physical assets is to modify the operational parameters of those assets in order to optimize efficiency. Similar to predictive failure, this is done by examining large data sets across entire fleets of equipment, determining the operational parameters of the best performing equipment, and applying those parameters to other equipment within the fleet.



How IoT Benefits Fleet Managers and Commercial Truck Manufacturers

There are several ways in which IoT systems benefit not only the truck manufacturer but also fleet managers and service centers.

Increased Uptime

Equipment downtime is the enemy of all participants in the transportation supply chain and there are several IoT strategies that improve this situation. Real-time monitoring of data transmitted from truck telematics instantly detects Diagnostic Trouble Code (DTC) faults as they happen. Since most failure modes trigger multiple DTCs, an IoT system is able to analyze all of the active fault codes along with current operating parameters and assign probabilities highlighting the most likely root cause. If needed, the system can ask the driver for information that is not available from sensor data such as visual inspection items. By understanding the most probable cause of a fault, parts inventory databases can be queried to determine which service center in the area is best equipped to quickly remediate the problem.

While this helps reduce downtime after the fault has occurred, there has been much progress in the field of prognostics, which is the combination of remote diagnostics and predictive failure analysis. Data analytics can identify leading indicators to a failure, serving as an early warning system. This enables fleet managers to schedule the repair at a time with least impact to the business.

Reduced Warranty Costs

Warranty costs represent a very significant expense for truck manufacturers, frequently two to three percent of total sales. This means, for example, that as much as \$4,500 could be accrued for anticipated warranty

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.

costs on the sale of a \$150,000 truck. This expense, while necessary, adversely impacts gross margin and, ultimately, profitability. Correctly designed IoT systems can reduce warranty costs in a number of ways. First, the real-time remote diagnostics analysis determines the severity of a fault, which is information drivers do not have today. Depending on severity, continued use of the truck can lead to additional damage, increasing parts and labor costs. IoT can take immediate action by sending commands to the appropriate electronic control unit (ECU) in order to minimize further impact.

Second, IoT systems have the ability to create an optimized repair plan, which summarizes all of the diagnostic work already performed while the truck was on the road, including which possible causes have been eliminated based on the available telematics data. 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.

Finally, IoT systems can keep track of what work was actually performed, minimizing erroneous or fraudulent warranty claims.

Device Optimization

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

Asset Utilization

Manufacturers of commercial trucks, as well as fleet owners and independent owner/operators, are often challenged with locating assets in the field and understanding how effectively they are being used. IoT systems can create geo-fence zones and apply unique logic per zone or asset. This can be used to reallocate underused assets or enforce business policies.

Monetizing IoT

Apart from benefits, businesses of all types, but most particularly manufacturers of commercial trucks, are keenly interested in monetizing the investment in IoT systems. This is partly a function of capturing a return on that investment but it is also a strategy for seeking new higher margin, service-oriented revenue streams to augment their core business.

ROI studies conducted by Bsquare have shown that for commercial truck manufacturers, reduction in warranty costs alone are more than sufficient to pay for the required IoT software and associated business process integration. An additional point of monetization for equipment manufacturers is derived from the ability to begin offering uptime and analytics services to their customers that manage fleets. What this basically entails is delivering a subset of data already being collected from trucks to the owners of that equipment along with analytics capabilities.

The Bottom Line

IoT technology is finding its way into many businesses around the world. But for industrial applications such as commercial trucking, IoT has been proven to provide tangible financial benefits to manufacturers while at the same time delivering superior products with greater uptime characteristics to their customers.

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

