

## Analytics at the Edge for Real-Time Production Processes

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### Keywords

Edge Gateway, Industrial Internet of Things (IIoT), Real-Time Analytics, Machine Learning, Dell, Eigen Innovations

### Summary

The Industrial Internet of Things (IIoT) will change the way industrial organizations generate, collect, and analyze data. Data will be generated

The Industrial Internet of Things (IIoT) will change the way organizations generate, collect, and analyze data.

Edge gateway devices will play an increasingly important role in that data infrastructure. This report will help OT and IT managers alike understand the benefits of real-time process analytics, and how those analytics can be delivered using an edge gateway.

faster and in greater volume than ever before – IIoT data is Big Data for industry. This will require the current plant information infrastructure to evolve.

One key part of this new infrastructure will be edge devices or intelligent gateways. These will securely collect, aggregate, filter, and relay data close to industrial processes or production assets.

They will also be capable of running powerful analytics, detecting anomalies in real time, and raising alarms so that operators (or, in some cases, even controllers) can take appropriate actions.

As ARC Advisory Group recently learned, the [Dell Edge Gateway 5000](#) series, based on Intel technology, provides an example of a new generation of devices built specifically for these types of industrial applications. This ARC report:

- Discusses the emerging need for edge gateway devices
- Highlights how [Eigen Innovations](#), a Dell partner, uses edge gateways to provide real-time analytics solutions for its customers
- Provides several real-world application and case study examples
- Suggests how edge devices may play a role in bridging the OT/IT divide



## **IIoT Changes Analytics Forever**

In many situations, the biggest obstacle to getting started with Big Data is that people think of data as a thing, rather than a journey. Many organizations are already on that journey, whether they realize it or not. For many industrial companies, Big Data is going to come from the Industrial Internet of Things (IIoT). This connects intelligent physical entities – such as sensors, devices, machines, other assets, and products – to each other, to internet services, and to applications. IIoT architectures build on current and emerging technologies such as intelligent equipment with an IP address, machine-to-machine (M2M) communications, mobility, cloud computing, analytics, and visualization tools.

However, for many companies, taking full advantage of the opportunities created by IIoT data will require a new approach to analytics. Traditional approaches to analytics have built-in delays. For example, data may be stored in a data historian or data warehouse for days, weeks, or months before being analyzed (if ever). Similarly, there are often delays in aggregating data before it even gets into a data warehouse. Such delays can be costly - or even catastrophic - for industrial processes.

### **Moving Analytics to the Edge**

Moving analytics to the edge of the network and thus closer to the data sources can help improve manufacturing process quality and production yields. In the past, analytics have often been centralized, partly due to the cost of hardware, software, and support. It made economic sense to bring data into a centralized data center for processing. Increasingly, though, inexpensive sensors and processors enable more production data to be collected and some data to be processed at the edge. Edge analytics allow new and existing types of production data to be analyzed in real time, immediately after the data are generated. Consequently, any emerging issues in the production process can be identified quickly, alerts generated, and corrective action taken. Without real-time analytics at the edge, scrap may be higher and machines and other assets could potentially be damaged.

### **Real-World Applications**

Industrial vision system supplier, Eigen Innovations, a member of the [Dell IoT Solutions Partner Program](#), uses video analytics to improve manufacturing processes and provide real-time quality control. Although there are

other vision systems on the market, the company strives to provide solutions that are easy to set up, operate, and retrain whenever a manufacturing process changes. These flexible solutions can be applied to a wide range of industrial applications.

The solution uses factory floor edge gateway devices to collect data. Although the primary form of input is vision data, data can also be collected from other sensors and programmable logic controllers (PLCs). By analyzing these data, Eigen Innovations can provide real-time quality control for the product as well as real-time asset monitoring. In some applications, the solution can also output to controllers to support closed-loop control.

The vision sensors typically collect data from the infrared light spectrum. Each pixel in a video frame provides temperature readings and the solution collects between 30 and 60 video frames a second – about 40 MB of data per second. This provides a very robust set of data. For example, not only does

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it provide the surface temperatures of a discrete product during manufacturing, it can also help indicate subsurface temperatures.

Eigen Innovations uses a combination of edge gateway devices and cloud-based machine learning algorithms to identify anomalies in the data. The gateway collects and filters incoming sensor and video data on product characteristics or real-time process parameters. Filtered data are then pushed up to a cloud repository. Smart algorithms also run on the edge, close to the process, so that alerts can be generated in real time and corrective actions initiated. These algorithms are created and fine-tuned by machine learning algorithms that run in the cloud and then downloaded to the edge gateway device. This enables real-time monitoring of both product and process. Any potential anomalies are flagged to an operator to verify if the anomalies are actually product defects, or other process situations worthy of note. In this way, the solution gets smarter over time.

In addition to reducing the required bandwidth, this approach also minimizes the need for operators to learn a new method and system. By pushing the training burden into machine learning software, Eigen Innovations can provide a solution that works well in complex situations, providing real-time process management across a variety of industries and use cases. These include both discrete and process manufacturing applica-

tions for which the secure, industrially packaged Dell Edge Gateway is well suited. A few specific use cases provided by Eigen Innovations follow. In all these applications, the gateway serves as a funnel to capture and filter plant-floor data at the edge of the network, push these data up to the Eigen Innovations analytics cloud, and then rapidly execute the algorithm.

### **Auto Manufacturing**

Eigen Innovations helped one auto manufacturer improve quality assurance for its rear window defoggers. In this use case, the finished product is inspected using a simple pass/fail approach. The defogger has a very distinct thermal image. So, as a vehicle comes off the production line, the defogger is turned on and the solution can rapidly check if all elements of the defogger are working correctly. Previously, the QA process didn't check all the elements. This makes the process more accurate and robust.

Other automotive manufacturing applications involve in-process activities such as applying glue beads or welding seams. In glue bead applications, the thickness and continuity of the glue are key. By mounting two different cameras to get two different inputs, the solution checks the glue coming out of the nozzle in real time and can rapidly fire off an alarm if necessary or, in some cases, initiate the appropriate action in the machine controller. A similar solution can check and help ensure the quality of weld seams.

### **Paper Manufacturing**

In this paper mill, the coating on high-gloss paper is applied during production while the paper is zooming along a machine at 4,000 feet per minute. If the coating is applied unevenly, the entire calendar roll can break; resulting in costly lost production, machine downtime, and/or machine damage. The Eigen Innovations edge analytics solution looks at the thermal signature of the paper surface to assess the distribution of moisture to determine how evenly the coating has been applied. The application "learns" what a streak looks like and then, in real time, sends a signal to the PLC controlling the machine to ease off the pressure on the roller to avoid breakage.

### **Metals Smelting**

It's challenging for operators in metals processing plants to understand exactly what is happening deep inside a blast or arc furnace during the smelting process. By collecting and analyzing infrared data, this solution

can help detect issues like buildup of accretion on top of the furnace burn layer. Typically, this is managed in a very crude way, such as ad hoc poking. By analyzing a stream of thermal image data, patterns and anomalies

can be isolated, so operators can get a much more accurate picture of the behavior within the furnace and take appropriate actions.



**Dell Edge Gateway 5000 Features Industrial Form Factor**

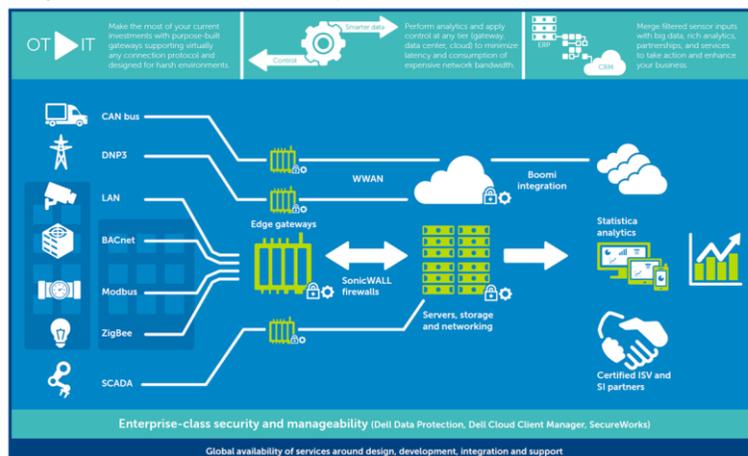
## Closing the Gap Between OT and IT

ARC has observed a welcome trend in recent years for the operational technology (OT) and information technology (IT) groups in factories, process plants, and other industrial facilities to work together to help solve specific production and business problems.

The Eigen Innovations team selected the Dell gateway device for the company's industrial edge analytics solution, in part because they recognized that the device can appeal equally to both OT and IT people.

### Dell Internet of Things framework

Enabling flexible, distributed IoT solutions that can be tailored to specific verticals and use cases



## Dell IoT Framework Helps Link OT to IT

tel Atom processor, runs a familiar operating system and software stack, and has built-in security and management features. These include Trusted Platform Module (TPM) chips to help protect network endpoints.

The gateway device is ruggedized and built for many factory- or plant-floor environments with an industrial form factor (including both wall- and DIN-mounting options); multiple I/O ports; wide temperature and humidity specifications; and a 24-volt power supply.

The Dell brand is also well known and trusted by IT organizations. The gateway device is powered by an Intel

ARC believes that Eigen Innovations' approach makes good use of emerging IIoT technologies. It leverages the edge gateway in two ways. First, the gateway is used to collect and filter incoming sensor and video data and pass the data up to a cloud repository. Second, smart algorithms run on the edge device, close to the process, so alerts can be generated in real time as events occur. The approach also leverages the cloud for scalable data storage and processor-intensive deep learning algorithms.

## Conclusion

While OT groups typically focus on process- and production-level issues and IT groups typically focus on data integrity and security issues, emerging IIoT solutions often require a more integrated approach; potentially connecting smart sensors and production assets on the plant floor all the way through to enterprise information systems. For this reason, it's more important than ever for business managers, OT managers, and IT managers to work together closely to drive change.

To succeed fully, technology projects in industrial plants require a collaborative, multi-disciplinary team to balance the respective needs and constraints of operations and IT organizations and business management. In this manner, these three functions can communicate better and converge their key skills and experience. Together, they can collaborate to deliver a project that meets business needs and addresses any required IT/OT standards and constraints, and do so on time and within budget.

As demanded by the rich, fast-moving data generated by the Industrial Internet of Things, industrial analytics is moving to the edge. Real-time

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analysis of machine, product, and process data can help reduce scrap and unscheduled downtime, increase both production and safety, and ultimately improve business profitability.

Edge devices – such as the Dell Edge Gateway 5000 – are an essential component of this class of IIoT solution. Simple, intelligent filtering of data before it is sent onwards to long-term storage

can help overcome network bandwidth constraints. High-performance processing is also necessary to run machine learning algorithms at the edge.

By running these algorithms close to the production processes, reliable, low-latency alerts can be generated when industrial processes go awry.

Furthermore, solutions that appeal to both OT and IT staff can help bridge the cultural gap that has often existed between these two diverse groups of employees, helping bring the real-world benefits of the IIoT to industrial organizations.

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