



## Case Study

# ProRefrigeration Extends Their AWS IoT Capabilities to the Edge with CEI America



## The Challenge

ProRefrigeration has been manufacturing industrial chillers for over 30 years with specialization across several industries, including dairy, craft beverage (breweries and wineries), food processing, and extracting. Delivering reliable products and services has enabled ProRefrigeration to cultivate and sustain relationships with thousands of customers around the world. In 2018, Pro Refrigeration extended their offering by employing Internet of Things (IoT) solutions which enabled them to stream telemetry data from their chillers to monitor performance, isolate anomalies, and prevent downtime using the company's PROElliot IoT application, running on Amazon Web Services (AWS).

PROElliot was announced at IoT World in Santa Clara in 2017 and later the Craft Brewing Conference in Nashville, Tennessee. As an early adopter of Industrial IoT (IIoT), ProRefrigeration disrupted the chiller market. Yet they also realized that many of their customers' use cases were in remote areas with limited connectivity, leaving them reliant on WiFi connection(s). This limited ProRefrigeration's ability to extend the solution to emerging cold chain use cases, including dairy, because they require constant connectivity and fidelity to ensure the milk stays at or below 40 degrees F throughout the production process. This is a critical measurement, as the bacteria load in milk doubles every 20 minutes at or above this temperature. This helps confirm that the product offered for consumption to the public is not only safer but also of a higher quality with less bacterial load. This also makes it possible for dairy farmers to charge a higher premium (5-10%) for their product, while reducing the producer's liability, which has resulted in less expensive insurance premiums for them.

Tracking the temperature and status of milk and dairy products has historically been done manually, using a government mandated circular paper chart, for 50-plus years. Sensing a modernization opportunity that could help farmers increase efficiency and reduce costs, ProRefrigeration, digitally replicated the chart in PROElliot to automate the collection and reporting of data. This is achieved by leveraging telemetry data from the chiller systems, heat exchangers, milk storage tanks, and other related assets. This automates the process of getting this crucial data from the equipment into the cloud and provides real-time results that can accurately identify when immediate action is necessary.

Understanding that they had created a potentially revolutionary IIoT service for dairy farmers and producers, ProRefrigeration realized they would need help extending their ProElliot solution to the Edge specifically for cold chain use cases that require the system to operate in areas with limited connectivity. Demonstrating its intrinsic value to customers, and compelling them to adopt it, would be a key step.

For PROElliot to address these emerging requirements ProRefrigeration enlisted the help of, CEI America, of Pittsburgh, Pennsylvania, to turn their vision into reality. This meant delivering PROElliot with device capabilities that went beyond just providing access to real-time data but that could also operate in environments with intermittent connectivity by filtering messaging, data queuing, and sending local alerts if an anomaly was detected or an asset was trending towards failure.

This not only extended PROElliot for dairy use cases, it also positioned them to assist with emerging cold chain opportunities, including tracking COVID-19 vaccinations. This ensures the safe and secure distribution from the point of origin to where the vaccines are most needed to expedite the process of getting everyone on the road to recovery.



## The Solution

Having gained an understanding of this request's details, and a clear definition of the expectations, CEI focused on leveraging native AWS IoT services, such as AWS IoT Greengrass. Integrating these components enables PROELIOT to reliably ingest and deliver real-time data and reporting on the status of the ProRefrigeration chillers in use on dairy farms. This updated solution requires the deployment of sensors into holding tanks, on milk trucks, as well as in other core holding and transportation infrastructures. Once in place and operational, the sensors send telemetry data to AWS IoT Greengrass, AWS IoT Events, and other AWS IoT services to track, monitor, report, and send immediate alerts if the milk or dairy product temperature is trending higher.

In addition, CEI's Edge solution enables PROELIOT to track and ingest data over the course of the entire process. It does this by first capturing pertinent real-time data on the status of the dairy products, then applies relevant third-party information (such as weather reports), before incorporating Artificial Intelligence (AI) to help accurately predict potential anomalies and trends.

The value of this solution is amplified by its capability to enable the system filter and store telemetry data offline while concurrently monitoring for cellular connectivity to subsequently send the offline data to AWS. This results in the quality of the milk and dairy products being accurately tracked throughout the entire process (from milking to distribution), even if WiFi or cellular connectivity is not available, and a real-time connection to AWS cannot be made.

Extending PROELIOT's IIoT capabilities to the Edge has made it possible for dairy farmers to monitor the temperatures of their products more effectively. Using the built-in alerts and alarm notifications, farmers instantly learn when their cooling systems are trending the wrong way before they are adversely impacted. This helps to not only protect and increase the value of desired milk fat, but also ensures safe, healthy delivery of milk and dairy products for sale to consumers.



## The Benefits

Implementation of this evolving solution has helped dairy farmers and distributors become more efficient. A practical example is demonstrated by auto triggering the milk tank agitator to engage when the milk truck enters the farm, while simultaneously sending a report back to the milk hauler with the current Cold Chain status and milk temperature. This enables dispatchers to schedule their pickups and deliveries more efficiently while reducing the time spent waiting for product to be loaded. As a result, the drivers can go to more farms and pickup additional product over the course of days, months, and years.

Incorporating reliable AWS IoT and AI capabilities into their solution has enabled CEI to help PROELIOT effectively leverage its edge functionality and more accurately evaluate key data, isolate potential trends, and more quickly identify the emergence of patterns that could affect business outcomes. The scalability and durability of the AWS IoT services ensure that thousands, if not millions, of devices can be scaled on demand, without concern for exceeding limits on the number of devices. Moreover, the scalability and elasticity of AWS compute and storage enables the ongoing ingestion of large data volumes which can be scaled up for immediate analysis and accelerates the process of detecting and isolating patterns and anomalies. Once completed, these can then be scaled back down to reduce costs and improve overall business outcomes.

AWS IoT—and specifically edge—technologies are critical to CEI's ability to build and deploy cold chain solutions that operate in environments where connectivity is not always reliable. These services continuously enhance both the solution and the pace at which new edge capabilities can be incorporated to add value. In the end, this helps reduce equipment downtime and associated costs, while ensuring the viability and value of the end-product.



### Added Efficiency Helps Increase Productivity

As the value of this solution is realized, it becomes evident that CEI's use of AWS services has helped increase the proliferation of PROElliot's use among the dairy farming community. The constant monitoring has enabled farmers to charge an additional 5-10% for their "cold chain verified" products. By capturing this critical IoT temperature and other data in real time, an average/large dairy farm (one that produces an estimated \$28,000 per day in milk), can increase the value of that same milk by \$1,400-\$2,800 per day. This estimation would generate an additional \$42K-\$82K for the same product/commodity, which transitions to \$500K/\$1M in additional annual revenue for the producer.



It has been exciting to watch PRO as we develop and transform from an equipment manufacturer into a technology company that builds equipment!

Jim VanderGissen Jr



### Improve Data Access with Edge Functionality Results in Real Data Costs

The combination of CEI and AWS is delivering impressive cost savings benefits, as well as adding revenue to the bottom line, for ProRefrigeration's customers. The PROElliot Cold Chain Verification Platform will drive a 30% reduction in pre-cooling water, delivering **annual savings over \$100,000**, and leaving more than 10 MILLION gallons of water in the ground. Combined with herd health, the PROElliot Cold Chain Verification is vital to reaching the Premium Quality Bonus payments that adds \$.10 per CWT of Milk, **another \$87,600 in annual revenue**. When additional sanitation savings are included for a single 3,000 head farm, the **total estimated cost benefit is just under \$200K, annually**.

