In order to deliver high quality products at the right value, the ability to control the environment and control the cost of delivery to that environment is vital. Quality assurance is reliant on the right parameters of performance, the ability to fulfil and managing the risk of waste.

The Cold Chain not only poses the opportunity to apply IoT solutions at the food production, storage, distribution and retail stages, but also the opportunity to then combine that data from those environments to strategically leverage the IoT and deliver considerable business value.

A third of the world’s food goes to waste, and most of the losses come from spoilage on its way to being consumed. The average piece of produce in the US travels 1,500 miles from its source.

Much of the waste is due to lack of proper refrigeration. Broadening and improving cold chain efficiency would extend the shelf-life and increase the supply of perishable foods like meat, fruits, vegetables and dairy — essential products that are more difficult to preserve than grain or rice.

The Cold Chain is a sophisticated and established infrastructure that is mature in corporate commitment to reduce waste, and part of a highly competitive and operationally cost sensitive landscape.

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The Context for IoT Delivery in the Cold Chain

The Machine Data Integration Layer

The Cold Chain is a machine rich environment, where a controls infrastructure already exists across large sections; the nature of these control systems necessitates an underlying sensor driven infrastructure.

The Enterprise Data Required for Context, Decision and Automated Action

Most corporate environments have already made substantial investments into centralised Enterprise Management systems, whether asset management, enterprise management or workflow and resource management or a combination of all of these. Much of this data can be used to contextualise the real-time information that is coming from the machines, in order to automate the distribution of required actions and audit their outcomes. Policies can also be set to ensure the IoT layer can execute required actions directly with the machine, while informing central systems and reporting on outcome.

Identified Risk: Failure within a refrigeration component that is essential to providing the cooling required for the food products.

IoT Enablement: The necessary de-merchandising of the product from the asset, fixing the asset and returning it as part of the infrastructure to provide the required cooling.

Integrated and Automated Management of Workflow:
- What the asset is
- Which resources are required to execute
- Which time frame it should be executed within
- Return to Normal SLA’s

By using the real-time machine data, both the nature of the fault on the asset and the resource required to resolve it can be ascertained. Through integration with the central systems, the contractor required to attend and the SLAs associated with that attendance are known. The order can therefore be dispatched to the right contractor, and the contractor can execute the work and close the order for payment. The IoT layer will then execute a condition assessment on the asset before automatically approving or declining the order for payment or recall.

Perimeter 1st, Central 2nd
Heavyweight Processing Capability at the Edge

In a data rich environment you need processing capability at the edge

Central only
Lightweight Processing Capability at the Edge

When there are minimal amounts of data that you don’t need to add value to, you can push it straight up
Follow these five examples to implement the IoT across the Cold Chain

1 | Assess efficiency opportunities across the cold chain

**Food Processing:** Ability to recognise any differentiations in tolerance throughout the process, highlight a risk that there may be a quality issue with that batch, taking into account quality assurance data, comparing against fulfilment for the customer, re-allocating the batch, amending the distribution cycle, and deploying an engineer.

**Distribution Trucks:** Access to real time temperature data, run time capacity, telemetry data and geographic locations we have the methodology and access to automatically take action if something goes wrong. We can automatically create a work order to deploy a qualified engineer to fix any issues, deploy an alternative vehicle to collect the contents, and share this data with the end customer.

**Cold Storage:** Cold storage is a major contributor to the cost of the Cold Chain. An integrated data system that balances the demand for cooling based on the volumes and distribution profile of the produce, matched with onsite generation capacity and real time reviewing of the energy pricing market, can create significant opportunity for both revenue generation and op ex compression.

**Food Retail Site:** Access to real time temperature data, merchandising data, compliance data and asset health and efficiency data. With access to the detailed merchandising system we are able to ensure that the refrigeration regime matches the product increasing quality and not only reducing customer complaints, but also reducing the demand for millions of degrees of cooling in the environment and delivering millions of dollars’ worth of saving and energy consumption.

2 | Determine available data and assess the size

The first step is to ascertain the size of the data that we currently have access to, and isolate areas where some investment in sensor driven infrastructure would be advantageous and cost effective. This legacy and newly implemented sensor driven infrastructure can then all be integrated under one IoT integration layer, and the depth of interactive capability can then be assessed, whether it is just acquiring data or whether it is a read/write functional capability.

3 | Assess which data you want to aggregate to determine the optimal architecture

We then have to assess the volume of data that it would be desirable to collect, whether we are looking at second intervals of incremental performance analysis, more aggregated, or purely exception handling types of data. This information will then dictate to us the nature of the IoT solutions architecture, from remote or on-site processing capacity and memory using the Dell Edge Gateway, or in some circumstances where data can be ported to a central or cloud instance directly.

4 | Contextualise the real time information that is coming from the machines

Using the real time performance of the machines and applying rules across that data gives thresholds for severity management, and the opportunity for scoring risk. This will give infrastructure operators a clear understanding of the real time produce risk inherent within the product flow, and the ability to make fast decisions about how to mitigate those risks and minimise the impact of food and margin loss.

5 | Automate Management of Workflow when an event occurs

Policies can also be set to ensure that the IoT layer can execute required actions directly with the machine but inform central systems and report on outcome.
To help create a blueprint for IoT deployments, Dell has developed a flexible architecture centered around the Edge Gateway 5000 and integrating qualified partners for a complete solution. The Dell Edge Gateway 5000 enables companies to collect, analyze, relay, and act on real-time data from energy producing, distributing, consuming, and measuring equipment and sensors. Through the deployment of its solutions onto the Dell Edge Gateway 5000, IMS Evolve leverages the real-time data of a business’s estate at the source to reduce energy consumption, manage waste, and transform the cost of asset ownership. Collection and management of data is executed at the edge, in context with other local data if required, and the actionable insight shared with the central resource. This leverages existing infrastructure and investment and, most notably, provides a platform for incremental expansion of IoT. Both process and decision-making capacity is disseminated to locations where there are either singular or high densities of devices. These perimeter based software engines enable independent asset and site-specific decisions and execution based on high volumes of granular data. Decisions and policy executions can be informed by specific asset and site-based rules, while including enterprise level data distributed to the perimeter from central cloud based implementations. This allows fully formed and contextualised events to be distributed throughout the enterprise and its supply chain, enabling significant cost efficiencies through automation, appropriate interventions, and monetisation of capacity and consumption.

**RFID in Food Distribution:** Individual shipments can be physically tracked as both an autonomous measure of performance on the batch itself, as well as a piece of contextualisation for order data i.e. to pick up errors and audit.

**Merchandising:** Regimes to manage temperature can integrate merchandising data and implement more layers of functionality.

**Related Demand:** In an environment where write down of produce quality within a food processing plant already exists, for example a cheese manufacturer, potential related demand for lower grade cheese in the individual marketplace can be married up and matched to client orders.

These applications are scalable by function; they release value and increase function, all while plugging into the same IoT enabled architecture.

**Architecture Overview**

Opportunities for cold chain logistics to benefit from the IoT include:

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These applications are scalable by function; they release value and increase function, all while plugging into the same IoT enabled architecture.
Along with our IoT Solutions Partners, we provide technology you can trust to help you get started quickly and efficiently.

Dell takes a pragmatic approach to the Internet of Things (IoT) by building on the equipment and data you already have, and leveraging your current technology investments, to quickly and securely enable analytics-driven action.

The Dell IoT Solutions Partner Program is a multi-tiered partner ecosystem of technology providers and domain experts to compliment Dell's broad portfolio of IoT-enabling technologies.

To learn more visit us online at www.delliotpartners.com

Contact Dell Sales to learn more about the Dell Edge Gateway 5000, our ecosystem of qualified partners, and to deploy this flexible predictive maintenance solution today.