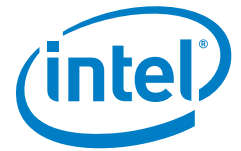


SOLUTION BRIEF

Intel® IoT
Connected Transportation and Logistics



Smart Freight Technology Powered by the Internet of Things

Intel enables real-time location and integrity monitoring and management of high-cost, high-risk shipments through smart sensor tracking and real-time edge analytics

“It’s not about doing the same thing better, it’s about doing a better thing. The direct result is that we’re digitizing things we’ve never digitized before.”

George Moakley
Senior Solutions Architect
IoT Connected Transportation
and Logistics, Intel

Disrupting the Global Logistics Industry through Connected Freight Technology

Freight shipping is a massive and rapidly expanding global industry, accounting for roughly 8 to 10 percent of the Gross Domestic Product (GDP) worldwide.¹ Cost-management efforts, tightly held within service-level agreement constraints, have been a decades-long value driver. The result is a highly fragmented and intermediated ecosystem of specialized businesses that conduct their operations based on centralized data systems.

A fundamental challenge for the logistics industry is the inevitable discrepancy between these centralized information system records and field realities. Anytime a human in the field scans a package while loading or unloading a shipment and, for whatever reason, fails to follow what the centralized system expects them to do (e.g., person gets distracted and fails to load a package or puts the package on the wrong truck), the result is a discrepancy between what the centralized information system “believes” is true and real in the field.

Traditional “track and trace” solutions have focused on doing the same thing better—attempting to improve the quality and reliability of centralized information system updates in real time. Intel is taking a different approach by doing a better thing—making the freight smart. By instrumenting freight with sensors and gateway devices, we create a solution in which the system of record is the reality in the field, and the centralized information system is a reflection of that reality.

The Global Smart Freight Opportunity

Many global businesses entrust their most pressing shipping and logistics needs to a highly fragmented series of carriers. Unfortunately, this inevitably results in discrepancies between centralized system records and in-the-field realities (inclement weather, road conditions, traffic, accidents, shipping vehicle malfunctions, and human error). Additionally, these solutions are often expensive and offer limited visibility into real-time events, data processing, and data analytics-gathering capabilities.

With the current fragmented state of the logistics marketplace, it is difficult to ensure that high-cost, high-risk items will arrive on time, safely—or in many cases—at all. In fact, the projected global market for connected freight and logistics represents a near USD 2 billion opportunity.¹

Imagine being able to know precisely when a shipping container of frozen food has changed temperature, or if a freight vehicle carrying fragile cargo has increased or decreased speed or experienced significant vibration. With sensor tracking and gateway technology, businesses can now view shipping environment data in real time, and make immediate changes to the shipping order.

As field instrumentation becomes increasingly intelligent, new classes of supply chain management services will create explosive revenue opportunities in this very large and significant market.

Real-Time Edge Data Collection and Processing Preserves Freight Integrity

When processing a shipment, a company often sources logistics to a third-party provider, or at the very least a company will charter a fleet of shipping vehicles. From there, the company will set up a mesh of waypoints, or warehouses—starting from the shipment location, going all the way to the destination address. Each vehicle will be directed to pick up the shipment from each waypoint. As shipments move through this complex process, freight databases are updated based on human-entered data. These updates can occur infrequently and are prone to error, lacking real-time data to monitor the quality and speed of shipping and logistics processes.

Instead, when we make the freight “smart,” it can speak for itself with much greater frequency and accuracy. Smart sensors attached to each box or item can feed data to a series of both mobile (inside shipments) and fixed (inside waypoints) gateways. Equipped with sensors like temperature gauges and accelerometers, this network allows businesses to monitor and record essential freight container environment data, and receive alerts when data is outside desired norms.

A more connected freight company can feed real-time shipment information to both its existing systems and to new big data analytics systems—enabling dynamic data delivery systems that customers can access while the shipment moves through its route.

For instance, if a food supplier is shipping ripe mangos to the US from Brazil, it must ensure that the shipping containers sustain optimum temperature for the duration of the shipment. By placing disposable sensor tags within the shipping container’s cooling system, both the logistics firm and the food supplier are able to track precisely when the temperature changes. Edge intelligence can monitor and evaluate sensor information to evaluate false positives or false negatives, or cross-reference readings to derive root cause. When freight instrumentation loses contact with cloud services, it can continue to process and evaluate information for rich analytics and will resume as soon as connectivity is restored.

This data can be sent to a gateway device attached to the shipment, which allows the food supplier to extract real-time shipping container environment data, and make any necessary changes to ensure that the mango shipment does not spoil by the time it reaches the destination warehouse facility, including diverting the shipment to a closer location for offloading and sale. Additionally, the motion of sensors in any given shipment can be used to detect unwanted insertions (e.g., smuggling). The gateway can also send relevant data back to the cloud to be analyzed alongside other business and environmental data for longer-term visibility and planning.

By applying Internet of Things technologies to in-transit shipments, Intel is digitizing business processes that have not been digitized before, and this is only the beginning of the opportunities this will create for the logistics industry.

Smart Freight Powered by Intel® Architecture

At the heart of the emerging smart freight revolution is the Intel® IoT Platform, a reference architecture for connecting sensor-tracking technology to gateways that communicate with a customer’s legacy data analytics and management system via an API firewall. The end-to-end platform includes:

- **Smart sensors:** Sensors with integrated processor, memory, and wireless communications; attached to packages
- **Gateways:** Mobile, battery-powered versions that accompany transit loads, and fixed waypoint versions associated with packages that have been received and/or

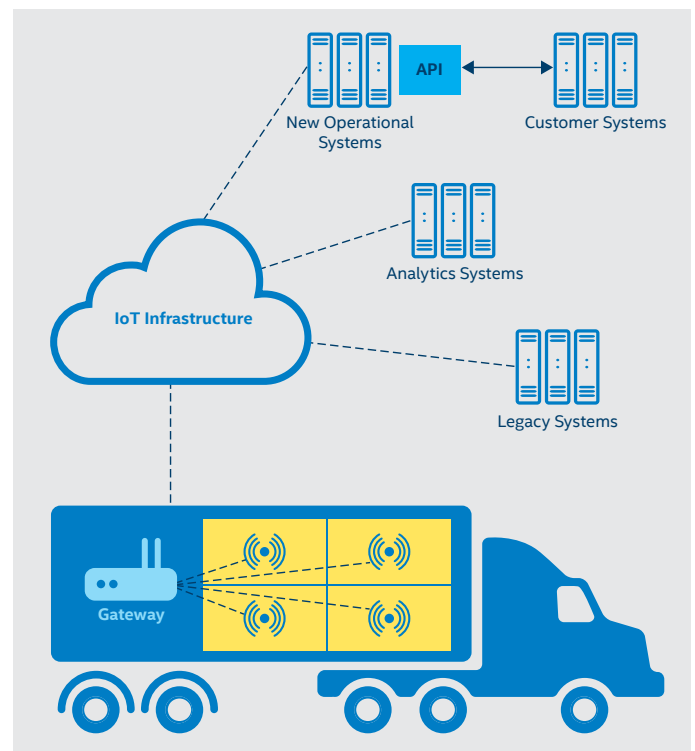


Figure 1. Making the freight smart

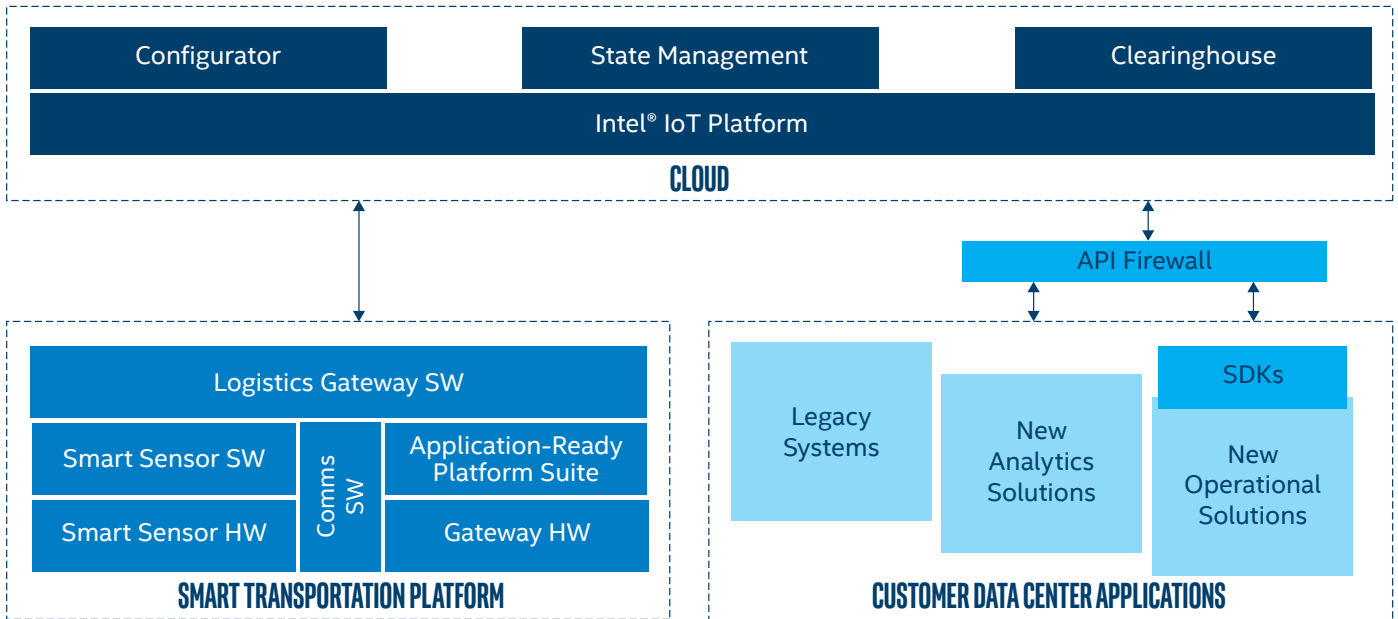



Figure 2. Simplified solution topology

yet to be shipped; managed by an application specifically designed to accept and provision against shipment parameters; include operating system and applicable packages for security, manageability, and local analytics

- **Configurator:** Cloud application that interfaces with customer apps to create configuration parameters for each load, including parameter adjustments
- **State Reconciliation Engine:** Cloud application that manages consistency between gateways and abstractions residing in customers' operational systems (shipments, loads, and waypoints)
- **Clearinghouse:** Cloud application-managing communications between gateways and customer applications (legacy, analytics, and operational); inbound periodic events and out-of-cycle events are received here for exchange with customer systems; outbound state changes and method invocations are received by clearinghouse for transmission to gateways
- **Software Development Kits (SDKs):** Tools provided to customers building new operational systems to ensure forward compatibility with gateway, clearinghouse, configurator, and state reconciliation engine feature enhancements



INTEL® IOT GATEWAY
 Along with providing essential connectivity, the Intel® IoT Gateway acts as a data router and filter between data-generating sources—such as sensors and intelligent equipment—and the cloud. It enhances data security, accelerates actionable insight, and more importantly, saves money—with the Intel IoT Gateway, companies can securely transfer only data that has operational relevance to the cloud, lowering costs for data transmission and cloud storage.

Join the Smart Freight Technology Revolution

Intel is transforming the way businesses move goods across the globe. Through a combination of sensor and gateway technology, the reality of a connected freight industry is closer than ever. While most companies are simply making the logistics data center smart, we are making the shipment itself more connected with smart technology powered by the Internet of Things.

For more information, visit: intel.com/transportation.



1. Global and Regional Infrastructure, Logistics Costs, and Third-Party Logistics Market Trends and Analysis, January, 2014.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software or service activation. No computer system can be absolutely secure. Learn more at intel.com, or from the OEM or retailer.

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