

THE INDUSTRIAL INTERNET OF THINGS DRIVING THE BIG DATA BOOM

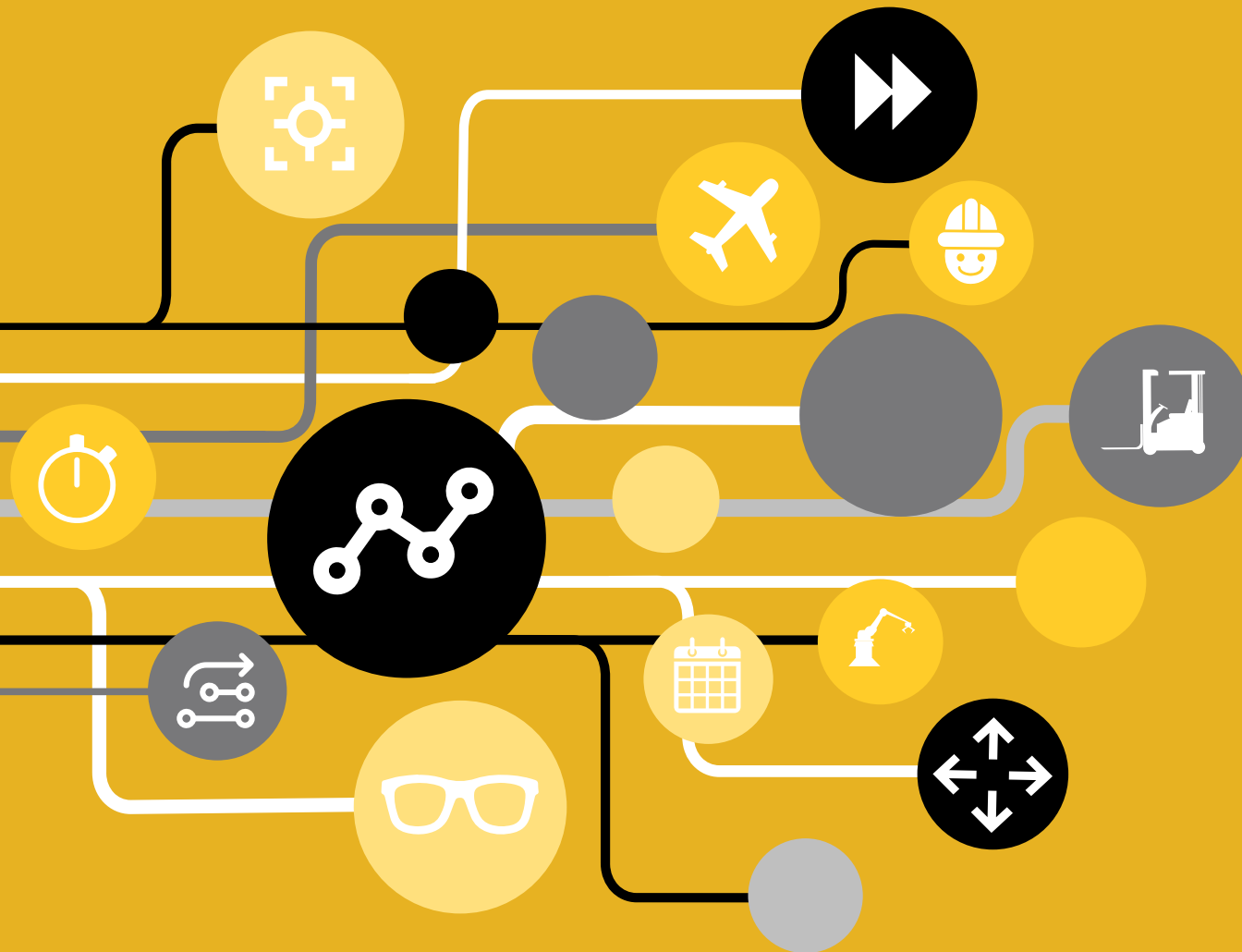


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Introduction

The 2000s saw a tipping point in consumer electronics that created something of a “Big Data Bang.” High-speed internet connections reached mobile devices and thus began the dawn of a new digital era that connected virtually everyone and everything.

The connected world has grown at an astounding pace ever since – from 2 billion “smart” devices in 2006 to an expected 200 billion by 2020. This has led to an explosion of information and terms like the Industrial Internet of Things (IIoT), big data, 5G and the cloud becoming common vernacular.

At a basic level, these terms refer to the near ubiquitous ability of devices to send and receive data. Users can then leverage this data to make more informed decisions and enable automated actions, thereby increasing labor productivity.

But what does that mean for businesses, particularly warehouses and distribution centers?



WHAT IS THE INDUSTRIAL INTERNET OF THINGS?

Advanced Analytics the cloud **BIG DATA**
MACHINE TO MACHINE COMMUNICATION M2M
IloT **Big Data** **M2M**
advanced analytics **M2M** **IloT** **ADVANCED ANALYTICS** **the cloud** **O T**
machine to machine communication M2M Communication **the cloud**

What is the Industrial Internet of Things?

Begin with the buzz words.

The cloud refers to internet-based, shared computing power that allows software and services to run on the Internet instead of a local computer. For an example of this cloud vs. local dynamic, think of online-based applications like GoogleDocs vs. Microsoft Word running locally on a desktop.

The Internet of Things, on the other hand, refers to the billions of electronic devices – everything from fridges to forklifts – that can collect and transmit data wirelessly, using Wi-Fi, Bluetooth, near-field communication and the cloud. The cloud and the IoT are truly two peas in a pod – they're inseparable. There would be no IoT without the cloud and the cloud constantly expands as the IoT grows. In essence, IoT enables localized decision making by leveraging – and enhancing – cloud-based aggregation.

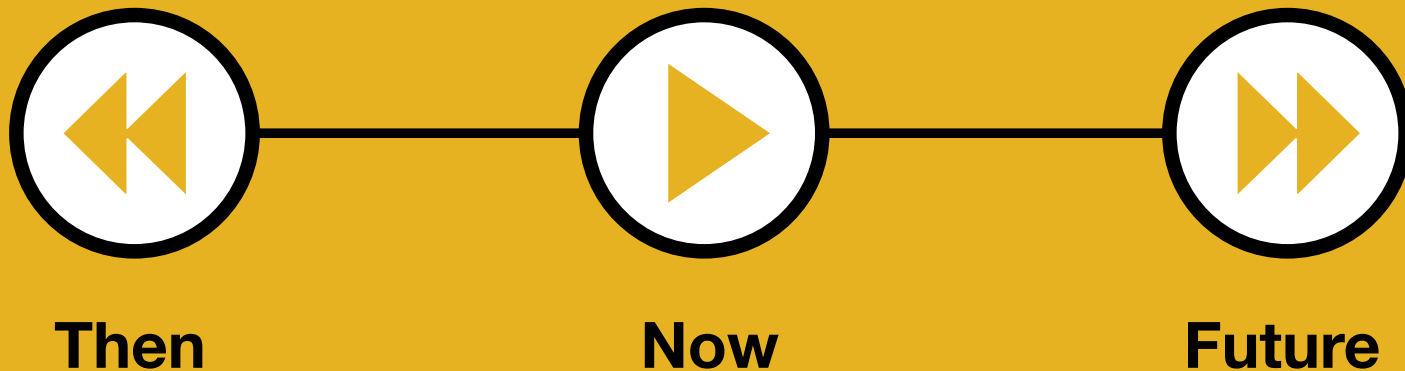
IIoT means the *Industrial* Internet of Things, so any connected device specifically in the industrial sector. IIoT holds great potential for quality control, sustainable practices, supply chain traceability and overall supply chain efficiency.

Machine-to-machine (M2M) communication is the framework of the IIoT. This broad term applies to any two devices exchanging information and performing actions without input from humans. M2M technology enables warehouse software systems to manage automated equipment, robotic lift trucks to communicate and maintenance management software to work with equipment like conveyors and sorters.

Big data is a term for the massive amount of data collected from billions of connected devices. These are data sets so big that they led to the invention of new computers to provide the necessary power to analyze them. With such significant volume and variety, patterns, trends and associations can emerge that reveal new insights and better business practices. Those insights are gained from **advanced analytics** – the scientific process of transforming big data into relevant insights.

Cybersecurity goes far beyond anti-virus software and password protection. It refers to the efforts to protect connected systems from attacks and data breaches – a threat businesses of all sizes must take very seriously as they capture greater volumes of data.

WHAT DOES IT LOOK LIKE IN MATERIALS HANDLING AND LOGISTICS?



What is the Industrial Internet of Things?

What does it look like in materials handling & logistics?

How can your operation benefit?

How much of a priority should you make the IIoT?

How can you protect your network against cybersecurity threats?

How do you get there?

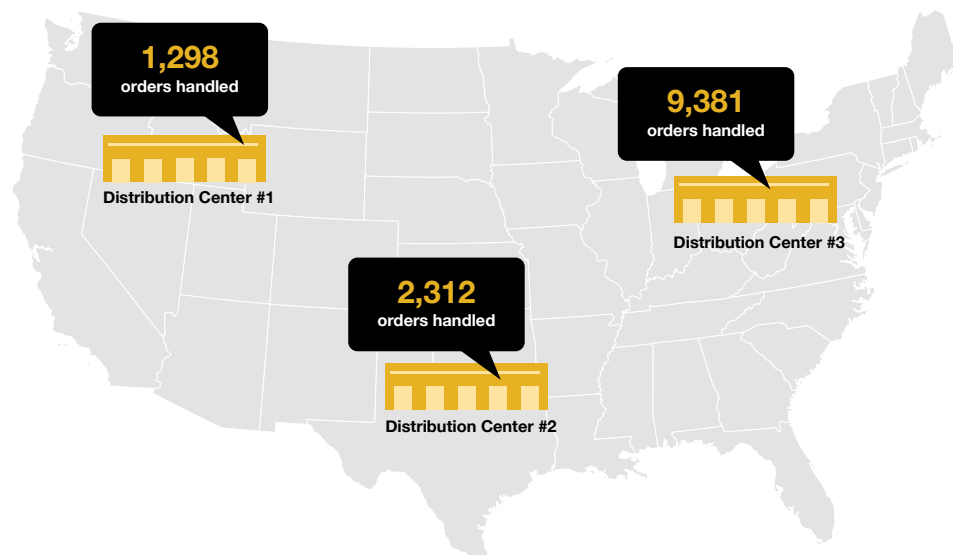
What does it look like in materials handling and logistics?



Then: The IIoT meets the supply chain

One of the first manifestations of the IIoT in logistics came in 2000 with the introduction of telematics and tracking sensors in over-the-road trucks. This provided enhanced, data-driven transparency and helped illuminate opportunities for increased productivity and efficiency in supply chain operations.

In the warehouse, early data collection applications focused primarily on analyzing basic point-to-point data, like the number of orders handled in a certain timeframe, and comparing the data across a network of distribution centers (DCs). This included basic operations like picking, put away and other common tasks.



What does it look like in materials handling and logistics?

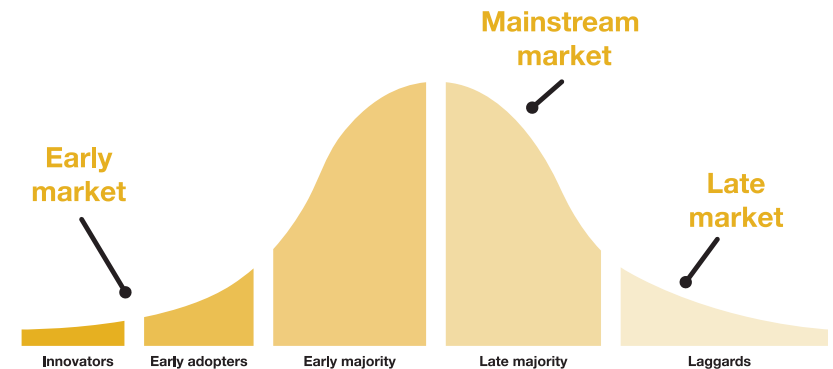


Now: The IIoT offers greater visibility in materials handling

Connectivity and cloud-based technology is experiencing more rapid adoption in materials handling operations than ever. Over 40 percent of all IIoT devices exist in business and manufacturing, and 43 percent of materials handling professionals engage in big data analysis.

Contemporary challenges, such as shipping pressures in e-commerce, government regulation in food and beverage and labor shortages across virtually all industries, lead to a need to leverage big data for greater labor productivity and overall efficiency. These data driven improvements extend to everything from lift truck fleet utilization and operator performance to energy use and maintenance.

Another effect of the proliferation of more comprehensive data is greater visibility into DCs. Since data collection has been expanded to nearly every aspect of a warehouse operation, managers can get insights that go deeper than ever before. For instance, a warehouse management system (WMS) may help a company establish how long it should take to move product from dock to rack via forklift, but big data that brings in more data sets from multiple systems can help explain why that time parameter is not always met.



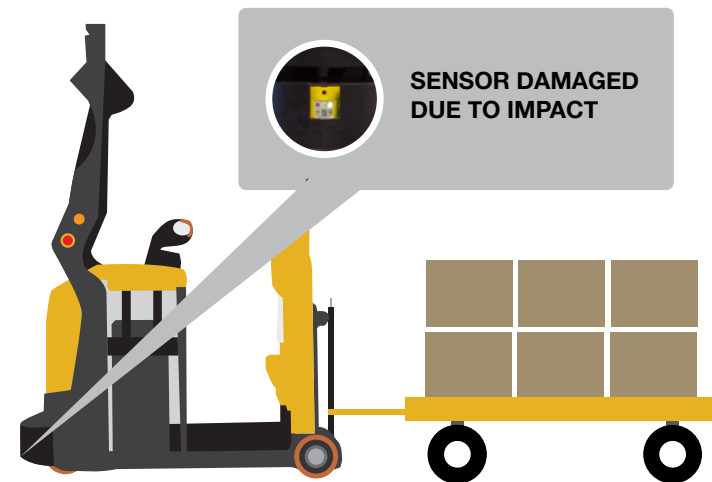
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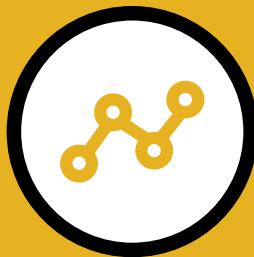
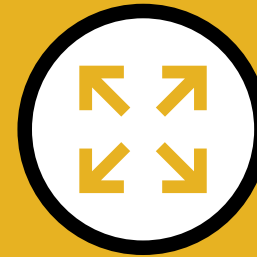
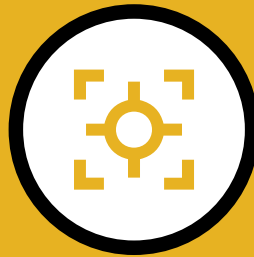
Future: The IIoT transforms materials handling

With more end-users and solutions providers recognizing the value of the IIoT, materials handling operations can move beyond reactive decisions to preventive and even predictive measures. For example, instead of using data simply to track the timeframe in which certain components will need maintenance, operations can monitor components via [vibration sensors](#) or other [telematic systems](#), and set up automated alerts in the event an anomaly, such as a low battery or a certain degree of wear, is detected.

These automated, if-then functions also make an impact with consumer devices, like wearables. A [patent application](#) describes how an Apple watch and iPhone can work together to automatically call 911 in the event a “care event,” such as a heart attack, is detected. Beyond automatic triggers, the next frontier is machine learning. Systems can not only take action based on data meeting a certain threshold, but can judge degrees of success and continuously optimize action based on tactical characteristics. For example, an autonomous vehicle may learn to adjust its route based on time of day, expected traffic conditions and other factors.



HOW CAN YOUR OPERATION BENEFIT?



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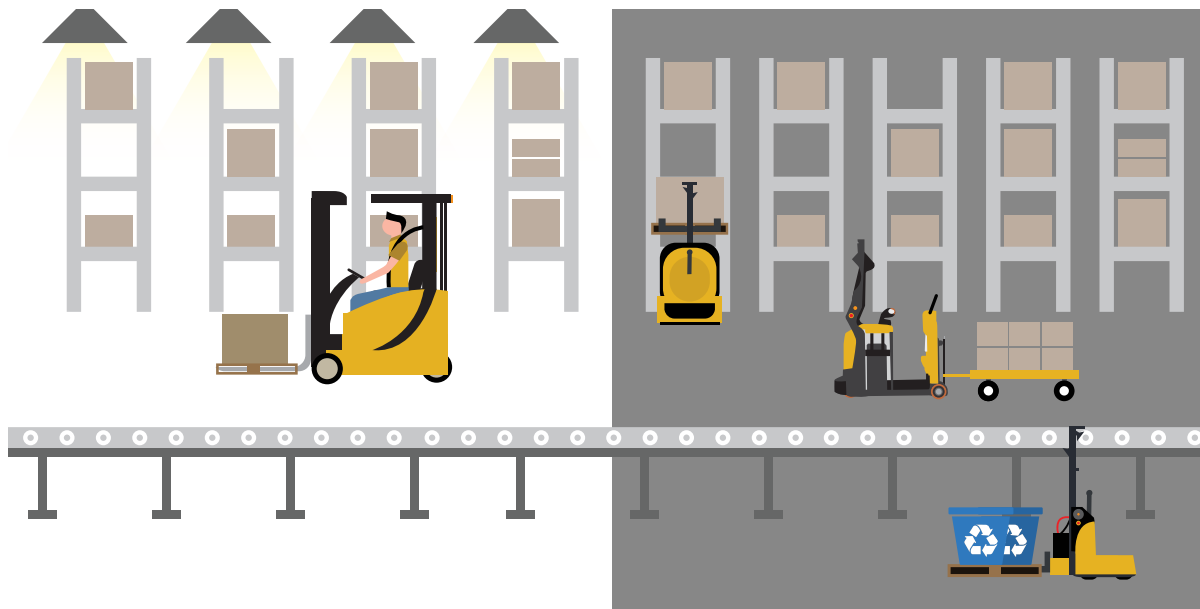
How do you get there?

How can your operation benefit?

Enter the Smart (IIoT-enabled) Warehouse

Warehouses host a multitude of processes, people and equipment, each of which holds data ready to be liberated and put to use for real benefit. This data can help:

1. Increase individual operator efficiency and overall labor productivity
2. Optimize assets
3. Maximize limited warehouse space
4. Increase the potential velocity of fast movers
5. Foster data-driven accountability
6. Increase visibility throughout the supply chain



How can your operation benefit?



Increase individual operator efficiency and overall labor productivity

In the warehouse, productivity depends in large part on how well operations utilize labor. With advanced telematics solutions, warehouse managers can monitor performance all the way down to the individual lift truck operator to help identify systemic inefficiencies.

- **Improve safety compliance and track OSHA adherence** – Telematic lift truck solutions can enhance safety regulation compliance by restricting truck access to only operators with proper certification and providing automated checklists to guide operators as they start their shift.
- **Analyze errors and injuries by equipment type and employee** – Some operators may excel with certain trucks but fumble with others, allowing management to better match the skills of the labor force with equipment, or adjust training and safety programs. Equipment choice can also influence the likelihood of chronic conditions and injuries from repetitive movements. For instance, while some operators may favor sit-down lift truck models, standup models can reduce the stress on knees from repeatedly getting on and off.
- **Plan for overtime and seasonal workers** – Break down throughput volumes by number of operators and trucks to help predict the amount of labor necessary to handle peaks.
- **Identify opportunities for automation** – Use data from utilization, GPS information, impacts and productivity reports to find opportunities to implement automated solutions, like robotic lift trucks.
- **Find the most efficient routes** – One operator may spend twice the travel time getting from point A to point B as another driver. With location and utilization data captured from the truck, warehouse managers can deduce the cause – whether an inefficient route, unscheduled break or other cause.

How can your operation benefit?



Optimize assets

Lift trucks can be equipped with telemetry systems and RFID readers to gather data on both the truck and auxiliary components for transmission to a centralized repository. This technology enables greater visibility into the lift truck fleet operation, allowing discovery—and correction—of various fleet utilization inefficiencies.

- **Measure fleet size, configuration and usage** – Monitor truck utilization and battery usage for leaner, more efficiently structured fleets.
- **Reduce maintenance and overhead costs** – Configure fault codes to automatically trigger maintenance functions or service calls without requiring any action from facility management or maintenance personnel.
- **Reduce truck abuse** – Monitor impact history, including identification of common impact locations.
- **Reduce risk of downtime** – Proactively alert technicians to service requests, which can keep minor issues from turning into big problems.

How can your operation benefit?



Maximize use of limited warehouse space

SKU proliferation pressures operations to store a wider range of ever-changing inventory. As such, intelligently structuring storage systems and pick aisles to facilitate efficient inventory movement is critically important. This requires collecting and analyzing order profiles and expected demand to optimize space and labor utilization.

Together with urbanization, SKU proliferation drives warehouse operations to build up rather than out. Understanding current space and growth trajectories can help inform equipment purchases – like narrow or very narrow aisle lift truck models.

But today's world changes faster than ever. Fidget spinners surged to popularity in a matter of months, [accounting for 17 percent of daily online toy sales in late May 2017](#). Real-time data from point-of-sale systems provides the data-driven backbone to inform storage and fulfillment strategies, and the up-to-the-minute visibility to adapt to newly popular items and rapidly rising demand.



How can your operation benefit?



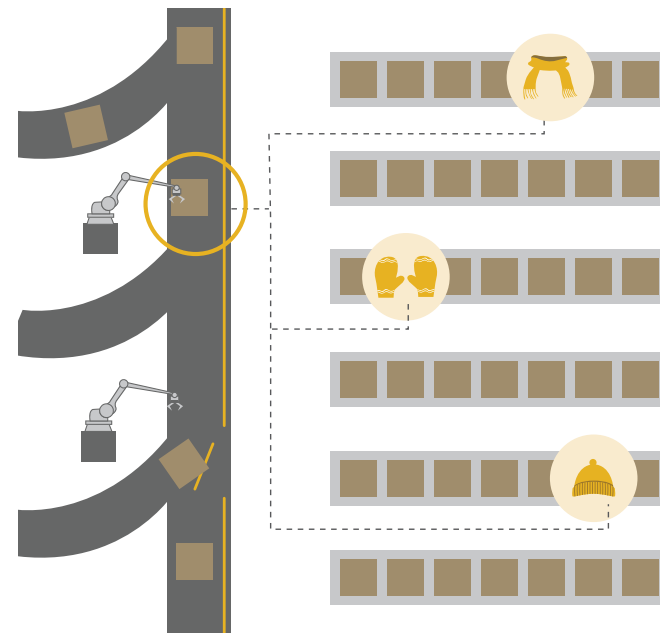
Increase the potential velocity of fast movers

The proliferation of connected devices has transformed DCs from opaque boxes with insufficient visibility of inventory to a transparent hub that offers detailed updates of order status.

RFID technology can track pallets and individual cases through each step of the supply chain, from sourcing raw materials and production sites, to distribution center, retail outlets via direct-store delivery and ultimately, the consumer's doorstep. This traceability is vital in sourcing foodborne illnesses, locating manufacturing defects and identifying component failure.

For operations feeling competitive pressure to provide speedy delivery of virtually any product, this enhanced visibility and more efficient operation is critical to handling contemporary challenges. Take an order that includes a pair of gloves, a scarf and a hat. [Shipping rates](#) incentivize retailers to pack and ship these items together. However, that pressures e-commerce fulfillment operations to find the most efficient way to bring together multiple items from different locations of the warehouse for shipment.

A lot of the big data that companies accumulate now addresses these challenges, helping companies determine how to optimally position goods that are often sold together. This enables easy order consolidation and avoids a lengthy reunion across thousands of feet of warehouse space.



How can your operation benefit?



Foster data-driven accountability

Corporate responsibility reporting has become more widespread in recent years, and for good reason. Companies can use real-time data and analytics tools to track actions affecting people, the planet and profits with greater accuracy.

- **Promote safe behavior** – Telematics solutions offer self-management capabilities through speed and impact information to further incentivize safe operator behavior.
- **Reduce carbon footprint** – Operational needs and optimal shipping schedules can be analyzed to reduce excess transportation costs and emissions.
- **Lead the pack** – Companies can now compare industry benchmarks on supply chain transparency, environmental impact, human rights and other corporate governance initiatives.

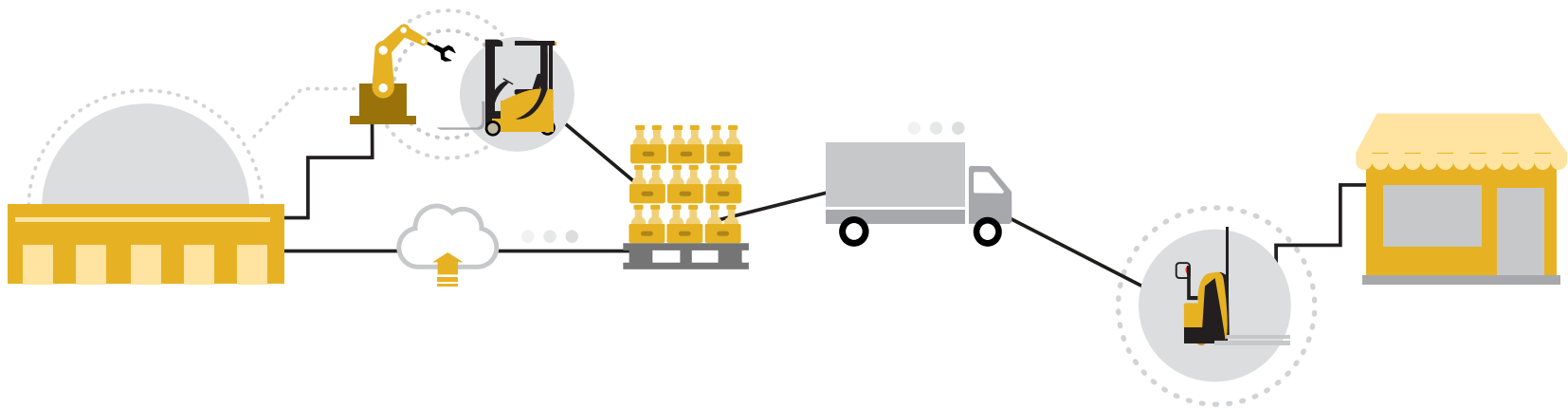


How can your operation benefit?



Increase visibility throughout the supply chain

One of the most important benefits of the IIoT and connected devices is visibility. In addition to optimizing equipment, processes and labor within a warehouse, its use extends beyond the four walls, creating intersectional opportunities to increase labor productivity throughout the supply chain. Thanks to big data, linear supply chains are evolving into complex, dynamic and connected networks, based on the exchange of information that drives increasingly efficient, more transparent manufacturing, distribution and direct store delivery.



HOW MUCH OF A PRIORITY SHOULD YOU MAKE THE IIOT? AND HOW QUICKLY WILL IT PAY OFF?



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How much of a priority should you make the IIoT? And how quickly will it pay off?

Today's warehouse and supply chain managers do not have excess time on their hands – in fact, it's quite the opposite.

According to the [General Electric Industrial Internet Insights 2015 report](#), 80 to 90 percent of respondents indicated that big data analytics is either the top priority or in the top three, but only 43 percent claimed they currently engage in big data analysis. Now is the time to take steps towards implementing analytic solutions to protect and grow market share.

While the pain of change is usually felt most deeply at startup, the long-term benefit of such investment is clear. Adding big data analysis can transition organizations from reactive into predictive and automated enterprises. Operating a smart DC on the cutting edge of big data and the IIoT also helps attract more qualified talent — a vital benefit in an industry that struggles to find and retain labor.



HOW CAN YOU PROTECT YOUR NETWORK AGAINST CYBERSECURITY THREATS?



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Understand the importance of cybersecurity

A Gartner study indicates that more than half of major new business systems will incorporate some element of the IoT by 2020. As generating and sharing digital information between organizations and suppliers becomes increasingly prevalent, keeping this data secure must be a top priority. After all, greater integration and connectivity points can mean a greater risk of vulnerability. Just one attack containing a singular piece of malware is all it takes to wreak havoc, hindering production and damaging a company's reputation as a secure business partner.

In 2013 and 2014, malicious cyberattacks struck large retailers across several industries, from office supplies and grocery to home improvement and general merchandise. By targeting point-of-sale systems, these data breaches exposed the personal and financial information of hundreds of millions of customers. The damage was significant, with retailers on the hook for significant financial damages to both consumers and banking institutions, and suffering heavy blows to their reputations in the eyes of consumers.



In 2018, cybersecurity spending is predicted to soar to **\$101 billion. And by 2020, spending is expected to reach **\$170 billion**.**

How can you protect your network against cybersecurity threats?

Know the risks: Collaborate with vendors and avoid weak links

Cybersecurity cannot be viewed as a solely internal venture, but rather a collaborative effort throughout the entire supply chain. Every entity a company does business with can pose a threat, as data loss and compromises via third parties are a growing problem.

Companies are only as secure as their weakest partner's cybersecurity protocols. Building a secure foundation requires extensive vetting and security statements from potential partners in every RFP and contract. After all, the high-profile data breaches could not have been prevented by in-house security measures alone. In one case, hackers gained entry to point-of-sale systems via stolen credentials from a third-party HVAC vendor.

In the warehouse, the WMS is a prime objective for cybercriminals. A vulnerability here risks bringing throughput to a halt and exposing sensitive information. Like all other business systems, warehouse software should be behind a secure firewall.



59% of companies do NOT have a process for assessing cybersecurity capabilities of third-party providers with whom they share data or networks.

How can you protect your network against cybersecurity threats?

Be proactive and secure against data loss and compromise

As cyberattacks become more common, the cybercriminals who perpetrate them become more brazen, skilled and relentless. Staving off such advanced, persistent threats leaves no room for complacency. Mounting an effective defense takes proactive, robust security protocols supplemented by ongoing vulnerability scans.

The following principles can lay the foundation for a reliable cybersecurity effort:



Educate everyone at every level – Many data breaches are the result of overlooking compliance rules. Start by training employees at every level to value the importance of cybersecurity.



Maintain communication across the supply chain – Remember, while an attack is generally only successful at the weakest link, it can interfere with the entire supply chain. Support consistency and avoid business disruption and uncertainty with regular communication among suppliers and customers.



Thoroughly vet vendor security capabilities – Institute a vendor vetting process before approving any new partner. This practice should also include annual reviews on compliance with security standards.

HOW DO YOU GET THERE?



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Investment in IT infrastructure can be daunting, so start small, track ROI and scale towards greater capability.

Identify potential holes and threats to operational efficiency, and then sort initiatives by priority. For example, if an operation's biggest concern is safety, they can track common accident locations. Or, if intense seasonal peaks are the norm, track labor productivity and utilization to plan for overtime workers.

Start with simple steps:

- **Equip forklifts with data-collecting sensors** – Take advantage of basic telemetry functions – fault codes, usage monitoring, GPS, etc. – and set up automated workflows to get the right information in front of the right people. This enables automation of fleet management, route adjustment and maintenance decisions. According to [SupplyChain24/7](#), putting a vehicle management system on a lift truck delivers a 5 percent increase in productivity by identifying inefficient operator behaviors.
- **Add sensors to key operational assets** – Sensors and detectors can be placed in various locations on conveyors, sorters and other mechanical equipment to capture a wide range of operational data. Smart systems can help collect and disseminate crucial information about warehouse operations and productivity, without overwhelming operations with data they cannot put to productive use.
- **Make adjustments to the WMS** – Data tracking and analysis can be used for simpler inventory validation to decrease errors and improve more complex decisions like determining ideal bin locations. Another important application of big data in the warehouse is a meaningful view across the enterprise. The more data the WMS captures, the more information available to drive more informed decisions and react quickly to solve problems.

As operations collect more types of data in more locations, they can combine different data sets and specific experiences to overall supply chain management. Choose the right partner with the right technology, knowledge and experience to address the challenges in deploying and managing a solution of such scale.



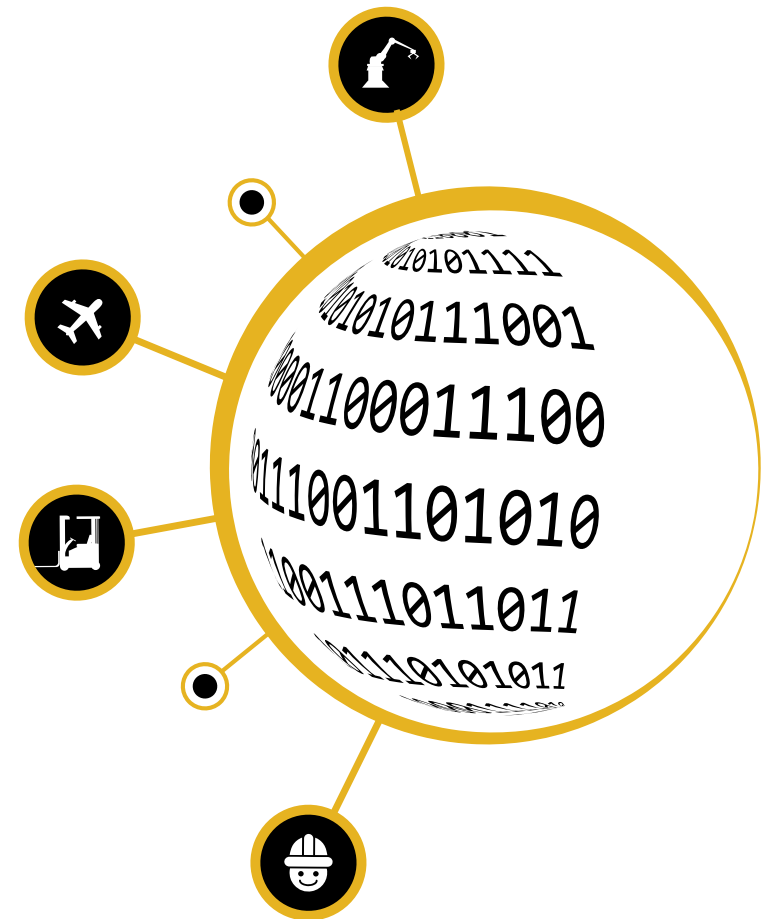
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Prepare for Industry 4.0

Industry 4.0 represents the ultimate end game of big data, connected devices and similar technologies. While Industry 3.0 focused on the automation of single machines and processes, Industry 4.0 focuses on the digitization of all physical assets in a warehouse, with robotics connected remotely to computers equipped with machine learning algorithms that can learn and control equipment with very little input from human operators.

Many of the applications of Industry 4.0 are still not yet widely adopted in today's warehouses, but that changes every day, with different industries implementing big data applications at varying speeds.

Whether used to plan labor, optimize lift truck fleet usage and maintenance, enhance safety or create ideal inventory flow, big data in materials handling can lead the way to tremendous competitive advantages. Furthermore, the early adopters of digital DCs of Industry 4.0 can help set or influence technical standards as adoption grows and these technologies become ubiquitous.





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