

The Internet of Things and the Modern Supply Chain



C3 Solutions

WHITE
PAPER

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In Brief

The Internet of Things is a term you've likely heard quite a bit in the past year or so. It's frequently mentioned in the same breath as supply chain, with the common observation that it will significantly impact supply chain operations.

This whitepaper will clarify what is meant by the Internet of Things (IoT) and will identify some of the ways in which it is expected to or already is transforming supply chain operations. It will also offer some suggestions on how to best leverage IoT opportunities in your business.



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Internet of Things: What is it?

The term was coined in 2009 by Kevin Ashton, RFID pioneer (radio frequency identification) and co-founder of the Auto-ID Center at the Massachusetts Institute of Technology (MIT), which created a global standard system for RFID. The simplest definition is the Internet of Things (IoT) is the network of physical objects embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data, often using the Internet. (1)

The McKinsey Global Institute defines IoT devices as those that “can monitor their environment, report their status, receive instructions, and even take action based on the information they receive.” (2)

Sensor technology has come a long way since the advent of the then-revolutionary RFID tag in the late 1990s that allowed a proximate scanner to read information embedded on a tag in order to track items and inventory. Now, items that can communicate thanks to embedded sensors and transmitters have proliferated to the point where the base of connected objects has reached into the billions, and analyst firm Gartner estimates by 2020 there will be over 26 billion connected things, worldwide.(3)

Even grander is Frost & Sullivan’s estimate that connected objects will total more than 50 billion by 2020.(4) The IoT is enabled by the widespread availability of broadband Internet, WiFi and Bluetooth connectivity. It’s also made possible by the increasing miniaturization and growing functionality of the sensors and transmitters needed to enable this communication.



What IoT means for supply chain operations?

What this means is a massive amount of data, coupled with new communications options, is becoming available. And, because it's new, many of the possibilities for exploiting the data probably haven't even been dreamed up yet.

"The IoT allows for virtually endless opportunities and connections to take place, many of which we can't even think of or fully understand the impact of today."

said futurist Jacob Morgan in a recent Forbes column. (5)

This nascent development means there will be a steady stream of new applications and services on offer as technology providers dream up more and more uses for the information that the global network of things can provide.

Already we have GPS that allows for real-time tracking of cars, trucks, stuff—and people—through our mobile phones. Sensors on sensitive infrastructure items like bridges report structural information. Vision systems can identify sub-standard products in manufacturing environments so they can be removed from the line. Tags embedded in products or shipping containers can record and report data about the condition of the cargo and events such as temperature fluctuations or excessive G-forces throughout the supply chain.

In-transit visibility, brought to you by the IoT

One area that will play a prominent role in the future supply chain, as it's impacted by IoT, is in-transit visibility. Analyst firm Berg Insight anticipates there will be a strong focus on cargo transport security and increased supply chain visibility in the coming years. Tracking of trailers and intermodal containers is increasingly common and technology advancements allow for even smaller logistics units such as individual pallets or cargo boxes to be tracked at reasonable costs.

The number of active tracking devices deployed in cargo loading units including trailers, intermodal containers, air cargo containers, cargo boxes and pallets reached 1.8 million worldwide in 2014. This number is expected to reach 5.8 million by 2019.

The maritime shipping industry has started to embrace real-time container tracking on a large scale.

"The foremost example to date is Maersk Line that recently announced a major implementation," said Johan Svanberg a senior analyst with Berg Insight. After several years of pilot projects, 290,000 of Maersk Line's refrigerated intermodal containers are now connected.

Logistics and transportation companies are now accelerating their IoT efforts to improve productivity and customer service levels by taking advantage of the increasing amount of data generated by cargo tracking solutions.

As well, effective cargo tracking will aid companies in ensuring compliance with the increasing chain of custody regulations being implemented worldwide. Especially for sensitive cargo like livestock or perishables, being able to collect and use data about conditions during transit will pay dividends when reports are required for regulatory bodies. (6)

Supply chain applications

The potential for IoT supply chain applications is huge. Objects that can communicate immediately open the possibility of knowing where they are at all times.

That can lead to effective real-time shipment tracking. It also means you can easily know how many of them there are in any given location—and now you have inventory visibility.

The tracking ability dovetails into asset management and better fleet management. It means you can avoid empty miles, determine more efficient routings for trucks, and organize schedules for pick-ups and deliveries very precisely.

The IoT will also contribute to better control over mobile assets, like forklifts or yard trucks, by having the ability to know where they are, but also to know how they are being used.

Downtime and ineffective time usage will be evident, and damage caused by operators can be more closely monitored.

Data analytics is a burgeoning field being made possible by advances in data acquisition, including the IoT. There is huge potential for useable demand information as items that have reached the end consumer will continue to provide data about how they are used, and when they reach the end of their lifespan. As observed by Kevin Ashton in 1999 on the potential of physical things communicating with the Internet: “If we had computers that knew everything there was to know about things—using data they gathered without any help from us—we would be able to track and count everything, and greatly reduce waste, loss and cost. We would know when things needed replacing, repairing or recalling, and whether they were fresh or past their best.” (7)

In the big picture, all these smaller benefits can be brought together to create process efficiencies through the sophistication that “smarter, highly integrated networks” can drive.

If all the discrete processes that used to take place in silos can be observed and managed through the analysis of the data provided, the holy grail—true supply chain optimization—may be within reach.

Pitfalls

Since the Internet of Things is still in its infancy, there are a lot of questions that will need to be answered when you're making a pitch to senior management to explain why your company will benefit from the outlay on new technology.

Security will continue to be a big concern. With IoT "growing at a dangerously fast pace," security needs to keep ahead of the technology. (8)

Two areas stand out in this realm.

First, with so many items talking to each other all the time, there is massive potential for loss of privacy. The ability to track not just people's movements, but also the fortunes of corporations based on the volumes they are shipping, or even exactly what they are shipping, must be considered a risk.

Secondly, with so many potential portals into the networks that are relied on for corporate data management, there is the chance that someone hacking your smart toaster, for example, might be able to get from there into your main operating systems.

The importance of addressing these and other security concerns is underlined by software provider WindRiver in a recent whitepaper:

"As we become increasingly reliant on intelligent, interconnected devices in every aspect of our lives, how do we protect potentially billions of them from intrusions and interference that could compromise personal privacy or threaten public safety?" (9)

It will be critical as IoT applications are developed and perfected that concerns about security are properly addressed. But according to WindRiver, "there seems to be a general expectation that some entirely new, revolutionary security solution will emerge that is uniquely tailored to IoT—that we can somehow compress 25 years of security evolution into the tight time frame in which next-generation devices will be delivered to market."

So, for companies seeking opportunities to adopt IoT applications caution is definitely recommended.

"There is no 'silver bullet' that can effectively mitigate every possible cyberthreat," WindRiver said.

There is good news, however, in that protocols that have been developed over the past quarter century to deal with other IT security challenges, "can be just as effective for IoT—provided we can adapt them to the unique constraints of the embedded devices that will increasingly comprise networks of the future." (10)

We're not there yet, but there is a groundswell of interest in the subject, witnessed by the development of new organizations like the Internet of Things Security Foundation, a non-profit grouping of leading tech companies that will vet internet-connected device for security vulnerabilities and offer security assistance to providers, system users and end customers.

The second concern, as with any new technology is the risk that it will ultimately fail, or be rapidly superseded by the next great idea.

With the Internet of Things, this danger is compounded, particularly at present, by the fact that the whole thing is relatively new and undergoing rapid development.

The Materials Handling Institute (MHI) in its report "The US Roadmap for Material Handling & Logistics", noted that the IoT is "in the early stages of development and probably won't be mature even in 2025." (11)

That means that even with the billions of items around the globe that the analysts predict will be communicating with each other and with us, we may still not really have a strong idea how to harness the opportunities that this information presents.

For companies in the supply chain sector, the constant pressure to control costs and streamline operations is unlikely to abate. Current trends towards even stronger demand for e-commerce and the accompanying need for faster, more accurate business-to-business and business to consumer deliveries will no doubt encourage innovative, early adopter-type firms to take the plunge with new technology.

But as the history of recent technological development shows us, it's that the greatest innovation ever—the one that's sure to be the world-beater—can just as quickly be rendered obsolete. Just look at a few of the well-known examples from history's dustbin: Format wars, from audio, to video to gaming consoles and more recently smartphone operating systems. Just about every one of us can painfully recall having committed to a technology that was swiftly made obsolete by relentless competition. It's one thing to lose a few hundred dollars on a gaming console, but when it comes to selecting a technology that your company will rely on for its supply chain success, you don't want to be the guy or gal who just bet the entire capital or IT services budget on the one that fails. A wait-and-see, cautious approach, looking for the proven technology is likely to pay off with IoT applications.



How to ensure you benefit

The IoT is going to be a moving target for the next five to ten years. That's the accepted wisdom from just about every analyst.

Although the concept has been around since 1999, it's still a very raw, immature and rapidly changing set of technologies and ideas. We really have no idea just how much of a revolution it might be.

What is certain is that the IoT will “create a torrent of raw data that must be converted into useful information.” (12)

In other words, it's not just “Big Data” it's GARGANTUAN data. It will be incumbent on the organization—but really the supply chain manager, working with IT—to figure out how to track, store, analyze and use it.

Chances are the next tech boom will be companies trying to cash in on the IoT by developing apps in a variety of areas to enable the tracking, storage, analysis and application of the available information. The trick will be to figure out what works, what's useful and what you actually need to drive efficiencies into your supply chain.

The MHI, in its roadmap report, established a number of benchmarks that will help in gauging whether the IoT has reached a sufficient level of maturity to be useful on an enterprise level in the supply chain. (13)

These include:

- ✓ Standards need to be in place for the format of data emanating from sensors. Without standards it will not be possible to automate simple supply chain decisions.
- ✓ In order to achieve that automation, software will be needed to “execute automated, event-driven decision making based on input from a variety of sensor systems.” (14)
- ✓ Data from the sensors will also need to be exchanged via standard protocols; this will ensure that all businesses will be able to have access without having to purchase ‘translation’ software.
- ✓ Data need to be shared universally, perhaps after being anonymized to protect competitive advantage.
- ✓ Data will need to be available in real time via Cloud-based or mobile-to-mobile applications.
- ✓ As noted above, security is crucial. The MHI says: “robust systems should exist to ensure the security of sensors and their related supply chain data systems.”

Another way to benefit as much as possible is to ensure you can leverage the technology assets you already have. Right now that means assessing what tech you have that's ready for the IoT onslaught.

One place to start is with the increasingly powerful and ubiquitous smartphone. This 'gadget' is changing the playing field for supply chain management. The combination of so much computing power in the palm of your hand, plus the data available through the IoT will revolutionize how we operate. Already there are many applications available that incorporate IoT functionality (see below).

Mobile Devices in the IoT supply chain

Current smartphones have up to 10 sensors embedded in them. They are able to capture location, light, temperature, pattern recognition, acceleration, voice, video and more. This capacity to capture what's going on around them makes them huge sources of data.

Add to that the ability to transmit the data and actuate remote functions through Bluetooth and near Field Communication (NFC), and the average smartphone is a truly powerful tool.

In fact, an Apple iPhone 5 has 2.7 times the processing power of the 1985 Cray-2 supercomputer, the gold standard of the time. (15) While vehicle-tracking systems have been an essential part of the logistics industry for the last few decades, they have been limited to specific set of applications used on owned fleets. Smartphones now provide a new generation of low cost apps that can be used by all participants in the supply chain – be they 3rd party truck drivers or any other field worker involved with the transportation of goods.

What kinds of apps have been found to work?

-  Phones can scan barcodes, which is useful for picking, packing and putaway operations in the warehouse or DC.
-  Dockworkers can use the camera in smartphones or tablets to capture load discrepancies and communicate this to all relevant parties in real time.
-  3rd party truck drivers arriving at distribution center yards can use the same type of applications that are commonly used by airlines to expedite passenger check-in.
-  Yard Management Apps exist that allow distribution centers that "live-unload" trailers to provide constant feedback and directions to truck drivers on where and when to bring their trailers to the warehouse.
-  Apps are also available for shippers to hire carriers, set pick-up appointments and update shipment status.
-  Asset management is another area where the phone can function as a tracking device, monitoring signals from objects nearby or far away.

Also crucial to ensuring a successful IoT application adoption is knowing what you should spend. Because it's all so new, there are few benchmarks available, and projects are still very much in one-off territory.

Gartner points out that initiatives vary by sector, with retail, healthcare, education and consumer services are frequently based on standardized things embedded in consumer goods. But for industrial and enterprise initiatives in the transportation sector, just to mention one, use less-commoditized technology. (17)

Up to 2018, Gartner predicts "there will be no dominant IoT ecosystem platform. IT leaders will still need to compose IoT solutions from multiple providers. This challenge is acute, because IoT solutions are not clearly understood and are relatively immature. IoT standards either don't exist or are still immature, and vendors are taking advantage of this 'Wild West' moment in IoT adoption to advance their own agendas and points of view." (18)

Practically, this means budgeting one of these projects is a moving target. But Gartner does break it down into a number of cost categories that will need to be accounted for:

- ✓ **Endpoints.** “IoT endpoints are a combination of things (real-world objects) and some form of hardware and/or software that detects or causes a change in the states of those things.” Depending on the implantation there can be a few or millions of endpoints required, and they vary hugely in complexity and lifecycle. Industrial and enterprise endpoints are often custom-built and therefore carry a higher cost.
- ✓ **Supporting Infrastructure.** This includes back-end systems, hosting platforms servers, storage, database management and backups.
- ✓ **Software.** Standard packaged software and custom applications.
- ✓ **Security.** As noted above this is a complex area, and requires careful attention.
- ✓ **Design**
- ✓ **Implementation.** Endpoint deployment and installation can involve intensive logistics efforts and consequently high costs.
- ✓ **Operating expenditures,** including day-to-day management, hardware and software services, administration.
- ✓ **Communications services**
- ✓ **Downtime**

It’s clear there’s a lot of work involved before you can reap the benefits of an IoT project. But it’s clear that the potential for supply chain efficiencies is enormous.

“It’s important to put IoT maturity into perspective because of the fast pace at which it is emerging, so supply chain strategists need to be looking at its potential now.”

said Michael Burkett, managing vice president at Gartner. “Some IoT devices are more mature, such as commercial telematics now used in trucking fleets to improve logistics efficiency. Some, such as smart fabrics that use sensors within clothing and industrial fabrics to monitor human health or manufacturing processes, are just emerging.” (19)

Given the great unknown that the IoT presents, supply chain managers need to keep a close eye on what will no doubt be the emergence of many new technologies that will leverage the data that’s becoming available.

Know the dangers but keep the potential benefits in mind as you watch this tech story unfold.



About C3 Solutions

C3 Solutions is an information technology company specialized in yard management (YMS) and dock scheduling (DSS) systems. Since its founding in 2000, C3 has gained the confidence of clients around the world and across many industries including retail, grocery, distribution, manufacturing and parcel post. Headquartered in Montreal (QC), Canada and privately owned, C3 is dedicated to developing, implementing and supporting the most complete yard management and appointment scheduling products on the market today.

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