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The Shape of 'Things' to Come

By Merrill Douglas   **8**

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What the Internet of Things means for the supply chain—now and in the future.

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If someone leaves Bill Tomasi's garage door open too long, the door opener sends him an e-mail. Recently, Tomasi's new car also sent him a note: Time for an oil change. One hour later, the dealership e-mailed him a coupon for exactly that service. "It could be a coincidence, but I don't think so," says Tomasi, vice president of product management at International Business Systems (IBS) (http://www.ibs.net/), a global supply chain software and management services company with U.S. headquarters in Folsom, Calif.

These days, everyday objects—cars, appliances, industrial machines—seem to be taking up almost as much Internet bandwidth as our smartphones. In Malaysia, thousands of sensors attached to machines in a Cisco Systems factory transmit data on energy consumption, as part of a

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conservation initiative, reports the Wall Street Journal. In 2013, Starbucks announced that it would connect coffeemakers to the Internet to track customer purchases, update recipes, and monitor equipment performance.

Welcome to the Internet of Things (IoT), where everything from the fitness tracker on your wrist to the refrigeration unit on your trailer sends data into the cloud, and software stands ready to transform that data into useful information.

When experts describe the promise of IoT, they're apt to mention supply chain management. In a study of IoT solution implementations that Zebra Technologies (https://www.zebra.com/us/en.html) commissioned from Forrester Consulting in 2014, approximately 45 percent of survey respondents named supply chain optimization as one of the top five benefits of IoT.

IOT NOT CLEARLY DEFINED

To appreciate what IoT means for the supply chain, first you need to understand what IoT is. The definition isn't simple.

"The Internet of Things is the ability to use a variety of different devices to collect information, trigger activities, control processes, or kick things off," explains Tomasi. "Generally, items that we would not normally think of as being connected to the Internet become connected."

You'll get a different definition from Mark Wheeler, director of supply chain solutions at Lincolnshire, Ill.-based Zebra, which sells tracking and visibility products such as bar-code scanners and printers, RFID equipment, and handheld computers. "The IoT is intelligent assets connected to the cloud, so that a digital representation of that asset is available to applications running in the cloud, and generally those apps are available to mobile users," he says.

Some definitions focus on applying high-powered analytics to data collected from devices. "IoT and big data are one and the same," says Greg Kefer, vice president, corporate marketing at supply chain technology company GT Nexus (http://www.gtnexus.com/), Oakland, Calif.

Although it's creating a great deal of buzz, some observers maintain that IoT isn't new. Companies have been attaching sensors to things, transmitting the data they collect, and extracting business intelligence from that data for many years. For example, motor carriers have put sensors and communications on truck trailers since the 1990s to monitor factors such as location, door closure, and refrigeration.

In the early days, however, that data often moved over proprietary networks for delivery to proprietary applications, where a single company put the information to use. Sharing information with trading partners meant "pushing" it out periodically—through reports, electronic data interchange, or other methods that don't work in real time. That has all changed since the world embraced the Internet.

"When you move data over the Internet to an application hosted in the cloud, you can easily share it with many users," says Tim Wills, vice president, marketing and support at Peak-Ryzex (http://www.peak-ryzex.com/), an integrator of supply chain automation and inventory management systems, in Columbia, Md.

"Software as a Service (SaaS), or the Internet, has given the supply chain ecosystem an infrastructure, allowing participants to align around the same data sets to make more informed decisions, and more real-time decisions," he adds.

"Inexpensive cloud services that store and process massive amounts of data let companies find new ways to use information collected from things," says Wade McDaniel, vice president of solutions architecture at Phoenix-based Avnet Velocity (http://www.avnet.com/en-us/Pages/default.aspx), which designs supply chain solutions for electronic components manufacturers. "That's probably the big difference between now and five years ago—how abundant cloud computing is."

DEMAND PLANNING ON STEROIDS

IoT could bring major changes to the way companies both plan and execute supply chain activities.

Karin Bursa, vice president of marketing at supply chain technology firm Logility in Atlanta, predicts that IoT will bring greater speed, power, and agility to the demand planning process. "This takes the whole idea of being demand-driven and puts it on steroids," she says.

To Bursa, perhaps the most crucial sensor feeding the supply chain's IoT is the bar-code scanner built into a retailer's point-of-sale (POS) system. By analyzing sales data captured at checkout, retailers and manufacturers can get a real-time view of demand, not only in aggregate, but at the level of individual products and stores. "I now know not only what I predicted demand would be one year ago, but also what flavor of yogurt at the Kroger on Peachtree Road in Buckhead needs to be replenished," she says.

Companies have been capturing and using POS data for years. "But not many companies have positioned themselves to have a customer-level forecast, for example," Bursa says. "Today, companies are planning a customer-specific supply chain for their top 10 or 20 customers."

INFO ON THE FLY

IoT can produce a supply chain with no data latency. "We can't wait one week for information anymore," Bursa says. "We can't wait one month, and we certainly can't wait eight weeks to figure out how a product is doing in the marketplace."

With immediate, continual feedback on market demand, a company can refine forecasts on the fly and modify its plan—perhaps shipping less product to stores where demand is soft, or launching new promotions to boost sales.

That principle of demand planning in near real time can operate earlier in the supply chain as well. Just as the bar-code scanner at the retail checkout sends valuable data into the cloud, so can scanners and RFID readers in the warehouse or other logistics facilities. With help from a cloud-based service, a company can use that data to keep trading partners informed about imminent demand.

"As orders come in, and as goods are shipped, if your suppliers know almost in real time the order velocity for that day or week, they can make better decisions on the demand that's coming through your business," says Wills. "If that inventory data were bottled up with your company and not shared, it could create a time delay." IoT allows you to expose the same set of data to multiple supply chain partners, he adds.

One company working with Avnet Velocity, SteadyServ Technologies of Carmel, Ind., is helping beer distributors and brewers plan for replenishment with data drawn not from POS systems, but from sensors attached to beer kegs.

"Restaurant owners typically send sales data to their beer suppliers every 30 days," says David Paulson, vice president, business development at Avnet Velocity. "By the time the distributors and brewers get that information, it's old and maybe inaccurate, because some of it is based on memory."

The standard method for measuring draft beer inventory in a restaurant is the shake test—literally lifting a keg and shaking it to feel how much is left.

In SteadyServ's system, an RFID reader captures data from a tag attached to each keg, identifying the brand and its packaging date. Each keg sits on a ring that includes a scale and other sensors. "The ring monitors the weight in real time, along with the temperature and everything associated with that keg," says Paulson.

It feeds the data over a wireless network to SteadyServ's system in the cloud. "The system combines that data with point-of-sale data and unstructured information about promotions and social media, and then provides those analytics to everyone in the supply chain," he says.

The restaurant owner gains a real-time picture of the inventory, the distributor gains a better understanding of what it needs to order from the brewer, and the brewer gains demand signals to help plan for future production.

REAL TIME VIEW, PLUS CONTEXT

IoT could also play a vital role in improving operational efficiency in the supply chain.

"Combining sensors with communications and a cloud-based analytics platform provides a clearer and more current picture of moving assets," says Wheeler.

"Let's say you have a refrigerated truck at a customer location, and it is waiting to be unloaded. Our transportation management department has visibility into that asset. We know where it is, the temperature inside the unit, and whether it's holding the temperature," says Wheeler.

"Other sensors might report on whether the reefer's door is open and monitor the unit's fuel level," Wheeler says. "With that information, we can drive higher utilization for those assets in the supply chain."

To developers at GT Nexus, the operational advantage of IoT springs from its ability to combine real-time status data about a load in transit with other information about that cargo. "The magic in making this viable is the notion of context," Kefer says.

The context comes from additional data held in a cloud-based platform like the one GT Nexus uses to link shippers, their trading partners, and service providers. "Consider an ocean vessel whose GPS system reports that it's 40 miles off the coast of Bermuda," Kefer says. "Not only do we know what containers are on that ship, but we know what stockkeeping units and orders are there as well."

In the past, a carrier might have told a shipper where the container was located, and the shipper's transportation management system might have known the contents, but there was no easy way to marry those two pieces of information. That all changes with IoT.

"It's all about linking related objects to one another to create a pouch of information," Kefer says. Everyone who's interested in the freight, and who has permission, can draw business intelligence from that pouch.

Another area of supply chain operations where IoT could provide significant benefits is regulatory compliance. "Existing and new regulations, such as the Food Safety Modernization Act, are largely focused on preventing food safety problems," says Wheeler. "Much of that has to do with managing temperatures." Systems employing IoT would make it easier to comply with such regulations in the food, pharmaceuticals, and other industries. For all the benefits IoT seems to offer, leaders of supply chain organizations should be careful not to leap heedlessly into an IoT project without understanding what they're doing, or why they're doing it. "It's easy to get caught up in the hype," Paulson says.

"Right now, there's a great fear of not being IoT-enabled, and being left behind," says McDaniel. But a company might already be hooked into this new trend without realizing it. For example, many production plants use sensors to monitor processes in real time, and some of those sensors might be connected to the Internet.

TAKE YOUR TIME

As some companies learn that they're already using IoT, others might discover that they haven't yet taken advantage of IoT technologies that have been sitting right under their noses.

"My first recommendation would be to ask if you have leveraged the mature technologies that fall under the broad IoT banner," says Wills. For example, some warehouses have yet to start scanning bar-code labels. "Make sure the user isn't doing something overly complicated and costly if the fundamentals aren't in place," he says.

Instead of rushing onto the IoT bandwagon, companies should first define the goals they want to achieve. "Companies aren't necessarily saying, 'I have an Internet of Things project.' They're saying, 'I'd like to keep track of where my employees are in the building in real time,' or 'I'd like to get better control of my inventory in a certain situation,'" says Wheeler. Once you define the business problem, you can examine how IoT might help to solve it.

"Put a business case around it. Figure out the goals,then make sure you're adopting technology to support them," says Tomasi.

As sensors, communications systems, and analytics solutions all become cheaper, faster, and more capable, many more things will start talking to one another via the Internet. Supply chain operations are already part of that exchange. Over the next few years, the conversation is likely to grow more intense, and even more productive.

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Sensors Power Stocking Strategies

Despite a popular prediction, the Internet of Things (IoT) hasn't yet brought us a refrigerator that automatically orders milk when the carton on the shelf nears its expiration date. But IoT has brought us vending machines that guide their own replenishment and maintenance.

San Francisco-based Cantaloupe Systems (http://www.cantaloupesys.com/) has installed telemetry units with wireless communications on some 150,000 vending machines. Interfacing with the machines' internal systems, these units track product sold and payment received, along with factors such as temperature levels and power interruptions.

Cantaloupe's Seed Cloud collects and analyzes this data to determine what products have been sold, and in what volumes, at each machine, and suggests how to optimize the replenishment plan.

Those recommendations include which machines to visit on a given day, and how many of each item to stock on the truck. "There's no risk of drivers running out of a popular item by the time they get to the last few machines on the route," says Mike Marett, senior vice president, business development at Cantaloupe. "It is all pre-determined by the system."

Depending on the customer's needs, Cantaloupe might integrate these recommendations into an enterprise resource planning or route management system, or it might present them through its own software, Marett says.

In a similar way, the system also monitors the health of individual machines, sending alerts to users when a performance indicator drifts out of the proper range, or transmitting that information to a maintenance system.

Besides helping a company determine how to stock machines and run delivery routes in the coming days, Seed Cloud can also help with longer-term inventory planning. For instance, if the company moves a machine to a new location, and that move triggers a new buying pattern for that machine, the system will detect the change and advise the company to adjust accordingly.

"If the system works perfectly, when the driver gets there to restock the machine, there will be one left of every item," Marett says. "The last thing you want is for a customer to walk up to one of those machines to purchase a product, and it's not available. The Internet of Things and machine-to-machine communication helps you manage that effectively."

IoT Gets Fresh with Reefers

Customers of Purfresh in Newark, Calif., use the Internet of Things (IoT) to keep produce, flowers, and meat fresh as those products travel to market.

Purfresh offers hardware and software solutions that rely on data collected from systems on refrigerated intermodal containers. Purfresh's Active Atmosphere systems monitor the environment inside the container, actively inject ozone gas, and have the ability to adjust carbon dioxide levels to control the ripening of fruits and vegetables.

The company's cargo monitoring software solution, *Intellipur*, uses two-way communications and an application in the cloud to monitor and control the atmosphere in the container. "We actively monitor and control our equipment. And in some cases, we connect to the refrigerated container, change some of the functionality, and run reports remotely," says Adam Valmoro, vice president of business development at Purfresh (http://www.purfresh.com/). "We also monitor, track, and trace the control panels and containers as they move through the intermodal supply chain."

Purfresh hardware is equipped with multiple sensors to collect data on temperature, humidity, carbon dioxide levels, and other factors. "Our devices also include a door breach sensor, as well as an accelerometer for cargo integrity and security monitoring," Valmoro says. "And, of course, we measure whether the reefer container power is on or off."

The system transmits the collected data via GSM wireless service or satellite to Purfresh's cloud-based *Intellipur* software platform, which makes the information available to customers.

Users view details about their cargo through a browser-based interface. The display also shows the container's location on a Google map, with tracking data obtained via GPS. Some customers monitor the cargo themselves, and some rely on Purfresh to do it for them. "We're looking at temperature and reefer performance and making sure the atmosphere is at the right setting for each individual commodity," Valmoro says. A set of parameters is pre-programmed for

each specific commodity, and if the parameters are exceeded, an operator can adjust the temperature remotely, or bring down the carbon dioxide level by opening a fresh air exchange.

Purfresh also transmits alerts and alarms when conditions exceed the set parameters, or when the containers enter or exit locations defined through geo-fencing. "For example," Valmoro says, "if a container is off power for an extended time, alerts are generated, allowing Purfresh or its clients to take corrective measures."

(http://oascentral.managingautomation.com/RealMedia/ads/click_lx.ads/www.inboundlogistics.com/cms/article/the-shape-of-things-to-come/1343485658/x75/default/empty.gif/7a422b41313156346b6d5941424f654a?x)

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