IoT in Retail: Engaging the Connected Customer

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IoT Comes to Retail

The Internet of Things (IoT) is a collection of network-connected physical objects and machines. They have embedded identifications, sensors, and software that can provide an understanding of where they are, what they’re doing, and what’s going on around them. These devices can communicate with each other and share their data via a network or a cloud-based platform. Examples we hear about most often include a power company’s “smart grid” with sensors collectively managing the flow of and demand for electricity, and an individual’s “smart home” with climate control, lighting, and security adjusted automatically and remotely.

In retail, the “things” in question run the gamut from tracking chips on inventory items to in-store infrared traffic monitors to digital signage and interactive kiosks. Store staff and customers themselves are part of the network of “things” through their smart phones and tablets.

For most applications, including in retail, what matters is not just the electronics in the objects, but the services associated with them and their networks; in other words, the software that makes them individually and collectively “smart.” The services could be as basic as reporting and visualization of the data that’s coming from these devices. It could be services to manage the devices themselves, or it could be a service where a piece of analytical software is determining what to do next and negotiating with the device. If a customer is carrying a mobile device, the service might enable communication between it and an in-store kiosk or between it and the retailer’s background information and analytics platform.

New Data, New Connections, New Opportunities

Much of the retailers’ attention has focused on the rapid growth of online shopping in recent years. They look at the flexibility and capability needed to understand customers and provide services online,
and they are keen on bringing the frictionless customer experience of online shopping into the store wherever possible. They want the store to be as smart as the website in recognizing customers and catering to their specific needs and tastes. That’s how to keep brick-and-mortar stores relevant, engaging, and competitive.

Retailers could not do that in the past because they really didn’t know what was happening between the front door and the point-of-sale (POS) system. Now with sensors in the stores and customers willing to share their identities via their smart phones, retailers can craft well-defined customer experiences inside the store. And, in the process, retailers can collect some detailed data on customers’ preferences and shopping behavior and use it to predict what products and services and promotions they’d be interested in, as well as how other customers might behave.

For example, retailers refer to the “endless aisle” online where an unlimited assortment of products can be offered. In contrast, in-store the mix is necessarily limited. But if a customer expresses interest in one article of clothing, she might be automatically informed of its availability in additional colors and styles in the store inventory and online. The customer might buy one item in the store and two more for delivery at home. The IoT application bridges between the online and in-store experiences, driving business to both. That’s just one example of the capabilities we call “connected customer.”

## What’s the Essence of IoT?

IoT enables retailers to do three fundamental things better and faster:

1. **Sensing** who customers are and what they’re doing. Smart devices generate enormous amounts of data, and the challenge is to capture and filter the most significant, to separate the signal from the noise.

2. **Understanding** customer behavior and preferences by analyzing that data, ideally in combination with data about the customer’s past behavior and purchases. Then perhaps anticipating what the customer is likely to be interested in next.

3. **Acting** smarter and faster, thus creating a more engaging experience for the customer. Should the retailer offer the customer a promotion, a discount, a suggestion, or a bit of personal attention and service?

Better sensing, understanding, and acting are, of course, not limited to customer interactions. Anytime IoT data can be rapidly captured, screened, and analyzed, the underlying business process can be automated and optimized. The goal is to have access to rich data and bring advanced analytics to bear.
**Smarter Supply Chains**

There are potent IoT applications in the supply chain, such as optimizing transportation and logistics through telematics. With the ability to understand shipping costs, retailers are experimenting with more distributed inventory and store-to-store replenishment. But IoT is also transforming warehouses and distribution centers. When items have tracking devices and pallets are automated to find them, inventory needn’t be pre-assigned to aisles and shelves. It can self-organize in more open and unstructured spaces based on the demand signals that are coming in from online and in-store. What items are most likely to move next and move together? Inventory replenishment and movement can be driven not just by sales history and plans and orders, but by more near real-time demand signals coming from customers. The flow is more continuous, as more inventory is “pulled” by the customer rather than “pushed” in her direction. At the same time, IoT provides richer data for longer-term demand models and forecasts, and even product design.

**The Smart Store**

IoT is also driving experimentation and innovation under the banner of “smart store,” and this can start outside the boundaries of the store. Mall-based retailers are interested in measuring foot traffic and patterns in order to draw customers into the store. In-store, they want to measure traffic patterns and trip times and check-out queues in order to devise ways, such as digital signage, to encourage shopping while also improving the customer experience. They can use IoT together with POS and historical sales data to optimize product placements and shelf management, and IoT can help orchestrate and get the best out of store staff.

The smart store is also the secure store, and retailers have high interest in loss prevention applications of IoT. These incorporate not just inventory tags but video and other sensors. This can combat, for example, mob-style thefts where groups come into a store and do something to distract security staff while designated individuals steal specific items. Another tactic is instrumenting high-value merchandise or the cases or shelves where it is displayed, thereby detecting when items move in-store without an associate’s assistance. Sensors can also help with loss prevention at loading docks and back-of-store, both by monitoring and automatically opening and closing doors, and by maintaining an unbroken “chain of custody” of valuable merchandise. While the goal is to detect and prevent losses in real time, loss prevention data can be saved and used forensically to analyze patterns of loss, anticipate vulnerabilities, and take preventive actions.

**The Connected Customer**

Every time someone comes through the door, it is an opportunity to convert and sell. Real time and near-real time responsiveness is now possible through advances in data streaming and analytics. IoT data can suggest where the customer is headed and how to meet her there. At the end of the day, success is driven by customer experience. Did the retailer meet the customer on the customer’s terms, deliver engaging interactions, and leave the customer feeling well served? IoT offers new ways to connect with customers through their personal technology. More fundamentally, it offers rich new data and immediate context that can be used to connect with the customer’s needs and wants.

For a connected customer, the retailer can market more directly and personalize the experience. Recognize and welcome the customer, anticipate the shopping intent, offer a customized promotion, suggest a complementary purchase – all can enhance the customer experience, all can create incentives to purchase, and all can be accomplished electronically.
or through store staff. Once we have a good understanding of the signatures of customers or shopping journeys, we can predict what the next best offer or next best action is. For example, if someone is buying a TV set, are they more likely to be interested in a warranty or an accessory? If a frequent shopper has consistently opted out of warranties both online and in-store, then the opportunity with that customer lies in offering accessories.

Near real-time customer data plus near real-time analytics lead to near real-time action and near real-time relevance which is how retailers can thrive in a technologically mediated world. If the customer is in the store for a reason, try to understand it and make sure you fulfill it. If the customer happens into the store, try to anticipate preferences and activate them. Responsiveness, relevance, and authenticity are the names of the game with the connected customer.

**Technological Challenges**

To seize the opportunities that IoT offers, retailers and their IT organizations have to be realistic about the technological challenges, their own capabilities, and where they need assistance. Much of the ground, in both data management and analytics, may be unfamiliar. We put the challenges in the following six buckets.

**Streaming Data**

IoT devices can generate enormous amounts of data, and IoT applications can involve a lot of devices. Some may transmit periodically, but many do so continuously. And, there’s wide variety in the data and the devices it comes from, so the data management infrastructure has to be versatile both in incorporating new data sources and in dealing with device and transmission failures. Most importantly, the data is streaming. It is moving fast. Most of it may be of fleeting relevance. And, it’s not organized in advance in conventional data tables. So, the technological challenge begins with determining what data to look at and capture. The analysts and data scientists need to understand the devices and more of the “native language” of the data stream itself.

**Enriching on the Fly**

Looking at a lot of fast-moving data is one challenge. Making it useful can be a bigger one. That starts with intelligent filtering to eliminate the “noise” and find the relevant subset of data. Then data from multiple sources may need to be integrated or enriched, for example, when it’s possible and appropriate to identify an individual customer and fold in purchase history. The data may need to be formatted or otherwise transformed for analytics, reporting, or communication to other devices. If the data and analytics are being used to shape interactions with connected customers online or in-store, then that entire process must happen in near real-time.

**Advanced Analytics**

Retail IoT analytics will be near real-time when an organization automates decisions and actions regarding inventory, store operations, or customer interactions. It will also be retrospective, recognizing patterns of activity that can then be used to improve customer intelligence and predictive models. The analytics will be largely rules-based when dealing with common situations, predictive when generating next-best actions, and discovery-based when detecting anomalies. Add it all up, and analytics staff and methods must be versatile, and include the ability to work with big data.

**Mobile Interface**

The connected customer won’t stay connected unless the interface is up to expectations, and those expectations are high. If a business is really going to
interact with a customer on a mobile device with a small screen, then it has to spend the customer’s time and attention effectively and engagingly. Customers have instant disdain for apps that are hard to use or waste their time. Poor presentation kills the sale, and the last thing a business wants to do is personalize the customer experience ineptly.

Data Storage

With so much IoT data available, there is a practical consideration in how much to store and for how long. It may be possible to store everything for a long time, but that incurs cost and maintenance effort. If we’re talking data about specific customers, there are privacy considerations, including how the data is anonymized or secured. For purposes of retrospective analytics, the question of how much to archive should be driven by the question of what the retailer is trying to learn. Finally, there’s the decision about where to store data, at least initially. To run analytical models on large data sets fast enough to engage and influence the connected customer, it likely warrants an in-memory analytics architecture.

Security

More data in play means more data to protect. More devices in play means more potentially vulnerable network entry and connection points. An IoT application has a larger “surface area” than most applications, and thus greater potential for intrusion. Ground rule #1 is to design and build in security up front before letting devices collect and transmit data. Ground rule #2, especially when the application includes a variety of devices from different vendors, is to know and compensate for their vulnerabilities. And ground rule #3 is to monitor and analyze the IoT network traffic continuously. The network that enables “things” to talk can also reveal their anomalous communications behavior. We can count on the fact that security challenges will not go away, and that the amount of data to deal with will continue to rapidly grow. The smart move for retailers may be to choose a leaner and more focused data diet.

Organizational Challenges

We’ve already alluded to new skills and tools that may be needed in streaming data, machine-to-machine communication, big data, and advanced analytics. IoT initiatives call for talent with strong data science skills, including in the “engineering” side of the role. The data scientists must understand the data that’s coming from the variety of devices and design an architecture to sense and collect the data and decide where it should be stored. They also determine how to condense data into other forms for store reporting, analytics, or delivery to customers’ mobile devices.

Another essential role is the network engineer who can configure and secure an evolving variety of IoT devices and their connections to storage and analytics platforms. New devices may be introduced at any time, including experimentally to prove their worth, or temporarily in conjunction with a promotion. A major fashion line might want to bring their devices into their section of the store and bring their brand experience into play for customers.

The broadest organizational issue to address may be “Who owns IoT?” Responsibility is often distributed. However, Marketing owns the customer experience, and other IoT applications in supply chain and store operations ultimately affect that experience. So, Marketing is usually the best candidate to own IoT data across the enterprise. IT has major roles to play providing expertise, infrastructure, and technological coordination. A retailer just getting started with IoT need not worry about the ownership question. Instead, just assemble a cross-functional team and start to explore what IoT means to your business and the customer experience.
Avoiding Technological Missteps

As retailers expand their IoT capabilities, there are some common pitfalls to avoid.

- Don’t become too enamored with today’s technology and get locked in. We can guarantee that device technology in particular will change — getting better, cheaper, easier to use. So maintain the technical architecture and skills to cut over to new technology as it emerges and proves valuable.

- Especially for connected customer applications, don’t let technology be in the lead and limit your thinking. Always storyboard the customer experience you want to deliver, and bring it to life as completely as possible with the technology available (always keeping in mind how high the bar is). Then make it more vibrant over time.

- Don’t try to have technology do it all. Store staff and technology must complement each other in delivering the best customer experience, and that people-technology mix will need adjusting over time. Staff should be field-testing the IoT technology and then be ready to introduce it to customers when it’s ready for primetime.

Seizing the Advantage

To take full advantage of IoT, retailers have to connect the dots. The three main application areas we’ve discussed — supply chain, smart store, and connected customer — must work together to engage and delight the customer. Your business may be stronger in one area than others, but address all three, as well as their interplay.

To differentiate through IoT, focus on the analytics. Data management poses new challenges, but ultimately devices and data — and even their platforms — are commodities. Advantage goes to the retailer who does the most with the data — leveraging advanced analytics to optimize today’s activities, anticipating tomorrow’s customer needs and preferences, gaining deeper insight into the connected customer, and giving the customer extra incentive to shop and to stay connected.

Additional Information

To learn more about this topic, please visit:

- Making Sense of Streaming Data in the Internet of Things (article)
- We’re All Connected: Analytics and the Internet of Things (video)
- The Internet of Things: Opportunities and Applications Across Industries (whitepaper)
About the Authors

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Currently, Dan is the Advisory Industry Consultant for SAS’s Global Retail Industry team that conducts advanced retail analytic research, provides sales support and market development support worldwide. The Retail Solutions team provides both business and technical knowledge with analytic expertise, enabling retailers to address new & challenging business problems. He is now directly involved in High Performance / Big Data Analytics, In-Memory recommendation & personalization engines, Customer Intelligence, Geo-Location, Text Analytics and Social Media Analytics projects in a sales support and marketing role.

During the last couple of years, he has been directly involved in incubating retail offerings to add breath to the SAS solution portfolio in various capacities including requirements analysis, design, prototyping, project management and customer implementation.

Some of those offerings are: Demand Forecasting for Retail, which provides merchandise planning forecast with robust automation and integration. Intelligent Clustering for Retail automatically creates store groupings and insight based on consumer demand to tailor specific product assortments. Loss Prevention for point-of-sale to allow retailers to find on erroneous tractions or fraud by cashiers. Assortment & Space optimizations to help both merchandisers and retail operations get the maximum spatial productivity for specific stores.

Prior to his current role Dan has served many application product management and development roles for approximately 20+ years designing, architecting, developing, benchmarking and marketing retail customer analytics, merchandise planning, pricing and space optimization applications with SAS.

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Robert Morison serves as Lead Faculty for IIA’s Enterprise Research Subscription. An accomplished business researcher, writer, discussion leader, and management consultant, he has been leading breakthrough research at the intersection of business, technology, and human asset management for more than 20 years. He is co-author of Analytics At Work: Smarter Decisions, Better Results (Harvard Business Press, 2010), Workforce Crisis: How to Beat the Coming Shortage of Skills And Talent (Harvard Business Press, 2006), and three Harvard Business Review articles, one of which received a McKinsey Award as best article of 2004. He holds an A.B. from Dartmouth College and an M.A. from Boston University.