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May/June 2014

- **PERSPECTIVE**
  How To Develop An Internet Of Things Strategy PAGE 10
- **TUNED IN**
  A Monumental Shift At LIVE! 2014 PAGE 48
- **SUPPLY CHAIN LINKS**
  RFID Takes The Guesswork Out Of Shipping And Receiving PAGE 51

2014 RFID JOURNAL AWARDS

Honoring the Best in RFID

Bechtel PAGE 16

Marks & Spencer PAGE 22

Hy-Vee PAGE 26

Skyview High School PAGE 30

Fiscal Information Agency, Taiwan PAGE 34

Post Foods PAGE 38

NXP Semiconductors PAGE 42

Joseph Andraski PAGE 45

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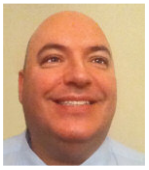

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Contents © 2014 RFID Journal LLC

16 RFID Helps Bechtel Manage a Megaproject
The engineering and construction giant is tracking materials from mainland storage areas to three sites on a remote island, to ensure the correct materials arrive at the right place on time. *By John Edwards*

22 Marks & Spencer Embraces Change
Based on the benefits achieved from RFID-tracking all apparel—and recognizing the importance of omnichannel shopping—the U.K. retailer plans to tag all general merchandise in stores. *By Samuel Greengard*

26 Hy-Vee Supermarkets Track Perishables to Ensure Freshness
Suppliers include RFID temperature tags in shipments to the retailer's distribution centers, and the DCs reuse the tags to monitor goods en route to the stores. *By Jennifer Zaino*

30 RFID Protects Students and Teachers
Skyview High School deployed a safety solution that can summon help in a disciplinary, medical or violent emergency. *By Minda Zetlin*

34 Electronic Invoices Reduce Paper Consumption
The Taiwan Fiscal Information Agency uses RFID and NFC technologies to enable shoppers to receive e-receipts. *Bob Violino*

38 Post Foods Adds NFC to Cereal Marketing Mix
Concertgoers access custom content with their smartphones. *By Jill Gambon*

42 Smarter Things
NXP's NTAG I²C NFC chip enables consumers and businesspeople to use smartphones to communicate with myriad electronic devices, cars and buildings. *By Paul Prince*

45 Item-level Idealist
Joseph Andraski saw the value of RFID in retail and worked energetically to promote its adoption. *By Mark Roberti*

departments

5 Editor's Note
The best of the best.

6 Out in Front
RFID sensors sniff out chemicals; giving RFID ears and eyes; fakes on a plane.

10 Perspective
Three lessons the RFID industry can learn from Apple; how to develop an IoT strategy.

columns

47 Software Savvy
The state of reader interfaces.
By Ken Traub

48 Tuned In
A monumental shift at LIVE! 2014.
By Bill Hardgrave

51 Supply Chain Links
An impartial observer.
By Ian Robertson

tune in online

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- Companies Deliver New Apps for Bluetooth Beacons
- Sanford Health Opens New RTLS-Enabled 'Patient-Centric' Facility
- Airbus to RFID-Tag and Track All Parts Made In-House
- Fujitsu Buys GlobeRanger, Bringing the Electronics Company Into the U.S. RFID Market

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1. Hospital
2. Internet of Things
3. NFC
4. Motorola
5. RTLS
6. Brazil
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- Can an RFID tag be temporarily disabled?
- Can an RFID tag easily be linked with Facebook?
- Where can I find RFID tags and Wi-Fi readers for tires?
- Are on-metal RFID tags vibration-resistant?

POLL RESULTS

Do you think the RFID market is maturing?

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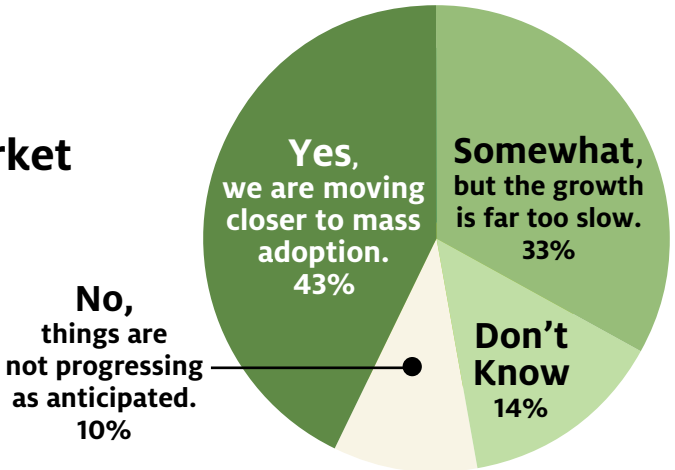

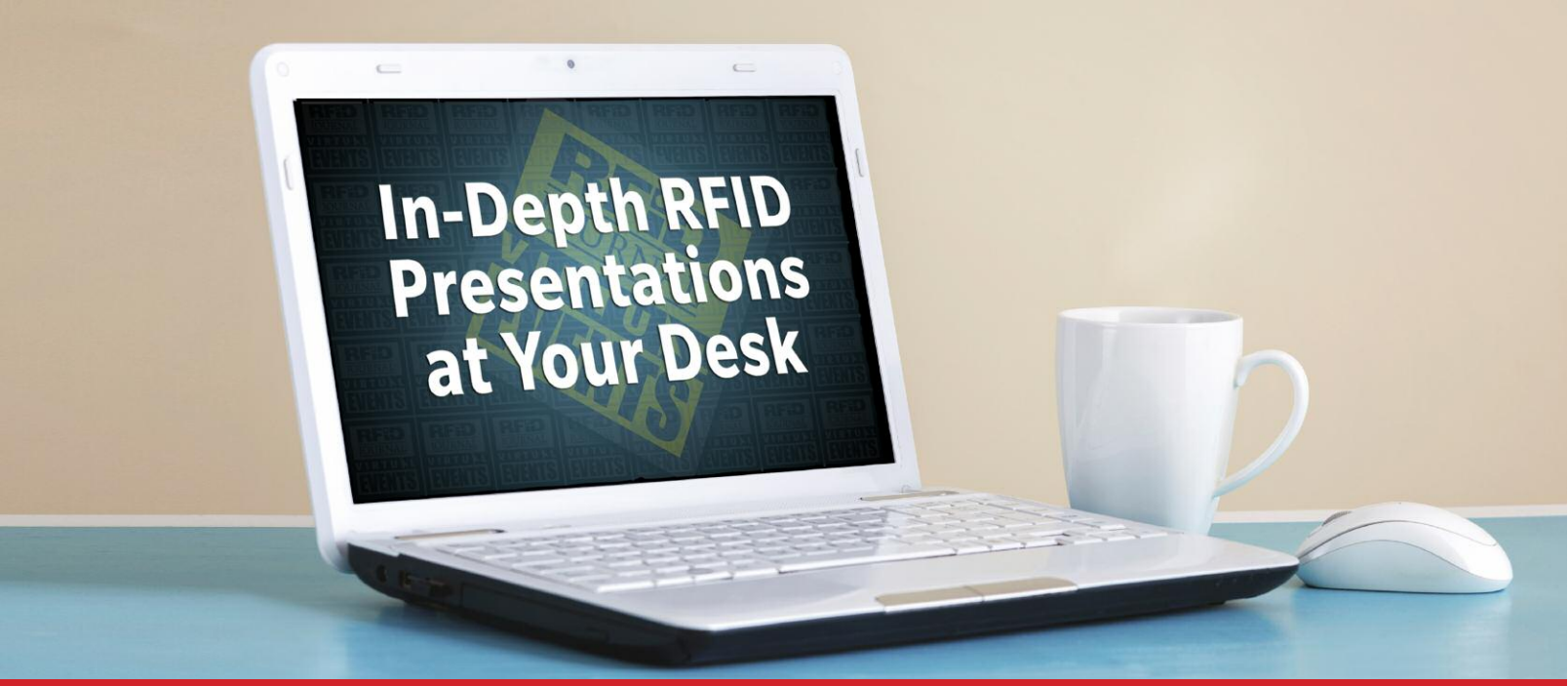

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- And much more

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The Best of the Best

WE HAVE BEEN HONORING outstanding RFID deployments for eight years now. In that time, we have seen the quality of the submissions improve significantly.

This year, in the Best RFID Implementation category, there were many large-scale deployments that merited recognition. The independent panel of judges cast their votes, and two companies were tied: Marks & Spencer, which is RFID-tagging all apparel and general merchandise items at 750 U.K. stores, and Bechtel, which is using RFID to manage materials for three major construction projects off the coast of eastern Australia. RFID JOURNAL editors tried to break the tie, but in the end, we gave both companies the award for Best Implementation. We profile their deployments in this issue.

PHOTO: TOM HURST | RFID JOURNAL

One of the reasons I like to publish deployment case studies is to inspire other companies to think about how they could use RFID, either for the same application or in a different way. When Skyview High School was looking for a way to improve the safety of schoolchildren, a guidance counselor's husband read about RFID tags being used for personnel safety at a psychiatric hospital in California and pointed out the idea. The school worked with the RFID provider, Ekahau, to adopt the health-care solution for the education sector. For thinking outside the box, Skyview was honored with the Most Innovative Use of RFID award.

RFID JOURNAL has been covering cold-chain technologies and solutions for many years, but only a few companies are using temperature tags to monitor some food products. That's likely to change when companies learn how supermarket company Hy-Vee is tracking all shipments of perishable goods from suppliers to its distribution centers, and then to the stores. For ensuring customers get the freshest foods, Hy-Vee earned the award for Best Use of RFID to Enhance a Product or Service.

This year's Green Award went to the Fiscal Information Agency of Taiwan for an RFID-based electronic-invoice solution designed to save trees and reduce CO_2 emissions. We introduced a new award this year, Best NFC Deployment, to highlight the use of Near-Field Communication technology, particularly in consumer applications. Post Foods was selected for its use of NFC cards to engage customers and generate brand loyalty.

Our annual Best In Show award, given to the best new product introduced at RFID Journal LIVE!, went to NXP Semiconductors for its NFC Connected tag, which makes washing machines, refrigerators and other electronic devices smarter. And Joseph Andraski was honored with the Special Achievement Award for his support for and commitment to promoting RFID adoption at the item level in retail.

Congratulations to all the companies honored with an RFID Journal award, as well as all the finalists. And thanks to the many other companies that submitted entries. Look for case studies about some of their excellent RFID projects in "Premium Content" on our website. I'm sure you'll be inspired.

Mark Roberti, Founder and Editor

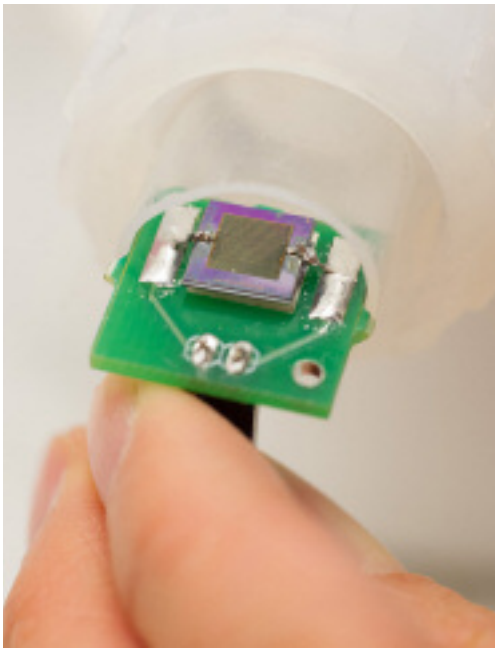
SECURITY

RFID Sensors Sniff Out Chemicals

Researchers at Georgia Tech Research Institute have developed wireless devices that can detect the presence of hazardous gases in the atmosphere.

Richard Reid boarded an American Airlines flight from Paris to Miami on Dec. 22, 2001, with explosives packed in the soles of his shoes. He attempted to detonate the explosives but was subdued by other passengers. In the not-to-distant future, tiny wireless sensors deployed throughout airports might be able to "sniff out" the chemicals in the explosives of such would-be bombers.

A team of researchers at Georgia Tech Research Institute (GTRI) has developed sensors that can be linked to radio frequency identification transponders, which would enable them to alert security wirelessly if they detected any of a variety of chemical vapors they are designed to pick up. "We can make the sensors at very low cost, and they consume very little power, so they can be scattered throughout an environment," says Xiaojuan (Judy) Song, a GTRI senior research scientist who is a principal investigator on the project. "They could provide an early-detection system for better security."



A prototype of a wireless chemical sensor, pictured inside a flow-cell test chamber.

Song is a chemical engineer who has researched wired chemical sensors. She teamed up with Christopher Valenta, a GTRI research engineer and co-principal investigator on the project, who has been working with RFID systems for the past seven years. Wireless sensors are cheaper to deploy, because they do not require running cable throughout an environment.

The sensors have a thin film made of carbon nanotubes and other materials. They are designed to detect specific chemicals, such as ammonia, which is present in most explosives. When chemical molecules land on the film, they either attract electrons from the carbon or the carbon attracts electrons from the molecules. This changes the resistance in the chemical sensor and that change can be communicated to the chip in the RFID transponder through a wired input port. The RFID transponder can then transmit that information to a reader wirelessly. Software would gather data from dozens of sensors and use pattern recognition to determine the presence of a chemical and reduce the likelihood of false alarms.

Song and Valenta developed a prototype sensor that is 10 centimeters square, but their goal is to improve the design so a multiple-sensor array and an RFID chip can be squeezed into a 1-millimeter-square device. The current prototype uses a battery-assisted 5.8 GHz tag developed by GTRI. The team chose 5.8 GHz because it allows for a smaller microchip, faster data transfer rates and better performance around metal, but Valenta says, "we could easily link the sensor to a completely passive 5.8 GHz tag or a commercially available 915 MHz passive tag."

Low-cost sensors that could be read by off-the-shelf and widely deployed passive ultrahigh-frequency RFID readers could also be used to monitor air pollution, detect vapors emitted by ripening fruit and vegetables to monitor freshness, and detect hazardous gases in chemical and power plants. "The sensors could be made small enough that people could wear them," Song says, "and they would alert you if you were exposed to small amounts of potentially harmful gases."

The researchers tested the prototype in a mock airport checkpoint. The sensor detected a specific chemical being targeted despite the presence of many other harmless chemicals, and the RFID component transmitted the sensors' readings. They have begun talking to companies interested in the technology. With appropriate funding, Song says, wireless sensors based on the team's work could be available commercially in three to five years. And then we can all sleep a little more soundly. —*Mark Roberti*

PHOTO: ROB FELT | GEORGIA TECH

HEALTH CARE

Giving RFID Ears and Eyes

A researcher at Duke University has shown that audio and video can be transmitted via passive RFID transponders, which could make way for new medical applications.

ILLUSTRATION: ISTOCKPHOTO

TYPICALLY, PASSIVE ULTRAHIGH-FREQUENCY RFID transponders transmit a unique serial number and perhaps some text information to readers. But Stewart Thomas, a research scientist in Duke University's electrical and computer engineering department, has proved they can do a whole lot more. Passive tags can transmit sound and video recordings, which could open the way for new implantable medical device applications.

While Thomas was studying to be an RF engineer, working on his Ph.D. at Duke under the guidance of Matthew Reynolds, he began to wonder if sound and moving images could be sent via the backscatter technique used by passive UHF systems. He got a chance to find out when he connected with Anthony Leonardo, a researcher at Howard Hughes Medical Center, who studies the neural basis of animal behavior. Leonardo was looking for a way to transmit data from a dragonfly in flight, but battery-powered transmitters were too heavy for the insect to fly normally.

Working with Reid Harrison, founder of Intan Technologies, which makes microchips that sense the weak electronic signals produced by biological systems, the researchers created an RFID transponder that could be attached to the back of a dragonfly. They attached sensors to the insect's body to capture neural signals, and the information from those signals was transmitted in real time via the custom RFID chip, which can communicate with a reader at 5 megabits per second (conventional UHF RFID systems transmit at 640 kilobits per second). "As the dragonfly flew around, we were able to capture its neural signals in real time using passive backscatter communication," Thomas says.

Thomas then used the same passive backscatter technique to stream audio recorded on an iPod and video from a slow-scan television. This approach has enormous potential in the medical field. Passive tags could help remotely monitor the movements and vital signs of the sick or elderly. Rich data could be sent from implants monitoring a patient's heart, brain or other organs—and because the tags don't require batteries, the implants would be relatively small and less invasive than other tags. "This kind of system could be used to capture information about the movement of animal or human muscles simply by using a patch placed on the skin," Thomas says.

The system used a special chip and air-interface protocol, but Thomas believes ordinary passive RFID systems could eventually be used to transmit neural signals as well as audio and video. "There's no fundamental difference between the tags and readers we are building and existing passive UHF RFID systems," he says. "The big challenge with sending a lot of data via existing RFID systems is making sure you get power to the tag constantly. Since the tag has no battery and only the means to store a small amount of energy for short periods, you'd need to keep the tag powered to capture continuous data from a patch on the skin." —*M.R.*

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Fakes on a Plane

Number of passengers impacted by an airport bomb threat:

Norway, 2013
5,000

Spain, 2007
3,000

Michigan, 2013
2,000

Texas, 2012
2,000

China, 2013
1,000

Scotland, 2013
300

–Rich Handley

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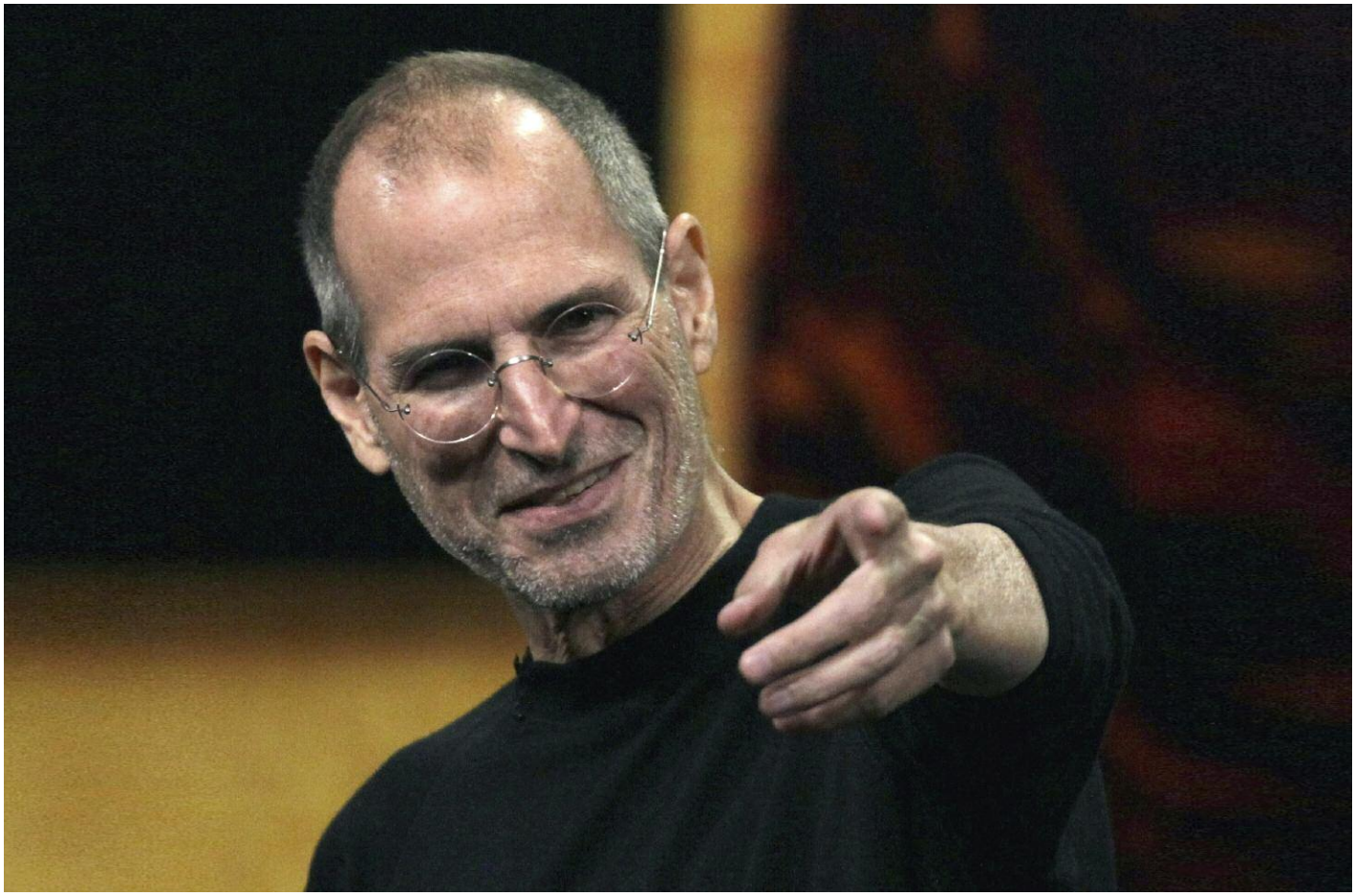


STRATEGY

Three Lessons the RFID Industry Can Learn From Apple

While RFID products continue to improve, technology providers must do more to make them easier to deploy and safer to invest in.

APPLE IS THE MOST successful technology company on the planet. As I write this, its stock is trading at $585 per share (down from a peak of $700 in 2012), and it boasts a market capitalization of $500 billion. Apple has become the "gorilla"—the dominant technology provider—in MP3 players, smartphones and tablets. It is rare for a tech company to dominate any one market, and no other company has done it three times. So as RFID companies seek to foster widespread adoption of their products, it's worth looking at Apple to learn a few lessons.

1 Build the Whole Product

The first MP3 player was introduced in 1997. At the time, consumers needed to purchase a CD-ROM ripper that could copy songs from a music CD to a computer. They had to purchase software to organize songs and copy them to an MP3

PHOTO: ISTOCKPHOTO

player, and they had to purchase the MP3 player itself. This was too complicated for most consumers, so by 2001, sales of MP3 players had reached just 750,000 units.

Around 2000, three years after returning to Apple, Steve Jobs surveyed the field of MP3 players and found most either "big and clunky" or "small and useless." He created a team to develop a new MP3 player. At the same time, Apple acquired a company called SoundJam MP, which offered software that ran on Apple Macintosh computers and allowed people to manage digital music and copy songs to MP3 players. Apple improved the SoundJam user interface and added the ability to write to CD-ROMs. The software was released as iTunes in 2001, and the iPod was released later that year.

Sales of MP3 players jumped to 1.6 million units in 2002. Two years later, sales had more than doubled, and by 2007, sales of MP3 players, dominated by iPods, topped more than 150 million units. Apple's iPod sales peaked in the first quarter of 2011, at just less than 20 million units.

The whole product is important because it reduces risk. For nontechnical consumers—the vast majority of us—having to buy a CD-ROM ripper, software and an MP3 player and get them all to work together means subjecting ourselves to risk. What if we can't figure out how to write songs to the MP3 player? Then, we've wasted a lot of money.

RFID systems are still too difficult to use. A nontechnical person cannot easily set up a reader portal and begin reading tags.

Risk is a huge barrier to adoption of RFID technology. What if we buy a lot of tags and readers, purchase expensive software and hire an integrator, and some or all of it doesn't work as advertised? Then, we've wasted a lot of money. Offering a whole product helps ensure the system will work and, therefore, reduces risk.

There have been many acquisitions in the RFID industry, but none have been similar to Apple's acquisition of SoundJam, geared toward creating a whole product. But a few recent partnerships are aimed in that direction. Checkpoint Systems announced a strategic partnership with Mojix that could enable the two companies to offer retailers overhead readers, software, and deployment and systems integration services (see Checkpoint Partners With Mojix to Offer Passive RTLS in Stores). Alien Technology, RFID Global Solution and Xerafy recently came together to offer hardware, software and services for tracking medical instruments (see Xerafy, RFID Global Solution, Alien Technology Partner on RFID Kit for Hospitals).

2 Make Products Easy to Use

Steve Jobs was not an engineer. He had limited technical skills and was not a proficient software coder. But Jobs understood his customers and what they wanted. He understood they wanted the technology to work, and they didn't want to spend hours making it work. When Jobs saw the original graphical user interface developed at Xerox Palo Alto Research Center (Xerox PARC), he knew immediately it would appeal to consumers more than the text-based commands then used by all computers.

In Walter Isaacson's biography *Steve Jobs*, Jobs recounts the story of a friend who took his iPad to Africa. He gave the iPad to children in a poor area who had never seen a computer, and within a few minutes they had figured out how to use the device. This gave Jobs enormous satisfaction.

RFID systems are still too difficult to use. A nontechnical person cannot easily set up a reader portal and begin reading tags. It's true that tags and readers have improved tremendously. Readers are more sensitive—they can pick up fainter signals from tags. Tags can be orientation insensitive—they can be read regardless of their orientation to the reader antenna. Tags also have many new features, including security and privacy capabilities. But ask any businessperson to reduce the power output of the reader antenna on a passive ultrahigh-frequency reader and you will witness an exercise in frustration.

Last year, we were working with a company on a project that involved coding tags. The reader manufacturer walked me through the process of writing data to the tags. When I tried on my own, I could not figure out how he had done it. I had to call him again to walk me through it. When I still had problems, he had one of his engineers do it for me.

Many of the smaller RFID companies are led by the engineers who developed the products. They make great products that often do more than the end user really needs, and they tend to resist any effort to simplify their products because they see this as a "dumbing down." But no

technology can achieve mass adoption if it requires lots of highly skilled engineers to deploy it.

3 Market Aggressively

Jobs was well-recognized for his intuitive understanding of consumers and what technology they will and won't buy. But Jobs was also a brilliant marketer. Apple's 1984 Super Bowl commercial introducing the Macintosh computer is still considered by many to be the best TV ad ever made.

Within a year of the iPod's launch, there were limited-edition models featuring the engraved signatures of Madonna, skateboard star Tony Hawk and singer-songwriter Beck. The goal was to make the iPod hip.

Jobs also approved an advertising campaign that consisted of humans silhouetted against brightly colored backgrounds, enjoying music through white earbuds attached to white iPods. There was almost no text in the ads—just the Apple logo and the word "iPod." These ads conveyed "cool"; they became iconic. Jobs, who initially resisted the ads, according to Isaacson's biography, backed them up with an aggressive budget.

Apple's advertising budget for all products in 2002 was $125 million. Jobs realized the popularity of the iPod could drive sales of Macintosh computers (a Windows version of iTunes did not come out until the following year). So he decided to shift advertising dollars away from computer products to the iPod.

"I moved $75 million of advertising money to the iPod, even though the category didn't justify one hundredth of that," Jobs is quoted as saying. "That meant that we completely dominated the [advertising] market for music players. We outspent everybody by a factor of about a hundred."

By contrast, most RFID companies spend nothing on advertising. They invest a lot of money in developing new products, but often leave no resources for promoting the new products. As a result, many end users who could use those products don't know they exist.

Small companies will argue they simply don't have the money to invest in advertising and when adoption picks up, they will be able to spend more. But adoption can't pick up if no one knows what technology is available and who makes it.

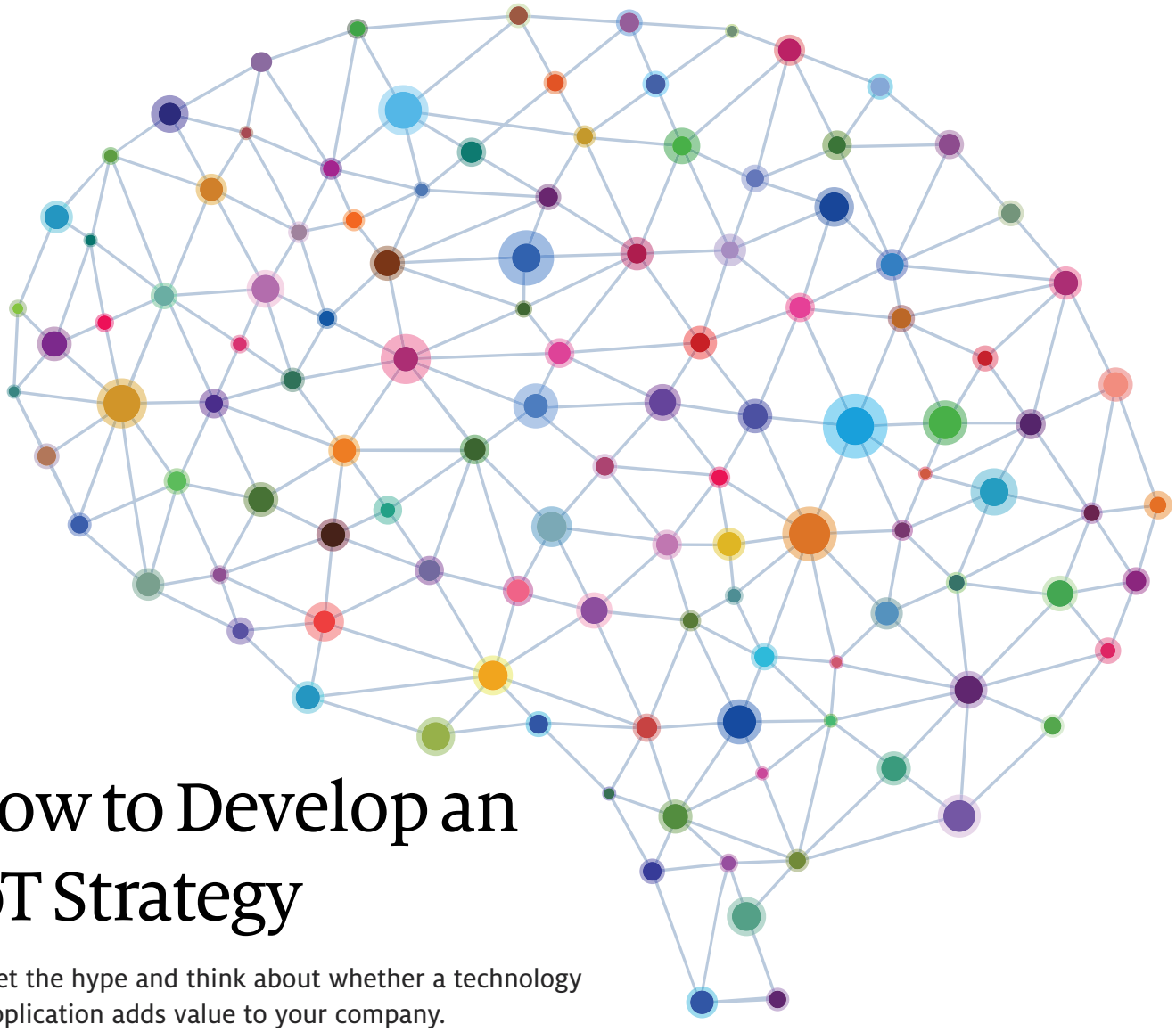
When Steve Jobs took over Apple, the company was struggling and Jobs was only brought back in a desperate attempt to save the company (its share of the PC market had fallen from 10 percent to roughly 4 percent, and it was losing money). Apple did not have unlimited resources to develop the iPod and iMac and to promote them. When Jobs came in, he slashed the number of products Apple was selling and focused on a few that had promise.

There is no single business formula that will be successful for all companies, but Apple has done many things right since 1997. It seems clear that if RFID vendors partner with or acquire other companies to deliver the whole product, make their products easier to use and market them to a targeted group, they would grow sales significantly and the overall demand for RFID solutions would soar. —*Mark Roberti*

Follow Apple's Acquisition Strategy

Apple has never made an acquisition simply to bolster its bottom line. Nor has it purchased companies to add customers to whom it could sell existing products. Apple's acquisitions have been about making its products easier to use or providing software to make its computers and laptops more complete solutions. Here are some of Apple's most significant acquisitions over the years.

Year	*Company Acquired*	*Product*	*Derived Product*
1997	NeXT	Computers	OS X
2000	SoundJam MP	Software	iTunes
2001	Bluefish Labs	Productivity software	iWork
2005	FingerWorks	Gesture recognition software	iOS
2010	Siri	Voice control software	Siri
2012	Chomp	App search engine	App Store



How to Develop an IoT Strategy

Forget the hype and think about whether a technology or application adds value to your company.

ILLUSTRATION: ISTOCKPHOTO

ONE OF THE HOTTEST BUZZWORDS in business these days is "Internet of Things." Cisco hypes it in TV commercials, and Google, Intel and Microsoft are reportedly investing in Internet of Thing technologies. Internet of Things conferences are held worldwide, and April 9th was the fourth annual Global Internet of Things Day, with events held in more than 18 countries.

The term Internet of Things, now commonly referred to as IoT, was coined in 1999 by Kevin Ashton, who was trying to explain radio frequency identification to executives at Procter & Gamble. Ashton envisioned a world in which computers would communicate with passive RFID transponders on cases of P&G products and maybe even the products themselves. This would enable computers to collect and analyze information about what was happening in the real world, without people having to type information into a computer or scan a bar code.

Today, some companies have expanded the term IoT to include a wide range of smart devices, cloud computing, Google Glass and other technologies they are trying to promote. The truth is, experts struggle to define exactly what the Internet of Things is. The European Union has funded IoT research, but the project's website does not define the term. Cisco says the IoT is a "network of physical objects accessed through the Internet." TechTarget, a popular IT website, says it is "a scenario in which objects,

animals or people are provided with unique identifiers and the ability to automatically transfer data over a network without requiring human-to-human or human-to-computer interaction."

RFID Journal recently surveyed its readers to learn their views on the Internet of Things. Six percent of the 516 respondents said the IoT is just a buzzword without much substance behind it. Half said it covers RFID and other technologies that are important, and 32 percent said it is an important trend their companies take seriously.

With the growing media hype, many businesspeople see the Internet of Things as something important they need to focus on. The question is: How do you develop an IoT strategy when it's not clear exactly what the IoT is?

Taken literally, the term Internet of Things covers any technology that links a physical object (other than a computer) to the Internet. There are, fundamentally, two reasons you would want to connect an object to the Internet. One is to be able to track and manage it. The second is to make it smarter.

Tracking and managing items is what RFID is all about, and many companies have been deploying RFID to identify assets, equipment, inventory, tools, work-in-process and other "things" to reduce operational costs, increase sales, improve safety and enhance customer satisfaction. Often, RFID data is filtered and transferred to software running in the cloud so it can be shared within an organization. Inventory data, for example, can be made available in near-real time to salespeople or to alert employees when goods need to be replenished.

The vast majority of "things" will be connected to the Internet via passive RFID technologies so they can be tracked and managed. This is because passive RFID costs much less than most other wireless technologies, does not require line of sight and is truly automatic. There are already standards, including the Electronic Product Code Information Services (EPCIS) standard, for sharing passive ultrahigh-frequency data with supply-chain partners via the Web.

Some items might be tracked and managed with other technologies, sometimes in conjunction with RFID. Vehicles, for example, might be located in a distribution yard with an active RFID-based real-time location system (RTLS), but use GPS and telematics systems linked to cellular networks when on the open road. And in some niche tracking applications, technologies such as 2-D bar codes, QR codes, infrared sensors or ultrasound, work better than RFID.

Tracking and managing assets, products and other things with RFID and sharing data via the Internet increases visibility and delivers other benefits. Take, for example,

Smart Product Interfaces

What makes a product "smart" is not always clear. Whether improving the way customers control products makes the items smarter, embedding an RFID transponder in an electronic device to enable remote control is going to become more common. Intel recently developed a computer and tablet central processing unit that has a wired link to an ultrahigh-frequency RFID chip. By sending signals to the chip, the user can control the device. The CPU, for example, could be locked until it receives a password via an RFID reader. Or it could be customized without opening the box if the user sends instructions to the RFID transponder (see A New Tool for Electronics Companies).

NXP Semiconductors received the Best in Show award at RFID Journal Live! 2014 for its new Near-Field Communication chip that has input/output ports similar to the passive UHF chip Intel is using (see page 42). The advantage of NFC is that many mobile phones have a built-in NFC reader, so companies can create new products that receive instructions from a smartphone. You could, for example, use a smartphone's relatively large, well-lit touch screen to set an automatic NFC-enabled light timer, instead of having to press tiny buttons on a hard-to-read timer display.

For applications in which products can be programmed remotely and automated over the Internet, wireless communications protocols such as Bluetooth, Wi-Fi and ZigBee will likely be employed. For example, Nest, recently purchased by Google, makes smart thermostats and smoke/carbon monoxide detectors that connect to the Internet via a home Wi-Fi network. These devices can be programmed and controlled remotely; the smoke detector sends messages to the user's phone and other Nest devices in the house if it detects smoke. —*M.R.*

ILLUSTRATION: ISTOCKPHOTO

Almacafé, a subsidiary of the National Federation of Coffee Growers of Colombia. The organization uses passive UHF RFID systems to track premium coffee beans from farms through processing and warehousing to better compete in the global market. The RFID solution also helps Almacafé boost sales and improve customer loyalty by enabling coffee manufacturers and consumers to access information regarding the origins of a specific batch of beans via the Internet (see RFID Helps Ensure That Special Cup of Joe).

The buzz surrounding the Internet of Things is more about making objects smarter by connecting them to the Internet. Making products smarter increases the potential profit margins they bring, because they are perceived as more valuable. There are several ways companies can increase the perceived value of their products by connecting them to the Internet:

1 An object can provide more information about itself—where it has been, how it was produced and so on. Embedding an RFID transponder in a product could enable a consumer to read the tag and go to the Internet to find the product's entire history.

2 An object can interact with other objects around it—for example, a printer might know that an ink cartridge being inserted is counterfeit and not allow it to be used.

3 An object can sense the world around it and react—a shipment of drugs might send an alert when it is being stored at a temperature outside an acceptable range, or a building might sense when rooms are empty and turn off the lights.

4 The object can be controlled remotely—a coffee maker might be programmed via the Internet to start brewing using a smartphone application (see "Smarter Product Interfaces" on opposite page).

Today, the Internet of Things is a fuzzy concept, and there is little agreement about which technologies are IoT technologies and which standards apply. What's important is to focus on creating value for your company. That can be done by tracking and managing "things" more effectively or by adding intelligence to your product. Choose the right technology for each application, and don't worry about whether the "experts" call it an IoT technology or something else. —*M.R.*

2014 RFID JOURNAL AWARD

BECHTEL

BEST RFID IMPLEMENTATION

RFID Helps Bechtel Manage a Megaproject

The engineering and construction giant is tracking materials from mainland storage areas to three sites on a remote island, to ensure the correct materials arrive at the right place on time.

BY JOHN EDWARDS

Even if the name doesn't sound familiar, there's a good chance you've visited, traveled on or otherwise benefited from at least one of Bechtel's many global megaprojects. Headquartered in San Francisco, the engineering, construction and project management firm has built, or played a major part in building, such modern marvels as the Bay Area Rapid Transit (BART) system, the Channel Tunnel, Hoover Dam, Las Vegas' McCarran International Airport and the Trans-Alaska Pipeline.

Bechtel is now involved in the construction of three liquefied natural gas processing and export facilities on Curtis Island, an ecologically fragile mile-long speck of land off the coast of Gladstone, Australia. The facilities are being constructed to process coal seam gas (CSG) produced by collection facilities on the Australian mainland. The plants will purify the gas into a liquid state for export to customers worldwide.

Even by megaproject standards, it's an epic undertaking. Each of the three sites will employ several thousand workers during construction. Yet there are no roads connecting the facilities to the mainland or each other, which makes moving people, vehicles and construction materials a formidable challenge. "It's basically an uninhabited island in the area we're working," says Ed Koch, the company's construction automation specialist.

With limited room on the island, the majority of the project's materials receiving and laydown (storage) sites are on the Australian mainland. The construction materials must be loaded onto ferries and transported across a harbor before reaching their installation location. "All the materials have to be handled multiple times before arriving at their final destination," Koch says.

The materials that sail across the har-

PHOTOS: BECHTEL CORPORATION

All materials are identified with Identec i-B2 active tags—roughly 60,000 so far. Some tags are recycled, so Bechtel estimates it has tracked well over 100,000 items.

bor must arrive at the correct island project destination on time and in the correct quantity. Mistakes are likely to generate a ripple effect, delaying construction in multiple areas simultaneously. "When you have materials mixed for three different sites, all in multiple storage areas, you really have to make sure the right thing gets selected and transported to the right place by the right time," Koch notes.

Bechtel needed an efficient, cost-effective way to track and organize the materials involved in the construction of the three facilities. The company selected RFID to serve as the nucleus of a new cutting-edge localized materials-management system. "For Bechtel, RFID provides a world of opportunity," Koch says.

First Steps

Since Bechtel couldn't do much to improve the projects' transportation situation, due to the island's remote location and protected wildlife habitats, managers knew they needed to take steps to ensure the efficient coordination and management of construction materials.

The search for a solution began in fall 2011, when they formed an evaluation committee in the United States to study how other major construction projects dealt with similar logistics challenges. Managers also closely scrutinized a pilot study Bechtel conducted in 2008 with the Construction Industry Institute that quantified the benefits of RFID tracking and management. "We knew we could find things approximately eight times faster, and we had seen, during the study, productivity improvements in excess of 4 percent," Koch says.

A crossfunctional team was formed in November 2011 to develop a formal design and deployment strategy. The team included representatives from Bechtel's business corporate divisions, and project technical experts from procurement and construction. "Involving all key stakeholders was vital to success," Koch says. The team identified three key goals:

- Integrate RFID into existing company-developed supply-chain software to achieve transactional benefits during materials handling.
- Track the location of materials as

As workers move tagged materials, the new locations are recorded with either vehicle-mounted readers (pictured) or gate readers.

they move through a complex localized supply chain from mainland distribution centers to Curtis Island job sites.

• Shorten cycle time and reduce costs for collection of materials and transfer of those materials to the individual project sites by using fewer personnel and equipment resources.

To develop a system that would meet all these goals within the limited time available, Bechtel turned to Atlas RFID Solutions, based in Birmingham, Ala. The company, Koch says, was selected for its focus on construction-industry solutions and its successful work with Bechtel on a previous project. Atlas was awarded the RFID project contract in late 2011.

Designing the System

Atlas completed the system's basic design in early 2012. A limited trial—Koch calls it "proof of reality"—was launched in the second quarter. But the deployment failed to meet Bechtel's expectations. "With that first deployment, we very quickly realized that everything that had been cobbled together stateside was not 100 percent reality when it actually went to the field," Koch says. "You've got to plan how you're going to deploy and then, once you get to where you're really going, you have to adapt."

Bechtel and Atlas needed to move fast to keep pace with an unyielding construction timeline. It took roughly six months to "recalibrate," Koch says, which included redesigning processes and conducting further tests.

Bechtel installed 13 gate readers from Identec Solutions at the entrances and exits of the project facilities: five at mainland-based materials storage yards, one at a pipe spool fabricator, four at mainland port sites, and one at each of the three Curtis Island port facilities.

The company distributed 37 Mobile Demand T7200 Tablets—equipped with Identec RFID readers, integrated barcode scanners and built-in GPS technology—to materials workers at all mainland and island project sites. The tablets are used in conjunction with four vehicle-mounted readers (VMRs), with one supporting the storage yards and one at each project site. All materials are identified with Identec i-B2 active tags—roughly 60,000 so far. Some tags are recycled, so Bechtel estimates it has tracked well over 100,000 items.

Atlas' proprietary Jovix software is used across the entire deployment to support the project's complex multi-site materials-control processes. The software is integrated with Bechtel's procurement system to exchange information such as materials receipt, movement, requests, picking and issuing. Since it was designed from the outset to handle complex construction-site tasks, Jovix required only a few minor modifications to mesh successfully with Bechtel's internal business software.

Supply-Chain Logistics

When the company completed final deployment in mid-2012, Bechtel found itself with a system that met or exceeded all its project goals. Although the Curtis Island facilities require a wide array of construction products, the materials logistics and management processes are virtually identical for all the materials, with only slight variations.

Materials are sent to Australia from suppliers worldwide. Upon arrival at the laydown yards, the materials are tagged. Then, Bechtel employees use their tablets to complete a formal receipt work process and upload detailed materials data from the tablets into Jovix, via Wi-Fi from the storage site or later if Wi-Fi is not available onsite. "This is our first knowledge that materials have been received," Koch says. Once the information is received in Jovix, it becomes accessible via Bechtel's internal procurement system as well.

As workers move materials around during laydown yard organization, the new locations are recorded with either the VMRs or the gate readers, which then feed the information into Jovix. When a materials withdrawal request

(MWR) arrives from a project site, notification is transferred into Jovix via the software's integration with the procurement system. Pick lists can be created and assigned to users, who then handle the picking using their tablets, which significantly decreases the time spent searching for materials.

Since all materials require transport to the Curtis Island project locations through a complex sequence of events involving trucks and cross-harbor ferries, documentation is required for any item loaded onto a transfer unit (trailer, flat rack, pallet or any type of ground transport platform). Field workers use their tablets to combine different materials onto an RFID-tagged transfer unit, and the software associates the items with the transfer unit. Desktop computer users can then generate packing lists for each transfer unit.

As transfer units move through the various gate readers, materials location and status information is updated automatically in Jovix to create full traceability. This process previously would have required vast amounts of manual data collection, system input and management via conventional clipboard and paper methods, Koch says.

Once the materials arrive on Curtis Island, a procurement team uses tablets to complete an issuing process similar to that used by a parcel courier. This passes the information back to the procurement system, which officially issues the materials to construction, depletes the quantity and closes the MWR, simultaneously recording what materials were issued, when and to whom.

The RFID tags remain attached to the materials until installation, ensuring locating and traceability, Koch says. All data for the movement and transactions of the materials are recorded and saved in a historical location that can be used for reporting.

For a project this size, Bechtel faced just a few small challenges. The firm needed a reliable local communications infrastructure. Existing connectivity between Australia and the United States, where the Atlas servers are located, was poor during the trial phase. To rectify the problem, Bechtel and Atlas engineers collaborated and concluded that moving the servers to an Australian data center would greatly improve data synchronization between the servers and end-user tablets. "This solution improved synchronization efficiency from approximately one hour to only minutes," Koch says.

While the system has only been in operation for a relatively short time, Bechtel is convinced it is generating considerable efficiencies.

The only read-rate problems encountered were caused by improper tag placements on the materials transfer units, Koch says. "Atlas helped us determine proper RFID tag placement on the transfer units, and the read-rate issues dissipated and performance issues were immediately improved," he says.

Koch also credits continuing emphasis on end-user training for the system's successful deployment. Training, conducted with the help of an Atlas representative, initially focused on getting workers up to speed on individual work processes. "There are now also ongoing refresher courses and on-site support," Koch says.

Quantifying Benefits

While the system has only been in operation for a relatively short time, Bechtel is convinced it is generating considerable efficiencies. Koch points to a Six Sigma process study that, for pipe spools alone, showed a time savings of one man-hour per MWR, with 300 MWRs generated weekly over multiple project years. "Total man-hour savings for the MWR work process is expected to be significant," Koch says.

The system offers other benefits, too, such as the ability to track transfer units via gate- and vehicle-mounted readers and GPS. Previously, personnel had to manually track transfer unit locations and materials, Koch notes. "Now," he says, "the system provides a real-time snapshot of precise transfer-unit locations and loads on project sites."

Several other Six Sigma studies are under way, with initial estimates showing a significant positive impact on indirect labor. "We believe digitizing these processes could potentially reduce our indirect labor costs by an estimated 5 percent on multiple billions of total project costs," Koch says. "The construction is ongoing, so final investment returns are still unknown, but we anticipate a large return on investment."

With the last Curtis Island facility not scheduled for completion for many months, Bechtel plans to keep making refinements to its RFID installation with an eye toward equipping upcoming capital projects with similar systems.

Bechtel is working hard to increase partner involvement. Koch notes that some fabricators are now tagging items before shipping. "They're also beginning to generate advance data that will help us improve the management of downstream work processes," he says.

"RFID keeps revealing new and innovative uses," Koch says, "and we're really pleased with that."

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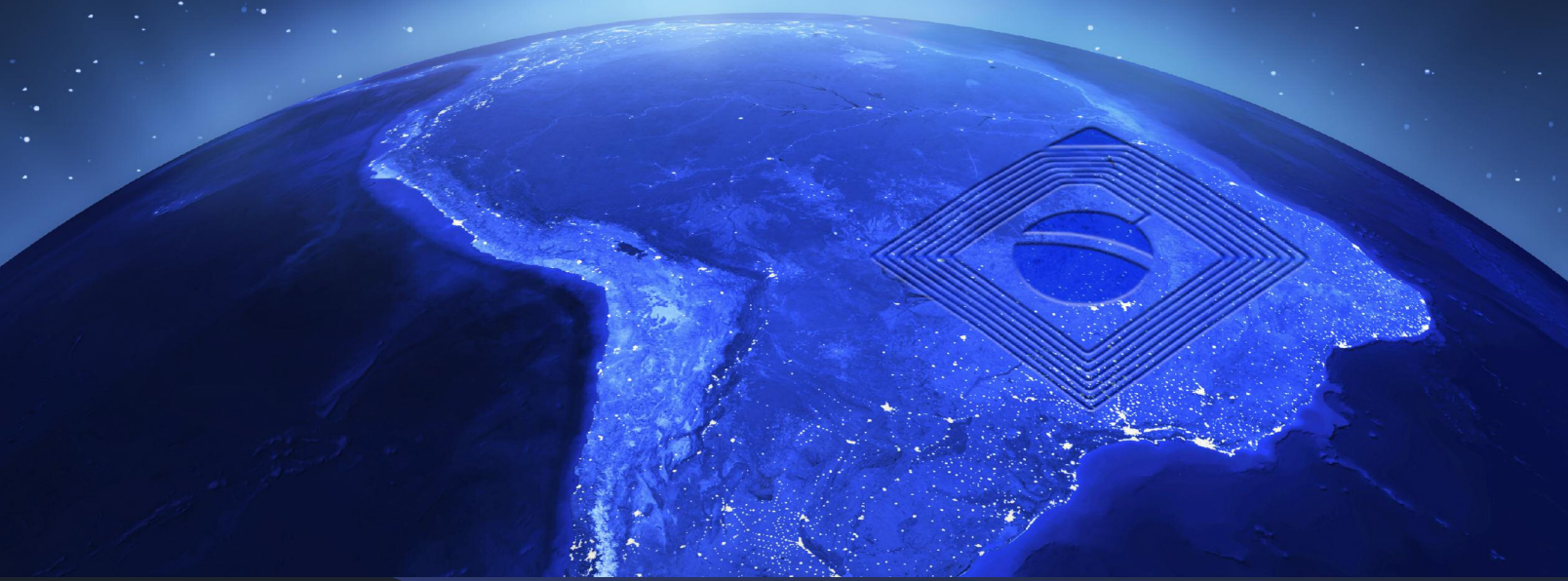

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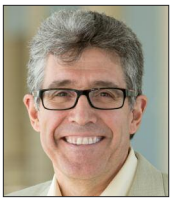

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2014 RFID JOURNAL AWARD

MARKS & SPENCER

BEST RFID IMPLEMENTATION

Marks & Spencer Embraces Change

Based on the benefits achieved from RFID-tracking all apparel—and recognizing the importance of omnichannel shopping—the U.K. retailer plans to tag all general merchandise in stores.

BY SAMUEL GREENGARD

In 2012, Marks & Spencer (M&S) made a bold but calculated decision. The London-based clothing and merchandise retailer, which has been using RFID to track and manage apparel items since 2003, decided to extend its RFID-tagging initiative to all general merchandise. M&S is rolling out the solution and plans to have it implemented by spring 2015. When M&S completes the project, all merchandise at 750 of the company's U.K. stores will be identified with RFID tags. In addition, M&S will employ RFID at 200 factories in 20 countries.

M&S, which earned £10.0 billion (U.S. $16.8 billion) in revenues for 2013, now operates 766 stores in the United Kingdom and 418 stores internationally, selling a variety of merchandise and food products. More than 21 million customers visit its stores every week. Its website attracts 3.6 million visitors per week. "We are implementing large-scale revolutionary change that spans our supply chain, stores, Web platform and IT infrastructure, creating a sound base for sustainable future growth," says M&S Chairman Robert Swannell.

The move to RFID-tagging home goods (such as bedding and kitchenware), jewelry, cosmetics and gifts is based on the benefits the company has achieved from tracking all apparel at all its stores and the recognition that mobility and more sophisticated digital tools are changing things, says Kim Phillips, M&S's head of packaging.

RFID has enabled the company to meet its goal of serving as "the store in which you can always find your size." That's no small task, given M&S stocks a complex mix of sizes and styles. M&S flagship stores, for example, stock as many as 25,000 bras, in roughly 60 combinations of back widths and cup sizes, in a variety of colors and styles. Similarly, the company sells jackets and

PHOTOS: MARKS & SPENCER

The tags had to meet the aesthetic requirements of cosmetic and other manufacturers.

pants in 20 different size combinations and various color combinations. To improve real-time inventory tracking, optimize stock levels and ensure the correct product mix is always on display in stores, M&S will use more than 400 million RFID tags this year.

The other motivating factor to tag all merchandise was the recognition that the company is "operating in an omnichannel world that transcends traditional marketing boundaries," Phillips says. Customers now want a seamless experience, whether they are shopping in a store, on a mobile device or at a home computer. Within this environment, he says, "There is an absolute need for stock accuracy. The use of RFID technology to replace manual methods of stock counting and stock checking is just another step in the ongoing digital revolution."

Building on the Benefits

To be sure, the move to tagging every piece of merchandise required extensive planning—despite the firm's previous experience with RFID (see Marks & Spencer Rolls Out RFID to All Its Stores). M&S had to thoroughly understand workflow, product flow and customer behavior. "In different categories, the causes of an out-of-stock item may be different from those related to clothing, but the problems of identifying it and managing it remain the same," Phillips says.

A crossfunctional steering committee with members from corporate, IT and store operations guided the initiative. The team also tapped retail and store representatives for feedback on the status and hiccups associated with deploying systems in the stores, on the floor and in the back room. Finance executives helped build the business case and determine the return on investment for specific deployments. At various times, the retailer also relied on external auditors and the executive board to provide input, Phillips says.

In addition, the retailer worked closely with its longtime partner, Avery Dennison Retail Branding and Information Solutions (RBIS), to develop all the

The EPC Gen 2 tags come in different sizes and shapes for a wide range of merchandise, including items that contain metal or liquids.

required systems and tags. The relationship paid dividends by helping M&S steer clear of many hurdles often associated with a new implementation. "The knowledge M&S possesses in RFID development, coupled with its understanding of internal processes and objectives, supported and guided total RFID implementation horizontally across all categories and vertically throughout the supply chain," says Karen Whittingham, communications director at Avery Dennison RBIS.

M&S had already taken steps to replace its early RFID technology with Gen 2 read-write tags and readers. The retailer also opted to bring RFID software development back in-house. Avery Dennison and M&S worked together to design EPC Gen 2 tags in different sizes and shapes for a wide range of merchandise, including items that contain metal or liquids. The tags also had to meet the aesthetic requirements of cosmetic and other manufacturers. All told, there are 10 tag formats and, because the retailer uses different color codes, 70 tag variations.

To ensure the RFID system would work correctly for all apparel and home goods items, M&S conducted tests at a mock store at the company's headquarters.

To ensure the RFID system would work correctly for all apparel and home goods items, M&S conducted tests at a mock store at the company's headquarters. Once the team had ensured consistent, accurate tag reads on the different materials, the retailer began testing the tags at the store level.

Within the stores, sales associates use handheld RFID readers to take inventory of merchandise in different departments on a rotating basis, once every two or three weeks. Employees use a drop-down menu on the handheld reader to select the appropriate department, then scan the sales floor and the stockroom, reading up to 15,000 items per hour. The mobile reader automatically removes duplicate reads. When the process is completed, the device transmits the data over the store's wireless network to the company's central RFID database. The system filters out stray reads from other departments and, once all the data has been verified, over writes the store's stock database. It automatically updates the daily delivery list, so missing store items can be replenished.

In addition, M&S developed an extensive system of checks and balances to flag unusual results. This allows store personnel to instantly confirm the accuracy of any count in question and, if a discrepancy exists, check for missing items. An in-store user feedback system aids in continual evaluation, refinement and upgrading of the RFID system while helping M&S boost overall performance.

The most recent field trial, which took place at 200 stores in 2012, confirmed that the business benefits associated with RFID tracking were consistent across a variety of store sizes and designs. Streamlining and speeding inventory tracking and stock replenishment means store associates spend less time looking for particular items, so they have more time to focus on customer service, which has increased sales.

In 2013, M&S began to roll out the RFID initiative to some homeware departments. This is significant, Phillips says, because it fundamentally changes the business. When customers purchase bedding, for example, they frequently buy complete sets of sheets,

RFID has already improved inventory accuracy by up to 50 percent and decreased out-of-stock situations by approximately 30 percent to 40 percent.

duvets, pillowcases and blankets. If a single item is not available, M&S could lose part of the sale or all of it. RFID inventory tracking greatly reduces the risk of out-of-stock items, he says, and helps drive total sales.

The Omnichannel Approach

Phillips says companywide RFID will deliver several key benefits, including labor savings, improvements in production efficiency, increased IT efficiency and enhanced visibility across the supply chain. He estimates that RFID has already improved inventory accuracy by up to 50 percent and decreased out-of-stock situations by approximately 30 percent to 40 percent.

RFID also supports the omnichannel experience for customers, Phillips says. Whether M&S customers are shopping at a brick-and-mortar store or online, they expect the items they want to buy will be available.

To execute ominichannel shopping required new thinking and greater integration of RFID with existing systems. M&S developed proprietary software that could analyze the ongoing stream of RFID activity and track the generated benefits. Executives and store managers now have access to weekly reports that display inventory and other data at both the store and departmental levels. In the end, Phillips says, it's a more seamless and flexible framework for both the company and its customers.

To execute ominichannel shopping required new thinking and greater integration of RFID with existing systems.

Moreover, the improvements resulting from deploying RFID have helped build an IT infrastructure that better supports new and emerging digital tools and technologies. Because the proprietary software is tied into standards-based hardware, Phillips says, there's full integration with M&S core IT systems, including touch-screen kiosks. A customer, for example, can place a shoe, belt or other item in front of an in-store touch screen. The camera can identify the item and present similar and associated accessories or garments onscreen. Customers can browse products, obtain information about merchandise, step through interactive guides and order products that aren't available in stores. M&S can also send information and documents to the shopper's iPad or other device.

In the coming months, item-level tagging will also pave the way for leading-edge features, including a "click and reserve" function that allows customers to go online and hold items in stores for later pickup and e-payment capabilities via a digital wallet or smartphone app.

Phillips says several factors were crucial to the RFID project's success, including executive support, ongoing communication and training. Over the years, he adds, the company has relied on classroom training, videos, manuals and other learning aids—including "train-the-trainer" programs—to push knowledge deep into the company and the stores. It also relies on support staff to troubleshoot technology issues at the store level.

The retailer's ongoing commitment to RFID and its focus on building a robust IT infrastructure have paid off bigtime. "We have won the hearts and minds of our store colleagues an management teams," Phillips says. "The project is part of the ongoing evolution of Marks & Spencer. By tagging all the merchandise, we are opening a door to a wide range of further enhancements and additional RFID applications."

2014 RFID JOURNAL AWARD

HY-VEE

BEST USE OF RFID IN A PRODUCT OR SERVICE

Hy-Vee Supermarkets Track Perishables to Ensure Freshness

Suppliers include RFID temperature tags in shipments to the retailer's distribution centers, and the DCs reuse the tags to monitor goods en route to the stores.

BY JENNIFER ZAINO

Most consumers have had the frustrating and costly experience of finding their milk spoiled or their lettuce wilted before the "use by" date printed on the packaging. That's because the freshness dates of dairy, produce and other perishable groceries are calculated on the assumption that the item has stayed within appropriate temperature boundaries during its journey from supplier to distribution center to retailer. But it's not uncommon for perishables to be exposed to significant temperature variations during transit, which can impair product shelf life and quality.

It's a problem grocery retailers and their distribution arms have been trying to tackle for years. Hy-Vee, a chain of 236 supermarkets in the Midwest, and Perishable Distributors of Iowa (PDI), a wholly owned subsidiary of Hy-Vee, began cold-chain monitoring roughly a decade ago. Some suppliers would attach a single-use digital temperature recorder to each shipment. When the shipment arrived at a PDI distribution center dock door, an employee would take the temperature-tracking device to the warehouse office and download the data from it. PDI developed algorithms based on exposure percentages to automatically determine from the data whether a shipment passed or failed. The system would alert employees if a supervisor needed to be called to investigate whether the shipment should be accepted or refused.

But the hike from any one of PDI's 54 dock doors to the office to download the shipment's information could tack five minutes or more onto the receiving process, says Kyle Oberender, PDI's director of safety. Oberender wanted to

PHOTOS: PERISHABLE DISTRIBUTORS OF IOWA

Employees automatically download tag data at a PDI distribution dock door, and then run algorithms to determine product freshness on the spot.

streamline the receiving process and take cold-chain monitoring to the next level: tracking the temperature of perishables from PDI DCs to Hy-Vee retail stores.

To accomplish 100 percent cold-chain monitoring using a closed-loop model, Oberender wanted to be able to clear and reset the temperature tags. TempTrip's RFID solution met this requirement. "For me," he says, "RFID is the only solution to be able to do 100 percent monitoring, because the tag can be reused and it can be efficient as well."

In July 2013, PDI began receiving RFID-tagged perishables at its Hy-Vee DC, in Ankeny, Iowa. Today, roughly 97 percent of dairy, fresh meat and seafood suppliers include one or more TempTrip ultrahigh-frequency RFID tags with each shipment. "Basically, we are running at full speed at the Hy-Vee DC for all fresh items," Oberender says.

PDI recently RFID-enabled a second, larger DC, in Chariton, Iowa, which is beginning to receive tagged produce, frozen foods, ice cream and other perishables. Hy-Vee in now in the process of RFID-enabling its retail stores.

Getting a Read on the Solution

Oberender had been looking for a reusable temperature recorder. When he learned about TempTrip's RFID solution, he knew it would accelerate the receiving process, because it would allow employees to download the tag data at the dock door and run the algorithms on the spot. Then, PDI could reconfigure the devices and use them to monitor shipments to the retail stores. "We had been keeping our eye out for a reusable recorder, because we knew the value it would bring," Oberender says.

PDI first conducted an outbound closed-loop trial in which employees placed TempTrip tags within shipments heading to a retail location. Company drivers retrieved the tags at the point of delivery and returned them to PDI, so the temperature recordings could be uploaded and reviewed. Following this, in May 2013, PDI formed a crossfunctional team to evaluate the solution, with representatives from TempTrip,

Hy-Vee suppliers order the tags online at TempTrip's website. PDI instructs suppliers on tag placement. TempTrip also sends an instructional flyer with every tag order.

the DC, and the IT, warehouse, transportation, food safety, purchasing and sales departments.

With the help of a supplier that volunteered to RFID-tag a shipment, PDI tested the receiving and data-integration processes. This trial still used the process of downloading the data at the warehouse office.

TempTrip then tested at its own facilities the setup PDI would use at its site to download the data right at the dock doors. "It worked, so we moved forward on install," Oberender says. The install included two Impinj Speedway Revolution R420 readers, one at each shipping/receiving dock, and 22 Impinj antennas, approximately one at every other dock door.

Now, when a shipment is received, a dockworker retrieves the TempTrip tag and holds it up to an antenna. The tag data—including ID, temperatures, dates and times—is automatically uploaded to TempTrip's Web application and Hy-Vee's server. Each record is associated with other information, including an assigned vendor number, the Department of Transportation number of the carrier that brought the product into the facility, the name of the PDI employee handling the load, and a separate temperature reading taken by thermometer at the point of receipt.

Once the data is uploaded, the algorithms run through an IBM System i server, which reports the pass/fail information back to a Motorola handheld computer. It takes only eight seconds for the data to be uploaded and the tag to be automatically cleared and reconfigured for use.

Hy-Vee suppliers order the tags online at TempTrip's website. PDI instructs suppliers on tag placement. TempTrip also sends an instructional flyer with every tag order. PDI tracks any "unstarted" tags, so it can follow up individually with any suppliers that may need to retrain their employees.

Typically, each shipment requires one tag. If a shipment includes various items—frozen goods and fresh produce, for instance—each item requires its own tag, to separately track temperatures and enable PDI's algorithms to appropriately evaluate the loads. "Lunchables items may not have as much exposure allowance as the pickles on the same load, so maybe the pickles pass and can be received but the Lunchables fail and need to be isolated," Oberender explains.

There have been some challenges in getting suppliers onboard, he notes. Some suppliers already manage a variety of temperature recorders to accommodate different customers, he says, and PDI's mandate for them to use TempTrip devices adds to their inventory-tracking load. In other cases, suppliers hadn't been doing any temperature tracking, and this is a completely new expense for them. "We get questions as to why we are doing this or what they will gain from this," Oberender says. "We explain to our suppliers that their name is associated with the product, and if their shipment has been jeopardized by temperature-control issues that hurt the product's quality, theirs is the name consumers will remember."

"Hy-Vee and PDI are investing in the outbound piece," equipping retail stores with RFID technology to tie the knot on end-to-end cold-chain monitoring, Oberender says. That is the finishing piece that adds visibility and increases control to ensure each supplier's product consistency, quality and food safety. "So we are asking for them to invest in the in-bound temperature data to the distribution center," he explains. When necessary, he adds, PDI works out funding issues with its suppliers.

PDI receives more tags than it needs for outbound deliveries to stores, so it has worked out a return-refund arrangement with TempTrip. "TempTrip wants to resell the recorders to suppliers quickly, and there's no need for us to keep more than we need," Oberender says.

End-to-End Monitoring

The TempTrip solution has more than met Oberender's two goals—it speeds receiving processes and allows the

temperature tags to be reused to monitor shipments from the DCs to the retail stores. The RFID solution lets PDI decide quickly whether to accept or refuse a shipment. "On the dock at the point of unloading, we can get that data evaluation down from five minutes to eight seconds for the answer of the temp exposure associated with those items we are receiving," Oberender says.

The RFID data also can be used to improve transport performance. Having access to the data via the TempTrip website is a convenient way to analyze operations, Oberender says. "We can narrow the data by carrier to see the total percentage of exposure to our products in the last six months, for example, and compare which carrier exhibits less temperature abuse," he says.

In many cases, Hy-Vee uses its own trucks and drivers or contracts with third parties to move products from suppliers to the DCs. PDI can analyze temperature-tracking information to provide insight into the carriers' performance. "We also are looking forward to managing exposure on the outbound side to let us discover information such as who is the Number 1 driver with the least amount of exposure over a certain period of time," Oberender says. "And we can set performance measures and possible incentives around managing temperature exposure. I don't think anyone else has the capability to do that."

Similarly, if a supplier manages its own transport to a DC and its shipments are refused, particularly if the supplier's temperature exposure records are unacceptable over time, PDI can provide the vendor with those records. The supplier can then opt to change its carrier partner or take other steps to remedy the problem.

Oberender recalls a case in which PDI received a shipment, from a supplier managing its own transport. The temperature appeared perfectly fine at point of receipt, but the data showed that for approximately one day of the seven-day transport process, the shipment had significant exposure to unacceptable temperatures. At some point, it appeared, the carrier had recognized the problem and gotten the refrigeration back under control for the last couple of days of travel. PDI shared the data with the supplier, which agreed the product should not be accepted.

"We explain to our suppliers that… if their shipment has been jeopardized by temperature-control issues that hurt the product's quality, theirs is the name consumers will remember."

KYLE OBERENDER, PERISHABLE DISTRIBUTORS OF IOWA

PDI distribution center workers attach the reconfigured TempTrip tags to shipments they're trucking to a Hy-Vee store. After delivery, the drivers return the tags to the DC, where the data is uploaded for after-the-fact analysis should a store report a problem with a shipment.

That process is changing, though, as Hy-Vee retailers begin to install RFID infrastructures on site, so they can do real-time evaluations of temperature data at the stores. "We plan to use this as another tool in our current receiving process to evaluate the product upon delivery," Oberender says. "It's not as much about accepting or refusing as it is about the green light to continue with confidence. The exceptions of a red light that need to have further attention will now be recognized and investigated, and the product disposition can be made on a case-by-case basis. The biggest benefit to the retailer is that we will be evaluating and managing any and all exposure on both our inbound and our outbound shipments with a goal of zero exposure on both sides. Even the very minor exposures that will not necessarily cause an immediate product issue will be managed unlike any other grocery retailer."

Hy-Vee RFID-enabled its first two stores in May. Hy-Vee and PDI predict the trial will be successful, and they plan to equip all retail stores before year-end.

Once stores are up and running with the RFID infrastructure, they can leverage their ability to use the RFID readers to assess the temperature exposures of shipments from other sources. "Milk suppliers typically do direct store delivery" rather than going through a PDI distribution center, Oberender says. "Now all the retailer has to do is require the TempTrip tag to be used for milk shipments to get real-time data evaluation at the retail level."

PDI is also taking steps to monitor more food categories. It's considering including products that aren't perishable but are temperature-sensitive—chocolate, for instance. The company is expanding its algorithms to support the new food categories.

Ultimately, a big part of this work is about improving the customer experience, Oberender says: "We want Hy-Vee customers to be able to buy the most stable, consistent, high-quality products."

2014 RFID JOURNAL AWARD

SKYVIEW HIGH SCHOOL

MOST INNOVATIVE USE OF RFID

RFID Protects Students and Teachers

Skyview High School deployed a safety solution that can summon help in a disciplinary, medical or violent emergency.

BY MINDA ZETLIN

A student at Skyview High School in Nampa, Idaho, was acting unruly. His teacher suspected he might have been drinking. Faced with such a disciplinary problem in the past, she would have had to leave the classroom to call for assistance from another teacher or security. Instead, she pressed a button on a tag worn around her neck.

In minutes, four administrators, two security officers and Brad Ford, Skyview's school resource officer (a police officer charged with protecting the school) converged on the classroom. "Seven people showed up here just because the teacher needed help?" the astonished student asked.

"Absolutely!" Ford told him.

A year ago, Skyview High School, which has roughly 1,300 students, deployed an RFID safety solution from Ekahau. All 130 teachers and school administrators wear Ekahau B4 tags on lanyards, which they can use to signal for help not only with a disciplinary problem but a medical emergency, or to issue a security alert and implement a lockdown.

"Violence in schools is not going away," Ford says. "We need to change our tactics and empower teachers." One concern with standard lockdown procedures is that teachers are expected to take many steps in rapid succession. "You need to get the kids in lockdown, shut the door, turn the lights off, call 911 and tell them what's going on," he says. "It's too much, I think."

▲▼ Thinking Outside the Box

The project began when Ford was discussing school safety with the school's guidance counselor, Mandy Petty, and her husband. In the wake of the 2012 shootings at Sandy Hook Elementary school in Connecticut, they wondered if there were measures they could take, beyond the usual lockdown drills, to keep students safe.

That conversation led to a lot of research. Many schools were putting panic buttons on walls or desks, but that didn't seem to be an ideal solution. What if, in an emergency, a teacher

PHOTOS: SKYVIEW HIGH SCHOOL

"Violence in schools is not going away," says Brad Ford, Skyview High School's resource officer. "We need to change our tactics and empower teachers."

were unable to reach the button? "Let's allow [teachers] an item that gives them better access," Ford says.

When the guidance counselor's husband read about RFID tags used for personnel safety at a psychiatric hospital in California, she knew he was on to something. It stood to reason that a similar system could work in a school. In January 2013, they contacted Ekahau, provider of the hospital's tags, to find out. The timing was fortuitous. "We looked at the large deployment in California and asked ourselves where else it could be used," says Mark Norris, Ekahau's president and CEO. "Skyview reached out to us at roughly the same time." Ekahau agreed to modify its health-care solution for the education sector.

Ekahau's safety solution turned out to be a perfect—and affordable—fit for Skyview High School. The company's battery-powered B4 tags are designed to work on any Wi-Fi network. Skyview, like many schools, has a robust Wi-Fi network, so there was no need to install a system of fixed readers or antennas. The company placed several of its wire-free infrared location beacons in the school's classrooms to help ensure the system's accuracy at locating tags.

At a community meeting, Ford advocated for the solution, and an anonymous donor funded the Skyview deployment with a grant of approximately $32,000, which covered the cost of the tags, beacons and software. Norris says that, in general, a price of $30 to $40 per student is typical for a school. (Prices are per student, in keeping with usual pricing practices for schools, though the tags are issued to the teachers.)

Deploying the system at Skyview took only three days, beginning on April 12, 2013. Ekahau reps spent the first day doing a site survey and distributing the tags. They also set up the Vision software, which lets Ford and the school administrators send messages to the tags' LED screens. In addition, Vision displays a map of the school by floor, showing the location of each tag in real time, so administrators can watch as tag

Skyview gave the local police department, as well as the fire department and emergency services, access to the software, which displays a map of the school.

wearers move through the school. The school has also given the local police, fire department, emergency medical service and emergency dispatch access to the software via Web browser.

On the second day, Ekahau pros taught Skyview teachers how to use the tags, and trained Ford and administrators to use the software. On day three, the Ekahau team stayed onsite to answer lingering questions and make sure things were going as planned. They completed testing by April 30, and got needed adjustments under way.

▲▼ Managing the Messages

The Ekahau tags function as two-way communication devices. A wearer can use a tag by pressing a red or blue button, or pulling down on the tag, which releases a tab at the top. Ekahau customized the functions for Skyview. A press of the red button signals a disciplinary problem and summons Ford, the school administrators and the security team. A press of the blue button signals a medical emergency—200 Skyview students have known medical conditions—and summons the school nurses, Ford and the administrators. A pull on the tag signals an emergency requiring lockdown and sends an alarm to the entire school.

Each tag also has a small LED screen in which brief text messages can be displayed. Ford or the administrators can send a message to individual teachers or the whole teaching staff, letting them know about an urgent situation and providing instructions, such as "Gather at the West Entrance." The LED screens also automatically inform those alerted to the nature and location of the emergency. If, for example, a physical education teacher pushes the blue button during class, Ford's tag will chime and alert him with a message on the LED screen that medical assistance is needed in the gymnasium.

The Wi-Fi tags, especially with the added beacons, are generally accurate at providing location information—so much so that many teachers assume they contain GPS technology. "Tags have full Wi-Fi radio two-way communication, just as a phone or laptop does," Norris says. Ekahau's technology specializes in determining location from a radio-frequency signal using probabilistic fingerprinting (which pinpoints location based on signal strength and other factors).

In a school setting, Norris adds, that level of accuracy is sufficient. "One hundred percent room-level accuracy isn't a requirement," he says. "It's more about the location of the event in the context of what it is. If you're a nurse headed to a medical event and you arrive at the room next door, you'll be able to figure out, based on noise and activity, that the event is 12 feet to the left."

Initially, the school chose to identify the wearer only by job function, such as teacher or nurse. "We didn't want teachers to feel that Big Brother was watching them," Ford says. But then teachers started requesting to have their pictures incorporated in the software when they sent a signal. "Now when they call for help, their picture pops up and I know who called," he adds.

High-school teachers, it turns out, are more prone than medical personnel to accidentally set off a tag, perhaps because health-care professionals are more accustomed to wearing delicate equipment around their necks. "We had 11 lockdown pulls the first week," Ford says.

Accidental alarms were a big concern, as they were likely to desensitize teachers and staff members who might stop taking them seriously. Even worse, employees might become reluctant to wear the tags at all.

After some discussion, Ekahau and the school arrived at a solution. Now, when a teacher pulls the tag, which signals a lockdown, the alert reaches Ford in 3.5 seconds, but the rest of the school is not alerted for 10 seconds. During those 10 seconds, the teacher can press a button on the tag to confirm the alert and have it go out immediately. Or, if the pull was accidental, the teacher can push the tab back in, canceling the alert.

The red and blue discipline and medical emergency buttons must now be held down for 3 seconds before an alarm goes out. Since these adjustments, the number of accidental alarms has decreased significantly.

Ford has discovered the tags' messaging feature can be useful even in non-emergencies. As teachers were getting used to the program, Ford sent a nightly reminder to the tags' LED screens reminding the wearers to charge the devices. The tags are charged in rack chargers at the school, and each wearer's name is written on his or her tag to avoid mix-ups.

Another time, Ford needed to talk to a teacher but his calls went unanswered because the teacher was in a noisy area and couldn't hear his phone. So Ford sent a message to the teacher's tag and knew it had been received when he saw that tag, via the software, moving through the school toward his office.

▲▼ Calculating ROI

Skyview is pleased with the safety solution and hopes other schools consider it. "Not everybody wants guns [in school], and not everybody can carry a gun," Ford says. "But everybody can carry a tag around his or her neck."

Since the Skyview High School rollout, nine more U.S. school districts have begun using the tags, Norris reports, in some cases at multiple schools. Further improvements for school use are under consideration, he adds. Some teachers have suggested that the blue (medical emergency) button carry a cross symbol, and the red (discipline emergency) button sport some sort of security symbol.

Ekahau may also make cosmetic changes to the tag. "The buttons and colors are laminated, and we're considering laminated fronts as well," Norris says. That way, the tags could sport the school colors or mascot.

Meantime, at Skyview, there have been many drills but fortunately no real-life lockdowns, although the tags have been used many times for disciplinary and medical emergencies. For Kellie Hannum, a language arts teacher, having the tags means feeling safer. "I've been teaching for 16 years and have always felt isolated," she says. "Communication has been our biggest hurdle. We're using Wi-Fi technology to reduce that isolation."

"Not everybody wants guns [in school], and not everybody can carry a gun. But everybody can carry a tag around his or her neck."

BRAD FORD, SKYVIEW

Just knowing that teachers can summon security at any moment seems to act as a deterrent, Hannum adds. "The kids know it's location-enabled, and the fact that we're all connected is very much in their minds," she says. "When we're out in the hallways, I've noticed far less behavior that would be questionable because we have a way to get other support staff there quickly if something were to happen. It's one more thing for them to think through before they take action."

Students feel safer as well, Hannum adds. "I deal with the older kids and, much as they may have a tough exterior, they see things in the news and they worry about their own safety," she says. "It has done wonders for them, knowing that at the push of a button or a pull of the device I can get help, and let other people know there are things going on that shouldn't be."

Another huge advantage is that when emergency personnel show up at the school in response to a call, they don't have to wonder where to go. Dispatch personnel have access to the same Vision interface Ford has, so they can see who called for help, and the location and nature of the emergency.

"Multiple times, the fire department would arrive and ask me, 'What have we got?'" Ford says. "I would have no idea because a teacher called the nurse and the nurse called 911 directly." With the Ekahau system in place, Ford is alerted to the location and nature of an emergency before assistance arrives, and dispatchers also have access to the Vision interface so they can see for themselves.

Giving emergency responders a better view into what's going on can make all the difference, Ford adds. "Unfortunately, we take our research from things that have happened. In Columbine, it took responders three hours to move through the building, and we lost a teacher [he bled to death awaiting help while responders made sure the building was secure]. If we can stop an incident, and get people where they need to be faster, and so save more lives, the system pays for itself."

2014 RFID JOURNAL AWARD

TAIWAN FISCAL INFORMATION AGENCY

GREEN AWARD

Electronic Invoices Reduce Paper Consumption

The Taiwan Fiscal Information Agency uses RFID and NFC technologies to enable shoppers to receive e-receipts.

BY BOB VIOLINO

In 2006, Taiwan set out to improve environmental conditions on the East Asia island. The state was issuing more than 8 billion paper invoices annually—the equivalent of 80,000 trees and 3,200 tons of CO_2 emissions, according to the Taiwan Fiscal Information Agency (FIA), a division of the Ministry of Finance.

The FIA launched an electronic invoicing system for business-to-business transactions. The effort helped reduce paper consumption, but not nearly enough. So in May 2010, the FIA established a three-year project to encourage the use of electronic invoices in the consumer sector.

From the outset, the FIA determined that radio frequency identification technologies could provide a convenient and secure way for consumers to receive and access e-invoices, according to Su Chun-Jung, director-general of the FIA and the project leader. To enable electronic invoicing, the organization needed a mechanism to link an e-invoice to its recipient. The FIA introduced the concept of a "carrier"—in essence, an identifier that is used to "collect" e-invoices.

Many consumers were already using RFID-enabled EasyCards to pay for rides on the island's Mass Rapid Transportation system and to purchase items in retail stores. (The EasyCard is based on NXP Seminconductors' Mifare contactless smart card technology.) Unlike ATM and credit cards, EasyCards are anonymous, so the FIA chose EasyCards as the carrier for e-invoicing, to reduce privacy concerns, Chun-Jung says. The agency determined that smartphones equipped with Near-Field Communication technology could also serve as carriers.

The FIA hired consulting firm PricewaterhouseCoopers (PwC) to design the e-invoicing process in physical retail channels and to help the agency establish strategies to promote the solution. The organization also brought in TradeVan Information Service as the systems integrator, to implement the back-end system that would support e-invoicing.

Today, more than 25,000 convenience and retail stores have adopted the

PHOTOS: FIA

Consumers can use their EasyCards to provide identification and associate their purchases with their e-invoices.

e-invoice solution, and the FIA expects that number will grow to more than 30,000 by the end of the year. Consumers that shop at brick-and-mortar stores can use their EasyCards to provide identification and associate their purchases with their e-invoices. They can also use their EasyCards to review their e-invoices at kiosks in convenience stores. (Taiwan has the highest density of convenience stores in the world, according to the FIA.) In addition, consumers can use their smartphones to receive e-invoices.

Making E-Invoicing Easy

The FIA set up a crossfunctional team with representatives from PwC and Trade-Van, as well as lawyers, researchers, system testers and marketing specialists. The team recognized that the success of the project rested on making the solution simple for both retailers and consumers.

Trade-Van developed an E-Invoice Integrated Service Platform that retailers could access through the Internet when processing e-invoices for customers. The cloud infrastructure includes three levels: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).

Each EasyCard is embedded with a unique number. During a transaction, the retailer simultaneously transmits the card number and e-invoice to the E-Invoice Platform. The customer can check an invoice at a kiosk by entering the number, so the process remains anonymous.

Trade-Van performed a security risk analysis for the whole system. The platform has an ISO 27001 certification for information security management.

The team estimated that roughly 20,000 merchants would need to connect to the E-Invoice Platform and upload approximately 12 million e-invoices daily, so team members tested the solution to ensure the collected data was accurate and the system could handle all the data. Then they adapted the E-Invoice Platform to distribute loads among dozens of systems. Finally, they

To make it easier for retailers to communicate with the E-Invoice Platform, the FIA developed a "turnkey" program that it gives to businesses for free.

evaluated the usability of the solution.

The FIA selected several major retail chain stores to field-test the solution. It installed an RFID reader that operates with a point-of sale (POS) terminal at each store's checkout counter, to record information from a carrier (either an EasyCard or NFC smartphone) and connect it with transaction data. The POS was equipped with a printer to print out paper-based invoices for customers who did not pay with a carrier. The pilots revealed several issues that the team addressed.

First, retail chain stores used different rules to represent the identity of RFID cards. That would mean people could not review all their e-invoices from different retailers at one kiosk. To solve this problem, the FIA defined rules to represent the identity of RFID cards.

Another issue involved the timing of uploading data to the E-Invoice Platform. Chain stores typically executed batch jobs to collect e-invoices from each register, but some retailers weren't always able to connect to the Internet.

Today, roughly 10 percent of Taiwan's consumers opt for paperless invoices.

The FIA decided to allow retailers 48 hours to upload e-invoices to the E-Invoice Platform. To accommodate customers that might not want to wait that long to access their invoices, the FIA defined the E-Invoice Delivery Specifications in Physical Channels, to enable retailers to deliver e-invoices to customers' smartphones via NFC.

To make it easier for retailers to communicate with the E-Invoice Platform, the FIA developed a "turnkey" program that merchants can install on their enterprise resource planning (ERP) or other back-end system. The program puts all e-invoice data into specified folders and uploads it into the E-Invoice Platform automatically. The FIA gives the turnkey software to businesses for free.

Because some retailers want to enhance existing POS applications or build mobile applications, the FIA also defined application programming interfaces (APIs) for developers to create customized systems.

Growing Acceptance

The e-invoicing project took two years to complete. When the FIA launched the system, it organized a promotion team that included marketing and IT specialists, as well as business consultants. As part of its efforts to build momentum for e-invoicing, this team developed programs to educate retail employees about e-invoicing.

"Transforming paper invoices to e-invoices is a change of consumer behavior," Chun-Jung says. "We provide both face-to-face and online courses to employees of merchants adopting e-invoicing, to introduce the concept of e-invoice and [the] benefit of it." The agency also prepared frequently asked questions and responses and provided this to merchants so their employees could troubleshoot any problems that might arise. Now, the FIA says, the system promotes itself.

The e-invoicing solution is meeting the FIA's goals. Today, roughly 10 percent of Taiwan's consumers opt for paperless invoices. Many stores have more than one kiosk where customers can use their EasyCards or smartphones to review their e-invoices.

The agency is now expanding the e-invoicing system to department stores, restaurants, transportation facilities and other retail venues. "In the near future," Chun-Jung says, "we will work on implementing this system into virtual channels, such as online shopping websites."

RFID End-User Case-Study DVDs

RFID Journal has created a series of DVDs containing presentations by end users, recorded at various live and online events.

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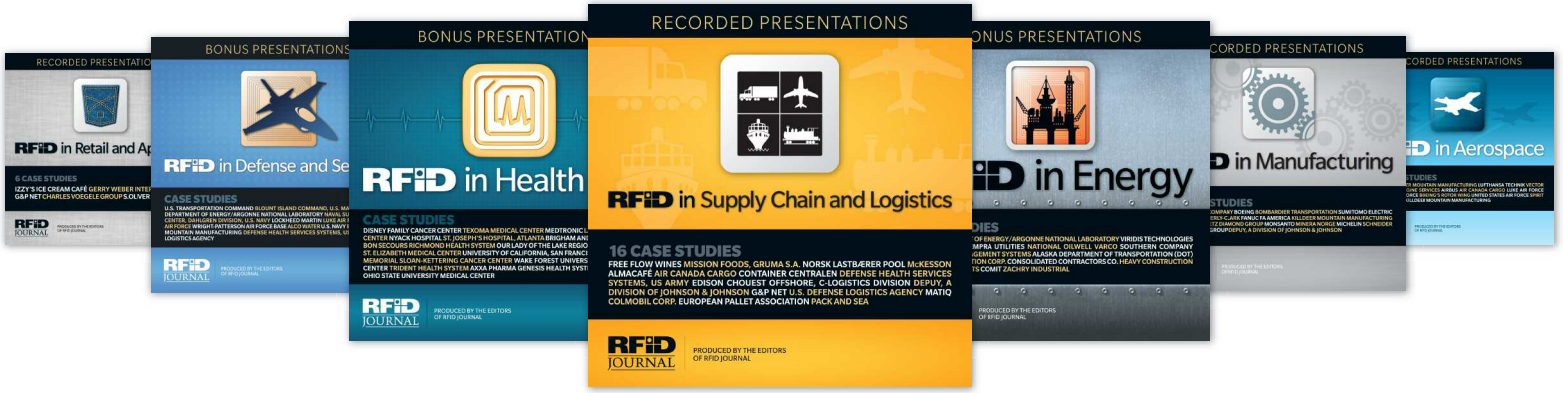

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2014 RFID JOURNAL AWARD

POST FOODS

BEST NFC DEPLOYMENT

Post Foods Adds NFC to Cereal Marketing Mix

Concertgoers accessed custom songs and video with their smartphones.

BY JILL GAMBON

The breakfast cereal business is highly competitive, with annual U.S. sales topping $10 billion. Each year, food companies spend hundreds of millions of dollars on advertising. Post Foods, which makes GrapeNuts, Honey Bunches of Oats and 13 other brands, is always on the lookout for ways to engage directly with consumers, to boost awareness of its cereal products and cultivate customer loyalty. As part of its digital marketing strategy, the old-line company has embraced emerging technologies. "It's a very competitive space," says Michael Foley, Post Foods' senior brand manager. "You have to try to break through the clutter."

Last year, Post Foods decided to try using Near-Field Communication technology to connect with consumers and encourage them to interact with custom-developed, branded digital content. The company also wanted to see whether the data from the customer interactions would provide insight into consumer behavior and a way to measure the effectiveness of the campaign.

Post Foods tested the NFC solution at a concert in Miami, which the company was sponsoring under the banner of its popular Honey Bunches of Oats brand. It provided concertgoers with NFC-enabled cards that allowed them to access unique content, including downloadable songs, videos and a customer survey, using their own NFC-enabled smartphones. "We wanted to see what consumer acceptance would be," Foley says. "And we wanted to get out ahead of the curve."

More concertgoers than expected activated the cards and used their NFC phones to access the digital content. "NFC is truly an affordable and effective way to engage our consumers," Foley says. "It is now definitely part of our marketing toolkit."

PHOTOS: POST FOODS

At the El Tour Positivo event, in Miami, more concertgoers than expected activated the NFC cards and used their smartphones to access the digital content.

A Controlled Environment

In 2013, Post Foods hired Camintel Group, a New York City-based startup that develops mobile applications for engagement marketing campaigns, to help develop the NFC solution. In a twist on traditional consumer advertising and outreach, engagement marketing seeks to actively involve individuals with a brand or product through social media or other means. It took just three weeks to design the solution.

Camintel provided the customized printed NFC tags and the cloud-based digital marketing platform, known as Touch2Like, which was optimized for mobile devices. XL Alliance, a cross-cultural marketing and strategy firm that works with Post Foods on digital and social-media campaigns, developed the content, which was hosted on Camitel's servers and could be updated or refined as needed.

Post Foods wanted to test the NFC marketing solution in a controlled environment, where attendance was limited and company representatives could be on hand to assist concertgoers who weren't familiar with their phones' NFC capabilities. The trial was integrated with another company marketing campaign—a Honey Bunches of Oats-branded national summer concert series known as El Tour Positivo (The Positive Tour), which targets Hispanic customers. The solution was introduced during a concert at Miami's Dolphin Mall, with the Venezuelan pop-duo Chino y Nacho, Latin Grammy winners, as headliners. Univision Radio, the leading Spanish radio network in the country, was a partner in the event.

At the El Tour Positivo event, "Bunchecitas"—brand ambassadors hired to interact with audience members—handed out boxes of Honey Bunches of Oats cereal to concertgoers, along with roughly 300 cards that bore the words "¡Descubre Más!" (Discover More!). Each card was embedded with a Smartrac BullsEye 13.56 MHz NFC tag made with an NXP Semiconductors NT203 chip. Instructions were printed on the card, in both English and Spanish, explaining the four-step process needed to access specially developed content,

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Bunchecitas—brand ambassadors hired to interact with audience members—demonstrated how to tap the phones on the NFC cards to access the custom content.

including music, videos and a survey. As concertgoers entered the venue, the Bunchecitas demonstrated how to tap the phones on the NFC cards to access the custom content. The phone's NFC reader captured the card's unique identification number and accessed a webpage associated with the Tour Positivo concert. Attendees also could access the material by typing in a QR code or URL.

An Engaged Audience

The Chino y Nacho audience, which was predominantly Spanish-speaking, was well-suited for the NFC project, Foley says, since Hispanic consumers are more likely to use Android and other smartphones with NFC capabilities than other groups. Apple iPhones do not come with NFC capability, although there is widespread industry speculation that will change with the next version of the phone.

Introducing the NFC project was a relatively simple process, Foley says. Camintel tested all the NFC cards before they were distributed, and there were no performance problems. The only challenge was the audience members' unfamiliarity with activating or using NFC features in their phones. But with assistance from the Bunchecitas, most people quickly learned how to activate the NFC features, he says.

Post Foods reports that 22 percent of the cards were activated—the majority via NFC devices, which exceeded Foley's expectations. Four percent of concertgoers used a QR code to access the custom content, and 4 percent typed a URL into their phone's browser. To his surprise, some people went back days or even weeks after the concert to access the content via the NFC card.

What kind of content was of most interest to consumers? The performing artists' music and videos, rather than Post's branded content and survey.

After the event, Camintel provided Post Foods with reports on how the campaign's content was accessed and viewed via its measurement software, Celerity Insight. With those reports, Post gained visibility into the NFC project, seeing what types of devices consumers used to access the online content and how much time was spent viewing the different types of content. In addition, Post was able to collect zip codes and IP addresses for targeted advertising. "It was an efficient way of collecting [consumer] data," Foley says.

Based on these results, Post Foods is incorporating NFC applications into its marketing efforts at as many as eight events this year. The company plans to distribute roughly 3,000 NFC cards to consumers and bloggers at concerts and other events, Foley says.

Post Foods also plans to expand its use of NFC technology for marketing. Foley expects NFC will be used to deliver tailored, consumer messaging, including updates on products or events, news about artists affiliated with the cereal brands, targeted coupons and more. The company says it will target both Hispanic and non-Hispanic audiences and different age groups. "This is a great way to go about brand management surgically," Foley says.

A benefit of using Camintel's cloud-based platform is that the content residing on the servers can be tweaked or updated for different events, Foley says, while the same version of the NFC card can be used at multiple events. Each card costs $1, and by eliminating the expense of reprinting, he says, it's an "extremely effective" solution. He envisions using the cards for tap-and-pay scenarios, to purchase Post brands online or at a local grocery store.

Foley believes using emerging technology to market an established product is a recipe for success. "It is really refreshing for consumers," he says. "We believe this is an excellent example of an established brand working with an emerging technology to provide a rewarding customer experience."

2014 RFID JOURNAL AWARD

NXP Semiconductors

Best New RFID Product

Smarter Things

NXP's NTAG I²C NFC chip enables consumers and businesspeople to use smartphones to communicate with myriad electronic devices, cars and buildings.

BY PAUL PRINCE

If only the walls—and other things—could talk! Now they can—and you can talk to them—thanks to NXP Semiconductors' new NTAG I²C NFC chip, which adds smart functionality to household appliances, thermostats, automobiles, office equipment, health-care devices and building infrastructure.

The chip combines passive high-frequency Near-Field Communication technology with a built-in I²C interface, enabling users to communicate directly with any tagged item via an NFC reader. What's smart about this solution is that it does not require consumers or businesses to purchase dedicated RFID readers. Instead, you can use the NFC reader that's standard on most mobile phones today to connect with the tagged products or things.

"Thirty years or so ago, when we were Philips Semiconductors, we invented the I²C serial interface," says Victor Vega, NXP's director of NFC and RFID solutions. "For our NTAG I²C chip, what we did was add a front-end NFC RFID, and connect it with I²C on the back end, so you dynamically make changes to a device whether there is power on or not."

An appliance manufacturer, for example, could install an NTAG I²C chip inside a basic washing machine and transform that appliance into a high-end product with more features, for little additional cost, Vega says. "Washing machines come in two flavors," he says. "One might be the low end of the spectrum, where you have your basic settings, such as temperature. But we can use an NFC phone as a remote interface and get a lot more."

For businesses, the NTAG I²C chip could solve the problem of getting consumers to register new appliances with manufacturers, Vega says. Tapping a smartphone against a washing machine when it is turned on for the first time enables the phone's NFC reader to receive the machine's serial and model numbers. "My phone has my personal information," Vega explains, "so for my registration process, I can say 'autofill and submit.' I am now registered in the cloud. Only 35 percent of the population fills out the warranty card, and when they do it costs the product manufacturer $2 apiece. So we just saved the company big bucks and got the population to register."

Consumers could access a range of options when they're ready to do a load

PHOTOS: NXP SEMICONDUCTORS

What's smart about this solution is that you can use the NFC reader that's standard on most mobile phones today to connect with the tagged products or things.

of wash. Most basic machines offer limited settings: cold, warm, hot; small, medium, large. But when a consumer taps a smartphone against a washing machine, the handset's screen could display an expanded range of choices. "Instead of 140 degrees, maybe I want 115," Vega says. "Maybe I want something in between small and medium for my load size. I can pick soil type and extend my spin cycle. If my child is napping, I can turn off the machine's alert function. And I can put the child-protection feature on, so he can't put the cat in the machine and turn it on."

If the washing machine LED screen displays an error code, instead of hunting for the owner's manual, the user could tap the phone against the machine and the phone would retrieve the information from the Internet, Vega says. "Error 3, the phone tells the consumer, indicates we have a foreign object in the gasket," he says. "Then, the phone provides an instructional video. Now, I eliminated the need for a service call."

If an appliance is completely out of commission and requires a service call, a consumer could tap the phone against the machine to schedule an appointment via the Internet, Vega says. When the repair worker arrives, he or she could tap a smartphone against the appliance to put the machine in service-diagnostics mode and retrieve all the error codes stored in the NTAG I²C tag, as well as the machine's repair history. If the problem were related to the appliance's firmware, Vega says, the worker could have the phone retrieve new firmware via the Internet and use the handset's NFC reader to load that software into the machine.

The appliance manufacturer could provide all this additional functionality merely by installing an NTAG I²C chip, at a cost of less than 50 cents, Vega says. To build comparable features into the appliance, he notes, might require a $20 touch screen and $10 Wi-Fi unit.

The NTAG I²C chip also could be used for other applications. The chip's RF energy-harvesting feature, for instance, could power LEDs and sensors via an NFC phone. In California, for example, buildings could have stress indicators installed on the supporting beams behind walls to detect damage caused by earthquakes, Vega says. "You don't want to open up the Sheetrock, and you don't want to put batteries in there," he says. "So what do you do?"

His suggestion: Install passive strain gauges powered by an NTAG I²C chip. Once a year, an employee could visit the building and tap an NFC phone against the walls; the sensors would indicate whether the beams were intact.

There is a multitude of other ways the NTAG I²C chip could help end users solve business problems or improve business operations, Vega says. A worker at a car-rental company, for example, could use a smartphone to quickly retrieve mileage, fuel, fluid levels and other information. "Your mind can go nuts with what you can do with this chip," he says.

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2014 RFID JOURNAL AWARD

Joseph Andraski

SPECIAL ACHIEVEMENT

Item-level Idealist

Joseph Andraski saw the value of RFID in retail and worked energetically to promote its adoption.

BY MARK ROBERTI

The Special Achievement Award was conceived to honor those who have made a significant contribution to the radio frequency identification industry, through the development of standards or education of businesspeople about the technology's value or in some other way. Joseph Andraski, this year's recipient, has probably done more to promote the use of RFID at the item level—in retail, specifically—than anyone else.

Andraski was president and CEO of the Voluntary Interindustry Commerce Solutions Association, known simply as VICS, from 2004 to 2012. VICS was founded in 1986, and he was elected to run the organization after a 25-year career with Nabisco as VP of supply-chain management. Andraski understood supply-chain issues, and he used that knowledge at VICS, where he led an effort called Collaborative Planning, Forecasting and Replenishment. Its goal was to foster cooperation between retailers and suppliers to reduce out-of-stocks and increase supply-chain efficiencies.

In 2008, VICS and GS1 funded research at the University of Arkansas' RFID Research Center to determine the value of RFID for managing inventory of clothing items in stores. A study at Dillard's stores found that RFID could boost inventory accuracy from roughly 65 percent to better than 95 percent. Another study, at Bloomingdale's, supported the earlier findings.

In 2010, Andraski led the formation of the VICS Item-Level RFID Initiative (VILRI), supported by Dillard's, Macy's, Walmart and other retailers, as well as some of their leading suppliers. The VILRI worked to promote adoption of RFID in retail and provide guidelines for the way the EPC Gen 2 standard should be used, so practices would be compatible among supply-chain members. It addressed questions that needed to be answered for RFID to gain widespread acceptance in retail, such as whether tags would be embedded in existing clothing labels or added in separate labels, and what data would be on the tags.

These efforts encouraged more retailers to begin using RFID technology in their operations and speeded the pace of adoption. In October 2012, VICS merged with GS1 US. Andraski left the organization and the initiative was put under the purview of GS1 US.

In a statement announcing Andraski's departure, Peter Longo, co-chairman of VICS and president of logistics and operations at Macy's, said Andraski had "guided VICS through a series of significant developments in key business areas like RFID, data synchronization, retail out-of-stocks, floor-ready merchandise, logistics and Collaborative Planning, Forecasting & Replenishment."

Andraski continues to write articles for magazines and speak at events, promoting the value of RFID in retail. There is no doubt his leadership, energy and enthusiasm has helped advance the adoption of item-level RFID in retail.

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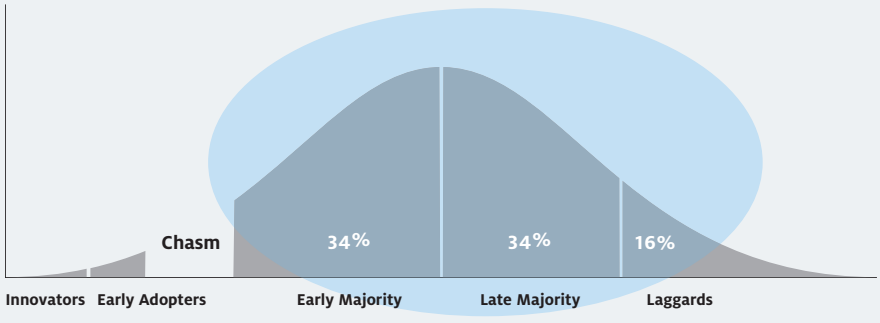

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The State of Reader Interfaces

UHF RFID companies can do more to ease the job of application developers.

By Ken Traub

WHILE I WAS at RFID Journal LIVE! in April, I visited most exhibitors of passive ultrahigh-frequency RFID to assess how their products support software development. I focused especially on the ease with which application software can get the data it needs from RFID readers. This is crucial to allow developers to focus on the business side of their applications.

GlobeRanger, InSync, OATSystems and RFID Global Solution each offered mature middleware—software that interfaces with readers and provides a sophisticated environment for creating RFID-based applications. Each vendor markets to specific industries, which promotes adoption in those verticals. But application developers in other sectors may not realize they could use one of these middleware products as well.

Developers can also interface directly with readers to build applications, but three of the four options available have disadvantages. Most readers have a proprietary interface, application toolkit or application programming interface (API). These are relatively easy to use, but change your reader vendor and you have to rewrite all the code that "talks" to the reader.

For this reason, many readers also support the GS1 Low Level Reader Protocol (LLRP), a standard interface that is the same regardless of vendor. But as the name suggests, this is a low-level interface, which means managing even a simple tag read is complex. Many of the vendors I spoke with reported that few customers use LLRP.

Another type of low-level interface supported by some readers is called a "wedge," which is good for an application that reads a single tag when a user presses a button. The wedge interface delivers the tag contents to a host computer in a way that simulates keyboard input.

All three of these interface types share a big disadvantage: The application gets just the binary contents of the tag's Electronic Product Code memory. But an application needs to have the data decoded as an application-level identifier—for example, a Serialized Global Trade Item Number (SGTIN). An interface giving an application the binary contents is like a bar-code reader providing only the pattern of black and white bars without decoding it.

The fourth kind of interface is based on another GS1 standard called Application Level Events (ALE). Using ALE, the application just states what data it wants. ALE delivers the data fully decoded, in a format most application programming languages are designed to understand.

Only a few vendors I spoke with—notably Harting and Mojix—said their readers support ALE; Intermec and Motorola (now Zebra) offer limited support on some models. Many vendors had not heard of ALE or did not understand its benefit to application authors. I think this is a shame, because readers with the ALE standard could help foster RFID adoption and the development of innovative applications.

Ken Traub is the founder of Ken Traub Consulting, a Mass.-based firm providing services to companies that rely on advanced software technology to run their businesses. Send your software questions to swsavvy@kentraub.com.

ILLUSTRATION: ISTOCKPHOTO

A Monumental Shift at LIVE! 2014

Retailers are no longer asking, "Should I?" They now ask, "How?"

By Bill Hardgrave

"I CAN REMEMBER the first RFID Journal LIVE! event, in 2003," I recently told a group of students. "Wow!" they said. "What was it like in the old days?"

"Well, way back then," I said, "people came to the conference to learn how to spell RFID." OK, so maybe that's an exaggeration, I admitted, but not by much. I recall the conference buzzed with excitement about the new technology. Walmart had asked its top suppliers to begin tagging pallets and cases, and the talk was about the "mandate" and how to satisfy it.

Let's be honest, in 2003 the technology was good, but it wasn't great. At Walmart's request, I began assisting suppliers in their tagging efforts, and soon after, I founded the RFID Research Center to further this mission.

At RFID Journal LIVE! 2014, the mood was unlike any I have seen. Attendance—by both end users and exhibitors—was up. End users were well-informed and asked intelligent questions during conference sessions and at vendor booths, to learn how to best use RFID to improve their own operations. Among the retailers, in particular, there was a palpable sense of urgency. Those who had not begun using RFID were feeling anxious about how late they were to the game, and those who were using the technology to improve inventory accuracy wanted to add applications (more on those use cases in my next column).

As at past events, I assisted RFID JOURNAL and GS1 with a preconference workshop for retailers and suppliers. Attendance has always been strong, but this year, the room was packed with many new retailers and many more suppliers. The supplier interest is particularly noteworthy, since we have reached the point in adoption that requires their participation.

RFID JOURNAL and GS1 also hosted a retailer-supplier luncheon, which provided an opportunity for folks from Macy's, VF and other companies who have been using RFID for several years to interact with those who were just getting started. The open-discussion format lasted well past the allotted two hours. To suggest attendees were thirsty for knowledge would be an understatement.

In addition to the workshop and luncheon, I met individually with many retailers and suppliers. In fact, I had so many meetings during

the event that I was able to attend only a few conference sessions; luckily, I was able to watch the rest of them online (they are posted in RFID JOURNAL's video library).

"Since you've witnessed the ancient RFID," my students asked, "do you have any prognostications about the future?"

"Hard to say," I replied. "I'm fairly certain RFID in retail will be commonplace. And I'll probably travel to LIVE! 2024 in an autonomous vehicle."

Bill Hardgrave is the dean of Auburn University's Harbert College of Business and the founder of the RFID Research Center. He will address other RFID adoption and business case issues in this column. Send your questions to hardgrave@auburn.edu. Follow him on twitter at @bhardgrave.

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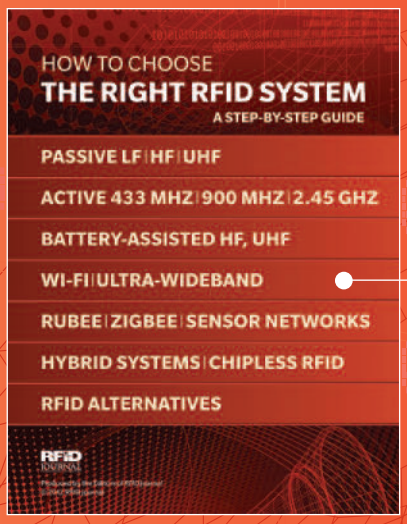

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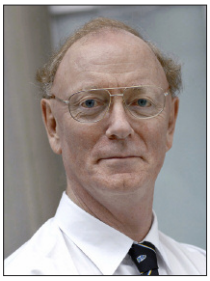
RFID takes the guesswork out of shipping and receiving.

By Ian Robertson



One of industry's most contentious issues is a customer claim that goods shipped by a supplier were not received or were received only in part, or that the wrong parts or items were sent. The supplier is not at the customer's receiving dock, so it cannot verify the claim.

The process of reconciling what was received against what was shipped incurs additional work, cost and time for both supplier and customer, and it can generate ill feelings between the supply-chain partners. Large customers may impose fines if they believe an order was not delivered correctly, and suppliers are likely to pay rather than risk losing the customer. Yet a 2004 study conducted at HP, when I was the company's worldwide program director of RFID, showed that in 82 percent of cases, the correct goods were delivered and most errors occurred on the receiving dock.

RFID can play a vital role in receiving reconciliation by enabling electronic proof of delivery (EPOD). Here's how it works: The supplier RFID-tags shipments and reads them automatically as they pass through a fixed portal at the warehouse exit. The data is uploaded to an Electronic Product Code Information Services (EPCIS) repository, so it can be shared with the customer. The tags are read as the goods move through a fixed portal at the customer's receiving dock, and the data is then shared with the supplier. Once all items in an order have been "seen" by the customer and confirmed to be accurate, the customer can pay the invoice. (If the goods are subsequently mislaid, the responsibility falls squarely on the receiver, not the shipper.)

Note that EPOD does not eliminate all receiving errors—genuine errors will still occur. But it does eliminate the need to chase down false errors and provide good data for resolving genuine errors.

The concept and value of EPOD was demonstrated 10 years ago, yet I don't know of any supply-chain partners that are using it. There are several issues, including the fact that few folks are aware of or understand the process. EPOD also requires cooperation—and trust—between two companies. While supply-chain partners often share data to execute demand planning, it is far less common to share data on actual operations. The concern is that this information could be used to measure contractual performance or raise questions regarding a partner's suitability. Still, the benefits outweigh the risks.

If order reconciliation is a concern at your company, I recommend sitting down with your partners and discussing the mutual benefits of employing EPOD. It is relatively easy and inexpensive to deploy. Keep in mind that EPOD data can also support auto-replenishment, which I'll explore in my next column.

Ian Robertson is CEO and president of Supply Chain RFID Consulting, a Texas-based firm providing services to companies that want to understand how to use and implement RFID internally and with partners. Send your supply-chain questions to ian.robertson@s-c-r-c.com.

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