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RFID JOURNAL

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  Promoting Professionalism In The RFID Industry
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ROLLING OUT RFID

8 Key Strategies

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Based on a new survey of RFID end users, this guide reveals:

- The state of adoption by industry and region
- Who the RFID buyer is
- How companies make RFID investment decisions
- The applications end users are pursuing

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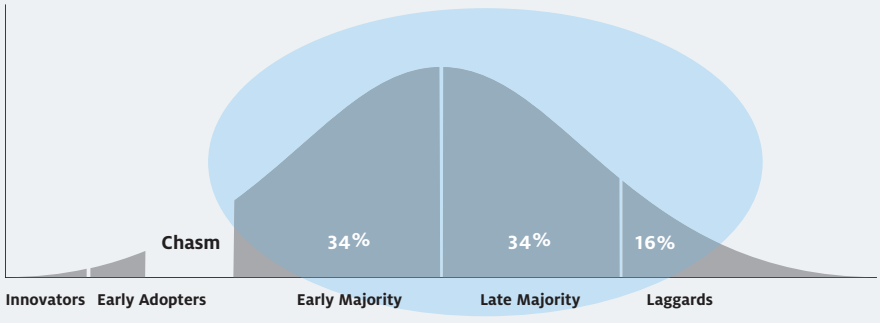
Almost 85 percent of companies won't invest until RFID crosses the chasm



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COVER ILLUSTRATION: STOCKPHOTO

tune in online

Find New Business Opportunities

RFID providers now have a new source to find companies worldwide that are actively seeking to deploy the technology. RFID Requests for Proposals is updated regularly, with new RFPs from companies in diverse industries. Each RFP includes detailed information, contacts and submission deadlines.

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Find products that can help you deploy RFID successfully, such as Keonn's AdvanFitting solution for retail fitting rooms. The narrow-beam antenna detects tagged items and enables the customer to interact with a touch screen. It also minimizes stray reads from neighboring fitting rooms.

Most-Read Stories in January

- General Motors Factory Installs Smart Bolts in Engine Blocks, Cylinder Heads
- Kohl's Rolls Out RFID for Select Product Categories at Its Stores
- Iotera Develops Active RFID Tag With 4-Mile Read Range
- Alien Markets Small EPC Tag With Long Read Range
- Proof Obamacare Requires All Americans to Be Chipped

Top 10 Search Terms On RFIDJournal.com

1. NFC
2. Kohl's
3. Round Rock
4. Blood tracking
5. Construction
6. Power Mapper
7. RTLS health care
8. Warehouse applications
9. American Apparel
10. Walmart

The Inside Scoop

What are end users saying behind the scenes? Why should the RFID community be optimistic about the industry? Who's spreading misinformation? Get insight and perspective at the RFID Journal Blog.

Ideas Exchange

RFID Journal maintains an Ask the Experts forum, where you can submit questions about RFID technology and its applications. Your questions will be answered by RFID Journal editors or outside experts. Recent questions include:

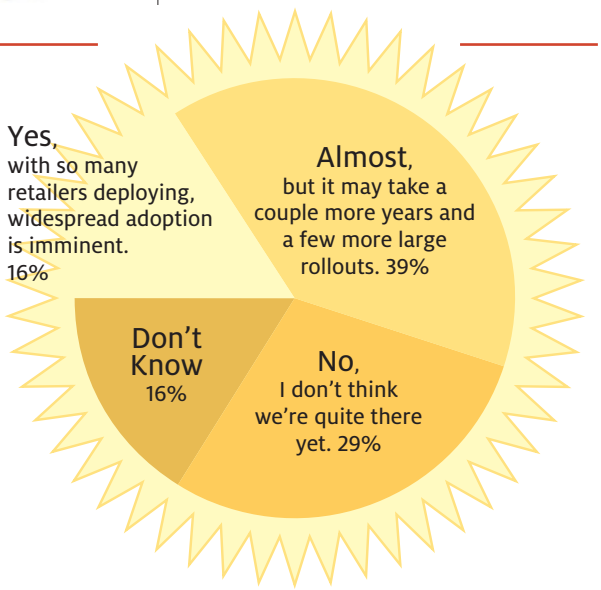
- Can RFID prevent tool theft?
- How much does an RFID tag cost?
- Where can I find a list of RFID vendors?
- Can RFID track objects containing metal?
- Are there any inexpensive RFID tags that can track surgical sponges?

POLL RESULTS

Has the retail sector reached a tipping point regarding RFID technology?

Cast your vote.

Each week, RFID Journal takes the pulse of the RFID community. See what other people are thinking—and make your opinion count.



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Using NFC to Deliver, Share and Collect Data

FEB. 11, 2014 • 11:00 AM - 1:00 PM EST

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MAR. 21, 2014 • 1:00 PM - 2:00 PM EDT

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Let's Roll (Out)

PHOTO: TOM HURST | RFID JOURNAL

WHEN WE LAUNCHED *RFID Journal* magazine in 2004, I envisioned it as something of a manual for RFID deployments. I don't mean that we would show you in these pages how to attenuate the output of a reader antenna. The magazine was, and still is, designed to be a reference companies can turn to for insights and information, so they can deploy RFID technologies successfully, to improve efficiencies and lower costs.

To that end, the magazine provides business strategies for deciding how to use RFID, case studies illustrating how companies deployed RFID, specifics on how organizations in a particular sector are using RFID, and guidelines for choosing hardware and software, based on the application. In addition, we synthesize the lessons companies learn from their RFID deployments into best practices for new adopters. Our cover story in this issue examines best practices for rolling out an RFID system from one site to multiple locations (see page 14). We talked with end users who have led multisite rollouts, including Cisco's Maryanne Flynn and Disney's Vinny Pagliuca, and solution providers who have been involved with numerous multisite rollouts.

In some ways, rolling out RFID to multiple sites is no different from rolling out any new technology across the enterprise. You must develop business and deployment plans. But RFID is still a relatively new technology, and you want to make sure your plans address specific issues. That's where those with experience deploying RFID can help you avoid pitfalls and make smart choices. Among the questions our best practices story helps to answer are:

- Should you require that all sites use the same hardware and software or provide some latitude about specific technology?
- Are workflows and processes the same at all sites or will adjustments have to be made?
- Can you transition to RFID without interrupting current business processes?
- Do the new facilities have any unique characteristics that could affect the RF performance of the system?

The answers we provide to these questions and other critical issues will be valuable regardless of the RFID solution you plan to roll out.

The mining industry is not a sector often associated with high technology, but a few companies, such as Vale, have been rolling out RFID systems, to automate manual processes and improve worker safety. In fact, using RFID for personnel tracking is a growing trend in many developed regions. Now, Vale and other early adopters are paving the way for using RFID to enable ventilation-on-demand, which improves air quality underground and delivers significant cost savings (page 22).

RFID Journal also keeps readers up to date on RFID innovations. Our Product Developments story on page 30 looks at the many emerging Near-Field Communication solutions, and the wide variety of NFC tags available for different applications.

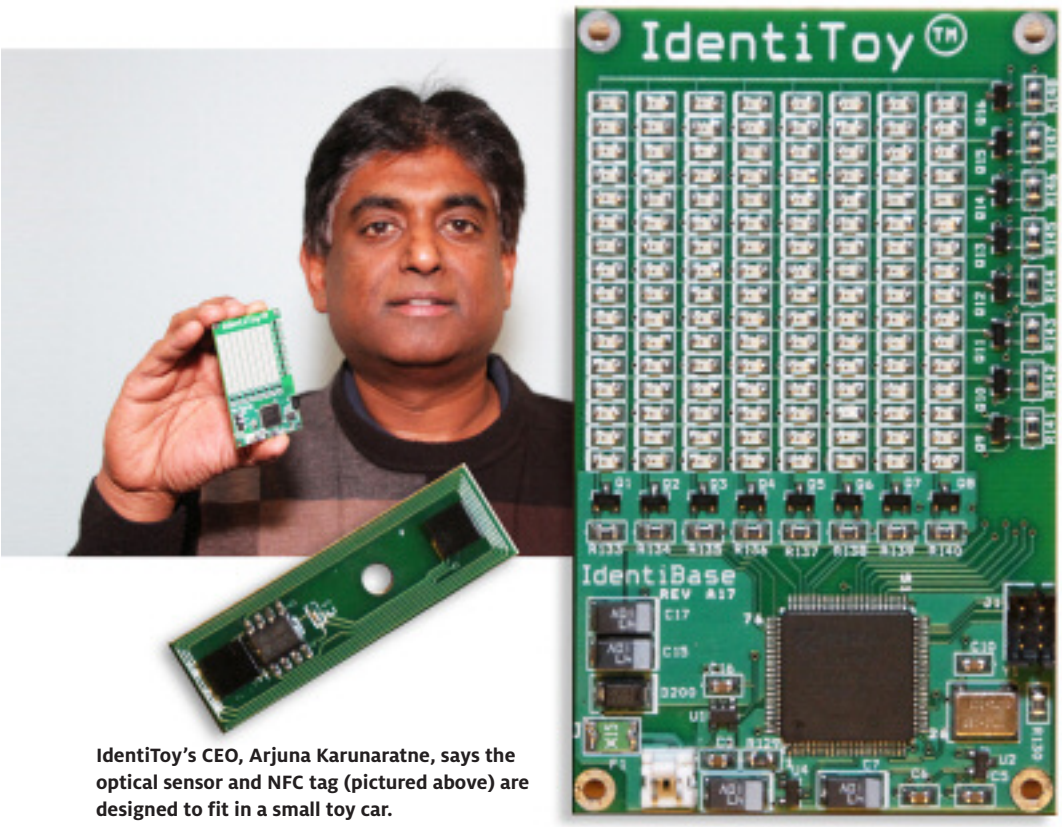
If you're planning a multisite rollout, I hope you'll first take a few minutes to read our cover story. It could save you a lot of headaches down the road.

Mark Roberti, Founder and Editor

ENTERTAINMENT

Turning Tablets Into Playland

By combining NFC technology and optical sensors, a startup hopes to enable tablets to recognize and interact with multiple toys simultaneously.



IdentiToy's CEO, Arjuna Karunaratne, says the optical sensor and NFC tag (pictured above) are designed to fit in a small toy car.

KIDS LOVE THEIR TOYS. They also love games on tablets, so it was inevitable that companies would invent toys that interact with scenes displayed on tablets. Disney, for example, has developed AppMATes. Small cars modeled after characters in the animated movie *Cars 2* have touch sensors that allow them to interact with the touch screen. As children move the cars, they can interact with images in a *Cars* application.

The current toys use touch technology, so only a few toys can be on the tablet surface at once. A company called IdentiToy hopes to overcome that limitation. Using Near-Field Communication technology, a tablet would be able to identify numerous toys on the tablet screen simultaneously. An optical sensor in the base of each toy would get position data from the tablet, which would be relayed back to the tablet via the NFC transponder. This would enable the screen to change as the position of the toys change.

IdentiToy has developed a prototype to prove the concept works and is offering an evaluation kit developers can use to create toys. The firm hopes to make money by licensing the technology. "There's a huge market for toys that can be put on a tablet to create an interactive experience," says CEO Arjuna Karunaratne. "That's what we are trying to promote."

The system won't work with most current tablets, because they don't have NFC readers and don't communicate position through a grid in the tablet screen. But Karunaratne says with a slight modification, the LEDs used to backlight tablet screens could create a grid with position data that would be communicated back to the tablet through an NFC chip, overcoming the limits of touch-based options.

"Imagine a child places a toy figure on a tablet, and the NFC reader in the tablet recognizes the toy," he says. "The device goes out to an external database, downloads the appropriate app and launches the app. And the child starts playing."

The concept could also be used for adult games. People could place chess pieces on a virtual chessboard, and the position of each piece could be saved, so the players could resume the game in the future. It could be a good teaching tool, as well. Placing an item on a tablet would call up interactive information about the object.

"I see this as being a part of the capabilities of all touch screens someday," Karunaratne says. "All devices will emit the position, and then people can use that information to have objects interact with the screen. The first tablet maker that provides positioning data and NFC capabilities will likely do well, just as Samsung benefited from embracing NFC technology in its phones." —*Mark Roberti*

PHOTO: IDENTITOY

ENVIRONMENT

The Birds and the Bees—And RFID

A simple tagging procedure could help solve a global problem.

HONEYBEES PLAY a critical role in the global food supply chain. They pollinate plants on farms worldwide, enabling crop production. But bee populations have been declining in North America, Europe and many other regions, due to colony collapse disorder (CCD), an unexplained disappearance of worker bees.

While CCD is not a threat in Australia, researchers at the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the county's national science agency, are RFID-tagging 5,000 honeybees in Tasmania to learn what environmental conditions are affecting bee behavior. Bees have been RFID-tagged before to try to identify the factors contributing to CCD and declining pollination rates, but this is the largest study to date.

The bees manage to fly normally with the chip positioned close to their center of mass.

PHOTO: CSIRO

"Honeybees play a vital role in the landscape through a free pollination service for agriculture, which various crops rely on to increase yields," says Paulo de Souza, head of the research team. "A recent CSIRO study showed bee pollination in Faba beans could lead to a productivity increase of 17 percent. Better understanding of bee behavior could help us improve pollination rates."

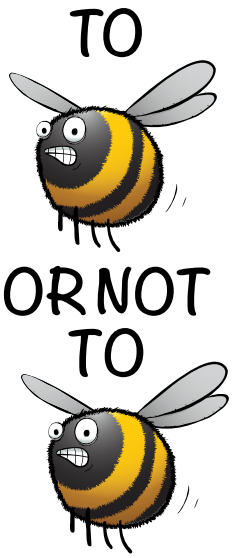
The project began in September 2013, when the researchers experimented with different glues and chip positions on the bees; the bees manage to fly normally with the chip close to their center of mass. The researchers chill each bee in a refrigerator for roughly 10 minutes, so the insect's metabolism slows down and they can glue a 2.5 mm by 2.5 mm RFID transponder from Hitachi Chemicals on its back. The transponders operate at 860 MHz to 960 MHz, and have an antenna etched into the chip itself.

The bees are released into the wild and then tracked using RFID readers from a variety of solution providers, which are placed around hives and feeders with pollen and nectar. "We managed to get readings from more than 10 RFID tags simultaneously at distances up to about 30 cm [almost 12 inches]," de Souza says.

The data collected enables the researchers to study when the bees leave the hive and when they visit the feeders. They hope to learn what environmental parameters influence bee behavior, and how pesticides added to pollen and nectar are likely to influence the bees' behavior or affect their health.

Data collection is scheduled to end in May, at which time it will be analyzed, and then the results will be published in a peer-review journal. De Souza and his team plan to deploy a new series of experiments in collaboration with the Vale Institute of Technology in Brazil, to investigate the behavior of bees and other insects in the Amazon region.

De Souza and the team hope their data will provide information the agriculture industry, government agencies and other organizations could use to better manage our environment and food production. —*M.R.*



Average annual honeybee colony loss in Italy:
50%

Average annual honeybee colony loss in Switzerland:
50%

Average annual honeybee colony loss in the United States:
45%

Average annual honeybee colony loss in Canada:
35%

Average annual honeybee colony loss in the United Kingdom:
34%

Average annual honeybee colony loss in Mexico:
30%

—Rich Handley

ILLUSTRATION: ISTOCKPHOTO

RFID CERTIFICATION

Promoting Professionalism in the RFID Industry

The International RFID Institute will offer its first certification exam at RFID Journal LIVE! 2014.

FOR THE PAST 20 MONTHS, I have been working with a group of dedicated professionals from the radio frequency identification industry to develop a roadmap for standardized certification exams, to promote professionalism in the RFID industry (see "Founding Members" on opposite page). We established the International RFID Institute and solicited feedback regarding the roadmap from members of the RFID community, including end users, systems integrators, hardware and software providers, and academics. We then revised the roadmap to incorporate their input. The institute is now preparing to offer a beta certification exam at RFID Journal LIVE! 2014, our annual conference and exhibition, being held April 8 to 12, in Orlando, Fla.

This exam is for the first of four levels of certification we hope to create (see "Certification Roadmap" on opposite page). The first level, the RFID Institute Certified Associate, would indicate to those hiring someone with the credential that the candidate has a fundamental knowledge of the different types of RFID systems and how they are used in business and consumer applications. The second level, the Certified Professional, also covers all types of RFID systems, but in more depth. The credential holder would have demonstrated a deep understanding of the different types of RFID systems.

The third level, the Certified Specialist, includes several exams, each focused on a specific type of RFID technology. It's designed to show that the certification holder has the detailed knowledge and skills to deploy the particular type of RFID technology for which he or she is credentialed. The aim is to get beyond textbook knowledge of RFID and demonstrate that the person understands and can address deployment issues.

The fourth level, the Certified Expert, is designed to highlight the level of knowledge achieved by someone who has passed all the Certified Associate, Professional and Specialist exams, and thus demonstrated the ability to deploy any type of RFID system.

The institute has drafted and approved a process for creating exams, which ensures the process is fair, rigorous and repeatable. For the first associate-level exam, we created a blueprint, solicited feedback from the community, revised the draft and approved it. We are now accepting questions from subject-matter experts. Then, other experts will edit and assemble the questions into the initial version of that exam.

The main goal of offering the first certification exam at LIVE! 2014 is to test the exam's validity. We want to ensure that all questions

ILLUSTRATION: ISTOCKPHOTO

are worded accurately and clearly. If not, we can revise as necessary, as well as change the content and format based on feedback from test participants. If the exam changes substantially, participants will be able to retake the exam within 12 months, free of charge. (Registration details for the exam will be posted on the RFID Institute website shortly.)

While RFID technology has become more reliable, it is still far from plug and play. As RFID adoption becomes widespread across many industries during the next 10 years, there will be a growing need for well-trained and experienced people to design and implement RFID systems. The International RFID Institute believes both end users and systems integrators will benefit from the certificate exams. Companies will feel confident they are hiring people who can ensure successful RFID deployments, and certificate holders will be more likely to land jobs. —*Mark Roberti*

Certification Roadmap

The International RFID Institute is developing four levels of RFID certification, which will cover all types of RFID systems and related technologies. This roadmap and the examination content could change over time as the industry evolves, and based on feedback from RFID experts and test participants.

Level One—RFID Institute Certified Associate (RICA): The RICA is intended for those who are just out of college or new to RFID. The RICA exam will cover the fundamentals of RFID and is designed to demonstrate that the RICA holder has the knowledge to understand the characteristics, proper usage and implementation considerations for the primary types of RFID in use.

Level Two—RFID Institute Certified Professional (RICP): The RICP is intended for those who have several years' experience in the RFID industry. Individuals who pass the RICP exam demonstrate that they have a comprehensive understanding of all types of RFID technologies and can evaluate technology options, identify potential problems and serve effectively on a crossfunctional RFID team. This certification is appropriate for those actively involved in designing or deploying RFID systems.

Level Three—RFID Institute Certified Specialist: This level includes four individual exams, each focused on a specific type of RFID technology. Those who pass an exam will receive an RFID Certified Technician (RICT) certificate for that technology.

The RICT-Passive UHF exam is designed for those who have mastered the complexities of passive UHF RFID deployments. Individuals with an RICT-Passive UHF certificate have demonstrated a level of expertise needed to deploy complex passive UHF RFID systems.

The RICT-Passive LF and HF exam is designed for those who have mastered the complexities of passive near-field RFID systems and deployments. Individuals with an RICT-Passive LF and HF certificate have demonstrated a level of expertise needed to deploy complex passive near-field RFID systems.

The RICT-Active exam is designed for those who have mastered the complexities of active RFID systems and deployments. Individuals with an RICT-Active certificate have demonstrated a level of expertise needed to deploy complex active RFID systems.

The RFID Institute Certified Software Developer RFID (RICSD) exam is intended for entry-level and midcareer software-development professionals who want to confirm their proficiency in developing RFID software applications and integrating RFID systems with existing software applications.

Level Four—RFID Institute Certified RFID Expert: This certificate will be awarded to those who hold all current RFID Certified Specialist credentials. This top designation indicates that the holder has demonstrated the ability to deploy all major types of RFID systems and has achieved the highest level of expertise in the RFID industry.

Founding Members

In 2012, the International RFID Institute was incorporated in the Commonwealth of Virginia. It has filed for nonprofit status with the U.S. Internal Revenue Service. The institute drafted and approved a detailed set of bylaws, which includes strong conflict-of-interest provisions, and held elections for the officers. Here are the founding members:

Chairman and founder
Mark Roberti, RFID Journal, CEO

Vice-Chairman
Ian Robertson, Supply Chain RFID Consulting, CEO

Secretary and founder
Diana Hage, RFID Global Solution, CEO

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ADOPTION

Item-Level RFID Adoption in Retail Gathers Momentum

Kohl's is the latest big chain to announce it is using the technology to manage items in stores.

IN JANUARY, Checkpoint Systems announced it had completed an item-level RFID deployment for Kohl's department stores. The Menomonee Falls, Wis.-based chain operates stores throughout the United States, selling clothing, home and beauty products.

In spring 2012, Kohl's began investigating the use of RFID technology to improve inventory accuracy by tagging select items and reading those tags during inventory counts. That fall, the retailer expanded the RFID pilot to 25 stores. Following the successful pilot, Checkpoint and Kohl's developed a plan to roll out the solution to track select product categories at Kohl's stores. The store deployments began in spring 2013 and were completed by year's end. The speed of the rollout suggests the benefits were clear to Kohl's and the technology is mature.

Kohl's implementation is part of an accelerating trend toward retailers using RFID to track items in stores, to improve inventory accuracy and boost sales. The table on the opposite page lists some of the major item-level RFID rollouts to date. It does not include retailers using RFID only in their supply

PHOTO: ISTOCKPHOTO

chains (such as Italy's Patrizia Pepe) or at the case level (Mexico's Liverpool chain). It does not include retailers that have carried out major pilots but not yet announced rollouts (Grupo Éxito in Colombia), or retailers that have deployed RFID but never made a public announcement (Spain's Zara chain is widely known to be using RFID at the item level).

Many other retailers are currently exploring RFID's potential. During a panel discussion at the recent National Retail Federation convention in New York, Bill Hardgrave, dean of Auburn University's College of Business and founder of the RFID Research Center, told a crowd of retailers from around the world that 20 of the top 30 retail chains in the United States are currently in some phase of RFID adoption (an initial pilot, a multistore pilot or the early phases of a rollout). "The fact is," he said, "if you are a retailer and you are not actively investigating RFID's potential, you are already behind." —*M.R.*

Retailer	Date Announced	Country	What they are tracking
Kohl's	Jan. 2014	United States	Footwear, denim and men's basics
Decathlon	Jan. 2014	France	Sporting goods
Bon-Ton	Dec. 2013	United States	All shoes on display
Matranga	Oct. 2013	Italy	Jewelry
Saks Fifth Avenue	Sept. 2013	United States	Shoes
C&A	Mar. 2013	The Netherlands	Clothing for men, women and children
Marks & Spencer	Mar. 2013	United Kingdom	All nonfood items
Borsheims	Jan. 2013	United States	Jewelry
Sissy's Log Cabin	Sept. 2012	United States	Jewelry
Crawford	Apr. 2012	Brazil	All clothing
Siberian	Apr. 2012	Brazil	All clothing
Argot	Mar. 2012	Spain	All books
Hush Puppies	Mar. 2012	Spain	All shoes
Lord & Taylor	Nov. 2011	United States	All shoes on display
Memove	Oct. 2011	Brazil	All clothing
Bloomingdale's	Sept. 2011	United States	All clothing
Macy's	Sept. 2011	United States	All clothing
Dallas Gold & Silver Exchange	July 2011	United States	Jewelry
American Apparel	Apr. 2011	United States	All clothing and accessories
Cleor	Jan. 2011	France	Jewelry
Fly London	Oct. 2010	United Kingdom	All shoes
Walmart	July 2010	United States	All men's jeans and basics
Sergio Blanco	Apr. 2010	France	All clothing
Gerry Weber International	Dec. 2009	Germany	All clothing

20

of the top 30 retail chains in the United States are currently in some phase of RFID adoption

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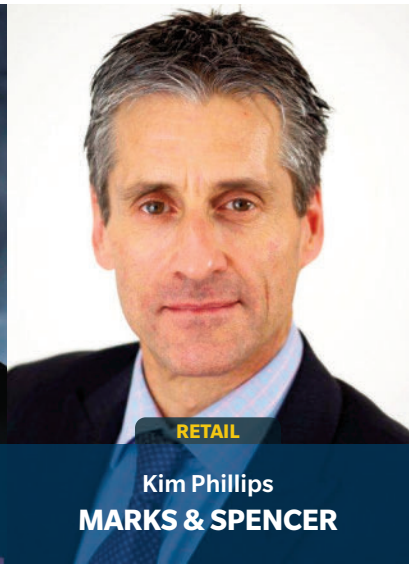

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BEST PRACTICES FOR ROLLING OUT RFID

BY SAMUEL GREENGARD

Companies and systems integrators that have deployed an RFID solution at multiple locations say the key to success is following these eight steps.

ILLUSTRATION: ISTOCKPHOTO

IN 2009, DISNEY deployed a radio frequency identification solution to manage costumes at one location within the Walt Disney World resort in Florida. Since then, it has expanded the solution to all costuming locations at that resort—and at Disneyland Resort in California, the Disney Cruise Line, Hong Kong Disneyland, Shanghai Disneyland and Disneyland Resort Paris (see RFID Helps Disney Employees Get Into Character).

From 2010 through 2012, Cisco Systems deployed an RFID solution to track fixed assets at 70 U.S. data centers and research and development labs, as well as at facilities in China, India and the Netherlands (see Cisco's Business-Driven RFID Strategy).

In November, Checkpoint Systems announced that it had worked with a retailer to roll out an inventory-management solution at 1,000 stores in 100 days (see Major North American Retailer Adopts Checkpoint Systems' RFID Solutions).

How did they do it? To find out, we talked to the people who led these deployments and to systems integrators who have helped other companies roll out an RFID solution at multiple sites. It is not a simple endeavor, they say. It involves careful planning and the ability to handle practical and technical challenges. But based on their experiences and the learnings they shared, there are common best practices that all companies, regardless of industry or application, should follow. Here, then, are eight strategies that can boost the odds for success.

1 ASSEMBLE A BUSINESS PLAN

Every RFID expansion project requires a roadmap. If you have deployed several RFID applications at, say, a

manufacturing plant—you're tracking assets, tools and work-in-process, for example—introduce one application at a time at the new location. The business plan should help you decide which task or business process to begin with, says Jason Warschauer, sales application engineer for HID Global's industry and logistics division.

A successful business plan takes into account physical site components, installation, costs, resources, training, solution components and post-implementation support, says Sue Flake, RFID director of business development at Motorola Solutions.

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—SUE FLAKE, MOTOROLA SOLUTIONS

The business plan must be based on a sound methodology that focuses on up-front planning, understanding functional requirements and getting customer acceptance for the end solution—before testing and prestaging the software and hardware for each location, says Sarabjeet Chhatwal, senior director of professional services at OATSystems (a division of Checkpoint Systems). In addition, he says, you must be sure it is possible to accept items into the system and have the ability to tag and encode at a high volume.

Cisco worked with business and deployment teams at 60 locations—and set up a concierge service to ensure that any and all issues were addressed—before introducing a solution over an 18-month span, says Maryanne Flynn, director of IT. When locations were ready to go live, they plugged in the new system.

Once Disney saw the value of expanding its RFID costume management solution to other locations, its business plan began with a cost/benefit analysis, says Vinny Pagliuca, director of creative costuming. "The size of this project warranted funding through a capital authorization request," he says. After receiving input from the finance, operation and technology teams, building an integration strategy and gathering formal cost estimates for equipment, software and labor, he developed a presentation for senior management justifying the project and explaining its benefits. By doing the "heavy lifting" up front—including negotiating pricing and discounts with suppliers—Pagliuca was able to gain support and quick approval. A bonus: The project ultimately came in under budget.

2 DEVELOP A DEPLOYMENT PLAN

Once you've decided where to roll out the RFID solution, you need to address how to do it, and that involves asking a number of critical questions. Should you demand that the site use the same hardware and software as the initial site or provide some latitude about specific technology? Are workflows and processes the same at all sites or will adjustments have to be made? Can you transition to RFID without interrupting current business processes? Does the new facility have any unique characteristics?

It's crucial to view a rollout in a comprehensive and holistic way, Flake says. Organizations, particularly retailers, can benefit from pilot projects that are set up at a limited number of sites and deliver information, including return on investment, that can be compared with older systems. This can provide clues about how to design a deployment strategy—including a phased rollout versus an all-at-once approach—and manage everything from the design and build-out of systems to site surveys and training. "It's also necessary to have post-deployment support in place and help workers get up to speed with new processes," she says.

To roll out an inventory management solution at as many as 200 stores per week, Checkpoint developed a detailed deployment plan. It's important to have a plan for dealing with

essential variations and adjustments to hardware and IT infrastructure, Chhatwal says. Typically, he notes, you don't need a separate plan for each location—though it's critical to understand the requirements and limitations of each location. "A retailer with 1,000 stores would have a limited number of site variations, based on store format, use cases and RFID hardware, so visiting a few stores representative of these variations would be enough," he explains. It's also wise, he adds, to "conduct a multistore pilot with representative stores to test the configuration and business metrics, making adjustments before rolling out an enterprise deployment."

The process must balance enterprise requirements with local requirements and preferences. "With any enterprise software deployment, regardless of regional variations, it's important to RFID-enable existing store processes, instead of starting from scratch," Chhatwal says. "It makes for easier training, employee engagement and compliance, resulting in a more successful deployment." Checkpoint attempts to standardize and provide plug-and-play components. "In the case of a recent chainwide deployment, we were able to load preconfigured software on RFID handhelds shipped to each store, and provide Web-based training tools to store associates," Chhatwal says. "Store managers were literally able to 'open the box' and get started. Software updates are all managed automatically with change-management tools."

A deployment plan must also consider available resources. Checkpoint works with customers to ensure adequate employee training and support is in place.

Disney split its project into two phases, each of which lasted approximately 12 months. Because of the magnitude of the endeavor, the company wanted to ensure user adoption every step along the way. "The phased approach allowed us to make minor design and process improvements as we saw how our cast and guests were actually using the new systems," Pagliuca says. It also allowed the firm to adopt a change management-centric strategy, he adds.

3 CONDUCT A SITE SURVEY AT EACH LOCATION

In most cases, it's critical to conduct a site survey prior to installing even the most proven technology. RFID equipment may not work as anticipated because each facility's physical layout—and the way items move through it—is different. Another potential problem is metal shelving and fixtures, which could cause RF interference. "If you are deploying with handheld devices, then a site survey may not be required," Motorola's Flake says. "If an organization relies on physical portals for receiving items, transitions or outgoing shipments, a site survey is probably required." Key factors include network connectivity issues and power requirements.

"Store managers were literally able to 'open the box' and get started. Software updates are all managed automatically with change-management tools."

—SARABJEET CHHATWAL, OATSYSTEMS

A site survey should also identify which technology components, tools, software and resources to use at specific sites. And what type of data and how much data can and should be stored on the RFID tag, HID Global's Warschauer says. "You can't just toss technology at a location—even if it has worked well elsewhere," he says. "It's crucial to have high-level confidence about what will work effectively."

Checkpoint relies on a worldwide field services team that conducts hardware site surveys. "Hardware site surveys are not required for RFID handhelds," Chhatwal says. "For RFID hardware installed in ceilings, fixtures and entry/exit doors, each store needs to be surveyed individually to assess electrical, environmental, construction, shielding and operating frequency requirements."

A starting point for a site survey is to document and photograph each area to fully understand how the technology will function in a particular space, Flake says. Once on site, it is critical for the systems integrator to review the site layout and validate the expected product flows. It may be necessary, for example, to understand how dock doors function and how they are used. "This determines the proper location of RFID readers and antennas for optimal read performance," she explains. "A systems integrator should be able to provide a report detailing the work that must be performed for installation of a system, the bill of materials needed at each site and all RFID read point locations, as well as the methodology to ensure the readiness of the system."

"Testing at every site was necessary to ensure there was no interference. In some cases, we modified designs to add shielding to protect against interference... but were able to keep to the same basic equipment designs at all locations." —VINNY PAGLIUCA, DISNEY

Disney's integration partner, a major hardware vendor, assisted with site reviews to ensure the system would work as billed at different locations, Pagliuca says. In addition, Disney placed a project manager on site to work with contractors, oversee permits, handle inspections and review IT installations. "Testing at every site was necessary to ensure there was no interference," he says. "In some cases, we modified designs to add shielding to protect against interference... but were able to keep to the same basic equipment designs at all locations." No two locations are identical, he adds, so varying levels of customization—such as construction to mount equipment—was needed to implement the technology.

4 TAKE A TEAM APPROACH

The success of any initiative is heavily dependent on obtaining buy-in from management at each location. Without this, a company is likely to encounter pushback and problems that could ultimately derail an RFID deployment. Experts say it's wise to adopt a team-based approach and rely on it throughout the planning and deployment phases. (For tips on getting front-line managers and other end users on your side, see Gaining Project Buy-in From Company Employees.)

Disney initially established a crossfunctional team to design and build its RFID solution. The team included staff members from the costuming workroom, costuming warehouse, laundry facilities, costuming metrics and systems, IT and costuming operations. It now insists that RFID project teams "stay connected with regular meetings to share technology ideas as well as discuss how to effectively benchmark site to site," Pagliuca says. The teams also address training, tagging issues and managing everything from equipment installation and upgrades to scheduling new RFID deployments. They examine the specifics of a park or other location, its operating hours and available labor.

Cisco also adopted a team approach when it launched its RFID initiative to track IT equipment, and as the company rolled out its solution at other sites, it formed and consulted with teams at those locations to understand their business processes and any local idiosyncrasies and challenges. Flynn and IT executives continue to engage with local finance, human resources and IT teams to ensure the organization is addressing all challenges and issues. "They are our eyes and ears," she notes. "They create a controlled environment that minimizes risk and maximizes the odds for success."

5 BE PREPARED TO MAKE SOME CHANGES

When Cisco expanded its RFID solution, it adopted a global standard for a passive RFID tag. The company identified ways to apply the tags

using adhesive stickers and zip ties, but also gave executives some discretion in how they approach practical, regulatory, security and other requirements. "We learned a lot by conducting pilots and proof of concepts before expanding the program," Flynn says. "Teams have had a chance to review deployment successes and challenges and make necessary adjustments."

"We partnered closely with the costuming and development teams in Hong Kong, Paris and Shanghai," Disney's Pagliuca says. "They all use our proprietary software system. Hardware varies from site to site, but functionality is similar enterprisewide."

Disney conducts ongoing analysis of its RFID system, Pagliuca notes, and has made changes based on a number of factors, including safety, ergonomics, system speed, read rate accuracy and efficiency. Metrics are a key part of the equation. "You cannot underestimate the value of testing, testing and more testing," he says.

Each retail store is different, OATSystems' Chhatwal says, but system changes don't have to be traumatic or expensive. In some cases, it's possible to swap out one reader for another or reposition devices to make things work. He believes it's wise to opt for hardware based on established RFID standards, to build in greater flexibility and ensure long-term system and data compatibility.

"Some changes are inevitable," Flynn says. "The key is to build a platform that allows you to make changes to technology and processes without a great deal of disruption." (For strategies on how to design and manage an RFID system that will keep pace with evolving technologies and business demands, see Future-proof Your RFID System.)

6 MANAGE THE TRANSITION TO RFID

Moving from bar codes and manual tracking to automated RFID systems requires a good deal of oversight. At times, some parts and items may be tagged while others are not. It may also be necessary to keep a bar-code system in place for a period of time as a backup. As Disney rolled out its RFID solution at various facilities, it left the bar-code technology operating until the scheduled go-live date, Pagliuca says. "At no time during the project did we close an operating location during scheduled operating hours in order to implement the system."

The same issues apply to software systems and data, Warschauer says. In many instances, hosted and cloud-based systems make the switchover from legacy technology more easily. "One of the advantages to the cloud is that it allows an organization to collect and push data anywhere in the world with fewer resources," he explains. It's also important to devote adequate time and attention to middleware during the transition period, he adds. "Fortunately, the software that manages the data is becoming more agnostic," he says. "It is becoming easier to link systems."

"One of the advantages to the cloud is that it allows an organization to collect and push data anywhere in the world with fewer resources. It's also important to devote adequate time and attention to middleware during the transition period." —JASON WARSCHAUER, HID GLOBAL

7 EXPECT UNFORESEEN CHALLENGES

Comprehensive planning and state-of-the-art project management cannot prevent unexpected events and circumstances—there's simply no way to plan for every possibility. When Disney expanded the use of its RFID system across the company and extended it out to cruise ships, it discovered that carbon fibers and other RF absorbing materials in some costumes created "unforeseen challenges" surrounding effective and accurate reads, Pagliuca says. The result was a need to adjust tag placements—and continue adapting costumes based on the role of the employee, environmental factors and other criteria. "Cruise ships

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also presented several new issues, predominantly due to metal surfaces onboard," he adds. "During our first installation attempt, we burned through a record number of readers due to bounce and static."

Cisco's Flynn says when the company launched its initial RFID program, "There were tags that would work in one country but not others. During the first few months of the U.S. rollout, a world tag became available." While it's crucial to stay abreast of changes in the industry and a company's specific RFID rollout, she says, it's important to build flexibility and adaptability into processes. "Things can and will change, and you have to be ready when this happens," she adds. It's during these trying times that executive sponsorship, a clearly defined change-management strategy and ongoing communication pay dividends. "Teams and employees must stay informed and remain confident," she says.

"There were tags that would work in one country but not others. During the first few months of the U.S. rollout, a world tag became available." —MARYANNE FLYNN, CISCO

8 DON'T OVERLOOK TRAINING AND POST-DEPLOYMENT SUPPORT

To ensure employees will accept a new RFID application—and use it correctly—training must be built into the scope of a project from the outset, Flake says. While some or most sites may sail through deployment smoothly, she says, other locales could experience specific challenges that could torpedo the entire project. It's essential for employees to understand how hardware and software works, be equipped to deal with potential problems and know where to seek help when a glitch or failure occurs.

Cisco provides training and certification to key personnel. "It isn't necessary for everyone to become an expert, and people don't require a Ph.D. in RFID," Flynn says. "It's simply important to make sure the right people have the right knowledge."

For tips on training the people who will be operating, managing and maintaining the system, see How to Develop an RFID Training Program.

"Organizations that take a best practice approach to build a targeted strategy for deploying the technology to multiple locations are far more likely to succeed," Warschauer says.

"Come up with a realistic timeline and be prepared for it to change," Pagliuca says. "Establish a small core group of key partners, and work closely with them on defining project scope, roll-out plans and process changes. The biggest word of advice, however, is communication and awareness. Before you try and get approval to make this level of change, talk to and showcase the changes to all levels of leadership in IT, finance, operations... anyone who may be touched by the technology. In the end, this will make the entire project run very smoothly."

Editor's Note: In our March/April issue, we'll examine best practices for adding applications to an RFID infrastructure.

Leveraging an RFID infrastructure can improve productivity and enhance worker safety.

MINING COMPANIES DIG DEEPER INTO RFID

BY JENNIFER ZAINO

PHOTO: AGÊNCIA VALE

MINING COMPANIES WORLDWIDE have begun employing radio frequency identification technologies to automate manual processes, streamlining production and reducing costs. Most of the RFID solutions have been standalone applications. India's largest producer of iron ore, for example, is using RFID to speed up customers' deliveries (see Sesa Goa Automates Mining Logistics Operations). The Telfer gold mine in Western Australia deployed an RFID solution to track trucks underground (see Australian Mining Contractor Prevents Vehicular Collisions). And as we reported in the Nov./Dec. issue, many mining companies are adopting RFID personnel safety solutions to locate workers in emergencies (see Protecting Employees).

But to understand RFID's future in the mining industry, consider the new Totten nickel mine in Sudbury, Ontario, Canada, which will begin production early this year. The Totten mine is operated by global mining company Vale, which has been using RFID since 2005 to track containers, rail cars and other assets. In 2008, for example, the company deployed an RFID solution at its Stobie mine in Ontario to monitor the grade or mineral concentration of ore as it is mined in real time (see Mining New Value From RFID). So as Vale planned

"There is an awful lot of lost productivity with people wandering around to find jeeps, loaders and other equipment."

ROBERT DUTCHMAN, VALE

its new nickel mine, the company decided to install a Wi-Fi network underground that would provide as much coverage as possible, and then build its RFID installation up from that base.

"Once wireless was there, RFID was one of the main systems to take advantage of it," says Robert Dutchman, Vale's IT project manager. "We had an opportunity to put in as much of the available technology as we could without having to retrofit the mine."

The company adopted AeroScout's real-time location system (RTLS) to track underground equipment and personnel. Approximately 100 pieces of equipment and 250 cap lamps worn by miners will be monitored with active Wi-Fi RFID tags, which will continuously transmit their location, based on zone definitions within the system. Voltage sensors built into some tags will provide additional information. A voltage sensor on a tag connected to a vehicle's diesel engine ignition circuit, for instance, can determine whether the engine is running.

AeroScout's MobileView software will provide a real-time visual representation of the location of assets and people on a map based on the mine plan's CAD drawings. Thanks to the Wi-Fi network, supervisors equipped with rugged tablets underground—not just control-room operators aboveground—will have access to this data in the Web application.

The deployment delivers a number of benefits. "First, safety to know where everyone is" during an emergency, Dutchman says, and to ensure personnel comply with fire drills and other standard procedures. If an incident, such as a poisonous leak, were to occur, the system also could provide a record of who was where, so those at risk could be tested for related health issues.

Monitoring the location and operational status of equipment is also critical, Dutchman says. "There is an awful lot of lost productivity with people wandering around to find jeeps, loaders and other equipment," he says. "Where these were, where the guy on the last shift left it—it's more of a challenge than you might think in these underground environments."

With the RTLS in place, Dutchman is working on the next step: leveraging the RFID data to enable ventilation-on-demand (VoD) for optimal airflow—basically, the process of lowering or raising variable fan speeds within the mine, depending on the number of people and operating equipment in a particular area. The Centre for Excellence in Mining Innovation (CEMI) estimates that VoD for production can lead to a reduction of mining costs of 8 percent to 20 percent through electrical savings. CEMI also heralds the potential for significant production gains—$8 million to $11 million per year—because mining companies can get "more tonnes out of the ground for a lower energy investment."

Managing VoD at Totten should begin by the time the mine moves into full production. "Now that we have a system that knows where everyone and everything is, and now that the RFID tags can let us pull up information about whether a diesel engine is running or not, that combination of information is a useful innovation to feed into ventilation systems and run optimized ventilation," Dutchman says. The fans themselves are heat generators, he notes, and the harder they run the more heat they generate, further complicating the ability to control the temperature underground.

The location information collected by MobileView from the RFID tags will be married with other air-quality data (temperature and carbon monoxide levels, for instance) that is wired directly into its process-control network, to inform "one big algorithm to decide how fast the fans will be running in each area," Dutchman says. "The more information we can get, the more optimized we can run the ventilation."

Monitoring Air Quality

Ventilation-on-demand appears to be the next frontier in developed countries, says David Corey, AeroScout's vertical industry sales director. While the concept has been around for years, the technology has improved and the cost savings for mining companies has now been validated. In addition, some governments are offering incentives to mining

PHOTO: AGÊNCIA VALE

Vale's Totten mine is leveraging RFID data to enable ventilation-on-demand, for optimal airflow within the mine. The circular tube is the main fresh air vent leading underground.

companies to encourage them to reduce power consumption on the national grid. Ontario's provincial government, for example, provides funding for such initiatives, he says.

RFID and VoD solutions are also helping mining companies comply with government regulations to monitor air quality to protect workers' health. Finnish mining law specifies that air quality for workers must be good, says André van Wageningen, engineering superintendent at an Agnico Eagle gold mine in Kittilä, Finland, 150 kilometers north of the Arctic Circle. "It's up to us to decide what good air is," he says, "but we don't want to have any incidents or unhappy employees."

To control ventilation, the Kittilä mine is expanding its deployment of a semiactive RFID solution from Nedap AVI that enables automatic vehicle identification up to distances of 10 meters (33 feet) and speeds up to 200 km/h (125 mph). It tested the solution in one production area, where it installed a long-range vehicle identification reader with built-in antennas and RFID-tagged roughly 20 large vehicles. "It's more when heavy equipment comes in that you need to increase ventilation, so we track heavy equipment," van Wageningen says.

RFID readers are being deployed at the entrance to each production level, to detect what vehicles are arriving or leaving, so ventilation can be increased or decreased accordingly. Each vehicle's tag is associated in a database with ventilation-related information, such as the equipment's horsepower-draw, as well as with information from sensors on the vehicle related to other air quality aspects. This data feeds into a control system to drive the adjustments. Being able to power down fans from running at 100 percent capacity at all times, van Wageningen thinks, should also bring a quick return on investment in electricity consumption savings.

Increasing Personnel Safety

Monitoring air quality is just one part of ensuring worker safety. The Kittilä mine is also introducing an Identec-powered active RFID personnel safety solution in a phased approach. "Personnel tracking is more and more an industry standard in the Nordic mines," van

An Agnico Eagle gold mine in Kittilä, Finland, is RFID-enabling rescue chambers, to identify workers who may hunker down in these rooms during an emergency.

Wageningen says, "and we feel it is just the right thing to do." The mine has issued more than 450 tags to workers, to be read as employees enter the mine, at 100 meters inside the tunnel and then in five different zones. The mine chose to use active technology because "with passive tags the reading distances are too small," he says.

The mine now is taking personnel safety to the next stage—expanding its data network infrastructure to its 10 rescue chambers and installing RFID readers, to identify workers who may hunker down in these rooms during an emergency. A mine typically has pressurized muster areas at different levels, such as dining rooms or workshops, where people try to gather when there's an accident, fire or other disaster. Mines don't usually equip rescue chambers with RFID as a first step because of their distance from conventional muster areas, and because they might not have the data networking infrastructure to support them right away, says Geir Nerbø, Identec Solutions Norway's director of business development, mining and tunneling.

Think of rescue chambers as "the lifeboat in the system," Nerbø says. The rescue chambers are backups to the regular muster areas if personnel can't reach them on time, serving as pressurized containers with supplies to get miners through hours or even days. "Now they can be counted as being in a safe area," he says.

The Kittilä mine is fortunate not to have had any major emergencies. But, van Wageningen says, you can expect a fire to happen every five to six years in a mine this size. In an emergency situation, Agnico Eagle wants to be sure people are in a safe place, and that radio traffic is minimized so important communications for the rescue efforts aren't disrupted. "Using RFID tags in rescue chambers and safe areas will allow us to do so," he says. "Not much additional network requirement is needed as the mine is already equipped with a fiber backbone."

The trend toward using RFID for personnel tracking at one level or another is on the way up, Nerbø says. "In Sweden, for example, there are regulations that tell the mining companies they need a system [though it doesn't have to be RFID-based] that tells how many people

PHOTO: AGNICO EAGLE

they have underground and where they are," he explains. "That is becoming common all over."

But the trend is more common in developed countries. Newmont Mining, one of the world's largest producers of gold, deployed an AeroScout Wi-Fi RFID solution at its Leeville and Midas mines in Nevada; it's tracking more than 600 miners and 95 vehicles to improve worker safety and drive operational upgrades. International mining group Glencore Xstrata also is using AeroScout's solution to improve safety and raise productivity at its Beltana Coal Mine, in New South Wales, Australia.

Managing Priorities

In less developed parts of the world, mining companies are focused more on vehicle productivity, AeroScout's Corey says. "In third-world countries, normally there are 2,000 to 3,000 miners at a site because it's not fully automated, compared to 300 to 700 in developed countries," he says. "They've got a lot of manual labor to draw on, and they want vehicle productivity to get more production out of the same assets."

AeroScout customers in South Africa, for example, want to use the company's Wi-Fi RFID RTLS solutions to know where their equipment

Tracking Conflict-Free Minerals

In August 2012, the Securities and Exchange Commission (SEC) adopted a rule mandated by the Dodd-Frank Wall Street Reform and Consumer Protection Act to require companies to publicly disclose their use of conflict minerals—tantalum, tin, tungsten and gold, which find their way into everything from mobile phones to jewelry—that originate in the Democratic Republic of the Congo or an adjoining country. While legal appeals are pending, in December, *The Wall Street Journal* reported that companies must make a "good-faith" effort to determine whether they have been conflict-mineral free this year.

The legislation amounts to a supply chain nightmare, according to the 2012 report, "Conflict Minerals: Another Supply Chain Challenge," by A.T. Kearney, a global management consulting company. According to the report, "Current estimates indicate 700,000 to 900,000 businesses would be subject to some degree of supply chain traceability effort." The report states, "Similar cases in other industries reveal how best to deal with the conflict minerals supply chain.... Many food companies are using radio frequency identification (RFID) technology to track food from its point of origin to its retail outlet."

Companies that don't comply may face SEC enforcement proceedings, as well as pressure from human rights and other nongovernmental organizations. This could have a big impact on companies with reputations to protect, says Ann Grackin, CEO of ChainLink Research. "If you are in violation and your self-reporting is erroneous, then the implications of that can be unpleasant for executives in those companies," she says.

ChainLink Research sees RFID as part of the solution to enable assurance of a product's history. Its recent report on RFID for retailers finds the jewelry category continues to rise to the top when

The four common conflict minerals (clockwise from top left): wolframite (tungsten), coltan (tantalum), cassiterite (tin) and gold.

it comes to planned use of RFID for securing products. "That's generally more about shrinkage, but some companies told us that with the Dodd-Frank issue there may be an opportunity to look further across the supply chain," Grackin says. "If we can get the right investment in place, they said, RFID could be a good way to know that our shipments are valid and meet the new criteria."

It's not an easy task, Grackin says, and probably would revolve less around mandating the use of RFID and more around "urging suppliers and manufacturers in a collaborative venture to figure out how to work productively with them, so there is a win-win here somehow." —*J.Z.*

PHOTO: ROB LAVINSKY, IROCKS.COM

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is when it's underground, and once they have that data, they can add dispatch systems to help optimize the use of that fleet, Corey says. "Having a dispatcher without real-time location information doesn't work," he says.

Material supply cars, for example, are delivered underground filled with operational supplies via elevator and train, Corey says. "The dispatcher at the surface is not aware when—or if—the material supply car made it to the correct destination, if it has been offloaded and if it is ready to be retrieved," he says. "So scheduling the delivery and pick up of these supply cars is extremely important, but the only way you can know the current location and off-load status of that supply car is by calling someone on the radio 10,000 feet underground. Using manual methods, the dispatcher is unable to effectively plan the supply car logistics." The materials management team, he adds, is essentially unaware of how much inventory is underground and what has been consumed. "Real-time location improves both logistics and material management in this scenario."

Once an RFID solution is in place to help with vehicle productivity, other capabilities can be pursued. "With our solution, you not only know where the vehicle is but also the hours it's run, who drove it and so on," Corey says. That way, mining companies can perform maintenance based on the number of hours a vehicle was actually used, not just on estimates of how much the vehicle should have been used in a calendar time period.

RFID is also helping mining companies in South Africa meet government regulations that have been introduced to keep unauthorized vehicles out of pit areas where blasting and mining take place, says Attie van Staden, principle presales specialist at South Africa systems integrator Business Connexion. He is working with a customer to deploy an AeroScout solution to address this issue. RFID can automate "the whole vehicle access control process, without requiring any specific human activity from the driver and human intervention from security personnel, to grant vehicle access to the pit area," he says.

Forecast

"There are not that many mining companies in the world, but definitely for the few companies there are, they all are either looking at RFID or doing some small deployments," says Anthony Palermo, director of business development at RFID Academia, in Canada, which has worked on ore tracking and personnel safety systems.

While some mining companies consider RFID, those that have deployed the technology are planning to leverage their infrastructure. At the Kittilä gold mine, for example, RFID also is used to track ore, and van Wageningen is now thinking about adding a collision prevention application.

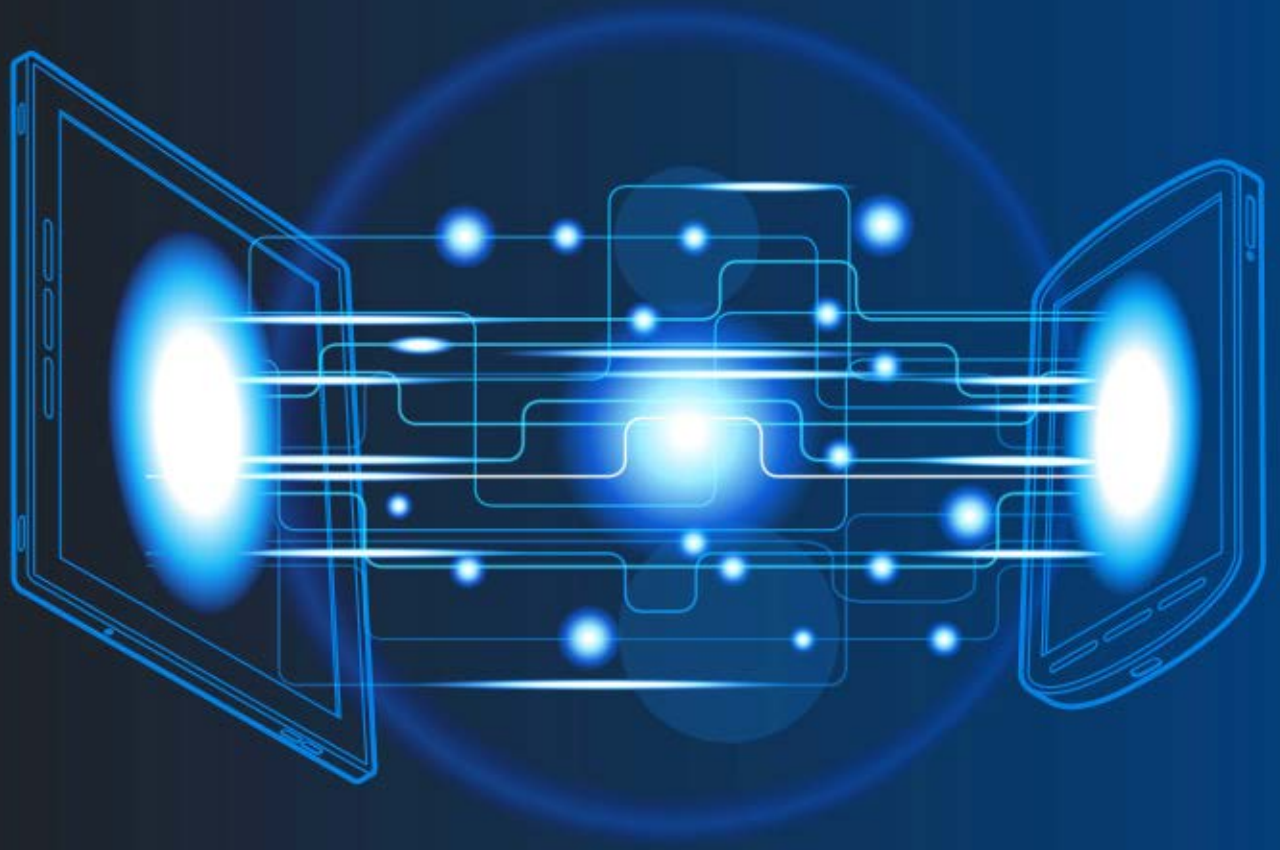
At the Totten mine, Dutchman says the "big, expensive Wi-Fi network supports many, many things, which makes the RFID implementation itself relatively cheap." He sees opportunities for using RFID to better track processes, such as how many trips a scoop makes from wall face to rock. Dutchman also would like to embed the location data the mine gets from RFID tags into its dispatch systems for equipment. "That's particularly important on ramps to better control traffic flow up and down the mine," he says. "We are trying to optimize those traffic routes, which is partly productivity, but in a great way that's safety, too."

Today, every mine Vale owns has some Wi-Fi in it, if not nearly the depth of coverage in place at Totten. "What we are looking at [installing in the company's other mines] is a slightly more compact version of this, to just give us specific key locations within the mines, to give them Wi-Fi hotspot coverage and to give us some sort of location coverage," Dutchman says.

But for many mining companies, whether a business case study turns into an RFID deployment depends heavily on the ups and downs of the stock market. For example, Palermo says, "The slightest change in the value of nickel can stop a project or any sort of investment in capital expenses."

"With our solution, you not only know where the vehicle is but also the hours it's run, who drove it and so on."

DAVID COREY, AEROSCOUT



NFC Tags

for New Business and Consumer Applications

By Bob Violino

Now that most smartphones are equipped with Near-Field Communication technology, RFID providers are offering a wide variety of NFC transponders.

NEAR-FIELD COMMUNICATION is a short-range, high-frequency (13.56 MHz) RFID technology designed to enable the exchange of information between two NFC-enabled devices, such as mobile phones. In 2004, Nokia, Philips (now NXP Semiconductors) and Sony founded the NFC Forum to ensure interoperability among NFC devices and promote the technology for applications such as access control, cashless payments and transit ticketing. They also envisioned that consumers would someday use NFC-enabled mobile phones to share telephone numbers, photos and MP3 files.

But they did not anticipate that vineyards would use NFC-enabled smartphones to improve productivity (see Argentine Winery Harvests Crops With RFID). Or that shoppers would use their NFC phones in retail stores to learn about products and availability (see Bon-ton Brings NFC to Shoe Displays). Or the many other NFC-based business and consumer applications companies are adopting—from improving patient care (see Brigham and Women's Hospital Tests NFC RFID for Patient Bedsides) to marketing products (see The New 'It' Tool for Branding Products and Services). Other NFC applications include tracking assets and inspecting and maintaining equipment in industrial environments, such as aerospace, manufacturing, municipalities, and oil and gas, says Chris Gelowitz, president and CEO of InfoChip, which makes a line of NFC tags.

"We've certainly seen a lot of changes in the industry" in terms of how NFC is being used, says Victor Vega, director of RFID/NFC solutions and marketing at NXP Semiconductors, which dominates the market for integrated circuits (ICs) that govern what NFC tags can do. "The industry started

ILLUSTRATION: ISTOCKPHOTO

Smartrac's line of BullsEye NFC inlays can be used for access control, product authentication, smart posters and ticketing.

with transactions," Vega says. "Now there are all these different emerging applications."

Several factors have led to the emergence of new applications. One is that an NFC tag—which can function as a passive tag or a reader, depending on the application—is present in the majority of mobile smartphones. In addition, RFID providers have developed NFC readers for PCs, laptops and other devices that accept USB peripherals. "More and more consumers have NFC-enabled smartphones, so the infrastructure problem has been solved," Vega says. "With infrastructure so abundantly available, adoption is naturally much more well received as consumers now pull for the technology, rather than manufacturers pushing it into the marketplace."

Another key factor is that RFID providers now offer a variety of NFC transponders in different sizes and form factors for specific business and consumer applications. Some were developed for key fobs, paper documents, smart posters and wristbands. Others are designed to track medical devices or activate and program consumer electronic devices. There also are rugged and on-metal NFC tags for tracking, inspecting and maintaining assets in industrial environments (see table on opposite page).

Consumers worldwide "are becoming more familiar with the benefits of NFC technology by way of NFC-enabled mobile payments, tickets, speakers, headphones, hotel-room door locks, car keys and event badges," says Matthew Bright, chair of the NFC Forum's Retail Special Interest Group and director of marketing at Kovio, which develops and manufactures printed silicon products for NFC. There is a growing number of applications "because NFC is fundamentally easy to use," Bright says. "By simply touching an NFC-enabled device to an object with an integrated NFC tag, the user can trigger an interactive experience." Unlike a QR code, which can take 15 seconds or more to read, he says, NFC tags can be read in a fraction of a second, making them "uniquely optimized for the fast-paced, mobile-first lifestyle that is rapidly emerging around the world."

On the business front, ultrahigh-frequency passive RFID technology might have an advantage over NFC in that the consumable tags have longer read distances and are generally available at a lower cost, Vega says.

But while NFC is not likely to replace business applications in which data can be captured automatically, without human in-

PHOTO: SMARTRAC

volvement, it can complement UHF RFID systems. NFC is preferable, for example, when the tags or assets need to be accessed by a wide group of people with their mobile phones, says Jari Ovaskainen, marketing director for tags and labels at Confidex, which provides both NFC and UHF passive tags. "UHF obviously brings benefits in use cases where its large read range and multiple asset reading [are needed] at the same time," Ovaskainen states.

NFC's short read range also makes it well suited to authentication applications, in which individuals are reading a small number of tags. "Many closed-loop applications require higher memory and various levels of security and password protection for authentication," and would therefore use NFC, says Corey Wilson, global director of consumer experience for Smartrac, which also produces both NFC and UHF tags.

French wine maker Château Le Pin, for example, adopted an NFC solution to reduce counterfeiting. The distributors and auctioneers that sell the company's wines can use any NFC-enabled Android phone to read the tags on the bottles and verify their authenticity (see

Some Leading Providers of NFC Tags

COMPANY	PRODUCTS	BUSINESS APPLICATIONS	CONSUMER APPLICATIONS
AMS ams.com/eng	NFC/HF interface and sensor tags; NFC/HF RFID reader ICs; NFC/HF booster	Industrial and medical automation; diagnostics and maintenance; product activation and passive programming in multiple markets, including consumer and home electronics	Not applicable
Confidex confidex.com	NFC labels for metal and nonmetal surfaces; rugged NFC Tag-Ironside Micro; small-size NFC Tag-Steelwave Micro II	Industrial asset management; brand and product authentication	Advertising; customer service; marketing; social media
HID Global hidglobal.com	NFC tags in a variety of form factors and sizes including general-purpose, on-metal and rugged tags, ID bands and cards, key fobs; cloud-based, anticounterfeiting Trusted Tag Services	Industrial asset tracking; authentication for valuable goods and documents	Not applicable
Identive Group identiveNFC.com	NFC standard and custom tags in a variety of form factors and sizes including inlays, labels, cards and key fobs; NFC readers for devices that accept USB peripherals	Industrial asset and medical device tracking	Marketing; social media
InfoChip infochip.com	DuraBand, DuraDisc, DuraPlug, DuraTab and DuraZip RFID tags are NFC compatible	Asset tracking; inspection and maintenance	Not applicable
Invengo invengo.com	NLoop and NTouch NFC inlays and labels	Access control; passports	Events; loyalty programs; marketing; payments; ticketing
RR Donnelley rrdonnelley.com	Custom NFC inlays that can be embedded in printed products	In-store showrooming	Marketing
Smartrac smartrac-group.com	NFC inlays and paper tags; BullsEye NFC, Circus NFC, MiniTrack NFC, RaceTrack NFC, available in a variety of sizes	Access control; product authentication	Advertising; payments; promotions; social media; ticketing
STMicroelectronics st.com	M24LR series, M24SR series	Access control; product authentication	Not applicable

InfoChip's DuraZip is designed for easy installation on tools, oilfield equipment, fire extinguishers and safety devices.

"Generally, it is simpler to adjust the form factor of a transponder to fit a particular application as opposed to adjusting the mechanical design of a system to accommodate the transponder."

–NICK LUKIANOV, IDENTIVE GROUP

Château Le Pin Uses NFC to Ensure Its Wine's Authenticity). Similarly, Giulietti, a Finnish company that imports and resells accordions, is using an NFC solution to track the sale and servicing of the instruments (see NFC RFID Technology Puts the Squeeze on Accordion Thieves, Counterfeiters).

Here are some features to consider when choosing NFC tags for business and consumer applications.

READ RANGE

An NFC tag's read range is often affected by the NFC antenna in a mobile phone. "Assuming a state-of-the-art tag IC is used, the 'coupling' of the tag and the reader [for example, a mobile phone] antenna will have an impact" on read range, Vega says. "The ideal coupling [or energy transfer] would be accomplished when the tag and the reader antenna are similar in geometric shape and size," he says. "But this is seldom the case, as NFC phone antennas vary wildly. Some are a bit on the small size, others are large. If there is a mismatch, the coupling is not optimal."

Typically, Vega says, phones with larger antennas demonstrate the best results. "Also, in general, the larger the tag, the better the performance," he adds. If, for example, a user has a mobile phone with a 2 inch by 2 inch antenna and the tag antenna is about the same, that's about as good as it gets. "But assuming a nice-size reader antenna, a good rule of thumb is that the expected read range would be approximately the diameter of the tag coil," he says.

So if you have a tag 30 millimeters (1.2 inches) in diameter, Vega says, common phones would average 20 millimeters to 40 millimeters (.8 inch to 1.6 inches) of read range. If you have a tag 25 mm (1 inch) in diameter, common phones would average 15 mm to 30 mm (.6 inch to 1.2 inches) of range. And if you have a tag measuring 18 mm by 36 mm (.7 inch by 1.4 inches), common phones would average 15 mm to 30 mm (.6 inch to 1.2 inches) of range.

InfoChip has a new DuraDisc in the works that enables a greater read range to enhance its scanning ability with NFC smartphones, Gelowitz says. "The idea is to be able to adhere the DuraDisc to a metal object like a valve or other oddly shaped object that has a nonflat shape that can interfere with the back of the phone being able to get close enough to the chip to scan it," he says. "So if we increase the read range, the phone could be at an awkward angle or be impeded by an oddly shaped asset and still be able to scan the chip. It would take

PHOTO: INFOCHIP

HID Global's Piccolino tag comes in a coil form, so it can be embedded by customers directly intro their products.

the read range from under [one-half inch] to potentially almost 2 inches."

SECURITY AND MEMORY

Some NFC tags have built-in encryption and password-protected memory, and some do not. "Tag ICs come in various flavors," Vega says. NXP, for example, offers a bare functionality tag with no security, ICs with a unique tag identifier to help with anticounterfeiting, and ICs that allow the end user to lock memory. The company also offers ICs with special provisions for anticounterfeiting via an "originality signature," which uses elliptical curve cryptography to create a validation signature with the unique tag identifier and a private key, then stores the result in the tag so a company can use the tag identifier and a public key to validate the authenticity.

"Then we jump up the security chain with our MiFare line of products, where security can go from lightweight to extremely heavy encryption," Vega says. "Inclusive of the level used for passports, transit tickets or for financial transactions, there are many options to choose from."

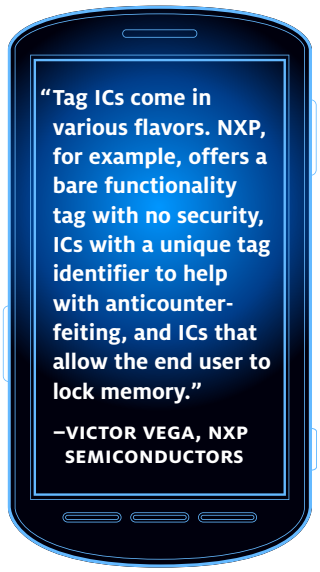
HID Global offers Trusted Tag Services, a cloud-based platform that can validate NFC tags to thwart counterfeiting, says Richard Aufreiter, the company's director of product management for identification technologies. The service is aimed at eliminating risks related to using NFC tags for authenticating high-value assets and documents, and for data login access.

There is a range of memory options for NFC tags. "Some of the more common NFC tags offer memory ranging from 48 bytes to 888 bytes," Vega says. "And a new one we [NXP] just announced is offered in [approximately] 1 kilobyte and 2 kilobytes." He says NXP's MiFare line goes up to about 8 KB.

SIZE AND FORM FACTOR

Today, there is likely an RFID vendor that has an NFC inlay, label or tag for your application, and, if not, some offer custom tags.

A 10 mm by 20 mm tag is ideal for the backbone of a slim shelf stock package, while an 8.7 mm circular tag would typically be used for item-level identification in retail, says Nick Lukianov, director, business development, ID products, at Identive Group. The company's 25 mm and 34 mm circular transponders are used in publications and posters for advertising, as well as in package identification, he says. "Generally, it is simpler to adjust the form factor of a transponder to fit a particular appli-



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AMS developed an NFC interface that can be integrated into consumer electronics, medical devices, shelf labels and games.

PHOTO: AMS

cation as opposed to adjusting the mechanical design of a system to accommodate the transponder," he notes.

HID Global developed some small and thin NFC industrial tags by incorporating direct bonding capabilities into the tags, allowing the RFID wire antenna to connect directly to a microsize chip, without the need for a bulky module housing additional soldering material, Aufreiter says. For example, the company's Piccolino tag has a 7.5 mm diameter, and its new LogiTag 121 has a 12 mm diameter.

"Small industrial tags are often embedded by customers into their goods or attached to them," Aufreiter says. "Here, the smaller the form factor, usually the better it is, since it provides more freedom in placing the tag, and it enables the tracking of small tools and equipment." Bagjack, a German messenger-bag manufacturer, is embedding HID's NFC LogiTag in bags, for brand protection and to thwart counterfeiting (see Bag Maker Adopts RFID Solution to Prevent Counterfeits, Gray Market). Tags that come in coil form, such as the Piccolino or ClearDisc, are typically embedded by customers directly into their products—for example, a biological probe-vial or a consumable cartridge, Aufreiter says.

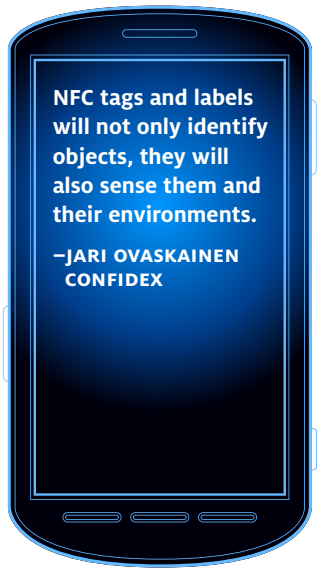
InfoChip recently developed an NFC DuraPlug tag that is only 2 mm thick. "Our intended markets for this tag are medical equipment and drilling assets," Gelowitz says.

ADVANCEMENTS

Some NFC tag providers are beginning to add sensor capabilities to NFC tags. AMS, for example, provides sensor tags that are designed specifically for the cold chain, health-care and logistics markets, says Giancarlo Cutrignelli, senior product manager, NFC. "The main targeted applications are data logging and monitoring," he says.

Confidex's Ovaskainen sees NFC sensor tags as a future trend, and says the company has the capabilities to design and manufacture NFC tags that include temperature and other sensors. NFC tags and labels will not only identify objects, they will also sense them and their environments, he says.

Efforts are under way to further expand the use of NFC. Roughly a year ago, the NFC Forum launched five special-interest groups designed to support and accelerate NFC's adoption in key vertical markets: consumer electronics, health care, payment, retail and transport. The groups bring together leaders from each sector to collaborate on implementation, interoperability, best practices and future requirements.



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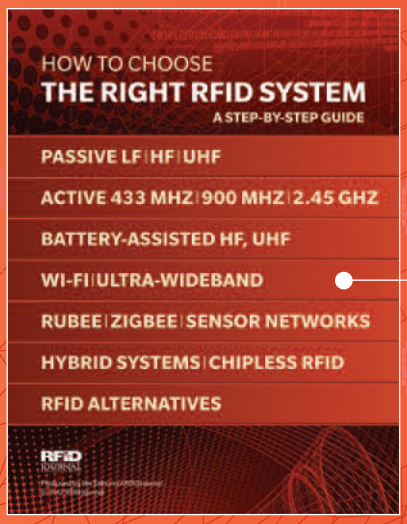

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Gen2v2 Ensures Tags Are Authentic

Counterfeiters will no longer be able to clone or spoof UHF RFID tags.

By Ken Traub

GS1 HAS RATIFIED a new version of the EPC Gen 2 ultrahigh-frequency RFID standard, which includes features that companies in many industries will find useful (see GSI Ratifies EPC Gen2v2). The hardware and firmware RFID vendors are developing to support the new Gen2v2 standard will likely incorporate different features designed for specific applications. In this column, we'll examine the software implications for using the new standard to build security and anticounterfeiting applications, previously available only in active or proprietary passive systems.

The Gen 2 protocol is vulnerable to cloning, because a counterfeiter can read the unique Electronic Product Code in an RFID tag and program it into a different tag that is indistinguishable to the reader. The tag manufacturer's tag identifier (TID) can also be cloned.

Gen2v2 solves the cloning issue by providing a secret authentication key that is programmed into the tag. Unlike an EPC or TID, this key cannot be read from the tag. Instead, a reader "challenges" the tag by sending it a random number. The tag encrypts that number using the secret key and sends the response back to the reader. The reader uses the secret key to decrypt the response. If the decrypted response matches the challenge, the tag is genuine. A counterfeiter cannot read the secret key or figure it out by listening in to the conversation between a tag and a reader. Without the key, it's impossible to clone a tag that a reader will authenticate.

To use this feature, companies must consider three new software requirements when procuring or upgrading their RFID applications or middleware. The application that programs the tag must choose a secret key—typically, a random number—and program that along with the EPC and other information. The application reading the tag must instruct the reader to issue a challenge, check the response and signal an error if there is no match. And a new database must manage the keys. The programming application stores the secret key associated with each EPC, and the reading application queries the database to get the key for verification. Obviously, access to this database must be secured.

RFID solution providers say the transportation sector is eyeing the new standard, because it allows operators of electronic highway tolling systems to switch from active tags to less expensive passive tags, with confidence that vehicles have legitimate tags and not unauthorized clones.

Authentication also works in the other direction: The tag can challenge the reader. This approach might be used in an RFID tag subway pass, in which the pass accepts a command only from a kiosk (the reader) to increase the dollar balance if it confirms that the kiosk is legitimate, and not being spoofed by a thief's device.

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

Will RFID Kill EAS?

Both technologies can perform effectively to thwart theft in retail stores, but one can enable additional benefits.

By Bill Hardgrave

LET ME GET THIS out of the way up front: I believe RFID will replace traditional electronic article surveillance for loss prevention in retail stores. The reason harkens back to the question I posed in my column Retail's Trilogy: Which is better, one or more benefits?

EAS does one thing—it detects if something is going through a portal with a tag that has not been deactivated. It can't tell you what the item is or whether more than one item is being stolen. RFID knows exactly what is going through the portal, and it can recognize each item. RFID not only extends EAS's single functionality, it also has the capability to address inventory accuracy, out-of-stocks and many other use cases. As my good friend Bill Holder (former CIO of Dillard's) used to say, "At least with RFID, we know exactly what was stolen, so we can restock it for someone else to steal."

When an EAS-enabled alarm sounds, it is generally too late to stop the loss from occurring. With RFID, a retailer has the opportunity to actually prevent loss. The key is to use RFID-generated data to develop a loss-prevention system. A store, for example, could set up the system to recognize anomalies that indicate a theft is likely to occur, such as when a shopper takes two identical items into a dressing room or performs a "shelf sweep," removing several products from a shelf quickly and simultaneously. The system could alert store personnel to keep an eye on the shopper, possibly preventing rather than merely detecting a theft.

Consumers have grown accustomed to the external EAS hard tags and EAS soft tags affixed to items, both designed to visibly warn a potential thief that an alarm will sound if the tag isn't deactivated at the point of purchase. Some stores that adopt RFID may elect to use "dummy," or empty, hard tags to continue the visual deterrent (especially on high-theft items), or post signs indicating that RFID is sewn or built into products. The RFID tags will need to be affixed to products so they cannot be easily removed. Some retailers are embedding RFID tags into the care labels of clothing, and I know of one European retailer that is sewing the tag into apparel.

EAS vendors are actively helping retailers transition from EAS to RFID by converting conventional EAS portals to dual-purpose portals that recognize both EAS and RFID tags, and by providing hybrid EAS-RFID hard tags.

Sorry, EAS, but your days are numbered. The issue is not whether EAS is a good technology, it's just that RFID is a better technology. And better always disrupts the status quo.

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

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