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RFID JOURNAL

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Futureproof Your RFID System

7 STRATEGIES THAT WORK

PAGE 12

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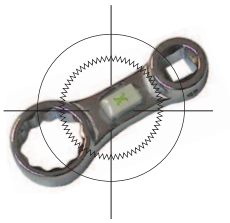
features



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This free interactive portal—with more than 9,000 members—features products to help end users and systems integrators find technologies that can aid them in deploying RFID successfully. Here's an example: The **ePix Power Mapper** is a battery-free UHF RFID meter that lets you identify null and dead spots in the read field.

Most-Read Stories In June

- Stanley Healthcare Solutions Acquires Wi-Fi-Based RTLS Company AeroScout
- Motorola to Broaden Handheld Reader Portfolio With Psion Acquisition
- That 'Internet of Things' Thing
- Honeywell Sees Its Optimus 5900 Reader as the First in a Series of RFID Products
- Getting Past Dr. No

Top 10 Search Terms On RFIDJournal.com

1. Food
2. Pharmaceutical
3. Library
4. Walmart
5. NFC
6. RTLS
7. Asset tracking
8. Health care
9. Mining
10. Jewelry

Worldwide RFID Deployment Map

RFID Journal's interactive map shows how widespread RFID adoption has become. The dots are color-coded according to industry, including aerospace, agriculture, apparel, defense, health care, logistics, manufacturing, pharmaceutical and retail. You can get more information about a particular deployment by clicking on one of the dots—a pop-up will appear.

To put your company's RFID deployment on the map, click here and fill out the form. It takes only a few minutes.

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 I use RFID in the hospitality industry?
- What is the cost of using RFID versus bar codes?
- Is RFID being used on public buses?
- Can chemical containers be traced from port to port?
- What standards govern passive RFID?

Avoiding Obsolescence

WHENEVER ANY COMPANY INVESTS in a new technology, there are concerns about obsolescence. No CEO wants to plunk down several hundred thousand dollars on a technology that is supposed to save money, only to find in three or four years that the technology must be replaced because the vendor went out of business, the proprietary system has been superseded by standardized technology or there is just better technology on the market.

PHOTO: TOM HURST | RFID JOURNAL

There are no guarantees—no matter how hard you try to find them—that the technology you buy today won't be obsolete in five years. But in our cover story, "Futureproof Your RFID System," John Edwards provides seven strategies to protect your investment in radio frequency identification technologies (see page 12). One of the most important things any company can do is invest in standards. Standards guarantee—or virtually guarantee—that you are not locked into a single technology provider. So if the firm that made your RFID system goes under, other companies can provide tags and readers, and service your infrastructure.

Standards also tend to evolve in ways that ensure backward compatibility. The IEEE standards for Wi-Fi 802.11b and 802.11g, for example, are interoperable. A new wireless router based on 802.11g can communicate with an older laptop using 802.11b. Similarly, GS1 is developing an enhancement to the second-generation Electronic Product Code air-interface protocol that will be compatible with tags and readers using the current EPC air-interface protocol. You will have to upgrade the firmware on your readers to take advantage of some new features, but you will not need to rip out your old readers when the enhancement is published.

Edwards also explains other strategies to avoid obsolescence. An important one is to plan for a broader deployment. Too many companies use RFID to solve a specific business problem, only to realize later that the system they bought cannot be expanded for other applications they'd like to deploy.

Planning is critical for financial institutions, which are beginning to deploy RFID to track and manage many different items. As reported by Jennifer Zaino in this issue's Vertical Focus (page 22), banks are using RFID to track storage media, such as backup drives containing sensitive data that could be stolen or misplaced. Some U.S. banks have adopted RFID to manage IT assets for Sarbanes-Oxley compliance. And banks in China, India and Europe are piloting or implementing RFID to track documents, money and other items.

Many construction, energy and manufacturing companies are interested in using RFID to automate processes to track and manage hand tools. This application can lower the cost of replacing tools, reduce the amount of time spent looking for tools and increase tool-utilization rates. In this issue's Product Development section (page 28), Mary Catherine O'Connor discusses some of the leading tool-tracking providers. As you consider their solutions, refer back to our cover story to ensure your tool-tracking system will be compatible with other applications you may want to deploy. This will help you futureproof your RFID system.

Mark Roberti, Founder and Editor

HEALTH CARE

Using Radio Waves to See

The HearMeFeelMe project is developing NFC applications to assist visually impaired seniors with daily tasks.

Minna Isomursu

PHOTO: VTT TECHNICAL RESEARCH CENTRE OF FINLAND | ILLUSTRATION: ISTOCKPHOTO

ONE OF THE VIRTUALLY inevitable results of growing old is impaired eyesight. While technology can't prevent visual impairment, it can help support those who must deal with it, says Minna Isomursu, coordinator of the HearMeFeelMe project, which is using Near-Field Communication (NFC), a short-range form of RFID, to develop applications to help seniors identify everyday items and manage their medications.

The idea behind the HearMeFeelMe project came about during work on a larger NFC initiative called SmartTouch, funded by the European Union, says Isomursu, who also is a research professor at the VTT Technical Research Centre of Finland, a prestigious applied research institute. VTT worked with Top Tunniste (an NFC systems integrator in Finland), Tecnalia (a private research company in Spain) and the National Centre for Scientific Research (a research organization in Greece that is also known as Demokritos) on the SmartTouch project.

"We've been exploring the technical challenges and application potential of NFC at VTT for at least 10 years now," Isomursu says. "Before the HearMeFeelMe project, we had a big European collaboration project called SmartTouch, and the idea for using NFC for helping visually impaired people emerged in this project."

During work on the SmartTouch project, the researchers found they could use NFC technology to build intuitive, easy-to-use

interfaces for digital services for older adults. "NFC-based interfaces can be designed so you do not need to read the screen or press the buttons of a mobile phone—both skills that become more difficult with aging," Isomursu says. "We built several service interfaces for older users, and found the technology was robust, easy to learn and use for older adults with physical or cognitive challenges."

In 2007, the collaborators won the annual NFC Global Competition, sponsored by the NFC Forum, for their "Seeing Eye Phone" idea. "We got lots of feedback and interest in the concept," Isomursu says, "and this made us think it would be worth investigating the idea further in a project specifically addressing the needs of visually impaired."

The HearMeFeelMe project was funded by the Ambient Assisted Living Joint Programme, a European organization dedicated to enhancing the quality of life of older people; the organization requires at least three countries to participate in a project. "Also, partners had complementing technical competences," Isomursu says. "Tecnalia has been doing NFC-related technical development for a long time. At VTT, we had expertise on service design and user studies, and Demokritos had competence in indoor location technologies."

The Touch 'n' Tag application lets visually impaired people identify everyday items, such as clothing and food, with the help of voice memos. Using an NFC-enabled phone, the user records an audio file—"This is a green sock" or "This is a red T-shirt," for example—that is stored in the phone and associated with a specific tag. When the user touches the NFC label affixed to the item, the tag is read, triggering a playback of the recording. Elderly volunteers who tested the applications developed by the HearMeFeelMe researchers said this was their favorite, Isomursu says. They used it most often to mark food packaging, and said it was useful in recognizing items and recalling product information. They liked that they could record information useful to them, she adds.

The researchers also developed five NFC applications for acquiring medical information. By touching an NFC tag on a pill bottle with a mobile phone, for example, the user can download product and dosage information, which can be played back on a phone or computer.

Another application that has not been tested yet by volunteers is an "almanac" demo designed to ensure users take medication at the proper times and tend to other important activities. The application makes use of an elderly person's social network. Nurses and family members can send reminder messages to the patient via cell phone about scheduled medicine doses or meetings, and the user can reply with an NFC acknowledgement. For example, the user can touch the pill dispenser with the phone to inform the caretaker he or she has taken the medicine.

To make the solutions attractive from a business point of view, the researchers needed to develop solutions that could be used across European markets, if not global markets. "Medication-management practices, such as procedures followed at pharmacy and doctor's office, and cultural and social aspects related to medication management, are very different in different regions," Isomursu says.

The researchers considered using 2-D bar codes for the applications, but chose NFC because it is easier for the visually impaired to use. "Through user studies, we have found out that users find touch-based interaction more intuitive and natural compared with using cameras and bar codes," Isomursu says. "The users describe the experience as 'magical.'"

The Touch 'n' Tag application is ready for commercialization. The other applications created would need further development before they were ready for consumer use. Now that the project is complete, Isomursu says, VTT and the other institutions involved have no plans to develop additional applications. Some folks who are visually impaired might feel that's a bit shortsighted. *—Mark Roberti*

PHOTO: ISTOCKPHOTO

Setting Sights On the Elderly

Number of Europeans over age 75 suffering from age-related macular degeneration:
1 out of 3

Number of visually impaired seniors in Spain, as of 2009:
355,400

Number of visually impaired seniors in Greece, as of 2009:
94,000

Number of visually impaired seniors in Finland, as of 2009:
46,000

Number of visually impaired seniors in Russia, as of 2009:
1,270,400

Number of blind or visually impaired seniors in the United States:
5.5 million

—Rich Handley

MERGERS

Will Acquisitions Lead to RFID Dominance?

The RFID industry is experiencing a wave of consolidation that seems to be aimed at companies' achieving "gorilla" status.

IT'S COMMONLY SAID that Saturday is "moving day" in professional golf tournaments, which typically start on Thursday and end on Sunday. There are varying interpretations of the term, but it is generally taken to mean Saturday is the day you need to move up the leaderboard and position yourself for potential victory the next day. It's the day a golfer might take extra risks to try to make up shots.

Several major acquisitions, which appear to be more strategic than past deals, indicate that radio frequency identification providers are seeing the current period in a similar way. With some major retailers, aerospace companies and hospital chains seeking to deploy RFID technology enterprisewide, solution providers seem to be positioning themselves to be the gorillas in the market ("gorilla" is the term coined by Geoffrey Moore, leading expert on the technology adoption life cycle, for a dominate technology provider, such as Apple in the MP3, smartphone and tablet markets).

It started in December, when Dutch RFID transponder company Smartrac N.V. acquired UPM RFID, a division of Finnish wood pulp, paper and timber provider UPM-Kymmene. Smartrac announced it planned to leverage UPM RFID's passive ultrahigh-frequency manufacturing capabilities to position itself as one of the world's largest providers of UHF RFID inlays. Smartrac previously had purchased two other transponder manufacturers: Neology and KSW Microtec. The three acquisitions represent Smartrac's interest in further penetrating the UHF RFID market by providing tags, as well as the inlays built into the transponders, and full RFID solutions.

Smartrac's purchases position the company to compete with Avery Dennison, one of the world's leading providers of RFID transponders. Avery has the largest market share in North America. Smartrac has penetration in Europe, and Invengo, another transponder manufacturer, has a strong position in Asia. It's likely these three companies will be battling for market supremacy in the coming years, and there probably will be more acquisitions as each company tries to strengthen its hand.

In June, Motorola Solutions announced it had reached an agreement with Psion to purchase the British handheld

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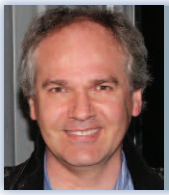
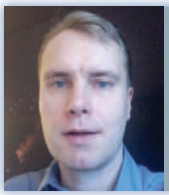


Tom Romanich — NORSK LASTBÆRER POOL



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computer manufacturer for $200 million. The deal is expected to close during the fourth quarter of this year. The acquisition appears, in part, to have been driven by Motorola's desire to dominate the market for handheld and fixed RFID readers.

Psion, which sells its handheld products to customers in more than 50 countries, has a large presence in Europe. Its RFID-enabled products include the Workabout Pro series with UHF, high-frequency and low-frequency reader modules. Motorola, the leading provider of RFID-enabled handheld devices, is most prominent in North America. The purchase of Psion gives Motorola a larger client base and greater penetration of the European market.

Motorola also may have been responding to recent moves in the RFID market made by Honeywell, a manufacturer of commercial and consumer technology products. (The companies became competitors in 2008, when Honeywell purchased Metrologic Instruments, a maker of data-capture and collection hardware and software.) In June 2011, Honeywell purchased LXE, which makes mobile RFID technologies.

Honeywell recently unveiled the Optimus 5900 handheld RFID reader and mobile computer, the first device in a line of RFID hardware the firm intends to develop as it ventures into the market. The UHF reader is a smaller and lighter alternative to handheld interrogators on the market, according to Honeywell. The device is geared to apparel retailers, though it also could be used in warehouses or for reading RFID tags elsewhere along the supply chain.

Another major acquisition occurred in June, when Stanley Healthcare Solution (SHS), a division of Stanley Black & Decker, the tool-manufacturing company, purchased real-time location system (RTLS) provider AeroScout. SHS provides RFID solutions designed to locate and protect individuals and medical equipment. AeroScout is a leading provider of Wi-Fi-based RTLS solutions.

The SHS line of wireless and electronic systems for monitoring assets, inventory and people includes the RFID-based Hugs, Pedz and Passport patient-security solutions, acquired, in 2008, from VeriChip. The company also offers fall-management solutions, such as Bed-Check, with pressure-sensitive pads to indicate unsafe movement, and HealthTrax, asset- and patient-tracking software that works in conjunction with RFID RTLS technologies. Approximately 15,000 customers, including hospitals and long-term and acute-care facilities, use SHS solutions. The AeroScout acquisition broadens SHS's product portfolio.

The acquisition also positions SHS-AeroScout to become a dominant player in the RFID health-care market. To date, AeroScout has approximately 800 customers of its RTLS solution, including 500 hospitals that employ its active Wi-Fi tags and MobileView software platform to manage location data.

Engineers at both firms are now developing products that will incorporate Stanley's existing RFID technology with AeroScout's Wi-Fi-based hardware and MobileView software platform. SHS will aim to sell the AeroScout RTLS to its customers and sell the SHS product line to AeroScout customers.

The key to achieving gorilla status, according to Moore, is to achieve a critical mass of customers. When critical mass is reached, Moore says, other end users go with the largest solution provider. That's the safe choice, since interoperability is virtually assured, as is vendor viability, because everyone is buying the product.

Acquisitions are one way to achieve critical mass. It remains to be seen whether the acquisitions by Smartrac, Motorola and Stanley Black & Decker will lead to those vendors' gorilla status in the RFID market. But it's clear these are strategic moves aimed at positioning the companies to win when the market takes off—just like on moving day in golf. —*Mark Roberti*

The key to achieving gorilla status is to achieve a critical mass of customers. When critical mass is reached, other end users go with the largest solution provider.

—GEOFFREY MOORE

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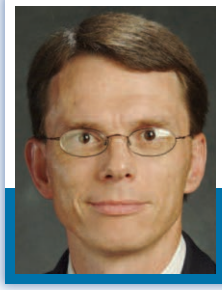

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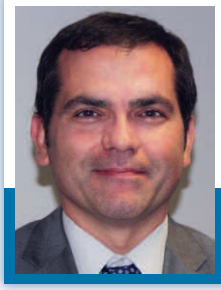

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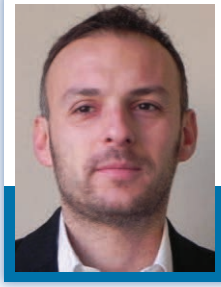

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PATENTS

Courting Confusion

LATE LAST YEAR, a patent-licensing company called Round Rock Research launched a barrage of lawsuits against end users of RFID technology, including American Apparel, Dole Food, Fruit of the Loom, Hanesbrands, JCPenney, Macy's, PepsiCo., Gap and VF Corp. The suits claim these companies are infringing on five U.S. patents relating to the use of ultrahigh-frequency RFID tags and readers. Round Rock acquired these patents—numbers 5,500,650, 5,627,544, 5,974,078, 6,459,726 and Re 41,531—from Micron Technology, a semiconductor company.

Other end users have received cease-and desist-letters from Round Rock, claiming plans to use RFID would violate Round Rock's patents. Round Rock was founded by John Desmarais, a patent attorney who became famous when he won a $1.52 billion verdict for Alcatel-Lucent against Microsoft in 2007. Round Rock is going after end users rather than technology providers, perhaps because they have more money and are more likely to settle and pay a licensing fee for the patents (settling could be cheaper than a long, drawn-out court fight).

In March, Motorola Solutions, a leading provider of RFID technology, filed a countersuit against Round Rock. According to Motorola's complaint, the company was asked to defend the retailers being sued, because Motorola had indemnified them in contracts signed when the retailers purchased the technology. Motorola is seeking a declaratory judgment that its RFID products do not infringe on the five patents, and that Round Rock's patent claims are invalid.

An anonymous party has requested reexamination of the patents, a process by which the U.S. Patent and Trademark Office reviews a patent that already has been issued, to verify the patent's claims and scope. Round Rock's lawyers have responded by requesting that the company be allowed to add more patents to the original complaints, a source told RFID JOURNAL. The judge has not yet ruled on these motions.

Some end users are now demanding that any RFID contract they sign include an indemnification clause. Companies that provide RFID solutions based on GS1's UHF Electronic Product Code air-interface protocol standard are looking for guidance from GS1. GS1 conducted extensive patent research when it developed the Gen 2 EPC standard, and requested companies with intellectual property used in the standard make it available without a license. Many companies did this, but Micron never ventured into the UHF RFID market. It worked out a deal, instead, with Round Rock.

If Round Rock patents are validated, legal sources say, there are several ways forward. End users could be required to pay Round Rock a licensing fee, or solution providers could negotiate deals with Round Rock, in which the solution provider would pay a licensing fee in exchange for Round Rock agreeing not to sue its customers. If the patent claims are found invalid, the issue will go away—until another patent-licensing company holding RFID patents decides to try the same trick. —*M.R.*

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RFID in High Tech, *RFID Journal's* first event in the Silicon Valley area, will bring together leading high-tech and electronics companies looking to learn about the benefits that radio frequency identification can bring to their operations, and how they can use the technology to enhance their products.

Learn how Cisco is using RFID technology to track IT assets, individual servers, storage media and other critical business elements; to improve business processes, such as inventory management; and to increase visibility into its enterprise IT systems. In addition, hear Intel discuss its new embedded RFID platform, as well as case studies involving the tracking of printed circuit boards during manufacturing.

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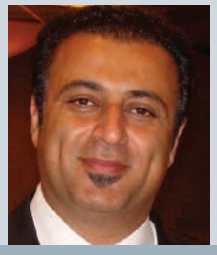

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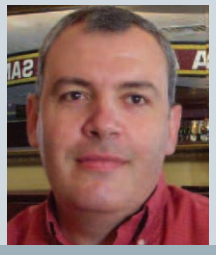

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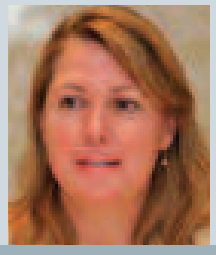

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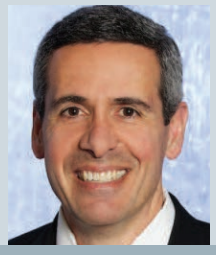

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FUTURE PROOF

YOUR RFID SYSTEM

BY JOHN EDWARDS

Industry insiders share seven strategies to design and manage an RFID system that will keep pace with evolving technologies and business demands.

Obsolescence. You believe radio frequency identification will help your organization handle tasks more efficiently and cost-effectively, yet that word lingers in your mind. While the benefits of RFID have been proven, there's still some risk in investing thousands of dollars in a relatively new technology. You fret about deploying a system that may be made obsolete within a few years by evolving technologies or business practices.

This is a real concern, but not a reason to put off deploying an RFID solution that can deliver benefits today, say early adopters, technology providers and analysts. By applying some "futureproofing" strategies, just about any adopter can ensure its new system will function smoothly and productively for many years.

Futureproofing means taking a holistic approach to RFID design, implementation and maintenance. That involves determining your goals, analyzing systems from multiple angles, and understanding the relationships among hardware, software, standards, scalability, design and quality—all with an eye toward maximizing durability and longevity. Futureproofing also means keeping up with emerging trends—examining what's new while knowing what may be heading toward obsolescence—and creating strategies to deal with inevitable changes in technologies and business practices.

Here, then, are seven strategies to futureproof your RFID system.

1 PLAN CAREFULLY

Futureproofed RFID systems are born on the drawing board. Careful and precise planning aimed at understanding current needs, predicting growth and determining how to integrate RFID with other existing and future systems is essential to ensure longevity.

"We want to get [customers] thinking about growth and future needs, and how their systems will accommodate these

ILLUSTRATION: ISTOCKPHOTO

changes," says Steve Halliday, president of RFID consulting company High Tech Aid, in Gibsonia, Pa. "It really comes down to understanding where you are today and where you want to be in the future. Probably 75 percent of people can't tell you where they want to be—they only have some vague ideas."

When working with a customer to develop an application, Halliday says, his firm leads the client through a logical thought process by asking questions such as:

- How do you do this now?
- What information is missing?
- What makes your process difficult?
- Who does this work?

"We then try to get them to think about their ideal solution," Halliday says. Questions include:

- What do you really want to make your life easier?
- Who/where is the bottleneck in your current system?
- How do you see the system working in two years? Five years? Ten years?

"From this, we try to create a plan for them for the implementation and for the future, so they have a path forward," Halliday says.

Strategic planning also can help early adopters manage risk. "In most cases, early adopters are the people who gain the most," says Chris Hood, Europe, Middle East and Africa channel sales manager for tag supplier Omni-ID, in Rochester, N.Y. "They get a march on their competitors." Yet, there's a reason brand-new technologies and approaches are often described as "bleeding-edge."

The key is to look for value in whatever product or service is being offered, and then measure potential opportunity against likely risk, says Michael Liard, RFID director at VDC Research, a technology market research and strategy firm in Natick, Mass. "You don't want to buy something with all the bells and whistles in the mistaken belief that it alone will provide a futureproofed solution," he says. "The best approach is to have a short-, mid- and long-term vision around RFID and what that will mean to your operations."

> "It really comes down to understanding where you are today and where you want to be in the future. Probably 75 percent of people can't tell you where they want to be—they only have some vague ideas."
>
> **STEVE HALLIDAY, HIGH TECH AID**

2 TACKLE CORE BUSINESS FUNCTIONS FIRST

A business' initial move into RFID should be an effort to improve core business functions, such as inventory management and manufacturing processes. Core functions generally offer the richest return on investment opportunities. Only later, when a business can leverage the experience gained while applying RFID to core functions, should RFID be extended into other, less critical areas.

"Everything starts with processes," says Roelof Koopmans, managing director for Europe at Los Angeles-based RFID systems developer Mojix. "Our customers do very well by identifying key processes where they think they can gain efficiencies or quality improvements."

Deployments that improve core business functions begin generating operational and financial benefits almost immediately and will continue offering productive service for many years, Koopmans says. "We've seen that the customers who do their homework, they're getting the most out of these technologies

RFID IN HEALTH CARE

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LEARN HOW INDUSTRY LEADERS ARE USING RFID TO CUT COSTS AND IMPROVE PATIENT OUTCOMES

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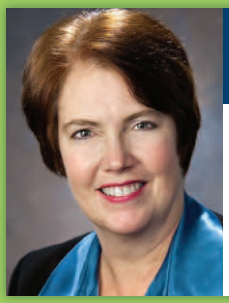

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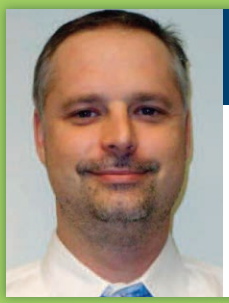

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"For us, RFID improved our inventory and maintenance processes, which are the core parts of our business."

JOHN M. KEIGHER, MIDWEST TRANSIT EQUIPMENT

because they know exactly where to enable processes with RFID technology."

Midwest Transit Equipment, a Kankakee, Ill., firm that specializes in commercial bus sales, is using Intermec RFID technology to track and manage its vehicle inventory. John M. Keigher, the company's director of systems and human resources, had his priorities in order before planning began on the bus inventory-management system. "For us, RFID improved our inventory and maintenance processes, which are the core parts of our business," he says. "We see the technology as a way to do things we could not have done with other technologies or our existing manual processes." System deployment has been completed at all four of the company's current bus inventory sites.

3 STICK TO STANDARDS

Unless you have a really good reason for doing something differently, design your system for compatibility with accepted standards. "We try to only supply systems that are based on standards," Halliday says. "We don't use proprietary stuff, because there's too much concern about whether it will still exist in two or five years."

At the technical level, there's already a large and well-established standards base. "By and large, particularly for passive UHF, we're in

good shape when it comes to standards," Liard says. Many once-innovative RFID technologies are also being rapidly standardized. "We're starting to see some additional development away from proprietary solutions in the active RFID community—ultra-wideband is a good example—as well as for some of the 2.45 GHz solutions," he says.

Industry-specific standards are now available in many areas, from retailing to manufacturing. "[When] using data standards from ISO or EPC or whomever, we look hard to determine if there are already standards in their industry that [the customer] should be focusing on," Halliday says. "A company might be working in the health-care arena, for example, and have no idea that there are already standards that relate to what they're doing." Such standards include Health Level 7 specifications that define the interchange of data and the ISO/IEC 15408-1 IT system security standard.

Still, futureproof-minded adopters must select their standards wisely. Glyn Matthews, senior IT project manager for Speedy Services, a tool-rental company in Haydock, England, was concerned about standards when he began investigating RFID tool-tracking systems. Colleagues told Matthews that low-frequency RFID was a better, cheaper choice than ultra-high-frequency. "When we started this project in 2010, there was a lot of skepticism in the RFID world about whether you could do tool tracking using UHF RFID tags," he says.

Matthews decided to find out for himself. "We were already using low-frequency tags in the rail division of our business," he says. "The technology was old, and the read range was not good enough for a walk-through portal. We wanted the tags to be inside [the assets]; we wanted them to be read without the customer having to do anything.

"I went to RFID Journal LIVE!, in Darmstadt, Germany," Matthews says, explaining he left the event convinced that UHF was the way forward. "It seemed LF tags were being phased out in a lot of places," he says. "That was one of our main reasons for going with UHF tags. It was very much about following the Gen 2 and GS1 [specifications]. I got quite a few contacts [at the event] and started contacting people to send me some tags." After studying and evaluating the products, he felt confident his gut instincts had been correct. "I had tags sent to me from all over the world, and the [UHF] Omni-ID tags were consistently giving us good reads inside an asset."

"It seemed LF tags were being phased out in a lot of places. That was one of our main reasons for going with UHF tags. It was very much about following the Gen 2 and GS1 [specifications]."

GLYN MATTHEWS, SPEEDY SERVICES

4 CHOOSE COMPONENTS CAREFULLY

Making a commitment to using high-quality system components, including durable tags, sturdy readers and bug-free software, is one of the most important steps a business can take to keep its RFID system running trouble-free for many years.

"Quality hardware and software components are critical for futureproofing," Midwest Transit's Keigher says. "They allow you to have a durable, robust system that lasts for a full technology cycle."

Organizations that deploy RFID in rugged environments, such as places afflicted by extreme heat or cold, often benefit the most from quality RFID products. "We wanted something durable because nearly everything we do is

outside in the weather," Keigher says. "We're in the Midwest—we've got snow and ice in the winter, and in the summer many days of over 100 degrees."

When used in industrial settings, particularly outdoors, poor-quality equipment is more susceptible to dust, bumps and drops. Keigher says his system needed to be resilient enough to resist all these conditions, so using quality components was essential. "We wanted something we would be sure was a long-lasting investment for us," he says.

Many RFID adopters with long-term goals focus on hardware technologies and specifications while neglecting software requirements. That can be a big mistake. "When futureproofing, you have to start thinking about the software capabilities," Liard says. "How are upgrades going to be handled? You've got to make sure that's done automatically and is part of the solution." Both system and application software need to keep pace with growing business needs and evolving technologies.

> "When futureproofing, you have to start thinking about the software capabilities. How are upgrades going to be handled? You've got to make sure that's done automatically and is part of the solution."
>
> **MICHAEL LIARD, VDC RESEARCH**

RFID hardware must also be able to accommodate new and enhanced types of software. "If there are any changes to application software, or different types of protocols that need to be pushed through to a reader device, you need to be able to do that through a firmware upgrade that's automatic," Liard says. "That will help you futureproof your RFID system from a technical perspective."

Adopters should be proactive in asking their hardware supplier—whether direct from a vendor or through a reseller or integrator—key questions around technology futureproofing and device upgrading via firmware, Liard adds. "Specifically," he says, "what are the associated costs, frequency of upgrades and features/functions that are upgradable?"

5 STRIVE FOR SCALABILITY

Some RFID systems meet a premature death because they can't keep up with growing operational demands. Careful scalability planning, performed at the project's start, can extend a system's service life by years, potentially decades.

"Scalability is important from day one—even if there is no current need, it has to be understood and discussed," Halliday says. "Unfortunately, it's real easy to design a system that can't be scaled—probably less expensive as well—because you're not looking at options for the future."

Failing to plan for future needs can lead to serious and expensive problems down the road, when managers and staff members find themselves struggling with a locked-in system that can't keep pace with increasing workflow demands.

Frank Zucca, a senior mechanical engineering technical associate in the Advanced Light Source (ALS) unit of the Lawrence Berkeley National Laboratory, says he took scalability into consideration when evaluating RFID systems to track and manage the equipment scientists and technicians use in the facility. In 2011, ALS deployed an active RFID solution from RF Code, with software from AssetPulse. "Most definitely, we needed to be expandable, because we're always adding new pumps and retiring older pumps that aren't supported by industry any more," he says. "There was a real

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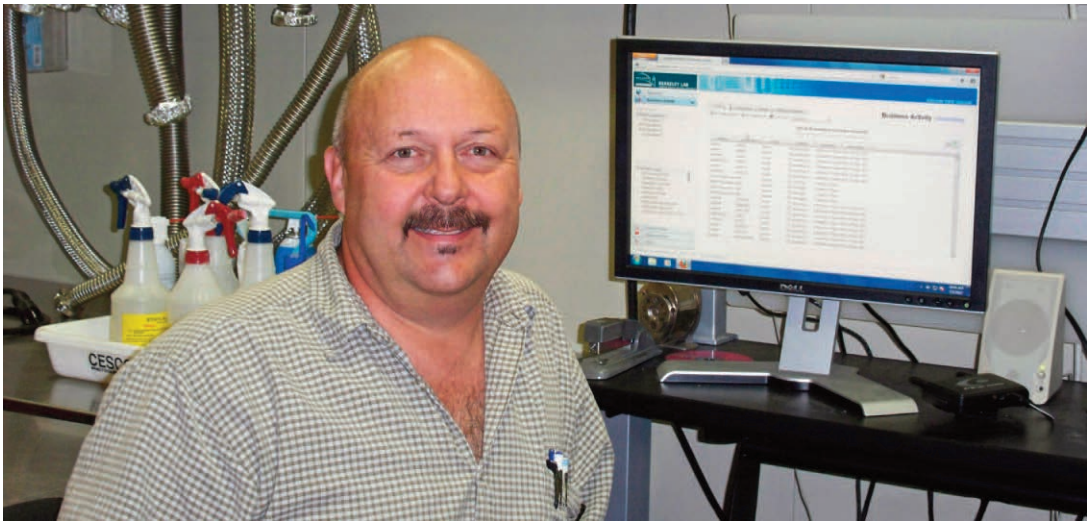

"Most definitely, we needed to be expandable, because we're always adding new pumps and retiring older pumps that aren't supported by industry any more."

FRANK ZUCCA, LAWRENCE BERKELEY NATIONAL LABORATORY

need to be able to expand."

Keigher made sure scalability was an integral part of Midwest Transit's bus inventory-management system. "It's a very scalable solution, because we can add any number of devices, and the cloud-based application doesn't impact our existing IT infrastructure," he says. "Additionally, the IP30 handheld RFID reader from Intermec supports a range of Intermec mobile computers, and it allows us to add RFID to mobile computers that we may migrate to in the future."

If your RFID solution provider doesn't raise the issue of scalability, ask. Understanding scalability and how to best achieve it is crucial to creating a truly flexible and adaptable system. "I think the worst thing is when a customer thinks they've got something that's going to last forever, and the supplier has done nothing to help them understand that it has severe restrictions and it can't be scaled for the future," Halliday says. "What's been proposed has been proposed down to a price rather than up to a requirement."

6 TEST, RETEST AND TEST SOME MORE

A futureproofed RFID system will last many years, so spending several months testing and retesting before deployment is a small price to pay for long-term reliability and performance enhancements. ALS' Zucca opted to trial two separate systems while evaluating RFID-based equipment-management systems. "We developed a beta test: a passive system and an active system," he says. The trial showed that the active system delivered operational benefits that far outweighed the passive approach's lower cost.

Jörg Sandlöhken, research and standards manager for German supermarket chain Rewe Group, is a strong believer in getting everything right before proceeding with final deployment. In 2010, Rewe Group began tracking returnable transport items at its Buttenheim distribution center with Mojix's STAR System. Like many RFID adopters, Rewe tested its

system architecture in a limited trial deployment before deciding to invest fully in the technology. "We first created a trial, spending just a little money to see how RFID might work for us," Sandlöhken says. "I think that researching your options and first doing something on your own is always the best way."

7 MAINTAIN YOUR SYSTEM

Futureproofing demands a commitment to RFID excellence that doesn't end on deployment day, Liard says. He notes that system maintenance, upgrade, enhancement and expansion projects all need to be made with an eye toward ensuring longevity and addressing anticipated needs. "Futureproofing is about maintaining your system: What do I need to do today, and what do I need to do tomorrow—just in case," he says.

It's essential to establish a maintenance schedule, since a poorly maintained system is likely to fail prematurely. "A customer or end user should feel very at ease once a vendor has completed work on deploying an RFID solution, and feel like the system should operate with very little maintenance," Mojix's Koopmans says. "The RFID solution should also have checks and balances on the health and status of its components, providing the customer with alerts for actions needed to remedy any issue."

These seven strategies will help any company futureproof an RFID solution. But even the most carefully designed system, using the highest-quality components and supported by the most rigorous maintenance program, will eventually become obsolete. Some new, better technology or business requirement will come along that simply can't or shouldn't be integrated into your existing RFID infrastructure.

"Nothing lasts forever," Liard says. "There are always going to be new developments, the next best 'XYZ' or the latest update to whatever product is out there. But if you already see the value proposition and you've got a solid ROI model, total cost of ownership is digestible and the use case is there for you, I wouldn't wait to deploy."

Keeping a steady eye on future plans and goals is admirable. But if you find yourself postponing RFID plans in the hope that something better will soon come along, there's a strong chance you'll miss out on available productivity, efficiency and cost-saving opportunities.

"I think that researching your options and first doing something on your own is always the best way."

JÖRG SANDLÖHKEN, REWE GROUP

"The RFID solution should have checks and balances on the health and status of its components, providing the customer with alerts for actions needed to remedy any issue."

ROELOF KOOPMANS, MOJIX

For Speedy Services, moving ahead with its tool-tracking system sooner rather than later led to immediate benefits. "We can see the utilization of the equipment, what's being used and what's not being used," Matthews says. "It makes the administration a lot simpler—there are cost savings for the customer. There's also a cost savings due to reduced losses by theft."

Banks and other financial firms keep mum on how they're using RFID, but solution providers say they're adopting the technology to track everything from cash to servers.

Hidden Benefits

By Jennifer Zaino

BANKS AND OTHER FINANCIAL INSTITUTIONS are in the business of securing sensitive information and, of course, money. So it's no surprise they prefer to keep their methods for protecting client assets private. The RFID solution providers we interviewed for this story agreed to discuss recent projects for financial firms as long as we'd keep their clients anonymous. Still, their input sheds light on where—and why—RFID is being used in the financial services sector.

The main RFID applications used by financial services are designed to track IT assets, mobile devices, storage, cash and documents. One RFID application that isn't under wraps is contactless payments (see "Contactless Payments: No Longer *If*, But *When*" on page 25).

In 2008, the Financial Services Technology Consortium (FSTC) published a set of standards for implementing RFID-based systems to track IT assets within data centers. Shortly thereafter, FSTC was acquired by the Financial Services Roundtable, and a communications representative for BITS, the Roundtable's technology policy division, says work in the area is outdated. A spokesperson for GS1 says, for now, there is no activity on its part to republish or otherwise use the standard.

Nevertheless, some banks are tracking IT assets in data centers, and technology advances are simplifying that process. In the United States, RFID facilitates compliance with the Sarbanes-Oxley Act (SOX), which requires a proper accounting of fixed assets. Banks must be able to document where their assets are, whether they have "ghost assets"

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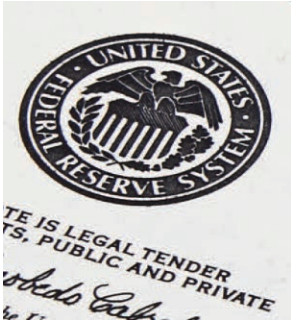


lingering on their books and how they gather information on their assets. The data collected with RFID can provide an accounting.

Another driver is data center consolidation, to reduce costs and complexity. Moving assets requires strong controls, and RFID can provide visibility into the process, according to a technology provider that has been working on consolidation projects with two global banking organizations.

The FSTC RFID standards called for EPC Gen 2 passive tags, with labels to include a human-readable version of the identifier. SOX compliance requirements demand that users be able to eyeball the inventory on a regular basis. Scanning passive tags with handheld readers lets inventory be taken 10 times faster than doing the job manually, while still fulfilling the need to physically see assets and also helping IT departments locate missing assets, according to RFID providers.

Financial institutions must be able to do holistic rollouts using consistent technology throughout their facilities.

Until recently, RFID-tagging IT assets was challenging for several reasons. It requires a small tag for devices such as blades, and the technology must provide accurate reads on metallic devices. In addition, financial institutions that have global operations must be able to do holistic rollouts using consistent technology throughout their facilities. The EPC Gen 2 standard specifies a global ultra-high-frequency RFID band from 860 MHz to 960 MHz. But a small subset of that band is used in various regions, including the United States, Europe and Japan. So a tag that could support the different operational frequencies was essential.

Today, Confidex, Omni-ID and Xerafy are among the RFID providers meeting these challenges. The Confidex SteelBit, for example, is a miniature UHF on-metal tag, based on the FSTC standards; it supports operational frequencies in the United States, Europe and Japan. The Omni-ID Prox also is a global, small UHF on-metal tag that is FSTC-compliant.

Xerafy recently debuted its flexible small form factor Metal Skin. The global EPC Gen 2 inlay is designed to track metal assets and can incorporate human-readable data. For the financial services industry, "the problem with hard tags is that they are not able to have their human-readable information printed on them, unless you do the labor of putting a label on top," says Xerafy marketing manager Kelly Stark.

Vendors developing RFID inlays that can be used to print on-metal RFID tags in a thinner, smart-label form factor to accommodate space constraints are opening a door for new uses, says Michael Liard, RFID director at VDC Research. "The cost point is much less than a hard tag," he says.

As low-profile, flexible designs and lower costs become the norm, Liard adds, it may become more feasible for financial firms to track their large contingents of laptops, tablets and other devices. This could be particularly helpful given the sensitive data that may reside on the mobile devices of financial firms' employees. "You've got lines forming in some environments for checking these in and out," he says. That process will go faster, he explains, if RFID-tagged laptops are identified automatically by serial number and associated by database with the proper individual, rather than hand-checked manually at security desks.

Storage is another IT asset ripe for RFID-tracking at financial services firms. There are many tapes and disk drives hosting sensitive customer financial information, for instance, and no business wants that data falling into

Contactless Payments: No Longer *If*, But *When*

La Caixa is Spain's leading financial institution in both retail and electronic banking as well as merchant services, with more than 200,000 businesses using its point-of-sale (POS) services. La Caixa also is a proponent of contactless payments, based on Near-Field Communication (NFC) technology, a short-range version of RFID. In January, following successful payment pilots in the town of Sitges and on the Balearic Islands, la Caixa announced that it would roll out NFC in Barcelona. By year-end, the bank plans to issue more than 1 million cards that can be used at 500 contactless ATMs, and it plans to distribute NFC-enabled POS terminals to 15,000 businesses, according to a la Caixa representative.

The la Caixa cards support the EMV (Europay, MasterCard and Visa) global standard for interoperable credit and debit payment cards, POS payment terminals and transaction processing networks. Cards with embedded EMV chips are becoming the norm in Europe. In the United States, MasterCard and Visa have published guidelines for migration from magnetic stripe to EMV technology, to enhance security for contactless payments made with NFC-enabled cards and mobile phones.

While more mobile phone makers, banks and businesses are embracing NFC, there's an entire ecosystem of components that must interact for contactless payments to be fully realized, says Michael Liard, RFID director at VDC Research. "The way I look at it is to picture a bunch of gears… that work to create the NFC machine—the integrated chip suppliers, mobile network operators, phone manufacturers, standards organizations, card issuers, banking community, mobile marketing and mobile money folks," he says. "And at the end of the NFC machine are us consumers, and we can shut that machine off with our indifference."

But the NFC ecosystem is beginning to coalesce. The Isis Mobile Wallet initiative, for example, is a mobile-commerce joint venture created by AT&T Mobility, T-Mobile USA and Verizon Wireless. The initiative is supported by American Express, MasterCard and Visa, as well as Barclaycard, Capital One and Chase. Starting in mid-2012, Isis reports, consumers will be able to load their eligible cards into Isis Mobile Wallets on their mobile phones and shop at participating merchants. The Isis Mobile Wallet is scheduled to launch in Salt Lake City and Austin, Texas, with a national rollout to follow.

"Other banks are looking at extending the functionality of their mobile banking platforms to include mobile payments—something we believe to be very compelling for consumers, and which is the basis of our partnership with mFoundry " says James Anderson, MasterCard's group head of mobile product development. mFoundry is a mobile banking specialist, with more than 500 financial institution customers. MasterCard's Tap & Go PayPass technology, which uses NFC, will combine with mFoundry's mobile financial services platform, so consumers whose financial institutions use the mFoundry platform will be able to make secure payments at PayPass-enabled merchant terminals. It will likely also lead to a mobile application that lets mobile phone operators offer MasterCard NFC-enabled PayPass payments from their phones.

"Banks do acknowledge that mobile, in general, is the way forward, and there is a need to focus on mobile applications, for mobile banking and payments," says Sirpa Nordlund, executive director of Mobey Forum, the bank-led not-for-profit whose mission is to drive a sustainable mobile financial services ecosystem. "For the banks, it is more a question of how to meet the needs of a new generation of customers who grew up away from the desktop."

But there are other issues to be explored, Nordlund says, including how customer service works in a world of mobile-payment applications on NFC-enabled phones. "If you have your credit card in a phone, who do you call if it doesn't work—the mobile-phone manufacturer, the network operator or the bank?" she asks. Maybe it's not working because you haven't paid your phone bill, in which case how could a customer-service representative at the bank be of help? "All these customer service centers need clearly defined roles, in order to deliver valuable services to consumers," she says.

While these concerns won't be easy to address, Nordlund says, "Every leading bank must have given a thought or two to NFC, so they must have made a strategic decision to move now or later. It's no longer a question of 'if' they need to do it—it's now more a question of 'when.'" —*J.Z.*

ILLUSTRATION: ISTOCKPHOTO

unauthorized hands—and then having to tell its clients the bad news, as required by legislation such as California's Customer Data Protection Act. "Data tapes with a lot of sensitive financial information sometimes have to go from point A to point B," Liard says. So tagging cases, individual tapes and vehicles that move the tapes to off-site storage facilities may be an option.

Tracking Money

But the holy grail for RFID asset tracking in the financial sector is all about the money, says Scot Stelter Sr., senior director of product marketing at Impinj, a UHF technology provider. "That is the biggest security issue there is," he says. This is especially so in cash-based economies such as China, where Impinj worked on a project with a commercial bank whose branches must deposit cash periodically with the state-owned Bank of China—this means the client must transport cash physically and the transaction must be auditable.

The holy grail for RFID asset tracking in the financial sector is all about the money.

Since mid-2011, several branches of the commercial bank have been RFID-tracking cash. The bank deployed RFID readers at its facilities and at the Bank of China. Machines wrap the cash in bundles of 10,000 RMB (US$1,568). These are wrapped in stacks of 100,000 RMB, and then placed in 40-stack cases. Forty cases are placed per trolley, totaling 160 million RMB. A Chinese services provider custom-designed an application that uses Impinj Monza UHF chips on tags for the case locks, which cannot be opened without destroying the tag. "When a trolley goes through the portal at the destination, which is manned by custom readers using Impinj's Indy reader chip, all the cases are read, so [it's clear] they haven't been opened and the cash is untouched," Stelter says.

A large bank in India—one of the largest banks in the world, in fact—is engaged in an RFID pilot using close to 20,000 UHF tags to track bundles of cash in different denominations, according to Anand Surana, CEO of Indian IT services provider Icegein, which supplied the software. The bank wants to know how many bundles are in its vault at any given time, to improve processes and logistics for next-day cash dispatches to its 40-plus branches in the country.

"Imagine thousands of bundles a day that you have to count with line-of-sight bar codes, and how cumbersome and tedious that is" compared with RFID, Surana says. Biometric security technology was part of the deployment; parties authorized to open the vault must present RFID access cards and have their fingerprints scanned for access. "So both bundles of money and people are tracked," Surana says.

Tracking Documents

The bank in India decided to pilot the cash-tracking application because of the success it had with a document-tracking solution, also provided by Icegein. "They realized that document tracking saved them huge time in finding documents that were misplaced, so why not try it with bundles of money as well," Surana says.

Icegein also developed a document-tracking solution for a banking client that has nearly 500,000 documents in one vault. "If documents that should be in Row A are in Row Z, it's a nightmare," Surana says. "With RFID, it tells you exactly where these particular documents are." Other benefits, Icegein reports, include faster stocktaking and reconciliation (5,000 files in 45 minutes), and better security thanks to alerts when docu-

ments are moved outside the restricted area.

Banks and insurance companies often hire document-shredding firms to securely shred sensitive materials. Earlier this year, Reisswolf, a European confidential-waste-management firm, introduced an RFID-based electronic lock system, to ensure that only authorized parties can unlock containers holding documents to be destroyed. The solution, which uses active and passive tags, also generates a report indicating who opened a container, when and for how long.

Banking on Innovation

While some financial firms are quietly employing RFID to track and manage assets, more technology innovation and education is needed before the sector embraces the technology.

Tracking mortgage papers and other documents that banks in India are required to keep on hand for years is a major challenge, says Ashim Patil, CEO at Infotek Software & Systems (i-TEK), an RFID system integration company in that country. RFID could help, Patil says, but he hasn't seen the technology's use in that respect pan out. After conducting a pilot at one big bank in India and a limited deployment at another institution, things got quiet. The industry would reach a turning point, he suggests, if more banks were to begin tagging documents at the source—from the day a client applies for a loan, for instance, not after the loan is processed—using RFID-enabled printers on site. "The moment we get that, RFID takes off," he says.

"Document tracking with RFID could be good for anyone from big banks to your local mortgage provider," Liard says. But, he agrees, it hasn't been on the fast track. "It's a large undertaking, and it might need more education, awareness and dedicated total solutions in that marketplace."

A total IT asset-tracking solution is needed for that application and others to take off in the financial sector, Liard says. What might move things forward is for technology companies to start embedding RFID technology into components. A recent innovation—Intel's new platform, which features a UHF RFID chip embedded in a device's motherboard and wired directly to the microprocessor—could be used for location-based access control. The data on the chip could be written to or accessed by a handheld or fixed reader, even if the device were powered down. A bank, for example, could station an RFID reader at the doorway of a secured area to disable a notebook PC removed from the space without authorization.

The industry would reach a turning point if more banks were to begin tagging documents at the source.

"People in the financial sector will find that valuable to comply with security rules about customer and other data," Stelter says. (Impinj created two RFID chips for the project; see "A New Tool for Electronics Companies.")

Cash-tracking applications could get a boost from version 2 of EPC Gen 2, due next year, Stelter says, because it will include encryption-based security. Tags will be able to authenticate readers and vice versa, and user memory will be partitioned securely. A commercial bank, for example, could use one section of user memory to store track-and-trace information it wants to keep private from a federal or state bank, or restrict it so the other bank can't change the information, he explains. "There will be new applications by virtue of really raising security capabilities," he says.

A few products based on the new Gen 2 spec may debut in late 2013, with more in late 2014, Stelter says.

A GUIDE TO RFID Tool-Tracking Solutions

By Mary Catherine O'Connor

Automating in-house and job-site systems to manage hand tools can reduce costs and improve safety.

MOST CONSTRUCTION FIRMS, energy and mining companies, and aerospace manufacturers have a common problem: The hand tools essential to their work tend to disappear from their plants and job sites. Whether tools are hoarded, mislaid or stolen, if the correct tool isn't in the right place when needed, it can delay or stop production. "Lost" tools that must be replaced have a negative impact on a company's or project's bottom line. And if a tool is accidentally left inside an engine or other piece of machinery, it could cause millions of dollars in damage or, worse, compromise safety.

The lost-tools problem has persisted despite the fact that tools are generally kept in secure cribs, managed by employees who record workers' names and the tools they check into and out of inventory. This manual process is slow, error-prone and labor-intensive. Some companies use bar-code technology in an attempt to automate their systems, but there are two major drawbacks: The bar codes on tools used in industrial environments are often too dirty to be scanned, and tools can't be located without a clear line of sight between the bar code and scanner.

"Some of our first customers using RFID tool tracking were in the roofing industry," says Dean Perry, president of ToolHound, a provider of tool- and equipment-management systems. "Tar dirt covers the bar code on a tool, and it can no longer be read. With RFID, if the tool is covered with tar, it does not matter."

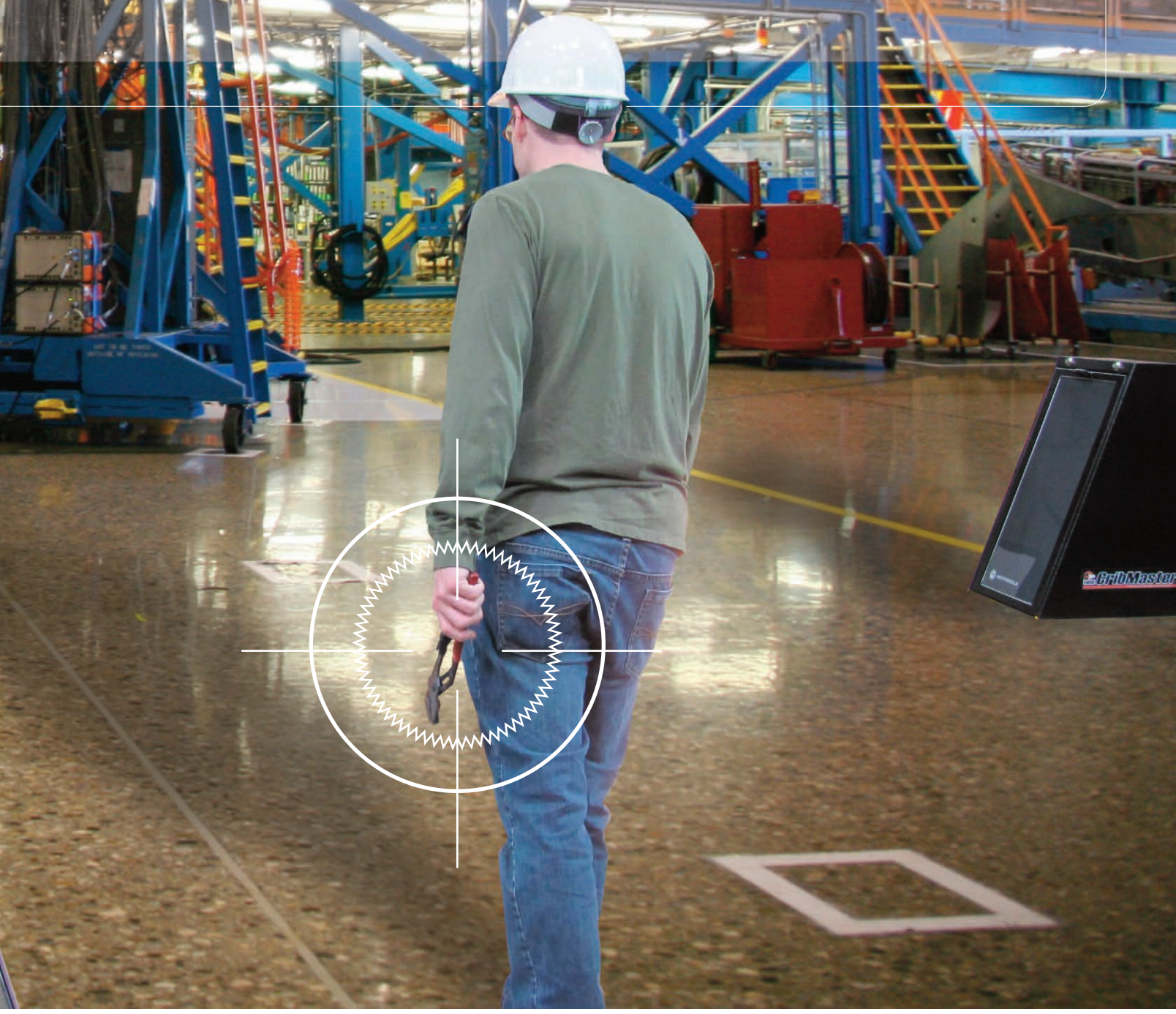
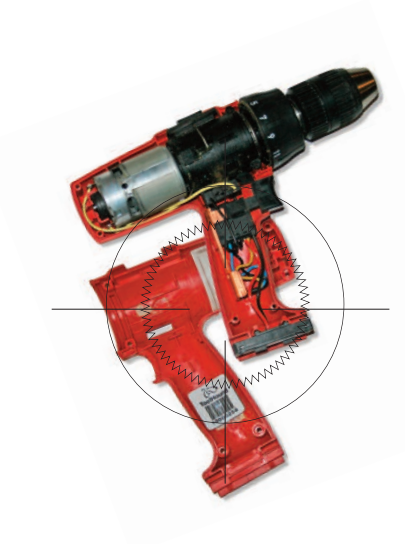


PHOTO COURTESY OF CRIBMASTER

Readers mounted near doorways or choke points can track the movements of tagged tools throughout a facility.

Tool-management vendors began testing and piloting passive and active (battery-powered) RFID tool-tracking systems in the mid-2000s. One of the main challenges at that time was that metal impairs read accuracy when using passive RFID tags, and many tools contain metal or are stored on metal shelves. The active systems delivered more reliable read rates, but the tags were expensive. The arrival, in recent years, of reliable metal-mount EPC Gen 2 ultra-high-frequency tags and widely available RFID readers and antennas in a variety of form factors has greatly improved the reliability and performance of passive tool-tracking systems. In the early days, passive RFID was being "oversold and underdelivered," says Mike Green, president of tool-management service JobSite Resources. Today, he adds, passive RFID technology is "more reliable and cheaper, so it's becoming more palatable to end users."

Several companies have worked with RFID vendors and systems integrators to develop tool-tracking systems (see "Custom Solutions" on page 31). But there also are commercial solutions on the market that include the tags, cribs, readers and software needed to track and monitor tools at plants or job sites. These packaged solutions can take from



two weeks to four months to deploy, depending on how many tools you need to track, how many features you select, whether you require software customization or integration with legacy software, and whether you have staff members available to attach tags to existing tool stock. (Most providers will help end users attach tags to the tools.)

Accu-traq, Choctaw Renewable Services and JobSite Resources have strategic partnerships with CribMaster to leverage its RFID hardware and software platform for both permanent and short-term tool cribs. Each markets CribMaster's hardware to specific industries—renewable energy, large building construction, and conventional and nuclear energy generation, respectively. ToolHound and ToolWatch also offer complete RFID solutions. Here's what you need to know to determine whether a commercial tool-tracking solution might be right for your company. For more details, see the vendor table on page 33.

Depending on the tool's construction, the abuse the tool might sustain and the ruggedness of the tag, providers will recommend embedding the tag.

In-House and Job-Site Solutions

Most tool-tracking providers offer a variety of on-site storage options to accommodate different sizes of tools. These can include cabinets, chests, kiosks, storerooms and vending machines.

Typically, the company issues workers RFID-enabled identification cards that they scan at a crib to access the tools. Readers identify the tools being removed, and inventory-control software records the information. With some solutions, such as ToolHound's Secure Crib Portal, workers use a touch screen computer to confirm the items being removed. Readers mounted near doorways or choke points can track the movements of tagged tools throughout a facility. A lost tool can be located quickly by setting a handheld reader to seek out the tag ID associated with the tool, then scanning a work area, using the reader as a sort of Geiger counter.

For short-term work, often involving multiple contractors, such as jobs at building construction sites, tool-management services generally set up secure, mobile tool cribs. These cribs are typically modular and, therefore, highly configurable. The providers say they will help you evaluate your needs, then set up portal readers, antennas and other hardware. You can decide whether you want a temporary crib staffed by the service provider, staffed by your employees or unstaffed.

JobSite Resources, for example, once set up a temporary crib at a construction site that linked three 20-foot shipping containers filled with RFID-tagged tools. Because the crib was so large, assistants helped workers locate the tools they needed.

Most tags are attached to the exterior of hand tools. But in some cases—depending on the tool's construction, the abuse the tool might sustain and the ruggedness of the tag—providers will recommend embedding the tag. With handheld power drills or sanders, for example, they will open up the tool's plastic casing and embed the tag inside. Either way, they will work with you to ensure the tags are reliable and readable at the distances and speeds your use cases dictate.

If you need to replace hand tools or add more to your inventory, the Proto-ID tools from Stanley Black & Decker come with embedded EPC Gen 2 tags, which can be used with the tool-tracking solution from CribMaster, acquired last year by Stanley Black & Decker. The tools are paired with foam liners inside tool drawers that are wired to an embedded reader in the tool chest or larger cabinet. Each tool has a designated home, matched exactly to the tool's size and profile, inside a drawer. When the tool is

PHOTO COURTESY OF TOOLHOUND

removed from its location, the RFID reader instantly recognizes the change and updates the tool inventory.

Software

Software is the key to automation for tracking hand tools. It controls which employees are granted access to unstaffed tool cribs, continuously updates tool inventory records and enables other benefits.

Service providers that previously offered bar-code tool-tracking systems have modified their software platforms to accommodate RFID tag data and tie tools' unique identifiers to employees' badge numbers. This way, if a worker does not return a tool at the end of a shift, management will know to whom that tool was issued and can start tracking it down.

In addition to using the software for inventory management, you can use it to track each tagged tool through its life cycle. The software will alert tool crib managers when specific tools are due for recalibration and other scheduled maintenance, for example.

To use certain tools, employees require

For short-term work, such as jobs at building construction sites, tool-management services generally set up secure, mobile tool cribs.

PHOTO COURTESY OF JOBSITE RESOURCES

Custom SOLUTIONS

SOME COMPANIES, such as those listed below, have developed in-house systems for improving visibility of and control over hand tools. Organizations have different reasons for electing to develop their own solutions. In some cases, the tools to be tracked require specialized tags, or the organization wants to customize an element of the tracking system and scale multiple locations.

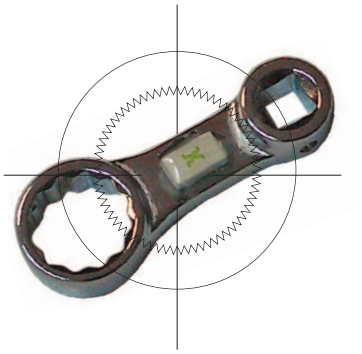
Grunnarbeid Begins Full-scale Rollout of Tool-Tracking System
After testing the use of EPC Gen 2 passive RFID tags to track tools as they enter and leave containers and vehicles, the central Norwegian construction company is installing the solution across all its operations.

Naval Surface Warfare Center Demos RFID Tool-Tracking Solution for Combat Ships
The system uses EPC Gen 2 UHF tags and readers to identify items loaded on board, in cabinets stored within steel containers, enabling the U.S. Navy to reduce inventory-tracking time from 32 hours to two minutes.

RFID Helps U.K. Tool Rental Company Better Serve Customers
Speedy Services' on-site solution provides continuous access to equipment, to meet work-crew schedules.

ThyssenKrupp Steel Europe Tracks Its Tools
The German company is employing passive HF RFID tags and readers to monitor the usage, maintenance and inspection of nearly 500 tools used at a ThyssenKrupp Electrical Steel plant.

special training. Software can verify that the employee checking a specific tool out of a crib has been trained in how to use the tool and is authorized to take it. If it detects an employee taking a tool that the individual is not certified to use, the software will send an alert to the crib manager.



Safety

In the aerospace and energy industries, tool tracking is not just a matter of inventory management—it's essential for safety. If, for example, a tool were inadvertently left inside an engine, it could cause significant damage. Most companies require safety checks as part of foreign object detection or foreign material exclusion programs. But these are often manual processes, which are error-prone.

RFID automates safety checks, making tracking RFID-tagged tools easy and reliable. After a mechanic completes a repair job on an engine, for example, a handheld RFID reader can be used to confirm that all the tools brought to a job site are accounted for. Lockheed Martin uses an RFID tool-tracking solution from CribMaster at five manufacturing sites to monitor when a particular tool was used and by whom—and to ensure tools aren't left inside a plane during assembly.

RFID automates safety checks—a handheld reader can be used to confirm that all the tools brought to a job site are accounted for.

The Donald C. Cook nuclear power plant, in Bridgman, Mich., uses an RFID tool-management solution from Accu-traq to monitor tagged hand tools, safety rigging and fire extinguishers. Plant employees use handheld RFID readers to perform fast, accurate inventory audits and to locate equipment that is missing or due for maintenance. The main tool crib still requires a manual checkout process, says Mike Frazier, Cook's tool crib supervisor, but the plant plans to transition to an automated system, in which employees will use RFID-tagged badges to access the crib.

The plant also plans to invest in CribMaster's mobile RFID tool chests, to monitor and account for all tools brought to work areas. This will ensure compliance with the plant's foreign material exclusion program. "Say you open up a turbine [for maintenance]," Frazier says. "You need to document that every tool that enters that area also exits it."

Some nuclear power plant customers maintain two separate RFID tool cribs, one of which is inside "hot" areas of the plant, says ToolHound's Perry. That's because tools exposed to radiation must remain in those hot areas. RFID readers mounted at portals can alert staff members if a hot tool is about to be brought out into noncontaminated parts of the plant.

The Cost-Benefit Equation

"For us, adoption of RFID-based tool tracking is still very slow—probably less than 5 percent of our customer base," Perry says. Cost is the main issue, he adds. Putting a bar-code label on a tool costs a few cents, but rugged RFID tags, specialized for metal mounts, can cost $3 to $5 each, he says. Plus, the RFID reader adds around $1,500 to the cost of a $2,400 handheld computer. But lost tools exact a toll on a company's bottom line, and he expects that as tag costs continue to fall, more companies will turn to RFID solutions.

"Large construction firms used to view tools as a necessary evil," says Mike Green, president of JobSite Resources. "Their margins were great, and they could throw more money at tools when they were lost. Now, margins are tight, so construction firms are looking to better manage their assets. Just in the past 18 months, we've seen a huge increase in the number of inquiries and prospects from the construction industry. With a lot of reductions in manpower, they can't have a manual process for tool check-in and check-out, so now they're looking toward [RFID] technology to improve the process."

PHOTO COURTESY OF ACCU-TRAQ

JobSite's tool-management service has helped customers reduce tool costs by up to 50 percent during construction projects, Green says. "Single, short-term projects can generate tens of thousands of dollars in lost tools. But large companies will have six or seven of these jobs going on simultaneously. So across an entire year, RFID-based tracking could save these firms "hundreds of thousands of dollars," he says.

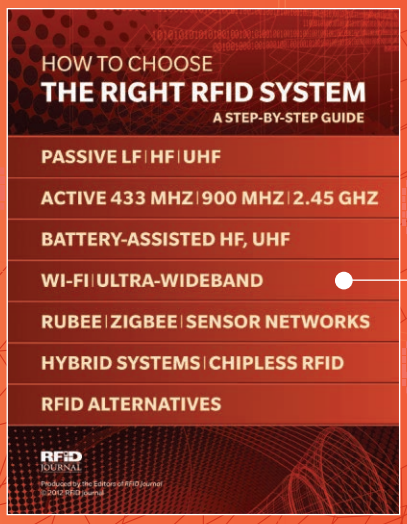
At ToolWatch, the current transition to offering RFID-based tool tracking is part of a larger movement toward enabling "machine-to-machine transactions" that remove humans from the equation, says Jason Watts, the company's senior programmer. Tools will be tracked around a job site, or between job sites, and the inventory-management software will be updated constantly and seamlessly.

For companies that are still tracking tools manually or with bar codes, the steps are tedious and slow, and any human error along the chain can lead to a tool's disappearance. With RFID automated tracking, Watts says, "It's still a really important part of [the workers'] day—but they won't have to think about it."

Some Leading Providers of RFID Tool-Tracking Solutions

COMPANY	SOLUTION	INDUSTRY SERVED	HARDWARE	SOFTWARE	PERMANENT	TEMPORARY
Accu-traq www.accu-traq.com	Accu-traq	Energy—specifically, nuclear power plants	Provided by CribMaster	Provided by CribMaster	Cabinet, crib, drawer, storeroom	Mobile, modular crib
Choctaw Renewable Services www.choctawtooltracker.com	Tool Tracker	Oil and gas, wind energy	Provided by CribMaster	Version of CribMaster	No	Vehicle equipped with tools
CribMaster www.cribmaster.com	CribMaster	Aerospace, construction, energy; services often deployed through partnerships	Alien Technology, Omni-ID and Xerafy tags; Impinj and Motorola readers; Proto-ID tools with embedded tags	Inventory control, personnel accountability, tool maintenance and purchase alerts, foreign object detection, tool kitting	Cabinet, crib, drawer, storeroom, vending kiosk	Mobile crib
JobSite Resources yourjobsiteresources.com	Automated Tool Rooms; Automated Mobile Tool Facility; Guardgoyle	Construction, energy	Provided by CribMaster	Provided by CribMaster	Tool room	Mobile, modular crib
ToolHound www.toolhound.com	SecureCrib	Construction, energy, mining	Xerafy tags, Psion and Intermec readers	Inventory control, personnel accountability, tool training management, tool maintenance and purchase alerts, across multiple sites	Walk-in crib, self-serve kiosk	Self-serve kiosk
ToolWatch www.toolwatch.com	Under development	Construction	Omni-ID tags, Motorola readers; testing other hardware	Cloud-based application for inventory control, personnel accountability, tool maintenance and purchase alerts	To be determined	To be determined

See the complete table of contents at
www.rfidjournal.com/howtochoose



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Enlisting Robots

Once robots are integrated into the Internet of Things, they can perform tasks automatically.

By Florian Michahelles, Rob van Kranenburg and Markus Waibel



Michahelles, van Kranenburg and Waibel

FOR THE PAST DECADE, researchers have been building mechanisms to enable the Internet of Things (IoT), a network of networks that promises to connect everything and everyone everywhere to everything and everyone else. Radio frequency identification is one of the backbones of the IoT, alongside Internet Protocol version 6, bar codes, Quick Response codes and active sensors. RFID uniquely identifies objects and people, linking them to digital information and bringing them into the network. Essentially, this serves as the IoT's eyes and ears, providing continuous awareness of where, and in which context, things and products are in the real world.

But the IoT is still missing the arms and legs to take action automatically. So far, screens and displays alert humans to, say, bring goods from one place to another. If RFID-enabled robots equipped with sensors could be integrated into the IoT, they could act automatically and, potentially, navigate in a smart environment faster, more safely and more accurately than humans.

The Auto-ID Lab at the University of St. Gallen/ETH Zurich is working with the Institute for Dynamic Systems and Control and The Internet of Things Council to investigate how IoT-instrumented environments could inform and guide robots with highly specific information in a targeted manner. Object recognition is a key unresolved challenge for robotics, but an RFID chip can provide information about, for example, a cup's color, size and weight. In addition, repetitive actions can be stored in knowledge repositories with their situational context, opening the door to further performance increases through learning and data mining.

Once robots get networked into the IoT, they can receive instructions and guidance from the network. The IoT, for example, could inform a service robot that an office waste bin is full. The network could help the robot navigate by passing commands to the building elevator. Once the robot reaches the waste bin, the IoT could point to the location of replacement garbage bags. Or, the robot could proactively discover and use information from the IoT to autonomously perform tasks. As part of a cleaning routine operation, for example, the robot could query the network to report about the state of all waste bins in the office building, enabling the robot to plan its path accordingly.

Our goal is to move beyond a robot- or cloud-centric vision of robotics toward an integrated solution as part of the Internet of Things. This will leverage the role of robots to turn information into action, to act as physical servants for IoT applications and to become actors querying IoT infrastructure to perform their tasks.

Florian Michahelles is associate director of the St. Gallen/ETH Zurich Auto-ID Lab. Rob van Kranenburg is the founder of The Internet of Things Council think tank. Markus Waibel is a senior researcher at the ETH Zurich Institute for Dynamic Systems and Control and program manager for RoboEarth.

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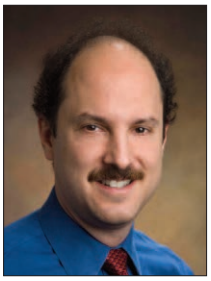
Next-Generation EPCIS

Planned enhancements to the EPC Information Services standard will improve traceability for nonserialized items and transformation processes.

By Ken Traub



THE ELECTRONIC PRODUCT Code Information Services (EPCIS) standard provides a way for companies to capture and share EPC data automatically. EPCIS defines an event—tagged items leaving a warehouse, for example—providing visibility into the supply chain. It lets businesses focus on the *what*, *when*, *where* and *why* of the event, without having to worry about *how* the RFID infrastructure captured the data.

In the five years since EPCIS was first published, it has proven extremely versatile, yet there are some business situations that can't be expressed naturally in the EPCIS language. With this in mind, GS1 recently kicked off a new working group within its Global Standards Management Process to create the next version of EPCIS. The upgraded standard is being designed to be fully backward-compatible with the existing EPCIS standard, and will expand the EPCIS language to handle business situations not expressed easily today.

One expected enhancement is the ability to trace objects identified by a batch or lot code. Existing EPCIS structures expect each object to be listed separately by its unique serial number. But in the health-care sector, for example, certain items, such as sutures and gloves, are identified by their manufacturing lot, rather than by a unique serial number on each suture or glove. The new EPCIS feature would allow an event to indicate one or more lots, as well as the number of items from each lot code that took part in the event. In addition, new EPCIS structures would show packing and unpacking of lot-identified items from a container, complementing the existing EPCIS structure that describes packing and unpacking of serialized items.

Another anticipated enhancement is the ability to handle "transformations." In the food-processing industry, for example, many companies grind together different cuts of meat to make packages of hamburger. The transformation of one thing into another occurs in many manufacturing industries as well. The new EPCIS structure would allow both a list of inputs consumed and a list of outputs produced to be carried in the same event.

It's also likely the working group will standardize data that many implementations today include through proprietary customization, such as "ship from" and "ship to" information, packaging levels and vocabulary used in pharmaceutical e-pedigrees. Standardizing this data will lead to greater cross-business and cross-industry interoperability.

The work is just beginning, so now is an excellent time to get involved in GS1 to help bring EPCIS to the next maturity level. End users and solution providers who use EPCIS—or are considering deploying RFID tracking within their supply chains—are encouraged to join, to help ensure EPCIS evolves to meet the needs of their industries, including health care, food processing, manufacturing and transportation.

Ken Traub is the founder of Ken Traub Consulting, a Mass.-based firm providing services to software product companies and enterprises that rely on advanced software technology to run their businesses.

ILLUSTRATION: VOLODYMYR GRINKO/ISTOCKPHOTO

Humanizing Robots

RFID is enabling robots to sense, identify and communicate with other robots and people.

By Kevin Ashton

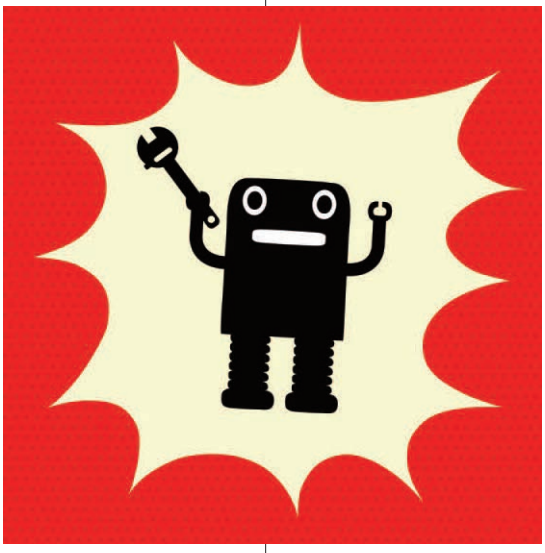
ROBOTS GENERALLY get a bad rap in the movies. They go wrong and turn sinister. They act as double agents who take the side of the alien. They travel back in time and hunt you down. Hollywood's plots contain a seed of truth. In real life, we have no idea how to get along with the robots that work in our distribution centers and manufacturing plants, or vacuum in our living rooms. Today's rules of engagement are simple: Stay out of each other's way.

But as they become more sophisticated, robots are starting to help people, rather than harm or replace them. A nice example of this is Boston Dynamics' BigDog, a robot designed to serve as a packhorse that moves alongside soldiers in the field, carrying their equipment. It has four legs that look like a horse's and bend like a spider's, giving it the balance and agility to climb snowy hills or run in sand.

Still, human-robot interaction research is in its early stages. Robots can't sense the presence of a human, identify a human or have a dialog with a human. RFID is being proposed as a solution to all these problems.

Researchers at MIT's Computer Science and Artificial Intelligence Laboratory envision a world in which robots in factories come out of their safety cages and do grunt work right next to human workers. "If the robot can provide tools and materials so the person doesn't have to walk over to pick up parts... you can significantly reduce the idle time of the person," says Assistant Professor Julie Shah, who leads the lab's Interactive Robotics Group. "Providing robotic assistants to do the non-value-added work can actually increase the productivity of the overall factory." Because so many workers already wear RFID tags, Shah says, this is the obvious way for robots to identify individuals.

At the University of Calgary's Interactions Lab, researchers are developing a way for robots to communicate with people and other robots via RFID tags encoded with messages. "Humans and robots asynchronously exchange information by placing physical tokens—each representing a simple message—in meaningful physical locations of their shared environment," the researchers say.



EL-E, pronounced "Ellie," a robot developed at Georgia Institute of Technology's Healthcare Robotics Lab, is designed to act as an assistant for physically impaired people. It uses RFID wristbands so the robot can identify people, and RFID tags on medicine bottles so it can identify medication. EL-E can then give people their medicine. According to the researchers, in all of 30 trials, "EL-E correctly verified the tag ID before manipulation, using its finger-mounted antennas." It completed its assignment of handing over the medication 90 percent of the time, and knew it had made a mistake when it failed, the researchers say.

As robotic technology advances and becomes more widespread, it looks like another important application for RFID is emerging: making sure humans and robots get along.

Kevin Ashton was cofounder and executive director of the Auto-ID Center.

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