RFID
Briefing

The UK leads Europe in the use of RFID

In this briefing understand how RFID is transforming business today in...

- **Airports and aviation**
- **Anti-counterfeiting**
- **Asset utilisation**
- **Chemicals**
- **Event ticketing**
- **Financial services**
- **Food traceability**
- **Manufacturing**
- **Retail**
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Foreword

The UK leads Europe in RFID implementation

Rt Hon Stephen Timms, MP
Minister of State for Competitiveness and Consumer Affairs

**DEPARTMENT FOR BUSINESS
ENTERPRISE & REGULATORY REFORM**

As the new Minister for Competitiveness and Consumer Affairs in the Department for Business, Enterprise and Regulatory Reform (BERR) I appreciate the role that technology can play in raising business productivity and efficiency.

Previously, I was 'e-Minister' in the old DTI at a time when we were experimenting with RFID at item-level tagging under the 'Next Wave' programme. The technology then was far from reliable, expensive and not well understood. There was uncertainty over standards and public concerns over how the technology might be used. A few champions, who could see the potential of RFID, came forward to share the risks of developing some prototype systems. We pulled together some research collaborations and started pushing the boundaries.

Since then, RFID has really come into its own as a key business technology. Government support has played a part, as have market developments like the Wal-Mart 'mandate' and the US Department of Defense 'Total Asset Visibility' programme. There have been important steps taken in rationalising standards and global spectrum harmonisation. The technology, whilst still not 'plug and play', is robust enough for business use and far more affordable. There is now a better public appreciation of what the technology is used for and the genuine concerns of employees and consumers have been well articulated.

Valuable benefits to business and consumers have been delivered in logistics and supply chain management. RFID allows much more efficient management of the supply chain, with better value for money and efficiency in things like stock control and ordering. People often make mistakes in keying in the wrong information. RFID brings that to an end. It improves business processes by reducing the number of out-of-stock items; it makes product recalls easier, and improves recycling procedures.

Scottish Courage benefited from the technology by tagging its entire stock of beer kegs. Now they know exactly where their kegs are at any given time, significantly reducing the numbers going missing and saving money through better use of assets.

Marks & Spencer have led the way on item level tagging on suits and lingerie. RFID is a proven, cost effective way to manage 'size complexity'. It increases stock availability, customer choice and customer satisfaction. This development came from the collaborative work in the Next Wave programme. That project proved that the technology was feasible; Marks & Spencer then had the harder task of fashioning the technology into an acceptable business solution. Many useful lessons were learned and shared.

Dr Kevin Hawkins, Director General of the British Retail Consortium summed it up well: "For RFID - as with any new technology - the really difficult issues arise when people are required to change the way they work. This typically challenges both the communication skills of senior management and the technical and educational capabilities of the workforce. In these circumstances it is essential that retailers who intend to introduce RFID, or any other ICT-related innovation, should learn the lessons of experience from those who are already doing it. Last year the Retail Unit, in conjunction with the BRC, mounted an excellent workshop on RFID and ignited a great deal of interest in what otherwise could have been a forbidding topic." (BRC Solutions May 2007)

Businesses in logistics, supply chain and retail have realised the value of RFID, but many other sectors can, could and should also reap the benefits:

• Transport is being transformed by RFID. The Transport for London Oystercard system speeds access to the bus and Tube networks and is being used more at mainline stations. It is convenient and has the added benefit that it can be topped up online.

• Many employees use the technology to gain access to their places of work. This is convenient and also contributes to safety as it allows certain knowledge of who is in a building – or even where in the building they are.

• RFID is used to manage participants in mass events like the London Marathon.

• Putting RFID into paper tickets not only makes those tickets 'smart' but also gives protection against counterfeiting and touting.

BERR is currently hosting an RFID Business Benefits Action Group to help spread best practice. Major retailers, technologists, and GS1 UK the standards body have come together to address standards and regulatory issues, future technology and how best to get other sectors benefiting.

Of course the issues spread more widely than the UK, and the European Commission recently issued a Communication on 'RFID in Europe - Steps towards a policy framework'. This identified the need for European level activity on security and privacy, governance, radio spectrum and standards. The Communication also noted a number of areas of research, including materials science and production techniques, needed to reduce the cost of commonly used RFID tags to below one euro-cent each. This price point is seen as the gateway to mass application. The need for additional research into devices, cryptography, active networking, sensors and power management was also highlighted.

RFID features in a number of current challenges within the European Community's Seventh Framework Programme for Research and Technological Development. This collaborative R&D programme will be used to stimulate research on techniques to enhance RFID security and privacy and encourage large scale pilots, evaluation studies and dissemination activities.

The UK leads Europe in the use of RFID, notably in public applications, and has already debated many of the arguments set out in the Communication. The UK was closely involved in helping the Commission determine the direction of its RFID policies in discussions during the consultation exercise.

RFID standards are best developed within the market. The Electronic Product Code appeared as a de facto standard in retail logistics in 2005, promoted by the standards body GS1 UK. The EPC standard is converging with, and becoming part of, the relevant ISO standards. The Government supports this convergence. Standards need to be global.

At the same time we are aware of the need to protect privacy and data as information technology potentially opens up access to information. This is why BERR works with the National Consumer Council, Ofcom and the Information Commissioner's Office to make sure regulations remain fit for purpose as RFID use spreads. We prefer a light touch, as far as possible. At this stage we do not think further legislation or regulation is necessary, as long as business introduces the technology sensibly and sensitively.

There is advantage for everybody in the promotion and adoption of open, global standards that allow new players into the market and let technology suppliers and users benefit from economies of scale. We saw this when the DTI worked with Ofcom to implement a European Telecommunications Standards Institute guideline, making UHF spectrum licence-exempt for RFID purposes. Far from seeing this as red tape, RFID suppliers welcomed the certainty this brought, and tell us it is likely to make the market grow.

RFID is here to stay. The technology is developing into really useful business solutions. If we implement it in an open and sensitive manner it will bring benefits to business and consumers alike.

EPCglobal RFID standards

The path to an efficient and accurate supply chain.

Radio Frequency Identification (RFID) is a data-carrying technology that has existed for decades in many common, every day applications such as enabling secure access to buildings and touch-in/touch-out transport ticketing systems. Today, RFID is increasingly being used to identify and track items as they move through global supply chains, from the point of manufacture to the final sale to the customer.

EPCglobal is a neutral, not-for-profit, subscriber-driven organisation, comprised of companies of all sizes, focusing on the creation and adoption of global standards for RFID in any supply chain. The goal of EPCglobal is to increase visibility and efficiency throughout the supply chain and improve the quality of information flow between companies and their key trading partners.

Industry has long accepted that standards, collaboration and open lines of communication are the fastest route to widespread, low cost adoption of any new technology, and RFID is no exception. The use of RFID, and the standardised data that RFID can carry, enables companies to trade more effectively by ensuring they all speak the same language in their business transactions. For the customer this ultimately means greater availability of products at cheaper prices.

A standards-based approach to RFID will benefit all supply chains and industries. For example, the healthcare sector has now recognised the advantages of standards, with the UK Government recently recommending that GS1 standards should be adopted throughout the NHS and its supporting industries. Bar codes and RFID will have an important part to play in guaranteeing the authenticity of pharmaceuticals and ensuring that patients receive the right drugs at the right time. This will not only save time and money, but ultimately, save lives.

Technology manufacturers are increasingly developing EPCglobal standards-compliant hardware, and the natural progression of this global, open market is that the price of RFID hardware is dropping significantly while performance continues to increase.

EPCglobal is part of GS1, the global organisation dedicated to the design and implementation of global supply chain standards and solutions.

You will come across GS1 standards almost every day in your life; most commonly in retail throughout the world where the overwhelming majority of stores use the GS1 System of standards for bar coding their products at all stages of the supply chain, including, of course, at point-of-sale. It is estimated that GS1 standards drive over five billion business transactions a day across the globe.

David Lyon,
EPCglobal Business Manager,
GS1 UK

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EPCglobal Business Manager, GS1 UK

What is RFID?

RFID is an established data-carrying technology used throughout industry. Data relating to an item is stored on a tag which is attached to the item. The tag is activated by radio waves emitted from a reader. Once activated, the tag sends data stored in its memory relating to the item back to the reader. This data can then be shared between organisations and trading partners via the EPCglobal Network in a secure manner.

What is the Electronic Product Code (EPC)?

The EPC is a globally unique serial number that identifies the individual item to which it is attached – be that an individual product, pallet, case, roll cage etc. This enables enquiries to be made about the individual item wherever it is within the global supply chain.

What is the EPCglobal Network?

The EPCglobal Network will enable the immediate, automatic retrieval of accurate, trusted information regarding individual items in the supply chain. Using a combination of RFID, EPC and current information systems (for example, the internet), the EPCglobal Network will allow trading partners to share this information securely.

Privacy issues around RFID in Europe

Marisa Jimenez

Marisa Jimenez is EPCglobal's Public Policy Director for Europe. A Spanish national, she's been in Brussels for ten years, working initially with the European Commission. She later joined Time-Warner and then worked with Deutsche Post where she first encountered RFID. She joined EPCglobal in 2005.
A trained lawyer, Marisa Jimenez has a background in EU and competition law.

She sees her role as representing the policy views of EPCglobal and its member organisations to European legislators and in working with other bodies such as consumer or trade organisations. Much of her work in the past has been with matters such as privacy, data protection and consumer affairs.
"In a way, I'm like an ambassador of EPCglobal in these relevant areas", she says.

Deployment of new technologies often leads quickly to concerns around threats to public safety and personal privacy. Public concern can follow alarmist or misinformed speculation but it's also true that enthusiasts for new technology can too often overlook or dismiss as trivial risks of societal damage.

"It's crucial that RFID gains wide acceptance among consumers and the public", says Marisa Jimenez, "And that's why EPCglobal set up European and US public policy committees right at the start. These report direct to the EPCglobal Board through the EPCglobal President."

"We don't believe the public is wrong to have concerns", adds Jimenez, "Concerns are concerns. They might arise from mistaken or incomplete information but we have to address them seriously."

Concerns about privacy were particularly marked when EPCglobal was established and so the committees looked first at this issue and published a set of mandatory guidelines (http://www.epcglobalinc.org/public/ppsc_guide). These complement national and international legislation and set out a responsible approach to using EPCs on consumer goods. There are four distinct elements.

"The main principle is transparency", explains Jimenez, "If you use RFID at item level you have to tell the consumer you're doing so. You've then got to give them information about the possibilities available to remove or disable the tag. Of course you should also point out the consequences of that, allowing the consumer to make an informed choice. Disabling the tag might make it less convenient to return the product if necessary, for example."

The third element is that manufacturers should inform and educate consumers about the technology and its use. Lastly, any EPC-related data collected should be used in compliance with applicable laws and companies should publish clear information on their policies covering retention, use and protection of any information gathered of possible personal relevance.

"It's important we don't make the same mistakes that businesses made with technology previously", says Jimenez, "This is a practical way to address not just the question of consumer fears, but also to work towards educating businesses about good practice."

Although some national governments have become notorious for finding ways round privacy and human rights legislation when they find it inconvenient, the EU has developed a wide ranging set of legislation intended to give individuals protection against excessive monitoring and the arbitrary use of personal data. These issues have become particularly complex with the growth of the internet, the web and of technology in general.

Jimenez believes that the EU's existing data protection and privacy legislation is adequate to deal with these concerns around RFID. Viviane Reding agrees for the present but has charged her new stakeholder advisory group with looking at the issue and reporting on privacy and security by the end of 2007.

"Perhaps one of the keys to the success of the EU privacy legislation is that it was written in pre-web times", says Jimenez, "It's some twelve years old but still applicable because it's technology-neutral. It's flexible enough and so applicable to RFID use. Beyond issues related to privacy, I don't believe the overall EU RFID debate will be over before 2009."

That may be so but the EC's policy paper on RFID prepared for the European Parliament comments that "there are serious concerns that this pervasive and enabling technology might endanger privacy" through collecting information directly or indirectly linked with an identifiable person or in other ways. The Data Protection Directive clearly applies to RFID but the Commission paper points out that as the ePrivacy Directive refers to "public communications networks" that doesn't directly include RFID, although the Directive is currently under revision and this possibility could be envisaged.

RFID data links to detailed databases and although the opportunity to, say, build purchasing profiles may be attractive to retailers customers may resent this and, in any case, may wish to opt out. Commentators also point out that monitoring an object typically associated with a person, perhaps a watch or mobile phone, amounts to location monitoring of that individual and so relevant to both the ePrivacy and the Data Protection Directives. The (UK) Information Commissioner's office has said that the Data Protection Act will apply whenever it's possible to identify an individual even if that is only in general terms such as being part of a group. It recommends that users do not collect or store personal data unless necessary.

A second and wider issue of concern is security. Security is very often a necessary part of ensuring privacy but also goes well beyond it.

"Security should not be seen as a blanket concept", says Jimenez, "When we speak about security as regards RFID we have to have a technical, a social and an operational perspective to have an effective approach. Some people believe that security is only related to privacy but it's much wider - it involves product integrity, for instance."

The European Commission says that it's far better for everyone to implement security and privacy by design rather than be forced to fire-fight later. This isn't just a matter of complying with legislation but also makes sound business sense to help ensure that RFID can fulfil its potential of bringing both business and social benefit rather than foundering on public concern, scepticism and downright hostility.

"Privacy and security are important priorities for EPCglobal", says Jimenez, "Hence our long-standing efforts around these areas."

Safe, fresh and hygienic

RFID in Food Traceability

by Joanna Bawa

As a powerful technology whose applications are fraught with political, social and technical issues, RFID will always be more than a detail of any business model, system or process. This often makes it controversial, but food traceability is one market where many people feel that RFID will do more good than harm. Food scares are infrequent but extremely alarming. Contamination in the food chain affects all of us directly and indirectly – our health might suffer, sometimes severely; and in the medium term our favourite foods might become too expensive, too regulated to import or too suspect to risk. Individual farms, agricultural communities and entire industries suffer,

not to mention the hapless animals which may be slaughtered by the million.

Chilling tales

The transportation of chilled and frozen food is a vast industry, and critical to effective operation is temperature control. Outside certain narrowly defined temperature parameters (typically 5°c to a maximum of 8°c) chilled food begins to deteriorate. It can survive a brief blip above its defined range, but how long depends on how long it was held at what temperature prior to the raise, and of course how long the temperature remains above the upper limit. Control is manageable within the confines of a purpose -built warehouse where food is stored at a known

and costant temperature for a known period. Trouble starts when pallets leave the warehouse and enter the distribution chain.

Refrigerated lorries can maintain a constant temperature but cannot guarantee the duration of a journey. Even when a road journey goes smoothly, drivers cannot control the length of time a pallet sits on the docks in the midday sun.

Because it is almost impossible to say with certainty that food produce has maintained the correct temperature for the full duration of its journey from warehouse to retail shelf, manufacturers are forced to err on the side of caution. If there is doubt, the 'best before' date may be brought forward, shrinking the window in which a product may be sold for the full price. If there was a definite period when the product was probably outside its temperature range, the entire consignment may be destroyed. Either way the costs are huge.

Stef-TFE is a French-based European specialist in

temperature -controlled logistics transporting fresh and frozen food around the EU at temperatures from -25°C to +15°C. Leon de Sahb joined the organisation in 2003 as General Manager and within a year had introduced the notion of RFID tagging to the Board. Unlike some advocates, he sees RFID as a whole-industry rather than an organisational solution, and recognises the importance of critical mass to its success – and the time it can take to achieve sufficient participation. "We began with a simple, internal-use-only, crate traceability RFID programme," recalls de Sahb. "It reduced the number of control mechanisms we needed, saved time and provided better information for customers. We presented our results to the industry to encourage wider uptake of RFID but found that few had any real plans to deploy the technology."

RFID cuts costs but threatens logistics jobs

Part of the reluctance to get involved, de Sahb believes, is

the threat to jobs which RFID poses. Unlike many work areas which stand to benefit from RFID, logistics management roles – particularly those dealing with warehousing, stock control, tracking and tracing – are largely redundant in a RFID-controlled environment. Even so, the increase in the scale and power of global food manufacturers means other players must find ways to cut costs. "We have perhaps three years to truly embrace RFID, before the big discount suppliers undercut
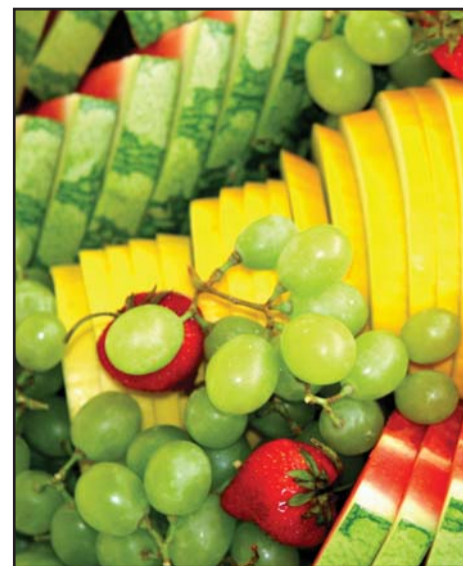
us completely," says de Sahb, "but in the food industry the problems are organisational, not technical."
The success of the pilot

project encouraged de Sahb to begin discussions with Orange Business Services which was developing its own interests in RFID and machine-to-machine (M2M) communication. As a legal and health requirement temperature is the single most important variable in the Stef-TFE business, so an effective means of monitoring it had clear significance. Semi-passive UHF thermal sensor tags are built into the system at crate level, having been programmed with the temperature range for the relevant product. The tags send regular 'ok' messages to the company's IT networks, and will send a particular alert if the temperature within any crate changes, and another alert if the temperature moves outside the defined parameters.

Integration with a GPS network means it is possible to monitor temperature continuously throughout distribution and identify the location of any vehicle emitting an alert. Each alert includes data about the time and duration of changes, providing very precise information about the status of the product.

"The tag information combined with location data

means we have plenty of warning if the temperature begins to rise before it exceeds the safe parameters. And we know the rate of

rise," explains de Sahb. "This allows us to decide whether to direct the van to continue on to the destination as planned; re-route the transporter to an alternative warehouse; or amend the 'best before' date. Not only can we preserve far more of our produce more effectively, but we have the report data to prove to customers that it has complied with temperature regulations at all times." This ability translates to direct savings through reduced stock loss, reduced driver delay and the elimination of uncertainty over stock quality. There's less need for human intervention to measure and maintain temperature, and a reduced need to dispose of spoiled food.

Fresh produce benefits too

Temperature control is a key benefit of RFID within the food chain, and Tennessee-based Evidencia LLP recently won the RFID World 2007 award for Excellence in a RFID Pilot for its cold chain logistics management for a Chilean avocado supplier. Because RFID tags are more rugged than barcodes, temperature monitoring begins by taping 13.56 MHz tags integrated with temperature sensors directly to avocados while they are still on trees. Temperatures are also monitored and recorded as the produce makes its 6,000-mile journey from Chile to Los Angeles. The trial achieved 100 percent read rates at 4,000 time and location collection points over three weeks, providing data which helps the grower validate the quality of its produce and holds its logistics partners accountable for meeting their cold chain commitments.
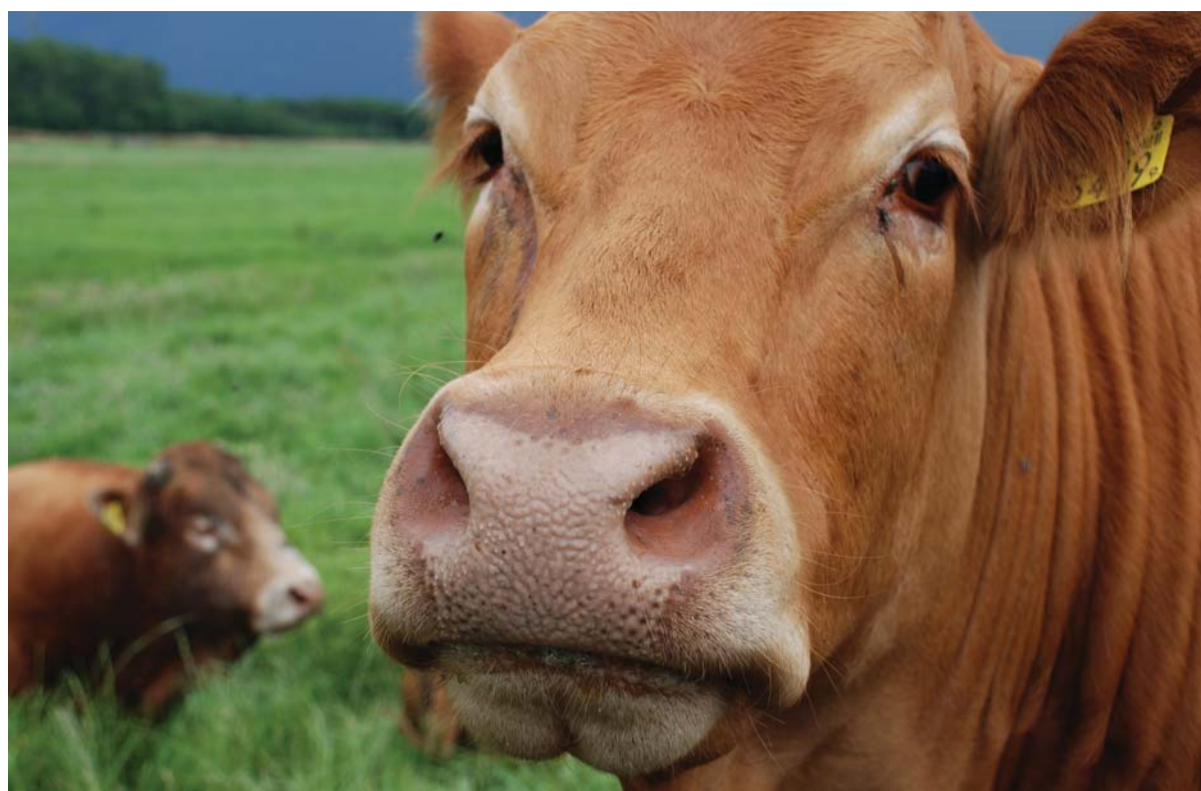
The End of Mad Cows?

Animal tagging has been widespread in many agricultural communities for some time. In the UK cattle born after 1 January 1998 must have a Defra approved eartag in each ear bearing the same unique number. Although it is not currently a requirement that this number is held on a microchip, the proportion of RFID-tagged cows is growing, and meat is increasingly leaving the slaughterhouses in tagged packaging.

But how does a RFID chip know that a cow has bovine spongiform encephalopathy? Or that a turkey has avian flu? And does tagging livestock mean the end of these terrifying disease outbreaks?

Of course it's never as simple as that. RFID chips have no medical diagnostic capability. They are not equipped with the means to test or analyse any specific bug or virus and cannot provide any statement on the 'health' of any creature. What they can do is flag up minor anomalies in the body temperature of individual animals and send an alert if the temperature of one animal reaches a certain level, or if several animals display even a small rise in temperature. This gives the farmer or veterinarian enough time to perform a visual or medical inspection and make a formal diagnosis of the condition before the virus can spread. Then adjacent parties in the food chain can be advised using formal protocols in a 'one-up-one-down' approach that an infection has been detected in its early stages, enabling them to take appropriate precautions. Although the infected animals may still need to be destroyed, they can be isolated, saving the others – and if the temperature rise turns out to be due to some other condition, they can be treated and returned to their herd.

Sounds simple – and it is – but uptake has been slow in the UK and USA for the following reasons:

• Low perceived risk: BSE and its human equivalent, variant Creutzfeldt-Jakob Disease (vCJD) are nasty, but extremely rare. The BSE outbreak in the UK in the mid 1990s was unprecedented and new control mechanisms have since been introduced to prevent another. Deaths from CJD are fewer than 1 per million worldwide, with WHO noting only 129 cases of documented vCJD since its recognition in 1996.

• Cost: Tags are generally fastened to cows as ear tags, which is relatively easy to do but also makes them vulnerable – a good scratch against a tree and they're gone. At around $2 each cheaper passive tags hold a 15-digit number which can be matched to a database holding all the relevant information, but can only be read within three feet of the $600 reader. Double your spend and get UHF or active RFID tags, which hold more information and can be read from a greater distance by $1,000 readers – as the herd gallops past, for example. Costs will come down but at present are being borne by farmers.

• Privacy of market data: Minimal data is held for each animal - generally date of birth, unique ID, premise number, and event code – but even so there are privacy concerns related to this kind of tracking capability because it could constitute valuable market data enabling late adopters to gain an edge over their more conscientious competitors.

So there are controversies in food traceability, much as there are in every other industry. Disease control is complex and expensive in much the same way that any systems management of living creatures would be, but with animal tagging routinely practiced in zoos and research establishments, it seems likely that RFID will continue to play an important role in disease control and food hygiene.

Traceability is Key...

RFID technology has the potential to change some aspects of supply-chain management, but it is not a panacea. There is a common mis-conception that implementing RFID technologies will deliver product traceability, and that simply isn't the case.

Historic Futures Limited (HF) are leading experts in the design, development and implementation of complete supply-chain traceability solutions from primary production through to retail, or "plough to plate" as some say. According to managing director Tim Wilson, "In many respects, RFID is simply a better mousetrap. Whereas barcodes require each coded item to be individually presented to a scanner, RFID tags can be scanned in bulk and from further away, so all the boxes on a pallet can be "scanned" as the fork-lift truck passes near a tag reader. The impact of RFID can be significant but the idea that RFID tags will magically provide full product traceability is simply wrong".

The development of RFID technologies has provided a renewed focus on product related information for all industry sectors. It heralds an era of "better data", but better data means different things to different audiences. For buying departments it could mean more detailed product specifications, logistics professionals are searching for real-time updates on location and stock levels, consumers on the other hand want to hear the story behind the product and to know that any label claims are true. RFID may have a role to play in meeting these needs, but it is the information "eco-system" throughout the supply-chain that is critical.

"When the checkout operator at the supermarket scans a tin of beans, the number encoded by the barcode is looked up in a something akin to an electronic telephone directory. This simply confirms that the item is in fact a tin of beans and that it costs X. You learn nothing whatsoever about that particular tin of beans – when it was produced for example, or where the beans were grown. RFID tags are like more efficient bar-codes" says Wilson.

RFID faces a number of technology challenges. Wilson continues "There are environments where RFID historically hasn't worked well, for example when the product is in a metal cage for transportation. The cage itself can block the radio signals so the tags won't read. There isn't a person presenting the individual items to a scanner, so you don't know which tags were read and which ones weren't. That's not great when you're after more accurate stock data".

RFID tag technology is evolving at a phenomenal rate. With a strong focus on relia-bility and readability, some vendors are now claiming near perfect read rates, even in relatively challenging operating environments.

The drive for traceability is often driven by a risk management agenda, but there is clear evidence that telling the story about how a product was made is a powerful consumer marketing tool. Marks and Spencer's recent "Look Behind the Label" campaign was reported as one of its most successful, while market research indicates that 78% of M&S customers want to know more about the products they are buying. "The real interest, for consumers and risk managers is a long way back in the supply-chain. It's the story of the primary producers; the farmers, fishermen and miners, often in developing countries that makes the difference.

These are the stories that consumers want to hear and are driving the growth in Fair Trade, organic and other "ethical" or sustainable shopping trends for example. But it is also at this level that the brand owner and retailer are exposed to the most reputational risk. "To tell the story behind the specific tin of beans requires information at the batch or lot level, not the product specification level. Then it is possible to describe the beans in that particular tin, where they came from, how they were produced. The rapidly increasing requirement for "carbon footprint " data also requires information on how those beans got from where they were produced to the manufacturing plant and into the retail store."

As Wilson points out, "There is a requirement for more product data and RFID will undoubtedly become part of the solution, but deploying RFID equipment in remote regions and in developing countries is not likely in the foreseeable future."

The good news is you don't need RFID to address this opportunity, you just need the data. This suggests a soulless focus on the noughts and ones of digital life, but in fact the text in your favourite novel is data, so is the news. HF are working with some of the world's largest brand-owners to capture the required information, wherever it comes from, using their innovative online technology known as **String**. "People are interested in the history of the products they buy. It doesn't matter whether that's consumers with ethical or sustainability interests, or brand managers with quality and reputational concerns. In future, everyone will care about the history of the stuff they buy. We're focused on making it easy to pick up the pieces of the story wherever and whatever they are, from organic certificates to photographs, video and audio.

We provide the tools to take the material online and stitch the story together using batch-level traceability."

The further you travel from point of sale, the more diverse and disorderly the information becomes. But using contemporary data management techniques including online databases and XML, coupled with established mechanisms for moving the data such as e-mail and mobile devices it can be collected and managed. As the product nears the retailers and their immediate suppliers, additional technology and standards can be applied. HF are working closely with global data standards body GS1, to make sure that the links into barcoding and RFID systems are seamless, and that emerging standards such as EPC (Electronic Product Code) are supported.

"We can clearly see exciting applications for RFID, but it's not a universal technology and maximising the benefit means focusing on the data systems the technology interacts with."

Asset Utilisation
Takes Off with RFID

Time consuming workloads slashed, operations streamlined and employees more empowered thanks to an RFID-based solution at rental company Aggreko plc implemented by Spartan Solutions Ltd.

Providing solutions to customers who need power, temperature control, or oil-free compressed air, Aggreko operates globally from 118 Service Centres and offices in 29 countries with customers served in over 90 countries. Example projects range from a weekend generator hire for a music festival, to multi-million pound contracts for powering petrochemical plants, or in some cases, entire cities in times of shortage.

In any company where assets generate revenue, the main focus is on maximising utilisation of the rental fleet and in Aggreko's specific case, every project is a customised solution. Prior to the Spartan solution, processing orders for delivery, return and service were complex processes involving significant amounts of paper and human effort.

There was a build up of paperwork that had to be entered into the company's Enterprise Resource Planning (ERP) system. This backlog resulted in the status and value of orders in the pipeline not being assessed in real-time. Aggreko decided to radically improve the operational processes at its Service Centres and get information into the ERP in real-time.

Spartan Solutions Ltd provided the answer. Spartan is a specialist Radio Frequency IDentification (RFID) solutions company with the expertise and software to operate in challenging physical environments like Aggreko's. The specific requirements were for an RFID tag to be fitted to each of Aggreko's 30,000+ assets, which ranged from large containerised metal generators to rubber hoses.

The tags had to be easily and permanently attached, robust and capable of being read by mobile handheld devices in almost any weather, in any location and on any Aggreko or customer site. Spartan met all these challenges and their Phalanx software allowed Aggreko staff to execute business processes even when handhelds did not have immediate network access to the ERP system.

The hardware selected was Motorola's flagship MC70 rugged handheld devices and WS2000 switches providing wireless coverage over the Service Centres. John Glen, Technical Director at Spartan said, "Motorola was chosen as they were the clear market leader in providing secure and scalable wireless infrastructure."

Jim Green, Managing Director of Spartan Solutions, explained that "Aggreko gave us three clear business objectives; increase asset visibility, increase asset utilisation and reduce operating costs."

The old processes used multiple paper forms and human effort to track physical assets and were not in line with Aggreko's vision of lean operations. Aggreko asked us to help them achieve their vision. Our Phalanx solution enabled business processes that had previously been bound to the ERP system to extend right out into the physical world of their Service Centres. All data is now captured electronically, accurately and in real time, with processes executed immediately in Service Centre yards. That combination delivers the business value Aggreko was aiming for."

Rapid Return On Investment

A common fear of large IT projects is the potentially lengthy time before any benefit is felt in the business. Even then, benefits can sometimes be hard to quantify. Spartan Solutions is firm on this point and Green has a strong view that "There must be a clear business goal with a minimum time for benefit delivery – in our case typically four months."

In the case of Aggreko, the time from award of contract to the first pilot implementation was 14 weeks and the business benefits were immediately apparent. The solution is rolling out to cover almost 120 locations across Europe and North America with 25,000 of Aggreko's 30,000+ products already tagged using a simple process managed entirely by Service Centre personnel.

Now, contract requirements are sent from the ERP system directly through Phalanx and out to the handhelds of Service Centre personnel.

Stephen Henry, Aggreko's Group Operations & Infrastructure Director, says "Phalanx has allowed us to eliminate the picking and fulfilment paperwork. An additional unexpected benefit is how much the system has shed new light onto some key details of our operations, previously hidden."

Cultural Challenges

Many RFID implementations focus on technology, but cultural challenges are often more important. Not surprisingly, some employees were initially sceptical of RFID's potential value to their work.

To overcome this, Spartan engaged users at the earliest stages of the project.

"Service Centre workload is so high that personnel will only willingly change their working behaviour if a system is easy to use and delivers immediate and obvious benefit to them", explains Raymond Lee, a member of the Service Centre staff in Dumbarton, Scotland. "With the RFID project, the benefits are obvious and significant, and nobody would now dream of going back to pen and paper."

Tom Armstrong, Aggreko's Chief Information Officer, said that "One seldom comes across a business solution that has a simultaneous immediate positive impact on operational efficiency and customer service levels but Spartan Solutions delivered just that."

Spartan Solutions is a company specialising in the delivery of RFID solutions to provide business value. Spartan provides RFID infrastructure skills, software and professional services.

Finding needles in warehouse stacks

By: Murdoch Mactaggart

Warehouse practice has changed greatly and it's against this background that Indyon GmbH, based in Munich, was founded in 2002. Two of the founders, Robert Riedl and Hermann Feigl have experience in logistics and warehouse management systems while the third, General Manager Dr Andreas Plettner, has a research background with fifteen years' experience of RFID and a period at the Fraunhofer Institute.

"We optimise forklift truck movements in managed warehouses", explains Plettner, "Our focus is particularly on locations where there are many movements of goods."

Indyon takes an innovative approach by embedding passive RFID tags in warehouse and related floors to provide real-time location tracking capabilities through their Track+Race system. Warehouses and production sites are often harsh environments, perhaps subject to extremes of temperatures and often very wet. Concrete flooring is typically built with rebar and this metal reinforcing, as well as racking metal and water, can affect reader capabilities and ranges and so Indyon uses 134kHz technology to offset this.

The small tags, each around the size of a thick matchstick, are sealed into holes bored 4cm deep by 0.5cm in diameter. The tags are spaced according to particular requirements but in a typical situation using 80cm wide standard pallets each truck is capable of horizontal location to a precision of better than 39cm. Each truck carries a protected antenna underneath and has height and loading sensors built in. This gives an effective three-dimensional location matrix so that the positioning of any pallet in a bin can be known with certainty.

"The big difference with Track+Race", says Plattner, "is that the customer doesn't need an RFID tag for every pallet that comes in. Instead, his investment is for one tag per floor location. That's very much cheaper and the ROI, in consequence, is very short."

Knowing a location is one thing but it's also necessary to know what a pallet or case holds and Track+Race is updated with this information when the item first enters the warehouse. If the item is already identified by tag or barcode this can be read but other methods can be used to get and enter the contents information.

Korbinian Sapper, Indyon's Head of Sales and Marketing, explains that the critical aspect is that Track+Race maintains this information accurately, irrespective of fork lift truck movements. This means that a company can be confident of finding promptly something it needs and can also know accurately what's in a pallet being moved, perhaps one for despatch to a customer.

"I've been speaking with a paper company", he says, "which has maybe ten thousand rolls of paper, each weighing a tonne. They have no real idea what paper is where and so they have to search. That takes time and sometimes they get it wrong. Track+Race would let them know exactly where all their different rolls were stored so that they could immediately collect a specific one when needed."

"Our focus is to sell solutions, not nuts and bolts", he adds, explaining that Indyon also offers a simple warehouse management system, their BinLocationManagement system (BLM), which can hold more detailed product information and which links closely to and enhances the location tracking capabilities of Track+Race.

Italian customised cable wholesaler SADA CAVI SpA has some 2,000 cable roll movements daily in its warehouse and uses this combined system. Its cable rolls are nearly all unique as regards residual length and this, coupled with different cable formats and storage requirements, meant that locating and picking given orders was very time consuming, taking on average six hours to put together a consignment of forty rolls. According to Sapper, the Indyon solution reduced these times six-fold to one hour, a significant improvement and cost saving.

"There are other benefits", adds Sapper, "Each truck has a wireless-enabled information system and we can use this to

show the driver the most efficient route or to warn him not to enter certain areas. One of our customers and partners is the truck manufacturer and we can actually control still trucks remotely, perhaps reducing the truck speed in sensitive areas or preventing high lifts where inappropriate. With Still trucks anything the driver can do, the system can do remotely."

Indyon's current focus is on Europe. It works frequently through specialised partners with logistics or warehouse understanding and experience and is actively looking for partners with appropriate skills. It doesn't intend to concentrate on any particular industries, however.

"We have customers from many industries", explains Sapper, "Food and beverages, cables, rubber, chipboard factories and more. Our systems are particularly good for industries where mistakes are very costly and where regulations demand traceability. If a food manufacturer sends out a faulty batch, for instance, then unless he knows exactly which items went to which retailers he will have to issue a general recall and that's extremely expensive. Our systems not only speed movements up but because users know exactly what is where help prevent costly mistakes of that kind. Many of our main customers are from that group."

The Achilles heel of the supply chain...

RFID's ability to improve supply chain efficiency will be severely compromised if the quality of data is not up to scratch.

A crate of urgently needed raspberries is opened and turns out to be strawberries instead. But mistakes may be more subtle, spinach in a bag marked with the wrong varietal name, perhaps, or lettuce already clearly past its best although the label claims there's still three days to go. Coding and labelling errors disrupt processes, may invite regulatory sanctions, sabotage traceability, erode customer confidence and are always inconvenient and often very costly to put right.

"The quality of data used in many supply chain implementations has become its Achilles heel", claims Claricom's managing director, James Butcher. Claricom, based in Nottingham University Science Park, began in 1999 when a small group of colleagues experienced in various areas of supply chain coding decided to develop enterprise solutions to improve accuracy and efficiency in manufacturing and in supply chain coding.

"This isn't a question of whether RFID or barcodes are more suitable for use in the supply chain", adds Butcher, "but of whether the data used is accurate. If it's not, then even the most sophisticated coding and tracking system is useless."

In a typical movement of produce from farm to retailer shelf a grower might send tonne crates of spinach to a distributor. The crates will carry barcodes and be labelled with human readable information showing product, variety, date of picking and other information. More information may be added as the distributor takes delivery.

The spinach is then brought into the production hall, checked, washed or cleaned, and duly packed into bags. The bags are packed into cases, the cases loaded on to pallets destined for different retailers and duly delivered.

Many of the labelling processes will be manual and it's here that errors can creep in. It's clear enough that the product is actually spinach but will anyone realise from looking at it that it's Bloomdale? This matters because although previous deliveries from this farm have always been Five Star that's now finished and, by agreement with buyers, a different variety has been substituted. The crate's labelled Bloomdale, certainly, but the production-run information is typed in by hand using data from a simple work spreadsheet, also prepared by hand but not properly updated with the changed variety. Case labels were printed the day before from similar sources

so they also get the variety wrong. And just to complicate matters further, the operator gets distracted and enters "2007/07/08" instead of "2007/08/07", immediately putting perfectly good spinach well past its notional sell-by date.

"The potential for errors rippling through a system unnoticed actually increases with increased automation, particularly where human-readable information isn't included", claims Butcher, "It's sometimes not until people get round to restacking selves that the mismatches are discovered."

Claricom's systems ensure that data is taken only from known reliable sources. The incoming crates are labelled with a barcode or RFID tag noting the time and date of receipt and adding information from the relevant purchase order such as product, source and variety. At the production line the operator opens her production plan, scans the job-specific barcode and is then directed to scan both the appropriate received crate barcodes and the barcodes on the outgoing case labels to ensure that everything matches as it should, incoming crate to packet to outgoing case. Similar checks can take place when cases are loaded on pallets.

"It's a simple process, really", says Butcher, "taking thirty to forty seconds at the start of the production run. What's very important is that we don't change the way the factory operates. It's a pragmatic approach. It lets the operations director run the factory whichever way he wants to run it. We interface to pretty much all the major ERP and MES or planning systems and it makes no difference whether it's barcodes or RFID tags or what types of printers or readers are used."

In a different area of data authentication Claricom has developed a product called CounterFight. This is aimed principally at high volume manufacturing of items such as the pharmaceuticals, cosmetics, wine, spirits and tobacco, industry where counterfeit drugs products can be a problem.

"CounterFight lets the pharmacist, customs official or the consumer pick up a package and quickly confirm whether it's genuine without the need for specialist equipment and infrastructure required by (say) RFID", explains Butcher.

Claricom does this using a mass serialisation process and bringing in elements of packaging design and other information to construct a cryptographic 12 to 15 digit

code, readable by humans (and electronically if wanted) which can be passed as a telephoned, emailed, SMS or similar query and used to confirm authenticity.

Butcher accepts that RFID has value in many instances but questions whether there's really a need for holding large amounts of data on cases or pallets. Far better, he suggests, is the approach of holding that information centrally and linking to it through a unique electronic product code, an EPC.

"The risk with RFID", he says, "is that it's increases people's capability to move poor data around a business. It absolutely has it place but it needs to be integrated into an environment where data accuracy is properly controlled and human error eliminated as far as possible."

RFID and EPCglobal in the UK

David Lyon, EPCglobal Business Manager, GS1 UK

RFID suffers from some widespread perception problems. It is generally accepted that the technology was hugely overhyped following reports of Wal-Mart's RFID deployment in 2004. Many people are also of the opinion that the technology is currently in decline and that the UK has always lagged far behind the US. In fact, RFID is developing according to a perfectly normal product lifecycle, both in the UK and elsewhere. Far from abandoning projects, companies such as Tesco and Marks & Spencer are moving forward with them steadily. To realise the potential of RFID and real time data exchange between trading partners, however, it is essential that a longer view is taken and that consistent standards are implemented worldwide.

When RFID first emerged in the FMCG supply chain in 2004, it stimulated worldwide excitement. The Wal-Mart "mandate", which was in fact an invitation for Wal-Mart suppliers to collaborate and invest in a supply chain RFID programme, gained a great deal of publicity. It also created a high level of excitement among many technology organisations who went on to spend large amounts of money on the development of solutions which ultimately proved to be premature in terms of the development cycle and adoption of the technology.

The media's tone rapidly lost its youthful enthusiasm. As the technology deployments didn't happen at the rate the media expected and pure RFID businesses began to struggle, RFID as a technology began to receive a bad press. Despite the arrival of the EPCglobal-facilitated Class 1 Generation 2 standard, which helped to drive tag prices below 10 US cents in late 2005, the predicted orders did not arrive. Matters were not helped in Europe, where the regulatory environment was perceived as unfavourable compared to other continents.

In reality, RFID is moving forward in the UK and Europe. The technology is following a pretty typical development and adoption curve. Companies are taking a pragmatic and methodical approach to their deployments but with the experience of the media over-excitement in mind, most are keeping these under their hats until they are ready to announce them. EPCglobal is constantly developing new standards and with breakthroughs in technology and technological price drops, adoption is likely to be significantly more widespread by 2009 – 2010.

UK RFID trial projects are growing steadily across a wide range of industries. The airline industry has long been a pioneer of RFID. 25 million tags were used for baggage handling in 2006, and trials have taken place for applications ranging from boarding card checks to aeroplane parts. Virgin Atlantic has even been testing RFID to track inventory at Heathrow airport. The healthcare and pharmaceutical sectors have also been serious about their adoption of RFID. Earlier this year the NHS announced its "scan and save" initiative, to track and trace sterile surgical instruments using a combination of RFID and bar code technology. Six hospitals have already signed up to the scheme, with more joining all the time.

The UK is already using RFID tags for many different purposes, not all of them related to the supply chain and not all heralded in the media. Anyone who has joined one of the UK's large charity races will be familiar with the RFID tags attached to shoes to monitor race times, while most Londoners carry RFID tags with them on a regular basis as they use their Oyster cards on the transport system. Shopping too brings people in contact with the everyday use of tags; Marks & Spencer, for example, has now extended its RFID tagging of clothing from 40 to 120 stores across the country.

Worldwide, the trials continue. Kimberly-Clark's US research centre, which is accredited by EPCglobal for its RFID testing, has unearthed unexpected benefits.

A project that began with a simple tag and reader, for example, developed into a much wider exploration of how the technology could be applied for data aggregation and trend analysis. Pallets in Columbia, containers in Singapore and fruit and vegetables in Japan are all the subjects of RFID trials. By 2009, independent research firm IDTechEx expects global demand for tags for pallets and cases to reach over a billion per year.

The comparison of RFID trends in different countries, however, misses the point. For the technology to develop, it is essential that discussions and forums take place on a global basis so that experiences and breakthroughs are shared wherever they occur. This is where EPCglobal comes in. The role of EPCglobal is to ensure that a successful trial in one country can translate into a working application in another.

EPCglobal is involved in projects as diverse as animal labelling in Australia, student cards in China and travel tickets in the Philippines. Any one of these may develop into a wider application. It is essential that the technology, no matter where it begins, develops with continuity and consistency – and this can only happen if the effort is not local, but global.
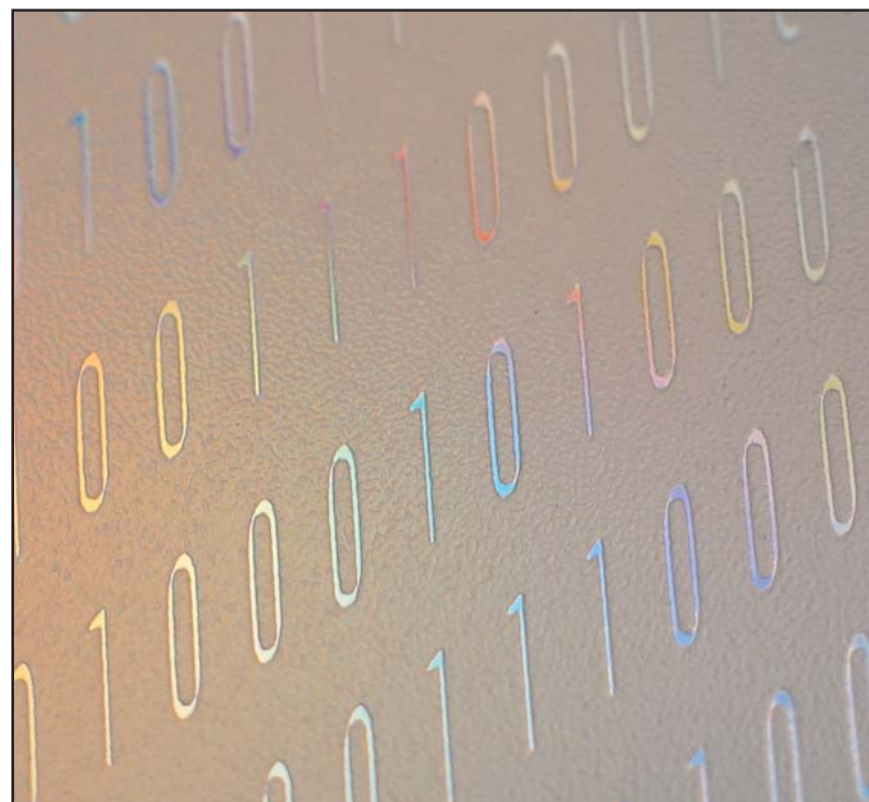
Fighting
the Counterfeiters

The incidence of counterfeit drugs has been growing steadily, particularly in areas such as Africa, SE Asia and South America. Counterfeiting may be viewed as a kind of rough justice for the many excesses and antisocial antics of the pharmaceutical companies but in reality the real losers are the poor and the ignorant. Correct formulations may have fake packaging but there are products with no active ingredients or which are positively dangerous on account of toxic material. During a meningitis epidemic in Niger in 1995, for instance, some 2,500 people died following inoculation with fake vaccines believed by the authorities to be legitimate. Counterfeiting occurs with both branded and generic products.

The World Health Organisation (WHO) estimates that counterfeit drugs comprise less than 1% of market value in the developed world while elsewhere can exceed 30%. Over 50% of medications bought from web sites with no physical address are thought to be counterfeit and potentially dangerous. The counterfeit drug market, says the WHO, has become a multi-billion dollar business.

It's against this background that Aegate launched in early 2004. A fully owned subsidiary of PAGroup Ventures the company has developed a process to combat pharmaceutical fraud and offers a real time service which extends into other areas of patient care and drug management.

"The pharmacist has a duty of care to the patient and is legally responsible for what happens", explains Gary Noon, CEO of the company, "They handle the medicines, for example to check contents or to add the patient's name to the package. This means they have line of sight and so scanning a barcode is easy. We offer a pragmatic solution fitting pharmacist practice."

The pharmaceutical supply chain is vulnerable at numerous points: bulk materials may be made in one factory but shipped to others for intermediate manufacture; specialist factories may manufacture drugs for different companies; bulk shipments may be packed for country consumption, sold on to major wholesalers, perhaps further customised for local outlets and sold on to short-line wholesalers before eventually ending up in pharmacies.

Aegate's solution is to give products a unique, product-specific serial code. This can immediately identify any item and provide its history and other information. This helps authenticate drugs, a valuable benefit for both drug companies and patients, but also helps pharmacists manage stock and reduce prescribing errors.

According to Alison Williams, Aegate's Marketing Director, Aegate's mass serialisation coding will work equally well using RFID or any recognised international standard including EPCglobal.

"The system gives a framework", she says, "which can work well with different processes. RFID is one suitable delivery mechanism. In many cases barcodes may be easier and cheaper, particularly as the pharmacist will already be scanning these."

Aegate's systems resembles that used by banks to validate credit card transactions. Scanning a code at the pharmacy retrieves information from the Aegate database and displays this on the dispensary monitor alerting the pharmacist to a package which is out of date, counterfeit, stolen, recalled or otherwise problematic.

"The major errors in pharmacies involve picking", says Noon, "A pharmacist might select the wrong drug or the wrong strength and the clear display of information on what's actually been scanned is very valuable. And where electronic prescribing between medical centres and pharmacies exists then any mismatch will immediately be highlighted." Aegate's system was trialled extensively in the UK and the US and has now been rolled out in Belgium with Greece scheduled to follow shortly. L'Association Pharmaceutique Belge (APB) represents some

90% of Belgian pharmacists and has co-operated with Aegate to ensure that Aegate's system is fully integrated with its standard pharmacy software, making the checking process an automatic element of the familiar dispensing mechanism. Belgium, which requires that all cost-reimbursable medicines carry a unique number, is the first country in the world to introduce such an authentication mechanism.

The system will also send advice proactively to pharmacies. "If products have been stolen or recalled", explains Noon, "then Aegate can work with the drug companies to advise pharmacies immediately. As far as we know, only Aegate's system can be relied on to track such material indefinitely. We had a case in the UK where the drug company thought everything had been traced but around a year later a small batch turned up and was identified immediately by our system." The current industry view is that barcodes, particularly 2D barcodes, will continue to be used in the near to middling future for labelling drugs but as Williams reiterates it's a matter of being pragmatic, of using the most appropriate process, recognising that the Aegate mass serialisation system is completely flexible.

"RFID can be very useful", she says, "but currently more so in the supply chain than in pharmacies, although that may change. In Africa, however, things are very fragmented, communications methods often poor, and NGOs may have no certainty that the drugs they're handling are authentic.

Using database and accessing it through mobile or fixed phone or SMS can make a major difference there in helping to save lives."

The Human Factors of RFID: Privacy, Trust and Control

By Joanna Bawa

Compared to its economic and technological potential, the delicate subject of our emotional response to RFID might seem a little irrelevant. It's not. Devices, software and systems have failed in the past because they failed to take account of human factors. Enlightened and successful manufacturers invest huge resources in user experience design, usability testing and increasingly, understanding the social and emotional context in which their products are used. And as connectivity becomes more widespread, the product itself becomes secondary – what's important is the wider system of which it is a part, because it's this that will define how people feel, how they engage and how much they spend.

Computers, computers - everywhere

An individual RFID chip is a relatively meaningless item. It acquires meaning from its relationship with the RFID reader and the data it can access and display on that reader. It acquires greater meaning when that reader is part of a network of other readers, which are also connected to wider IT systems, such as stock control; medical history or a preference database. The more widespread and pervasive the network (of which RFID is just an element) the more powerful it becomes. The way to make it infinitely powerful is to make it ubiquitous.

Ubiquitous computing is one of the research interests of Robin Mannings, a Futurologist at British Telecom's Adastral Park.

An increasing level of computerisation has been going on for a long time, he says, with chips routinely appearing in domestic appliances and children's toys.

Most are no more than a place to store small programs defining how the item operates (toasters, microwave ovens, Buzz Lightyear), but some – such as supermarket store cards – know who we are and what we buy. RFID is a big leap in the ability not only to hold information but to make connections between other things which hold information.

"Ubiquitous computing means the digital storage of time, space and identity," says Mannings. "RFID chips have the potential to be much more than tags – they will become the record holders of who and where we are, what we do and when. When combined with sensors they can detect pressure, temperature, humidity or daylight.

Multiple sensors mean the ability to detect the context of use for a particular device, from which emerges a form of primitive sentience. On the one hand this could mean a blister pack of pills which bleeps to remind you that you need to take today's pill before 11.00am.

Extend the application and you might walk into a party and have your shirt tell you (probably via your mobile phone or a similar handheld device) that the person in the far left corner has chosen to disclose that they are the opposite gender, aged within three years of your age, in close proximity to a dry martini and share your interest in Tolkien novels."

The Internet of Things

Mannings sees this accumulating sentience as the tip of a network where every tangible item is a node, because it is in some sense a computer. "What we're building is the next generation web, an 'internet of things', where every object around us has a tag and an awareness of other objects, much as web pages are connected to one another via hyperlinks today," he says. It is this 'internet of things' which requires managing, since it raises issues deeper than convenience, cost-benefit and time saving.

Exciting to many, the possibility of computer-mediated life management is perceived as an inexcusable violation of privacy and the thin end of a totalitarian wedge, where governments eavesdrop on all of us, accumulating vast quantities of information about our movements, purchases, preferences and partners.

The key to harnessing RFID, like any other powerful technology, is to find a balance between its pros and cons. This means recognising potentially harmful or unwelcome applications, acknowledging them and putting in place the controls necessary to minimise their reach. Take personal privacy researchers point out that we routinely
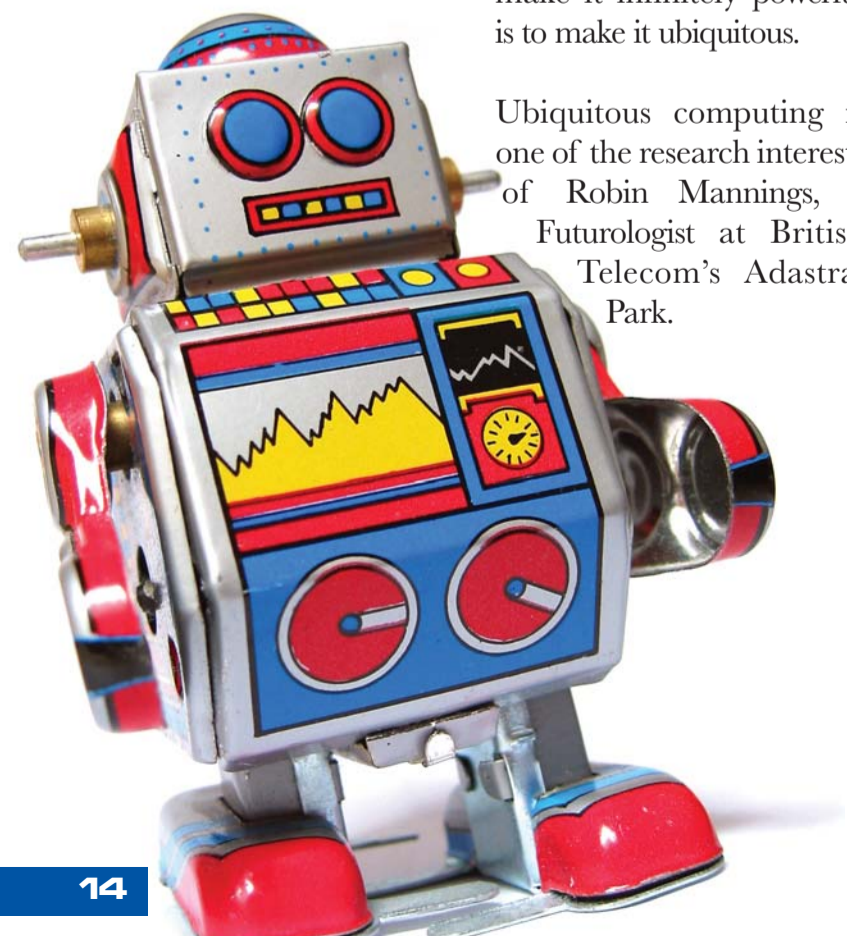
trade our privacy for other, valued social goods. Friendships are formed by the exchange of confidentialities; doctors offer treatment and confidentiality in return for a lowering of patients' privacy barriers. Some of these trades are governed by unwritten rules, others by formal contracts, but the desired outcome is generally of greater value to the individual than their privacy. So it is with RFID. In a commercial sense, RFID requires the lessening of individual privacy in return for greater speed and convenience (in shops, airports etc). In a social and personal sense RFID will offer greater sociability to those who are prepared to reveal more of themselves.

Balancing the two already is new online inventory management service, www.mythings.com, whose purpose is to allow individuals to create and manage a portfolio of their personal possessions on the web. MyThings is developing partnerships with retailers, manufacturers, insurance companies and law enforcement bodies, creating a network of product and service providers which will be available to MyThings members.

Barcode reading at the point of sale is the main method by which item details are entered into a portfolio but site founder and CEO, Benny Arbel, expects to see more RFID tags. "Tagged items cannot be counterfeited, and if stolen they cannot be resold since it will be easy to prove their origin and history," explains Arbel. And although sociability is not the main point of MyThings, a community format enables members to chat (anonymously)

about their items, exchange tips on maintenance or establish market value. It's a form of highly controlled and controllable network, where minimal privacy is exchanged for significant convenience.

Only connect
The concept of RFID-enabled item awareness is already established and since RFID also supports the cashless society an RFID-enabled phone could serve as a wallet, travel pass and event ticket on a day out. Marc de Jong, European Vice President for NXP Semiconductors (formerly Phillips Semi-conductors), is enthusiastic about the benefits an RFID-enabled system can bring to individuals and

economies – particularly where the application of RFID is appropriate to human needs and readily understood.

"Over 150 major cities around the world have switched or are in the process of switching to contactless interface technology for public transport and automatic fare collection," he explains. "NXP's MIFARE platform was used for the authentication of over 3.2 million tickets at the FIFA World Cup in Germany, and is a core technology at major sporting venues around the world." It works, he feels, "because it's easy to see that the benefits significantly outweigh any reservations."

Who's in control?
A sense of being in control is absolutely fundamental to psychological health, in all aspects of our lives. With regard to RFID, it's more accurate to say that the biggest concern is not the need for total privacy, since this is regularly traded for other valued services, but the need to feel a sense of control over the technology and its uses. For RFID users (whether knowing or unknowing), this means knowing and controlling what information is being held about them and who has access to it. "The most important means of placing citizens in control of RFID and technologies like it is to provide education," says Marc de Jong. "It's widely accepted in the

industry that it would be extremely counter productive to collect or use personal data covertly. For that reason RFID-enabled systems will be built on an 'opt-in' basis, where you have to choose actively to participate."

Robin Mannings of BT agrees. "There's actually nothing new about RFID," he says. "It's a well understood and managed technology – but it's reaching a level where it will soon start to bring about major changes to the way we live, work and play. It's change at this social and cultural level that seems alarming, but it's nothing we haven't dealt with before. And ultimately, because we all need to choose to participate to make it work, our gains will tend to outweigh our losses."

Radio Frequency Identification in Europe: steps towards a policy framework

In March 2007 the Commission of the European Communities presented to the European Parliament the beginnings of a policy framework for the management of RFID, intended to find the right balance between privacy, security and business growth. Marc de Jong of NXP was a panellist at the EU consultations and observes that "industry participants showed high levels of awareness of the need to develop transparent RFID mechanisms where the user is in control, where chipped devices can be switched off and be seen to be switched off. The success of RFID requires trust and it's in the interests of the entire industry to honour this."

The report states: "When linked to databases and communications networks, such as the Internet, this technology provides a very powerful way of delivering new services and applications, in potentially any environment. RFIDs are indeed seen as the gateway to a new phase of development of the Information Society, often referred to as the 'internet of things' in which the internet does not only link computers and communications terminals, but potentially any of our daily surrounding objects – be they clothes, consumer goods, etc."

Benefits aside, the report also acknowledges the "…serious concerns that this pervasive and enabling technology might endanger privacy: RFID technology may be used to collect information that is directly or indirectly linked to an identifiable or identified person and is therefore deemed to be personal data; RFID tags may store personal data such as on passports or medical records; RFID technology could be used to track/trace people's movements or to profile people's behaviour (e.g., in public places or at the workplace). Indeed, the Commission's public consultation underlined the concern of citizens about the potential of RFID to be an intrusive technology."

Such concerns are clearly potentially damaging to the commercial success of RFID systems, and it is not purely out of concern for people's sensitivities that the Commission advises: "It is clear that the application of RFID must be socially and politically acceptable, ethically admissible and legally allowable. RFID will only be able to deliver its numerous economic and societal benefits if effective guarantees are in place on data protection, privacy and the associated ethical dimensions that lie at the heart of the debate on the public acceptance of RFID."

It's good to know that moves are afoot to safeguard privacy and personal data, but ultimately, the effective management of RFID relies on education, user control and our own willingness to at least enter into negotiations with RFID-enabled systems to see what they can do for us.

Understanding why NFC is more than contact less, Bluetooth, or RFID...

Among the hottest of topics in the ID world today is Near Field Communication (NFC), an exciting and relatively new technology.

While it has become a household term in most identification-centric circles, a significant gap in understanding of its technical operations and capabilities remains.

Ask a number of people to define NFC, and you are likely to get responses like: 'It's a way to make payments with your mobile phone'... 'It's contact less but it can fit into a other devices'... 'It's like Bluetooth but it is in a card."

While each of these descriptions are accurate to a degree, they fail to capture the true understanding of what sets NFC apart from other technologies.

NFC's industry association, the NFC Forum, defines the technology as "a standards-based, short-range (a few centimetres) wireless connectivity technology that enables simple and safe two-way interactions among electronic devices, allowing consumers to perform contact less transactions, access digital content and connect electronic devices with a single touch." Described another way, it is a standard that enables contact less, bi-directional communication between devices. These devices can be NFC-equipped mobile phones, computers, consumer electronics, cards, tags, signs, posters, washing machines... virtually anything that can be tagged.

NFC standards are the result of work conducted by Ecma International, a global industry association dedicated to the standardization of technology and consumer electronics. The NFC effort was initiated within Ecma by the creators of the technology, Sony and Philips (now NXP). The standard created by Ecma was titled ECMA-340 and it was subsequently submitted to the International Organisation for Standardization (ISO) for consideration. ISO adopted it as ISO/IEC 18092 in October 2003. ISO/IEC 18092 details the modulation, coding, data transfer speeds, anti-collision, data exchange, and other technical operations that enable standardised operation across NFC devices.

NFC is closely related and complementary to other contact less technologies with which it shares the 13.56 MHz frequency band. Specifically, the popular ISO 14443 standard is a key building block for much of the Near Field operations. NFC is compatible with the ISO 14443 Type A and B standards, NXP's Mifare, and Sony's FeliCa technologies.

Initiators and targets

NFC splits the components of a communication session into initiators and targets. The initiator is the device that begins and manages the communication and exchange of data. The target responds to requests from the initiator. This is where one of the key qualities of NFC comes to light: devices can act as either an initiator or a target.

In traditional RF systems, a device is either an initiator (called a reader or interrogator) or a target (called a card, token, or transponder).

Establishing protocols for devices to act in either role enables bi-directional establishment of communication and enables devices to function as what is commonly referred to as 'either the card or the reader.'

The significance of this dual-role capability is best explained with an example. (see sidebar)

The same device, the waiter's handheld, has functioned as both a contactless reader and a contactless token to complete the transaction. One of the elegant features of NFC is that it opens doors for functionality never before possible. As the NFC Forum describes it, "an NFC-enabled device can operate in reader /writer and peer-to-peer mode, and may operate in card emulation mode."

Passive and active NFC modes

Another important feature of NFC is that it defines two distinct modes of communication. In the active mode, both devices are responsible for creating the RF field to carry data. In the passive mode, only the initiating device creates the RF field. This enables battery -powered devices, such as mobile phones, to avoid power consumption at the RF level during periods of inactivity.

The benefits of ease of use According to Ecma, the short-range nature of NFC is optimal for its application. Because NFC devices must be no more than 20 centimeters apart for operation (most agree actual distance is smaller in operation), the "touch" metaphor applies. This means that devices must, in essence, touch each other to establish communication. Ecma notes the following benefits:
• "Devices can rely on the protocol to be inherently secured since the devices must be placed very close to each other. It is easy to control whether the two devices communicate by simply placing them next to each other or keeping them apart."
• "The procedure of establishing the protocol is inherently familiar to people: you want something to communicate - touch it. This allows for the establishment of the network connection between the devices to be completely automated and happen in a transparent manner. "

Initial applications

NFC developer Innovision cites peer-to-peer, payment and ticketing, and service initiation as the three initial applications that will drive NFC's growth. It describes these applications as follows:
In peer-to-peer applications, NFC can set up a separate wireless connection via Bluetooth or WiFi. Typical peer-to-peer applications are printing photos straight from a digital camera, establishing an Internet or network connection, transferring files between devices, or sharing electronic business cards.

Initially, NFC-enabled devices are likely to be used for low-fraud, limited-value payment situations, such as quick-serve restaurants, kiosks, vending machines and parking meters. Service initiation applications use NFC to transfer a small amount of information to the NFC device (e.g. text, a web address (URL), phone number). Smart posters direct the device to a web site for info, to book tickets, or access video or audio files without the need to key anything into the phone to open the browser or input the URL.

Imagine a restaurant scenario where a diner and waiter are settling the bill. The diner holds out his contactless card and the waiter simply touches it with his NFC-equipped device (e.g. PDA, point of sale add-on, mobile phone) that is functioning as a 'reader.' The waiter captures the payment info and the customer verifies it on the device and adds a gratuity.

The waiter walks back to the main counter and touches the device to the central point of sale (POS) reader. The waiter's device then switches to 'card' mode as the central POS reads the payment information for processing.

Touch is the new click...

NFC handshake welcomes new dawn of helpful objects.

by Murdoch Mactaggart

Bluetooth is a useful technology which enables, for example, the user to back up an address book to a computer or use a hands-free facility in any car. Yet users are deterred by complicated pairing and set-up processes. Near Field Communication (NFC) is a technology which merges RFID with the consumer objects of the future to free users from such technical complexities. Using magnetic field induction to enable discreet communication between devices linked by a simple touch, NFC establishes a link and either transfers data itself or uses complementary technologies such as Bluetooth or WiFi. "You might have photographs on your mobile phone that you want to print," says David Wollen, CEO of Innovision Research & Technology plc, "just touch your phone to an NFC-enabled printer and it's done."

Wollen gives a socially useful illustration of such simplification of complex functions on mobile phones and other consumer devices. "Elderly people may remember faces better than phone numbers, so stick tags programmed with the phone numbers onto family photographs," he says, "and all the person has to do to ring someone is to touch their NFC phone to the photograph or a specific person in it." This solution serves a "consumer pull" rather than a "technology push" and NFC-compliant RFID tags have reached a price point where smart stickers are a feasible proposition.

Far more significant NFC developments are in the pipeline enabling mobile phones to replace credit cards, become contactless ticketing systems and do away with the need for low-value cash and coin transactions. Some forecasters are stating that as much as $36 billion of mobile payments could be transacted by mobile phone by 2011. Financial, telecom and systems companies are driving this globally, and UK based Innovision is one of the pioneers developing the underlying NFC semiconductor technology to make this happen.

Innovision, headquartered in the southwest of England, design and supply custom RFID solutions, but their primary focus is on semiconductor intellectual property (IP) for NFC. "We develop, licence and provide the IP and IC technology to systems integrators and semiconductor corporations.", explains Wollen, "They develop this into fully-fledged RFID systems of various kinds or include the IP in their own semiconductor devices. Essentially we design and licence smart radio systems on chips."

In addition to past work in industrial applications, toys and airport passenger flow monitoring, Innovision also developed and is supplying limited-use contactless ticketing technology, based on their Jewel® RFID tag. Jewel's cost and performance has been refined to the extent that it can replace a single-use paper ticket on a bus or train with a contactless solution, thus creating many advantages for transport operators. Contactless mass transit ticketing is also strategically important for NFC deployment worldwide.

However, the real breakthrough came with migrating such RFID technology to mobile devices and building not only tags but also readers into handsets.

"We're moving into a world of interactive smart objects, where the mobile handset is the primary reader", explains Wollen, "NFC consolidates the existing standards for contactless smartcards and tickets, i.e. ISO14443A/B and ISO15693, into one global standard, so a device can build on the existing infrastructure. The mobile phone becomes a complete contactless transaction system based on RFID, with these services integrated with the other functions of the phone." NFC deployment is in its infancy but Wollen is confident that it won't be long before you can download various services to your phone. An evening out could be transformed as you use your phone to touch in and out of a car park, touch an NFC "smart poster" timetable to get times at the train station and use your phone on the train and tube in place of an Oyster Card, then touch in to enter the theatre and walk straight to your seat. All without the need for paper tickets, cash or credit cards.

The real key here is developing NFC IP solutions which can be licensed to manufacturers of wireless and other chips already in or planned for a phone or other consumer device. Instead of a handset manufacturer having to fit separate additional NFC chips in the very limited space available, NFC IP blocks can be licensed to add the extra NFC functionality and share circuitry with the existing Bluetooth chip, for example, with minimal extra cost and complexity. This extra functionality enables the Bluetooth, GPS, power or bio-security chip supplier to differentiate and add value to his product.

Although Innovision develops custom solutions, it has also introduced its own Topaz® NFC/RFID read/write tag family, designed to be compatible with relevant NFC ISO standards and with a 96-byte memory, useful for storing information such as long web addresses. Topaz is one of only three such formats now ratified as part of the NFC standard alongside others from Sony and NXP (formerly Phillips).

"We work with customers on custom engineering development and then licence and take royalties on the shipment of our IP." says Wollen, "So we're looking for mass market applications of these devices and our view is that real volume markets will appear around 2010."

"We have moved from the pioneering early stages to what is effectively our fourth generation of such RFID deployments. Our wealth of IC engineering talent means Innovision R&T are recognised as both global leaders in custom IP solutions across different semiconductor processes and fabs, and the only company capable of working with all of the different chip manufacturers."

Whats on r

**Every emerging technology has two sets of people predicting what's c
the people who develop it and look at what's actually possible. Guy C
prospects for RFID.**

The story so far is that RFID has delivered in a lot of areas and failed in a number of others. Professor Peter Cochrane, now a consultant, is an ex-CTO of BT and has been responsible for over 2000 researchers. He sees a number of successes: baggage handling systems at airports, high-value items in the retail chain, shelf loading systems for CDs and DVDs, pallet designators, security systems and badges, hospital patient and asset management and military asset management are a handful of obvious examples.

Other areas have been less stunning. The vision that every retail item would have an RFID tag so that it could be located immediately simply hasn't happened. So, is it going to? "Getting an RFID tag to work on a can of coke is a killer," says Cochrane. This is for a simple reason. "Getting an RFID tag to cost in on really low cost items is a killer and can only really happen when there has been mass deployment that drags down the cost." He also perceives, in spite of claims by some of the manufacturers, that passport applications have yet to take off as they might.

The user perspective

Essentially there are two people who will determine what works and what doesn't in RFID. One is the company that deploys it and the other is the end customer. The deployer of RFID has to tailor their system so that it works in the way the customer wants.

One such company is Zipcar, which launched in the UK in 2006 to offer hourly car rentals. Each of its cars has an RFID reader attached to the windscreen; this is connected to a wireless 'black box' in the car. Members swipe the windscreen with their membership card to lock and unlock the vehicle, and packets of data are sent to the vehicle in real time to let it know who to expect and at what time.

Doug Williams is the engineering VP for the company and he has a number of items on his wish list for the future, although from his comments it's clear that he is content enough with the vehicle operation side of the system. "In five years, RFID should provide universal interoperability," he says. "People would be able to move

currency and personal information seamlessly between the banking network and their favourite personal devices. Data would be protected by biometric security standards for trust and ease of use." That's his ideal world scenario; realistically he expects a little less. "I expect that interoperability standards will eventually become prevalent, but it will depend on technological advancement as well as business adoption," he says. "Business adoption rates are likely to be the bigger challenge since it will require cooperation between large, competing players. In five years time, I expect that RFID will allow Zipcar to support its members with new solutions - ranging from access via third-party cards and devices - to direct access via biometric verification."

The nuts and bolts – what the makers say

Customer expectations are inevitably vital to the future of any technology. Even more important for actually getting the ideas into the market is the view of the manufacturer of the components that make it work. Christophe Duverne is Senior Vice President and General

Manager of the Identification business within RFID chip manufacturer NXP Semiconductors as well as chairman of the NFC Forum. The company's chips go into the automotive industry as well as general security, animal tagging and a broad base of applications including London's Oyster Card transport system.

"Initially RFID has been used most widely in transport applications," he says. "And in a number of industry applications such as tagging of parts through value chains. We see now that it's moving more into the consumer domain with international interest in the payment area, which is something happening a lot in the US and Asia Pacific, and also starting in Europe with the UK being in the lead."

There has indeed been a lot of interest in the micropayment and financial services arena but the myth of the cash card for your daily newspaper

remains just that – a myth – in most territories. Ted Iacobuzio is managing director and practice lead for payments at analyst house Towergroup, which follows the area carefully. "In America, RFID's greatest success has been with PayPass from MasterCard and Express Pay from American Express, and with Visa's version – unlike MasterCard and American Express, Visa has not named its solution, but incorporates a logo on the card," he says. "PayPass and ExpressPay have extended the reach of card payments to classes of merchants - quick-serve restaurants, for example - that would have hesitated to take cards as payments. There, the issue is velocity,and proximity payments help with that." Whether this trend will become universal is open to some debate because of the underlying technology, he explains. "Chip-authorized payments using the EMV

next?

coming next – the people who use it and know what they want and
Clapperton talks to a few commentators about the mid-term

standard are for the most part authorized in batch, rather than individually and in real time, as they are with magnetic stripe. This could present some issues in transferring the benefits of proximity payments to Europe." Also in the consumer market is the trend towards putting RFID chips into mobile devices, the NFC side pioneered by NXP. "This is starting to get a lot of traction from wireless carriers," comments Duverne, who adds that there will be a lot of commercial deployments from this year onwards. "It's about embedding your card, whether your credit card or your transport card, into your mobile device. It provides a platform for multi-application cards running on a cellphone and enables you to buy things over the air with a much easier user interface. The beauty of this is that it's fully backwards-compatible. So if

you're running, say, a courier company that's trading internationally it'll work in Japan just as easily as it will in Europe." There aren't any official announcements on when this will start in Europe but Duverne confirms that pilots are happening now and strong commercial deployments will happen in 2008, backed by a white paper from the GSM congress only a month ago.

There will be challenges from the manufacturers too. Duverne says there are many opportunities for using RFID in combination with sensor technology and this will be a matter of setting up the right interoperabilities with the chips and the sensors. "Many people in the industry are working on it, it's going to be a case of gaining experience and moving along the learning curve then making the solutions

more affordable." He adds that he wants to see further work in passports; the embedded chips will need to be more secure and more tamper-proof, he says. "Basically they will carry more data. We have won so far 80 per cent of passport projects worldwide, and you will also see us pushing a lot of innovation into the ID card field."

Towergroup's Iacobuzio adds that manufacturing will continue to benefit. "Supply chain management is another area where RFID is really taking off," he says. "RFID is being used in an experimental way to replace barcodes to track stock, for example companies such as Walmart and Tesco could effectively tie the supply chain into the purchasing and track what customers are buying."

The Art of the Financially Possible

Ultimately the future of RFID, at least in the medium term, will be less about what can be done and more about whether it can be done in a financially sensible manner. Asked where the technology has failed to
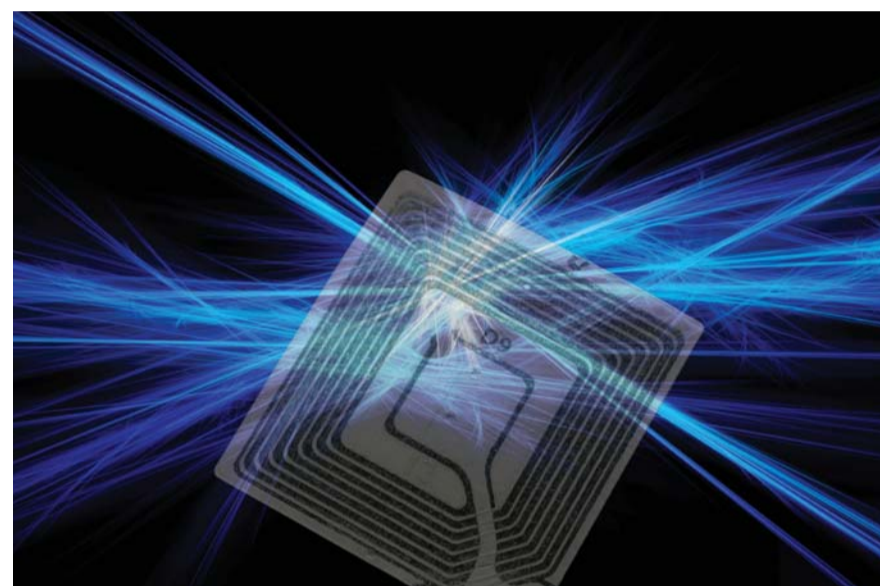
deliver, Peter Cochrane is forthright: "It always delivers," he says. "The question is: does it cost in?" It will continue to grow and to do well everywhere, he believes, when the business case and numbers add up. "It is reckoned that $20Tn can be saved in the global logistics chain by filling containers and trucks. Current truck fills are only 17 per cent in the UK and 22 per cent in the USA, for example."

The technology won't look the same as predicted initially, he believes, but it never does. "Most likely it will have greater processing power, more reader and addressing range and more memory," says Cochrane. "The most advanced tagging systems will have GPS and sensor systems built in and – hopefully – more of our tagging systems will be able to talk to each other."

It remains the case, however, that RFID hasn't behaved or evolved in the expected manner from when the technology first emerged. Costs have been an issue and it's not unreasonable to suggest that consumer concerns over just what's being tagged and how closely their behaviour is being monitored will limit some of the applications into which it will go. Duverne's wish to enter the ID card market will depend as much on the political climate as on the capability of the technology.

The possibilities for tracking and traceability through RFID are very considerable; factors of customer resistance and cost will continue to be as important as the technology in shaping what actually happens.

A little voice told me something...

"We try to use RFID in combination with existing technologies to do small but very interesting improvements in day-to-day applications," says Jan Vermeesch. He is vice-president of marketing for Belgium's 25-year-old Zetes Industries, a long-time specialist in supplying integrated systems for mobile professional workers, typically in warehousing, retail, and manufacturing. Zetes believes adding RFID to existing voice systems will make applications like stock-picking faster and more accurate.

"We focus on mobile professionals," Vermeesch says, who notes that Zetes has been supplying voice systems for more than five years. "We are advocating further optimising processes with RFID."

Given that almost all products are available from multiple sources and competing products are often nearly identical in features, today's intense competition in the retail sector is won by superior supply chain performance and services. The success of Wal-Mart and Dell Computer, the two companies that most famously built their businesses on just-in-time inventory management, has sparked industry-wide adoption of these techniques. The upshot is enormous growth in the number of stock pickers and warehouse management systems, as many more, much smaller deliveries supply shops with only the amount of stock they expect to sell in a single day.

Zetes, the brain child of Alain Wirtz, who is still CEO, started out as a systems integrator around the time that barcodes were being introduced. Its first big project in fact was with the first Belgian retailer to implement barcodes. The company became the market leader in Belgium by the 1990s, and then, with no further room to grow domestically, began expanding into the rest of Europe. Today, its €140 million in annual revenues come from 600 staff working in 12 subsidiaries covering most of Europe and Israel. Its British offices are in Ascot and Manchester; in Ireland it has homes in Dublin and Limerick, where it, amongst others, supplies printer applicator solutions to nearby Dell Computer. "We have competitors in all the countries we work in," says Vermeesch,

*Alain Wirtz,
CEO Zetes*

"and our subsidiaries are not always bigger entities than the other players in those markets. But we are the only one with the international size, critical mass in solution development and drive for international customers."

The company made a deliberate decision to go into voice when the technology began to mature. Vermeesch and Marcel Kars, vice-president in charge of competence centres for Zetes, both came to Zetes from voice specialist SyVox Europe, which went down in the wake of its technology-supplier Lernout & Hauspie.

*Jan Vermeesch,
VP Marketing, Zetes*

The type of voice solution Zetes supplies through the competence centre Kars set up is rather different from the speech recognition technology sold for full-blown dictation systems. The vocabulary needed for a real-time warehouse solution is much more limited, and therefore the technology is much simpler. These systems speed up warehouse picking.

Traditionally, Kars explains, the many thousands of people across Europe picking orders in warehouses – "You cannot imagine how many people are doing that" – would be given a piece of paper listing where to go and what to do. The instructions were difficult and exacting to read, and there tended to be many errors.

The solution then was to give each worker a mobile terminal and stick a barcoded label on every location. People saw on their screens where to go, scanned the barcodes of the items they needed to pick, and saw confirmation on their screens before moving on to the next item.

"After a while," says Kars, "people thought it was

*Marcel Kars,
VP 3i Competence Centres, Zetes*

extremely slow." Managing a mobile terminal is difficult for workers, who often need both hands to deal with products, and some of these systems allowed no feedback from the worker like notifying damage or product spills.

Voice solves these problems. The paper is gone. Instead, workers receive instructions via headsets to tell them where to go next and what to pick; they confirm by speaking into their headsets as they select the items. The German food wholesaler Edeka, for example, reports that the 280 voice terminals it has installed have improved the reliability and productivity of its order processing.

RFID, Zetes believes, can build on these voice systems to improve the accuracy and speed of order processing even further.

RFID, says Kars, can automate many of the checks that are necessary but slow down today's workers. A picker no longer has to say where he's going; the system can confirm he's at the right location by reading the tag.

"Where we try to use RFID is to smooth current processes," he says, "not to change processes." Reading the RFID tags as a picker chooses boxes means that the picker can be told immediately over his headset if there's been a mistake and what needs to be corrected. Similarly, the system can check that the right number of boxes is on the pallet.

It would waste a lot of time to go back, unload the wrong boxes, add the right boxes and go through again. Instead, says Kars, "We try to integrate RFID into the process itself without changing the process. It is much more powerful to automatically correct it at the moment you make a mistake."

Kars says that one of its significant RFID markets is laundries, including professional clothing rental services that supply uniforms to garage mechanics and hospital workers, among others. RFID allows the clothing to be tagged so that garments are always returned to the correct location and are read automatically for invoicing purposes.

In a more sophisticated case, Zetes has worked with WPS Horti Systems to refine control of its greenhouses. The Netherlands-based company uses RFID tagging to automate its order and delivery system so that plants can be chosen to meet very specific criteria: height, colour, even the number of branches.

"It's a very interesting market," says Kars. "RFID can exactly trace the growing processes. It's a very high-tech industry."

In another system supplied by Zetes, Belgian company Java Food Service uses RFID tags to ensure that every order is traceable, as required for all food supplies by European law. Java believes that the system's ability to assist customers

with this part of their administration is a selling point versus the competition. Java is now installing a voice system to make its order picking hands-free.

Despite these applications where RFID is successful, Vermeesch and Kars both believe that RFID has been overhyped and oversold. Both are sure that RFID is an important technology and will be widely used in future, but both also think that much of the publicity has focused on the wrong kinds of applications.

Basically, says Kars, RFID is good at "everything that has to do with closed-loop systems." That is, RFID is good at tracking and tracing items within a controlled environment. For example: asset tracking, or carrying packages that stay within a small group of users.

Open-loop applications, such as the entire supply chain, he says, are "hugely complex" because of the need to make sure that everyone is using the same standards and can feed their information into a single, centralised system.

"Everybody can scan a barcode," he says. "Not everybody can scan an RFID tag." Kars believes it will take another technology to drive the kinds of huge applications that such systems would require.

Given that Zetes wants to sell RFID systems, this may sound strange.

But, says Vermeesch, "We feel as a company that our role towards our customers is to be a pragmatic consultant when it comes to what kind of technology is suitable for you and your business case in

real life. The difficulties that RFID technology in general is facing in the marketplace is due to themselves overhyping the technology and putting forward wrong uses of the technology or creating false expectations in the marketplace. The RFID industry and vendors are promoting uses and applications that are unrealistic and not providing much benefit." So, he says, customers come to Zetes confused and sceptical.

RFID, like computers themselves, is not a panacea. It cannot solve all problems, and it cannot, by itself, change or completely automate a company's business processes. It can, however, "optimise a lot of things".

Vermeesch cites more detailed examples of bad – or at least unlikely in the short term – uses of RFID. For example: the oft-discussed notion that a consumer can bring home a bag of tagged groceries, set it down on a smart patch of kitchen counter, and have the contents automatically logged. The technology is not there at the moment, and even if it were, he thinks both consumers and businesses will think, "Why do I need that?" In any event, RFID tags are not (yet) cheap enough for this kind of usage, though they are valuable for higher-priced goods like pharmaceuticals.

Also unlikely, he thinks: the oft-discussed media image of the consumer wheeling a completely filled shopping card past an RFID reader at the check-out that will read all the items in his cart and automagically charge his credit card. Vermeesch believes this is impossible, and anyone who tries to install such a system is bound to be disappointed even though the vision appeals to him personally since, like everyone, he hates standing on line.

"If you pack expensive items between the cans and water bottles," he says, "there is a 99 percent chance the items won't get read. It's the physical limitations of the technology. Is RFID usable technology? Absolutely. Is it usable as portrayed by many players? No, it is not. As an independent systems vendor we try to be a pragmatic partner for customers driving them towards usable and beneficial applications, and away from unrealistic applications."

Understanding how tec work for different busir will provide a key for su

In 1966, the year the first commercial barcode applications began to appear, Intermec was established to capitalise on the new market in automated data capture.

"We were one of the innovators in barcoding technology", says Mike Wills, Senior VP of Global Sales and RFID, "Intermec, working with others, was a pioneer in developing standards. We developed Code 39; perhaps the most widely used alphanumeric code. 'Interleaved 2 of 5', the supermarket standard for marking boxes, came from us

commercial systems to start to be deployed.

In 1997 Intermec bought out IBM's RFID research facility and followed that up by buying RFID pioneer Amtech Corporation, increasing its commitment to RFID some ten-fold. The Amtech purchase took Intermec into transportation RFID use, areas such as tollway monitoring, garage applications and railcar tracking. Importantly, it also gained the company practical expertise which helped Intermec win contracts to implement closed loop applications and, later, supply chain systems.

"Closed loop applications

and so did Code 11, widely used in telecomms."

The technology behind RFID is even older. The transponder was invented in Britain in 1939 as a means to identifying friendly allied aircraft to radar and although the first recognisably modern RFID system appeared in 1971, it took a further two decades for

are typically internal, with ROI in a six to eight month time frame", explains Wills, "The initial projects usually aren't large but they're attractive because they give a foot in the door. When a customer sees how handsome the returns can be and how positive the impact on the business is, multiple larger projects often follow."

The focus

As with barcodes, Intermec works with standards bodies and others to develop RFID standards. In 2001/2002 it committed to work with EPCglobal on supply chain initiatives and later contributed relevant IP through licensing agreements to develop RFID equipment for supply chain applications, bringing in companies such as Texas Instruments, Philips, Symbol, Cisco and others to expand the market.

At the same time it was developing its own RFID tags and readers, continuing with its core business of developing and manufacturing barcode equipment and rugged mobile computers and providing consultancy. According to Intermec RFID is simply another approach to the problem of capturing and managing data to improve the efficiency of business processes and particularly of the supply chain.

"I think that one-dimensional (1D) and two-dimensional (2D) barcodes can peacefully coexist with RFID for the foreseeable future", says Wills, reflecting the company's claim to offer the most suitable tool for a particular task.

1D barcodes have served industry well and will remain in widespread use for the foreseeable future, but with the addition 2D barcodes and RFID it is now possible to choose a range of systems with progressive price and

performance improvements. Where more information needs to be stored, perhaps for tracking dynamic data from initial product construction through all maintenance to final destruction, 2D barcodes can be used. Last year Intermec introduced the EX25 reader, an auto-focus scan engine for both 1D and 2D barcodes with reading distances ranging from six inches to fifty feet. 2D symbology and improvements in smart label technology can be seen as pointing the way to the eventual adoption of UHF RFID for item level RFID tagging. Intermec's high performance RFID tags are already in use for a variety of reusable asset tracking applications.

Simple tags are now cheap but they're still much more expensive than barcodes. The price of sophisticated tags remains high and although this may be justified for specialist applications price remains a barrier to item level tagging. Here 1D barcodes excel, speeding up greatly the processes of identifying and tracking goods. Where more information needs to be stored, perhaps for tracking dynamic data from initial product construction through all maintenance to final destruction, 2D barcodes can be used.

"Really, if you boil it down", remarks Wills, "Intermec has always been about enabling our customers to trace and move assets through their supply chain in a faster, more

productive way. Often barcodes are best, but sometimes RFID's specific advantages make it preferable."

RFID in practice

Container ships, trucks and warehouses can be pretty harsh environments and Intermec has a name for building rugged devices. Work done for truckers and logistics companies, for the likes of Boeing and Chrysler, recently for waste management companies in domestic trials in New York and in industrial situations elsewhere, have all demanded tags that can stand up to harsh weather and knocks and readers that forklift operators or garbage collectors can forget about.

More recently the US Department of Defense has been using tags in both Afghanistan and Iraq.

Yet perhaps Intermec's involvement with NASA in the latter's Material International Space Station Experiment (MISSE) programmes will be the ultimate test of their products' robustness.

MISSE6, scheduled to be put in place by the shuttle Endeavor in December 2007, will include Intermec's Gen2 passive RFID tags to test suitability for use on space missions. The tags will be on the outside of the international space station for approximately a year, exposed to extreme heat and cold, ultraviolet radiation

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and the vacuum of space. Back on earth they'll then be tested by NASA in their clean room at Langley Research Center using standard Intermec readers.

Intermec may not envisage future supply chain opportunities between earth and the planets but the company seems to have plenty to occupy it in working with large organisations such as Carlsberg Breweries, Southampton Container Terminals, METRO Group [see sidebar] and others both to implement solutions and to develop and test applications. In fact Intermec claims to have 75% of Fortune 500 companies and 60% of Fortune 100 corporations as its customers.

Wills states that Intermec's strength comes from its experience. "We've been dealing for four decades with virtually the same business problems that our customers are now facing. We understand their business models

intimately", he says, commenting, "Add in that we have a very broad range of our own designed and manufactured products which work well together out of the box and that our field-based expertise helps us to knit together optimised system designs to provide what the customer needs, and we have a great competitive advantage."

What of the future?

The critical issue is tag cost. Dr Gerd Wolfram, MD of MGI METRO Group Information Technology, points out that developing wireless solutions for the whole supply chain to item level benefits everyone but that no one wants to bear the cost on their own. This is an ongoing debate with, at the same time, newer technologies and economies of scale leading to downward pressure on tag prices as well as on the overall costs of implementation.

"The supply chain initiatives sponsored by the likes of Wal-Mart, METRO Group, Tesco and others will remain on course", says Wills, "But new companies are coming in. People are now saying that it's time to commit, time to introduce RFID fully to the enterprise. Interestingly, the pilot phases are now much shorter and this leads to wider deployment." RFID, although a relatively small part of Intermec's business, shows the highest growth rate compared to other segments. This may level off, Wills says, but will continue to grow rapidly and become increasingly important. "As we exit 2007", he says, "we'll start to see much more item level tagging."

That's a good growth sector for Intermec but Wills sees opportunities also for sophisticated active tags for the international global logistics sector, the movement of pallets and containers from trucks or railcars to ships and planes. Active tags can supply dynamic information on the detailed history the containers themselves and their contents. "This is where you get into GPS, into sensors using active tags. There's a whole flourishing path there for supply chain applications and we are now looking closely at that and building our capabilities and expertise for the future."

METRO Group leads with RFID

METRO Group is one of the most important international retailing companies and today trades in 30 countries. Its sales of around €60bn come from the following sales brands which operate independently in the market: METRO/Makro Cash & Carry – world market leader in cash and carry wholesale, Real hypermarkets and Extra supermarkets, Media Markt and Saturn – market leader in consumer electronics centres in Europe, and Galeria Kaufhof department stores. METRO Group competes directly with companies such as Wal-Mart and Carrefour and is moving strongly into eastern Europe and Asia.

Dr Gerd Wolfram, MD of MGI METRO Group Information Technology, sees RFID as particularly valuable in improving efficiency. "I started working with RFID in 2000 in a research project at MIT very closely connected with EPCglobal", says Wolfram. "In 2003 METRO opened its Future Store to test technology in real life environments. We implemented RFID there for the first time and now we're rolling it out across Germany. Nearly two hundred stores will be using RFID later this year."

There's also the METRO Group RFID Innovation Centre in Neuss, Germany, an initiative to test and deploy RFID with partners under real working conditions. This has a complete model of the wholesale and retail supply chain and is the first accredited EPCglobal Performance Test Centre in Europe.

"RFID's main benefit is in goods receiving", explains Wolfram. "We get increased throughput and a higher quality of data about the goods. We can unload trucks faster and we know exactly where everything is. This means that we have better control of stock and so avoid out of stock situations more readily."

METRO Group has a long relationship with Intermec and uses Intermec's rugged readers on entry doors and fork lift trucks. In the company's busiest distribution centre in Unna, for instance, it uses a system to identify and sort garments on hangers at rates of up to 8,000 an hour.

Incoming pallets pass through a dock door portal fitted with Intermec IF5 readers which capture the Serial Shipment Container Code (SSCC) and filter out data from the tagged cases. This information is then automatically matched against METRO Group's system, incomplete shipments detected immediately and stock levels updated. The system uses WiFi to Intermec CV60 rugged computers mounted on forklifts to alert drivers to collect and store items, the various tags being read automatically to match goods and storage locations and to warn the drivers of problems. When orders arrive from stores the system works in reverse ensuring that the correct items have been picked before the pallets are shrink-wrapped. At the stores themselves a smaller version of the goods inward process operates with similar benefits. "Right now, RFID is used only in the logistics processes", explains Wolfram, "It's our vision to have it also at the product level and I think that in ten or fifteen years time it will be in every supermarket. With some categories, clothing for example, it will appear much earlier. In the end, however, RFID will be widespread and this will greatly reduce out of stock situations, ultimately benefiting the customer."

Exhibiting Value

Significant cost savings are being racked up by supply chain management company TDG and its customers, while Reed Exhibitions has successfully piloted techniques to improve the visitor experience at trade shows and deliver greater value to exhibitors. Both successes are due to different Passive RFID solutions from RadiantWave.

Visitor experience enhancement with Reed Exhibitions Because Reed Exhibitions runs over 470 events such as trade shows worldwide, many people are familiar with the conventional way in which visitors are tracked entering exhibition halls, by running a wand over a barcoded visitor's badge. But that record of a visitor's arrival is about all the information the organisers currently receive regarding their physical movements.

"If you have visitors with RFID tags in their badges, and then locate readers at the entrances and exits of your exhibition halls, you can not only capture that information without visitors having to wait to be wanded, you also find out when they leave", says David Rowe, IT Manager with Reed Exhibitions UK. "We would get valuable data on the length of stay."

It's with applications like this in mind that Reed run a pilot at a trade show in March,

sending around 100 selected visitors UHF RFID enabled badges with their knowledge and agreement. However, Reed had in mind not just getting a bit more information about how long visitors stayed for, but a range of other applications. By positioning readers in additional locations, the exhibition organiser, exhibitors, advertisers and sponsors could gain valuable information to improve the visitor experience and hence the return for the exhibitor.

"We wanted to understand better how the visitors move around the hall. If we know that, we might be able to look at the layout of the hall to end up with a better physical design", says Rowe. "Another possibility is to use this information to help exhibitors. For example, we could go to an exhibitor and say we know you are interested in meeting IT directors, and now we can tell you that 50 walked past your stand on Monday. If they didn't come onto your stand, what can

we do together to help attract them next time?"

Other uses envisaged for the RadiantWave solution, which was delivered to Reed Exhibitions through BT Media, include offering visitors some incentive or benefit to visit an exhibitor's stand if they have been detected entering an area, or perhaps have been observed reading advertising material.

Although an innovative and imaginative application, the Reed pilot does illustrate the benefits of selectively using RFID. "We help organisations get the most out of RFID." commented Martin Kruse, Managing Director, RadiantWave. "For Reed, we developed a simple but effective solution, showing the benefits to stakeholders made possible with RFID".
A passive RFID solution is also an enabling technology in an Asset Management solution delivered to TDG by RadiantWave.

TDG Case Study

A large number of supply chain management company TDG's customers distribute TDG's products in large plastic bottles of about 1000 litre capacity. "These are known as intermediate bulk containers (IBCs), and sit on a plastic pallet surrounded by a metal cage", explains Mark Webster, General Manager, Unitisation with TDG Chemicals. "We distribute vast quantities of these through our supply chain network."

"The business problem that we were presented with was from

our customers", continues Webster. "Generally chemical manufacturers, they spend a vast amount of money on these IBCs but have a lot of difficulty finding out where they go and what happens to them. Traditionally they buy this packaging, maybe warehouse it for a period of time, and then sell it to a customer. After that, the customer may or may not return the container, and the manufacturer may or may not re-use it."
The problem was that some IBCs simply didn't come back, and if they did, there could be a considerable delay before this valuable resource was returned to be put back into active service. "We wanted a tracking technology to give us visibility of these IBCs as they moved through the supply chain", says Webster, "which had to stand up to what is a pretty industrial environment, in terms of handling and hazardous chemicals. They also had to withstand our vigorous cleaning process."
As it happens, TDG looks after both the transport and the warehousing of these IBCs throughout their lifecycle. TDG was uniquely positioned for RadiantWave to deliver an integrated RedPrairie Mobile Resource application with Trovan Chemical Resistant Tags to track the containers anywhere in the process without having to involve numerous other parties in the tracking process. "We can make sure they don't go missing; move about faster and don't hide anywhere; and if damaged, we can identify where in the supply chain the damage happened", says Webster.

As a result, the assets are worked harder, which has not only saved costs for TDG, but has also allowed a new business model to be introduced, whereby customers can trip-lease the containers. This saves them money too.

Access all areas...

Whilst 'live entertainment' continues to grow, sports stadiums, entertainment arenas and venues are having to adapt their business models to maximise the use of their facilities by providing an increasingly integrated approach to infrastructure with the aim of 'enhancing' the level of visitor experience.

This crucial cultural and business shift is being driven by the rise of empowered consumers who have greater control and choice over where they spend their social time and spend their disposable income.

Intelligent Venue Solutions [IVS] Ltd, a team of industry professionals with a vast collective experience of the sporting, commercial, entertainment and technology sectors, is creating opportunities for stadium and venue operators to exploit the potential of their venues through the use of 'intelligent' technology.

The 'intelligent' approach allows venues to unite existing infrastructure, rather than requiring wholesale replacement.

IVS promotes rfid in sporting and entertainment venues with smart card stadium ticketing and access systems, crowd control programmes, asset management operations and wireless technology, together with targeted CRM and data management all combining to provide the venue and stadium operator with multiple direct communication channels with their visitors.

At Manchester City Football Club's City of Manchester Stadium, where rfid has driven its 92 turnstiles for several seasons, IVS has been assisting MCFC to develop innovative opportunities in the commercial and retail areas.

The system has so far has continued to help to increase annual revenues and is bringing fans into the 48,000 capacity stadium at a rate of 1,200 a minute. The smart cards, which are held by 140,000 fans, can be used at turnstiles, retail tills, kiosks and via handheld computers carried by stewards.

Wireless technology also presents new opportunities and can provide a more interactive spectator experience via laptops, mobile phones and PDAs, which can access information including advanced arrival instructions, video footage and match highlights, match statistics and ticket availability.

IVS Ltd and MCFC are also at the forefront of the future of the spectator experience with the introduction of Near Field Communication (NFC). A trial at the stadium has allowed the use of a NFC-enabled Nokia mobile phone to simply swipe against a reader to act as a ticket to a match or as an electronic wallet.

The NFC handsets also provide a great information channel for the club's marketing team as fan's profiles can be created easily to illustrate buying patterns and behaviours. The club are also in early discussions about integrating Bluetooth technology for marketing initiatives with the RFID cards.

Today's empowered consumers are becoming much more interactive with the services they choose and how they use their preferred technology to access them. IVS Ltd provides the solutions for stadium operators to reach out to their customers and increase their interaction with the venue.

SIZE
matters

By Guy Clapperton

A technology like RFID has to be deployed by companies of a certain size to make it pay, but some installations are more substantial than others as Guy Clapperton reports...

Whatever the size of a manufacturing business, the challenges remain the same – to manage the processes efficiently and deliver an excellent product to the maximum benefit of the customer. To keep prices down this involves efficient management of the assembly process, consistent reduction of inventory levels and preferably a good grasp of the underlying financials.

This has been the goal of Toshiba in its Regensburg manufacturing plant in Germany, reckoned to be one of the largest employers in this region, since its inception in 1990. It has an impressive track record. It builds every one of its laptops to the customer's individual specification and the company is in fifth position in the overall EMEA PC ranking.

Clearly this has meant adapting to and taking advantage of new technologies as they emerge, and RFID has been among them in recent years.

The market
Toshiba is one of the market leaders in laptop computer manufacturing, and laptops themselves are driving the overall growth of computing in EMEA. IDC figures suggest that laptops in EMEA are growing at 19.7 per cent, with growth also in the CEMA region and the whole of western Europe. Toshiba sells to the consumer and to the SME markets and constant pressure for keener price points means every efficiency and cost saving can make a substantial difference to market share and profitability. As a result vendors compete fiercely.

The manufacturing process plays a powerful part in this equation. IDC comments that IT vendors need to develop processes that address specific pain points in manufacturing; this means understanding functions, processes and business challenges of their organisation. In this way, says the research company, they will be able to identify where technical solutions can apply to add substantial value to their business rather than simply to automate an existing procedure.

The solution
The central difficulty facing the Toshiba plant was a bottlenecking problem. During the last five days of every month the plant had to handle 40 per cent of the orders for that month, with the totals peaking on the last day. There was a definite need for improvement in logistics. "In simple terms, instead of scanning 20, 36 or 56 individual products (our pallet quantities) one-by-one we needed to devise a method for effective receipt and scanning of products in bulk," says Gerd Holzhauser, Toshiba Regensburg Manager. "We knew this would save time and speed things up significantly." In addition, the volume requirements were far from static. "We were faced with an increase in volume, which had to be handled within the same space and warehouse configuration," he adds. "To cope, we had to address bottlenecks in our facility, improve workflow and enhance logistics efficiency."

The first step was to assemble a team to analyse the problem. "We started a SIX SIGMA project and

calculated the cost of poor quality (COPQ), then used this to estimate the savings that could be achieved," explains Holzhauser. "After discovering that the potential RFID label costs would be covered and some further cost benefits would be secured, we began development of the RFID project in March 2006."

The team shortlisted vendors including IBM and ADT. IBM lost out due to projected timescales and costs. The ADT bid, which was successful in the end, was mounted in partnership with UPM Raflatac, which provides RFID labels, with Tyco/ADT offering the hardware and services element of the arrangement. The service element included performance testing, site surveys and deployment. Toshiba Tec provided RFID enable printers to the project.

David Berglund, RFID Business Development Manager for ADT Europe explains. "Toshiba conducted some initial label testing in-house and came to ADT with a basic requirements description.

We guided the project team through a requirements definition phase by working through every step of the existing physical process and mapping it to a new process that relied on RFID technology," he says.

"Based on this requirement, ADT were able to work with the partners to develop a cost efficient and rapid deployment plan. A formal proposal was made by ADT in late June, the project moved to pilot phase in September and then went live within a month."

Technical issues
A number of technical challenges faced the team developing the new system. First they realised that the positioning of the RFID label was crucial. "We conducted some preliminary tag placement testing at our EPC Certified Testing Lab in Echt," says ADT's Berglund. "This testing was instrumental in reassuring Toshiba that ADT could complete the work successfully, with minimal risk."

The centre itself is accredited by EPCGlobal and it was

found that by optimising the label's placement it interacted well with Tyco's Agile II reader. The labels themselves were based on UPM Raflatac's passive RFID technology, passive meaning they required no external power supply, instead drawing power from local electrical resonance. This means that the product will travel well and be readable throughout the world in all UHF frequency regions regardless of local variations and regulations. The competitive advantage in handling the issue this way rather than tailoring a logistical solution for every individual territory is clear for an organisation trading internationally as Toshiba does.

Another area of comparatively low stress was the interface between the existing Oracle ERP system and the new source of input. "Our internal programmers (INITPRO, based in Regensberg) were well supported by ADT technicians, so they had no real difficulties in adapting our ERP systems," says Toshiba's Holzhauser. ADT's Berglund adds: "This was one of the easiest parts of the project thanks to the knowledge of the INITPRO team, the availability of interface documentation to our Extended Operating Software (EOS) product suite and the support of our European Solution Architecture team."

The other unique part of the installation is the structure of the labels themselves, as made by the newly-formed Toshiba TEC B-SX4 desktop printer. It offers a 'head-up' feature whereby the print head is lifted over the chip. This protects the smart label as well as the print head itself and minimises the mean time before failure of the equipment, which inevitably results in less downtime.

Timescales

Once the project had been scoped and agreed things moved quickly, confirms Holzhauser. "Basically implementation and roll-out took from the beginning of April through to the middle of September [this being from conception and specification to going live]. Since the beginning of October 2006, Toshiba has used approximately three million labels," he says. "We have had no problems at all with the work undertaken by ADT. There was a slight short-term difficulty with label quality, but that has been resolved and we are now reporting read rates between 99.97% and 100%."

Benefits in future

The technology is beyond all doubt elegant and performing well, but this would be of academic interest were the business not being served by its implementation. Holzhauser is bullish about the medium-term advantages on offer.

To begin with he expects the bottlenecking effect to vanish almost completely, while the warehouse booking throughput per head at the Regensburg plant of fully-configured laptop PCs will increase by 57 per cent thanks exclusively to the RFID installation. This is going to be essential in a growing market for laptops with Regensburg having anticipated a near 100 per cent increase in total demand from 2006-2007.

The main process that has changed is the handling of the palates pallets of completed laptops. Previously a pallet of 36 computers would be brought in by truck and awaited scanning by staff. Only after all 36 laptops were scanned could the items move on. Now the palate pallet moves through a single RFID gate which scans and logs the laptops automatically. Holzhauser believes that 90 per cent of the time taken processing individual items has been eliminated which has impacts both on cost and efficiency to the customer. Double handling and product availability delays have been eliminated.

Clearly the long-term advantage of such a system emerge when it becomes ubiquitous throughout the supply chain and partners start to take advantage of it. This hasn't happened yet, explains Holzhauser, but there are signs that it might. "We have had customers like Carrefour visit to explore how they might utilise our tagged products. The Metro Group is also interested. The benefits for them are certainly very tangible. They get item level tagged products with UHF RFID technology virtually for free. We even make sure that we replace any defective tags before shipping, so they get a guaranteed 100% reliability rate." Berglund is understandably enthusiastic about this.

"This is the next step and illustrates one of the unique facts about this implementation," he comments. "For once, a supplier further up the chain is ahead of their retail customers in moving RFID tagging at the item level into production. Until now, the trend in many parts of the world has been for retailers to drive implementation back up their supply chains. This change a major step forward for RFID adoption in Europe and it will be interesting to see whether other electronic manufacturers in Europe will follow Toshiba's lead in pushing RFID technology down to the retailers."

This will be an interesting process to watch since the retail market is not accustomed to following leads from its suppliers, it normally works the other way around. Whatever happens in that direction, however, Toshiba has cut a lot of unnecessary process out of its manufacturing thanks to the system – and the foundation of Toshiba TEC as part of the scheme gives it a platform to sell the system on to others.

EPCglobal:
Bringing RFID to market
By Murdoch Mactaggart

RFID is old technology but its commercial deployment is very recent. It's around a decade since any widespread deployment began although it's certainly been in use in specialist areas such as transportation for longer. Seeing the potential for the supply chain, manufacturers like Kimberly Clark and Proctor & Gamble, working with the Uniform Code Council (UCC), helped establish and fund the Auto-ID Center at the Massachusetts Institute of Technology (MIT). This had the aim of developing an electronic product code (EPC), conceptually similar to the bar code in that it could be used to identify objects but with far more potential when used with other electronic data.

GS1 is the successor to EAN International (the Electronic Article Numbering association) which had earlier joined with UCC. It's a global network with principal offices in Brussels and Princeton, New Jersey, US, and has over a hundred separate country member organisations such as GS1 US, GS1 UK, GS1 Germany and so on. GS1's remit is to develop an international system of supply chain standards in different areas

of technology and across all relevant commercial sectors. One of these technology areas is RFID and EPCglobal, an independent subsidiary of GS1 and effectively a successor in the commercial area to the Auto-ID Center, is responsible for promoting the commercial use of RFID and for developing an internationally agreed set of user driven standards. The research-orientated successor to the Auto-ID Center is Auto-ID Labs, a network of seven universities across the world, and this works closely with EPCglobal.

"EPCglobal was set up at the end of 2003", explains Chris Adcock, President of EPCglobal, "and took off at a fairly blistering rate to develop standards and help drive the adoption of RFID."

Adcock, an Englishman, has made his career in the consumer goods industry in sales, marketing and general management, latterly with the Gillette Company. Gillette has long been active in encouraging the use of RFID commercially and Adcock was excited by the opportunity offered to help build a user-driven standards body in this new and emerging technology area.

"With RFID we have an opportunity to avoid some of

the issues that arise from having competing standards", he says. "We can create - from scratch - a global infrastructure of standards for this technology; customer -driven and therefore directly relevant to real business requirements."

EPCglobal is a not-for-profit member organisation. Around two thirds of the members are RFID users while the remaining third are developers and suppliers of the technology. There are a few additional members such as academic departments or bodies like the US Food and Drugs Administration, the FDA.

Current membership is around 1,100 companies, up from less than 200 in June 2004. Perhaps 60% of these are from the US with the remainder equally divided between Europe and Asia-Pacific. Interestingly Germany accounts for nearly 40% of the European membership followed some distance behind by the UK and France.

One of the common tensions in the area of technology standards is that between de jure and de facto versions. A company like Microsoft may argue that its influence in certain areas is so enormous that what it says goes in practice
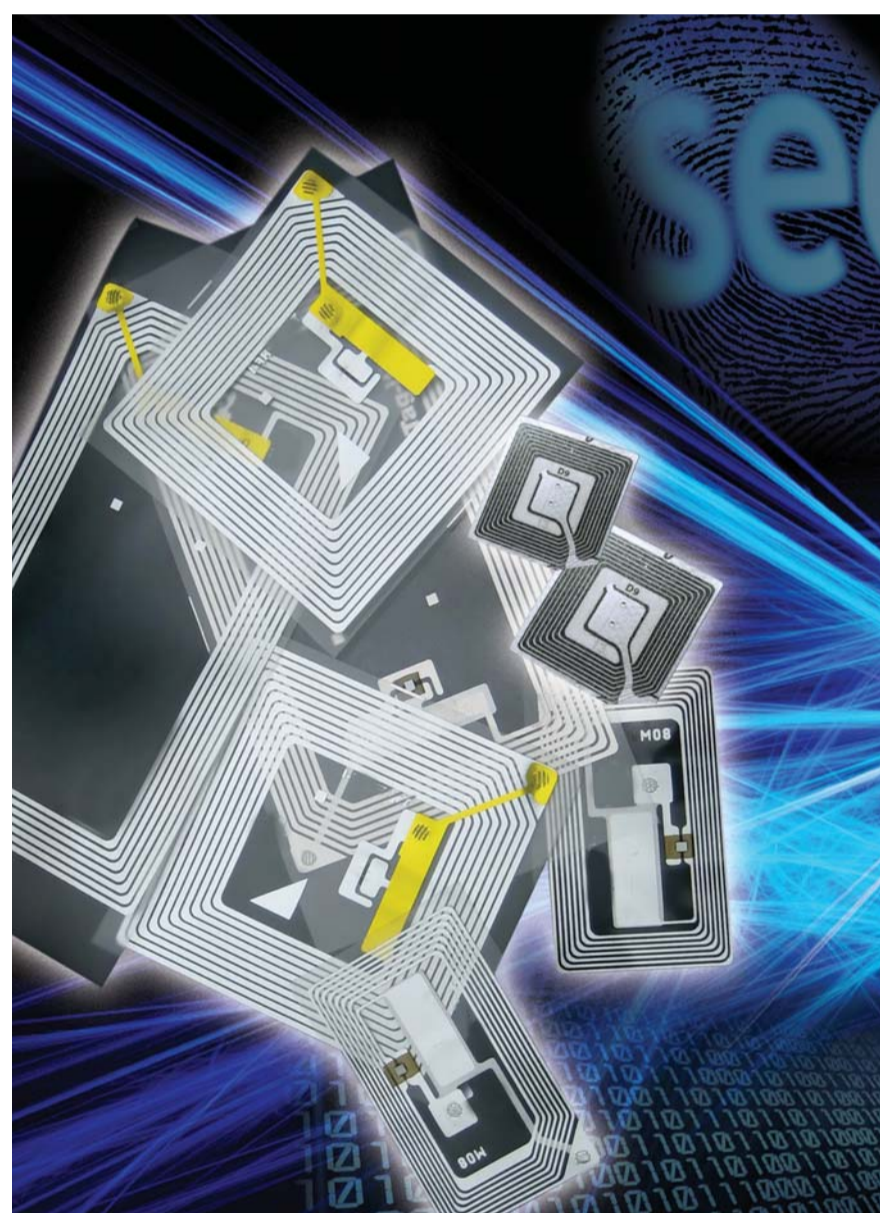
and that innovation will be held back if everyone waits for a standards body to deliberate and decide. This is where starting from nothing is so exciting, according to Adcock, who points out that in any case there's no single RFID company with the clout of a Microsoft to impose its will.

In the three years of its existence, EPCglobal has developed eleven standards, an impressive

output given the scope and complexity of many of them. EPCglobal's member companies take the view that participating in the groups working on standards is important and that it's greatly in their interests to develop standards rapidly, grow the industry and avoid the pitfalls, complexity and additional costs associated with competing standards

"One of the most significant early standards was the air interface protocol called Gen 2", explains Adcock, "This specifies how a reader can interrogate populations of hundreds or even thousands of tags and identify each one in an effective and efficient manner. There were five member companies which, it transpired, had relevant intellectual property interests in the standard. However, they freely gave up this IP in order to create a global standard and so advance the industry overall."

Joseph Stiglitz, Nobel Laureate and former World Bank Chief Economist, is one of an increasing and influential group who would approve, arguing as he does that the patent infrastructure has become debased and increasingly tends to stifle innovation rather than advance it, so holding back technical, commercial and social progress.

"Many companies now realise that it's within the market place that they can compete most effectively", says Adcock, "Competing in the standards arena can be done, of course, but it's not very effective. We now see companies within EPCglobal quite frequently giving up IP so as to ensure that relevant global standards can be developed."

The process of developing standards relies on members being active within a range of Action Groups. The Industry Action Groups, for instance, comprise representatives of subscribing companies using or planning to use the technology. They aim to establish business requirements across multiple industries to improve supply chain efficiency.

There are Industry Action Groups currently in the retail supply chain, healthcare and life sciences, and transportation and logistics services sectors and groups are being formed in the aerospace and defence, consumer electronics, packaging goods and automotive sectors. There are also Technical Action Groups looking at both hardware and software standards solutions to the business requirements developed within the EPCglobal community.

These requirements and solutions are developed within the scope of a standards development process that ultimately concludes with a request to the Board of EPCglobal for ratification. There are about 100 work groups and over 4000 active individuals in that community, according to Adcock.

"At its heart the process is very simple", he says, "We start with very specific user requirements identified by our members. This isn't some kind of theoretical academic analysis but a look at real business challenges and problems which need to be solved. People understand that if everyone works to standards then they can reduce complexity. And by reducing complexity you can reduce costs. Ultimately you can allow trading partners and divisions or elements of companies to share information in a more efficient, effective and secure manner than before. These are real business benefits for real companies."

The international perspective is something which Adcock stresses constantly. Passive tags typically work in the UHF band, between about 860 and 960MHz, with Europe at the lower end around 865-868MHz, north America in the middle and the Asian countries at the top end around 950 to 960MHz. "With a standard such as Gen 2", explains Adcock, "You can write a tag at 952MHz in Japan and read it perfectly at 868MHz in Europe with no degradation in performance. That's what you need to underpin a global standard, something that can be used anywhere in the world." And it's not just purely commercial enterprises getting involved.

"I listened to a US Department of Defense presentation recently", he adds, "Explaining how they're using RFID and EPC technology in twenty countries. They track 2,500 containers a day and they have 1,567 active RFID sites around the world. And when those containers arrive they then track the individual pallets and the cases."

It's perhaps particularly in the global supply chain where RFID scores well. Item-level tagging is still generally too expensive but packages and pallets increasingly carry passive or semi-passive tags. These travel from continent to continent in containers which typically carry active tags holding dynamic records of contents, routes, environmental conditions and more.

"We have a very significant pilot taking place during this year, partly funded by the Japanese Ministry of Industry, looking at goods movement around the world," says Adcock, "In the first phase goods manufactured in China are being tracked from there through Hong Kong to Japan and in the second stage from China to the US. Along those supply chains there are multiple read points and different technologies being used. All that information needs to be connected so that the partners in the supply chain can use the technology to drive efficiency and change their processes to become more effective."

"They hope that later Customs will be involved as they're very interested in how this technology can make the Customs processes more effective but also more secure."

Like any new technology RFID has its share of detractors, concerned about risks to public health and to the potential of breaching privacy and for monitoring the public covertly.

Fortunately EPCglobal's approach is equally robust in terms of establishing guidelines to good practice and in requiring member organisations to adhere to these. These approaches, that on consumer privacy and rights being the first, are developed by two public policy groups, one European and one North American. These comprise expert EPCglobal staff working with member representatives with similar knowledge and experience.

It's perhaps too early to say just how successful these initiatives will be and, importantly, what leverage, if any, EPCglobal can bring against any errant member companies. However, the EPCglobal community is clearly intent on taking a responsible approach to self regulation in order to allay any concerns amongst consumer groups or other interested parties.

"We're not aware of any member who has broken any guidelines", says Adcock, "But, yes, we are aware that we may need to go further to put into place mechanisms to implement something more accountable. We need to make it easy for consumers or others to bring to our attention issues we can then act on with member companies."

Following a successful corporate career, Adcock clearly relishes his new role overseeing a rapidly growing organisation whose members are working cooperatively to implement global standards to solve problems identified as the use of the technology grows. "It's not some academic exercise", insists Adcock, "It's real companies gaining significant benefits in using the technology based on standards which we – and they – have developed. And, very importantly, it's world wide. We're trying to play a global leadership role in developing and promoting these user-driven standards over a wide range of industries using the electronic product code. Companies and individuals are gaining real benefits in the process."

Improving business processes with Measurable Return

European Enterprise has achieved higher visibility and time cycle improvements across the supply chain by applying RFID.

Increased visibility and management across its extended supply chain are what European returnable packaging company Euro Pool System has achieved with RFID, along with cost savings from claims, deposits and from reconciliations with retailers and growers. And with its own RFID implementations, HP has reduced inventory by 28% over a six-month period in one project alone, and has slashed cycle times by up to 27% on a variety of different production lines.

"These cycle time improvements allow us to reduce resources, and that's the biggest benefit of RFID to date", explains Greg Edds, Worldwide RFID programme lead for HP, "although the labour savings are very significant too." In one clever bit of lateral thinking, RFID tags on printer boxes are also programmed with the expiry date of the inkjet cartridges enclosed in the package, allowing HP to ensure printers are despatched in date order. This in turn avoids the costly exercise

of replacing inkjet cartridges nearing their best-before date.

But HP believes that these benefits, while substantial on their own, are only the tip of the iceberg. With experience gained over several years from 33 of its own sites in its own global business, and from customer engagements worldwide, HP has

extensive understanding not just of the technical challenges of RFID but, more importantly, the business opportunities. "The technical challenge has been absorbing too much attention, while what really matters is to determine how RFID can improve your business processes, with a measurable ROI.", says Jean-Francois Remy,

marketing director with HP EMEA for the Consumer Goods, Retail and Logistics Industries. Having tagged over five million cases to date, and with an expectation of tagging 19 million cases in total during 2007, HP's had plenty of opportunities to see what RFID can do. Remy now believes the real revolution promised by RFID for manufacturing industry is in transforming the supply chain, as is already starting to happen at HP itself. Meanwhile the savings and benefits that asset management can deliver, such as those achieved by Euro Pool System, will continue to be important for many companies for some time to come.

Labour-saving through printer tagging at HP

"We've eliminated manually scanning every case on a pallet by using RFID", says Greg Edds, Worldwide RFID programme lead for HP. "We fix an RFID tag to each printer box, programmed with the EPC code, but in fact we don't have to read every single tag each time we need to know what's on the pallet. We have a carefully managed process, and by just reading a few tags we know what else is on the pallet."

Of course, life isn't always that easy, and at one point in the process HP does need to verify every product on the pallet. "Before RFID we were having to scan the barcode from every case on the pallet – now, we've eliminated that manual step", explains Edds. Much the same applies to inkjet cartridges – traditionally, an operator would manually scan every bulk pack on a pallet to count and verify the contents – a process that, for QA purposes, happens several times. "It's pretty time-consuming", says Edds, "and can't be done at all with barcodes, because you simply can't see the packs in the middle of the pallet."

Even RFID faces a challenge to read all these packs of inkjet cartridges, simply because of the number of packs on the pallet. But HP's experience equips it to take challenges like this in its stride: "We simply rotate the pallet as it's read", explains Edds. "The result is a reduction in the cycle time, and a saving in labour."

Euro Pool System saves costs through asset tracking

Europe's biggest returnable packaging company Euro Pool provides a packaging solution using returnable foldable crates, for bottles, fruits, vegetables, meat and other goods. Up to 304 of these crates can be stacked on a single pallet, but it's important for Euro Pool to be able to track and trace these crates, not just to protect what is a very significant asset but also to maximise the efficiency of the supply chain, reduce costs, reduce asset shrinkage and avoid stock-outs.

Euro Pool's extended supply chain reaches out to retailers at one end, and fruit growers at the other. Retailers pay a deposit on these crates, so data accuracy is essential to ensure the correct money is returned. Unfortunately, however, the crates suffer a particularly inhospitable environment, being washed with high pressure hot water between trips.

HP focussed on what would improve Euro Pool System's business processes to deliver tangible benefits, and was left with the inescapable conclusion that reading all 304 tags accurately was the key to full traceability. Not only has this been achieved, but the data is made available to IT systems immediately, so the reconciliation and deposit refund processes can be increased significantly.

But these benefits, together with the reduction in costs associated with claims, deposits and reconciliations with retailers and growers, is only the start. Ultimately, Euro Pool System will be able to deliver the same level of customer service with a lower asset investment.

IT asset tracking

Tracking beer kegs, food crates and the like improve customer service and save money, but by no means represent the complete picture of asset tracking. Other assets that are expensive, very useful but with a disposition to wandering are those under the purview of the IT department itself. "Large data centres have an unfortunate tendency to lose servers", explains Christian Verstraete, VP Solutions Development for Manufacturing at HP. "They are moved from one rack to another, and after a while people lose track of where they are."

HP's solution is a low-cost reader on the door of each server rack, and a tag on the servers themselves. "Every time you close the door the reader reads what servers are in the rack and transmits that back to the asset tracking system", says Verstraete.

"With RFID we now have a physical view to complement the logical view of IT assets that we get from management systems. We don't just know what's attached to the network, but where it physically resides."

Customer service and even mission criticality are dependent on the ability to find another IT asset – backup tapes. "You have typically 30,000 customers on a tape so if you misplace one you put at risk 30,000 customers", says Guillaume Oget, RFID Solutions Manager, HP. So tracking IT assets doesn't just save the labour associated with recording their location manually, but helps deliver better customer service too.

Industrial plant and equipment

Physical security is important, too, for such IT assets, and knowing where they are, and when they've left your data centre, can be very useful. But other industrial equipment, often with a much higher value, can be distributed over a much wider area of a site, and isn't neatly confined to server racks and data centres. "If you have industrial equipment that should not be moving maybe you want to raise an alert to notify somebody", says Oget, "so we have tags that also incorporate motion detectors. These tags could, for example, transmit a beacon just once an hour when motionless, but every five seconds when they spot that they're on the move."

But for many organisations, the highest value assets are not industrial equipment, but human beings. "Knowing who is where can be key to ensuring their safety and security", says Frank Lanza, Director of RFID Solutions at HP. "In some large sites such as shipyards or mines, you could have thousands of workers many of whom can't be seen." Of course, it's not all about keeping people safe – there are clear productivity benefits to knowing if people are having to hang about waiting for other steps in the process to complete.

Supply chain transformation

Back in your supply chain, knowing exactly what goods are where goes a long way to making sure that customers get what they want just when they want it. However, if you're only tracking goods within your own supply chain, while the ability to look at one web portal and see where everything is gives you immense power and control, you're still ultimately reliant on the customer placing orders at the right time – and giving you as little notice as they can negotiate. To truly achieve benefits of supply chain transformation that HP envisages, you need to go one step further. "We wanted to see how we can help with customer inventory and in particular avoid out-of-stocks", explains Edds. "It would be great, for example, to see when goods move out of the stockroom at the back onto the shop floor – particularly important when you're trying to track something that's faster-moving such as a promotion. The only real way to take advantage of those pos-sibilities is working with a partner that is RFID-enabled, and who's prepared to share data with you."

And this, really, is key to transforming the supply chain. "What we've been working on for 18 months is to make that chain more resilient", explains Verstraete, "by being able to track materials right across the chain. For that you have to get more information both from your suppliers and your distributors."

A clear example is the automotive industry, where the OEMs keep less than a day's inventory, but simply by moving inventory out to dealers and suppliers, without removing the cost. "With true visibility you can start applying lean concepts to the whole supply chain and actually bring costs down rather than push them around, cut wastage and grow your sales", says Verstraete.

What's in...

Technologies such as RFID have traditionally been identified as applying to tangible, physical products. This might well become an illusory distinction, however, as Guy Clapperton reports on examining the financial services market...

The first thing people need to understand about financial services is surely that it's a service. You cannot, repeat cannot, attach a label or RFID tag to a service, so how is it actually relevant to discussions on the subject?

There are in fact numerous other examples of how RFID is going to affect the delivery and shape of financial services to the individual or corporate entity. One of the best ways to find out what's likely to happen is to look at someone else's crystal ball. First it's instructive to note RFID is active in the present as well as likely in the future.

Time like the present

The future can appear either intimidating or enticing depending on one's point of view. Douglas Hogg, chief executive of UK RFID specialist RFTRAQ, points out that banks actually already make use of passive RFID technology in terms of personnel identification and allowing visitors access to areas in the premises. Active tags are starting to offer their own solutions, though, he says. "Active RFID passes can now enable Banks to monitor visitors continuously in real time and thus by location within the premises.

For example if a visitor strays into or enters a restricted area like a trading floor, an alarm will sound to security who can investigate, why, because he or she is being monitored by the system continuously," he says. "As soon as the 'tagged' visitor enters the software supporting the system will notify the intrusion and no security guard is required to monitor the person." Clearly this needs intelligent handling. If a visitor is supposed to have access to the non-general areas then he or she needs a tag that will tell the system not to sound the alarm" Visitors can be issued with passes for discrete areas, with passes that are 'time controlled' i.e. if they are still in the building after 2 hours a notification again is sent by the automated software system. This functionality derives not just from the capabilities of Active RFID tags but as importantly the software that manages the system.

Security rather than service is where the systems shine at the moment. Document Shredding is a key example, says YY. "Documents are shredded and exit the building in special security containers, but what happens next? The waste contractor is relied upon to dispose of the same. Who knows, but that contractor, what actually happened to the shredded documents?"

Active RFID systems can track the box of shredded material on leaving the building to the place of disposal in real time. "If in that process the security box is opened the software managing the system will register the fact and notify / alarm. All boxes have to be opened on specified premises and a log of disposal is kept.

In short, Active RFID can provide a real time security monitoring and audit trail of disposal which does not exist today save for the use of personnel."

The present is exciting but the future may be moreso. Luckily a couple of players have built their own crystal balls.

Case study example: The Agile Bank/Next Generation Bank

Some commentators choose to speculate on what is going to happen in the future. Fortunately others choose to produce full working prototypes – BT is among them with its Agile Bank 'showcase' at its Adastral Park facility. This is designed to demonstrate a number of the possible technical advances that can be made, with RFID playing a major part in delivering them.

Take, for example, the idea of personalising advertisements to appear to the right customer who is using a service through a VDU – this is already working at the Park through an RFID chip in the park.
In addition, as banks increasingly see the benefits of RFID technology in the retail sector, consider the possibility of a greeter whose job is to welcome extremely affluent customers as their card tells a bank they have just come in. Another area in which the Agile Bank is benefiting is in equipping its 'customers' (remember this is a demonstration at the moment) with RFID tags in their letterheads, prompting photo IDs so that there is an extra layer of security.

Take also those features currently being demonstrated by Accenture's Next Generation Bank. There is more information in the box, but the company is convinced that branch banking will remain important to core customers and that RFID will be among the mix enabling the bank to perform a number of key tasks from customer identification to product information.

The advantages of a universal technology such as RFID stem from its size and compatibility; someone wanting information on mortgages or advice on their account can have their card scanned anywhere there is a terminal so they are automatically liberated from the need for an actual branch unless that is where they wish to be.

Accenture has therefore developed prototypes for a future branch, a 'department store branch' and a financial boutique aimed at high-value individuals. The smart cards and documents and the prompts they carry are identical so the environment can be tailored to the individual's wishes.

your wallet?

Legal implications

So far, so theoretical. There are other considerations, however, about financial services, and none of these is more important than the legal and contractual arena. Lawyers have for some time been watching the impact of new technology on finances.

Addleshaw Goddard is a law firm specialising in technology and cautiously welcomes the idea of tracking customers through technology; if someone has just spent thousands on a holiday there can be no reasonable objection to a display in a chemist changing to a sun cream ad immediately they walk past, and this will be feasible.

Margaret Harvey, a partner at Addleshaw Goddard, accepts this but urges caution. "Information is as valuable an asset as you can get, often undervalued in contractual terms. And now RFID is stretching into Financial Services, the plethora of data that can be collected is more valuable than ever – patterns in behaviour effectively map out the days of your lives," she comments. "So now more than ever, meticulous due diligence is crucial. After all no company is an island and many parties can be involved in moving, storing and analyzing data and the only way to ensure it doesn't get misused at any point is to have watertight processes and contracts." The attitude of so many organisations could be a stumbling block here, she suggests. "Data protection legislation should not be seen as an obstacle that must be conquered. It is there to protect the customer and the companies that go above and beyond to protect their customers will win their trust and loyalty."

This might sound unduly negative but it shouldn't. Susan Mann, a solicitor in the technology team at solicitor Reed Smith Richards Butler, believes RFID will help overcome major challenges in financial accountability and the American Sarbanes Oxley laws. "For example, a Minneapolis financial audit consulting group, Security Financial Group (SFG) through a spinoff, Enterprise Compliance Inc., has come up with middleware intended to send RFID tag data from mainstream supply chain tracking applications to Sarbanes-Oxley compliance reporting software made by Certus, a provider of software tools for corporate governance applications," she explains. "The middleware is designed to eliminate data errors and thereby increases accuracy in compliance reporting." S-Ox is a major cost to companies to whom it applies and the contribution of RFID in cutting those costs will be considerable, she believes. "I am fairly certain that other financial sectors will develop similar applications to assist with compliance. A similar application in the EU could help smooth the transition to MiFID with its reporting and transparency requirements."

Accenture – Feedback from Tech Labs

Accenture researched customer touch points and wishes for future banking services. The results have implications for anyone designing a customer architecture of the future.

UK customer touch points:
- 55% still use the branch
- 27% use online banking
- 14% use phone banking

Market segmentation:
1) Mass market customers – these are 'people' customers who will want to spend time in a branch.
2) Affluent customers – these are the time-poor customers who will want to spend time online or telephone banking.

RFID technology on trial:
ID cards
- These can be equipped with an RFID chip activated when the customer enters a bank's premises, telling the manager who has walked in. This might prompt a number of reactions.
- The same card could facilitate entry into the bank to exclude criminals.
- There is scope to make an RFID card interact with suitably sophisticated documents – so that a customer looking at a mortgage leaflet would automatically be approached by someone from the mortgage teams.

Mobile Payments:
- In future a mobile phone can carry an IC card inserted with an antenna and this will effectively self-scan
- The mobile phone then acts like a debit card, carrying cash and dispensing it. This has been trialled in Japan where the phone acts as an Oyster Card and works with vending machines.

Knowing the difference

The US and Asia have two years of success stories.

By Patrick Sweeney

When The International Financial Press start writing about an emerging technology like RFID it is sound indication that organisations should be mindful of looking at and adopting that technology If not enterprises should be be prepared to play catch-up to their competitors. By the time a novel and disruptive technology like RFID makes it to mainstream adoption, early movers are already gaining a key strategic benefit from the technology; so far those early movers are US-centric companies.

Success stories from the US Department of Defense, Wal-Mart, Best-Buy, Pfizer and other large companies are becoming commonplace while the EU wins are limited to Marks & Spencer, BMW and relatively few others. Why have US companies already benefited significantly from using RFID in supply chains, for asset management, to optimise manufacturing and to increase security and the EU is falling short? RFID enables automatic data collection about individual items without any human intervention or error, but requires specific skills and expertise. These skills are more prevalent in the US, as are corporate leaders who understand the benefits and advantage to be gained by being a first-mover.

The strategic competitive advantage companies are earning through RFID are applicable to industries like Aerospace, Defence, Pharmaceutical & Healthcare, Retail, Transportation & Logistics, and Manufacturing. Having automated RFID data allows organisations to act and improve efficiency, quality, customer services and competitiveness. This only creates an effective system if the data collection system, the RFID, is 100% accurate and 100% reliable. Understanding how the technology foundation plays a role in success is the first step in gaining advantage.

An RFID system with accuracy above 99% is only possible if the system is based on optimal technology

An RFID system with accuracy above 99% is only possible if the system is based on optimal technology selected specifically for the items being tagged, the environment in which the system is deployed, and the business process that it operates within. In other words; there is no one size fits all solution. Unfortunately for

companies looking to reap value from this new technology selecting the right technology can be quite confusing. There are three simple steps to take in order to select the optimal technology and prove the efficacy of a system before it expands to the production environment. The three steps can be referred to as the Four P's – Planning, Physics, Pilot and Production.

The Planning and Physics will determine the technology, and the Pilot will test and verify that solution. Planning largely focuses on the business processes where RFID will become embedded and how that will change, or what exception process would be created. The Physics is extensive testing using devices such as spectrum analysers, signal generators to determine what is happening in the environment and what happens when the items being tagged are exposed to various RFID components.

Once a company's RFID committee has identified areas where time can be saved, accuracy can be improved or security can be bolstered by the use of RFID it makes sense to list and describe them in a "Top 10" list. With a list of likely RFID successes the team can look for common requirements –such as a 10 meter read range, ability to select one item out of 500, resolution
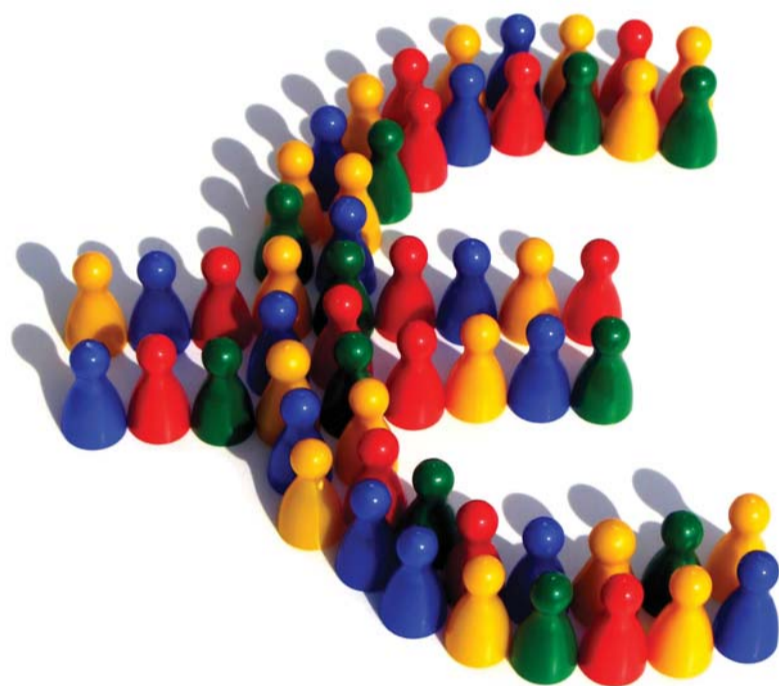
down to a meter in a 100,000 square meter warehouse. This business process analysis will then drive requirements for the Physics component.

The Physics testing acts as the company's lie detector. RFID hardware manufacturers have many tricks up their sleeve to make their kit look like the perfect choice. The incorporation of proven science and processes will separate the fact from the fiction. For instance using "trial and error" testing a company may simply set up two different readers on a particular conveyor and then send items down the conveyor to see which one reads the most. The flaw with this technology is some readers have embedded software which report reads many times per second, where as other readers have

sophisticated filtering to limit network traffic, figuring that if an item is read once it should not be read again. Therefore the better reader in the "trial and error" test may show one read, while the inferior reader would show hundreds of reads, leading the novice to believe the inferior reader is actually superior. Using science and proven test protocols can eliminate these potential traps, adding an understanding of global standards, such as EPCglobal, can ensure there is lowered risk of technology obsolescence.

Scientific testing and accurate business process analysis are required for successfully selecting an RFID technology. However, a little knowledge of what is available in the market can help choose the most likely technologies to test – streamlining the

process and making sure that all options are considered. Below is a summary of the various technologies being used when people refer broadly to "RFID".

Low Frequency (LF) – is a band of radio frequency that operates between 30 and 300 kilohertz and is also used for some navigation systems, and AM radios. LF cards have been used for decades for their bread and butter application – access control. Many corporate offices have doors with card readers controlling who gets in and who doesn't. The range of LF is usually no more than a centimetre or two, however the frequency is not greatly effected by the presence of liquid (like a human body) or metals.

High Frequency (HF) – this technology uses a globally acceptable frequency of 13.56MHz and is the clear favourite of item level tagging applications in the pharmaceutical, health care, and life sciences industry. The tags gather energy from being in the magnetic field of a reader and feature a coil like design that is easily identified. The tags can be read at a distance of up to one meter and are not easily effected by the orientation of the tag to the reader or composition of the item being tagged.

Ultra High Frequency (UHF) – distance and speed are the key criteria that has made Wal-Mart, the US Department of Defense, Metro, Marks & Spencer and others deploy large scale UHF systems. This is the catalyst technology that sparked the RFID revolution. UHF can read many objects at ranges up to ten metres, and the tag costs are dropping dramatically to below $0.05 by the end of 2007. Recently global giant chip maker Intel has announced a UHF reader on a chip bringing the cost of

readers down exponentially and adding increased functionality. There are percieved drawbacks voiced from some quarters of industry. Some technologies do not work well at item level and can be affected by metal and liquids.These issues are now are being addressed and remedied by industry .

Ultra Wide Band (UWB) - UWB is a precise real-time location system (RTLS) utilising ultra-wideband (UWB) technology that locates items being tagged within an accuracy of 15cm in 3D. UWB can legally operate in a frequency range between 3.1 GHz and 10.6 GHz at limited transmit powers. UWB uses a tag with a battery on board to send out pulses or bursts of RF that last a few nanoseconds each. These RF bursts radiate outward in a wide band, transmitting over many frequencies simultaneously.

UWB is so secure that it is a favoured technology of the military, logistics, retail, manufacturing, workplace, entertainment, healthcare and hazardous environments.

As a result of their ultra-low power, short bursts and proprietary pulse signatures, several UWB networks can overlap one another without RF interference or eaves-dropping. UWB is so secure that it is a favoured technology of the military, logistics, retail, manufacturing, workplace, entertainment, healthcare and hazardous environments. The drawbacks

are the size of the tag and the cost of the system.

Surface Acoustic Wave (SAW) - The reader emits a radio wave pulse that is directly converted into a nanoscale ripple or wave on the chip surface by the "IDT" (interdigital transducer). That acoustic wave travels past a set of wave reflectors to produce uniquely encoded acoustic wave pulses, which travel back to the IDT. The SAW chip operates using the piezoelectric effect and does not require DC power so the tags can be made both small and cheap. SAW technology makes use of 915 MHz or 2.4 GHz frequencies. The technology is not yet in development stage. SAW technology can also be married with sensors like temperature and chemical sensors which can be used in the food industry.

Rubee - RuBee is an initiative based on the Institute of Electrical and Electronics Engineers (IEEE) standard P1902.1which is a two way radio tag protocol that uses Long Wave (LW) magnetic signals to send and receive data packets in a local regional network. The standard is in its final stages of approval by the IEEE. A typical RuBee Radio Tag has a 4 bit CPU, 1 Kbytes sRam, crystal, and battery with expected life of five years all built into a relatively expensive tag. A typical RuBee radio tag is about 3cm x 3cm by 50mm, has a 4 bit CPU, 1 Kbyte to 5 Kbyte of sRAM, a clock, optional sensors, and can have displays and buttons to provide functionality. RuBee is bidirectional, on-demand, peer-to-peer and can operate at other frequencies (e.g. 450 kHz) but optimally at 131 kHz. RuBee tags can have sensors (temperature, humidity), optional displays and may have a full 4 bit microprocessor with static memory. The RuBee protocol uses Internet Protocol (IP) or IP Address and may hold data in its own

memory. The main application for Rubee technology has been asset visibility but is still emerging.

Active RFID - Unlike passive RFID tags, active RFID tags have their own internal power source, which is used to power the integrated circuits and broadcast the signal to the reader. Active tags, due to their onboard power supply, also transmit at higher power levels than passive tags, allowing them to be more effective in historically "RF challenged" environments like water, metal, or at longer distances such as at a shipping port or in a rail yard. Many active tags have practical ranges of hundreds of meters, and a battery life of up to 10 years. Active tags are also easily, but not cheaply, coupled with sensors like temperature, vibration, shock, etc. Active technologies uses frequencies usually at 433 MHz and 2.4 GHz. The United States Department of Defense has successfully used active tags to reduce logistics costs and improve supply chain visibility for more than 15 years, on every shipping container that travels outside the United States.

Clearly no one size fits all, and while US companies have made more mistakes than their European counterparts – those learning pains have led them to viable solutions. It is a flawed strategy to think there is a silver bullet, however careful scientific testing, and comprehensive evaluation of the technologies, standards and issues will provide an RFID network which enables 100% read rates. With trust in the RFID network, accuracy and high reliability the extensive data collected can be turned from bits and bytes into actionable intelligence.

If organisations are competing on a global playing field the imperative is not to let competitors pull away for lack of technology understanding.

EPCIS sets the standard for RFID

With EPC Information Services (EPCIS) the dream of exchanging RFID data between trading partners will soon become a reality. GS1 EPCglobal recently announced that this groundbreaking industry standard has been ratified, following more than two years of planning and testing through the EPCglobal open standards development process.

The standard provides the capability for unprecedented visibility of the movement, location and nature of assets, goods and services throughout the world. The EPCIS standard allows for the seamless, secure exchange of data at every point in the lifecycle of goods and services. It will be used to enhance supply chain processes such as tracking of goods, product authentication, promotions management, returns management, electronic proof of delivery and operations management.

"EPCIS is an increasingly relevant standard and I believe it is critical to the success of EPCglobal. It is necessary for the storage, communication and dissemination of EPC data in a secure environment, allowing EPC read data to be exchanged between user companies. I call EPCIS the key that unlocks the information door and allows organisations to steer the information according to a common set of protocols," said Chris Adcock, President, EPCglobal.

How does EPCIS work?

EPCIS is a standard interface which allows supply chain partners to share and exchange EPC-sourced information efficiently, even though they may store the information in different types of underlying databases. EPCIS acts as an independent clearing house of RFID information.

During any business event in the supply chain, EPCIS enables the following data to be captured:
• What – the object involved in the event
• When – the time the event happened
• Where – the location where the event happened
• Why – the business step and status

That means that trading partners using EPC data can exchange information about the progress of their products in real time throughout the supply chain.

Why is EPCIS so valuable?

EPCIS provides a standard data model, and standards for data capture and query interfaces to enable track and trace, product authentication, diversion detection, and other uses across supply chain partners in multiple industries.

Data shared via EPCIS also plays an important part in electronic proof of delivery, chain of custody, traceability
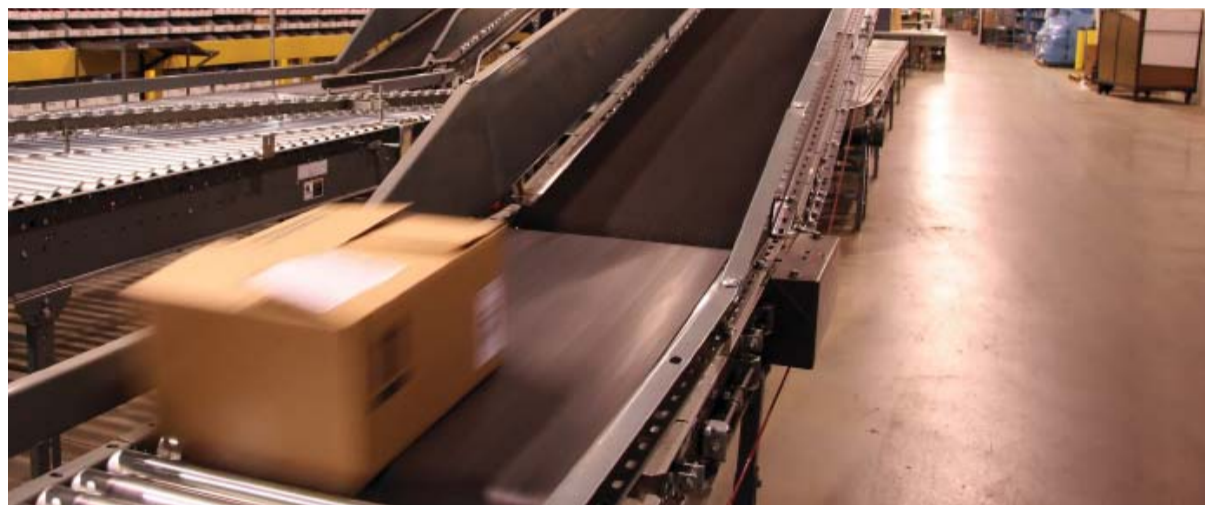
and ePedigree, product authentication, returns management and operations management and diversion /theft detection.

Take the example of retail promotions, for example, the launch of a new computer game console. You can give a unique EPC to each case of a promotion-packaged item on an RFID tag. By having RFID readers in areas such as dock doors, trucks, retail back-room door, and dumpsters, it is now possible to measure and drive retail promotions in terms of:

• Timeliness – is promotional packaging reaching the shelf and therefore, the consumer in time?
• Effectiveness – is the promotional item selling better because it has reached the shelf when the advertising campaign said it would be there?

Without the EPCIS standard, companies will inevitably have to implement multiple, proprietary mechanisms and data protocols in order to communicate RFID data with their supply chain partners. This will be more costly and time-consuming because the companies will

have to build and maintain separate, custom interfaces for each of their trading partners, rather than use a single, common interface such as EPCIS.

The Unilever trial

Unilever in the US is undertaking a trial using an IBM data repository and T3Ci's EPCIS-based software so it can collect and access RFID data from its own manufacturing operations and from several retail customers. Unilever is focusing on analysing promotions and how they impact sales and will measure RFID read rates and supply chain visibility. Unilever claim the EPCIS standard will improve data exchange among different RFID applications, data stores and product information management systems.

"We are pleased to be pioneering the use of this new RFID standard and emerging capability. This standard hits at the pressing need to allow more effective exchange of data among trading partners and simplifies interoperability among different RFID applications, data stores and product

information management systems," said James Jackson, Vice President IT, Unilever.

"By replacing manually intensive data exchange tasks with automated processes, more time is available for analysis and value creation. As RFID begins to proliferate, EPCIS will serve as the foundation for manufacturers like Unilever to gain valuable insight, predict needs and problems before they occur, and improve our business operations and responsiveness to each of our partners within the supply chain."

EPCIS pilots in the UK

In the UK, GS1 UK, together with BT Auto-ID and BEA Systems, is currently piloting an EPCIS service. This will enable UK-based organisations to build pilots that track the progress of goods as they move through the supply chain. The service will provide important new capabilities for UK businesses to improve efficiency, security and visibility in the supply chain.

Turning information into benefits...

By Murdoch Mactaggart

An RFID system needs tags, readers and software. But according to Floris Kleijn, Commercial Development Manager of the Global RFID Team at CHEP, the most important item is the often overlooked fourth, a brain to identify potential benefit. "The goal of RFID is to turn information into benefits for our customers and for ourselves", explains CHEP's European President, Miguel D'Cotta. Kleijn agrees, adding, "That's what we see as the key to RFID success."

CHEP is the world's leading supply chain equipment pooling company. With headquarters in Orlando, Florida, and operating in forty-four countries, its customer list includes many of the world's largest companies in the consumer goods, food and drinks manufacturing and retailing sectors, and in the automotive industry. CHEP's assets run to some 280 million items including pallets, reusable plastic containers (RPCs) and containers for automotive products. The familiar plastic boxes holding fruit and vegetables at greengrocers and in supermarkets may well belong to CHEP.

Importantly, CHEP uses RFID pro-actively both to improve processes and to develop benefits for its customers.

As D'Cotta points out, "With RFID businesses can make informed decisions to improve their supply chains."
CHEP uses only passive tags, built to its own specifications. These adhere to EPCglobal standards to ensure that customers anywhere can read them with standard readers. "We have two EPCglobal data structures on our tags", explains Kleijn, "One is for our customers to record their own information on whatever product is being carried. The second structure carries what is essentially a globally unique asset identifier. Storing these codes together provides several benefits including, for instance, improving traceability and the management of product recalls."

Companies in the EU using supply chains involving food and feed must now provide information at each handoff stage as to the product's source and destination – traceability one up and one down. Barcodes could be used with packages but food is often also carried in bulk, perhaps for later packing, or trays of fruit in general are not barcoded. Combining information on the one RFID tag can make both current reporting and possible later tracing far more efficient in such cases.

CHEP's tags, known internally as 'identifiers', are composite devices comprising a passive tag, a linear barcode and some human-readable text so that customers who have not yet moved to RFID can still gain benefit. However, the RFID component carries most information and it's from there that CHEP and its customers gain most value.

It would be simple if pallets and containers were issued to a manufacturer and duly collected a week or two later, which is not always the case. Rental fees, as well as charges for loss or damage, would be easy to calculate. In reality CHEP's assets travel all over the EU and the world, precisely because their function is to provide a robust platform for goods in transit and so they typically move through every point in the supply chain from manufacturer through distributor to retailer.

Manufacturers and distributors can have numerous customers and retailers receive goods from any number of different sources. Following the introduction of RFID, with pallets and containers being tagged with unique identifiers, easy to read and with minimal human intervention required, it is possible to analyse flow data to gain a better understanding of what was is really happening in the supply chain.

"Using RFID we can reduce cycle times, that is, the time an asset takes to leave a CHEP service centre and duly return to us", explains Kleijn, "We can track slow moving assets and we can manage asset and product damage that much better. The important issue in all three of these areas is variance."

Companies vary greatly in how they use pallets and containers and by tracking unique asset identifiers CHEP can identify both good and poor practice and then work with its customers to improve processes and procedures. CHEP might identify regular backlogs or excessive damage occurring in the supply chain. Action could then be taken to improve asset handling or in developing processes to reduce cycle times. This improves the value added benefits which CHEP can offer its customers, and at the same time ensuring assets will work harder.
As well as this benefit of improving local pooling efficiency, CHEP sees four further direct customer benefits. "There's electronic docket, that is, proof of delivery", explains Kleijn, "and supply chain coordination, which can help our customers rank different carriers and methods for efficiency. There's supply chain assurance – that's all about traceability and products recalls – and then there's post event evaluation, which concerns managing stock profiles and stock levels to minimise both stockouts and overstocking."

There's the further benefit that as CHEP sources, tests and supplies tags, and physically fixes them to their own assets while simultaneously providing space for product information, their customers can save on the fairly substantial overheads which they would otherwise incur had they to manage their own unit-level product tagging. It's a good selling point for the service.

"RFID now helps us measure things accurately", explains Kleijn, "That allows us to derive the facts so we can be confident we're addressing the most important issues both for customers and CHEP and, in the process, increasing the value added benefits of the CHEP service and customer satisfaction."

From 'always on' to 'always there'

The long term prospects for RFID

By Joanna Bawa

Is RFID here to stay? Love it or hate it, there seems no doubt that it is, and most industry experts see a bright future for the technology. It's easy and natural to want to classify RFID as either hugely beneficial, or as sinister spying technology which will control us if we don't control it first. Like many such dichotomies, the reality is more likely to be somewhere in the middle - a combination of applications and benefits which we can broadly predict, and a raft of user-driven, user-generated innovations which we can't. Assuming that a responsible industry and its governing bodies continue to develop appropriate regulatory mechanisms to protect personal privacy and allow us to control our own data, researchers and industry experts suggest the positive power of RFID is substantial.

In business

Stephen Proud, RFID Partner for EMEA, with Accenture, says that RFID will always have to make a business case, even in the longer term: "The key question to ask is 'what is the gain-changing potential of RFID?', because it is considerably greater in some industries than others."

The pharmaceutical market, for example, will gain a great deal, as will the luxury goods market, but it's harder to justify a big spend on RFID systems for low value items since it will take longer to achieve any return on investment. "RFID is not a unitary technology," Proud points out. "It is a system, with many elements requiring the re-engineering of deeply ingrained business processes and models. Right now, RFID is a better mousetrap. In the long term it will be the system that not only persuades mice to go elsewhere, but tags and tracks them as they leave."

Transportation is an early adopter of RFID, it being an industry where things – vehicles, people, items – move around in a purposeful and time-bounded way. David Hytch, Director of Consulting for Logica CMG's Transport Group, sees transportation as a key business driver for RFID, with smartcard ticketing such as London underground's Oyster card (occasional glitches aside) being a clear example of RFID as a meaningful contributor to social and economic efficiency. "The longer term uses of RFID within transportation are considerable," comments

David Hytch. "The information which can be collected – journey times and routes on trains; vehicle driver behaviour and fuel consumption – could provide powerful evidence for a greener travel agenda, and support the maths behind a move towards new ways of working." A more compelling example of RFID's long-term application in transportation is the use of 'motes'– tiny RFID chips just square millimetres in size, which can be embedded in paper, paint or fabric. "The Cumbria train crash earlier this year was the result of some bolts and one of three stretcher bars, which regulate the distance between rails, missing from the points," says Hytch. "If these components had been coated with RFID mote-embedded paint, there would have been warnings that components were missing."

Contact, and the absence of it, is the perceived future direction of RFID according to David Wollen, Chief Executive Officer of Innovision Research and Technology Plc. His company has expertise in Near Field Communication (NFC), a RFID-compatible standards -based, short-range wireless connectivity technology that enables two-way inter-

actions among electronic devices, allowing consumers to perform contactless transactions, access digital content and connect electronic devices with a single touch. "Smart objects which are aware of each other are clearly significant now and in the future," he says. "We see NFC as a key enabler for an entire infrastructure of interactivity. An individual device containing a RFID reader – a phone or keyfob – will be able to read

timetables, buy tickets, send photographs, and exchange business cards. In effect we're bringing hyperlinks into the real world where touch becomes the new click."

'Ageing in Place'

The Institute for the Future in California sees smart homes and sociable devices as two major future directions for RFID. These views

coincide with others, including Intel, who see 'ageing-in-place' as the new buzzword and a huge future market – a concept describing the rise of homes bristling with RFID-enabled gadgets which support and enhance the lifestyle of older people, prolonging their independence and reducing the need for costly nursing homes.

A connective system could provide prompts to an elderly person to call a relative, then enable that call –

touch a digital picture of your daughter and the phone dials her number. Even more sophisticated is the Digital Family Portrait, developed by Georgia Tech engineers as part of the Aware Home Project. The portrait is a computer screen with the older adult's picture displayed in a digital frame and hung, just like a painting, in the adult child's

home. Sensing data from the parent's home feeds the portrait's frame with 28 butterfly icons that change in size, indicating the parent's daily activity levels for a 28-day period. If the adult child wants more information about a particular day, she touches that icon for a more detailed visualisation for that day, including weather and temperature at the older adult's home, and a bar graph reflecting the person's room-to-room activity.

By contrast, an assistive system would have a more specific remit to to help users with everyday tasks. A smart medicine chest, equipped with RFID readers, could be connected to medical databases and other services. It would remind users to take their medicine and verify that they've completed a prescription-drug course – contributing to a slow-down in the rate at which illnesses become drug-resistant due to patients' non-compliance. It could warn patients against taking drug combinations that produce adverse effects and even reorder supplies when these run low.

Intel recently partnered with the Industrial Development Agency of Ireland to develop a range of 'ageing in place' technologies. The three-year, $30 million collabora-tion establishes the TRIL (Technology Research for Independent Living) Centre, where researchers from Intel and Irish universities will create devices ranging from video screens for elderly patients to communicate with caregivers, to sophisticated co-ordination tests that track symptoms of Parkinson's disease and detect when medications should be changed.

RFID – whatever you want it to be

The long term future of RFID potentially involves a lot of fun, too. While many of these applications are already being trialled in labs around the world, we can still expect the main source of innovation to be ordinary users. Like the telephone, the personal computer and the mobile phone before it, RFID is in many ways a blank slate on which we can sketch our own wishes, needs and ideas. Innovation is a social process, whereby the 'catch-iness', not the cost or intended use, of a technology determines its success. Throughout history, user innovation has steered tech-nology in ways that create and exploit sociability by allowing people to come together, to share, and to co-operate. Instant messaging and peer-to-peer file sharing; text messaging; blogging; and social networking have all emerged unexpectedly. Many have become big business, while others, such as Twitter, are still gestating.

The inventory concept to which RFID so readily lends itself will inevitably extend beyond the web-based format of mythings.com into the domestic space, whereby a smart home automatically tracks every RFID-tagged item within it. This could automatically generate a full inventory of home con-tents for insurers as well as finding all the lost socks, biros and books once thought to have disappeared down a wormhole. Extend that to social software, and groups of friends, colleagues or club members can exchange goods without losing track of them.

RFID is a truly pervasive technology, so that even if some of its potential applications fail, or are rejected, many more will succeed and go on to generate other novel and unexpected uses. The future of RFID may be unclear, but it's not uncertain.

Back home, it's time to tidy up. Locate lost objects by asking your home RFID reader where they are – or get the tidybot to pick them up and return them to their proper place. No need to sort your RFID tagged clothes before laundering, the smart washing machine will do that, as well as choosing the correct wash programme. Come dinner time, your fridge not only suggests what to cook based on its contents, it also reorders favourite items, possibly after comparing price – or whatever criteria you've set – from different outlets.
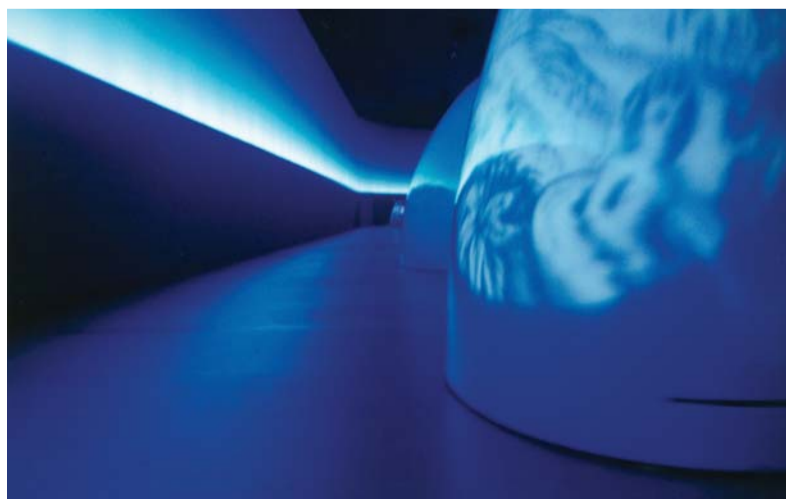
My life on a chip

For a computer user it can be sobering to see an entire life's work stored on a single DVD or USB memory stick. We'll have to re-evaluate the meaning of life once again when our entire lives can be accessed by a tiny RFID chip. A lifetime of buying, selling, shopping, working, travelling, holidaying, phoning, visiting and choosing will generate a pattern of information which effectively defines us – and while the sheer volume of data this generates makes it relatively unuseable, it will be, nonetheless, there.

Convenience, speed, accuracy, integrity. RFID delivers it all. But this power to do good is also the power to do bad – and it's up to all of us to get the balance right.

So, anything else we can expect from RFID?

RFID lends itself to inventory tracking and preference selection. That's something a lot of people pay personal shoppers for, so could RFID do a better job? Some years down the line, if you're in the market for a specific item you'll be able to request user reviews of that item delivered either to your email address or phone. Want a closer look? Expect to see more retail outlets – and not just clothes stores – offering online stock checks for items you want before you leave the house.
Once you're there, anything you've asked for will either be waiting for you in a fitting room, or a digital map will direct you to its location. If you like it, the RFID checkout will deduct the price from your wallet as you exit. Go back next month and expect RFID-enabled LEDs to indicate where items similar to your previous purchase are held, and, based on your past buying behaviour, what new stock might be of interest .

To RFID or not RFID?

Go for the win or risk getting a red card

By Patrick Sweeney

Corporate leaders constantly looking for a competitive edge often drive their CIOs and CTOs to a "moment of truth" regarding new technologies. Should they adopt before competitors or wait and see? Where does the latest technology application really fit into corporate strategy?

What's fact and what is fiction? Some technologies - like email -are too obvious to ignore – the timing and methods of adoption are evident. Highly publicised technologies such as Radio Frequency Identification (RFID) are not as clear cut. RFID has a demonstrated ability to dramatically improve asset visibility, inventory costs, business processes, product availability and security, but no one single application fits every enterprise.

RFID deployments vary due to the technologies broad applicability to many business problems where organisations want to track things. Daniel Engels, the former Director of MIT's Auto-ID Center and the current Director of the RFID programme

at the University of Texas Arlington says it this way, "computers are very good at identifying other computers but poor at identifying objects. Placing an RFID tag on an object makes it look like a computer that can be identified through wireless networking. RFID enables the internet of things."

So how does business know the right way to evaluate and adopt RFID to create a winning strategy ?

The key to reaping the benefits are hidden in the timing of adoption, the understanding of the physics and planning for long term accuracy and support.

Seizing Competitive Advantage

There are many companies that have gained a significant competitive advantage as early adopters of RFID technology. Well publicised success stories from Marks & Spencer, Wal-Mart, the United States Department of Defense and others have proven the benefits of in transit visibility, inventory reduction; lean manufacturing and customer service are quite real.

When a technology is new there is a short window of 2-3 years, where the total cost of technology first dips below the long term economic value added by adopting the technology. This initial time period is seldom recognised by the mass majority of companies, and it is what has led businesses like M&S, Wal-Mart, Target and others to significantly out-perform their peers by leveraging technology. It is the equivalent of knowing which way the keeper is going for a penalty. After those early adopters pave the way for the more generalised use of the technology there is a long term 5-7 years of mass adoption. After most competitors have adopted the laggards get the business equivalent of a red card if they still have not adopted – their entity value suffers because they can not adequately compete. RFID is a game-changing technology. The notion of an initial period of strategic benefit, followed by a requirement to adopt leading up to a penalty for not employing it is applicable across many industries such as healthcare, aerospace, government, retail, auto-

motive, manufacturing, consumer goods and others, however each industry will have it's own timeline based on the economic benefit of RFID's benefits.

In 3-5 years most manufacturing or distribution oriented companies will have more RFID readers than servers; in those same companies 10 years hence the number of RFID readers will eclipse telephones.

The Elements of an RFID System

RFID's benefit is the automatic transfer of information, without human intervention, from a mobile asset or item to a central system. The system transfers individual serial numbers to an application (such as SAP or Oracle) via a reader, and if the system is correctly built, allows some action to be taken. There are many benefits to using RFID over traditional bar

code or vision technologies. The technology differs from bar codes in two primary ways:

1. RFID does not require line of site (so things inside boxes can be read without opening the boxes and needing to see a bar code) and

2. many items can be read at once where as bar codes are limited to reading one at a time.

The decision to use RFID must be based on economic or strategic benefit. However the total cost of ownership can vary widely and has followed Moore's Law (Moore's Law states that the number of transistors on an integrated circuit for minimum component cost doubles every 24 months) over the past two years dropping precipitously for the same computing power. For example RFID tags now cost between €0.07 and €100.00 each depending on the technology. RFID tags, because they also have on-board memory can contain more detailed information about a product than a simple bar code can. To get he most economic value the data accuracy must be 99.9%, and reliability of the systems as good as any other manufacturing or information technology component.

High reliability brings confidence in the information residing on the RFID tags. This extra information allows automated responses and transfers into "Actionable Intelligence".

An RFID system is made up of a tag, a reader, and software. The tags have a very small integrated circuit or

chip on them, and an antenna that is specifically set to one frequency range. Often the press will talk about UHF or ultra-high frequency, HF or high-frequency, Ultra Wide Band or UWB and several others as being "RFID". These systems can be correctly referred to as auto identification systems or Auto-ID systems and would encompass the gamut of technologies which use a wireless communication mechanism to

transport information back and forth. Regardless of the nuances of the type of RFID, the RFID "reader" in all these instances is similar to a laptop computer in size and complexity. The reader usually has one or more processors and a series of antennas attached to it. The readers are set up in an area called an interrogation zone which is where the tags can be read. The key to achieving read accuracy and consistency (99.9% accuracy) is understanding and leveraging the physics of radio frequency. The invisible wavelengths of electricity or magnetism act very differently from each other, and knowing how they act is the secret

to getting reliable, accurate read rates.

RFID can be passive, meaning the tag has no battery and receives its energy from the radio field emitted by a reader – and therefore can only be read when in close proximity to a reader (from a few millimeters away to up to 15 meters away depending on frequency and tag design). Active RFID is a type of tag that also has a battery attached to it and actively beacons or broad-

casts a signal to the outside world at pre-determined intervals. Today's production readers are built to read just active tags or just passive tags, but not both.

There is often talk of RFID middleware whose primarily role is to filter out redundant reads, since a reader may read several hundred times a minute and most applications only need to know if an item crossed an interrogations zone once and at what time. This filtering of data is relatively simple and should be considered a commodity. As the RFID industry matures large organizations with applications such as SAP, Oracle, Websphere should look to deploy RFID without spending significant additional capital on middleware. The business intelligence from RFID is usually derived from knowing that an article has made it to certain location. That information needs only be transferred once, hence the need for filtering.

Designing and RFID System

Many early adopters of RFID fall into two potential traps – not using science to design and deploy the system and not designing for resiliency. Often the IT staff will simply buy some hardware and start turning and twisting knobs and switches hoping they get successful read rates using trial and error, rather than sound scientific approach and proven processes.

Once a complex RFID system is up and running the same folks often mistakenly assume that the system they use to monitor and manage servers or desktops can be used for RFID. Unfortunately existing monitoring software does not account for the complex

physics and intricate interaction of radio frequency waves with the environment. Planning for support, and resiliency of devices on the edge of their network is usually counterintuitive for CIO's or COO's who are doing their best to consolidate their data centers and servers into one central location.

This centralization strategy stems from having learned the benefits of placing specialized resources, back up systems, and redundancy in one location. The primary benefits of RFID come when there are hundreds of nodes at the outermost edge of the network – at dock doors, manufacturing lines, inside vehicles and in other austere environments. This means that for an RFID network to provide 99.9% uptime capability the monitoring, managing, optimisation and remediation need to be automated for the specifics of RFID.

If the enterprise is looking to gain a strategic competitive advantage by decreasing inventory, increasing asset visibility, leveraging lean manufacturing or increasing client interaction RFID is the latest arrow in an ever evolving technology quiver for global businesses. The question that business leaders need to answer is "When is the timing right for my organisation?" if you are not an early adopter will you lose any competitive advantage, if you wait too long will there be a significant penalty for losing touch with the early adopters. The simple solution is to find a project with a demonstrable 12 month ROI, and even if the ROI is below corporate hurdle rates the real economic value addition comes in the learning and potential future applications of the technology to gain a leg up over your competitors.

Retailers play tag...

RFID sounded a good idea to retailers when the technology first emerged a decade or so ago. The original idea has evolved, however, and niche markets are applying it differently. - **Guy Clapperton reports.**

The great dream that RFID presented to retailers initially sounded too good to be true. Every item would carry an RFID tag. A computer system in a shop would be able to track the whereabouts of every item and, interfacing with an EPOS system, it would be able to issue alerts when any customer moved towards the exit with items for which they had yet to pay, whether in error or otherwise.

This was indeed too good to be true. Technical factors were one issue but the cost of attaching a tag to a low-price item was utterly prohibitive.

Nevertheless, retail remains an important area of growth for RFID. Ivano Ortis is program manager for Manufacturing Insights, an IDC company, and agrees that the initial promise of item-level tagging hasn't happened and isn't going to. "It's faded away over the last couple of years, but there are still some compelling reasons for retailers to adopt the technology," he says. "It varies from region to region but in a nutshell our research has identified three major differences. In the US it is mostly customer mandates and regulatory requirements and the lower priorities include track and trace; in Asia the major goal is asset management and visibility, while in Europe the focus is mostly supply chain efficiency. This is because of the tight logistics requirement in our region, which requires more precise systems and processes."

These processes include in particular management and distribution efficiencies and inventory management. "I spoke to Tesco's head of barcoding and RFID development recently and he confirmed they are no longer focusing on the performance of the technology but rather on how to achieve sustainable control of it," says Ortis. "There is a renewed focus on making a rapid return on investment."

Steady but slow beginnings

His predictions for RFID in European retail markets remains conservative. "In the short term we're still seeing adoption among retailers lagging behind compared to process management and transport or logistics," he says. "It's not a huge difference; in our last survey we found 20 per cent of manufacturing and logistics companies had already implemented or had short term plans [next six months] to implement the technology; when it comes to retailers that figure shrinks to about 13 per cent. So there's no huge difference but a kind of wait and see attitude."

Niche markets act differently

Most retailers, he believes, will hold off any major RFID investments well beyond the end of this year. There are a number of notable exceptions, however. Rexam in France specialises in making the containers into which a number of products go before they reach the retailer including drinks cans – but although it takes a keen interest in what the market is doing it has so far incorporated tags only in its Pharma division. "Traceability and Anticounterfeiting are key concerns for the pharmaceutical industry," explains marketing director Patrice Lewko. "Counterfeiting is not only a financial loss, it can be deadly for patients and traceability is also paramount to guarantee patients' safety. Rexam Pharma came up with the idea of integrating the RFID function into the

containers so that one could get full traceability from the start and benefit from optimal read performance."

This is arguably a gamble as Europe has yet to sanction RFID in the pharma industry, but Lewko believes the company has done the right thing. "In the USA, the FDA has recommended the use of RFID for pedigree implementation and the state of California goes a step further by mandating its use from 2009 on," he comments. "This was a key driver for our involvement in RFID. In addition, we quickly discovered that the wealth of information that can be fitted on one tag was especially suited to traceability for pharmaceuticals."

Rexam started its RFID pilot project in conjunction with a number of suppliers in late 2005. It supplied the experience of industrial volumes of containers while the RFID suppliers stuck to their speciality. The result was that in 2006 Rexam started putting tags into most of the pharmaceutical containers it supplied, particularly pill jars. A few things have to happen before it makes the tags more widespread throughout its range, says Lewko. "RFID is still a nascent technology in the pharmaceutical industry. As its use expands and regulatory requirements evolve, we will see a clarification of the standards that will boost its implementation and drive the costs down," he says. The products are

ready to use, though. "We are ready to deploy our production of RFID enabled pill jars to supply the industry an easy-to-use, robust and cost effective solution."

It's useful to consider pharma as a retail category in its own right because it illustrates that retail isn't a single sector by itself. The common suggestion that palate-level tagging is going to be the most commonplace application for RFID technology can't apply to pharmaceuticals, believes Lewko. "RFID in the pharma industry is about traceability which means that is has to be implemented at item level," he asserts. "RFID enabled containers allow the industry to comply with regulatory requirements, it improves patients' safety and is efficient against counterfeiting. RFID enabled containers, such as those supplied by Rexam Pharma, will allow the industry to simplify and improve the traceability procedures during manufacturing."

Rexam has yet to make moves into RFID in its other divisions such as beverage cans. Its conservative start suggests that the dream of everything having its own RFID tag is indeed some way away. Manufacturing Insights' Ortis can't see it happening for quite some time. "People are taking a pragmatic approach," he says. "There has to be a business justification. People are taking an item-level approach mostly to high-value goods, white goods and consumer elec-

tronics." The vast majority of activity is on the palette-level tag rather than the item-level version, he says.

Reduction of waste

One of the larger examples of RFID installations in Europe is Marks and Spencer. Ortis points to a number of benefits that company has seen since travelling this particular route: Faster replenishment, increased customer management as a result, increased sales as a further result and a reduction in waste. "Reduced waste in terms of resources and money links well with the supply chain concept, which is being developed by the supply chain council," he comments. "They have developed a complete methodology for adding value to the supply chain and focusing on improving waste and services." Interestingly, where there is an item-level focus this tends to be on the returnable, re-usable item, he adds. "Last year this was the second biggest level of focus," he says.

The future is notoriously difficult to predict with any accuracy. Ortis expects to see more implementations around customer-facing technologies and applications. "The kind of applications that add value to the consumer experience while in store or shopping online can make a difference to a business' profitability. We will also see promotion management becoming quite a sweet spot; digital signage didn't become a

huge industry here in the UK as it did in the US but there is an opportunity to do more. RFID can help; you can imagine a digital poster becoming more interactive thanks to the application of a tag which could identify a user and his or her loyalty to a particular store; you could supply general-purpose advertisements as well as an entirely personalised version."

It isn't perfect yet. Rexam's example is instructive: a business can do a lot to protect the customer and retailer from forgery by tagging a container but until it can tag the pills themselves no assurance can be 100 per cent. And no consumer is likely to agree to all their medication being tagged prior to swallowing it. Even if these objections were overcome, the costs of mass tagging in the low-value retail market don't add up for the moment. Nevertheless the shape of retail has changed and is evolving thanks to the new technology and the impact overall is most definitely positive.

RFID and Marketing in the Retail Environment

One area of retail in which RFID is growing ahead of projections is not so much in tracking items or indeed tracking palette-loads of goods but in marketing the items. Point of purchase materials need to go into retail premises and to be displayed. bezier works with companies including Asda, Boots, Imperial Tobacco, Home-base and KFC on utilising RFID to make this work.

Julie Smith, Innovations Manager at bezier, explains: "Integrating and printing RFID onto P-O-P displays enables the retailer/client/manufacturer to track the display's movements from leaving the storeroom to being installed on the shop floor. The major benefit of this process is that it allows us to monitor P-O-P, and check that it is displayed at the correct times. Often display material can be forgotten about and left out too long, or in some instances, not put out at all.

There are other clear benefits including tracking a display to ensure it has reached its destination site. Marketing to individuals is also a key benefit, says Smith. "When a shopper lifts a product from the shelf, RFID is capable of sending a message to a nearby screen, displaying a message such as 3 for 2, by reading the data from the product selected. This will in turn may encourage the shopper to purchase more items."

Horses for courses...

By Murdoch Mactaggart

Like many in the developing RFID industry, Zebra Technologies insists that RFID isn't central to all its customers' needs.

"RFID is part of a range of technology solutions that Zebra offers", explains Christine Watts, Marketing Director EMEA, "So it's one part of the toolkit to support business processes. RFID might be absolutely the best solution for a particular process but it may be that static or mobile barcoding is actually better. We want to make sure that we offer the full range so that we can help end users make the best choice in the particular circumstances."

Zebra Technologies, formed in 1969 to manufacture high speed electromechanical products, is based in Illinois in the US and operates in nearly one hundred countries. The EMEA HQ is based in High Wycombe, in the UK. In 1982 Zebra moved to producing speciality labelling and ticketing devices and is now known as a specialist printer manufacturer. Unusually, perhaps, for a modern electronics company all its products are manufactured in the US itself. Zebra printers range

from small portable devices used by the likes of traffic wardens or delivery drivers through to high performance industrial printers weighing 25kg or more for 24 x 7 manufacturing companies.

"All Zebra printers can print barcodes", says Peter Gooding, Product Manager EMEA, "and mostall are capable of being used wirelessly." Wireless, in this context, means WiFi (specifically 802.11g) so that data can readily be sent to printers across factory networks, although mobile printers may be Bluetooth enabled.

"We have applications where we can link directly into SAP or other ERP systems", adds Gooding, "and by making some of our printers RFID-capable we can offer customers a wide choice, not just for barcoding, not just for ERP functionality, but now also for RFID use as well."

Zebra's been taking an increasing interest in RFID over the past decade. In October 2005 it increased its patent portfolio some 75% by acquiring over 200 US and foreign patents or patent applications around RIFD in a $9.65.5 million deal with BTG plc. Earlier this year it announced the launch of an interface to allow ready integration of Zebra RFID products with the Microsoft BizTalk

RFID platform so facilitating management and control through Windows systems.

More importantly, Zebra spent $126 million in January 2007 to buy WhereNet, a Californian company focussing on location-based RFID systems, so acquiring knowledge and experience in the specialist area of active tagging of high value units such as containers, large pallets or individual items such as vehicles. "WhereNet are leaders in offering wireless solutions for tracking and managing enterprise assets in real time", explains Watts, "and that fits in very well with Zebra's existing strengths in barcoding and in generating smart labels." Smart labels are devices which can be produced by specialist Zebra printers and which include an encoded passive tag together with bar codes and human readable information.

Recently Zebra has been an active partner in two separate RFID pilots. One of these, named Tellitrace, ran in spring 2006 as a venture between the Dutch electronics and mobile phone retailer KPN and TNT Logistics (now SEVA Logistics) to test GEN2-UHF tags in a demanding distribution-centre environment. Zebra label printers produced tags which were then applied to mobile telephones, their packaging and the pallets on which they travelled between the TNT warehouse and the KPN shops.

"It's what we call 'slap-and-ship'", says Clive Fearn, Zebra's Vertical Marketing

Manager, EMEA, "and one of the driving forcesers was to find ways of tracking products more securely, to reduce what's euphemistically called stock shrinkage - theft, in other words."

The Sony pilot began in January 2007 and focussed particularly on developing hands-on understanding of the processes, limitations and benefits involved in deploying RFID in outbound processes downstream and in the supply chain. Shipments of Sony flat screen and CRT television sets from Sony plants worldwide are received at the Sony Logistics Europe (SLE) centre in Tillburg, NL and were tagged at case level and duly tracked as they were moved to the more localised European distribution centre in Cologne.

"The results were good and the companies involved are looking to roll out to phase two shortly and to bring in more of the supply chain", says Fearn, "because the ROI really increases asthe

more elements of the supply chain can use that same tag. What the Sony and Tellitrace pilots showed was how you could strengthen the ROI quite markedly by pushing deployment back down-stream to the manufacturing sites."

There are still technical and financial problems to be overcome before RFID becomes as ubiquitous as its proponents would like. In the meantime Zebra is building its knowledge and experience in RFID while continuing to support customers who prefer to stick with barcodes.

"RFID fits many companies", says Watts, "but it's not yet for everyone and, not yet for every process. We try to identify what's needed and offer the appropriate solution for what our customers need now while keeping open opportunities to move easily to RFID later."
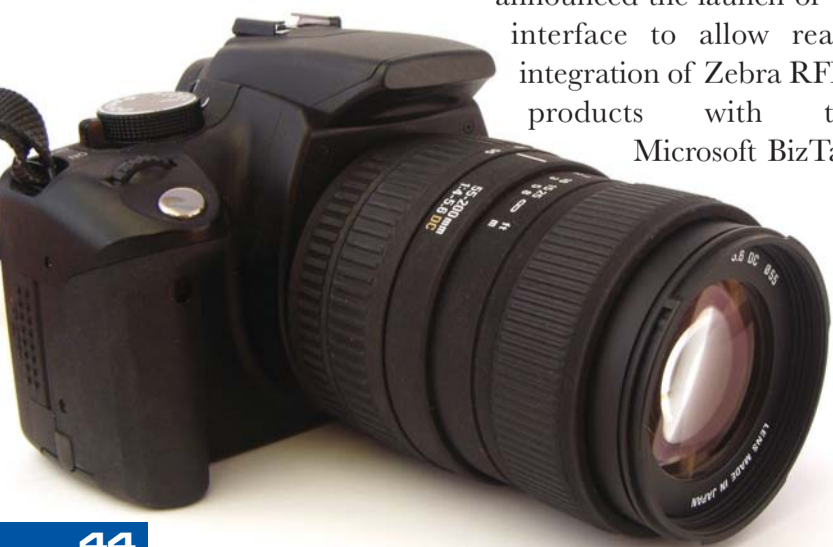
EU regulatory environment for RFID

Despite the considerable commercial activity around RFID in Europe, understanding and awareness among legislators and public officials may be surprisingly low. Even Viviane Reding, the EU Commissioner with responsibility for the Information and Media Directorate General, admitted in March at CeBIT (the world's largest computer expo) that the year before she'd had little idea of what RFID was.

Following a year-long public consultation on RFID, Reding announced a watching brief on the technology, taking a currently hands-off approach to regulation and saying that she was setting up a stakeholder group to examine issues, particularly around personal data and privacy, and make recommendations for action. Although she insisted that the market had to be left to grow without interference from the Commission, she was equally forthright in offering facilitating support for spectrum management and particularly for supporting the development of global standards.

EC activity around RFID has been growing over the past year. Projects in different areas have been set up, funded though the Framework Programme 6 and now gathered together under the title "Cluster of European RFID Projects" (CERP). The EC has delivered its policy objective and understanding in a paper to the European Parliament, RFID in Europe:

steps towards a policy framework. There's been a detailed online consultation, to which EPCglobal responded in detail. The German federal government hosted a conference in late June under its Council presidency, intending to get politicians and others who continue to be ignorant about RFID rapidly up to speed on what the technology means for European economic and social progress.

BRIDGE (Building Radio frequency IDentification for the Global Environment) is one of the important FP6-funded projects and is scheduled to run for three years from July 2006. It covers research, development and deployment and takes no prisoners in aiming, as one of its documents has it, "to catalyse the massive adoption of this new technology by European industry".

European deployment of RFID lags behind world average growth and some commentators have seen inconsistent standards as having an effect. For instance, Europe alone has a mandatory protocol called Listen Before Talk (LBT) intended to avoid interference between RFID readers and other Short-range Radio Devices (SRDs) such as door openers.

"The problem is that LBT effectively limits the number of readers in a given space", explains Marisa Jimenez, "And that in turn affects trials and pilots. In principle, there is no guarantee that a reader finds an open channel if it

needs one. For time-critical applications, this is not appropriate and in turn affects the usability of the technology . However, the industry and ETSI, the relevant European standards institute, have developed an alternative which eliminates the need for LBT on four channels that are used by the readers, the other 11 being used by the RFID tags. This works well but, as it involves an update in the spectrum management rules, will take time to resolve because so many people are involved – other users, telecom regulators, national legislators, EU legislators."

Reding recognises the importance of spectrum management and made a formal decision in late 2006 requiring UHF spectrum harmonisation by May 2007, effectively requiring member states to ensure availability. "Businesses don't restrict themselves to one country", Jimenez points out, "so there has to be a level playing field for Europe as a whole. At least the European Commission understands that proper spectrum management is crucial to growth, that it's a Europe-wide matter and ultimately an international one."

The objective of the BRIDGE project is to research, develop and implement tools to enable the deployment of EPCglobal applications in Europe. It consists of 15 work packages covering all areas of the subject from hardware, security and network requirements, to

business case analysis and pilot trials in seven different sectors (pharmaceuticals, textile, reusable assets, manufacturing, etc). The project will also deliver training material (WP12) and adoption tools (WP13), these two areas being led by GS1.

Curiously the EC policy framework document already cited, although it speaks glowingly of the economic potential of RFID – "a new motor of growth and jobs" – and acknowledges the many potential social benefits, says almost nothing on the need for training and for disseminating advice and information. The March BRIDGE newsletter, however, explains that one reason many companies are not yet ready to implement RFID is that there simply aren't enough trained people.

"BRIDGE is certainly looking at producing training materials at different levels and for different sectors and including material for small and medium enterprises", says Jimenez, "There's also been discussions with unions to consider RFID in work contexts. The ILO published a report last year on the impact of technologies in the retail sector which was very positive and underlined the need to develop good training and, hence, skilled workers able to benefit from shifting work roles and responsibilities."

EPCglobal is also seeking to persuade governments to play their parts. "We all should work with governments in developing training", says Jimenez, "So that it's not just companies alone, but companies, unions and governments."

A study conducted by LogicaCMG on behalf of GS1 suggests that passive tag RFID is poised for significant growth in Europe but with high-value item-tagging remaining the largest opportunity. "RFID is developing very differently from the way most people envisioned a few years ago", it adds, suggesting that the next five years may well show equal divergence.

As Jimenez remarks, "A well-developed, robust and properly managed RFID industry benefits not just European businesses but also European citizens in areas such as food safety, stock availability and others we're beginning to recognise. Our ambition is to have in Europe the most friendly regulatory or policy framework for the development and rollout of RFID technology."

Up, Up, & Away...

By Andrew Ward

By stream lining and automating processes using RFID, Airbus is gaining a strategic advantage over its competitors by saving time, money, resources, and eliminating literally millions of barcode scans and manual data entry steps. Airbus is pro-actively introducing RFID to increase visibility of business operations and enable process improvements across its 16 global assembly and manufacturing plants, multiple industry partners as well as its production and spares supply chain.

"All business savings come from process improvements. It's visibility that we use to improve our processes, and RFID is one of the vehicles we use to achieve that visibility", explains Carlo K Nizam, Head of RFID programmes at Airbus. Airbus understands that RFID can enable process improvement, which in turn leads to competitive advantage, and so the company has taken a proactive approach to identifying where RFID can deliver significant business benefit. "Visibility is something that can help all business processes, both within our four walls and in the wider context of our value chain", explains Nizam, "including all the Airbus entities - manufacturing, logistics and more our suppliers, the operators that use our aircraft and the partners that support them."

However, achieving these process improvements calls for data that's 100% accurate - not always a feature of RFID implementations. That's why Airbus has chosen ODIN Technologies as its hardware Integration partner. ODIN and their team of RFID experts will provide solution design, deployments and support services for Airbus.

"The EasyReader suite of products, used to ensure that RFID deployments achieve the necessary 100% accuracy. It, automates the configuration, tuning and testing of readers as they are deployed", explains Patrick J. Sweeney II, President and CEO of ODIN Technologies. "This service- delivery automation tool has reduced the time to deploy an RFID interrogation zone from eight or nine hours down to 90 minutes."

Airbus adopted a three phase approach to new RFID programmes aimed at improving business processes across its value chain. Phase one looked at warehouse logistics and asset tracking. "We performed a number of industrial, full-blown operational pilots last year", explains Nizam. "Some of those have already been implemented into full operation."

This philosophy matches the ODIN approach to RFID projects: planning, physics, pilot and production. "The planning phase focuses on how RFID will change existing business processes; the physics process focuses on using science to determine the proper strategy for tagging, readers and systems; and then a four to six month pilot determines if the business case is proven", says Sweeney. "Following a successful pilot and metrics comparison, the system can then be scaled up to production. We aim for a 12-month or sooner return on investment (ROI)."

A380 final assembly

One of the phase one pilots, now fully implemented and saving significant amounts of time, money and space, was based at the final assembly plant for the A380, in Hamburg, Germany. RFID tags are fitted to the containers that transport parts between the logistics centres and the final assembly line. There are 750 of these bulky containers needed per A380 and they are delivered across four stories. "Manually tracking the location of such a high volume of containers is very time consuming", says Nizam, "If a container is mis-delivered to the wrong location, the amount of time it would take to find it can cause a lot of disruption. So it's vital to know that they are delivered at the right time to the right place and didn't get misrouted." The containers all look the same and are sealed so workers would only find out they have the wrong one when they open it up which would be too late.

With the entire assembly line now wired up with 40 RFID readers, and all 3000 containers tagged, Airbus has experienced significant benefits from the use of RFID. "RFID allowed us to streamline the process and automate it. It's now a lot faster. Containers are tracked automatically and delivered on time, at the right time, the first time", says Nizam. "That means we don't need extra containers to compensate for the lack of visibility, and they're not cheap. They also take up a tremendous amount of space. And if one ever did get misrouted, then at least with RFID we can easily find it." Another phase one pilot was set up by Airbus with some of its suppliers to label packages with RFID shipping labels. "We worked with enough products and suppliers to give us statistically valid data but without inducing too much risk", says Nizam. "We found the logistics processes were leaner, we achieved 100% data accuracy, we drastically reduced the paper shuffling and hence cut the physical handling time by between 65-70%."

Airbus Beluga transport aircraft

Featuring one of the most voluminous cargo holds of any civil or military aircraft flying today, the Airbus Beluga, or A300-600ST Super Transporter was developed to carry complete sections of Airbus aircraft from different production sites around Europe to the final assembly lines in Toulouse or Hamburg. To be loaded into the Beluga, aircraft parts such as fuselages are first loaded into jigs - in effect, very large, expensive and specialised packing crates. "When the jig is delivered, the aircraft section is unloaded from it, and the jig is now empty", says Nizam. "On its next visit, the Beluga will again offload new parts and should load up with empty jigs from the previous trip.

All these activities need to be tracked in order to protect smooth transport planning and supply to production lines. Today this tracking is performed via paper and will become more difficult to maintain as we ramp up our production rates. If the empty jig isn't where it

should be, the aircraft can't leave and this can ultimately impact the production lines", says Nizam.

Helping to solve this problem is the driving force behind one of the pilots in Airbus's phase two RFID rollout, which focuses on automating and streamlining global transportation, production and manufacturing processes. "We're putting RFID tags onto the jigs and installing readers on the cargo loaders that roll the jigs on and off the planes at Hamburg. That information is sent via a wireless network to our business systems, so the planner in the office can see exactly what's going on in real time. So far, the results from the pilot are very positive and in line with expectations."

Sheet metal tracking

Another candidate for a phase two pilot is sheet metal tracking at the Bremen plant. "Inside the plant there are many different parts made from sheet metal", explains Nizam. "Each piece is processed on average 10 times, and between each process, you need to confirm what's happened. That is done through confirmation of a work order, which today is a sheet of paper with lots of barcodes. If you add it all up, that's about 1.5 million times per year that a barcode is scanned to say that a stage of a process is done."

That alone represents a lot of effort, but it can get even more complicated. "If the priority changes or the process changes you need to find where the piece of the material is, and quickly. We have tested what happens if you RFID tag the work orders. We wanted to know, can you see an improvement in the process?

Can you allow multiple automatic confirmations? Typically RFID doesn't work in a metallic environment, but we've had 100% read rates in our pilot", says Nizam.

ODIN attributes this success to a deep understanding of the physics and then choosing the proper technology to suite the business requirement. This accuracy level is thanks not only to the ODIN Technologies EasyReader suite, but also to the experience ODIN has gained in over 125 customer engagements worldwide, including the largest global projects ever deployed, such as the global rollout for the US Dept of Defense's Defense Logisitics Agency.

Production tooling

Airbus uses many different types and categories of tooling, such as hammers, drills, templates and spacers, at all stages of production. Nizam says: "What's important is that they are in the right place at the right time, so if it moves, it needs to be tracked.

But tools also need to be calibrated. You would typically calibrate on a fixed schedule, perhaps every six months. However, in that time, one tool might have been used only once, and another a hundred times."

Another pilot is therefore looking affixing RFID tags to production tooling. "From a cost and performance perspective you can then calibrate only the ones you need to, only when they need it", says Nizam, "with a clear saving in time and money."

Part traceability

When Airbus builds a plane, every part that goes into it needs to be traced. "The customer needs a clear idea of each part - every serial number", explains Nizam. "Traditionally, that's done using bits of paper, and we do a good job with paper, but this is going to get more difficult as our production rates ramp up." "We are going to launch an RFID pilots putting tags on the parts themselves, and we think that will increase the efficiency of the data entry process, as well as the integrity, accuracy and robustness of the data itself. This has particular ramifications for us because it's a tremendous amount of our activity – building aircraft is what we do and we have to track and trace what we deliver. This is one of the most interesting pilots – really, one of the key highlights of our visibility and RFID programme."

Parts in service

Finally, phase three looks at the potential benefits that

RFID can offer when its use extends further down the supply chain – parts actually in service with airlines. "For example, when a part is repaired, you can help improve the maintenance process using RFID by reducing the amount of paper", says Nizam. "Usually, when a part comes off a plane you have to wait for the paperwork to catch up. By having the information encoded in an RFID tag on the part itself, you improve the process. And when the part goes back to a supplier, they need that information too."

"The future of RFID is to build business value based on sound metrics", says Sweeney. "Companies like Airbus that have seen this potential in RFID are creating a competitive strategic advantage by deploying RFID before their competitors."

As Airbus progresses with RFID, ODIN's experience as the global leaders in design and testing will be leveraged to pick the appropriate technology for the specific task. This will include using passive RFID, active RFID, as well as investigating and possibly deploying other visibility technologies such as surface acoustic wave, ultra wide band, and real-time location systems.

Pro-active RFID logistics container management

Improving internal supply chain

by Martin Kruse and Martin Hiscox

Far beyond the bright lights of the highly publicised retail sector, RFID is really coming into its own for managing high value goods through distributed supply chains. While they may seem un-sexy, items such as transport containers for electronic parts, machinery and equipment -- known as stillages -- and cable drums that hold broadband or telephone cables are essential to many businesses. If these industrial strength containers are lost or misplaced, it can end up costing millions and detracting from a company's bottom line.

BT's supply chain unit provides logistics services for 30,000 engineers, across the UK. Using a network of two distribution centres, 17 depots and more than 350 vehicles, the BT supply chain delivers critical parts directly to its engineers anywhere in the UK.

With such a wide area to cover, the logistics process can be complex. Whilst the parts themselves were generally arriving on time with the engineers, the stillages that carried them were often left un-returned or even went missing during their journey between the distribution centres and depots. BT identified thousands of pounds were lost per year when more than one third of its stillage containers, holding went missing or were severely delayed in returning to the distribution centres

In addition to missing containers, BT was also experiencing a low rate of returns of its cable drums shipped out to engineers. Once empty, the drums were often left on site or even disposed of locally, making them difficult to recover and with the bigger drums costing £150 each, it was turning into an expensive problem. The team needed a way to compress the lag time for the distribution and returns of these high value goods, as they were impacting the profits of the unit.

Building the case for RFID

BT needed to build a 21st century network to distribute its ever evolving products and services. The group had been flirting with using RFID as a technology for 2 or 3 years without finding a viable business case for deployment, but it quickly became the apparent it was the right solution to BT's stillage tracking issues. RFID would help the team save valuable time and money by ensuring that its equipment was in the right place at the right time and arrived their via the right route.

Active RFID provided the right solution BT's problem. Its long range read capabilities as well as its ability to read through obstacles, onto vehicles while in transit was essential in order to accurately identify the tagged vehicles and their contents.

To avoid extra paperwork and cut down on errors, the RFID process needed to be totally automated in its recording of vehicles and stillages and work with BT's

existing business processes. BT's supply chain unit's vision was that when a vehicle drove through the exit gate of the distribution centre, its identity and the identity of all the stillages onboard would be automatically identified and recorded with a 100% level of accuracy. Anything less than this would not be acceptable.

The BT supply chain team looked to its long-term supply chain software provider RedPrairie and its RFID partner, RadiantWave to deliver the solution. The RadiantWave team was selected for its understanding of logistics, its track record in RFID and its familiarity with BT's existing infrastructure. BT was already using the software application from Red Prairie to which the advanced RFID enabled software could be easily bolted, so the team knew it was in safe hands and could get up and running very quickly.

RadiantWave and RedPrairie worked closely with the BT team to implement a RFID infrastructure that would work with its existing, secure logistics network. In order to justify the cost of the project to the business, BT needed a quick turnaround and proven ROI within the first year.

BT ran a number of trial scenarios with RadiantWave

before finding the one that yielded the 100% accuracy rate it required. The supply chain unit had to prove that RFID was worth the investment, so it was essential to show that the new system would immediately yield results.

The project was live and working within 3 months and has already covered its costs since its November 2006 launch date. The new RFID solution allowed BT to quickly gain the visibility of its stillages and to avoid buying new stillages when it wasn't necessary to do so.

How it works

BT and RadiantWave set up the RFID network, using Active RFID equipment from Wavetrend, to work with the company's existing infrastructure, including its 8 major transport depots located throughout the UK. The

result is a RFID network combined with logistics management. The new system uses RedPrairie's enterprise asset management application and is accessible anywhere within BT on the company's intranet.

Each of BT's transport depots has been fitted with RFID readers which monitor tagged items as they enter and leave the depots. Stillages, pallet bins, cable drums and transport vehicles each carry individual active RFID tags that send a signal to the readers when enter or leave depots, updating locations to appropriate parties to show where the containers are within the supply chain at any time.

"Working with BT and the RadiantWave team we were able to design a user-friendly system designed to track anything," said Martin Hiscox, RedPrairie's international managing director. "The system has enormous potential for growth both within BT and beyond. Industries like automotive, manufacturing and retail where it's critical to know the exact location of goods and assets at any given time can benefit from better visibility, lower costs, automatically monitored processes and tighter security. We are speaking to several companies who plan to follow BT's lead." The RFID network of tags and

readers gives BT supply chain partners' operators visibility into the coming and going of goods. It helps ensure that the right container is on the right vehicle and is delivered or returned to the right location and at the right time.

RadiantWave configured the RFID hardware and RedPrairie software to automatically alert the appropriate people when:

• When tagged items leave a depot on a vehicle, so operators know when and where an item started its journey

• tagged items are returned to their 'home' depot or dropped off at another depot to ensure the right assets are delivered and returned to the right place

The alerts serve to reduce lag time between an incident being reported and a member of the BT team taking action to solving it. The system alerts the appropriate logistics managers if:

• a stillage, cable drum or other tagged asset has left the depot, but has not been returned in a timely manner
• there is no movement from a tagged asset, indicating that it has been left behind or dropped off in the wrong place

• a tagged asset is on the

wrong vehicle. For example, a stillage being transported on a specialised crane vehicle. Overuse of these specialised, more expensive vehicles can lead to higher repair costs for wear and tear as well as safety implications.

BT's RFID Item tracking solution not only avoids the cost of replacing stillages which are to all intents and purposes missing, but allows the team to know where the containers are helps them to plan ahead. RFID has streamlined BT's supply chain unit's transport fleet which has ultimately translated into faster response times from its engineers, helping to raise the level of its customer service.

Cultural changes

The adoption of RFID was not without its complexities for BT supply chain partners. One of the key factors for us was that we were already a customer of the RadiantWave software package which was enhanced to support RFID. The team worked closely with RadiantWave to ensure the application worked effectively.

The whole of the BT supply chain team was trained on how the technology worked (and assured that RFID was being used to track the vehicles

and the goods being transported, and not the drivers and operators).

Using RFID to track and trace goods actually makes the drivers' jobs easier, as it takes the onus of manually tracking deliveries and returns off them. The RFID readers and tags means the team doesn't need to rely on written records and drivers' memories to keep a log or remember each delivery – this automatic tracking system helps increase accuracy and leaves the drivers to concentrate on what they do best: getting the goods from point A to point B by the most efficient route. It also alerts us when events deviate from the expected norm, enabling them to quickly be corrected.

Looking ahead

BT supply chain partners, RedPrairie and RadiantWave have laid the groundwork for

future applications using RFID within the supply chain. With the system already operating and in place, BT can track any number of goods through its supply chain. RadiantWave continues to work with BT supply chain partners to investigate other areas where the tagging and tracking of items will help with the security and avoid losses to its fleet and its bottom line.

BT has already come a long way in a short time using RFID – stepping up the tracking from stillages and pallet bins to cable drums and vehicles. It's looking into future applications, including using RFID throughout BT to track high value goods and to speed up returns on faulty items.

Reward without risk

RFID technology can deliver business efficiency gains in excess of 25 per cent for certain types of operation. BT Auto-ID explains why so many businesses – from right across the whole spectrum of industry – are now adopting the technology

RFID technology is proving itself to be an agent for business transformation – already driving significant improvements in efficiencies and performance across many types of industry. However, RFID is still evolving. Understanding exactly where and how best to apply it is a non-trivial problem.

BT Auto-ID is one of the UK's leading RFID solutions companies, helping businesses to realise the benefits of the technology. Its sales director, Melvyn Schofield explains: "RFID has the power to change the whole dynamics of a business because it enables real-time reporting of its key performance indicators.

Changing the dynamic

"People tend to have a very narrow view of RFID that it's like a kind-of 'smart' barcode – and they tend to think of it as a technology primarily for retail applications," he says. While he believes that RFID is good for those things, he says that is to dramatically underestimate its potential.

Typically, says Schofield, a business' IT reporting system focuses at the transactional level: "The visibility that goes up to management is based on document movement – typically invoices and delivery notes. The issue is that this doesn't always correlate with what's important to know – such as information about the status of the company's physical assets and its products."

Mark Chamberlain, Marketing Director, says, "To be able to get real-time visibility of the movement, performance and condition of these key attributes of a business – which is what RFID can enable – represents a step-change in terms of what IT systems can deliver, and therefore in the information available to management for its decision-making."

However, says Schofield, when it comes to implementing RFID, businesses tend to be looking for pieces of the solution. "Our experience is that businesses that try to run their own internal RFID trials often do not achieve the results they hope for. They end up being locked into one particular implementation and then, before they know it, it's the technology that is starting to drive the kinds of applications and where they can be used."

Business visibility

The challenge is to get businesses to look at the big picture. "BT Auto-ID's role is one of being the impartial and agnostic advisor that shows how best to apply RFID technology in order to realise the maximum return," he says. "We're not in the same business as our customers - and this turns out to be a huge advantage. We don't have an agenda, and we're not a competitor."

With RFID, the challenge is in selecting the most appropriate particular technology - or combination of particular technologies. "We do this by ensuring that we are fully immersed with the wide variety of technologies and technical products now available, and through a deep engagement with the relevant standards development bodies, government and regulatory bodies," explains Schofield. "Our goal is to ensure that with any customer application they get the best in class."

Enabling collaboration

RFID is usually a collaborative enterprise, whether that partnership involves different parties within and without the business, or different parties involved with the technology – or more usually all of the above. Collaborative enterprises that succeed are often managed and coordinated by an independent provider who specialises in that service. And this is where BT Auto-ID is uniquely placed to help.

"BT Auto-ID's specialisation is the management of data – in very high volumes – on a global scale," explains Schofield. "And its service is to provide the vehicle to enable parties to collaborate."

The core of the BT Auto-ID RFID offering is a common data system – the BT Auto-ID Intelligent Event Management Platform. This acts as an integration layer between whatever RFID reader technology – or a basket of different reader technologies – is deployed and the existing ERP systems of the customer's business. BT Auto-ID manages, monitors and maintains system performance.

"Capturing data is the easy part," says Chamberlain. "It's a much more difficult challenge to extract the interesting information from the extremely large volumes of data that RFID systems generate and then to deliver that in a form that is useful to existing corporate systems and that can easily be purposed to help inform business decisions.

"That's what the BT Auto-ID platform is good at. Crucially, it will work with whatever ERP system and whatever asset management system is already in place at a business," says Chamberlain. "This means a business doesn't have to change all their systems to take on the benefits of RFID," he adds. Businesses can see their data how they want to see it, and at whatever level they want to see it. They can pass the data into their own middleware systems, drop the data into their database systems, or have access to the data in virtually any way that they want it.

Business focus

"The RFID world is dominated by people with a focus to solve technical issues rather than business issues," says Schofield. "That's not our vision. Our first job is to open a customer's eyes to the business possibilities. They understand their business

best, but we can help them to understand the art of the possible and what RFID could do to help create efficiencies and drive business advantage," he says.

The challenge, he says, is to match the capability of RFID to the needs of any particular business, not only now, but also in the future – so that any investment that a business makes in the technology is protected as far as is possible.

Risk mitigation

"Vitally, we buffer the customer against being a technology 'guinea-pig'," says Schofield. "It's a risk mitigation strategy that we offer. We are managing the risk associated with the new technology on the behalf of the customer. We work with the customer to reveal the opportunities for business advantage, we help develop the business case, undertake thorough evaluation of possible vendors, prove the business benefit via trial, commission and implement the system, and evaluate delivery against the agreed financial business performance goals. We will even offer 'future proofing' if that is what the customer requires."

Up until now, all of BT Auto-ID's RFID implementations have been bespoke solutions. However, that looks set to change. "We do recognise that there are some common business needs that RFID can address," says Schofield. "Over the next few months or so – in addition to our existing services – we plan to roll out a small series of cost-effective pre-wrapped RFID solutions – pre-configured to meet some of these identified common business requirements."

Melvyn Scholfield & Mark Chamberlain BT Auto ID

BT's core business is working with huge volumes of data – such as those generated by RFID systems. It is trusted to hold and manage probably more data than anyone else in the UK. It maintains substantial R&D facilities and has a record stretching back more than 100 years of understanding and working with wireless technologies. Currently BT is continuing to invest in its data networks and platforms at an unprecedented level through its ongoing 21CN project.

"RFID absolutely plays to all those strengths of the BT organisation," concludes Chamberlain. "We consider ourselves to be an innovative but also safe pair of hands in helping any organisation to deploy RFID successfully."

BT Auto-ID offers an RFID strategy that mitigates risk. Its solution integrates with pre-existing ERP systems to deliver business-critical data however and wherever it is needed.

So what can RFID do?

When integrated with appropriate sensor technology, RFID technology can be applied to any type of physical asset at whatever volume it occurs. It can report on each individual asset's location and condition. It can report on events since each asset last self-reported. On what conditions each has it been exposed to, who maintained it and when, and who's used it. Any RFID-enabled asset can self-report if it is brought within range of a proximity reader. Combined with WiFi or GPS/GPRS an asset can self-report at distance.

* RFID can be used for conventional supply-chain management, but also allows for redirection on -the-fly depending on the changing condition of the product. Perishable goods, for example, that is nearing its sell-by date can be re-routed to locations where demand is high to avoid losses

* It can be used to monitor performance of individual components of a machine. For example, reporting back factors such as run-time, vibration or temperature history. With that information, a business can build a programme of selective maintenance, as opposed to scheduled maintenance, which can increase asset up-time and value. Typical applications would be in high-reliability technology applications such as aerospace, manufacturing and the oil industry

* By implementing RFID in a WiFi mesh network environment (within an area of continuous wireless coverage) a business can get real-time visibility of a complete end-to-end manufacturing or assembly process. It can empower such a facility to be able to deliver 'mass customisation' – the ability to automatically customise an end product for individual customers – driving sales, increasing margins, or improving customer satisfaction. Manufacturing operations in the aerospace, automotive and specialist plant industries particularly lend themselves to this type of application

* RFID can be used to maximise product utilisation, for example, by helping to marry products up with the containers they must be transported in, for example, for a shipping/logistics business.

* In the last decade, one of the defining trends has been the desire by businesses to outsource non-core parts of their operations. Where expensive assets are concerned, the trend has been towards businesses wanting to pay on an 'as-used' basis. RFID can be used not just to track and trace such assets, but to establish when they are in use and by whom – for example in a plant hire or campus environment. With the right system in place, the asset can self-report its usage and the client invoice can be generated automatically.

* Another application is with 'end-of-life' management – a particular concern for the automotive and electronics sector. New European legislation, particularly in regard to waste and recycling of certain types of assets, is placing increasing burdens of compliance on businesses. RFID can deliver item-level traceability, helping to cut the cost of that compliance.

* There are Health & Safety applications. Equipment can be automatically secured against operation unless personnel have the appropriate protective clothing, for example.

* In healthcare RFID can be used to help combat drug counterfeiting and also to help ensure that the right patients receive the right drugs in the right dosages.

Chemical Brothers

Sometimes the problem that an RFID installation is set up to fix is more than commercial. Chemical companies constantly deal with hazardous substances which absolutely must be dealt with safely. Guy Clapperton talks to Dow Chemical about how technology has helped track these substances.

Guy Clapperton

One of the world leaders in chemicals, Dow Chemicals, has a reasonably simple mission in life: to stay at the top of its field as far as is humanly possible. The chemical industry being as it is, this is a far from straightforward process: there are safety concerns, identity concerns, industrial secrets and numerous other factors which simply need to be right.

The emergence of RFID therefore appeared to offer the natural solution to many of the difficulties the company might have anticipated. Dave Kepler, chief information officer, explains that the company was already inclined to use new technologies whenever they became available. "Dow Chemical is committed to leveraging best-in-class technologies that support value growth and productivity, while enabling innovative ways of doing business," he says. "As such, we believe

RFID, in combination with other technologies, has that potential to enhance the company's global value chain, safety and security efforts and productivity improvement, among other notable benefits."

This might seem pretty evident to anyone in the commercial world but as Dave Asiala, IT director for shared services clarifies, it was about more than adopting a new technology. It was about remodeling strategies. "RFID and GPS technology is less about problems to solve as it is about opportunities", he says. "Like many companies, Dow had utilized the technology for several years. We had continued to evaluate it from a technology perspective and find it suitable for additional uses."

The backstory

The project began in 2006 when Dow took a strategic view of the technologies it

used and how they could best be aligned to business strategies. When it came to a strategic look at RFID, the company brought its business development process, Six Sigma methodologies and value based investing principles to bear on what would benefit the organisation

the most. Kepler speaks highly of the people the company deployed: "The strategy combined Six Sigma processes and collaboration with Dow's Technology Advisory Board comprised of external technology leaders – making it unrivaled in scope and external collaboration." The focus was on accelerating productivity

as well as incorporating safety and security, topped off with an added emphasis on customer service. The business leaders brainstormed a range of options using not only RFID but also GPS and Auto ID technologies. Eventually a list of 450 ideas became 50

destined for actual implementation.

Asiala adds that customer input was achieved through one of the Six Sigma processes called Voice of the Customer. "We talked with key internal Dow business leaders to uncover areas of opportunity to improve their businesses. The team was organized by Dave

Kepler and had representatives from Information Technology, Supply Chain and Purchasing and Manufacturing as primary participants," he explains. RThere was a core project team of 6-10 leaders to which was added 20-30 additional people identifying opportunities for prioritisation.

It also added external expertise as a sanity check for its expertise in the technology's maturity by drawing on TAB, a set of technology companies with which it has business relationships including Accenture, Cisco, IBM, Intel, SAP and Savi Technologies.

Selection processes

Early on it became clear that the company wanted to choose from a selection of technology suppliers who would each add their own best-of-breed elements of the whole solution. This was because Dow regarded the technology as a whole

string of auto-id capabilities. It aimed for active uses of bar codes passive RFID, active RFID and GPS devices. "On the software side we are using core software from SAP and Savi as integration engines," explains Asiala, stressing that it won't stop there. "We continue to be technology agnostic while at the same time believing in the value of integration. Given the size of the company and the breadth of uses expected to implement in the ten years of the planned implementation, many hardware and software vendors will be involved."

Early integration and future development

Perhaps unusually, the system doesn't yet integrate fully with the rest of the company's systems as it is focused on only one area which is tracking mobile assets in the supply chain for reasons of security and safety. "We have chosen to integrate multiple technologies into the Savi software solution which includes an event /alert engine," says Asiala. In subsequent phases Dow will provide data integration to existing ERP systems.

It can be gathered from this and the overall scope of the project that it is going to take time. 2007 is its first official year as a running concern but it will involve tens of projects and multiple implementations of a particular technology and each will follow sequentially using the first layers as their base.

What's not being done

Clearly, then, it is very early indeed to be reporting on what can be achieved. Kepler believes there is tremendous opportunity for adding value throughout international trading communities using both RFID and EPC, but there are a couple of stumbling blocks. "I want to stress the importance to help drive the adoption of global standards," he says. Asiala concurs completely: "Maturity of standards is a critical opportunity. Without effective standards, the technologies will face strategic limits to their usefulness," he says. "Standards will bring a level of commoditization to the devices and an interoperability that allows a tagged asset to move through a value chain and for each value chain partner to obtain value from automatically reading the information."

He willingly concedes that there are cases in which companies can demonstrate considerable value already but believes that once the high productivity gains in the supply chain start to emerge as possibilities the need for standards becomes paramount.

The future

Dow's current strategy is very much at its early stages and the future depends on continuing to pull together a best practice capability around use cases. It then needs buy-in from the businesses involved so that they can align the processes around what the technology can achieve. Asiala refers to this as the 'multi-generation plan' MGP). Kepler: "If you look at the MGP that Dave Asiala mentions, you will see that it is essentially developed to enhance the safety, security and reliable delivery of products across the global value chain. Implementing these technologies is a natural extension of Dow's current use of bar coding and other automatic identification and data collection (AIDC) technologies."

Partners and others

Dow is keen to spread the benefits of using this technology internally and externally as far soon as it can. Asiala points to Dow's passive tag application that has been applied to the Dow AgroSciences Sentricon product. "The RFID-enabled Sentricon Termite Colony Elimination System is a proven solution that mines, baits and traps termites,"

he says. "This Presidential Award winning Green Chemistry service was RFID enabled providing better aesthetics for property owners, productivity for authorized installers and better data for Dow AgroSciences." The RFID Journal recognized this as their 2007 Most Innovative Award Winner at their U.S. conference, RFID Journal LIVE!.

Both men believe there is much the chemical industry can learn from Dow's experience and the RFID experience overall. Kepler points to the Responsible Care principles that have already been adopted by major players within the industry, and says implementation of RFID aligns with industry and government product stewardship programs including the

Responsible Care Security Code and Department of Homeland Security requirements.

Asiala says the technologies offer additional visibility to supply chain movements and this increases the levels of safety available to anyone in the field that uses them. "On top of that, our industry strives for continuous innovation in our products and in our efficiencies in delivering products to customers," he says. RFID and GPS technologies are being used in the chemical industry both for safety and security and value chain productivity. "As an early adopter, we encourage other companies

and other industries to consider developing a strategic view of the technology that aids in the implementation process and achieves improvements in both critical areas."

The lesson seems to be that RFID is great for automating existing processes and ensuring that someone's products are trackable. Clearly the existing applications such as personnel tracking and item-level tagging are easily implemented and the benefits become visible almost immediately.

For Dow and others, however, the emergence of RFID is of more strategic importance. It has allowed the company to refresh its overall view of how it conducts its processes and how they might all be

improved as long as the stakeholders within an organization examine what they do in the context of what is now achievable.

It's a long and complex process. Dow anticipates that the 50 projects they will implement will take years rather than months to complete and each 'layer' will have to be working successfully before the next can begin, and it's arguable that the company is taking a risk by beginning in the absence of any firm standards. The benefits, however, are already being felt, and there is every reason to believe this will continue.

Pack up your bags and fly - RFID in airports

By Joanna Bawa

Air travel is a regular feature of life for many executives and professionals, but few look forward to each new airport with relish. Airports combine unmissable deadlines with hours of tedium; and heightened security with unavoidable separation from valuable luggage. It makes for a stressful, high pressure environment for customers and employees, and recent years have seen increased passenger numbers and increased risks to both safety and security.

Anything that can ease the challenge of getting people and their possessions into the air and across borders quickly, safely and reliably is to be welcomed. RFID, many claim, can do just that – and more. RFID-based track and trace can minimise the risk of criminal attack, improve protection against general hazards, speed up throughput, and virtually eliminate human error. This reduces the cost of having to deal with any of these issues by preventing their occurrence, but RFID also contributes directly to cost savings by offering a cheaper and more reliable tagging solution than the current widely used system, barcoding.

Higher read efficiency erodes long-term costs

According to SITA, an established provider of IT business solutions and communication services to the air transport industry, a baggage tag incorporating an RFID chip and antenna costs around 20 US cents, compared to the cost of a barcode tag at one cent. With some two billion baggage tags used every year, switching to RFID means an increase in the cost of tags from about US$ 20 million to US$ 400 million. But the crucial difference between barcoded tags and RFID tags is their reliability – the efficiency in read rates. Baggage tags must withstand a great deal of wear and tear during a typical flight, with 15 percent of baggage typically rejected by barcode readers. For an airport handling 50,000 bags a day, that's 7,500 bags that need to be manually coded. RFID tags are less damage prone and their failure rates are typically less than one percent, requiring fewer than 500 bags a day to be processed manually. Over time that erodes the cost benefit of barcoding, and RFID usage increases and demand rises, costs will fall sharply, further enhancing the price differential. The forecast spend on RFID systems, including tags,

exclusively for the air industry sees early rapid growth of baggage tagging which will become commoditised at the tag level in 5-10 years.

The main airports trialling these systems are Las Vegas and Hong Kong. Hong Kong International Airport (HKIA) is one of the world's busiest, handling 40 million passengers and over 19 million departure bags a year. The airport has worked with SITA to revamp its baggage handling system in a multi-million dollar overhaul, using Symbol Technologies' Radio - Frequency Identification (RFID) tags and RFID read-points to track and manage baggage. The system went live at the end of 2004, and is now fully operational – and it's a project expected to deliver long-term savings to the airport of over HK$ 85 million a year.

Symbol Technologies has also implemented a RFID baggage labelling solution at Las Vegas McCarran International Airport, primarily to address security issues raised by the 9/11 terrorist attacks and subsequent luggage screening mandates. The same benefits are now emerging in Hong Kong. "At Hong Kong International Airport the authority implemented a new process that effectively

ensures each piece of luggage can be placed into the right ULD (Unit Loading Device) - the large metal container used by carriers for storing luggage on their aircraft," explains Mike Saunders, Director of Aviation at Symbol Technologies. "When you consider the huge volume of bags at HKIA, especially during peak times, invariably, a bag is placed into the wrong container."

To reduce the error rate, Symbol Technologies created an RFID field in front of the ULDs. Now, when the RFID tag on the item of luggage passes through the field in front of the ULD, it registers a signal visually and audibly to advise the handler whether or not that bag is being placed correctly. "In other words," continues Saunders, "if a bag tagged for LAX is incorrectly placed into it an

ULD destined for LAS, the handler is advised immediately of that error. It's a process change that developed because of RFID technology, something that could not be achieved with an optical barcode system."

The issue right now is determining the ROI. To fairly asses the financial benefit, an airline or airport must take account of the effective process change that RFID brings to an operation. Certainly HKIA has proven what can be achieved with RFID, and the technology has demonstrated similar benefits via process change in other verticals. It is just a matter of time before airlines and airports reap those benefits as they further experience and exploit the advantages of RFID.

Easier process management through component tagging It's not just luggage that moves around in airports. An element of aircraft safety depends on the availability of high quality aircraft components which meet the best cost-quality tradeoff and can be clearly identified and located. The management of central logistics through RFID has been attempted by Virgin Atlantic, whose Heathrow operation needed to improve competitiveness by finding ways to increase efficiency and risk reduction in the spare parts supply chain.

The airline commissioned a trial of RFID where the primary objectives were to identify potential ways to use RFID technology to improve the turnaround of

components through stores, increase visibility of parts and materials within the maintenance environment and trial the use of mobile technology using wireless networking. Several organisations contributed technology, including TATA Consultancy Services (system integration expertise); Oracle (middleware and database skills); Symbol (LAN technology); and Printronix, who supplied a number of RFID printers which feature intelligent RFID tag management, allowing Virgin Atlantic to ensure 100% readability of the RFID smart labels entering their supply chain. The entire trial underwent rigorous assessment at each implementation stage for speed, efficiency and data accuracy compared to existing averages. This

constant measurement through-out the pilot also allowed Virgin Atlantic to identify any supply blockages or fast track items for a deeper understanding of the true ROI of RFID in their supply chain. "The trial offered very tangible measurements and also generated positive feedback from all the users involved," says Graham Holford, Senior System Analyst with Virgin Atlantic. "For example, we were able to cut in half the time needed to locate each inbound item. For a department that receives and locates hundreds of items each day, this has the potential to offer us considerable cost savings and process task time improvements."

The trial delivered conclusive proof that the selected UHF RFID technology is dependable, reliable and provides efficiency gains. Holford concludes: "As a result of this trial, Virgin Atlantic is able to build a more detailed business case and ROI model for a fuller implementation of RFID technology, including detailed requirements on the entire supply chain in order to be as prepared as possible for wider adoption."

So what about RFID Passports?

While an automatically read RFID-tagged passport could theoretically get you through Customs in a fraction of the time it normally takes, the invasiveness of others reading your personal information creates far more panic than the insertion of a chip beneath the skin. We want our privacy but we definitely don't want the queues, delays and uncertainty involved in travel – so which will it be?

The British Government has been issuing RFID passports to its citizens since March 2006, in compliance with the post 9/11 US decision to insist on more secure 'machine-readable' identity documents, ie microchipped biometric passports, from citizens of all 27 countries in its visa waiver programme – which includes most EU members and the UK. They've been designed by the Home Office to an encryption technology specification called 3DES – three times more secure than standard military-level data-encryption.

The RFID chip is on the back of a laminated page of the passport (the front of which displays standard holder information; photograph, passport number, name, nationality, sex, signature, date and place of birth, and the document's issue and expiry date. Encoded on the passport's RFID chip are details of the printed information; an image of the holder's photo and a security device protecting the integrity of the rest. In order for the airport RFID reader to 'talk' to your passport it needs a secret key which unlocks this encryption to display the holder's picture and details on the immigration screen. According to security experts who've investigated these chips (documented in The Guardian, November 2006; and the Daily Mail, March 2007), the fatal flaw is that this key comprises non-secret information, namely the passport number, the holder's date of birth and the passport expiry date. This means that a cheap RFID reader and some clever but not extraordinary software can read and interpret the data in a matter of minutes.

The Home Office counters this by pointing out that the information on the chip is the same as that already published in the passport document and contributes nothing towards any illicit activity. In addition, forging a passport means forging the entire document, not just the digital information, and many levels of security exist to prevent this. Nor has data integrity been breached, meaning data can only be copied, not changed, so the new user would have to look a lot like the original holder to make use of it.

It's not cheap or easy to break into a RFID passport, but it is possible. And although there are mechanisms to improve security now being fitted – including foil covers which prevent the closed passport from being read by a remote reader – the concentration of personal data into a single electronic document is something of an invitation to the unscrupulous. Only far better facial recognition software than currently exists can close this loophole, which means the only viable solution today is more customs officials to double-check by inspection what the chip readers tell them. Which means more queues, more expense, more scope for human error and more delay.

Maybe we should just stay at home.

Making standards work: EPCglobal Class 1 Generation 2

The EPCglobal Class 1 Generation 2 UHF Air Interface Protocol Standard, or Gen 2 as it is more commonly known, is a real life example of global standards not only helping to reduce the cost of RFID but also improving its performance.

Put simply, Gen 2 defines the protocol for exchanging information between an RFID tag and an RFID reader. Gen 2 was developed by EPCglobal members, based on their own requirements, via EPCglobal's open standards development process. Prior to its ratification as an EPCglobal standard in December 2005 there were numerous 'standards' for RFID tags and readers, resulting in confusion in the market as different manufacturers produced equipment that only worked with their own proprietary protocols.

Over a year has now passed since manufacturers started to produce tags and readers which comply with the Gen 2 standard. During this time the RFID market has changed dramatically – price reductions and improvements in performance of the technology have demonstrated how critical this standardisation has been to the RFID marketplace.

Gen 2 has now been integrated into the International Standards Organisation's standard, ISO 18000-6C, paving the way for its use throughout supply chains globally. There is no doubt that standards serve organisations well, both by reducing the cost of procuring the technology and by simplifying communication between trading partners. But more needs to be done.

In a world where products are being sourced from further afield it is clear that proprietary numbering schemes and one off technology solutions no longer go far enough. Standards must be open, global and cross sector. For example, there are currently two RFID solutions being implemented by libraries and booksellers – one at 13 MHz and the other at 850-950 MHz. These two diverging paths, in the same industry, are incompatible.

Despite the success in fostering development of Gen 2, EPCglobal President Chris Adcock is aware more work needs to be done to make global, royalty-free standards a reality. "Gen 2, which allows readers and tags to communicate, was ratified by the EPCglobal board in December 2004 and by ISO in June 2005. We have a standard that's relevant to real business needs. Tags perform well across a wide range of UHF frequencies, be it at 952 MHZ in Japan or 868 MHz in the UK, with close to 100% read rates."

"It has also driven a significant hardware price drop from 45 US cents to lower than 10 US cents, and performance has been well ahead of expectations. Tag Data Standards, which define the structure of data on tags have been well accepted in the Retail/CPG sector and have formed the basis for many other industry initiatives."

"Without standards, industry would still be relying on higher priced, lower performing protocols," said David Lyon, EPCglobal Business Manager, GS1 UK. "Standards such as Gen 2 are forcing prices down and performance up, benefiting the whole industry."

Traceability from farm to fork

Food origins and food purity are hot topics. But despite EU legislation promoting greater transparency, there are serious gaps in disclosure. According to Knut Joerstad, Chairman of TraceTracker, there are particular problems with fruit as recently reported in international media

"China has 11-12% of the world's export fruit market, mostly apples for concentrate", he says, "This is used by retailers all over Europe. You think you're buying for healthy juices from maybe British apples whereas the concentrates comes from China and the apples, grown along the Yellow River, are contaminated." TraceTracker began in Oslo in 2000, aiming to offer full global traceability. Now based in Heidelberg, TraceTracker has some fifty employees in offices around the world. It's developed the Global Traceability Network, GTNet, a specialised hub which keeps track of links to the internal traceability information of its subscribers. The major focus is on traceability but the system is also a sophisticated information infrastructure allowing subscribers to exchange product data with trading partners. It's available as a subscription service with different levels of functionality.

TraceTracker's initial work was around pelagic fish sourcing and related marine foodstuffs. Much of its work still focuses on food chain traceability but the GTNet model is suitable for any value chain.

According to a recent Gartner report, Food traceability in Europe, current legislation does little other than enforce labelling rules to guarantee source. Joerstad comments, "EU legislation on Food traceability requires only information one step up and one down at each point. That isn't sufficient and doesn't allow fast response to incidents."

"You need complete history", adds Joerstad, "Sainsbury has 34% of the UK fish market and wants to guarantee its products are from sustainable sources. With farmed salmon, for instance, it can only do this if it knows where the mackerel used to make the salmon feed came from, which trawler landed them at which port on what date. Through GTNet they can know this with confidence and so reassure their customers."

GTNet maintains a full and interlinked audit trail and this means that it becomes impossible to introduce dubious or illegal material. Port authorities will record quota fish catches with a globally unique identifier but catches introduced illicitly won't have the necessary link right back to the authoritative source.

Organic and FairTrade products are in strong demand at premium prices and this attracts criminal interest. "In South America the mafia are feeding ordinary coffee into the supply chains, calling it FairTrade and laughing all the way to the bank", claims Joerstad, "but GTNet can prevent that. This is exactly what consumers are now demanding, and responsible retailers providing, namely authoritative confirmation of the real source of products."

Effectively we are introducing a food passport that delivers trust and value across the whole chain from suppliers to consumers.

One Step at a Time

Addressing business process issues is the key to unlocking RFID's potential

By Guy Kewney

When Tesco announced that it was switching on its RFID systems in 2005, it was the biggest contract ever in the newly-emerging automated identification business - and it went to a group probably better known for its burglar alarms than for its microscopic silicon tracking systems - ADT, part of Tyco.

That record has since been broken, of course. But there is something of a mystery about why it hasn't been utterly smashed: why isn't RFID utterly pervasive in inventory tracking and tracing? Find the answer to that, says ADT, and the industry will burgeon.

The first step, however, is to take advantage of a mass of expertise and experience in finding profitable applications for today.

"The situation today is that widespread uptake is dependent on decisions involving the key issue of business processes," said John Smith, Vice President of Retail Sales for ADT Europe, Middle East and Africa. "Re-engineering business processes is a key enabler for realising large-scale benefits, but the need for business process re-engineering is slowing RFID uptake because of its impact on return on investment."

The challenges, three years ago, were largely technology based. Today, that isn't the case. A unified standard has been ratified and implemented across Europe. Early adopters such as Tesco, Metro and Marks & Spencer have proven the reliability and performance of the technology. The ability to read hundreds of tags in an instant is now a reality. RFID has come a long way.

The problem isn't the long-term vision either. The potential of RFID to improve business operations has been well documented; the question is 'how do we fund the initial infrastructure in a business environment that is often focused on the short term?'

John Smith believes that the secret is finding profitable applications which self-fund that infrastructure. "To be able to capitalise now, short term, companies need to look for applications that don't require those major changes, and therefore give you a more immediate RoI," he says. "These are projects that allow you to tweak, rather than re-invent, business processes."

The easy way to discover these low-hanging fruits is to learn from the experience of others, and establish where quick and real benefits exist.

Tesco has focused on the use of RFID to realise efficiencies in its vast supply chain. One of its key suppliers, Robert Wiseman Dairies, is tagging roll cages of milk for delivery into Tesco's supply chain.

Toshiba has significantly improved the throughput of its EMEA laptop configuration plant by using RFID to eliminate bottlenecks and improve efficiency.

Domestic consumables manufacturer Papstar is shipping tagged cases of product to Metro, who have mandated that all their major suppliers are RFID-enabled by October.

Returnable transport item company Euro Pool Systems has RFID-enabled its asset base to better track goods and is now tagging pallets of food destined for Carrefour in Belgium.

The next stage in the evolution of the technology, item-level tagging, is likely to happen first in the apparel business, where it can drive revenue, not just process efficiency. A unique Apparel RFID Solution Centre was opened in Europe in May, specifically for garment manufacturers, brand owners, retailers and logistics providers. German retailer Karstadt has since announced that it is well advanced with item-level tagging of clothing.

Coupled with this will be the deployment of a higher density of readers, now made possible by seminal research at ADT's European RFID Performance Lab. This facility allows companies to test and refine crucial aspects of their RFID solution before deployment and has resulted in several technology breakthroughs.

The Performance Lab opens the door to future applications, as evidenced by the testing conducted for Robert Wiseman Dairies. "It was a difficult application involving both metal and liquid, which have historically caused problems for RFID system performance, but these were overcome at the Lab," said Ken Scotland, Vice President of Commercial Sales for ADT EMEA.

"We foresee a snowball effect," he added. "As the infrastructure grows inside more companies, the ability to extend the business process improvements will extend the reach of RFID. It will also mean the ability to integrate with other data capture systems to further enhance operations."

What has also become evident in this fast paced, evolving industry is the need for effective partnerships. The vendors delivering RFID solutions need to partner to leverage their respective strengths and deliver a complete solution. The Apparel RFID Solution Centre, for example, is a joint venture between ADT, Salpomec and UPM Raflatac. Likewise, the partnerships between the vendors and their customers are also critical. Euro Pool Systems, for example, chose ADT and HP as its long term RFID partners.

RFID is not about technology. It is about solving companies' pain points in order to improve their business operations. The practical ways that RFID is being applied now are the roots from which larger scale implementations, that address business process issues, can grow. In a decade, these will prove to be the advancements that provided a platform for long term competitive advantage.

One-stop shop for RFID
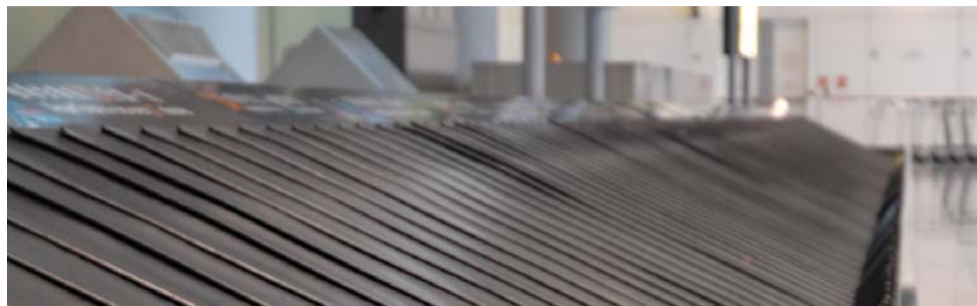
Are Saturn's rings made entirely of lost airline baggage as sometimes claimed?

Whatever the truth of that, lost baggage is a serious problem which inconveniences and distresses passengers and costs airlines and airports significant amounts of money. The figures are quite staggering, running to well over 14,000 items each day in the US alone. However, this is an area where Siemens AG is making a useful contribution. At Fürth, in Germany, the company has build a complete airport infrastructure, the Siemens Airport Centre (SAC), to develop and test process-orientated solutions for a range of airport needs, including handling baggage efficiently and speedily.

IATA, the International Air Transport Association, wants airlines to tag items on check-in, claiming this will save some $760 million annually, but that development is clearly some time off. Siemens' current solution uses RFID technology to direct the movements of the track-guided plastic bins, so-called "trays", which carry baggage to and from loading gates and other locations at speeds of up to 40kmph. A tag on each tray is written with the destination of the various pieces. This is read automatically at each branch or check point and the tray routed automatically, an approach which minimises both contents misrouting and the time passengers spend waiting for baggage to arrive. Frankfurt and Munch airports have already installed the system and others are looking to do so.

Siemens, with headquarters in both Berlin and Munich, is one of the world's largest electrical engineering and electronics companies with activities covering a wide range of business sectors. It's worked with RFID for nearly thirty years and claims to be a one-stop shop for its deployment - manufacturing its own chips, readers and control systems, carrying out extensive R&D in its test centres at Fürth, Feldkirchen, Magdeburg and elsewhere, and offering technical, as well as sector specific process consultancy and deployment services linked, in many cases, to its general business experience in various sectors such as the retail supply chain, medicine or automotive, chemicals & pharmaceuticals and other industrial production.

As the IT saying has it, Siemens eats its own dog food, a test of whether a supplier has sufficient confidence to use its own solutions. For instance, it's been using its own RFID technology for the past fifteen years to control bespoke production of up to 1,500 switchgear variants made at its factory in Amberg. Such switching devices are the work horses of numerous electrical installations and Siemens offers delivery of customised devices within 24 hours, an impressive example of automated JIT (Just In Time) production. According to Siemens the use of RFID is key.

The production line is divided into around sixty distinct substations each carrying out one production step. Each unit to be assembled travels in a carrier fitted with a tag programmed with the particular instructions needed. Readers at each station interrogate these carrier tags and duly carry out whatever production steps are required to build the particular variant ordered.

Siemens' total investment was €155,000 with ROI made in two years. This came partly because the RFID automation allowed capacity to be increased by 70,000 units annually, partly because quality control and consequent wastage was improved, and partly through reducing earlier IT needs at the plant.

Building motor vehicles has become a very highly automated business where savings of seconds on production lines can make a substantial difference to costs. At Volkswagen's Golf production plant in Wolfsburg, for instance, an RFID installation helped reduce data acquisition times from thirty to just three seconds each time, shaving five minutes off the production cycle time for each car.

Quality control is also essential, in part because of legislation but also because quality failures can lead to expensive products recalls and erosion of customer confidence. Add in the complexities of modern automotive production whereby a wide range of model variants are built on the same line

and it becomes a complex problem to ensure that the right component is ready at the right place for installation at the right time into the right vehicle body.

At its plant 1.1 in Munich, BMW makes saloon and estate car versions of its 3 series ranges. However, it's not just the body shells, engine or gearboxes which vary but also peripheral elements such as equipment options or finishes. Further, components will come from a wide range of other BMW plants and independent suppliers and all these materials, modules and units need to be correctly identified and used precisely. Lastly, the whole process has to be recorded for each vehicle and duly written to a document showing an audit trail of processes and relevant quality information.

BMW links the car's wiring harness intimately with its specific customisation and it's therefore essential that the correct harness is paired with the correct body, something which BMW controls through RFID. Harnesses are bagged individually and MDS mobile data storage units, which hold the unique data necessary for identification, are then sewn in. The bagged harnesses pass by an RFID read/write device which then associates each harness with a specific order number linked to a given vehicle. When the vehicle reaches an appropriate assembly point the harness is ordered by number and duly delivered for fitting, several further local checks ensuring that everything is correct.

This is particularly important as fitting the wrong harness can mean that the vehicle needs to be scrapped.

Following an early problem arising from the copper in the wiring looms affecting the strength of the RFID signals (which Siemens solved by replacing certain metal rollers with plastic versions) the system has worked well and BMW is now considering extending it to other plants.

A number of retailers and wholesalers in the garment or food industries work with Siemens, among them the long established Swiss meat producer Bell.

Founded in 1869 and based in Basel, Bell now employs over 3,200 people and sells both fresh and processed meat and meat products. It uses RFID to control containers carrying meat and meat products through various production processes.

Hygiene is critically important in such a plant and so there is regular and extensive cleaning with high pressure water and with disinfectant. This, coupled with the generally rough and testing production environment means that both readers and tags need to be robust.

Oliver Schulp, logistic manager at the Oensingen factory, explains, "If the tag label is not absolutely watertight, humidity gets in and the tags will no longer be identified correctly."

Bell's approach is to place two tags diagonally on each plastic container. Meat products are added

to the container and the tags are updated with this product information by operators using touch screens. Weights are taken automatically and checkpoints read the tags, route the containers as

necessary for storage or further processing and relay information to the factory ERP system. Checkpoints and readers around the factory ensure that the location of tagged containers is always known precisely.

Jürgen Schmidle, IT logistics planner, says that the previous barcode system outlived its usefulness and that the necessary move to the power and versatility of RFID is working well. "However", he adds, "we're not yet utilising it to its full extent. In future we could load more product information on to the tags and make it available for processing in third-party factories."

Siemens is now looking to build on its long experience of RFID and its capability of offering everything from one source by introducing new, flexible models for supply chain deployment.

Volker Klaas, Head of the Siemens Global Competence Centre Auto-ID/RFID, explains that closed loop supply chain installations are starting to give way to open loop ones, these involving third parties in both directions from distributors or retailers and where products are being tracked from one end of the chain right to the other.
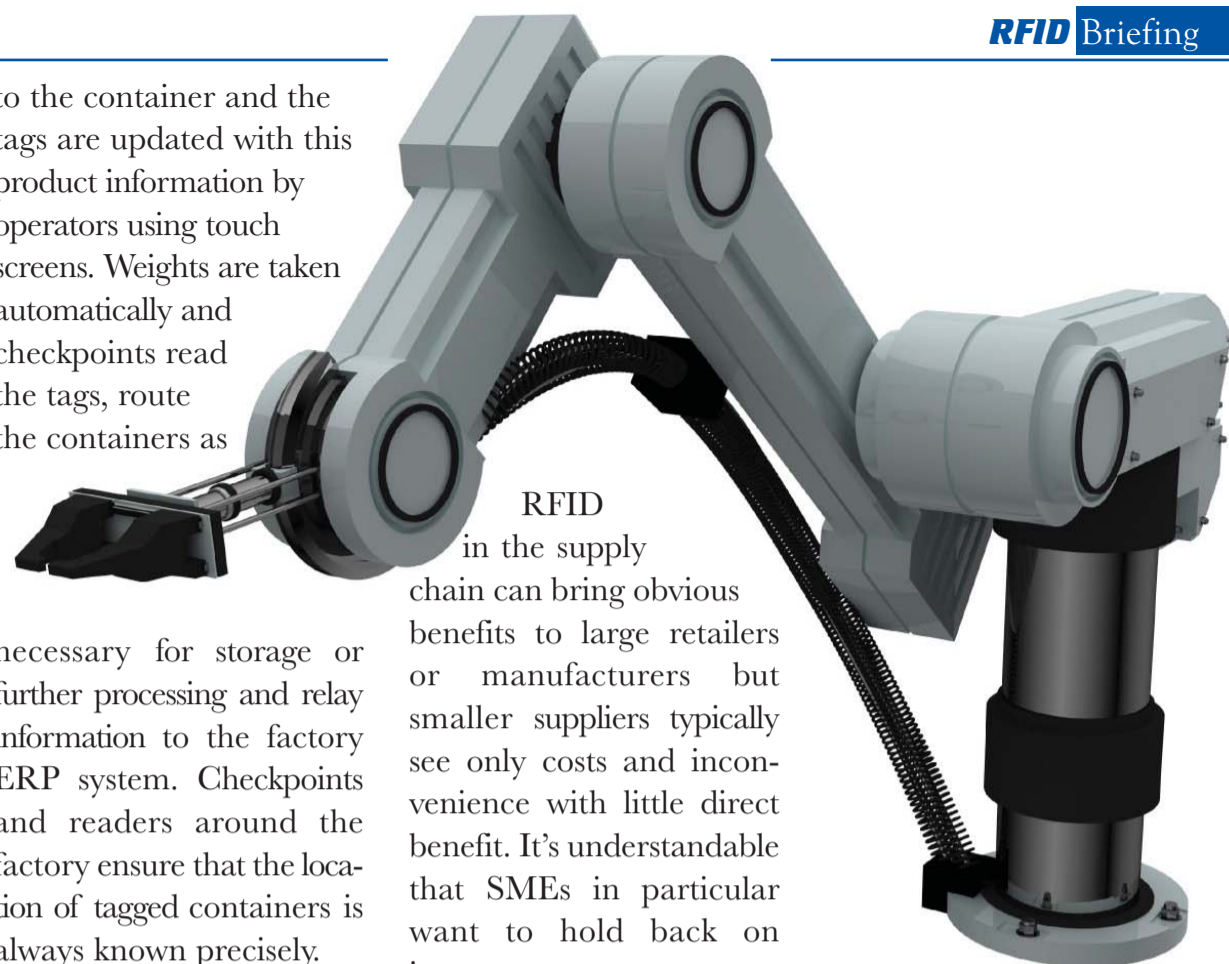
RFID in the supply chain can bring obvious benefits to large retailers or manufacturers but smaller suppliers typically see only costs and inconvenience with little direct benefit. It's understandable that SMEs in particular want to hold back on investment.

Siemens' approach is to set up, own and run an Auto-ID backbone and to leave it up to the individual partners in the supply chain to source the necessary local equipment. There are different charging models but one approach is to bill strictly according to usage, something which Siemens sees as bringing RFID benefits to small suppliers without their incurring excessive costs.

Although RFID has been a long time coming its future looks assured. Siemens is very positive about the benefits and points to the potential benefits of combining RFID with other technologies, particular sensor technologies. Companies already use active tags to maintain a dynamic audit trail of the events affecting containers but this can be taken much further. Siemens has recently launched several security initiatives, for instance, including using a special form of asymmetric cryptography to secure RFID transmissions from
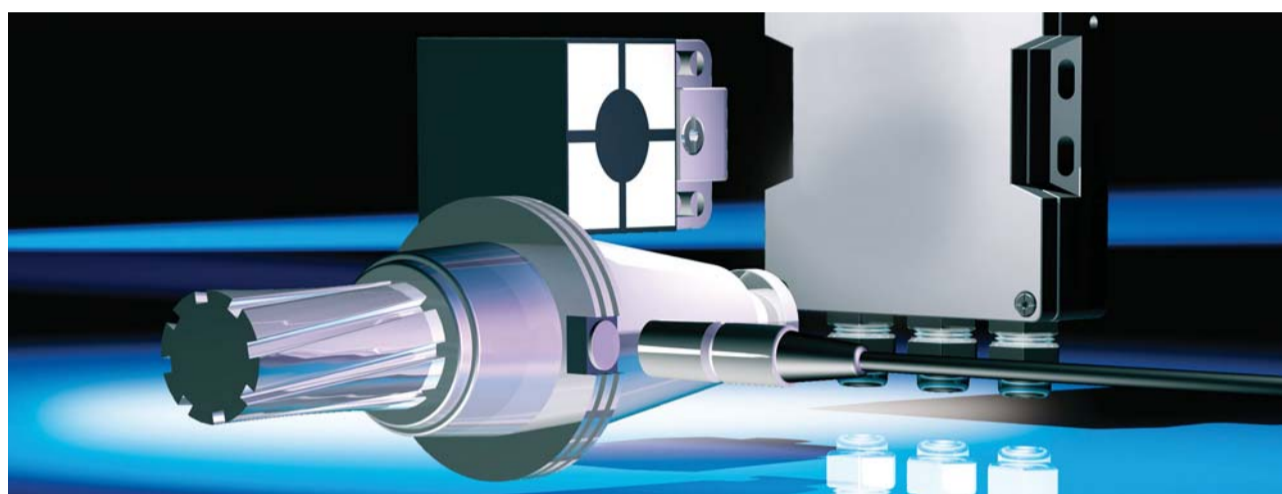
interception and modification. It's also developed a method of using passive chips to confirm the authenticity of documents, such as waybills, and to link them irrefutably with tagged packages or containers. The EU initiative, the so-called 'internet of things' whereby widespread communication occurs in the background - monitoring health and transmitting alerts, for instance, or instructing fridges to order automatically as stocks fall - is some way off but seems eventually assured.

"The combination of RFID with other technologies will give the market new emphasis", says Klaas, "Companies will provide new services and that will contribute significantly to the benefits and so to the spread of RFID".

Industrious Industry

How can you tell by looking at a tool such as a drill bit how many times it's been used and how soon it needs to be sharpened or replaced? How can you tell by looking at the outside of a personal computer or a car which options have been installed on the factory production line? How can you check if the tool that's about to hold a semi- conductor wafer for cutting is an original rather than a fake that raises the failure rate to unacceptable levels? How can you be sure an industrial robot has the right gripper installed in its arm when the wrong one will break the part it's going to grip? If a television tests faulty on the production line, how can you make sure it gets repaired before it's shipped out and sold?

All of these are problems that come up regularly in industrial manufacturing, especially since many of today's assembly lines are designed to be flexible enough to handle many different products – or the same product in many different customised versions. A company like Dell or BMW, for example, wants to be able to run the same outer shell down a single assembly line, fit it with a mix of standard and custom components, and track it accurately through the entire process until it's shipped to its eventual owner.

It was, says Norbert Popp, head of the identification systems division for the sensor specialist Balluff, the automotive industry that requested automated identification systems first, as production lines shifted from mass production to customisation.

"Manufacturers used to make 100,000 engines all the same. Now, they are niche products with different types and there's a huge mass of variants. They need to produce, with high flexibility, different products on the same line with high efficiency."

For this sort of track-and-trace application, barcodes are too limited. For one thing, in the hustle and dirt of a factory floor barcodes are easily damaged – even a scratch or a small amount of dirt can make them unreadable. If they do survive the rigours of the factory environment, once the part they're stuck on is installed inside the product-in-progress it's no longer visible or, therefore, readable. For another, barcodes are read-only technology and have very limited storage capacity. They can't be updated to reflect configuration changes or the results of quality testing. A similar situation applies to tool identification. In an industrial setting, the computerised numerical controller in charge of production needs to know the parameters of the tool it's using, including data such as length, radius, the length of its life, and the number of times it's been used. In the previous way of working a barcode or written number only identified the tool. A worker had to look up and input all the parameters manually, with all the risks of error that implies. Attaching an RFID tag to the tool means that the data can be read automatically and updated as necessary, including the record of how long or how many times the tool has been used and when it's due for replacement or mainte- nance. Automating this process means changing tools is faster and more accurate. If there's a change of machinery and the tool goes back into stock, the information about how much of its life is left goes with it, to be read if and when the tool is reinstalled. Also, knowing how long the tool has been used makes it possible to change it proactively instead of waiting until it fails, preventing unnecessary downtime.

All these things, Popp says, save "real money for the company. It's a real benefit for customers."

Tool identification in particular is an application where RFID has been used for a long time –real years, not Internet years. Balluff began installing RFID systems for these kinds of applications as long ago as 1984. The sensors were not, then, known as RFID, a term that came into use in the mid-to-late

1990s; back then Balluff simply called it "Identification system". The first sensors were the size of a pack of about 100 business cards. "It was initiated by the tool machine manufacturers," says Popp, by way of explaining the drive behind the system's development.

Since its first tags in 1984, Balluff has gone on to develop many other types of tags, ranging in price from €3 to €120 and in size from that pack of business cards down to a tiny glass cylinder about the size of a small piece of lead from a mechanical pencil. Tags can be provided for a variety of environmental conditions – under water, high temperatures, low temperatures, and logistical setups that make access difficult. The small glass tags, for example, are intended for use in manufacturing contact lens solutions, where plastics can't be used because the demineralised water used in such solutions would leach out the minerals. In these closed-loop systems, tags are reused for as long as ten to 15 years. "We can still read or write to tags we delivered 20 years ago," says Popp. The tags are made in Balluff's own factories.
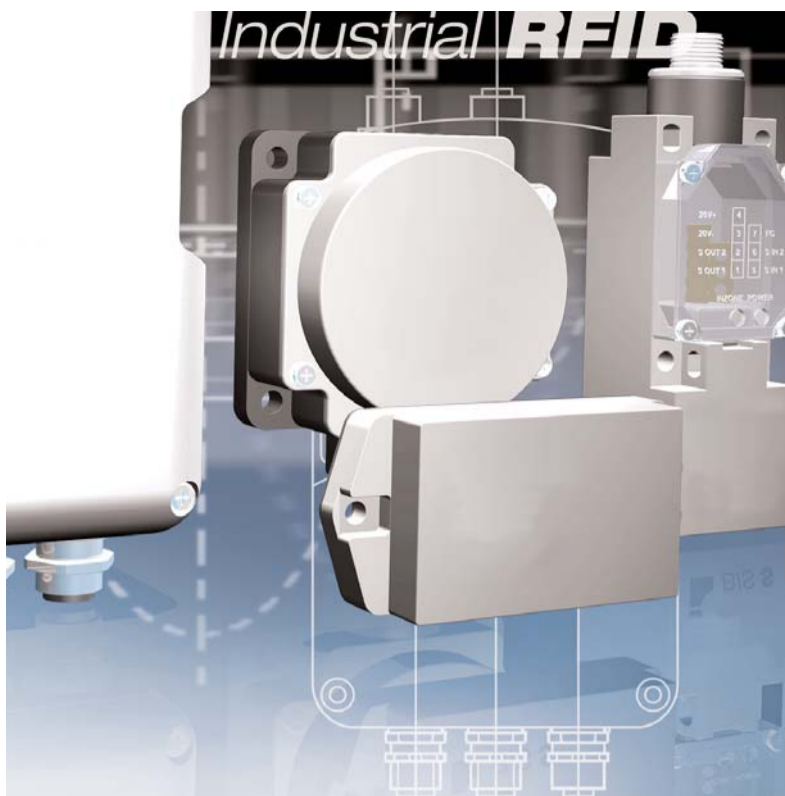
Unlike the mass-market applications that scoop up most of the media coverage, in this type of RFID application the cost of individual tags does not have the same critical importance as it does if you're planning to tag every pair of jeans or every razor blade you sell. Instead, the more important issues are reliability and longevity.

"The customer expects a minimum of ten to 15 years," says Popp, "especially in the automotive industry." Balluff supplies identification systems to almost every car manufacturer outside Japan, where the market is "a little bit specific".

Balluff vice-president for business development and marketing, Thomas Richter

says, in the beginning with Tool ID solutions we had focused on machine manufacturers, now due to potential RFID applications for intra logistics and asset management we are targeting prospective customers who have the ownership for their entire supply chain and production processes.

For BALLUFF, serving successfully the RFID market it is a specific Business Model which requires a different style of sales channel, marketing and engineering approach. And therein we see strength of our company, says Richter, to be able to adjust the Business Models according to the specific market requirements.

In the last few years, says Richter, "There's really been hype in the market, where everybody is talking about RFID but people don't really understand it." Balluff's applications sound modest compared to the Wal-Mart idea of tagging every one of billions of retail products, no matter how small. But Richter says fulfilling that particu-

lar plan is some way off, partly because it's still not possible to tag all products and partly because the tags are still just too expensive to deploy by the disposable billion. In any case, "It's a field we don't want to participate in. It's not our market and not our approach." Instead, Balluff looks to expand into what Richter and Popp call "unsolved applications" in the world of industrial manufacturing. Loosely, these revolve around logistics systems in which barcodes are could be replaced with RFID tags in a price-competitive way in markets where the ability to write data on the tag could add significant features or improvements.

For example:
A different niche market for this type of system is wind energy, which currently is growing enormously as an energy source. But like all renewables there are hidden costs. Maintaining and repairing the installed turbines, particularly when they're offshore becomes a challenging task for all turbine manufacturers. Avoiding down times or replacing a damaged generator or gearbox in a turbine, Richter explains, requires large and expensive service efforts.

Therefore, they're really strongly focused on reliability of all the components and they need a highly accurate tracking system to organise the maintenance and make it efficient. So they're interested in identifying every component inside the turbine." Again, price is less of an issue:

we're not talking about millions of tags.

The bigger issue is ensuring that the tag is reliable under these environmental conditions and has enough capacity to store the necessary data. Using RFID tags, if the company does have to remediate a failure it can take advantage of the situation to identify and replace, at the same time, any nearby components that are approaching the ends of their lives.

"The philosophy of Balluff is that our products should solve a problem," says Popp. "We sell a complete system where we guarantee the system. If you only sell components – and some do – and one person sells the tag and someone else the read/write head and someone else the controller unit nobody's guilty if something's not running. We sell a complete system and we are responsible if something goes wrong." This scope of supply and services is, he says, vital for all our applications we have solved.

Very high, sometimes unrealistic expectations are held today for RFID systems. The success or failure of RFID projects depends chiefly on selecting the right partner. Long years of experience and qualified assistance are decisive factors in success. The technology works.

Connecting trading partners across the global supply chain

In October 2006 GS1 EPCglobal launched a major pilot programme using RFID and EPCglobal standards and technologies to track and trace sea containers through some of the busiest trade routes in the world - between Hong Kong and Japan, and China and the USA.

The pilot aims to demonstrate how organisations across a global supply chain can exchange real-time event data and track shipments from the point of manufacture in one country through to the final point of distribution in a second country. One of the goals of the pilot is to capture the complete shipping history for all EPC-tagged items.

The availability of such detailed data provides unparalleled up-to-the-minute tracking information (the current location of the item) and detailed tracing information (where the item has been). Real-time access to such information about products and shipments as they travel along the supply chain give trading partners invaluable insight to supply chain processes, ultimately allowing businesses to run with more knowledge, accuracy and efficiency.

If successful, the pilot programme will validate the use of EPCglobal standards and technologies, which allow global trading partners to achieve unprecedented visibility of the movement of goods in the global supply chain. The combination of RFID and the internet makes this possible,

with the standards providing the framework for a network where information is captured and shared, giving real-time product movement data for items such as pallets, cases or individual units, to authorised users.

Phase one

The first phase of the pilot, ran in conjunction with a leading footwear manufacturer, was successfully completed in April 2007. This phase tracked in real-time the location of cargo containers shipped between Hong Kong and Japan. With extensive support from The Ministry of Economics, Trade and Industry (METI) in Japan, the pilot successfully assessed the use of both passive and active UHF EPC/RFID tags for sea shipment of cartons and containers between the two locations. Associated data was exchanged through the EPC Information Services (EPCIS) of the recently developed Hong Kong EPCglobal Network and another EPCIS in Japan. The pilot successfully addressed specific business needs of the partners, such as matching tagged products with purchase orders.

Goals of the first phase included:

• Demonstrating interoperability between multiple trading partners and service providers in a global supply chain
• Utilising EPCIS/RFID technology components and EPCglobal standards
• Enabling visibility of critical events across the supply chain
• Testing and developing

requirements for active RFID and integration with associated technology
• Identifying standards opportunities for transportation and logistics providers
• Creating an environment of open results and information sharing for the EPCglobal member community

"This truly multi-industry, multi-stakeholder initiative is a significant step toward standardising RFID data," said Chris Adcock, President of EPCglobal Inc. "Phase one of the pilot has demonstrated the value of the EPCIS standard which was used to track the progress of cartons and containers across the supply chain between multiple trading partners."

Based on this phase of the pilot it is now anticipated that users of EPCglobal standards in the transport and logistics sector can enjoy enhanced visibility of cargo, enabling them to gain greater control over lead times, inventory and cash flow.

"We strongly recommend EPCglobal as a reliable RFID standard to secure and facilitate global trade," said Tetsuya Hamabe, Director of Distribution and Logistics Policy Division of METI.

Phase two

The second phase is now underway and is scheduled for completion in February 2008. This phase will demonstrate interoperability among multiple trading partners and service providers in a global supply chain. The

EPCIS dimension of phase one will be more widely deployed, with information being exchanged between end users such as customs administrations for automatic customs clearance. This phase will cover the busy trade lane between Shanghai and Long Beach, California and will again involve ocean containers but will also be extended to include air transport.

Goals of phase two include:

• Utilise EPCglobal standards-based RFID technology components
• Ensure visibility at critical events in the supply chain
• Test and develop requirements for active RFID and integration with associated technologies
• Identify standards opportunities for transportation and logistics providers

• Open results and information sharing for the wider EPCglobal member community

The results of this phase will be fed back into the EPCglobal standards development process, taking us one step closer to the ultimate goal of complete visibility of the movement of goods in the supply chain.

Pilot participants include several hardware and software companies, government bodies, and global supply chain providers including METI, Maersk Logistics, Schneider National, Inc, APL, DHL, NYK Logistics, GS1 Hong Kong, IBM, BEA Systems, WhereNet, Symbol, Toppan Printing, Toppan Forms, Savi, Allumis, NRI, Oracle, IIJ, NTT COMWARE, Monohakobi Technology Institute, VeriSign and Schenker.

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