

Microsoft Retail

October 2004

RFID: An Introduction

More Information

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Executive summary

Radio Frequency Identification (RFID) is evolving as a major technology enabler for tracking goods and assets around the world. It can help hospitals locate expensive equipment more quickly to improve patient care, pharmaceutical companies to reduce counterfeiting and logistics providers to improve the management of moveable assets. It also promises to enable new efficiencies in the supply chain by tracking goods from the point of manufacture through to the retail point of sale (POS).

As a result of the potential benefits of RFID, many of the world's major retailers have mandated RFID tagging for pallets and cases shipped into their distribution centres by 2005. The consequence of this RFID activity in the retail sector is likely to impact on around 200,000 manufacturers and suppliers globally, and will fuel the market for hardware and software to support RFID.

But while the technology has received more than its fair share of media coverage over the last 12 to 18 months, many are still unfamiliar with RFID and the benefits it can offer. In fact, Microsoft-commissioned research of the retail and manufacturing industries, from independent research consultancy Benchmark*, found that 31 per cent of senior decision makers in large UK manufacturing companies have never heard of RFID. A further 24 per cent may have heard of the term but know nothing about the technology beyond the acronym. Indeed, only 26 per cent of those interviewed understood the technology and its capabilities.

Lack of good information about RFID and its benefits will potentially impede uptake of the technology. This is illustrated by the Benchmark research, which found that 53 per cent of respondents have not even considered deploying RFID and a further 21 per cent have only vague plans. Only two per cent of companies use RFID tagging extensively, showing how far the industry has to go.

In the face of this need for clear, comprehensive information about RFID and its benefits, this paper defines the opportunities offered by the technology for all organisations involved in the production, movement or sale of goods. It is equally relevant for organisations wishing to track or locate existing goods, assets or equipment.

In addition, the paper seeks to outline the business and technical challenges to RFID deployment and demonstrates how these issues can be addressed with technology from Microsoft® and its partners. Above all, it explains how Microsoft technology – which provides the software architecture underpinning the solution rather than tags or readers – can support the deployment of RFID-based solutions.

* To request the executive summary of the Benchmark research please email: msrfidrequest@microsoft.com

The story so far

What is RFID?

RFID systems consist of tags, readers and a range of applications that track, monitor, report and manage items as they move between physical locations. These devices and software must be supported by a sophisticated software architecture that enables the collection and distribution of location-based information in near real time.

Tags contain a unique identification number called an Electronic Product Code (EPC), and potentially additional information of interest to manufacturers, healthcare organisations, military organisations, logistics providers and retailers, or others that need to track the physical location of goods or equipment.

The technology, which was first used during World War II to track military vehicles, has already been piloted for animal tracking and identification, speed pass lanes on toll roads, controlling access to restricted buildings and enabling electronic payment processing at petrol stations.

All information stored on RFID tags accompanies items as they travel through a supply chain or other business process. All information on RFID tags, such as product attributes, physical dimensions, prices or laundering requirements, can be scanned wirelessly by a reader at high speed and from a distance of several metres. The basic components of any RFID system include:

- Tags (or transponders), which can be either active or passive. Active tags have their own means of sending a signal, whereas passive tags rely on power from tag readers
- Data stored on tags, which could be a simple ID number relating to an online catalogue or complex information such as manufacture date, lot number, serial number and so on
- Readers (or interrogators) are used to identify all tags within the reception coverage area and aggregate and “smooth” the data collected
- IT infrastructure to support the collection, management and use of key RFID data

The origins of RFID

In 1998 researchers at the Massachusetts Institute of Technology (MIT) Auto-ID Center began to research new ways to track and identify objects as they move between physical locations. This research, which has a global outlook, centred on radio frequency technology and how information held on tags can be effectively scanned and shared with business partners in near real time.

The work of the Auto-ID Center focused on:

- Reducing the cost of manufacturing RFID tags
- Optimising data networks for storing and delivering larger amounts of data
- Developing open standards

It became apparent that the ideas being proposed, combined with other ongoing technological and standardisation activities worldwide, would help to reduce the costs of RFID tagging.

By 2003, the centre had over 100 sponsors from four continents. Its final task was to conduct a large field trial with 40 participating companies in 10 US cities. Today, the work of the Auto-ID Center has helped to make RFID economically viable for pallet and carton-level tagging. The technology is also becoming more affordable for high-value items.

The Auto-ID Center officially closed on 26 October 2003, transferring all its technology to EPCglobal, which will administer and develop the proposed standards in the future.

Market overview

Wal-Mart has announced that its 100 top suppliers must tag their deliveries (at pallet level) by 2005. This mandate for a phased rollout, in tandem with large pilots at Target, Albertson and other organisations, including some US pharmaceutical companies, have raised expectations for future market size and growth. This uptake in the supply chain is mirrored by RFID deployments by the US military and by a range of other applications in agriculture, tourism and asset management.

As a result of global RFID pilots and phased deployments, projections for 2005¹ indicate that growth in the worldwide transponder (RFID tag) market will be €667m (\$854m), equating to 24 per cent. At the same time, the value of the reader market globally will grow by 59 per cent to €535m (\$685m).

In Europe, Carrefour, METRO and a host of other organisations are already trialling RFID solutions. Manufacturers such as KiMS in Denmark are also piloting the technology. Research by RF & Microwave Industry News suggests that 41 per cent of European retailers are planning RFID pilots for 2004².

UK logistics provider TrenStar is already using RFID to track reusable assets such as beer kegs. RFID-enabled solutions have also been trialled by leading retailer Marks & Spencer and technology provider HP. In addition, UK government agency the Department of Trade and Industry (DTI) has contributed significant funding to developing RFID technologies to help small and medium-sized businesses (SMBs) increase the efficiency of their operations using RFID-enabled technologies.

This local and global interest in RFID as a key enabler for the supply chain and for achieving greater traceability for goods and equipment is also stimulating the market for software that supports RFID. In 2005, this will increase by 40 per cent to €465m (\$594m)³. ABI Research also highlights that RFID integration services will surpass RFID equipment revenues by 2007, reaching more than €1.1m (\$1.5m) by 2005⁴. In addition, many UK organisations are extending their logistics solutions to incorporate RFID.

¹ Venture Development Corporation, 16th March, 2004

² RF & Microwave Industry News, 5 February, 2004

³ *ibid*

⁴ ABI Research, 10 February, 2004

Understanding the challenges

Supply chain inefficiencies

Today, many supply chain inefficiencies originate from inaccurate data about where products are in the supply chain. Retailers may provide point of sale (POS) data to the manufacturer, but without the knowledge of existing inventory levels and stock in transit, these data points are not sufficient for accurate demand planning.

While there is increasing pressure on manufacturers, distributors, and retailers to maximise efficiency, minimise cost and provide the best value to the end customer, these companies face the following challenges:

- Buffer stocks, out-of-stocks and late shipments impact on margins
- Inaccurate data causes expensive manual interventions
- 30 per cent of supplier transactions contain errors⁵
- €23m (\$30m) is lost per year due to supply chain inefficiencies⁵
- Discontinuous data flow across the supply chain leads to redundant data entry/duplication of effort
- Inability to trace products and ingredients to suppliers and customers makes information sharing and product recalls complex and expensive
- New legislation to track products from source to origin, including European Union directive 2001/95/EC and the Transportation Recall Enhancement, Accountability and Documentation (TREAD) Act
- Leading retailers are mandating supply chain changes

⁵ Market estimates

Technology considerations

RFID presents a number of technology challenges. First, organisations must manage vast quantities of data generated by reading tags on individual pallets, cartons or high-value items. In addition, they must implement a fully-integrated software architecture that enables this data to be analysed and made available to internal and external systems in near real time.

Additional challenges include:

Configuration and management of reader devices – where organisations deploy a large number of readers, the process can be simplified with highly automated tools for set-up, configuration and batch management.

Tremendous data volumes – Each RFID tag is scanned several times per second and many facilities will be scanning hundreds of products simultaneously.

Information maintenance and look-up – Each time a tag is scanned its key attributes must be looked up in a corresponding database in near real time.

Ownership and partner data integration – In complex environments, such as the supply chain, supporting infrastructure must protect data owned by different business partners.

Standards and architecture interoperability – Systems must be compliant with EPCglobal standards for defining product attributes and exchanging data.

To overcome these technical challenges, organisations need to establish clear strategies for RFID deployment. They should also build their solutions on highly scalable systems that are built on open standards such as XML. In this way, they can rapidly create interfaces to enable real-time data exchange between internal and external systems.

Typically, today's trials are based on specific areas of the supply chain where immediate returns on investment can be realised with minimum disruption to existing business processes or technology infrastructure.

Global standards

Many large European retailers have already completed RFID trials with their supplier communities. Such trials are putting pressure on manufacturers and suppliers to tag products before they start their journey through the supply chain. But manufacturers cannot cost-effectively manage RFID tagging mandates from the disparate retailers they serve unless global standards are established.

As RFID reaches a critical mass for deployment and leading retailers and suppliers take the initiative, the goal is to tag goods in a standard way at the point of manufacture. This requires the creation and acceptance of data standards that apply to all countries. It also requires scanners to operate at compatible frequencies.

With Wal-Mart and other large retailers issuing mandates to their top suppliers in the US, the drive to establish global RFID standards is fast gaining momentum. This pressure is being reflected across Europe.

Global Data Synchronisation

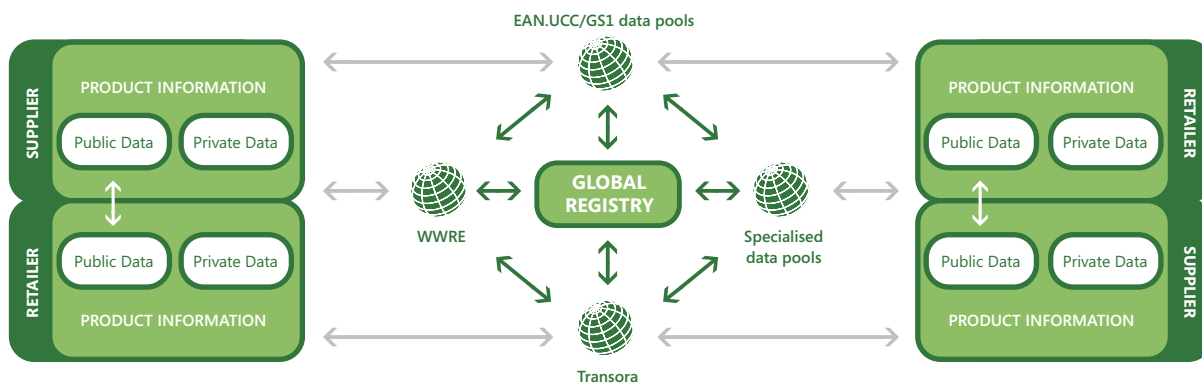
Global Data Synchronisation (GDS) should be viewed as an emerging market in Supply Chain Management. Essentially it is the backbone for enterprise collaboration and the foundation for next generation applications like traceability, RFID-based tracking and CPFR (collaborative planning forecasting and replenishment). As a result data synchronisation is the first step on the path to electronic collaboration. The 'Data Sync First' concept is accepted by most suppliers and retailers in the grocery sector.

GDS is designed to help keep the supply chain operations of all trading organisations synchronised by ensuring that basic product data, such as the description and category stored by one company, matches the data stored by their trading partners. Organisations submit their product data in a specified format to data pools around the globe which will then be validated against a global data registry. Any changes will be flagged immediately across the trading community.

GDS standards are being steered by a group of retailers and manufacturers known collectively as the Global Commerce Initiative (GCI), and are being developed by EAN International and The Uniform Code Council (EAN.UCC/GSI). The standards assign key attributes to product data, enabling manufacturers, suppliers, retailers and other supply chain players to share and understand product-related data worldwide.

EAN.UCC/GSI says: "Imagine, as a manufacturer, that your product catalogue is available worldwide in an efficient and easy to search way. Imagine, as a retailer, that you could search for any type of product and have access to what is available worldwide. Imagine now that when you start doing business with your trading partner, data will be exchanged in a seamless and streamlined way all along the supply chain allowing for the right amount of goods to become available at the right place and at the right time."

By cleaning and synchronising data, organisations create a firm foundation for the deployment of RFID. However, additional standards are required to support wide spread adoption of the technology.



EPCglobal

EPCglobal, a member-driven organisation comprised of leading firms and industries focused on creating global standards is developing a standards-based network to support RFID globally. Where data has been synchronised effectively, the technology makes it possible for business partners to identify items and share information relating to them, including their location. This information can then be made available to other business partners as required.

The Electronic Product Code (EPC) is a key element of this RFID network. It is held on RFID tags and identifies specific items as they travel between locations.

By providing a standard way to attach information to products, EPC enables organisations to share information more effectively. It also increases the speed of supply chain operations because all items are recognised quickly and easily worldwide.

Whereas barcodes refer to a category of product, EPC codes refer to specific events related to a product. As a result, retailers can see exactly what they are selling and whether stocks of blue trousers or black trousers are running low, for example. This also enables greater visibility of customer buying practices, enabling retailers to enhance the customer experience and increase the effectiveness of loyalty schemes.

EPCs are typically embedded in low cost, passive RFID tags. When a reader scans the tag, it transmits back the unique EPC code. This is done with little to no manual effort required compared to the work needed to open boxes and scan barcodes. As a result, all supply chain partners achieve significant operational benefits.

Microsoft and RFID standards

Microsoft is playing a key role in the development of RFID standards globally. It has been an active member of the EAN.UCC working groups, collaborating with organisations such as GCI, CIES, UDEX and others to play a key role in defining standards for data synchronisation.

In April 2004 the company joined EPCglobal, supporting the organisation's goal to make EPC the global standard for immediate, automatic and accurate identification of any item anywhere in the world.

As well as joining EPCglobal, Microsoft has formed a Microsoft RFID Council. The group will look at how retailers and manufacturers can track and ship their merchandise more effectively using the technology.

The Council highlights a growing ecosystem of partners that are building innovative RFID solutions on the Microsoft platform to enhance control of key business processes, improve inventory visibility and provide better customer service for manufacturers, distributors and retailers.

The Council, which operates worldwide, aims to deliver RFID solutions that comply with global standards. They will also be low-cost, simple to deploy and built on a robust, scalable technology infrastructure. Members of the Council already include major consulting firms, system integrators (SIs), independent software vendors (ISVs) and hardware manufacturers.

Microsoft partners Manhattan Associates, Alien Technology and Printronix have also launched an RFID showcase at the world renowned L'échangeur IT showroom in Paris. An Auto-ID lab in Cambridge also showcases the technology and bolsters it with a hands-on introduction to RFID and practical training for RFID adoption.

Data privacy

Key issues for consumers

The benefits offered by RFID provide a compelling case for deployment within the supply chain. However, organisations must be mindful of privacy issues surrounding the technology.

Today, most RFID deployments are supply-chain applications such as tagging for shipping containers or pallets. These do not associate personally identifiable information (PII) with tag identification (EPC) numbers. But with 'item-level' tagging, unique identification numbers in EPCglobal tags might become associated with an individual at the POS when the tagged product, such as an item of clothing, is acquired.

The situation is of concern to privacy pressure groups because:

- RFID can be read through materials, items or packaging, so consumers can never be sure when a tag is present or being scanned
- RFID can be read at a small distance with no overt physical action required to scan the tag
- Data collected from RFID tags can potentially be held by multiple parties, including Internet-accessible databases, causing security concerns
- Tags can potentially remain active outside of the store environment

To ensure that customers' concerns are addressed, retailers and other organisations must undertake initiatives to educate the public on the realities and myths of RFID. Increasingly, such initiatives will demonstrate that RFID is designed to track products and physical assets rather than people.

The kind of passive tags that will be deployed for most retail applications, for example, are only readable from a few metres, ensuring that customers cannot be tracked once they exit the store.

Tags can also be disabled as they leave the store, or placed inside labels that customers can remove from products once they have purchased them.

In addition, it is imperative that all customer-facing RFID-enabled solutions are optional. That means customers must always give their permission before data about them is used.

Microsoft and privacy

Microsoft has a single principle that guides its policies around consumer privacy and data protection: Microsoft customers will be empowered to control the collection, use and distribution of their personal information.

Microsoft's approach to putting consumers in control of their personal data is based on the widely-accepted concept of fair information practices, which form the basis of a number of privacy laws and industry guidelines. As such, Microsoft privacy policies provide a set of standards that apply to all PII, irrespective of the technology in use.

In brief, Microsoft follows the following policies relating to RFID:

- Conspicuous notification must be posted and the governing privacy statement must be available near readers and tags when RFID tags are in use
- Items or packaging tagged using RFID tags must be labelled accordingly
- Privacy statements must include information on the purposes for which tags and readers are being used
- Consumers must be provided with the choice to remove or deactivate tags on purchased items
- Consumers must be notified if personal data associated with RFID tags is being transferred to third parties and provide explicit consent for any secondary use
- Data transfers of personal data must include appropriate security measures
- Reasonable access must be provided for customers to their personal data so they can correct or amend it
- Appropriate security measures must be in place to protect personal information from unauthorised access, use or disclosure
- Reasonable steps must be taken to ensure personal data is relevant for its intended use
- Consumers must have a mechanism for resolving disputes with the RFID data collector
- There must also be an affordable, independent recourse mechanism when complaints or disputes cannot be resolved

To download a Microsoft white paper on RFID Privacy, please visit: www.microsoft.com/twc

Transforming the supply chain

RFID technology promises to create significant value for businesses and consumers by increasing the visibility of products, processes, vehicles and equipment across the supply chain and beyond. In fact, AMR Research estimates that better tracking of goods throughout the supply chain could ultimately result in savings of three to five per cent of total supply chain costs, representing savings of more than €389m (\$499m) per year for manufacturers, distributors and retailers globally.

Not only does RFID reduce the need for manual processes, such as receiving products in the distribution centre, and cut capital tied up in excess inventory. It will also enable impressive benefits for retailers in store. This is because they will be able to check inventory levels in real time and automate the replenishment process. In addition, fully-automated checkout is a realistic possibility for the future, enabling additional efficiencies at the POS.

A recent study from Benchmark Research, on behalf of Microsoft, asked decision makers from within UK manufacturing organisations, where RFID might bring the greatest benefits. Although many did not fully understand the capabilities of the technology, 54 per cent suggested that RFID would increase visibility of orders despatched to customers. At the same time, 52 per cent were interested in the potential of RFID to deliver fully accurate, up-to-date inventory and store

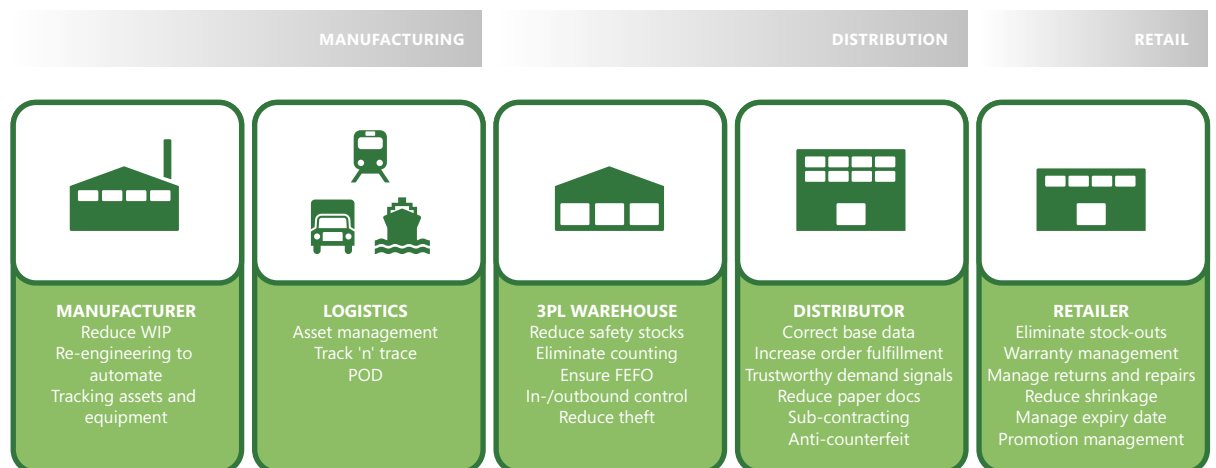
records information, while 39 per cent mentioned better overall visibility across the supply chain. Reduced labour costs were also important to 39 per cent of respondents as was the potential to reduce shrinkage (30 per cent).

By achieving better visibility across the supply chain, many UK manufacturers and suppliers are also hoping to take control of the replenishment process and move to a fully vendor-managed inventory model that delivers benefits to all supply chain players. These suppliers can also make significant efficiency gains from managing product recalls more effectively.

But the retail supply chain is not the only area where RFID promises to deliver greater efficiency. Pharmaceuticals and healthcare providers, for example, are embracing RFID to reduce counterfeiting. In addition, military organisations are successfully tracking the physical location of critical equipment and troops using the technology.

In addition, a range of logistics and distribution companies are exploring the potential of RFID to streamline the management of moveable assets such as cages, vehicles, pallets and beer kegs. Those that have deployed the technology are already experiencing significant benefits. For more details of how RFID can be deployed to increase operational efficiency and minimise costs, please see pages 11-13.

FIG 2 – RFID SUPPLY CHAIN BENEFITS



RFID in practice

To fully understand the capabilities of RFID, it is helpful to consider how the technology can be beneficial in real business situations. The following examples illustrate how the technology can impact throughout the supply chain, delivering efficiencies for three types of organisation: manufacturers, distributors and retailers.

The scenarios focus on a bicycle manufacturer that produces high-end bicycles for the global market. All parts are purchased from vendors, except for the frames, which are made in-house from raw steel pipe. The description shows the potential of RFID to deliver benefits at every stage of the supply chain as the bikes are assembled, distributed to retailers and finally sold to customers.

Manufacturing

The company and all of its suppliers use RFID to share location and other information about the various bicycle parts and subassemblies. This enables vendor managed inventory (VMI) for bicycle components.

For example, a tyre company supplies the bicycle manufacturer with an in-house stock of tyres. Using VMI, this supplier takes responsibility for stock levels at the bicycle manufacturer, which never has to place an order. Each tyre contains an RFID tag that holds product information such as the item and batch number, enabling automated ordering when stocks run low. Both companies always know how many tyres are available in the warehouse and react to requirements in real-time.

Scheduling of assembly orders

Once the bicycle manufacturer has an order of frames ready, it ships them to a paint shop on RFID-tagged pallets containing the production order number and destination. The paint shop is equipped with readers that register specific orders when they are delivered. These are then routed to the correct workstations, paint booths or powder coating facilities.

When the frames have been painted, the system updates tags on the pallets with 'production order complete' status and are then shipped back to the manufacturer. When the goods leave the paint shop, the manufacturer is informed when the goods will return. If there were any problems, this information is entered onto the tag, allowing the manufacturer to take appropriate actions.

RFID readers at the manufacturer recognise the goods when they return from the paint shop. The system automatically notifies the final assembly facility and the order begins.

Distribution

A wholesaler manages the distribution of the manufacturer's bicycles to retailers of all sizes all over the world. This company works with a distributor to deliver a container of bicycles to a retailer. The lorry driver unloads the pallets of goods into the warehouse. As the pallets move from the truck into the warehouse, they pass an RFID reader. This reader picks up the information about the items received and displays them on a screen next to the doors so the driver can see what has been unloaded. Once all the goods are unloaded the trucker confirms that the order is correct and the retailer and distributor systems are updated in real time.

Picking

Picking at the warehouse is done on an order-by-order basis and the goods are shipped to stores on pallets. The pallets carry RFID tags which store the pick list for the order. Because the warehouse handles fulfilment of many sporting goods manufacturers to a number of outlets, the list may contain other items as well as the bicycles.

As new orders are released in the warehouse they are written to the tag on an empty pallet. The next available forklift operator picks up the next empty pallet. The reader on the forklift reads the pick list from the tag on the pallet and displays it on the operator's screen.

The operator drives to the first location to pick the required items. The system monitors the goods collected, verifies that they are correct and deducts them from the pick list. If incorrect goods are collected a warning is triggered. Once the order is complete the operator brings the pallet to the packing area.

If, for example, the tyre manufacturer had a short run of bad tyres, the bicycle manufacturer may need to recall them. In this case, the system would notify the operator when a bike is on the recall list. The operator then takes any recalls to a special section of the warehouse, where they are automatically removed from inventory and put on a pallet for return shipment.

Checking the right goods are on the right truck

Each outbound door has an RFID reader which monitors all pallets that leave the warehouse. Once all the pallets that are being shipped have been loaded onto a truck the operator can confirm that this has been done correctly on screen. A warning is triggered if there are any errors.

Retail

Retailers track items using systems similar to those in the warehouse.

Store level inventory control

One of the bicycle manufacturers' customers is an exclusive retailer in the United Kingdom. The retailer uses a perpetual SKU-level inventory scenario that tags and tracks items through the receiving process. In the future, it intends to extend this to tagging individual items and tracing them through to the POS.

Receiving

As soon as an order is despatched from the warehouse, the retailer receives information on when the goods will arrive. When the shipment is unloaded at the back of the store, data is collected from RFID tags attached to each pallet. This is accessed, summarised and compared to the expected shipment.

Any discrepancies are reported and considered as "shrinkage" until the discrepancy is resolved because the store will be charged for items present in the shipment data.

Receipts are logged into a store perpetual inventory database. Items that have been recognised are entered into the store inventory records. As a result, systems are updated automatically in real time, increasing the efficiency of their operations and ensuring the accuracy of data by eliminating human error.

Shelf stocking

As pallets of merchandise are received in the back room, the data is made available to a function for scheduling the stocking process. The application is 'aware' of current

inventory levels in the store and will schedule stocking of merchandise that is either out-of-stock or at a low inventory level. Merchandise that is bulky or difficult to stock is scheduled for delivery when the store is closed or customer traffic is expected to be light. Merchandise is stocked in a sequence that spreads the available stocking labour throughout the store.

Available store labour resources are taken into account when a shop stocking schedule is produced. The stocking application can present the shop assistant with a shelf stocking list either on a printer or wireless terminal. The shelf stocking work list indicates the location of the merchandise on the pallet as well as indicating a shelf location for merchandise placement.

When the store assistant indicates that the shelf or rack stocking is complete, an RFID shelf-checker application audits the restocking function and the store shelf inventory levels. Some stores have backroom or secondary stocking areas within a store. The stocking function not only includes putting away new merchandise but also moving merchandise from secondary locations to primary selling areas.

Store replenishment and ordering

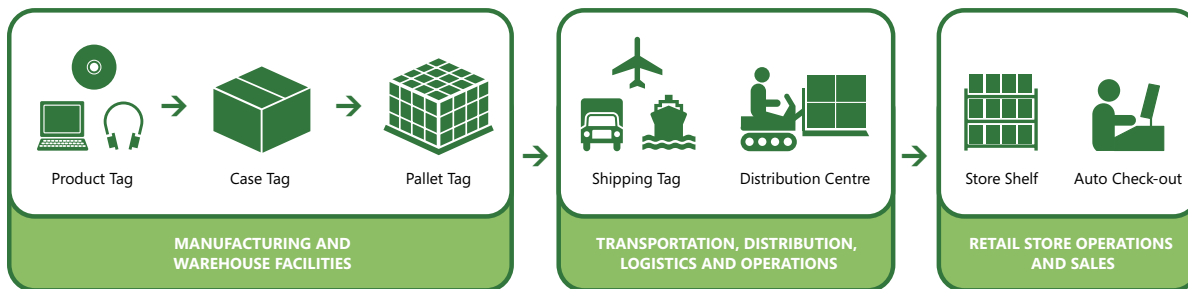
In the future, each item of stock will have an RFID tag attached at the point of manufacture. These will enable the store to check its inventory levels quickly and effectively. The item-level tags will be able to see discrepancies between the items on the shelves and the store inventory. These could then be noted and reported.

After checking inventory levels in store, the system will also generate an order and check it against the supply chain for any likely problems.

POS checkout process

Traditionally, all checkouts use barcode scanning. If a local cycling team bought new kit, the shop assistant currently scans the first item and then uses the quantity key to multiply that scan, instead of scanning each item individually.

FIG 3 – RFID-ENABLED TRACKING OF INVENTORY THROUGH THE SUPPLY CHAIN



As a result, the retailer can't collect accurate pricing information or details such as the size and colour of goods sold.

To address these issues, the store plans to upgrade its checkout process to include RFID scanning of all products at the POS. This will enable the store to implement an end-to-end automated inventory process.

The proposed system will independently recognise each product sold at the register using RFID for inventory and the barcode for sales.

In addition, goods will be scanned at the POS with no human intervention as they pass within a certain distance of a reader. This makes the checkout process faster for the customer and more efficient for the retailer, who can deploy employees to other, more customer-facing activities.

Theft

The store is also planning a system to deactivate the tags as products leave the store. The devices that will disable tags can also potentially be used to determine whether items have been scanned at the POS before they leave the store. In doing so, these will help stores to detect shoplifters and reduce shrinkage accordingly.

Find merchandise in the store

The retailer could also use item-level tags to quickly locate items in the store, thereby increasing operational

efficiency and service for the customer. Phone calls and wasted visits to the stock room will no longer be necessary.

Customer loyalty

The retailer caters to an exclusive clientele of racers and aficionados. As an ultimate goal, it would like to give each customer a store card with an embedded RFID tag. Customers who agree to having such a card could be scanned as they enter the store. Those who prefer not to be identified would have a privacy flag next to their details on the database. In this case, nothing would disturb the customer while shopping.

By tagging loyalty cards, the retailer could potentially harness information on customer shopping history to offer willing customers personalised offers in store. To enable this, a shop assistant would have to review customer data once they are identified by the system. The employee could then approach the customer and offer items that may be of interest. Eventually, this process could be fully automated, with offers and promotions made to customers' phones or PDAs, through mobile devices mounted on shopping trolleys or through kiosks.

Item level tagging will mean that each bike sold eventually has a tag containing the date of sale, service plan and repair record. This would enable the retailer to effectively manage warranty agreements and identification of bicycles in the event of theft.

Microsoft architecture for RFID

Microsoft has created a reliable, cost-effective software platform to support RFID-enabled solutions. It is built on open-standards-based technologies that can work with third party applications and business processes. With the choice of sourcing and integrating hardware from a wide range of suppliers comes potential for a resultant reduction in hardware costs.

Flexible middleware that connects with existing software and maximises the value of previous technology investments, enhances the Microsoft platform, and drives interoperability with other applications and technologies.

What follows is a high-level vision of how Microsoft technologies can be implemented to support RFID.

RFID layered architecture

Microsoft offers a comprehensive software architecture to support RFID-enabled solutions. This is based on existing products and some proposed new components and is based on work that is currently underway in the Microsoft technology labs. The architecture incorporates:

Layer 0 – Devices

Consists of RFID devices, which are primarily RFID readers and barcode scanners from third-party manufacturers.

Layer 1 – Data collection and management

Includes the entire hardware infrastructure, operating systems, networks, and other components required to support RFID. This layer understands when RFID tags have been read more than once and discards unwanted data.

Layer 2 – Event management

Enables business processes and solutions to leverage the real-time data generated by RFID technology. It also provides structure for integrating with multiple facilities and partners, and interoperating with the EPCglobal network.

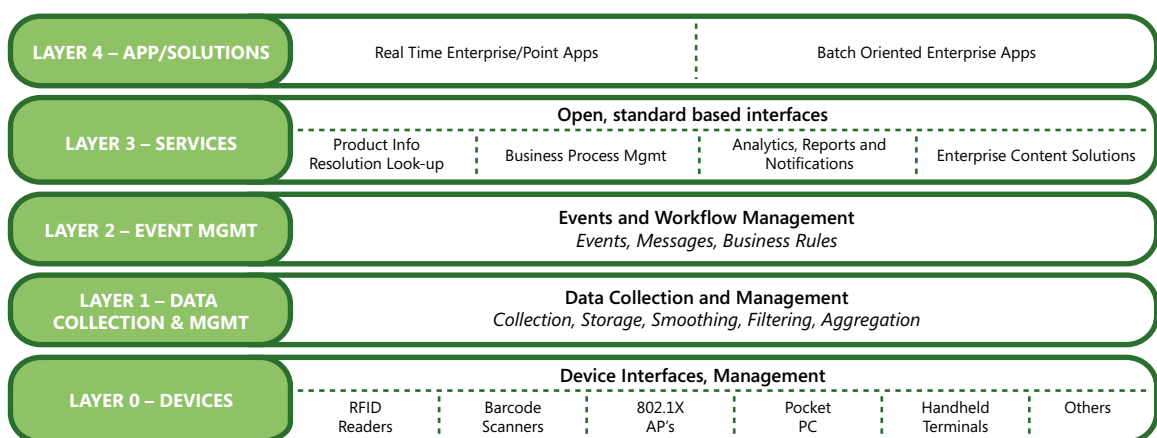
Layer 3 – Services

Includes various services relating to business intelligence, analytics and reporting.

Layer 4 – Applications/solutions

Enables the deployment of specific enterprise applications such as Microsoft Business Solutions ERP or RFID-enabled partner solutions for specific vertical sectors.

FIG 4 – RFID LAYERED ARCHITECTURE



Partner strategy

Microsoft's RFID strategy is based on collaboration with world-class industry experts, application software vendors, systems integrators, equipment manufacturers and retailers.

Software, hardware and integration partners are required to develop and implement a solution. In turn they need an affordable, reliable, open-standards-based platform that can support RFID devices and applications – enabling customers to achieve greater operational efficiency and reduce costs.

Microsoft takes the position that because RFID functionality is seen as a competitive differentiator, it is important to maintain a position of continuous opportunity evaluation to support partners' RFID efforts. To complement this activity, Microsoft created a global RFID Partner Advisory Council to address critical customer challenges jointly with key partners.

Microsoft and its partners also recognise that within this development and support activity, the need to respect customer's privacy expectations and concerns around RFID technology is paramount.

Details of a sample of Microsoft's key partners who are developing RFID-based solutions can be found within this section; however this is not an exhaustive list. For further information on the full Microsoft partner ecosystem for RFID please visit www.microsoft.com/partners



Accenture has been working with RFID technology for nearly a decade. The Accenture Technology Labs predicts and resolves key issues surrounding the implementation of RFID. For the near term, the vision for RFID is to eradicate black box areas of the supply chain – allowing for a new level of visibility into product location and movement that would eliminate uncertainty across the value chain.

Accenture is leveraging RFID solutions to deliver innovation to companies today. Benefits include:

- Reduced shrinkage
- Increased supply chain visibility
- Improved manage asset management
- Reduced labour
- Counterfeit prevention
- Easier product recall
- Reduced out of stock

As technology uptake and enhancements deepen, another wave of direct-to-consumer applications can be foreseen where products will communicate to their owners when they are near-empty, or send a warning if they are being improperly used.

Accenture is a pioneer in the area of RFID and electronic product codes: It is a founding member of EPCglobal (formerly the Auto-ID Center), the group that is setting the standards for this technology around the world. For the past eight years, the Accenture Technology Labs have been immersed in RFID and electronic product code research and development.

Accenture offers high-performance solutions that help its clients across varied industries to seize the opportunities the technology offers – from efficiency and profitability to complete value chain transformation. It is recognised by analysts and the media as the leader in RFID and electronic product code technology.

Partner strategy continued



Capgemini
www.capgemini.com

Capgemini, one of the world's foremost providers of Consulting, Technology and Outsourcing services, has a unique way of working with its clients, which it calls the Collaborative Business Experience. Through commitment to mutual success and the achievement of tangible value, the company helps businesses implement growth strategies, leverage technology, and thrive through the power of collaboration. Capgemini employs approximately 55,000 people worldwide and reported 2003 global revenues of 5.7 billion euros.



HP
www.hp.com

HP is dedicated to driving global RFID standards, implementing RFID practices within its own supply chain and developing new solutions and services to help customers simplify change and reduce costs. To help tighten the link between business and IT, HP has launched the first of several RFID Centres of Excellence and expanded its RFID technology solutions.

HP has also joined EPCglobal, an international RFID standards board leading the development of industry-driven standards for RFID and electronic product code (EPC) technologies.

HP offers RFID-enabled retail goods and RFID consulting and integration services. It is also a participant in global RFID standards development, an early adopter of RFID in its own operations, and an innovator of technology solutions.

HP is committed to RFID testing involving both pilot testing and global rollout. To support overall readiness for RFID-tagging goods to be shipped to Wal-Mart, HP has begun programmes at all appropriate sites worldwide. All targeted sites have been provided with overall RFID awareness and education and have project managers prepared to work with the best-practice solutions developed at the pilot sites.

HP's current efforts in RFID are being applied across five pillars:

- Providing vision and innovation
- Leading the move toward global standards, and new products and solutions
- Using RFID to achieve internal benefits
- Providing RFID-enabled goods such as printers and printer cassettes to customer supply chains
- Providing services that will help transform supply chains, increase velocity and visibility.



Intel
www.intel.com

Intel is working with technology leaders, retailers, consumer packaged goods companies and researchers around the world to drive solutions from Intel® Itanium® 2 architecture running back-end databases, to end user devices based on Intel® Centrino™ Mobile Technology or Intel® XScale® technology. These technologies will provide the underpinnings of a transformation that will lower inventory and supply chain management costs and drive customer loyalty through a new personalised shopping experience.

Intel, the world's largest chipmaker, is also a leading manufacturer of computer, networking and communications products.

Infosys (NASDAQ:INFY) defines, designs and delivers IT enabled business solutions. These provide you with strategic differentiation and operational superiority, thereby increasing your competitiveness. Each solution is delivered with the industry-benchmark Infosys Predictability that gives you peace of mind. With Infosys, you are assured of a transparent business partner, business-IT alignment with flexibility, world-class processes, speed of execution and the power to stretch your IT budget by leveraging the Global Delivery Model that Infosys pioneered.

The key to realizing the benefits of RFID lies in ensuring that enterprises do the right things and do them right. Infosys helps you get more out of your RFID program by ensuring that you do both. The success of your RFID program depends as much on selecting the right processes within your value chain as on effective technology selection and efficient implementation. Our phased approach is designed to help you in identifying and mitigating process, technology implementation and adoption risks that could derail your RFID program – thus increasing the chances of realizing the results you envision. Infosys' 7 Layer RFID reference model illustrates how various component 'layers' need to come together to realize the benefits that RFID can deliver and is a useful lexicon for communication between business and technology stakeholders. We start by helping you identify strategic benefits of employing RFID within your enterprise in the context of your organization' readiness to harness the technology's innovative potential. We then help you develop the business case and implementation blueprint – and then seamlessly move to the solution construction and implementation phase. Infosys' Logical Reference Model and Reference Architecture for RFID Integration (Patent Pending) enable seamless integration with your existing Enterprise Systems. Our lightweight, low TCO software solution for RFID Integration is flexible and both vertically and horizontally scalable. The combination of our RFID experience, proprietary service stacks and software components, alliances and deployment expertise helps you get more from your RFID investments. Our work with successful RFID initiatives spans multiple industries. We have been involved across the RFID adoption chain from upfront RFID potential assessment to architecture and all the way through implementation. The first-hand insights we have gathered into the challenges, opportunities, solution approaches, best practices and success factors, complement our domain knowledge and technology expertise. To you, this translates into the higher likelihood of being able to get to where you should be with your RFID program.

Intellident is the leading UK system integrator for solutions based on Radio Frequency IDentification (RFID) technologies, which are already revolutionising many areas of business where barcodes have previously dominated. Part of the £1.2 billion LINPAC group, Intellident has already secured the world's largest contract for the roll-out of RFID technology in the retail supply chain.

Its corporate strategy is to be the leading system integrator of RFID technology in the UK. With over 20 years experience in installing cost-justifiable barcode labelling and tracking systems, and more than 5 years experience in delivering RFID solutions, it is well placed to offer the products, solutions and expertise required to maximise the potential of RFID in real world applications.

Its corporate client base includes over 1000 installations across Europe, all relying upon the Intellident 'single source' approach. Clients include many household names such as Marks & Spencer, Unilever, Sony, IBM, Natwest Bank, Barclays Bank, Zeneca Pharmaceuticals, Glaxo Wellcome, Smith Kline Beecham and John Lewis Partnership, all of whom have invested in and trust Intellident's ability to deliver and support.

Partner strategy continued



Manhattan Associates
www.manh.com

With so many steps involved in implementing an RFID solution, it can be hard to know where to begin. For example, which type of tags, readers, printers, middleware and software to choose and which vendor to use for each of these components.

Manhattan Associates' RFID in a Box solution is a flexible, scalable and componentised solution that provides everything needed to deploy and begin using this technology.

Manhattan Associates' highly configurable Integration Platform for RFID eases integration across platforms and eliminates much of the custom development typically required of an RFID project. Built on a foundation of integration with high-speed, high-volume systems – such as conveyors, advanced material handling systems and voice recognition technology – this platform can integrate RFID into any supply chain execution (SCE) or ERP application. The result is a reduction in overall implementation time and cost.

The first supply chain software provider to join the Auto-ID Center (now EPCglobal), Manhattan Associates has used this knowledge to become an early adopter of EPC-compliant technology and develop partnerships with best-in-class RFID suppliers. Manhattan Associates has over 900 clients with solutions installed in more than 1600 facilities worldwide.



TrenStar Inc.
www.trenstar.com

TrenStar Inc. is focused on pioneering its unique "pay-per-use" mobile asset pooling model that is best described by its highly publicised beer keg partnerships with Scottish Courage, Carlsberg-Tetley and Coors in the UK that utilise RFID tracking technology. The UK operation, formerly KTP Limited, is TrenStar's centre of excellence for systems integration with particular expertise in bar coding and radio frequency technology. TrenStar UK deliver data capture solutions to customers on a "technology-only" basis as well as data capture solutions as an enabler to the overall TrenStar mobile asset management proposition.

Over the years, TrenStar UK, has enjoyed consistent growth and established a depth of expertise that has attracted a large and loyal, blue-chip customer base dominated by the European supply chain.



Unisys
www.unisys.com

Unisys has extensive industry expertise in: life sciences, consumer packaged goods and transportation/logistics, dedicated specialists in supply chain management and emerging technologies. Our Global Infrastructure Services unit works closely with an array of partners, enabling fast, efficient, secure and robust deployment of the latest technologies. Our component-driven architecture provides for optimal flexibility in integrating emerging technologies with legacy and enterprise applications. As a member of EPC Global, we are well versed in the business case analysis and value targeting across all elements of the supply chain.

Examples of Unisys experience in RFID

- Implementing zero-gap security solutions for the Department of Defense, the U.S. Transportation Security Administration and other exacting clients. Specifically, Unisys helped the U.S. Army build and manage the world's largest RFID network, securing more than 25,000 containers per day in more than 50 countries.
- Leading four pilots for the TSA's Operation Safe Commerce and including the largest pilot at the Port of Long Beach/Los Angeles.

Conclusion

RFID offers new levels of visibility for companies that want to track physical items between locations. In the retail supply chain, goods tagged at the point of manufacture can now be traced from the factory to the shop floor, providing a real time view of inventory for all supply chain partners.

Awareness of RFID technology and the benefits it delivers is increasing across the industry. By playing a key role in developing the infrastructure required for RFID, Microsoft is contributing to the momentum of mass deployment.

The fully-integrated Microsoft architecture for RFID embraces a vision for increased operational efficiency and reduced costs. It enables the exchange of RFID-related data in near real time across disparate systems and corporate boundaries. It also supports standards for global data synchronisation and interoperability with EPC, which is a prerequisite for global adoption of RFID.

Microsoft is playing a leadership role in RFID, data alignment and traceability through participation in a number of industry initiatives and involvement in the development of standards for RFID. Our RFID Council is also contributing to the development of the technology by helping organisations track items more effectively.

Through a network of world-class partners, including ISVs, hardware vendors and systems integrators, Microsoft is delivering RFID solutions that add value to businesses and enable fast returns on technology investments.