

## RFID tags – an intelligent bar code replacement

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**Key topics**

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- ***Describes how the use of Radio Frequency ID (RFID) wireless technology significantly enhances supply chain processes and delivers customer service improvements***
- ***Establishes strategies and describes processes for integrating RFID tags into core business applications***
- ***Emphasises the requirement to develop an information management structure to drive business improvements***
- ***Sets out the key success factors in ensuring a successful RFID implementation.***

**Executive summary**

As global competition intensifies in response to tougher trading conditions, organisations are striving to attain process efficiencies that will enable them to drive down costs and provide competitive advantage.

As a result, throughout the supply chain, from manufacturer to retailer, organisations are looking to drive down cost. During the past decade, supply chain management has seen a complete overhaul of traditional logistics procedures as tight integration between warehouse, distribution and retail have smoothed out duplication and improved time to market.

However, further improvements have been constrained by the technology used to track goods through the supply chain. Bar codes, while representing a significant step forward when first introduced decades ago, have significant limitations. In addition to being prone to damage, they require human intervention to be read and provide limited information since they only represent a product number.

To achieve the next leap forward in supply chain efficiency, many organisations are turning to Radio Frequency Identification (RFID) Tags. The use of Radio Frequency ID wireless technology provides organisations with an opportunity to significantly enhance supply chain processes and deliver improvements in customer service.

Unlike bar codes, RFID tags are robust and do not need line of sight identification, removing the need for human intervention. They are also programmable, holding information such as destination, expected weight and a time stamp.

RFID tags enable automation throughout the supply chain, including optimisation of warehouse space, reduced shrinkage and improved goods tracking. This provides a platform for cost reduction and improved customer service.

This paper considers the importance of integrating the use of RFID tags into core business processes and business systems to achieve real efficiency improvements, cost reductions and customer relationship enhancements. It also sets out the case for a strategic look at the development of an information management structure. Only with this in place can organisations exploit the availability of real-time, accurate information and drive new applications and processes that will deliver additional value.

#### **The business challenges**

Economic slowdown is putting huge pressure on organisations to remove extraneous costs from their business processes. As a result, over the past decade there has been a revolution in the way retailers interact with their manufacturing and distribution partners.

Through strong partnerships, most retailers have squeezed as much cost out of the products as possible and are increasingly focusing on eliminating cost from the supply chain. This means at every link in that chain, organisations are tasked with addressing key areas of inefficiency.

Just-in-time retailing has seen stock levels fall to unprecedented lows within the retail environment. However, this has increased the pressure

on manufacturing and distribution companies to meet retailers' specific needs within a shorter timeframe. Since order cycles are down, the time goods spend in transit also needs to be reduced if delivery pledges are to be met.

#### **Improving supply chain efficiency**

However, there are still further areas to address:

##### *Maximising warehouse space*

With the high costs associated with storage real estate, the goal is to maximise warehouse space. This will improve utilisation without undermining the ease with which goods can be moved in and out.

##### *Minimising goods shrinkage*

Theft combined with imprecise inventory management can create a significant shortfall in actual versus expected goods available. Within the retail environment goods shrinkage is widely perceived to account for up to one per cent of stock, representing a significant dent in profit margin.

##### *Minimising errors in delivery*

The more tightly integrated the supply chain, the less leeway there is for error. Misdirected deliveries or incorrect orders can immediately result in on-shelf out-of-stock situations for a retailer leading both to reduced sales and damaged customer relationships. Indeed, for organisations reliant on the delivery of specific components to fulfil their own order schedule, such errors can have a serious impact on customer satisfaction.

*Minimising inventory*

The widespread introduction of just-in-time retailing has enabled retailers to reduce their stock levels but distribution companies now hold increased quantities of just-in-case, or buffer stock, to ensure they can meet retail demands. Improvements in supply chain visibility based on accurate, up-to-date information will aid the reduction of these buffer stocks.

**Improving customer service**

In addition to specific improvements across the supply chain, organisations are also constantly striving to improve customer service to create a tighter bond between supply chain members and build customer loyalty.

Real-time tracking of goods throughout the supply chain provides excellent opportunities for improving customer service. Real-time information on delivery time supports just-in-time manufacture and retail, enabling organisations to make strategic decisions with full confidence in the availability of goods.

Goods tracking is also important for direct end-customer service. Leading package delivery companies have gained significant market share by offering parcel tracking via the Internet as a fundamental element of the service.

There are many additional areas where accurate, real-time goods tracking can deliver significant improvements. For example, lost luggage is estimated to cost the airline industry in excess of \$100 million annually. Any improvements in this area not only reduce the cost of compensation payments to customers but also significantly improve customer service.

### **Current limitations**

Over the past couple of decades, goods passing through the supply chain have been traced via bar codes. However, bar code technology has a number of limitations and does not meet today's needs for several reasons:

#### *Damage*

Bar codes are prone to damage. Because they have to be placed on the outside of a package they can easily be physically destroyed. Additionally, in warehouses and during distribution, grease and dirt can make them difficult to read.

#### *Human Interaction*

Bar codes require human intervention to operate the scanning device that reads the codes. This need for close line of sight between the scanner and bar code constrains stock storage design – and hence warehouse space allocation – to ensure goods can be easily located.

#### *Lack of Information*

While bar codes have undoubtedly helped to deliver significant supply chain improvements by providing information which drives operational systems, they cannot be programmed and can only provide the most basic product number information.

This passive technology is constraining the development of automated processes that can improve supply chain efficiencies.

### **The role of RFID tags**

Radio Frequency ID (RFID) takes the concept of automatic data capture a significant step further. A RFID tag is a wireless system composed of a tag containing a semiconductor device (which can be either active or passive) and a reader or radio.

Active tags are larger, more expensive and contain a battery to provide power to the semiconductor device. A common example of an active RFID tag is the automated car toll system employed on many bridges and toll roads such as EZPASS in the Northeast US.

Passive devices can be quite small, are usually under \$1 in cost and do not contain a battery. The radio sends out a signal through the air, which activates the RFID tag device and causes it to send out its data. This technology is already in use in many ways today – albeit invisible to the user – in cars and running shoes.

Over the past few years, RFID has begun to move from an experimental phase into mature, proven technology – its inclusion in major consumer applications underlines this.

#### *RFID in use – Prompt purchasing with Speedpass*

In the US, the MobilExxon Speedpass uses RFID to enable customers to buy petrol and other goods from a petrol station without using cash or a credit card. An RFID transponder in the pump or cash register recognises a Speedpass user's dedicated identification code and then automatically charges purchases to an existing credit or debit card.

*RFID tag technology – the benefits*

One of RFID's most important attributes is that the tags do not require line of sight to be read or close proximity to the reader. This means that readers can be located at the entrance to a warehouse for example, automatically tracking goods in and out. Additionally, without the need for human intervention, RFID tags are ideal for 'clean environments' such as scientific or electronic production areas.

Unlike bar codes, RFID tags are programmable and can hold a variety of information including location, destination and product identification number. Additional information such as size and weight can also be included where required.

Unlike bar codes, RFID tags are also not susceptible to damage from dirt, grease, or being physically damaged.

RFID tag technology has achieved maturity over the past few years. Products are manufactured by a number of different suppliers and are now reliable and flexible in design and application.

However, price remains a limitation. Today, RFID tag prices do prohibit their use extensively within a retail environment where the unit price of goods is low – grocery for example. However, they are applicable for higher priced goods, particularly those vulnerable to theft such as electronic goods. As the use of RFID tags increases, prices are expected to reduce significantly, opening up new business application opportunities.



*Integration with core business applications*

The key to RFID tags' further enhancement of the supply chain is automation. To achieve those benefits, the information held on the tags has to be made available in real-time to business-critical applications.

By leveraging RFID tags' programmability and integrating them into core business systems, such as ERP applications, organisations can begin to introduce new business processes. These can then address the challenges outlined above – namely warehouse maximisation, inventory minimisation and improved customer services through accurate goods tracking.

*RFID in use – Keeping track of goods with RFID*

On route to their end destination, goods often pass through several depots. As they move in and out of each depot their location is identified automatically by an RFID tag system. The information is then automatically sent to a central monitoring application where it is used to direct the goods to an appropriate part of the depot or next transport vehicle. Information can also be shared with the sender and end customer. Goods arriving late, or at the wrong destination, are immediately flagged up and reassigned to the correct place – all without human intervention and in real-time. In this way, the accuracy and timeliness of goods flowing throughout the supply chain is significantly enhanced.

Exploiting the power of RFID technology is not simply about replacing bar codes with tags. The specific benefits that RFID tags offer over bar codes present the opportunity for entirely new ways of working.

RFID automates the collection of information, making it more accurate and less costly. Making the most of this technology requires an enterprise-wide information management infrastructure that can handle the information quickly and direct it towards the right business application.

#### **RFID application areas**

RFID data collection is only the front-end to a total solution. It is the way in which organisations use this information that drives improvements throughout the supply chain.

##### *Warehouse management*

Because it does not require line of sight or human interaction, RFID enables improved use of warehouse space. Goods do not need to be stored according to product type for manual location, so can be stored in the most efficient manner based on size and shape. If necessary, warehouse managers can also use hand held devices to locate goods, improving the efficiency of location and picking.

Since goods are automatically tracked in and out of warehouses, the process of inventory management is totally automated using RFID tags. With automated readers, pallets do not need to be checked for individual content and the process of moving goods in and out of the warehouse is improved. Additionally, the significantly improved accuracy of inventory reduces the level of shrinkage experienced in the warehouse, while the tags also provide an excellent means of combating theft.

*Distribution*

The information held on RFID tags provides highly reliable tracking throughout the distribution system. Goods can be tracked in and out of depots and if required, in and out of specific vehicles. One of the main causes of goods being delayed or lost in transit is as they pass through different depots on their way to the final destination. Automated, real-time tracking minimises that risk, particularly with the addition of date/time information programmed into the tags to provide a comprehensive audit trail.

Additionally, distribution companies can automatically inform customers – and suppliers – when goods are in transit and provide accurate expected delivery times.

This information can also be made available over the Web, providing customers with self-service access to delivery schedules.

*Retail store*

While these tags are still too expensive to be used for small price items, they do have a place in stores with higher priced goods that are vulnerable to theft – such as CDs and electronic goods. Introducing RFID tags enables retailers to reduce shrinkage due to theft and inaccurate stock-taking.

*RFID in use – Healthy customer relationships with RFID*

A hospital equipment provider is dependent on a critical component part to deliver a key service to a customer. The company needs to know whether the part will arrive within a pre-defined time frame or whether to make contingency arrangements. With RFID tags, the component part provider, and/or distribution company, can share this information with the customer with complete faith in the accuracy of estimated time of arrival. This enables the hospital equipment provider to take the appropriate course of action to meet its customer's needs.

*RFID in use – High quality manufacturing assured with staff tagging*

Manufacturing environments with complex but essential production processes are attaching RFID tags to staff to ensure the right processes are being carried out. Should an incorrect process be undertaken, an alarm is automatically raised, reducing the production of incorrect or under-par goods.

*Smart labels*

In response to requests for cheaper RFID tags, the industry has recently introduced 'smart labels'. These labels are being produced in very high volumes and costs are in the tens of cents rather than dollars range. This technology is applicable to items with a lower unit cost, such as library books, express parcels and insurance or legal documents. A further cost benefit is that the labels are re-writeable, so can be easily updated in line with a change in document status, for example.

*RFID in use – Streamlining libraries with smart labels*

Libraries are using ‘smart labels’ to streamline the flow of books and other materials making the checking in and out of items faster and more accurate than previous bar code readers. Each smart label has a unique identification number and is programmed with additional information such as type of media and storage location. In addition to improving inventory management, libraries have faster access to information about the availability of a book for example, improving the service offered to customers.

**Ensuring a successful RFID implementation**

Bar codes have become completely integrated in the supply chain process with direct links to ERP applications. At a basic level, replacing bar codes with RFID tags is a simple concept. However, to really achieve long-term, quantifiable benefits throughout the supply chain, organisations need to take a more strategic look at business processes and how they can be improved or amended to take advantage of the depth of accurate, real-time information now available.

Key success factors include:

- *Working with a partner who understands not just RFID technology but core business systems and supply chain challenges. The technology is relatively mature, it is its implementation that needs to address business issues.*

Work with partners who understand your ERP application to ensure good integration of RFID tags into core systems. IBM has huge experience in supply chain and logistics and works closely with strategic business partners such as i2.

- *Understanding how RFID tags can work for your business. This is dependent on the cost of individual items – are RFID tags appropriate or is the individual unit cost too low? Would smart labels be a viable option?*

What is the most appropriate location of the tags? RFID tags can be introduced to goods during the manufacture process, either on individual item or at pack, box or pallet level, depending on relative cost. What information should the tag hold? Tags can hold a range of information, including destination, identification number and number of items on a pallet as well as time or date stamp information for audit tracking.

- *Understanding the pitfalls of RFID. RFID is not infallible and has to be used within the technology and distance limitations. Radio waves are always vulnerable to interference so it is important to work with a partner who understands how to design a robust, reliable system.*
- *Developing new applications and processes to leverage the information now available.*

*a. Business Intelligence strategies*

Business Intelligence tools enable organisations to leverage the wealth of information available to drive operational and strategic improvements throughout the supply chain.

*b. Customer service initiatives*

Sharing information with customers and suppliers up and down the supply chain not only drives efficiency but also provides a platform for building customer loyalty.

*c. Completely new applications*

For example, automated luggage handling systems.

*RFID in use – Limiting lost luggage with RFID*

As airlines discover that customers are more worried about lost luggage than delayed flights, airports are beginning to exploit RFID to improve luggage tracking. New luggage handling systems incorporate smart labels, enabling luggage to be tracked throughout the system from check-in through to the destination luggage reclaim. Using the programmable nature of RFID tags, alarms can sound if an item of luggage is being loaded onto the wrong flight, or unloaded too early from a long-distance flight with stopovers. The systems are widely expected to result in significant reduction in lost luggage and a resultant improvement in customer satisfaction.

**Conclusion**

Supply chain efficiencies are being driven by improvements in information accuracy and availability. RFID tags represent a significant step forward from traditional bar code technology and offer highly reliable data capture without manual intervention.

RFID automates data capture, but it is only by integrating that data capture process into core business processes and business systems that real improvements in efficiency, cost reduction and enhancements to customer relationships can be achieved.

Organisations need to take a strategic look at the development of an information management structure that exploits the availability of real-time, accurate information and amend and develop business applications that drive business improvements.



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