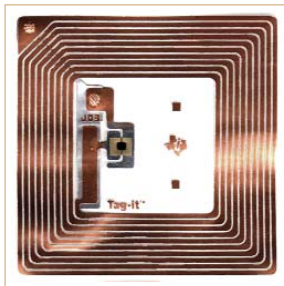


*White Paper:*  
RADIO FREQUENCY IDENTIFICATION (RFID) IN RETAIL

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PREPARING FOR FURTHER  
GLOBALIZATION WITH RFID

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# PREPARING FOR FURTHER GLOBALIZATION WITH RFID

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*According to RFID survey results from AMR Research's third annual Retail and Consumer Goods Executive Conference, more than 60 percent of participating executives indicated that their companies are currently evaluating RFID and electronic product codes, the latter planned as the next generation of the UPC. This finding suggests that due to the sheer volume of companies considering the use of new tracking options, companies that fail to develop a proactive RFID strategy may find themselves at a competitive disadvantage in the near future.*

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## INTRODUCTION

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Radio frequency identification (RFID) may very well represent a competitive imperative for retailers. Its ability to help reduce costs, improve customer satisfaction, increase efficiency in supply chain management, improve security and control inventory loss is immediate and measurable. It may be the “silver bullet” that will help some retailers make the transition to new global product code standards being imposed in 2005.

The Universal Product Code (UPC) system of bar codes has served its purpose wonderfully for many years. Its groundbreaking ability to provide valuable information to retailers was without precedent. Now, however, it is time to look at technology that can offer quantum leaps in benefits to retailers.

This white paper introduces RFID, presents a list of ways that retailers can benefit from RFID technology, and examines the impact of trends that are emerging elsewhere in the world.

*Retailers need innovative ways to differentiate themselves in highly saturated and cluttered markets. New, enabling technologies that speed processes—and, as a result, customer service or supply chain activities—can help accomplish this objective. One such technology is radio frequency identification.*

## WHY RFID?

Retailers need innovative ways to differentiate themselves in highly saturated and cluttered markets. New, enabling technologies that speed processes—and, as a result, customer service or supply chain activities—certainly deserve a place at the top of any retailer's wish list. Yet any such technology must also help reduce costs and produce other business benefits, such as rapid return on investment and serving as a springboard to other opportunities.

One such technology is RFID. Simply stated, RFID uses radio frequencies to transmit data between a portable device and a managing com-

### REAPING THE FULL BENEFITS OF RFID

RFID technology will affect nearly every touch point from the manufacturing of goods through the placement of goods at the retail shelf.

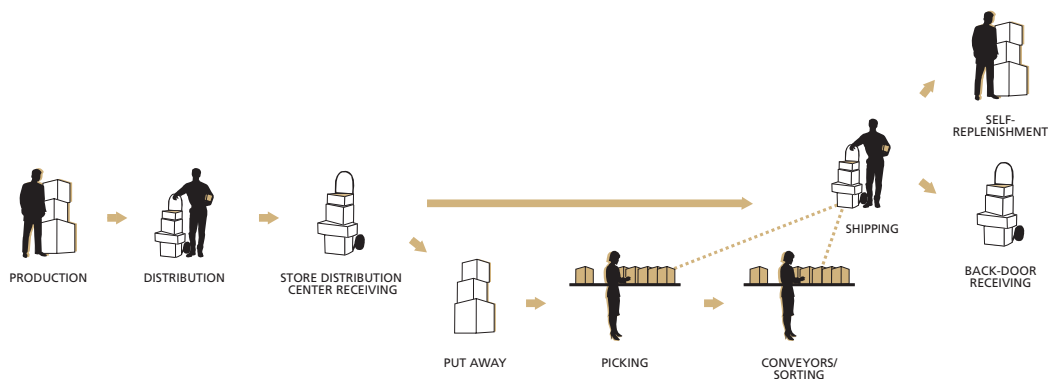
Requirements for site, tag, antennas, reader, multiplexer and controller must be analyzed. The level of tracking—for example, item, container and pallet—must be determined before implementation. Thereafter, the maintenance of the hardware and the analysis of data will be required to sustain the value RFID can provide.

puter. RFID allows a remote mechanism, such as a hand-held device or a satellite, to track products.

The most common use of RFID is as a replacement for the aging UPC technology. RFID tracking devices offer many advantages over bar-code systems, including:

- *No line of sight required.* Physical contact is not required between the data carrier and the communication device. For the typical retailer, this means that instead of having to walk down each aisle within a store or warehouse to take inventory, workers can execute a command somewhere within that same building and complete the inventory calculation in minutes. The savings of time and money can be enormous, as can increases in accuracy and data availability.
- *Read/write capabilities* can be performed within the same assembly line or remotely across continents.
- *Mobile tracking devices* can be reused or disposed, as the RFID operation requires.
- *RFID ensures a 100-percent scanning achievement rate* in the first pass of the item being scanned. This compares very favorably with the best bar-code systems that still experience a 2 to 3 percent failure rate in first passes.

## WHAT IS RFID?



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*Some pundits refer to RFID as being “bar codes on steroids,” but it is really much more than that. Fortunately, the technology behind RFID is not as complicated as it may first sound. In addition, the benefits of RFID can be significant, as leading retailers have already proven by implementing this technology in stores and warehouses.*

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- *Multiple tags can be read simultaneously.* This is known as cluster reading and accelerates the data collection process considerably.
- *All-weather capability.* RFID provides the retailer with the ability to scan through all types of weather, as well as through other surroundings such as metals, bodies of water and dirt. With this capability, RFID succeeds where normal bar-code scanning typically fails.
- *Cost takeout.* RFID can lower total costs for a retailer’s scanning operations.

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## BUSINESS BENEFITS OF RFID

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RFID technology can produce many benefits within a retail environment, including:

- *Automated checkouts.* RFID technology can calculate the total cost of merchandise in the cart automatically, thereby reducing operating costs, speeding the checkout process, reducing errors at the cash register, increasing customer satisfaction and reducing theft.
- *Pricing accuracy and localized pricing.* Smart shelves with liquid crystal displays can ensure pricing speed and accuracy. With the increase in the use of price optimization applications,

RFID allows for immediate local pricing based on the results from the optimization output. This can reduce promotional re-pricing time significantly, providing retailers with enormous competitive advantage and labor savings. For example, one retail chain discovered that it could save \$11 million per year by reducing the labor efforts necessary for weekly price changes at the shelf level in 4,000 stores.

- *Store visibility.* Retailers enjoy better visibility into store operations using RFID, including receiving, backroom stock information, stock-outs and the whereabouts of inventory in the store, whether on display or in the dressing room. This visibility enhances both customer service initiatives and merchandise security endeavors.
- *Automated physical inventory counts.* With RFID-ready detectors on all items, retailers can run physical inventories multiple times daily or on demand. Inventory counts take just minutes to complete and require literally no human intervention once they are set up the first time. Retailers can save millions of dollars annually by reducing or eliminating physical counts.
- *Supply chain efficiency.* RFID tags can provide extra security for cargo, improve visibility and lower the cost of moving goods. They ensure that the right merchandise is shipped to the right store at the correct time. Supply chain efficiency results in the reduction of labor force and an increase in sales, including asset tracking, reduction of out-of-stock scenarios, reduced inventory, quicker delivery, ability to determine freshness status, track and trace, produce to demand, faster recalls, and easy and accurate returns.

- *Merchandise quality.* RFID can alert the retailer regarding expiration dates and times on food and pharmaceutical products. This allows spoilage and legal liability to be constructively contained.
- *Loss prevention.* With RFID tags, items can be marked and tracked electronically. For example, asset tracking typically leads to better merchandise management in stores. RFID can also identify sources of diversion and counterfeiting and help with theft prediction.

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## RFID BASICS

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RFID has been around for many years and has advanced greatly since those early years. It enables the data capture and tracking of items using radio frequencies to transmit data between a managing computer, also known as a host or programmable logic controller (PLC), and any of several portable devices. The key components of an RFID system include the portable tracking devices and an antenna and controller:

### *Portable Devices*

Four types of portable devices are most widely used for RFID solutions:

- *Passive tag*—a low-cost device that has a near-limitless shelf. Because of their cost, retailers usually use these tags for inventory tracking instead of consumer applications.
- *Label*—a low-to-medium cost, self-adhesive paper or plastic tag that uses a radio frequency coil printed, embedded, punched or etched into it. These devices enable companies to track items once they are on a store shelf, thereby enabling virtually instant physical inventory counts.
- *Printed circuit board* —a medium-cost, high-end radio frequency device that can withstand high temperatures, although it does require additional protection in order to be able to withstand other environmental hazards such as water, moisture, dust and mud. These devices are popular because they can be embedded directly into shipping pallets (plastic ones work best), thereby creating a highly durable and traceable shipping container.
- *Active tag or transponder*—high-cost device with its own internal power source, usually a renewable power source or a battery with an extremely long life. Transponders are commonly used for tracking high-value inventory. In retailing, these might include portable bar-code scanners, computers or other targets of theft.

Operational considerations will determine which of these are best for a given RFID solution.

### *Antenna and Controller*

An antenna and a controller complete the RFID cycle once the portable tracking device has been chosen. The purpose of the antenna is to transmit radio waves to and from the mobile tracking device. The controller manages this communication and moves the data from the antenna to and from the personal computer or PLC device. A PLC device is

### KEY COMPONENTS OF AN RFID SOLUTION

- Hardware, which includes servers, readers and writers, tags, controllers, and cabling.
- RFID software for integration to back-end and legacy applications.
- Enhancement of legacy applications to sustain the value RFID can provide.

an RFID reader and writer machine that has both an internal antenna and a controller.

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## OPERATIONAL CONSIDERATIONS

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As with any technology, RFID solutions include variables that need to be considered as part of the solution design, including:

- *Data needs.* The most important consideration is the amount of data that must be stored on the tag or label. In the event that more than a few dozen bytes of data storage are necessary, options may quickly become limited.
- *Data transfer requirements.* The amount and direction of data transferred in a single transaction is a key consideration. In a read-only environment, any tag type is available, but in a read and write situation, active or passive tags may be the only options.
- *Climate.* Where RFID is deployed is a major factor in determining the most appropriate types of client devices. In a retail environment where dirt and moisture are prevalent and bumping or jarring can occur, the ever-sensitive active tags or printed circuit boards may not be good choices. Labels are typically better options in retail. Should items need to be submerged—tags on live lobsters in a grocery are good examples—certain types of passive tags may be required.
- *Cost.* If cost is no barrier, choices abound. However, if cost is an issue, passive labels remain the cheapest alternative.
- *Operating environment.* Distances and data transmission and receiving speeds in a given situation may dictate the type of tracking device used. For example, tags and printed

circuit boards are good for situations requiring both data reading and writing. But if speed is an issue—such as when tagged items are speeding by on a conveyor belt—a tag may be the better option. In the same scenario, the RFID reader also probably needs to be very close to the conveyor belt for optimal performance.

- *Antenna options.* Three factors determine antenna choice. First is distance. Tracking every item in a store, warehouse or scope of operation mandates use of a standard RFID antenna. However, the size and position of the antenna is dependent on distances between the tracking devices, as well as any barriers between the tracking devices and the antenna. The choice between a PLC device—that incorporates the controller into the antenna—and a series of cheaper antennae is another

## COST STRATEGIES

RFID deployment cost strategies include:

- *Low cost*—passive tags, which are read-only tracking devices.
- *Low to medium cost*—labels, which include low-cost read-only versions and medium-cost read and write versions that actively store data.
- *Medium cost*—printed circuit boards, which are read and write tracking devices.
- *High cost*—active tags, or transponders, which are read and write tracking devices that may actively seek out antennas and controller devices.

Other cost considerations include the breadth and complexity of the business problems being solved. For example, the solution may encompass the entire supply chain or only one point within it.

consideration. In addition, the tracked items' route—that is, whether or not it goes through an RFID tunnel (see “Send It in a Letter”) will determine the necessity for using multiple antennae.

- *Radio frequency bandwidth range.* The Federal Communications Commission strictly regulates and mandates which frequency ranges are permissible in any RFID solution—specifically, 50-500 KHz, 13.553-13.567 MHz, or 0.9-2.48 GHz, also known as the low, medium and high ranges, respectively. The low range is typically for short distances. The high range is for long distances. Note that the gigahertz range, which uses microwave technology to transmit RFID data, can hit dead spots that can effectively prevent an RFID antenna from “seeing” its tagged devices. While the likelihood that this may occur is slight, this condition can occur when a microwave radio wave bounces back to its source after contact with a metal object—a problem that is neither consistent nor predictable. Yet because it is still an issue, this bandwidth range is best used on moving targets rather than stationary objects—which means that even if a dead spot is hit, once the targeted device moves, this “dead zone” should automatically be eliminated.

Ultimately, the total cost of ownership will be a key factor in the decision as to which RFID solution is selected and how it is deployed.

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## TRENDS AFFECTING RFID ADOPTION

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In addition to the benefits and operational considerations surrounding the question of RFID deployment, a number of other key issues and trends should be considered, including emerging concerns

about privacy and the transition to true global product identity code standards.

### *RFID and Privacy*

One of the leading arguments against the use of RFID in retail stems from the perceived loss or lack of privacy that would otherwise be provided to the recipient of the RFID-tagged item. Many consumer-oriented watch groups have identified RFID as a technology from which consumers

## ARCHITECTURE AND DESIGN CONSIDERATIONS

- Read-only tracking devices versus read and write capabilities.
- The distance to be covered for any read/write operations.
- Amount of data storage in the client-side tracking device—for example, tag, printed circuit board or label.
- Frequency of operation.
- Frequency of client-side tracking device usage.
- Maximum speed of client-side tracking devices as they pass a reader.
- Location of the reader and antenna device(s).
- Amount of data transferred during read and write operations.
- Minimum physical separation distance between client-side tracking devices.
- Number of client-side tracking devices to be read simultaneously or individually.
- Reading and writing of client-side tracking devices through physical barriers such as plastic, metal, water, dirt or the like.
- Implementation of data security.

### SEND IT IN A LETTER

Several postal organizations employ a postal tracking system to track bags of mail as they are sorted and shipped throughout a postal system. This RFID solution uses the positioning of multiple read and write antennae that can read and write data from multiple locations in a fast-paced operation.

potentially will need protection. They reason that the ominous parties, perhaps government organizations, might use RFID to track prison parolees, postage stamps, currency and individuals using a national identification card.

Although deployments of RFID in the consumer sector have not approached this level of invasion, consumer protection groups continually remind the public that RFID technology has the capability to be invasive. This being the case, they contend, it is just a matter of time before serious privacy invasion takes place.

Consumers Against Supermarket Privacy Invasion and Numbering (CASPIAN) has lobbied against RFID and has enjoyed some success, most notably in regards to Benetton's plan to deploy some 15 million RFID chips into its clothing labels. An international boycott of Benetton by CASPIAN resulted in a settlement of sorts: In April 2003, Benetton released a statement that said it would only use embedded RFID chips in tags that could be discarded at time of purchase. The situation with Benetton highlights potential consequences that could result if the privacy issue is omitted from RFID deployment decisions.

#### *The Push Toward Global Trade Item Numbers*

RFID technology can help push the consumer products industry into a more rapid adoption of

both Global Trade Item Numbers (GTIN) and Electronic Product Codes (ePC).

UPCs are used throughout North America, with the notable exception of the book industry, which long ago standardized on the International Standard Book Number sequencing that is best known as ISBN. The European Article Numbering (EAN) standard is the product identification used internationally. Under EAN, GTIN is considered a replacement for the 12-digit UPC code on the back end, while ePC is intended to be the updated form of the UPC bar code. There has long been a push to standardize on the EAN globally. Giving strength to this push is the fact that 99 member organizations within the EAN international group represent 101 countries—a powerful presence in business communities.

Evidence of this influence already exists. The Uniform Code Council has declared that, on January 1, 2005, all U.S.- and Canadian-based companies must be capable of scanning and processing EAN-8 and EAN-13 symbols. This is in addition to being able to handle the current UPC standard symbols at all U.S. and Canadian point-of-sale (POS) devices.

This requirement will immediately affect two major areas within most consumer products businesses: front-end POS systems and back-end enterprise resource planning, supply chain management and merchandise management systems. Some experts believe RFID can serve as the driving force in the transition, perhaps even helping companies achieve “sunrise compliance” long before 2005.

Why is this transition critical? POS scanners and systems must have the capability to scan EAN symbols, because offshore producers will stop relabeling with

UPC symbols, while increasing the size of the ISBN numbering system from 10 digits to 13, which means that even the book industry will need to comply with EAN. Back-end systems must be updated to replace internal product identification capabilities—often UPC—with GTIN or provide a mapping function for data synchronization and trading partner document creation, such as purchase orders and receiving documents. Primary concerns involve the ability to scan EAN-8 and EAN-13 symbols in addition to UPCs at POS devices. It is also critical to assess if the computing systems are in a position to process GTINs.

Delays in compliance can create serious business consequences for retailers, distributors and manufacturers of all products. For example, the failure to update systems may include one or more of the following consequences:

- The inability to share standardized information with trading partners.
- Additional product marking costs for trading partners and, ultimately, consumers.
- Service problems for consumers.
- Time-to-market delays and other critical inefficiencies.

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## NEXT STEPS

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An RFID solution is a demand and supply chain process improvement technique, as opposed to being merely a new technology. From trials to mass adoption, RFID may require years of development before it achieves critical mass across the retail industry, even though the impending “sunrise 2005” date may accelerate the pace. Trigger points include diminishing prices of the tags and readers,

awareness and education of executives within retail supply chain and store operations, and the potential to improve inventory management and customer service while reducing selling, general and administrative costs.

With all of these factors in view, an obvious next step is to increase familiarity with this latest process-improvement technique. The easiest way to accomplish this is through workshops, conferences and online meetings, although a quick perusal of a Web site might serve as a good starting point.

You can also rely on the consumer team from BearingPoint to provide guidance and insights into the world of RFID. With our view of the entire RFID “ecosystem,” we are well positioned both to devise an appropriate RFID strategy for your enterprise and to operationalize it. To learn more about RFID and how our associated merchandise supply optimization solution can help you drive sales and improve margins, please contact your local BearingPoint consumer professional.

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