

Implementing RFID for Rapid ROI and Long-term Success

Radio frequency identification (RFID) technology is poised to dramatically impact and improve the way manufacturers, distributors and retailers do business and interact with each other. RFID technology replaces printed barcodes with electronic tags that can discretely identify individual items and can be automatically tracked as they move through distribution channels. By helping companies observe and understand the movement of inventory in real-time, RFID will reduce instances of out-of-stocks and unsaleable product, reduce shrinkage and product loss due to theft and dramatically reduce the cost and manpower affiliated with moving and monitoring inventory.

While many companies have experienced project-specific success with internal RFID-based asset tracking and small-scale pilot programs, larger scale RFID adoption is now being driven by mandates from very large retailers and consumer such as Wal-Mart, the United States Department of Defense, Target and Albertson. These purchasers are requiring suppliers to implement RFID tags on all cases and pallets within the next few years.

To satisfy these requirements, manufacturers are rapidly designing, testing, and implementing RFID technology specifically to satisfy the conditions of the mandates as they are currently defined. However, analysts warn that companies that rush to develop “slap and ship” RFID programs specifically to satisfy mandates like these are likely to implement technologies that will need to be replaced in just one or two years. In addition, these purely mandate-driven RFID initiatives fail to consider and leverage the many ways that RFID can enable internal improvements in areas such as revenue generation and operational efficiency.

As the world's largest independent provider of business integration software and a leading enabler of real-time business, TIBCO is uniquely committed to helping companies implement standards-compliant RFID solutions that meet today's requirements while supporting tomorrow's needs.

This paper is an introduction to the benefits and challenges of implementing RFID technology, and TIBCO's solution for RFID implementation and integration.



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The Impact and Importance of RFID

Imagine a supply chain where manufacturers, distributors, and retailers can automatically locate any of the items that were shipped in a given case or pallet. In this scenario, receiving facilities would know immediately whether a shipment's contents match the advance shipping notice, and the right personnel would be immediately notified of any discrepancies. Manufacturers and retailers would automatically adjust forecasts and orders based on sales velocity during promotions. Theft or tampering would be immediately evident, without requiring product inspection.

Radio frequency identification (RFID) technology is poised to transform this futuristic vision into reality by replacing printed barcodes with unique tags that store individual item information and transmit the data to RFID readers. RFID tags can store large amounts of unique information (upwards of 64 bits), dramatically surpassing the potential of barcodes which can hold only 12-15 characters of information. This means that RFID tags can be used to identify not just a class of products, but individual instances of pallets, cases and items.

Unlike barcodes, which require an established line of sight and correct orientation with a scanner, RFID tags transmit identification data through almost any kind of packaging, so the contents of a case or pallet can be read and confirmed almost instantaneously without requiring individual product scans. By "tracking and tracing" RFID-generated data across the supply network and putting it in the context of detailed business process information (such as manufacturing and shipping history), RFID can provide complete, real-time visibility into product lifecycle and supports strategic demand-driven supply network initiatives.

The Evolution of RFID Adoption

Although in its early stages, RFID is expected to transform industries by enabling enterprises to gather detailed information at the pallet, case, and product level at any point in the distribution process. Several global companies experimenting with RFID initiatives have already realized exceptional results. By placing RFID tags on their high-value beer kegs, British brewery Scottish and Newcastle saves \$25 million annually by reducing the number lost in transit or not returned by customers. After a three-month pilot program, The Gap, Inc. reported that RFID tagging improved in-store inventory accuracy from 85 percent to 99.9 percent. After replacing barcodes on trays, dollies, and roll cages with RFID tags that include the supplier's name, product information, and sell-by date, Marks & Spencer's Food and Logistics estimates that they reduced the amount of time required to read stacks of trays by more than 80 percent.

However, the widespread adoption of RFID technology will be driven not by internal initiatives such as these, but by mandates being established by some very large retailers and consumers. Wal-Mart, Target, Tesco, and other large retailers intend to reap the benefits of RFID technology by requiring that cases and pallets delivered by suppliers use RFID tags, with deadlines ranging from 2005 to 2007. These purchasers plan to use RFID to streamline their own business processes by speeding the identification and processing of massive inventories and reducing the amount of hands-on product handling. Some analysts expect Wal-Mart to save more than \$1 billion annually.¹ And this is just the beginning. Over time more and more large purchasers, retailers, and government agencies will see the potential value of RFID and implement similar mandates. For example, the U.S. Food and Drug Administration suggests the broad adoption of RFID tagging to ensure pharmaceutical security and integrity by 2007, and at some point will almost certainly convert this suggestion to a mandate of some kind.

Benefits

RFID offers potential benefits beyond compliance with customer requirements. Enterprises can utilize data gathered from RFID scans to create real-time supply chain visibility, making it possible to identify and respond to challenges as well as opportunities for improvements. Some benefits of RFID include:

- **Reduced out-of-stocks.** Reading RFID tags at the case level enables retailers to identify potential out-of-stocks and place immediate replenishment orders with the distribution center or manufacturer, improving customer satisfaction and increasing sales.
- **Enhanced security and reduced shrinkage.** By tracking individual cases of high-value products as they move through the supply chain, RFID tags helps reduce theft and tampering, and decreases costs associated with loss prevention.
- **Improved delivery receipt and reconciliation processes.** RFID speeds the order-to-delivery cycle time by providing instant, accurate information about the contents of a shipment, making it possible to quickly ensure correct delivery and improved shipment receipt reconciliation or more accurately identify the discrepancies and analyze root cause.
- **Improved management of time-sensitive goods.** Goods with limited shelf lives can be more closely monitored so older products can be rotated to the shelf front before expiration.
- **Better inventory and warehouse management.** RFID improves inventory accuracy by reducing the number of times workers must "touch" a case or pallet to determine its content, and reduces warehouse cycle times by allowing personnel to identify the contents of cases and pallets without slowing down to locate and scan each individual barcode.
- **Better defect tracking and recall management.** If a product is discovered to be defective after it has been delivered to the consumer, RFID-generated data can be used to analyze the product life cycle in the supply chain. This information can potentially be used to discover where the defect was mostly likely introduced and determine what products need be recalled
- **Faster product velocity.** With the real-time analysis of track and trace information, companies can use RFID data to accelerate product velocity by identifying sales velocity, eliminating distribution bottlenecks and improving inefficient business processes

Requirements for Effective RFID Implementation

Companies seeking to implement RFID are undertaking a significant investment: AMR Research estimates that a CPG company shipping 50 million cases annually will spend between \$13 and \$23 million simply to meet Wal-Mart's requirements.² To recoup their costs, companies should seek to maximize return on investment by choosing technologies that not only meet short-term requirements but expand to meet the company's future needs as well.

Industry analysts at Meta Group suggest that companies develop a proactive plan that includes leveraging RFID data for their own purposes, and not merely a reactive plan that only addresses purchaser's requirements.³ However, some RFID solutions vendors present implementation models that account only for the initial engagement at the warehouse or manufacturing facility. While this approach may appear to be cost-effective, such solutions may limit a company's ability to support future mandates and emerging standards. These short-term approaches also fail to provide a strategy

² RFID in 2005: The What Is More Important Than The When With Wal-Mart Edict. AMR Research. Kara Romanow and Scott Lundstrom. August 27, 2003.

³ RFID: Playing Tag with the Future. Meta Group. Gene Alvarez. January 27, 2004.

or technology approach that will support the integration of an ever-increasing volume of RFID data into the enterprise infrastructure.

According to InformationWeek, AMR Research predicts that many companies racing to meet external deadlines will implement RFID solutions based on architectures that will need to be replaced in just a few years.⁴ Companies should aim to implement an RFID solution that addresses the issues of enterprise-wide scalability and flexibility. Long-term planning considerations include the following:

- How will the enterprise technology infrastructure support massive amounts of new data gathered from RFID scans and route it to the correct applications and business processes?
- How will the enterprise provide business context to the RFID data to identify problems and opportunities?
- What technologies will enhance existing business processes and support reengineering so that the company can implement new practices and applications revealed by data analysis?

To help enterprises develop an RFID implementation and integration strategy that is viable for the long haul, TIBCO has developed a four-stage RFID implementation model which addresses the technology and process management challenges that companies will face in each stage.

2004-2005	2004-2006	2005-2007	2006-2010
Stage I	Stage II	Stage III	Stage IV
Tagging and Tracking	Integrating RFID Data into the IT Infrastructure	Leveraging RFID to Improve Business Processes	Predictive Business

Stage I: Tagging and Tracking

At the first stage of RFID implementation, informally called by some "slap and ship," manufacturers will seek only to satisfy the requirements of mandates established by their key distributors or customers. While they might realize some improvements in inventory, order fulfillment, packing, and shipping, RFID is primarily seen as a cost center at this stage. At this stage, companies evaluating RFID solutions should consider the following issues:

- **Scalability.** The technologies used to gather and distribute RFID data at manufacturing and warehouse facilities should provide the foundation for delivering RFID data throughout the enterprise. The solution should be scalable enough to support the gathering, storing, and routing of increasing amounts of data.
- **Data scanning and integrity.** Tag readers and data collection and filtering mechanisms should offer sufficient data management and smoothing capabilities to accurately read and manage large amounts of incoming data.
- **Long-term viability.** To ensure the protection of investments, companies should invest in a solution that is flexible enough to accommodate future enhancements and emerging standards.
- **Integration with warehouse and factory management systems.** At this stage, RFID solutions should support seamless, real-time data delivery to the local warehouse or manufacturing management system in the appropriate format with the business context.
- **Manageability.** At this stage, RFID solutions should include comprehensive remote equipment monitoring and management capabilities to identify and alert personnel about current or potential failures and noise, and support rapid troubleshooting and problem resolution procedures.

⁴ Data Avalanche. InformationWeek, Rick Whiting, February 16, 2004.

Stage II: Integrating RFID Data into the IT Infrastructure

After assuming the costs of RFID tagging to meet customer requirements, companies will seek ways to recoup their investments and generate additional ROI. Incorporating RFID technology into supply chain management activities can improve asset management and order reconciliation, but realizing these improvements requires that RFID data from warehouses and manufacturing facilities be integrated into the corporate infrastructure.

This requires a solution that can transform, enrich and route the massive amount of data in such a way that it can be accessed by enterprise applications performing tasks such as order and warehouse management. When evaluating a solution's ability to support this requirement, companies should consider the following issues:

- **Reliability and scalability.** An effective platform must reliably manage and route information without interruption. In addition, the distributed architecture must support not only the existing RFID data but also the potentially immense amounts of events that may be created in the future by the utilization of more RFID tags (such as tagging at the item level), more scanning points in the supply chain, and more facilities creating and/or shipping products.
- **Application connectivity.** The solution must provide packaged adapters that can deliver data to ERP, CRM, files, databases, and other systems in the appropriate format immediately and with minimal configuration. The solution must also manage metadata across these applications and maintain cross referencing relationships.
- **Partner connectivity:** The solution must support the large-scale transfer and synchronization of data and documents among trading partners. This should include the execution of UCCnet-based data synchronization and AS2-compliant EDI transactions, and the incorporation of EPC data into advance shipping notices, purchase orders, and other inter-company documents. The solution must be flexible enough to support interactions ranging from batch EDI push to dynamic query responses in real time.
- **Manageability.** To ensure maximum availability and lights out operation of mission-critical applications distributed across manufacturing and distribution facilities, the solution must give administrators the ability to monitor and manage the health of all infrastructure components, including those associated directly and indirectly with RFID.

Stage III: Leveraging RFID to Improve Business Processes

After making incremental supply chain improvements by incorporating RFID data into existing applications, organizations can realize greater gains in supply chain execution by changing the way they do business in such a way that they can identify and respond to changing conditions and demand in real-time.

However, as Forrester Research states, "Firms won't benefit from RFID investments without analytical frameworks that generate actionable insights."⁵ Such an analytical framework will help companies aggregate raw RFID events, decipher business impact and relevance, and transform these insights into actionable practices and processes.

Enterprises that wish to leverage RFID into business process improvements will need the help of business process management and business activity monitoring software that together help them ensure that their people, processes, and technologies are aligned in support of organizational goals. When evaluating technologies that support business process improvements, organizations should consider the following issues:

- **Event-driven rules-based architecture.** An event is an item of interest to a company such as an order, shipment, inventory transfer or a price change. RFID solutions must not only support the identification and management of increasing numbers of events created by RFID, but also the definition and execution of increasing complex of business rules that govern the routing, aggregation and processing of those events.

⁵ The Smart Product (r)evolution. Forrester Research. August, 2002.

- **Visibility into business data and processes.** To enable employees to glean beneficial insights from RFID-enriched data, enterprises must support the aggregation, analysis, and presentation of relevant, timely, contextual, and filtered information about internal and external business activities and key performance indicators.
- **Adaptability.** To ensure that business personnel can rapidly implement process improvements, these solutions should allow business users to define and modify business rules and processes in a graphical, point-and-click manner without requiring custom coding efforts from IT staff.

Stage IV: Moving Toward Predictive Business

Companies that wish to reap the full reward of RFID will ultimately identify the need and ability to incorporate predictive business into their operations. Predictive business enables companies to not just rapidly respond to problems, but to identify and address problems *before* they occur. By using advanced analytics and algorithms to identify and respond to opportunities before they occur, companies that embrace predictive business will create new opportunities to better meet customer needs, such as real-time personalized promotions targeted directly at customers in retail aisles.

TIBCO's Solution for RFID Implementation and Integration

TIBCO, a leading provider of business integration and process management software, offers a comprehensive suite of products and services to help companies design, implement, and maintain a flexible, scalable architecture that deliver the benefits of RFID data throughout the enterprise. And in partnership with RFID leaders, TIBCO provides the hardware, enterprise backbone, middleware, adapters, and application software necessary to implement an effective long-term RFID strategy in compliance with our practical RFID implementation model.

Why TIBCO?

TIBCO's experience and expertise in the following areas help companies ensure a comprehensive long-term RFID strategy and an effective implementation scenario:

- **Leader in Real-Time Business.** RFID will shorten fulfillment and planning cycle times and enable corporations to identify exceptions in real-time. However, before an organization can leverage real-time RFID data, the data must be available and in the proper format to the applications that require it when they require it. TIBCO has been a real-time business pioneer since the 1980s, when we delivered a comprehensive real-time digital infrastructure for the financial services industry. More than 2100 customers around the world, including NASDAQ, FedEx, Delta Airlines, and eBay rely on TIBCO software to route billions of mission-critical real-time events and transactions across their businesses.
- **RFID Leadership and Experience.** TIBCO has established a leadership position in international RFID standards groups. TIBCO was an original member of MIT's Auto-ID center and is a member of EPCglobal, a nonprofit joint venture between EAN International and the Uniform Code Council dedicated for developing industry-driven standards for the Electronic Product Code (EPC) Network. TIBCO Vice President Tom Laffey, who leads TIBCO's RFID development effort, is a technology board member and chair for a Software Action Group for EPCglobal's EPC Information Service. In addition, TIBCO has forged partnerships with the RFID industry's leading providers to deliver complete, best-of-breed solutions to our clients.

Technology Advantages

- **Comprehensive:** TIBCO's software provides everything you need for real-time business in one unified but modular platform with modular components – from messaging and monitoring to application connectivity and

process management to portal and business activity monitoring. TIBCO's software is ideal for the phased implementation of projects ranging from departmental initiatives to enterprise-wide deployments.

- **Reliability and Scalability:** TIBCO's software is based on a service-oriented architecture for maximum performance, reliability, availability and scalability. It also leverages leading security technologies to ensure the privacy and integrity of your sensitive data and processes. Most importantly, TIBCO's software has been proven in real-world customer implementations for many years and in some of the most demanding computing environments around.
- **Easy to Use:** TIBCO's software makes it easy to design, deploy, and manage integration projects with graphical user interfaces that virtually eliminate the need for coding, support for leading standards such as XML, J2EE, Web Services, and evolving EPC standards, automated deployment capabilities, and much more. This ease-of-use translates into rapid time-to-benefit, lower total cost of ownership (TCO), and greater return on investment (ROI).

The Components of TIBCO's RFID Solution

TIBCO has been helping many of the world's leading companies optimize their supply and demand chains for many years. TIBCO's software provides a powerful framework that companies can use to efficiently manage and utilize the massive flow of real-time information that RFID generates.

Enterprise Backbone Software: Messaging and Monitoring Infrastructure

TIBCO's enterprise backbone software utilizes a unique Information Bus™ architecture to provide an extremely reliable and scalable infrastructure for disseminating RFID-driven data and information about business events and activities that are impacted by that data. With powerful messaging and monitoring capabilities, this software serves as the complete foundation for the service-oriented, event-driven architecture that is required to fully integrate and leverage RFID data throughout the enterprise.

EPC Agent and Event Cache Software

TIBCO has developed EPC agent and EPC information server software that supports the demanding requirements of implementing and integrating RFID. An EPC ALE-compliant edge agent ensures that RFID information can be disseminated based on rules and content, and makes it possible to monitor and manage edge applications. The event cache software is a distributed information cache that has been specifically tuned for EPC information service so that RFID information can be rapidly stored in such a way that it is always accessible and can be enhanced with contextual information from business systems for advanced queries and analysis.

Business Integration Software: Connectivity and Process Management

TIBCO's business integration software enables companies to connect any number or variety of endpoints, coordinate processes of any level of complexity, and streamline activities across technological, organizational, and geographical boundaries. This enables the incorporation of RFID-generated information and events into applications and business processes across organizations and their networks of customers and partners.

Business Optimization Software: Business Activity Monitoring

TIBCO's business optimization aggregates, filters and delivers information and interfaces so people can access the data and services they need to participate in business processes, monitor and measure performance, and take action to respond to threats and opportunities as they arise. This ability to incorporate massive amounts of RFID-generated data into a clear and contextual picture of operations and performance makes it possible for companies to use RFID as the impetus for dramatic process improvements.

TIBCO's Solutions in Stage 1

Although the first stage of RFID implementation is typically limited to individual facilities, forward-looking companies will choose infrastructure software and delivery methods that support future requirements for transferring data throughout the enterprise and supply chain. TIBCO's innovative technology solutions for companies at the first stage of RFID include the following:

- **EPC ALE-compliant Filtration and Routing Software.** TIBCO's EPC agent software offers intelligent, rules-based filtering; content-based routing; full compliance with EPC ALE standards; and comprehensive management and monitoring of distributed edge applications. This EPC agent provides enterprise systems and applications abstractions from evolving and maturing lower level reader and edge filtering applications so they can support RFID as capabilities and requirements mature.
- **Messaging Software.** TIBCO's messaging software uses a unique Information Bus™ architecture to provide an extremely reliable infrastructure for communicating both RFID-driven data and higher-level business events. In addition, the software scales seamlessly to serve as the foundation for the service-oriented, event-driven architecture that is required to fully integrate and leverage RFID data throughout the enterprise.
- **Event Cache Software.** TIBCO's expertise in delivering real-time events to highly distributed applications forms the basis of innovative event cache software, a standards-compliant distributed information cache specifically tuned for EPC data (a TIBCO version of EPCglobal EPC information Service). This event cache ensures that RFID information can be rapidly stored, archived, and accessed as well as enhanced with contextual information from business systems for advanced business queries.
- **Management and Monitoring Software.** All aspects of the TIBCO RFID solution are supported by TIBCO's comprehensive management and monitoring software, which extends the monitoring and management capabilities of existing enterprise management software.

TIBCO's Solutions in Stage II

Companies planning for the second stage of RFID implementation will benefit from TIBCO's established position as the industry leader in business integration. TIBCO's enterprise backbone and business integration software ensure that companies can seamlessly incorporate vast amounts of data into their existing infrastructure and applications. These solutions include the following:

- **Messaging Software.** As RFID is rolled out to cover more products and facilities, and the high volume of events that RFID generates increases, the ability to deliver increasing amounts of real-time data is crucial for successful RFID implementation. TIBCO's messaging software provides a foundation for information distribution with extraordinary performance, reliability, and scalability.
- **Business Integration Software.** TIBCO's business integration software offers flexibility, scalability, and extensibility to deliver a long-term event driven and service-oriented architecture that supports not only today's data and application requirements but also the potential exponential growth of data. TIBCO BusinessWorks software is the core element of TIBCO's business integration software. It provides a common framework for integrating incompatible, distributed systems, and supports rapid deployment as well as integration lifecycle.
- **Event Cache Software.** In the second stage of RFID implementation, multiple installations of TIBCO's event cache software can be deployed throughout the enterprise to capture, aggregate, store, and forward EPC information gathered throughout the physical supply chain. TIBCO event cache software holds aggregated EPC information that is further enhanced with business context such as purchase orders, invoices, etc. so it can be used to analyze business process performance and monitor exceptions.
- **B2B Integration Software.** TIBCO offers an extensive line of B2B integration solutions that leverage the TIBCO enterprise backbone to ensure that all partners and customers receive a constant flow of updated, accurate

information, including support for AS2-compliant EDI and UCCnet product data synchronization. These solutions can enable company to exchange business information such as ASN with EPC enhanced data.

- **Portal Software.** TIBCO's portal software leverages a complete set of proven EAI, B2B integration, process management, and Web Services solutions to help customers deploy enterprise portals that give people and trusted suppliers and partners personalized interfaces into EPC information with business context as dynamic, process-driven machine that is your business.

TIBCO's Solutions in Stage III

With the second stage of RFID implementation complete, enterprises have successfully met external tagging mandates and integrated the new data into their existing applications. Organizations will now seek ways to use RFID data to generate unique insights, and optimize business processes to act on newly recognized opportunities.

- **Process Management Software.** In the third stage, organizations can tap into the process management capabilities of TIBCO BusinessWorks to lower IT costs and improve business agility by making it easy to change the technology infrastructure that supports business processes. Wider deployment and infrastructure will enable corporations to adapt business processes and require a substantial change in business processes of order and inventory management while leveraging enterprise wide systems to realize the benefit.
- **Workflow Management Software.** TIBCO's workflow management software helps coordinate business activities for processes that require significant human intervention (such as manual processing or frequent exceptions), and provides tools to measure and optimize their efficiency.
- **Business Activity Monitoring Software.** Business Activity Monitoring (BAM) refers to the aggregation, correlation, and presentation of relevant and timely information about business activities. TIBCO's BAM software provides more accurate information about the status and results of various operations, processes, and transactions so you can make better decisions, more quickly address problem areas, and reposition your organization to take full advantage of emerging opportunities.

TIBCO's Solutions in Stage IV

In the final stage of RFID implementation, enterprises will leverage widespread support for granular, real-time data to sense and respond to rapidly changing conditions and opportunities. TIBCO's Enterprise Event Management (EEM) initiative is leading to the development of software that will help these organizations address complex financial, operational, regulatory and competitive challenges with the following capabilities:

- **Sophisticated business interaction management** to identify problems and opportunities in the ongoing stream of business interactions and events. TIBCO EEM software will help companies track and trace product through supply chain to reduce claim, unsaleables, and diversions. The solutions helps enhance safety and security of supply chain and assists product recalls.
- **Service instrumentation and management**, which improves performance of existing enterprise and legacy systems by capturing key business activities and initiating new processes to replace inventory with information.
- **Ad hoc activity management**, which improves response rates and lowers costs by enabling the identification and management of unanticipated events. TIBCO EEM solutions help companies turn unplanned events into insights by monitoring velocity and deviation. With enhanced visibility of inventory in motion, companies can direct inventories to the customers that need it the most.
- **Real-time operations analysis**, which enables enterprises to measure the real-time impact of business activities on operating objectives such as promotion related revenue management, inventory deployment and to identify exceptions immediately.

Engaging with TIBCO for RFID Success

Contact TIBCO at the onset of your RFID project to develop a customized solution that addresses all stages of the RFID implementation model. Engagements may include the following:

- Business case analysis to determine the most effective RFID implementation strategy for your enterprise
- Pilot programs to deliver proof of concept
- Company-wide rollout in warehouses and manufacturing facilities
- Enterprise-wide RFID data integration based on TIBCO's award-winning enterprise backbone and application adapters
- Business process improvement solutions that leverage RFID data to enable a variety of enterprise-wide benefits

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