

# **RFID in Supply Chains**

**Sunil Avhad**

**Kshitij Ghude**

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### Patni Computer Systems Limited

#### India

Akruti, MIDC Cross Road No.21  
Andheri (E), Mumbai 400 093  
Tel: +91 22 5693 0205  
Fax: +91 22 5693 0211

#### North America

238 Main Street  
Cambridge MA 02142  
Tel: +1 617-354-7424  
Fax: +1 617-876-4711

#### UK & Europe

Vistacentre, 50 Salisbury Road  
Hounslow, Middlesex, UK. TW4 6JQ  
Tel: +44 20 8538 0120  
Fax: +44 20 8538 0276

#### Japan

4<sup>th</sup> floor, Aoyagi Building, Chuo 5-39-11,  
Nakano-ku, Tokyo 164-0011  
Tel: +81 3 53281952  
Fax: +81 3 53281951

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## INTRODUCTION

During the last decade, most organizations have implemented enterprise-wide applications and integration platforms. These implementations have delivered benefits in terms of data synchronization and information flows within the organization, and with trading partners providing valuable inputs for planning and optimization of schedules and reporting. However, automated data capture and tracking in real-time has been a major bottleneck, affecting the ability of organizations to optimize their investments in supply chain solutions.

**RFID or Radio Frequency Identification** is emerging as a technology that could provide the answer to these problems. Using tags, readers and radio waves to communicate between the two, RFID combined with the EPC (Electronic Product Code) would be able to address these pain points and deliver a whole range of benefits across various verticals like manufacturing, distribution, retail, logistics, security. The potential benefits arise from increase in supply chain visibility, increase in efficiencies and decrease in costs due to better data synchronization, increase in responsiveness to changes due to real time information visibility and a number of additional industry / vertical specific benefits. Thus, RFID promises to have a major impact on supply chains allowing trading partners to collaborate more effectively and achieve new levels of efficiency and responsiveness.

Realizing the potential of RFID to deliver major benefits in the supply chain, both end users and technology vendors are moving quickly to harness its potential. End users are conducting pilots to understand the technology, its impact on their processes and the costs of adoption. At the same time, the technology vendors are working to reduce costs and improve effectiveness for the technology. This has led most analysts to predict that the RFID market will touch a few billion dollars by 2005-2007. Meanwhile, announcements from major end users like Wal-Mart, Tesco, US DoD mandating their suppliers to comply with RFID within the next 12-18 months has brought new urgency into the RFID adoption plans of manufacturers and distributors.

## SUPPLY CHAIN PAIN POINTS

Before we delve deeper into what RFID is or how it impacts business processes, let us first try and understand the typical problems that organizations face due to lack of real-time product and data. Some of the problems can be listed as in Table 1.

**Table 1: Pain areas in various verticals**

For Manufacturers	For Distributors
<ul style="list-style-type: none"><li>▪ Lack of real-time data for JIT, Kanban, Kaizen, Six Sigma or Lean Manufacturing strategies</li><li>▪ Tracing product genealogy and location in the supply chain for better recall handling</li><li>▪ Asset utilization due to theft, misplacements, wrong routings and non-visibility of status</li></ul>	<ul style="list-style-type: none"><li>• Labor costs for receipt, put-away, picking and shipping</li><li>• Inventory accuracy, value and location</li><li>• Order dispatch accuracy and rates</li><li>• Shrinkage – Inventory inaccuracy due to the products being misplaced, lost, stolen or wrongly packed for dispatch</li><li>• Low status visibility resulting in higher</li></ul>

<ul style="list-style-type: none"> <li>▪ Equipment effectiveness resulting in lost production or rejections</li> <li>▪ Demand/Supply synchronization</li> <li>▪ Information tracking for compliance with standards and regulations</li> </ul>	<p>inventory levels to cover for higher lead times</p>
<p style="text-align: center;"><b>For Retail Stores</b></p> <ul style="list-style-type: none"> <li>▪ Product receiving labor costs and paperwork</li> <li>▪ Lost sales due to out-of-stock due to incorrect inventory, misplacements, etc.</li> <li>▪ Dated point-of-sale data for planning</li> <li>▪ Proper management of date sensitive inventory</li> <li>▪ Check-out station labor and times</li> <li>▪ Product shrinkage (theft) and return frauds</li> <li>▪ Product return / recall management</li> </ul>	<p style="text-align: center;"><b>For Freight Transport</b></p> <ul style="list-style-type: none"> <li>▪ Data and control for shipment consolidation</li> <li>▪ Asset (fleet, containers, pallets, etc) utilization</li> <li>▪ Asset tracking to manage asset inventories at optimum levels</li> <li>▪ Reduction in waiting time and unnecessary onsite personnel / equipment due to lack of visibility</li> <li>▪ Safety, security and authentication of containers</li> <li>▪ Shipment route audit trail</li> </ul>

Most of these problems can be traced to the lack of real-time product and tracking data.

## ADVANTAGE RFID

RFID, with its ability to read data in tags attached to items, cases, pallets or containers automatically, without manual intervention and irrespective of placement, orientation and at a high rate, is an ideal technology to enhance the visibility in the supply chain. Additionally, RFID enables each item to be uniquely identified, allowing item level tracking to increase the granularity in the supply chain. The data that can be stored in the tag can range from a simple item code to a complete manufacturing or distribution audit trail. This data can also be updated as the item progresses through the supply chain. These key differentiators further enhance the appeal of RFID as a transformational technology to have a major impact on the efficiency of the supply chain.

Before we discuss the value of RFID in the supply, let us first understand how the technology works and what are its major components.

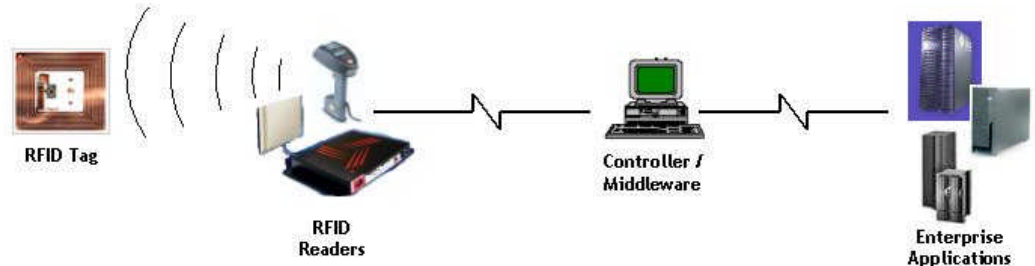
## RFID – HOW IT WORKS

RFID works using radio waves, which means that it is contact-less and does not require a line of sight. At its simplest, a RFID transponder is a tag containing a silicon chip (the memory) mounted onto an antenna (the transmitter). This tag is fixed to an item being tagged. This tag is scanned using an RFID reader (also called an interrogator), which sends energy to the transponder using radio waves. These waves power the transponder, which then transmits the information stored in its chip back to the reader for onward processing. The reader transfers this data to various enterprise applications through specialized middleware, which also acts as a reader controller and preliminary data filter and aggregator.

# RFID SYSTEM COMPONENTS

The key components that make up a RFID system are shown in Figure 1.

**Figure 1: Key components of RFID system**



## RFID TAGS

A RFID tag consists of a silicon chip that stores data and an antenna that receives instructions from and transmits data to the reader. RFID tags can be either active or passive, read-only or read-write. Depending on the application requirements, the relevant tag type can be selected.

## RFID READERS

An RFID reader accomplishes two tasks – it receives commands from the application software; and it communicates with tags. Readers may be stationary, handheld or mounted on mobile objects like forklifts. The reader transmits radio waves through an antenna. The key attributes for a reader are read range, read rate and handle tag or reader signal collisions. These attributes are dependant on the frequency of the radio waves – the most commonly used frequencies are 125~134 kHz, 13.5MHz, 415MHz, 868-925MHz, and 2.4GHz.

## SAVANT OR MIDDLEWARE

Savant or specialized middleware software manages the huge amount of data that is coming from all the readers. Savant performs the functions of aggregating this data, filtering it and forwarding it to the relevant data storage systems or enterprise applications for further processing.

## ONS (OBJECT NAME SERVICE)

ONS would typically store the DNS addresses where additional information related to the EPC is stored, i.e. they would act as the online directory of product information servers.

## PRODUCT INFORMATION SERVER

The product information servers contain detailed useful information about individual EPC codes. This information is stored in a format called the Physical Markup Language (PML), which is based on the widely accepted XML standard.

## WHAT VALUE RFID BRINGS INTO THE SUPPLY CHAIN

The basic benefits that RFID brings to the supply chain are automated real-time data capture related to product information, status information, location and environment status information. Thus, RFID provides a real-time view of how goods are moving through the supply chain, thereby dramatically improving the supply chain visibility, and opening up opportunities for unprecedented gains in the operational efficiency for any organization connected to the supply chain.

The above listed basic benefits drive the secondary business benefits, some of which are as listed below.

**Table 2: Benefits to Manufacturers**

Business benefits	Arising from:
<ul style="list-style-type: none"> <li>▪ Prevention of wrong production runs</li> <li>▪ Measure of actual WIP</li> <li>▪ Ensuring compliance with standards &amp; governmental regulations</li> </ul>	<ul style="list-style-type: none"> <li>▪ Tagging material through the manufacturing process</li> </ul>
<ul style="list-style-type: none"> <li>▪ Improved demand planning</li> <li>▪ Improved availability (product available where required)</li> <li>▪ Reduce excess / safety inventory</li> <li>▪ Identify counterfeit products and their potential entry points</li> </ul>	<ul style="list-style-type: none"> <li>▪ Enhanced real-time visibility in the distribution chain</li> </ul>
<ul style="list-style-type: none"> <li>▪ Audit trail for key products</li> <li>▪ Improved recall management</li> </ul>	<ul style="list-style-type: none"> <li>▪ Ability to track products from raw material to finished product in the retail store</li> </ul>
<ul style="list-style-type: none"> <li>▪ Increase asset utilization</li> <li>▪ Reduce production quality errors</li> </ul>	<ul style="list-style-type: none"> <li>▪ Tracking location, condition and relevant parameters of assets</li> </ul>

**Table 3: Benefits to Retail Distributors**

<b>Business benefits</b>	<b>Arising from:</b>
<ul style="list-style-type: none"> <li>▪ Reduce labor costs for warehousing processes</li> <li>▪ Increase in warehouse processing accuracy and throughput</li> <li>▪ Increase in inventory accuracy</li> <li>▪ Speed up physical inventory process</li> </ul>	<ul style="list-style-type: none"> <li>▪ Automated data capture and compare</li> </ul>
<ul style="list-style-type: none"> <li>▪ Reduce thefts, misplacement and misrouting</li> <li>▪ Optimize work processes to increase productivity</li> </ul>	<ul style="list-style-type: none"> <li>▪ Tracking goods handled</li> </ul>
<ul style="list-style-type: none"> <li>▪ Increase on-time deliveries</li> <li>▪ Reduce inventory levels and safety stocks</li> <li>▪ Reduce inventory of obsolete products</li> </ul>	<ul style="list-style-type: none"> <li>▪ Enhanced real-time visibility in the supply chain</li> </ul>
<ul style="list-style-type: none"> <li>▪ Increase asset utilization</li> </ul>	<ul style="list-style-type: none"> <li>▪ Tracking location, condition and contents of assets</li> </ul>

**Table 4: Benefits to Retail Stores**

<b>Business benefits</b>	<b>Arising from:</b>
<ul style="list-style-type: none"> <li>▪ Reduce labor costs, paperwork and quantity reconciliation</li> <li>▪ Increase in inventory accuracy</li> <li>▪ Speed up physical inventory process</li> <li>▪ Increased customer service levels</li> </ul>	<ul style="list-style-type: none"> <li>▪ Automated data capture and compare</li> </ul>
<ul style="list-style-type: none"> <li>▪ Reduce thefts, misplacement and misrouting</li> <li>▪ Better handling of date sensitive inventory</li> <li>▪ Better returns management and warranty authentication</li> </ul>	<ul style="list-style-type: none"> <li>▪ Tracking goods handled</li> </ul>
<ul style="list-style-type: none"> <li>▪ Better replenishment / re-order control</li> <li>▪ Reduce inventory levels and safety stocks</li> <li>▪ Reduce inventory of obsolete products</li> <li>▪ Higher sales (low OOS)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Enhanced real-time visibility in the supply chain</li> </ul>



**Table 5: Benefits to Freight Transporters**

<b>Business benefits</b>	<b>Arising from:</b>
<ul style="list-style-type: none"> <li>▪ Better control over shipment consolidation</li> <li>▪ Reduced labor and increased throughput</li> <li>▪ Better shipment planning</li> <li>▪ Compressed shipping times</li> <li>▪ Faster and efficient customs clearances</li> </ul>	<ul style="list-style-type: none"> <li>▪ Automated data capture and compare</li> </ul>
<ul style="list-style-type: none"> <li>▪ Enhanced security during shipping</li> <li>▪ Audit trail for tracing shipments</li> </ul>	<ul style="list-style-type: none"> <li>▪ Tracking goods handled</li> </ul>
<ul style="list-style-type: none"> <li>▪ Better delivery reliability and efficiency</li> <li>▪ Better route planning</li> </ul>	<ul style="list-style-type: none"> <li>▪ Enhanced real-time visibility in the supply chain</li> </ul>
<ul style="list-style-type: none"> <li>▪ Increase asset utilization</li> <li>▪ Optimize asset inventories</li> </ul>	<ul style="list-style-type: none"> <li>▪ Tracking location, condition and contents of assets</li> </ul>

**Table 6: Benefits to Life Sciences**

<b>Business benefits</b>	<b>Arising from:</b>
<ul style="list-style-type: none"> <li>▪ Tracking</li> </ul>	<ul style="list-style-type: none"> <li>▪ Automated data capture and compare</li> </ul>
<ul style="list-style-type: none"> <li>▪ Tracking batches / lots</li> <li>▪ Compliance with governmental regulations</li> <li>▪ Better recall management</li> <li>▪ Audit trail for high value, critical drugs</li> </ul>	<ul style="list-style-type: none"> <li>▪ Tagging and Tracking goods handled</li> </ul>
<ul style="list-style-type: none"> <li>▪ Identify counterfeit products and their potential entry points</li> </ul>	<ul style="list-style-type: none"> <li>▪ Enhanced real-time visibility in the supply chain</li> </ul>

## SOME EXAMPLES OF RFID USAGE

A large number of organizations have already started RFID pilot programs to understand the impact on business processes, the benefits that RFID drives and the various issues involved during implementations. Most of these pilots have been more than successful and organizations have either started slowly rolling out RFID on a larger scale or are working on plans to do so.

Some of the examples where RFID has been used successfully to record significant benefits are given below:

***Trials carried out by Auto-ID Center, a joint venture between MIT, end users and technology vendors.*** Participants included Wal-Mart, Tesco, Proctor & Gamble, Gillette, Kraft Foods, Coca-Cola, Savi, Matrics, SAP, etc. The trials were conducted in the US and Europe.

**The Metro Group, one of the large supermarket chains in Europe** opened its Extra Future Store supermarket in Rheinberg, near its Düsseldorf headquarters, in April 2003. The store showcases a range of emerging technologies such as intelligent scales, smart shelves and electronic price labels as well as some item-level RFID tagging to offer a completely different level of shopping experience to its customers; and now has plans to rollout RFID to most of its 800+ stores in a phased manner.

**Prada, the fashion house**, is using RFIDs in its Epicenter store in New York City to enhance the shopping experience with kiosks that give customers access to product information such as cut and fabric details, designer sketches and runway demonstrations in addition to suggestions on accessories or alternative products.

**Ford** uses an RFID system in its automobile assembly plants to request parts replenishment to the line and help forklift drivers deliver those parts more quickly and efficiently.

**TrenStar, an asset management company** provides Carlsberg-Tetley Brewing Ltd and Scottish Courage Ltd., two of U.K.'s leading brewers, with a keg management service. TrenStar put RFID tags on the rim of each beer keg and installed fixed readers in its own depots. Handheld units were given to drivers who scanned the kegs as they went on the truck and as they were delivered to pubs. TrenStar provided kegs to the breweries as they needed them, delivered them to the pubs, picked them up from the pubs, weighed and washed them and then sent them back to the brewery to be refilled.

The results: container losses were cut in half. Cycle time – the amount of time from when a keg is first filled, to when it comes back from a pub and is refilled – improved to 40 days, from 47 days. For each day of improvement, the company was able to free up \$14 million in cash. The company was able to boost sales by 3 to 4 percent by being better able to control the unofficial supply chain.

**Goldwin Sportswear Europe**, the European branch of one of the largest branded sportswear companies in Japan, has piloted the use of RFID tags on individual clothing items to track shipments, prevent unauthorized out-of-area distribution and authenticate products.

**CHEP, a provider of pallets and containers**, is piloting an RFID system to track its pallets to improve how it uses and manages its assets.

## CONCLUSION

It is quite clear that tremendous momentum is building up for the use of RFID in various applications across multiple verticals. The question of implementing RFID is therefore no longer of “Why?” and “When?” but more of “Where?” and “How?”.

## ABOUT THE AUTHORS

### **Sunil Avhad**

Sunil has over 14 years of experience in IT consulting to large industries in manufacturing and distribution, while working in the US, across Europe and in the Asia-Pacific region. He has delivered IT solutions to global clients like Hewlett-Packard, Acer, Sony, Fiat, Carrier, Sensormatic (now Tyco) and Electrolux. He has managed large projects in the area of ERP implementation, development of country locations, data migration, ERP Integration, Application support and Trading Partner collaboration. He has good experience on ERPs viz. SAP, Oracle Applications, BaaN, and PeopleSoft-One (JD Edwards). In Patni he heads a practice in the Enterprise Application SBU and also leads the organization-wide RFID initiative. He holds a Master's degree in Production Technology from IIT Delhi.

### **Kshitij Ghude**

Kshitij is a Software Specialist with a techno-functional expertise of over 14 years. He has worked extensively in the manufacturing industry supply chain with roles in customer requirement analysis, design, procurement, manufacturing, assembly and testing. In IT consulting, he has worked with clients in the areas of ERP, SCM, EDI and eProcurement.

## ABOUT PATNI

Patni is a global IT Consultancy and Services provider with revenues in excess of US \$188 million and over 6500 professionals. Our six offshore development facilities and more than 22 international offices offer strategic advantage to several Global 2000 companies.

Patni delivers high quality, reliable and cost-effective software solutions to clients in the Insurance, Banking & Financial Services, Manufacturing, Energy & Utilities, Hospitality, Retail and Healthcare industries. Our focus areas include eBusiness, enterprise applications, embedded solutions and enterprise systems management, while our service offerings comprise Business Process Outsourcing, re-engineering, application development and support. These capabilities are complemented by our alliances with leading software vendors like Microsoft, IBM, SAP, Oracle, BaaN, Siebel, BroadVision, webMethods, Tibco, SuniForce, Business Objects, Cognos.

An ISO 9001:2000 certified organization, assessed enterprise wide at SEI-CMM Level 5, SEI-CMMI Level 5 and P-CMM Level 3, Patni has also integrated Six Sigma techniques to focus on continuous, measurable process improvements.

### **Patni's RFID expertise**

Patni's dedicated RFID practice offers a complete range of RFID services as part of its Enterprise Application solutions. Patni, with its unique combination of internal strengths and external partnerships, is well placed to address this emerging market for RFID adoption. Patni strengths are derived from domain expertise and service competencies in the areas of ERP, SCM, CRM, Retail, e-Business, Embedded Technologies and Application and Systems Integration. Added to these are the strategic alliances with Enterprise Application vendors.

Patni has forged an alliance with OATSystems Inc, a key technology company, to enhance its service offering and provide greater value to its clients. OATSystems' Senseware provides a complete and powerful standards-based RFID solution for companies in the retail, CPG, manufacturing, pharmaceutical, and logistics markets. In addition, Patni also has partnerships with key RFID hardware vendors.

Patni's RFID Lab is manned by dedicated expert teams. This lab allows clients to understand the impact/ benefits of RFID on their business processes, develop a prototype or simply enhance their understanding during the various phases of RFID adoption.

Patni offers a range of solutions spanning impact assessments, readiness assessments, 'proof of concepts', and full-fledged implementation, enabling RFID adoption with minimal disruptions.

For more information, visit <http://www.patni.com> or contact [rfid@patni.com](mailto:rfid@patni.com).