Supply Chain RFID Applications

Radio Frequency Identification (RFID) technology is a growing area of innovation as Wal-Mart and other retailers make a big push to "tag" items on their shelves for easier inventory management and tracking.

This patent landscape covers the patenting activity with respect to the use of RFID in the supply chain in various industries. The patents reviewed are organized by timeline, companies, industries, and applications. The patents are organized by claims, applications, and a detailed SWOT (Strength-Weakness-Opportunity-Threat) analysis is also provided.

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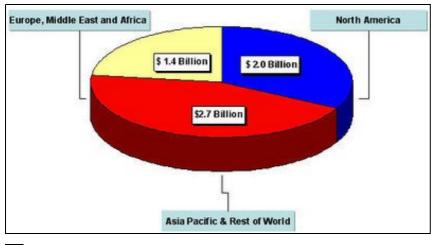
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Rationale

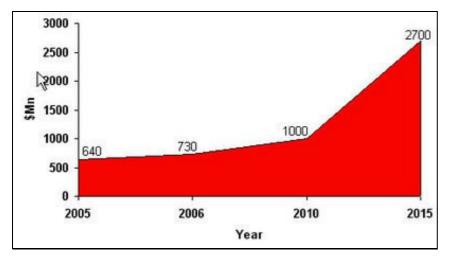
- ?A billion people will interact with a million e-businesses via a trillion intelligent interconnected devices? Louis V Gerstner
- Technological developments in RFID are taking place rapidly Source
 Innovation is occurring in the RFID market, but it is diffused and application-specific Paul Faber
- RFID has been spawning a lot of innovation. One of the newest is Jewel (disposable RF-enabled tickets) Source
- Scientists are developing a system that combines RFID tags and high-definition CCTV cameras to track passenger movements in busy
- airports Wal-Mart Doubling RFID-Enabled Stores - Source
- Oracle and Intel join forces for RFID push Allyson Fryhoff, vice president of Oracle
 Oracle boosts supply chain management tool Don Klaiss, Oracle
- U.S. FDA to reduce the counterfeiting of prescription drugs Source
- Ignorance putting RFID rollouts at risk ABI Research
- Cash under threat from RFID payments ABI Research
 ?It?s inappropriate to use RFID technology for tracking and authenticating identities of people? Pattinson
- CDT Working Group on RFID: Privacy Best Practices for Deployment of RFID Technology Center For Democracy & Technology

RFID - Market Potential

• Estimated value share of RFID market in 2010, by region



• The global forecast of RFID hardware, middleware and IT market

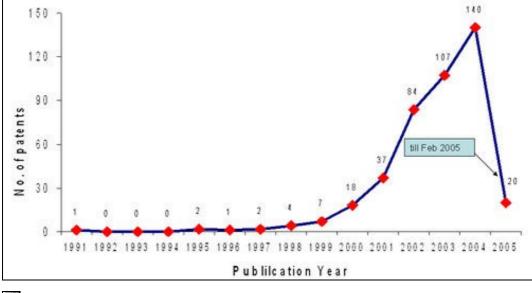


- The RFID market is anticipated to continue to grow rapidly in these and many other market sectors and industries including the food and drug industry, propelled by United States FDA mandates. The technical issues that have made standardization more challenging are heading toward resolution with the emergence of the second-generation of UHF RFID
 Retail RFID is estimated currently at just under 27% of the overall RFID market and supply chain management (SCM) applications, when considered as separate from warehouse and distribution and transportation, represents just over 15% of the overall RFID market. These distributions will undoubtedly change rapidly and should be reconsidered at regular time intervals as the RFID technology and established and emerging markets mature (Source BCC Research)

Patent - Quantitative Analysis

IP landscape over years

- According to the search data, IP activity in RFID based supply chain applications seems to have started during the year 1991
 The graph shows terrific growth from 2000 onwards and high activity during 2004 with 140 patents alone
 Around 423 patents have been published in a span of 4.2 years from 2000 till date (Feb. 2005) indicating the potential in the field



IP landscape over years: Growth in RFID base supply chain applications

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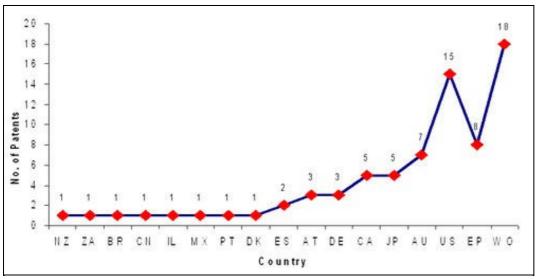
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IP landscape by region

IP landscape of RFID based supply chain - Based on selected 30 records

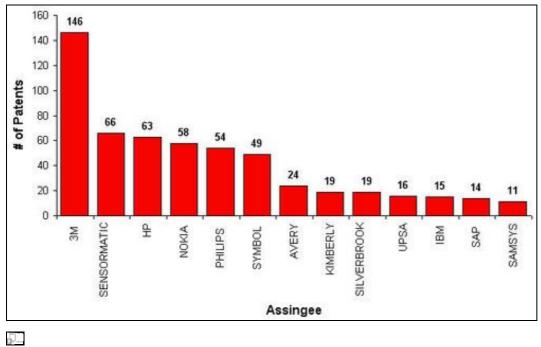
• The graph reveals that the growth in RFID based supply chain applications patenting has been across all the regions. United States is more active than Europe, Japan and Australia



IP landscape by region: RFID base supply chain

Competitor landscape

Top players



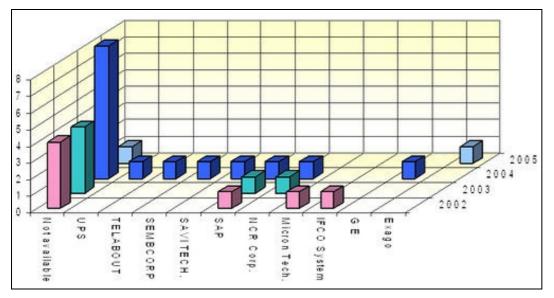
Top players

Competitor Analysis

Growth in RFID based supply chain - The present graph and interpretation is based on selected 30 records

The graph indicates SAP as leading and consistent player with 3 patent records
EXAGO seems to be the new entrant in 2005

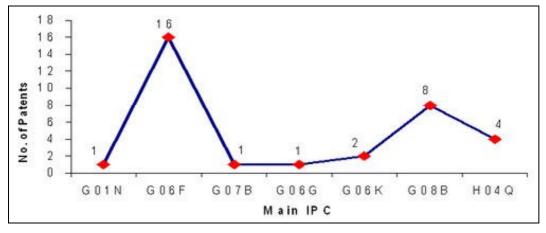
It is interesting to note that the competitors in 2004 have not shown any activity in the beginning of 2005



Competitor landscape - Growth in RFID base supply chain

Technology trend

Technology Trend (Main IPC) - Based on selected 30 records



Technology Trend (Main IPC)

The above graph indicates technology focus by various assignees

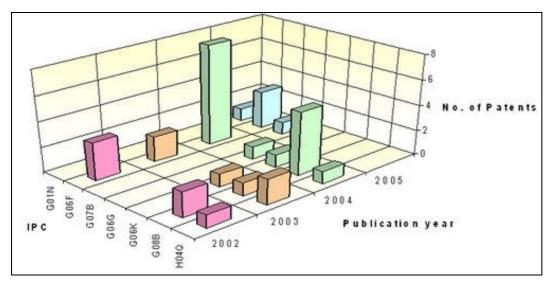
- G06F Computing, calculating, counting Electric Digital Data Processing
 G08B Signaling Signaling Or Calling Systems; Order Telegraphs; Alarm Systems
 H04Q Electric Communication Technique ? Selecting (Switches, relays etc.)

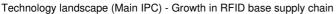
IPC code and Description table

Technology landscape (Main IPC)

The present graph and interpretation is based on selected 30 records

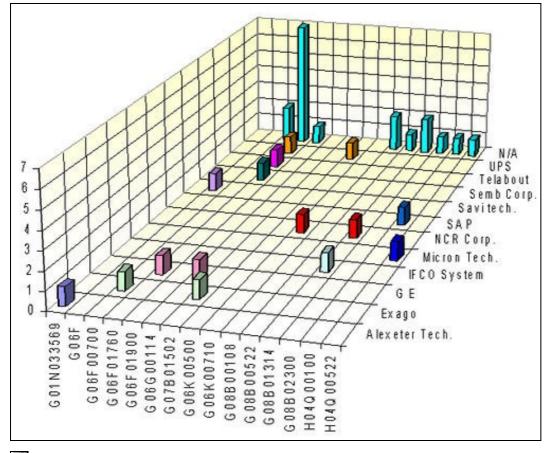
- It is evident from graph that G06F (Electric Digital Data Processing) technology is widely used in RFID based supply chain applications showing continuous progress throughout
- The progress indicates key technology area targeted by many players and having market potential
 Followed by G08B (Signaling), H04Q (Electric Communication Technique) and G06K (Recognition of data; Presentation of data; Record carriers; Handling record carriers)





Technology landscape ? Assignee wise

According to the present data, most of the leading players have focused on building sound: Administration, commerce, management, supervision and forecasting (electronic cash registers other than digital data processing) aspects for RFID-based supply chain applications

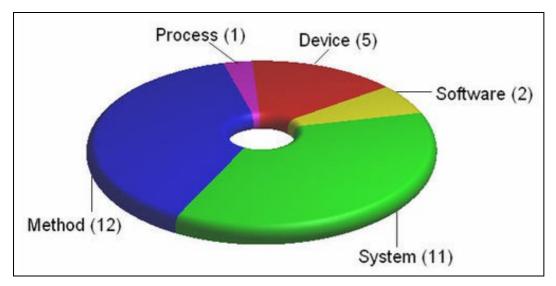


Technology landscape ? Assignee wise

Qualitative Analysis

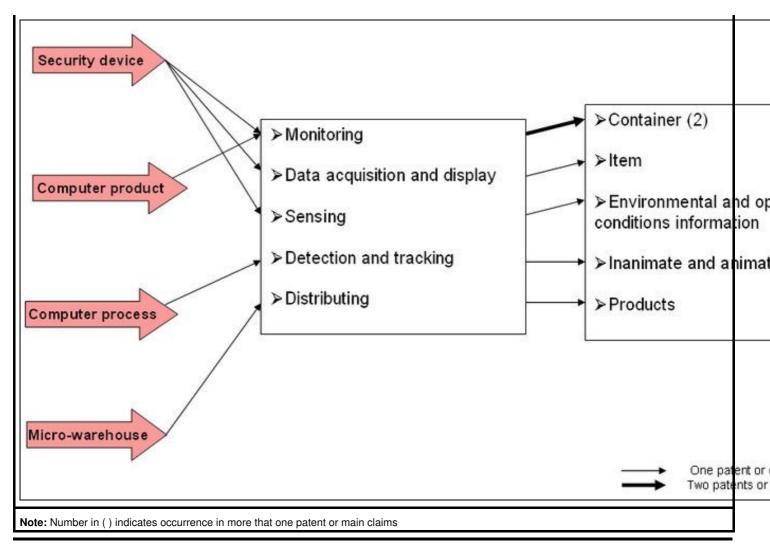
Classification of patents based on main claims

The following graph indicates various subjects that have been covered by various assignees in the area of RFID based supply chain applications. The various subjects are the result of SAO analysis. More granularity on subjects is presented in the table below and clusters



Classification of patents based on main claims **SAO analysis clustering**

Subject	Action	Object
Method	 Delivering Monitoring (3) Processing Detecting (2) & tracking (6) Displaying information Computing the orientation and position of a wearer Unattended distribution or retrieval of returned Return of a return Retrieving ordered (2) Receiving Wirrelessity exchanging Enabling enhanced Facilitating an interaction Distributing (3) Collecting Entering event data common to a group of individual animals 	 Between a consignor and a consignee Container Inanimate and animate objects Items (2) Data acquisition and display device Calibrating a fixed camera Assets (2) Unattended facilities Item to an unattended facility Tenvironmental condition associated with an item of inventory Shipment record from the intelligent asset management and sensing device Information Asset management and tracking capabilities Between a user and a product item Products from a macess restricted area Products from a necess restricted area Products from an incrited access area having an entry point Number of mail units (2) Livestock information (2)
System	* Detecting & tracking (5) * Processing(2) * Unattended distribution or retrieval of returned * Inventory management * Monitoring (2) * Networking Enabling enhanced * Enabling enhanced * Facilitating an interaction * Distributing (3)	 Inanimate and animate objects Item (6) Time Environmental condition Unattended facilities Sensing device Asset management and tracking Container Number of mail units Articles through customs



Problem vs Solutions

Prior art Problems	Solutions	Patent number
 A central system has limited visibility of containers in the global supply chain Drawback of the central system is the delay in alerts concerning the container Typical central systems have difficulty in collecting reliable information across heterogeneous systems 	A decentralized state system comprising containers to automatically provide continuous and uniform monitoring of a container state is needed. A container should be robustly configured with localized logic capable of determining a state in response to real-time events experienced by the container relative to dynamic and static event information concerning expected events State determinations made through local information are more reliable to typical prior art systems that use central systems to make inferences about the security state	US20040246130
 A major disadvantage of all transponder based tag designs is the special anti-collision method used A short range reader must be used to individually address each tag within the larger field A second major disadvantage is that to obtain long ranges (100-1,000 feet), higher frequencies are required and these lead to high power consumption 	 & 2. By using lower frequencies (not exceeding 1 MHz and typically under 300 KHz) and a base station design that uses large loop antennas (such as 10 times. 10 feet to 500 times.500 feet) and by transmitting a digital ID to selectively activate a selected client tag, rather than a non-selective signal which would activate many tags simultaneously Networked RF Tags (NRF Tags) have significantly reduced power consumption and long range (1000 sq feet to 10,000 sq feet per antenna), have the power capacity to add displays (e.g. LCD) and light emitting diodes (LED?s) and detectors and buttons so they may become fully interactive "tag clients" (this is not possible with transponder) 	US20040201454
 One drawback of these systems is that they require the goods to be passed through designated gateway areas, typically causing great inconvenience Another drawback is that it is not possible to track the location of the goods within the warehouse 	 Each ID tag is coupled to an asset and is configured to wirelessly communicate with other ID tags in the network within a predetermined proximity Each tag is also configured to relay communications from other ID tags so that a communication path is established between the RMS and any ID tag in the network, either directly or via other ID tags 	US20040174260

Features cited in analyzed 15 patent records

1. The container can be reprogrammed to include updated logic, updated states, and/or updated expected event information (US20040246130)

2. The system comprises a truck server and an optional in-truck data communications means, which comprise a digital cell phone or satellite link (US20040201454)

3. A local computer communicates with the see-through display, information gathering devices and orientation sensors, optical tracking system and business applications over one or more networks (US20040182925)

4. OmniTRACS.RTM., which is a two-way satellite communication system that allows trucks to be monitored and tracked and to allow data communication with dispatchers (US20040174260)

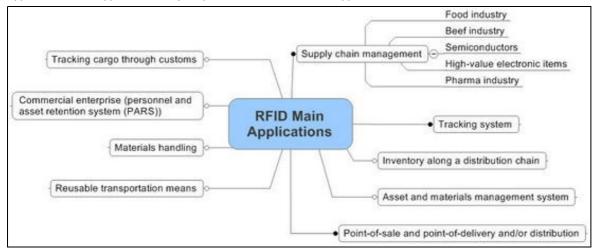
5. The data report from the reporting software can alert the user as to when the detrimental event occurred and identify the custodian who caused the detrimental event (US20040049428)

6. Web-based information system for a beef marketing alliance; value-based procurement and supply chain management (US20020158765)

7. The software contains a component for determining the best time for an animal to go to slaughter based on a target weight (US20020158765)

RFID - Main Applications

Applications which appeared in analyzed patent records have been mapped



The product moves through the global supply chain which involves various stages (places and processes). The table below indicates the details about the various stages involved in supply chain applications, software applications and hardware used.

Main applications of RFID: Analysis

Application-1	LOGISTICS CHAIN MANAGEMENT SYSTEM IN FOOD AND PHARMA INDUSTRY.		
Place of events	Process involved	Type of S/W & Hardware	
 Airlines and shipping companies Ancillary Suppliers, Cargo Community Networks [CCN] which are made up of some of the other participants, Customs and Quarantine authorities, Freight forwarders, Fresh produce exporters, Fresh produce importers, Government agencies such as freight export information providers, Packer/cool store, Transporters including road haulers and carriers in the importing country. 	 Consignment Supplier Transport and Storage 	 Central database A communication secured network Internet with three interactive databases. Database and applications (data in a range of formats (maxima, minima, averages, graphical etc) Passive tag - RW 	
Application - 2	GLOBAL SUPPLY CHAIN OF SEMICONDUCTORS.		
Place of events	Process involved	Type of S/W & Hardware	
 International suppliers Airport Customs agency Distributors Shipping dock Manufacturers 	 Transport Inventory Shipping Origin of port Transshipment port Destination port and A consignee 	 Program instructions can be in any appropriate form, such as source code, object code, or scripting code. Computing device: Enterprise servers, Application servers, point of sale terminal etc Passive tag - RW 	
Application - 3	SUPPLY CHAIN MANAGEMENT OF HIGH-VALUE ELECTRONIC ITEMS & PHARMACEUTICALS.		
Place of events	Process involved	Type of S/W & Hardware	

 Warehouse Truck Freight container Sea vessel Distribution center 	1. Shipping 2. Recipient	 Central data processor is operable for communication with an internet router. Low frequency tag ? 300 KHz
Application - 4	TRACKING SYSTEM	
Place of events	Process involved	Type of S/W & Hardware
1. Assembly line 2. Warehouse	 Package handling Baggage handling Parts assembly Navigation through marked waypoints Item retrieval and packaging Inventory control 	 Business applications (cause sorting and loading instructions to appear on the items so that wearer?s of the data acquisition and display device do not have to read each item?s label.) Passive tag
Application - 5	SUPPLY CHAIN MANAGEMENT.	
Place of events	Process involved	Type of S/W & Hardware
 Storage facility Shipping container Shipping vessel Airport Shipyard Military heavy assets Warehouse Factory 	 Shipping goods Transportation (truck) Retail or wholesale locations Train depot Inventory Delivery Outbound transit Inbound transit Advanced shipping notification 	 Firmware and software to modulate and demodulate the data for the particular protocol Various communication algorithms and command response algorithms UPS Supply Chain Solutions Passive tag ? RW ? Low freq. or 900 MGz
Application - 6	INVENTORY ALONG A DISTRIBUTION CHAIN	
Place of events	Process involved	Type of S/W & Hardware
1. Distribution 2. Storing 3. Manufacturer (warehouse)	 Inventory Monitoring Transportation Tracking Retailer or consumer Wholesaler 	 Anti-collision software Program for correlating the environmental condition data with the location data. The data reporting medium is a computer display, a LAN, or a web page. Active or passive tag- RW
Application - 7	ASSET AND MATERIALS MANAGEMENT SYSTEM.	
Place of events	Process involved	Type of S/W & Hardware
1. Lay down yard 2. Warehouse 3. Asset storage	 Inventory Shipping Asset management Tracking asset material Material identification information Description of the 	 Software applications (Web application" TagDetect") files may be in HTML format, XML or other formats. Software applications supporting a client-server system or n-tiered computer system. Internet and Central data repository Active or passive tag - RW

	material c. Purchasing details d. Storage and maintenance details e. Material location and f. Destination information. 5. Receiving		
Application - 8	POINT-OF-SALE AND P	POINT-OF-SALE AND POINT-OF-DELIVERY AND/OR DISTRIBUTION.	
Place of events	Process involved	Type of S/W & Hardware	
 Distribution Micro-warehouse Manufacturing Marketing Customer relation management 	 Point of sale Delivery Inventory Billing 	 MW (Micro-warehouse) enterprise application XML middleware such as Biz Talk.RTM. software. ERP system, web ordering system Passive tag ? RW - freq 2.45 GHz 	
Application - 9	REUSABLE TRANSPOR	REUSABLE TRANSPORTATION MEANS.	
Place of events	Process involved	Type of S/W & Hardware	
1. Distribution	 Tracking: Receptacle or Container or Packing or Pallet or Trolley car. Wholesale distributor Chain sales store 	1. No Software application 2. Passive tag - RW	
Application - 10	MATERIALS HANDLING	MATERIALS HANDLING	
Place of events	Process involved	Type of S/W & Hardware	
1. Express mail 2. Storage	1. Transport 2. Tracking 3. Delivery	 Software modules may include: 1. A database module configured to store data on the storage medium. 2. A decision module configured to determine the presence or absence of stale mail based on information provided by the database module.3. 3. Passive or active tag ? read only 	
Application - 11	COMMERCIAL ENTERP	COMMERCIAL ENTERPRISE (PERSONNEL AND ASSET RETENTION SYSTEM (PARS))	
Place of events	Process involved	Type of S/W & Hardware	
 Industrial sites Power plants Refineries and Ports of entry 	 Tracking Monitoring Inventory Security 	 Company databases are: Material management systems Procurement systems and Time and attendance systems. Applications programming Information access through standard formats such as XML and HTML. Passive tag - RW 	

Application - 12	TRACKING CARGO THROUGH CUSTOMS.	
Place of events	Process involved Type of S/W & Hardware	
1. Airlines 2. Distributor	1. Shipping 2. Receiving 3. Tracking	 Central server runs a program which acts as a central host for processing the information communicated between the different computers. Passive tag - RW
Application - 13	SUPPLY CHAIN MANAGEMENT IN BEEF INDUSTRY.	
Place of events	Process involved	Type of S/W & Hardware
1. Factory	 Identifying Tracking Monitoring Livestock production and processing cycle Inventory 	 BeefLink.TM. Software (is a collection of components written primarily in VISUAL BASIC® 6.0 programming language and ACTIVE X® programming methodologies.) Inventory-type report can easily be generated. MicroSoft Excel Passive tag- read only

Sample Landscape View - RFID Warehouse Application

This is supposed to be a flash animation. You'll need the flash plugin and a browser that supports it to view it.

Sample Landscape View - RFID Application - Company XYZ

This is supposed to be a flash animation. You'll need the flash plugin and a browser that supports it to view it.

SWOT analysis

STRENGTHS	WEAKNESSES
 Advanced technology Easy to use High memory capacity Small size 	 Lack of industry and application standards High cost per unit and high RFID system costs Weak market understanding of the benefits of RFID technology
OPPORTUNITIES	THREATS
 Could replace the bar code End-user demand for RFID systems is increasing Huge market potential in many businesses Need for standardization 	 Ethical threats concerning private life Highly fragmented competitive environment

Conclusion

It has been observed that selection of RFID tag depends upon the frequency desirable in supply chain application. Industrial focus is on passive RFID technology. The integration of software technology with electronic identification system will definitely give new dimensions to the supply chain management

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