



RFID - Radio Frequency Identification

The Road Map



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What is RFID?

Radio frequency identification (RFID) is an industry term that is used to refer to technologies that use radio waves to automatically identify individual items. The most common method of identifying objects using RFID involves devices called transponders or tags. The identification information is stored on a chip and the antenna transmits this information to the readers. The reader translates the radio waves emitted by the RFID tag into a form that can then be stored and channeled to computers that can make use of it.

RFID Applications and History

RFID is a technology that has been in use since the 1940's. The applications most people are familiar with include keyless access to buildings, automatic payments for retail goods and services such as fast food and fuel, and fast-lane bypassing of tollbooths. But other non-consumer RFID applications have been in existence for years. Logistics companies track the movement of rail cars and freight containers. Hospital patients wear RFID wristbands to assure correct medication dispensing, ranchers track livestock with RFID chips attached to cattle and manufacturers monitor work-in-process (WIP) materials to gather information to better improve process control. RFID is also used in security (restricted access to buildings and networks),

RFID Benefits

Following are some of the value propositions of employing a solution that can intelligently use extra data provided by the RF technology.

- Improved visibility into your supply chain
- Reduced capital investment by reducing excess inventory
- Lesser number of stock outs due to the lack of tracking information
- Improved customer satisfaction by providing accurate product availability information
- Improved replenishment plans

Other benefits of using RFID

- No line-of-sight required
- Unattended hands-free execution
- Labor savings
- Secure information
- Quality control

Innovative solutions may help in realizing more value out of such investment.

“Should we or should we not?” is not the real question. It is a good idea to evaluate the solutions specific to your business to maintain your competitive edge.

Common Questions

Many businesses find themselves asking the following questions when it comes to RFID

- When should you embrace this technology?
- What solution would bring the best value to your particular business?
- What are the capabilities of a particular solution?
- Would it be important to change some of the business processes to realize the full value of any solution?

- And many other questions related to your specific needs.

In some cases, the big discount retailers like Wal-Mart and DOD have mandated that their suppliers become RFID compliant. The real challenge in those cases is to look for ways to get the “value” out of your investment by leveraging this technology.

Just like any other technology solution – It is important to improve your processes, reduce wastes and to customize the solution for your specific needs. Any off-the-shelf solution without proper business consulting (internal or external) has limited benefits.

RFID Solution Components

The following are the main physical components that make up an RFID solution. See Appendix A for photographs.

1. Tags
2. Antenna
3. Reader
4. Host Computer

RFID tags come in different shapes, sizes and material. They are listed below.

| Tag Type | Description | Advantages | Disadvantages | Applications |
|------------------|--|---|---|---|
| Active | Active tags have a battery that transmits signals to a reader. | Can be read at greater than 100 feet. Works well with metals/liquids. Good for process monitoring-they can transmit alerts. | Active tags cost a dollar or more, which is expensive to put on low cost items. | Tracking high value goods that need to be scanned over long ranges, such as railway freight cars or cargo containers. |
| Passive | Passive tags don't have a battery they are powered by electromagnetic waves from a reader that creates current in the tag's antenna. | Passive tags are far less expensive than active tags and require no maintenance. The relatively low cost makes these tags attractive for current retail distribution requirements. | Short read range and lower power creates problems reading through liquids and metal products. | Inventory control, theft prevention, and automatic customer checkout. Future applications include, tracking consumer goods through the supply chain. |
| Read-Only | Read-only tags have information stored on them during the manufacturing process. The information on these tags is permanent. | Easily produced. No maintenance. Low cost. | Information cannot be changed. | Each product has a unique ID code attached to it throughout its development so that it can easily and accurately be recognized. |

| | | | | |
|-------------------|---|--|--|--|
| Read-Write | New information can be added or existing information can be overwritten when the tag is within range of reader. | As the tag moves through the supply chain, new information can be written to the tags. | Read-write tags are useful in only specialized applications. They are more expensive than read-only tags, making them impractical for tracking inexpensive items. | A piece of luggage is scanned in an airport and the tag is updated with the date and time of scanning. |
|-------------------|---|--|--|--|

RFID Application Types

RFID application implementation could be defined in different ways. Below are common industry approaches.

Closed vs. Open RFID Environments

Closed Environments

Closed RFID environments typically operate with a fixed number of tags that provide temporary identity to containers or in-process materials, continuously circulating within the confines of a distribution facility or manufacturing process. Closed environments typically implement proprietary RFID tag and reader technology from a single vendor, with equipment carefully selected to match the physical, environmental, and operational requirements of the application. Because the RFID tag is effectively captive to the application for which it was engineered, the tags do not have to be readable by external parties or interoperate with other vendor's reader equipment, or have its internal data formatted to any particular structure.

Open Environments

Open RFID environments are creating a buzz in the industry. The vision is that a product/object can move through the supply chain, being handed off from one company to the next, until it reaches its final destination, the consumer. At each step of the way the RFID tag will be updated with information specific to that object, and at any point along the way, the complete genealogy and history of that product can be retrieved. This, of course, has consequences requiring standards to ensure compatibility, interchangeability, interoperability, and non-interference.

Industry solutions could be divided into two categories.

a. Before the "beep" solutions

All the hardware and software needs to prepare the tags with appropriate data and put the tag on items fall in this category. "Beep" refers to the point where information is read in to the computer system through the readers.

Smart label printers, or tag writers, are used to prepare the labels or tags. Some vendors offer services to supply ready-made tags as well.

b. After the "beep" solutions

As the tag moves through the supply chain, the tag information is read into the system by the reader at all the necessary points.

The time-stamp flows into the system with the other integral information stored in the tag. The real challenge lies in managing this information in a useful manner. The middleware software solutions are used to feed all this data into the enterprise applications.

Software solution categories

a. Middleware

These software solutions read the data from the readers and feed it into the enterprise applications (ERP). The difficult responsibility of this software piece is to filter the load of data to get very precise information for the ERP software. Many niche players have developed core competency in this segment. Most of the big ERP application companies have also announced their middleware software solutions or partner solutions.

b. Enterprise Integration Software

This layer receives filtered data from the middleware and feeds it to the enterprise application. Most of the big ERP/Warehouse Management software vendors have their own integration packages. However, this layer needs a lot of customization and configuration. No middleware solution is similar in terms of hardware compliance or interfaces – and it is difficult to find two SAP implementations that look just the same. Several start-up companies offer their services in developing integration and data collection solutions for SAP console applications. This category has many vendors with expertise depending on the domain and ERP package. This segment requires very specialized knowledge of the software packages and domain.

Remote Services

The offerings of this technology and practical applications in the industry have created a niche market of 'Remote Services'. The remote services include remote asset tracking, diagnosis and maintenance, software upgrades, and system monitoring. Most of the businesses find it economical utilize remote services rather than employing their in-house teams.

Remote services also bring the challenge of keeping information secure and safe from the outside world. Many proprietary development platforms have in-built communications and security solutions to assist businesses in procuring these remote services.

Any of these solutions require quite a bit of business process consulting as well.

Industry Drivers:

1. Wal-Mart and DOD requirements.
2. Productivity
 - a. Scans of cases happen simultaneously.
 - b. Less effort to position labels and barcodes properly to be read.
 - c. Fewer missed scans.
3. Reliability
 - a. Barcodes may get damaged in harsh environments.
 - b. Replacement of damaged barcodes is time consuming.
4. Storage Capacity
 - a. More data can be saved to RFID tags; some are modifiable compared to barcode code labels, which are not.
5. Flexibility
 - a. Using the read/write capability, it is possible to track the complete life cycle of an item and insure quality and tracking integrity.

Implementation Issues

Proprietary Standards

RFID technology vendors have been producing proprietary tags and readers using different radio frequencies, and detection algorithms. Such differences prohibit widespread adoption of RFID technology in an open supply chain environment.

Readability

Liquids absorb radio waves while metal reflects them. In addition, frequency “noise” from a conveyor system may also be problematic. While these conditions present challenges, they are by no means restrictive.

Hardware Costs

While the cost of some tags has plunged from \$2 to 20 cents, existing barcode tags cost a fraction of a cent. In the next two to three years, prices are likely to fall; but they will still be many times more expensive than bar code labels. RF readers are also substantially more expensive than bar code scanners.

Infrastructure Costs

Tracking every unit of product through the supply chain will generate huge data volumes that need to be stored and transported to data warehouses. The existing infrastructure, which includes networks, databases, and IT applications, are not ready for this type of volume and high frequency of event data.

RFID Trends

RFID market projected to be \$2.7 billion in 2005, and estimated to be \$60 billion in 2010. RFID will be the cornerstone of supply chain management in 10-20 yrs

Conclusion

The mandate by Wal-Mart and DOD has created a panic in the manufacturing industry. Executives are trying to evaluate their options while still thinking it as an added cost without any value. The reality is that the RFID technology in isolation is quite mature, but the standards are evolving. The current cost of a tag is considerably higher than the feasible adoption threshold. Analysts predict that this cost would reduce significantly as the adoption rate would increase in

the coming years. At this point, the only mantra to success is to prepare your own customized action plan. Make judicious investments in terms of educating your management, finding a reliable partner, and experimentation through prototyping and pilot projects.

This technology has significant value in the form of inventory shrinkage, enhanced response to demand variability, reduced wastages, better visibility through the supply chain, improved asset tracking, etc. All this directly turn into \$\$ savings if achieved.

About Productive Technologies

Productive Technologies is an RFID and software solution provider company based in Oklahoma City, OK. Productive Technologies offers a complete spectrum of IT expertise that best fit the Business-IT requirements with the aim of high rate of ROI (Return on Investment) to the client.

The strength of Productive Technologies lies in the solid strategic alliances the company has built to access the best talent and most suitable technologies for the opportunity at hand. Our operations strive to be efficient with emphasis on quality and on-time delivery. Our agility allows us to pass on the saving to customers as well as invest in more research and development efforts to help clients in the long run.

Our goal at Productive Technologies is to build long-term business bonds while delivering superior solutions. Accountability, Integrity, Creativity and Quality are the foundations of our organization. Our commitment to help our client succeed speaks for itself in all of our engagements.

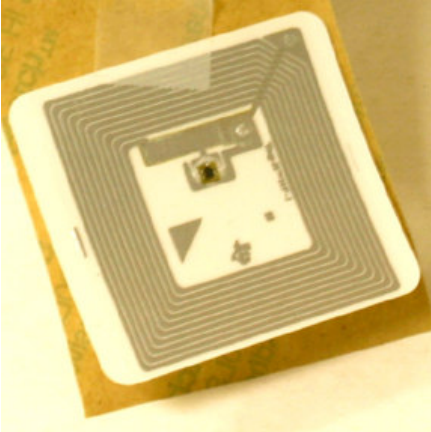


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Appendix

Sample RFID tag



Antennas



Card transponders



Transponder Reader



Handheld reader



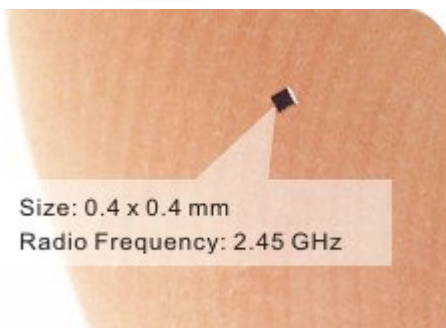
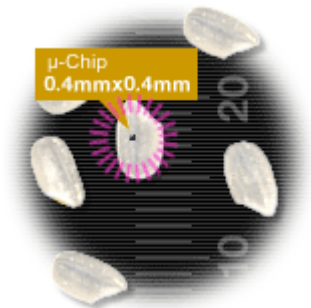
Label printer



RFID Tags to track museum articles



Tiny RFID by Hitachi



Application Example: Gift Certificate

