RFID JOURNAL
THE WORLD'S RFID AUTHORITY

RFID: THE TECHNOLOGY'S EVOLUTION

From 1970 to 2010

www.rfidjournal.com

Mark Roberti
Founder and Editor
RFID Journal

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THE WORLD'S RFID AUTHORITY

OVERVIEW

- Background about the technology
- Why I launched RFID Journal
- Who is implementing it and why
- How the technology will be adopted in the supply chain
- Smart packaging and products

HISTORY

- RFID Traces its routes to the friend or foe system developed during the second world war
- In the 1970s, Los Alamos developed a passive tag for tracking cows
- It also developed an active RFID system to track trucks carrying nuclear materials

THE 1970S

- Passive RFID
- Low frequency (125 kHz)
- Niche applications
  - Cattle tracking
  - Access control

THE 1980S

- Passive and active RFID
- High frequency (13.56 MHz)
- Niche applications
  - Supply chain tracking
  - Asset tracking
  - Access control
  - Toll collection systems

THE 1990S

- Ultra-high frequency (915 MHz)
- Niche applications for 13.56 MHz
  - Supply chain tracking
  - Asset tracking
  - Access control
  - Automobile immobilizers

THE NEW MILLENIIUM

- ISO pushes for UHF standard
- Auto-ID Center founded in 1999
- Companies seek new efficiencies
- Internet establishes a means of sharing data
- The real-time enterprise

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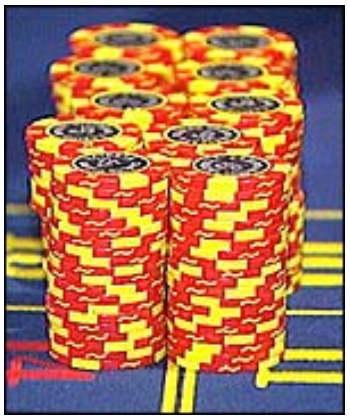
IN THE BEGINNING

- Founded: March 1, 2002
- Total startup capital: $500
- Today RFID Journal is:
  - The world's most popular RFID site
  - Events and education
  - Print magazine

www.rfidjournal.com



Why bet on RFID?

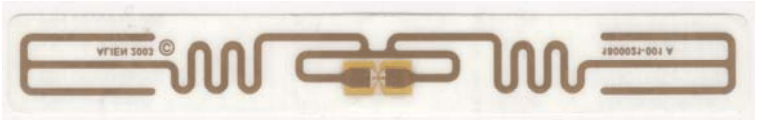
- Companies needed:
  - Accurate data
  - Real-time data
  - A way to share data across the supply chain

WHY IS A 30-YEAR-OLD TECHNOLOGY SUDDENLY HOT?

Why RFID was primed to take off?

- Emergence of UHF systems
- Standards development
- Internet makes it possible to make use of RFID data
- Competition is forcing companies to become ever

WHAT IS RFID?



- A passive RFID transponder consists of a microchip attached to an antenna
- Sandwiched in a protective layer
- Can come in many form factors
  - Tags, cards, wands, labels, etc.

WHAT IS RFID?

- A reader has:
  - An antenna
  - Digital signal processor
  - Network connection
  - I/O ports

HOW IT WORKS

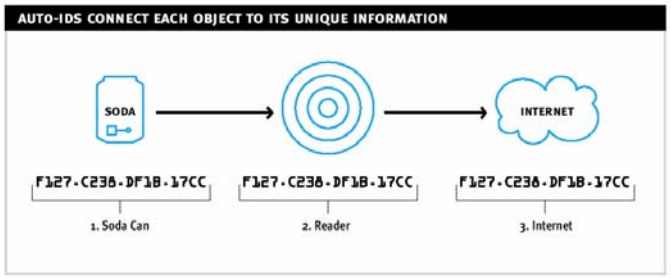
- The reader emits energy
- The tag antenna “harvests” the energy and powers the chip
- The chip modulates the antenna and reflects back a different signal
- The reader captures the signal and converts it into digital info
- A computer turns it into a unique serial number

ISO OR EPC?

Why EPC was the right choice:

- The focus was on a *low-cost* system of sharing data
- The system would be based on open standards
- EPC was backed by Wal-Mart, Gillette, P&G, the UCC and other powerful players

WHAT IS AN ELECTRONIC PRODUCT CODE?



- Header
- Manufacturer
- Product type
- Unique serial number

THE FIRST MANDATE

- June 11, 2003—Wal-Mart CIO Linda Dillman announces that her company would require suppliers to start tagging pallets and cases beginning Jan. 1, 2005.

ADDITIONAL MANDATES

- Dept. of Defense announced it will require RFID tracking starting on Jan. 1, 2005

More companies announced RFID mandates, including:

- Albertsons
- Best Buy
- Target
- Tesco in the U.K.
- Metro in Germany

Boeing and Airbus team to create one RFID standard in airplane manufacturing

- Pushes RFID into heavy industrial manufacturing
- Complements DOD efforts

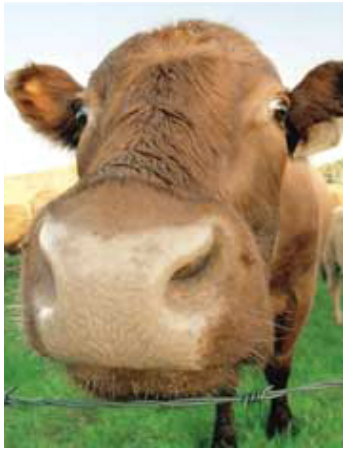
QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Delta announces plans to spend $25 million to use RFID to track baggage

- Pushes RFID into in to the baggage handling industry
- More than 2 billion bags moved annually

RFID adoption is picking up

- Need for greater efficiency
- Security
- Regulation compliance
- Anti-counterfeiting



Mad Cow disease discovered in the United States

- RFID can identify individual animals
- Animal IDs can be tied to meat products
- Stable to table tracking

FDA strongly recommends RFID tagging to reduce counterfeiting of drugs

- Using RFID to create an electronic pedigree
- Sched. 2 drug makers already moving to item level tracking

OBSTACLES TO ADOPTION

The technology is still immature. Issues that need to be resolved:

- Standards are in flux
- Interoperability is not assured
- The cost of equipment is still high
- IT systems can't handle real-time data
- The performance of the technology needs to improve

Physics issues:

- Products made of metal or in metal packaging will reflect radio waves
- Water and products with high water content absorb radio waves
- Readers can interfere with existing wireless equipment
- Motors emit electromagnetic interference

SOLUTIONS TO THESE PROBLEMS

Good system design can get around many of these obstacles

- Metal mount tags avoid detuning antennas
- Tag placement can overcome problems with water-based products
- Readers can use frequency hopping to in the interfering with wireless devices
- Motors can be shielded

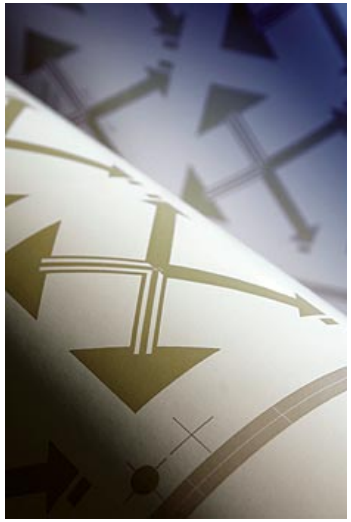
Where is the technology going?

- Stage 1: RFID tags will be applied to the outside of cases
- Stage 2: RFID tags will put inside the packaging
- Stage 3: RFID tags will be integrated with the packaging
- Stage 4: RFID will be combined with sensors to create smart packaging

Smart labels will be applied

- To comply with RFID mandates, companies will apply labels with RFID transponders inside of them
- These labels will typically have bar codes printed on them
- The cost today for a smart label is 25 cents and up, depending on volume and the capabilities of the chip

Printed RFID antennas — challenges:



- Maintaining performance
- Maintaining speed of production
- Environmentally friendly
- Developing equipment that can place a chip so it connects to the antenna

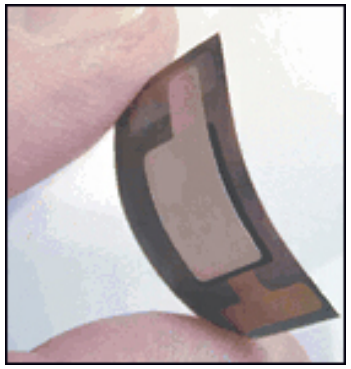
Embedded RFID transponders:

- CHEP has created a transponder that goes inside plastic pallets
- Rafsec has created a transponder that goes inside corrugated cardboard
- Rafsec has also created a special tag that goes inside injection-molded plastic containers

The package is the computer

- RFID will drive smart packaging
- Sensors will track:
  - Temperature, vibration, shock
  - Toxins, bacteria in food
  - Radiation in the air

Thin-film batteries will power sensors



- Thin film-batteries are low-cost
- Some are environmentally safe
- They take up almost extra space
- And they can be embedded in or printed on packages and products

Printed circuits will change everything

- Researchers at Infineon have printed an integrated circuit on ordinary aluminized foil
- Non-silicon circuits are much cheaper
- The ability to print circuits on commercial printing presses would transform packaging

What the future holds for RFID

- Tags are put on all pallets and cases in the supply chain
- Widespread use of RFID in the supply chain drives down the cost of tags and readers
- Eventually, RFID tags are put on all consumer packages and smart products

What the future holds for RFID

- Advances in technology bring sensors to many ordinary packaging applications.
- Low-cost printable circuits make RFID cheap and ubiquitous
- Interactive packaging and other concepts emerge

Thank you

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DEPLOYING RFID TO CREATE BUSINESS VALUE

Point Solutions and an Infrastructure for Change

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OVERVIEW

- Understanding how to deploy RFID
- Point solutions vs infrastructure
- The benefits stack
- The bottom up business case
- Wal-Mart's approach to RFID
- Top 10 lessons learned
- Where to get more information

- Identify people or things
- Applications:
  - Animal identification
  - Access control
  - Payment systems
  - Security
    - Car immobilizers

THE MOBILE DATABASE

- RFID was used as a mobile database
- Information traveled with the product or package
- The benefits:
  - Accurate information
  - Hands-free scanning
  - Instant access to data

MOBILE DATABASE APPLICATIONS

- Asset tracking
- Maintenance
- Security
- Quality control

A TOOL TO SOLVE A PARTICULAR PROBLEM

Using RFID to boost throughput

- A P&G facility in Spain installed a system that cost under $100,000
  - Increased throughput
  - Improved order accuracy
  - Reduced the number of forklift drivers by one per shift

IMPROVING ASSET UTILIZATION

Air Canada was losing $2 million worth of food carts per year

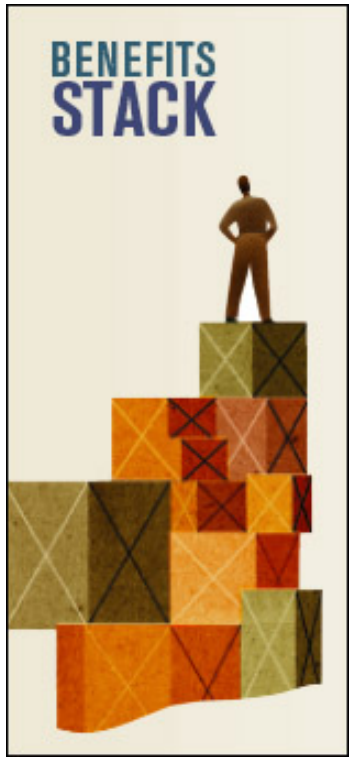
- 2% reduction in the total inventory
- 5% reduction in maintenance
- 20% to 50% in trucking charges
- 80% reduction in shrinkage
- 100% reduction in costs for auditing yearly inventory counts

DEPLOYING RFID AS INFRASTRUCTURE

No one application will deliver a return on investment

- RFID is infrastructure
- It's an enabling technology
- Once installed and networked, readers can be used for many different applications
- This is similar to the Internet

THE BENEFITS STACK



How do you deploy infrastructure in a way that delivers an ROI?

- Deploy within a benefits stack
- Small savings add up to big savings
- Think of Mayor Rudy Giuliani

THE BOTTOM UP BUSINESS CASE

Start with your biggest macro-level problem and attack the small issues that contribute to it.

- Out of stocks
- Excess inventory
- Manufacturing defects
- Losses due to excessive theft or counterfeiting
- Losses due to obsolete or unsaleable goods

EXCESS INVENTORY

Contributing factors:

- Administrative errors
- Cargo transfer errors
- Poor inventory visibility
- Receiving errors
- Put away errors
- Internal theft

OUT OF STOCKS

Contributing factors:

- Administrative errors
- Poor forecasting
- Poor inventory visibility
- Poor order accuracy
- Receiving errors
- Put away errors
- Internal theft
- Slow order fulfillment

HOW WAL-MART IS REDUCING OUT-OF-STOCKS

Deploying an RFID infrastructure

Readers are being installed at:

- Dock doors at DCs
- Shipping doors at DCs
- Receiving doors at stores
- Between back room and retail floor
- Handhelds in back room

HOW WAL-MART IS REDUCING OUT-OF-STOCKS

Suppliers are asked to tag pallets and cases.

- Suppliers are updated within 30 minutes from the moment a tag on one of their products is read
- Suppliers can see dwell times and adjust replenishment algorithms

HOW WAL-MART IS REDUCING OUT-OF-STOCKS

Cases are read when they arrive at the store

- Wal-Mart now knows a case is in the back room
- Case is read when it is brought out to the sales floor
- Case is read when it is thrown away

HOW WAL-MART IS REDUCING OUT-OF-STOCKS

Wal-Mart knows how many items are on the shelf

- By using point-of-sale data, Wal-Mart knows how many items are on the shelf
- Wal-Mart can now react before an out-of-stock occurs

HOW WAL-MART IS REDUCING OUT-OF-STOCKS

Benefits:

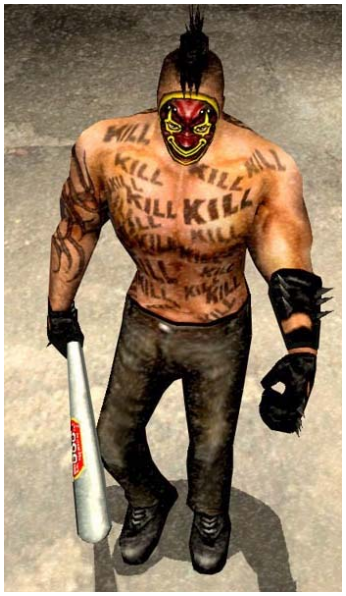
- Wal-Mart can automatically generate pick lists
- Wal-Mart can prioritize pick lists
- Wal-Mart can confirm that an item has been picked
- Handheld RFID readers reduce picking time

THE RESULTS

University of Arkansas is studying the affect of RFID on out of stocks at Wal-Mart:

- Bill Hardgrave is running the study
- First results expected this summer
- Quantifiable benefits will drive adoption

TOP 10 LESSONS LEARNED

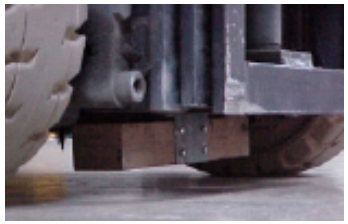


- Lesson 1: There is no killer app
  - RFID is an enabling technology
  - It will enable many applications
  - Savings from several apps to offset the investment in RFID

TOP 10 LESSONS LEARNED

- Lesson 2: Early adopters have higher costs
  - The industry is immature
  - Companies have to do their own testing of tags and readers
  - Suppliers pay for the tags
  - Suppliers must exchange RFID data in different ways with different customers

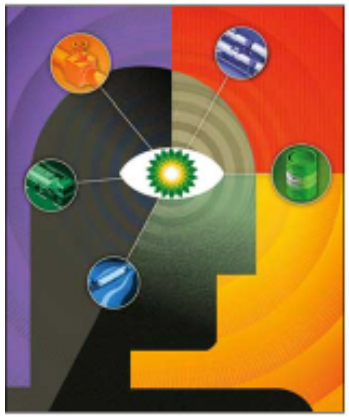
- Lesson 3: Your business is not as efficient as you think
  - A paper company found people were riding around up to 60 percent of the time with nothing on the forklift
  - Associated Foods had 125 people entering data at its distribution yard and the data was wrong 40 to 70 percent of the time



Lesson 5: There are ways to reduce the cost of deployment

- Install readers on forklifts, not shelves
- Tag samples of goods moving through the supply chain
- Share costs with supply chain partners

- Lesson 6: There are benefits beyond the supply chain
  - Boeing deployed a system to track parts internally
    - Reduced the amount of labor needed to scan bar codes
    - Provided visibility of parts
    - Reduced delays in getting parts to the assembly line



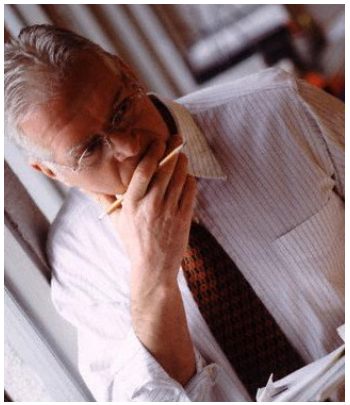
- Lesson 7: Look beyond identification and location
  - BP is tracking the state of its people and assets
    - Reduced insurance cost
    - Reduced maintenance costs
    - Better utilization of assets
    - Better return on investment

- Lesson 8: It might pay to track inexpensive assets
  - Hospitals can gain by tracking items that cost as little as $90 based on today's tag prices
    - Reduced labor costs
    - Reduced shrinkage
    - Reduction of inventory
    - Threat detection

- Lesson 9: Use RFID to deal with regulatory issues
  - Create electronic shipping manifests
  - Track food imports
  - Comply with customs requirements
  - Comply with Sarbanes-Oxley
  - Save $462 per container

TOP 10 LESSONS LEARNED

- Lesson 10: Training is critical
  - Prada spent millions to outfit its NY Epicenter store
  - The project failed because workers weren't trained to use the system
  - The system was later removed



RFID is for real

- It will affect every large and midsize company that makes, transports or sells products
- It will affect every industry
- All companies must adapt
- Benefits go beyond case tracking

CONCLUSIONS

- Prices will fall — and benefits will rise

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WHERE TO GET GOOD INFORMATION

- RFID Journal (www.rfidjournal.com)
  - 150,000 unique visitors per month
- RFID Alliance Lab (www.rfidalliancelab.org)
  - Performance testing
  - Durability testing
- Auto ID Labs (www.autoidlabs.org)
  - SIGs on packaging, network architecture anti-counterfeiting
- EPCglobal (www.epcglobalinc.org)
  - Business action groups

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