RFID: THE TECHNOLOGY’S EVOLUTION
From 1970 to 2010
INTRODUCTION

Mark Roberti
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RFID Journal
• 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
• 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
• Ultra-high frequency (915 MHz)
• Niche applications for 13.56 MHz
  • Supply chain tracking
  • Asset tracking
  • Access control
  • Automobile immobilizers
• 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
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
Why bet on RFID?

• Companies needed:
  • Accurate data
  • Real-time data
  • A way to share data across the supply chain
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
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
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
• 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.
• 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
THE BIG STORIES OF 2004

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

• Pushes RFID into heavy industrial manufacturing
• Complements DOD efforts
Delta announces plans to spend $25 million to use RFID to track baggage

- Pushes RFID into 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
SECURING THE FOOD CHAIN

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
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
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 be 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
• 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
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
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
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
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
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
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
Contributing factors:

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

- Administrative errors
- Poor forecasting
- Poor inventory visibility
- Poor order accuracy
- Receiving errors
- Put away errors
- Internal theft
- Slow order fulfillment
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
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.
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
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
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
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
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
• 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
TOP 10 LESSONS LEARNED

• 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
TOP 10 LESSONS LEARNED

• 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
• 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
CONCLUSIONS

• It will affect every large and midsize company that makes, transports or sells products.

• All companies must adapt beyond case tracking.

• It will affect every industry.

• Benefits go beyond case tracking.

RFID is for real.
CONCLUSIONS

• Prices will fall — and benefits will rise
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
RFID Journal’s 3rd Annual Executive Conference
Chicago, April 10 to 12, 2005
www.rfidjournallive.com
Thank you

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