ICT@*USAID* Technology Series

Radio Frequency Identification (RFID)

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Topics

- History
- Technology
- Domains of Usage
- Security
- Applications

RFID History

RFID born as IFF

Electronic Article Surveillance (EAS) for retail and libraries

Animal tagging

Auto-ID established

- Toll collection
- Access control
- 1st Gulf War tagging

WAL★MART®

Announces top 130-150 suppliers must use RFID by Jan. 1 2005

announces all suppliers must use RFID by Jan. 1 2005

RFID and item tagging

1940s 1960s 1970s 1980s 1990s 2003 2010

RFID is referred to as the next generation barcode

Characteristics of RFID

- A form of electronic labeling (read/write capability)
- Can be interrogated at a distance and hands free “On-the-Fly” reads
- Depending on the frequency, does not require physical line-of-sight or contact between reader/scanner and the tagged item.
- Can contain large quantities of unique digital info.
- Greater placement flexibility on or in an item
- Virtually low maintenance on the product
- Extremely low error rate.
- Data cannot easily be copied.
- Can be interfaced with other micro sensors to collect previously non-existent environmental data/Location

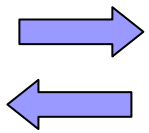
RFID System

An RFID System consists of 4 Components

Tags

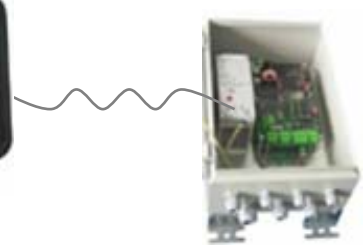
- Device made up of an electronic circuit and an integrated antenna
- RF used to transfer data between the tag and the antenna
- Portable memory
- Read-only or read/write
- Active or passive
- Usually attached to specific items

Antenna



- Receives and transmits the electromagnetic waves
- Wireless data transfer

Reader



- Communicates with the tag via antenna
- Receives commands from application software
- Interprets radio waves into digital information
- Provides power supply to passive tags

Host Computer

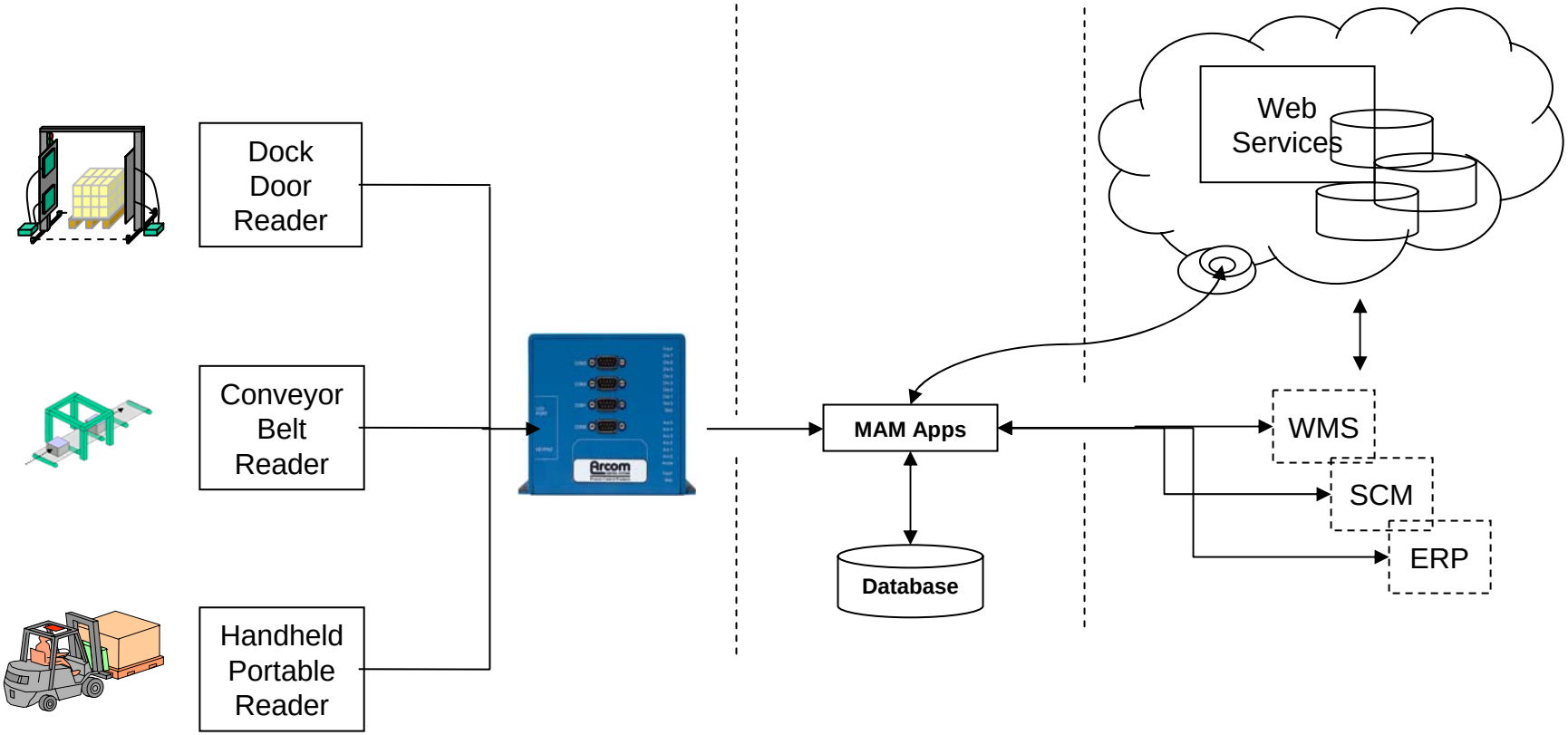
- Reads/writes data from/to the tags through the reader
- Stores and evaluates obtained data
- Links the transceiver to an applications, e.g. ERP

How does RFID compare to Bar Codes?

Barcode Labeling and Scanning Technology	RFID Technology
Barcodes are currently cheaper per item than RFID	Current RFID tags are expensive compared to barcode labels, but new polymer-based tags are being developed. However there are doubts as to whether the penny tag is achievable.
Barcodes are limited by space, and typically only store identifiers like lot #; SKU#	Some RFID tags can hold a substantial amount of data, reducing the need for a back-end database to track each material transaction
Once applied, barcode labels cannot be modified, only reprinted and reapplied	Once affixed to the material, some RFID tags may be overwritten and updated with new information very easily, without removal
Requires line-of-sight between reader and label	Requires only proximity to read the data from the tag. This enables rapid counting with no need to de-palletize and restack
Barcodes can include human-readable information	RFID tags cannot be read without a special reading device; however hybrid labels available
Barcodes are completely passive with “static” data	Intelligent RFID tags (smart labels) are being built that can track variables like temperature as they travel with the material

RFID Solution Overview

Tags **Readers** **Facility Server with RFID Data Collection** **EPC and/or Mobile Asset Management** **Enterprise Apps Web Services**



Data Collection | **Business Logic** | **External Applications and Business Services**

Current RFID Applications

Transportation	Manufacturing	Security	Financial	Other
Airline Transponder	AGV Control	Access Control	Electronic Cash	Animal Identification
Container ID	Assembly Line ID	Auto Immobilizer	Automated Fueling	Finish Line
Global Positioning	Configuration Management	Baggage Tag	Payphone Token	Gambling Token
Pallet ID	Factory Automation	Boarding Pass	Ski Tickets	Gas Cylinder ID
Parking Control	Forklift Positioning	EAS	University Cards	Laundry Tracking
Toll Collection	Inventory Control	Electronic Keys	Food Service	Loyalty Programs
Traffic Management	Maintenance	Fleet Management	Time & Attendance	Medical Device ID
Truck Fleet Tracking	Paint Shop	People Locating	Document Control	Membership Cards
Rail Car Identification	Process Control	Security Areas		Mining
Parcel Logistics	Tire man/tracking	Theft Prevention		Patient ID/tracking
Vehicle Movement	Brand Identification	Vehicle Access Control		Library tracking
Passenger Tracking	Supply Chain Mgmt	Counterfeiting		

RFID Cuts Across Boundaries

Key Benefits From Business Initiatives

Factory

- Plant Inventory Accuracy (Finished Goods).
- Automatic and Verified Shipment Data Reported to Finance and Inventory Systems.

Finished Goods Warehouse

- Reduced Labour Costs in Receiving, Putaway, Picking, and Shipping.
- Proof of Ownership During Transit
- Reduction in Reverse Logistics/Returns and Claims.
- Improved Goods Transfer and Payment Process.
- Improved Service Levels Through Reduced Out-of - Stock.

Distribution Center

- Improved Efficiencies in Receiving and Payment for Receivables.
- Reduction in Labour Costs.
- Reduction in Reverse Logistics/Returns
- Reduction in Inventory.
- Reduction in Obsolescence.

In-Store Handling

Store-Shelf

- Inventory Reduction (Backroom, Lower Obsolescence).
- Better Visibility of Back Room and On-Shelf Inventory.
- Decreased Theft.
- Improved On-Shelf Availability and Reduction in Out-of-Stock (Improved Replenishment).
- Store Labour Productivity Improvement.
- Reduced Defensive Merchandising Leading to Improved Sales.

Manufacturing

- **Fast assembly**
- **Identify and eliminate counterfeit parts**
- **Improved accurate/reactive production planning**
- **Reduced stock/work in process (WIP), increase make-to-order**
- **Reduced efforts on stock counts**
- **Reduced product recall costs**
- **Correct parts identification, reduced maintenance**
- **Accurate and real-time inventory**
- **Accurate packing list and invoice information**
- **Cheaper disposal**
- **Tighter linkage to distributors**

Transportation & Logistics

- **Work with shipping customers to provide**
- **RFID compliance services that solve the compliance challenge**
- **Expand service and revenue base to suppliers and customers by using the RFID tags to define new information-based services as a source of competitive differentiation**
- **Talk to receiving customers who have issued a compliance mandate; explore the question: could the logistics carrier use the RFID-tagged merchandise to provide innovative services to the receiving company?**
- **Cross-docking operations to increase efficiency**
- **Faster delivery turnaround**
- **Faster custom clearance**
- **Theft prevention**

Warehouse Management

- **Shipping and Receiving:**
  - Automated processing of loading and unloading
  - Reduced labor requirements
  - Faster processing
  - Automatic cross docking
  - Automatic generation of 100 percent accurate electronic manifests
- **Storage and Fulfillment:**
  - Correct product storage locations
  - Faster product retrieval
  - Fewer order errors
  - Reduced losses and shrinkage of assets
  - Improved order fill rates and times
  - Less safety stock required
- **Task and Resource Management:**
  - Automatic updating of tasks for each resource
  - Improved automation and accuracy of flow control
  - Improved real-time monitoring of operations
  - Automatic conveyance and sorting
  - Automated and accurate picking and packing

Retail Supply Chain

- **Benefits of Speed:**
  - **Eliminate lost sales due to out of stocks**
  - **Speed up store receiving, processing, replenishment plus point of sale (POS) and returns processing**
  - **Notification of units needed on sales floor upon store receipt**
  - **Satisfy customer requests immediately by locating products on sales floor and in the backroom**
  - **Fast, accurate inventory audits**
  - **Increased distribution center efficiency and accuracy**
- **Benefits of Visibility:**
  - **Unit, carton and pallet-level visibility throughout supply chain**
  - **Immediate identification of exceptions at check points**
  - **Visibility to replenish the right product to the right place at the right time**
  - **Block defective merchandise and counterfeit merchandise**

RFID Security/Privacy Threats

Threats to data security:

- **Enterprise espionage threat - espionage via supply chain dynamics**
- **Trust perimeter threat - data sharing via networks**
- **Infrastructure threat - Jamming, physical damage, counterfeit tags**
- **Competitive Threat – competitive analysis of supply chain**

Threat to personal security:

- **Action threat - determining action based on tags**
- **Association threat - associating personal identity with tags**
- **Location threat - determining tag location**
- **Preference threat - revealing personal preferences**
- **Constellation threat - RFID "shadow"**
- **Transaction threat - determining transactional information**
- **Breadcrumb threat - No way of dissociating data from identity**

Privacy issues arise when RFID leads to collection or connection of information about individuals

RFID Security Threats

Threats also include (not all inclusive):

- ***Rogue readers introduced to network (physical security)***
- ***Rogue access to legitimate readers***
- ***Counterfeit tags***
- ***Rogue tags (cause malicious damage or slow-down the network)***
- ***Eavesdropping or insertion of data into passive tag-reader comms***

Aspects of RFID Security:

- ***Authentication and Identification***
- ***Operating System "Hardening"***
- ***Business Process changes***
- ***Application Security***
- ***Physical Security***
- ***Security Test and Evaluation***
- ***Security Certification and Accreditation***
- ***Encryption***

Security and Privacy concerns will be exposed with the additional available data

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Applying RFID

- Sketch Current Business Processes
- Categorize Improvement Opportunities
- Scrutinize Object & Data Flows
- Modify Processes & Infrastructure
- Describe Partner Data Requirements
- Evaluate System or AIT Alternatives
- Evaluate Costs vs. Functionality
- Select/Define Technology & Systems Changes

RFID is a Process Enabler

Applications for Development

- **International commerce**
- **Wholesale and Retail Business**
- **Asset Management**
- **Medical and Health**
- **Any process that would benefit from tracking object location and movement**

Demonstration

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Discussion/Feedback