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# Introduction to RFID

(WS 05/06)

# Brief History

## ■ Automatic Identification (Auto-ID) and Data Collection (AIDC) Technologies

### ■ Ubiquitous:

- Supermarket
- Credit/Bank/ID Cards
- Car Keys

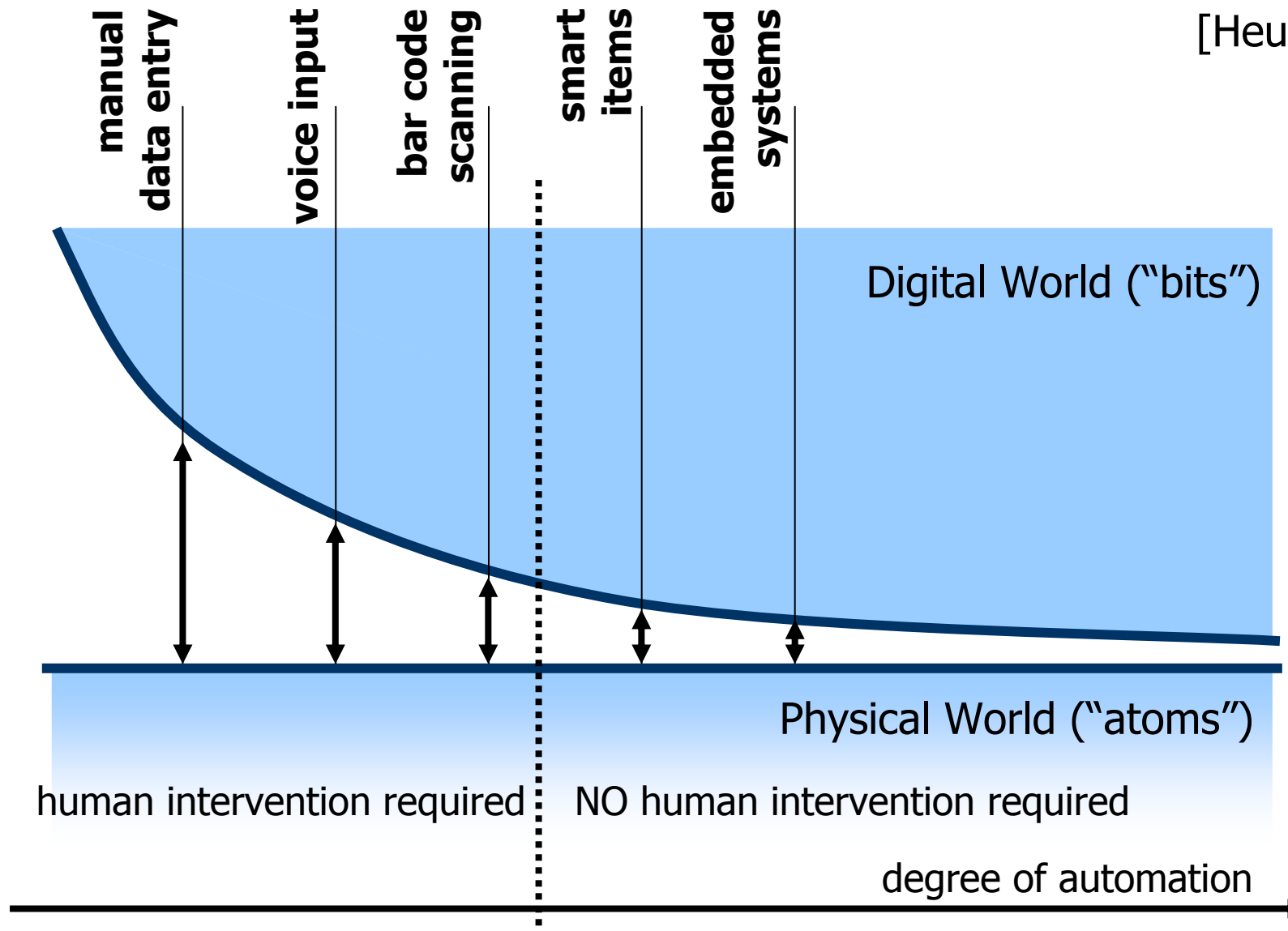
### ■ How Old Are These Technologies?

- 1930's, 40's: Magnetic Stripes
- 1950's, 70's: Bar Codes, UPC
- 1949....: Radio Frequency ID



# Physical and Digital Worlds

[Heuser'04]



- **An AIDC Technology using Radio Frequency:**
  - **RFID Tags**
    - **Chip for Holding Data**
    - **An Antenna**
  - **RFID Readers**
  - **Radio Waves Characteristics**
  - **Computer Network (if any)**
- **Many Types of Tags**
  - **Active / Passive / Semi-passive**
  - **Read / Write**
  - **Various Frequencies**

# RFID Tags

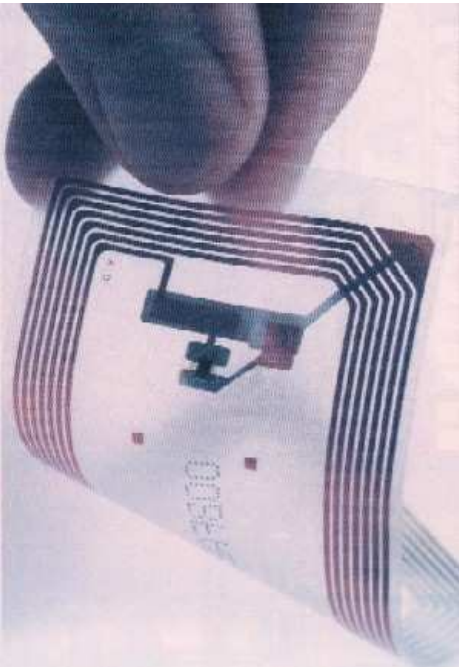
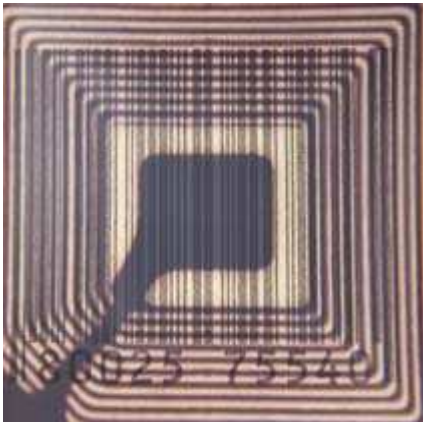
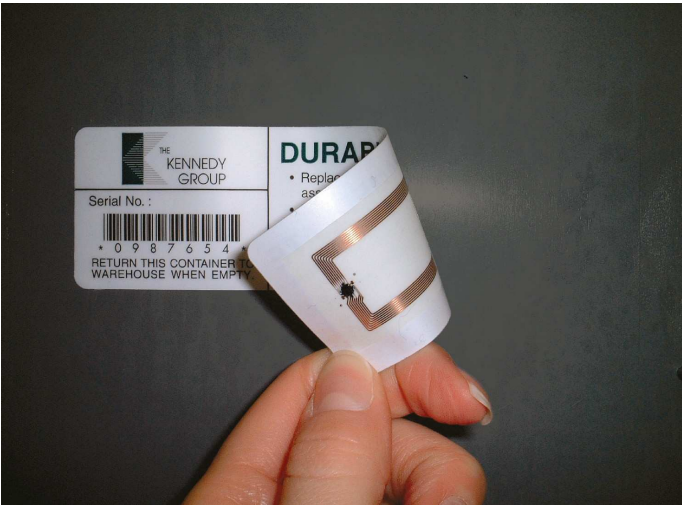


image source: Hitachi



### labeling

- **code** (unique identifier) is stored in a RFID Tag
- Tag is attached to a product
- Product becomes now unique identifiable

### use

- Product transmits **code** from the embedded tag (active tag)
- Reader gets the message (**code**)
- **code** needs to be processed
  - corresponding action(s) to be taken here

# RFID - Use Cases

- **Badges/Smart keys**
  - Grant or deny access
- **Agriculture**
  - Livestock Tracking
- **Toll roads**
  - Tracking and charging
- **Asset Management**
- **Maintenance**
  - Aircraft – Intelligent Toolbox
  - Equipment - Record/db on Tag
- **Supply Chain Mgmt**
  - Inventory control
  - Logistics

## RFID – Supply Chain Mgmt

- **Innovate ways to identify, locate and monitor goods as they travel through the supply chain of many industries**
- **First Benefits**
  - **Increase accuracy of orders**
  - **Reduce inventory handling cost**
    - **Improve inventory handling**
  - **Fewer misplaced items (in warehouse)**
  - **Reduce losses from theft (ca. \$31 Bi in 2002)**



# RFID – Supply Chain Mgmt (cont)

## HOW EFFICIENT IS YOUR SUPPLY CHAIN?

XPLANATIONS<sup>®</sup> by XPLANE<sup>®</sup>

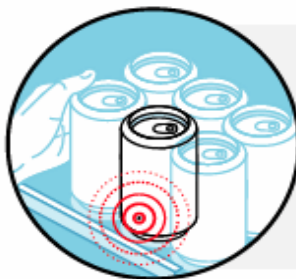
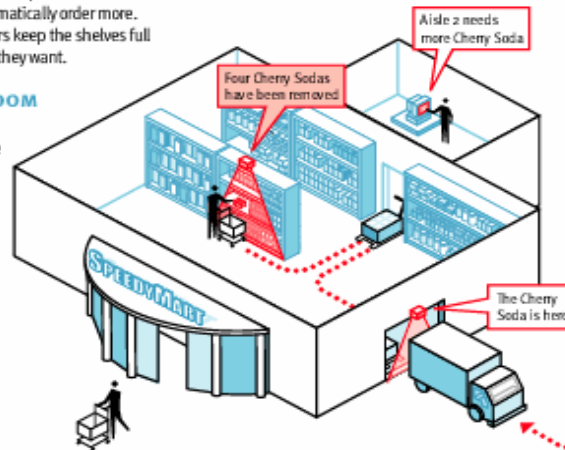
The EPC<sup>™</sup> Network can track individual items throughout the supply chain, from manufacture to sale. This will revolutionize the way people buy, sell and distribute products. Here's how it works.

### 1. ON THE RETAIL FLOOR

The moment a customer takes a product from the shelf, "smart shelves" automatically order more. Stock people and distributors keep the shelves full so customers can buy what they want.

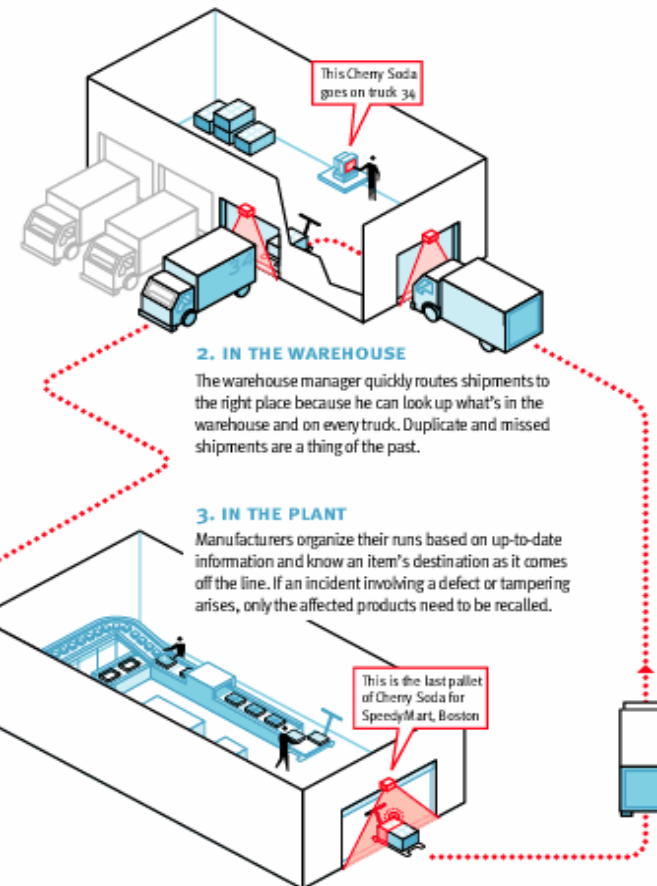
### AND IN THE BACK ROOM

The EPC<sup>™</sup> Network tells the retailer exactly what's on the shelf and in the stock room as well as what's rolling off the truck. There is no need for clerks to maintain costly buffer stock or manually break a pallet down in order to check every case.



### HOW IT WORKS

Every item contains a microchip with a unique identifier — called an Electronic Product Code (EPC<sup>™</sup>). This Radio Frequency Identification (RFID) tag allows precise tracking of the product. Cases and pallets can carry their own unique tags. Learn more about the EPC<sup>™</sup> Network at the Auto-ID Center's web site at [autoidcenter.org](http://autoidcenter.org).



### 2. IN THE WAREHOUSE

The warehouse manager quickly routes shipments to the right place because he can look up what's in the warehouse and on every truck. Duplicate and missed shipments are a thing of the past.

### 3. IN THE PLANT

Manufacturers organize their runs based on up-to-date information and know an item's destination as it comes off the line. If an incident involving a defect or tampering arises, only the affected products need to be recalled.

The Auto-ID Center | ©2003 XPLANE.com<sup>®</sup>

# EPCglobal Network

- **Based on 5 Main Pillars:**
  - **Electronic Product Code (EPC)**
  - **ID System**
  - **EPC Middleware**
  - **Discovery Services**
  - **EPC Information Services (EPC IS)**
- **EPC:**
  - **Unique “object” identifier (worldwide)**
  - **96-bit number**
  - **Extension of the Universal Product Code (UPC)**

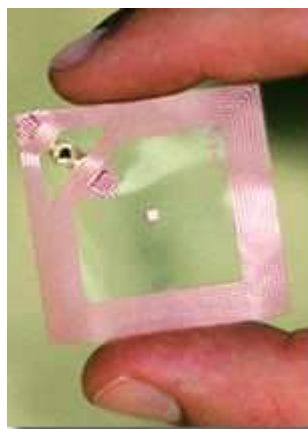
header	manufacturer	product	serial no
8 bits	28 bits > 268 Million	24 bits > 16 Million	36 bits > 68 Billion

## EPCglobal Network (cont)

- **ID System**
  - EPC Tags
  - EPC Readers
- **EPC Middleware**
- **Discovery Services**
  - Object Naming Service (ONS)
- **EPC Information Services**

**EPCglobal** ™

# RFID – More Pictures



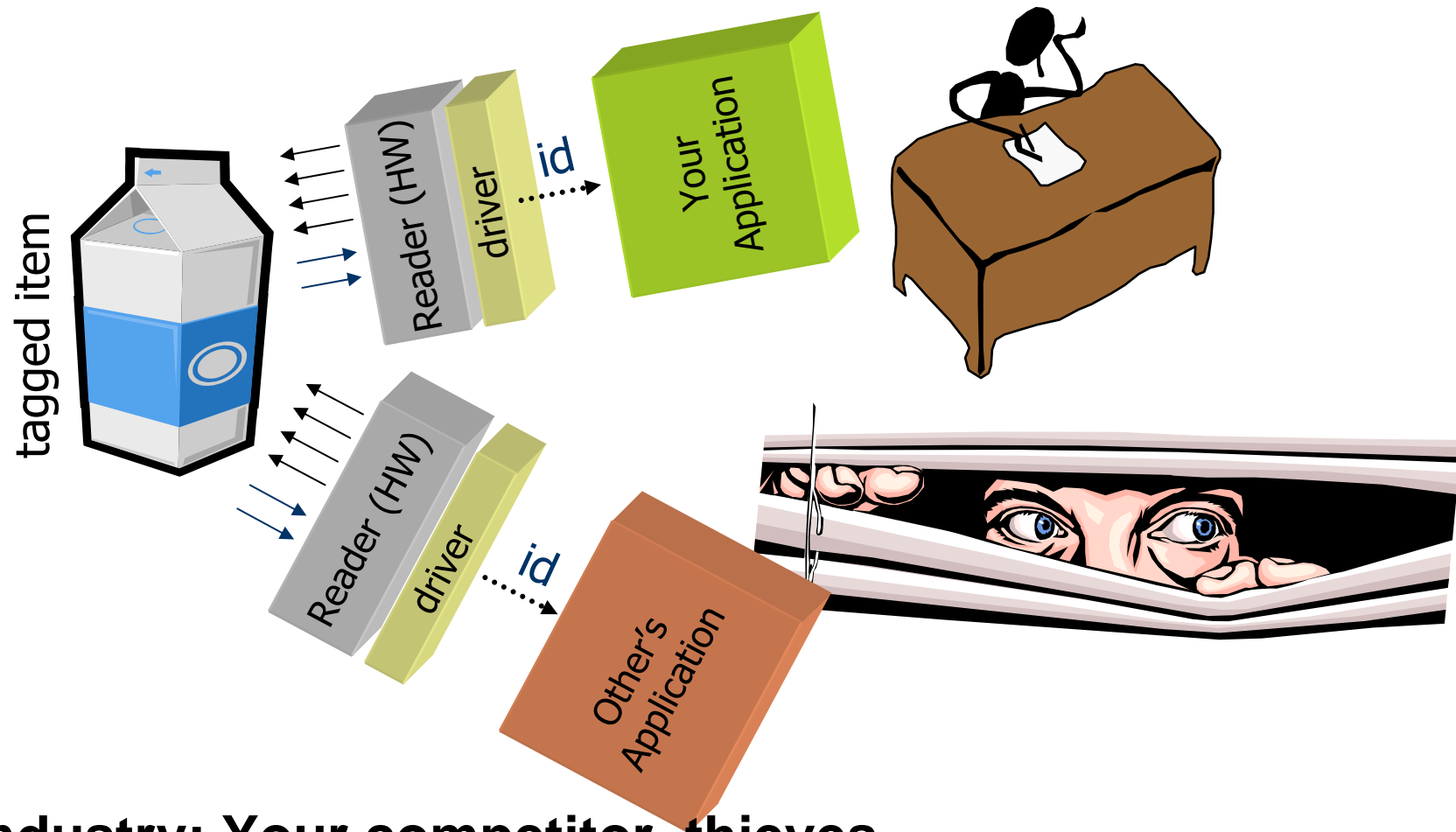
# RFID – Some Challenges

- **Reduce Tag Prices (5 Cent Initiative)**
- **IT Infrastructure**
  - **Data Processing**
    - Online Handling of Huge Amounts of Streaming Data
    - Storage, Network Bandwidth & Systems
  - **Integration**
    - DBs, Data Warehouses and Enterprise Apps
- **Global Standards**
  - **Frequency of Tags & Readers**
    - USA, Europe and Japan using Different Frequencies

### From Consumers' Perspective:

- They are not well informed
- Unclear reason for its usage
- Companies usually have low credibility
  - They could have something to hide
- Laws do not really protect people against misuse
- Secure technology?
  - Enough experiments?

## RFID – Privacy Concerns (cont)



**Industry: Your competitor, thieves, ...**

**End Consumer: companies trying to profile you, thieves**

- **Efficiency, Convenience**
- **Anti-Counterfeiting and Tampering**
- **Trend: Integration of Physical and Digital Worlds**
- **Understand (on Field) the Problem and then Select Appropriate Solution**
- **Read and Write Capability**
  - **Portable Database**
- **Uniquely Identify Every Physical Object**



Thank you! ;^)

