
RFID: Changing Supply Chains of the Future

Alan Thorne (& Duncan McFarlane)
February 2005



Centre for Distributed
Automation and Control

1



UNIVERSITY OF
CAMBRIDGE
Institute for Manufacturing

Overview

- Auto ID Labs – A Global Research Network
- Auto ID Labs at Cambridge
- Project Areas
- Three Application Domains



Overview

- **Auto ID Labs – A Global Research Network**
- Auto ID Labs at Cambridge
- Project Areas
- Three Application Domains

Auto ID Center: 1999-2003

- **Mission**
 - Re-think the role and implementation of the barcode
 - Connecting information and physical flows (“ bits to atoms”) in the supply chain
- **What do you need to do this?**
 - Some way of automatic, reliable transfer and update of information based on physical operations
 - One single system for the whole supply chain
 - RFID as the key element
- **Project:** 103 companies, 6 universities, \$15M

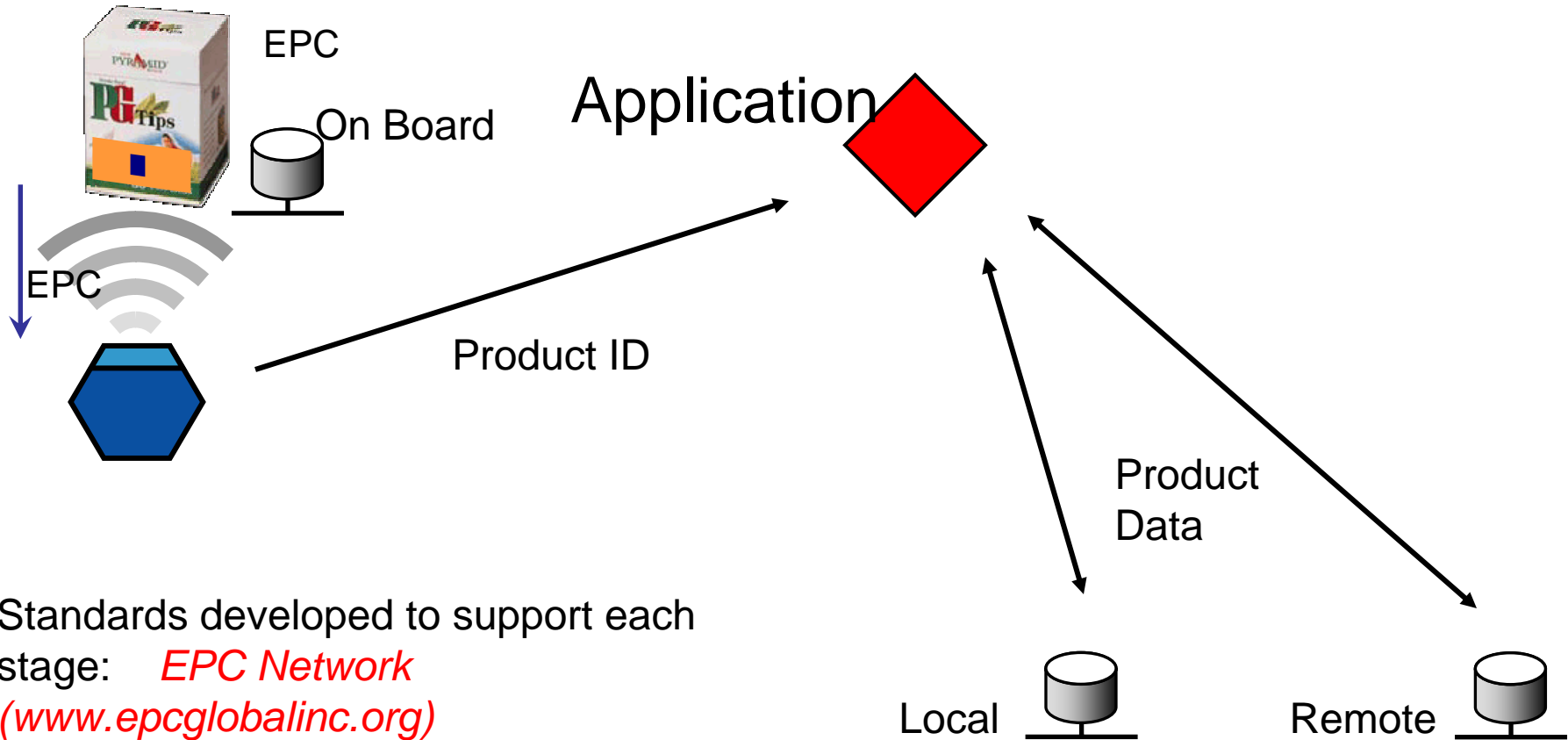


Auto ID Center: Key Thrusts

1. low cost tags and reader systems
 - > reducing chip price = reducing amount of silicon
 - > minimising information stored on chip
 - > ID on chip only, other information on data base

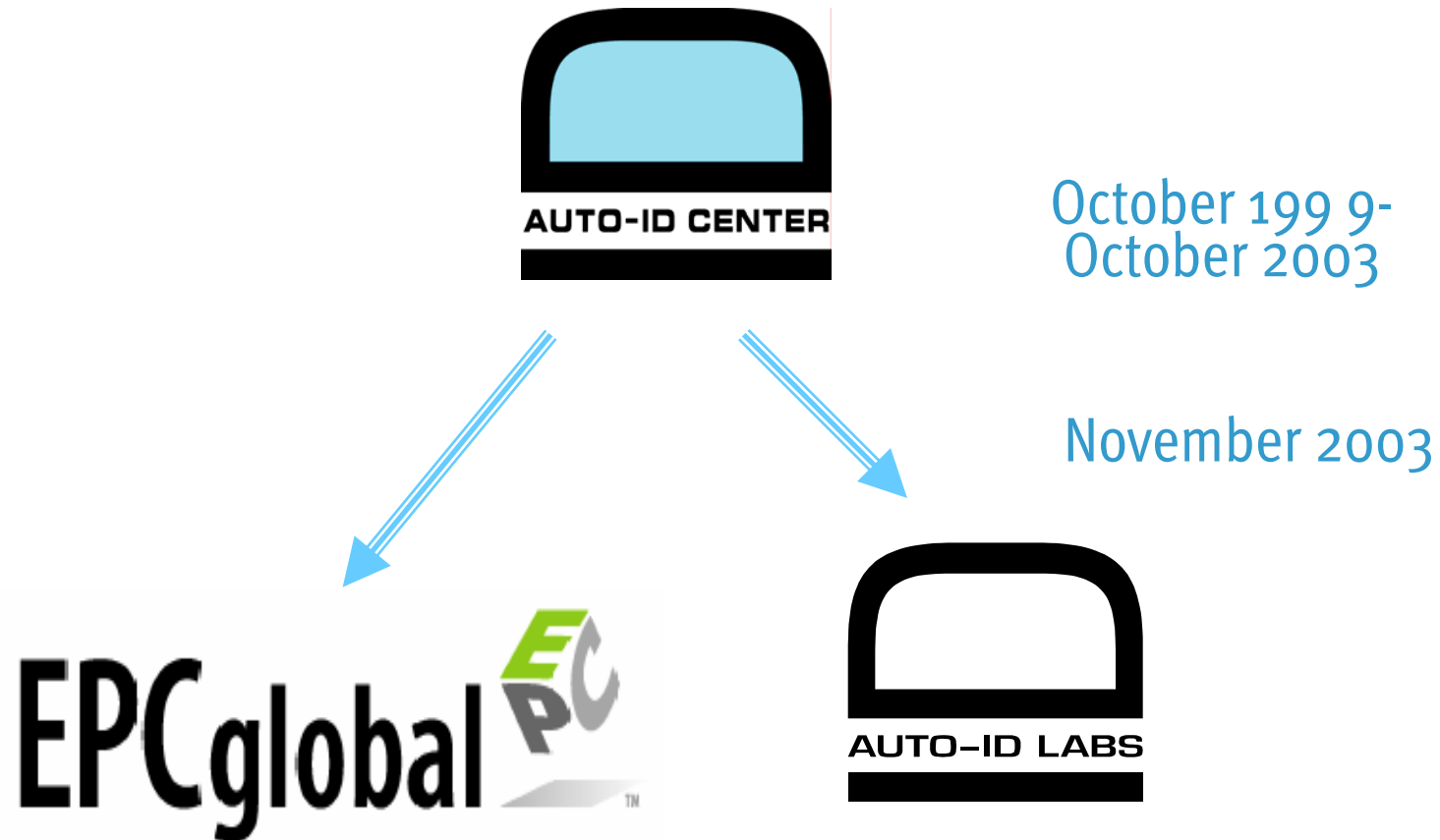
2. business justification through multiple applications/companies
 - > standardised tag/reader systems
 - > standardised data management and comms
 - > RFID network as extension to the internet

Auto ID Center: Networked RFID



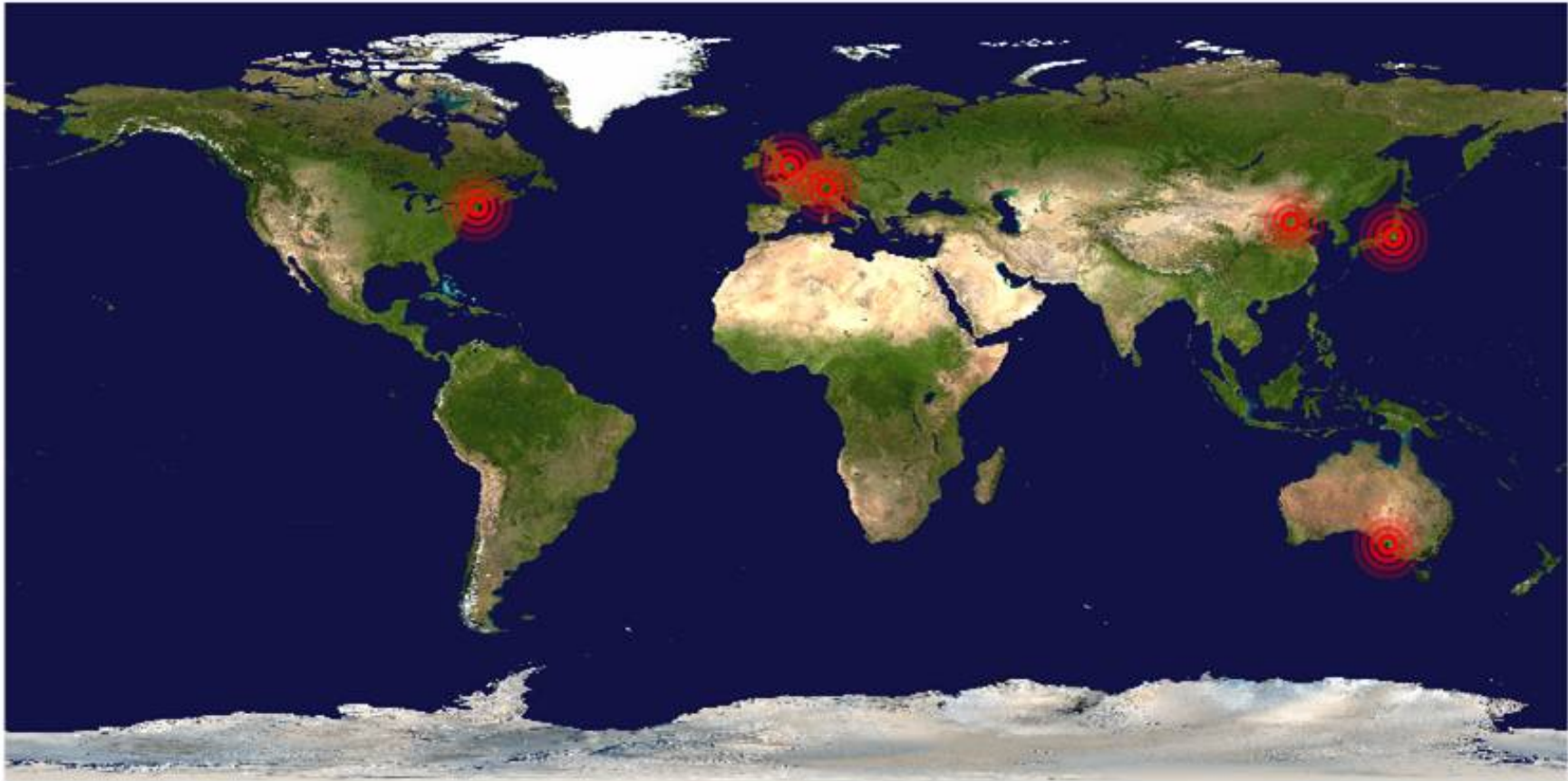
Standards developed to support each stage: *EPC Network* (www.epcglobalinc.org)

EPCglobal and Auto ID Labs



Centre for Distributed
Automation and Control

Auto-ID Labs - a global network



Centre for Distributed
Automation and Control

8



Overview

- Auto ID Labs – A Global Research Network
- **Auto ID Labs at Cambridge**
- Research Areas
- Three Application Domains

Cambridge Auto-ID Labs

- Based in Institute for Manufacturing at Cambridge
- Intelligent automation Systems research since 1995
- ran European Auto ID Center 2000-2003
- Industrially driven research programme
- 7 staff, 9 researchers, 3 industrial fellows
- Key People:
 - Director: Duncan McFarlane
 - Associate Directors: Alan Thorne, Mark Harrison
 - Business Manager: Andy Shaw



Industrial Collaborators

Manufacturing: Britvic, Unipart, Alcatel, ASW, Corus, Henkel, BAeSys, Druck, Daimler Chrysler, BHP Billiton, Unilever, Kawasaki, Gillette, P&G, Bombadier, Fiat

Retail: Tesco, Walmart, Ahold, Metro

Systems: SAP, Invensys, Rockwell, OMRON, AOS, BT, Accenture, CGEY, IBM, Fanuc, Siemens

Remanufacturing: Mbaker, RefurbIT, Klassic, MIREC, Calyx, SecureIT,



Automation Laboratory

- centre piece to CDAC activities
- enormous development over 7 years
- industrial strength testing of research developments
- ongoing visitor stream (>1 per week)
- third phase of development concluded
- work underway integrating Rockwell, Invensys systems

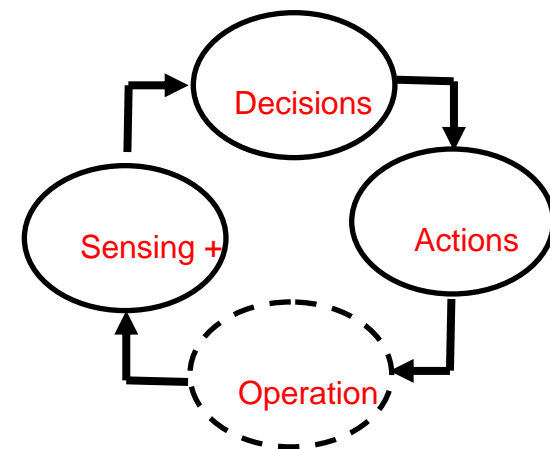
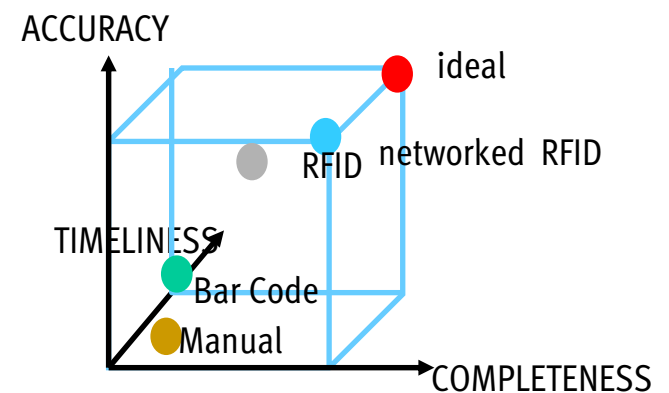


Overview

- Auto ID Labs – A Global Research Network
- Auto ID Labs at Cambridge
- **Research Areas**
- Three Application Domains

Cambridge Research Focus

- Focus on managing ID information once on network
 - EPCIS
 - Distributed Product Information
- Closed Loop ID Systems:
ID -> Product Information -> Decisions
 - Assessment of Product Data Quality
 - Impact of Product Information on Business
- examining impact along supply chain

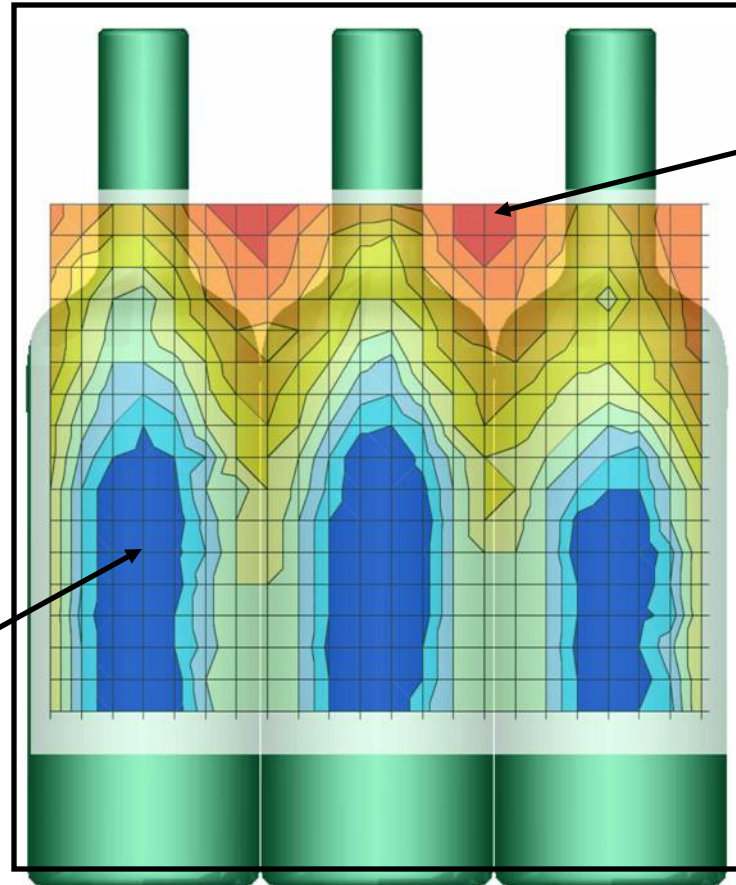


Assessing Product/Tag performance

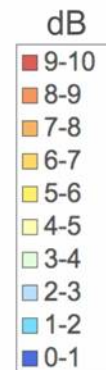


Face of case being tested

Poor tag response



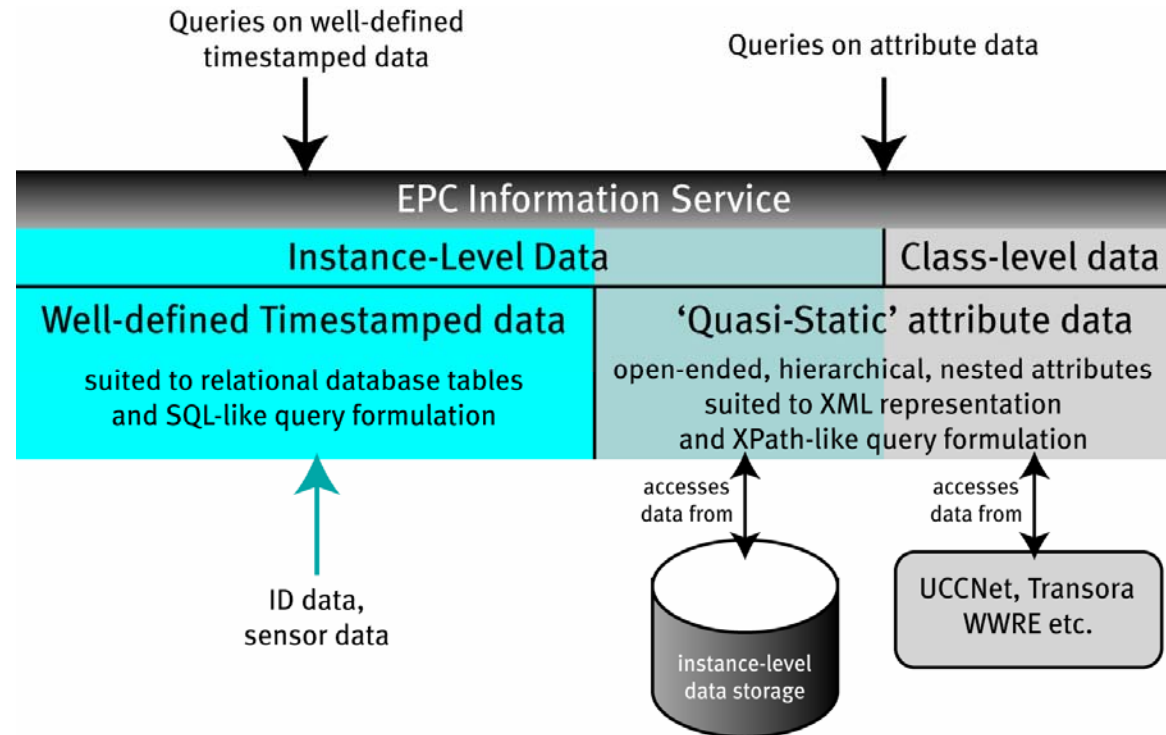
Good tag response



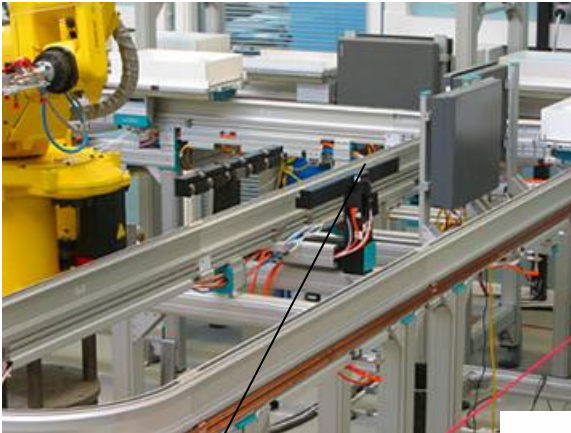
EPC Information Service

- provide an open, universal approach for accessing product data
- solution as a set of interface specifications

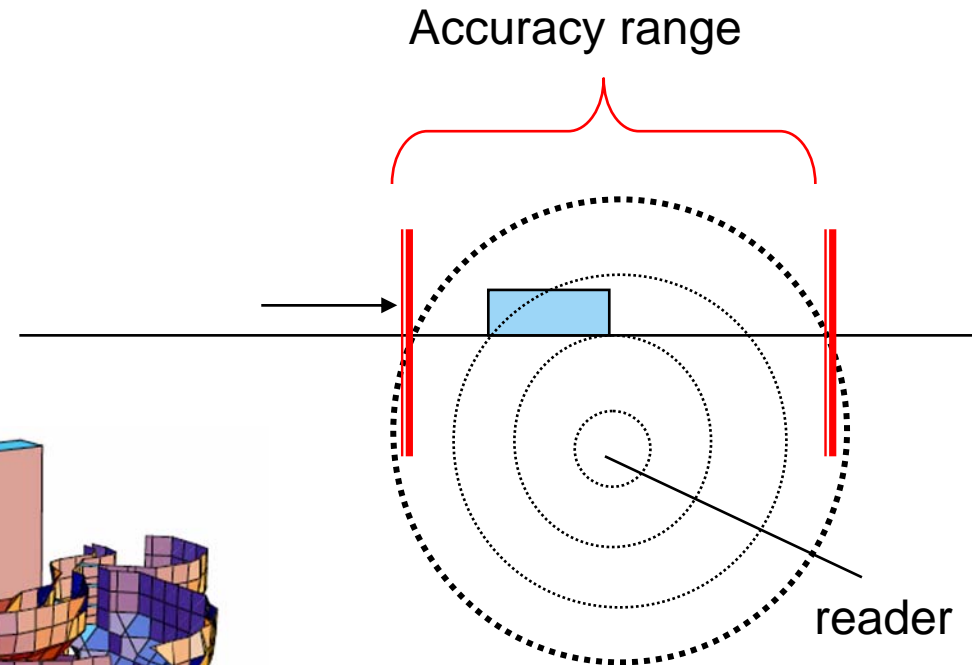
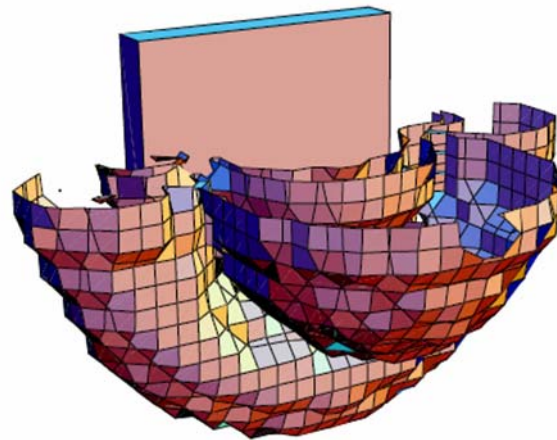
- specification due early 2005



Location With RFID Information?



Locate item on conveyor

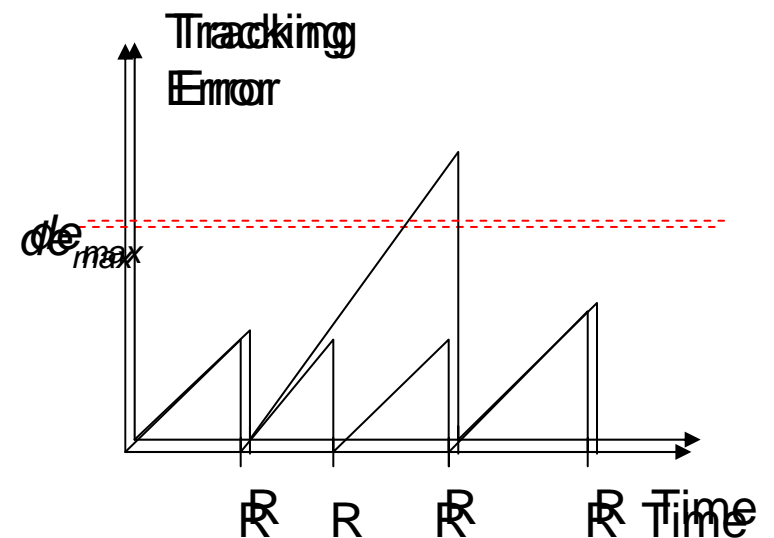


*RFID doesn't provide location:
NEED other sensors,
constraints, models*

RFID based Tracking?

“The provision (on demand) of an accurate, timely and complete representation of the location of an item”

- Tracking is a model based process
- RFID simply provides sensory inputs to enhance that model
- **Tracking can be 100% accurate, RFID cannot!**
- Quantification of the impact of RFID on tracking of products



RFID and Late Customisation



the ability to delay the commitment to a particular customisation decision to the latest point in the order fulfillment process.

- related to mass customisation
- occurs in manufacturing, distribution, retail ...
- Late customisation requires
 - Flexible operations
 - Adaptable control logic
 - High fidelity sensing

Intelligent Products & Orders

- linking of physical products via RFID to instructions for quality control, routing and customisation
- Linked concept of *order driven control: an order or product “escorting” its own production or distribution*
- Applications in manufacturing, distribution, retail, recycling



High-speed conveyor belts and state-of-the-art technology help move merchandise efficiently through the distribution centers, keeping Wal-Mart's nearly 3,000 stores in stock.



Overview

- Auto ID Labs – A Global Research Network
- Auto ID Labs at Cambridge
- Research Areas
- **Three Application Domains**
 - FMCG/Retail
 - (Electronics) Recycling
 - Aerospace

FMCG/Retail: Mandates etc

- FMCG/Retail “Mandates”
 - WalMart: By January 2005 top 100 suppliers using EPC tags on cases and pallets
 - Tesco: Selected product lines to be tagged starting Sept 2004
 - Also Target, Albertsons, Metro
- Significant trialling elsewhere (e.g. M & S)
- EPC Global driving specification adoption



High-speed conveyor belts and state-of-the-art technology help move merchandise efficiently through the distribution centers, keeping Wal-Mart's nearly 3,000 stores in stock.



Wal-Mart Supercenters range from 109,000 square feet to more than 260,000 square feet and offer shoppers a wide variety of goods and services.



FMCG/Retail: Status

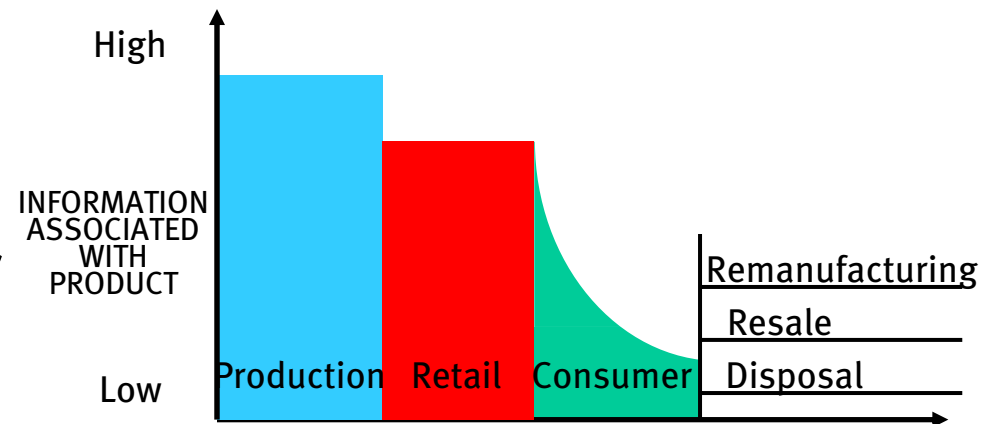
- Initial reports on WalMart trials positive
- WalMart involving suppliers 100-300 in current discussions
- focus currently on stand alone RFID deployment (2005 “Year of Network” – Chris Adcock, EPC Global)
- focus currently on case and pallet
- item level tagging being trialled in high value areas
 - CD, DVD, clothing, razors



RFID in Recycling

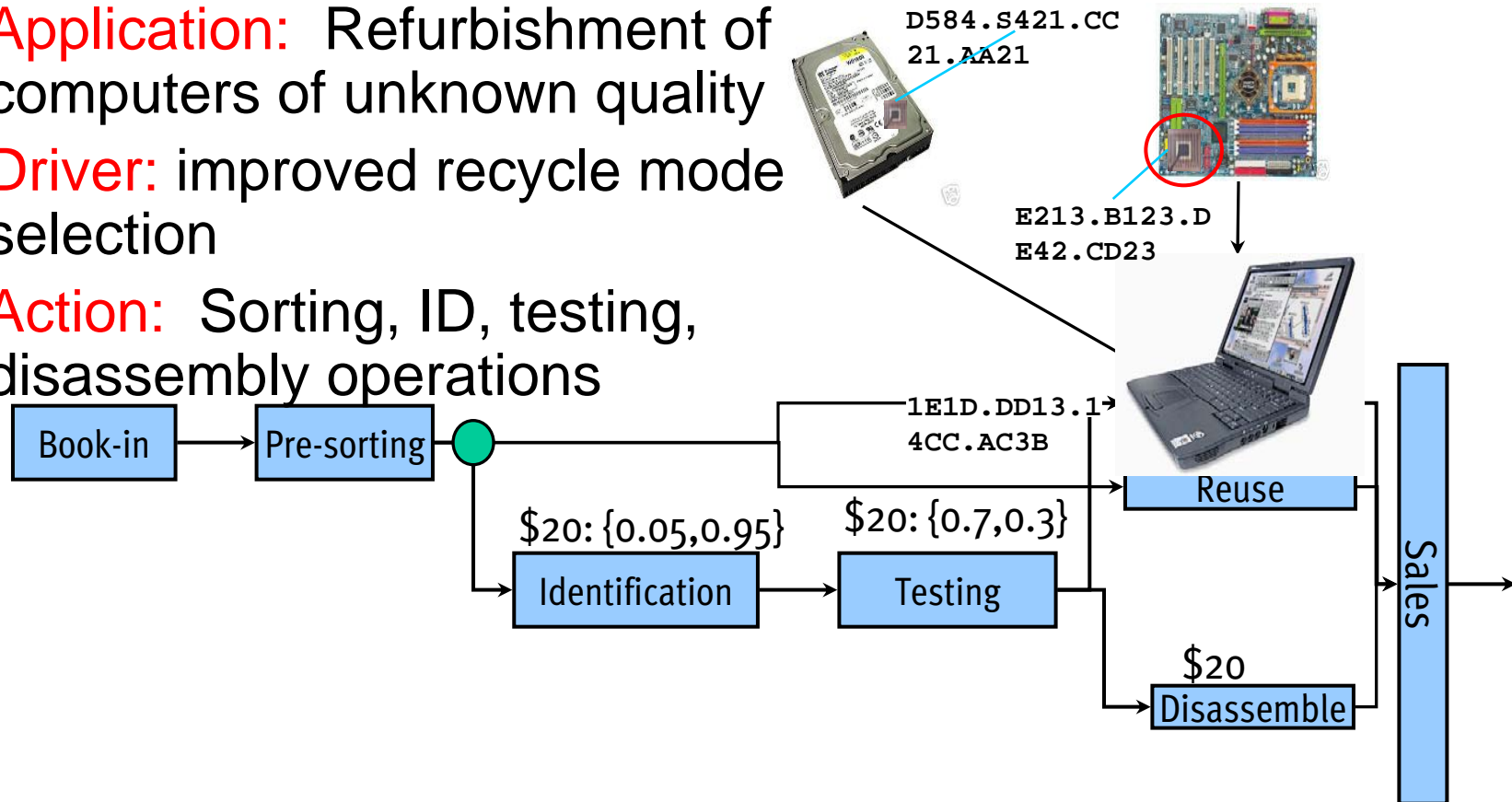
- Disposal -> Reuse shift
- Legislations: EU, Japan, ...
 - electrical goods
 - auto
 - Packaging
- Real disposal costs assigned to user/ retailer /manufacturer

- RFID issue: Product (life) information is key to effective retirement decisions



RFID in Recycling: Intelligent Reuse

- **Application:** Refurbishment of computers of unknown quality
- **Driver:** improved recycle mode selection
- **Action:** Sorting, ID, testing, disassembly operations

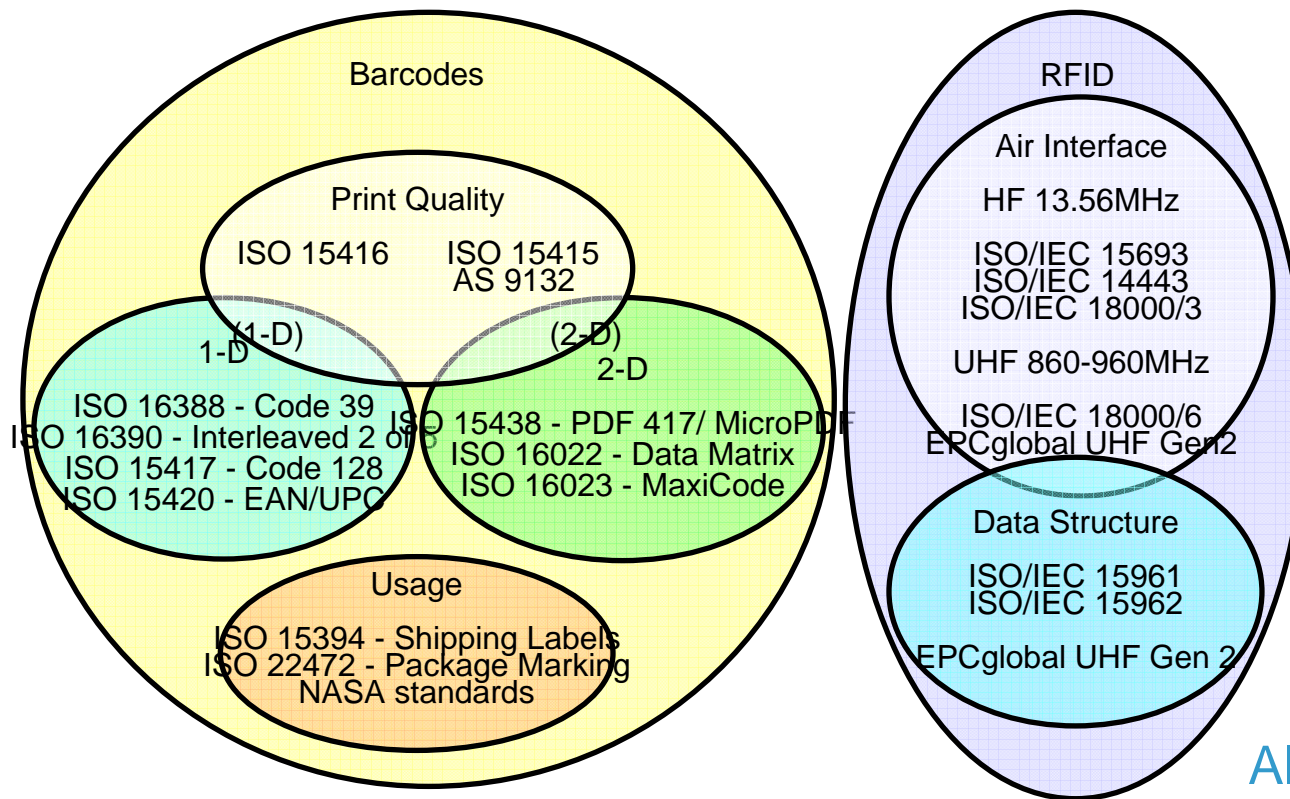


Aerospace: Adoption Issues

- Investigations by individual companies
- Boeing and Airbus joint initiative
 - Aim: promote the adoption of industry standard solutions for RFID on commercial airplane parts
 - RFID integrated into Air Transport Association standards
 - RFID tags integrated with existing bar codes
 - Initial Focus on Cabin Parts
- Military – standards activities exist
- (Baggage handling initiatives underway)
- Standards are complex!



Aerospace Standards - part marking



Also product data standards

Aerospace ID Programme

- Aim: To remove barriers to widescale Automated ID deployment through timely and effective R&D
- Launching March / April 2005
- Approach: 18 month programme focussed on key research barriers
- *Synchronise research with Boeing/Airbus industry initiative*

Aerospace: Research Issues

- Lifecycle ID Management
- ID Technologies Application Matching
- Sensor Fusion
- RFID Enhanced Track and Trace
- Tag and Database Synchronisation

Overview

- Auto ID Labs – A Global Research Network
- Auto ID Labs at Cambridge
- Project Areas
- Three Application Domains
 - comparison

Common Issues

- Low Cost Tagging Solutions
- Multiple, simultaneous read requirement
- Network connectivity
- Unified specifications and standards
- Data Security
- Exception Management orientation

Key Differences

- Tag Life Expectancy
- Supply Chain Drive Position:
 - Maker, Mover, Seller, User?
- On Board/Off Board Memory
- Tag – Network Data Synchronisation
- Legislative v Economic Imperative
- Privacy