
Networked RFID Across the Product Life Cycle

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INTRODUCTION

Auto ID Center/Auto ID Lab

Introduction: Auto ID Center

- **Mission**

- Re-think the role and implementation of the barcode
- Connecting information and physical flows (“ bits to atoms”) in the supply chain

Merging Bits and Atoms

- How to connect the physical world and data world?
 - Give each object a unique identity number
 - the electronic product code (EPC)



Physical-world Object

Data-world Information

Introduction: Auto ID Center

- **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?**

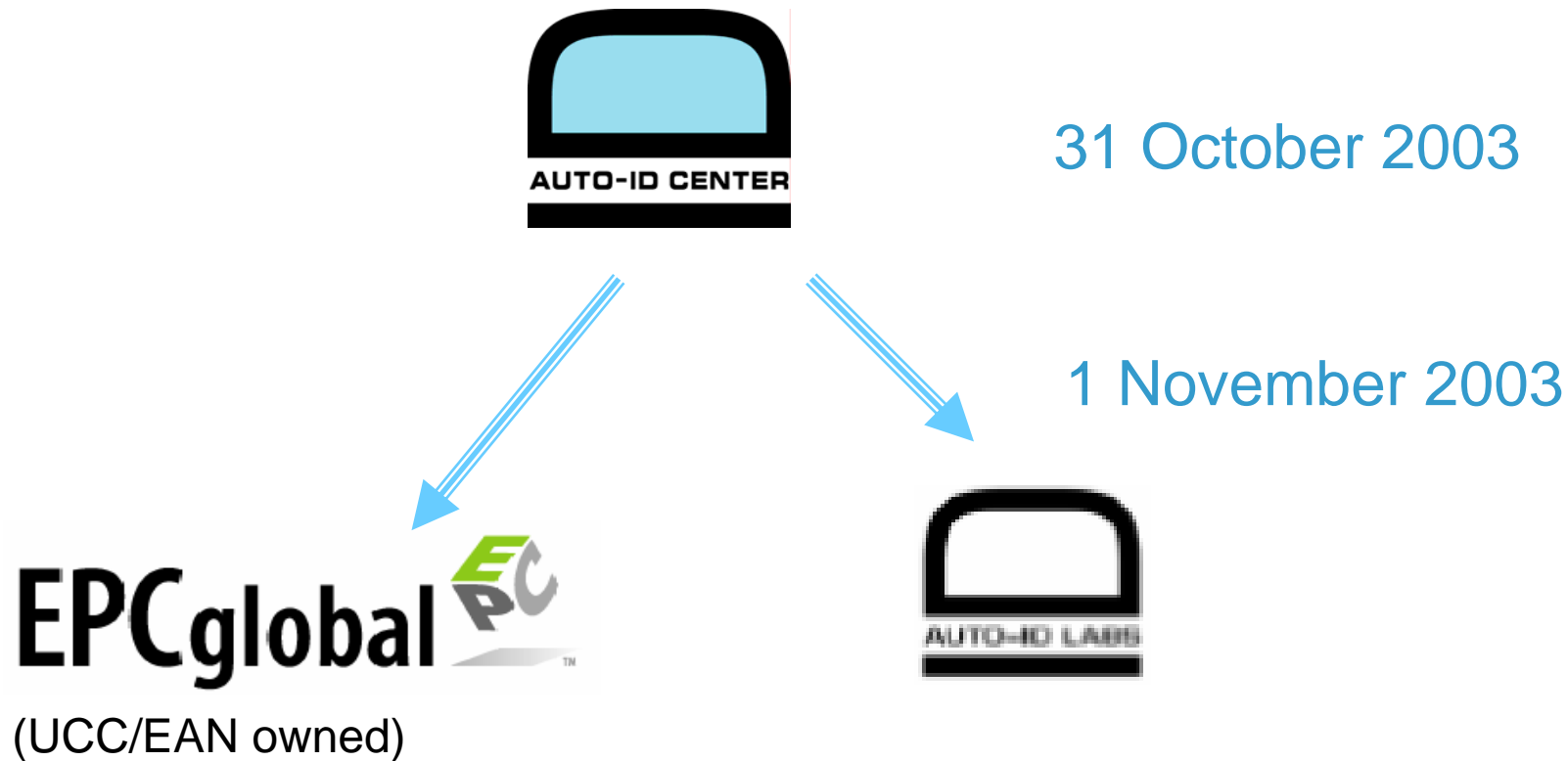
- Some way of automatic, reliable transfer and update of information based on physical operations
- One single, low cost system for the whole supply chain
- RFID as the key element

Auto-ID Centre sponsors

- Gillette
- Wal-Mart
- P&G
- Unilever
- Kraft
- Philip Morris
- Nestle
- Best Buy
- Target
- Tesco
- Home Depot
- CVS
- BT
- Sun
- Philips
- Intel
- ST Micro
- Canon
- Alien
- NTT
- Metro
- Mitsui
- Pfizer
- Sara Lee
- USPS
- UPS
- DoD
- UCC/EAN
- Accenture
- IBM
- Coca-Cola
- Pepsi
- Kodak
- NCR
- SAP
- Symbol
- Ahold
- Metro
- Carrefour
- Kelloggs
- Kimberly Clark
- Johnson & Johnson
- Home Depot
- Chep
- AC Neilson
- Accenture
- CGEY

...103 in total

Introduction: EPCglobal and Auto ID Labs



FUNDAMENTALS: Auto ID Center's Networked RFID Approach

Auto ID Center: Key Thrusts

1 low cost tags and reader systems

- > reducing chip price = reducing amount of silicon required
- > 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 communication systems
- > EPC network system as extension to the internet

The Electronic Product Code (EPC)

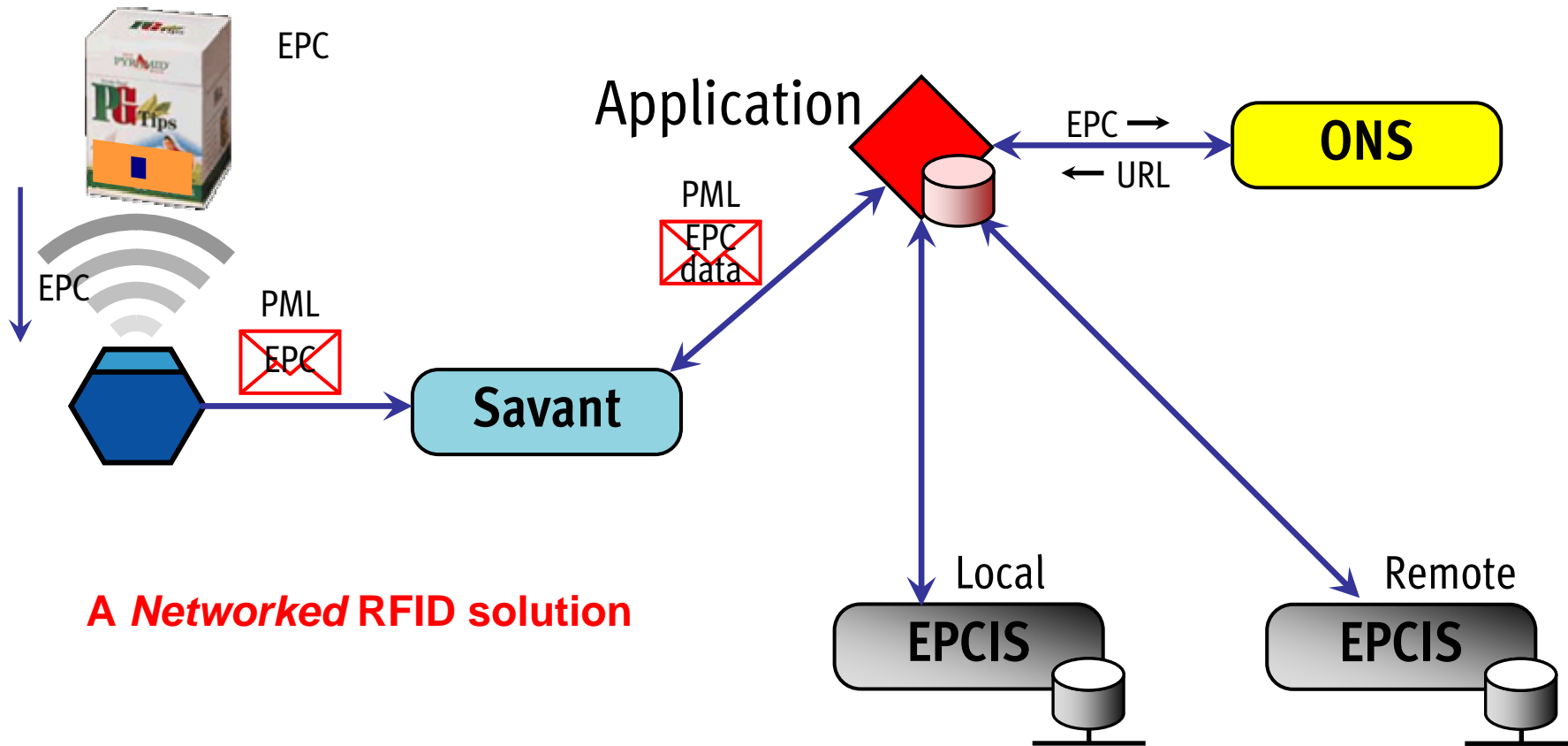
- The EPC is a bit like a unique web address for each object.
- The EPC itself doesn't tell you much about what the object is, but like a web address allows you to find further information about the object using the EPC network (Internet of Things)



01.0000389.000162.000169740

Header	EPC Manager	Object Class	Serial Number
8 bits	28 bits	24 bits	36 bits

Auto ID Center: EPC Network



Networked RFID/EPC Network

- Low level information on tag, linked information on networked databases
- Tag price from \$0.50 in 1999 to ~\$0.05 in 2004 (for 10^{10} tags)
- Initial focus on replacing manual barcode processes in FMCG/Retail

FUNDAMENTALS: Impact of RFID

Extracting Benefits from RFID

Networked RFID provides product data that is:

- Accurate
- Item-level
- Complete
- Automatic
- Timely
- Universal



Typical Product Data

- Item ID
- Size
- Status
- History
- Instructions
- “Location” Information

How can this be made useful?

Extracting Benefits from RFID: Visibility??

Some “quotes”:

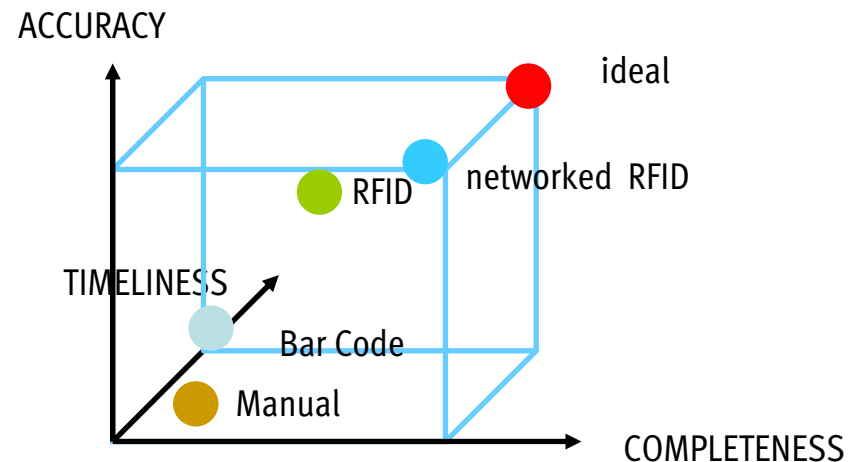
*“RFID will give us total **visibility** of our supply chain operations”*

*“**Visibility** is critical to improving our service levels while at the same time reducing inventory”*

*“We expect that – eventually – RFID will provide complete **visibility** throughout the entire life cycle of our products”*

Extracting Benefits from RFID: *Better Information*

- *Visibility: The availability of information about the status of an object (on a production line/ truck/ shelf) on demand.*
- value of networked RFID is in enhancing the quality of product information
- information quality dimensions
 - accuracy
 - completeness
 - timeliness



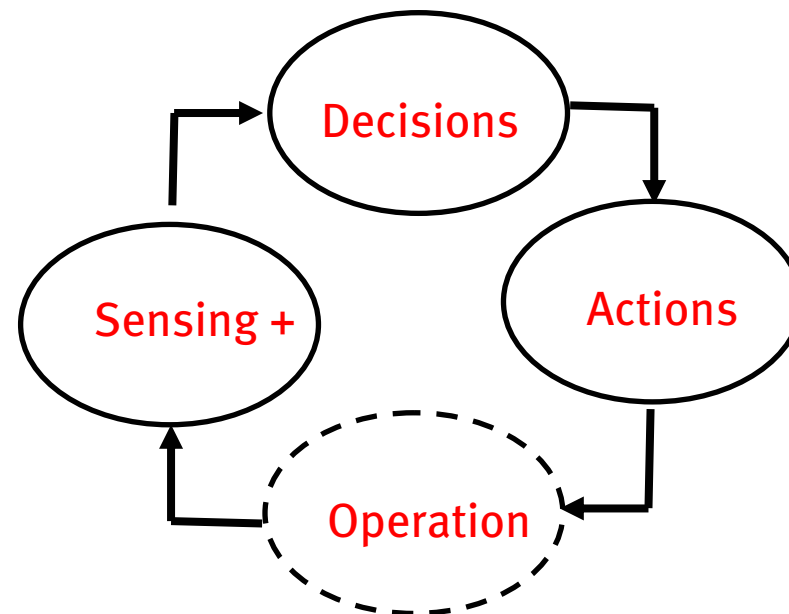
Extracting Benefits from RFID: *closing the loop*

- RFID enhances the *visibility* of operations

BUT sensing doesn't deliver benefits on its own!

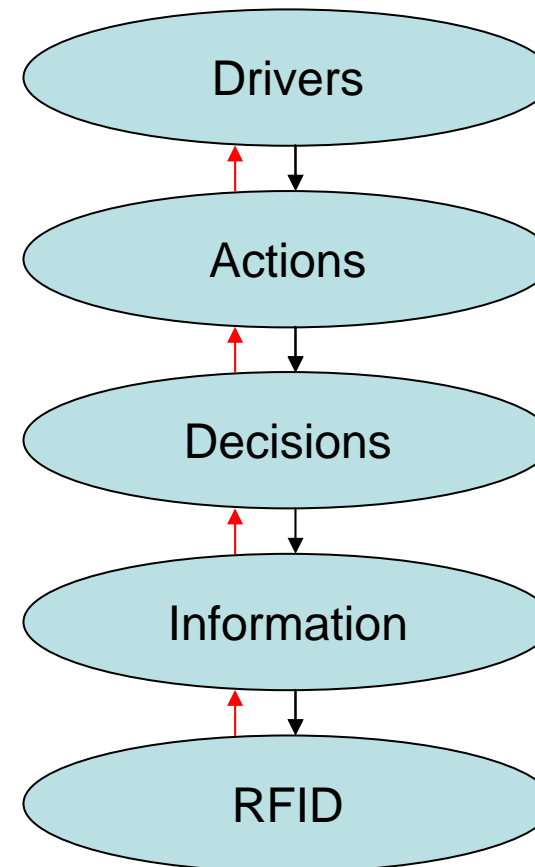
- need to examine the “control” loop

... *visibility* is only useful where it influences a decision



Extracting Benefits from RFID: *Drivers first*

- business drivers must underpin RFID deployment
- determine actions which impact on drivers – options?
- determine decisions which influence actions – flexibility?
- identify product information characteristics required to change decisions
- map characteristics to RFID or other sensory specifications



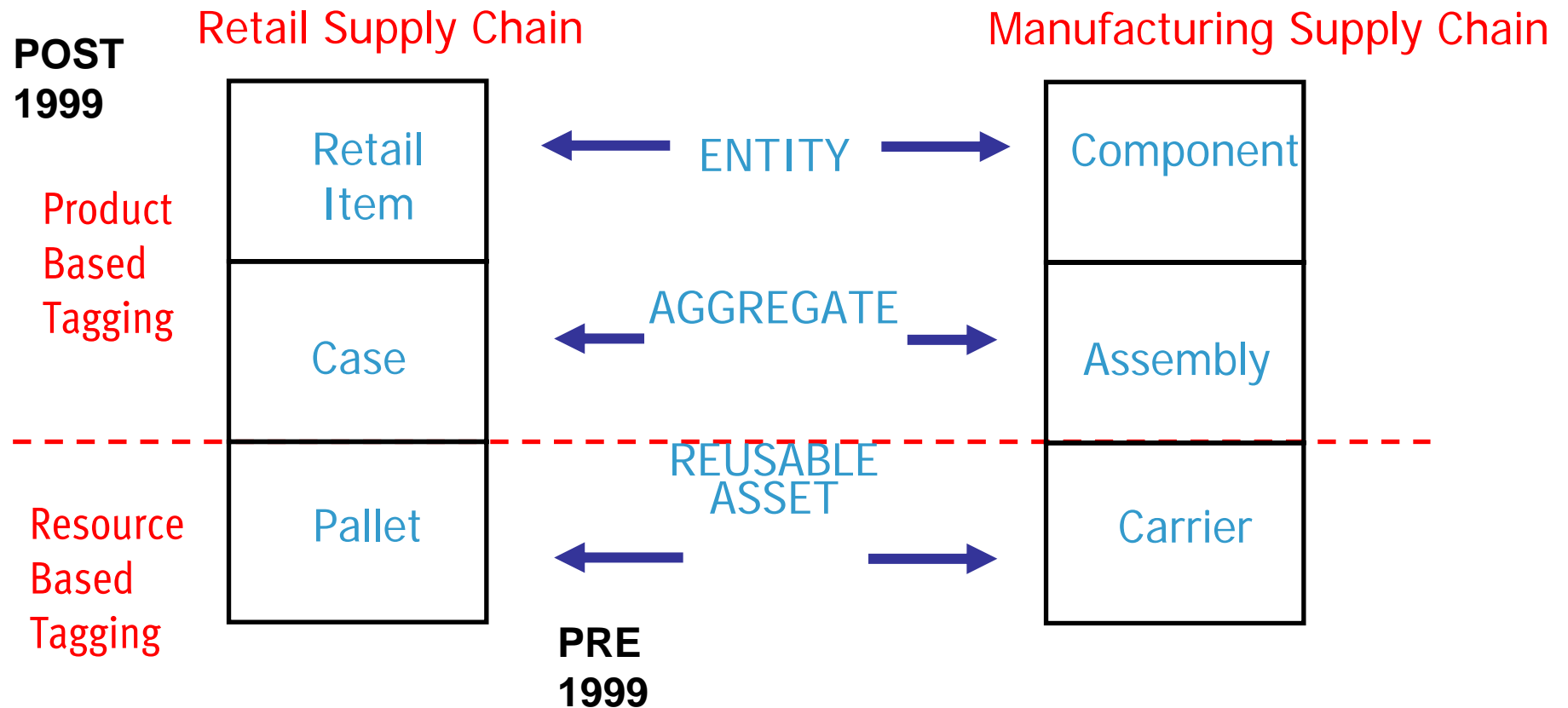
APPLICATIONS: Approaches, Drivers, Mandates

Approaches: Application Characteristics

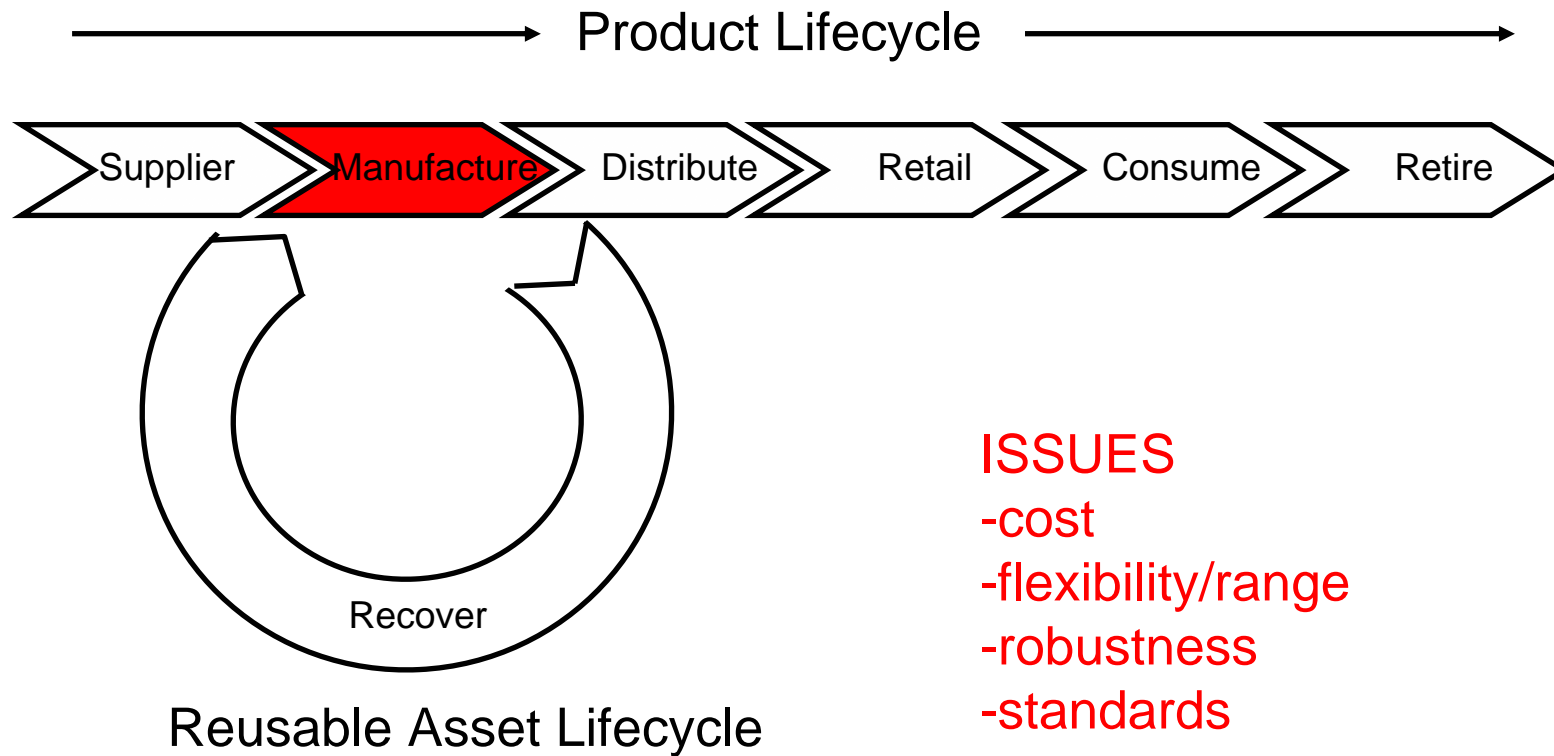
	Tolling	Library	Asset	Baggage	EAS	Supply Chain
Complexity of Information on Tag	M	L	H	L	L	L
Single or Multiple Applications for Each Tag	S	S	S	S	S	M
Volume of Tags	L	L	L	M	M	H
Expected Life of Tag	H	H	H	M	M	L

Source: Hodges, McFarlane, Radio Frequency Identification: Technology, Applications and Impact, OECD Report, Dec, 2003

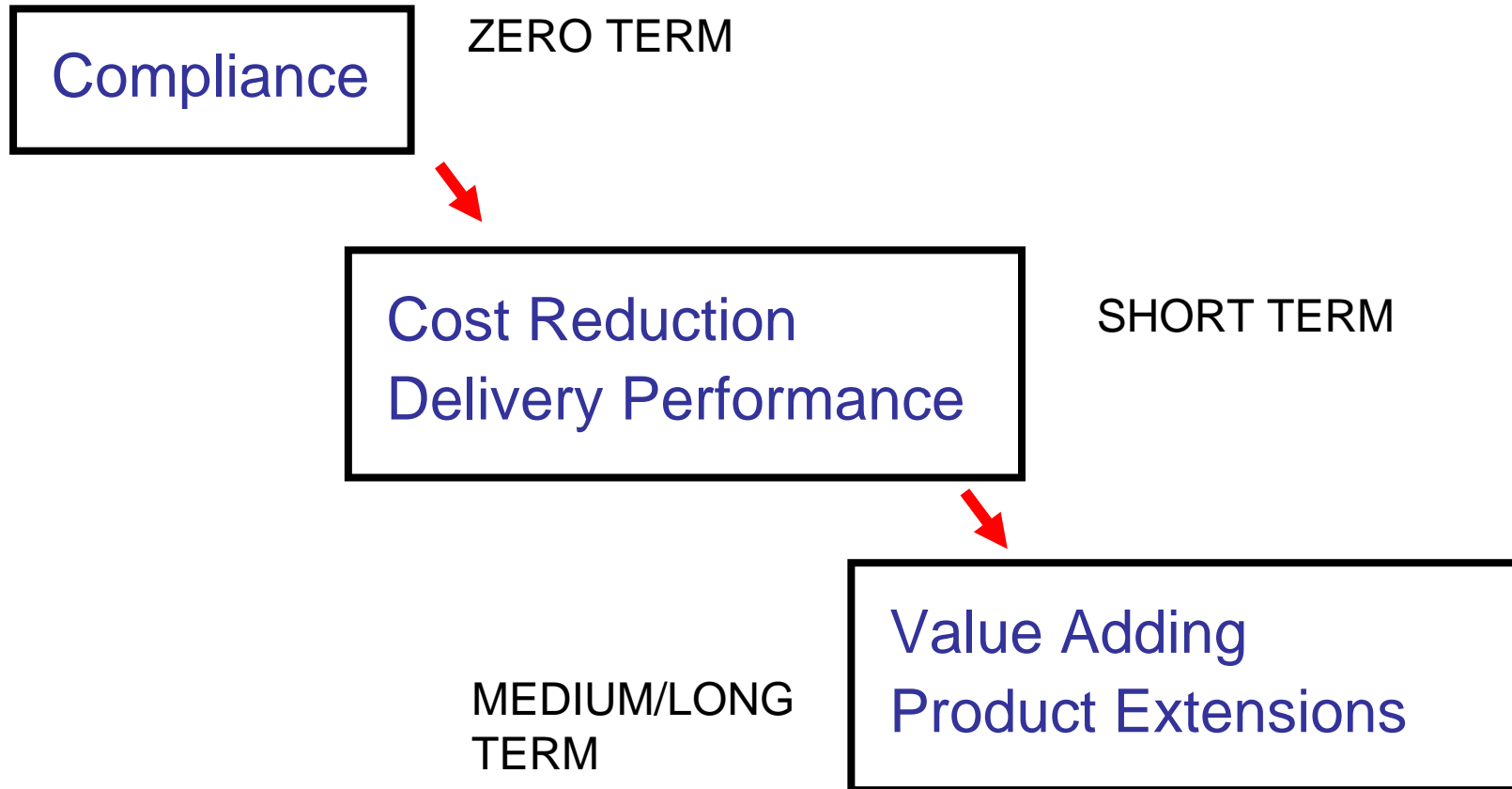
Approaches: Deployment Levels



Approaches: Tag Lifecycle



Drivers – *Zero, Short, Medium Term*



RFID Adoption Activities

- FMCG/Retail
 - WalMart: By January 2005 top 100 suppliers must use EPC tags on cases and pallets
 - Tesco: Selected product lines to be tagged starting Sept 2004
 - Also Target, Albertsons, Metro
 - Defence: *DOD* suppliers to use RFID by January 2005 (active/passive mix)
 - Aerospace: Boeing/Airbus announcement
 - Pharmaceutical: FDA announced item level tagging for 2007
 - Automotive: Automotive Associations examining
 - Other influences: Food Traceability, Recycling legislation
-

APPLICATIONS: Today's Issues & Challenges

Integration with existing systems

- Simplification of Systems Integration Challenges
 - Physical hardware: *getting systems installed and **connected!***
 - Information systems: *middleware: **coordination** of existing processes with EPC data*
 - Business processes: *achieving **coherence** – redesign of processes from scratch to leverage EPC*

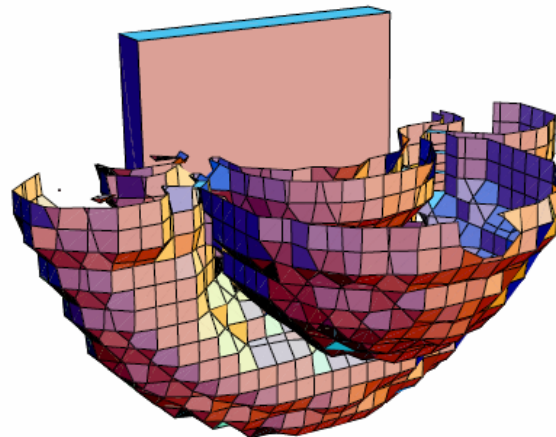
RFID Physical Event
to Transaction
Conversion

RFID Data to
Physical Event
Conversion

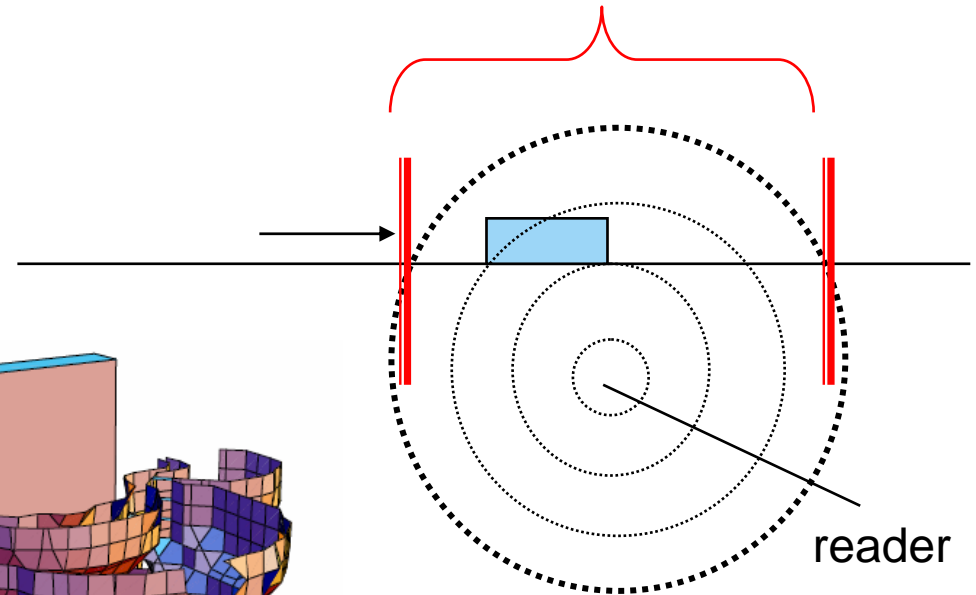
RFID and Location



Locate item on conveyor



Accuracy range



NEED
other sensors,
constraints, models

EPC Network training

- *RFID is not immediately acquired*
- Auto ID Labs only running a small number of intensive courses
- Spun off separate company to support commercial training: easyEPC
- Range of course levels
 - easyEPC for adopters
 - easyEPC for implementers
 - intensive easyEPC
 - customised easyEPC
- Working with 3rd party providers
 - RFID Journal University, e Centre, IDTechex

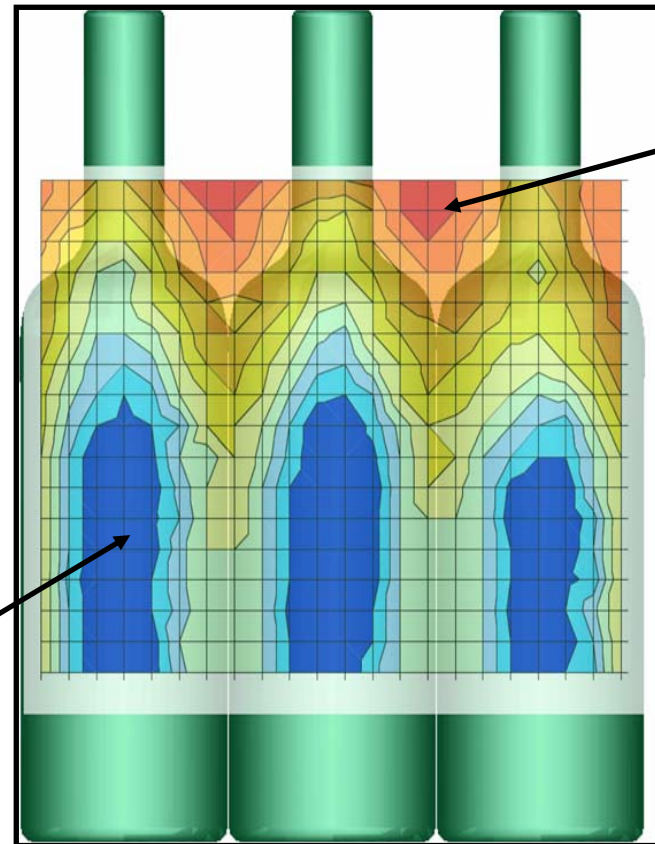


[http:// www.easyEPC.com](http://www.easyEPC.com)

Reducing Uncertainty in Product/Tag performance



Face of case being tested

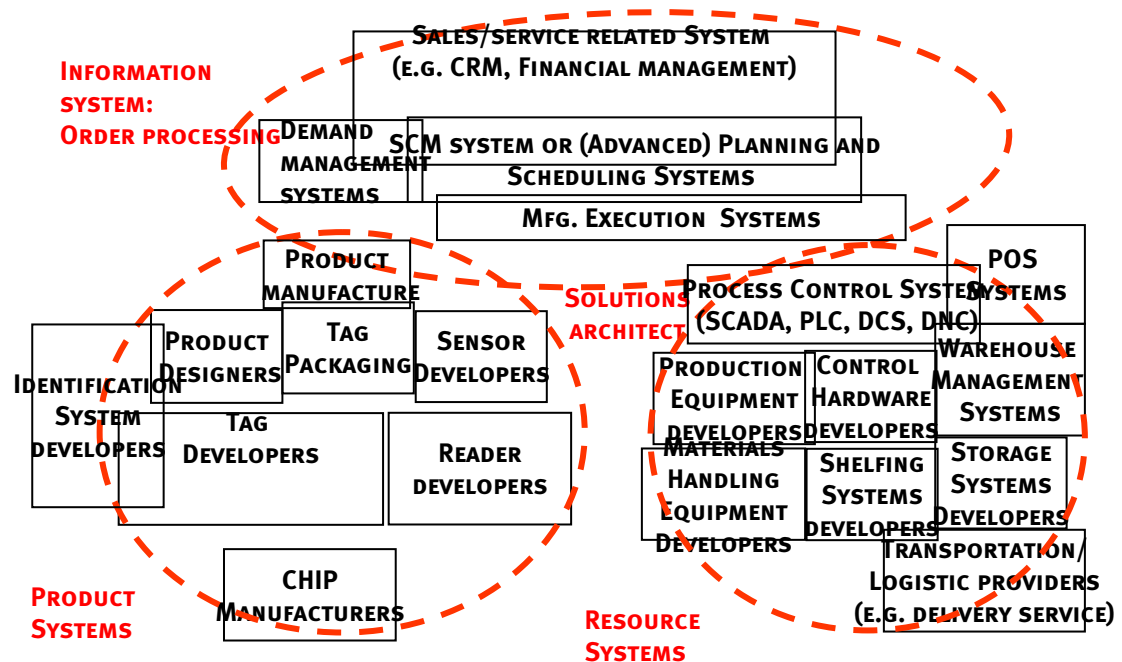


Good tag response

Poor tag response

Knowing what to do and who to Work with?

- **objectivity**: critical for assessing many options
- **interoperability**: needed to guard future
- **vendor space**: large, complex, growing



Extracting Benefits for Manufacturing

- getting over the mandate mountain in FMCG
- need to use a global standards beyond FMCG
- activities in aerospace, automotive, pharmaceutical, etc
- impact of RFID / EPC Network within manufacturing operations (safety, quality, track/trace)
- dealing with difficult products, environments ...
- specific issues: on tag v off tag data



*** Manufacturing Special Interest Group at Cambridge Auto ID Labs ***

APPLICATIONS: Future Developments

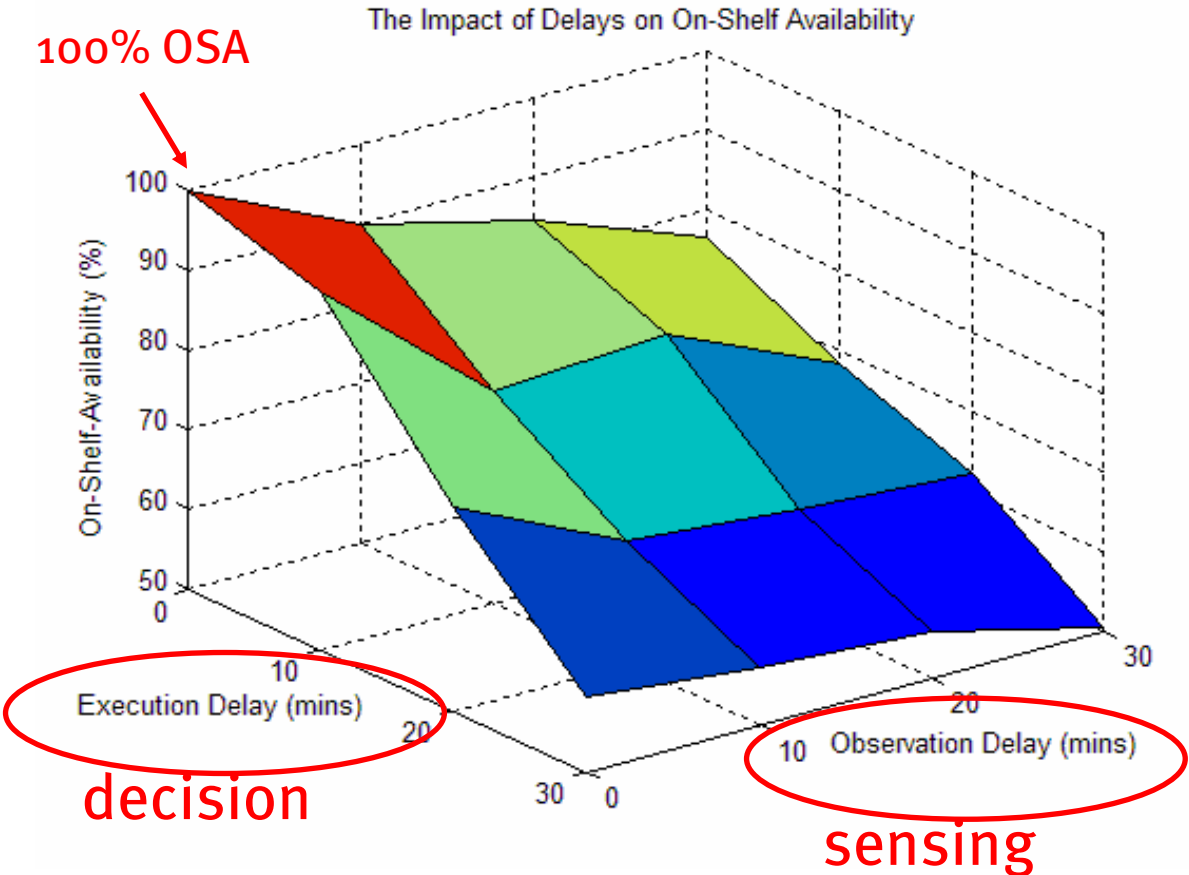
RFID in Manufacturing: Mass Customisation

- Real Time RFID based data greatly enhancing customisation capabilities
- Enables Customer Driven, Late Customised Packing Operations



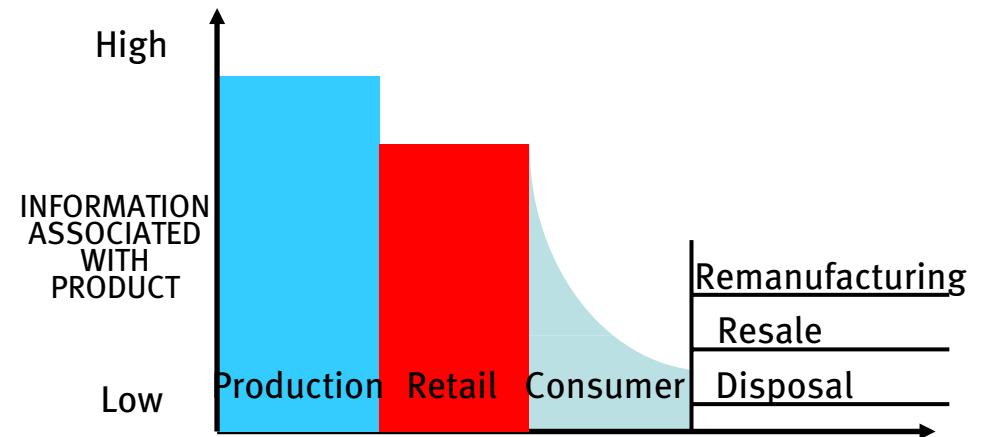
RFID in Retail: New Replenishment

- Item Level Tagging to
- reduce shelf space allocation,
 - Improve on-shelf-availability,
 - Reduce out-of-stock

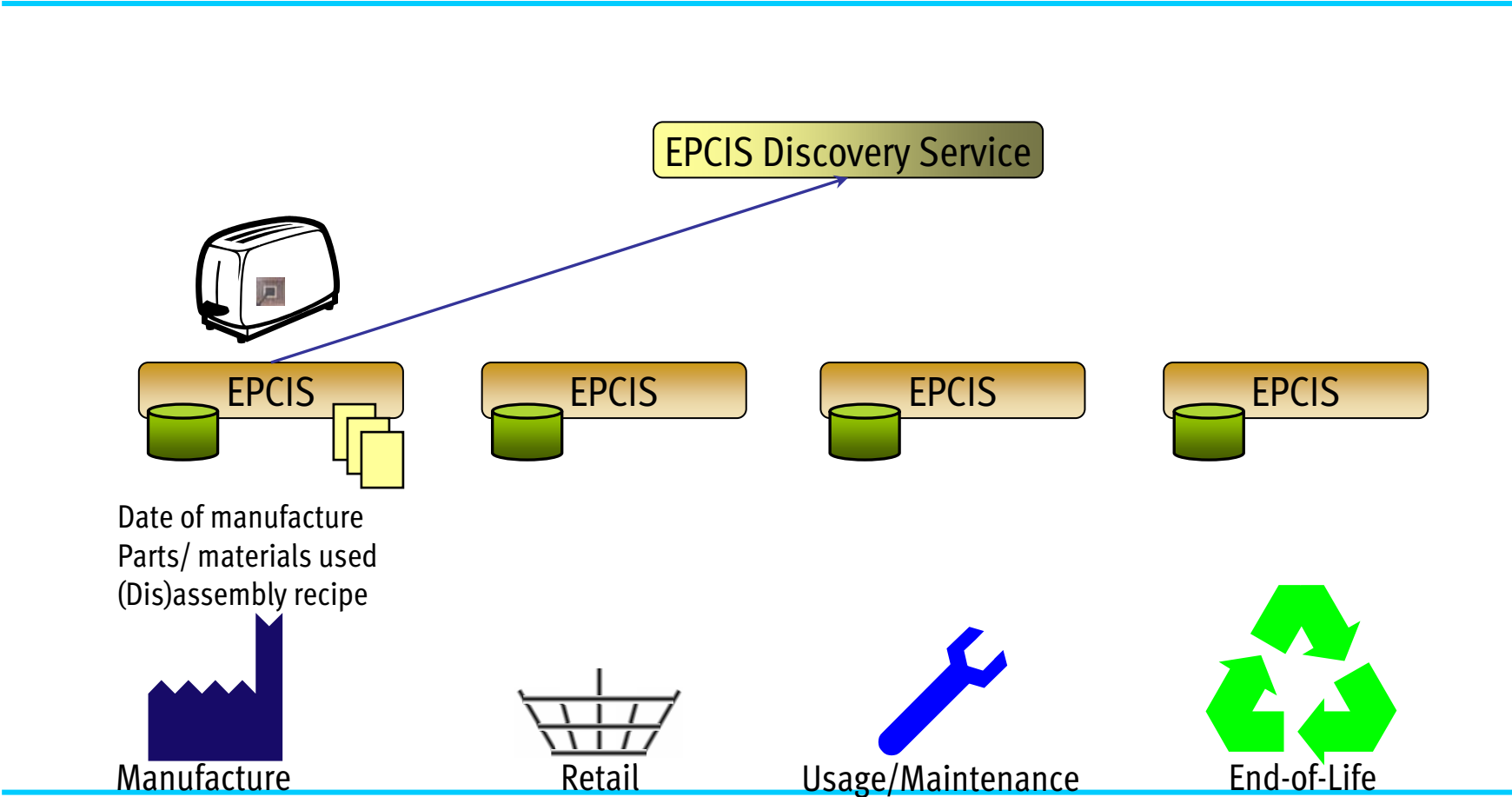


RFID in Recycling: Issues

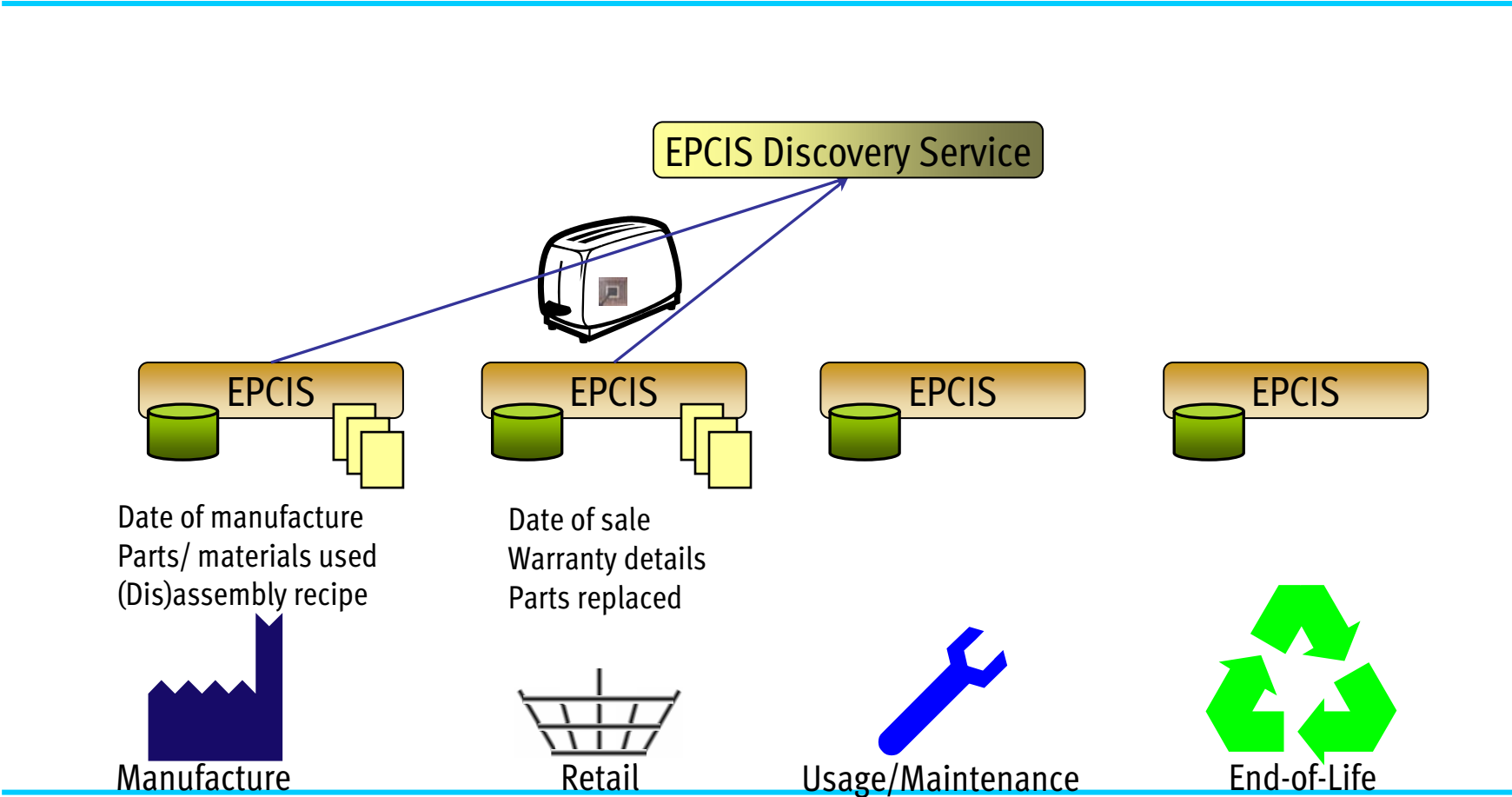
- Disposal -> Reuse shift
- Legislations: EU, Japan, ...
 - electrical goods
 - auto
 - packaging
- Real disposal costs assigned to user/ retailer /manufacturer
- RFID issue: Product information is key to effective retirement decisions



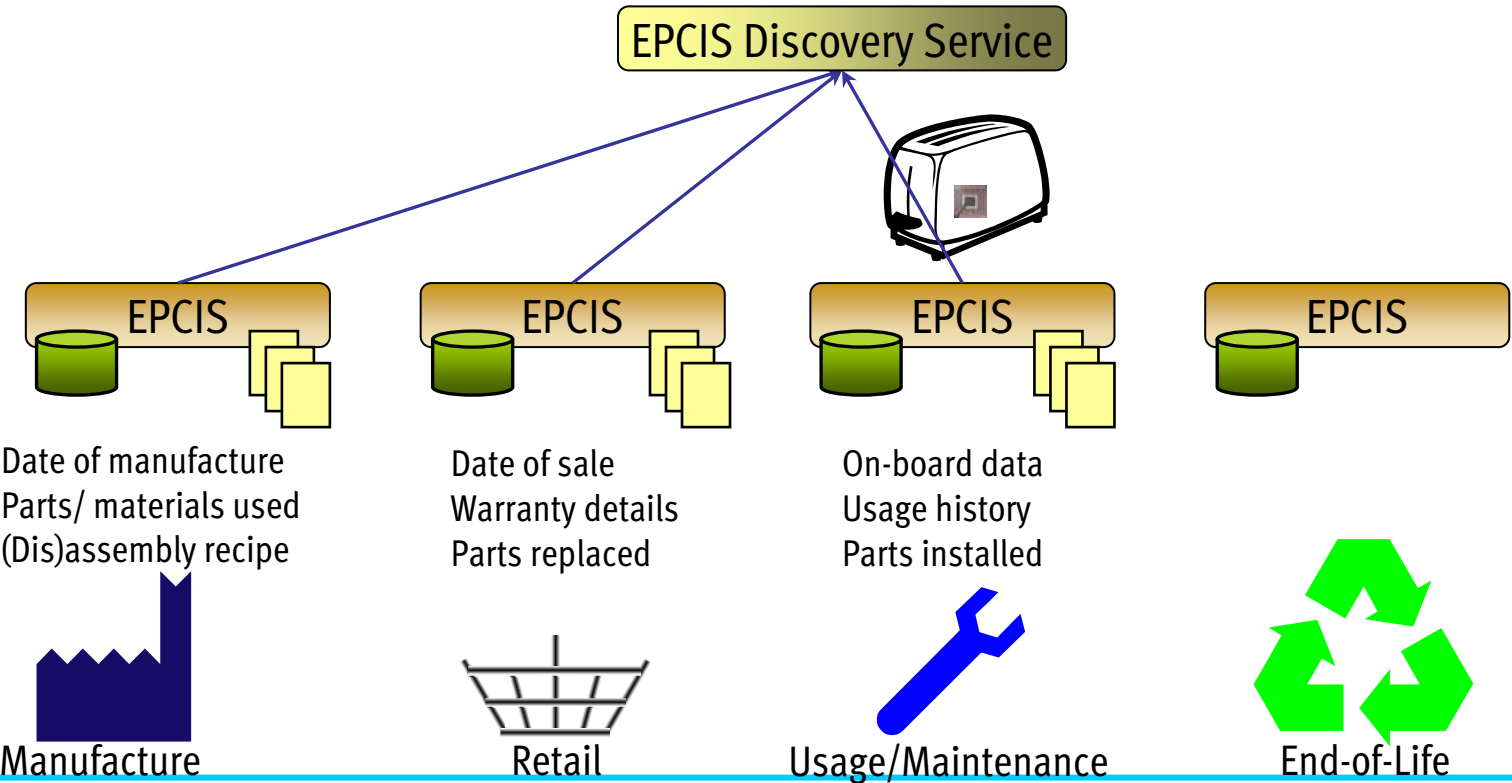
RFID in Recycling



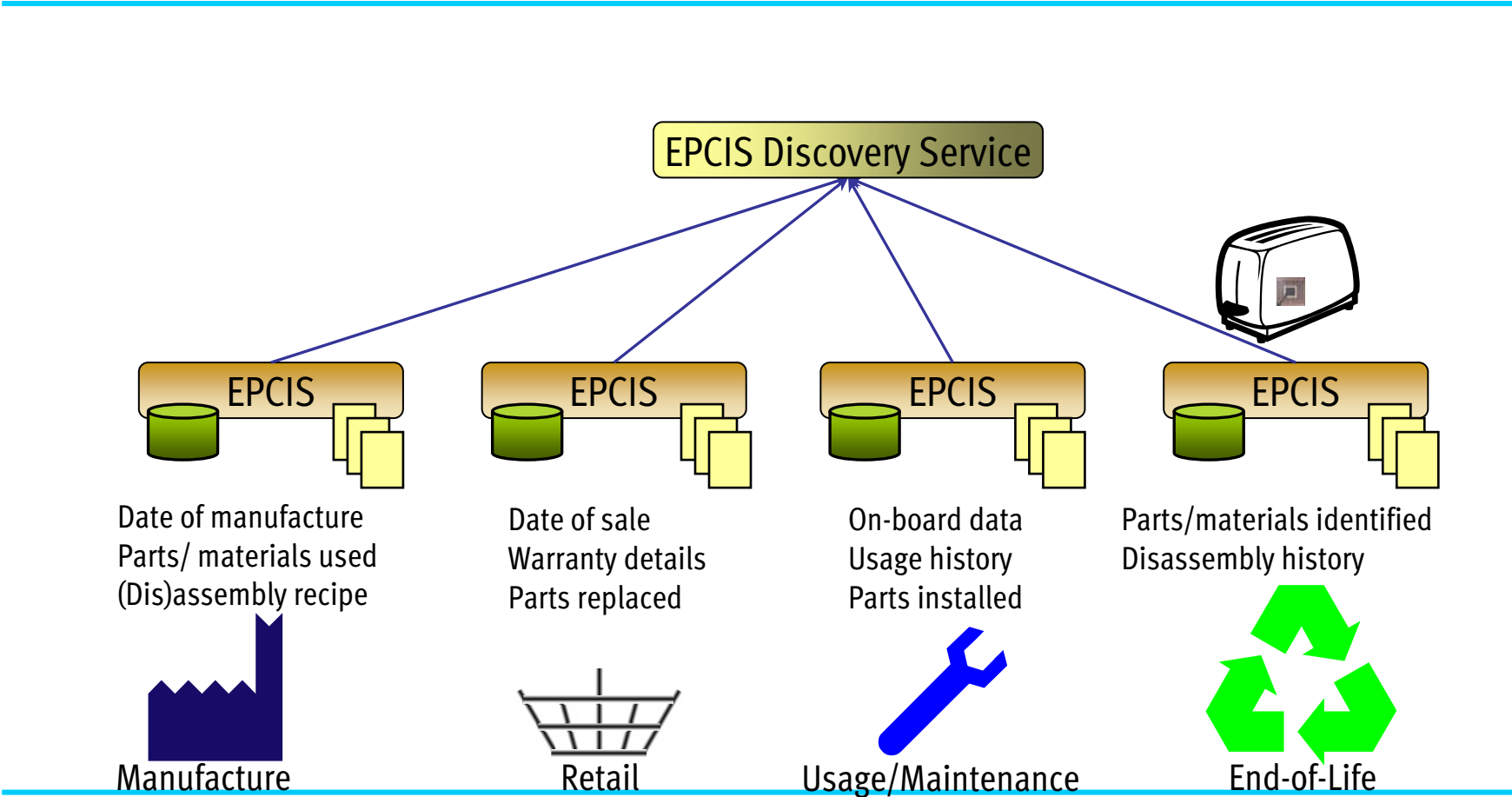
RFID in Recycling



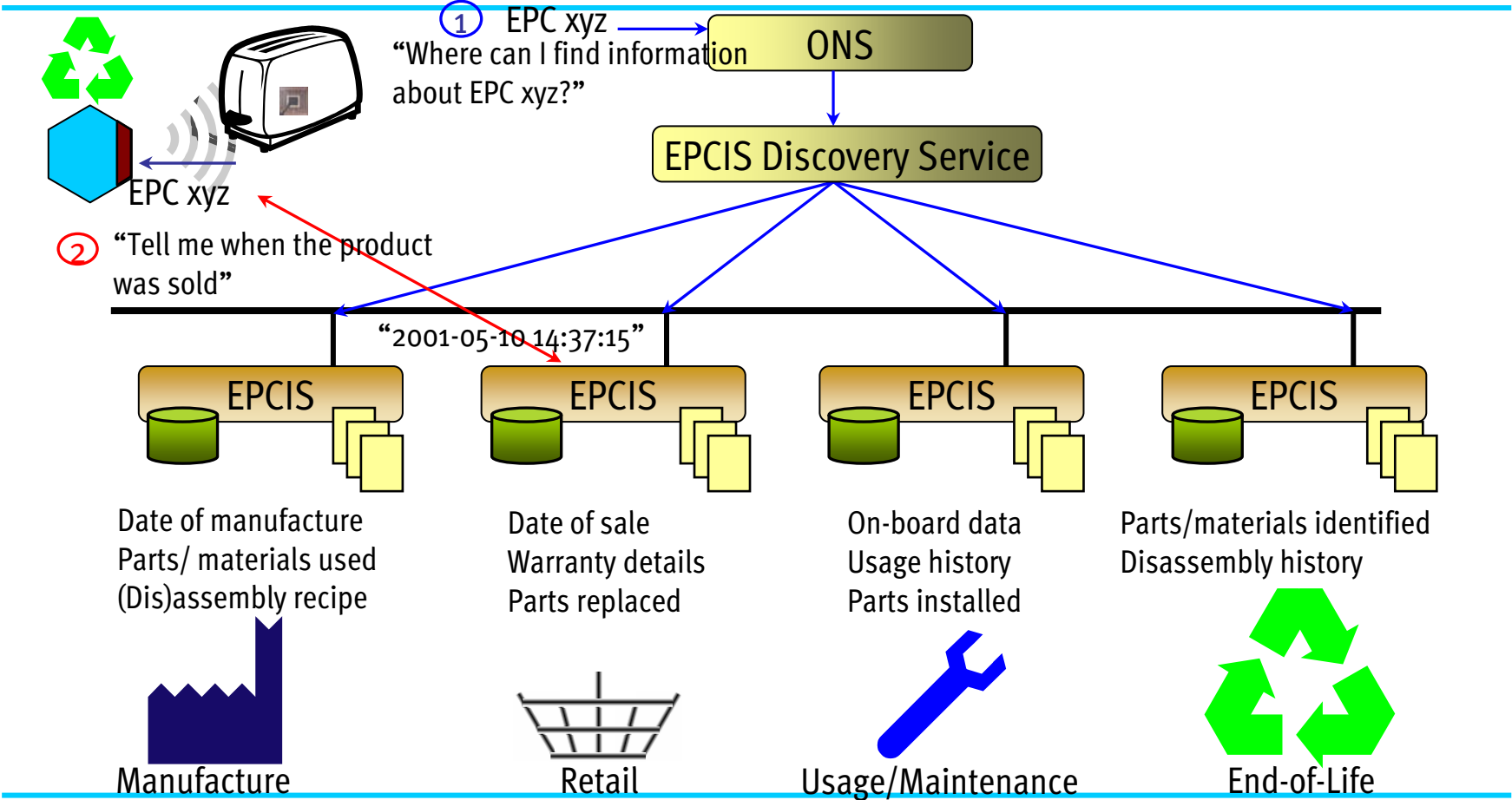
RFID in Recycling



RFID in Recycling



RFID in Recycling



Future Developments

- General: reconsider assumptions in supply chain
 - Inventory: location & levels
 - POS as the *good-bye* point
- Manufacturing: customisation and customerisation
- Retail: from *STORE* to *store* OF THE FUTURE?
- Product Lifecycle: Cradle to Grave management of consumer products

Contacts

- Duncan McFarlane, Auto ID Labs @ Cambridge:
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Tag Testing / Future Models: dcm@eng.cam.ac.uk
- easyEPC training courses: enquiries@easyEPC.com
- EPCglobal: commercial roll out of EPC Network:
www.epcglobalinc.org