



## RFID - Erfahrungen aus der Praxis

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# METRO AG



## FUTURE STORE INITIATIVE

Source: Metro (1\_01\_welcome\_and\_project\_overview.pdf)

## FSI Project Overview



### *Concept*

- After completion of redesign, the extra store in the town of Rheinberg, Germany had reopened on April 28., 2003 with new store layout and innovative service offerings
- A state-of-the-art store is presented with technical innovations to improve and to support in-store and supply chain processes.
- Partners can develop and implement new applications in a real environment with direct feedback from customers, suppliers and public as well as participate in other partners activities.

### *IBM involvement*

- IBM joined the initiative as gold level partner and became platinum partner in 2003
- Initial work has been done on process design, use case and blueprints development
- In January 2003 IBM assumed the role of the FSI system integrator
  - with overall responsibility for delivering an RFID integration solution
  - and providing networking services for a complex wired / wireless installation
- Also IBM installed the POS system and information kiosks

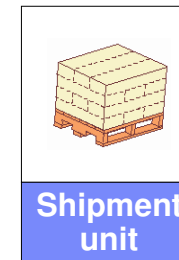
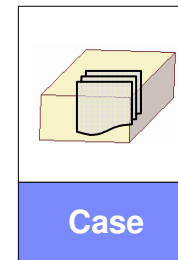
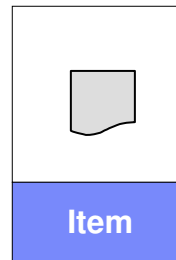
## METRO Group Future Store Initiative – The Partners



# RFID Technology is used in Supply Chain Management and Inventory Management for Automation, Integration and Optimization of Existing and New Processes

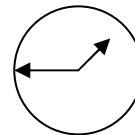
- RFID based asset tracking for

- Products (Alpha items)
- Case
- Pallets

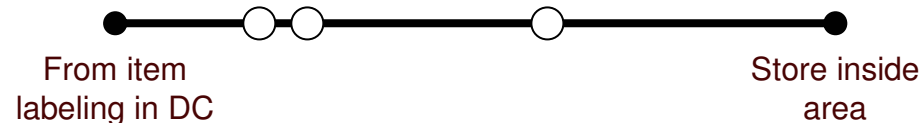


- Logistic (SCM) Information

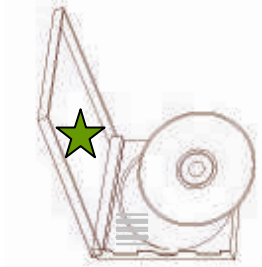
- in realtime
- time synchronized
- coordinated



- Tracking End-to-End



## Two RFID Frequencies are used within the FSI UHF for Cases & Pallets and 13.56 MHz for Items



### RFID 13.56 MHz

- Alpha products like CDs and DVDs are tagged using 13.56 MHz
- Reading distance is 0.9 meter
- RFID data is individual article information in GTAG format



### RFID UHF

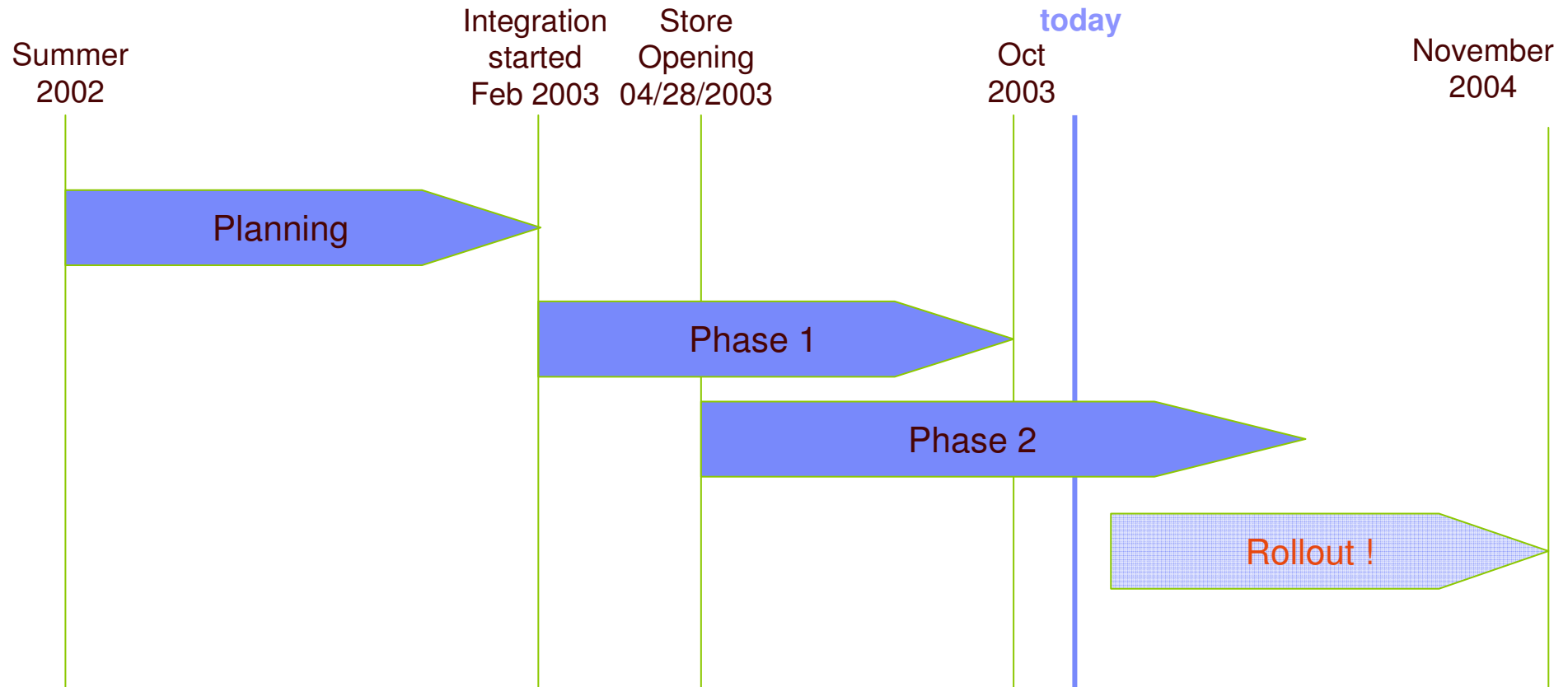
- Individual case
- Reading distance is a few meters
- RFID data is individual article information in GTAG format
- For Alpha Products, case can contain various different items



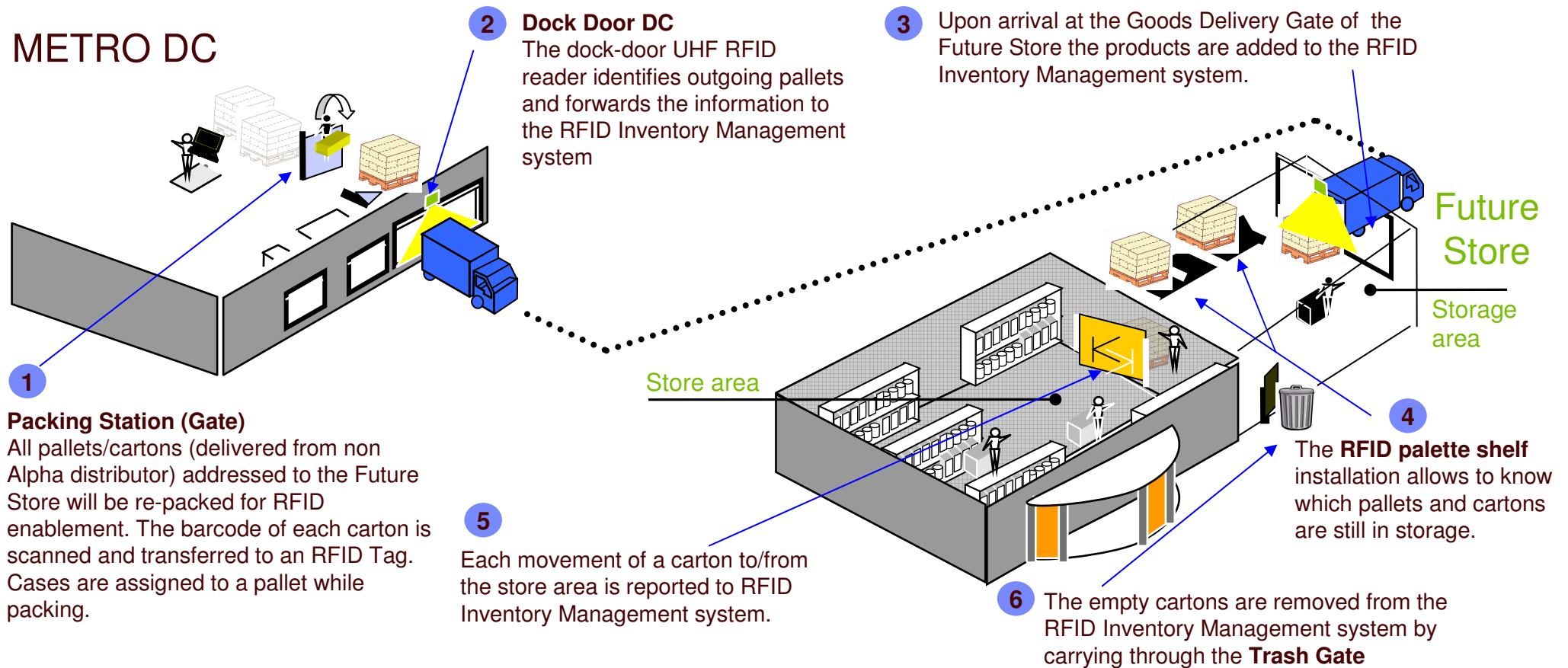
### RFID UHF

- Pallet carries UHF label
- Reading distance is a few meters
- Case information is linked with Pallet during packing
- Pallet will be reused

# Timetable

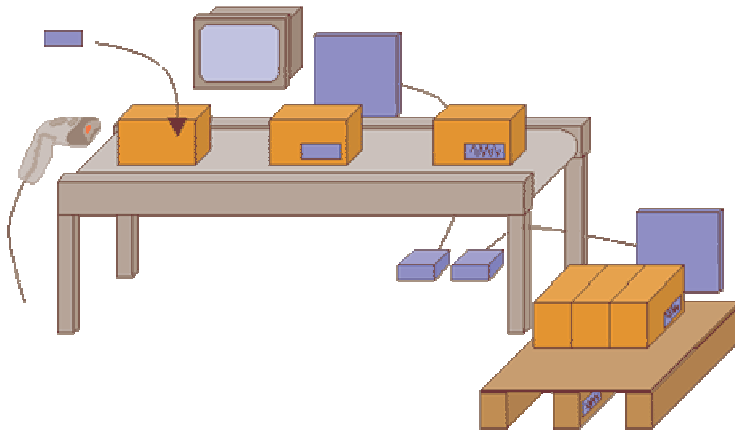


# Supply Chain Process from METRO Distribution Centre (DC)





## Use Case – Pallet Packing



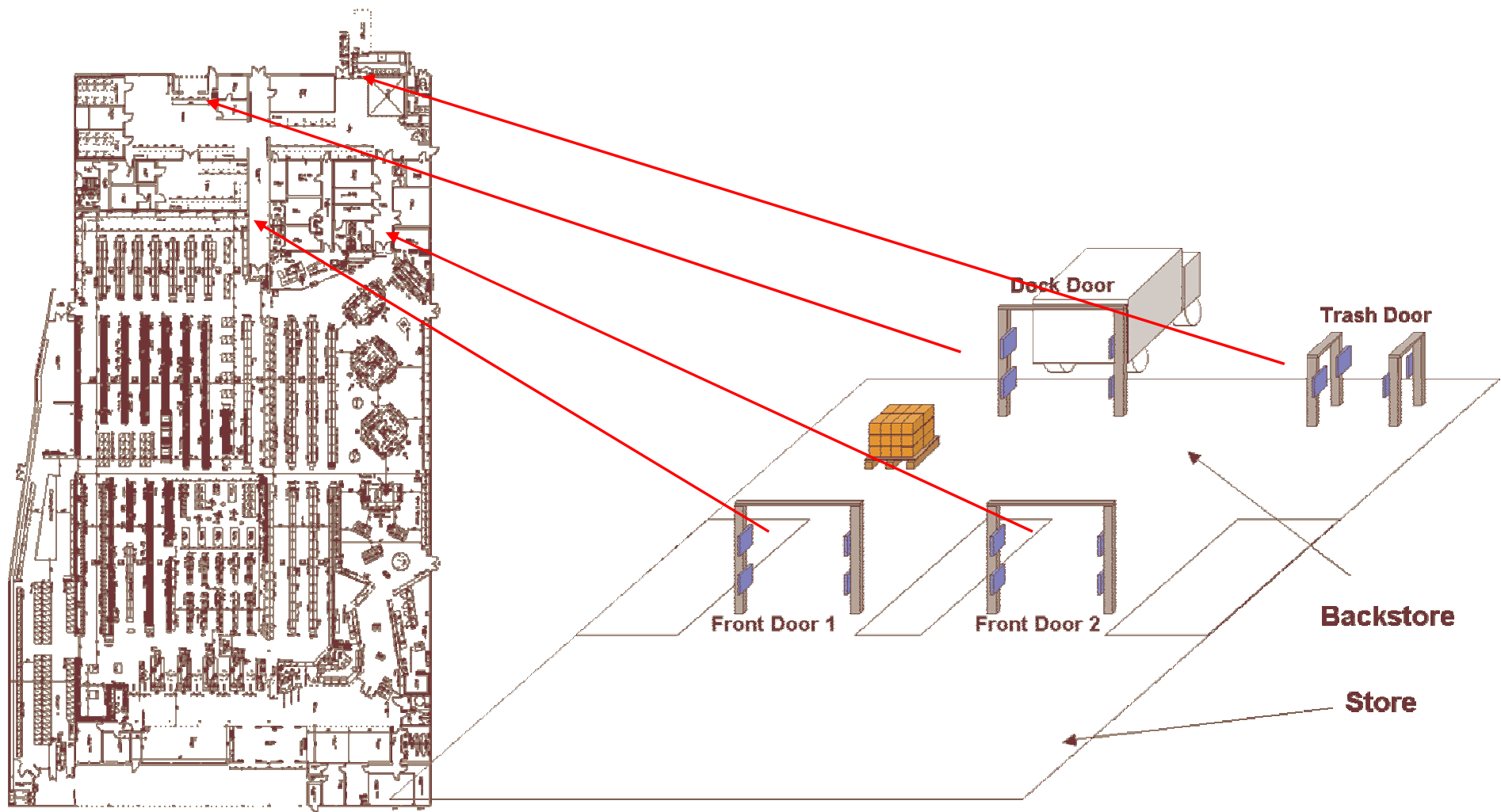
### RFID information on case level

- Pallet packing process provides data with the highest reading accuracy, as each case is handled separately.
- Door read events conclude from single cases/pallet to pallet packing data that is used as reference

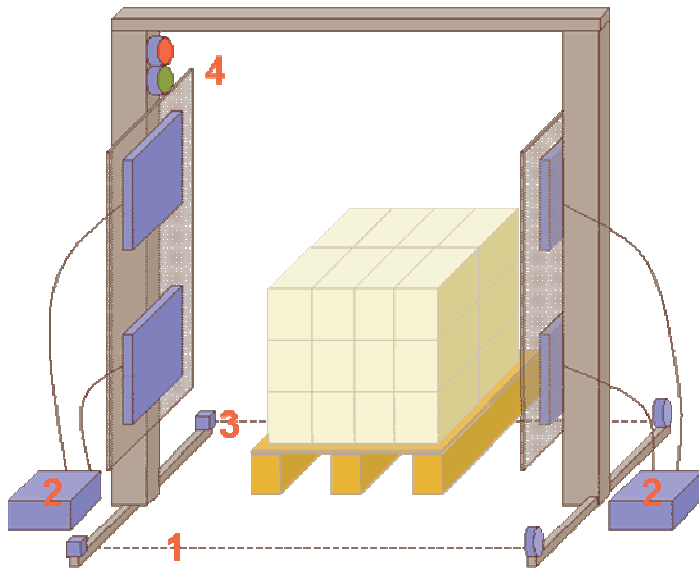
### Process

1. Barcode reading on case level
  - Conversion of article information to GTIN format
  - Generation of serial number
  - Placement of UHF-label on case
2. Transfer of product information to UHF-label
3. Control read of storage pallet

## Replenishment Process – Pallet Tracking



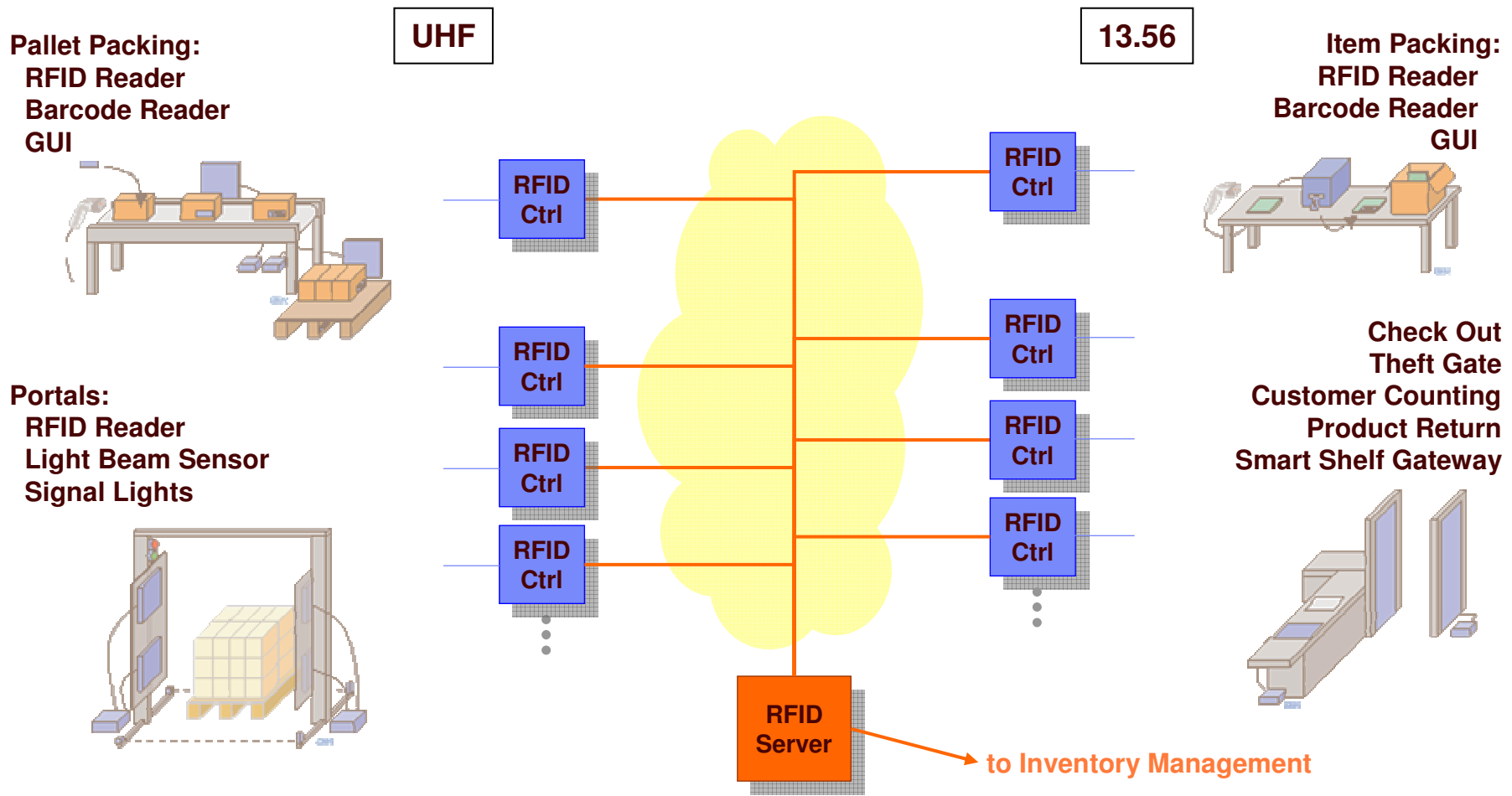
## Use Case – Portal



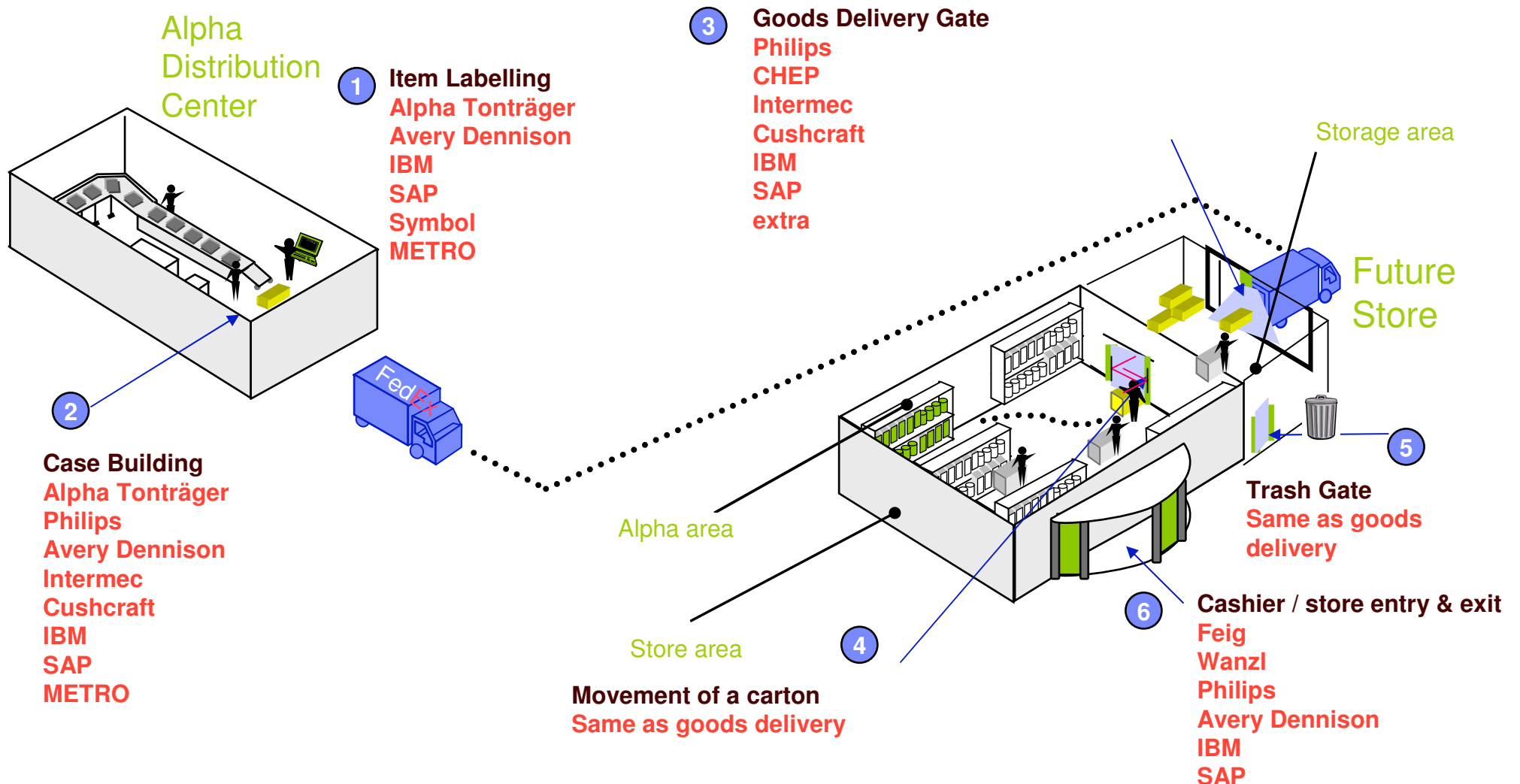
### Process

1. First light beam triggers reading process
2. RFID-Reader with 4 UHF-antenna read pallet and packet RFID-tags
3. Reading process ends when second light beam is uninterrupted again
4. Optional traffic light signals if work force should slow down, as reading process isn't finished
5. Reader event message is generated and sent to Inventory Management system
6. As readers are probably not grasping all RFID-tags on pallet, the Inventory Management system concludes from individual collected RFID-tags to original packed pallet

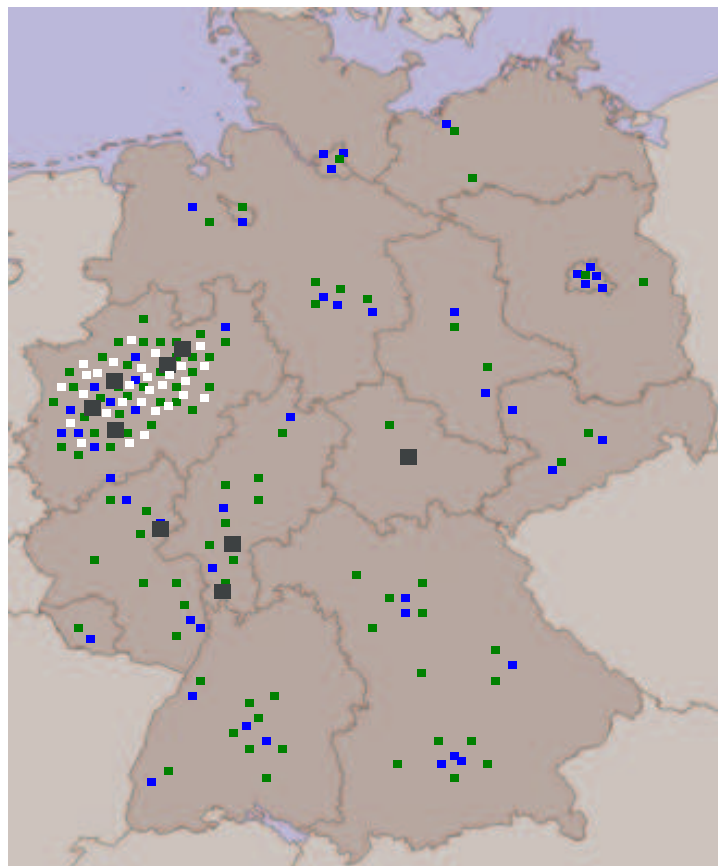
# Architecture Overview Phase 1



# Multi party system integration was major challenge



## METRO Group RFID Rollout



■ MCC   
 ■ Kaufhof   
  Real  
■ METRO Group Distribution Logistics DCs

### Timeline and Phase 1 scope

- Nov 2004 – Dec 2005
- Goods Receive / Goods Issue, Replenishment to Storage Area, Automatic Checking

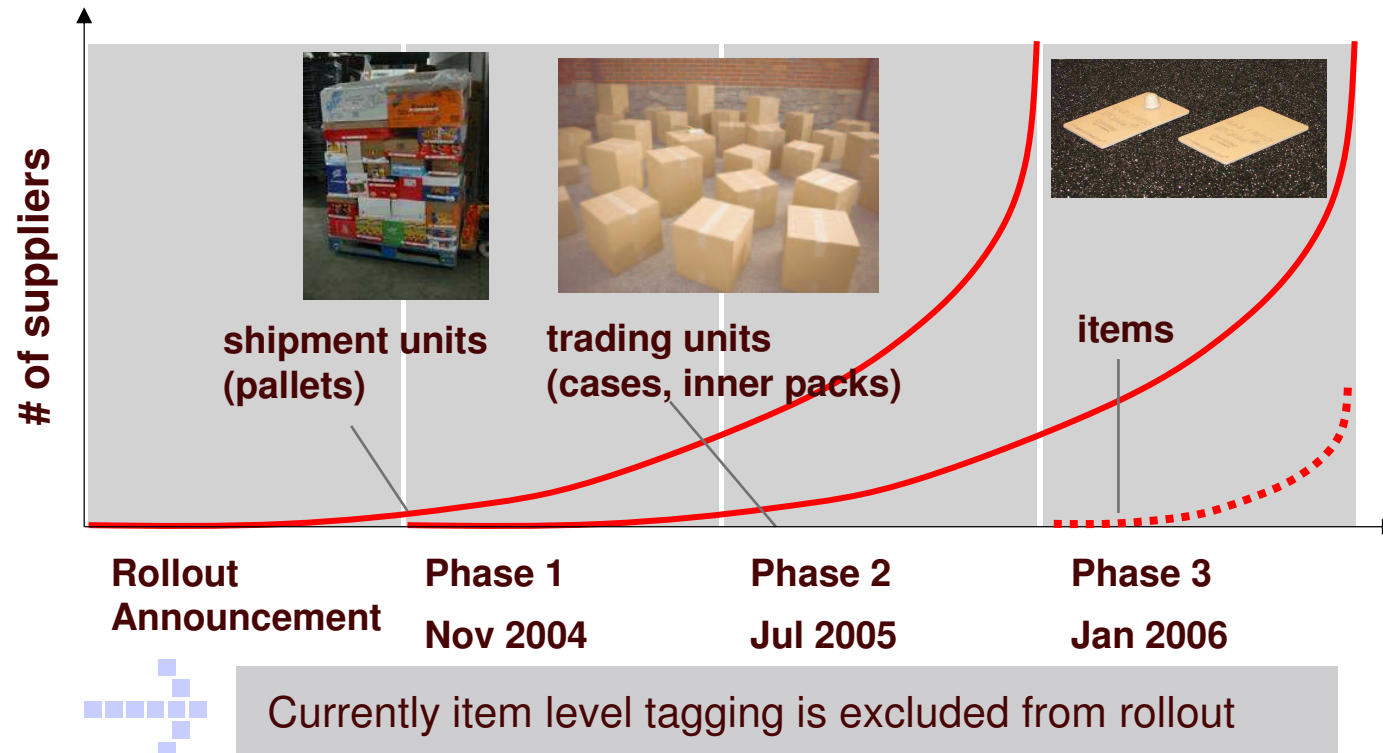
### Coverage in Germany

- 10 Distribution Centers
- 100 Supplier
- 269 Stores
- Till 2007 all Metro markets (ca. 800) will be RFID enabled

### RFID Tags on ...

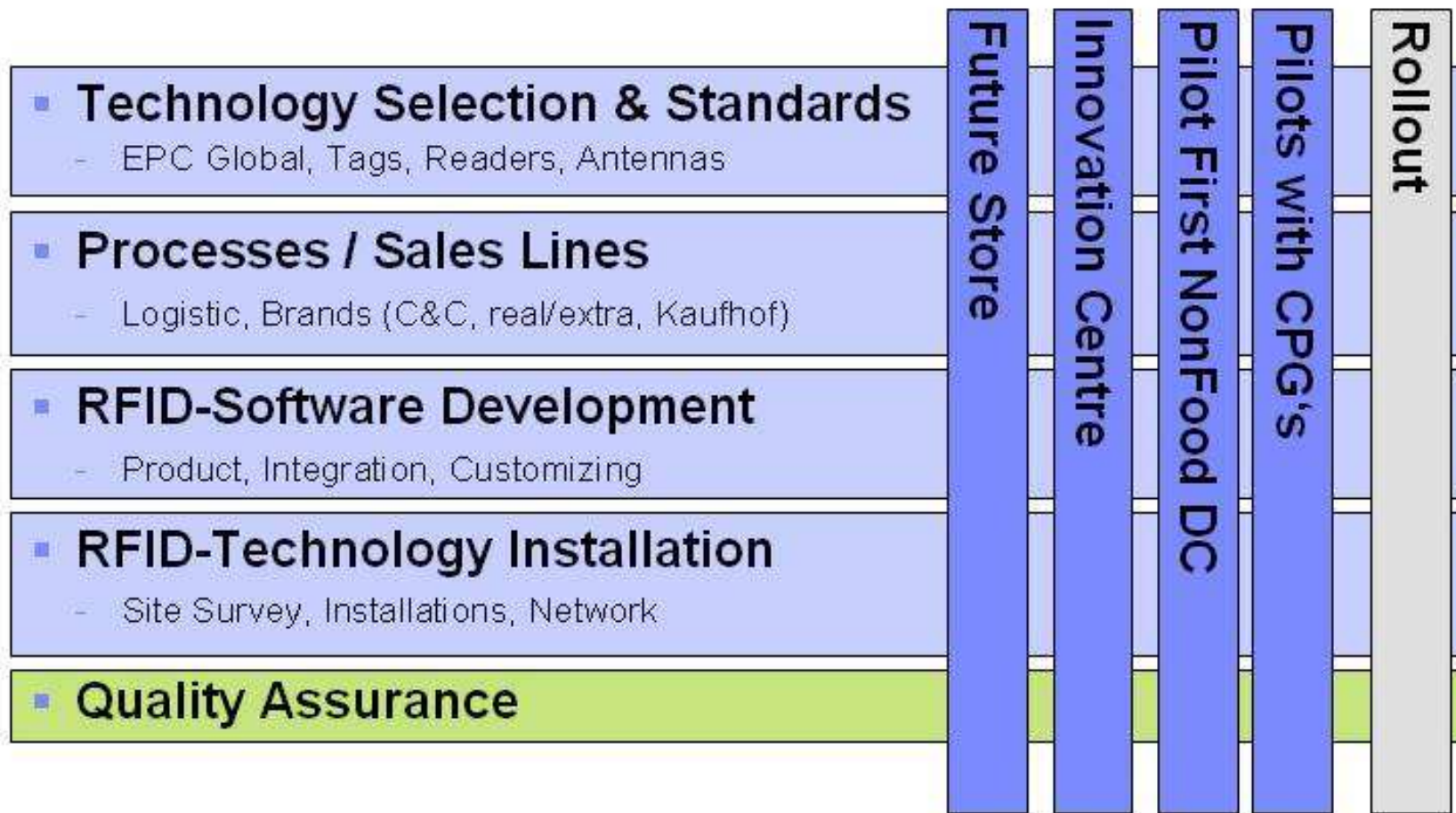
- shipment units (pallets) and trading units (Cases)
- no item level tagging in this phase of the rollout

## Metro Roadmap



- **Jan. to Oct 2004:** Pilot and technical feasibility studies and definition of RFID requirements
- **Nov 2004:** Start of Rollout with 20 suppliers, 9 DC's and 237 stores of the METRO Group  
Tagging of pallets and logistic units
- **Jul 2005:** Extension to 100 suppliers - Tagging of pallets, logistic units and cases
- **Jan 2006:** Extension to more suppliers, DC's and stores of the METRO Group  
Tagging of pallets, logistic units, cases and inner-packs

## IBM Project Organization @ Metro FSI

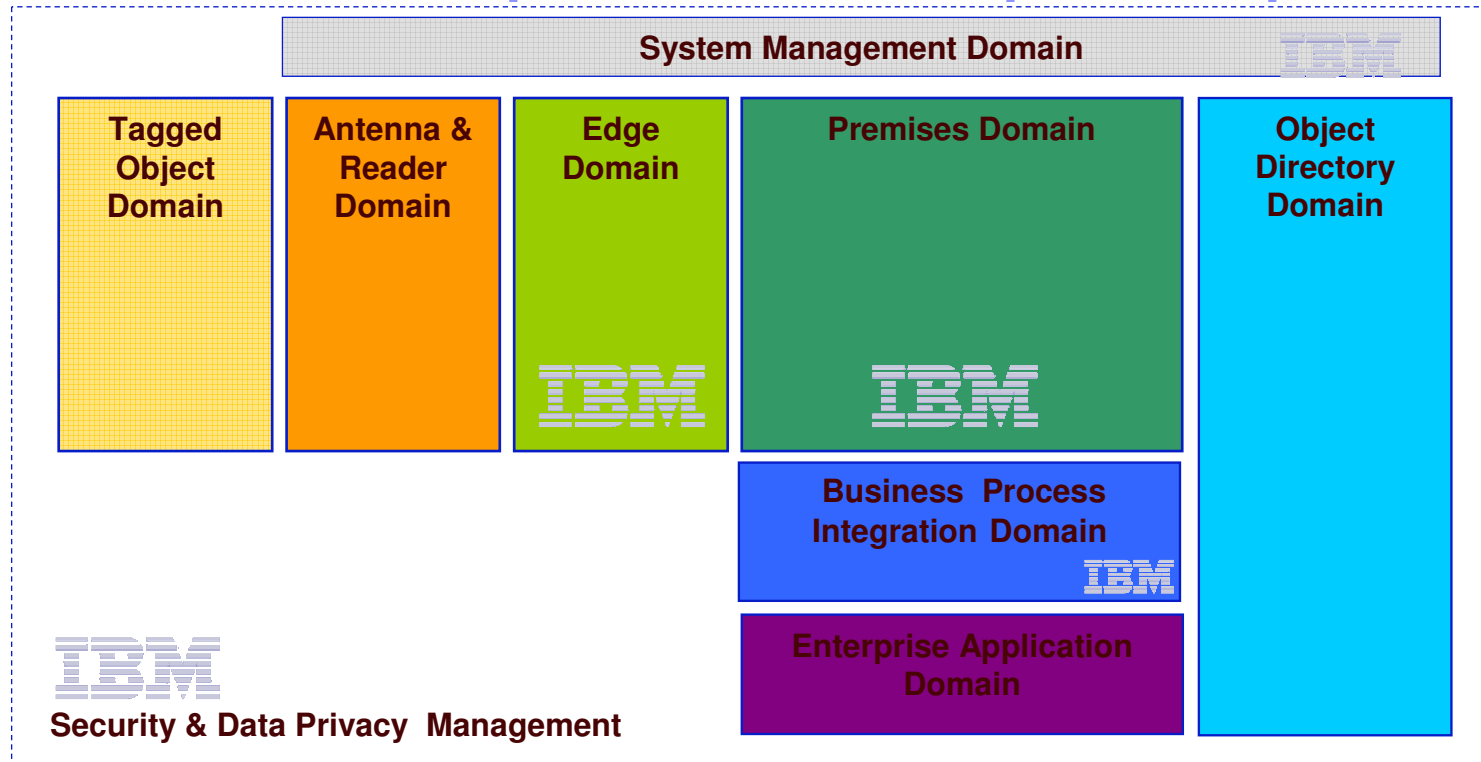




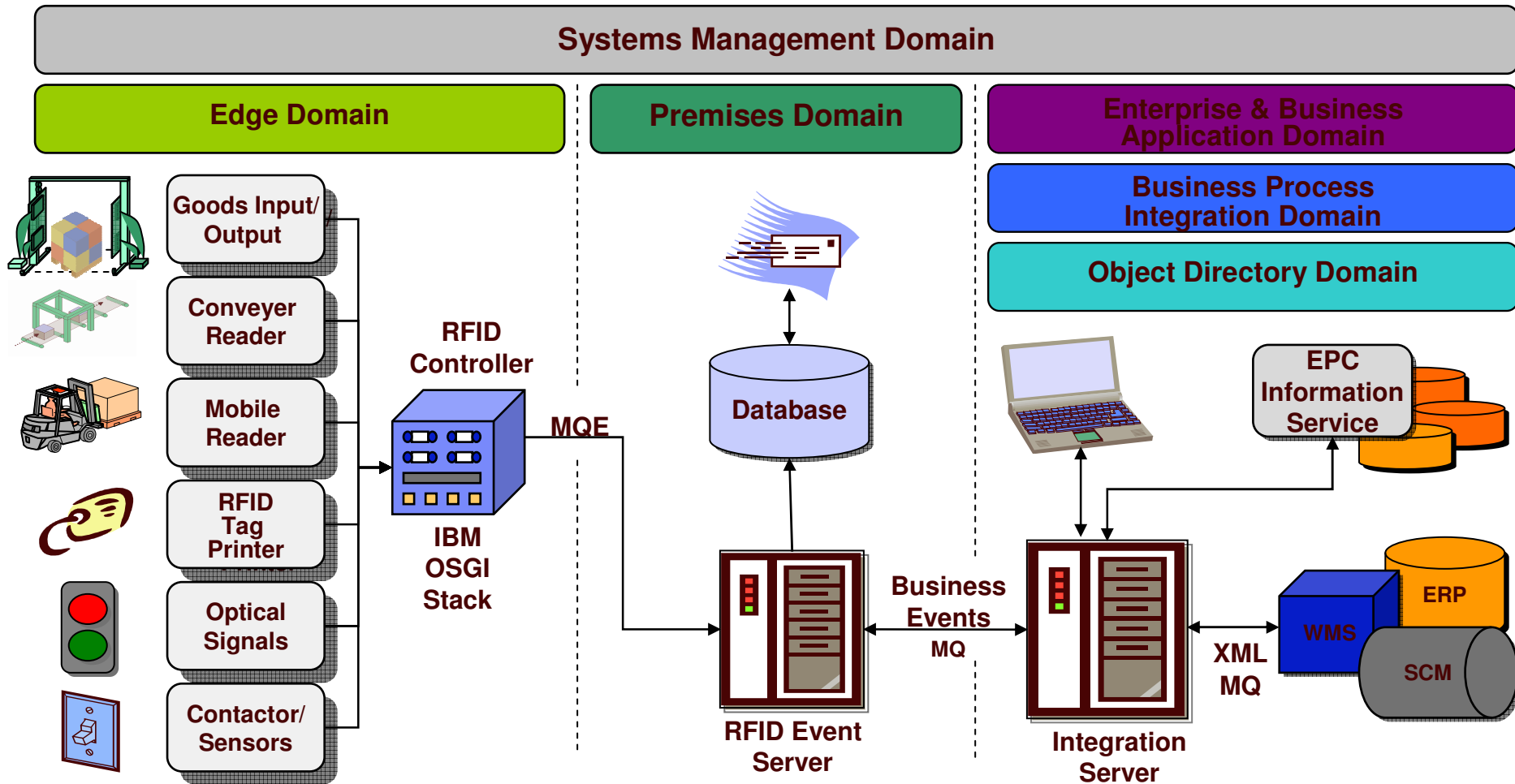
## General Requirements for RFID Middleware

- State of the Art modular software preferred over monolithic approach
  - Better to test
  - Much more flexible for changes in requirements
  - Suited for different deployment models, such as various local premises
- Separate Business Integration Layer required
  - More flexibility to adapt to specific use case requirements without changing ERP backend
- Device Management Solution mandatory for medium to large scale deployments
- Security & Privacy considerations are gaining importance for RFID installations
- Scalable Solution requires carefully designed architecture and needs scalable modules
- Edge Server has to be robust, industry environmental-friendly and capable of implementing complex use cases
  - Different peripherals, local non RFID requirements
  - Deployment on embedded hardware to survive in rough environments

## The End-to-End Component Model is split into specific domains



# IBM-Middleware-Solution for RFID



## IBM WebSphere RFID Solution

- Consists of 2 products
  - IBM WebSphere RFID Premises Server
    - Full Passport Advantage Product
    - Available since 16th. Dec 2004
    - Based on Standard IBM Middleware

[http://www-306.ibm.com/software/pervasive/ws\\_rfid\\_premises\\_server/](http://www-306.ibm.com/software/pervasive/ws_rfid_premises_server/)

- IBM WebSphere RFID Device Infrastructure
  - Available through OEM – e.g. Arcom
  - Available since 16th. Dec 2004

## IBM WebSphere RFID Premises Server

- WebSphere Application Server 5.1.1 and WebSphere Application Server Network Deployment 5.1.1
- DB2 Workgroup Server 8.1.4
- WebSphereMQ 5.3.0.2
- WebSphere Connection Server Micro Edition (MicroBroker) 1.0
- Service Management Framework 3.6.0
- Tivoli Configuration Manager 4.2.1
- Tivoli Enterprise Console 3.9
- Tivoli Monitoring 5.1.2
- ITM for Web Infrastructure 5.1.2
- ITM for Database Servers 5.1.1
- ITM for Business Integration 5.1.1
- RFID Technology Preview - Event Server 1.0

## IBM WebSphere RFID Device Infrastructure

- WebSphere Client Technology Micro Edition 5.7.1 (Additional packages beyond stock WCTME 5.7.1)
  - Service Management Framework 3.6
  - WebSphere Everyplace Custom Environment 5.7.1
  - Extension Services for WebSphere Everyplace 5.7.1 – Includes several sub-packages, DB2e, MQ...
  - Embedded Standard Widget Toolkit 5.7.1
- WebSphere Connection Server Micro Edition (MicroBroker) 1.0
- OSGi Application Framework 3.0
- Device Kit with RFID device extensions 3.0
- WebSphere Connection Server Micro Edition Application Framework 1.0
- Arcom WebSphere Everyplace Custom Environment and WebSphere Everyplace Micro Edition 5.7.1
- RFID Tracking Kit 1.0
- RFID Technology Preview – Reference Sample Implementation 1.0

## IBM RFID Software Capabilities

### RFID events become Business Transactions

- **Robustness**
  - Reliable Messaging Infrastructure
  - Persistent Data for Intermittent Networks
- **Scalability**
  - Pilot to production implementations
  - Distributed Implementation
- **Flexibility**
  - Integration to additional applications is key to realizing business value: Legacy and New
  - Platform for Business Innovation
- **Manageability**
  - Remote deployment, configuration and updates of distributed infrastructure

**Robust, proven platform for innovative business capabilities**

# IBM RFID Software Solution

## Edge Domain

### Embedded Software



#### OEM Package:

- Support for selected network-based readers
- RFID filtering & aggregation
- Event buffering for intermittent networks
- Embedded application environment (sub-second alerts, expected tag lists...)
- Pre-installed by industrial controller provider
- Build on WebSphere Embedded Software
  - Embedded Java
  - OSGi framework for remote management
  - Reliable messaging framework
  - Embedded database

## Premises Domain

### Windows Linux



#### SWG Package:

- RFID Event Filtering & aggregation
- Mapping of RFID events to business events
- Event persistence / local cache
- Premises exception handling
- Encryption capabilities
- Business process application platform
- Scaleable, mission-critical J2EE platform
- Consistent with Store Integration Framework

## Systems Management Domain

#### Systems Management capabilities for Edge & Premises offerings:

- Remote deployment
- Remote monitoring and management
- Integrated logging and problem determination
- Lights out operation
- Automated install & configuration for large-scale deployments

## Business Process Integration Domain

### AIX Linux



#### SWG Components:

- Service Oriented Message Bus
- Publish/Subscribe Message Broker
- Reliable Messaging
- Workflow
- Business process management
- People and roles integration
- Prepackaged business process templates (Pick/Pack/Ship, Goods tracking)

#### IBM Services:

Installation, configuration / Application design & implementation / Business process integration



# Typical Hype Cycle of Technology



## ETSI Standard 300220

Vfg 71 / 2003 = Allgemeinzuteilung von Frequenzen für die Benutzung durch die Allgemeinheit für nicht öffentliche Funkanwendung geringer Reichweite; Non-specific Short Range Devices (SRD)

= aktuell rechtliche Grundlage zum genehmigungsfreien Betrieb von RFID Anlagen

Frequenzbereich in MHz:	869,4 - 869,65
Max. Kanalbandbreite in kHz:	25
Max. äquivalente Strahlungsleistung (ERP):	500mW
Relative Frequenzbelegungsdauer bezogen auf 60 Min..	<10%

Es ist darauf zu achten, dass RFID Reader und Antenne als eine Einheit vom Hersteller für diesen Standard zertifiziert sind.

## ETSI Standard 302208

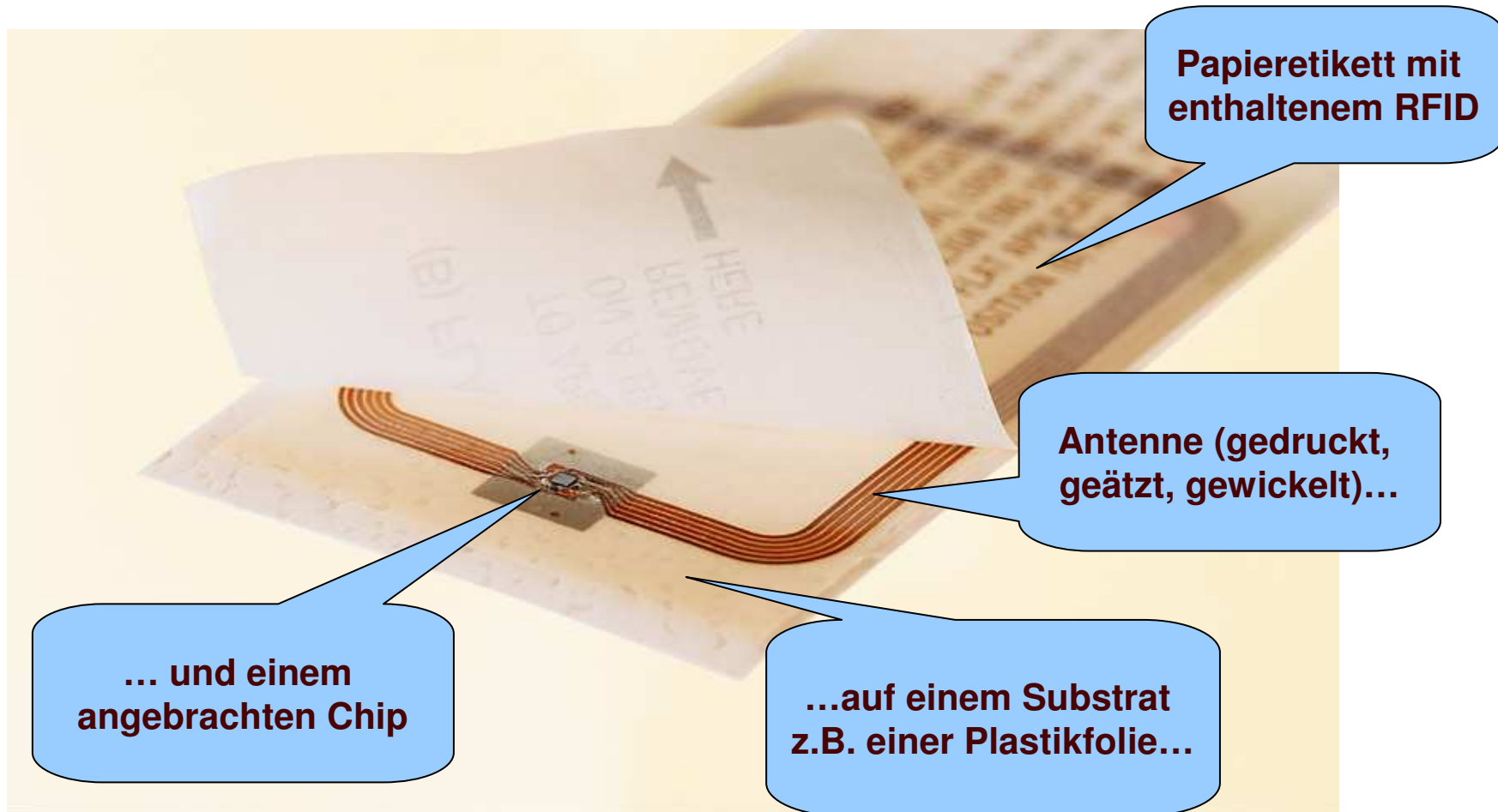
Allgemeinzuteilung von Frequenzen für die Benutzung durch die Allgemeinheit für nicht öffentliche Funkanwendung geringer Reichweite; Non-specific Short Range Devices (SRD)

= aktuell rechtliche Grundlage zum genehmigungsfreien Betrieb von RFID Anlagen

Frequenzbereich in MHz:	865,4 - 868,6
Max. Kanalbandbreite in kHz:	10
Max. äquivalente Strahlungsleistung (ERP):	2 W
Relative Frequenzbelegungsdauer bezogen auf 60 Min.:	100% listen before talk

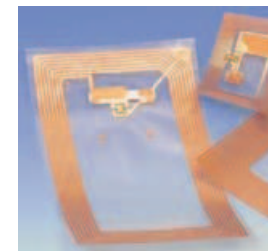
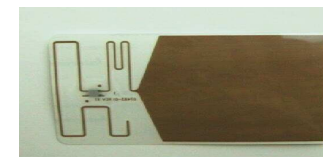
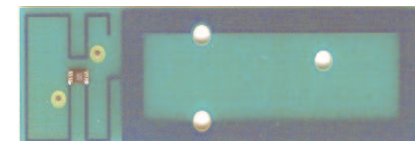
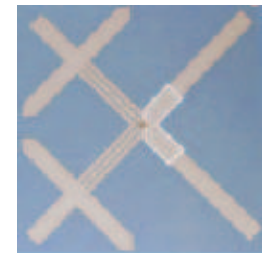
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## Was ist ein RFID-Tag ?

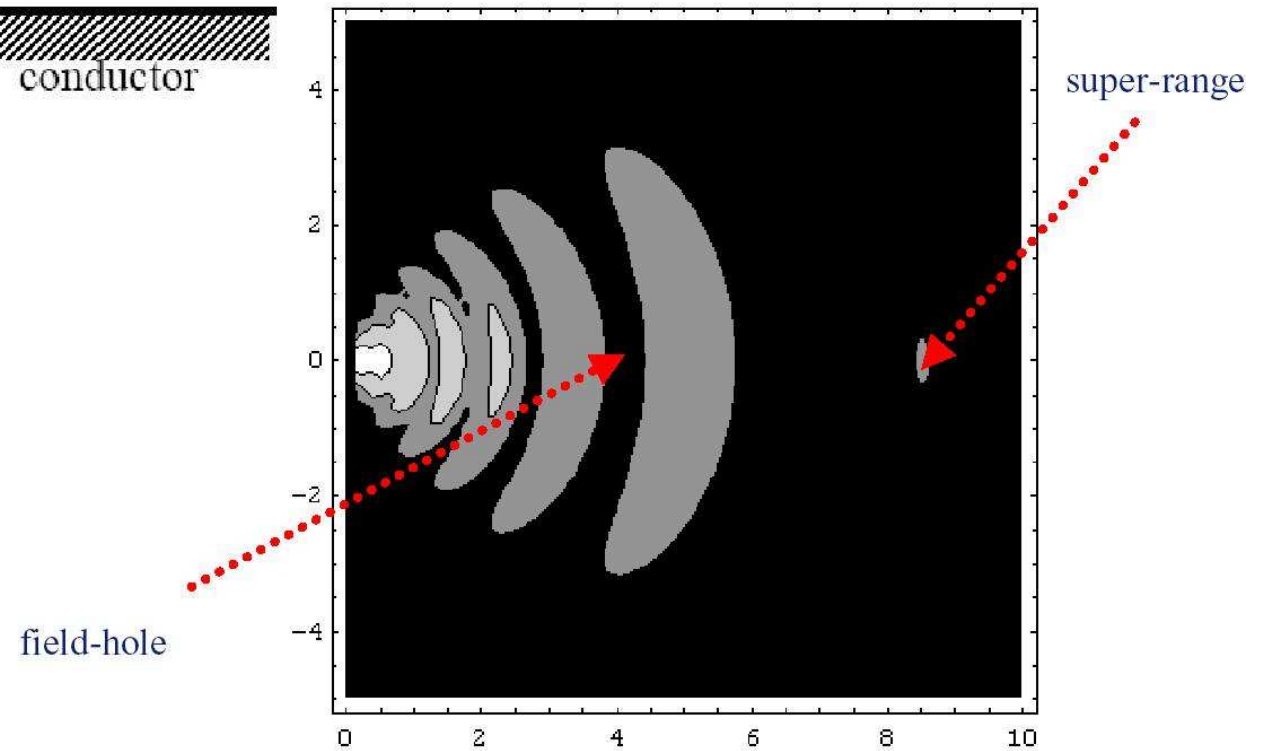
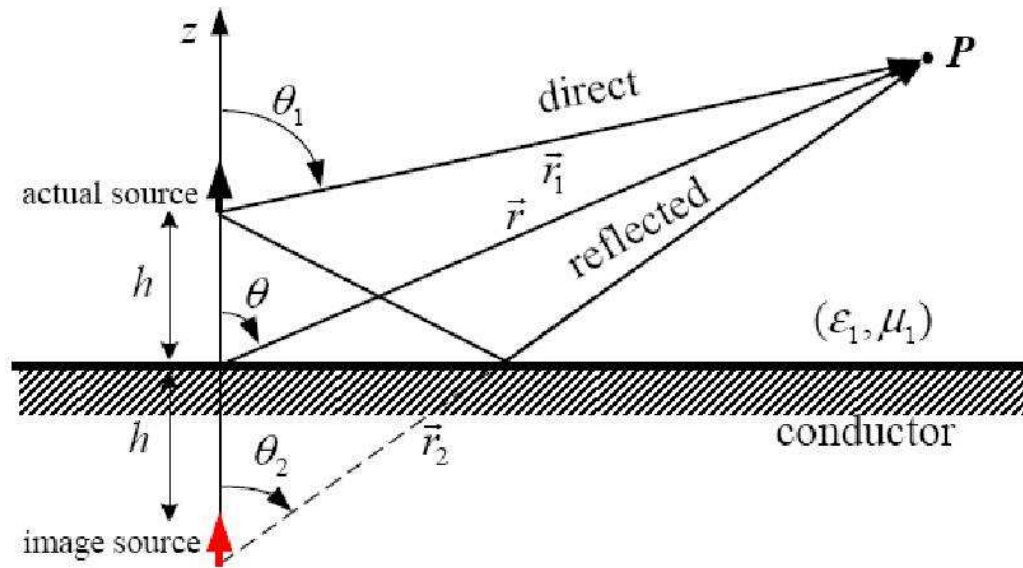


## Different Tags for Difficult Things.

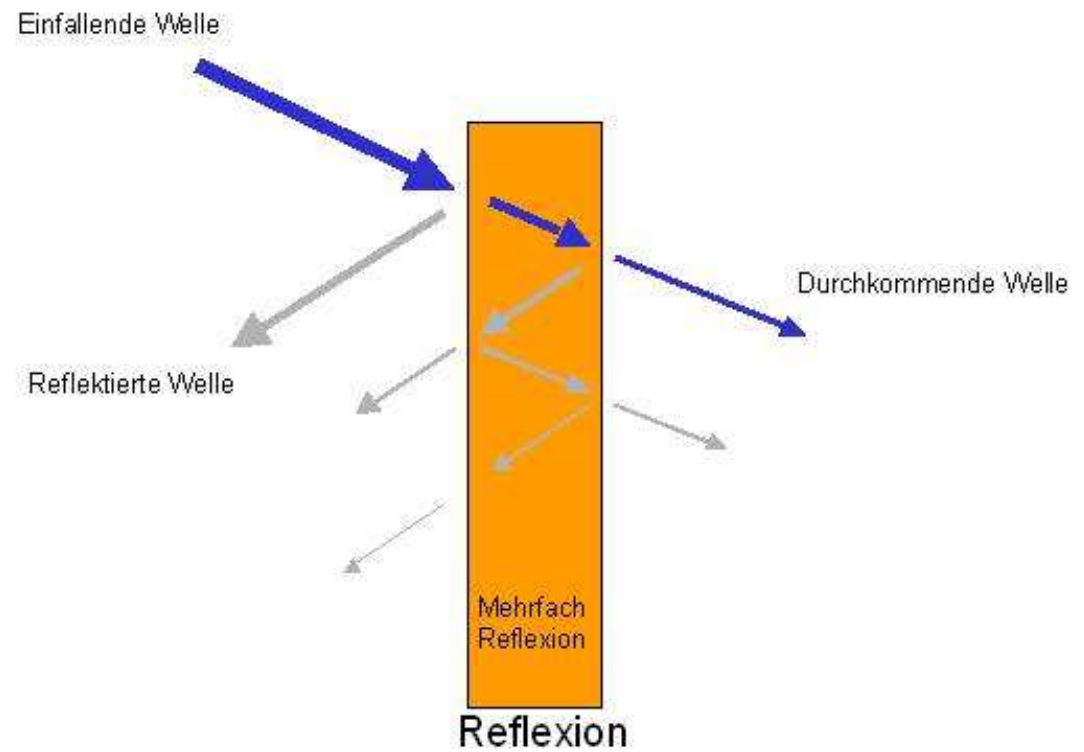
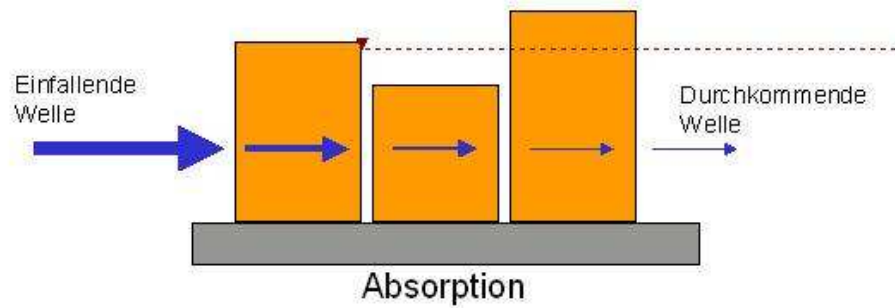
- Tags differ in antenna design and substrate:
  - **Standard** tag with dipole antenna: good performance on easy materials.
  - **Folded** dipole antenna: overcomes reading angle problems.
  - Ferrit **coated** substrates: eliminates reflections from metallic surfaces and detuning effects.
  - **Stand-off** tags: tags with foamed plastic element as distance piece enhances performance in multiple situations.
  - **Frequency tolerance**: tags with higher tolerance to frequency detuning are available but have lower overall performance.
  - **RF sensitivity**: minimal threshold of signal strength that the tag needs to operate
  - **Isotropy of RF sensitivity**: ability to operate the tag at the minimum threshold of signal strength regardless of the orientation of the tag



## Multipath propagation

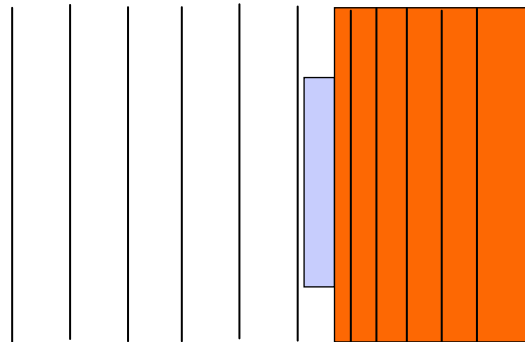


# Absorption and Reflexion

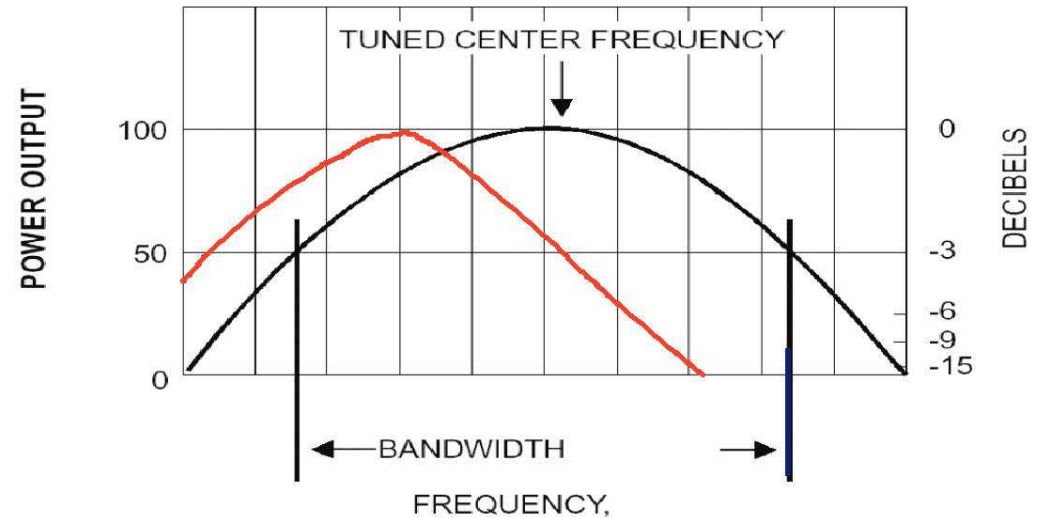
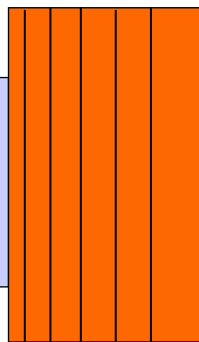


## Detuning effects caused by different propagation velocities

Velocity Speed  
of Medium 1



Velocity Speed  
of Medium 2

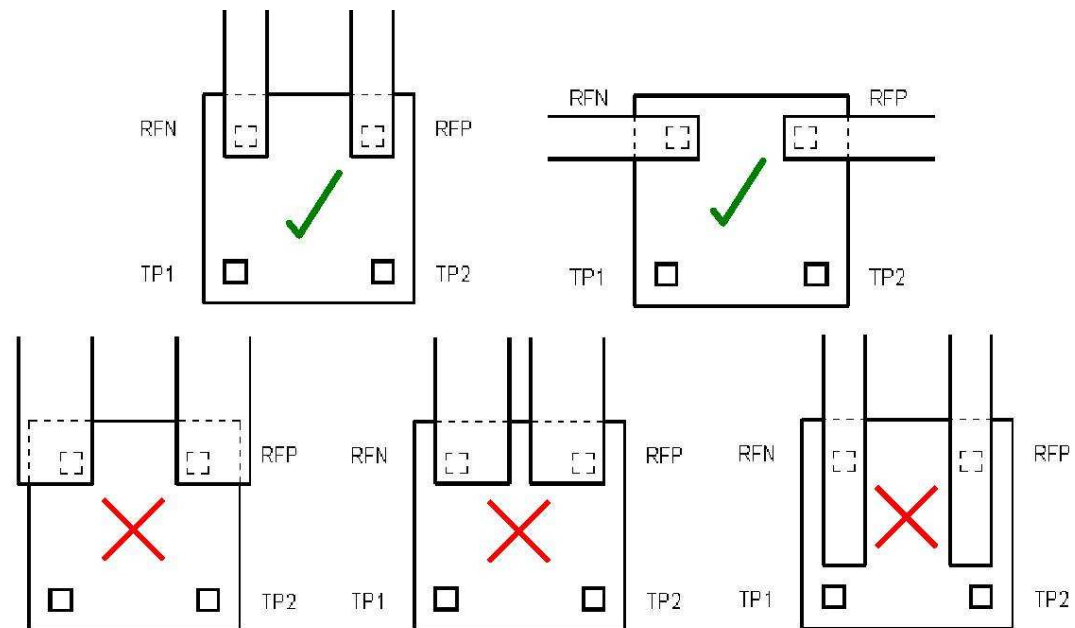


- Different materials have different propagation velocities
- Tag on surface experiences shifted resonance frequency

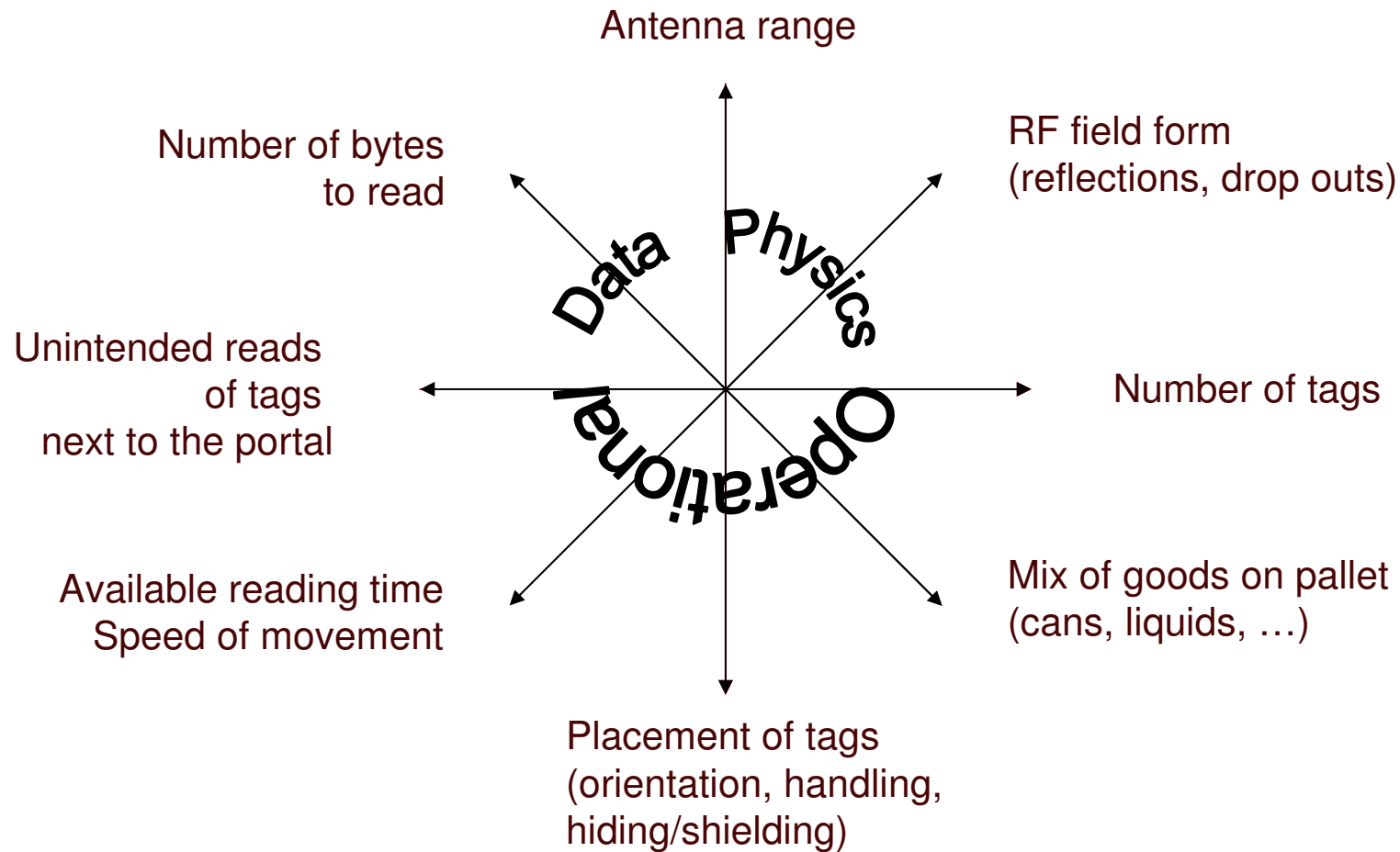


## Various production factors have an influence on the resonance frequency

- Tag production is done with high speed label printing machines
- Production knowhow of tag manufacturer determines quality variance of labels
- Knowhow is expensive
- Additional quality assurance processes are expensive too
- Dont buy the cheapest labels or you will get problems in the field...

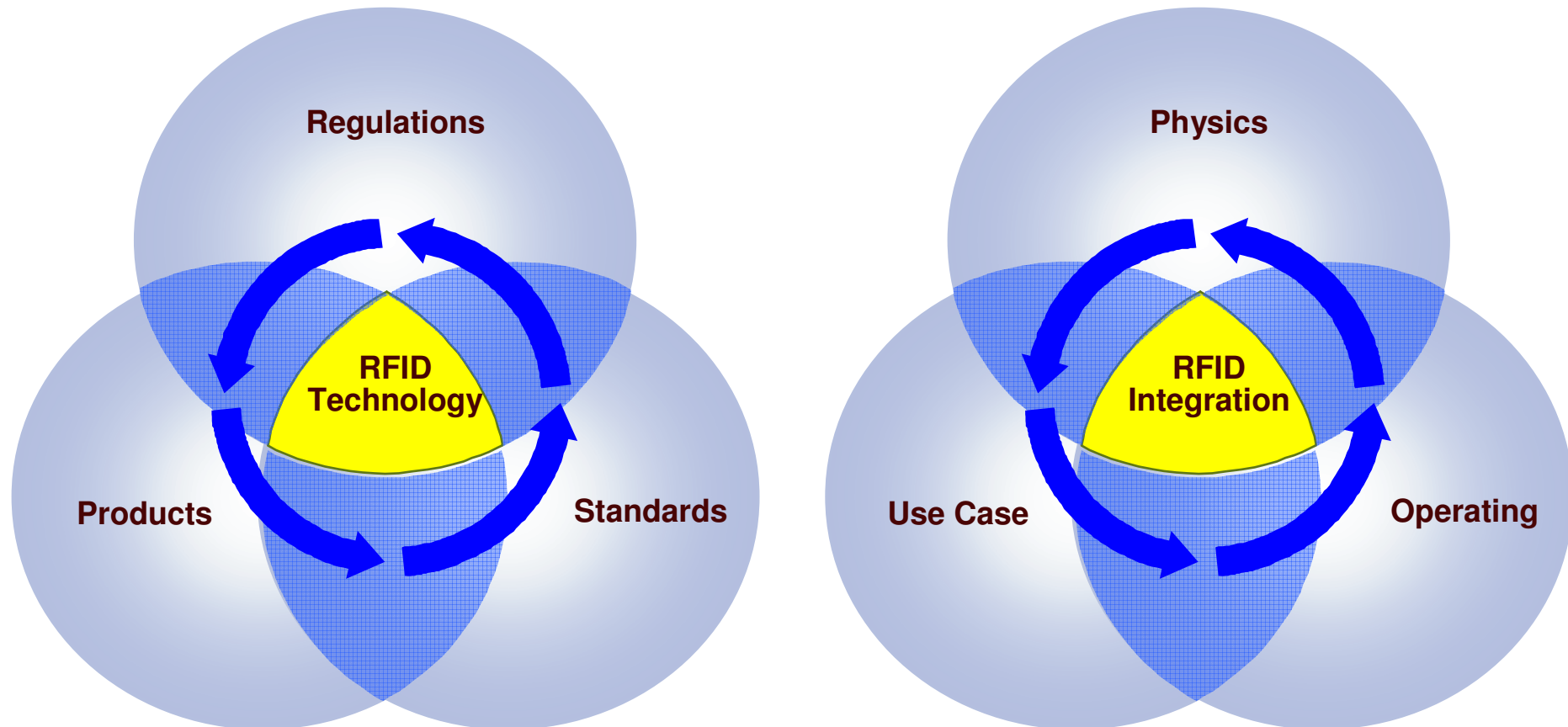


## What does influence read results



## Conclusion: RFID System Integration is a multidimensional game

Customers need to choose an SI that understands ALL dimensions of RFID



## Overview of our RFID Experience



“ IBM is helping us develop an end-to-end assessment of the specific costs and benefits in adopting AutoID technology for our products and business processes. ....**Throughout this process, IBM is bringing a deep level of expertise, experience and commitment to AutoID in a unique blend of business consulting and technology expertise that is providing real value to K-C.**”

- Mike O'Shea, Director, Corporate RFID Strategy



Duesseldorf (Germany) 7 July 2004 – METRO Group, the world's fourth largest retailer, has chosen IBM to provide the software to integrate the rollout of RFID throughout their supply chain, IBM announced today. Using IBM RFID systems integration to help guarantee that goods are delivered on demand when they are needed, METRO Group is automating its goods receiving process, with the aim of eliminating stock counting errors and keeping customers happy by avoiding “out of stock” situations.

METRO Group is also opening its new RFID Innovation Centre in Neuss near Duesseldorf in a program led by IBM for the retailer. The center is an RFID working platform for the Retail and Consumer Products Industries, which will allow suppliers to test their readiness for RFID while evaluating emerging technologies for retail. IBM is providing the overall systems integration and technology for the center.



March 19, 2004—The U.S. Department of Defense has awarded a three-year contract to IBM Business Consulting Services to help manage and support the DOD's planned deployment of RFID technology in 2005. IBM's main role will be to determine the business case, provide advice and determine the success of the rollout as it moves forward. "We're going to help them define this program and exactly what passive RFID means for the DOD," says Bill Phillips, a partner and defense-industry leader at IBM Business Consulting Services, an IBM division based in White Plains, N.Y. "The first priority is to help them build the business case, which is important for getting a budget approved for the RFID program, and we will help them develop the criteria used to judge the success of the program.



The objective of the project was to help Philips increase inventory turns. The project provides near real-time inventory visibility to the Philips Semiconductors business units. It will also enable changes to policies in production and inventory planning systems which will, in turn, drive increased inventory turns. The initial deployment is at two distribution centers. IBM provided an end-to-end solution that encompasses services to support Philips Semiconductors in the STAR proof of concept project approach will be delivered during the following project phases : Vendor selection, Design and validation, Construction and testing, Targeted launch and Evaluation. The project will help PSC to further optimize its supply chain and is another step in the route to become an on demand company. The savings will be used to reinvest in competitive advantage and growth.

## Customer Reference: Supply Chain: IBM Fishkill Plant

### Challenge

- \$2.5B Corporate 'from scratch' investment in 300mm Manufacturing and Development. Fishkill then made the decision to use RFID after assessing barcode and infra red systems. The plant needs to use thousands of different active containers for different functions that are transferred from storage area, process tools and manufacturing facilities - all of which are very valuable (\$1K per container holding goods worth ~\$2M). Their challenge was to create a real time, common container tracking system

### Solution

- Every container has an integrated passive RFID tag with a unique ID (common across all IBM sites) - know where its been, where its going and its history
- IBM software is used to create and write the ID to all new containers
- The contents of the container, wafer or reticle, are associated with the ID in the Factory Control System's DB2 database
- The transponder is read at every processing step to validate that the correct container and material are going to the correct process tool result

### Benefits

- Chip fabricators moved from infrared systems to RFID allowing real-time vs. point to point tracking of wafer containers (on average 18 wafers in each container) providing true track/trace capability
- RFID enabled increased efficiency, decreased error rates, and reduced labor requirements
- RFID systems facilitated prioritization of orders, processing of specialty orders, and order routing during retooling or maintenance accelerating time to market
- RFID has enabled IBM's 300mm fabricator to run with 60 to 70 process operators compared with an industry average of 100 to 120, allowing IBM to add value to its products without necessarily adding cost
- With automation enabled by RFID, IBM is able to run the plant with skeleton crew when normally they would shut it down (e.g. holidays)



## RFID Pilot: Supply Chain: *Sinebrychoff Finland Pilot Project*

### Challenge

- The European Union (EU) issued new regulations designed to improve the recall process in the food and beverage industry. By 2005, all food and beverage companies will have reengineered their systems to enable them to identify and trace products through the entire supply chain. For Sinebrychoff, this means installing a solution to link shipments to specific production batches.

### Solution

- Sinebrychoff decided to work with IBM on a proof-of-concept (POC) to evaluate the viability of radio frequency identification (RFID) technology in tagging and tracking pallets and cases. The company wanted to know what kind of accuracy and speed the wireless technology could lend to the shipping process. The IBM Wireless e-business Solutions team helped Sinebrychoff label cases and trays with 13.56Mhz RFID tags and supplied an industrial gate reader to scan them. The RFID gate antenna automatically reads the tags as they travel through the shipping door and sends the information to an IBM eServer xSeries server running IBM DB2 and a tracking solution from Stockway Oy, called Trackway. The application correlates the RFID data with specific production batches and routing information. Sinebrychoff's next step will be to expand the solution to its trading partners.

### Benefits

- Compliance with the EU regulations not only keeps Sinebrychoff from paying heavy fines but also enables the company to trace individual products efficiently and on the spur of the moment. Because regulations require that a full day's worth of production be withdrawn from the market in the event of a recall, it is critical that Sinebrychoff can trace its supply chain quickly and cost-effectively.

During the pilot, Sinebrychoff scanned a full pallet (which holds 56 individual beer cases) with 100 percent accuracy in just 15 seconds - a significant improvement over the two minutes it took to do the job manually. Moreover, routing errors were eliminated, representing a dramatic reduction in liability costs as these errors cause recalls and can result in costs up to approximately €1.2 million.

- The company plans to implement fully when the tag prices drop.

## Customer Reference: Supply Chain: US Department of Defense

### Challenge

- The U.S. Department of Defense is dedicated to becoming an early adopter of Radio Frequency Identification (RFID) technology. The DoD is currently preparing to read RFID tags at key sites within their supply chain. Beginning January 1, 2005, the Department of Defense has mandated that all suppliers place passive RFID tags at the case, pallet, and Defense Department Unique Identifier (UID) item packing level.

### Solution

- IBM is working with the Department of Defense to:
- Develop test pilot milestones and manage test pilot requirements
  - Create project metrics and reporting
  - Build a business case analysis of the overall RFID implementation
  - Monitor implementation issues and resolution
  - Assist in the development and release of RFID business rules
  - Establish commercial best practices
  - Provide Subject Matter Experts to develop the short term and long term implementation plan

### Benefits

IBM seen as trusted brand for US DoD





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