

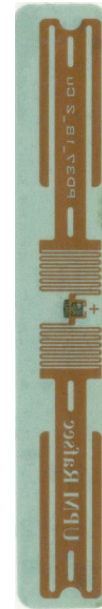
# How does a passive tag auto id system work (really) ?

Electronic labelling. Read/Write features.  
The ISO Standards. The ISO-RFID-TAG-X.

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## Contents

- RF-ID Tags
  - Readers
- Physics, Anti-collision
- Tag data for returnable container
  - AFI tag data structure
  - Where are we now?
- Conclusions



**ENERGY**

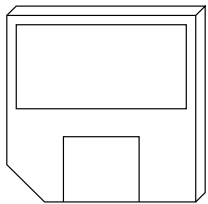
RF-ID Tag technology is engineering

# RF-ID Tag

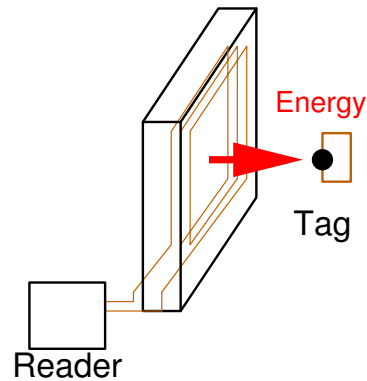
**Data storage media  
with radio connection  
and radio power transmission**

**4 functions of an RF-ID Tag:**

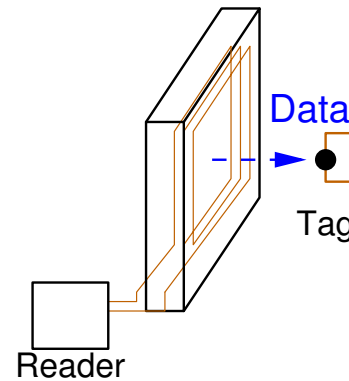
**Data Storage**



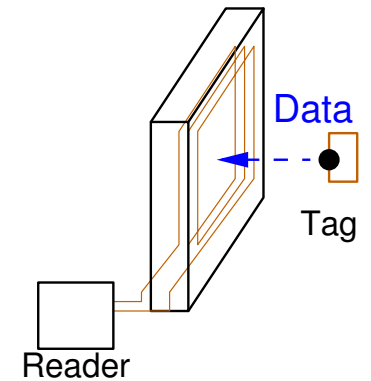
**Power reception**



**Data reception  
(write to tag)**



**Data emission  
(read from tag)**



# Components of the RF-ID Tag

Focus now: 898MHz foil RF-ID Tags –ISO18000-6

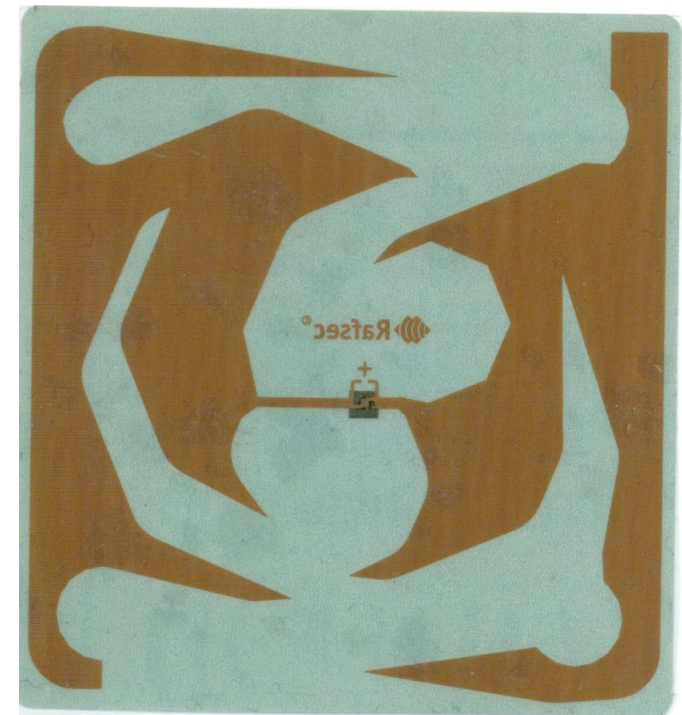
## Antenna

Dipole

Backscatter -> electromagnetic field

Serves 3 purposes:

- Energy transmission
  - Data reception
  - Data emission
- **IC – Integrated Circuit**
- both ends of antenna connected to IC
  - Size < 1mm<sup>2</sup>
  - All functions included



Tag inlay covered with paper  
(smart label)

## Tag reader

**Communication partner of  
RF-ID tags.**

- **Establishes a stationary field of  
fix frequency 980MHz (energy).**
- **Reads and writes Data to/from  
RF-ID tag.**

**Main visible component:  
Antennas**

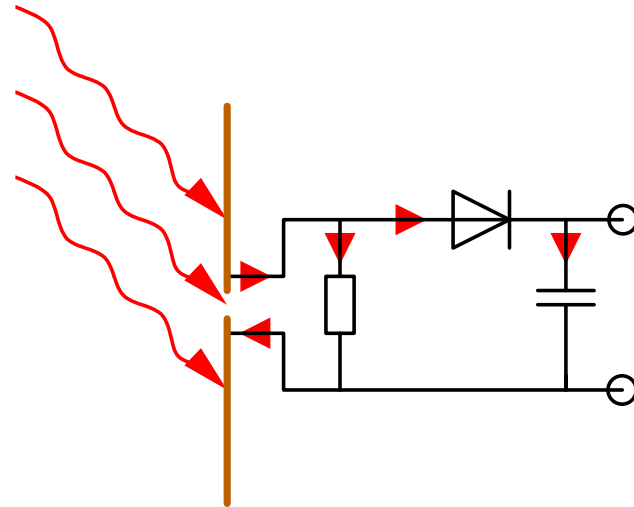


**Portable Device  
with tag reader**



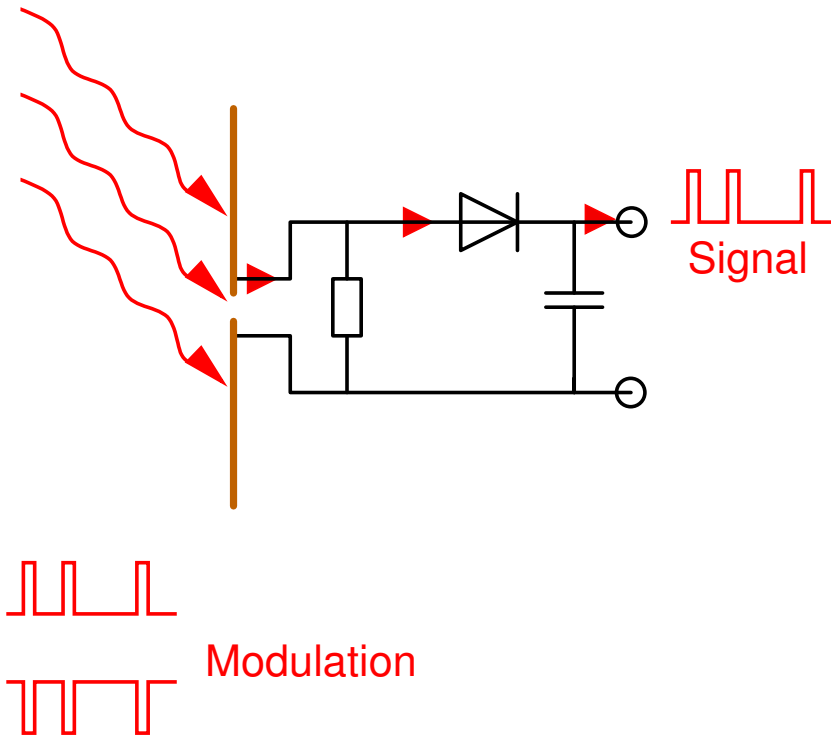
**Gate reader**

## Tag Function 1: Energy reception



## Tag function 2: Data reception

Cmd: Send memory block 2, bit 0 to 64

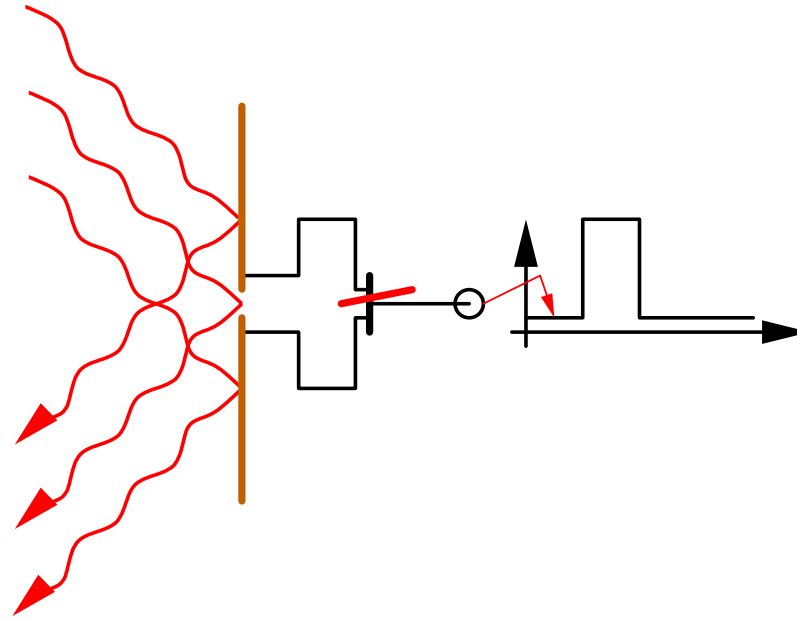


**Date rate: up to 40kBit/s**

**Data transmission to all tags in field simultaneously**

## Tag function 3: Data emission

Cmd reply: Sending memory block2, bit 0 to 64



Reflecting the wave (Sending)

Tag to reader: 160 kBit/s max

**Oscillator in short-circuit state:**

- no energy consumption (reflection) of the tag
  - Reader receives reflected wave
- Reception only possible, if only one tag talks ->Anti-Collision

# Anti-Collision

**Capability to communicate with multiple tags in the reader field.**

**All tags receive power and commands simultaneously.**

## Problem to solve

**If multiple tags are sending data:**

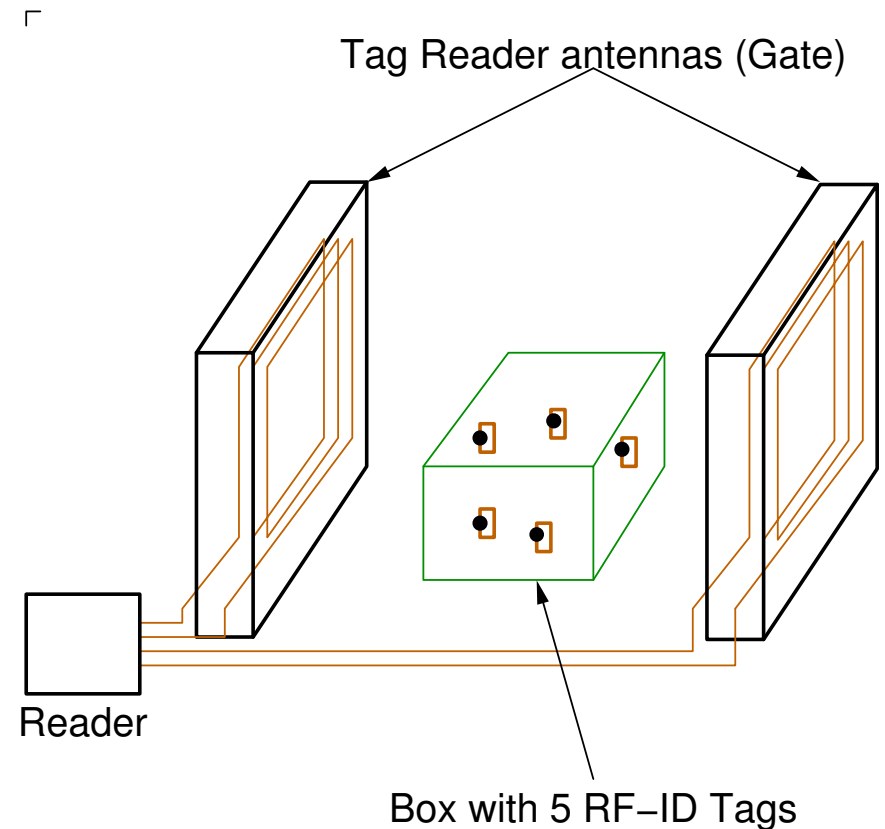
**-> reader detects only collision**

**-> reader does not receive any data.**

**→ Anti-Collision methods**

**(a) ALOHA, (b) Binary Tree,**

**(c) slotted random**



**5 Tags in reader field**



# Anti-Collision – unique tag ID

**Necessary to address tag directly**

**If reader knows tag ID it may communicate only with this tag**

**Tag ID: ISO 15963**

**Technology-Independent tag-id standard:**

**<Org><Manufacturer><Serial number>**

**Tag ID example:  
E0170B01AA000CD8**

**Organisation:**

**E0: ISO/IEC7816-6/AM1**

**E2: EPCglobal**

<b>E0 +</b>	<b>E0 +</b>
<b>01 Motorola</b>	<b>0D Mitsubishi</b>
<b>02 STM</b>	<b>0E Samsung</b>
<b>03 Hitachi</b>	<b>0F Hyundai</b>
<b>04 Philips</b>	<b>10 LG</b>
<b>05 Infineon</b>	<b>11 Emosyn</b>
<b>06 Cylic</b>	<b>12 Inside</b>
<b>07 TI</b>	<b>13 Orga</b>
<b>08 Fujitsu</b>	<b>14 Sharp</b>
<b>09 Matsushita</b>	<b>15 Atmel</b>
<b>0A NEC</b>	<b>16 EM</b>
<b>0B Oki</b>	<b>17 KSW</b>
<b>0C Toshiba</b>	<b>19 XICOR</b>



# Anti-Collision – Pre-selection on application family (AFI)

Pre-select group of RF-ID tags

EPC/AFI

Example: Flight baggage

→ Ignore any other tags like goods

Advantage: Faster Anti-Collision

AFI: Application family identifier

Byte which composes into two sub-fields:

- Application family
- Application Subfamily

- 1 Transport
- 2 Financial
- 3 Identification (Access control)
- 4 Telecommunication
- 5 Medical
- 6 Multimedia
- 7 Gaming
- 8 Data Storage
- 9 EAN.UCC System (AI's) (Retail)
  - 9-? ?EPC?
- 10 ASC (DI's)
  - 10-1 Items
  - 10-2 Transport units
  - 10-3 Returnable containers
- 11 UPU (Universal Postal Union)
  - 11-1 Items
  - 11-2 Transport units
  - 11-3 Returnable containers
- 12 IATA
  - 12-1 IATA Baggage Tag

## **Summary:**

- **Standards: ISO/IEC18000-6c**
- **Anti-Collision using Unique ID for up to 200 tags.**
  - **Reading distance: up to 8m,  
may be restricted by local power limitations.**
  - **Spot-light shaped reading zone:  
stack of readers to increase performance**

# Tag data for returnable container

- Unique ID: Composed of: Issuer, container
  - Container Type: **KLT1521**
  - Additional data: current contents

## How ?

- Compatible to present Bar Code to be compatible to present infrastructure

### ISO15459-5 Returnable Container

- **25BODABCDQQD184AC+BKLT1521**  
(registered Odette issuer)
- **25BUN123456789QQD184AD+BKLT1521**  
(registered DUNS issuer)
  - <sup>FNC1</sup>**800312345671234567QQD184AE**  
(registered GS1 issuer using EAN128 data structure (Global Returnable Asset ID))

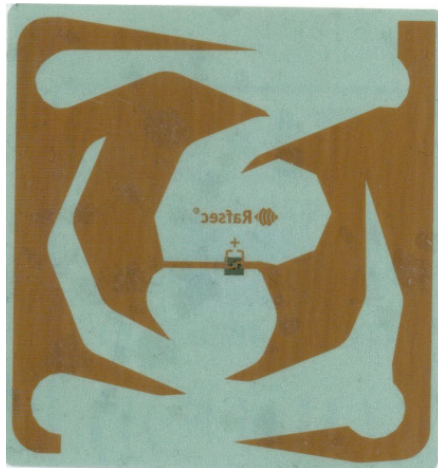


# RFID Data Structure ?

## AFI Structure

- All Bar-Code versions may be represented
  - Additional data welcome
- (Use tag as portable data base)

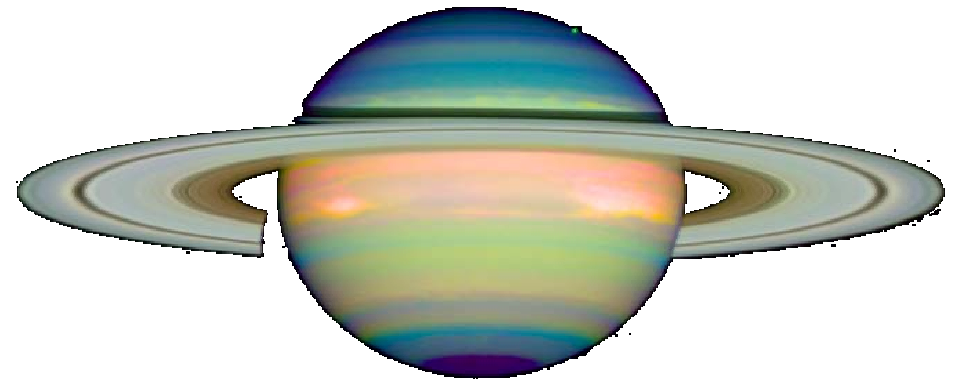
Data on Tag



## EPC Structure

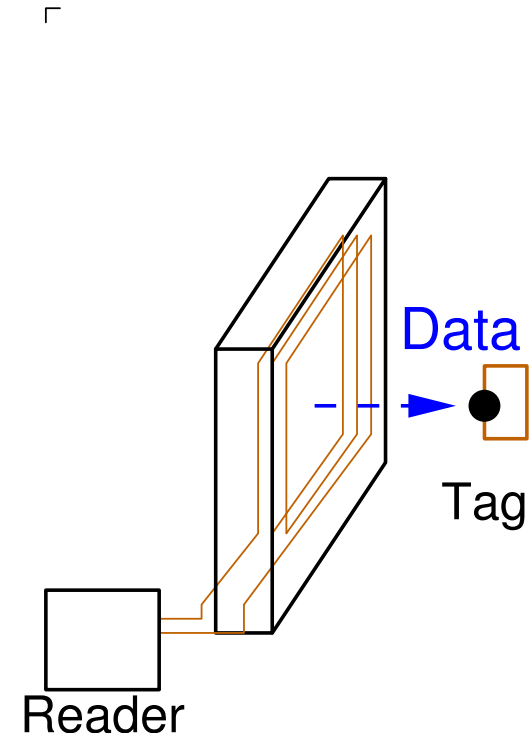
- Tag data is a database pointer (GRAI)  
(Only some GRAI can be represented)
- Other data should be hold in the EPC framework (set of worldwide data bases)

Data on Network

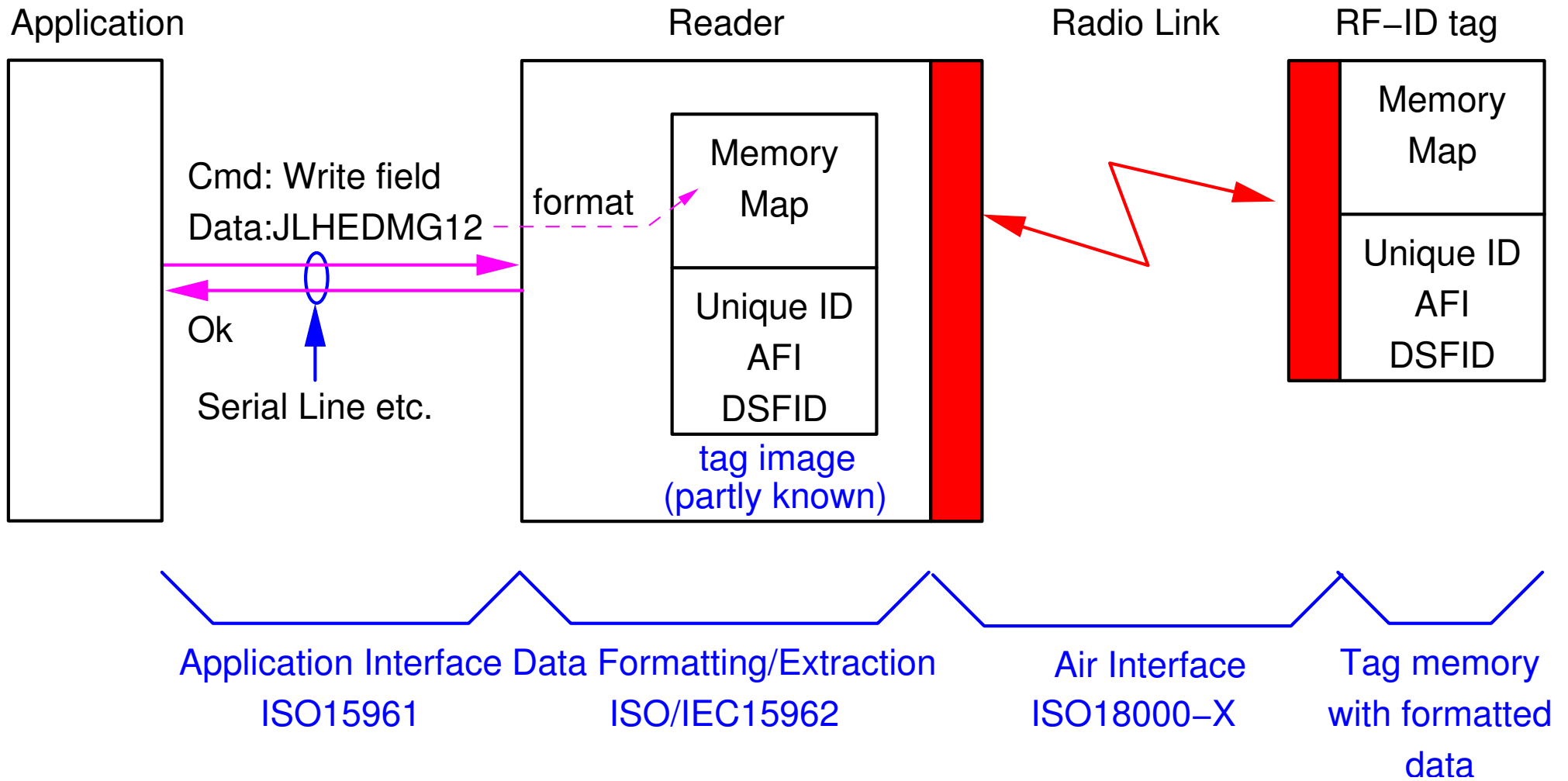


# ISO (AFI) RFID tag data structure

- **RFID tags advanced features:**
  - Writeable
  - Big memory
  - read without view
- **How to extend present systems with RFID tags ?**
  - **Compatible RFID data structure**
  - **ISO/IEC15961**



# ISO/IEC15961 & ISO/IEC15962 Overview

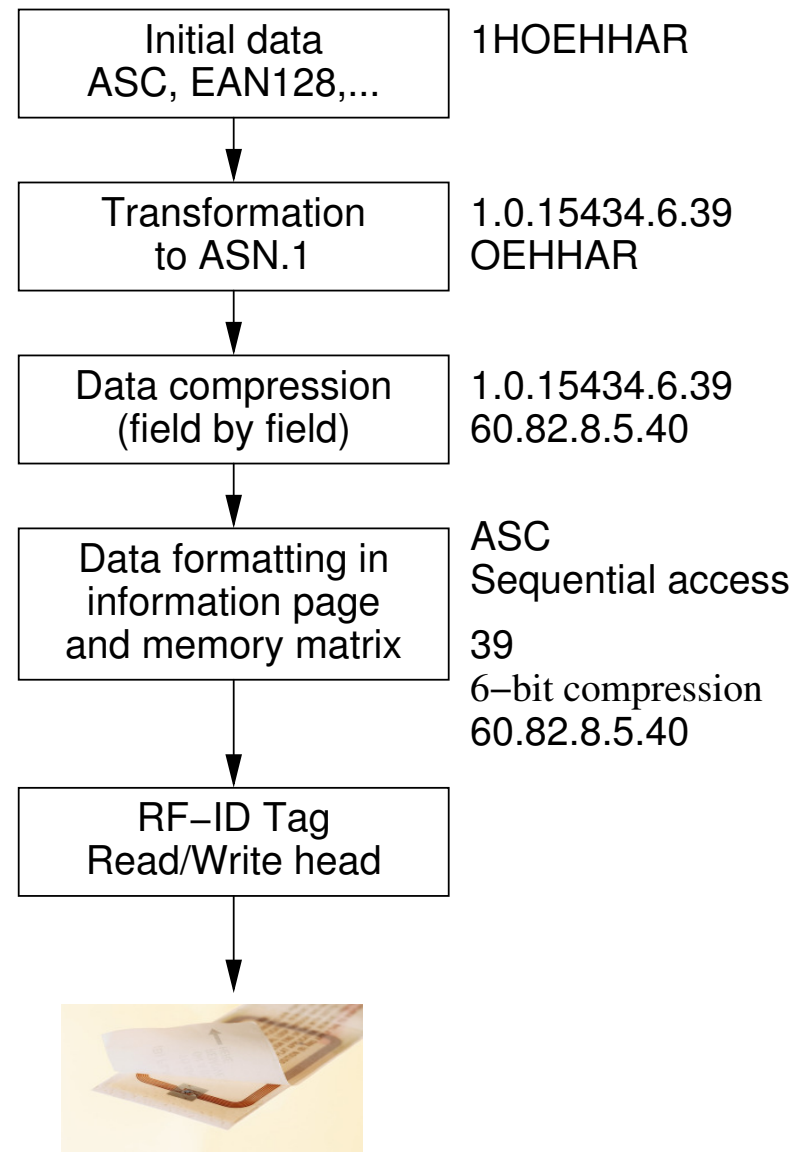




# ISO/IEC15961 & ISO/IEC15962

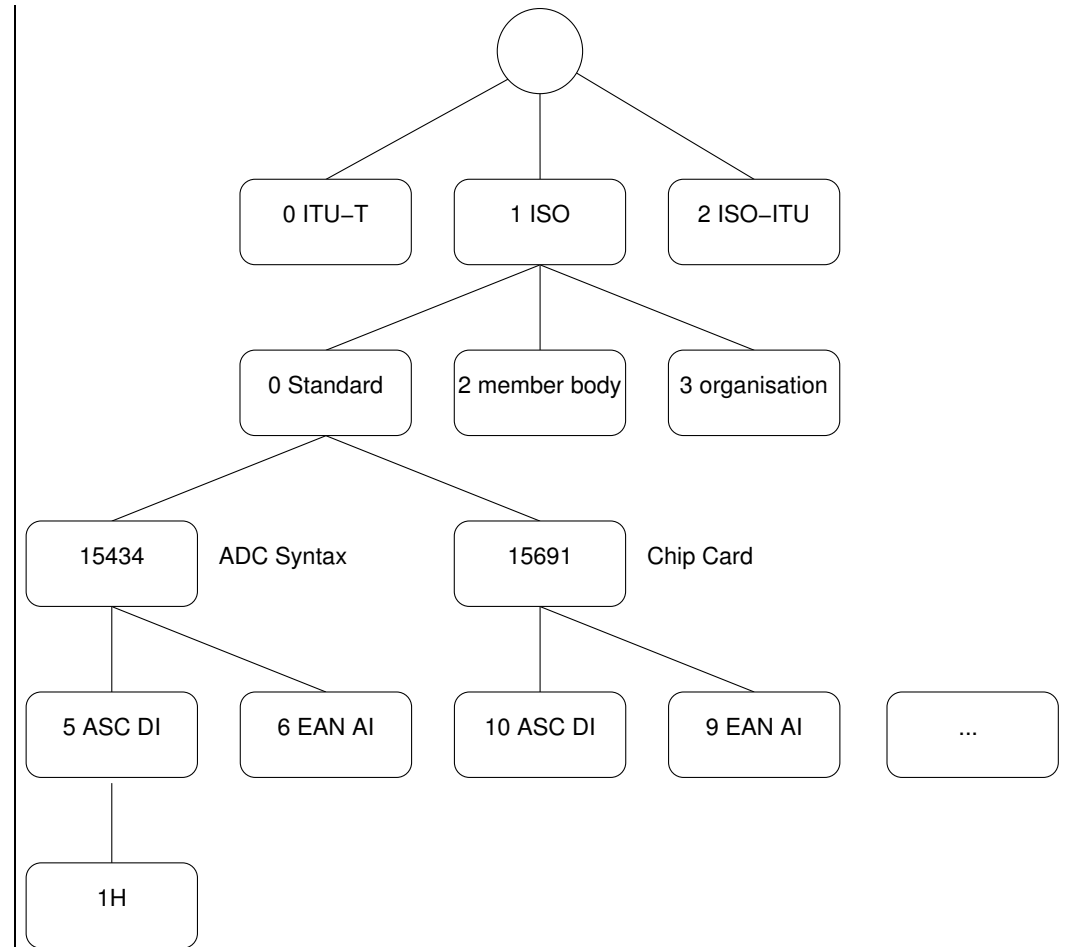
## Features

- **Compatible to other material handling data structures**
- **Treats ASC/EAN128 transparently**
- **Defines commands read/write**
- **Select tags suited to my application quickly**
- **Fast access on key fields**  
"What is your transport unit?"
- **Fast access on arbitrary fields**



# ISO/IEC15961: Conversion to Abstract Syntax Notation One (ASN.1)

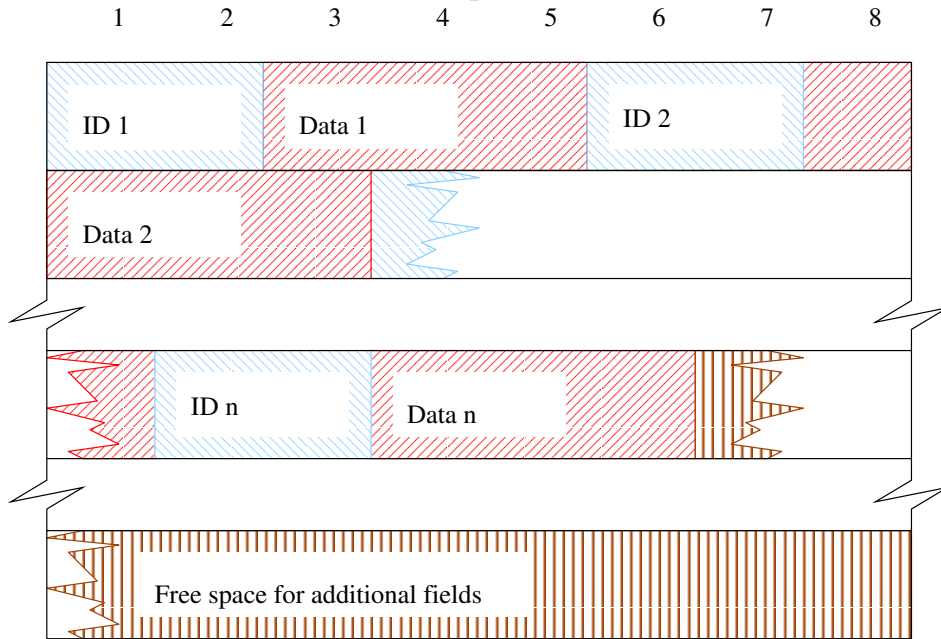
- **Definition of commands:**  
write field, read field, ...  
**Commands and data on one wire**
- **Identifiers are organised in a tree covering ASC, EAN128, ...**
- **Example:**  
**ASC 1H → (40 248 74 6) 39**  
**40 248 74 6: ISO15434-6**  
**39: 1H**



**ASN.1 identifier tree (OID)**

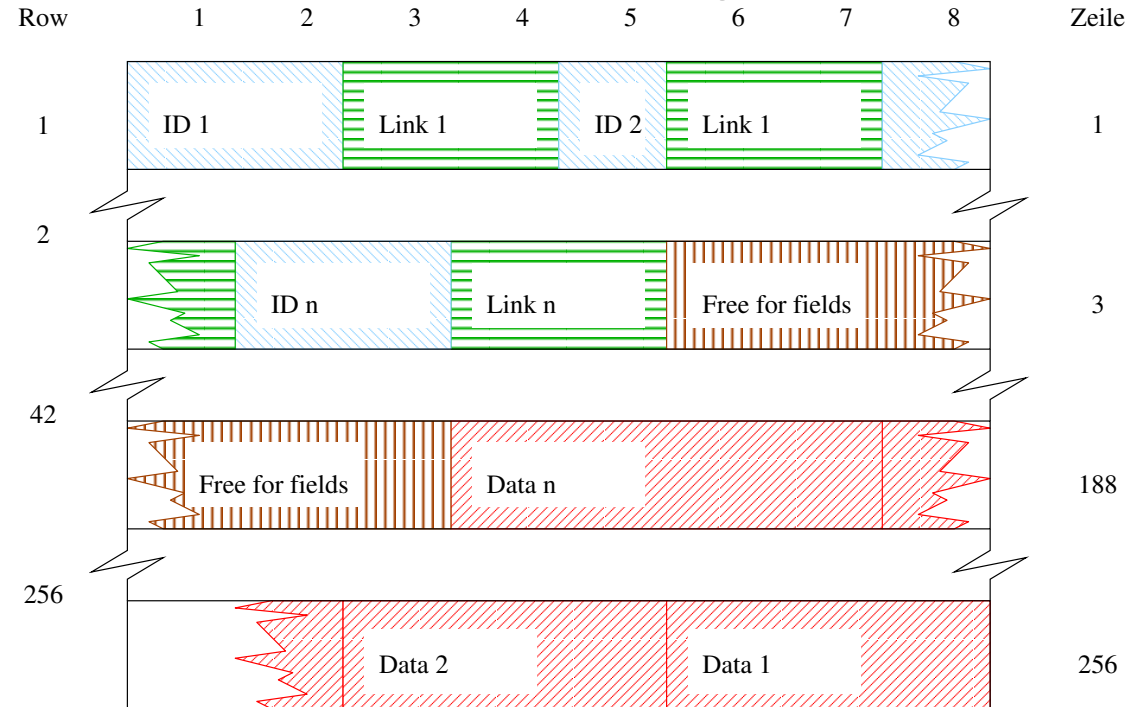
# ISO/IEC15962: - Memory organisation

## Sequential



- Very quick access on first field
- Access speed decreases for each field
- Less memory usage than directory method

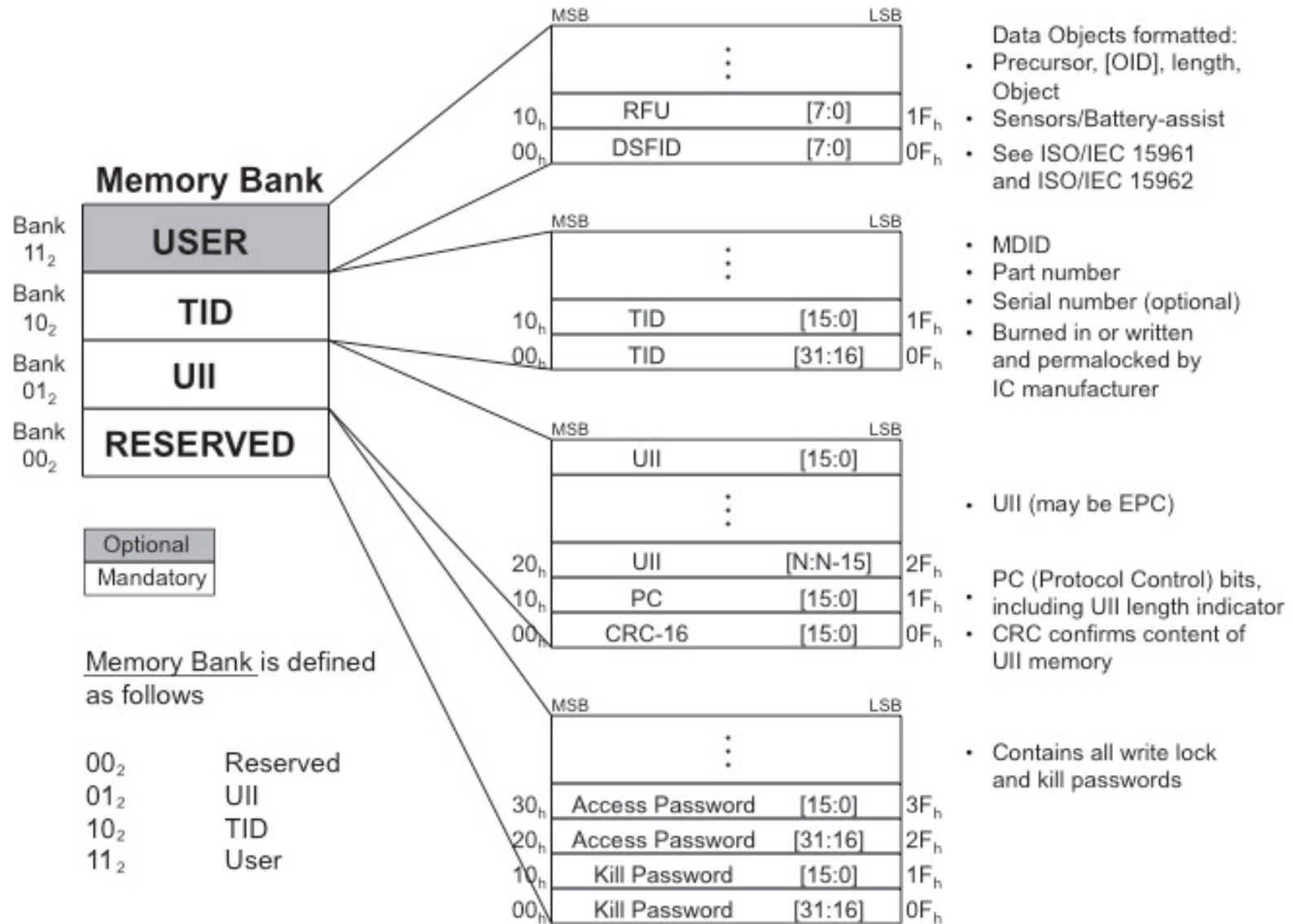
## Directory



- Quick access on any field
- Directory may be buffered or fix for the application

# Where are we today ?

ISO17364: Supply chain applications of RFID – Returnable transport items (RTIs)



Next Step: CEN TC225 3th of may in Brussels

# Conclusions

## → Data structures of automatic-identification: ASC, EAN128, Transfer Syntax, ISO-RFID Tag

- Type information is added to the data for the information system
- World wide uniqueness is achieved using labeler IDs.
- ISO Standards guarantee communication within branches.
- Data structures may be transmitted by different media independent of the data structure.

## → RF-ID Tag data structures establish compatibility within tags and to barcode.

- Usable standard 15961/15962 ready for use.
- Complex ? That's normal, it is RF-ID !