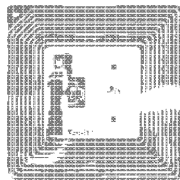
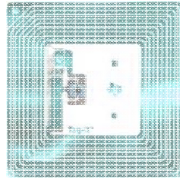
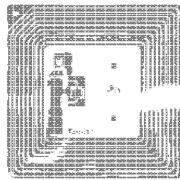
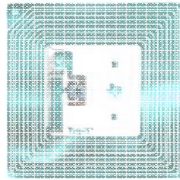




June 13th, 2007

Christian Meiß

RFID - Logistics and Supply Chain  
Management



## 1. Introduction Fraunhofer IML

2. openID – The open platform for the integration of identification systems

3. Fields of application

4. The internet of things

5. Discussion

# The Fraunhofer society



- 58 institutes in Germany
- 12.700 employees
- 1,25 billion € turnover
- More than 925 million € in contract research
- Branches in USA, Malaysia, Singapore, China, Japan
- Leading organization for technical innovation in Europe
- Applied science in all engineering faculties



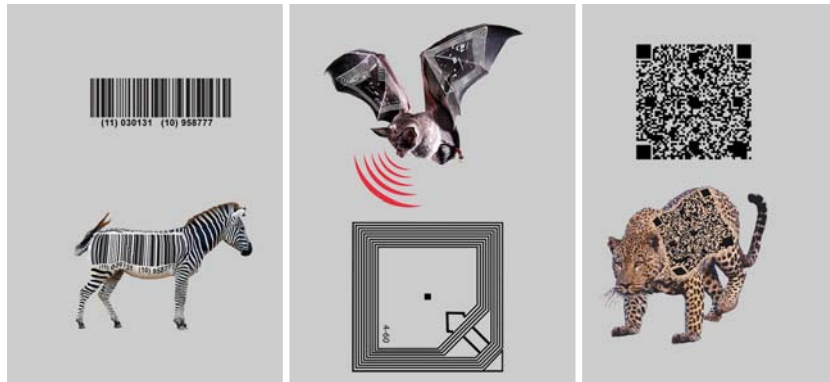


# The Fraunhofer IML



- Founded in 1981
- More than 170 scientists
- Approx. 250 student assistants
- Turnover of approx. 18 million €
- Thereof > 60% from industry, trade and services
- Branches and projekt centers in Cottbus, Frankfurt on Main, Prien on Chiemsee, Paderborn, Lisboa (Portugal) and Beijing (China)

# Capacity overview RFID at Fraunhofer IML



## Capacity overview RFID

### Pre-test at openID-center

- **Neutral** tests of RFID-devices for products and packaging
- **Pre-tests** with conveyer and warehouse devices
- **Recommendation** for tuned components and frequency band



- Analysis and monetary evaluation of current ident-systems
- **Feasibility Study**
- **Evolution of RFID-scenarios**
- Cost-benefit calculation
- Requirements specification for ident-systems

## Economic + technical feasibility

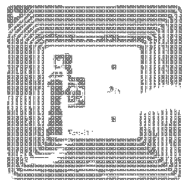
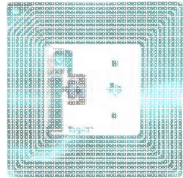
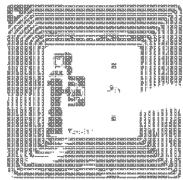
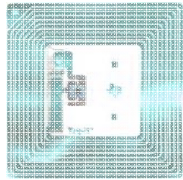
### On-Site Test, installation and trainings



- **Single- and Bulkreading under real conditions**
- Installation and tuning of the Ident-Systems
- Evolution of **Middleware**
- Monitoring **starting phase**
- Employee training



# Agenda



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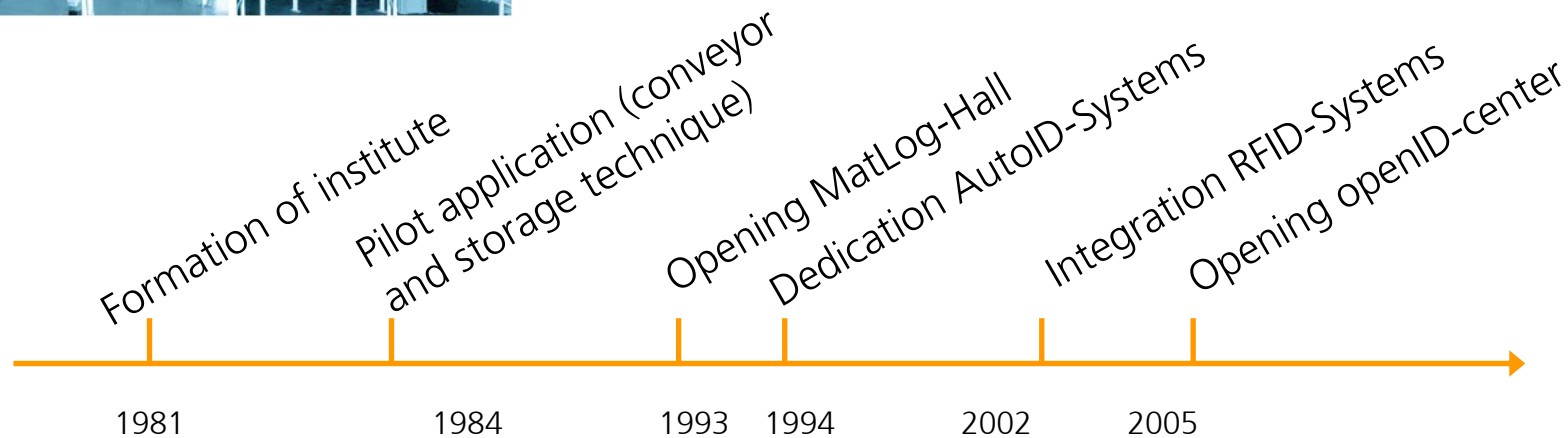


# History of origins



## Initial situation

- Former Matlog-Hall with diverse systems of conveyor and storage technique on a surface of 1.500 qm
- Idea of the openID-center: Integration of RFID-components into existing logistic systems



# openID-center



Automatisches Hochregallager



Regalbediengerät



Palettierroboter



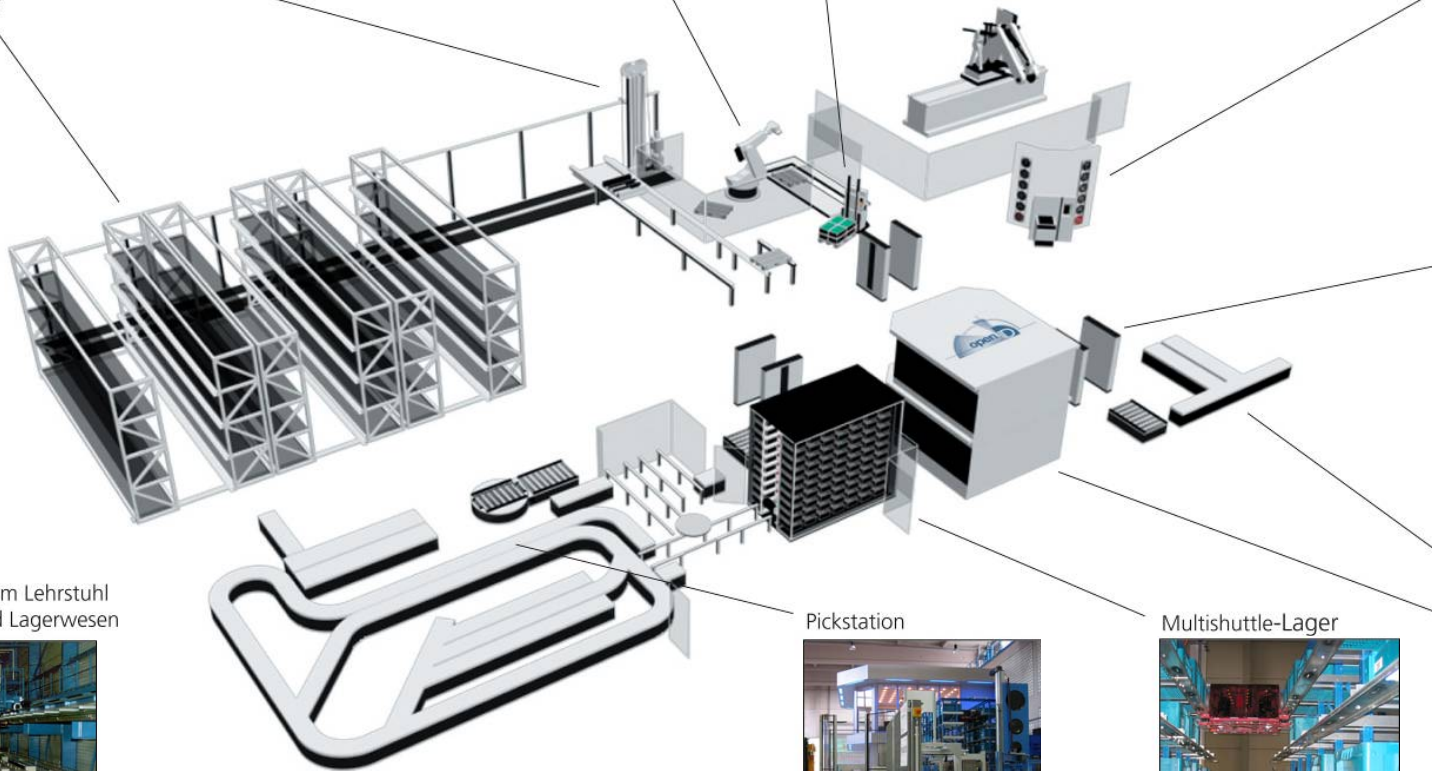
Fahrerloses Transportsystem



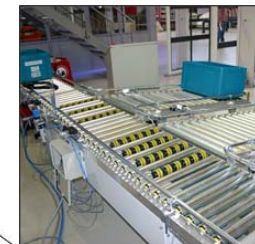
Fahrerloses Transportsystem



Tower24®



RFID-Gate



Mehrweg-Depot



Konferenzraum

Versuchshalle im Lehrstuhl für Förder- und Lagerwesen



Pickstation



Multishuttle-Lager

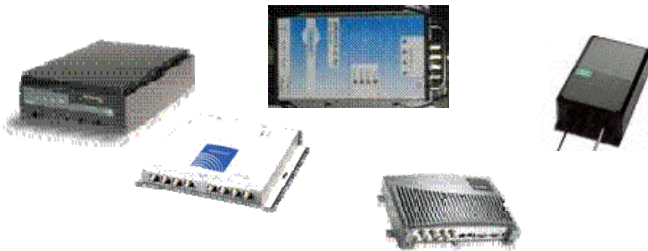


# Co-operation partners and sponsors





## Reader



## Antennas



## Transponder



## RFID-tests at the openID-center

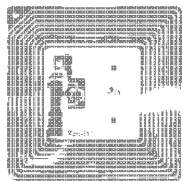
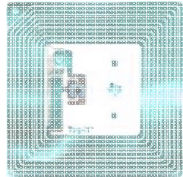
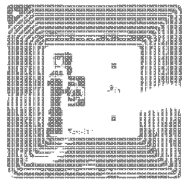
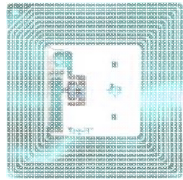
- 29 HF Reader and 25 HF antennas  
16 UHF Reader and 44 UHF antennas
- Conveyor techniques for RFID-tests with a speed of  $\sim 3,3$  m/sec (equals 12 km/h) will be installed in June 2007
- AGV (automated guided vehicle) for long-term tests
- Diverse HF and UHF Transponder, to some extend with temperature sensors
- Only few LF and MW applications tested

# Video: RFID-tests in the openID-center





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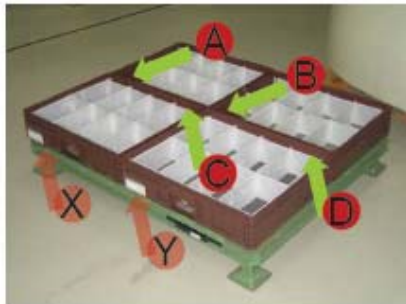


## DAIMLERCHRYSLER



### Technologic pretests

- Evaluation of currently available RFID technology
  - Functional test of transponders and readers
  - Analysis of achievable read rates, ranges and optimal antenna fixation and adjustment
- General read range and read rate analysis of on-metal transponders and smart labels
- Analysis of three RFID-applications: handheld, gate and forklift



A-D:  
rarely  
capturing

X,Y:  
occasionally  
capturing



## Gate reader

- Gate width up to 6 m possible
- 100% capturing only with low speed ( $< 0.4$  m/sec)
- With a gate width of 6m and a speed of 3,5 m/s all of pallet tags detected

→

## Handheld

- Read range up to 3,50 m (single reads)



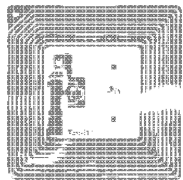
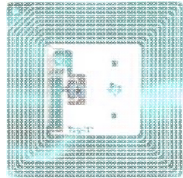
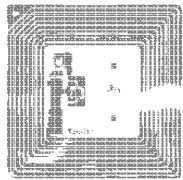
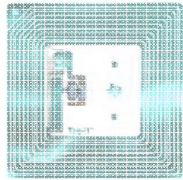


## Forklift

- Test with an antenna prototype:  
Coverage of five to six casks  
(Pallet tags) on the fork
  - Circular polarized antennas viable
  - Size of antennas restricts field of view and  
can cause destroyed antennas (overlaps  
vehicle contours)
- Development stands at the beginning, but  
is promising



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# The internet of things - definition

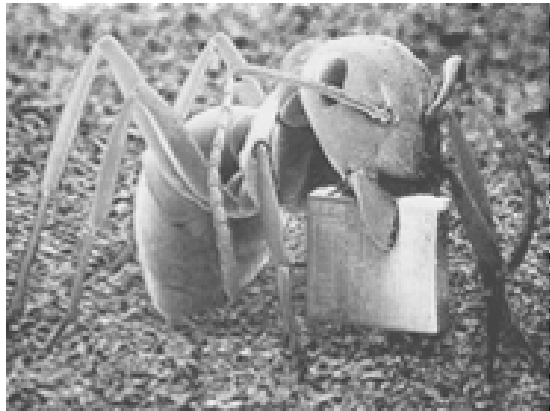


„The internet of things is a logistic system, in which the logistic object (packet, container, pallet etc.) determines its way autonomously caused to integrated intelligence based on RFID through internal and external networks and request the necessary resources.“  
source: Logistik-Lexikon 2006





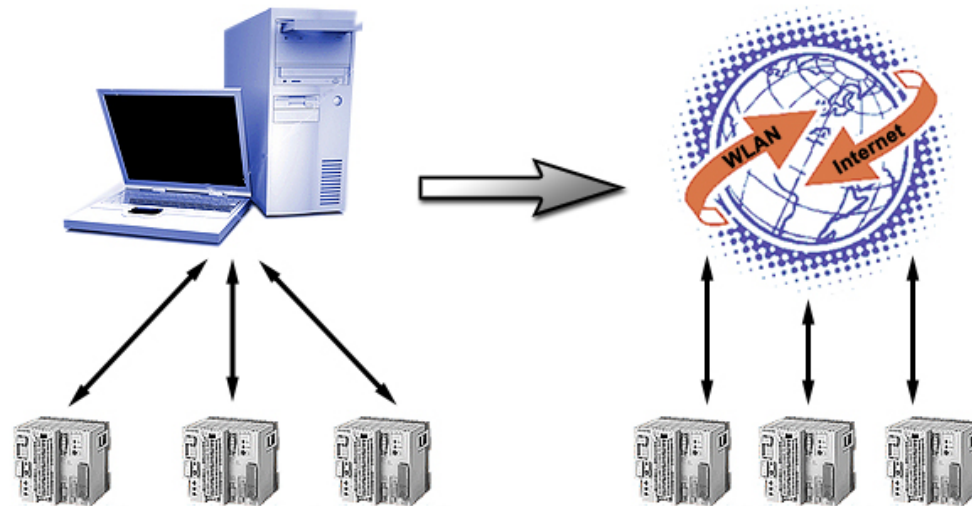
# The Internet of things



- Optimization of material flows are a mayor aim of logistic engineering
- RFID enables a realtime control and better organization of objects and their moves, therefore RFID is important for logistics.
- The integration of RFID affects two dimensions in the **internet of things**:
  - **Real World Awareness**  
RFID enables the connection of virtual world of data and the real world of objects in real time. Therefore emerges a new image of the world.
  - **Self organization on the basis of autonomous objects**  
Autonomous objects, which targets and strategies are stored on RFID chips, organize the material flow by themselves.

# Autonomous material flow module

Change of paradigm from external to internal control of logistic processes



Each element should be able, to realize its environment, to handle the information that had been won and to accomplish based on the information its particular task.

# Research Project Smart and Aware Objects



## Intelligent objects in logistics

- offer more than just identification
- allow high dynamic and decentralized control systems
- give maximum transparency of the object
- are able to be localised easier
- are a substitute for fixed control infrastructures
- enlarge the security of logistical processes



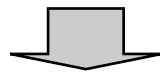


Thanks to RFID and the realtime storage of information on tags local decisions can be made without super ordinate instances.

- Test facilities of Fraunhofer IML and FLW
- Control of the steady conveyor and sorter by means of containers equipped with UHF transponders 868 MHz
- Computer on Linux basis with own homepage



Chair of transportation and warehousing, University of Dortmund



**Internet of things**

**Thank you for your attention!**

**Christian Meiß**

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**open ID**

