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

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

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

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
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
**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
RFID-tests at the openID-center

- 29 HF Reader and 25 HF antennas
  - 16 UHF Reader and 44 UHF antennas
- Conveyer techniques for RFID-tests with a speed of ~ 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
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
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
**Implementation details (I)**

**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
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 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
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 ships, organize the material flow by themselves.
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.
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

Internet of things
Thank you for your attention!

Christian Meiß
Fraunhofer IML
Department of trade and packaging logistics
Joseph-von-Fraunhofer Str. 2-4
44227 Dortmund
christian.meiss@iml.fraunhofer.de