M-Lab: The Mobile and Ubiquitous Computing Lab

The Potential of RFID for Moveable Asset Management

Ubiquitous Commerce Workshop at Ubicomp 2003

October 12 2003

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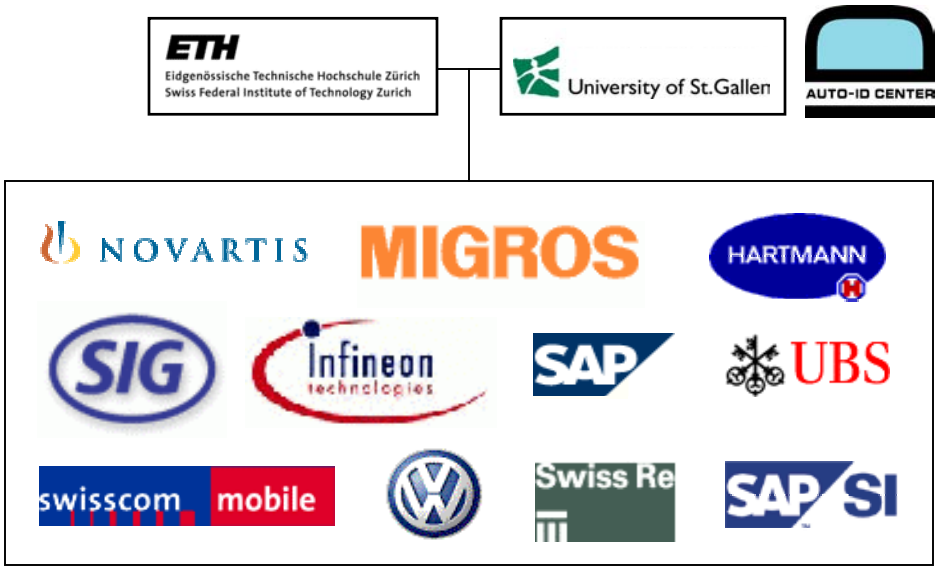
Swiss Federal Institute of Technology Zurich

University of St.Gallen

Overview

About the M-Lab



A joint initiative of ETH Zürich and University of St. Gallen

Auto-ID Center Lab

Applied research in ubiquitous computing with several industrial partners

Technologies

Demonstrators

Business Ideas

Business Cases

Technical and business aspects

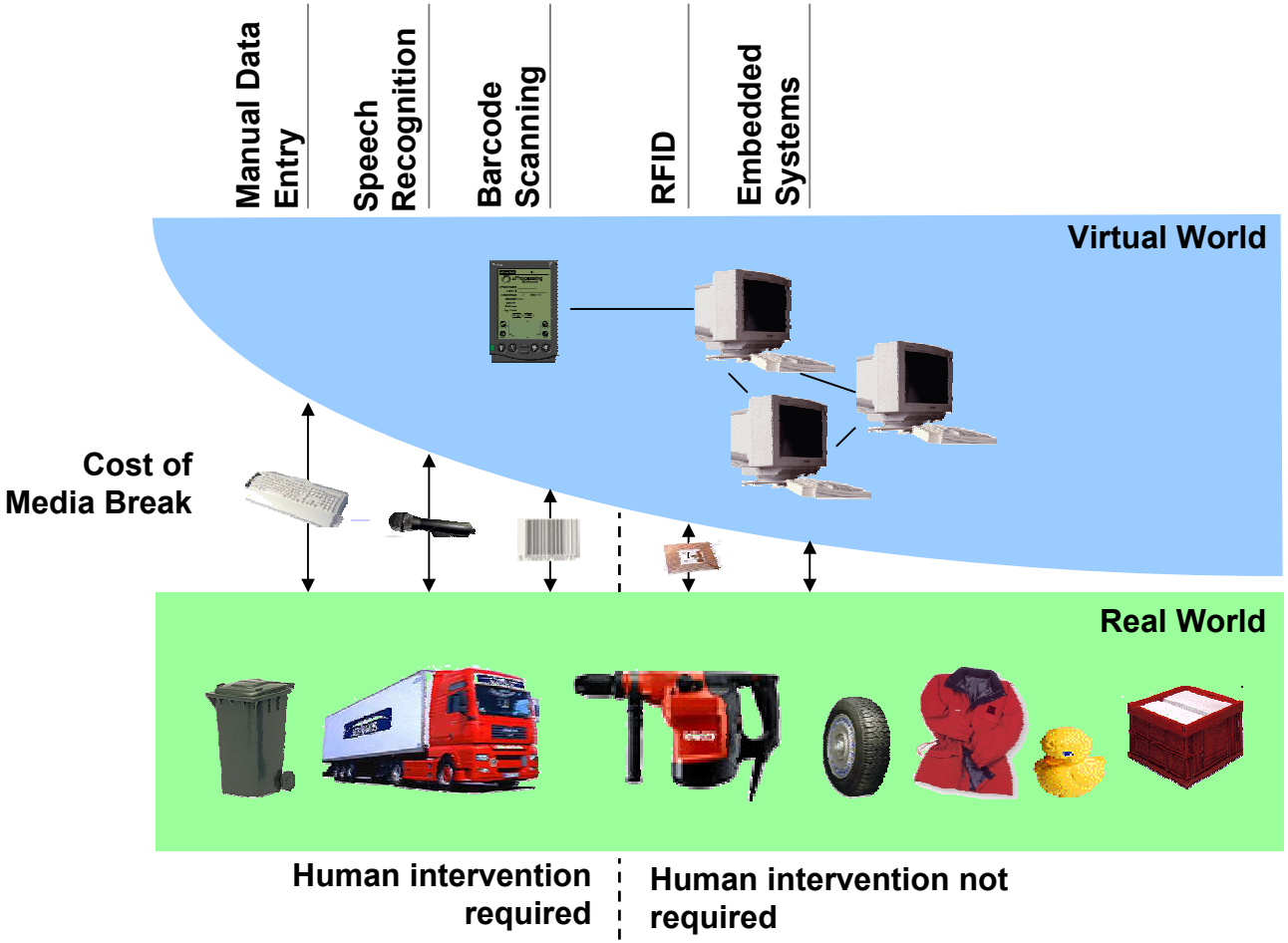
Overview

Movable/Reusable Asset Management

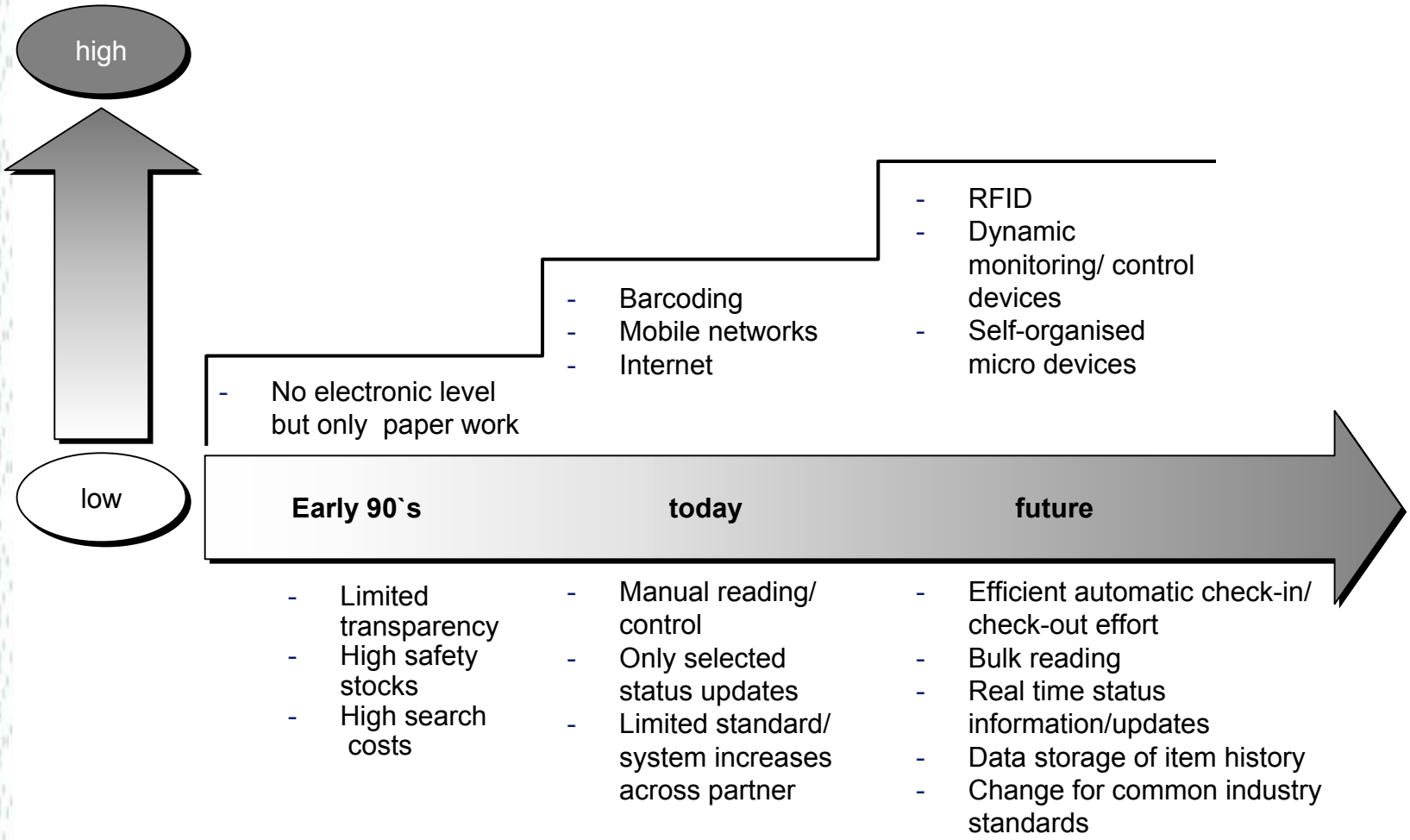
- The goal of moveable asset management is to make assets available when needed and ensure their efficient use
- Asset management systems should be able to
  - Manage assets individually
  - Allow to locate the right asset
  - Provide information about the current physical status (quality) of an asset
  - Keep an information history of an asset
- Typical drawbacks of today's asset management systems:
  - Missing direct integration of physical assets with the IT-system
  - Only number of assets in stock managed and not individual items
  - Not designed to store all related data with an asset, e.g. usage data or status information

  → Manual data capturing (expensive and error prone)

Integration of Physical and Virtual World



RFID for Total Asset Visibility



Overview

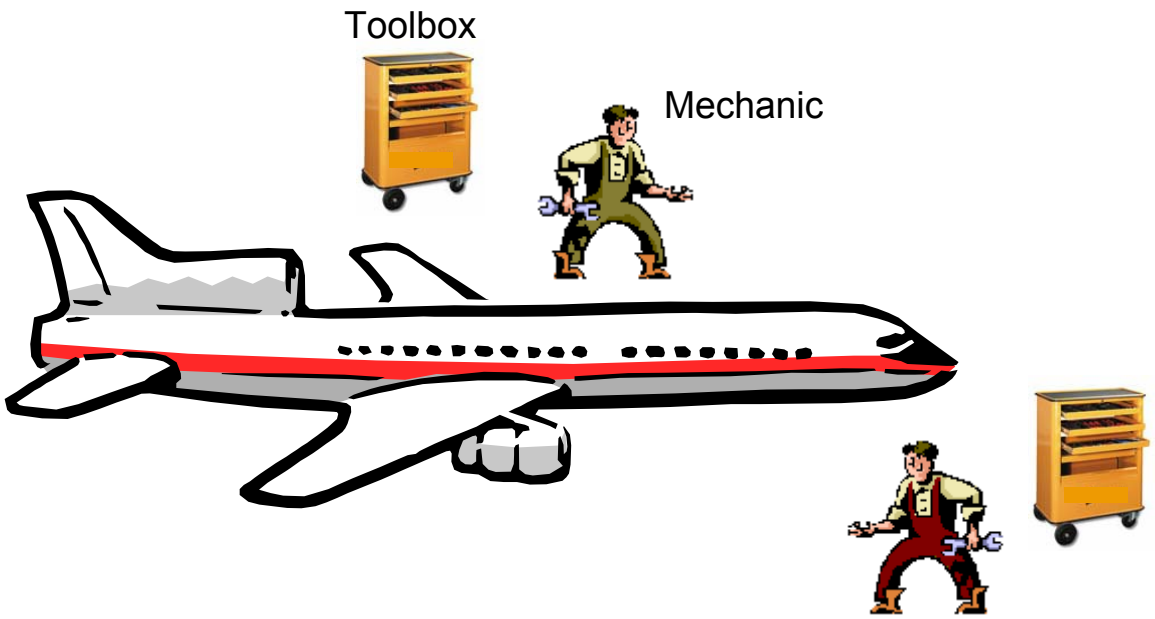
About the M-Lab

RFID and Moveable Asset Management

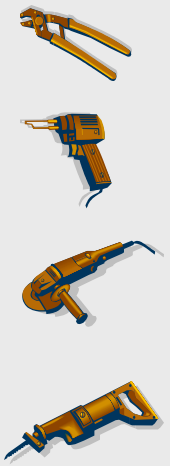
Smart Solution for Aircraft Maintenance

Summary

Aircraft Maintenance at Fairchild-Dornier



Tool Inventory

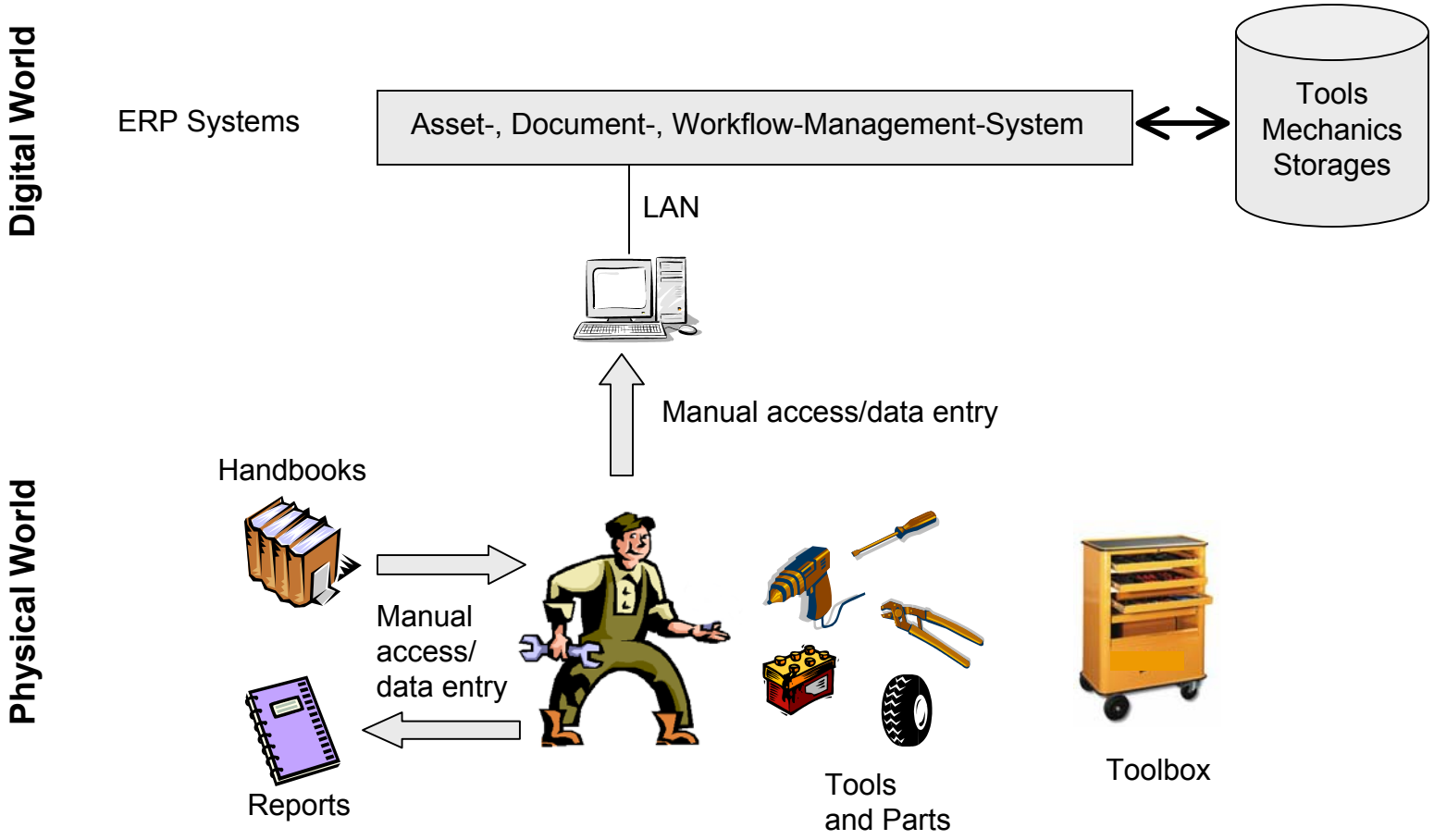


Handbook Library
Shelves with handbooks, maintenance manuals of manufacturers

Desktop
Central place where all necessary documentation can be found (MPDs, RODs, IPCs).

Shelves for parts
Dismantled parts for immediate reintegration or repair, spare parts.

Aircraft Maintenance Environment



Toolbox for Aircraft Maintenance

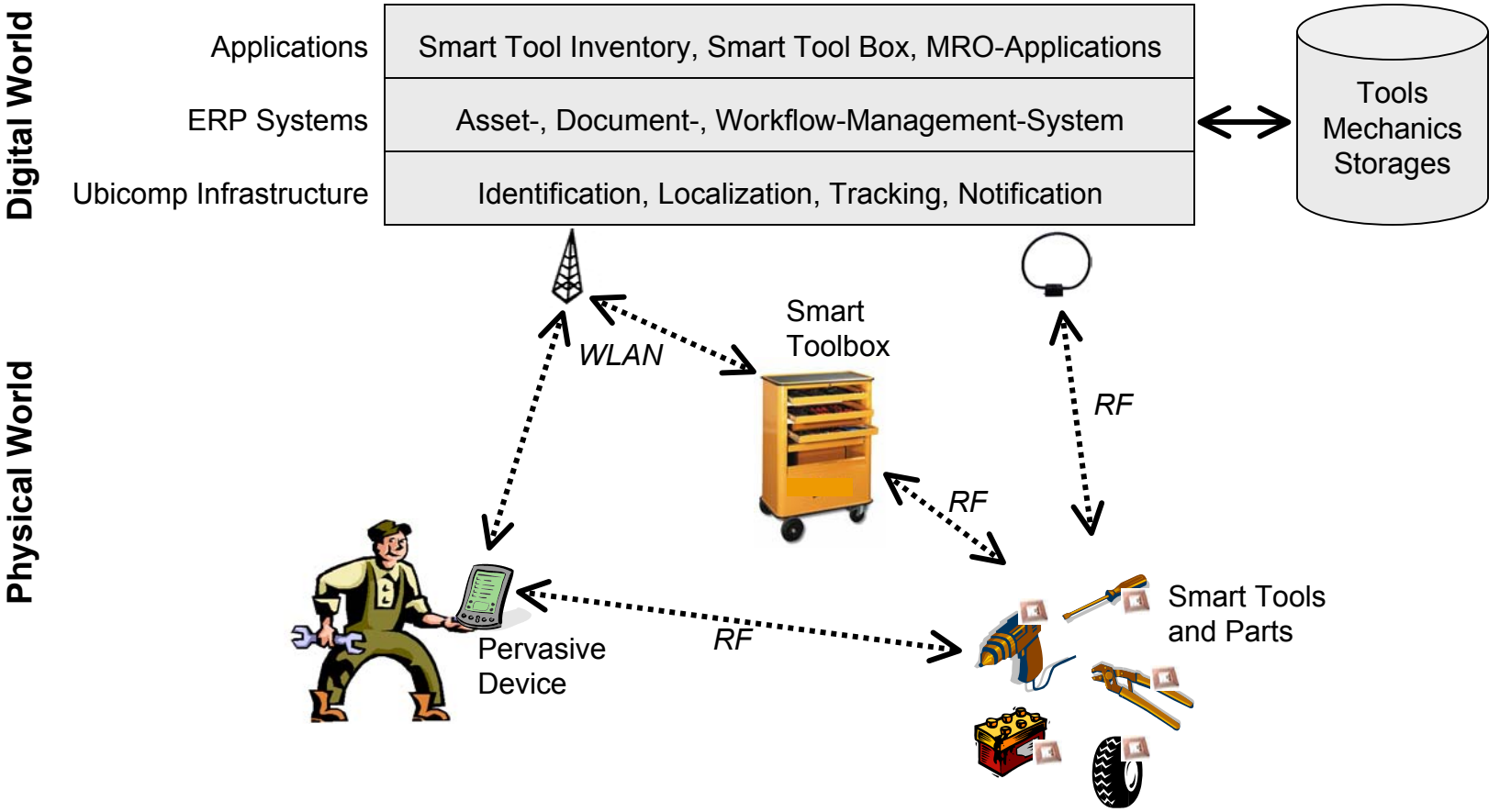
- **Problems**
  - Daily and monthly time consuming checks for completeness and correctness of tools get neglected
  - Manual marking of tools
- **Impacts**
  - Time consuming and costly searches for forgotten tools in aircrafts
  - Tools between mechanics get mixed up

  → problems with accountability of mechanics

Tool Inventory

- **Problems**
  - No data about checkout and return processes stored
  - Metal tokens accidentally placed in wrong position
- **Impacts**
  - Assignment of tools to mechanics not easily possible
  - Time consuming visual availability check
  - Time consuming search for wrongly placed tokens
  - Late return of tools
  - No history about lent tools available

Envisioned Aircraft Maintenance Environment



Smart Tool Box Demonstrator

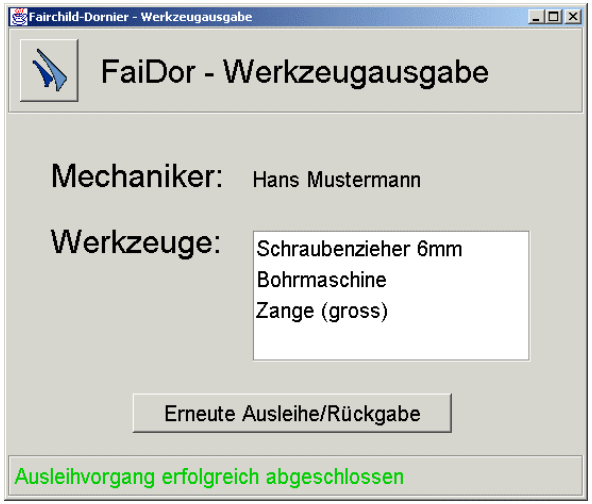
- Solution
  - Tagging of tools with RFID labels
  - Automatic completeness and correctness checks
  - Smart Tool Box application to implement functionalities
- Lessons learned
  - Concept works
  - Real-world implementation difficult
    - Tool box made out of metal
    - Tools small and made out of metal

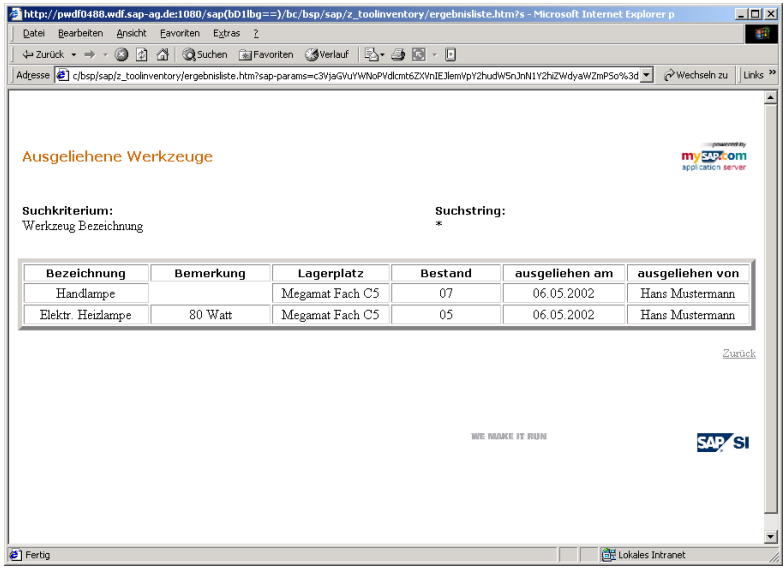
"Business Case" – Smart Toolbox

- **Potentials (speedup of tool checks, avoidance of searching for tools, avoidance of manual marking of tools)**
  - **Working hour of mechanic (70 EUR)**
  - **Tools in toolboxes are marked initially and every 1.5 years, after 6 years toolbox is exchanged, 16 working hours for marking process, for 60 toolboxes 640 working hours (44800 EUR) per year**
  - **Weekly checks 2 hours per toolbox with two mechanics, 60 toolboxes, 46 working weeks per year → 11040 working hours per year (772800 EUR)**
  - **3 hour per year of unexpected waiting time during aircraft maintenance (69000 EUR of cost savings for customer)**
  - **→ approx. 886 600 EUR**
- **Costs**
  - **Abschreibungsfrist is 6 years**
  - **Tagging of tools with RFID done at tool producer: average 1 EUR per tool, Reader and antennas 2000 EUR per toolbox, for 60 toolboxes annual costs of 21500 EUR**
  - **Maintenance of smart toolboxes approx. 100 working hours per year (7000 EUR)**
  - **→ approx. 28500 EUR**

Smart Tool Inventory Prototype

- **Solution**
  - Checkout/return process with employee ID-card and RFID tagged tools
  - RFID-client application for checkout/return process
  - Web application for information retrieval of tool status
  - Integration with SAP
- **Benefits**
  - Quick and easy lend/return process
  - No more metal marks require
  - All information accessible



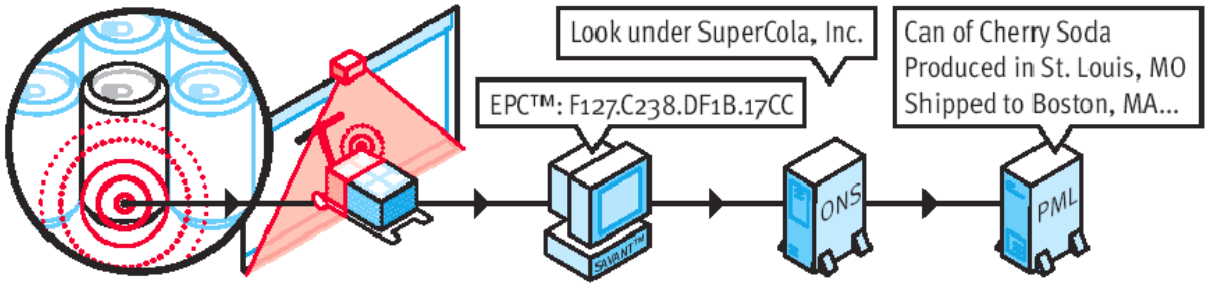


"Business Case" – Smart Tool Inventory

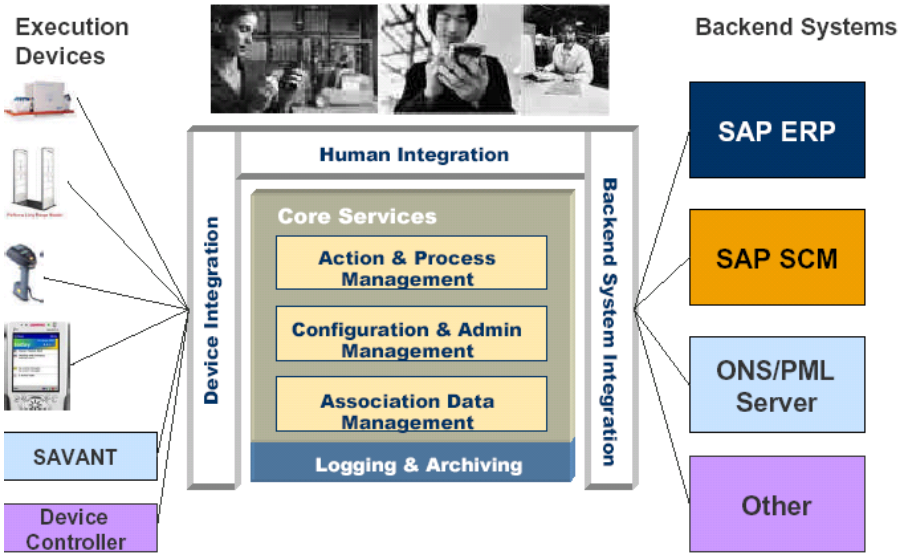
- **Potentials (avoidance of searching for tools, more efficient usage of tools, correct maintenance/exchange of tools)**
  - **Working hour of tool inventory clerk (70 EUR)**
  - **3 hours searching for tools per week → 53 hours per year (3640 EUR)**
  - **Reduction of tools by 5%, average value of tool 10 EUR, number of tools 1200 → savings of 100 EUR per year**
  - **Tools always in correct state → saves 1 hour per year of unexpected waiting for maintenance/exchange of tools during aircraft maintenance (23000 EUR of cost savings for customer)**
  - → **approx. 30000 EUR**
- **Costs**
  - **Abschreibungsfrist is 6 years**
  - **Tagging of tools with RFID done at tool producer: average 1 EUR per tool, Reader and antenna 2000 EUR, results in annual costs of 532 EUR**
  - **Maintenance of smart tool inventory approx. 20 working hours per year (1400 EUR)**
  - → **approx. 2000 EUR**

Possible Auto-ID Infrastructures

AUTO-ID CENTER



SAP



Overview

Summary

- RFID technology enables smart asset management
  - avoidance of media breaks by automating or reducing manual tasks
- Benefits
  - identification of the right assets
  - locating of assets
  - monitoring the quality or state of assets
  - keeping the history of assets
- Challenges
  - Technology drawbacks
    - Metal environments
    - Reader/antenna configuration
  - Lack of standards

Questions/Discussion