Hasso Plattner Institut

IT Systems Engineering | Universität Potsdam

Seminar

In-Memory Applications for RFID Data Processing

Organisatorisches, Einführung in die Thematik und Vorstellung der Projektseminarthemen

| 18. Oktober 2011 | Dr. Alexander Zeier, Martin Lorenz, Matthieu Schapranow, Jürgen Müller |

Agenda

- **Organisatorisches**
  - Rahmenbedingungen
  - Ziele des Projektseminars
  - Inhalte des Projektseminar
  - Auswahlprozess für die Projektseminarthemen
- Einführung in die Thematik

Organisatorisches

Rahmenbedingungen

- Verantwortlich: Dr. Alexander Zeier
- Tutoren: Martin Lorenz, Matthieu Schapranow, Jürgen Müller
- Ort: SNB, E. 9/10, Hasso Plattner High-Tech Park
- Zeit: Dienstag/Mittwoch, 11h00-12h30
- 4 Semesterwochenstunden
- 6 benotete Leistungspunkte
- Einschreibefrist 2. November 2011

Organisatorisches

Ziele des Projektseminars

- Gesamtüberblick über das Themengebiet erlangen und das eigene Projektthema einordnen können
- eigenständiges Einarbeiten in einer Themenstellung
- spezielles Wissen im Projektthema gewinnen
- Projekterfahrung sammeln
- Präsentationstechniken aneignen
- Grundlagen des wissenschaftlichen Arbeitens erlernen

Organisatorisches

Inhalte des Projektseminars

- Vorstellung des Themengebietes “RFID in SCM"
- Einführung in wissenschaftliches Arbeiten
- Präsentationen der Projektgruppen zu projektrelevanten Themen

Leistungserfassung

- Projektergebnisse & Ausarbeitung 40%
- Zwischen- und Endpräsentation 20%
- Wissenschaftliches Arbeiten und persönliches Engagement 40%

Besonderheit: ca. 60min Treffen pro Woche mit Betreuer

Organisatorisches

Auswahlprozess für die Seminarthemen

- verschiedene Themenvorschläge
- Einschreibefrist: 2. November 2011

1. Für Projektseminarthemen bewerben
   * Prioritätenliste abgeben
   * Im Seminar oder per Mail an Martin
   * Inhalt: drei priorisierte Wünsche
   * Deadline: 25. Oktober 2011, 16h
2. Zuordnung von Projektteams zu Projektseminarthemen (26.10.2011)

Soviel zum Organisatorischen!

Fragen?

Nun zur Einführung in die Thematik…

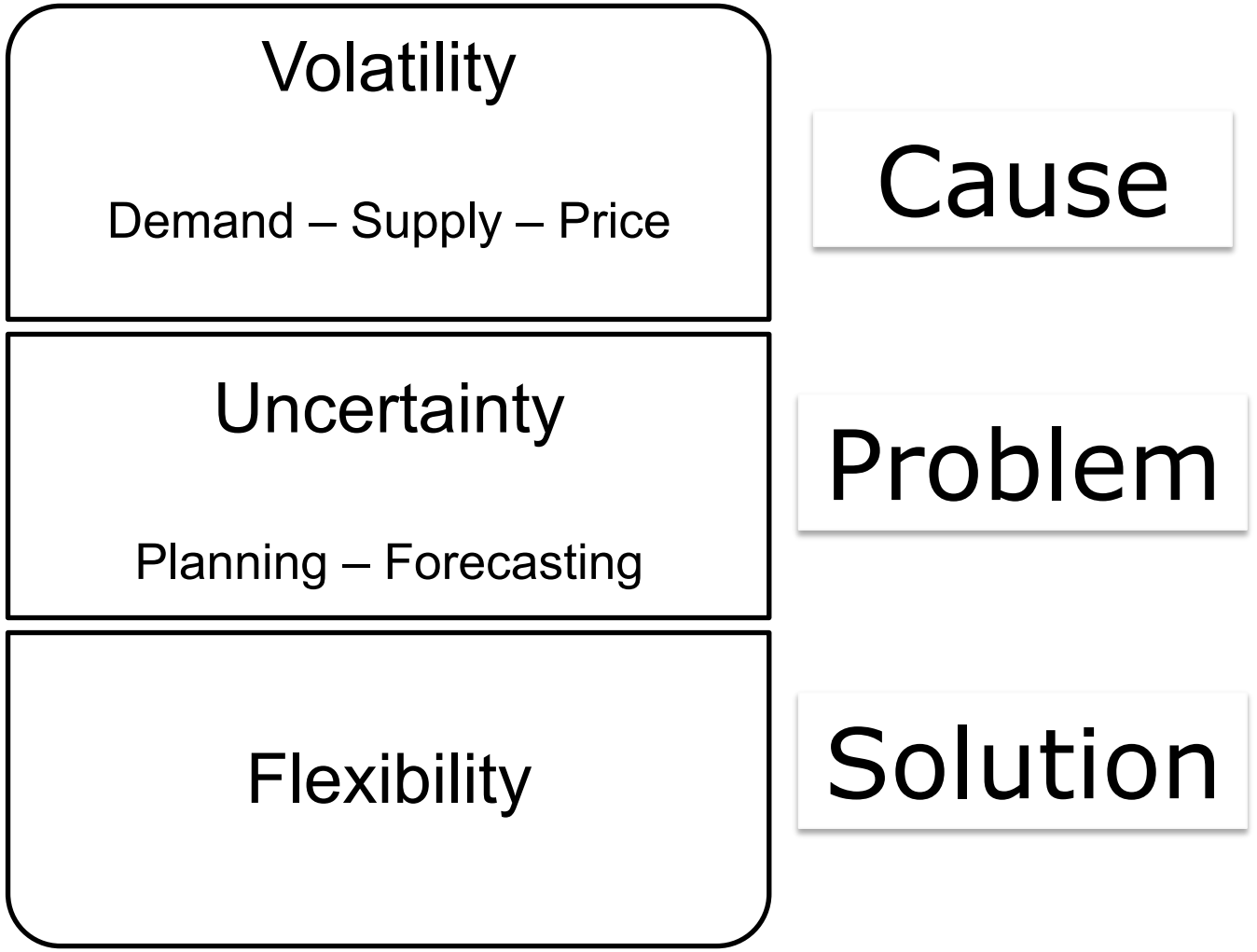
Today's Business and Supply Chain Challenges

- Globalization
  - Long lead times
  - Changing in labor costs in developing countries (legal regulations, strikes)
  - Change in logistics costs (natural disasters)

WE HAVE TO DEAL WITH **UNCERTAINTY!**

  - Shorter product lifecycles
- Supply volatility
  - Fast changing commodity price (oil, gold, steel)
  - Unexpected shortages (earthquake, tsunami)

Cause– Problem– Solution



How to implement Flexibility in SCM?

Flexibility is the ability to respond, or react, to change

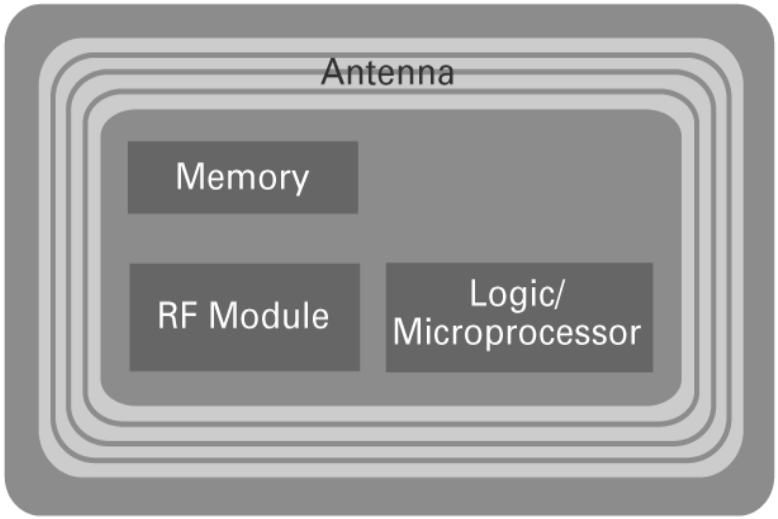
Basic RFID Tag (Passive Tag)

Power

• Passive tags are powered by the energy sent from radio waves to the tag from the reader.

Antenna

• When the antenna receives radio waves in the right frequency, the tag uses the energy to wake up and respond by sending information to the reader.



Memory

• Passive RFID tags have small amounts of memory, usually only a few bytes, to store an ID number. Some passive tags have read/write memory.

Logic/Microprocessor

• The logic on the tag responds to instructions sent to the reader about what information to send back or how to manage collisions.

RF Module

• The Radio Frequency Module makes sense of the signal sent through the antenna and uses the antenna to send information back to the reader.

Smarter RFID Tag (Active Sensor Tag)

Antenna

• Antennas on active tags may be able to send and receive from greater ranges on many different frequencies.

Memory

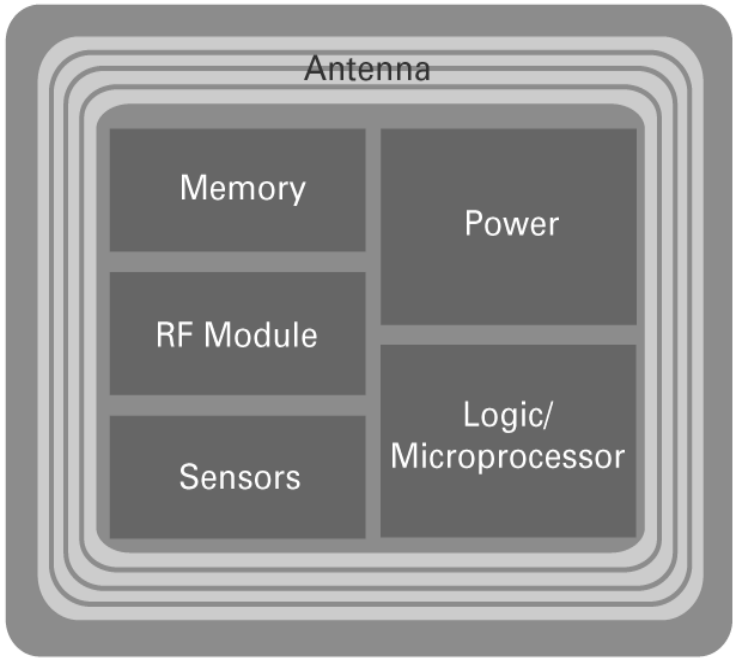
• Active RFID tags may have substantial amounts of memory to record data from sensors or data transmitted to the tag about the history of the tagged item.

RF Module

• The Radio Frequency Module of active tags may be able to receive and transmit on several frequencies.

Sensors

• Sensors enable active tags to gather more information about such quantities as pressure, temperature and vibration that may be related to the tagged item and its environment.



Power

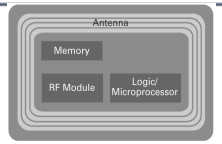
• Active RFID tags may have their own power source, a battery attached to the device or an external power source.

Logic/Microprocessor

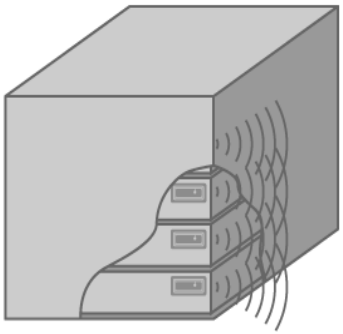
• Processing capability of active tags allows filtering of information collected by sensors, advanced collision management mechanisms, and a set of complex commands. This level of processing power allows the tag to act as an intelligent device and only report meaningful events. Some active tags have RFID readers in them.

Bar Codes Versus RFID Tags

RFID



- No line of sight required
- Highly accurate
- Information captured in seconds
- RFID tags contain more information

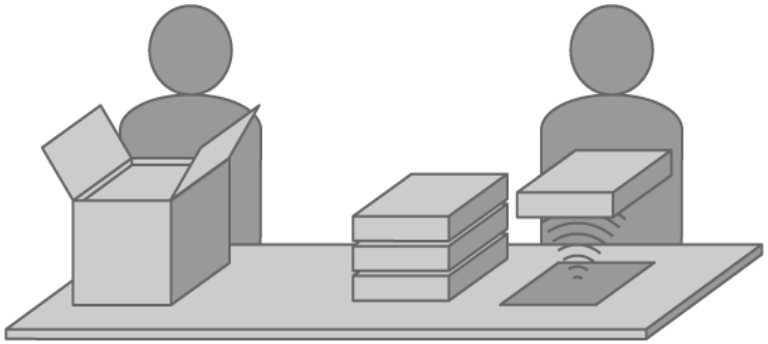


Unopened carton containing numerous products

Hand-held readers

Bar Codes

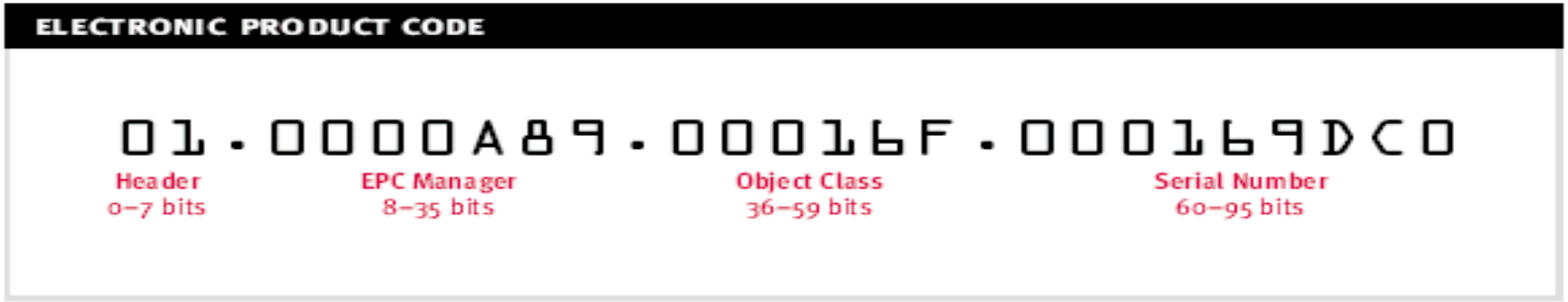
- Line of sight required
- Margin of error
- Time consuming
- Cost/labor intensive



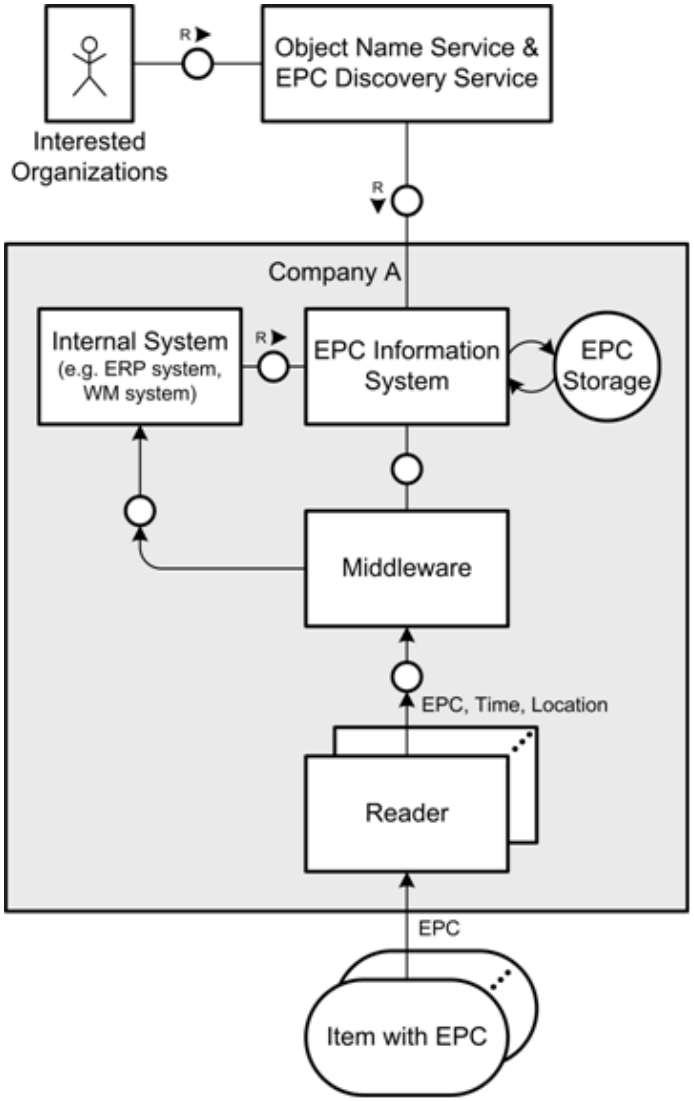
1. Open carton and remove contents

2. Scan individual items

”Electronic Product Code“ (EPC)

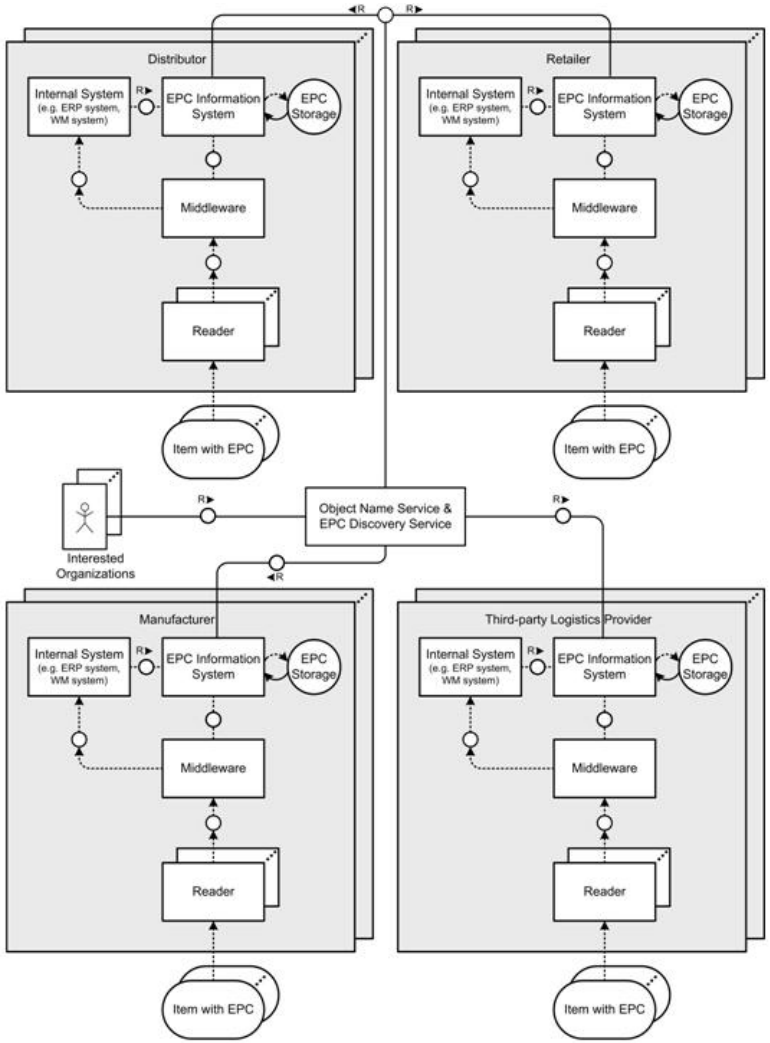


EPCglobal Network Architecture I / II



- Issues
  - Interfaces to other external companies
  - Additional IT components
  - Security of infrastructure
  - Tremendous volume of incoming data
  - Capacity limits of
    - Network links
    - Database systems
    - Processing power
    - ERP system

EPCglobal Network Architecture II / II



- Issues
  - Data exchange between supply chain parties
  - Information retrieval from unknown resources
  - Dynamic trust relations

How does RFID support Flexibility?

RFID bridges the gab between physical and digital world

- Real-time awareness
  - Transparency throughout the supply chain
  - Real-time control of object flow
- Data capture
  - Higher quality, accuracy
  - Higher quantity
- Higher degree of integration
  - Automatic integration of enterprise information systems
  - Integration of new, innovative information systems
- Higher degree of automation
  - Data capture without the line of sight
  - Automatic triggering of business processes

Vielen Dank für die Aufmerksamkeit!

Fragen?

Weitere Informationen auf

http://epic.hpi.uni-potsdam.de/Home/RFIDDataProcessing2011

(EPIC --> Teaching --> Master Curriculum Winter Term 2011/12)

Soviel zur Einführung in die Thematik!

Fragen?

Nun zur Vorstellung der Projektseminarthemen…

Seminar Topics

Responsible: Martin, Jürgen

1. **GraphML for modeling complex supply chains**
2. **SAP OER on NewDB**
3. **Parallel distributed supply chain simulation**
4. **Tracing and Filtering Algorithms on NewDB**

Responsible: Matthieu

5. **Management of fine-grained authentication details in EPC information service**
6. **Policy Administration with History-based Access Control for EPC Information Services**

Responsible: Christian

7. **Track and Trace RFID Data on RAMCloud**

GraphML for modeling complex supply chains

- **Problem**: sophisticated operations, such as analyzes and simulation of supply chains need a proper model, which can be leveraged for automatic processing
- **Hypothesis**: GraphML provides means to define a model for complex RFID-enabled supply chains that can be used for automatic processing
- **Tasks** to solve:
  - Understand the concept of GraphML
  - Understand the building blocks of global distributed supply chains
  - Extract supply chain characteristics from these findings
  - Define a GraphML-based model for complex supply chains

SAP OER on NewDB

- **Problem**: Performance of SAP's OER (EPCglobal compliant EPCIS) is not sufficient for most companies' requirements
- **Hypothesis**: Request processing time of OER is dominated by DB performance. NewDB can improves insert and query performance.
- **Tasks** to solve:

Parallel distributed supply chain simulation

- **Problem**: Simulation of complex event interactions, based on given supply chain model
- **Hypothesis**: Parallel, distributed event simulation can perform simulation results in realistic sizes in reasonable time
- **Tasks** to solve:
  - Get familiar with existing event simulator (developed last semester)
  - Develop concept how to distribute the simulation of events
  - Prototypical implementation

Tracing and Filtering Algorithms on NewDB

- **Problem**: Data transfer and computation outside of NewDB is a performance critical task
- **Hypothesis**: NewDB provides programming interfaces (L,R, BFL, SQL-Script) that provide a better performing alternative to outside DB calculations
- **Tasks** to solve:
  - Get acquainted with Discovery Service tracing and filtering algorithms
  - Analyze NewDB programming interfaces
  - Prototypically implement algorithms on NewDB
  - Compare and evaluate results

Management of fine-grained authentication details in EPC information service

- **Problem**: what is an appropriate level of granularity for authentication of individuals, e.g. per company, per department, per floor, etc.
- **Hypothesis**: the use of individual authentication details per supply chain participant can reduce impact of key exposure
- **Tasks** to solve:
  - Learn to work with and extend our fosstrak in-memory prototype
  - Learn to measure and interpret benchmarks
  - Show that in-memory technology is applicable for very fast key/license lookup
  - Multiple key renewals per day are feasible
  - Malicious clients can be blocked individually in case of disasters without affecting operation of remaining supply chain participants
  - Implement key renewal with the help of in-memory prototype

Policy Administration with History-based Access Control for EPC Information Services

- **Problem**: user needs to define abstract rules via user interface in a convenient way
- **Hypothesis**: using modern interactive user interface elements reduces efforts for unskilled users to create access rules and to automatically create rule set from them
- **Tasks to solve**:
  - Learn to work with and extend our fosstrak in-memory prototype
  - Learn to define rules as XML dialogue, e.g. ODRL, XACML, etc.
  - Develop user interface for administration of access rules
  - Develop filters from defined rule sets (Python)
  - Apply filters to extend functionality of existing fosstrak in-memory prototype
  - Benchmark performance of developed filters

Track and Trace RFID Data on RAMCloud

- **Problem**: RFID-based product tracking produces large amounts of data which have to be analyzed within seconds
- **Hypothesis**: RAMCloud – a scalable distributed in-memory storage system – is suited for handling the involved data processing
- **Tasks** to solve:
  - Create a partitioning schema for RFID data on RAMCloud
  - Implement a ”Trace Operator” on RAMCloud for retrieving the shipment history of a single product
  - Execute benchmarks with a realistic workload on 10+ nodes
  - Evaluate the ease of scaling out your solution