



SAP RESEARCH

SYSTEMATIC THOUGHT LEADERSHIP FOR INNOVATIVE BUSINESS

# Data-on-Tag: An approach to Privacy friendly Usage of RFID Technologies

Kerstin Werner

3rd European Workshop on RFID Systems and Technologies

THE BEST-RUN BUSINESSES RUN SAP



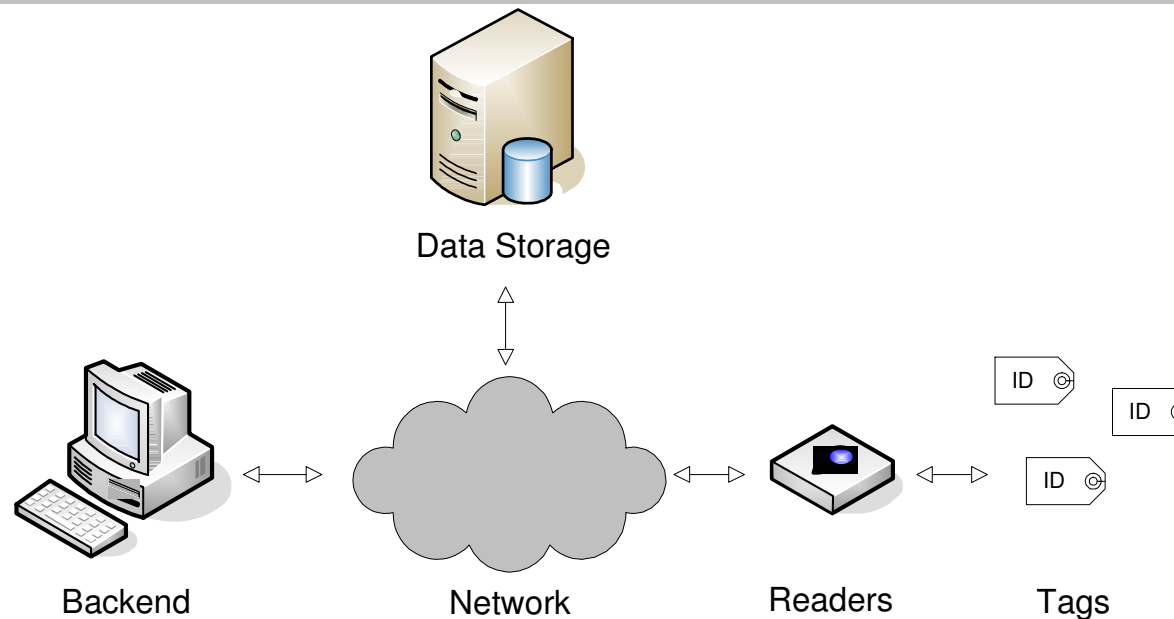


**SAP RESEARCH**

**Motivation**

**Data-on-Tag: An Approach to privacy friendly RFID Utilization**

**Summary and potential Future Work**



## Storage of RFID based Data on Networks to provide cross-company access (*Data-on-Network*)

### Characteristics

- Centralized data storage
- Exclusive storage of ID information on Tags
- Use of low cost RFID Tags possible
- Recently high efforts in standardization

## Accumulating data includes information about an objects

- Context
- Content

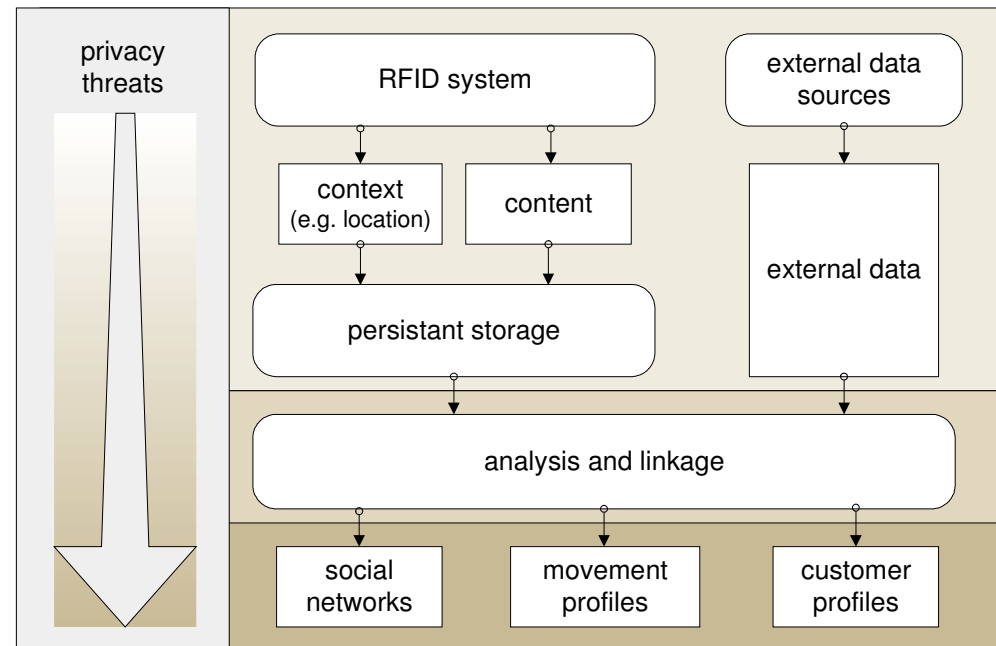
## Persistent storage on networks simplifies

- Linkage
- Analysis
- Distribution

## of RFID based data

## Threats emerge regarding

- Location Privacy
  - ◆ Movement Profiles
- Data Privacy
  - ◆ Social Networks
  - ◆ Personal Preferences in Shopping, Eating or Leisure Time Activities



# RFID specific privacy requirements

SAP RESEARCH

<b>Transparency</b>	Easily pursuable usage of tags and intended purpose of stored data
<b>Notification</b>	Hindered unnoticeable utilization of RFID-technology
<b>Opt-In</b>	Indispensable prerequisite for the collection of individual-related data
<b>Limitation to specified purpose</b>	Beforehand declared usage to consumers
<b>Appropriate security measures</b>	Data protection regarding confidentiality, integrity and availability
<b>No creation of individual-related profiles</b>	Separate processing and storage of RFID-based data
<b>Blocking mechanisms</b>	Hindered undesired readouts
<b>Deactivation mechanisms</b>	Opportunities to deactivate RFID tags for consumers

## Examples of legal measures

### Fair Information Practices

- Openness
- Individual Participation
- Accountability
- Collection Limitation
- Purpose Specification
- Use Limitation
- Security Safeguards

## Examples of technical measures

### Controlled Access to stored data

- Access Controls
- Coverage
- Encryption of stored data
- Blocker Tag

### Disabled data transmission

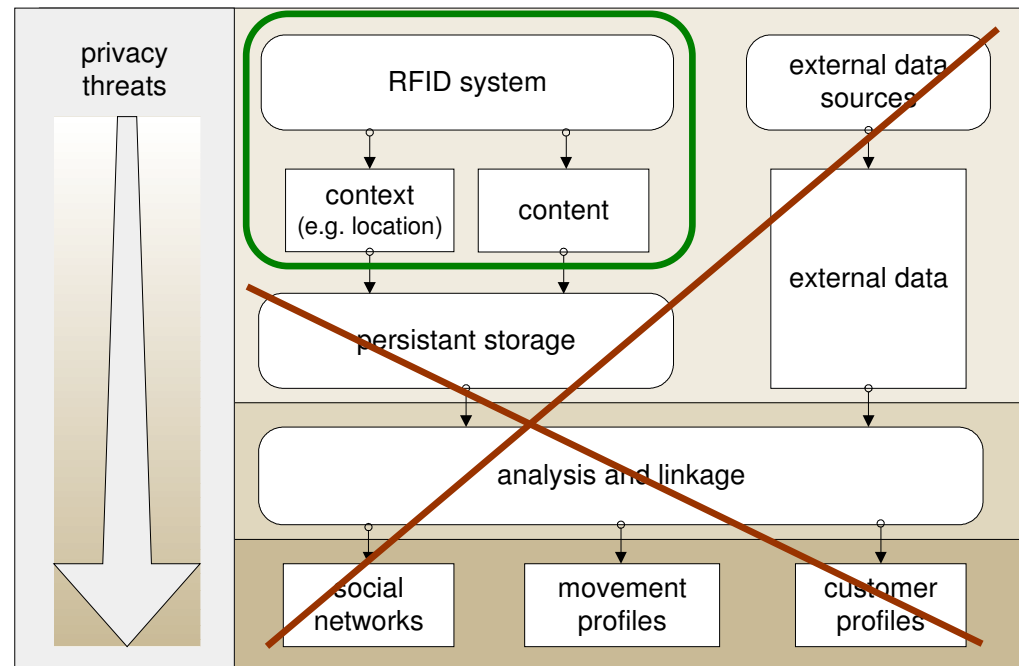
- Kill command
- Chemical or mechanical destruction

For further information see  
[Garfinkel05, Crispo06, Langheinrich05]

# Data-on-Tag: Privacy friendly RFID utilization

SAP RESEARCH

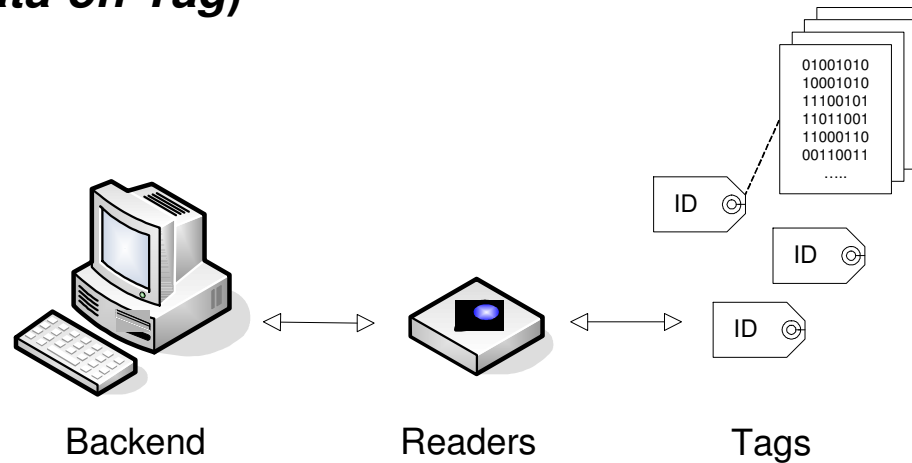
**Avoid centralized storage, Linkage and Analysis → Exclusively store data on tags (*Data-on-Tag*)**



# Data-on-Tag: Privacy friendly RFID utilization

SAP RESEARCH

Avoid centralized storage, Linkage and Analysis → Exclusively store data on tags (*Data-on-Tag*)



## Characteristics

- Decentralized data storage
- Storage of any relevant data on tags
- Complex demands on usable tags
- Low efforts in standardization so far

Related work is provided by [Diekmann07]



## Improved Control by Consumers

- Support of informational self-determination
- Clearly identifiable tags → detachable and destroyable
- Ability to read, edit and delete stored data
- Ability to determine access (read or write)
  - ◆ Simple write protection bit
  - ◆ Fine-grained access control system

## Increased Consumer Acceptance by Additional Value Provision

- Example: domestic appliances
  - ◆ determine which products they contain
  - ◆ provide relevant information (recipes, expiry dates, etc.)
- Improved recognition, sorting, and grouping of objects
  - Customization of object's digital properties

### Benefits for Companies

- Possible usage in areas without or unstable network access
- Simplified co-operation with frequently changing partners
- Saved costs involved in establishing and maintaining network infrastructures
- Access Control: inferred by the physical access to Tags
- Self-controlling logistic networks:
  - ◆ Autonomous Smart containers
  - ◆ Digital packing slips

### Anti Counterfeiting and Supply Chain Integrity Monitoring

- Active field of research: Prevention or detection of counterfeiting
- Two main approaches
  - ◆ Unclonable tags
  - ◆ E-Pedigree stored on tags
- Quality ensurance for consumers

### Restricted Tracking and Tracing

- Storage of tracking history on tags
- Hybrid approaches
  - ◆ Information storage
  - ◆ Changing behavior

### Increased Costs

- Larger memory capacity
- Necessity of read/write tags
- Appropriate security safeguards: shift of threats to tag level and the air interface
  - ◆ Encryption
  - ◆ Access control
  - ◆ Key management facilities
- Observable trend towards cheaper and more powerful computing devices

### Advanced Requirements

- Usage of special hardware and software
  - User acceptance, education and equipment [Crispo06]
    - ◆ Ease-of-use
    - ◆ Necessity of purchase incentives
- Influence on price, development and deployment efforts

### Few Efforts in Standardization

- Current focus on Data-on-Network facilitates production and sales
- Obstacles in Data-on-Tag standardization:
  - ◆ Context dependent varying of stored data
  - ◆ Low industry adoption so far
- Need of increased attention to Data-on-Tag and its potentials in research and industry
- Positively influence costs by fostering standardizations

- Present threats to privacy result to large extent from current RFID utilization
  - Existing legal protection measures have to be supported by appropriate technical measures
  - Measures representing a for customers prevent from technology acceptance
  - Approach to privacy friendly RFID utilization: Data-on-Tag
    - No centralized storage and consequences
    - Advantages for customers and companies
  - Facing existing drawbacks: hybrid approaches might be a compromise
- Need for greater attention in research, development and industry

[Diekmann07]

Thomas Diekmann; Adam Melski; Matthias Schuhmann: Data-on-Network vs. Data-on-Tag: Managing Data in Complex RFID Environments. In: hicss 0 (2007), S. 224a. – ISSN 1530–1605

[Langheinrich05]

Marc Langheinrich: Die Privatsphäre im Ubiquitous Computing – Datenschutzaspekte der RFID Technologie. In: FLEISCH, Elgar (Hrsg.) ; MATTERN, Friedemann (Hrsg.): Das Internet der Dinge – Ubiquitous Computing und RFID in der Praxis. Springer-Verlag, 2005, S. 329–362

[Garfinkel05]

Simson Garfinkel; Beth Rosenberg: RFID. Applications, Security, and Privacy. Addison-Wesley Longman, Amsterdam, 2005. – ISBN 0321290968

[Crispo06]

Bruno Crispo; Rutger Hofman; Andrew Tanenbaum: A Platform for RFID Security and Privacy Administration. In: Proc. USENIX/SAGE Large Installation System Administration conference. Washington DC, USA, December 2006, S. 89–102

 **Thank you for your attention!**

**SAP RESEARCH**

**Questions and discussion**