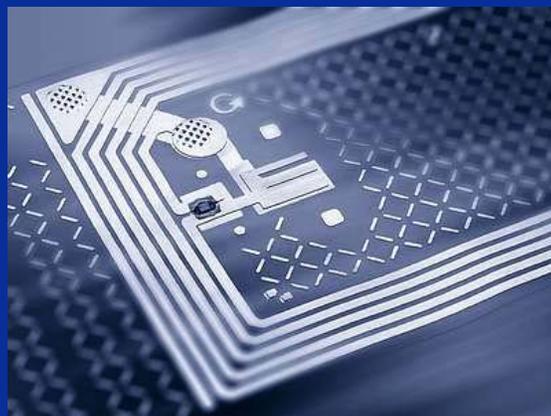


Business Security and Privacy Risk of RFID

Are you ready for the Internet of Things?
May 10, 2010

Oslo

Dr. Lothar Fritsch



Lothar Fritsch

- ▶ **Research Scientist in IT Security & Privacy in Norsk Regnesentral's ICT research department**
- ▶ **Master degree in Computer Science, specialist on information security & privacy**
- ▶ **Product manager for a German e-business-security firm**
- ▶ **PhD studies at Frankfurt's Goethe University's Information Systems department in m-commerce security, privacy and business models**
- ▶ **Participant in EU privacy technology research, e.g. SEMPER, PRIME, FIDIS projects**

Web: <http://www.nr.no/~lothar>

	Norsk Regnesentral NORWEGIAN COMPUTING CENTER	Lothar Fritsch
	forsker · research scientist DART · department of applied research in information technology	
dir. phone: (+47) 22 85 26 03		
mob. phone: (+47) 968 85 758		
Lothar.Fritsch@nr.no		
Norsk Regnesentral · Norwegian Computing Center		phone:
Gautadalleen 23, P.O. Box 114, Blindern		(+47) 22 85 25 00
NO-0314 Oslo, Norway		fax:
www.nr.no · nr@nr.no		(+47) 22 69 76 60

Agenda

1. **The popular view on RFID security and privacy**
 - **Privacy issues**
 - **Business risks**
2. **RFID applications are larger than tags & readers**
 - **Analysis of information in the whole system**
3. **Case studies: Business risks with RFID**
 - **Boycott phone**
 - **Retail espionage**
 - **Fisheries information chain**
 - **The RFID future through the looking glass**
4. **Approaches and solutions for secure RFID applications**
 - **Risk analysis & evaluation**
 - **Identifier management schemes**
 - **Access control & information flow design**
 - **Checklist for RFID risks**

Popu

- ▶ RFID
- ▶ The p
relate
pass
- ▶ NGO
RFID
- ▶ RFID
frequ
"clon
- E

FOXNEWS.COM HOME > SCITECH

Hackers Clone Elvis Presley's Passport

Thursday, October 02, 2008 [E-Mail](#) | [Print](#)

FOX NEWS

Share:      



THC.org

A group of Dutch hackers has shown the vulnerability of the new "ePassports" by making, and then using, one for Elvis Presley.

Even worse, they tell you exactly how to do it.

The U.S., Canada, the European Union and other developed countries have been introducing electronically reinforced passports in which a radio-frequency ID (RFID) chip is implanted in the passport's cover.

The chip, meant to be read by a scanner at border controls, duplicates much of the information printed in the passport: photo, name, address, place of birth and often a fingerprint.

A screen grab of the Elvis passport hack video.

ress.

es

and



search **spychips.com**
terms/keywords:

submit

subscribe to our
free newsletter!

enter email address:

submit

what you can do as...

A CONSUMER >>

A LAWMAKER >>

A COMPANY >>

VERICHIP IMPLANTS >>

PATENTS

New! Includes IBM's patent application, "Identification and Tracking of Persons Using RFID-Tagged Items"

RFID

NINETEEN EIGHTY-FOUR

Spychips: How Major Corporations and Government Plan to Track Your Every Purchase and Watch Your Every Move
by Katherine Albrecht and Liz McIntyre

>> [click here](#) to order the paperback...

>> [click here](#) to learn more about the other books in the "Spychips" series...



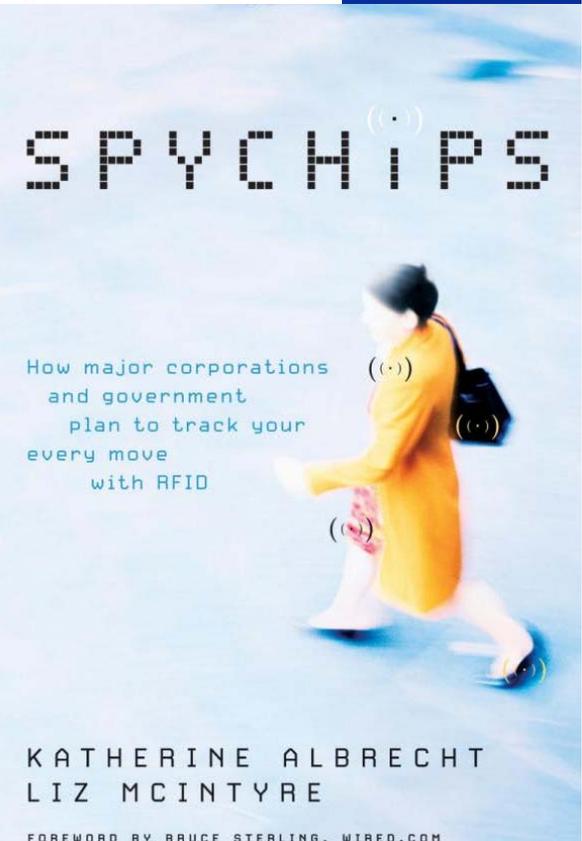
SPYCHIPS.COM

HOME OVERVIEW FAQ BLOG PRESS GET INVOLVED ABOUT I

RFID Privacy Issues and News



Our RFID protest in NYC was a huge success! You can check out our original [press release](#), see a [local news story](#), read about the outcome on [digg](#), or go directly to the report (with video) at [homeland stupidity](#)



How major corporations and government plan to track your every move with RFID

KATHERINE ALBRECHT
LIZ MCINTYRE

FOREWORD BY BRUCE STERLING, WIRED.COM

Computerworld - Ekspert: Let at klonne biometriske chip-pas - Mozilla Firefox

hvis du vil noget med it
COMPUTERWORLD

Forside | Nyheder | Debat | Blogs | Web-tv | Branchequiden | Whitepaper

Ekspert: Let at klonne biometriske chip-pas

En tysk RFID og sikkerhedsekspert kalder de nye elektroniske pas' for hjemmedøde på grund af for ringe sikkerhed. USA afviser, at passene kan forfalskes.

AF [Jesper Stein Sandal](#)

Publiceret d. 4. januar 2006

Sikkerhedskonsulent i myndighedene i Danmark af, hvordan de nye pas kan klonnes. Det skriver magasinet Wired.

Radiobrikker eller RFID bruges i de nye pas, og det er en mulighed for at lagre blandt andet information, der kan bruges til biometri.

Informationerne på pasene er imidlertid ikke krypteret, og det er nemt at kopiere dem på en måde, der gør dem ubrugelige.

Hjernerød
- Hele pasdesignet er imidlertid ikke krypteret. Som det er alle disse pas, er alle disse pas spild af penge. Det er ingen måde sikkerhed på.

Nye problemer for RFID-baserte billetter - digl.no : Bedriftsteknologi - Mozilla Firefox

Nye problemer for RFID-baserte billetter

Av , mandag 9. jan 2006 kl 10:24

De nye kontaktfrie billett-automatene på trikker og busser snakker ikke med NSB og SL.

Oslo sporveier skulle etter planen ha lansert sitt nye billettsystem allerede sommeren 2005. Boksene for kontaktfri avlesing av billettene er allerede installert på mange busser og trikker, men de vil ikke tas i bruk på lenge. I sommer ble ny tidfris satt til nyttår, men nå følger

Får du bredband test linja di med surfer

Der Metro-Skandal - FoeBuD e.V. - Mozilla Firefox

FoeBuD e.V.

Der Metro-Skandal

Metro ist nach eigenen Angaben einer der größten Handelskonzerne der Welt. In Deutschland gehören dazu große Ketten wie Media Markt, Saturn, real, extra, Praktiker, Galeria Kaufhof. Mit dieser Marktmacht versucht das Unternehmen, RFID flächendeckend einzuführen. Ein eigener Test-Supermarkt der Metro AG in Rheinberg bei Duisburg war das erste, was uns von Metros Aktivitäten ins Auge fiel. Was wir dort erlebten, ließ uns aufhorchen. Denn mit dem Methoden, die bei der Einführung von RFID angewandt werden, hätten wir nicht gerechnet.

Vieleicht sind Sie über unseren Protest gegen den Metro-Konzern auf uns und die STOP RFID-Kampagne aufmerksam geworden? Dann finden Sie auf dieser Seite alle Hintergründe und Ereignisse im Zusammenhang mit dem Metro-Konzern. Überschreiben möchten wir das mit einem Zitat von Spiegel-Online:

„Es ist ein ungleicher Kampf - eine Handvoll ehrenamtlich arbeitender Enthusiasten des FoeBuD gegen milliardenschwere Konzerne - doch er zeigt Wirkung.“

Aus gegebenem Anlass hier die Bitte: Unsere Arbeit ist komplett ehrenamtlich. Bitte unterstützen Sie unsere Arbeit für Ihre Privatsphäre mit einer Spende.

Travelon

Om Travelon | Kundeservice | Referencer

2025 RFID Blocking wallet black



✓ På lager

Pris: 150,- NOK

Antall:



Travelon - Hovedside

- Bagasjelapper
- Magevesker og pengebelter
- Lommebok og passlommer
- Speare Reisepute
- Reisetilbehør
- Hygieneartikler
- Toalettvesker
- Vesker
- Webshop
 - Bedriftskunder
 - Butikkansvarlige
 - Privatkunder

RFID Position Statement of Consumer Privacy and Civil Liberties Organizations - Mozilla Firefox

RFID Position Statement of Consumer Privacy and Civil Liberties Organizations

Privacy Rights CLEARINGHOUSE

Posted: November 20, 2003

Search Our Site:
www.privacyrights.org/search/search.php
Have a Question?
www.privacyrights.org/page/contact_us.html
Web: www.privacyrights.org

amazon.de

Hallo! **Melden Sie sich an**, um persönliche Empfehlungen zu erhalten. Neukunde? **Jetzt los**

[Bitte hier starten.](#)

Mein Amazon.de | Sonderangebote | Wunschzettel | Gutscheine | Geschenke

Alle Kategorien ansehen

Suche

Haus & Garten | Erweiterte Suche | Stöbern | Küche & Haushalt | Großgeräte | Kleingeräte | Kochen | Wohnen

Überprüfen Sie in den Kaufoptionen zu diesem Artikel, ob sich der Artikel für Amazon Prime qualifiziert.

pointprotect® ePass Reisepass RFID Schutzhülle Silver Ghost

[Viadis GmbH](#)

Noch keine Kundenrezensionen vorhanden: [Schreiben Sie die erste!](#)
[Mehr zu diesem Artikel](#)

Erhältlich bei diesen Anbietern.

1 Angebote erhältlich ab EUR 9,95

Fragen zum Artikel? Antworten gibt's auf den [Service-Seiten des Herstellers](#).

[Größeres Bild](#)

EPCglobal Guidelines on EPC for Consumer Products



1. Consumer Notice

Consumers will be given clear notice of the presence of EPC on products or their packaging and will be informed of the use of EPC technology. This notice will be given through the use of an EPC logo or identifier on the products or packaging.

2. Consumer Choice

Consumers will be informed of the choices that are available to discard or remove or in the future disable EPC tags from the products they acquire. It is anticipated that for most products, the EPC tags would be part of disposable packaging or would be otherwise discardable. EPCglobal, among other supporters of the technology, is committed to finding additional efficient, cost effective and reliable alternatives to further enable customer choice.

3. Consumer Education

Consumers will have the opportunity easily to obtain accurate information about EPC and its applications, as well as information about advances in the technology. Companies using EPC tags at the consumer level will cooperate in appropriate ways to familiarise consumers with the EPC logo and to help consumers understand the technology and its benefits. EPCglobal would also act as a forum for both companies and consumers to learn of and address any uses of EPC technology in a manner inconsistent with these Guidelines.

4. Record Use, Retention and Security

The Electronic Product Code does not contain, collect or store any personally identifiable information. As with conventional barcode technology, data which is associated with EPC will be collected, used, maintained, stored and protected by the EPCglobal member companies in compliance with applicable laws. Companies will publish, in compliance with all applicable laws, information on their policies regarding the retention, use and protection of any personally identifiable information associated with EPC use.

Revised September 2005, Source: http://www.epcglobalinc.org/public/ppsc_guide

Ontario's RFID privacy guide lines



- ▶ **Focus on RFID information systems, not technologies:** The problem does not lie with RFID technologies themselves, but rather, the way in which they are deployed that can have privacy implications. The *Guidelines* should be applied to RFID information systems as a whole, rather than to any single technology component or function;
- ▶ **Build in privacy and security from the outset – at the design stage:** Just as privacy concerns must be identified in a broad and systemic manner, so, too, must the technological *solutions* be addressed systemically. A thorough privacy impact assessment is critical. Users of RFID technologies and information systems should address the privacy and security issues early in the design stages, with a particular emphasis on data minimization. This means that wherever possible, efforts should be made to minimize the identifiability, observability and linkability of RFID data; and
- ▶ **Maximize individual participation and consent:** Use of RFID information systems should be as open and transparent as possible, and afford individuals with as much opportunity as possible to participate and make informed decisions.

Ontario's privacy commissioner, Ann Cavoukian, 2006-2008

http://www.ipc.on.ca/images/Resources/up-2006_06_19rfid.pdf

http://www.ipc.on.ca/images/Resources/up-1rfid_HealthCare.pdf

EU draft recommendations



1. **RFID operators shall conduct privacy risk assessment!**
2. **Risk assessments should honor stakes, and cover all stakeholders!**
3. **Take appropriate technical and organizational measures to mitigate the privacy risks!**
4. **Assign a responsible person for audit and adaption of the above!**
5. **Privacy & security risk management shall be aligned.**
6. **The privacy risk assessment summary must be published latest upon deployment of the RFID application.**

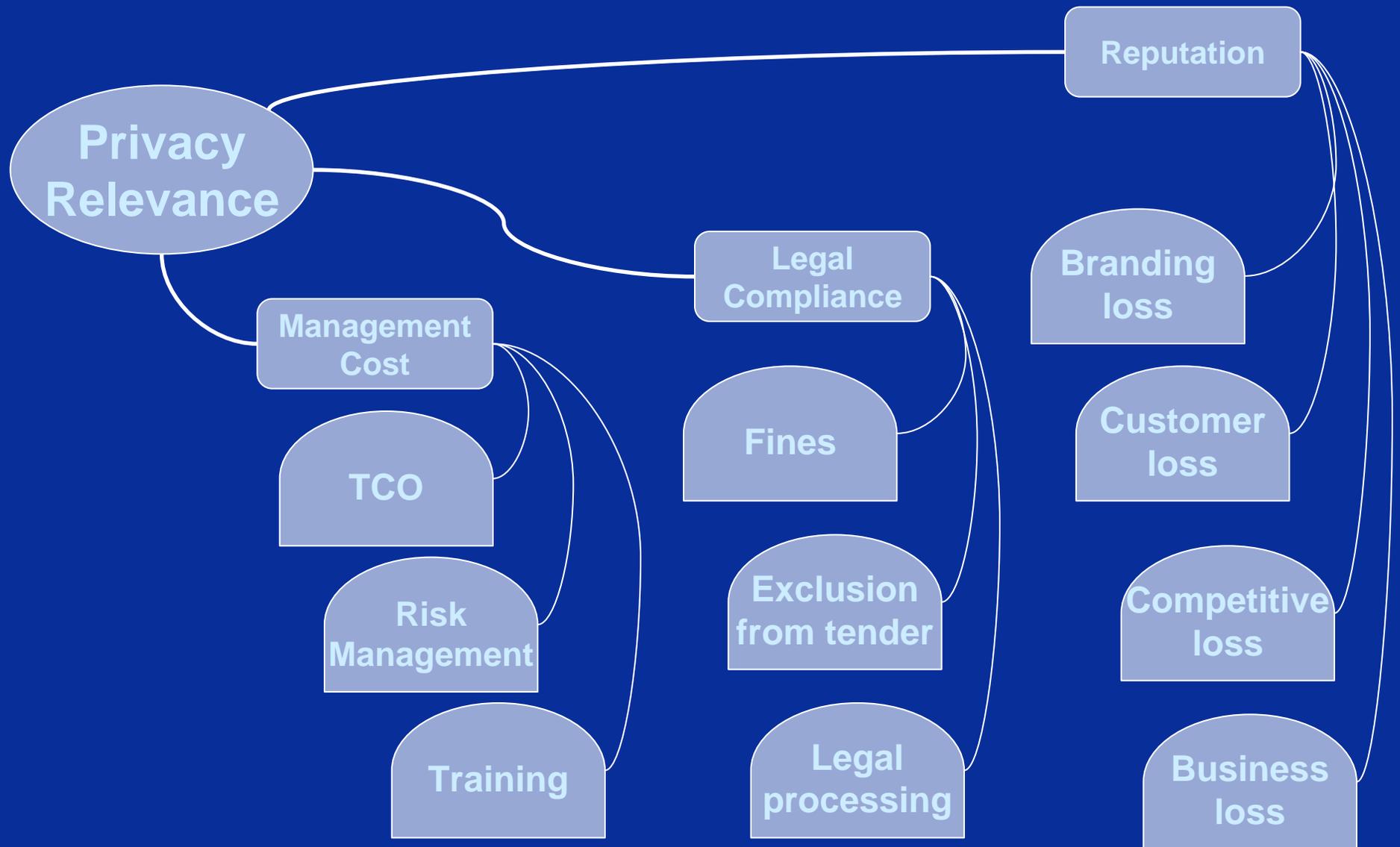
Norwegian Regulation



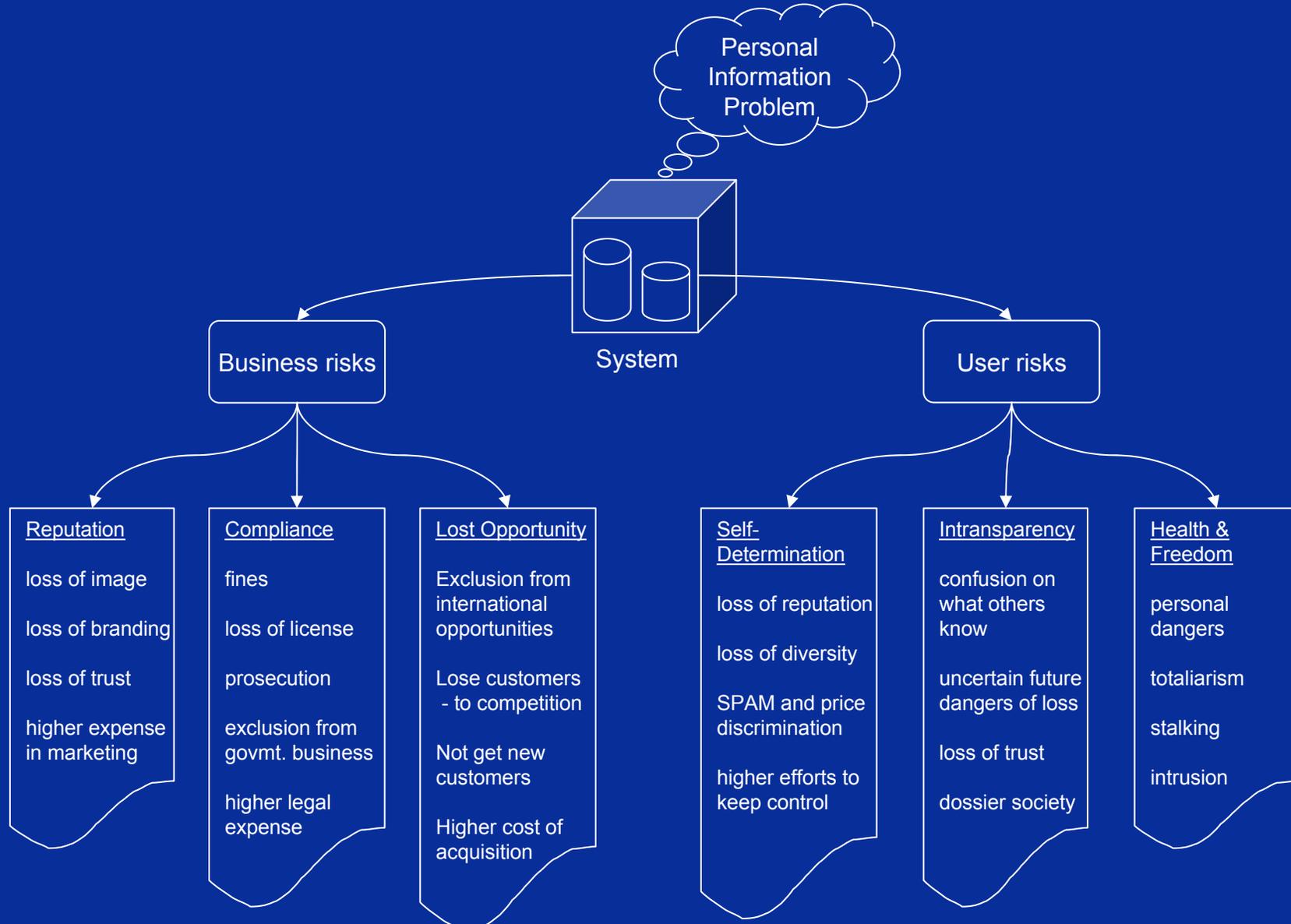
- ▶ General rules in "personopplysningsloven" apply to RFID applications. No specific regulation has been implemented.
- ▶ BUT: Datatilsynet has already commented several RFID-based projects and formulated stringent requirements, e.g. in the case of passports:
 - Politidirektoratet shall assess privacy risks of biometric passport handling with respect to §13 personopplysningsloven (POL) og §2-4 personopplysningsforskriften.
 - Politidirektoratet shall provide all necessary information to applicants and holders of biometric passports acc. to §19 POL.
 - Politidirektoratet must design and implement an internal privacy controlling system according to §14 POL. The system must not be outsourced.

▶ <http://www.datatilsynet.no/upload/Dokumenter/saker/2006/passflvarsel.pdf>

Privacy Protection matters.



Duality of Privacy Risks



Return-on-Investment depends on security & privacy

- ▶ **ROI of RFID infrastructure investments can be at risk**
- ▶ **Surprises (e.g. unplanned for data protection or privacy requirements)**
- ▶ **Malicious players take advantage (espionage, sabotage, hacking, exposure)**

**Security and privacy analysis provides to
sustainability of investments & to the business
projects!**

Agenda

1. **The popular view on RFID security and privacy**
 - Privacy issues
 - Business risks
2. **RFID applications are larger than tags & readers**
 - Analysis of information in the whole system
3. **Case studies: Business risks with RFID**
 - Boycott phone
 - Retail espionage
 - Fisheries information chain
 - The RFID future through the looking glass
4. **Approaches and solutions for secure RFID applications**
 - Risk analysis & evaluation
 - Identifier management schemes
 - Access control & information flow design
 - checklist

RFID applications: Beyond privacy, tags & readers

- ▶ Much research has been published on RFID tag security, reader protocols, and access control to the tag's data fields.
- ▶ However, the privacy and business intelligence risks are created by a link between tags and a particular context:
 - a person
 - a product
 - a vendor
- ▶ Thus, both the middleware and the application context are critical inputs to risk analysis.
- ▶ Unfortunately, most technical descriptions describe tag & reader products detached from the application context.

Scenario assumption: RFID applications

Business application / business logic

Ambient-to-application "management" layer

Identifiers

Access keys

Protocols

Ambient Devices, Readers & Communication



Agenda

1. **The popular view on RFID security and privacy**
 - Privacy issues
 - Business risks
2. **RFID applications are larger than tags & readers**
 - Analysis of information in the whole system
3. **Case studies: Business risks with RFID**
 - Boycott phone
 - Retail espionage
 - Fisheries information chain
 - The RFID future through the looking glass
4. **Approaches and solutions for secure RFID applications**
 - Risk analysis & evaluation
 - Identifier management schemes
 - Access control & information flow design
 - checklist

Case 1: The Boycott



Web community

←----- 3G data connection -----→

Boycott
FLATFISK
ASA!

Boycott all
farmed
salmon!

Get 2 for the
price of 1 at
FJORDFISK!

Illegal
fish!
Boycott

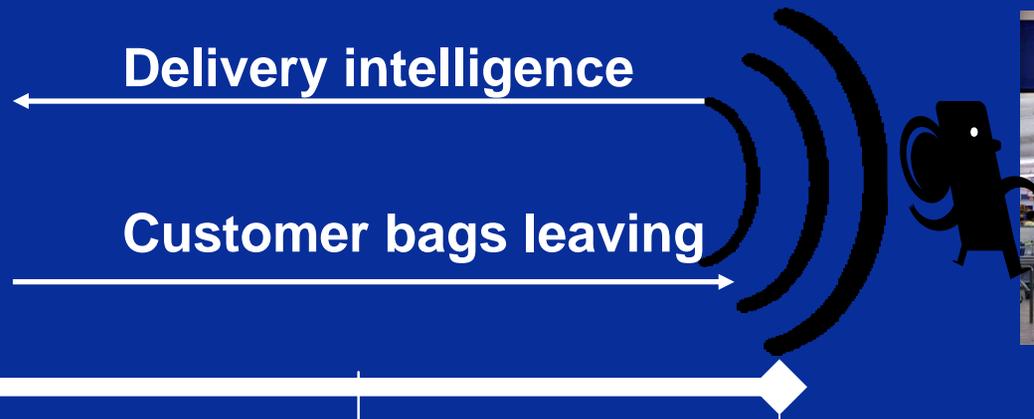


Supermarket cart



Case 2: Retail espionage

- ▶ What if a new market player could obtain intelligence about delivery, and carry-out of tagged items from competition?
- ▶ Targeted special offers & location-optimized assortment.
- ▶ *AC Nielsen* creates vast profits with such information.



Case 3: Fisheries information

FLATFISK ASA loses contracts with markets



Rotten fish from FLATFISK ASA



► Many different stakeholders involved – where is information stored?

5 weeks later: FLATFISK ASA out of business due to credit problems

► see which part of the information is held liable for damages

3 weeks later: Mattilsynet confirms warehouse problem

► how to prevent premature information dissemination

Case 4: RFID future uses – the two-edged sword

Imagine a world where...

- ▶ **A vendor's trash (packages, products) will be tracked around the globe, even 20 years after production, until it turns up on a polluted site in Africa – and on some NGO's agenda;**
- ▶ **The city trash removal facilities read RFIDs on package waste to bill the producers for the trash processed;**
- ▶ **Corporate tax & toll is adjusted based on scanners at borders, ware houses and waste dumps.**
- ▶ **Does the "kill" function kill TID?**

Agenda

1. **The popular view on RFID security and privacy**
 - Privacy issues
 - Business risks
2. **RFID applications are larger than tags & readers**
 - Analysis of information in the whole system
3. **Case studies: Business risks with RFID**
 - Boycott phone
 - Retail espionage
 - Fisheries information chain
 - The RFID future through the looking glass
4. **Approaches and solutions for secure RFID applications**
 - Risk analysis & evaluation
 - Identifier management schemes
 - Access control & information flow design
 - checklist

Risk Analysis & Evaluation

- ▶ Risk assessment is an integral part of security management, e.g. in ISO 27000 or ISO 17799.
- ▶ Risk assessment analyses and evaluates risks to information security, and suggests control measures to contain the risks.
- ▶ Risk assessment has to be done regularly, e.g. as audits, within the risk management methodology.

Identifier Management

- ▶ Tag identifiers can tell many stories.
- ▶ The most simple approach is a tag serial number indexed in a data base.
BUT: Who owns the data base, and how will it be protected from unauthorized use?
- ▶ Tag data standards move some of the data to a tag. But now, the tag is out of the security perimeter of the vendor.
- ▶ The use of anonymizing schemes, cryptographic methods, randomized numbering schemes and zero-knowledge-protocols for identifier management should be considered.
- ▶ Identifiers should be analyzed for information leakage and possible risks.

Access Control & Information Flow

- ▶ **Multi-level and role-based access control models are used in server & mainframe computing for more than three decades.**
- ▶ **Security models implemented on a "need to know" basis.**
- ▶ **But today's RFID approaches aim for maximum transparency, efficient data access, and global standardization.**
- ▶ **Information flow analysis and access control models are essential to protect business secrets.**

Privacy & Security Checklist

- ▶ **Are you aware of all contextual information that can be correlated to your tags?**
 - **delivery frequency & destinations**
 - **return quotas & retail rates**
 - **predictable identifiers (e.g. serial number sequences)**

- ▶ **Countermeasures:**
 - **Identifier management**
 - **Encryption from tag to application level**
 - **Use tags without individual numbers**

Checklist

- ▶ **Do your tags contain interpretable information?**
 - product keys
 - receivers or customer information
 - indications of object value
 - origin information

- ▶ **Countermeasures:**
 - Identifier management
 - Encryption & Access control
 - Tag self-destruct / deactivation or self-sealing

Checklist

- ▶ **Are your tags person-relateable?**
 - **Equipment check-out**
 - **e-tickets**
 - **consumer items**
 - **ID cards, door cards, passports, bank cards**

- ▶ **Countermeasures**
 - **De-activation (including chip serial number!)**
 - **Identity management**
 - **Privacy risk assessment & audits**
 - **Privacy-enhancing technology (PET)**

Checklist

- ▶ **Are your tags securely bound to the tagged objects?**
 - **Tag-switching destroys food tracing ROI (e.g. rotten meat with "good" tag)**
 - **Fraudulent customers switch product tags to shop cheaper**

- ▶ **Countermeasures**
 - **Redundant information on tag & object**
 - **"Biometrics" derived from the object stored on tag**
 - **Fingerprinting techniques based on secrets**

Questions & discussion

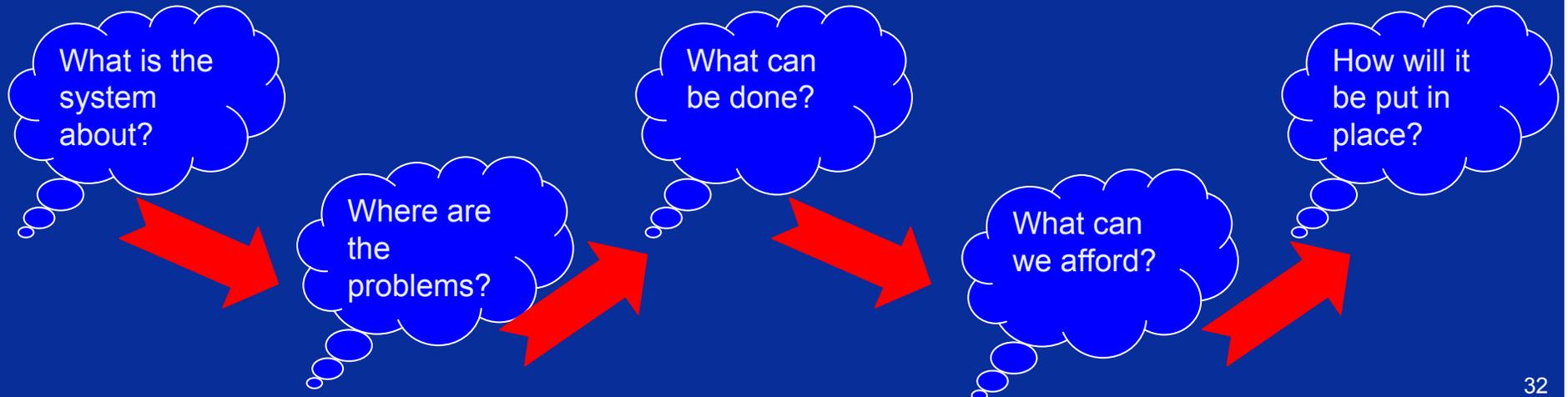
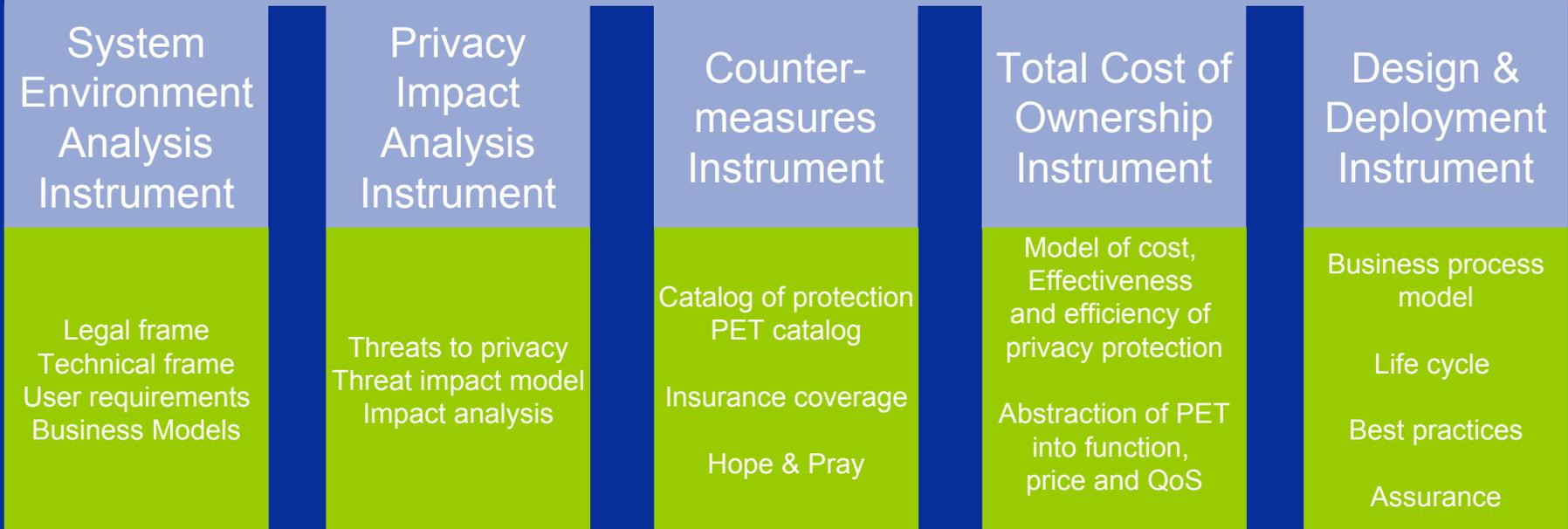


What can Norsk Regnesentral provide to your RFID project?

- ▶ **Scientific research & consulting in security concepts**
- ▶ **Evaluation of security systems, properties & privacy impact**
- ▶ **Preparation of IT certification or audit**
- ▶ ***Industry- or publicly funded research***
- ▶ **Open or confidential cooperation**



Privacy Investment Decision Instruments



Contact

Lothar Fritsch



forsker · research scientist
DART · department of applied
research in information technology

dir. phone: (+47) 22 85 26 03
mob. phone: (+47) 968 85 758
Lothar.Fritsch@nr.no

Norsk Regnesentral · Norwegian Computing Center
Gaustadalléen 23, P.O. Box 114, Blindern
NO-0314 Oslo, Norway
www.nr.no · nr@nr.no

phone:
(+47) 22 85 25 00
fax:
(+47) 22 69 76 60