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AUTO–ID LABS

Combating counterfeit products with RFID

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Auto-ID Labs and M-Lab

Fakes often have to cross national borders…

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…and there are many creative ways…

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…which are hard to detect…

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…and require experience.

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Physical inspections triggered by experience-based risk analysis

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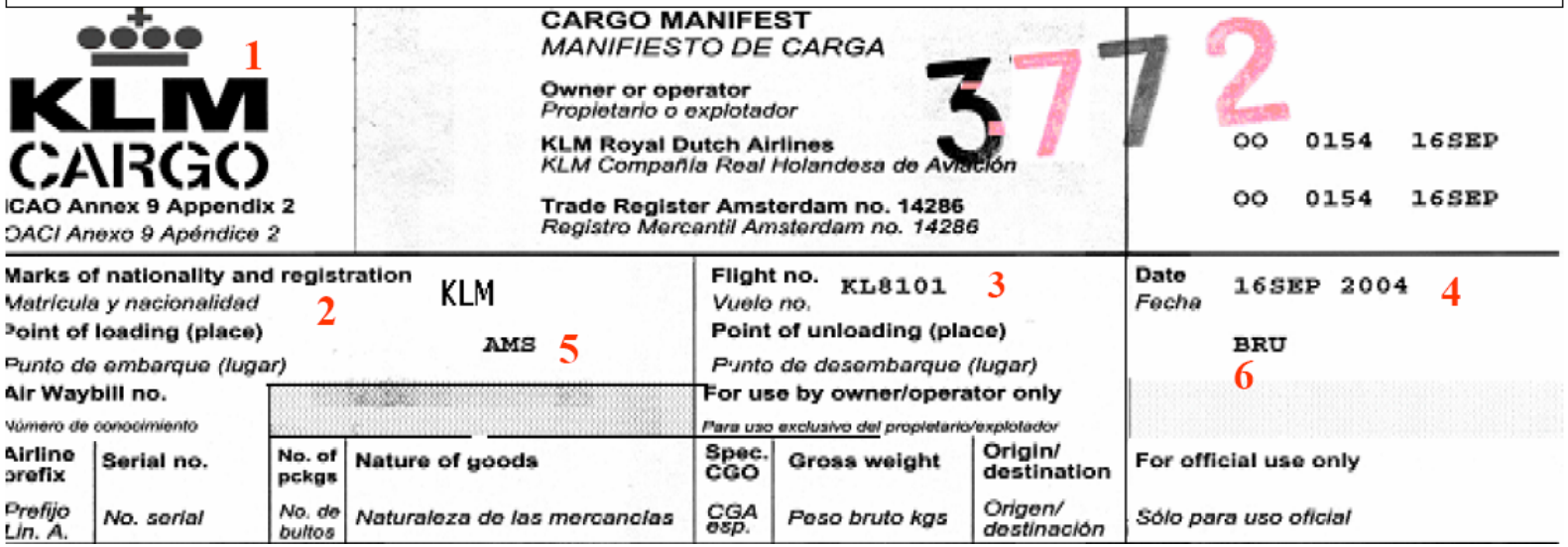
:

HEAD

1) Company
2) Nationality
3) Flight Number
4) Date of departure (is not always the arrival date !)
5) point of lading
6) point of unlading



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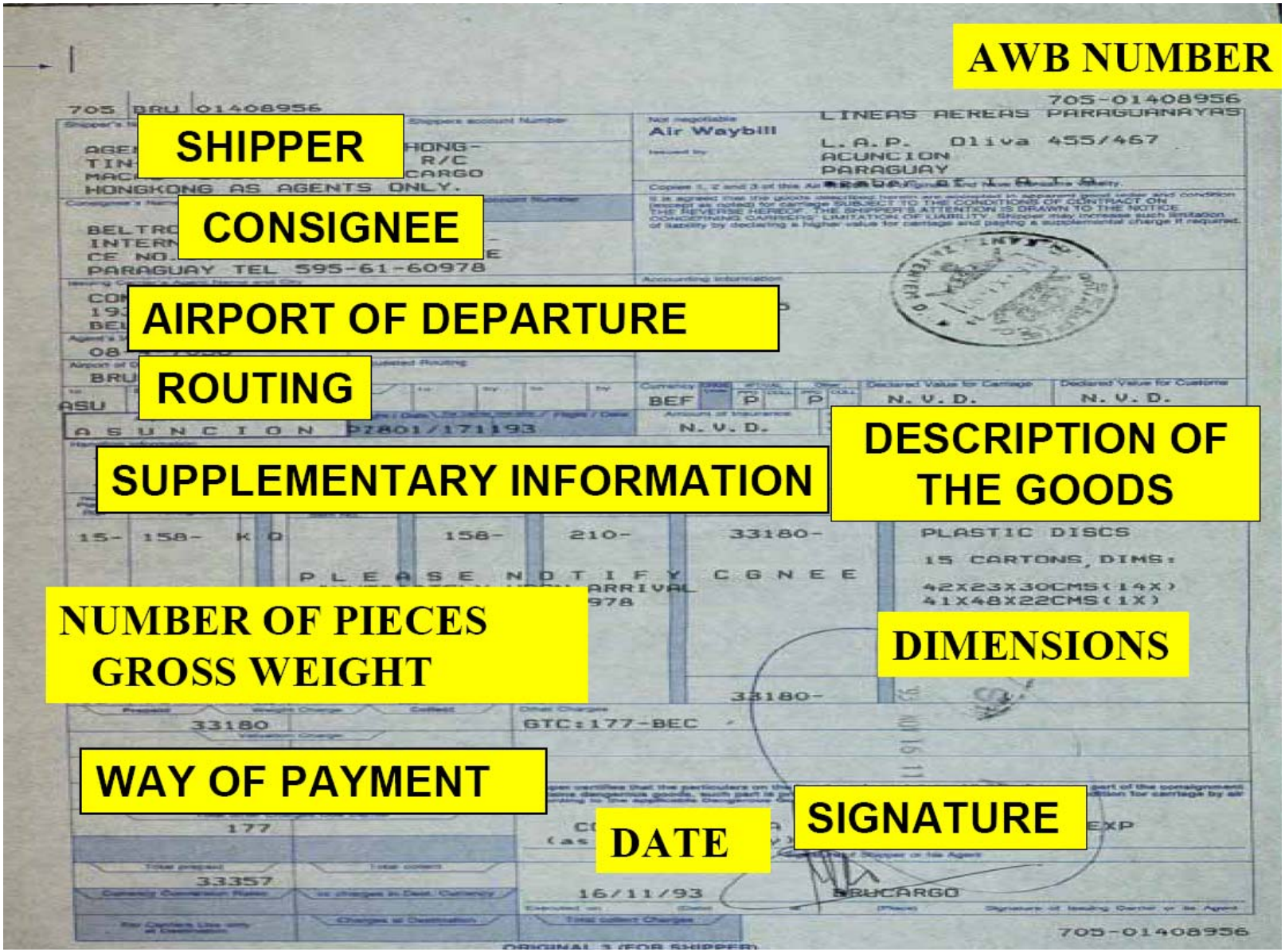

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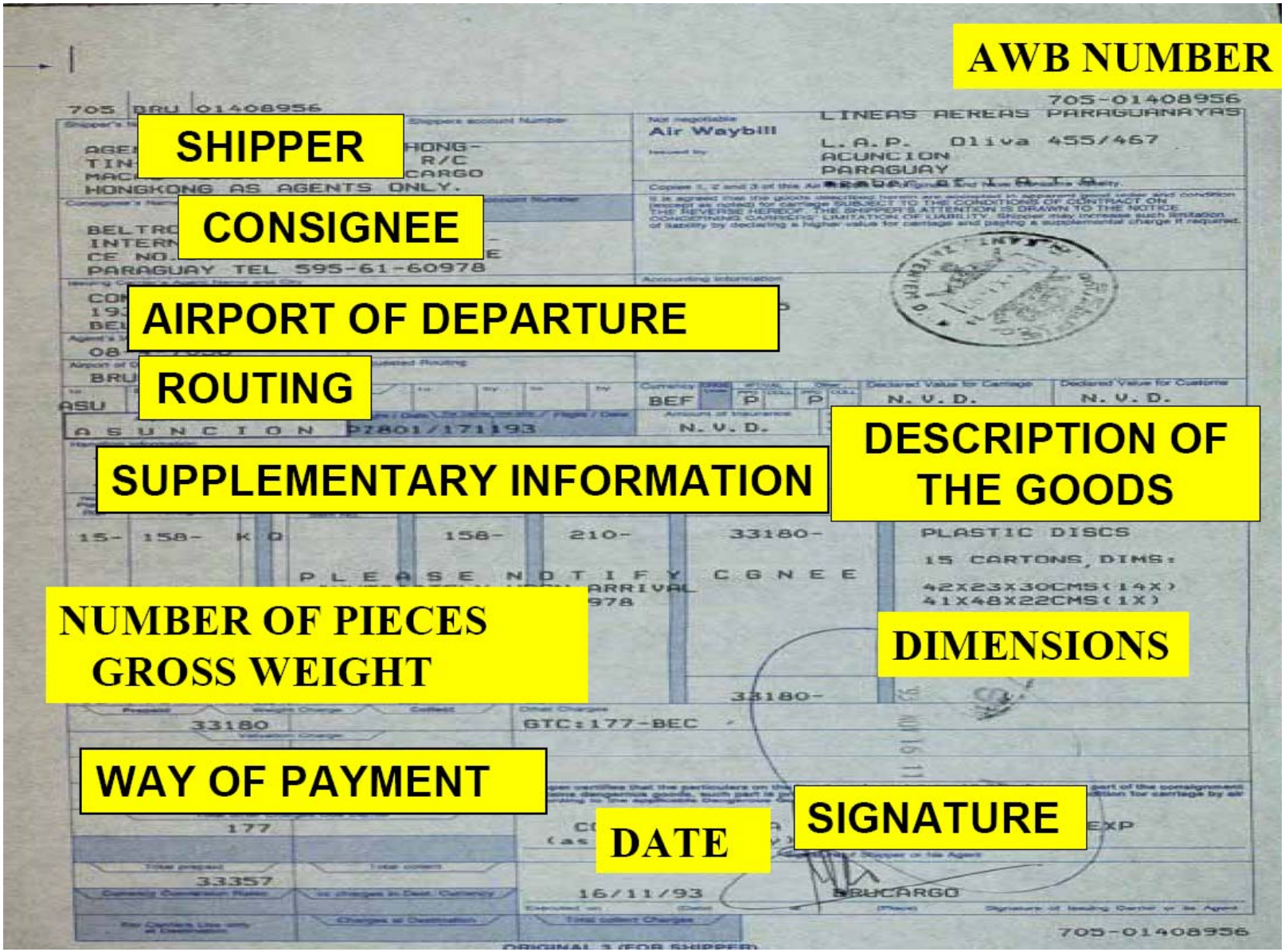

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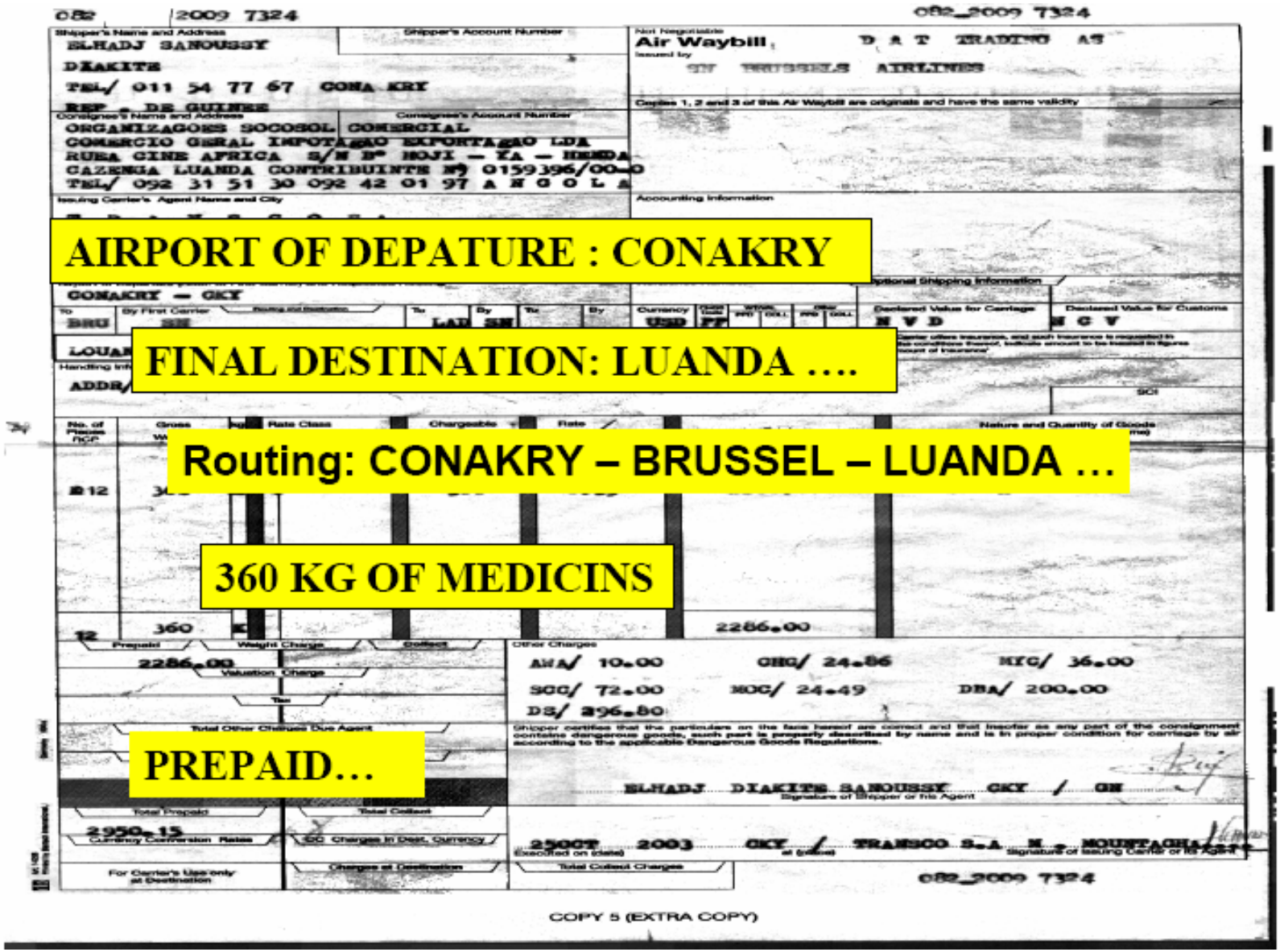

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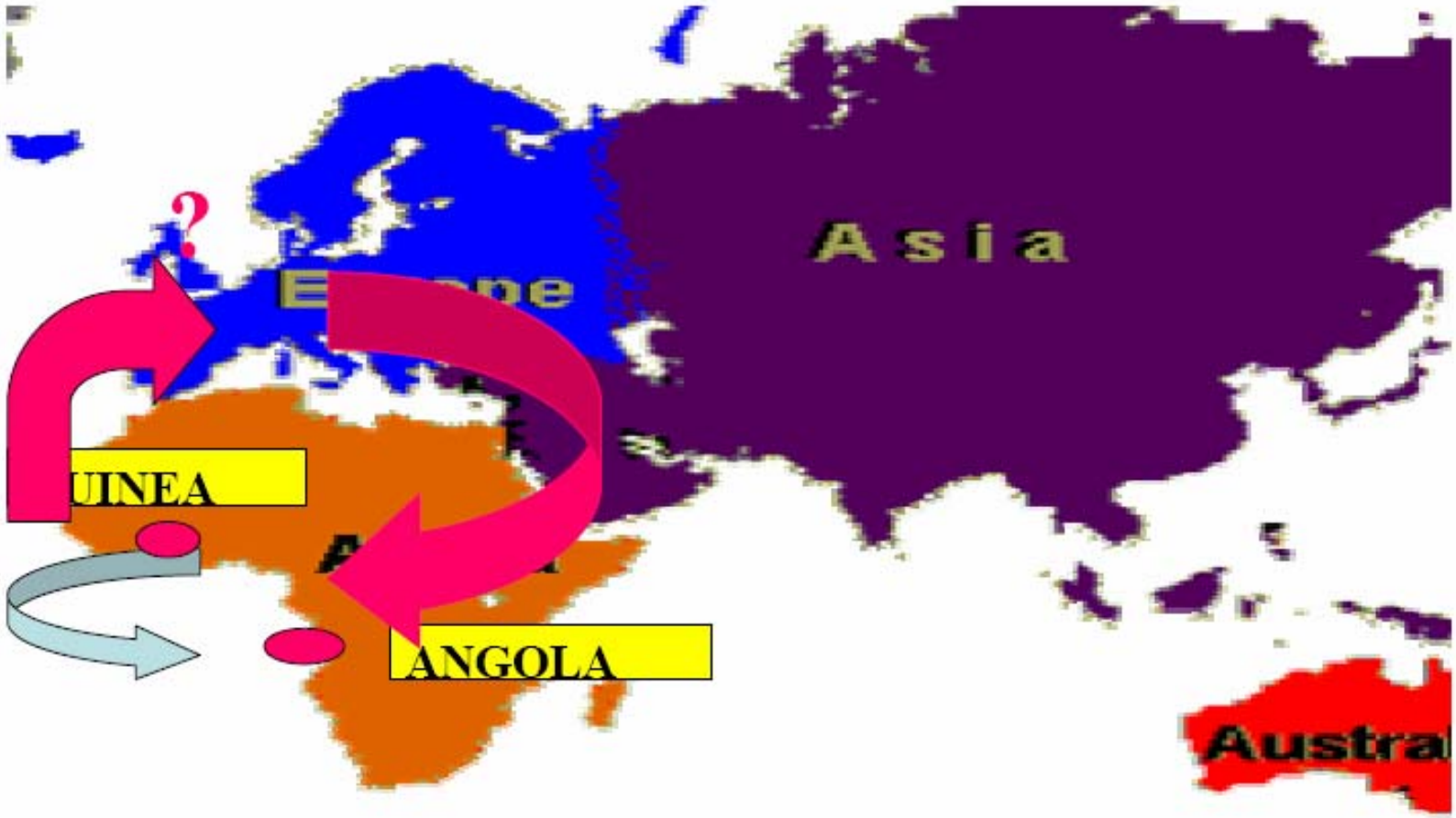

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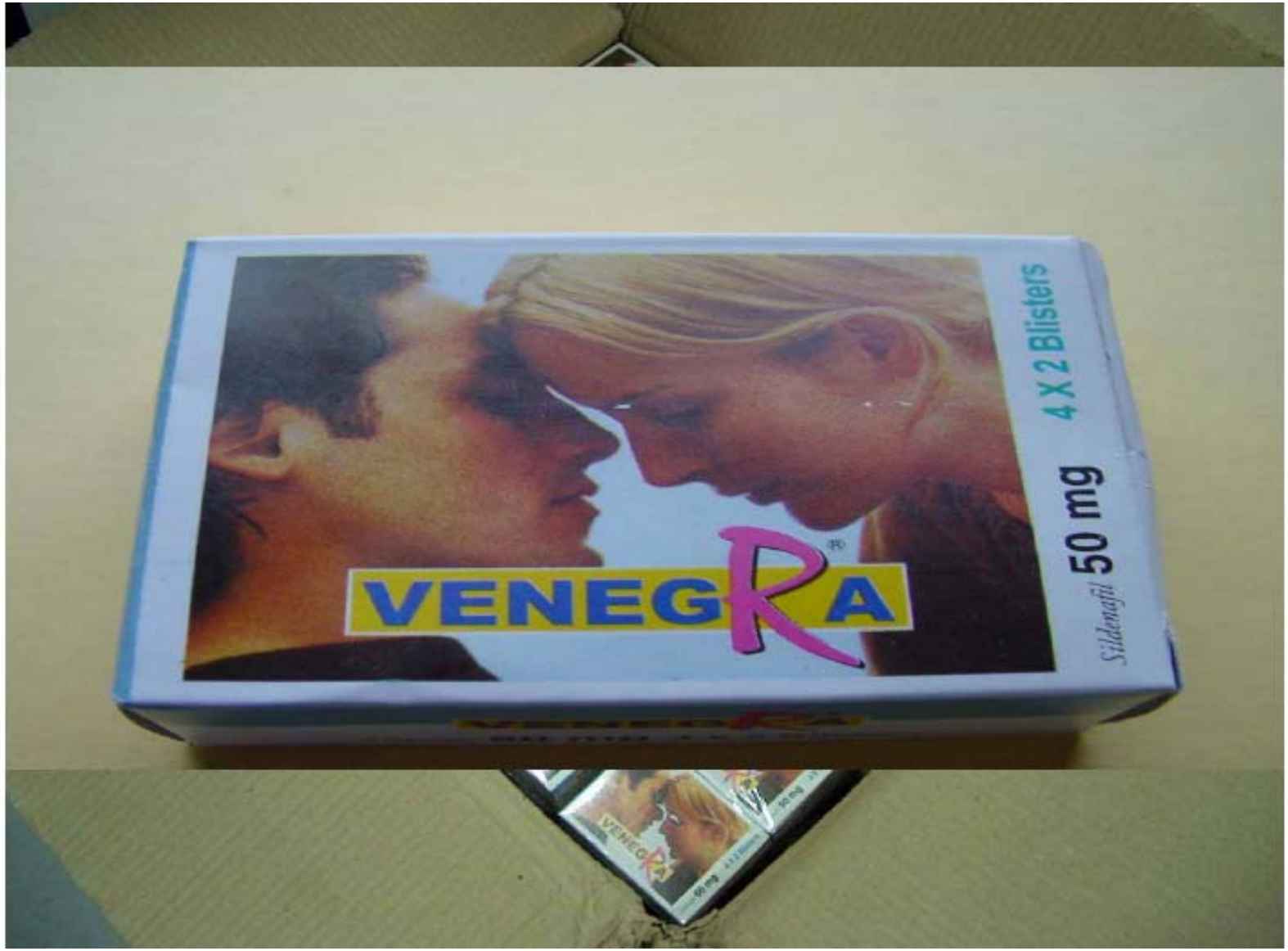

Distribution Channels for Counterfeit Products

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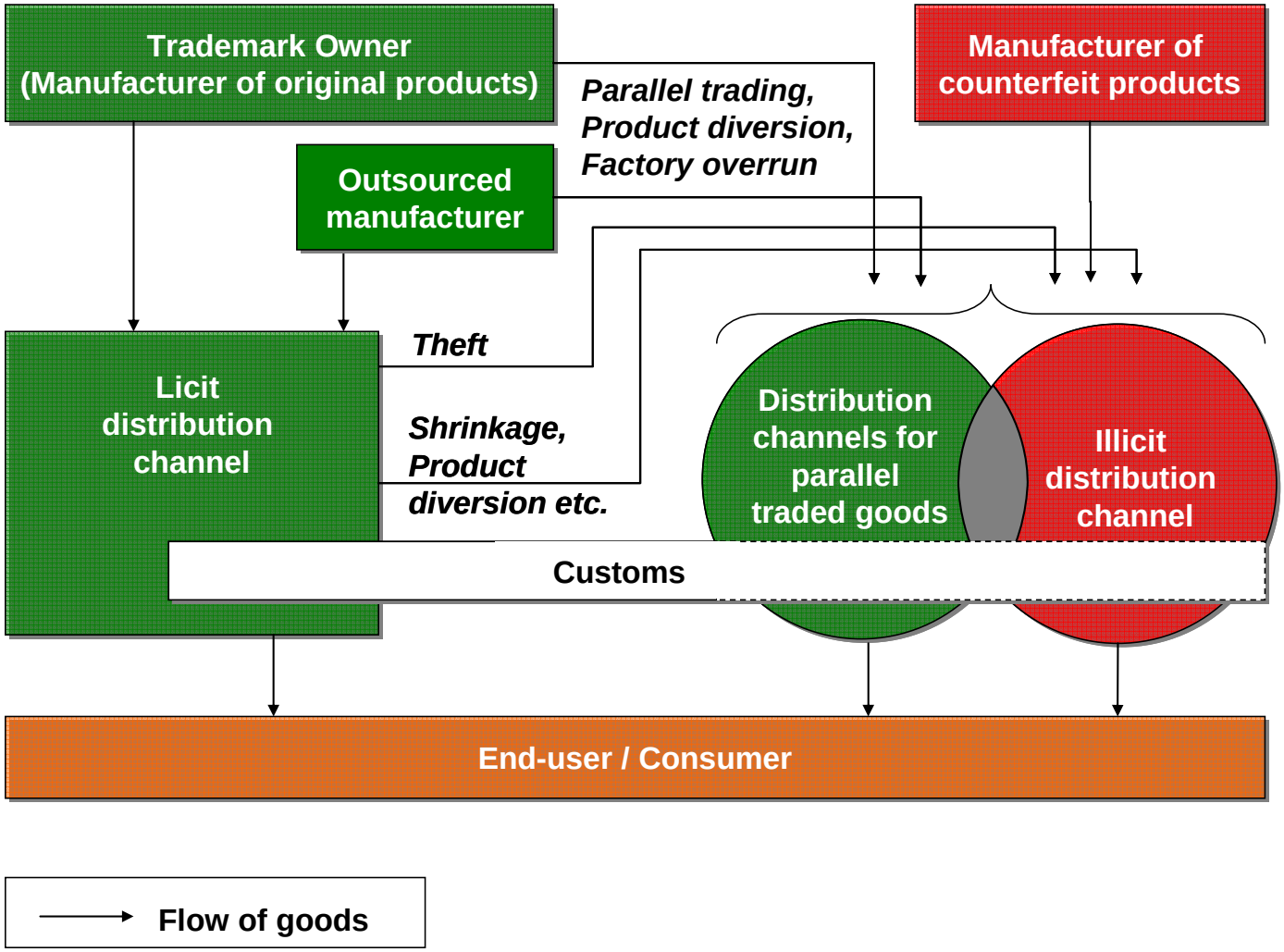
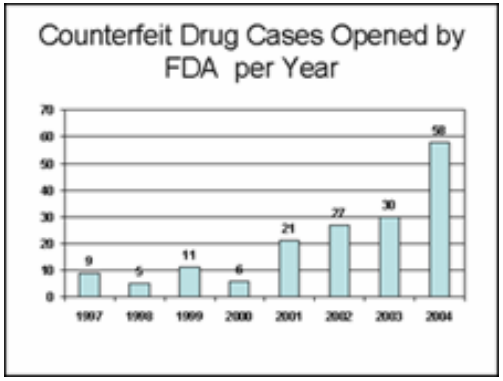


Overall extent of counterfeiting

- By definition, the problem is hidden and difficult to measure
- ICC estimated the overall cost of counterfeiting in the world about 5-7% of world trade (International Chamber of Commerce, 1997)
  - Often quoted but very unreliable number
- OECD has recent, more accurate estimate that counterfeiting and piracy is likely to account for less than USD 176 billion, or 2% of international trade
  - Result is extrapolated from detection statistics

[ICC]



[Food and Drug Administration]

Drivers and enablers of illicit trade

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- Advances in manufacturing technology
- Increased international trade
- Growing professionalism
- Low political will to help: Anti-counterfeiting has low overall priority Parallel trade is legal
- Internet as distribution channel (Lacking regulations, no liability of service providers)
- Low risks and high returns *(Law of greed)*
- Emerging markets (China)

Illicit trade is mostly beyond the control of individual companies

Illicit trade in…
IT Industry

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- Software industry suffers from product piracy
- Example cases of product counterfeiting
  - Re-labeling of 233 MHz Intel Pentium II processors to 266 MHz (1998)
  - Counterfeit electronic devices such as cell phones or MP3-players can contain fake or modified chips
  - Millions of counterfeit mobile phone batteries per year (e.g. Nokia)
  - Replacing branded parts (e.g. memory chips) of computer packages by non-branded ones

Illicit trade in…
Automotive Industry

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- Profit margins very slim, aftermark
- Expensive parts that are easy to copy and frequently used are most often targeted by counterfeiters
  - filters, spark plugs, headlamps, bumpers, side mirrors, brake pads
- Counterfeits manufactured in e.g. in Asia, East-Europe
- Internet, free garages, non-certified retailers are most important distribution channel of counterfeit parts

Illicit trade in…
Pharmaceutical Industry

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- Production of counterfeit drugs is relatively easy:
  - Technology is easily available, global distribution, valuable brands
- Distribution through Internet or by injection to licit distribution channel
- Re-packaging can open door for counterfeits
- Parallel trade and diversion
- Patient safety is companies priority

Illicit trade in…
Aerospace Industry

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- Counterfeit airplane spare parts endanger passenger safety
- Almost all parts in airplane hold certificate of authenticity and a lifecycle report
- Problem mechanism
  - Refurbished parts are often reused in different aircrafts
  - Counterfeits are sold as refurbished parts
  - Complex spare parts can contain counterfeit parts

Illicit trade in…
Luxury Goods Industry

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- Luxury brands communicate exclusiveness, higher quality
- Problem is counterfeit products from low to high quality
- Most counterfeit luxury products are of low-quality, sold outside authorized distribution channels
- Consumer survey shows that
  - almost as many consumers buy a counterfeit product than an original one
  - those who have bought counterfeits are actually more likely buy also original products

Illicit trade in…
Consumer Goods and Retail Industry

- Counterfeit consumer goods include textiles, sportswear, food, furniture etc.
- In some cases counterfeit products can even be found in retail stores
- Counterfeit products are mixed with parallel traded goods

Impact of illicit trade

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Impact on companies

- **Counterfeiting is theft from the brand owner**
- **Direct impact contains**
  - Counterfeits substitute (partly) original products
  - Liability claims such as warranty
  - Increased workload for monitoring, preventing, and intervening
- **Indirect impact:**
  - Decreased brand value (e.g., exclusiveness) and goodwill
  - Risk factor from liability
  - Decrease return on investment (ROI) of marketing and RnD

Impact of illicit trade on consumers and societies

- **Impact on consumers**
  - Counterfeit product can be perceived as *good bargain* by consumers
  - Safety and health of consumers can be endangered
- **Impact on societies**
  - IPR infringements discourage innovation decreasing economic growth
  - Counterfeiters do not pay taxes and are not model employers

What does that mean for anti-counterfeiting?

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- Counterfeiting and illicit trade form serious and variable problems among different industries
- Quantity of counterfeit products is increasing and quality is improving
- Technical anti-counterfeiting system should increase the risk profile of counterfeit players
- Core of the solution is product authentication, it depends on the case how and by whom this should be done

Agenda

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- The Problem of Counterfeits
- Promises of RFID technology
- Towards an Anti-Counterfeiting Solution
- Current Projects
- Outlokk & Implications

Low cost minicomputers ...

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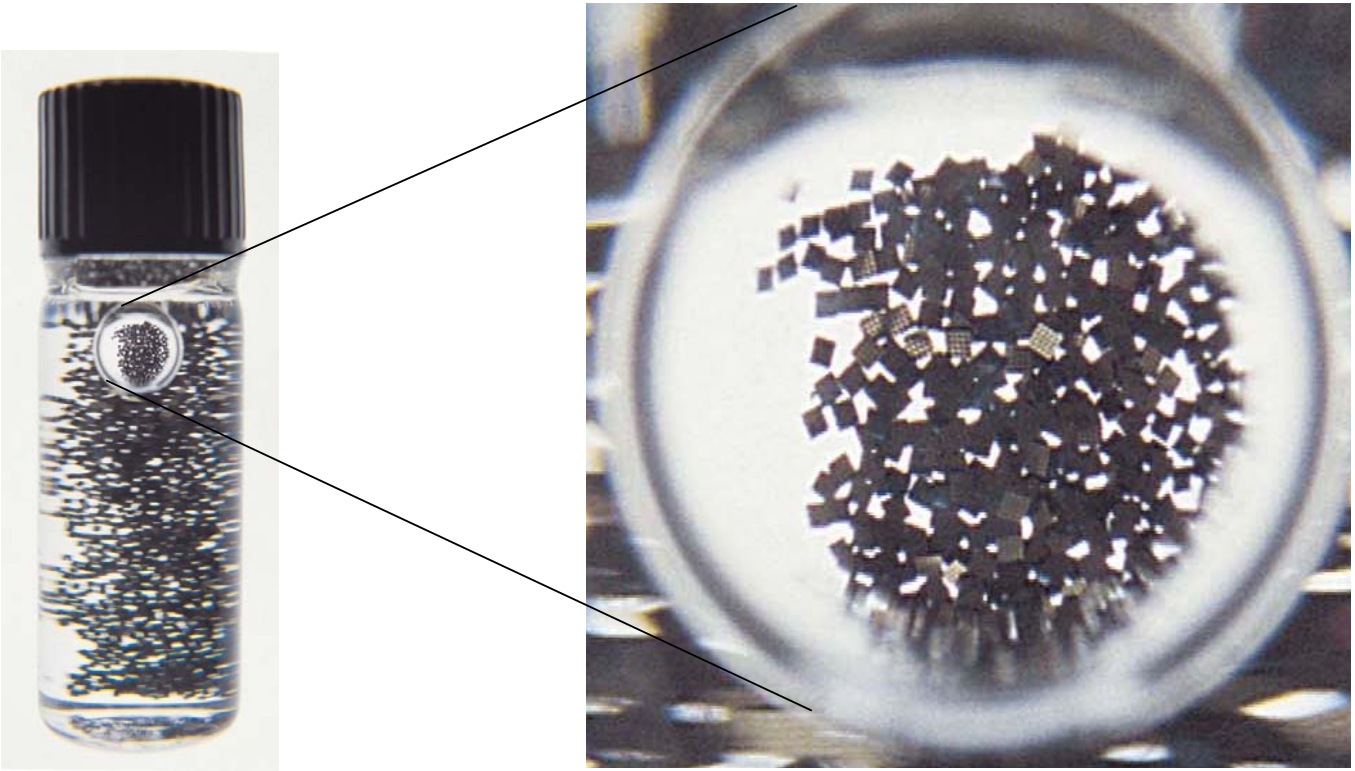

... with mobile communication capabilities ...

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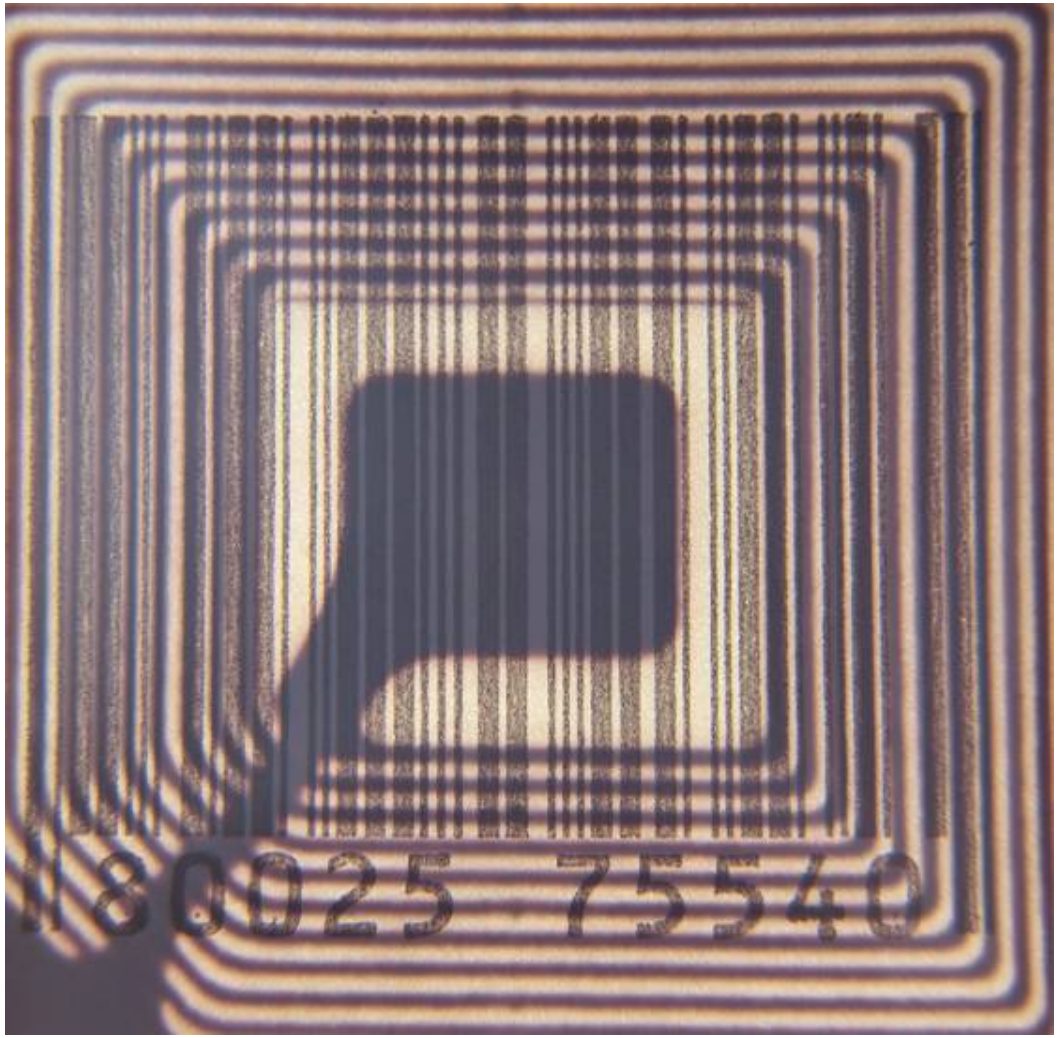

Recent advances in miniaturization, …

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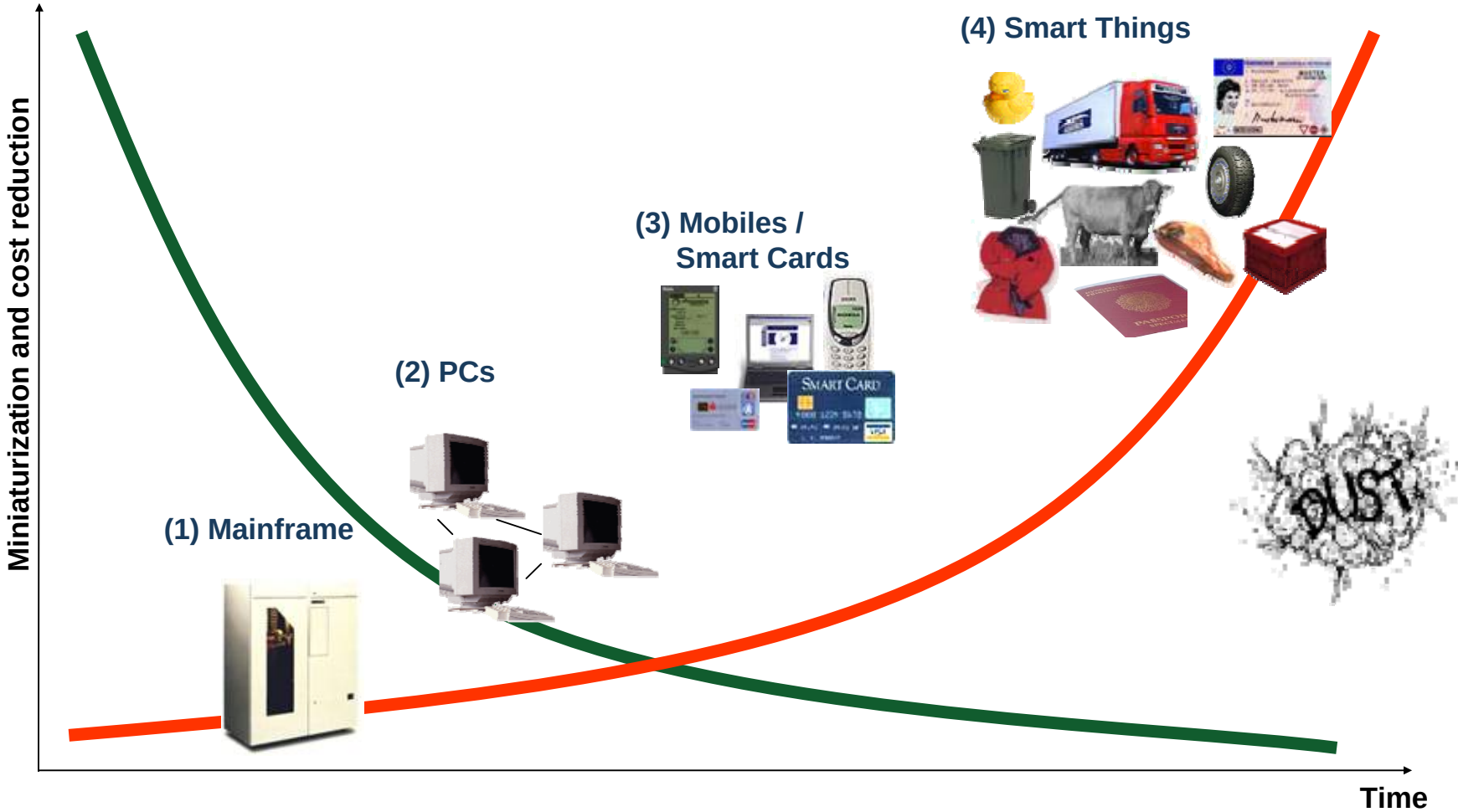

… finally help to link real world things at low cost to homepage(s),…

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Virtual world

Real world

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Agenda

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- Outlook & Implications

Towards an Anti-Counterfeiting Solution

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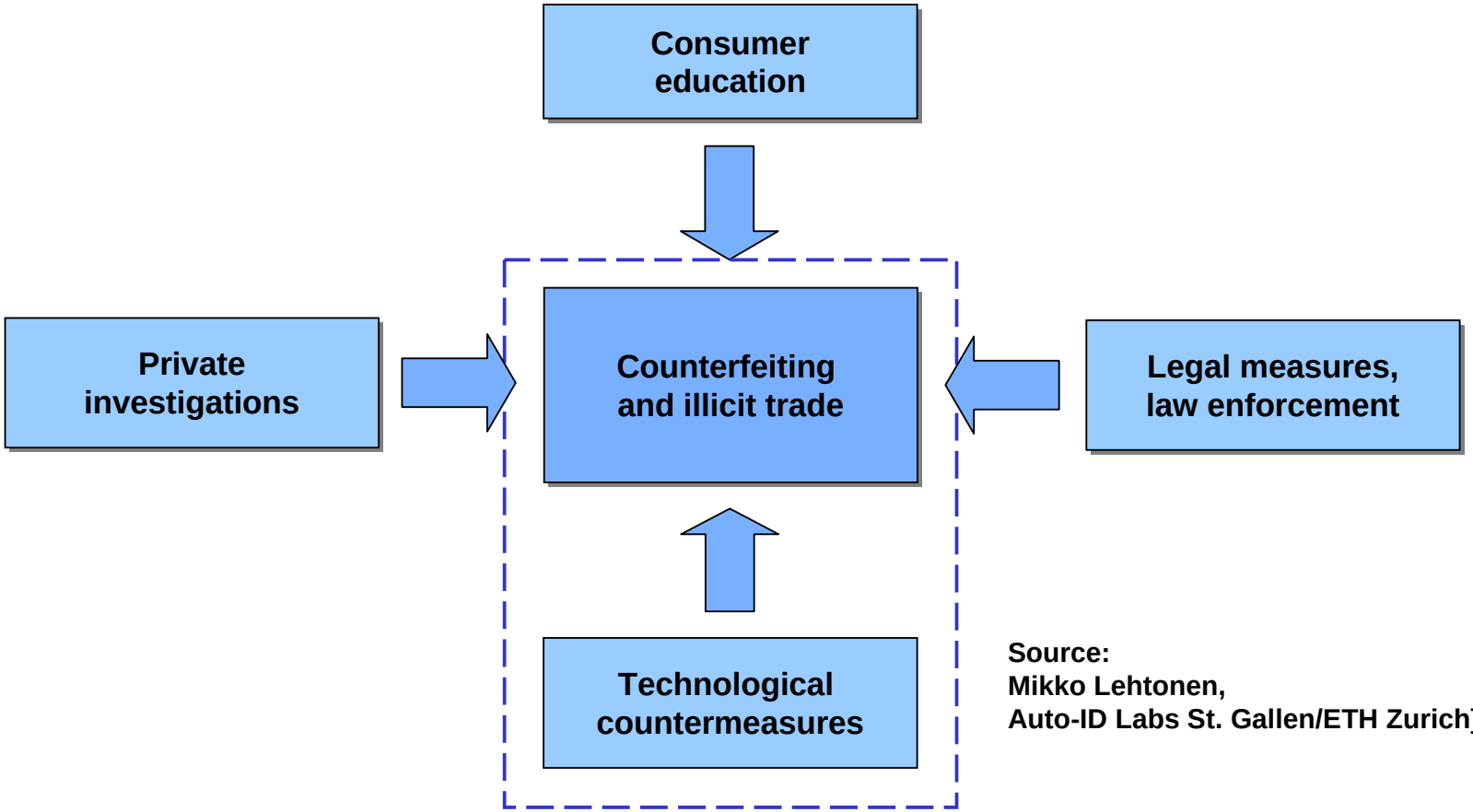

Source:
Mikko Lehtonen,
Auto-ID Labs St. Gallen/ETH Zurich]

- Our approach: Authentication of products
  - Distinguish genuine from fake goods
  - Easy-of-use, broaden the user base
  - Long-lasting
  - Reliability

Mechanisms of illicit trade

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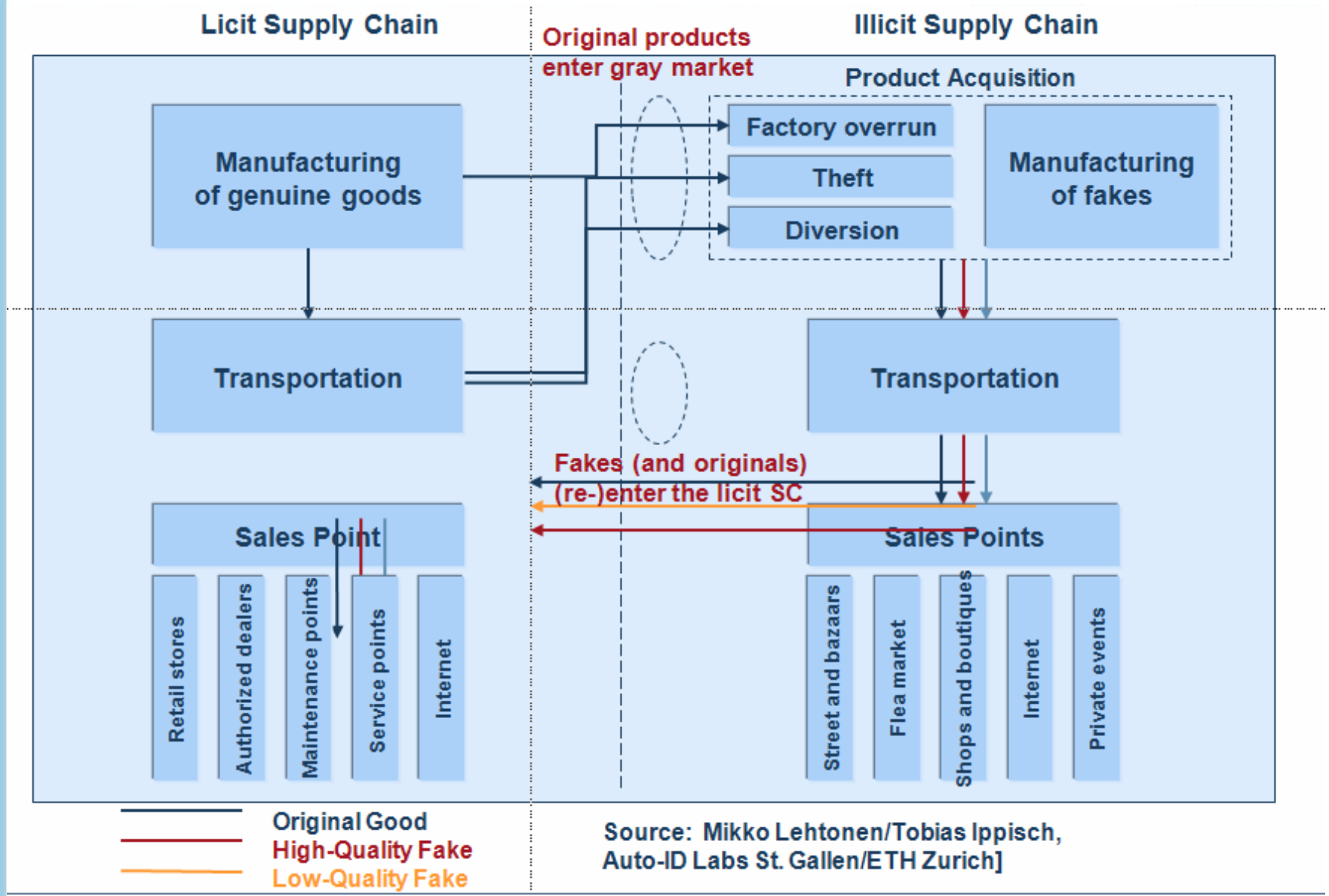

Use Cases of Product Authentication

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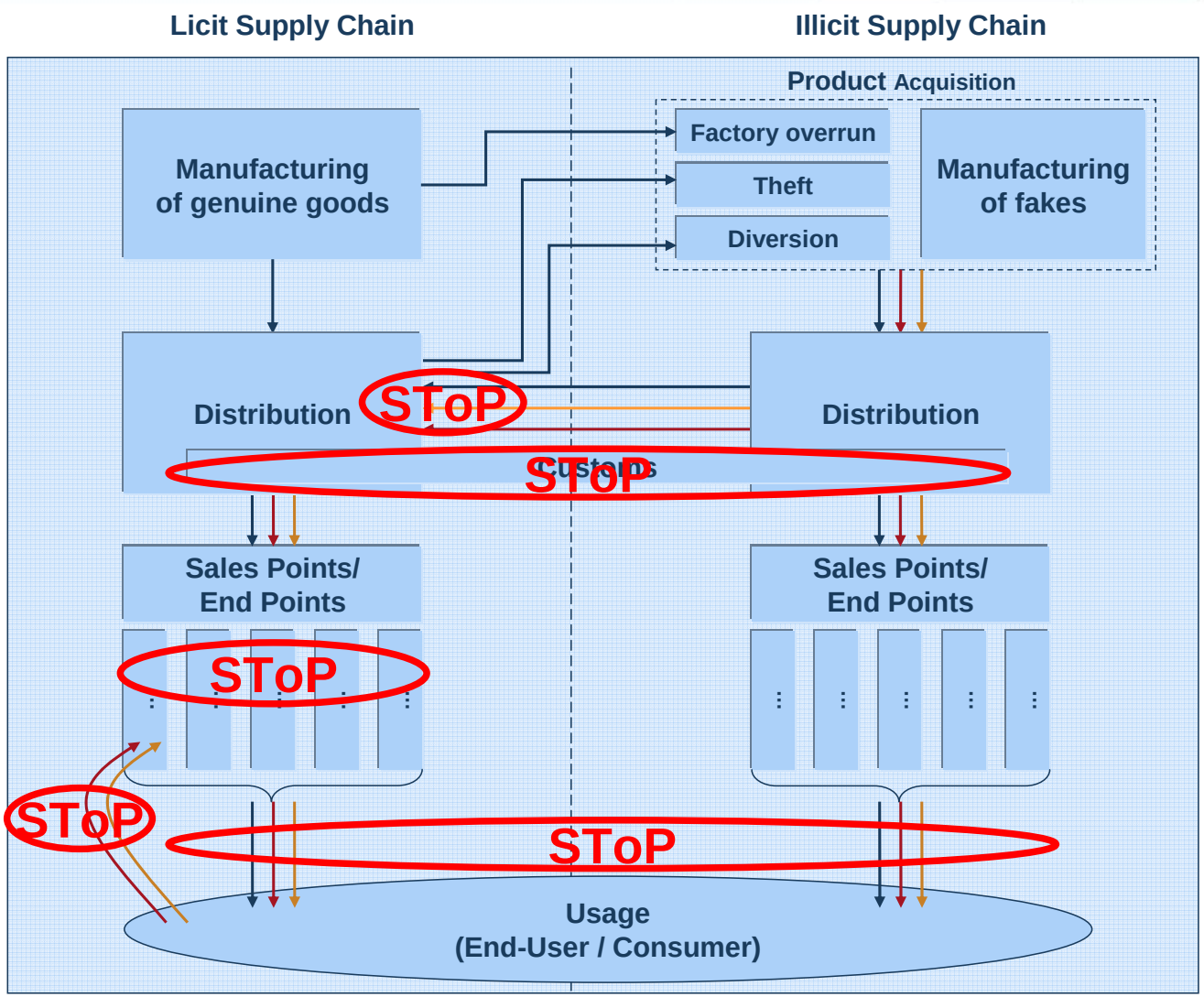

Original Good
High-Quality Fake
Low-Quality Fake

Use Cases of Product Authentication

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- Product authentication is a tool that can be used to find counterfeit products

- This tool can be used to achieve following goals

1. Prevent counterfeits from entering the licit distribution channel
2. Help customs to detect infringing products
3. Keep sales-points and end-points clean from counterfeits
4. Enable authentication of products that are in use
5. Enable after sales services to authenticate products

Principle anti-counterfeiting solutions under study

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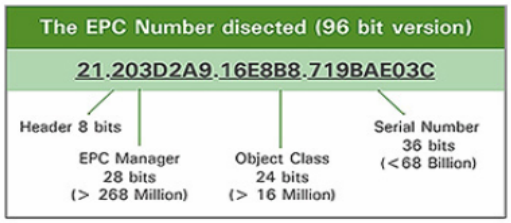
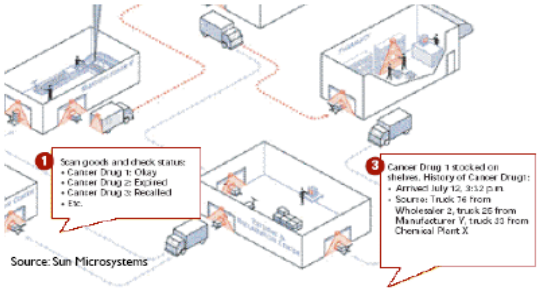
Unique serial numbering



Source: Auto-ID Lab

Track and trace based plausibility checks

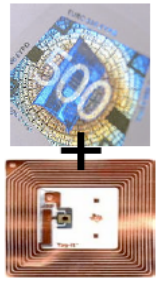


Source: Sun Microsystems

Source: Auto-ID Lab

Product verification with RFID

- Combination of measures
- Integrated into product
- Use physical properties



Object-specific features

[Source: Alex Ilic]

Unique serial numbers on item or case level

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- Unique serial numbers stored on RFID transponders
  - Lowest cost
    - per feature
    - per check
  - Reasonable level of security
  - Reasonable complexity
  - Foundation for further solutions
  - Ready-to-implement solutions are available

Unique serial numbers stored on RFID transponders

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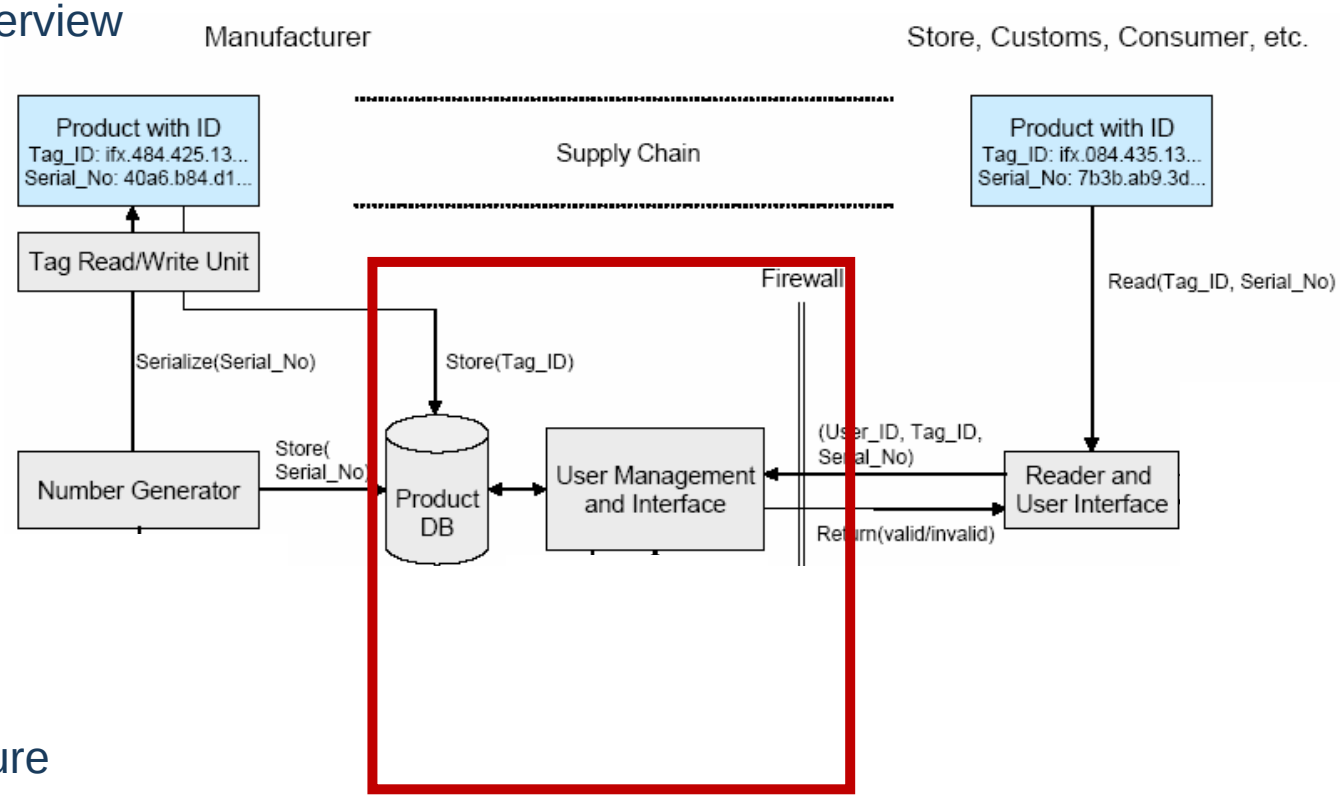
Infrastructure overview



- Lowest cost
  - per feature
  - per check
- Reasonable level of security
- Reasonable complexity
- Ready-to-implement solutions are available
- Foundation for further solutions

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User management

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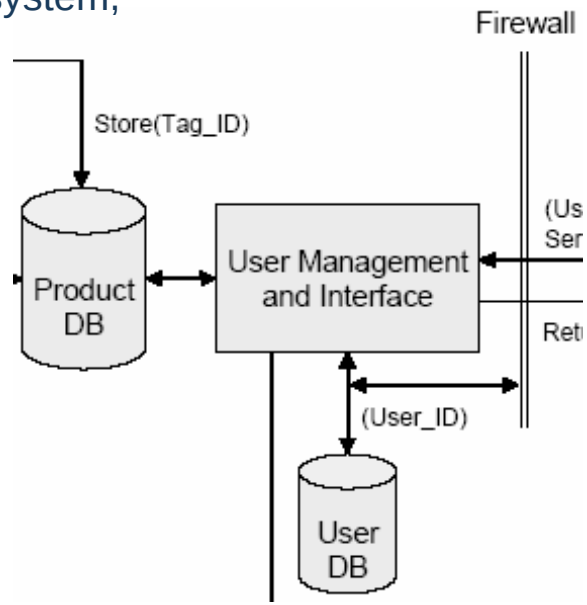
- Opening the system for a larger number of users increases is usability
- However this allows for attacks: Problems may arise if illicit actors retrieve valid numbers.

- Customs and supply chain partners
  - enabled to conduct bulk checks
  - access control

- Public access
  - restricted number of requests per time → avoid denial of service-attack
  - authentication of the requesting party :
    - User registration.
    - No registration, but answer provided by email
    - Using authentication of the requesting system, e.g. caller ID from cell phone
  - Reward the check, and place it as service

➔ Approaches not restricted to RFID



Using trusted address services

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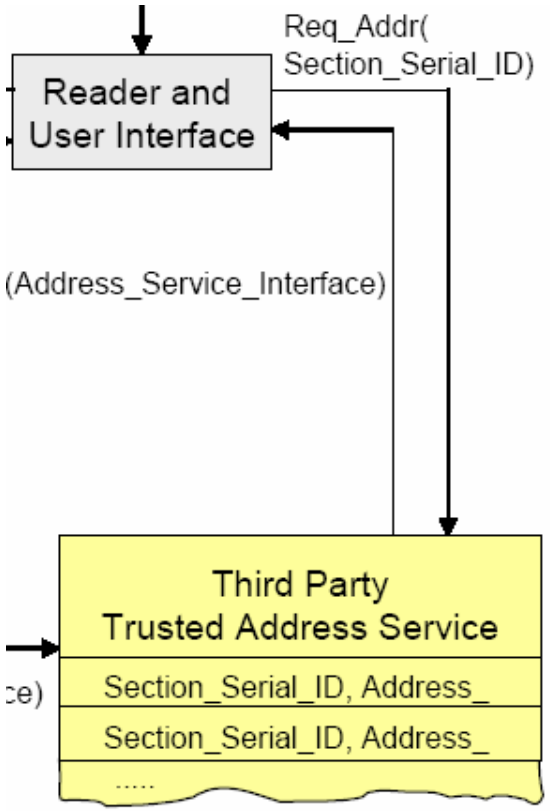
- The lean "hard wired" solution is not feasible in m to n environment
- An external, trusted address service is necessary if
  - The web page is not a desired entry point
  - Test equipment is not under control of the brand owner, or
  - Many brand owners use the same application and numerous service addresses
- A standardized directory service, e.g. ONS proposed by EPCnetwork, would be required
- Link address is crucial for security
  - Only for registered manufacturers
  - We suggest an additional manufacturer registration process



Plausibility checks based on track and trace

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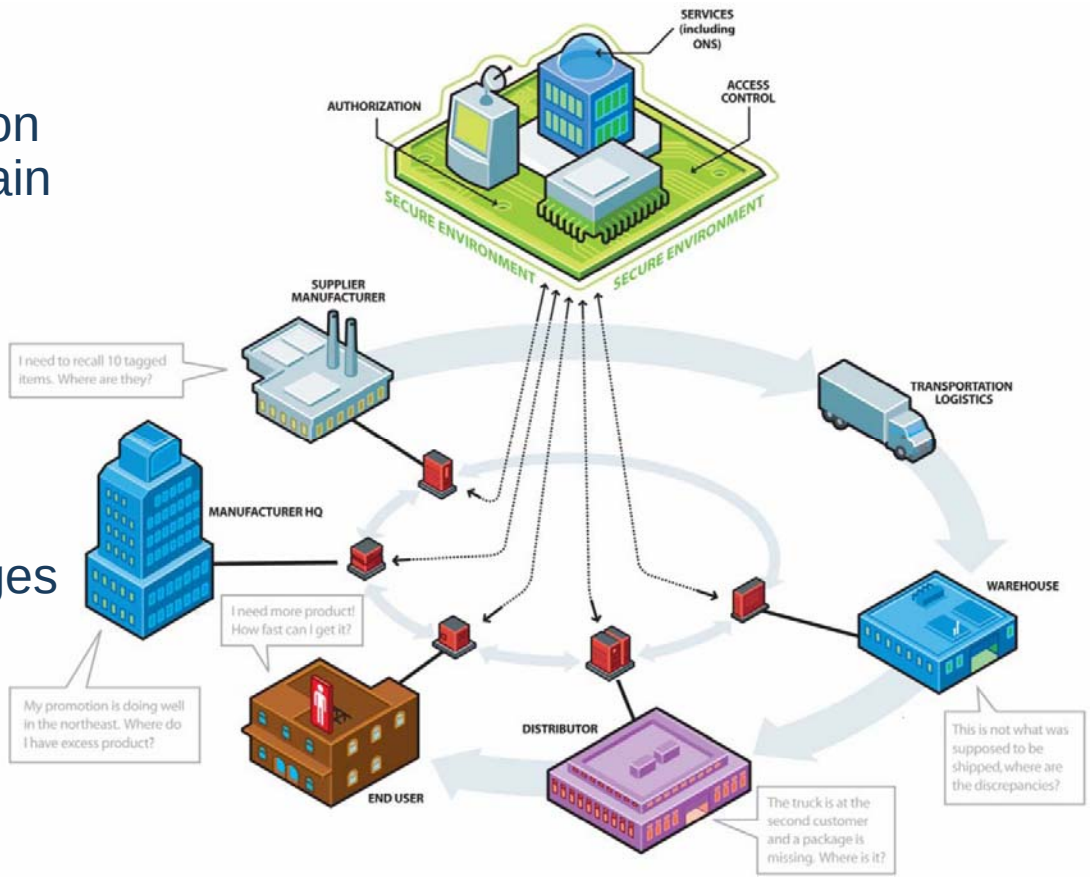
- Record of past and possible future owners or locations
- Illicit trade can be detected using business logic
- Promising for highly regulated industries
- Provides numerous additional benefits

- Requires the cooperation of numerous supply chain organizations:

➔ Technical challenges
  - Access rights
  - Business logic
  - Data exchange formats
  - Standardization

➔ Organizational challenges
  - Different interests



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Track & Trace

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- Pros:
  - Cloned tags are easier to detect
  - “Ok” to implement in a simple supply chain
- Cons:
  - Requires network access to authenticate tag/product
  - Gets complex in non-predetermined supply chains (access rights, ...)
  - Requires standardized network infrastructure
  - Business partners might not be willing to share these data
  - Tag-cloning not completely eliminated
- Our recommendation in the context of anti-counterfeiting
  - Important approach for the pharmaceutical industry
  - Only powerful if all partners use it
  - Don’t wait for ready solutions, use the unique serial approach instead

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Crypto tags

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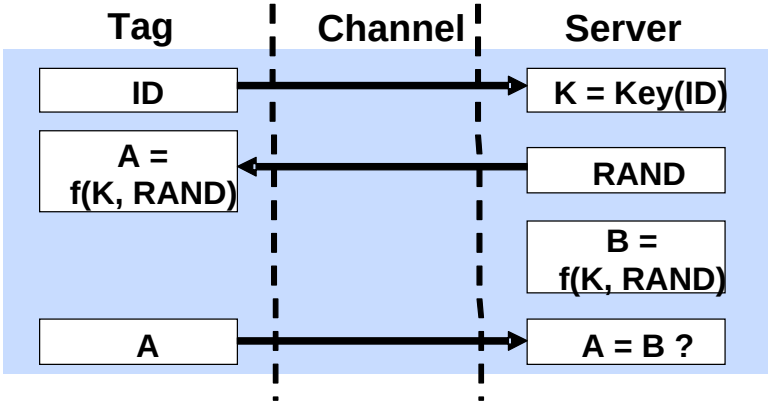
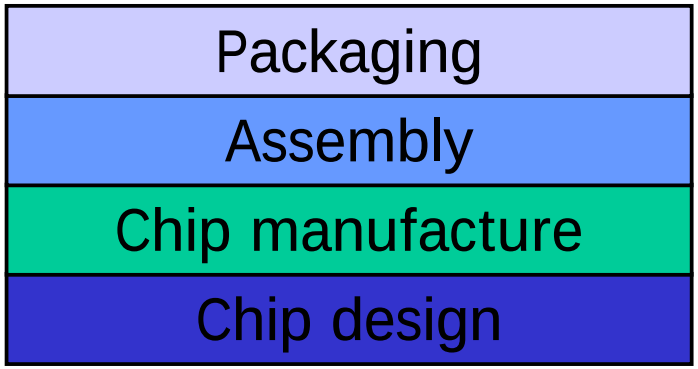
- Pros:
  - Cloning attacks become unfeasible
- Cons:
  - Tags are still expensive and not standardized
  - Extra time required for challenge/response protocol
  - Read range is limited
  - How to deal with recycled tags?
- Will become more important in the future
- Only for very expensive and security relevant parts, e.g. in the aviation industry





RFID cost drivers

Object Specific Security

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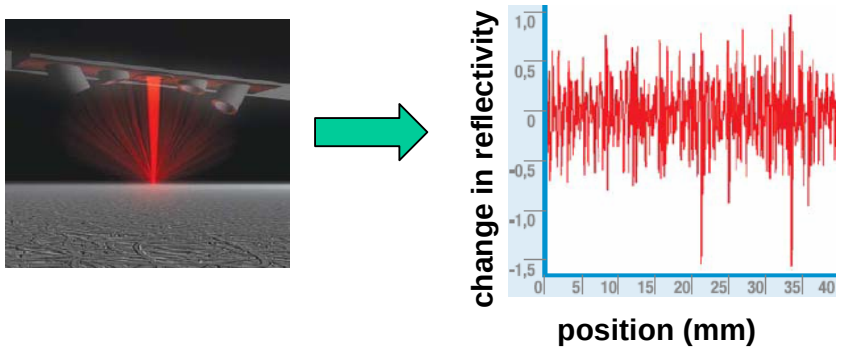
- The previous approaches concentrate on preventing cloning attacks
- RFID is a tagging technology
  - It is still the transponder you authenticate
  - Care must be taken to that a genuine tag cannot be removed and reapplied to an illicit product

- Goal: integrate RFID-tag into the product
  - incorporate RFID tags during manufacturing
  - “passport approach”: store object specific features
    - weight
    - shape
    - surface



Source: Protexxion, Bayer Technologies

Object Specific Security

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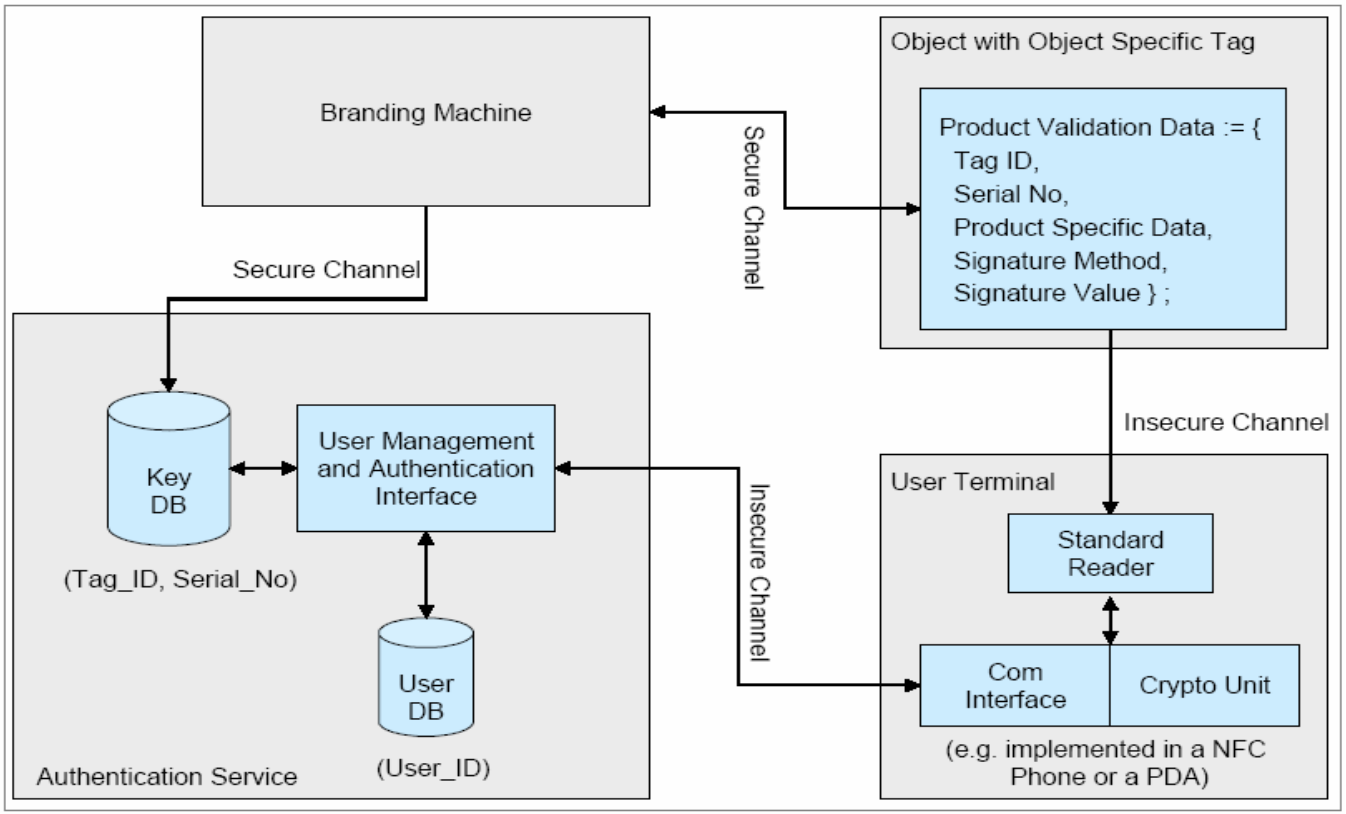
- Approach: tag-product integrity by storing a “fingerprint” on the tag



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Requirements: secure against attacks

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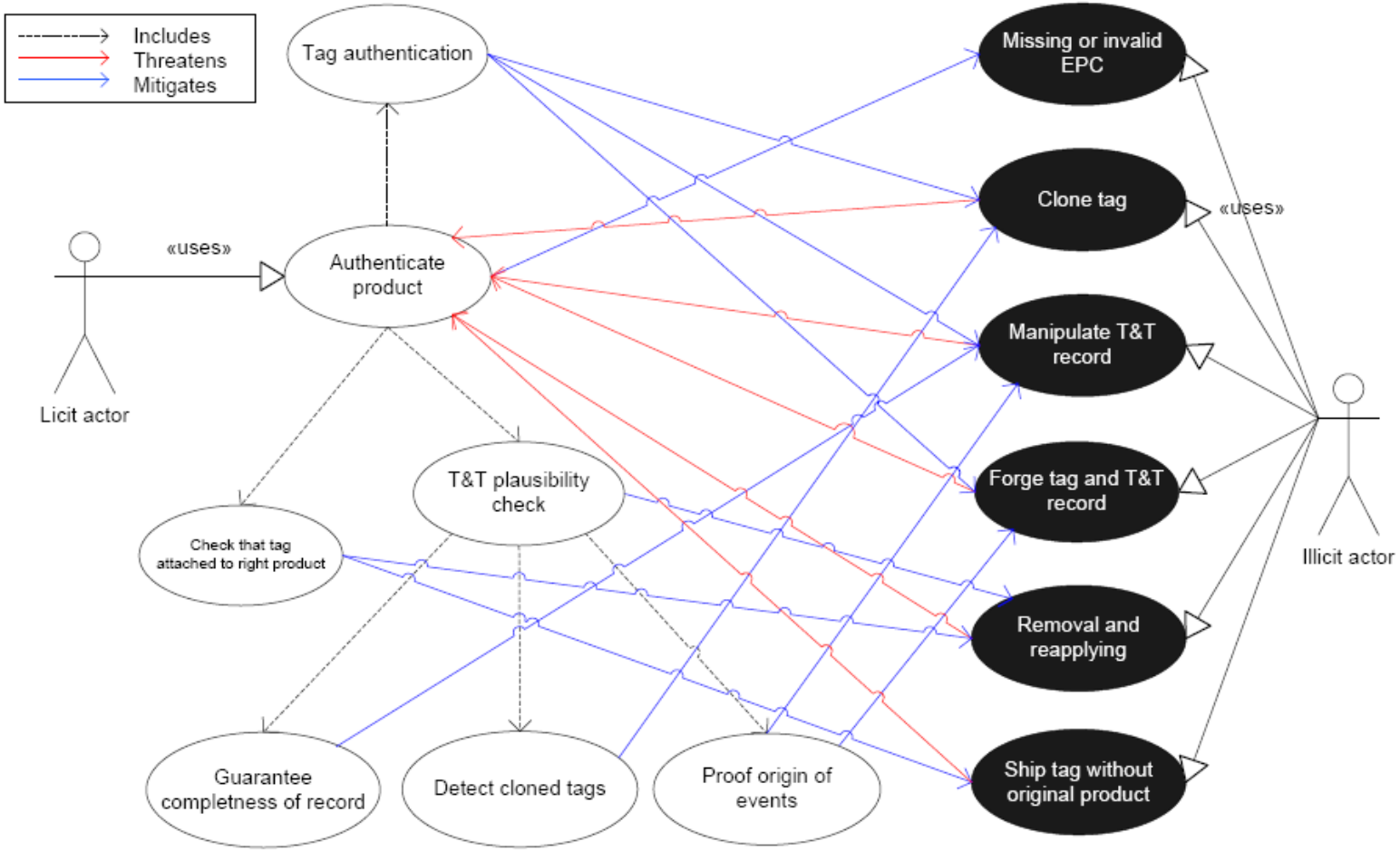

Source: Mikko Lehtonen, Auto-ID Labs St. Gallen/ETH Zurich]

Empowering the end-user: The Auto-ID Product Check

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Phase 1
PDA
CF-Card RFID Reader

Phase 2
Cell-phone
NFC Reader

Phase 3
Cell-phone
NFC/EPC Reader
EPC Network

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- The Problem of Counterfeits
- Promises of RFID technology
- Towards an Anti-Counterfeiting Solution
- Current Projects
- Outlook & Implications

The Auto-ID Labs architect the Internet of Things. Their research is global, relevant (partner of EPCglobal), long-term, and cross-discipline

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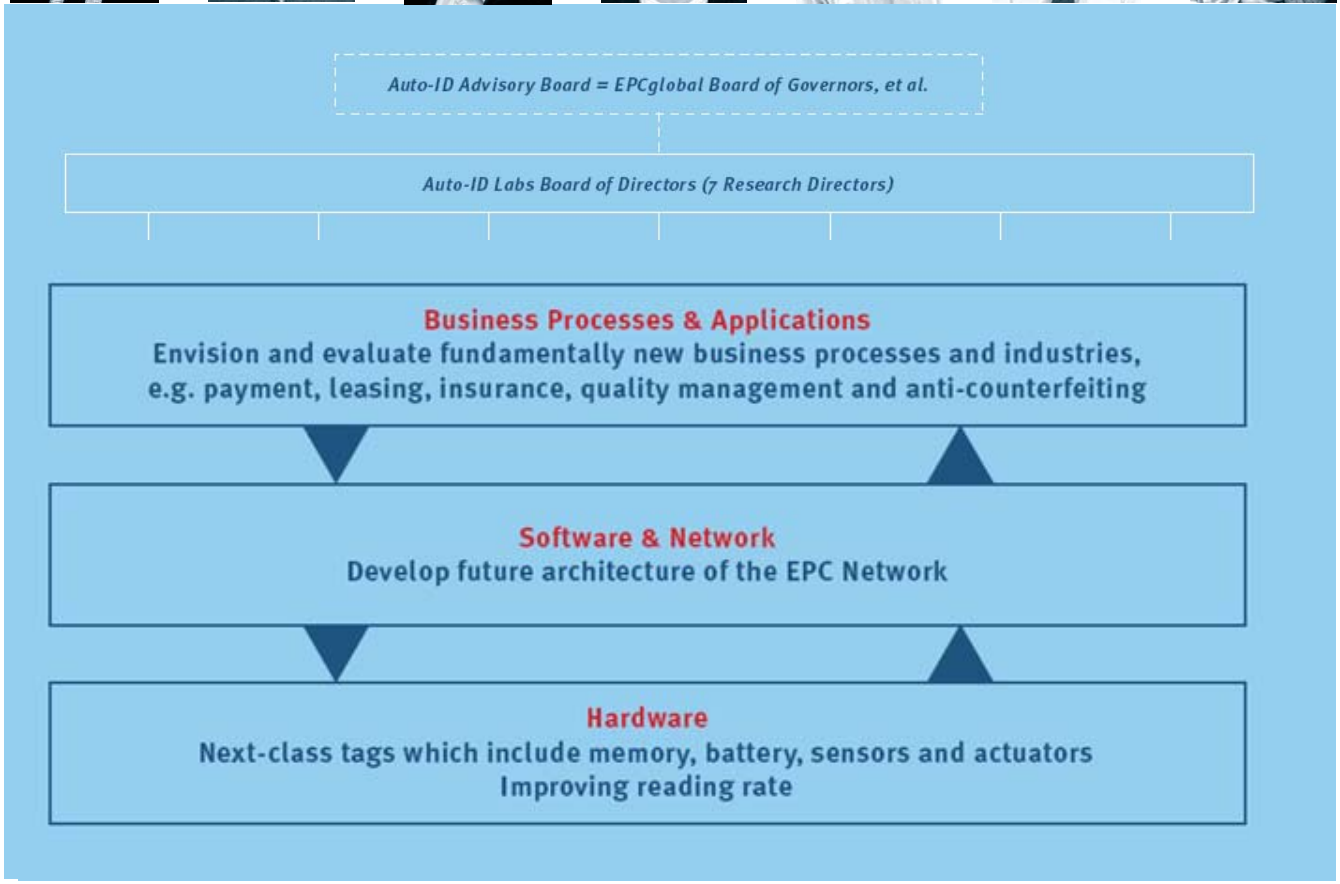

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Research:
Mission 1 – RFID as a tool against Counterfeiting

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"The Special Interest Group Anti-Counterfeiting will identify the true potential that RFID / EPC technology offers to combat counterfeiting"

Research topics of the Anti-Counterfeiting Initiative:

- Business Impact
- Network Issues
- Shortcomings of the EPC Network, e.g. Security
- Cross Industry Requirements

The SToP Project

http://www.stop-project.eu/

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- SToP overview:
  - EU 6th Framework Programme
  - Specific Targeted Research Project (STREP)
  - Duration: 1 Nov 2006 – 30 Apr 2009 (30 months)
  - Budget
    - Total: 4 888 448 EUR
    - European Community: 2 780 000 EUR

  - SAP, Univ. St. Gallen, Spacecode, Oria Computers,
  - Novartis, Richemont, Airbus, Bundesdruckerei

Expected outcome of StoP

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DRAFT VERSION 0.9 – DON'T DISTRIBUTE

AUTO-ID LABS

Project Report

Auto-ID Labs St.Gallen / Zurich

Thorsten Staake, Florian Michahelles, Frédéric Thiesse, Elgar Fleisch

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Internet: www.autoidlabs.org

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- **extend of Counterfeits**
- **impact of Counterfeits**
- **industry sector specific solutions**

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BRIDGE RFID Platform

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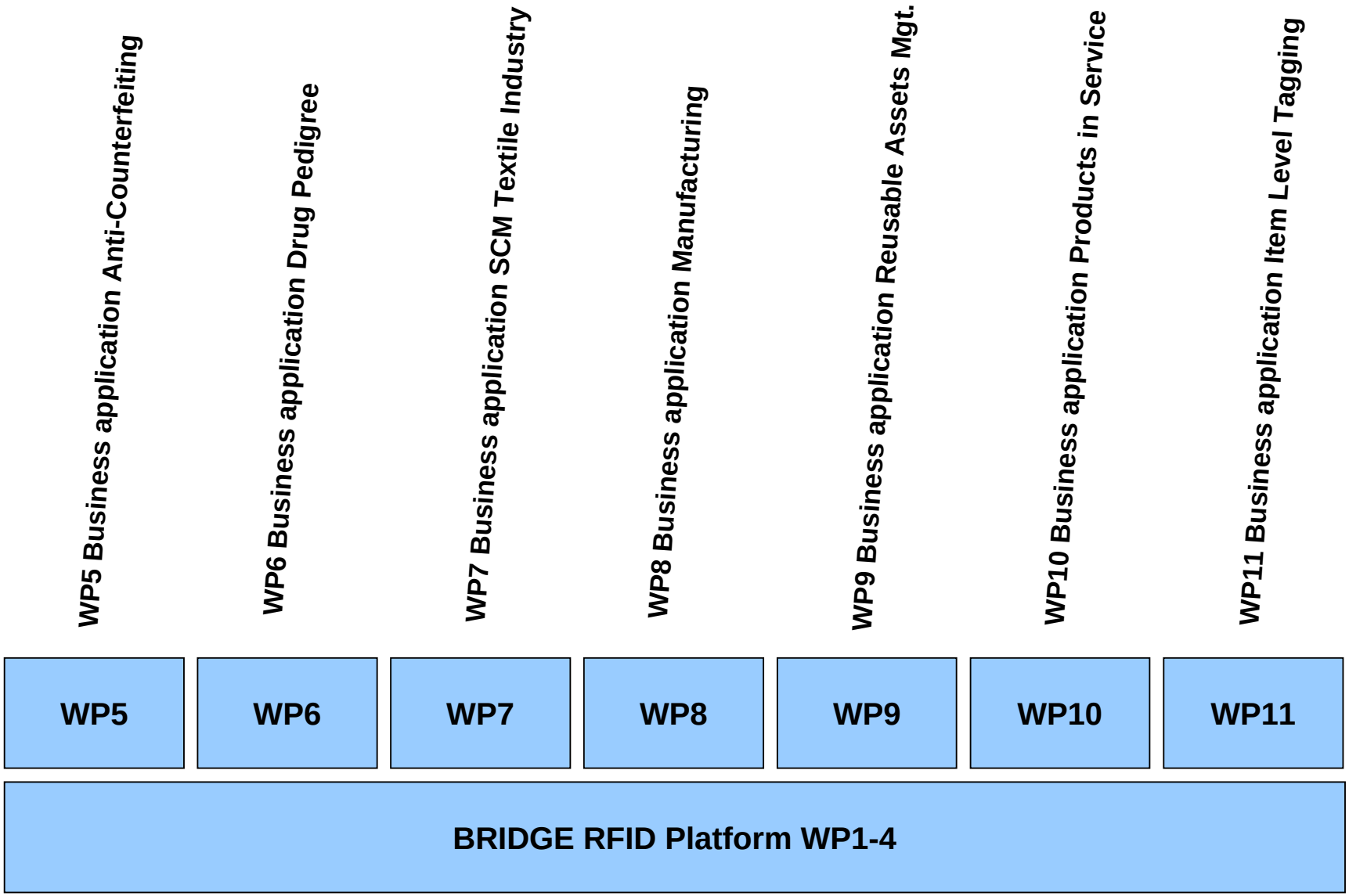

BRIDGE in a nutshell

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- BRIDGE is an Integrated Project (IP)
- The duration is 3 years, starting in June 2006
- 30 partners with a balance representation of GS1 MOs, Labs, Users and Solution Providers
- The total “real cost” is €14,3M. The grant from the European Commission is €7,5M. The difference is covered by the participating companies

BRIDGE Partners

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GS1	Labs	Users	Sol. Providers
GO	Cambridge	Carrefour	BT
France	St Gallen	Benedicta	SAP
UK	Fudan	Kaufhof	AIDA
Germany	UPC Barcelona	Gardeur	Caen
Spain	TUG Graz	Nestlé	Confidex
Poland		Sony	Cetecom
China		El Corte Inglès	Rafsec
			Verisign
			Melior
			Unisys
			Domino
			JJ Assoc.

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BRIDGE WP5

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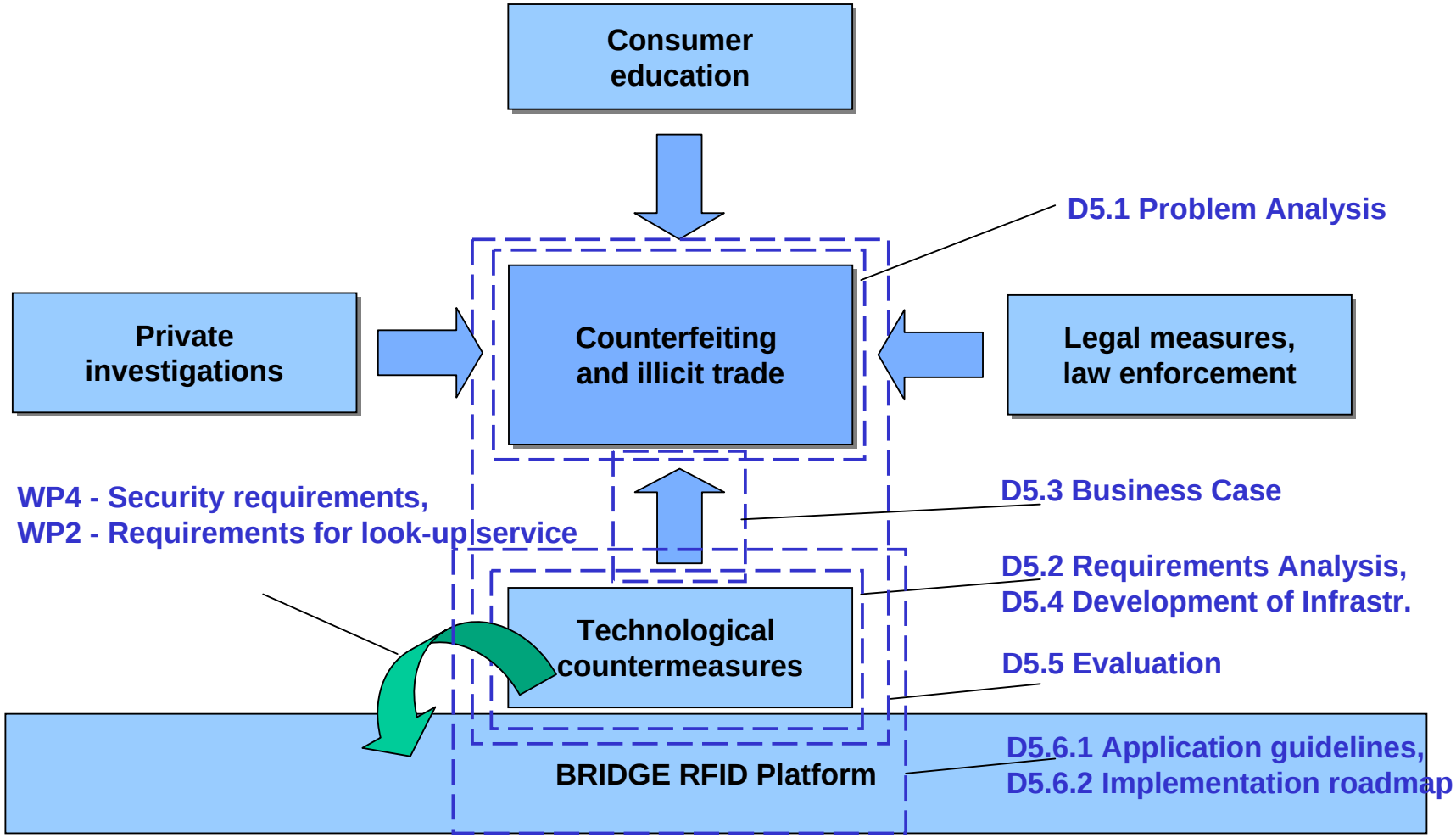
Florian Michahelles
25 April 2007



Research:
Mission 2 – RFID in new industries

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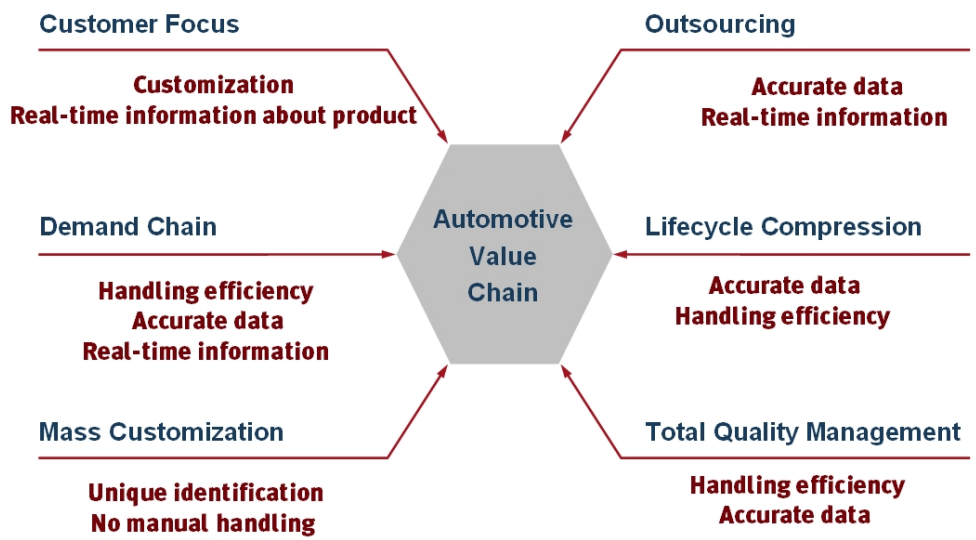
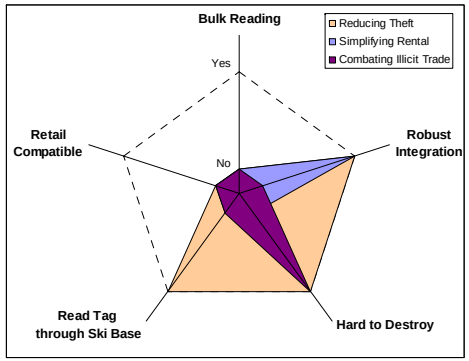
25 April 2007

- establishing RFID standards in new industries:
  - Automotive



  - Ski Industry



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Research:
Mission 3 – Enhancing the EPC network

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- transforming EPC into a trusted network
  - suitable network for secure track and trace
  - cost-efficient measurement against counterfeiting
- preparing EPC for the future
  - integration of sensors on tag
  - sharing of sensor data across the network
  - data access
- developing/enhancing ONS
  - P2P approaches
  - OpenSource EPC network

Agenda

- The Problem of Counterfeits
- Promises of RFID technology
- Towards an Anti-Counterfeiting Solution
- Current Projects
- Outlook & Implications

Non-functional requirements of secure product authentication

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- Availability: all genuine products must be tagged, the tags must work
- Trust in parties who authenticate products
- Data sharing policies (for track and trace based approach)

“Weak products authentication” with RFID

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1. Putting an RFID tag on genuine products detects fakes that are not tagged
2. Verifying ID numbers detects fakes that don’t have valid IDs
3. Verifying the transponder ID number (EPC Class-1 Gen 2 tags) makes the genuine tags harder to copy
4. Verifying if the product has already been checked helps detecting some cloned tags

Not a 100% secure system, but increases the effort to clone a product. Good solution for short-term or for inexpensive products.

Long term goal:
Product authentication in the EPCnetwork

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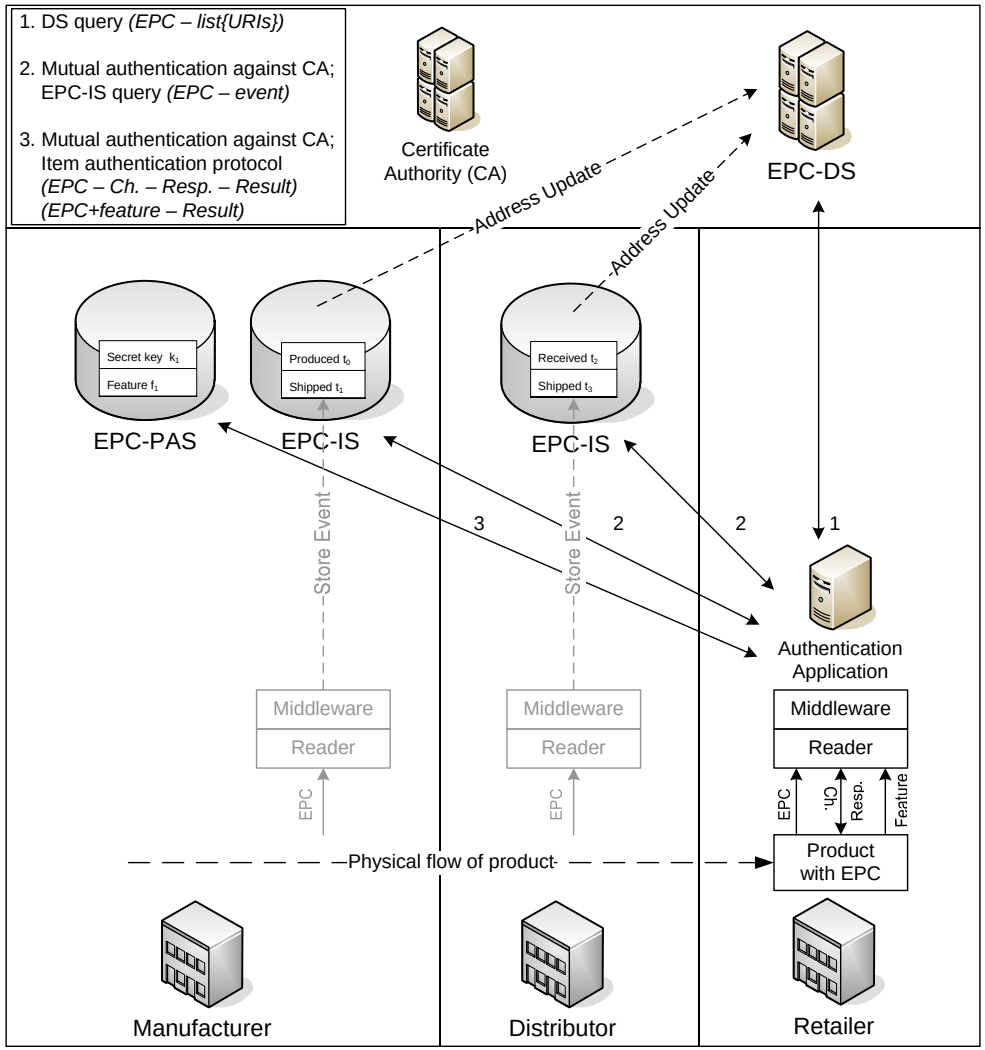
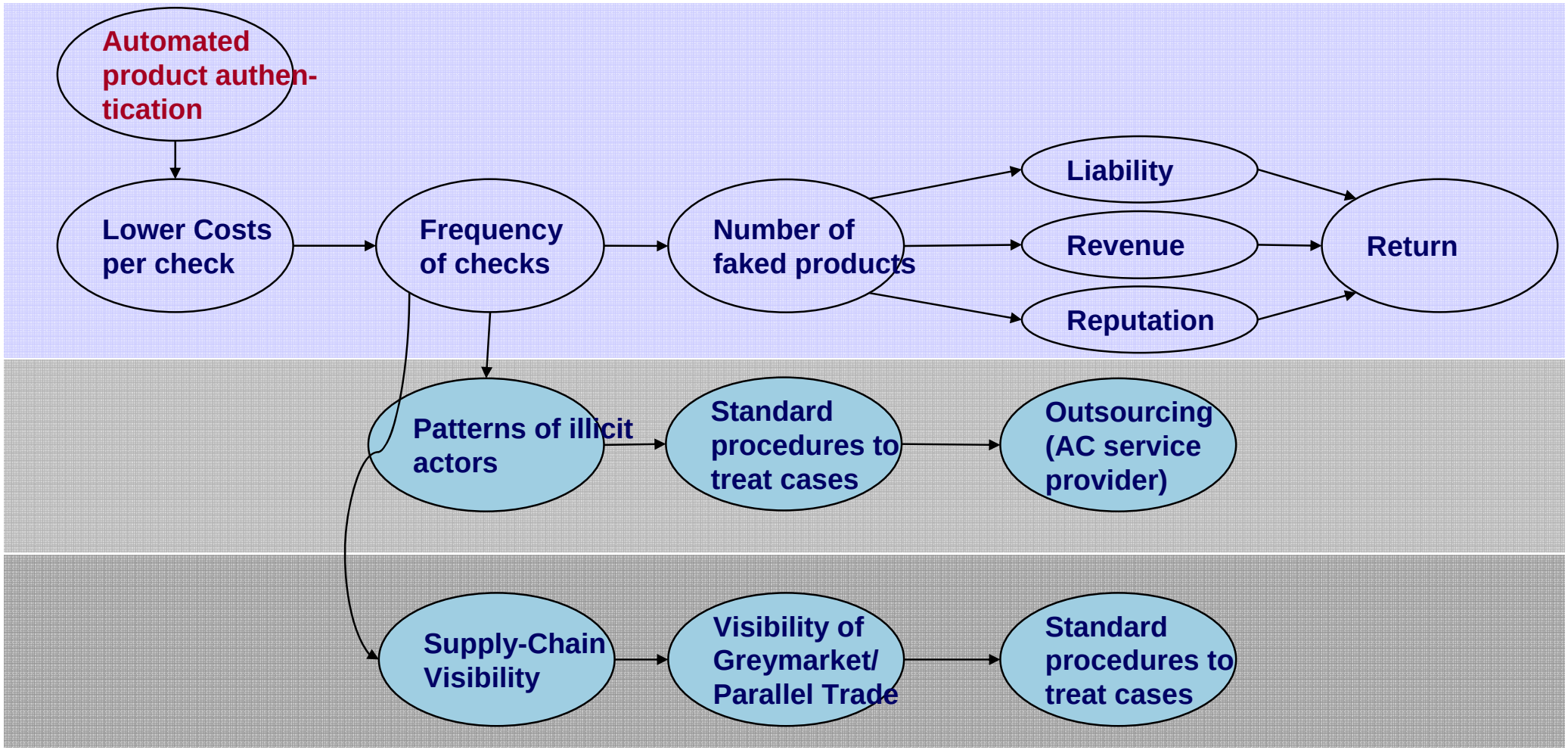


Implications and Long-Term vision…



…calls for a comprehensive infrastructure of the internet of things.

Core Characteristics:

- look-up service
- quality of real-time
- trusted parties
- defined ownership of data
- scalable data access model
- life-cycle of data

Use Cases of Product Authentication

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- Product authentication is a tool that can be used to find counterfeit products

- This tool can be used to achieve following goals

1. Prevent counterfeits from entering the licit distribution channel
2. Help customs to detect infringing products
3. Keep sales-points and end-points clean from counterfeits
4. Enable authentication of products that are in use
5. Enable after sales services to authenticate products
6. Help private investigators

Take home message

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- There is no business model for anti-counterfeiting, it is not about ROI, but it is about
  - trust
  - customer safety
  - brand protection
  - countermeasures against future competitors