ProAuthent
Integrated Protection against Counterfeiting in Mechanical Engineering through Marking and Authenticating Critical Components

Dipl.-Wi.-Ing. Dominik Stockenberger

05.09.2011
6th Future Security, Berlin
A2: Supply Chain Security

fml - Lehrstuhl für Fördertechnik Materialfluss Logistik
Prof. Dr.-Ing. Dipl.-Wi.-Ing. W. A. Günthner
Technische Universität München
1. **Product Piracy in Mechanical Engineering**

2. **Integrated Protection System**
   - 2.1 At-Risk Components
   - 2.2 Fraud-Resistant Features and Originality Check
   - 2.3 Check Results and Documentation

3. **Summary**
## Agenda

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Product Piracy in Mechanical Engineering</strong></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Integrated Protection System</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.1 At-Risk Components</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.2 Fraud-Resistant Features and Originality Check</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.3 Check Results and Documentation</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Summary</td>
<td></td>
</tr>
</tbody>
</table>
1. Product Piracy in Mechanical Engineering

Global Impact

- International trade with fake and illicitly copied products 2005: $200 billion per year

  Containing only goods of cross-border trading, no fakes/copies in national trade or internet distributed products

- Actual volume could equate to several hundred billion US$ more

Volume of Goods assured by Customs [Mio US $]

Source: [OECD-08] p.57

Number of Countries Reporting to the OECD

Source: [OECD-08] p.57
Impact on Mechanical Engineering in Germany

- Economical damage due to product piracy: €7 billion per year

- 68% of German mechanical engineering enterprises are affected

Direct economical damages
- Loss of sales and profit
- Expenses for protection measures, registration and assertion of trademark rights and patents

Indirect economical damages
- Damage to reputation
- Sinking price level
- Product liability
- Loss of know-how

Estimated Loss in Sales at Affected Companies 2007

Source: [VDMA-08]
Distinguishing between Originals and Counterfeits

• High product quality – no longer a measure for product authenticity: Differences between original product and counterfeits are often hardly noticeable for customers

• Meaning to expanded supply chains and sales networks: Challenge of communicating to all participants differentiating features

→ Trademark protection approach: Product protection by marking with fraud resistant features for sustainable (manual) authentication

Source: Aktionskreis gegen Produkt- und Markenpiraterie e.V. (APM)
Supply Chain Surveillance

• Simple supply and logistics structures become complex supply and logistic networks

• Tracing one’s own products along the supply chain and discovering counterfeits, illicit sales etc. becomes uncontrollable without qualified systems

Logistics approach:
Applying tracking and tracing functions based on databases which store information about the serialized product’s progress through the logistics chain.

Source: [GS1-10]
1. Product Piracy in Mechanical Engineering

Anti-Counterfeiting for Components and Spare Parts in Mechanical Engineering

<table>
<thead>
<tr>
<th>Trademark protection approach: Marking with fraud resistant features</th>
<th>Logistics approach: Tracking and Tracing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of information about the components’ Authenticity solely on-site</td>
<td>Implementation of an area-wide online data comparison system necessary</td>
</tr>
</tbody>
</table>

Efficient protection system against product piracy for mechanical engineering?

Research project ProAuthent funded by The Federal Ministry of Education and Research (Bundesministerium für Bildung und Forschung)
# Agenda

1. **Product Piracy in Mechanical Engineering**

2. **Integrated Protection System**
   - 2.1 **At-Risk Components**
   - 2.2 **Fraud-Resistant Features and Originality Check**
   - 2.3 **Check Results and Documentation**

3. **Summary**
2.1 At-Risk Components

- Marking every component with fraud resistant features and checking authenticity is cumbersome.
- Cost-benefit ratio prohibits marking every component.

Criteria for the selection of components to protect must be developed.

**Components to protect**
- Valuable and important for original manufacturers
- Appealing to counterfeiters

**Basis aspects**
- high margin
- high sales figures
- high research, development and know-how intensity
- unique selling points

**Additional aspects**
- security relevance
- functional relevance
- risk of damage to manufacturer’s reputation
- linked services
| 1 | Product Piracy in Mechanical Engineering |
| 2 | Integrated Protection System |
|   | 2.1 At-Risk Components |
|   | 2.2 Fraud-Resistant Features and Originality Check |
|   | 2.3 Check Results and Documentation |
| 3 | Summary |
## 2.2 Fraud-Resistant Features and Originality Check

### Selected marking technologies

The following four marking technologies are realized in a demonstration system and industrial pilot installations:

<table>
<thead>
<tr>
<th>Hologram</th>
<th>IR color pigments</th>
<th>Copy detection pattern</th>
<th>RFID</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="" alt="Hologram Image" /></td>
<td><img src="" alt="IR Color Pigments Image" /></td>
<td><img src="" alt="Copy Detection Pattern Image" /></td>
<td><img src="" alt="RFID Image" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feature</th>
<th>Hologram</th>
<th>IR color pigments</th>
<th>Copy detection pattern</th>
<th>RFID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secure on-site authentication (offline)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✗</td>
</tr>
<tr>
<td>Data transfer in central data base for transparency along the SC</td>
<td>✔️ (Via manual input)</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Not with simple software</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✗</td>
</tr>
</tbody>
</table>
2.2 Fraud-Resistant Features and Originality Check

RFID: Authentication Mechanism with Cryptographic Signature for Offline-Authentication

Online-Authentication

- Electronic Product Code (EPC): easily reproducible
- Unique tag ID (UID): written in the read-only-memory of the chip, reproduction very expensive and complex
  → Security level using UID is very high

Offline-Authentication

- EPC + UID are signed by the manufacturer
- EPC and signature of a tag can only be copied to transponders with same UID
  → Secure mechanism applicable in mechanical engineering
2.2 Fraud-Resistant Features and Originality Check

RFID: Authentication Mechanism with Cryptographic Signature for Offline-Authentication

**Manufacturer**
- Private key for encryption
- EPC, UID signature

• Generation of the signature on the basis of EPC and UID

**Point of Authentication**
- Public key for decryption
- EPC, UID, signature

• Decryption of the signature
• Comparison with EPC and tag ID for originality check
<table>
<thead>
<tr>
<th>1</th>
<th>Product Piracy in Mechanical Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Integrated Protection System</td>
</tr>
<tr>
<td>2.1</td>
<td>At-Risk Components</td>
</tr>
<tr>
<td>2.2</td>
<td>Fraud-Resistant Features and Originality Check</td>
</tr>
<tr>
<td>2.3</td>
<td>Check Results and Documentation</td>
</tr>
<tr>
<td>3</td>
<td>Summary</td>
</tr>
</tbody>
</table>
2.3 Check Results and Documentation

Data Transfer from every Point of Authentication to Central Database

Offers customers, retailers and manufacturers various possibilities for data analysis and additional benefits (condition monitoring, customers classification etc.)
# Agenda

## 1 Product Piracy in Mechanical Engineering

## 2 Integrated Protection System

### 2.1 At-Risk Components

### 2.2 Fraud-Resistant Features and Originality Check

### 2.3 Check Results and Documentation

## 3 Summary
Functions of the ProAuthent-System

Basic Functions:

- Marking of “at-risk” parts and components with fraud resistant features to distinguish between originals and counterfeits
- Possibility of a secure on-site authentication (offline) for different marking technologies to be sure of the originality
- Possibility to transfer checking results to a central data base

Functions of tracking and tracing:

- Tracing of products along the supply chain with different authentication points to protect the whole supply chain against counterfeits
- Protection of machines
- Increasing the transparency along the SC
- Documentation in the central database for subsequent traceability
Agenda

1. Product Piracy in Mechanical Engineering
2. Integrated Protection System
   2.1 At-Risk Components
   2.2 Fraud-Resistant Features and Originality Check
   2.3 Check Results and Documentation
3. Summary

Thanks a lot! Any questions?
<table>
<thead>
<tr>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>[BMBF-06] Bundesministerium für Bildung und Forschungs:</td>
</tr>
<tr>
<td>BMBF, Bonn, 08.08.2006</td>
</tr>
<tr>
<td>‘Fingerprinting’ documents and packaging</td>
</tr>
<tr>
<td>Unique surface imperfections serve as an easily identifiable feature in the fight against fraud.</td>
</tr>
<tr>
<td>[Fuc-06] Fuchs, H. J.; Kammerer, J.; Ma, X.; Rehn, I. M.:</td>
</tr>
<tr>
<td>Piraten, Fälscher und Kopierer</td>
</tr>
<tr>
<td>Strategien und Instrumente zum Schutz geistigen Eigentums in der Volksrepublik China</td>
</tr>
<tr>
<td>Gabler, Wiesbaden, 2006</td>
</tr>
<tr>
<td>[GS1-10] <a href="http://www.gs1-germany.de">www.gs1-germany.de</a></td>
</tr>
<tr>
<td>Date: 11 June 10</td>
</tr>
<tr>
<td>[ICC-06] ICC – International Chamber of Commerce:</td>
</tr>
<tr>
<td>anti-counterfeiting technology</td>
</tr>
<tr>
<td>A guide to Protecting and Authenticating Products and Documents</td>
</tr>
<tr>
<td>ICC, Barking (GB), 2006</td>
</tr>
<tr>
<td>[Mal-05] Malik, H.; Schindler, S.:</td>
</tr>
<tr>
<td>Fälschungssichere Verpackungen</td>
</tr>
<tr>
<td>Sicherheitstechnologien und Produktschutz</td>
</tr>
<tr>
<td>Hüthig, Heidelberg, 2005</td>
</tr>
</tbody>
</table>
OECD:
Die wirtschaftlichen Folgen von Produkt- und Markenpiraterie
OECD, Paris, 2008

PTB – Physikalisch-technische Bundesanstalt:
Aufruf am 29.10.2009

Rat der EU:
Sicherheitsdokumente
Sicherheitsmerkmale und andere einschlägige Fachbegriffe
Aufruf am 29.10.2009

VDMA:
Produkt- und Markenpiraterie in der Investitionsgüterindustrie 2008
Bundesministerium für Bildung und Forschung

Wildemann, H.; Ann, C.; Broy, M.; Günthner, W.A.; Lindemann, U.
Plagiatschutz
Handlungsspielräume der produzierenden Industrie gegen Produktpiraterie
TCW, München, 2007

Winkler, I.; Wang, X.:
Made in China – Marken- und Produktpiraterie
Strategien der Fälscher & Abwehrstrategien für Unternehmen
www.fml.mw.tum.de

Dipl.-Wi.-Ing.
Dominik Stockenberger

Thanks a lot! Questions?