Physical Intrusion Detection Using RFID

Trends, Technology, Problems

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Classical Divide: Physical vs. Logical Security

- **Physical**: Fire alarm, burglar alarm systems, door locks, badges and access cards, video cameras, etc.

- **Logical**: Server logs, Router security, Firewalls, IDS / IPS, Honeypots, Network AAA services (Authentication, Authorization, Accounting), etc.

Convergence of Logical and Physical Security

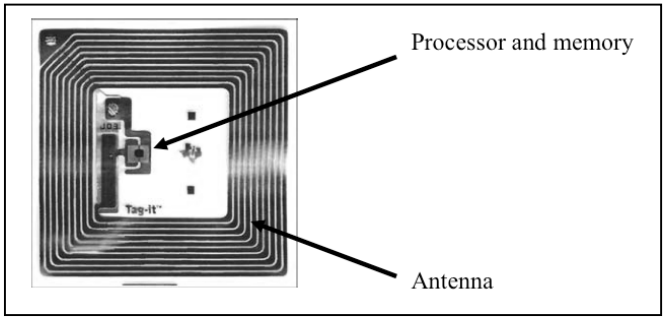
- **Convergence**: Physical and logical security systems start to cooperate.
- Integration into **Enterprise Security Management** systems.
- In the field of **Intrusion Detection**, existing detection and analysis infrastructure can be upgraded to deal with physical events: **Physical Intrusion Detection** (PHIDS).

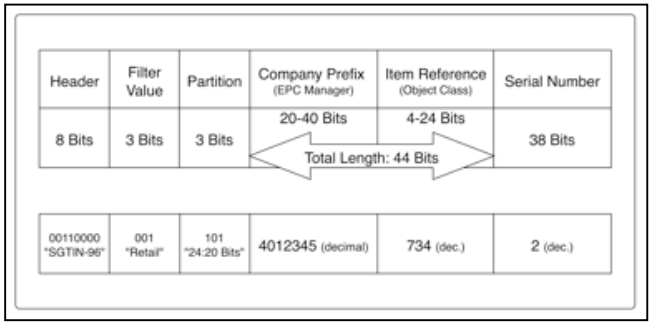
Physical Intrusion Detection (PHIDS)

- **Monitoring access** to buildings, rooms, devices.
- **Tracking**: Detailed tracking of employees and devices in high security areas.
- **Asset management**, including verification of change requests.
- Identification and tracking of (infected) **mobile devices** inside of the company perimeter.
- **Global RFID tagging** of items could create a new quality of physical monitoring.
- Automated **detection and exact interpretation of physical objects** (e.g., cameras, weapons), unauthorized use of company property, theft.

RFID & EPC: Further Bridging the Gap

- **Electronic Product Code** (**EPC**): RFID Tags on objects transmit a **globally unique serial number** - via radio.
- Reading range depends on model, frequency and surroundings (absorbing materials).



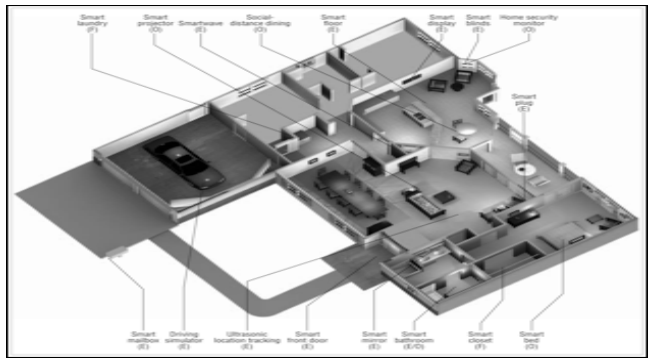


RFID: The Impact of Item-level Tagging

- First pilot deployment of **item-level** RFID-tagging in logistics and shops today.
- Tagging of consumer items is expected by many business experts within the next decade - caveat: **Privacy concerns.**
- Item-level tagging could also enable **after-sale services**.
- Example home applications: **"Smart" shelves and fridges** know their inventory, enabling delivery or recommendation services.

The Future Office?
Ubiquitous Computing and Smart Buildings

- RFID is a key enabling technology for **"Smart" Environments** (Ambient Intelligence, **Ubiquitous Computing**).
- Even if other sensor technology and image recognition advances, **RFID will stay simple, effective and cheap**.
- Examples: Gator Tech Smart House, METRO Future Store.



PHIDS Method 1: Using RFID Readers

- RFID readers can in principle **read all tags in their vicinity** via radio communication. These directly collected EPCs could then be analyzed for **patterns of misuse**.

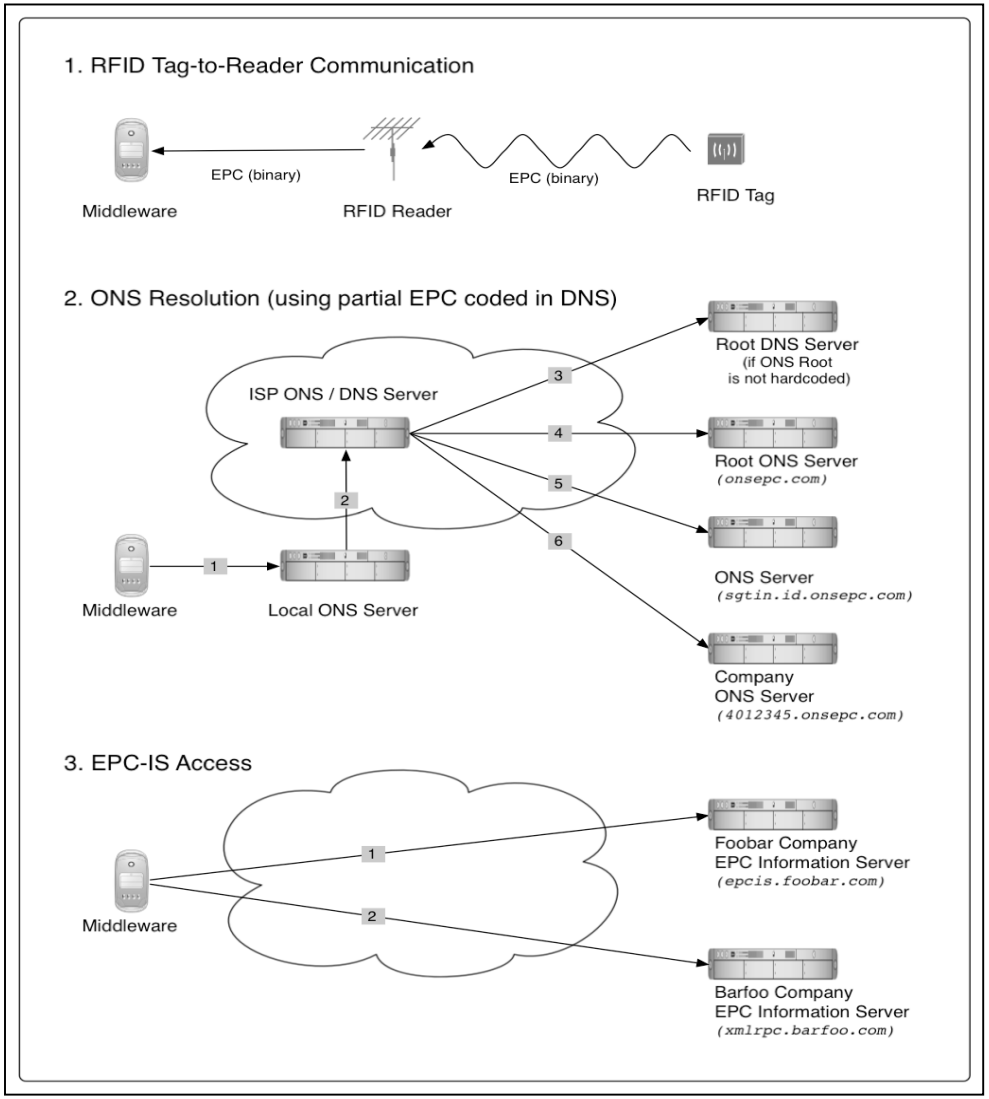
- Cost reduction for tag and reader infrastructures: Readers could be **already in place** for a primary business function.

- Placing of **additional readers at critical locations**, like elevators, stairs, exits could increase **monitoring coverage**.

PHIDS Method 2: Investigating Network Traffic

- Using RFID in an enterprise will generate huge amounts of **EPC-related network traffic** between readers, middleware, applications. This can be investigated using normal **Network IDS**.
- **EPC Network**: A global distributed information storage and retrieval system for object information and history.
- Its **lookup** service called **Object Naming Service** (ONS) will be based on **DNS**.
- The **actual data sources** are called **EPC Information Services** (EPCIS): They use **Web Services** communication (e.g., XML-RPC, SOAP).

The EPC Network



Physical Markup Language - From Supply Chains to PHIDS Signatures?

- PHIDS **signatures** will need to **"understand"** parts of the **physical topology**, as well as **item categories**, and how they relate to corporate security policy.
- This information will already be needed for **many business processes**, and could be adapted to PHIDS. PHIDS could be used to **audit and verify** these processes.
- This information will be formulated using the **Physical Markup Language (PML).** PML is based on XML, created to describe RFID and sensor data, as well as object properties.

Detection and Correlation Problems

- Data Storage, Aggregation and Transfer: How to cope with anticipated **data masses** to be investigated and generated by PHIDS, e.g. in smart environments?
- Integration and correlation of **heterogeneous physical and logical security systems** will not be easy (e.g., event logging).
- **False positives**! What are the **implications** of errors, i.e., would building doors stay shut, or police be constantly alarmed?
- **False negatives**! Tag **removal**, radio **transmission problems** and emerging **RFID protection measures** (though corporate policy may forbid protected tags).

Backlash on Corporate Privacy: EPC Resolving

- One problem in **classical** intrusion analysis: Reverse DNS lookup of attacker IP addresses can **inform attackers** of who and when someone follows their actions.
- PHIDS using RFID (actually every EPC Network application): **Resolving EPCs can create traces** on networks and servers outside of the company.
- Corresponding potential **profiling of item flows** could constitute valuable **business intelligence**, and in turn increase corporate risk.

Risks for Individual Privacy

- Ubiquitous reading out of **personal assets**?
- **Tracking people**.
- **Profiling** of individuals (employees, customers, visitors).
- Creation of **global surveillance infrastructures** by linking local PHIDS (e.g., outsourcing using third party **Managed & Monitored Security Services**)?
- What **Privacy Enhancing Technologies** could be used? Protecting the tag, protecting the EPC, the collected data and preventing inferences by **data mining**?

Conclusion

- RFID, EPC Network, PML: New and systematic approach for **identifying, interpreting and tracking of physical objects** by IT systems.
- High demand: RFID in **supply chains** and **asset tracking**.
- PHIDS using RFID could be used as an **independent audit trail of core business processes** ("... are my smart objects really moving where my ERP system tells me?") and **corporate security policy**.
- **Privacy**: Where will this convergence lead us to? **Are the negative effects on personal privacy controllable at all**? Which PET could be implemented to reduce these threats?