Contactless Payments Chip Design
CTST 2009 – New Orleans, LA

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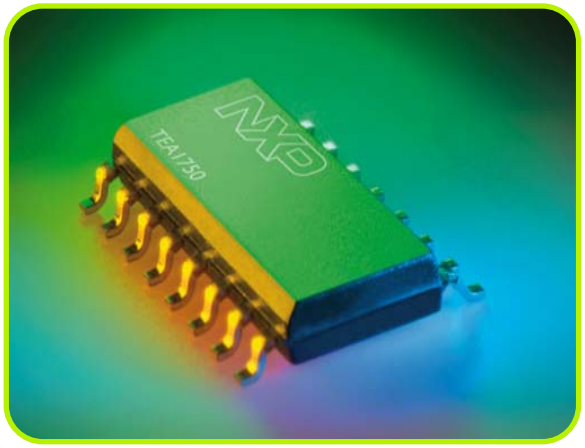
Agenda

1. NXP Semiconductors
2. Setting The Stage
3. Secure Chip Design
4. Secure Chip Environment
5. Secure Chip Evaluation and Certification
6. Conclusion

Company Profile

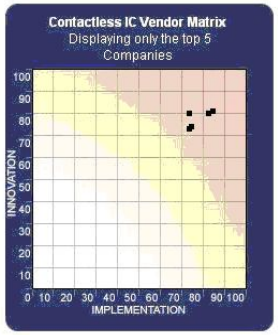
- **President & CEO:** Rick Clemmer
- **Headquarters:** Eindhoven, The Netherlands
- **Net sales:** $5.4 billion in 2008 *)
- Established in 2006 (formerly a division of Philips)
- 50+ years of experience in semiconductors

- **Leadership positions in contactless & security**
  - **Banking solutions**
    - Supplied >500 million banking cards in 35 countries
  - **eGovernment solutions**
    - Supplying 80% of ePassport projects worldwide
  - **Public Transportation**
    - Mifare is used in >70% of the global transport infrastructure
  - **NFC solution**
    - Creator of NFC technology together with Sony
    - NXP products used in about 100 NFC trials worldwide



Contactless IC Vendor Matrix Top 5 Listing:

RANK	COMPANY
1	NXP Semiconductor
2	INSIDE Contactless
3	Infineon Technologies AG
4	Texas Instruments Inc
5	Sony Corporation



Denotes highest rated company along the Implementation scale
Denotes highest rated company along the Innovation scale

Source: ABI Research, 2008

*) These figures include the Mobile & Personal business which was largely part of the ST-NXP Wireless JV in 2008

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Setting the stage

Contactless Payment Chip Design - Objective

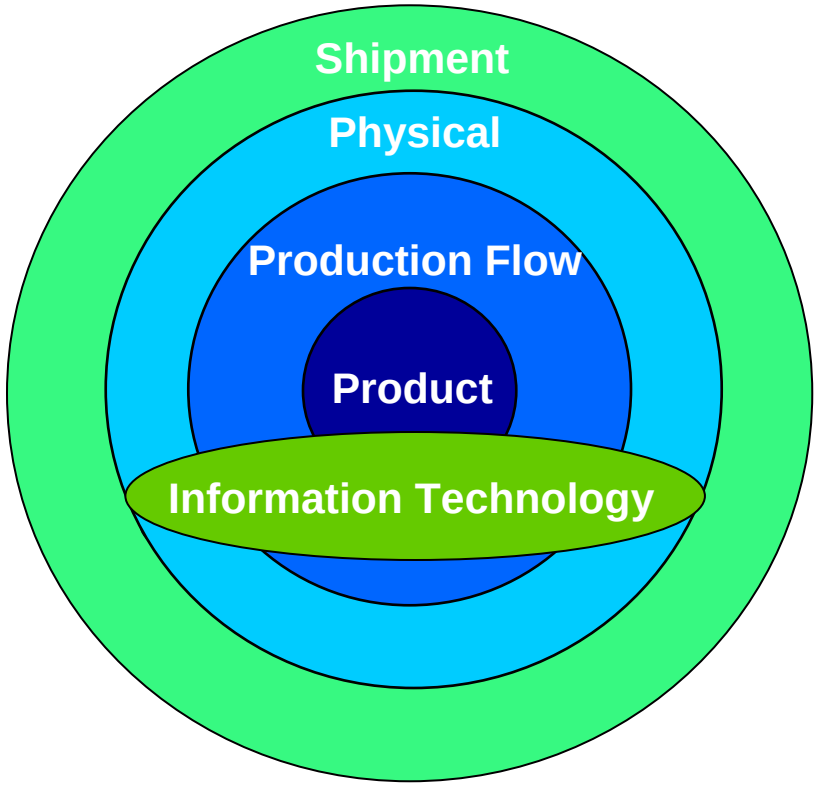
To meet or beat the customer's requirements in the application in terms of

- **Performance**
  - Typically defined in the application specification
  - Analog!
- **Security**
  - Typically defined by the (end-) customer
  - Often referencing standardized or non-standardized security criteria
- **Reliability**
  - Supply
  - Reputation
- **Cost**
  - Competitiveness

Product Security Assessment

General Approach

- **Product**
  To meet the customer's security requirements in the final application.
- **Production Flow**
  To prevent/ detect loss or manipulation of the security product.
- **Shipment**
  To prevent/ detect loss or manipulation of security product.
- **Site Security**
  - Physical Security
    To prevent unauthorized access to security data, products and facilities
  - Logical (IT) Security
    To prevent loss of confidentiality and integrity of security objects/data



Product Security Evaluation & Certification

General Aspects

- **Security** is defined as a state free from unacceptable risk.

- To obtain a **Security Certificate** for a Security Product (Chip), the evaluation comprises the following aspects.

  - **Chip related**
    - Evaluation of the design (including source code)
    - Tests to verify the design
    - Vulnerability Assessment

  - **Chip environment related**
    - Evaluation Audit of the Configuration Management
    - Evaluation Audits of the development environment at the concerned sites
    - Evaluation Audits of the production environment over the entire supply chain

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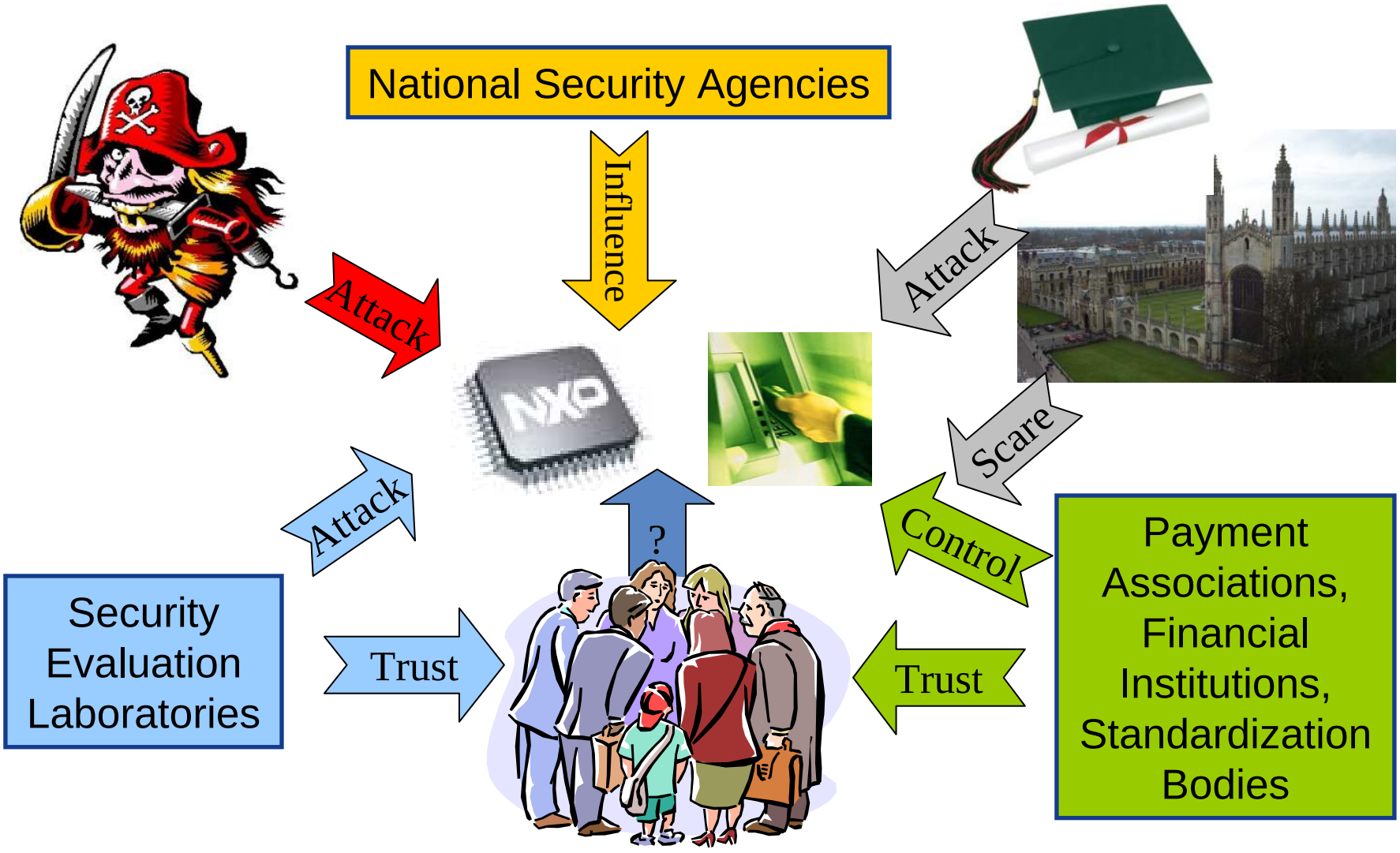
The Battleground

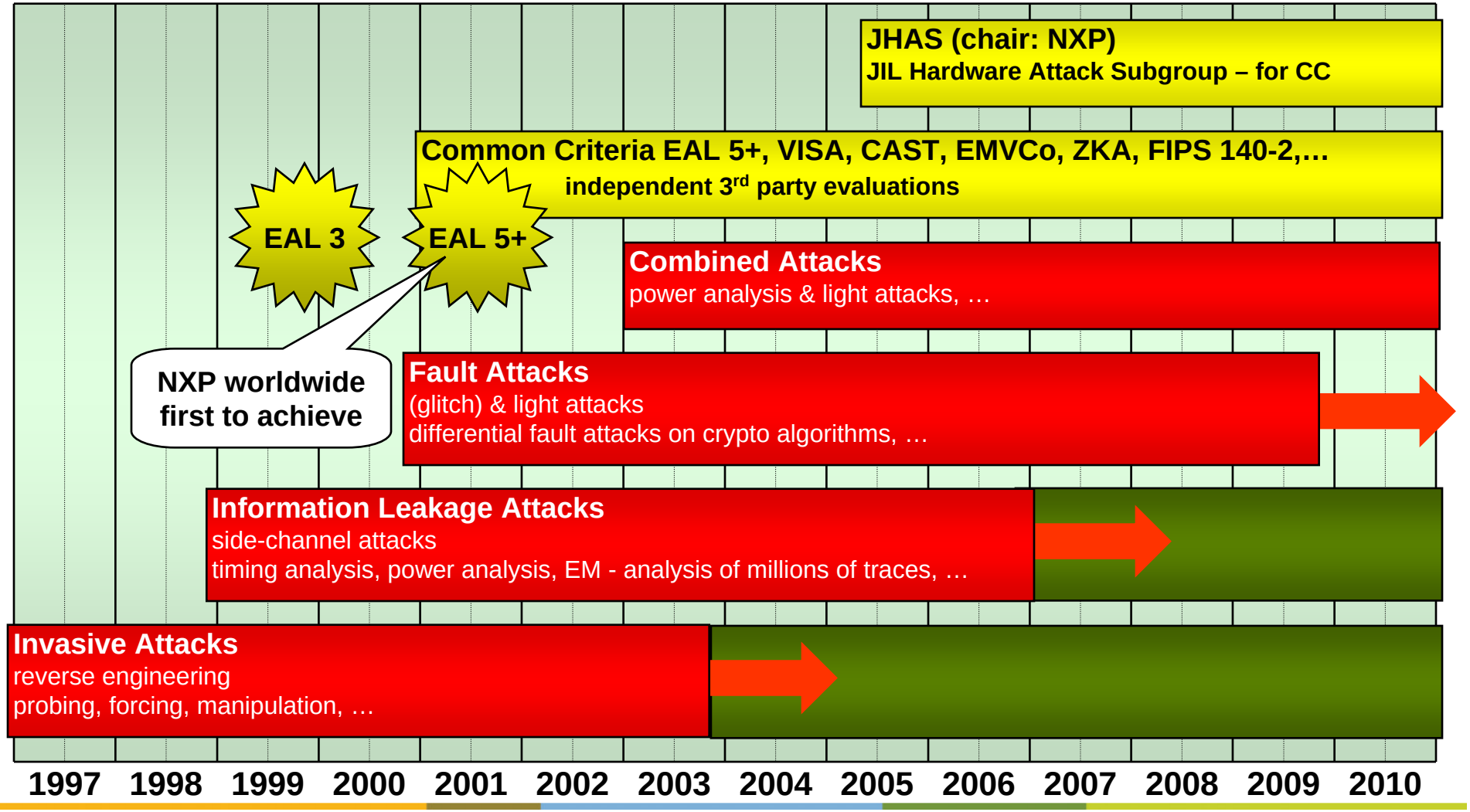


Introduction – Smartcard-based Systems

- **The security of a system is a holistic property**
  - A system usually consists of many components, all of which contribute.
  - The system is only as strong as its weakest link.
- **Light-weight card systems**
  - Are based on relatively cheap cards (e.g. simple ASICs or standard OTS [Off-The-Shelf] CPUs), and a very strong back-end system.
  - Typically used when the number of (to be) deployed consumables is very large (e.g., Public Transport).
- **Heavy-weight card systems**
  - Are based on more expensive, highly secure cards (containing a dedicated high-security CPU core and crypto coprocessors) that “can survive on their own” for a long time in a hostile environment.
  - Typically used when the number of cards is not so large, or no back-channel exists (e.g., Banking, Access Control, eGovernment, Pay-TV).
  - Typically certified with Common Criteria at EAL 4+, EAL 5, or EAL5+

Security Roadmap

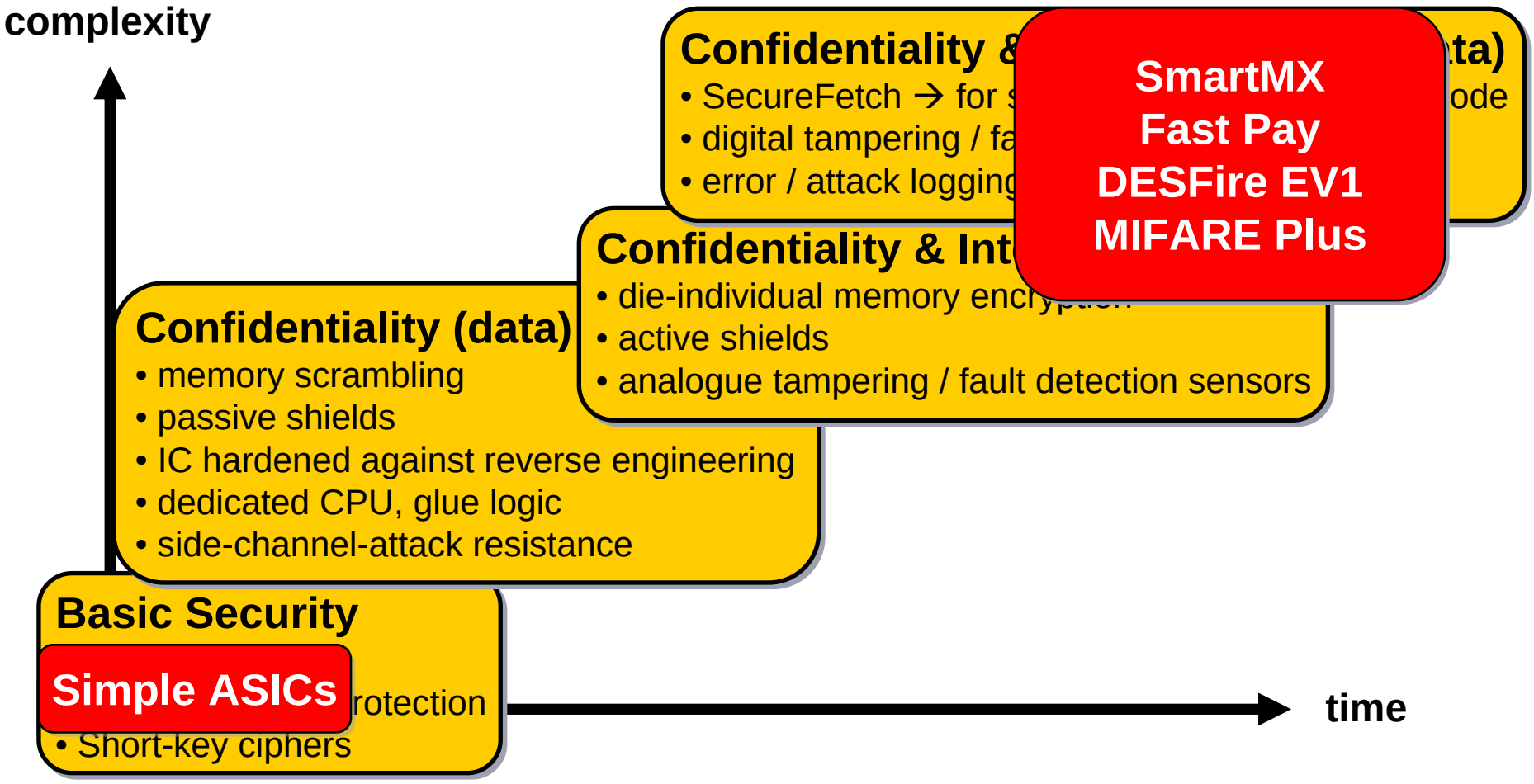
Attacks on Smart Cards



JHAS group in CC Scheme – ~30 Members

Security Roadmap

Evolution of Defences



Security threats landscape – SmartMX

NXP comprehensive Security Concept

More than **100 unique security features** harden the SmartMX.

Licensed Countermeasures against Differential Power Analysis (**DPA**).

Proven by third party security assessments and type approvals:

EMVCo security evaluation
CAST
VISA
Common Criteria EAL5+
ZKA
Approval for German Signature Card


Deutsches IT-Sicherheitszertifikat

BSI-DSZ-CC-0227-2004
Philips P5CT072V0M and P5CC072V0M Secure Smart Card Controller
from
Philips Semiconductors GmbH
Business Line Identification

Evaluation Results:
PP Conformance: Protection Profile BSI-PP-0002-2001
Functionality: BSI-PP-0002-2001 conformant plus product specific extensions Common Criteria Part 2 extended
Assurance Package: Common Criteria Part 3 conformant EAL5 / augmented by: ALC_DVS.2 (Life cycle support - Sufficiency of security measures), AVA_MSU.3 (Vulnerability assessment - Analysis and testing for insecure states), AVA_VLA.4 (Vulnerability assessment - Highly resistant)

Born, 16 September 2004

Common Criteria

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Security Management System

Secure Chip Environment

- **Implementation of a Security Management System (SMS) minimizes the (unacceptable) risks of**

  - Breach of Confidentiality (i.e. information leakage)
  - Integrity (i.e. manipulation of information)
  - Misuse (of information and resources)
  - Economic damages
  - Damage to Reputation

  and supports a close, auditable relationship between Chip Maker, Suppliers, and (End-) Customers.

Security Management System (SMS)

General Requirement

- SMS Implementation throughout the entire development and production process
- Security Policy - Management Team Commitment and assigned responsibilities
- SMS Documentation as integrated part of the Quality System Documentation
- Sufficiency and effectiveness of the SMS need to be checked periodically by 3rd party evaluation site visits.
  - The SMS can e.g. follow security assurance requirements according to Common Criteria (ISO15408)

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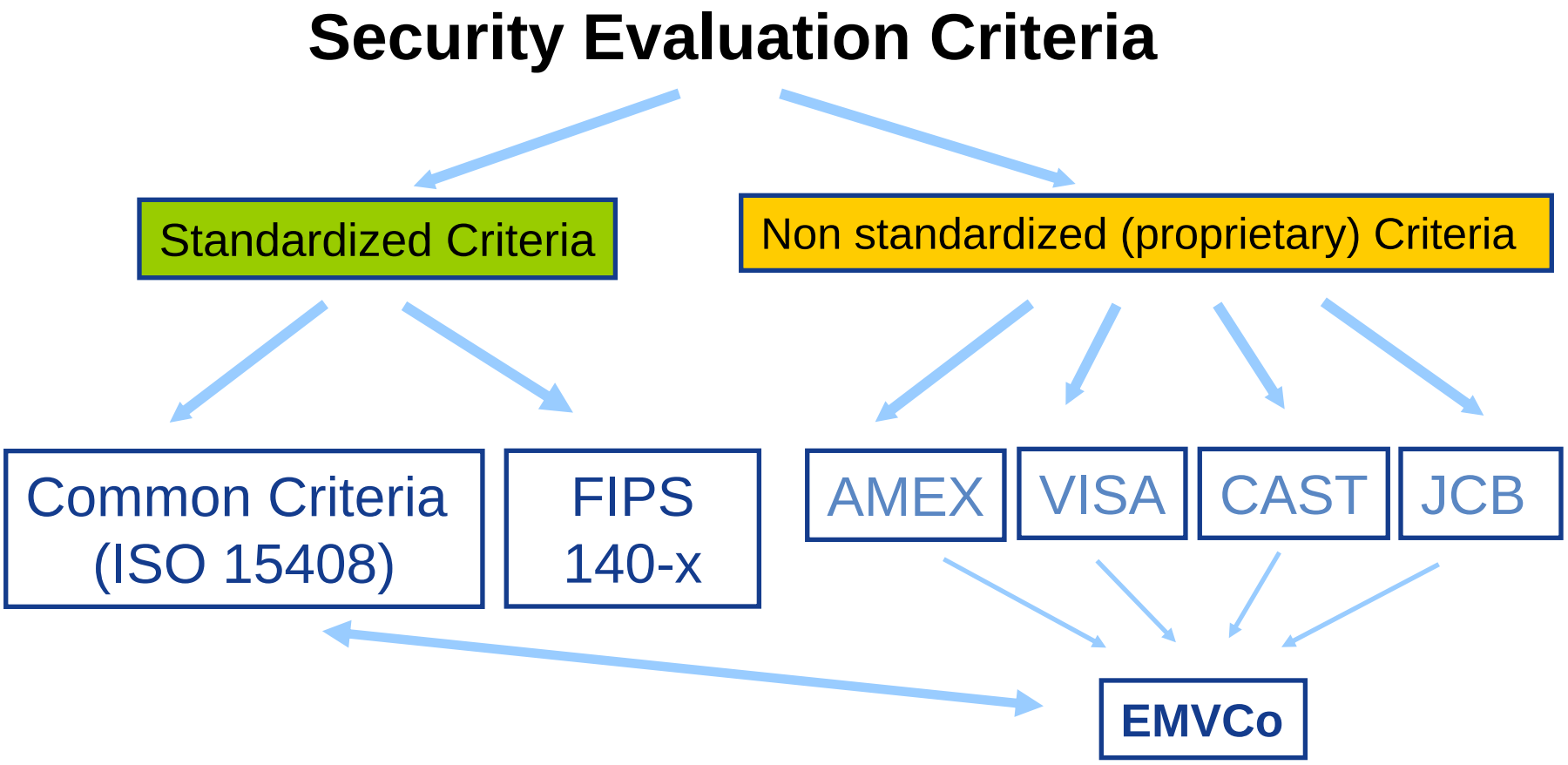
Security Evaluation

Current situation

- Different requirements for different applications
  - Common Criteria
    - German Sig. Law, Passport, Healthcard, Tachograph
    - French banking applications or health card
  - Market driven criteria (banking applications)
    - VISA / MC (CAST) / JCB
    - EMVCo
    - ZKA
  - FIPS 140-2
    - E.g. US Government requirements
  - MULTOS
- Several evaluations of the same HW
  - Time consuming, expensive

Security Evaluation

Current situation



EMVCo approval = H/W approval, Basis for Type Approval

Relevant Formal Card Testing Processes

Example: MasterCard & Visa Type Approval

- **Pre-requisite:** EMVCo. (H/W) Approval
- **MasterCard**
  - Analog Interface Testing
    - Electro-magnetic behavior
  - Digital and Application Testing
  - Performance Testing
  - Combination Testing
    - Card – Reader interaction
  - Card Quality Management
    - Audit of the manufacturing site(s)
  - Compliance Assessment & Security Testing (CAST)
    - Security evaluation of the chip, the OS, and the application
- **Visa**
  - Chip Hardware Security Evaluation Process
    - Not applicable for MSD 1.4.2
  - Functional Testing
    - Analog and Digital Testing
      - magnetic field characteristics
      - timing, anti collision, and protocol
    - Application and/ or Visa GlobalPlatform Testing
  - Risk Testing
    - Security evaluation of the chip, the OS, and the application

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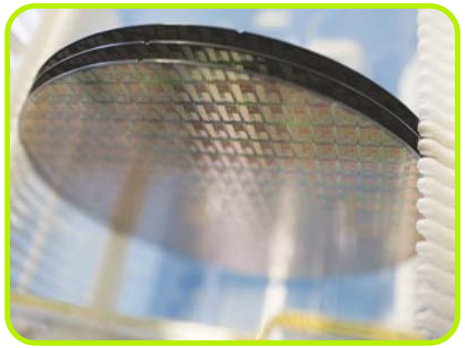
Conclusion

- Design of a (secure) Contactless Payment Chip is a very **involved** and **resource-intensive** process.
- Time to market and cost of security evaluations and certifications will continue to drive the **consolidation of non-standard security criteria** to standard security criteria such as Common Criteria.
- Chip Security is a moving target (a race). Market participants contribute to constantly raising the bar for secure chip design. Continuous investments into both **Secure Chip Design Processes** and a holistic **Security Management System** have proven to be a successful and sustainable approach.

Thank You for your attention!

Q & A



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