

Smart Card Technology Capabilities

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Smart Card Basics

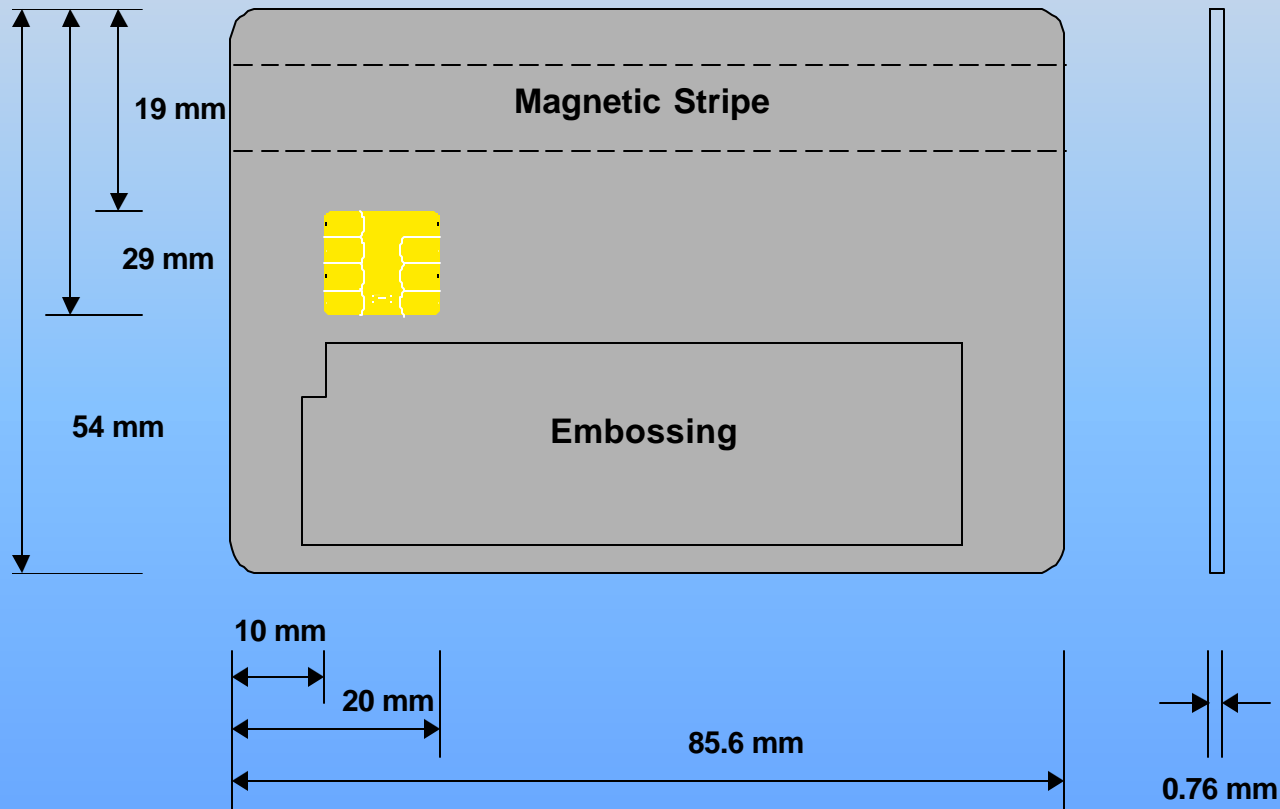
- Definition
- Components
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- Applications

Definition

- What is a smart card?
 - A plastic card with an embedded microprocessor chip.
- What is the essence of a smart card?
 - Authentication
 - Data storage
 - Validation
 - Self-lock mechanism

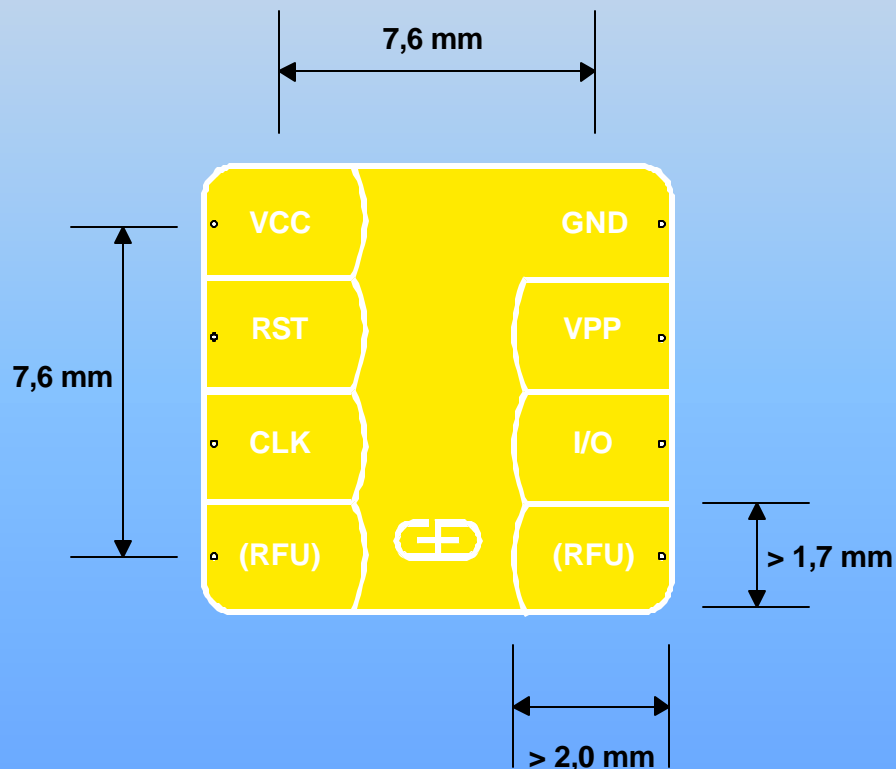
The Dimensions

Smart Card according to ISO/IEC 7810 and ISO/IEC 7816-2



The Contacts

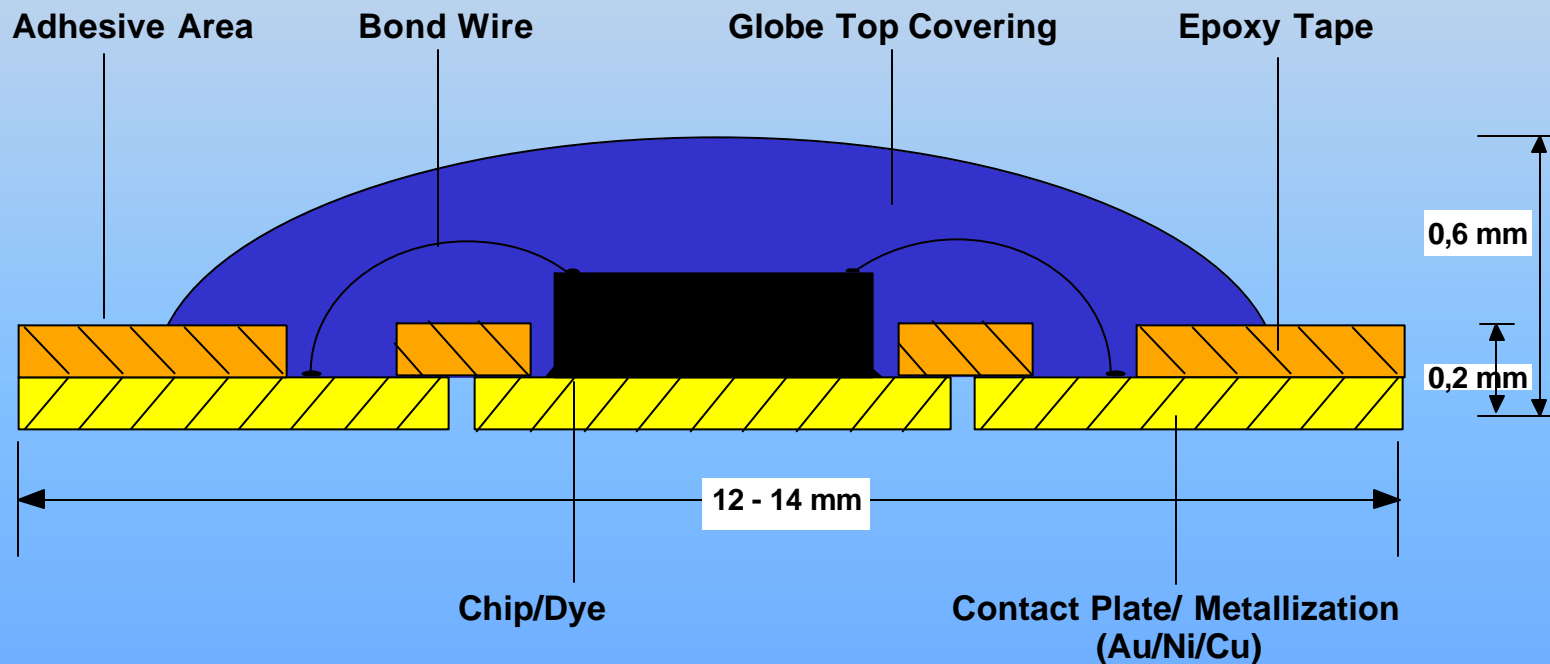
Contacts of the Smart Card Module according ISO/IEC 7816-2



- VCC Power Supply Voltage
- RST Reset
- CLK Clock
- RFU Reserved for Future Use
- GND Ground
- VPP Programming Voltage
- I/O Input/Output

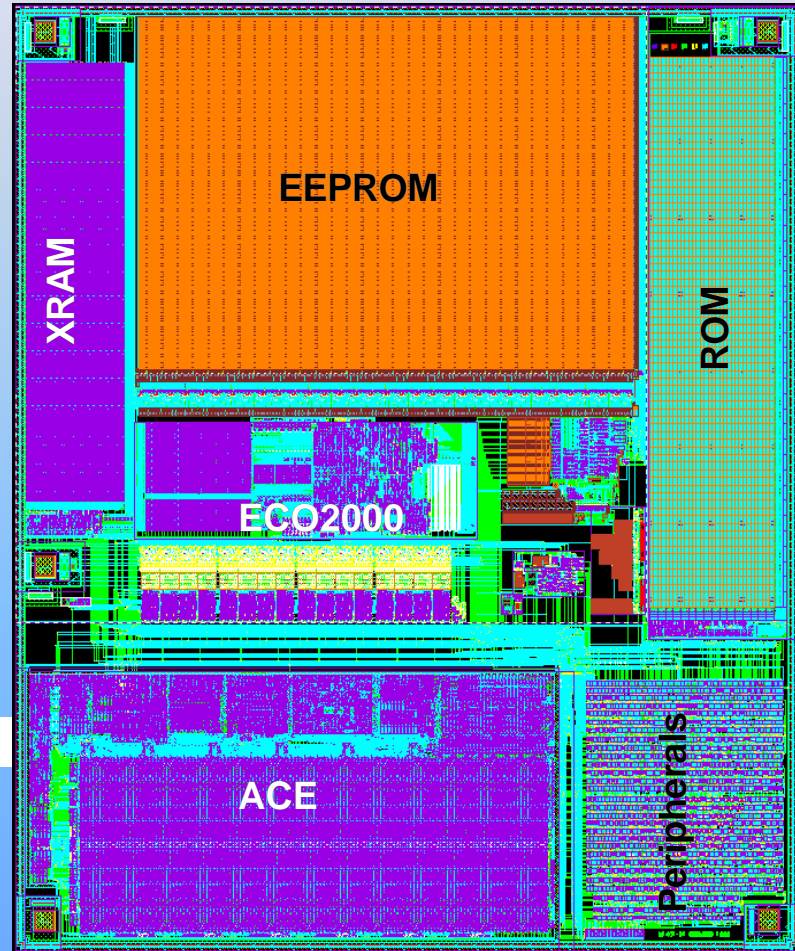
The Module

Cross-Section of a Smart Card Module

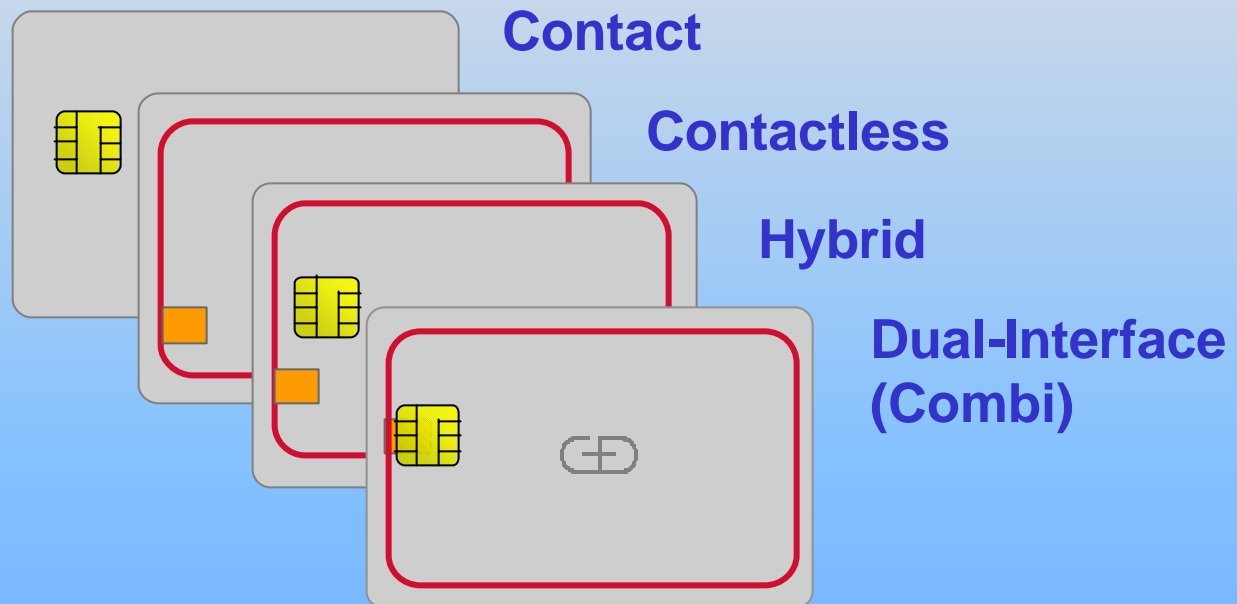


The Chip

- Features:
 - 32 kByte ROM
 - 16 kByte EEPROM
 - 1.3 kByte RAM
 - Crypto Unit ACE
- Chip size:
 - Area = 21.23 mm²
 - x = 4.28 mm, y = 4.96



Different Types



How Smart?

- Simple Memory Card
 - No Security
- Intelligent Memory Cards
 - Access Control Conditions for defined areas
 - Dedicated functionality (e.g., Telephone-Chip Card)
- Microprocessor Card
 - Microcomputer / Microcontroller
- Super Smart Card
 - Microcomputer, Keypad, Display, Battery, etc.

Relevant Standards and Specs

- ISO 7810
- ISO 7816
- ISO 14443 Types A and B
- Java Card 2.1.1 and 2.2
- Global Platform Card Specification 2.0.1' and 2.1
- GSCIS v2.1 (draft)

Types of Usage

- Identification and authentication
- Encryption and digital signature (RSA 1024/2048 bit; on-card key-pair generation)
- Biometric (on-card matching)
- Secure Data storage
- Single Sign-on

Assessing the Current Technology

Areas to Assess:

- Card Operating System (COS)
- Protocol
- Memory capacity
- Functionality

Card Operating System

File-structure vs. Java Card

ISO 7816 part 4 +
compliant COS



Java Card and
Global Platform
compliant COS

Analogous to

Unix

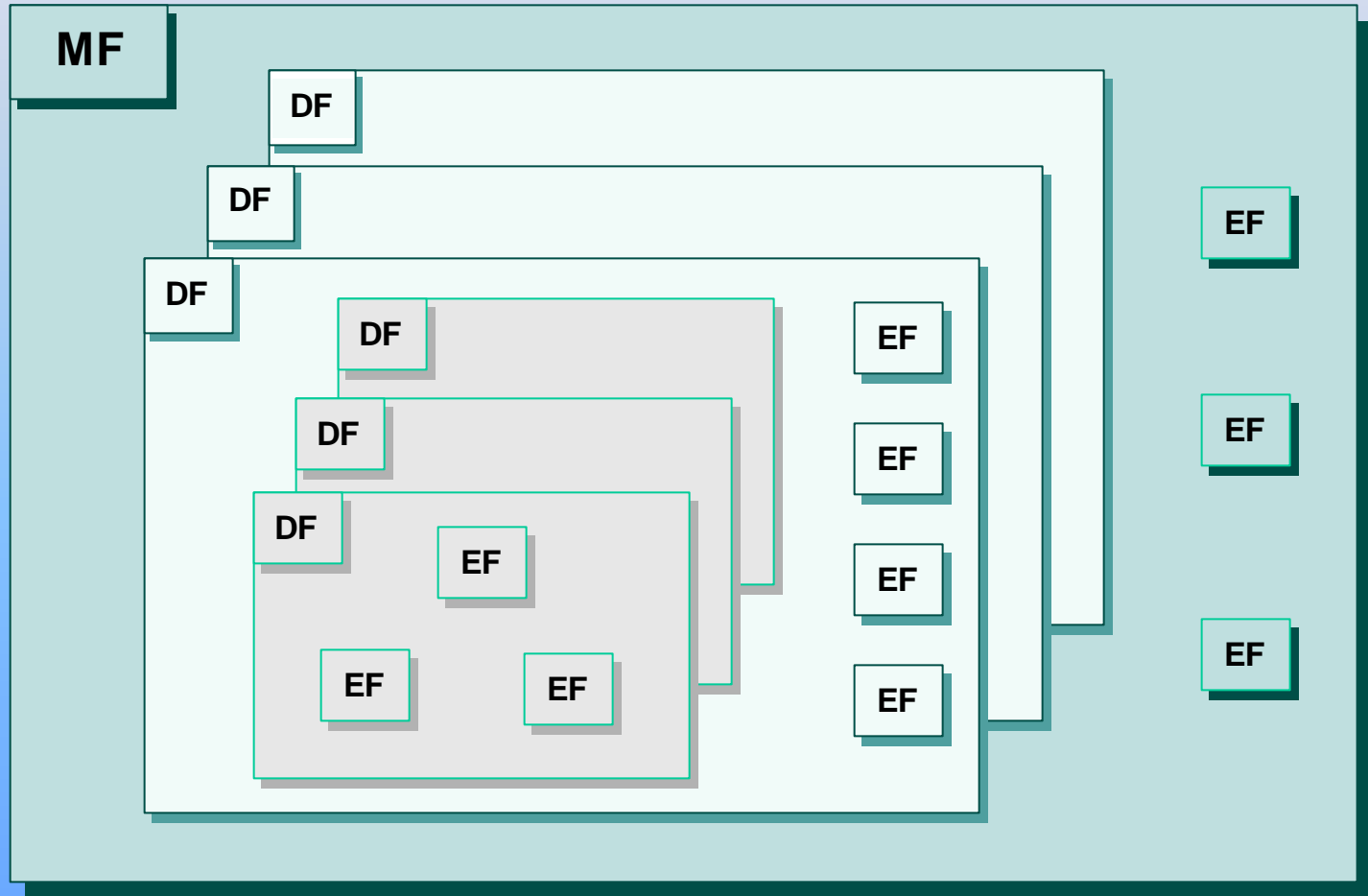


Windows[®]™

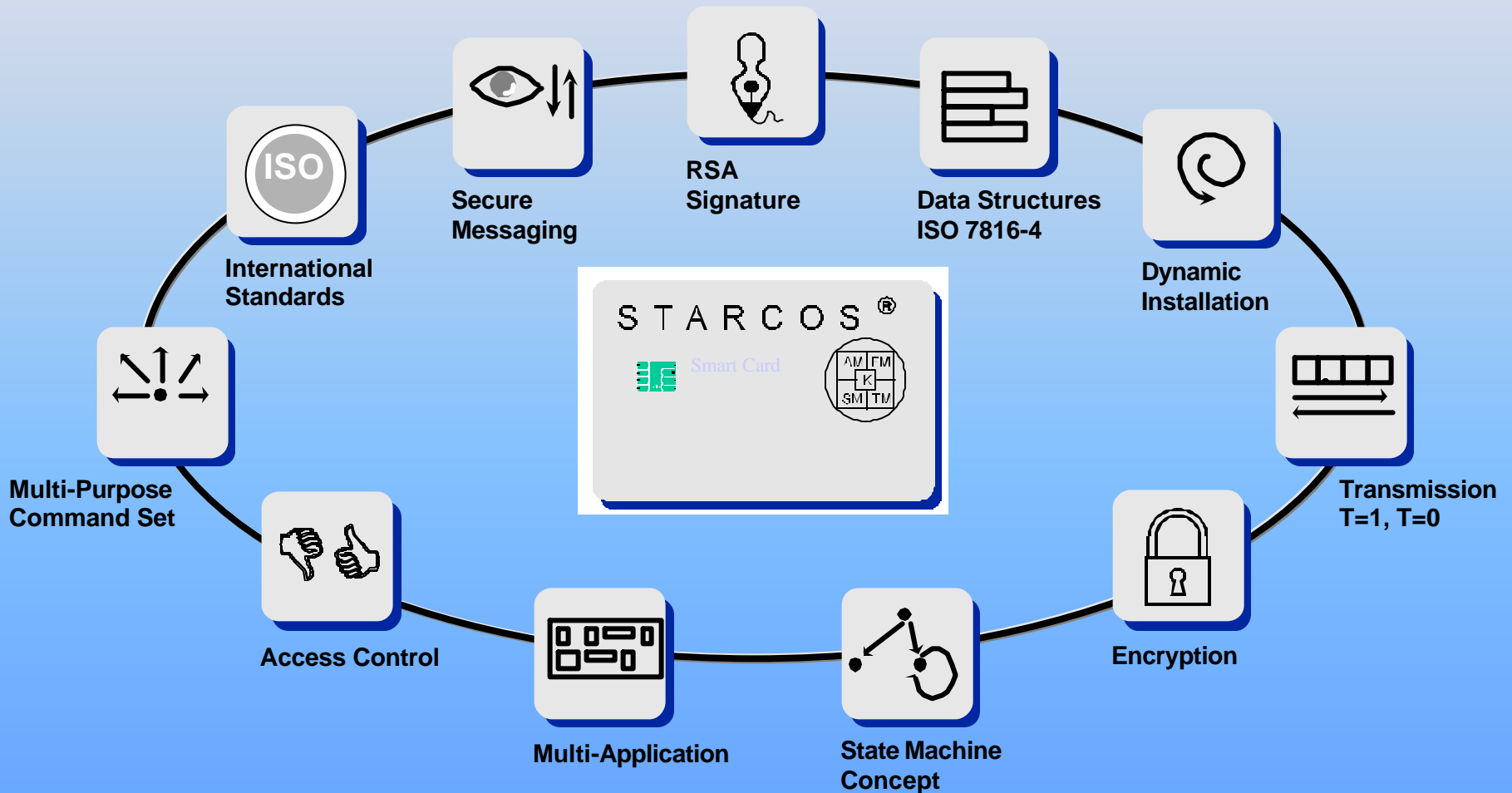
There are Pro's and Con's for both types of COS's. Both can be made secure and flexible. It is analogous to comparing Unix and Windows[®]™ operating systems. The philosophical arguments can be made for file-structure-based or Java-based card.

However.....Java Cards are in fashion!

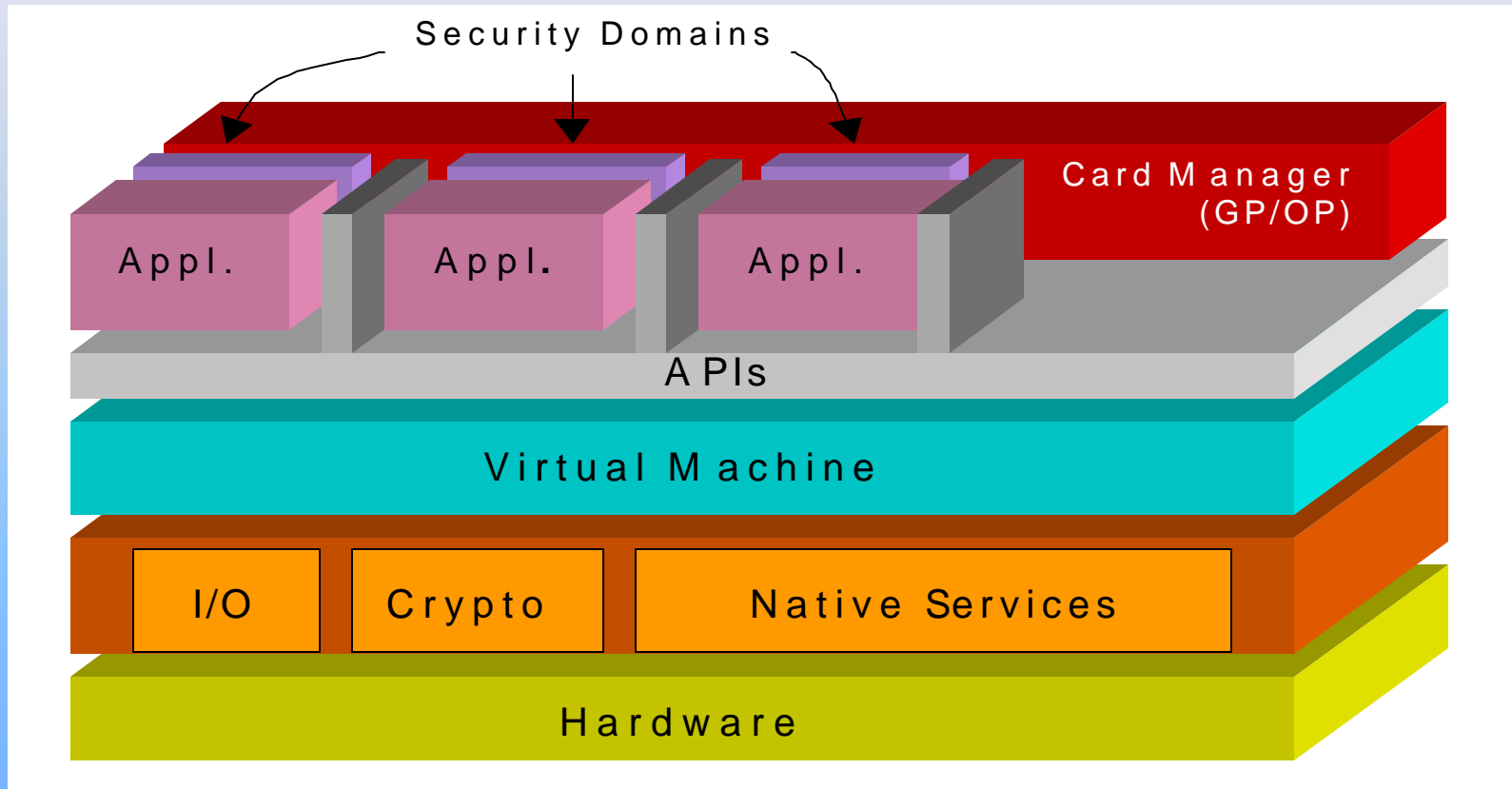
File-Structure Based Smart Cards



Purpose of a Smart Card OS



Java Card Security



- Security is provided by the JCVm, Firewalls and Security Domains

Java Card Basics

- A multi-application smart card
 - Several applications can be loaded on to the same card
 - “Firewall” between applications
 - Sharing between applications
 - ISO-7816/4 compliant application selection.
- Smart card interoperable--
 - at the source code level
 - at the load file level
 - at the loader level.

Protocol

- T=0 : Byte transfer. Developed by the French
- T=1 : Block transfer. Developed by the Germans
- USB : Based on existing USB v.1.1+ Specs.

Memory Capacity

- 16 KB
- 32 KB *
- 64 KB
- 128 KB

* Currently most popular

Functionality

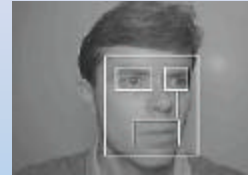
Highlights:

- RSA 1024/2048 bit algorithms
- Triple-DES, SHA-1
- On-card key-pair generation
- On-card Biometrics matching engine

Biometrics On-card Matching

- **Main advantages:**

- Sensor independent



- **Latest developments:**

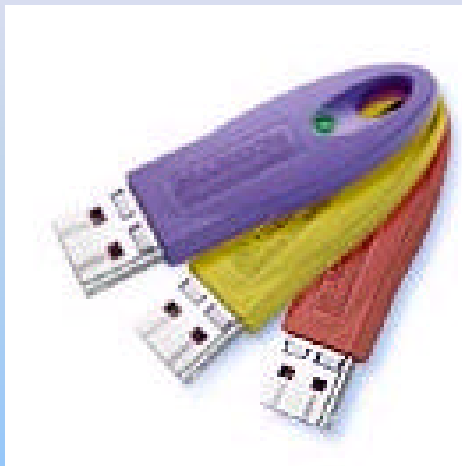
- Fingerprint on-card matching
- Iris on-card matching
- On-card matching Java applet



Basics of On-card Matching

- The actual data is preprocessed in the background system and sent to the card
- Biometric verification takes place on the chip card
- Reference data does not leave the card
- The card itself changes the security status (e.g., unblocks itself) after a successful verification.

Other Form Factors



- Smart chip with USB interface.
 - Same Chip Operating System as on smart card.
 - Connectivity through USB port. Smart card reader not necessary.



- Three features in one single USB device:
 - Multiapplication smart card operating system
 - Fingerprint sensor
 - Image processing software

Current Trends

- Java Card 2.1
- Global Platform 2.0.1'
- 32 to 64K EEPROM
- On-card key-pair generation (RSA 1024-bit)
- Biometric on-card matching (fingerprint)
- Hybrid and composite card bodies (ISO 14443)
- FIPS 140-2, Level 2 or 3

Current Trends



Requirements and Standards

CAC Release 2.0 ICC Specification	
• Java Support	➤ Java Card 2.1
• Standards:	➤ ISO 7816, parts 1-7 ➤ T=0 ➤ EMV. ➤ Global Platform 2.0.1. ➤ DAP verification ➤ Delegated management and services ➤ ISO 10373 Parts 1-3 ➤ ISO 7810 ➤ GSCIS 2.0
• Micro-controller/ Processor:	➤ 32KB EEPROM ➤ 8-bit processor. ➤ Cypto co-processor

Requirements and Standards

CAC Release 2.0 ICC Specification (Cont'd)	
<ul style="list-style-type: none">• Crypto Algorithms:• Digest Algorithms:• Key Exchange:• Signature Algorithms:	<ul style="list-style-type: none">➤ Triple DES➤ SHA-1➤ RSA➤ RSA (1024-bit key length)➤ FIPS PUB 180-1 Secure Hash Standard➤ FIPS PUB 186-1 Digital Signature Standard
<ul style="list-style-type: none">• On-Card Key Generation	<ul style="list-style-type: none">➤ 30 seconds or less
<ul style="list-style-type: none">• Security:	<ul style="list-style-type: none">➤ FIPS 140, Level 2 or 3 validation➤ Countermeasures for Differential Power Analysis and Simple Power Analysis Attacks

Requirements and Standards

Requirements on the horizon:

- \geq 2048-bit key length
- On-card Biometric Verification
- Contactless PKI
- Hybrid and Dual-interface cards
- Super Smart Cards

Next Steps

- Standards are needed to address the coming requirements.
- Existing standards may need to be updated to accommodate the changing technology.
- Validations are needed to test conformance.