Smart Card Chip Operating System Platform
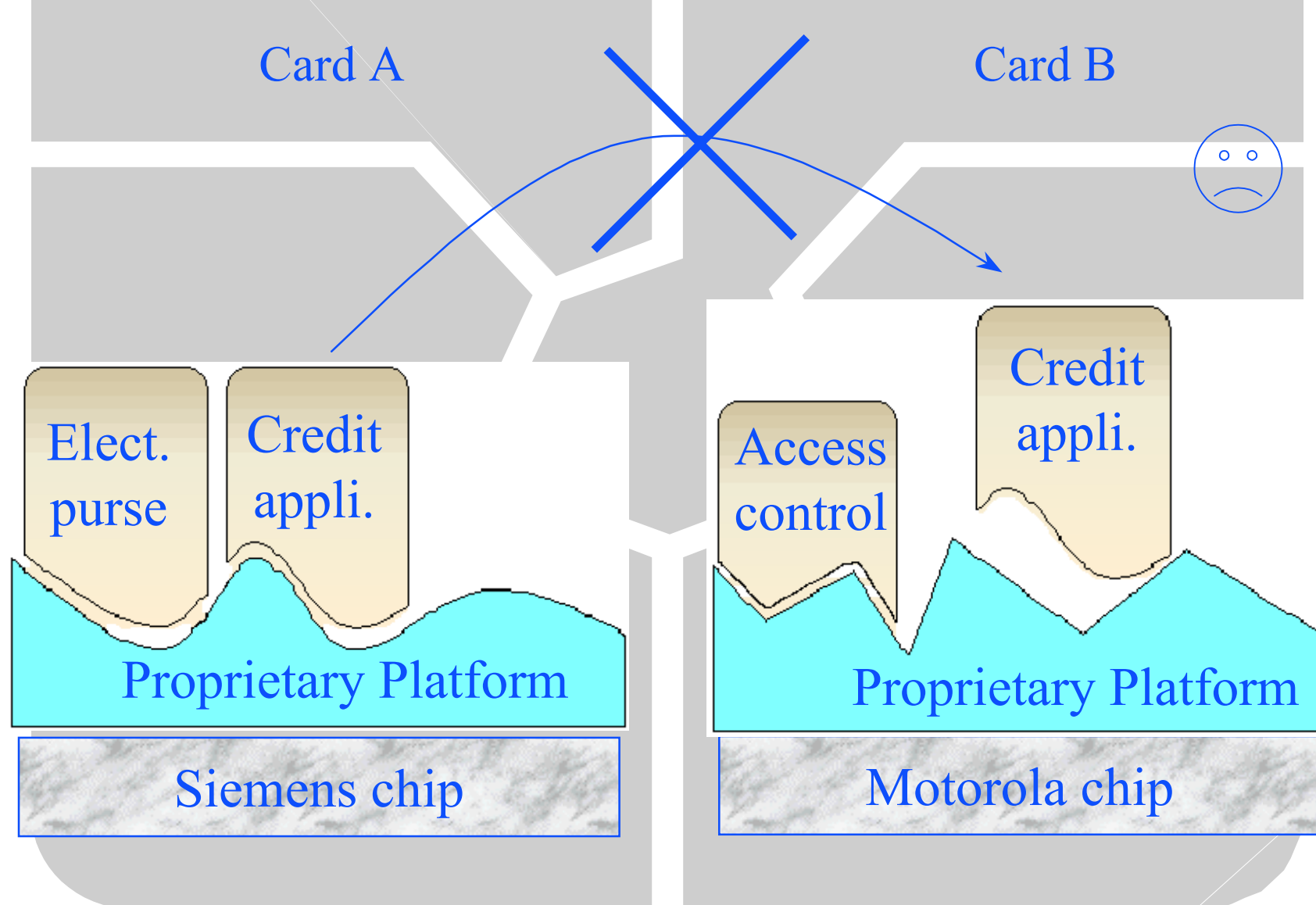
- **Proprietary**
  - non portable across different vendors
  - not open to outsiders
  - Single source
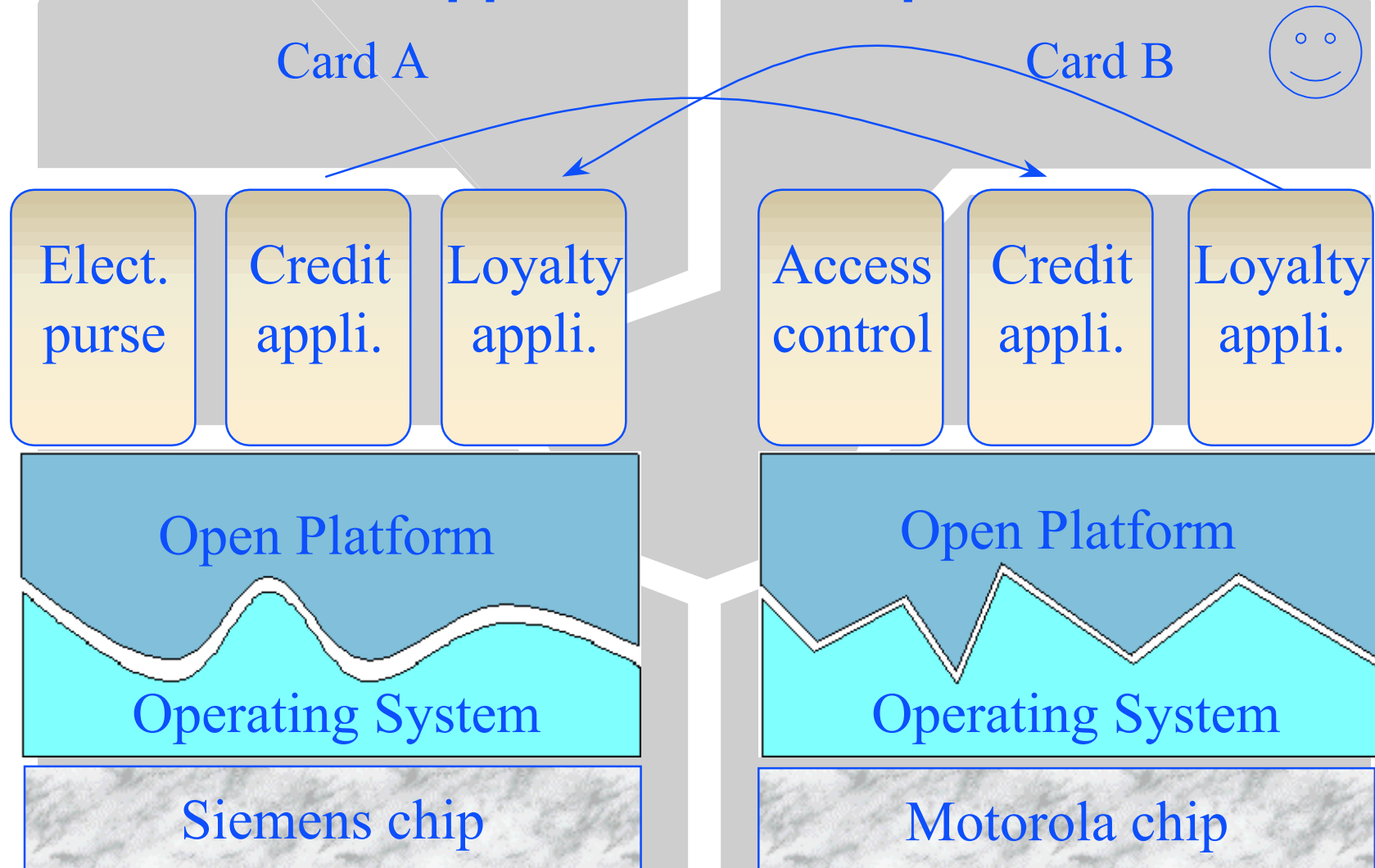- **Open**
  - Multos card
  - Java card
  - Smart card for Windows

Non-Portable Application On Proprietary Platform

Card A

Card B

Elect. purse

Credit appli.

Access control

Credit appli.

Proprietary Platform

Proprietary Platform

Siemens chip

Motorola chip

T&C Technologies

Portable Application On Open Platform

Card A

Card B

Elect. purse	Credit appli.	Loyalty appli.

Access control	Credit appli.	Loyalty appli.

Open Platform

Operating System

Siemens chip

Open Platform

Operating System

Motorola chip
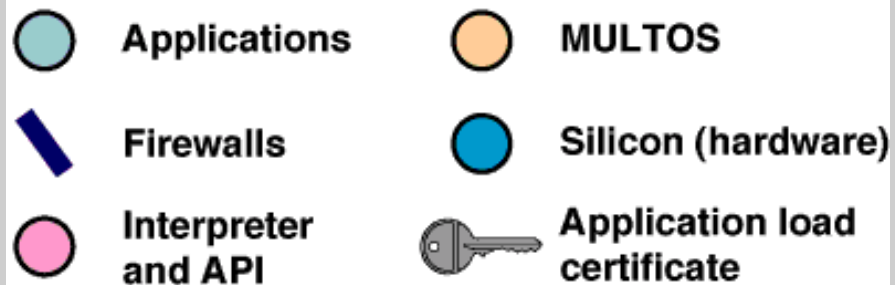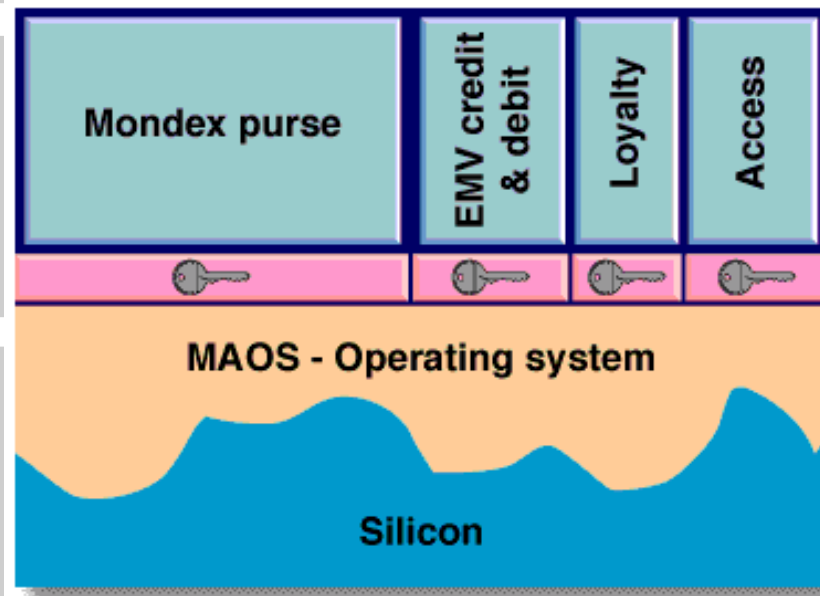
Multos Card

◆ **MULTi-application OS developed by Mondex and MasterCard**

◆ **Rely on the Multos API**

◆ **ITSEC E6 certified firewalls for card application segregation**

◆ **extremely secure smart card**

◆ **internal structure is similar to Java card**

Multos Card (cont.)

Mondex purse	EMV credit & debit	Loyalty	Access

MAOS - Operating system

Silicon

Applications

Firewalls

Interpreter and API

MULTOS

Silicon (hardware)

Application load certificate

Multos Card (cont.)

- ◆ **uses dedicated programming language, Multos Executable Language (MEL)**
- ◆ **can develop using C and then convert to MEL**
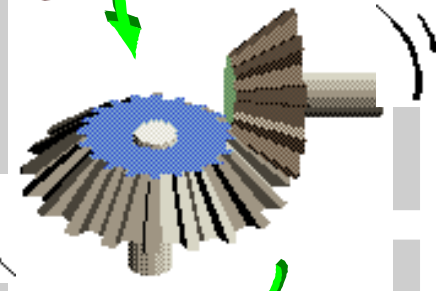- ◆ **Java cardlet can also be run on Multos card**
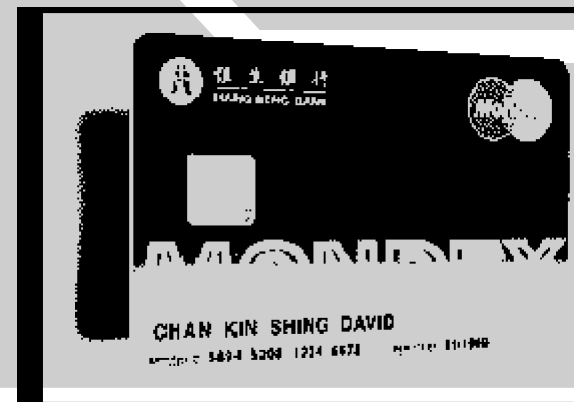
Java Card

- Oriented Object Language

- Syntax similar to "C" and "C++"

- Interpreted language

"app.java"

Public class ...
... private static...
private static...
private void ...

Source File

Compilation

"app.class"

... BCFD876543FCDE
76FD45EC76890FD
FDABAA453BCDEA
CBDE7654CDAB78 ...
} byte-code

Loading

Byte-code
verification
Execution

Device with
Java Interpreter
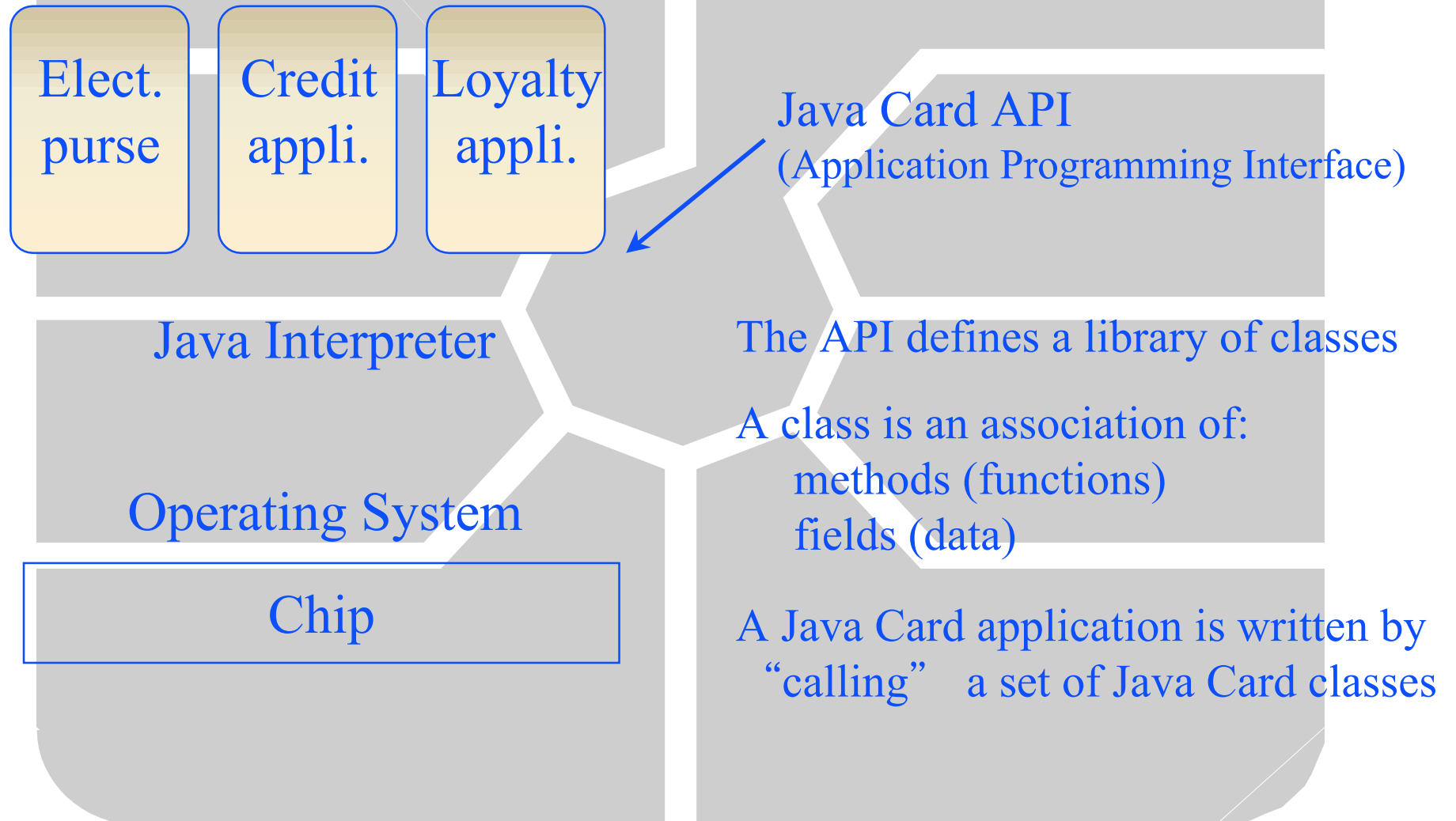
Java Card (cont.)

Applet 1 → Applet 2 → Applet 3

Applications loaded in the device

API

Application **P**rogramming **I**nterface

Java Interpreter

Operating System

Hardware

Virtual Machine (hardware independent)

What is Javacard API

| Elect. purse | Credit appli. | Loyalty appli. |

Java Interpreter

Operating System

Chip

Java Card API
(Application Programming Interface)

The API defines a library of classes

A class is an association of:
  methods (functions)
  fields (data)

A Java Card application is written by
  "calling"   a set of Java Card classes

Visa Open Platform card

Visa Open Platform Card

◆ **Key features**

  ❖ **compliant card used by financial industry**

  ❖ **with VisaCash, E-purse Cardlet defined and preloaded**

  ❖ **Dynamic post-issuance loading of Applications**

Visa Open Platform card

Visa Open Platform Card

- ❖ **Portability of Applications across chip-cards**
- ❖ **Standardization of Personalization**
- ❖ **Backward compatibility with existing terminals & systems**

Visa Open Platform card

Java Card 2.1 :
specify the basic API

Note:
Visa Open Platform is **optional**.
VOP 2.0 standardise the loading
Mechanism for all vendors.

Smart card for Windows

◆ **Proposed by Microsoft in Oct 27th 1998, released in Nov 15th 1999**

◆ **Multi-application OS using 8K ROM**

◆ **low-cost**

◆ **easy to program using VB on NT or Win 2K**

◆ **Cardlet can be downloaded to the card**

T&C Technologies

Smart card for Windows

Smart card for Windows

◆ **Secure operating system**

　❖ control of a FAT file system with Access Controls Rule

　❖ on-card Win32 API,

　❖ language-neutral virtual machine and popular cryptos

◆ **Rapid application development tools**

　❖ support Visual Studio

　❖ with PC simulator

Smart card for Windows

◆ **Application used**

- ❖ secure network authentication

- ❖ secure corporate transactions

- ❖ health-care information

- ❖ electronic cash

- ❖ customer loyalty programs

T&C Technologies

PC/SC Standard

◆ **formed in May 1996 in partnership with major PC and smart card companies**

  ❖ Groupe Bull

  ❖ Hewlett-Packard

  ❖ Microsoft

  ❖ Schlumberger

  ❖ Siemens Nixdorf

PC/SC Standard

◆ **ensure compatible communications between all types of smart cards**

◆ **standard model for interfacing smart card readers and cards with PCs**

◆ **Device-independent APIs for enabling smart card aware applications**

T&C Technologies