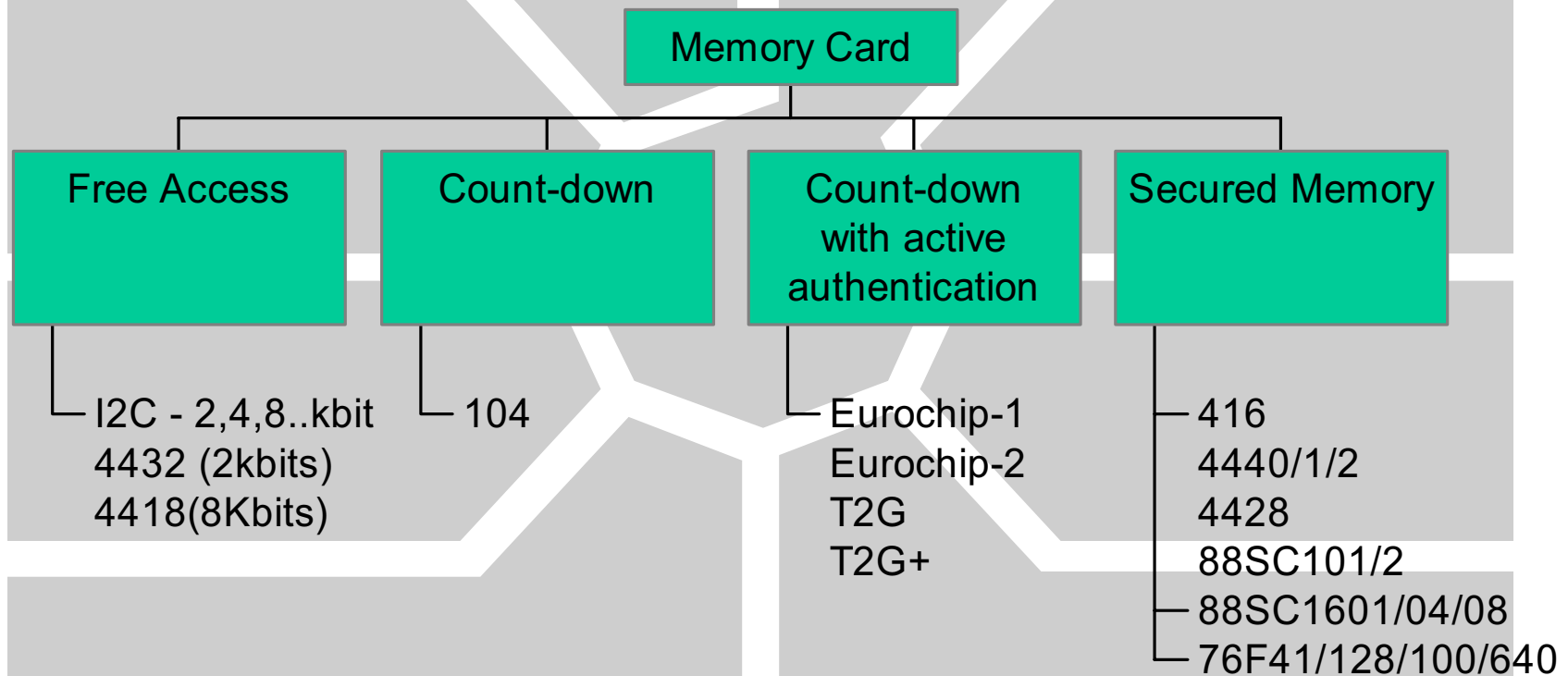


Types Of Memory Cards



I2C Free Access Memory Card

- ◆ I2C = inter-IC connection
- ◆ Using 2 wires – clock & data instead of conventional address bus & data bus
- ◆ Clock used for synchronization, data carrying control and data information
- ◆ Connecting memory to the CPU
- ◆ Used commonly in consumer electronics but mounted in a ISO-7816 smart card to become an I2C free access memory card
- ◆ Read Binary; Update Memory

104 Card Memory Organisation – Issuer Mode

Byte		TSC=0	TSC=1
0	Manufacturer Area	Read	R/W
1			
2	Issuer Area	Read	R/W
3			
4			
5			
6	Fuse	Read	R/W
7			
8	Presentation Counter	R/W	R/W
9			
10	Transport	None	R/W
11	Secret		
12	Code		Erase

CARD LIFE PHASES

Manufacturing



Personalization



Logical blow fuse

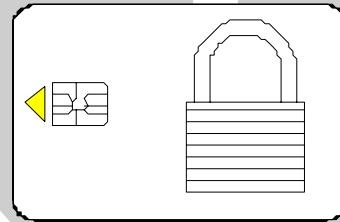


Down Counting

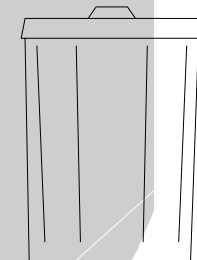
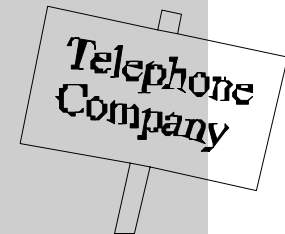
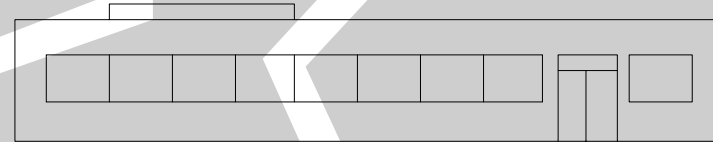


Card Empty

manufacturer



Transport
Code



MANUFACTURER AREA (read-only)

Bit

0

Chip Type

Chip Version

7

8

Chip
Manufacturer

Card Manufacturer
Code

15

16

Application Code

23

104 Card Memory Organisation – Countdown Mode

Byte

0

1

2

3

4

5

6

7

8

9

10

11

12

Manufacturer Area

Issuer Area

0 C4096 0 0 0

C512

C64

C8

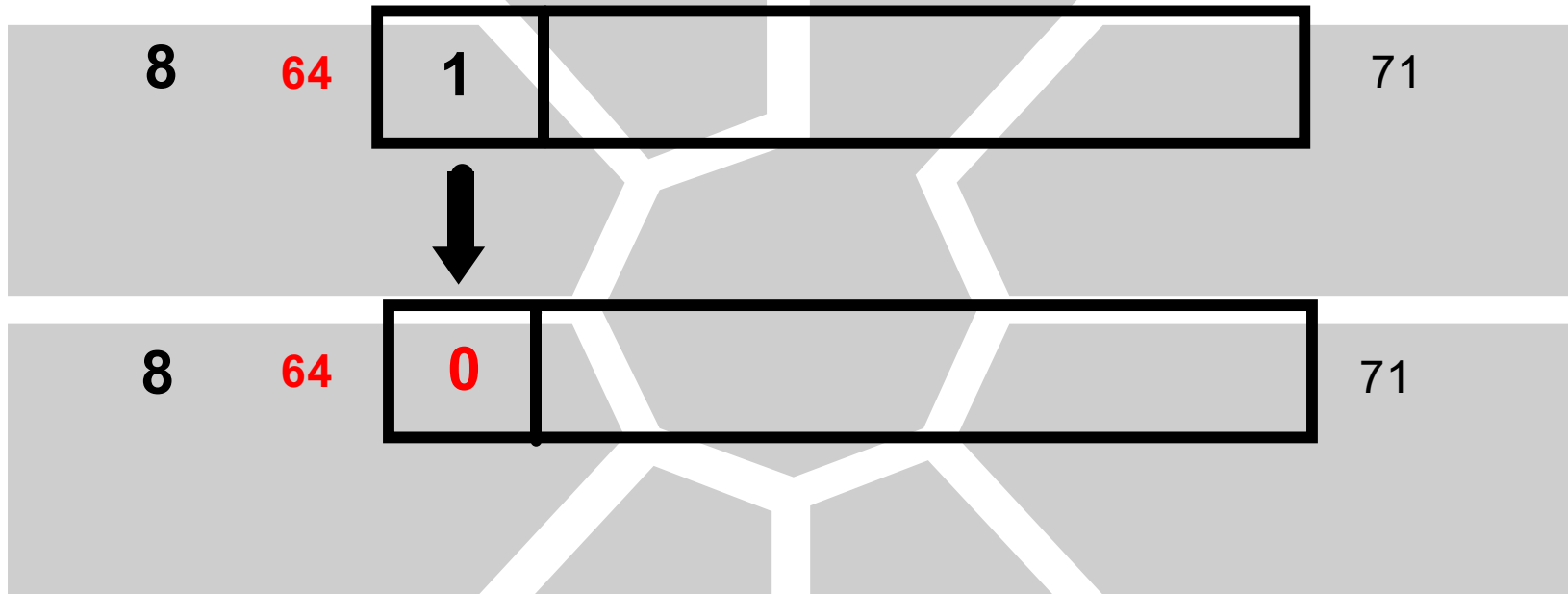
C1

Read - Only

Read - Only

**Abacus
Counters
(Read/Write)**

FUSE BLOW



**Writing to the Logical Fuse (Bit 64) changes the 4406 from
Personalization Mode to Count Down Mode
This is irreversible**

BEFORE AND AFTER FUSE BLOW

■ Before (**Personalization Mode**)

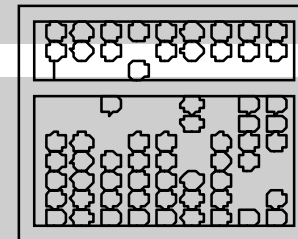
- ◆ 24-bits Manufacturing information (read only)
- ◆ Blank One time write 80-bits Issuer Area
- ◆ Protected by 24-bits transport code
- ◆ 7 attempts to present transport code then the card is useless
- ◆ Loadable counter with value 0-21,064

■ After (**Count Down Mode**)

- ◆ Down Counter from loaded value to zero
- ◆ Issuer and manufacturer information is read only

COUNT DOWN PHASE

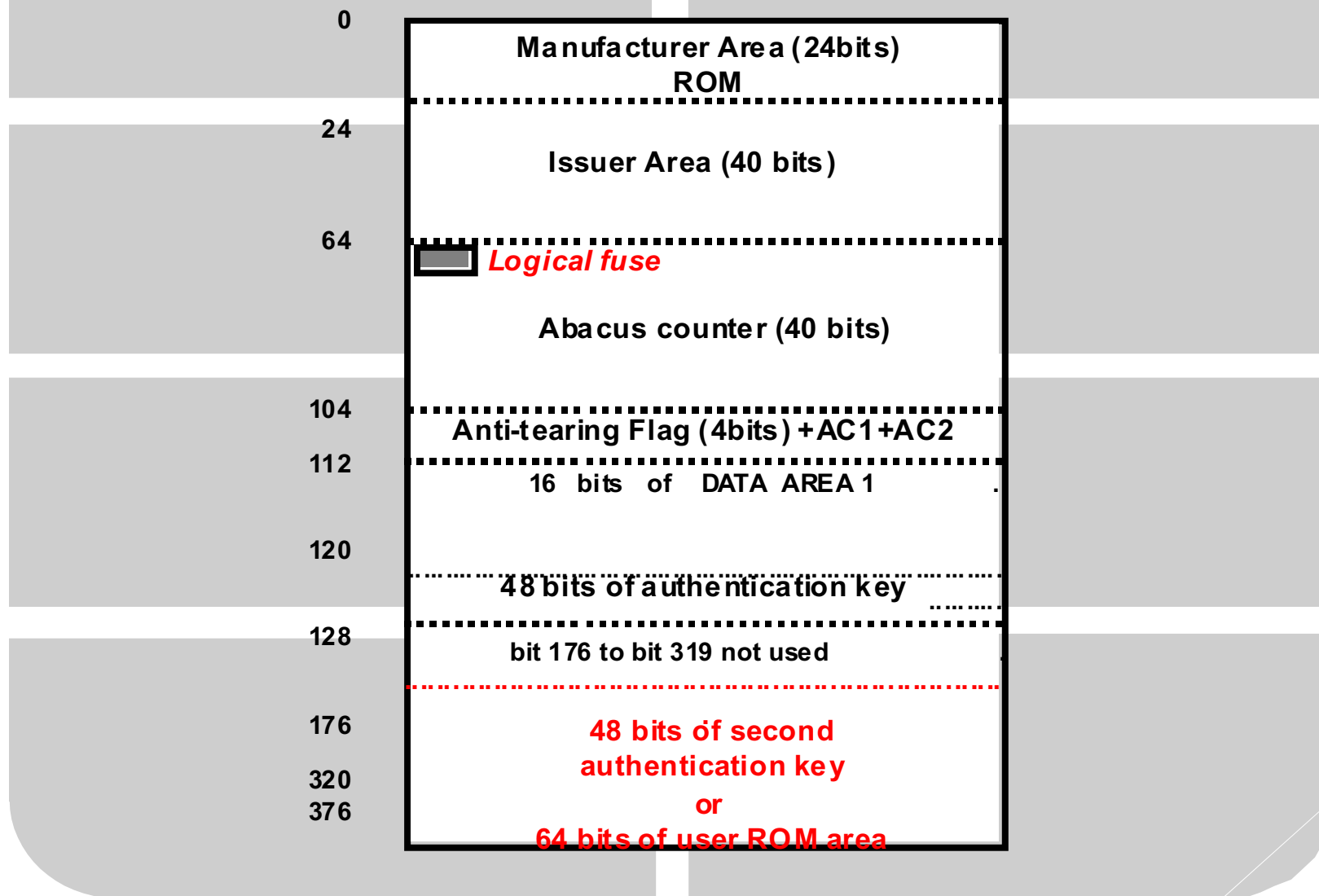
- **Verify Issuer Data and Manufacturer Data for valid card**
- **Count down units, Issue Service**
- **If Empty, Throw away**



104 CARD COMMENTS

- 104 card is among the lowest priced card, but security offered is very limited
- Security relies on procedural control of chip and card manufacturers
- application not limited to telephone prepaid card application but designer's creativity
- issuer must have control of the terminals to prevent card emulation
- tokens may be lost if card is pulled out between write and write-carry
- this card is obsolete

EuroChip Memory Organisation



ADDITIONAL FEATURES COMPARED TO THE SLE-4406

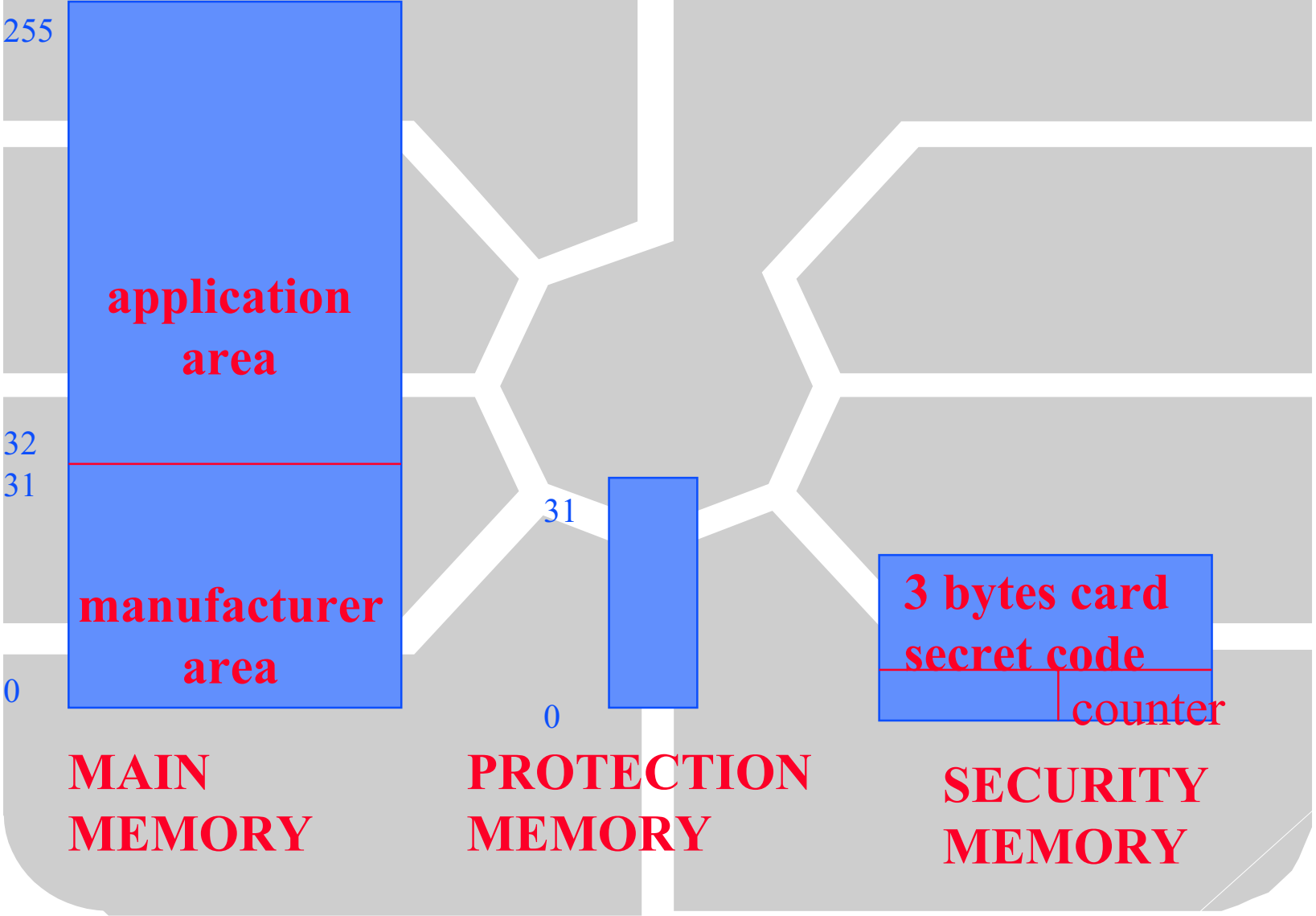
- **Card cryptographic authentication algorithm**
- **More memory with an 80 bits extended Issuer area with a 48 bits authentication key or 16 bits extended issuer area with two 48 bits authentication keys**
- **Protection of the counter content against power down (Pull out)**

SLE-4442 Memory Card

◆ main features

- ◆ 256 x 8 bits application EEPROM
- ◆ 3 bytes card secret code, 3 bits error counter
- ◆ 32 bits memory protection control
- ◆ 5 volts (10 mA)
- ◆ 6 contacts
- ◆ erase (virgin) state is 1

Memory Structure



Main Memory

255

**application
area**

32

31

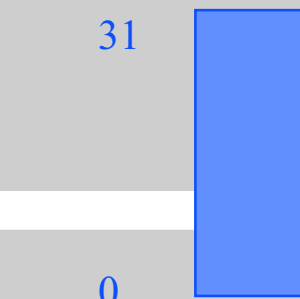
**manufacturer
area**

0

**MAIN
MEMORY**

- ◆ chip manufacturer reference
- ◆ chip type and version
- ◆ card manufacturer reference
- ◆ card serial number
- ◆ manufacturer area is byte-wise write/erase lockable by the Protection Memory
- ◆ application area can be written / erase after presentation of CSC
- ◆ the entire main memory is free read

Protection Memory



**PROTECTION
MEMORY**

- ◆ 32 x 1 EPROM bits used to protect the 32 bytes manufacturer area
- ◆ protection memory is free read
- ◆ setting a bit write / erase lock the corresponding byte in the manufacturer area
- ◆ protection bit can only be set by sending the address and the data to be protected
- ◆ a matched content sets the protection bit

Security Memory

- ◆ 4 bytes EEPROM comprising 3 bytes CSC and 3 bits error counter
- ◆ error counter is free read
- ◆ CSC cannot be read (000000) before correct presentation
- ◆ a wrong CSC presentation will result in a bit in the counter set to 0
- ◆ correct CSC presentation required to update the CSC

3 bytes card
secret code

counter

**SECURITY
MEMORY**

SLE4442 Reader Emulation Commands

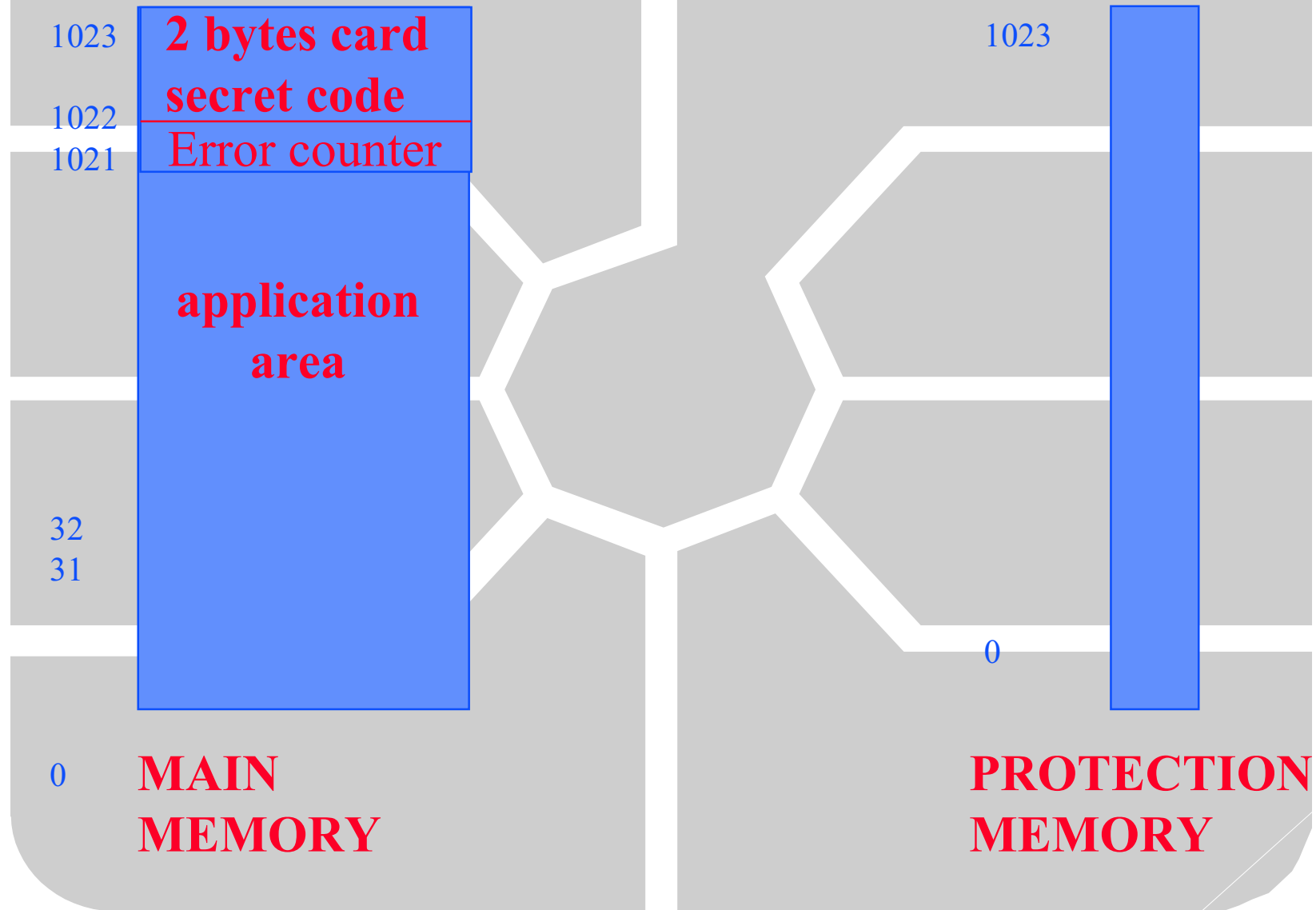
- ◆ memory card does not comply with ISO-7816 part 3 and therefore does not have ISO commands
- ◆ however to easy application development and upgrade, it is wise for the reader to perform an emulation to make the card looks like a CPU card
- ◆ Pseudo commands:
 - ◆ Read Binary, Update Binary, Verify, Update_Lock_Memory

SLE-4428 Memory Card

◆ main features

- ◆ 1024 x 8 bits EEPROM
- ◆ 2 bytes card secret code (03FE-03FF)
- ◆ 8 bits error counter (03FD)
- ◆ 1024 bits memory protection control
- ◆ 5 volts
- ◆ 6 contacts
- ◆ erase (virgin) state is 1

Memory Structure



Main Memory

1023

**application
area**

0

**MAIN
MEMORY**

- ◆ manufacturer area is byte-wise write/erase lockable by the Protection Memory
- ◆ application area can be written / erase after presentation of CSC
- ◆ Memory 0 to 1021 always free read, CSC always 0000 before presentation / wrong presentation
- ◆ the entire main memory is free read after correct CSC presentation

Protection Memory

1023

0

**PROTECTION
MEMORY**

- ◆ 1024 x 1 EPROM bits used to protect the 1024 bytes manufacturer area
- ◆ protection memory is free read
- ◆ setting a bit write / erase lock the corresponding byte in the main memory
- ◆ protection bit can only be set by sending the address and the data to be protected
- ◆ a matched content sets the protection bit

Security Memory

- ◆ 3 bytes EEPROM comprising 2 bytes CSC and 8 bits error counter
- ◆ error counter is free read
- ◆ CSC cannot be read (000000) before correct presentation
- ◆ a wrong CSC presentation will result in a bit in the counter set to 0
- ◆ correct CSC presentation required to update the CSC

**2 bytes card
secret code**
counter

**SECURITY
MEMORY**

SLE4428 Reader Emulation Commands

- ◆ memory card does not comply with ISO-7816 part 3 and therefore does not have ISO commands
- ◆ however to easy application development and upgrade, it is wise for the reader to perform an emulation to make the card looks like a CPU card
- ◆ Pseudo commands:
 - ◆ Read Binary, Update Binary, Verify, Update_Lock_Memory