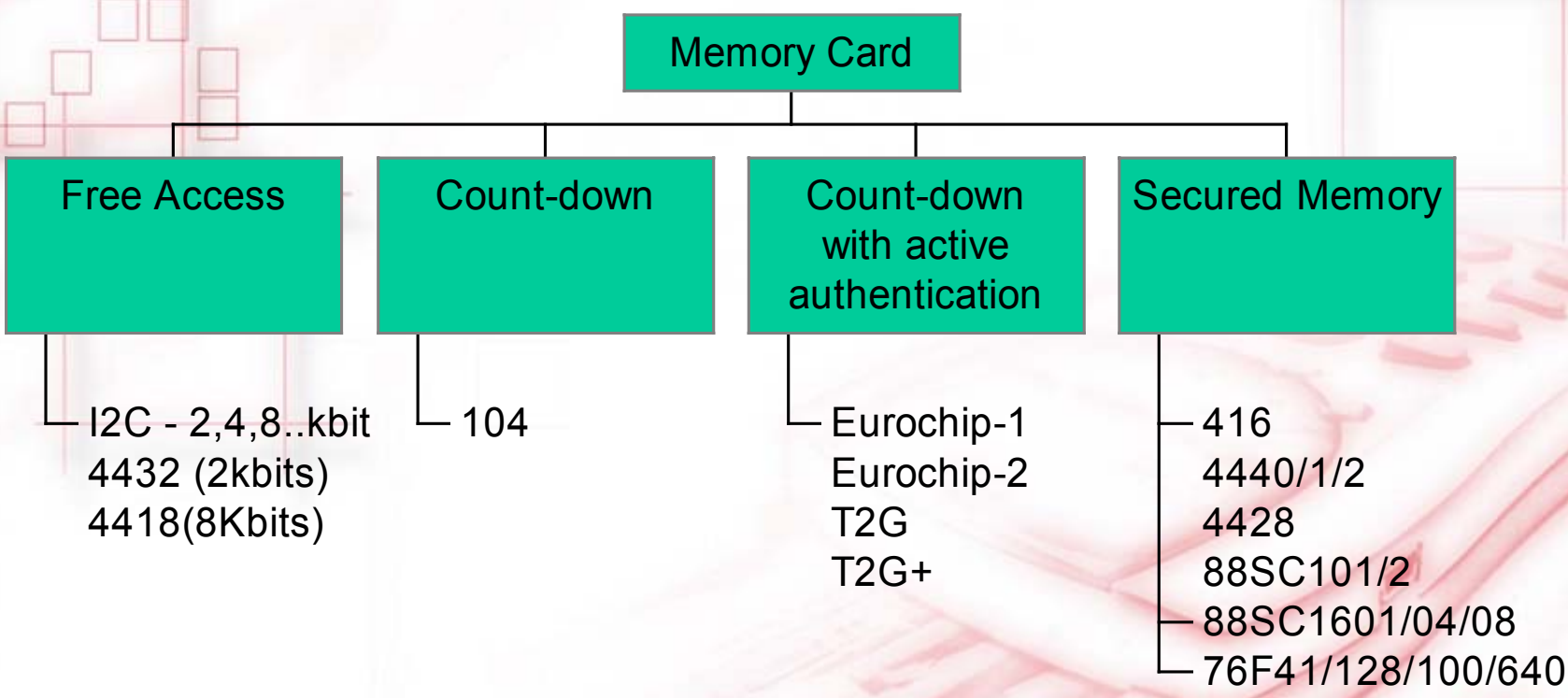
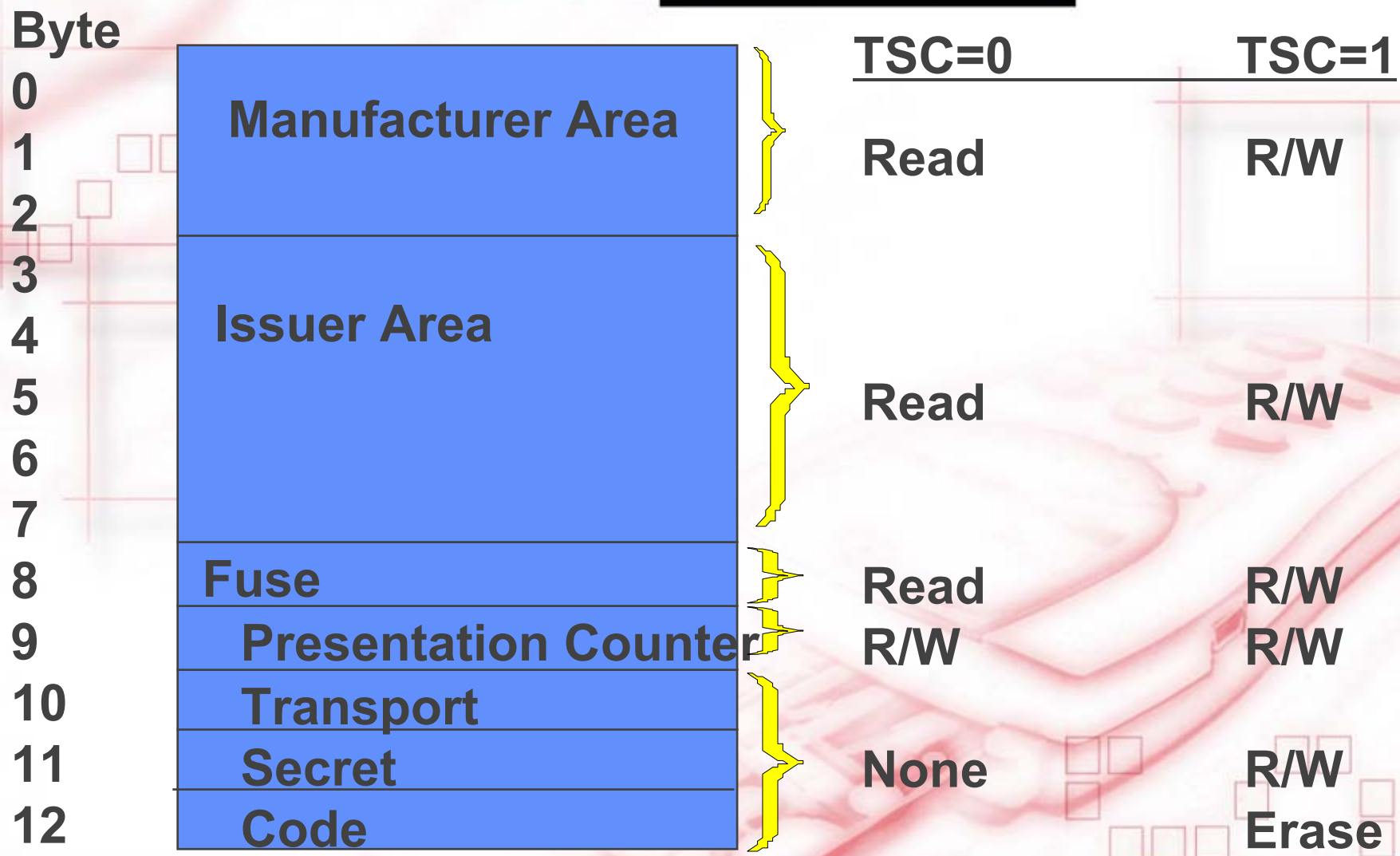
Types of Memory Cards



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 an ISO-7816 smart card to become an I2C free access memory card
- Read Binary; Update Memory

104 Card Memory Organization – Issuer Mode



Card Life Phases

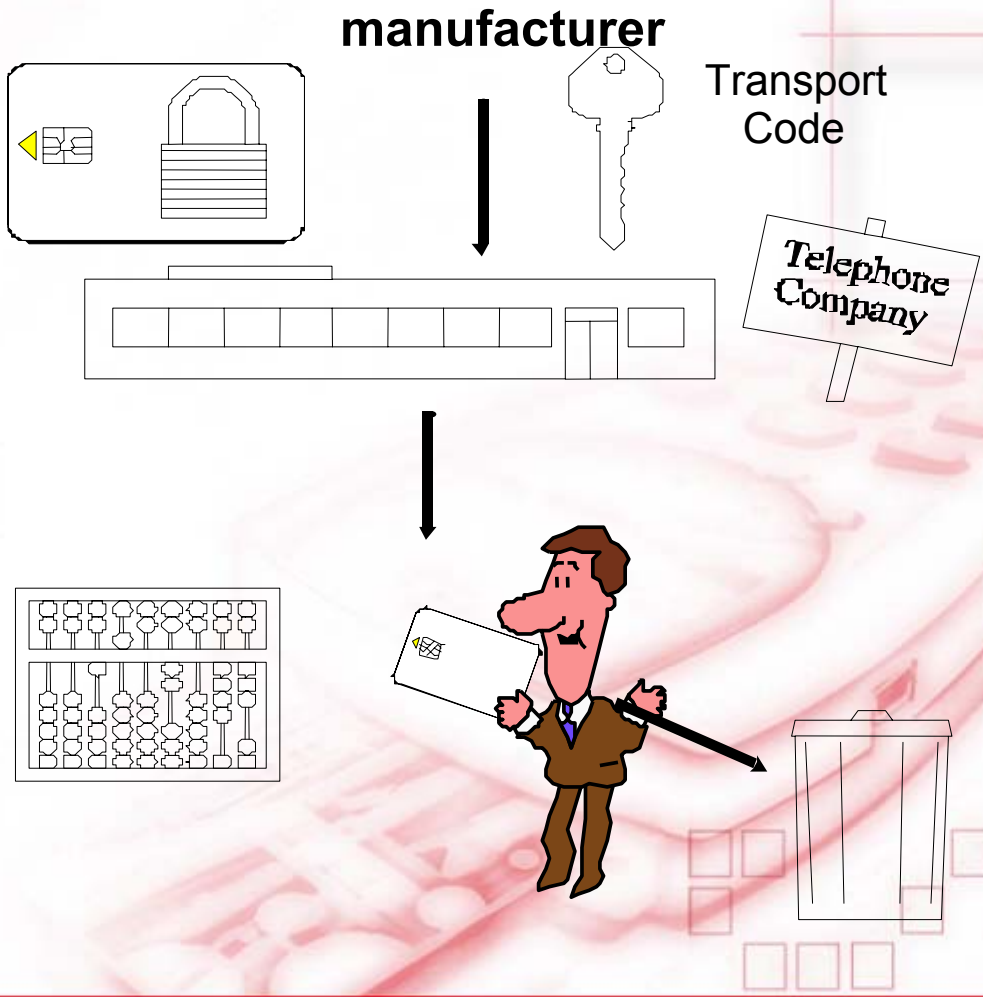
Manufacturing

Personalization

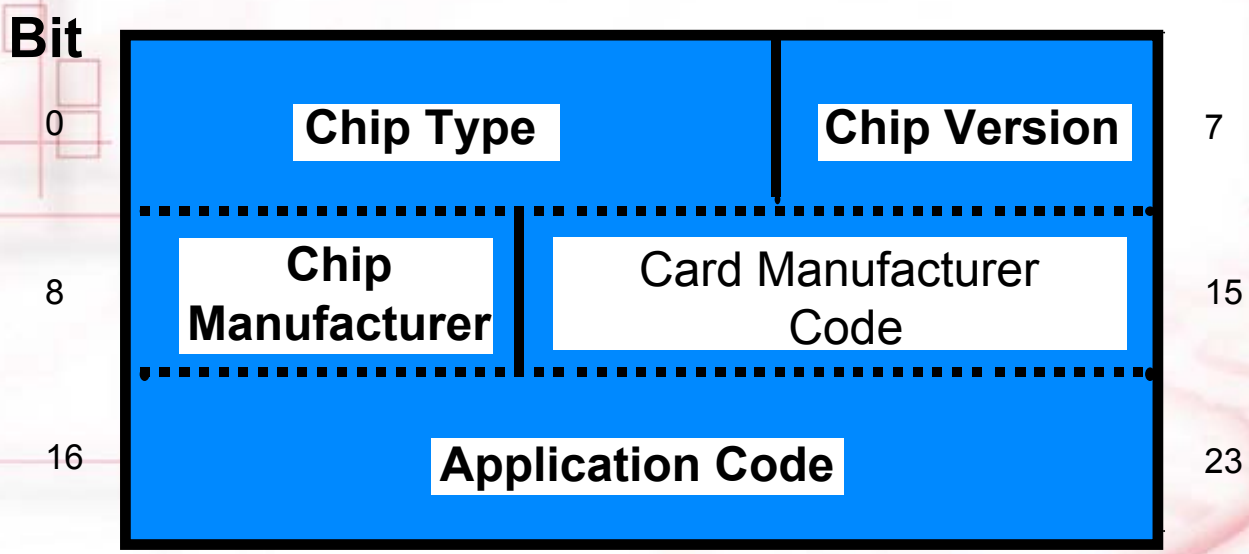
Logical blow fuse

Down Counting

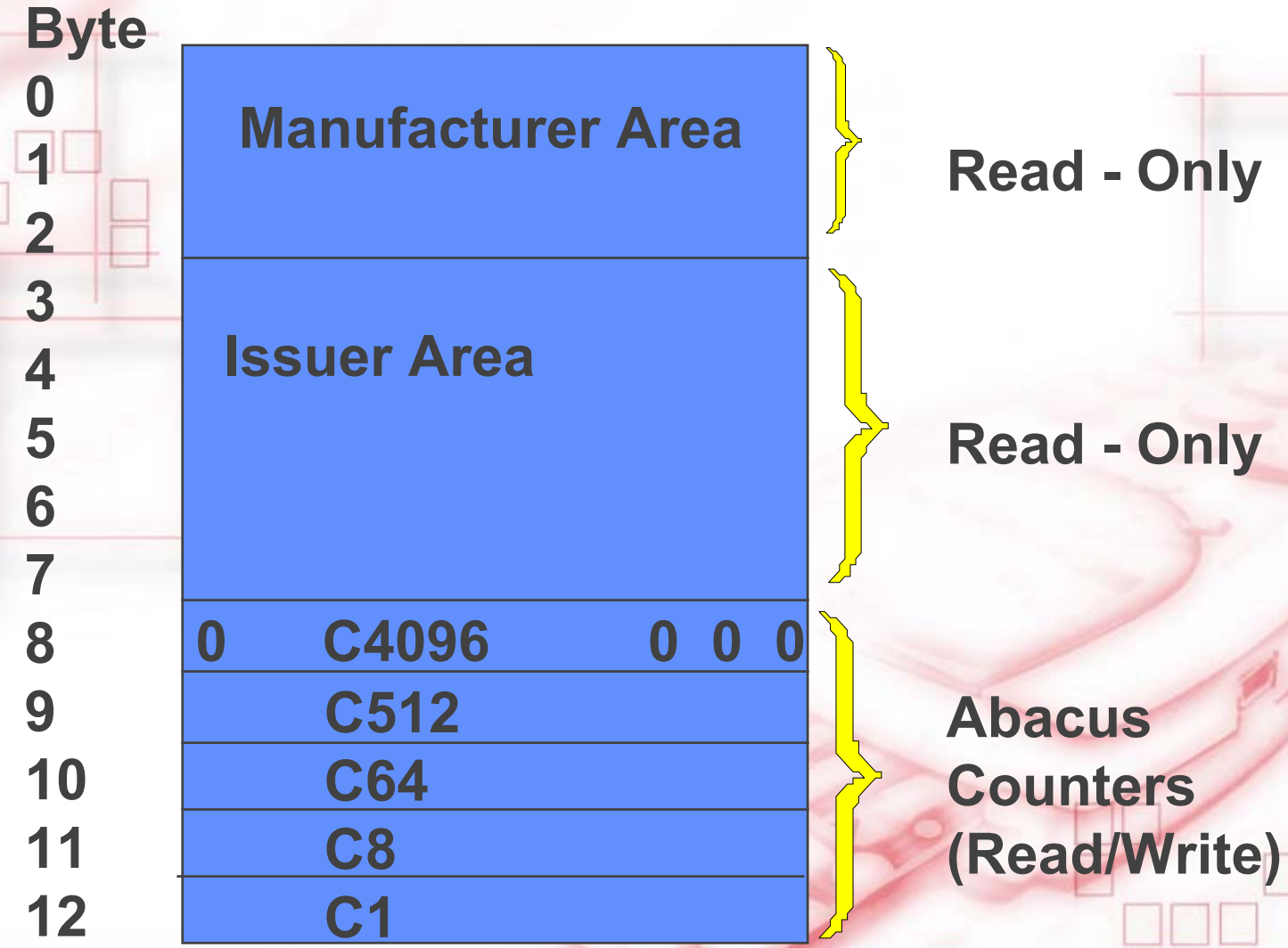
Card Empty



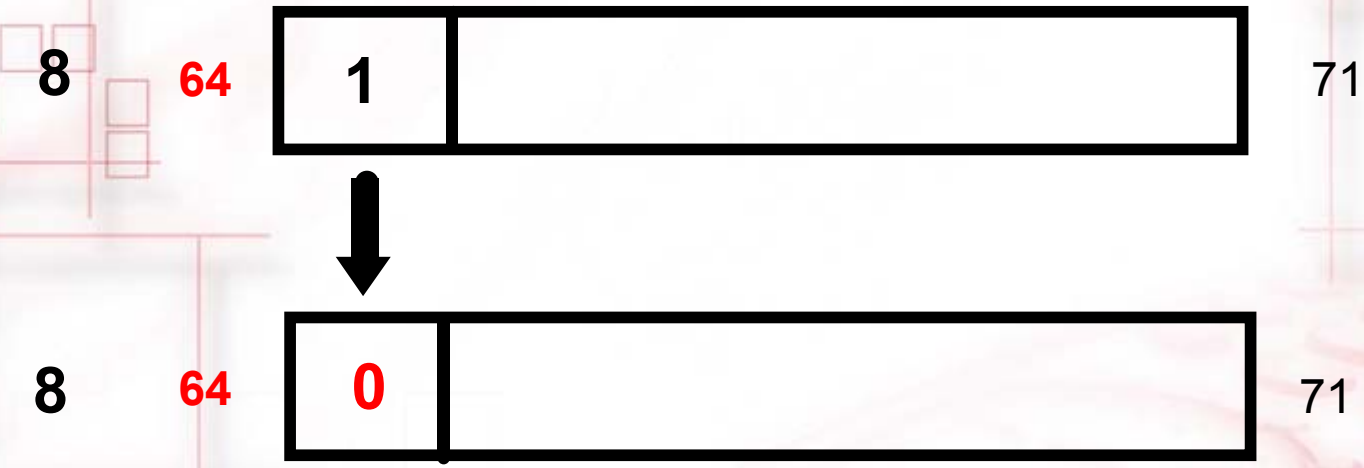
Manufacturer Area (Read-Only)



104 Card Memory Organization – Countdown Mode



Fuse Blow



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

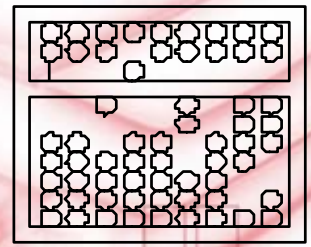
This is irreversible

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

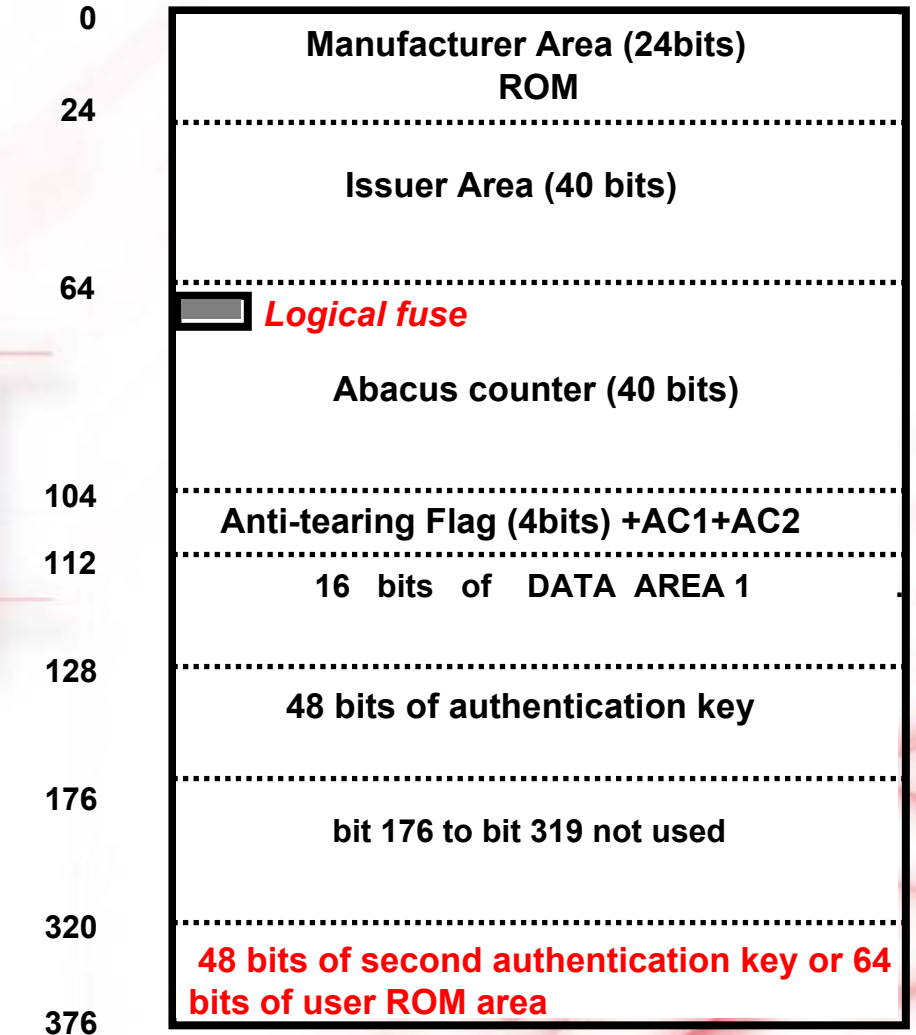
- Verify Issuer Data and Manufacturer Data for valid card
- Count down units, Issue Service
- If empty, throw away



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 Organization



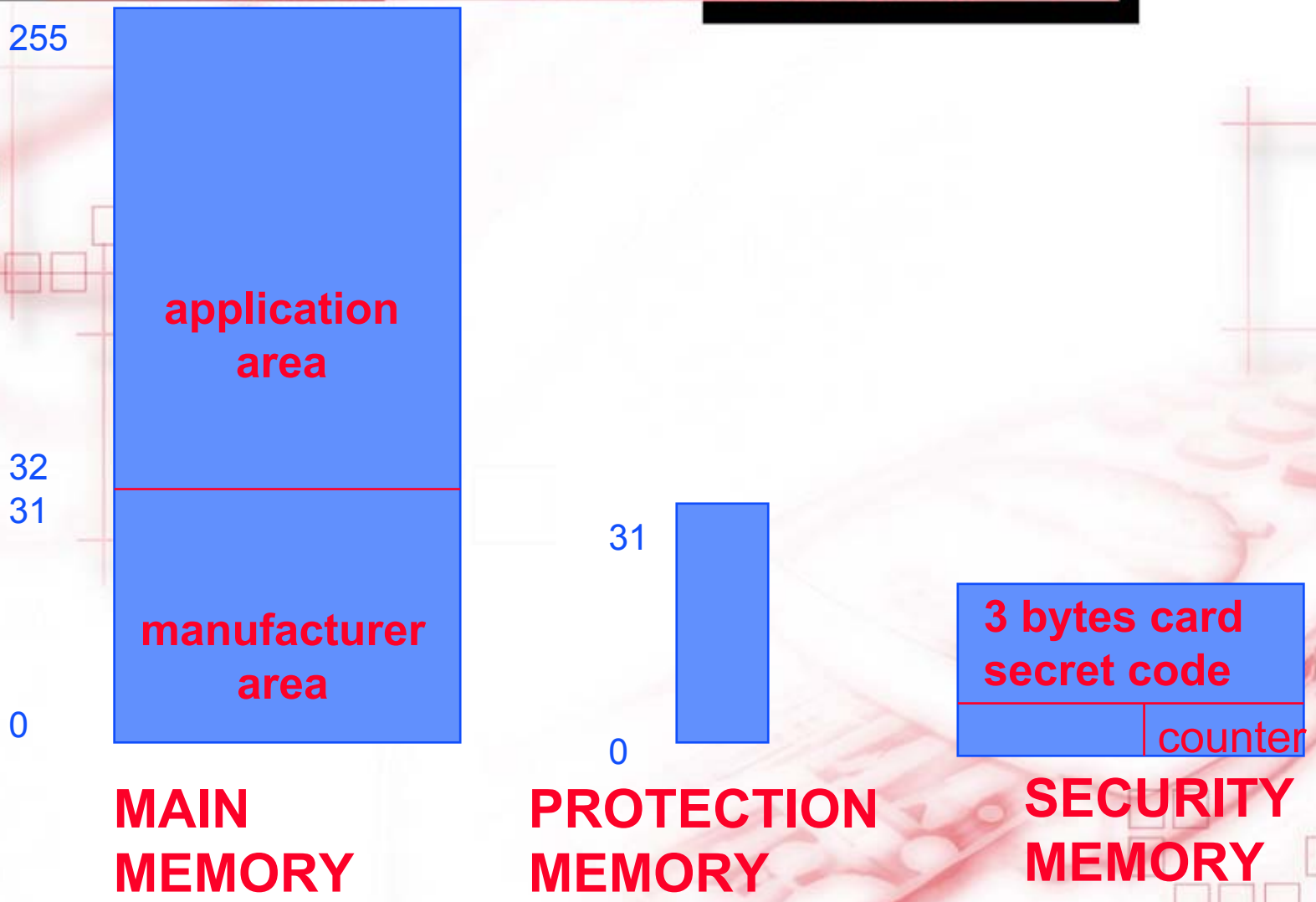
Additional Features Compared to the SLE-4406

- 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)

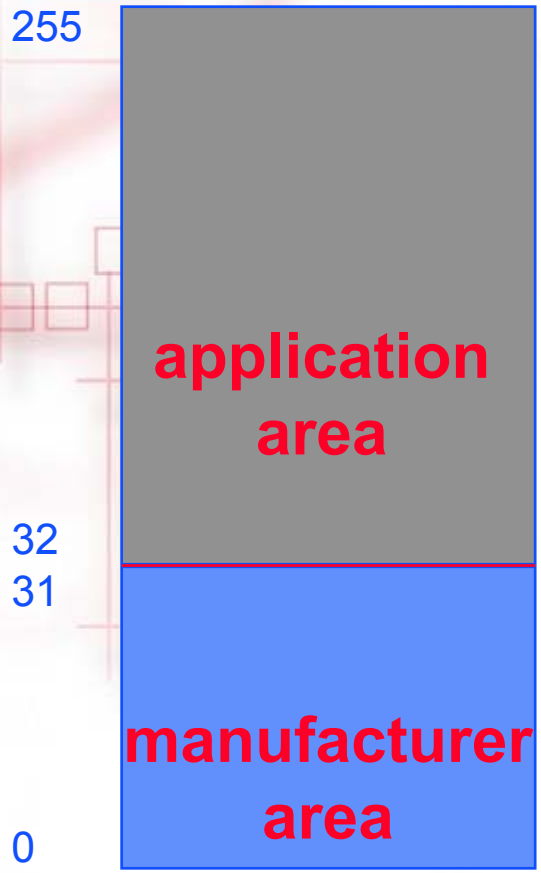
SLE-4442 Memory Card

- 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

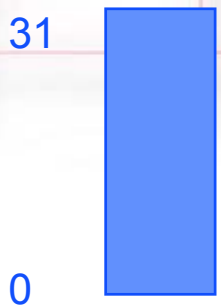


MAIN MEMORY

- 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

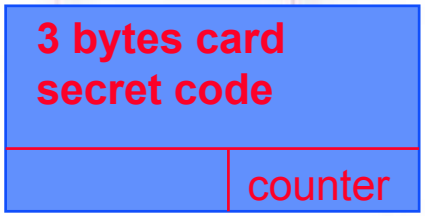
- 32 x 1 EPROM bits used to protect the 32 bytes manufacturer area
- Protection memory is free read
- Setting a bit write / erase lock the corresponding byte in the manufacturer area
- Protection bit can only be set by sending the address and the data to be protected
- A matched content sets the protection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



PROTECTION MEMORY

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



SECURITY MEMORY

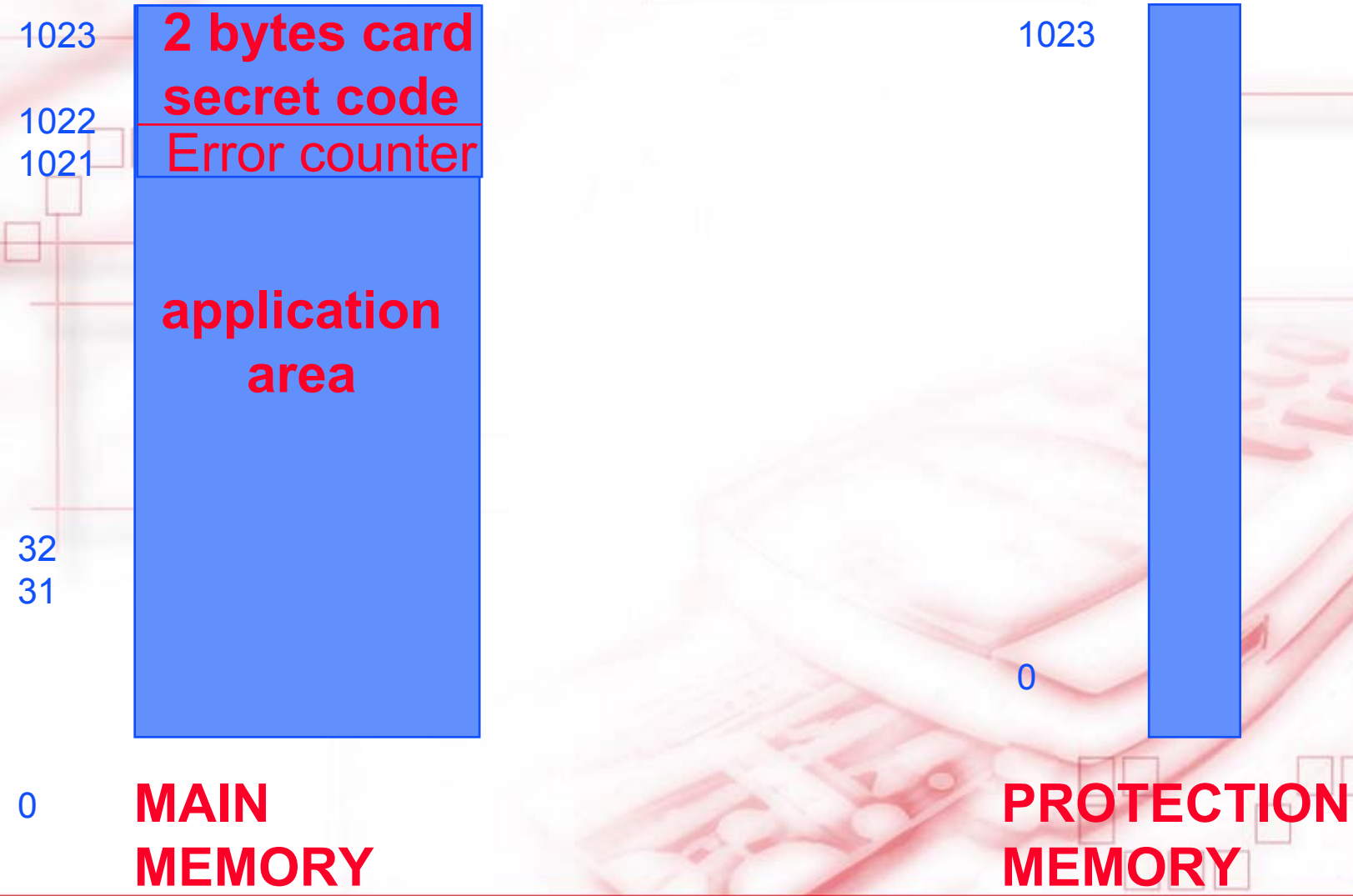
SLE4442 Reader Emulation Commands

- Memory card does not comply with ISO-7816 part 3 and therefore does not have ISO commands
- However for 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

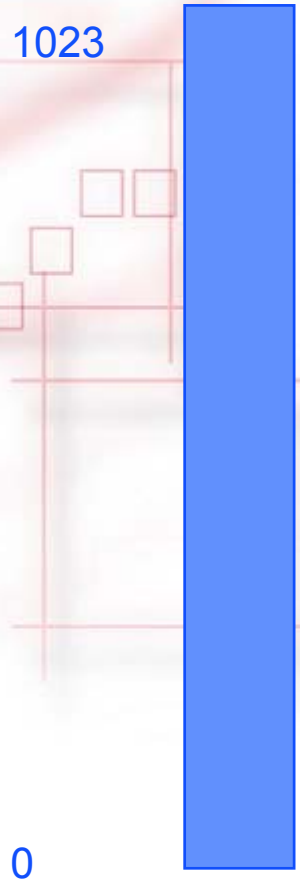
Memory Structure



Main Memory

- Manufacturer area is byte-wise write/erase lockable by the Protection Memory
- Application area can be written / erased 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



PROTECTION MEMORY

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- Protection memory is free read
- Setting a bit write / erase lock the corresponding byte in the main memory
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- A matched content sets the protection bit

Security Memory

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- Error counter is free read
- CSC cannot be read (000000) before correct presentation
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- Correct CSC presentation required to update the CSC

SECURITY MEMORY

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