Mifare classic 1k
&
NFC-Tools Api

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Mifare Classic 1k description

- 16 sectors, each sector contains 4 blocks,
- 3 user blocks (block 0 to 2) and one key block (block 3)
- Sector 0 block 0 cannot be used (contains manufactory data)
- Each block contains 16 bytes.
  - 16 * 4 * 16 = 1024 bytes = 1k

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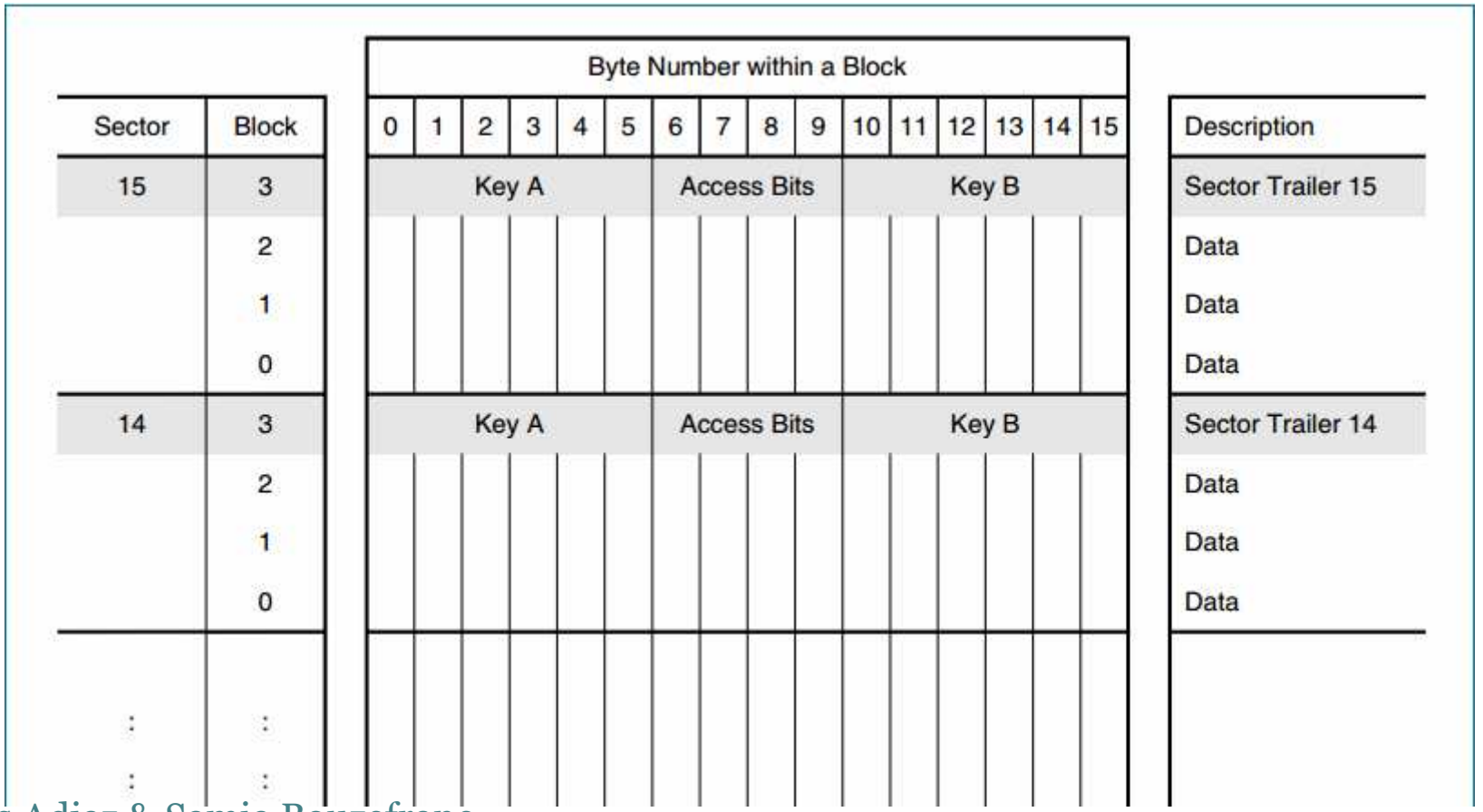
Memory organization



Sector	Block	Byte Number within a Block																Description
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
15	3	Key A						Access Bits				Key B						Sector Trailer 15
	2																	Data
	1																	Data
	0																	Data
14	3	Key A						Access Bits				Key B						Sector Trailer 14
	2																	Data
	1																	Data
	0																	Data
:	:																	
:	:																	

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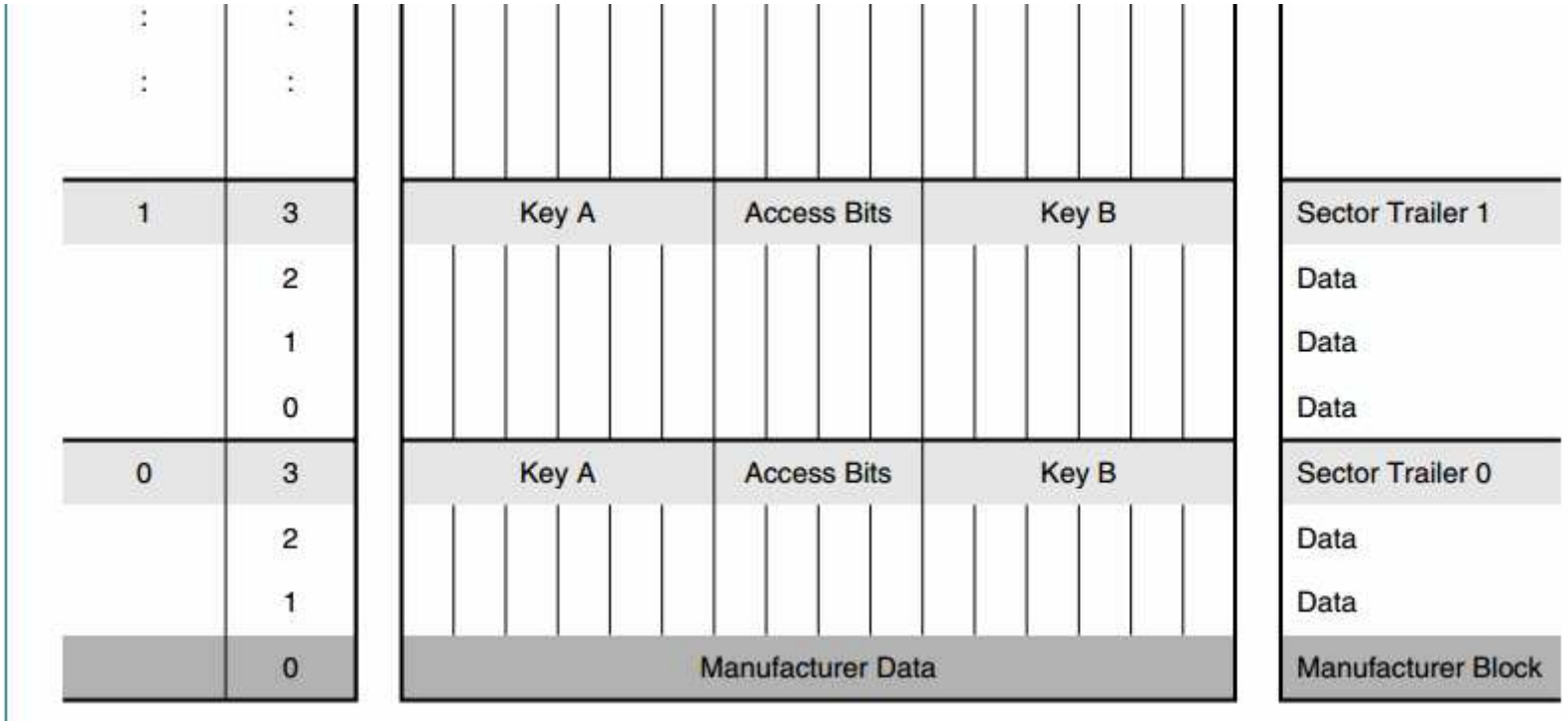
Memory organization



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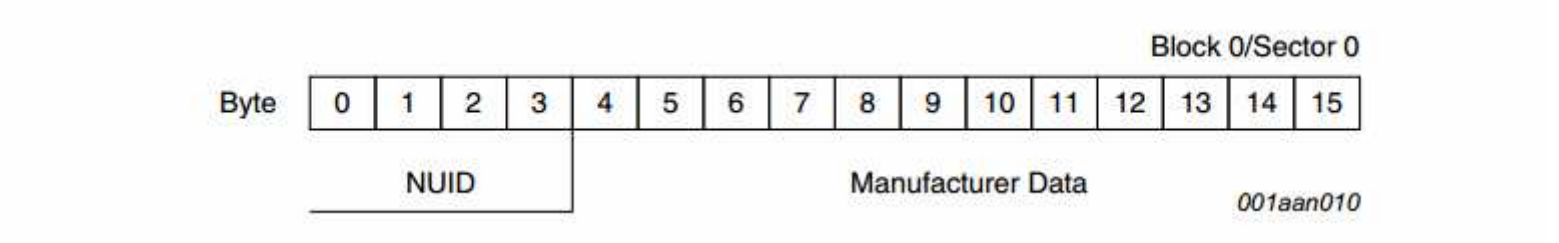
Manufacturer block



- Programmed and write protected during production
- Non unique Identifier

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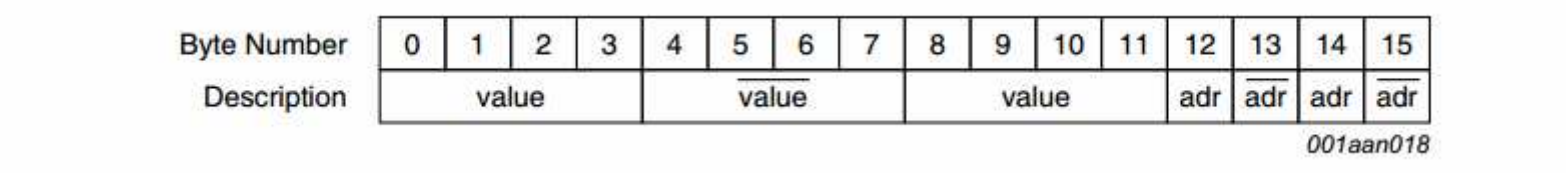
User's blocks

- Two types of user's blocks (Data block and Value Block)
- Data block has no memory structure (read/write block)
- Value Block has a memory structure with a value and an address



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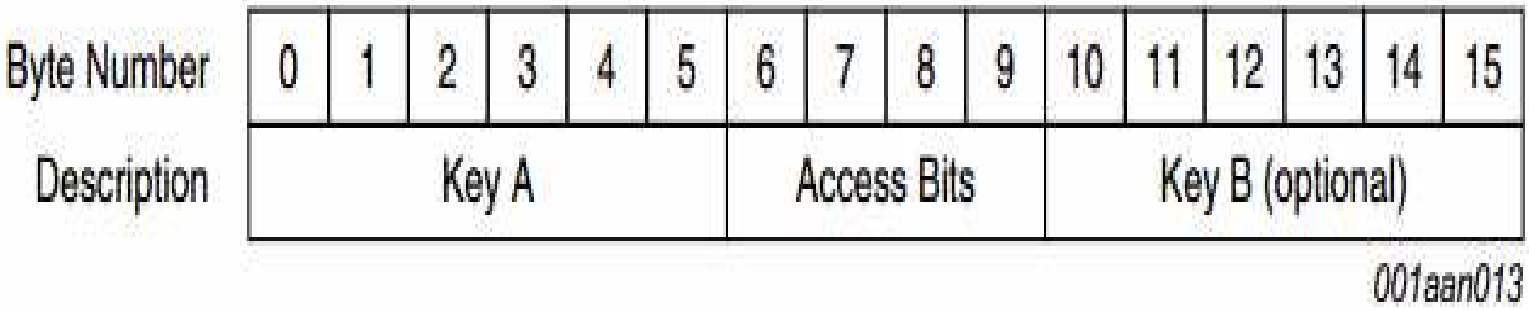
Sector Trailer



- At chip delivery keys are set to FFFFFFFFFFFFh

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Memory Access

Operation	Description	Valid for Block Type
Read	reads one memory block	read/write, value and sector trailer
Write	writes one memory block	read/write, value and sector trailer
Increment	increments the contents of a block and stores the result in the internal data register	value
Decrement	decrements the contents of a block and stores the result in the internal data register	value
Transfer	writes the contents of the internal data register to a block	value
Restore	reads the contents of a block into the internal data register	value

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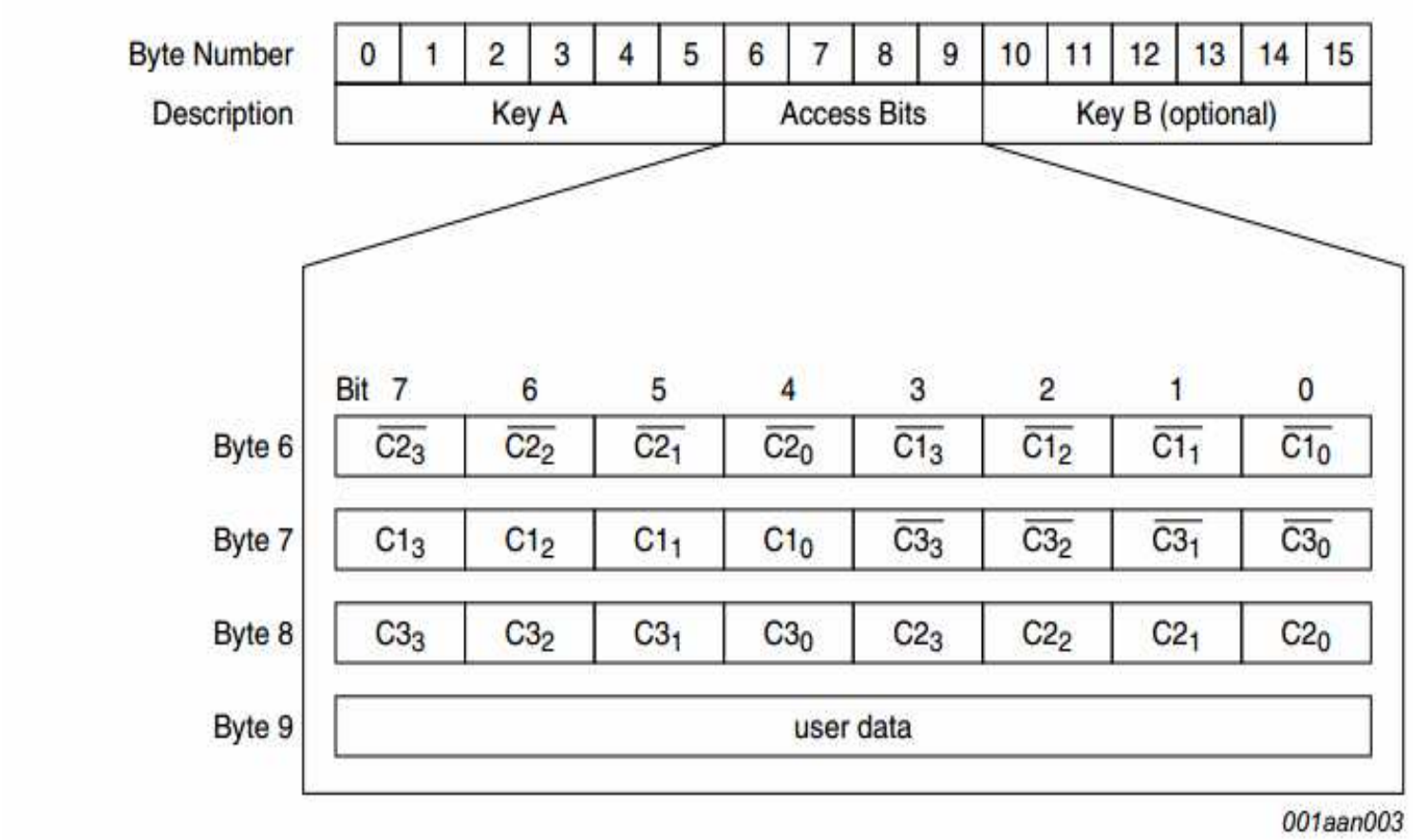
Access conditions



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Access conditions for sector trailer

Access bits			Access condition for						Remark
			KEYA		Access bits		KEYB		
C1	C2	C3	read	write	read	write	read	write	
0	0	0	never	key A	key A	never	key A	key A	Key B may be read[1]
0	1	0	never	never	key A	never	key A	never	Key B may be read[1]
1	0	0	never	key B	key A|B	never	never	key B	
1	1	0	never	never	key A|B	never	never	never	
0	0	1	never	key A	key A	key A	key A	key A	Key B may be read, transport configuration[1]
0	1	1	never	key B	key A|B	key B	never	key B	
1	0	1	never	never	key A|B	key B	never	never	
1	1	1	never	never	key A|B	never	never	never	

[1] for this access condition key B is readable and may be used for data

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Access conditions for data blocks

Access bits			Access condition for				Application
C1	C2	C3	read	write	increment	decrement, transfer, restore	
0	0	0	key A|B[1]	key A|B1	key A|B1	key A|B1	transport configuration
0	1	0	key A|B[1]	never	never	never	read/write block
1	0	0	key A|B[1]	key B[1]	never	never	read/write block
1	1	0	key A|B[1]	key B[1]	key B[1]	key A|B[1]	value block
0	0	1	key A|B[1]	never	never	key A|B[1]	value block
0	1	1	key B[1]	key B[1]	never	never	read/write block
1	0	1	key B[1]	never	never	never	read/write block
1	1	1	never	never	never	never	read/write block

[1] if Key B may be read in the corresponding Sector Trailer it cannot serve for authentication (all grey marked lines in previous table). As a consequences, if the reader authenticates any block of a sector which uses the grey marked access conditions and using key B, the card will refuse any subsequent memory access after authentication.

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NFC-Tools Api

- Class TerminalHandler
- Methods
  - void addTerminal(Terminal)
  - Terminal getAvailableTerminal(String)

Example:

```
TerminalHandler handler = new TerminalHandler();
AcsTerminal terminal = new AcsTerminal();
handler.addTerminal(terminal);
handler.getAvailableTerminal("ACS ACR1281 1S Dual Reader 00 01");
```

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NFC-Tools Api

- Class NfcAdapter
- Constructor NfcAdapter(Terminal, TerminalMode)
- Methods
  - void registerTagListener (NfcTagListener)
  - void startListening ()
  - void stopListening ()

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NFC-Tools Api for Mifare

- Class AbstractCardTool which implements NfcTagListener (generally we inherit from this class and redefine the method “doWithReaderWriter”)
- Class MfClassicAccess

  Constructor MfClassicAccess(KeyValue, int sector, int block, int blocksToRead)
- Class MfBlock
- Class DataBlock -> DataBlock(byte[] data)
- Class ValueBlock -> ValueBlock(int value, byte address)
- Class TrailerBlock -> TrailerBlock(byte[] data)

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NFC-Tools Api

- Class MfClassicReaderWriter

- Methods
  - void writeBlock (MfClassicAccess , MfBlock)
  - MfBlock[] readBlock(MfClassicAccess)

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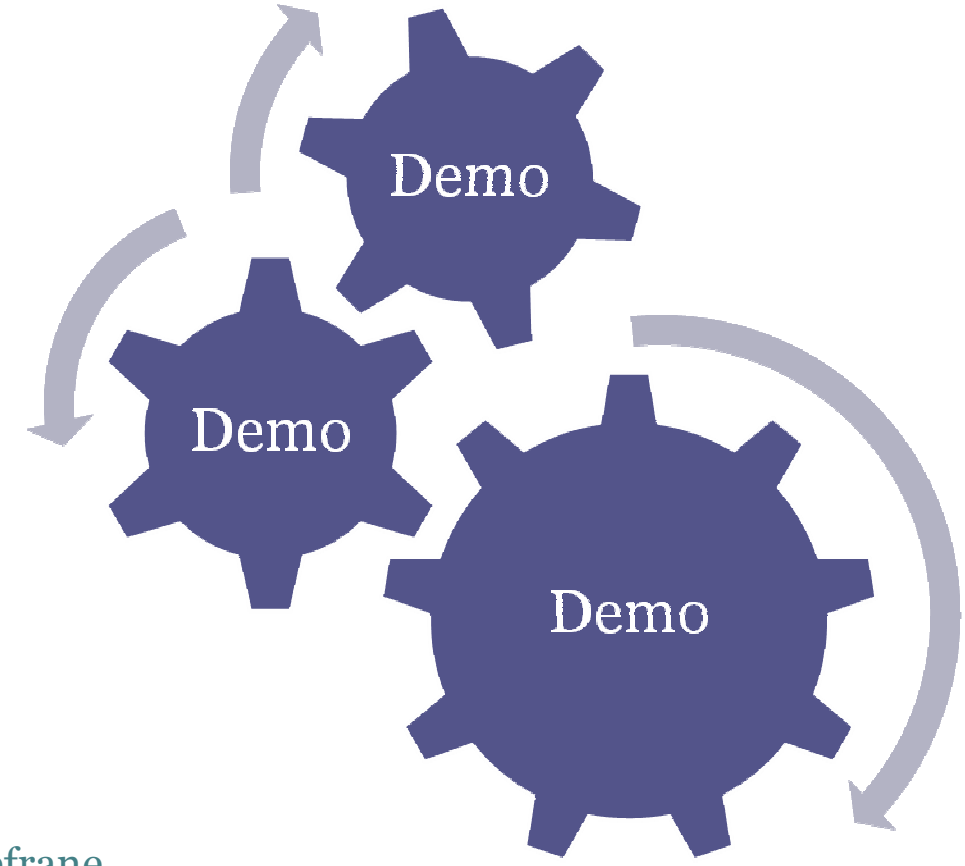
NFC-Tools Api



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Exercise 1

- Create an application which writes the value 2014 hex to the sector 4 block 0
- Modify the application that we saw in the demo to read only the sector 4 block 0
- The API (jar files) is accessible here:
  - http://cedric.cnam.fr/~bouzefra/cours/Api.zip
- The program that reads a Mifare tag is accessible here:
  - http://cedric.cnam.fr/~bouzefra/cours/Tag_Lecture.zip

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Exercise 2

- Modify the application of writing to write the trailer sector of sector 4 (change the value of key A to FFFFFFFFFFFE hex) DO NOT CHANGE THE ACCESS BYTES
- Run the application of reading (what do you see?)
- Modify the application of reading in order to read the sector 4 block 0
- Restore the default key A of the sector 4 (FFFFFFFFFFFF hex)

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References

- [MF1] MF1S503x Manual
- [GRU] https://github.com/grundid/nfctools
- [ACR] ACR122 and ACR128 Manual
- http://cedric.cnam.fr/~bouzefra/cours/Api.zip
- http://cedric.cnam.fr/~bouzefra/cours/Tag_Lecture.zip
- http://cedric.cnam.fr/~bouzefra/cours_smos.html