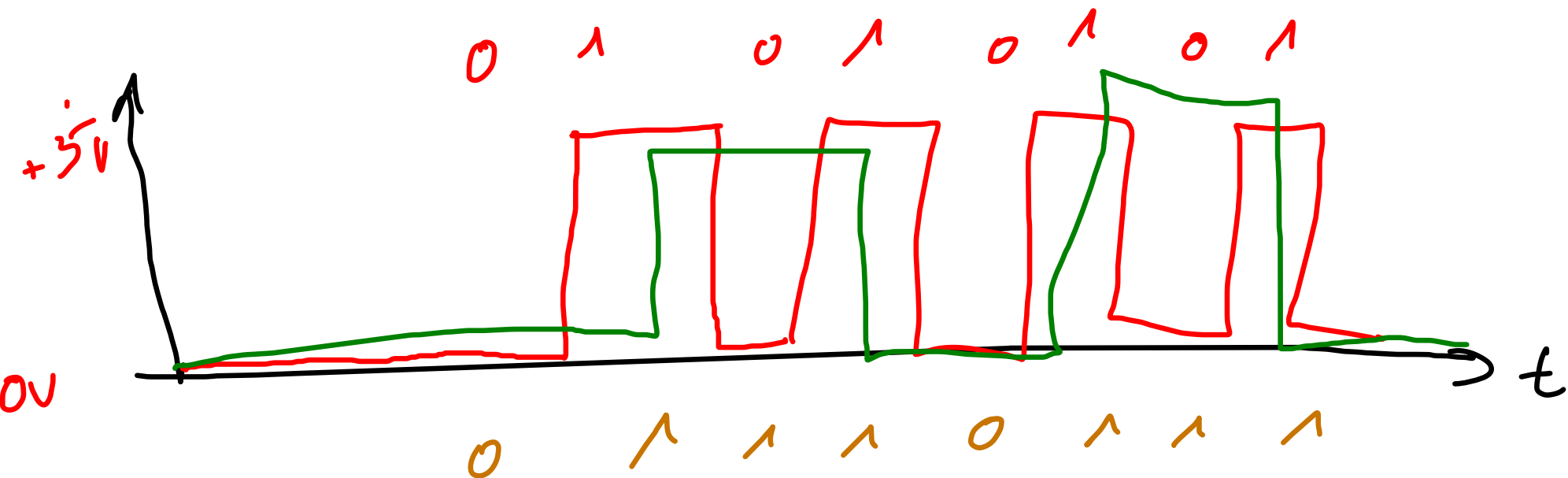
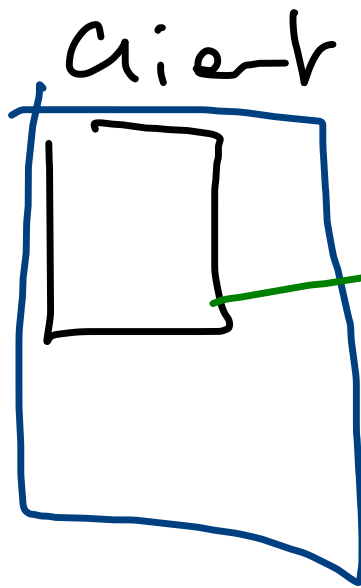


Alan TURING  
The imitation game

Somme de contrôle - Checksum



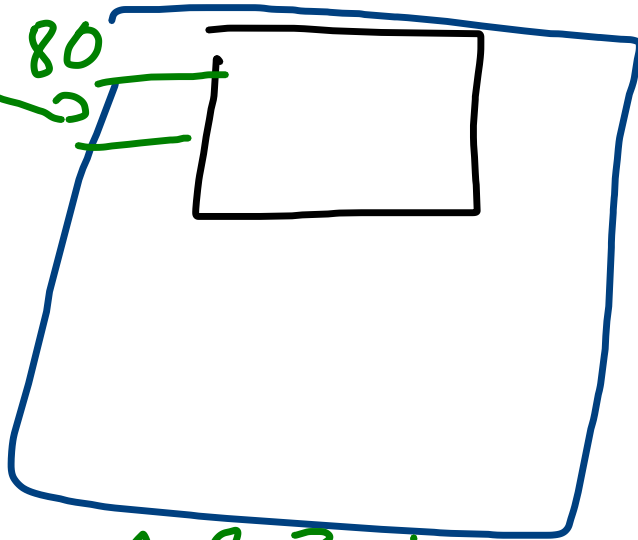


②

3 Request  
4 Response  
5 Server

①

Server



80

1.2.3.4

HTTPD

Apache

NGINX

LIGHTTPD

Mosaic (-> Mosaic Killa)

Netscape

Mozilla Firefox

Webkit

- Safari

- Chrome

- Edge

Opera

HTTP

Hyper Text Transport Protocol

HTML

Hyper Text Markup Language

$$\begin{array}{c}
 10 \\
 \swarrow \quad \searrow \\
 1 \times 2^1 \quad + \quad 0 \times 2^0 \\
 \underbrace{\hspace{1cm}} \quad \downarrow \quad \downarrow \\
 2 \quad + \quad 0 \times 1 \\
 \hspace{1.5cm} \underbrace{\hspace{1cm}} \\
 \hspace{1.5cm} 0 = 2
 \end{array}$$

$2^5$

$$\begin{array}{c}
 11 \\
 \swarrow \quad \searrow \\
 1 \times 2^1 + 1 \times 2^0
 \end{array}$$

$$\begin{array}{c}
 1101 \\
 \swarrow \quad \downarrow \quad \downarrow \quad \searrow \\
 1 \times 2^3 \quad + \quad 1 \times 2^2 \quad + \quad 0 \times 2^1 \quad + \quad 1 \times 2^0 \\
 \underbrace{\hspace{1cm}} \quad \underbrace{\hspace{1cm}} \quad \underbrace{\hspace{1cm}} \quad \underbrace{\hspace{1cm}} \\
 8 \quad \quad 4 \quad \quad 2 \quad \quad 1
 \end{array}$$

Calculer la valeur décimale de

- 0110 : 6  
- 1110 : 14  
- 111000 : 56  
- 10011100 : 156  
- 10011010 : 154  
- 1001111011 : 635

|          |       |
|----------|-------|
| $2^0$    | 1     |
| $2^1$    | 2     |
| $2^2$    | 4     |
| $2^3$    | 8     |
| $2^4$    | 16    |
| $2^5$    | 32    |
|          | 64    |
|          | 128   |
| $2^8$    | 256   |
|          | 512   |
|          | 1024  |
|          | 2048  |
|          | 4096  |
|          | 8192  |
|          | 16384 |
|          | 32768 |
| $2^{16}$ | 65536 |

bits

octets = 8 bits

Byte = mot de X bits

0..F: 0 1 2 3 4 5 6 7 8 9 A B C D E F

$2^{10}$  : K

$2^{20}$  : M

$2^{30}$  : G

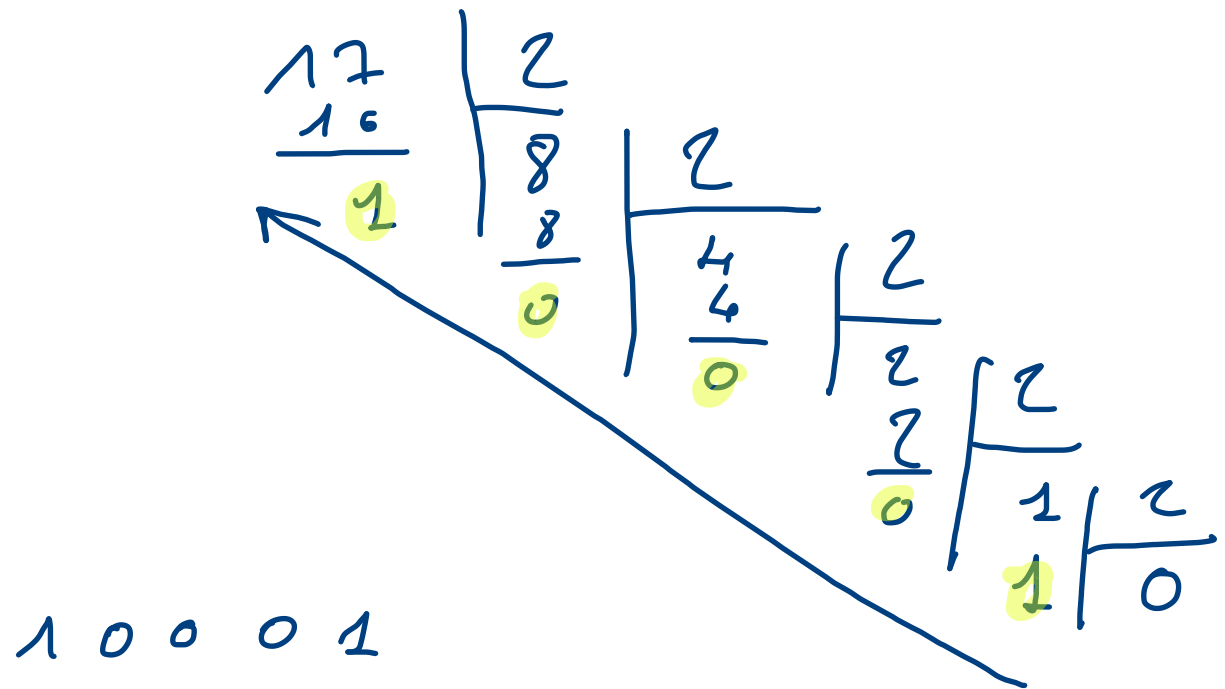
$2^{40}$  : T

| Décimal | Hexa | Binaire |                                                            |
|---------|------|---------|------------------------------------------------------------|
| 0       | 0    | 0       | bits                                                       |
| 1       | 1    | 1       | octets = 8 bits                                            |
| 2       | 2    | 10      |                                                            |
| 3       | 3    | 11      | Byte = mot de X bits                                       |
| 4       | 4    | 100     |                                                            |
| 5       | 5    | 101     | 0..F: 0 1 2 3 4 5 6 7 8 9 A B C D E F                      |
| 6       | 6    | 110     |                                                            |
| 7       | 7    | 111     |                                                            |
| 8       | 8    | 1000    | hexadécimal                                                |
| 9       | 9    | 1001    | - 1F : 0001 1111 : $2^5 - 1$ : $32 - 1 = 31$               |
| 10      | A    | 1010    | - EF : 1110 1111 : $14 \times 16^1 + 15 \times 16^0 = 239$ |
| 11      | B    | 1011    | - C2 : 1100 0010 : $12 \times 16^1 + 2 = 194$              |
| 12      | C    | 1100    | - CAFE : 1100 1010 1111 1110                               |
| 13      | D    | 1101    | - BABA : 1011 1010 1011 1010                               |
| 14      | E    | 1110    | - F0 : 1111 0000 : 240                                     |
| 15      | F    | 1111    | - F1 : 1111 0001 : 241                                     |
| 16      | 10   | 10000   | - F8 : 1111 1000 : 248                                     |
| 17      | 11   | 10001   |                                                            |

1- Représentation binaire  
2- valeur décimale

Convertir en base 2

- 5
- 16
- 21
- 32
- 512
- 511
- 673
- 1000
- 60000



Convertir en base 2

- 5
- 16
- 21
- 32
- 512
- 511
- 673
- 1000
- 60000

$$\begin{array}{r} 17 \\ 16 \longrightarrow 1 \times 2^4 (16) \\ \hline 1 \longrightarrow 0 \times 2^3 (8) \\ 0 \longrightarrow 0 \times 2^2 (4) \\ 1 \longrightarrow 0 \times 2^1 (2) \\ 0 \longrightarrow 1 \times 2^0 (1) \\ \hline 1 \\ 2 \\ 1 \\ \hline 0 \end{array}$$

$$2^{-1} = \frac{1}{2}$$

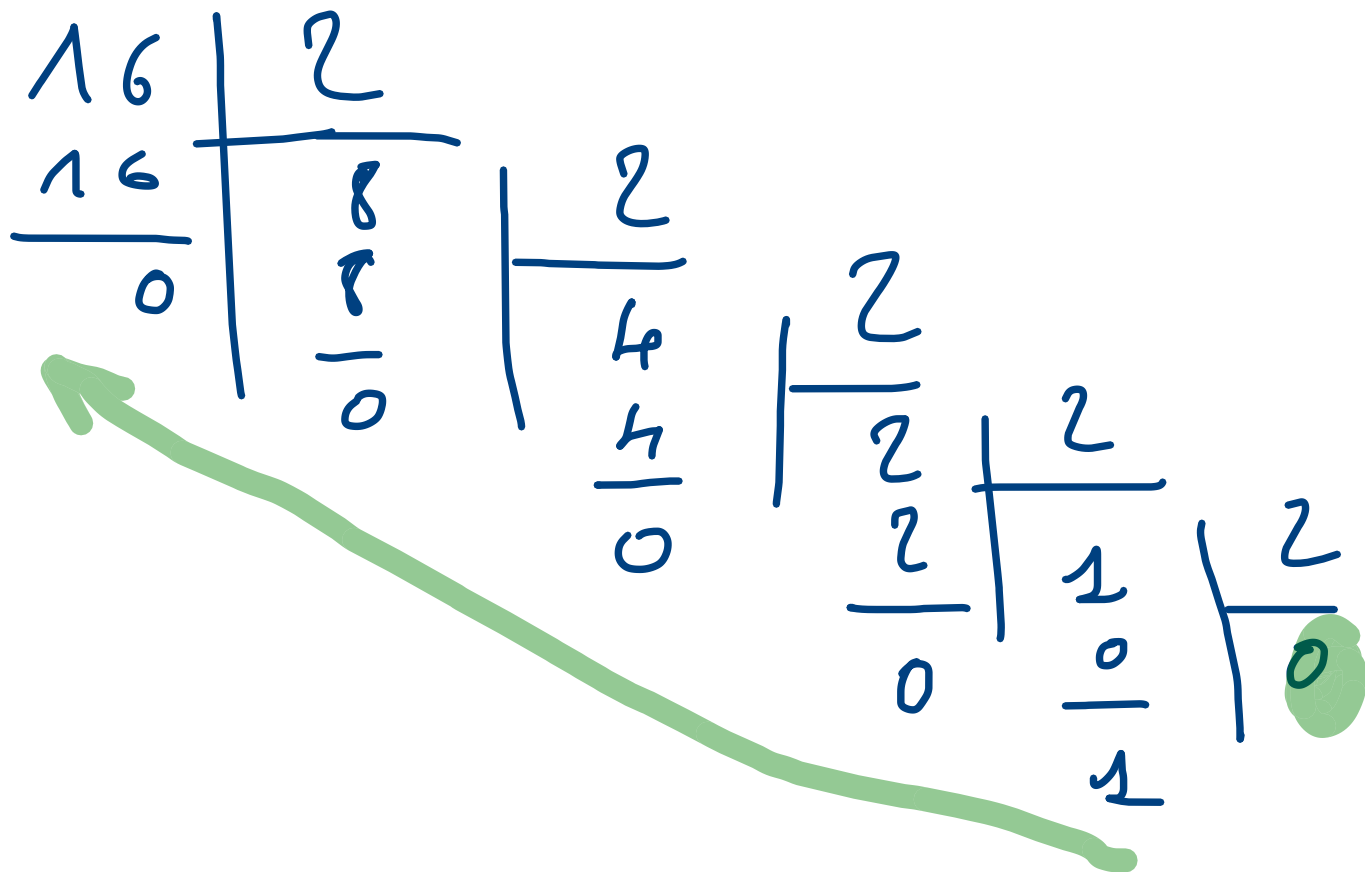
$$\begin{array}{r}
 41 \\
 32 \\
 \hline
 9 \\
 0 \\
 \hline
 9 \\
 8 \\
 \hline
 1 \\
 0 \\
 \hline
 1 \\
 0 \\
 \hline
 1 \\
 1 \\
 \hline
 0
 \end{array}$$

$$\begin{array}{l}
 1 \times 2^5 (32) \\
 0 \times 2^4 (16) \\
 1 \times 2^3 (8) \\
 0 \times 2^2 (4) \\
 0 \times 2^1 (2) \\
 1 \times 2^0 (1)
 \end{array}$$

$$101001$$

Convertir en base 2

- 5
- 16
- 21
- 32
- 512
- 511
- 673
- 1000
- 60000



[illegible]

60001000 - - - - -

- - - - -

offset

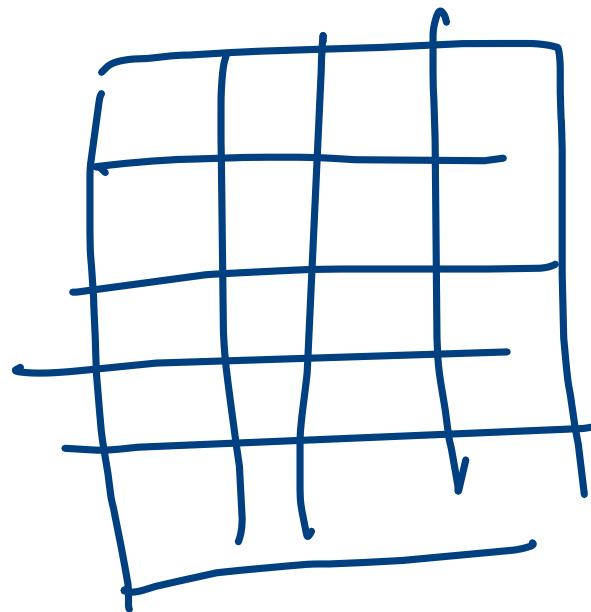


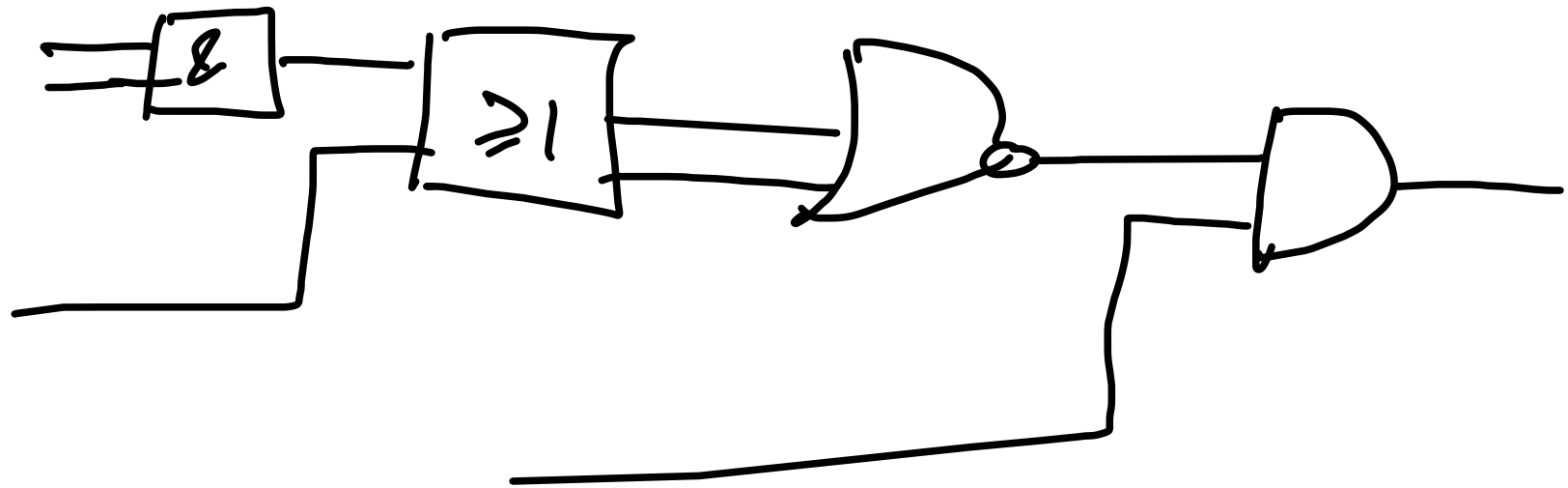
0

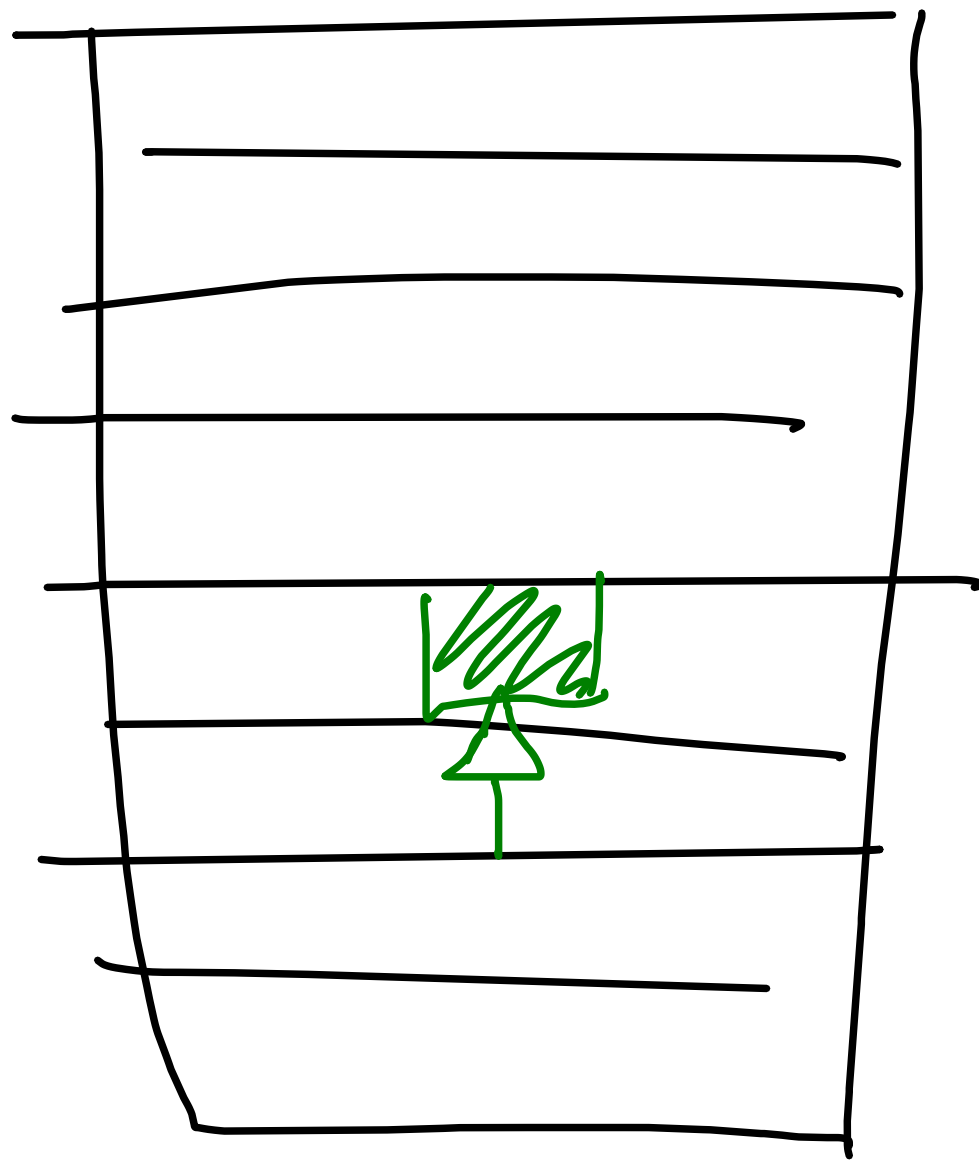
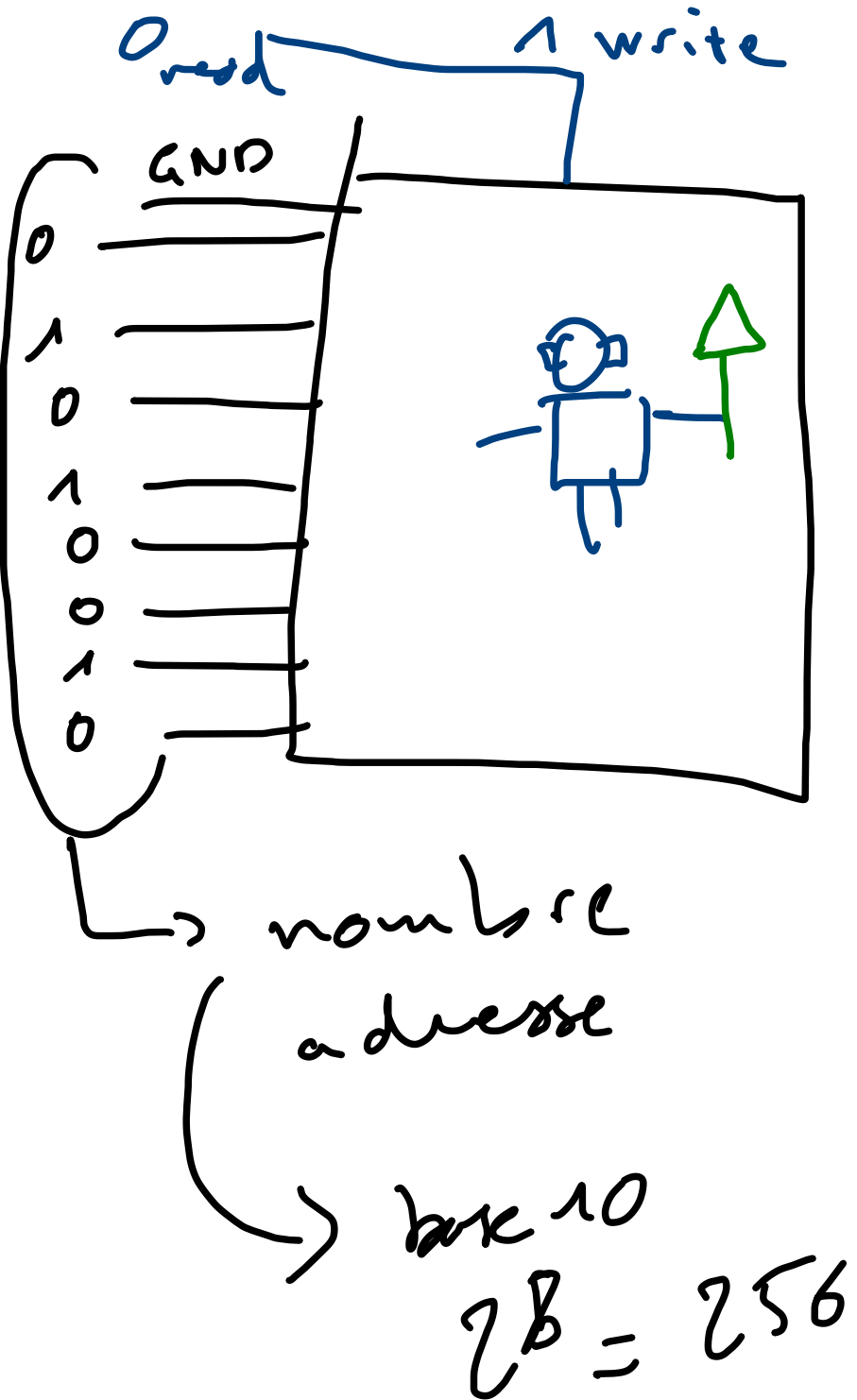
$2^{30}$

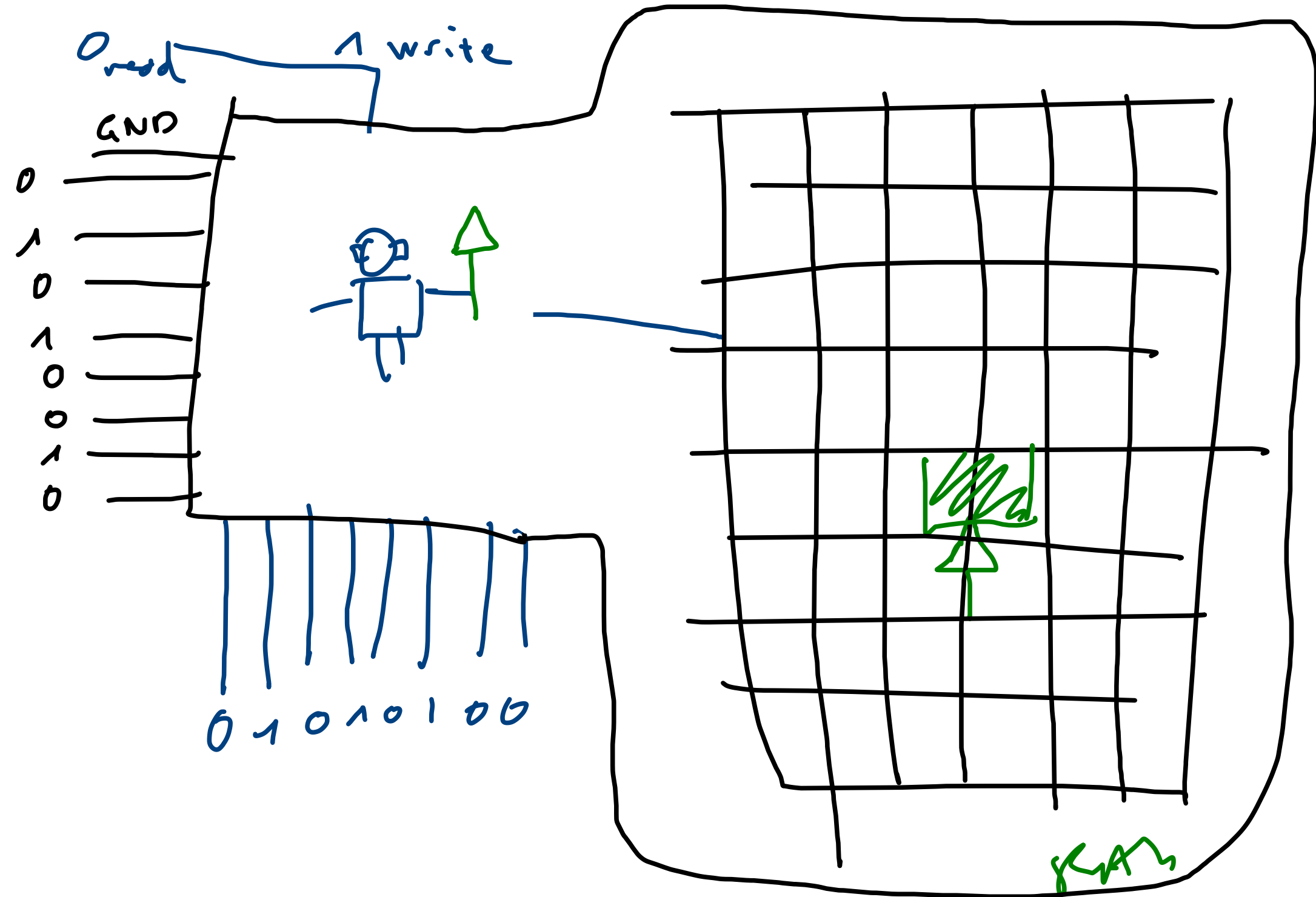


CPU









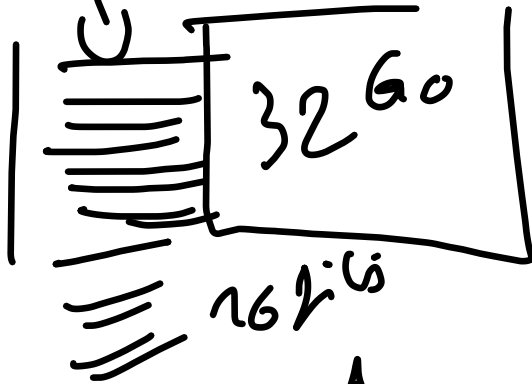
Steve Jobs - Steve Wozniak

32 Go



$$32 \times 2^{30} \times 8$$
$$2^5 \times 2^{30} \times 2^3 = 2^{38} \text{ bits}$$

bus  
did not



256

~~2<sup>8</sup>~~  
2<sup>16</sup>

elements

$$2^{38} \left| \begin{array}{l} 2^{16} \\ \hline 2^{22} \end{array} \right.$$

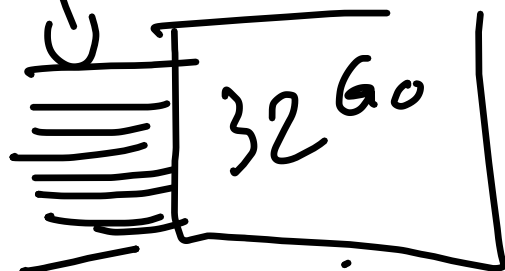
32 Go

→

$$32 \times 2^{30} \times 8$$

$$2^5 \times 2^{30} \times 2^3 = 2^{38} \text{ bits}$$

bus  
did not



$$2^{38} \mid \frac{2^{32}}{2^6}$$

Address  
32 bits

$$2^{38} \mid \frac{2^{64}}{2^{26}}$$

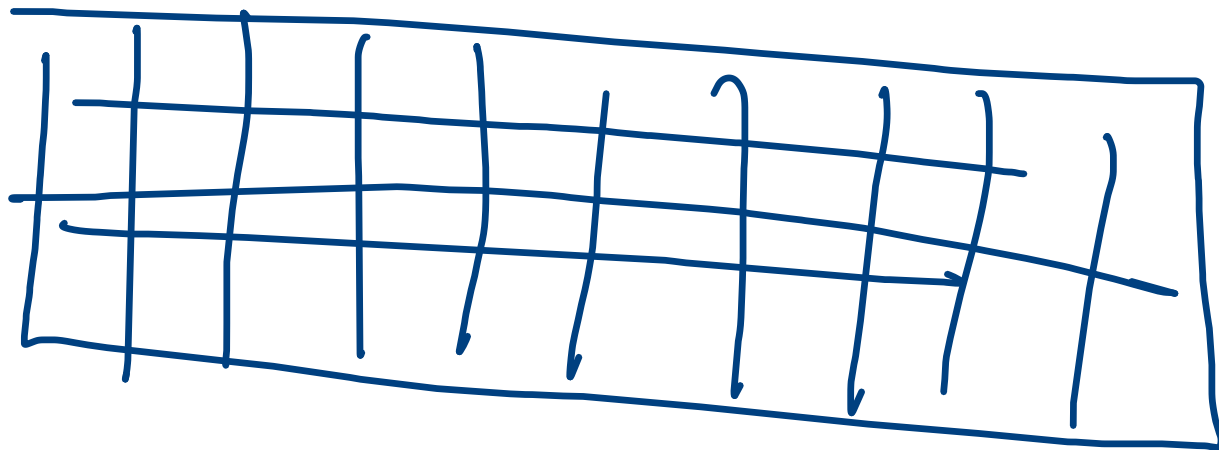
64 bits

32 bits

32 bits

$2^{32}$

1



16 G0

$16 \times 2^{30}$  o desk

$2^4 \times 2^{30} = 2^{34}$  o desk

$2^4 \times 2^{30} \times 2^3 = 2^{37}$  bits

$2^{16}$  cores

$2^{32}$

$2^{37} \mid \begin{array}{l} 2^{\cancel{16} 32} \\ 2^{\cancel{21} 5} \end{array}$

- Entiers relatifs (Complément à 2)
- IEEE754 (nombres à virgule flottante)
- ASCII
- CP1252 (ISO 8859)
- Unicode (UTF-8 etc)

|    |     |      |           |                            |
|----|-----|------|-----------|----------------------------|
|    | -7  | 1111 | 10000     | Complément à 1             |
|    | -6  | 1110 | 1111 (-7) | 0 -> 1                     |
| -9 | -5  | 1101 |           | 1 -> 0                     |
| -7 | ... |      |           |                            |
| -2 | -2  | 1010 |           | -1 : 0001 -Ca1-> 1110 (-1) |
| -1 | -1  | 1001 |           |                            |
| 0  | -0  | 1000 |           |                            |
| 1  | 0   | 0000 |           |                            |
| 4  | 1   | 0001 |           |                            |
| 9  | 2   | 0010 |           |                            |
| 18 | 3   | 0011 |           |                            |
|    | 4   | 0100 |           |                            |
|    | 5   | 0101 |           |                            |
|    | 6   | 0110 |           |                            |
|    | 7   | 0111 |           |                            |

Complément à 1

0 -&gt; 1

1 -&gt; 0

-1 : 0001 -Ca1-&gt; 1110 (-1)

-7 1000

-6 1001

-5 1010

...

-2 1101

-1 1110

-0 1111

0 0000

1 0001

2 0010

3 0011

4 0100

5 0101

6 0110

7 0111

Complément à 1+1 (Complément à 2)

0 -> 1

1 -> 0

-1 : 0001 -Ca1-> 1110 -Ca1+1-> (-1) 1111

-8 1000  $-2^{4-1}$   $n=16$   $-2^{n-1}$

-7 1001 (1000 + 1)

-6 1010 (1001 + 1)

-5 1011 (1010 + 1)

... 2 147 483 647

-2 1110 (1101 + 1)

-1 1111

0 0000

1 0001

2 0010

3 0011

4 0100

5 0101

6 0110

7 0111

$2^{4-1} - 1$

$2^{n-1} - 1$

1/1/1970

$n = 4 \text{ bits}$

|    |      |                                              |
|----|------|----------------------------------------------|
| -8 | 1000 | $\rightarrow 2^3 = -2^{n-1}$                 |
| -7 | 1001 |                                              |
| -6 | 1010 |                                              |
| -5 | 1011 |                                              |
| -4 | 1100 |                                              |
| -3 | 1101 |                                              |
| -2 | 1110 |                                              |
| -1 | 1111 |                                              |
| 0  | 0000 |                                              |
| 1  | 0001 |                                              |
| 2  | 0010 |                                              |
| 3  | 0011 |                                              |
| 4  | 0100 |                                              |
| 5  | 0101 |                                              |
| 6  | 0110 |                                              |
| 7  | 0111 | $\rightarrow 2^{n-1} - 1$<br>$2^3 - 2^0 = 7$ |

|      |      |      |                                 |
|------|------|------|---------------------------------|
| -128 | 1000 | 0000 |                                 |
| -127 | 1000 | 0001 |                                 |
| ...  |      |      |                                 |
| -9   | 1111 | 0111 |                                 |
| -8   | 1111 | 1000 |                                 |
| -7   | 1111 | 1001 |                                 |
| -6   | 1111 | 1010 |                                 |
| -5   | 1111 | 1011 |                                 |
| -4   | 1111 | 1100 |                                 |
| -3   | 1111 | 1101 |                                 |
| -2   | 1111 | 1110 |                                 |
| -1   | 1111 | 1111 |                                 |
| 0    | 0000 | 0000 |                                 |
| 1    | 0000 | 0001 | -Ca1> 1111 1110 + 1 = 1111 1111 |
| 2    | 0000 | 0010 |                                 |
| 3    | 0000 | 0011 |                                 |
| 4    | 0000 | 0100 |                                 |
| 5    | 0000 | 0101 |                                 |
| 6    | 0000 | 0110 |                                 |
| 7    | 0000 | 0111 |                                 |
| 8    | 0000 | 1000 |                                 |
| 9    | 0000 | 1001 |                                 |
| ...  |      |      |                                 |
| 127  | 0111 | 1111 | -Ca1> 1000 0000 + 1 = 1000 0001 |

$$n=8 \quad -2^{n-1} \text{ à } 2^{n-1} - 1$$

Limites de codage

Nombres entiers signés sur

- 16 bits : -32768 à 32767

- 32 bits :

min -2 147 483 648

max 2 147 483 647

- 64 bits

-  $2^{63}$  à  $(2^{63})-1$

Même calcul avec des entiers NON signés

fixed point



00002500,00000000  
10000000,\_\_\_\_\_

0,00157

$1,57 \times 10^{-3}$

$10^3 \sim K$

$2^{10}$

2500



$2,5 \times 10^3$

1575127

$1,575127 \times 10^6$

$2^5$

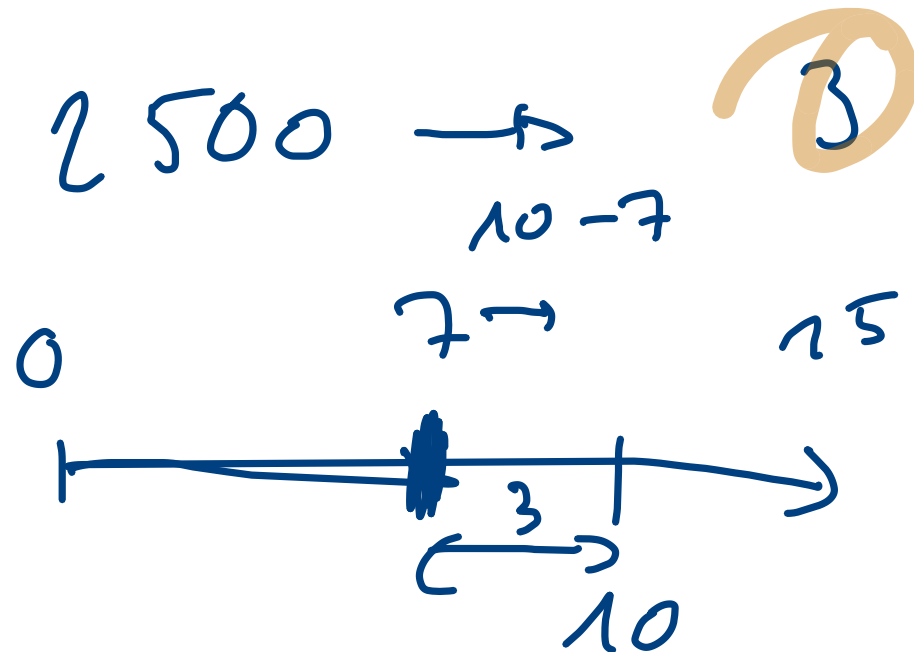
$2^{-3}$

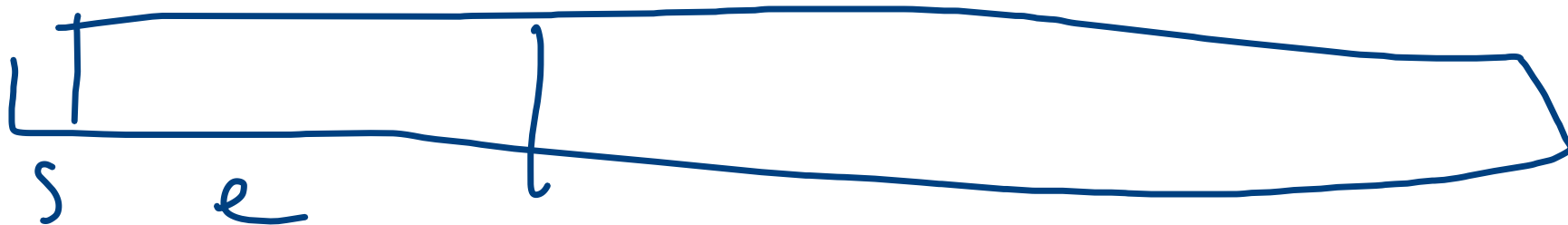
$2^{-10}$

|       |          |                     |
|-------|----------|---------------------|
| 0,5   | $2^{-1}$ | $1/2$               |
| 0,25  | $2^{-2}$ | $1/2/2$             |
| 0,125 | $2^{-3}$ | $1/2/2/2 = 1/(2^3)$ |

|       |           |                       |
|-------|-----------|-----------------------|
| 0,1   | $10^{-1}$ | $1/10$                |
| 0,001 | $10^{-3}$ | $1/10/10/10 = 1/1000$ |

4 bits  
 ↓  
 16 valeurs  
 0 à 15  
 ↓  
 10





$$2^{(e - \text{bias})}$$

~

$$2^{\cancel{252}}$$

$$-128 \text{ or } 127 \rightarrow 2^{-128}$$

$$2^{127}$$

$$\text{bias} = 2^{e-1} - 1$$

$$2^{10} \rightarrow K$$

$$10^3$$

$$2^{20} \rightarrow M$$

$$10^6$$

$$2^{30} \rightarrow$$

$$10^9$$

$$2^{120} \rightarrow \dots$$

$$10^{36}$$

Sur 8 bits

Calculer l'opposé de:

\* 67

\* 64

\* 92

\* 100

\* -47

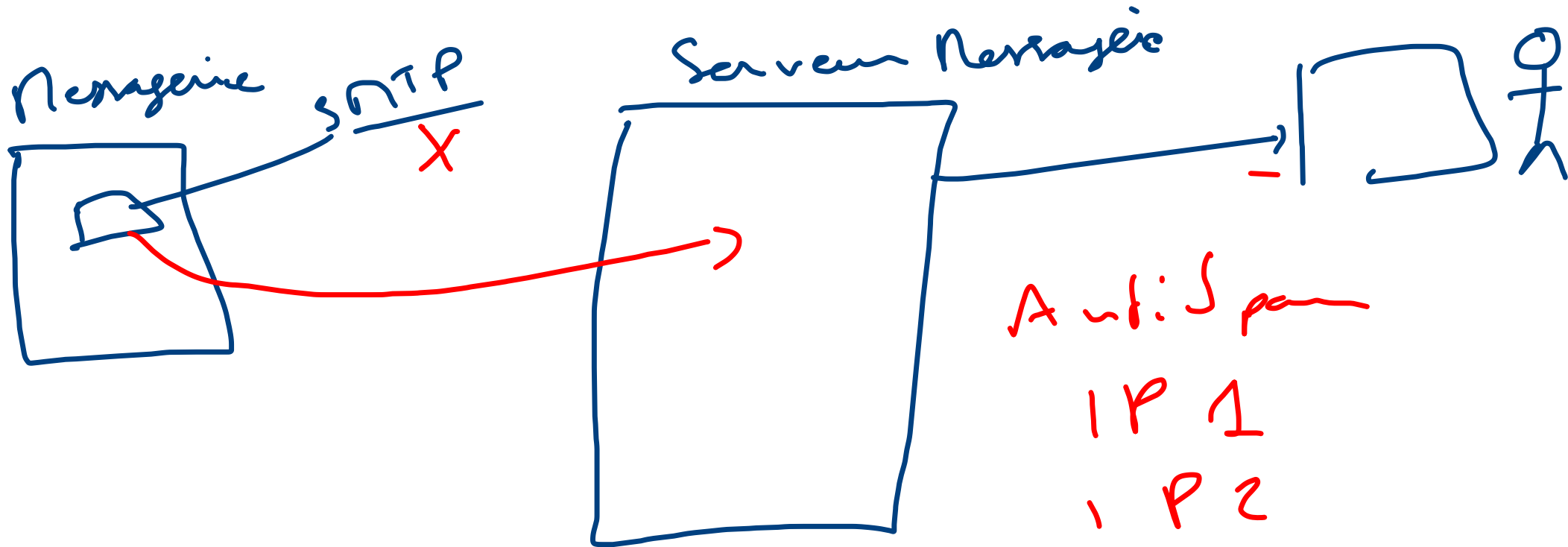
\* -120

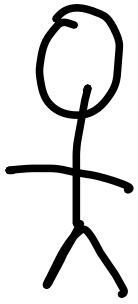
\* -17

\* -85

# SMTP

Simple Mail Transfer Protocol

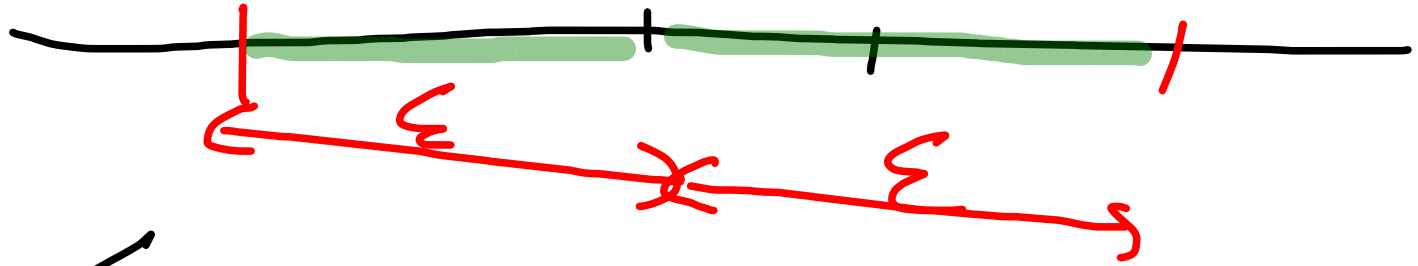




$$a = 1,5$$

$$h = 1,5000000000000000000000$$

a b



$$|a - b| < \epsilon$$

$$a - \varepsilon \leq b \leq a + \varepsilon$$

|      |      |      |
|------|------|------|
| -128 | 1000 | 0000 |
| -127 | 1000 | 0001 |
| -126 | 1000 | 0010 |
| -125 | 1000 | 0011 |
| -124 | 1000 | 0100 |
| -123 | 1000 | 0101 |
| -122 | 1000 | 0110 |
| -121 | 1000 | 0111 |
| -120 | 1000 | 1000 |

...

|    |      |      |
|----|------|------|
| -9 | 1111 | 0111 |
| -8 | 1111 | 1000 |
| -7 | 1111 | 1001 |
| -6 | 1111 | 1010 |
| -5 | 1111 | 1011 |
| -4 | 1111 | 1100 |
| -3 | 1111 | 1101 |
| -2 | 1111 | 1110 |
| -1 | 1111 | 1111 |

|   |      |      |
|---|------|------|
| 0 | 0000 | 0000 |
|---|------|------|

|   |      |      |       |      |      |   |   |   |      |      |
|---|------|------|-------|------|------|---|---|---|------|------|
| 1 | 0000 | 0001 | -Ca1> | 1111 | 1110 | + | 1 | = | 1111 | 1111 |
|---|------|------|-------|------|------|---|---|---|------|------|

|   |      |      |
|---|------|------|
| 2 | 0000 | 0010 |
|---|------|------|

|   |      |      |
|---|------|------|
| 3 | 0000 | 0011 |
|---|------|------|

|   |      |      |
|---|------|------|
| 4 | 0000 | 0100 |
|---|------|------|

|   |      |      |
|---|------|------|
| 5 | 0000 | 0101 |
|---|------|------|

|   |      |      |
|---|------|------|
| 6 | 0000 | 0110 |
|---|------|------|

|   |      |      |
|---|------|------|
| 7 | 0000 | 0111 |
|---|------|------|

|   |      |      |
|---|------|------|
| 8 | 0000 | 1000 |
|---|------|------|

|   |      |      |
|---|------|------|
| 9 | 0000 | 1001 |
|---|------|------|

...

|     |      |      |       |      |      |   |   |   |      |      |
|-----|------|------|-------|------|------|---|---|---|------|------|
| 127 | 0111 | 1111 | -Ca1> | 1000 | 0000 | + | 1 | = | 1000 | 0001 |
|-----|------|------|-------|------|------|---|---|---|------|------|

|       |      |      |      |
|-------|------|------|------|
|       |      | 0111 | 1000 |
| Ca1   | 1000 | 0111 |      |
| +     |      |      | 1    |
| ----- |      |      |      |
|       |      | 1000 | 1000 |

10.29.19.86  
00001010.00011101.00010011.01010110

10.29.16.242  
00001010.00011101.00010000.11110010

255.255.248.0  
11111111.11111111.11111000.00000000

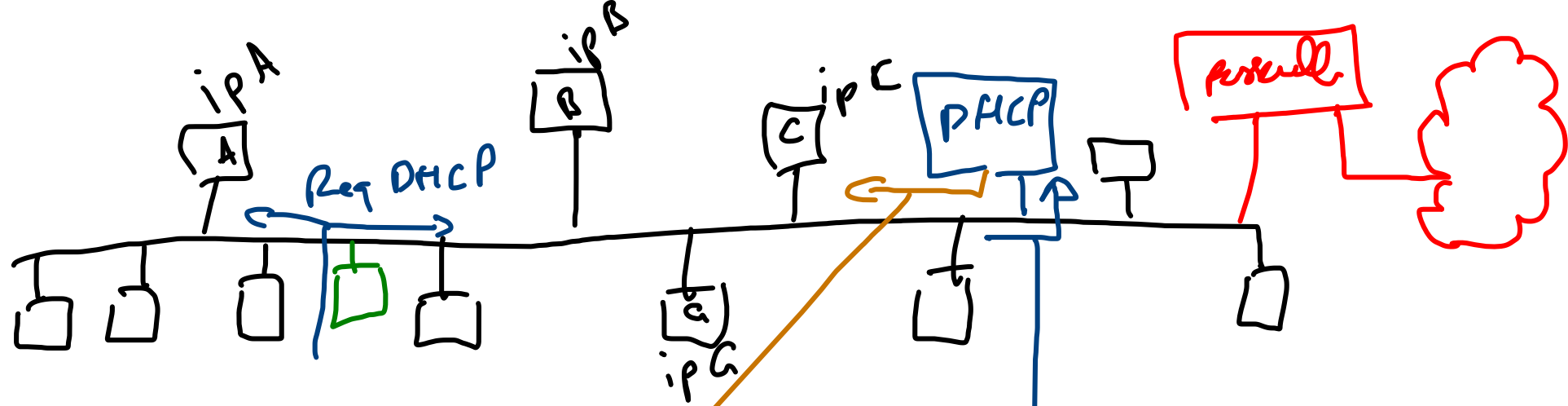
0xff ff f8 00  
11111111 11111111 11111000 00000000

00001010.00011101.00010011.01010110  
11111111.11111111.11111000.00000000  
00001010.00011101.00010000.00000000

00001010.00011101.00010000.11110010  
11111111.11111111.11111000.00000000

00001010.00011101.00010000.00000000

10.29.248.0/21  
 $\Rightarrow 2^{(32-21)} = 2^1 = 2048$



ip: 10.29.19.122  
masq: 21  
broadcast: 10.29.23.255  
passerelle: 10.29.23.254  
dns: 8.8.8.8  
dns2: 8.8.8.4

MAC  
Hardware  
Physique  
ether ethernet