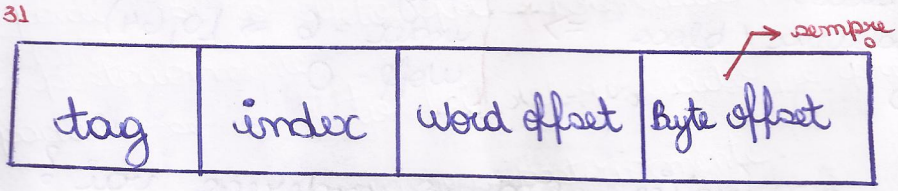
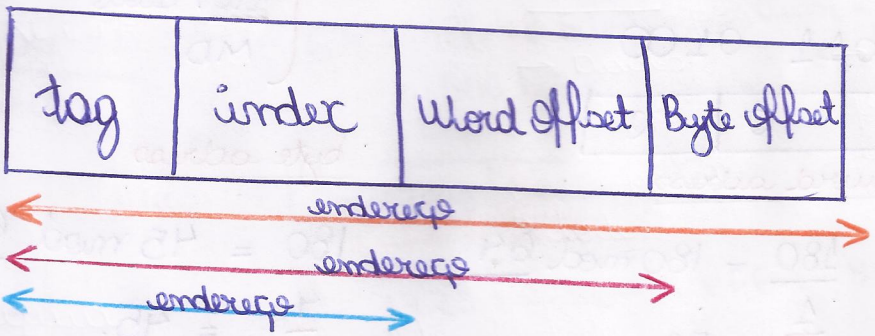
Mapeamento Direto

→ Definição: cada endereço da memória mapeia para um único bloco.



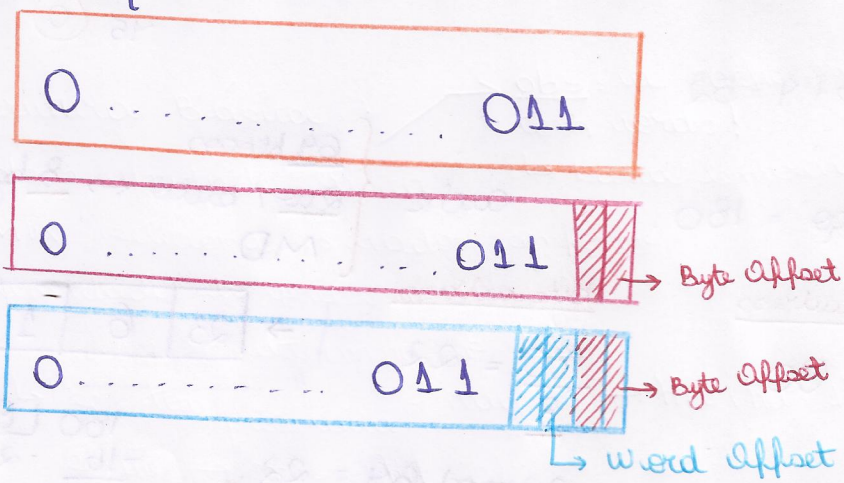
→ Block adress vs Word Adress vs Byte Adress



ou seja:

- "tampa" os bits do Byte Offset (30 bits)
- "tampa" os bits do Word Offset e do Byte Offset (30 - bits Word Offset)
- os 32 bits representam o endereço.

Ex: endereço (inteiro) = 3. e Word Offset = 2 bits.



→ Descobrindo a quantidade de bits para tag, index e Woff:

Cache: { n blocos; m palavras por bloco; mapeamento direto } ⇒ { tag: $32 - 2$ (Byte Offset) $- \log_2 n - \log_2 m$; index: $\log_2 n$; Woff: $\log_2 m$ }

Ex 1: Cache { 1024 blocos; 4 palavras / bloco; MD. } ⇒ { tag = 32 − 2 − 10 − 2 = 18; index = 10 → [0, 1024); woff = 2 → [0, 4) }

Ex 2: Cache { 64 blocos; 1 palavra / bloco; MD } ⇒ { tag = 32 − 2 − 6 − 0 = 24; index = 6 → [0, 64); woff = 0 }

→ Como achar o índice onde o endereço vai?

Ex 1: endereço = 180.

Cache { 64 blocos; 1w / bloco ↔ 4 bytes / bloco; MD }

binário = 1011 0100

→ | 24 | 6 | 0 | 2 |

block address

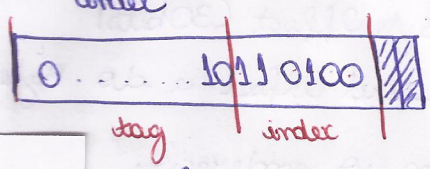
180 mod 64 = 52.

↓ index

180 | 64
−128 | 2
052

word address

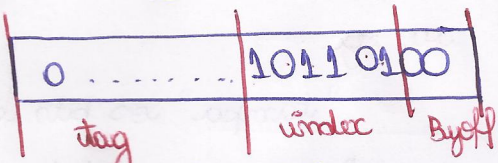
180 = 180 mod 64
1
= 52.
↓ index



index = 52
tag = 2

byte address

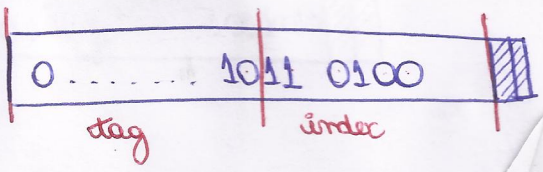
180 = 45 mod 64
4
= 45.



index = 5 4 3 2 1 0 = 101101 = 32+8+4+1 = 45.

tag = 0

45 | 64
45 | 0



index = 5 4 3 2 1 0 = 110100 = 32+16+4 = 52

tag = 0...10 = 2.

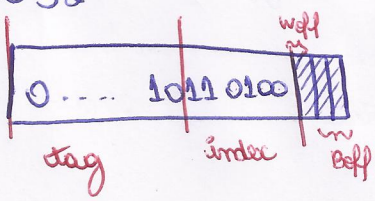
Ex 2: endereço = 180.

Cache { 64 blocos; 2w / bloco ↔ 8 bytes / bloco; MD }

block address

180 mod 64 = 52.

180 | 64
−128 | 2
052



index = 52

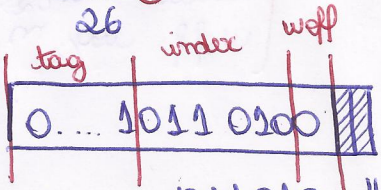
tag = 2

word address

180 = 90
2

90 mod 64 = 26

8 1
90 | 64
−64 | 1
26



index = 011010 = 16+8+2 = 26
4 3 2 1 0

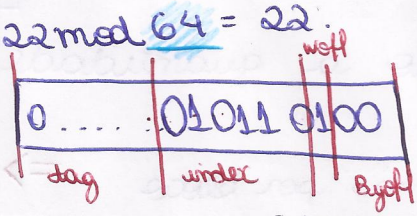
woff = 0 → 180 mod 2!

tag = 1

byte address

180 = 22
8

22 mod 64 = 22.



index = 5 4 3 2 1 0 = 010110 = 22

woff = 1 → 180 mod 8 / 4

tag = 0

→ | 23 | 6 | 1 | 2 |

180 | 8
−16 | 22
20
−16
4

22 | 64
22 | 0

Quantidade de Bits que uma cache precisaria

① Cache { 64 blocos; 1w/bloco; MD }

② Cache { 64 blocos; 2w/bloco; MD }

Obs: Cache size (KiB) → quantidade de dados em bytes / bits / 1 / 1

Cache 1: $32 \cdot 64 = 2^5 \cdot 2^6 = 2^{11}$ bits = 2 Kbits.

Cache 2: $2 \cdot 32 \cdot 64 = 2^1 \cdot 2^5 \cdot 2^6 = 2^{12} = 4$ Kbits.

Cache 1:

$i \in [0, 64)$

Bloco i:

válido	tag	word 0
1	24	32

24	6	0	2

$\frac{\text{Bits}}{\text{Bloco}} = 1 + 24 + 32 = 57$ Bits

$\frac{\text{Quantidade de Bits}}{\text{Cache}} = 57 \cdot 64 = 3648$ bits

$= 456$ bytes.

Cache 2:

Bloco i:

válido	tag	word 0	word 1
1	23	32	32

23	6	1	2

$\frac{\text{Bits}}{\text{Bloco}} = 1 + 23 + 2 \cdot 32 = 24 + 64 = 98$ bits

$\frac{\text{Quantidade de Bits}}{\text{Cache}} = 98 \cdot 64 = 6272$ bits

$= 784$ bytes.