05 May 2020 12:03

3.1.1 Direct mapping

Example Memory of 2^{24} words (1 word = 32 bits = 4B) [MM capacity]

Addressing is made at word level (not byte)

1 block = 4 words $= 4 = 2^2$

How do we implement DM of the specified addresses, with a 1 kiline (1Ki block) cache memory: 2^{10} blocks

Address: 8192, 4100, 12292

MOVE → Code 230
BNE → Code 2715
ADD → Code 170

$\frac{2^{24} \text{ words [MM size]}}{2^2 \text{ words [block size]}} = 2^{22}$ blocks [MM size]

<12> | <10> | <2>
Tag | Index | Block offset
Address
Word
24

MM

Address | Block number

	0	1	2	3	
0	0	1	2	3	0
4	4	5	6	7	1
8	8	9	10	11	2
12	12	13	14	15	3
4092					1023
4096					1024
4100	2715	~	~	~	1025
8192	230	~	~	~	2048
8196					2049
12292	170				3073
$2^{24}-4$					$2^{22}-1$

2048 mod 1024 = 0
1025 mod 1024 = 1
3073 mod 1024 = 1

	V	Tag <12>	32 bit: 0	1	Data 2	3
0	1	2	230	~	~	~
1	1	~~1~~ 3	~~2715~~ 170	~	~	~
2						
3						
i						
1023						

$2^{10} = 1024$
$2^{11} = 2048$
$2^{12} = 4096$
$2^{13} = 8192$

12292 − 8192 = 4100 − 4096 = 4

$12292 = 2^{13} + 2^{12} + 4$

	Tag	Index	Block offset	
8192	0 ... 0 0 0 1 0	0 0 0 0 0 0 0 0 0 0	0 0	Address
4100	0 ... 0 0 0 0 1	0 0 0 0 0 0 0 0 0 1	0 0	
12292	0 ... 0 0 0 1 1	0 0 0 0 0 0 0 0 0 1	0 0	