

3.1.1 Direct mapping

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

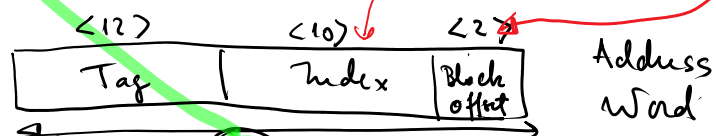
Addressing is made at word level (not byte)

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

How do we implement DTM of the specified addresses, with a 1k-line (1K block) cache memory:

Address	
8192	MOVE → Code 230
4100	BNE → Code 2715
12292	ADD → Code 170

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



Address	Block number
0	0
4	1
8	2
12	3
...	...
4092	1023
4096	1024
4100	1025
...	...
8192	2048
8196	2049
...	...
12292	3073
...	...
$2^{24}-4$	$2^{22}-1$

Tag	Index	Block offset
0	1	2
1	3	1
2		
3		
...
1		
...
1023		

$$2048 \bmod 1024 = 0$$

$$1025 \bmod 1024 = 1$$

$$3073 \bmod 1024 = 1$$

Tag	Index	Block offset
8192	000010	000000000000000000
4100	000001	0000000000000100
12292	000011	00000000000100

$$2^{10} = 1024$$

$$2^{11} = 2048$$

$$2^{12} = 4096$$

$$2^{13} = 8192$$

$$12292 - 8192 = 4100$$

$$4100 - 4096 = 4$$

$$2 = 4$$

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