A SMALL DIRECT-MAPPED CACHE

Cache

Data	Tag	Index
		00
		01
		10
		11

Main Memory

Address

Data	Tag	Index	
	00	00	xx
	00	01	xx
	00	10	xx
	00	11	xx
	01	00	xx
	01	01	xx
	01	10	xx
	01	11	xx
	10	00	xx
	10	01	xx
	10	10	xx
	10	11	xx
	11	00	xx
	11	01	xx
	11	10	xx
	11	11	xx

Note the following characteristics of this diagram:
1. a Memory word can be copied only into the Cache location that has the same color
2. only one Memory word of each color can be in the Cache at any given time
3. we need a mechanism to tell us which word of each color is in the cache
4. the address of each word in Main Memory is divided into three fields
   a. the Tag field is in red ink
   b. the Index field is in black ink
   c. the byte offset is always "xx" because it is not interesting
5. the fat red lines divide Main Memory into 4 blocks
6. each block has a color pattern that matches that of the Cache
7. the Index values of each block also match those of the Cache
8. in every block, the Tag value is the same for all of the words
9. every block has a different Tag value
10. items 8 and 9 are discussed in more detail on the page "Fun with Address Spaces"
11. when we place a word into the Cache, it goes into the place whose
    Index value is the same as the Index field of the word's address
12. this just happens to be the place that is the same color as the word
13. at the same time, we copy the Tag field of the word's address into the Tag field
    of the Cache location into which the word is going
14. when we need to find a word in the Cache, the only place to look is the
    Cache entry whose Index matches the Index field of the word we are looking for
15. if the Tag field of that Cache entry also matches the Tag field of the
    word's address, then we have found the word in the Cache; i.e. we have a hit
16. if the Tag fields do not match, then the word we are looking for is not in
    the Cache; i.e. we have a miss