Lab6-Cache Simulator

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Notice

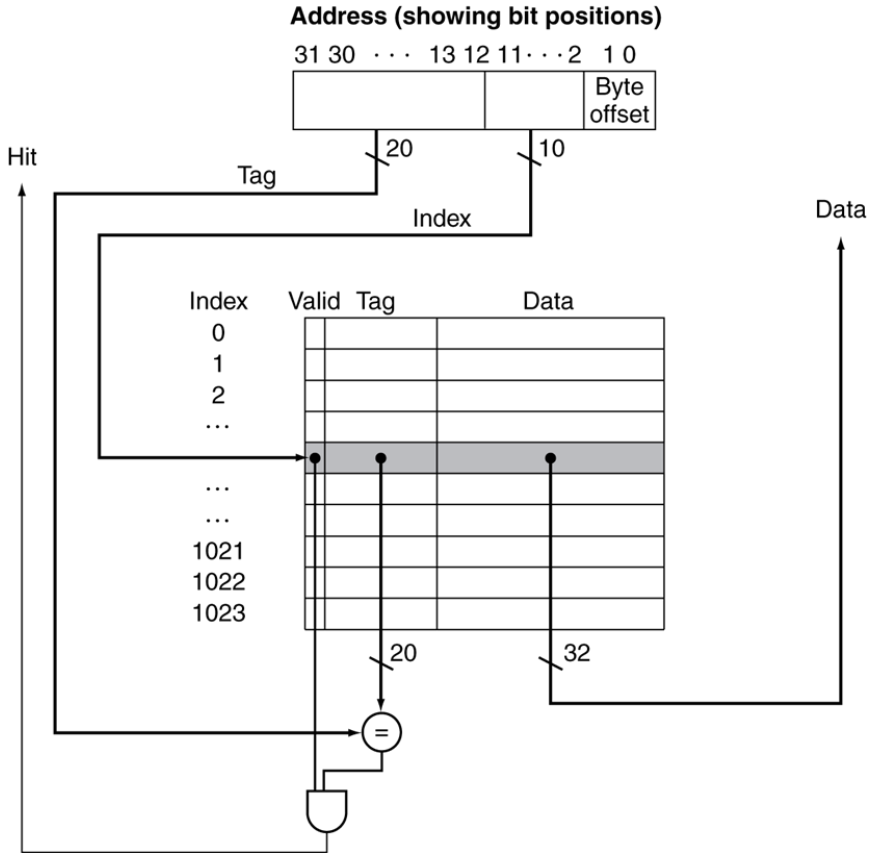
- This lab intends to help you understand in detail how a cache implementation works.
- **Good news: We will provide a template and written in C++ style**
- Lab6 is a group work
- Please follow group ID from the previous lab
- Lab6討論區

Attached file

- **TODO**
  - direct_mapped_cache.cpp
  - set_associative_cache.cpp
- **RUN**
  - ./demo.sh(Lab6 need to run in **UNIX-like** operating system)

Direct Mapped Cache

- 32-bit addresses
- Direct-mapped cache
- Block size: 4B
  - Offset: need 2-bit size
- Cache size: Hold 4KB
  - Index: need 10-bit size
- Tag: 20-bit size (32-10-2=20)



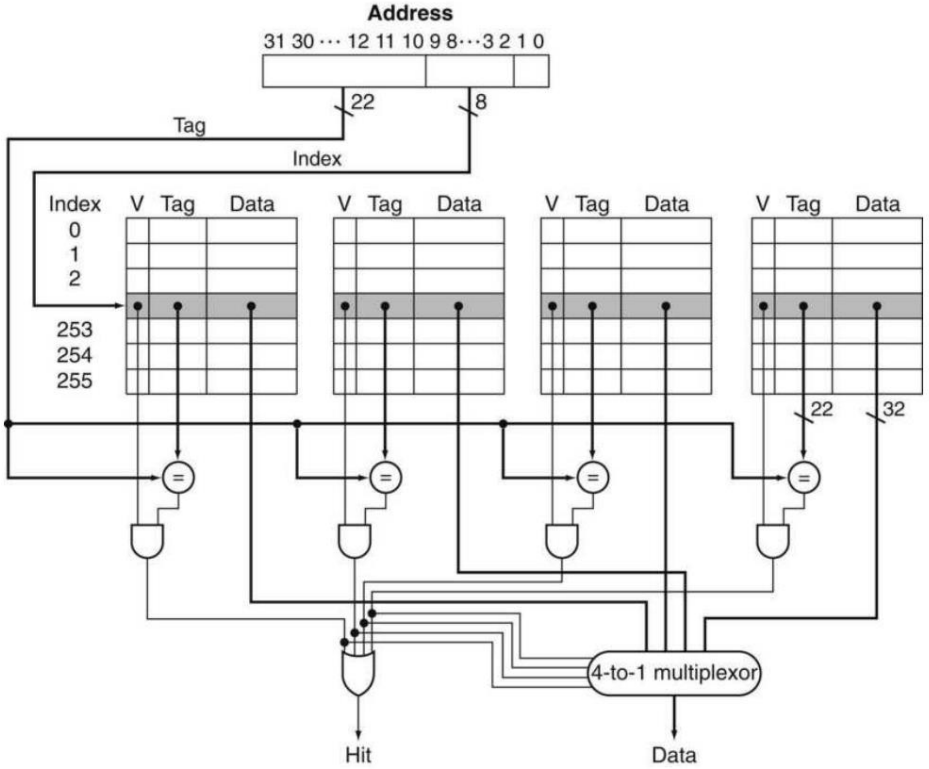
Directed-mapped result (Schematic diagram)

- Complete the following results table

Miss rate		Block size (Byte)				
		16	32	64	128	256
Cache size (Byte)	4k					
	16k					
	64k					
	256k					

Set Associative Cache

- 32-bit addresses
- 4-way set associative cache
- Block size: 4B
  - Offset: need 2-bit size
- Cache size: 4KB
  - # of index: 1024/4 = 256
  - Index: need 8-bit size
- Tag: 22-bit size(32-8-2=22)



Replacement policy: LRU

- In an associative cache, we have a choice of which block to replace
- The most commonly used scheme is **least recently used (LRU), which we used in this lab**
- LRU: Replace the one that has been unused for the longest time

Address of memory block accessed	Hit or miss	Contents of cache blocks after reference			
		Set 0	Set 0	Set 1	Set 1
0	miss	Memory[0]			
8	miss	Memory[0]	Memory[8]		
0	hit	Memory[0]	Memory[8]		
6	miss	Memory[0]	Memory[6]		
8	miss	Memory[8]	Memory[6]		

N-way set-associative result (Schematic diagram)

- Complete the following results table

Miss rate		Associativity (Block size:64B)			
		1-way	2-way	4-way	8-way
Cache size (Byte)	1k				
	2k				
	4k				
	8k				
	16k				
	32k				

Sample test cases

- Direct mapped

Miss rate		Block size (Byte)				
		16	32	64	128	256
Cache size (Byte)	4k	0.0795226				
	16k		0.042784			
	64k			0.0234072		
	256k				0.0151914	

- Set Associative

Miss rate		Associativity (Block size:64B)			
		1-way	2-way	4-way	8-way
Cache size (Byte)	1k				
	2k	0.0827779			
	4k		0.0362734		
	8k			0.0266625	
	16k				0.0229422
	32k				