Consider this data word:

1 0 1 1 → change last bit to 0 → results in 4 changes

Even-parity Hamming code word:

$\boxed{0}$	$\boxed{1}$	1	$\boxed{0}$	0	1	1
1	2	2, 1	4	4, 1	4, 2	4, 2, 1

changing any other data bit results in 3 total changes in the code word

Hamming distance of real Hamming code is ∴ 3 bits

ED = up to 2 bits

EC = 1 bit

<u>Homework</u>:

Read pages 82-85: cache ← together

and Big/Little Endian ← you } quiz

Cache

HDD ⟶ MM ⟶ caches ⟶ registers

big
far from cpu
cheap
slow

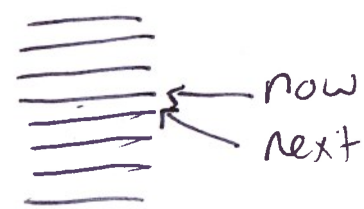
word-sized
in cpu
expensive
fast

CPU issues a <u>MM address</u> on the bus, asking for the data (one word) from main memory. Cache intercepts this request and if it contains that word, it returns it (relatively quickly) to the cpu. If the cache does not have that word, it fetches the word from memory along with a large block of its physical neighbors into the cache, then it gives the cpu its requested word.

☆ <u>Principle of Spatial Locality</u>: words near a requested word in memory are likely to be requested soon.

in cache grabs whole blocks

Analogy! sedin canucks } score hockey henrik daniel



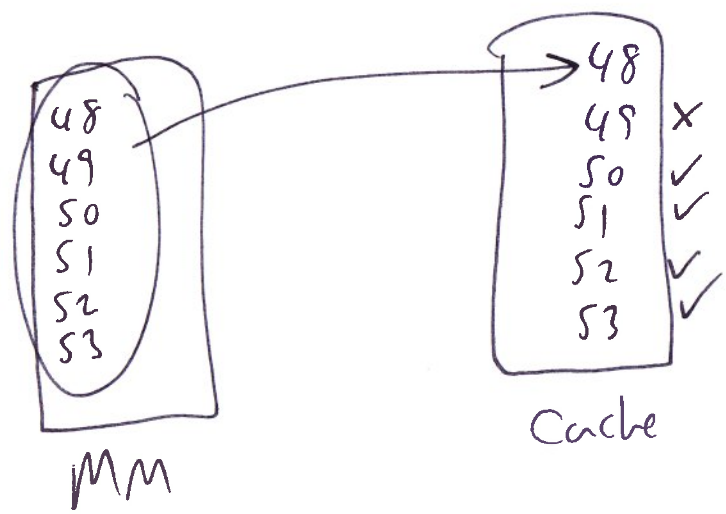
Hit Ratio: $\dfrac{\#\text{ of hits in cache}}{\#\text{ of requests}}$

In general, in a small interval of time,

$h = \dfrac{K-1}{K}$ out of K attempts

Cache only goes to MM on a cache miss.

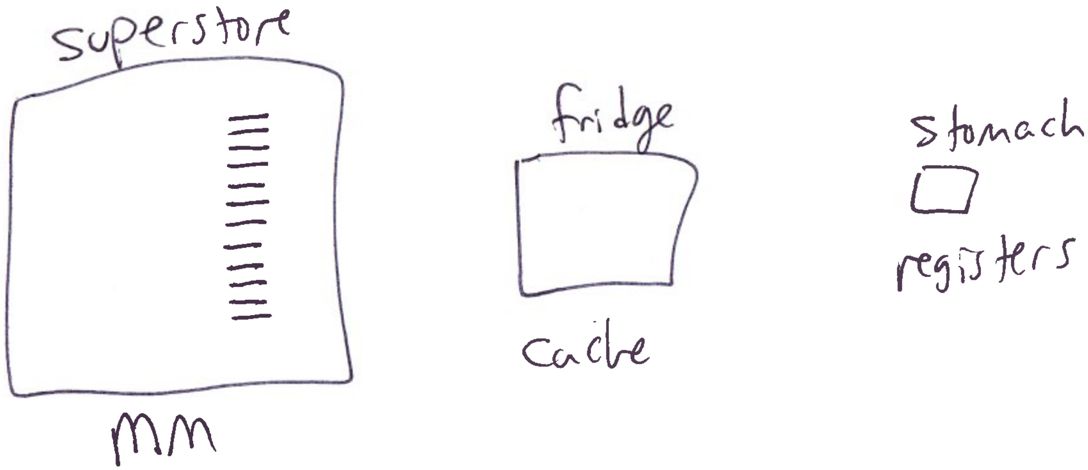
cpu wants word 49



cpu wants 54

Miss again

Analogy:



- taco shells
- beef
- cheese
- lettuce
- salsa

Principle of Temporal Locality: A word being used now by the cpu, will likely be reused soon.

∴ keep recently-used words in the cache

Mean memory access time
(Average)

h = hit rate

$$\boxed{\text{mean mem. avg access time} = \text{cache access time} + (1-h) * \text{mm access time}}$$

$$m.a.t. = c + (1-h)m$$

∴ Cache is always checked before going to memory

∴ only go to memory when cache doesn't have the word.

Q: mat if hit rate is 0%? 5 + 100 = 105 nsec

Q: mat if hit rate is 100%? impossible but 5 nsec

Q: mat if hit rate is 80%. $5 + (1-0.8)100$ = 25 nsec

c.a.t. = 5 nsec

m m.a.t. = 100 nsec = 0.1 μsec

-7-

worst!

~~racist~~
~~cruel~~
~~greedy~~
~~drug addicted~~
lazy

<u>best!</u>

kind
disciplined
generous ← wealthy ≠ greedy

<u>avg.</u>