

Characteristics of memory

◆ Location

- ◆ on CPU, main memory, external

◆ Capacity

- ◆ how many bits

◆ Cost

- ◆ cost per unit, space

◆ Unit of transfer

- ◆ words, addressable units

◆ Access method

- ◆ sequential, direct, random, associative

◆ Performance

- ◆ access time
- ◆ memory cycle time
- ◆ transfer rate

◆ Physical type

- ◆ semiconductor, magnetic, optical

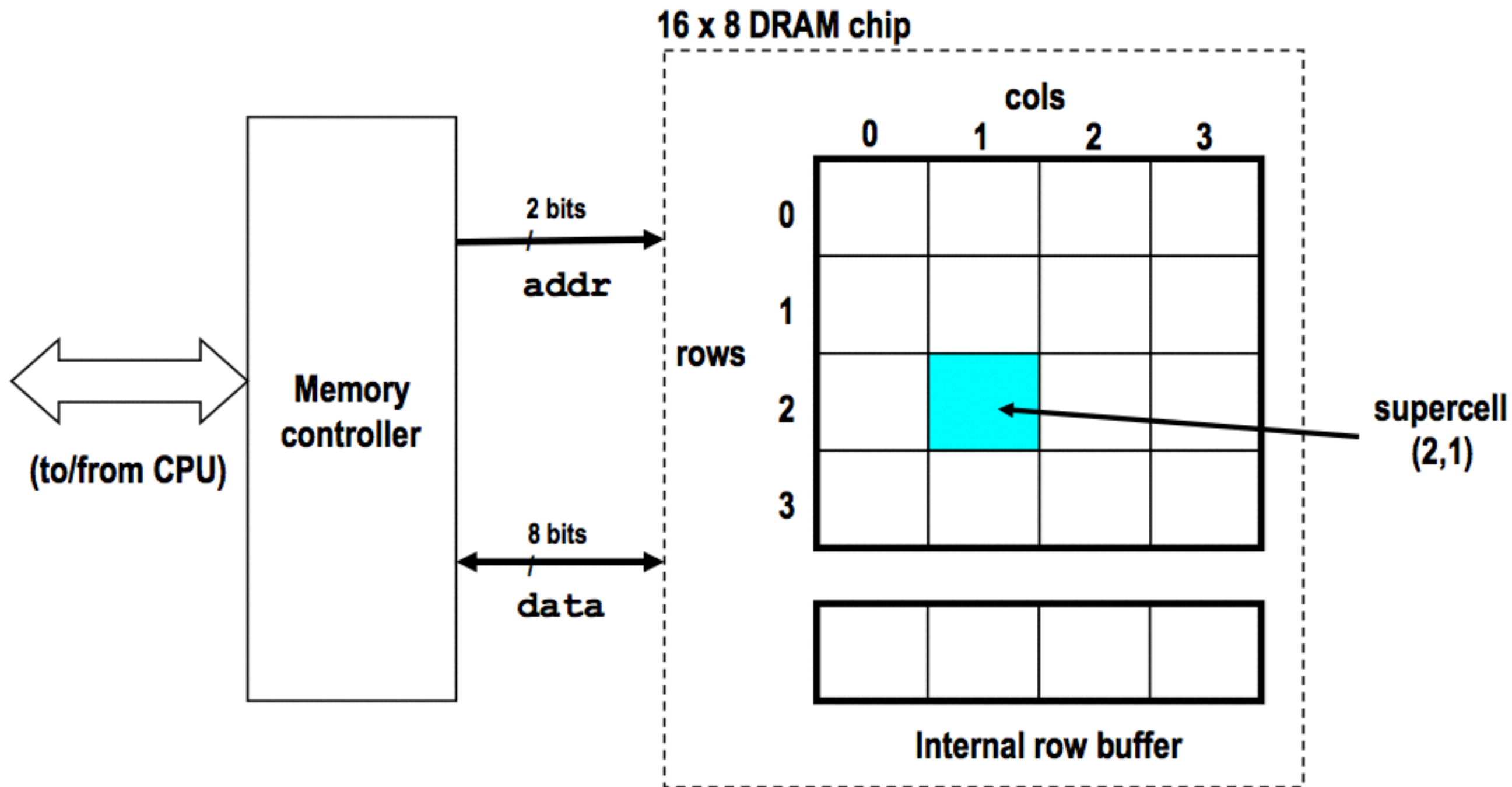
◆ Physical characteristics

- ◆ volatile, erasable, power consumption

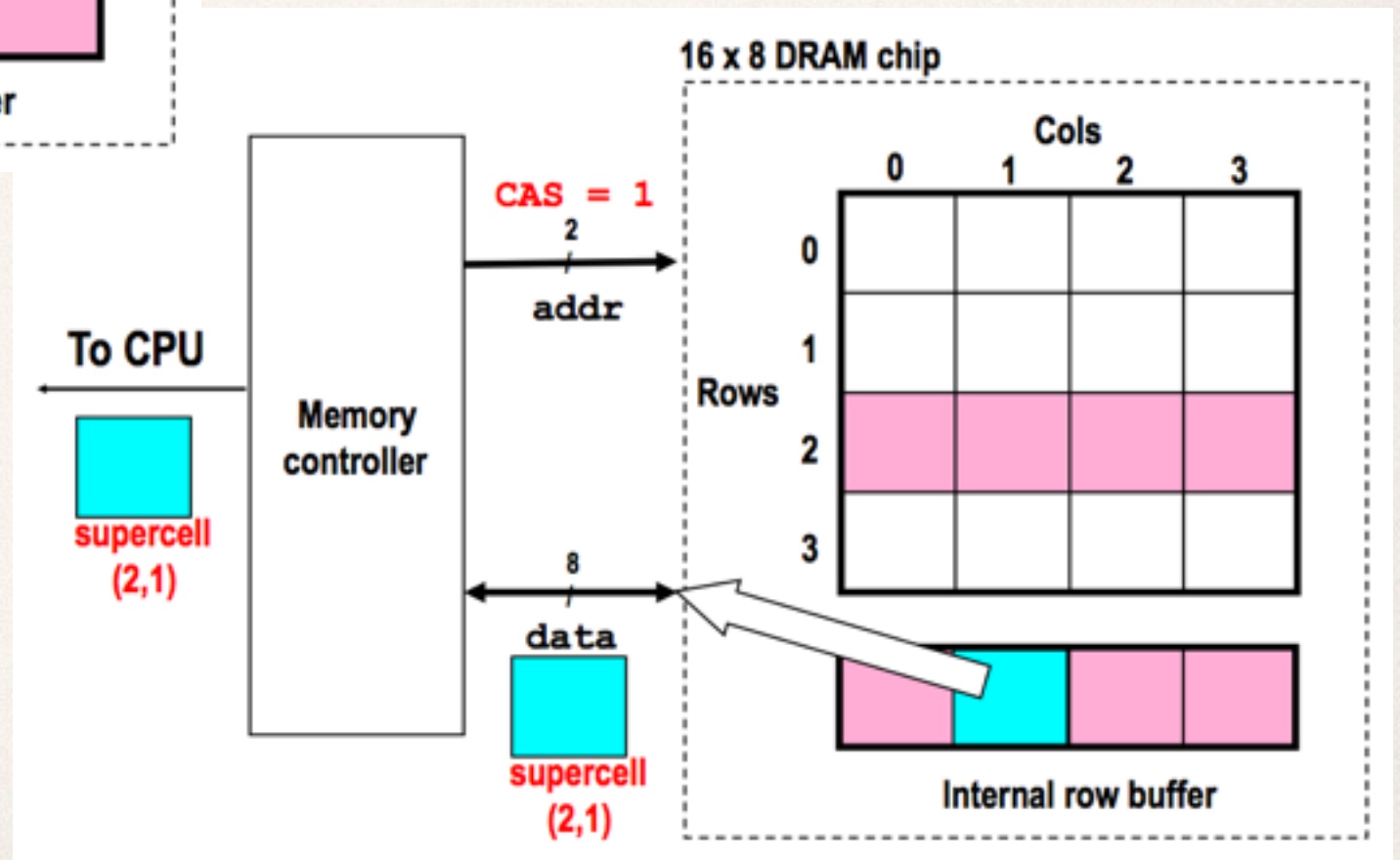
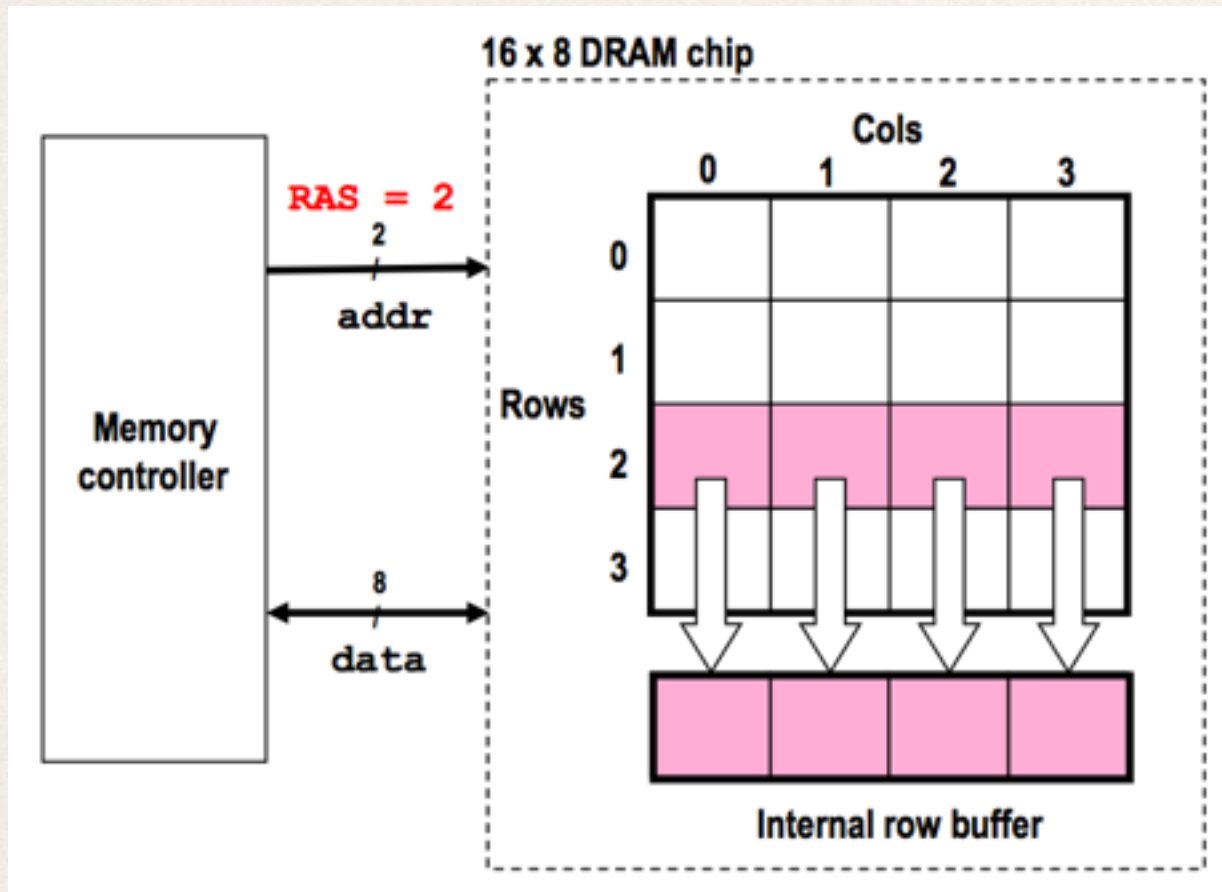
◆ Organization

- ◆ internal structure

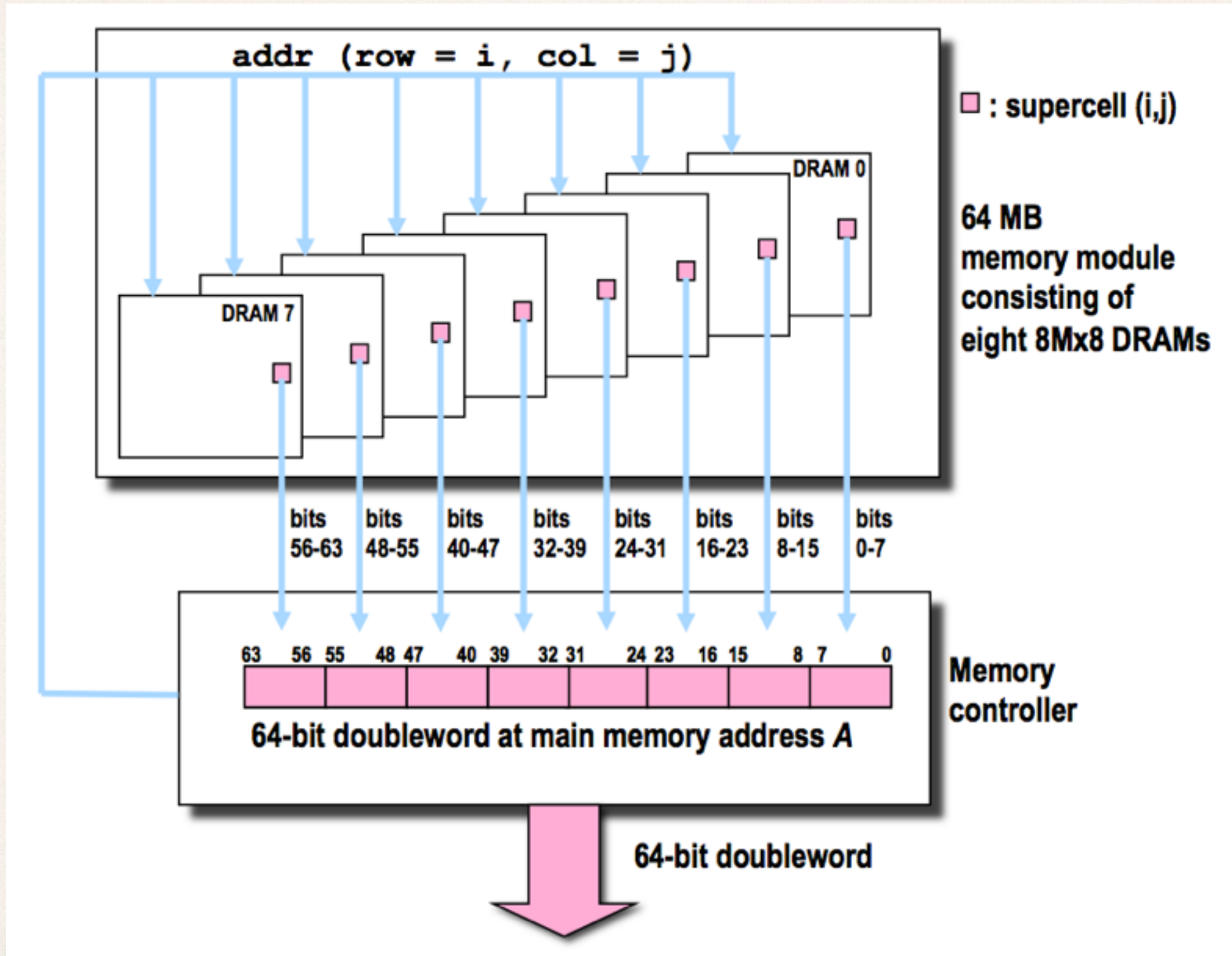
DRAM Organization



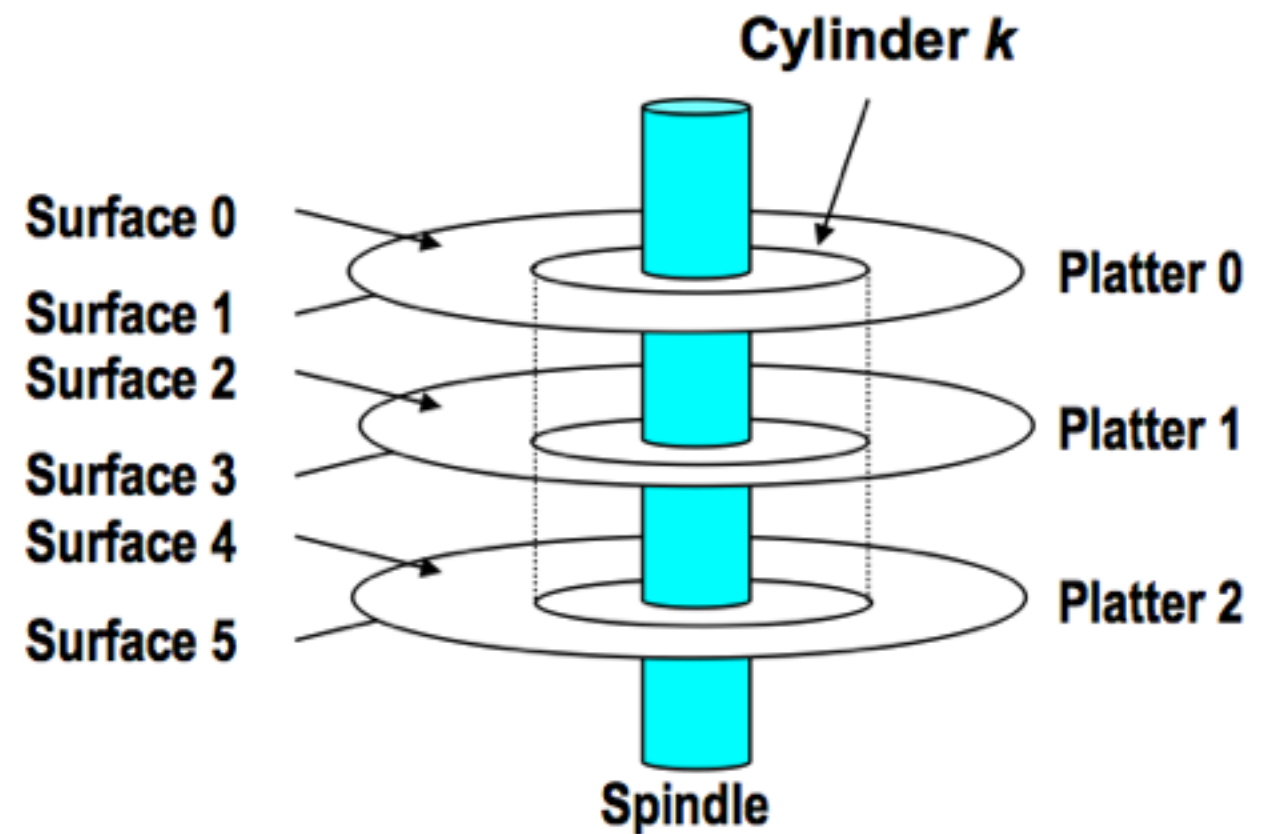
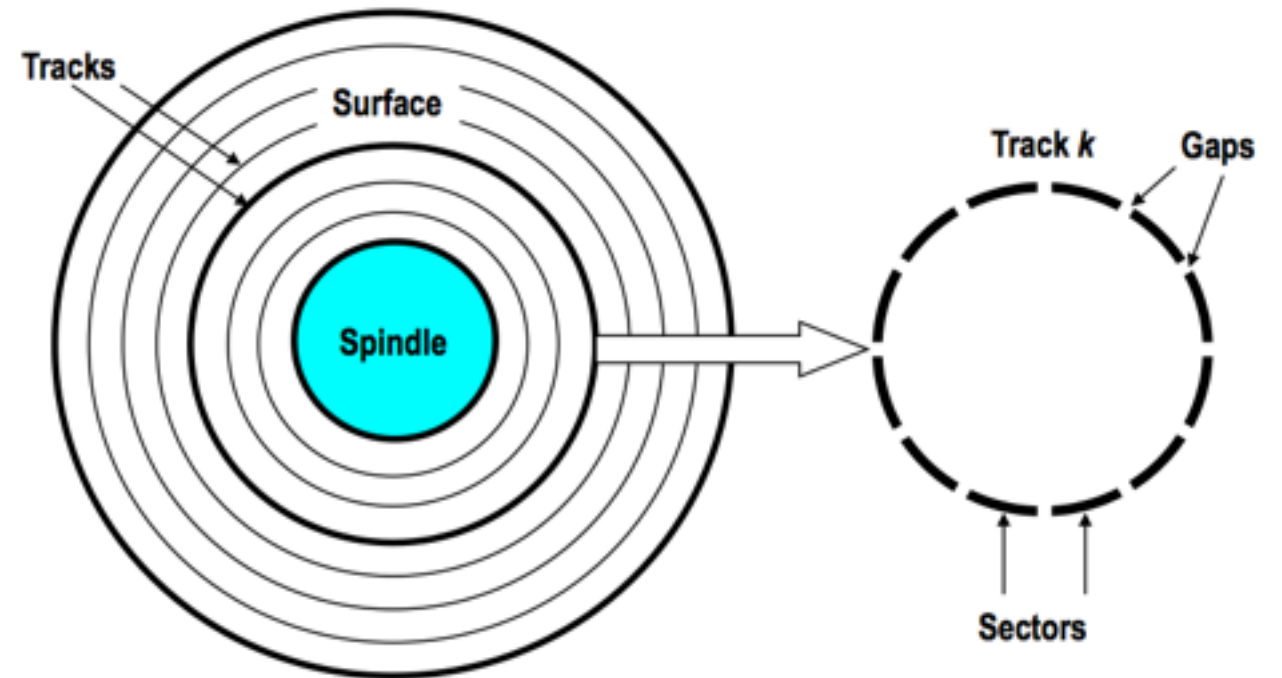
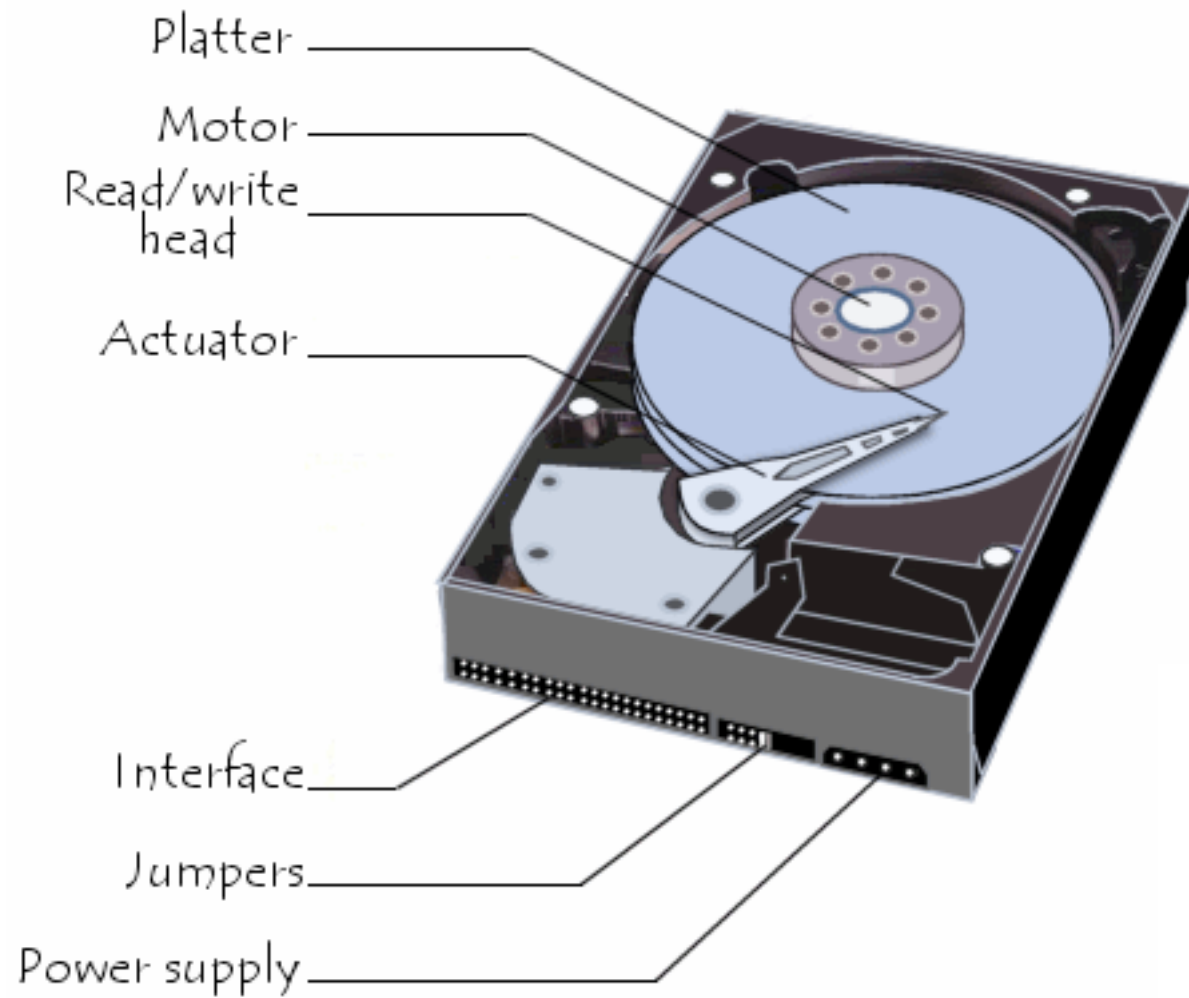
DRAM Access



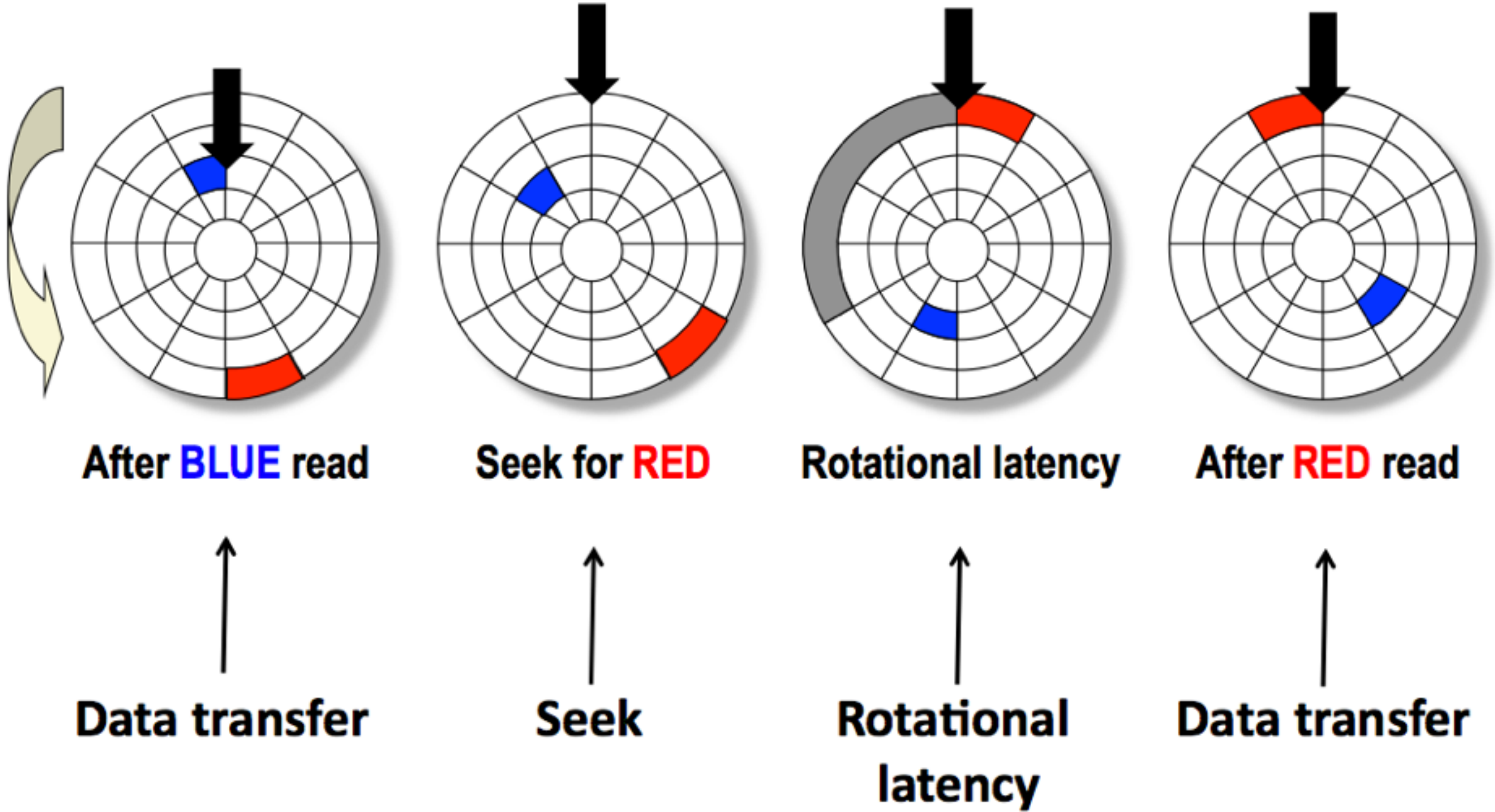
DRAM Modules



Hard drives



Disk service time



technology	access time	\$/GB	in my Laptop
SRAM	0.5-2.5ns	\$1500-\$5000	4.5 MB
DRAM	50-70ns	\$6 - \$20	8 GB
magnetic disk	5,000,000 -20,000,000 ns	\$0.07 - \$0.20	1TB
flash	85,000 ns	\$1.5-\$2 (SSD) \$.50 - \$1.25(thumb)	