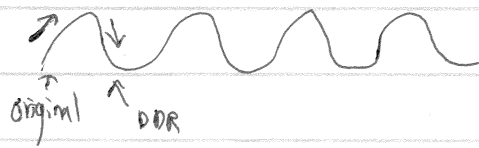
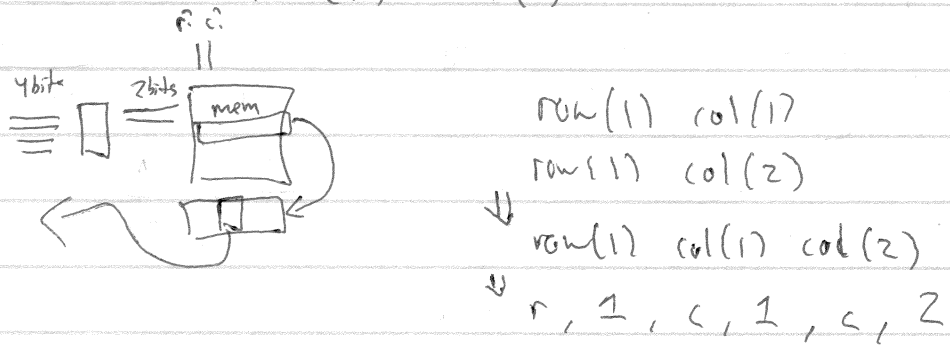
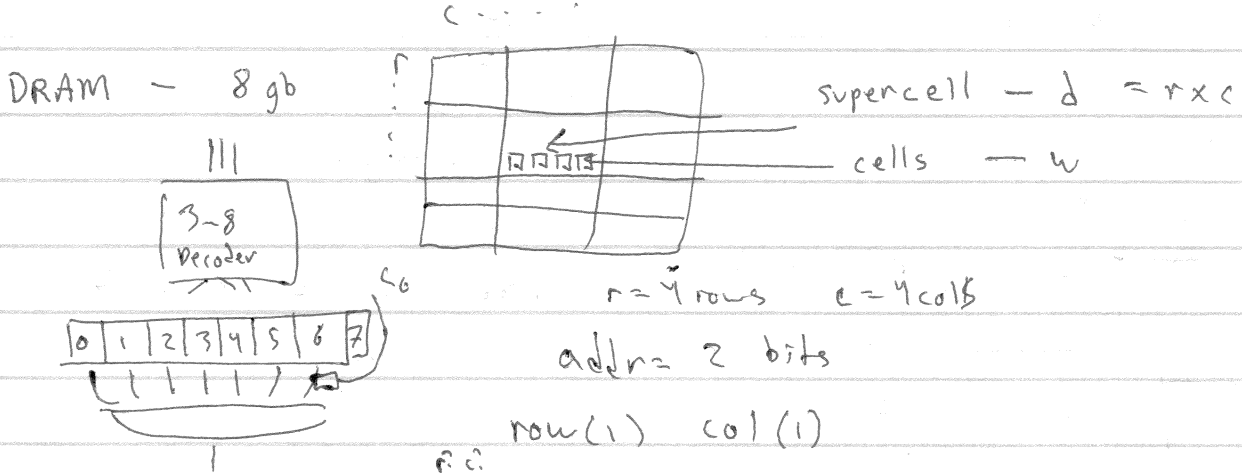


Registers (6 transistors, bit stable) 100x more expensive

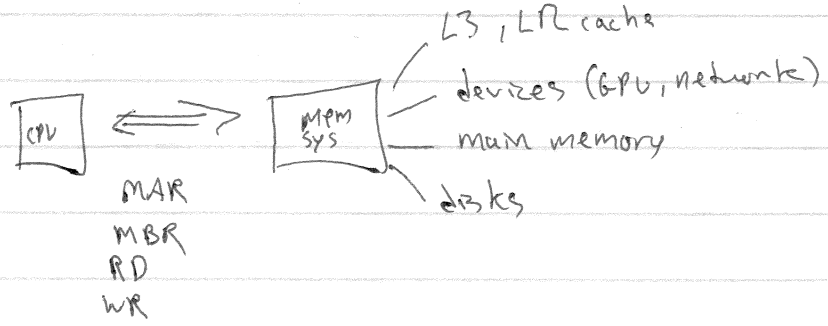
DRAM (1 capacitor, very cheap)

(10x to read) unstable → forget in 10/100ms

registers ← speed varieties of memory → cheapness slow memory disk/ssd, platters



DDR - double data rate

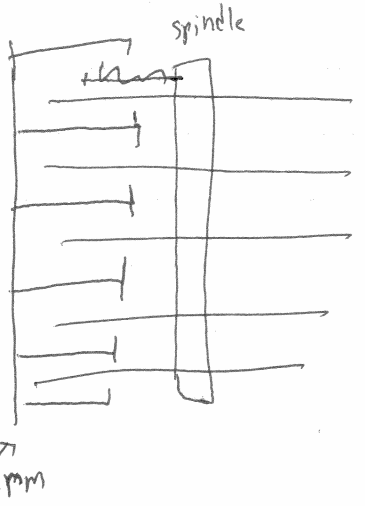
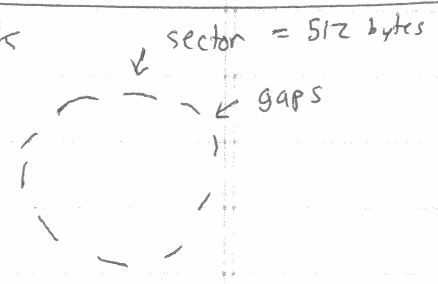
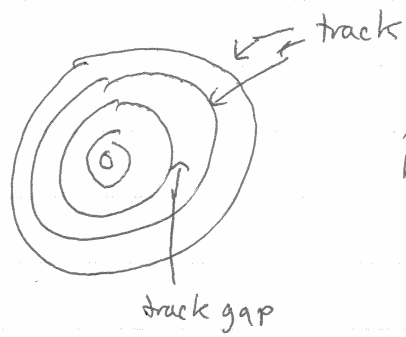
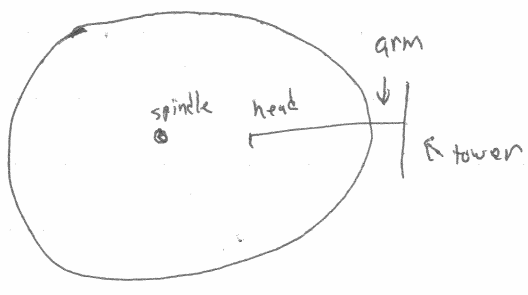


15-2 / non-volatile — Stable w/o electricity / power

PROM — bits are connected to fuse and write-once by blowing fuse

EPROM — UV light resets — 1000 times

Magnetism —



read track 2, sector 7
↑
cylinder

$$\text{Capacity} = \frac{\text{bytes}}{\text{sector}} \times \frac{\text{sectors}}{\text{track}} \times \frac{\text{tracks}}{\text{surface}} \times \frac{\text{surfaces}}{\text{platter}} \times \frac{\text{platters}}{\text{disk}}$$

$$30 \text{ gb} = \frac{512}{1} \times \frac{300}{1} \times \frac{20000}{5} \times \frac{2}{1} \times \frac{5}{1}$$

$$T_{\text{access}} = T_{\text{arm}} + T_{\text{rotate}} + T_{\text{transfer}}$$

avg = 3.9ms
max = 70ms

$$\text{max} = \frac{1}{\text{rpm}} \times \frac{60}{\text{min}}$$

$$\text{avg} = \frac{1}{2} \text{max}$$

$$\text{avg} = \frac{1}{\text{rpm}} \times \frac{1}{\text{avg sector/track}} \times \frac{60}{1 \text{mm}}$$

7200rpm, $T_{\text{arm}} = 9 \text{ms}$, 400 sectors per track
 $T_{\text{rotate}} = 4 \text{ms}$ $T_{\text{transfer}} = 1.02 \text{ms}$
 $T_{\text{access}} = 13.02 \text{ms}$