Real Computers

Our textbook wants to build a computer using nothing but Nand-gates.

This is cool and it's nice to show that a working computer can really be built using nothing but Nand-gates, but it's not realistic.

Real computers:

- are built from transistors (and other components);
- do not use Boolean logic only.

Memory technology

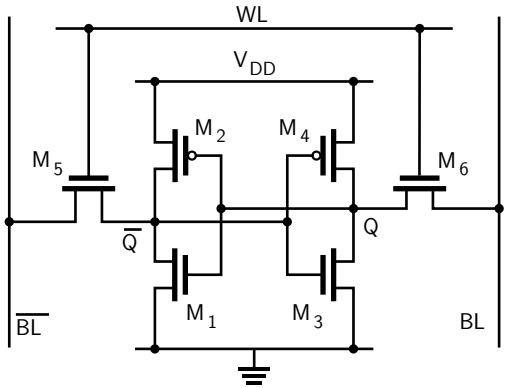
- Static RAM (SRAM)
  SRAM is built using Flip-Flops, so conceptually it works like our RAM chips.
- Dynamic RAM (DRAM)
  DRAM uses only one transistor and one condensator per bit of memory, so more memory fits on chip, so large-capacity chips can be made at a lower price.
- Hard disk
  A rotating magnetized disk.
- SDD and Flash memory
  Hardly distinguishable from magic.

I/O-devices

SRAM

SRAM uses Flip-Flops...

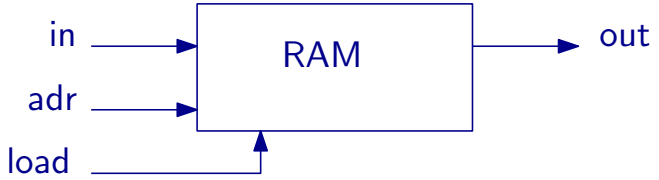
...but it's more efficient to make them from transistors directly.

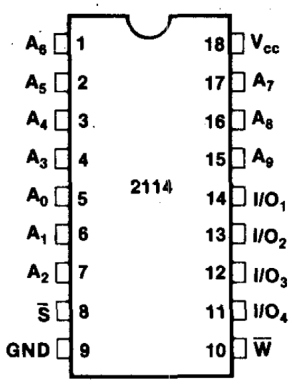


For comparison:
One Nand-gate uses four CMOS-Transistors.

RAM connections

Our RAM:





A 2114 SRAM chip (1024 x 4 bits)