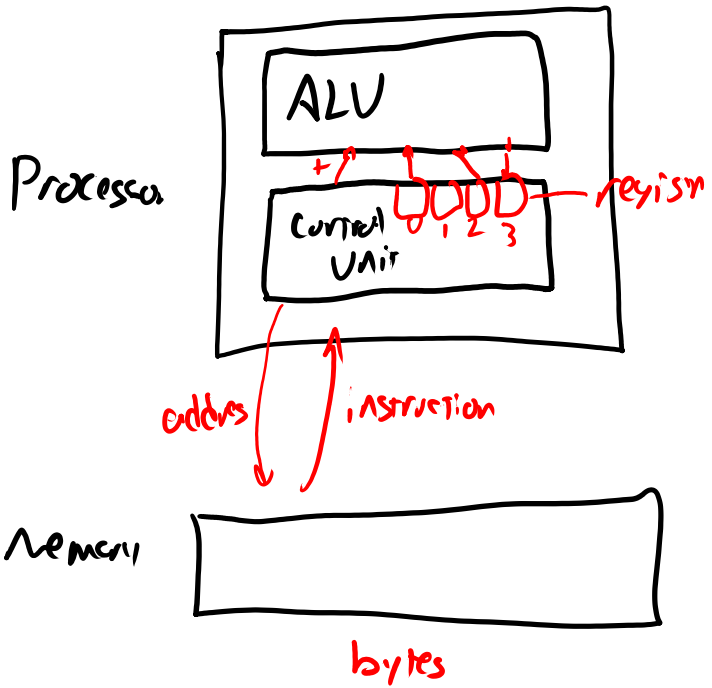
1. Modern computers
   ↳ vulnerabilities

2. programming

Von Neumann architecture



$V_0 + V_2 \to V_3$

32-bit reg

$2^{32} \sim 4$ GB memory

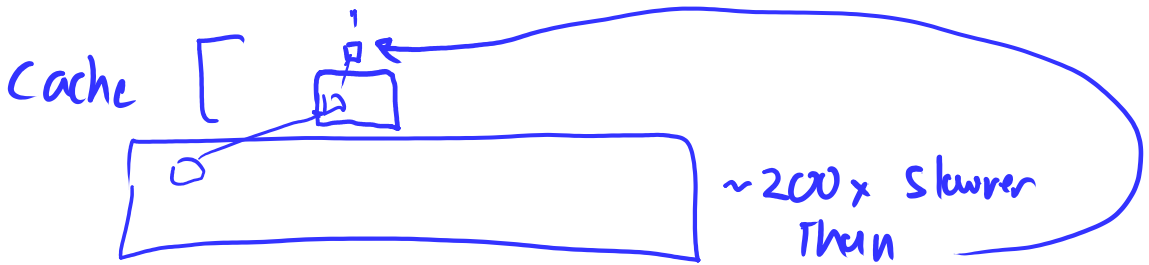
64-bit reg

$2^{64} \sim$ very very big

goes away on pow-off

lasts

Memory ~ RAM



Storage ~ disk

~ 1 million x slower

16 GB

run programs

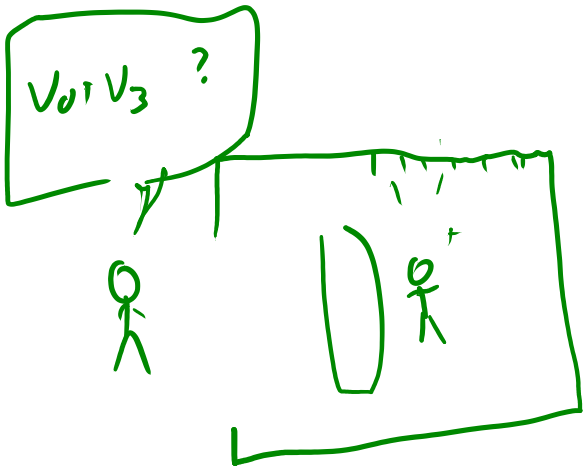
Enough or not

500 GB

Store files

HDD ~10x speed SSD - erase count ~10k

Processor



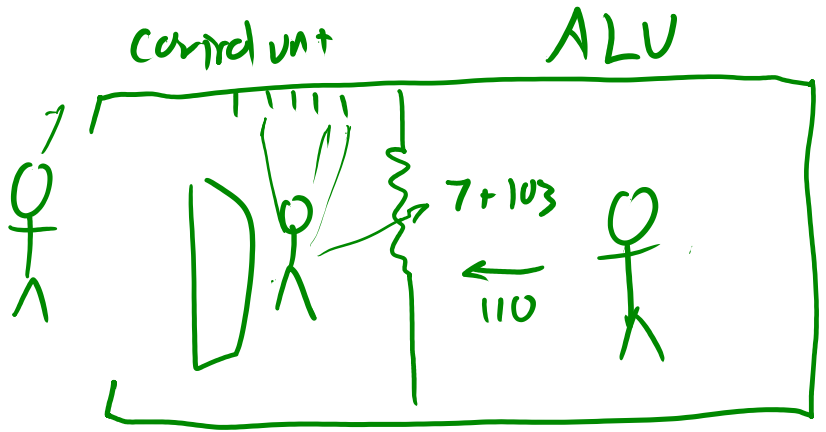
$y = mx + b$

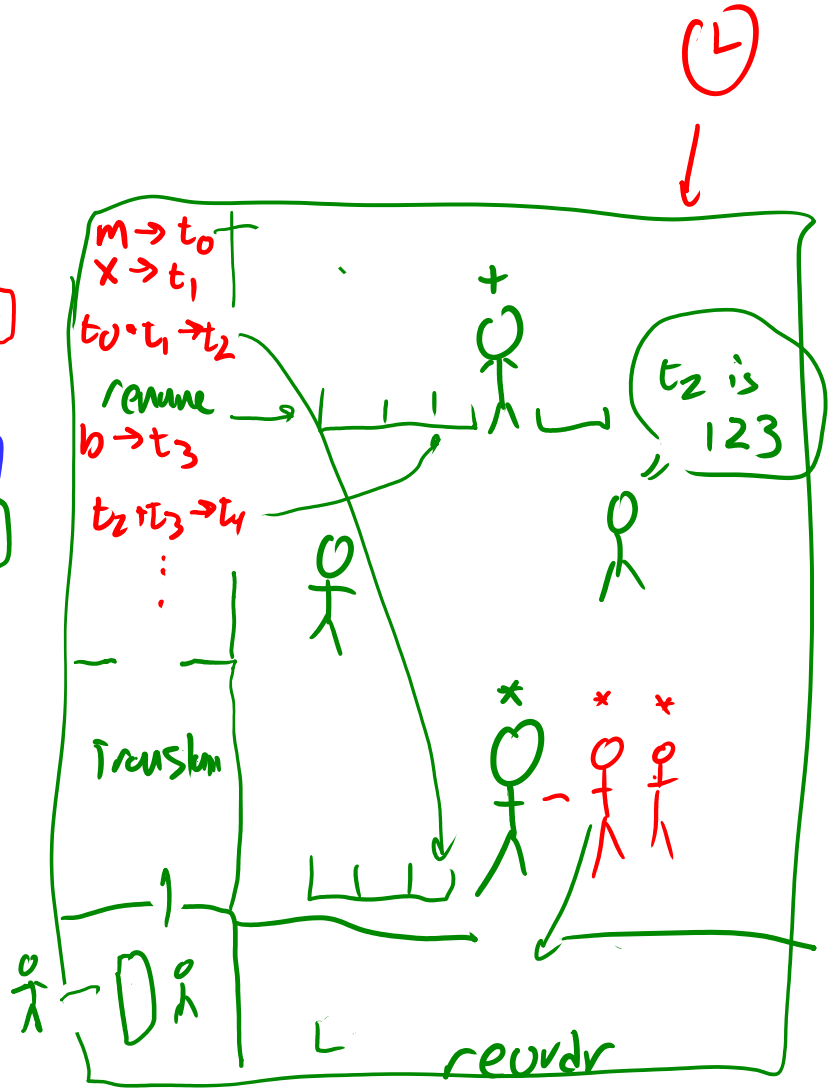
$m * x \rightarrow t$

$t + b \rightarrow y$

$a + b \rightarrow t$

$t * w \rightarrow x$

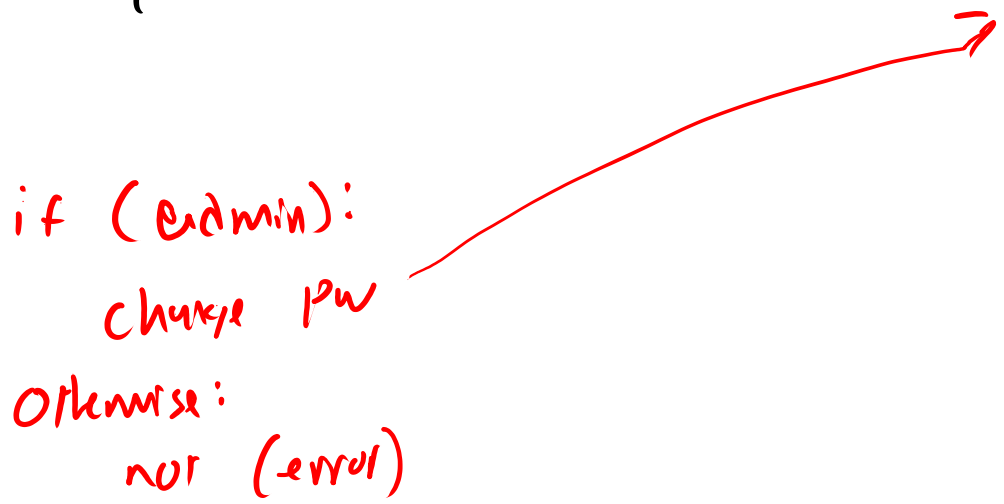




Speculation ~ 10-100x speedup

Processor
speculation

memory
cache



Programming Languages

1st gen

bits

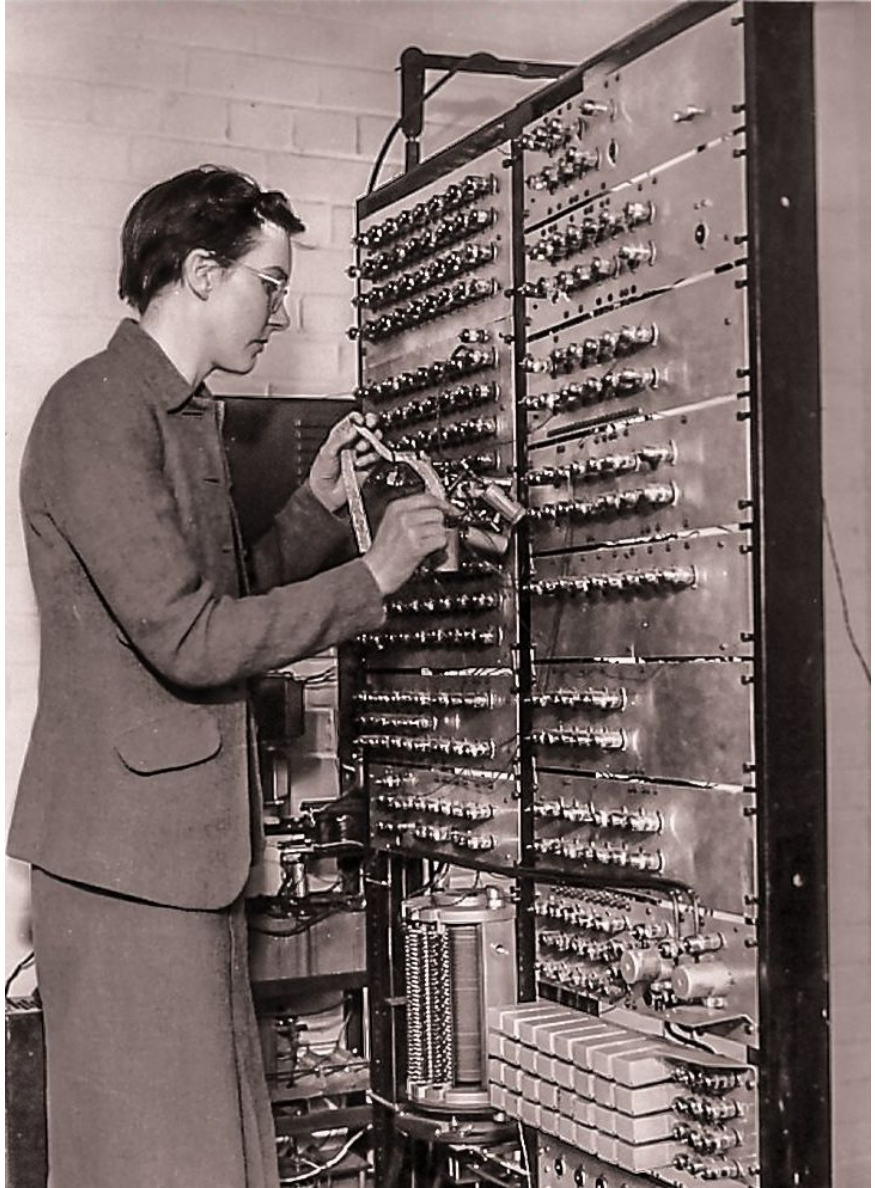
machine instructions

$V_0 + V_7 \rightarrow V_9$

0001 | 00000 | 00111 | 01001

2nd gen

assembly

add V_0, V_7, V_9

3rd gen