

<http://public.gettysburg.edu/~cpresser/cs221/MIPS-Pipeline.png>

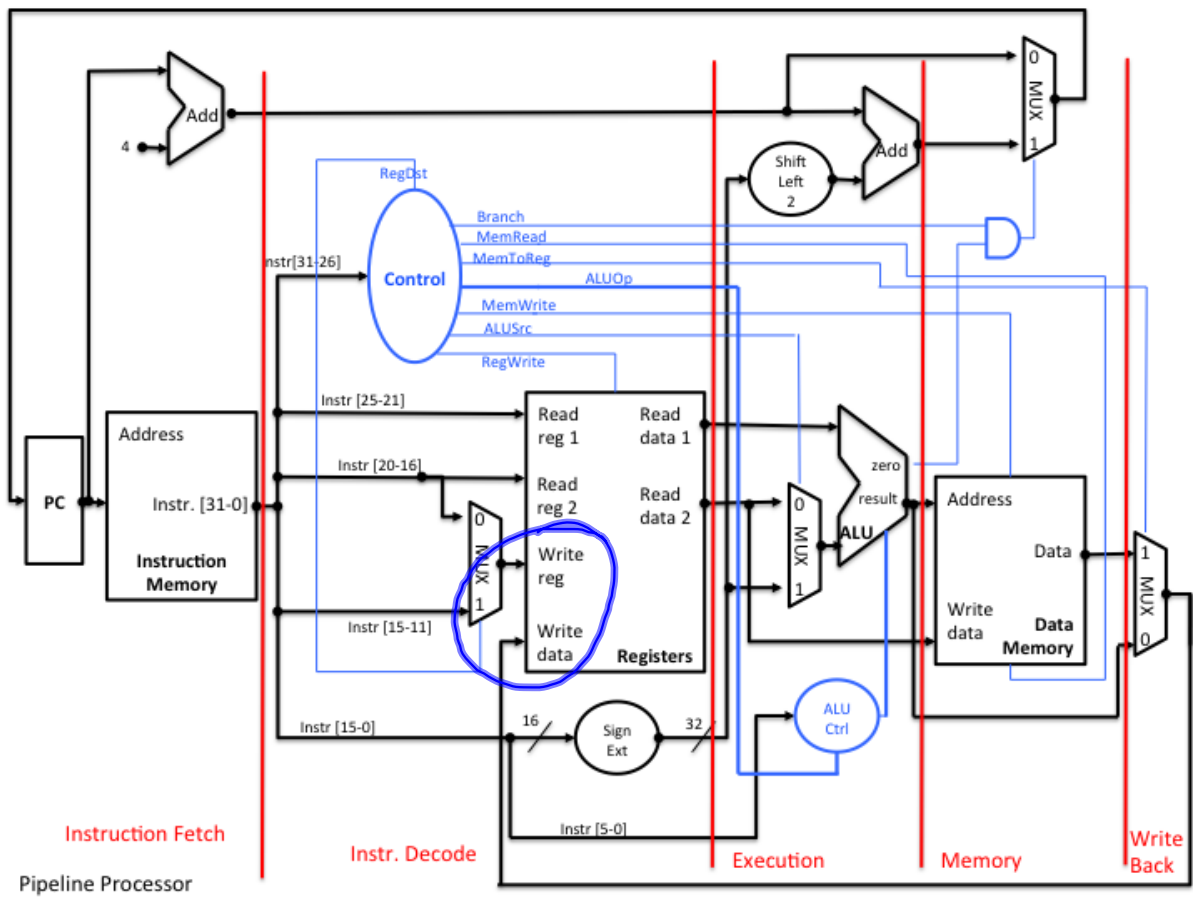
Fetch

Decode

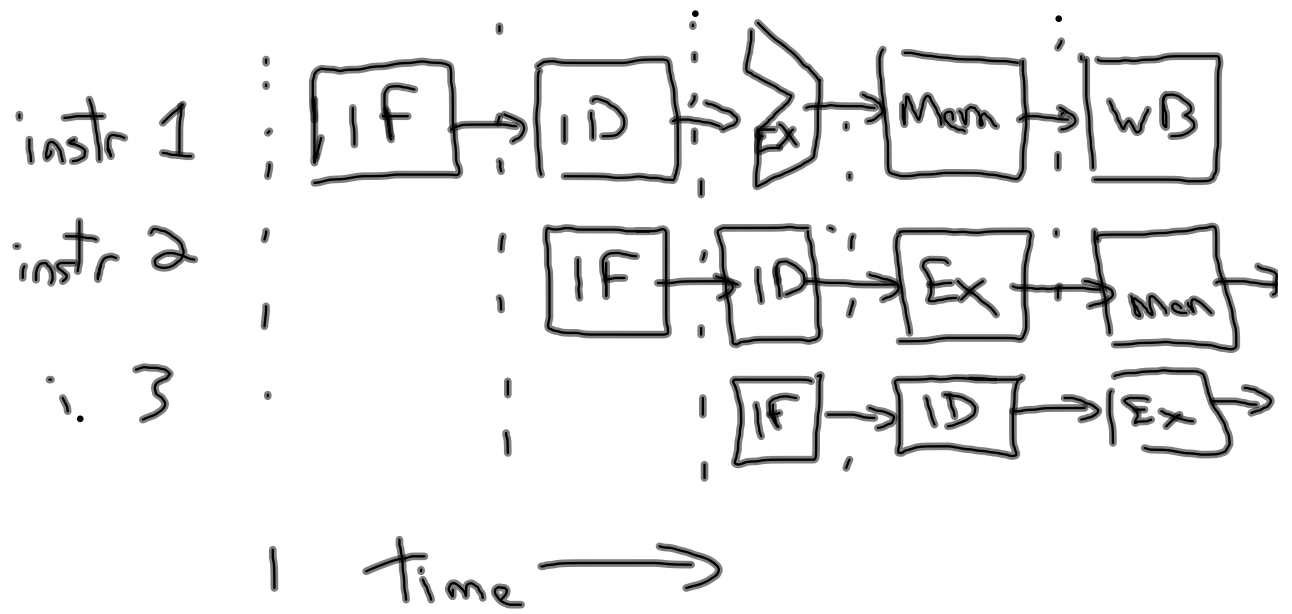
Execute

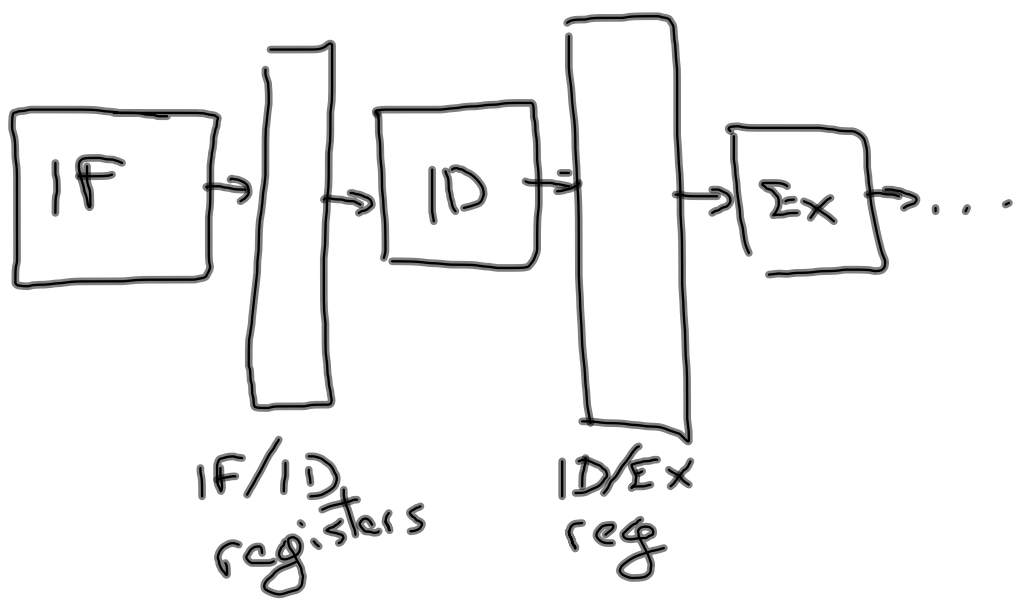
Memory Access

Write back to register



Pipeline Processor



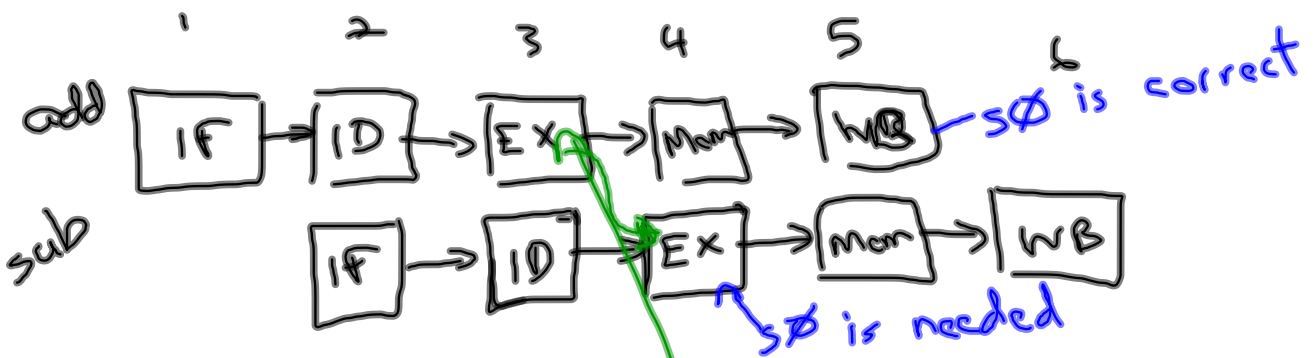


Hazards

Structural Hazards

Data Hazard

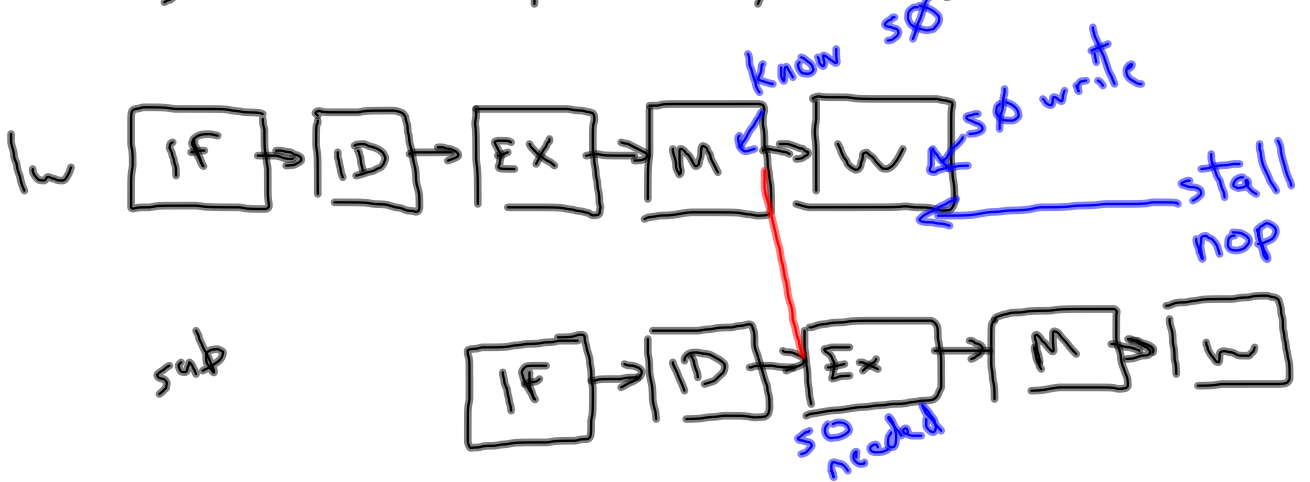
add \$s0, \$t0, \$t1
sub \$t2, \$s0, \$t3.



stall: insert nop's

s0's value is known forward to next instr.

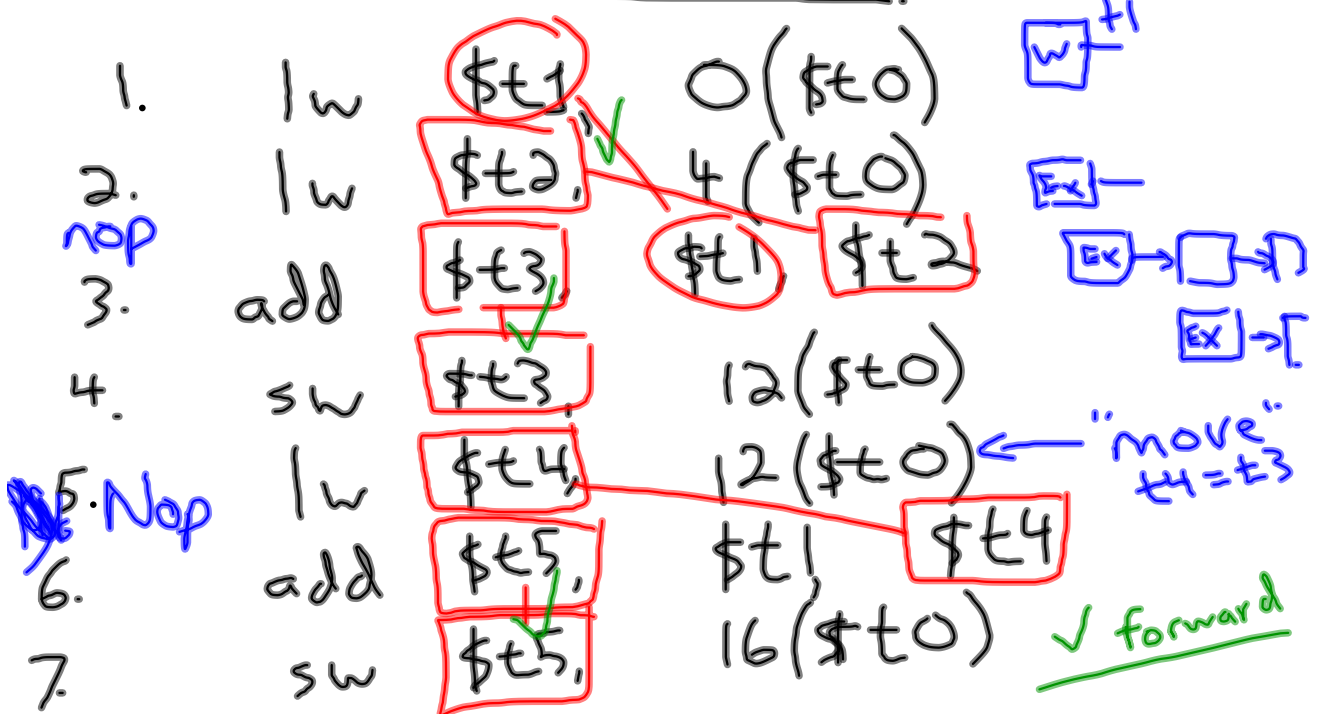
lw \$s0, 20(\$t1)
 sub \$t2, \$s0, \$t3



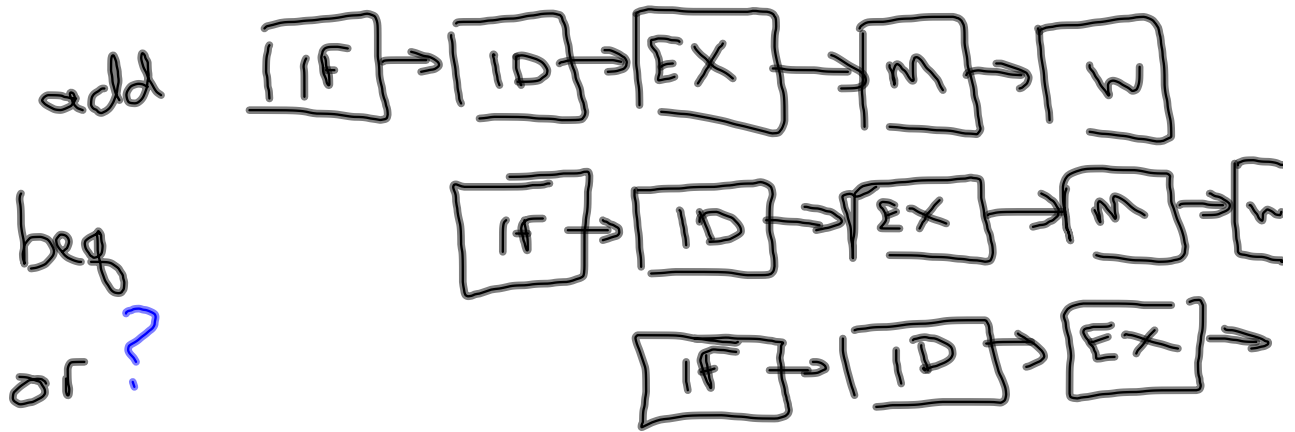
$$a[3] = a[0] * a[1]$$

$$a[4] = a[0] + a[3]$$

addr of
a is in
\$t0



Control Hazards



Branch Prediction

static - always assume branch
- always assume backward jumps

dynamic - base guess on previous execution

Jumps

