Pipeline Architecture

Pipeline
Data Hazards
Branch Hazards
PC → Instruction Memory

Instruction Memory → IF

IF → ID/RF

ID/RF → registers

Registers → ALU

ALU → EXE

EXE → MEM

MEM → WB

WB → PC

Data Memory → read

Data Memory → write

Sign Ext → ALU

ALU CTRL → ALU

CONTROL

write

read

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ADD

ADD

MUX

MUX

MUX

MUX
Data Hazards

- Software: nop
- Hardware: stall
Branch Hazard
Branch Hazard

Accelerate Branch Target Computation

Accelerate Branch Detection