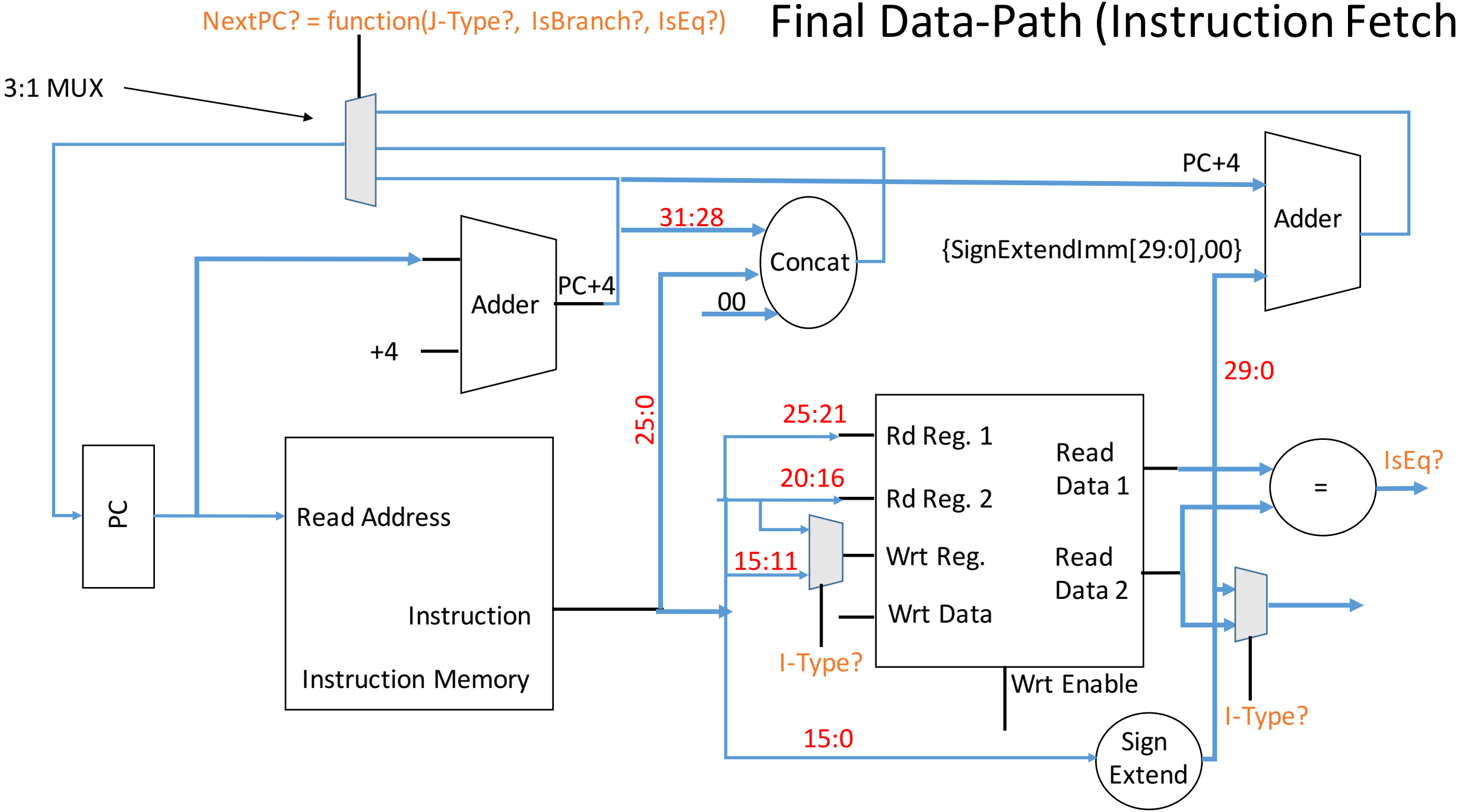
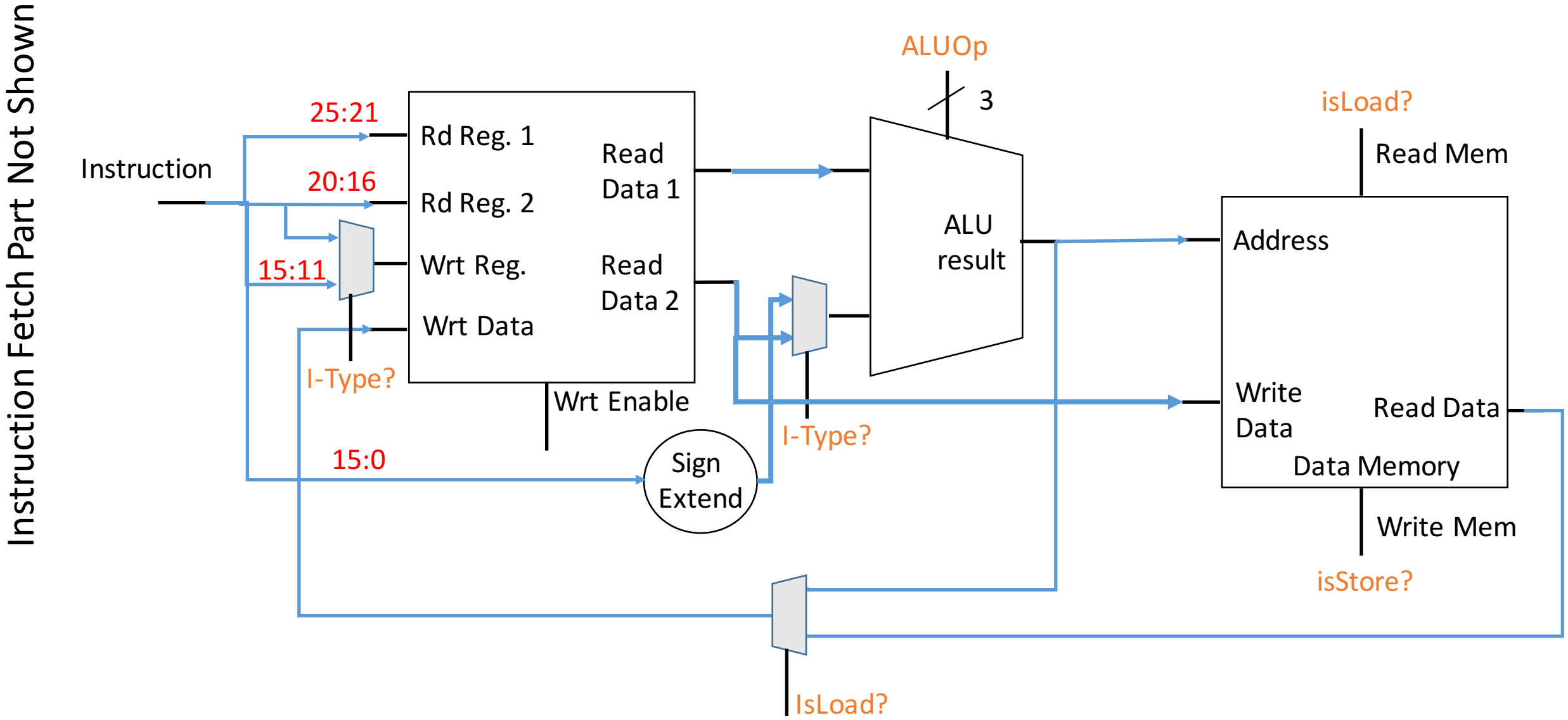
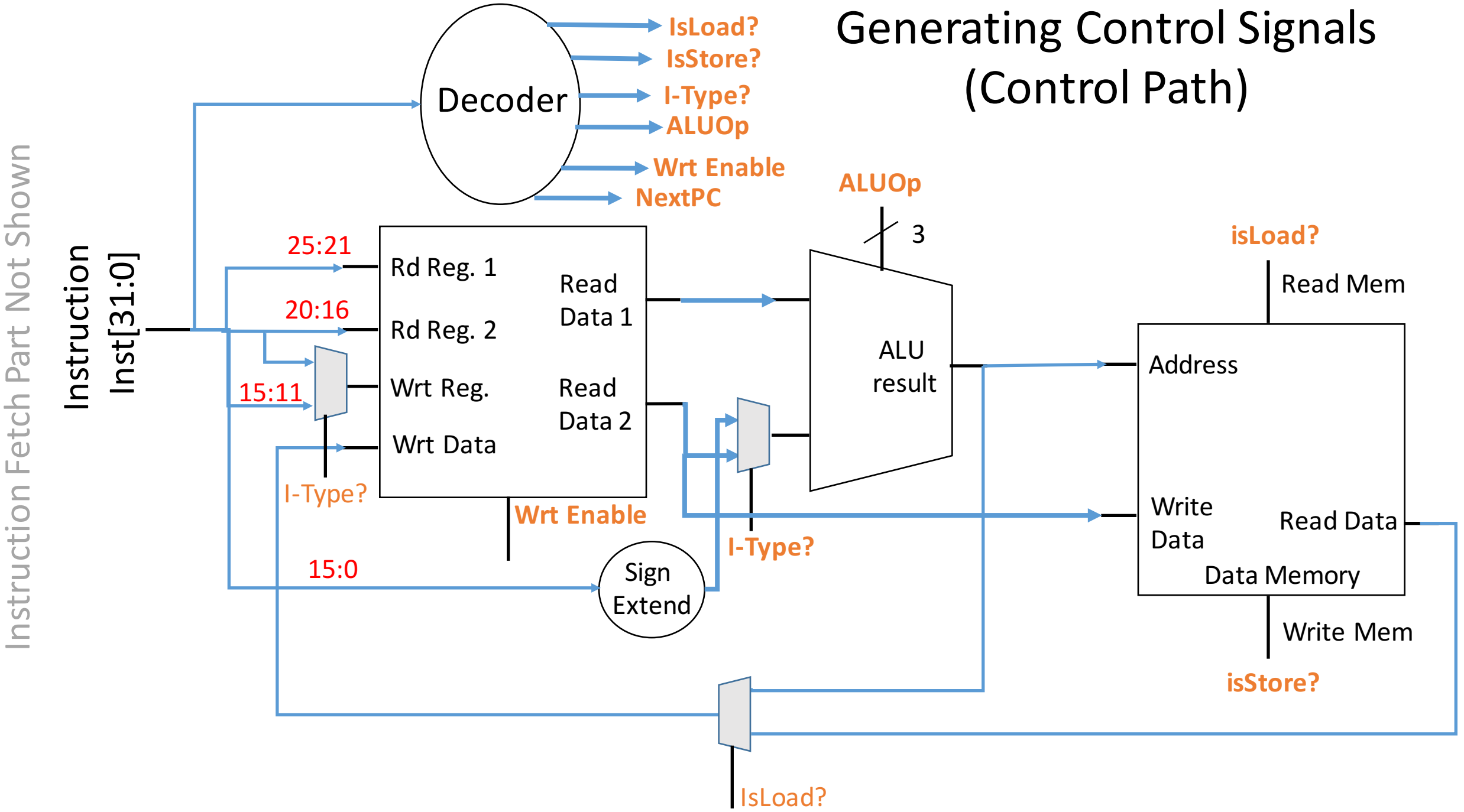
Final Data-Path (Instruction Fetch)

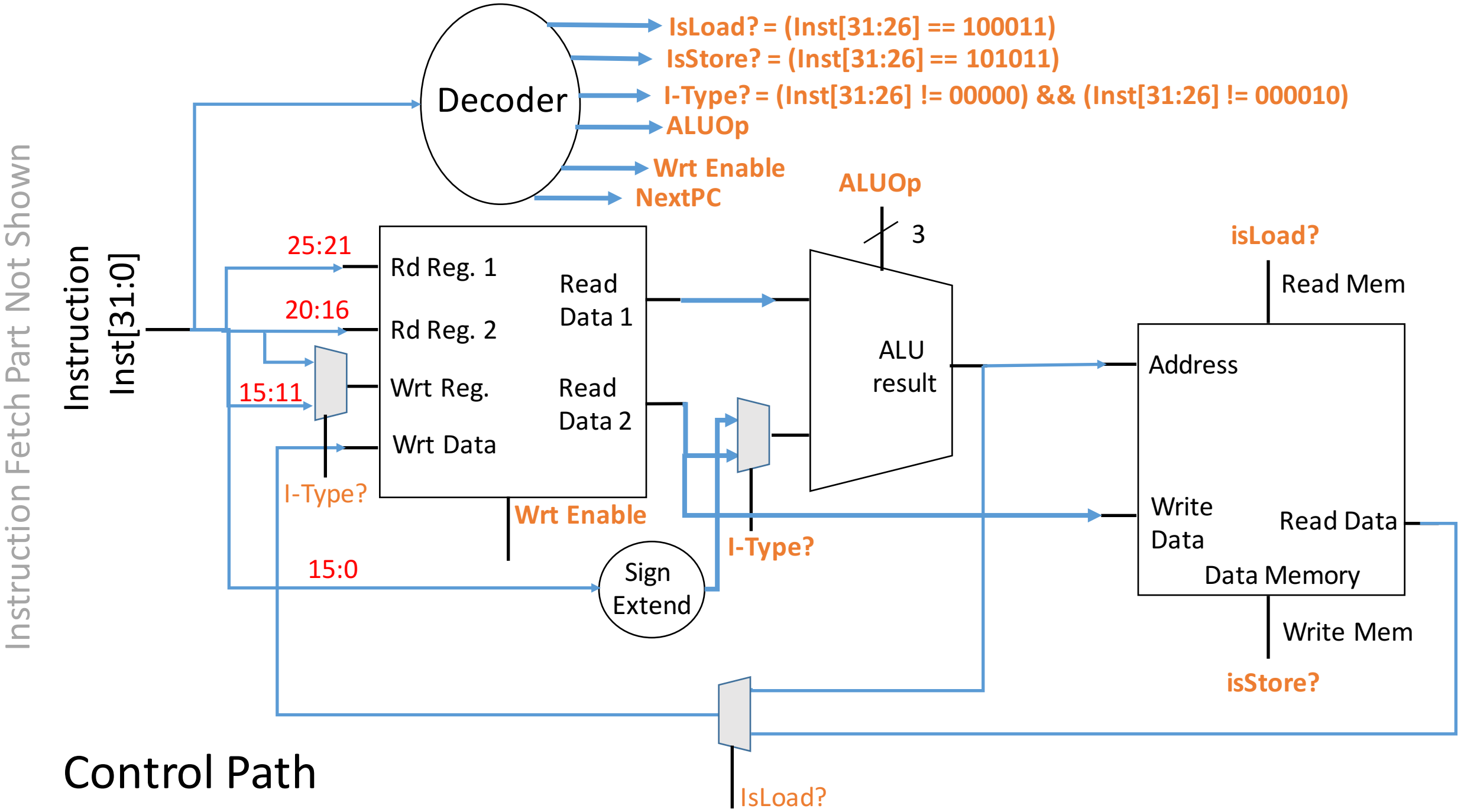


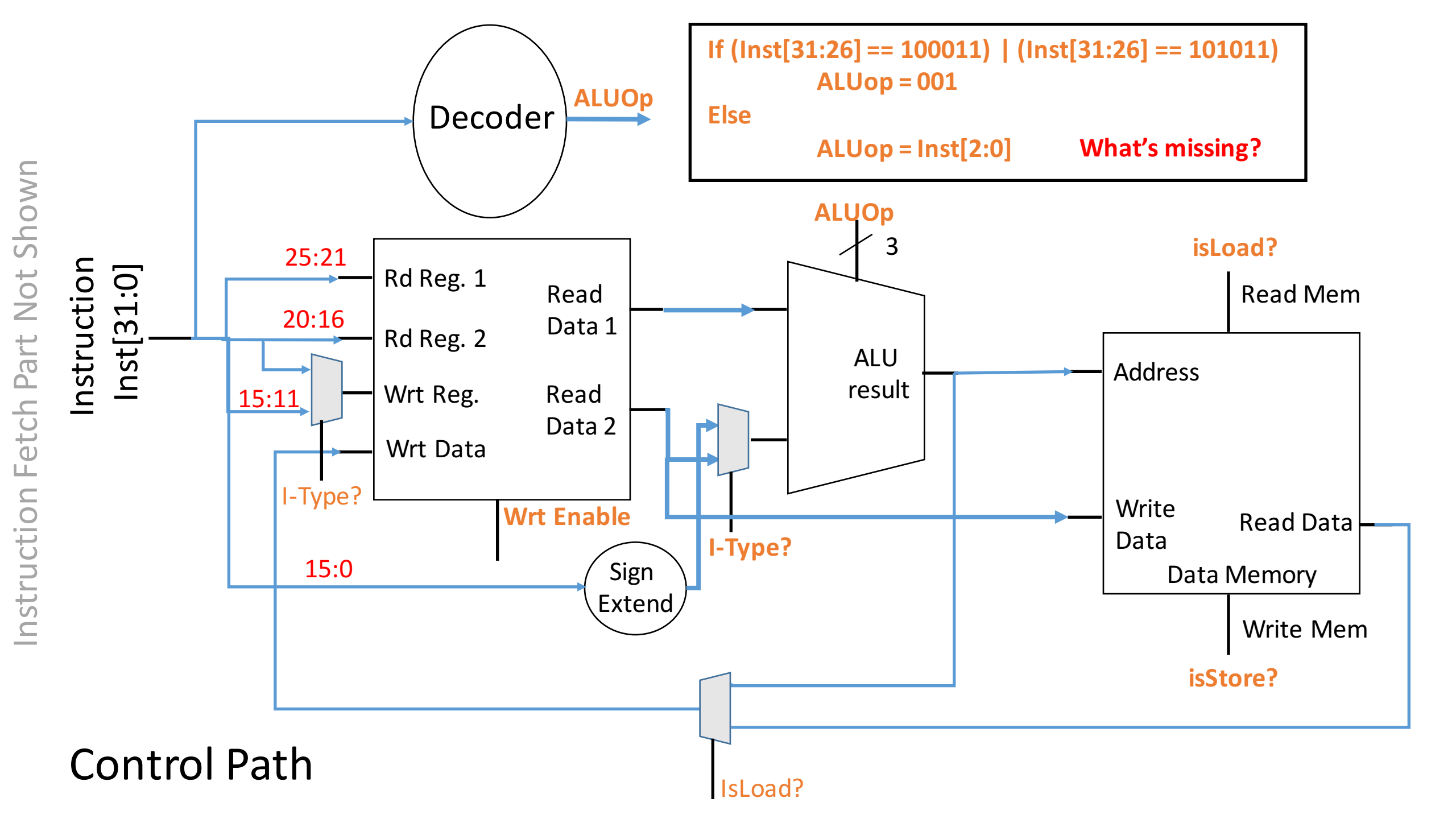
Final Data-Path (Reg Rd/Execute/Mem/Write-back)



Generating Control Signals (Control Path)



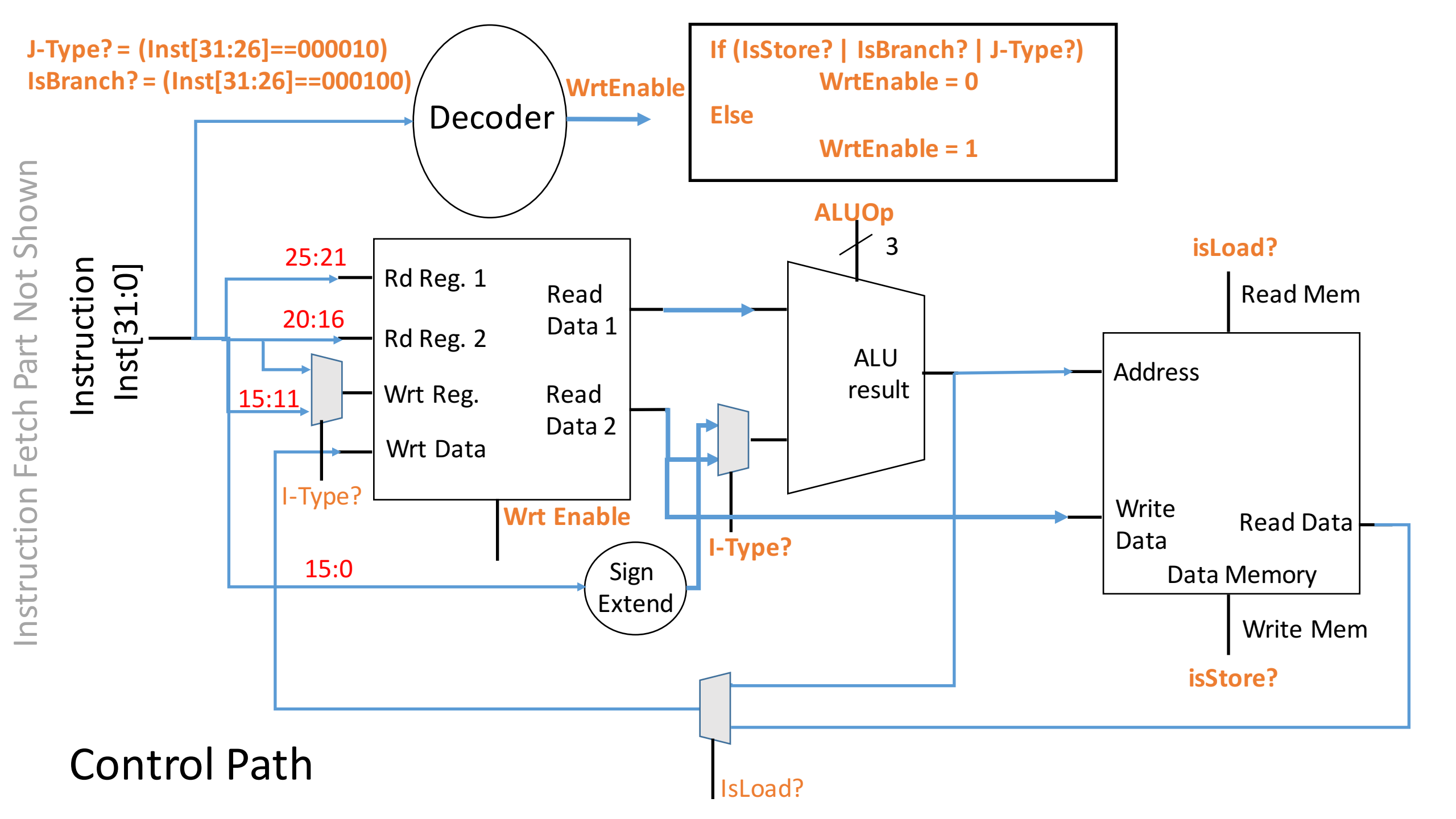

Instruction Fetch Part Not Shown
Decoder
IsLoad? = (Inst[31:26] == 100011)
IsStore? = (Inst[31:26] == 101011)
I-Type? = (Inst[31:26] != 00000) && (Inst[31:26] != 000010)
ALUOp
Wrt Enable
NextPC
Instruction
Inst[31:0]
25:21
20:16
15:11
15:0
Rd Reg. 1
Rd Reg. 2
Wrt Reg.
Wrt Data
Read Data 1
Read Data 2
I-Type?
Wrt Enable
Sign Extend
ALUOp
3
ALU result
I-Type?
isLoad?
Read Mem
Address
Write Data
Read Data
Data Memory
Write Mem
isStore?
IsLoad?
Control Path

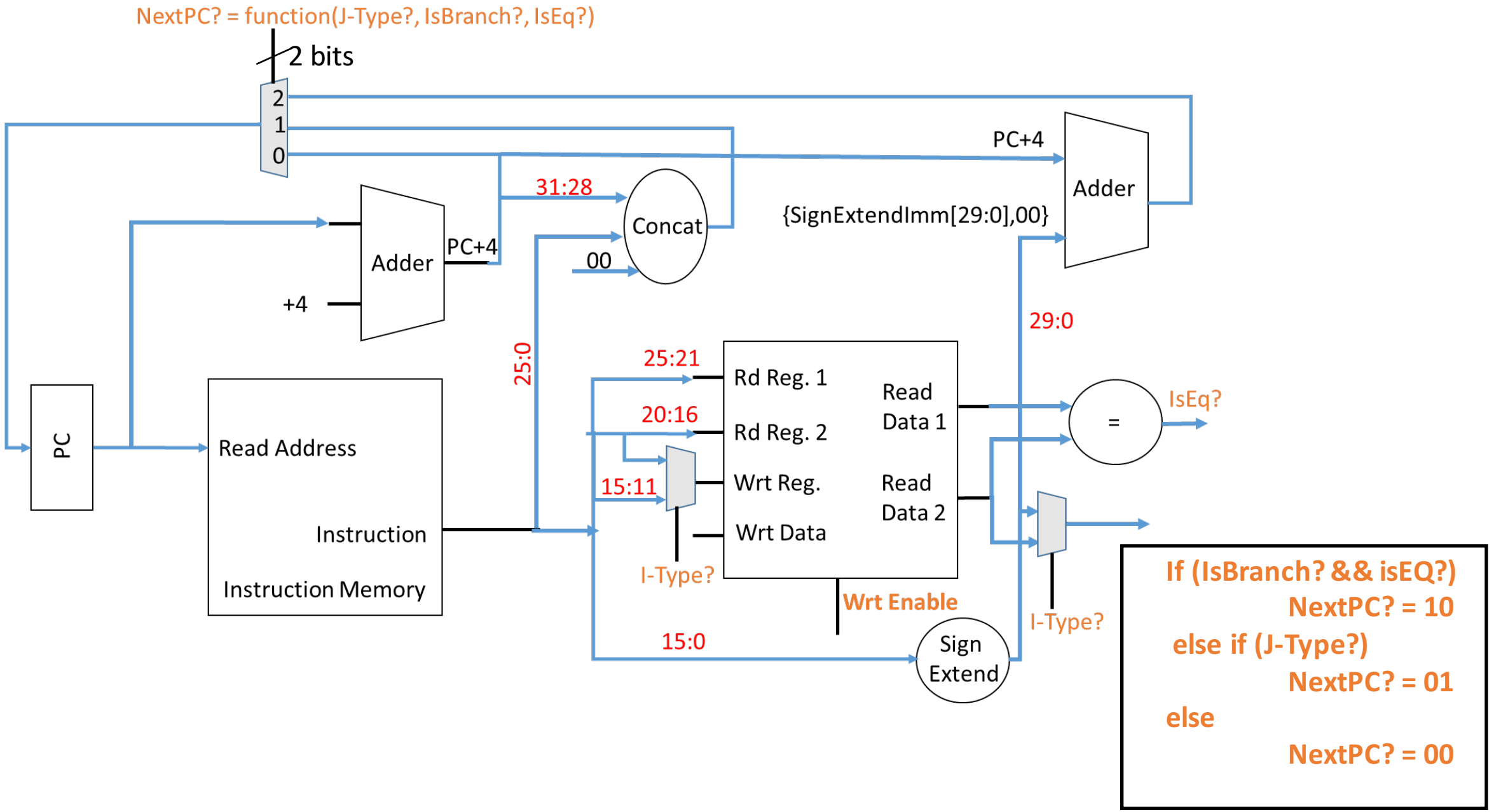

Instruction Fetch Part Not Shown
Decoder
ALUOp
If (Inst[31:26] == 100011) | (Inst[31:26] == 101011)
ALUop = 001
Else
ALUop = Inst[2:0]
What's missing?
Instruction
Inst[31:0]
25:21
20:16
15:11
15:0
Rd Reg. 1
Rd Reg. 2
Wrt Reg.
Wrt Data
Read Data 1
Read Data 2
I-Type?
Wrt Enable
Sign Extend
ALUOp
3
ALU result
I-Type?
isLoad?
Read Mem
Address
Write Data
Read Data
Data Memory
Write Mem
isStore?
IsLoad?
Control Path

Instruction Fetch Part Not Shown

```
If (Inst[31:26] == 100011)  | (Inst[31:26] == 101011)
        ALUop = 001
Else If (Inst[31:26]==000000)
        ALUop = Inst[2:0]
Else
        ALUop = Inst[28:26]
```

Control Path


J-Type? = (Inst[31:26]==000010)
IsBranch? = (Inst[31:26]==000100)
Decoder
WrtEnable
If (IsStore? | IsBranch? | J-Type?)
WrtEnable = 0
Else
WrtEnable = 1
ALUOp
3
isLoad?
Read Mem
Instruction
Inst[31:0]
25:21
20:16
15:11
Rd Reg. 1
Rd Reg. 2
Wrt Reg.
Wrt Data
Read
Data 1
Read
Data 2
ALU
result
Address
Write
Data
Read Data
Data Memory
Write Mem
isStore?
I-Type?
Wrt Enable
I-Type?
15:0
Sign
Extend
IsLoad?
Instruction Fetch Part Not Shown
Control Path


NextPC? = function(J-Type?, IsBranch?, IsEq?)
2 bits
2
1
0
PC+4
Adder
{SignExtendImm[29:0],00}
31:28
Concat
00
Adder
PC+4
+4
29:0
25:0
25:21
20:16
15:11
Rd Reg. 1
Rd Reg. 2
Wrt Reg.
Wrt Data
Read Data 1
Read Data 2
=
IsEq?
I-Type?
I-Type?
Wrt Enable
15:0
Sign Extend
PC
Read Address
Instruction
Instruction Memory
If (IsBranch? && isEQ?)
NextPC? = 10
else if (J-Type?)
NextPC? = 01
else
NextPC? = 00