Pipelining

Pipelining is a standard technique for exploiting parallelism in tasks that are ordered. Two considerations:

- Balancing the step size.
- Avoid hazards.

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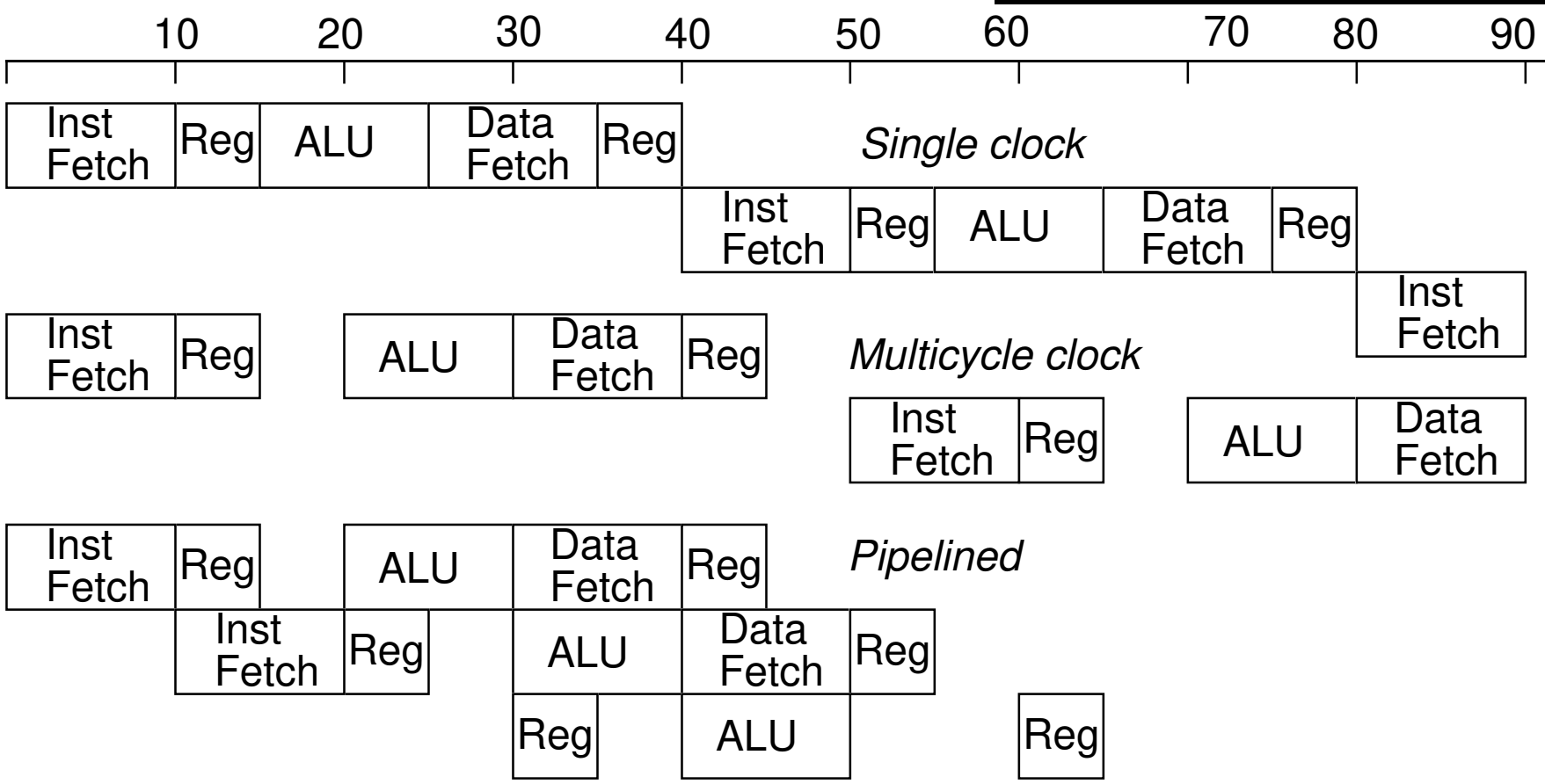
Benefits of Pipelining

Suppose the following times apply ...
- Memory units: 10ns
- ALU and adders: 10ns
- Register file ref: 5ns
- All other operations: 0ns.

Charges for instructions are ...

R-format:	30ns
Load inst:	40ns
Store inst:	35ns
Branch:	25ns
Jump:	10ns



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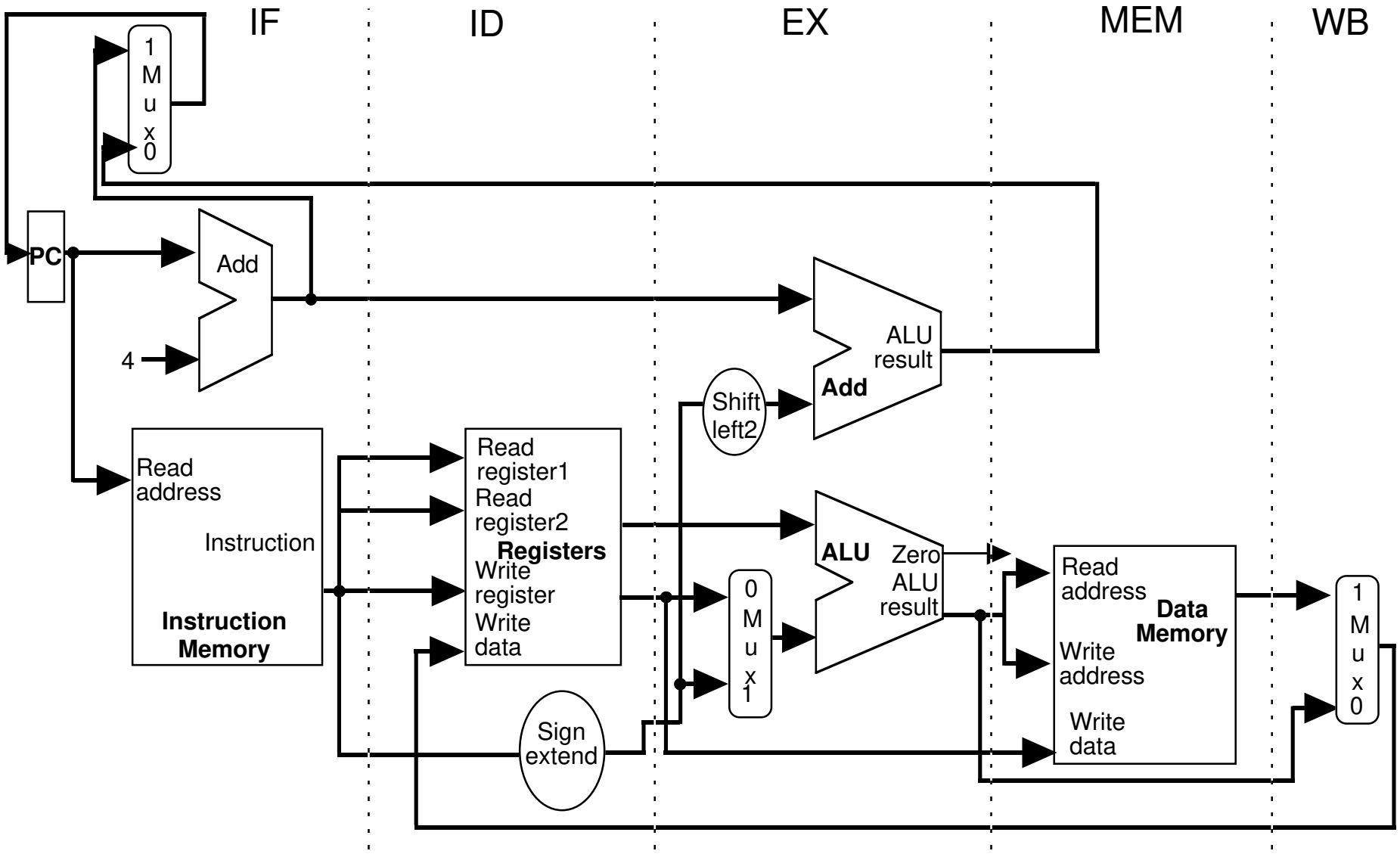
Single Cycle Data Path



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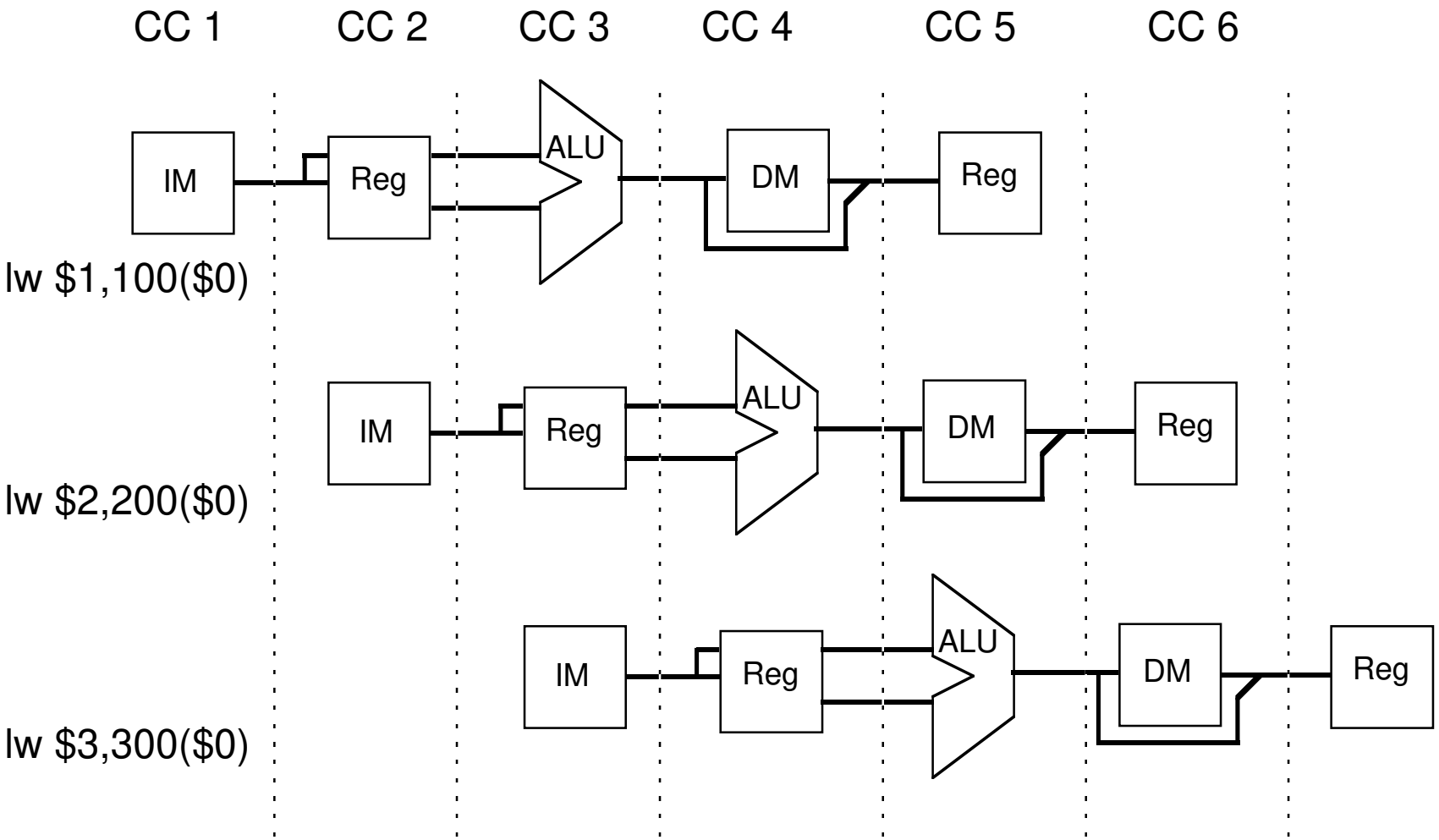
Pipelining the Data Path



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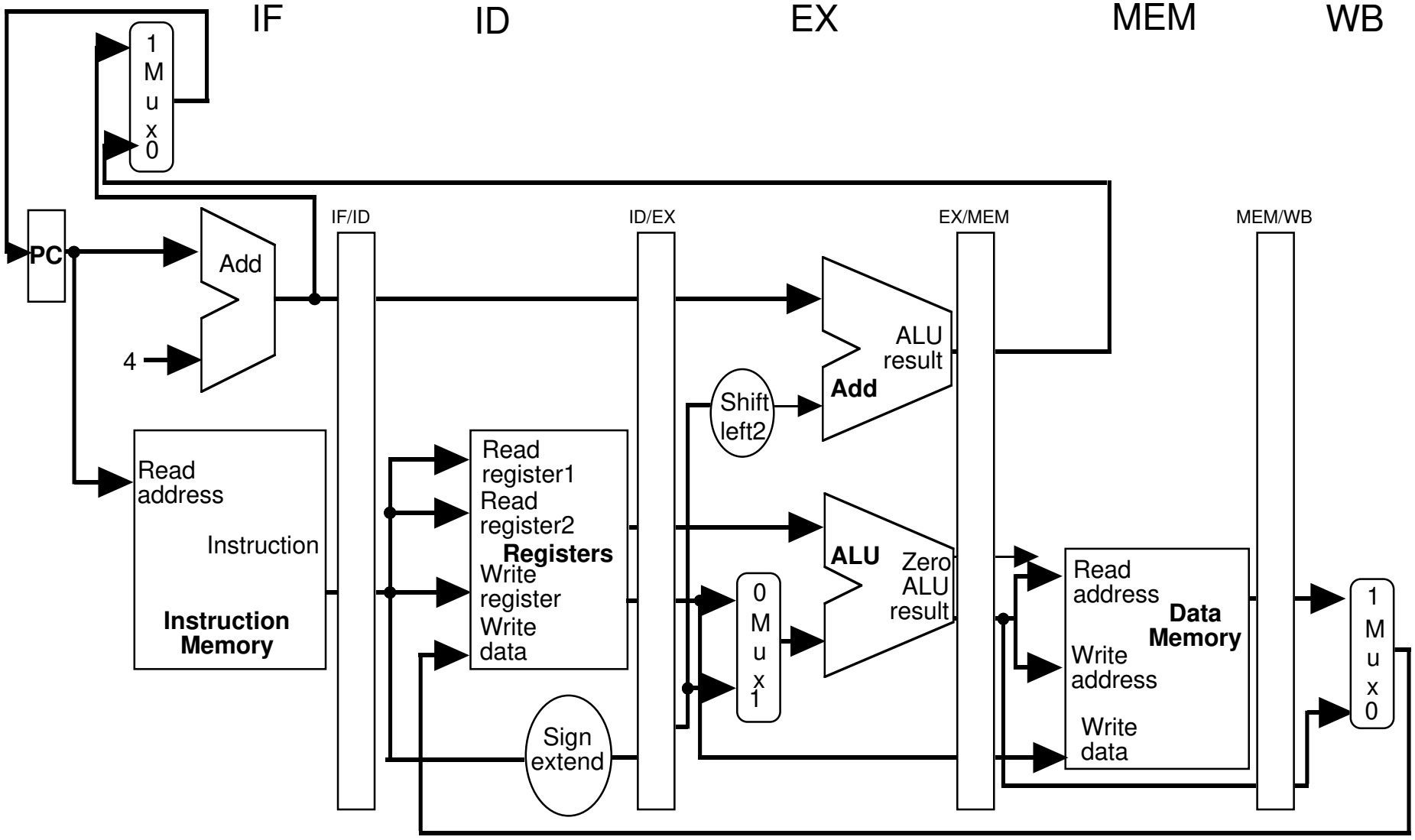
Pipeline Registers



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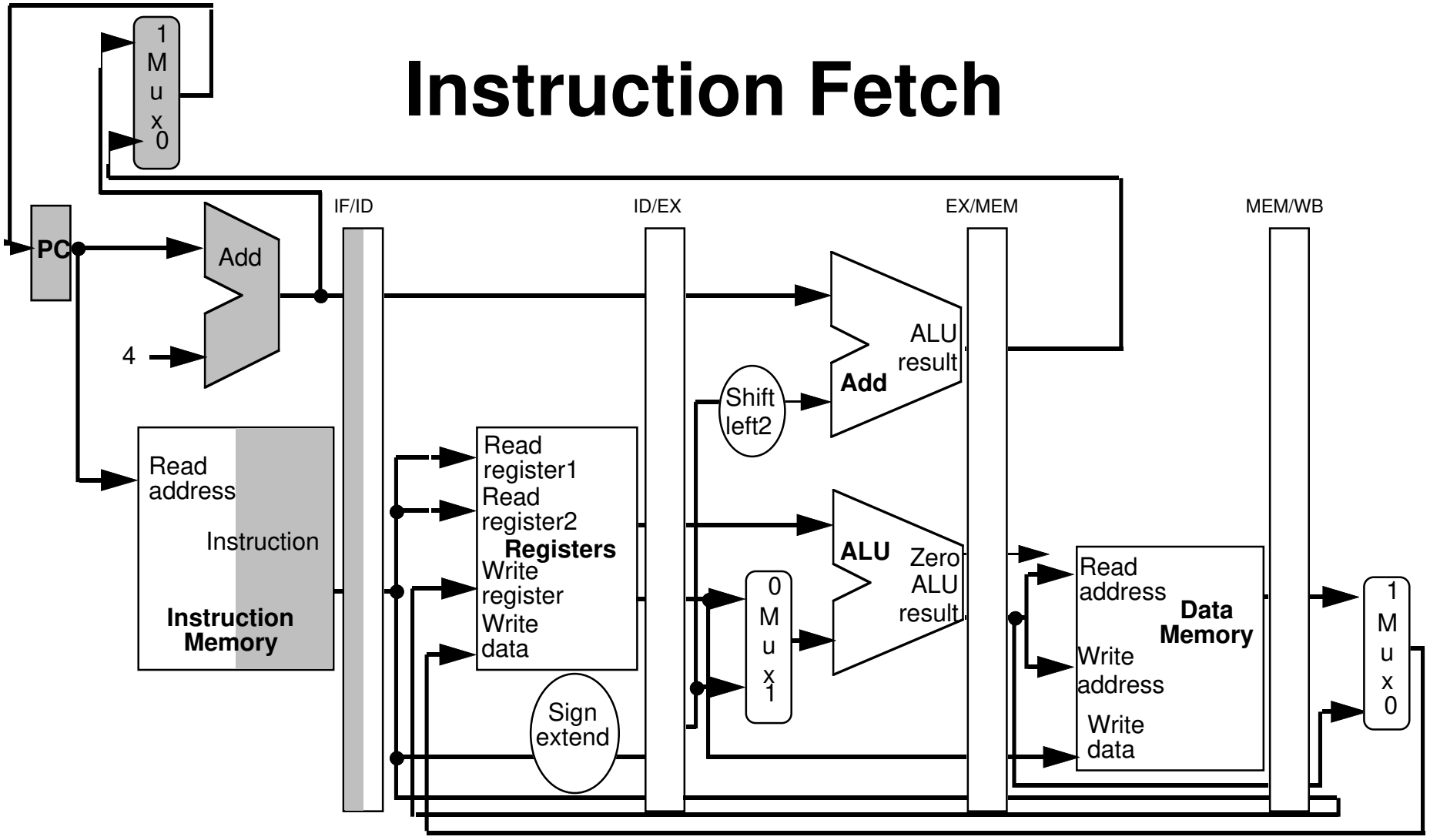
Instruction Fetch



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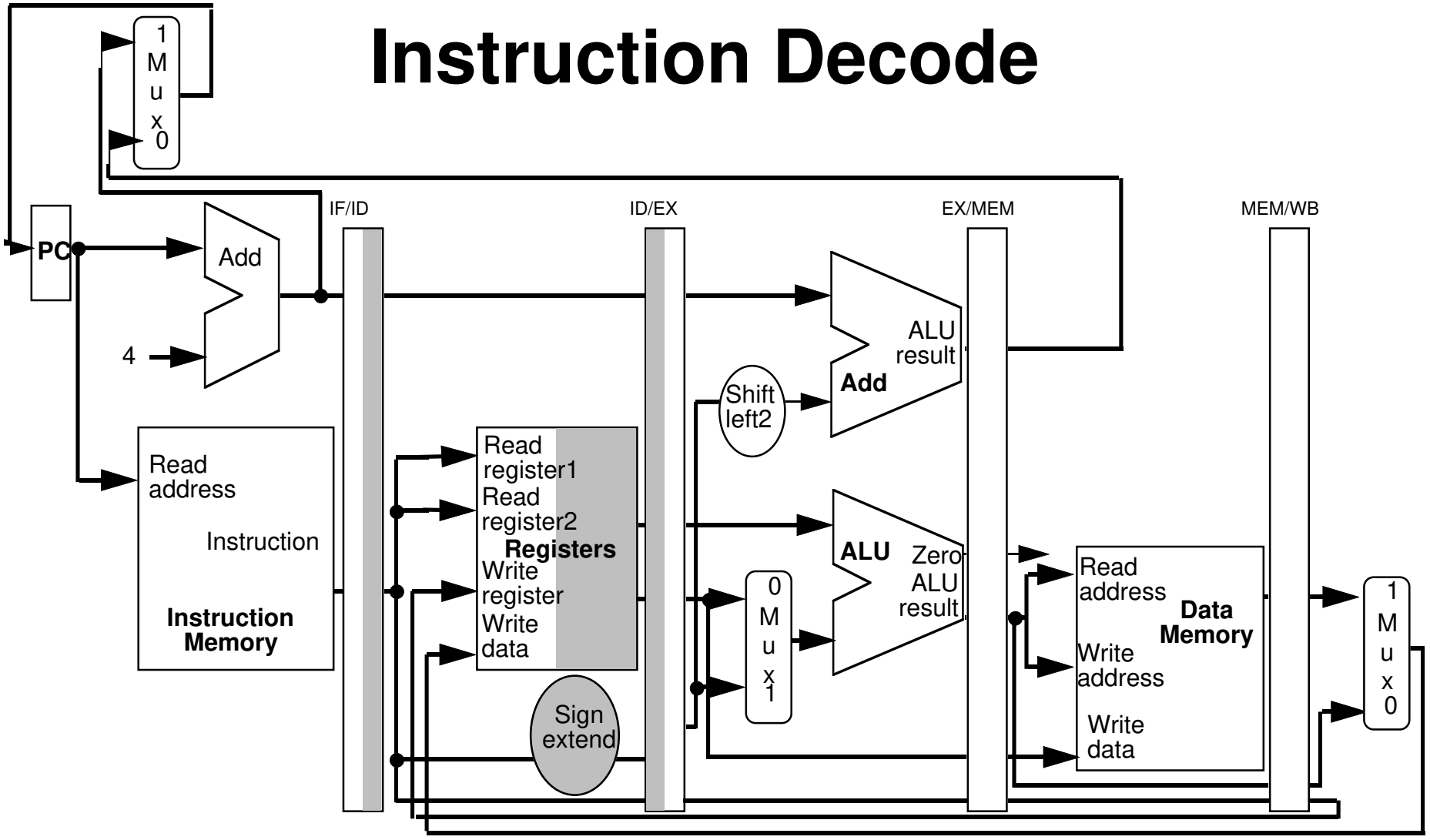
Instruction Decode



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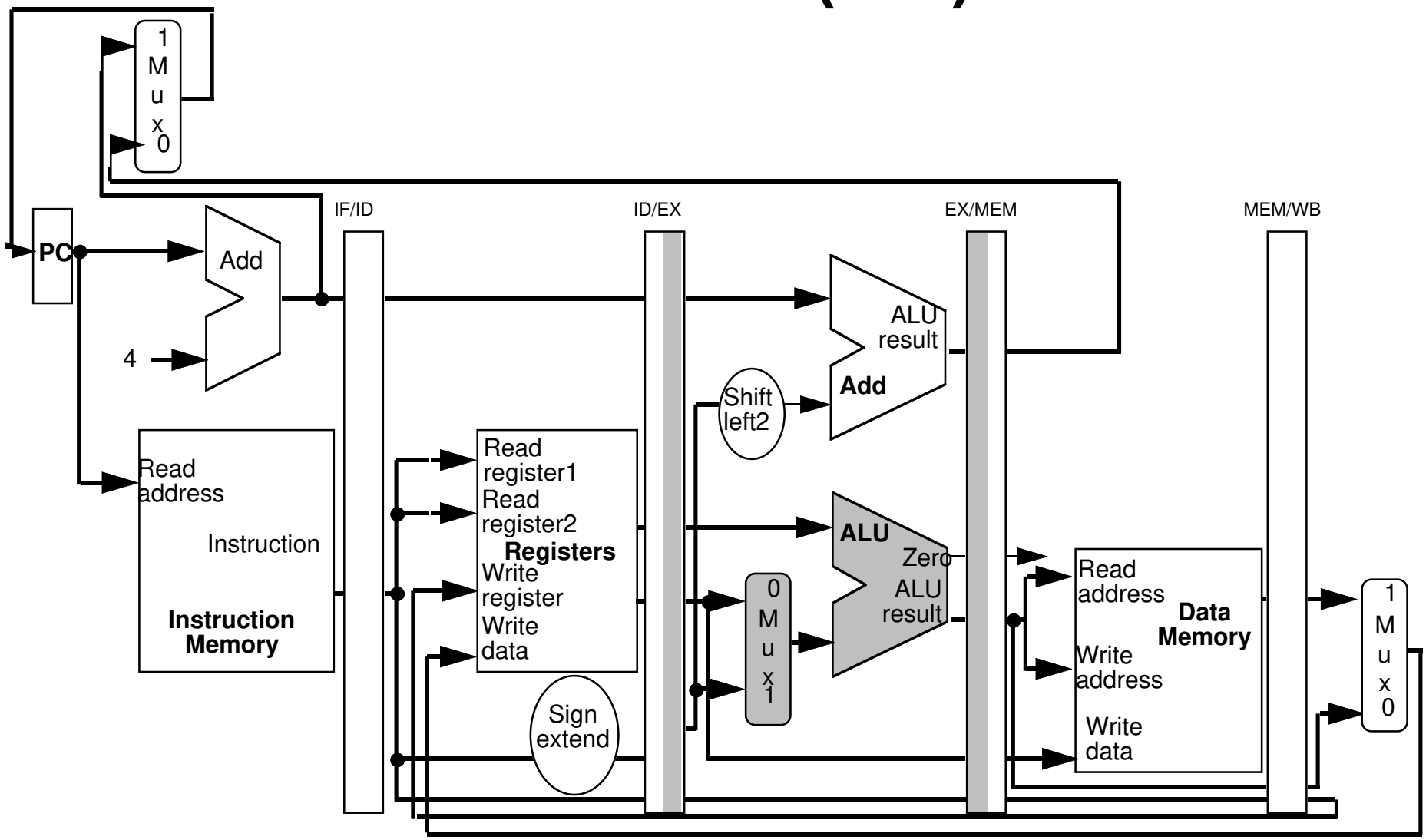
Execution (LW)



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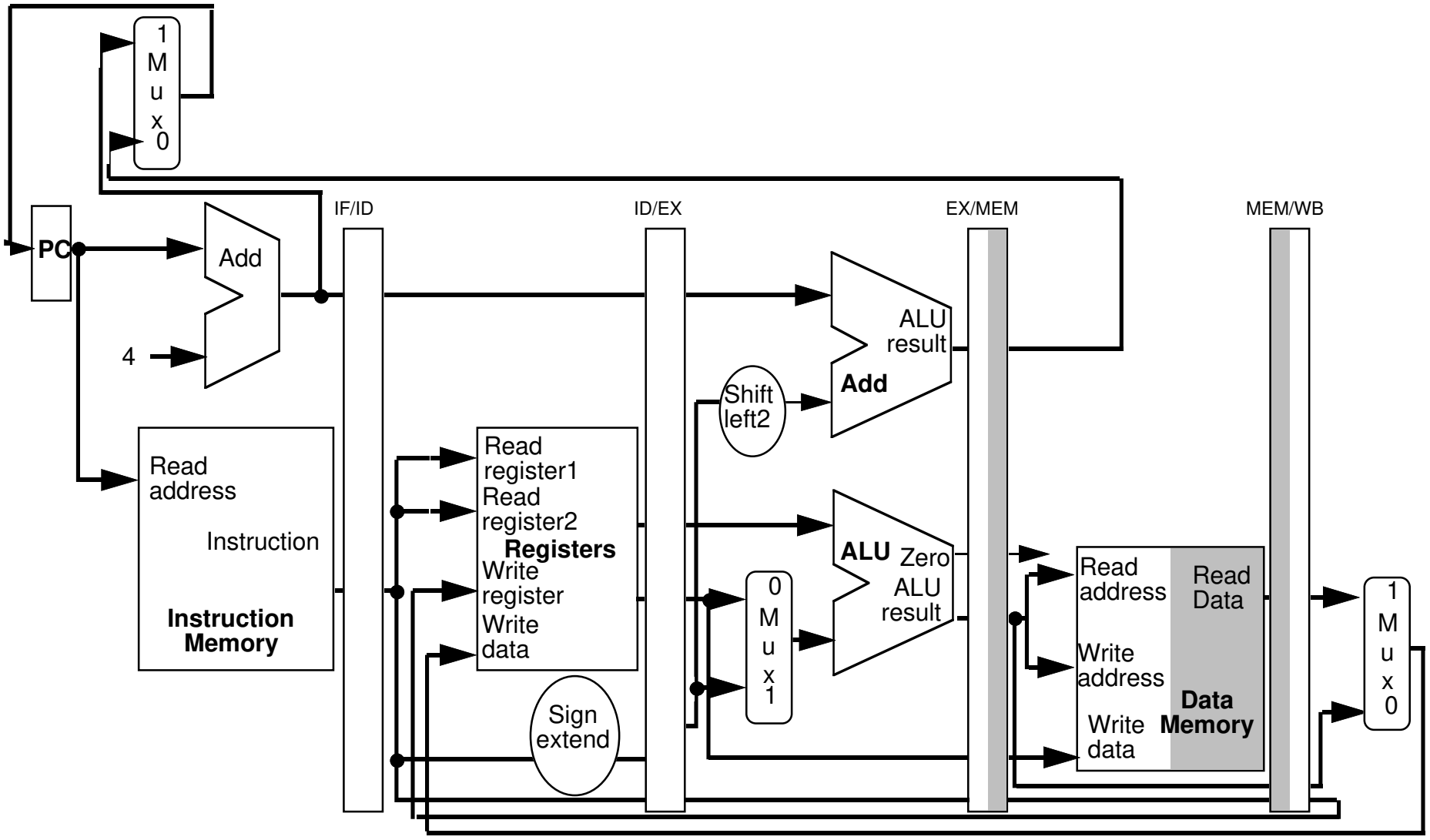
Memory (LW)



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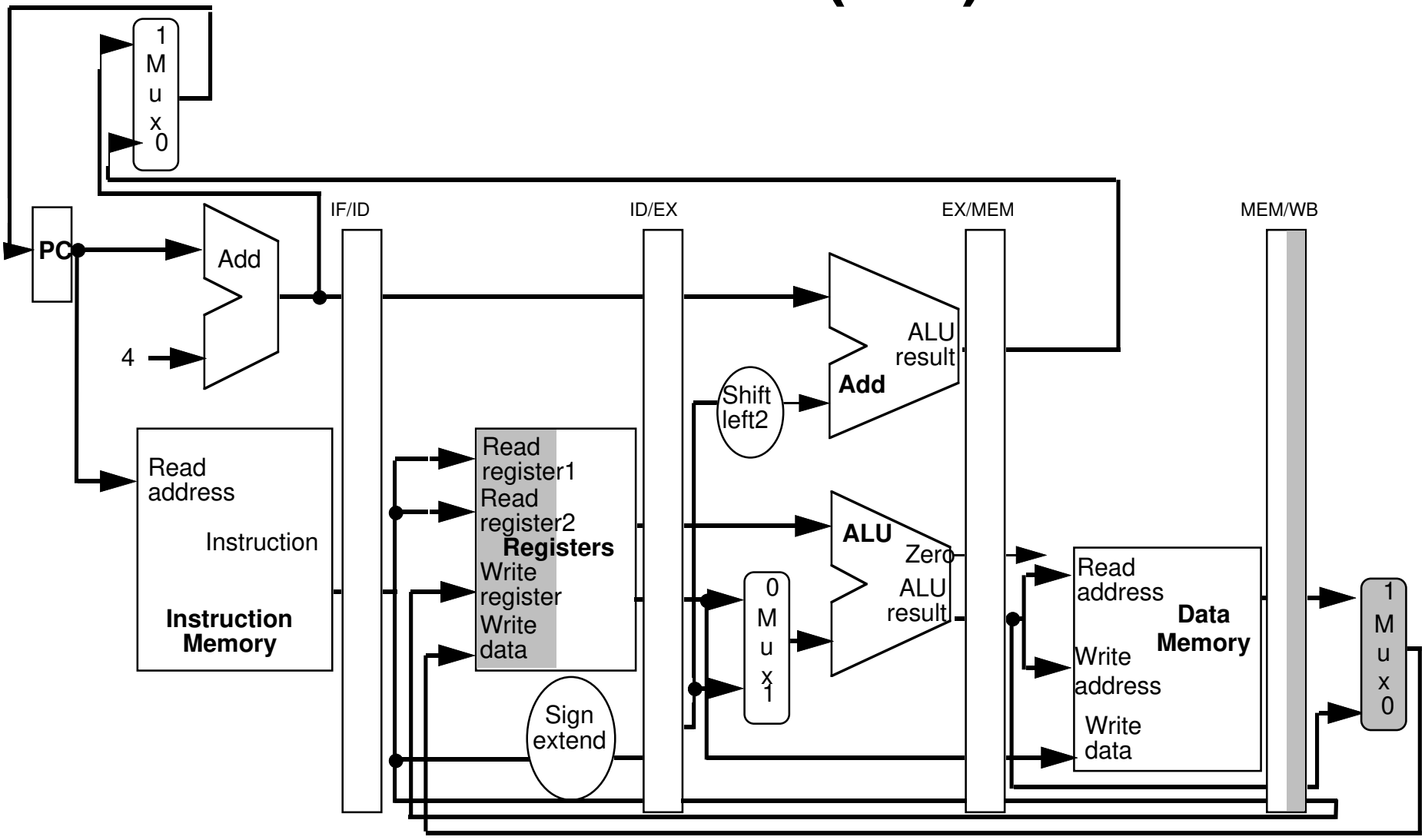
Write Back (LW)



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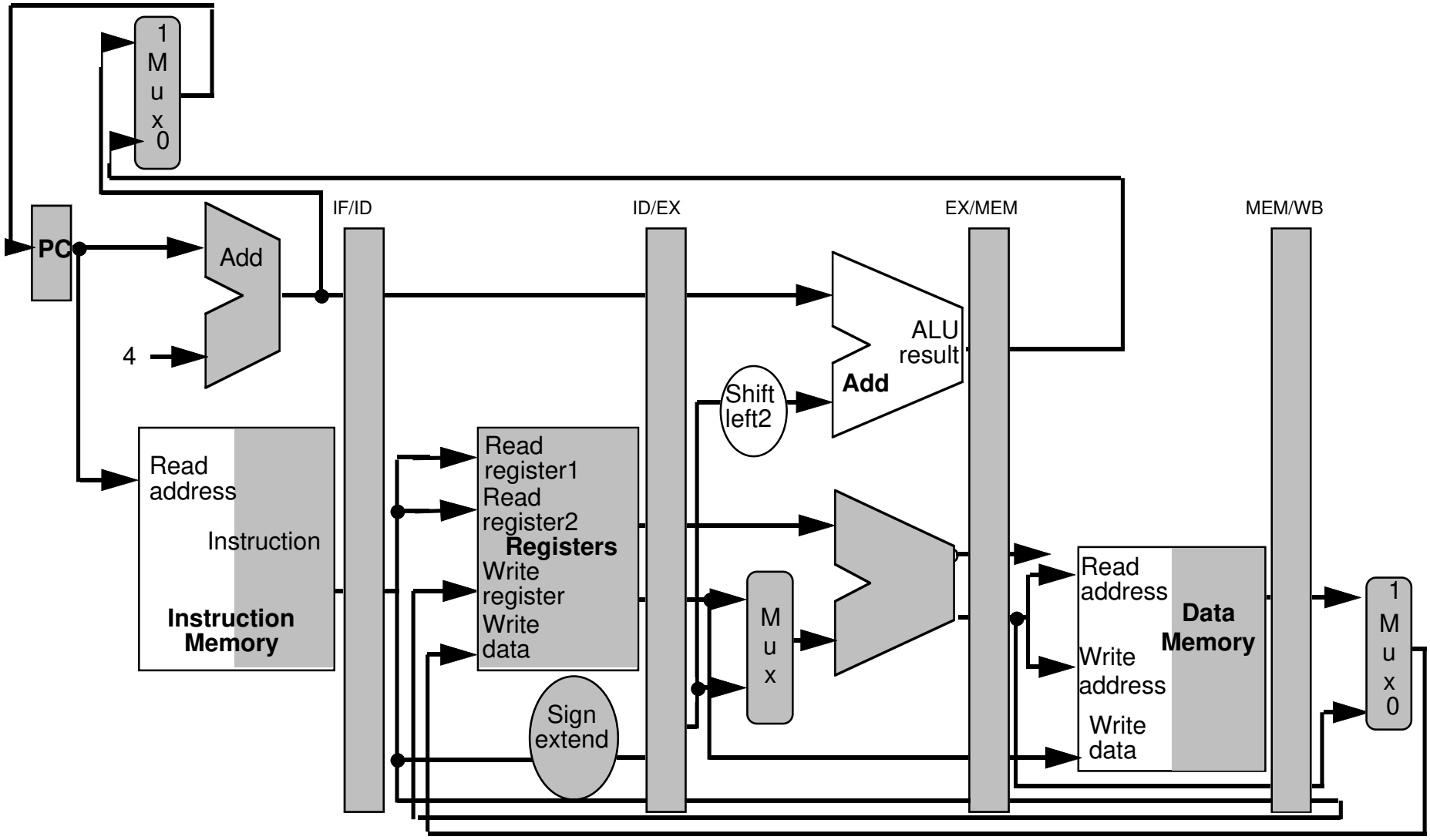
Summary



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