

Computer Architecture
Lecture Week 3 (Part I)

Von Neumann and Harvard Architectures

Artem Burmyakov

September 18, 2026

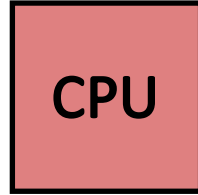


INNOPOLIS
UNIVERSITY

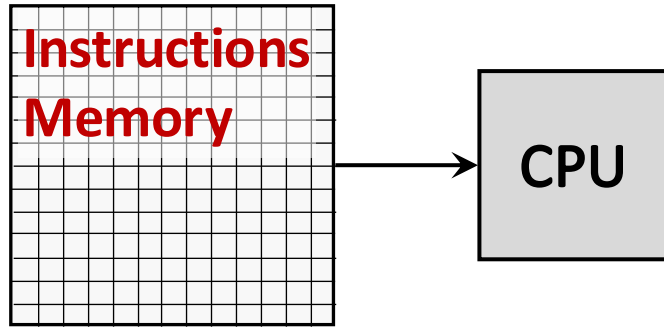
Fundamental CA Ideas: Recap

1. Hierarchy of memories
2. Design simplification via abstraction use
3. Moore's law for CPU performance
4. Performance via parallelism
5. Performance via pipelining
6. Performance via speculation (prediction)
7. Dependability (reliability) via redundancy (spare parts)
8. Make the common case fast
9. Finite State Machines

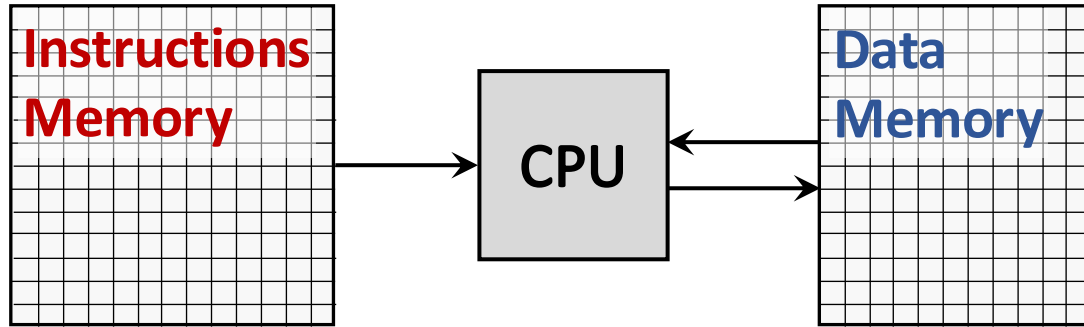
Computer Architecture



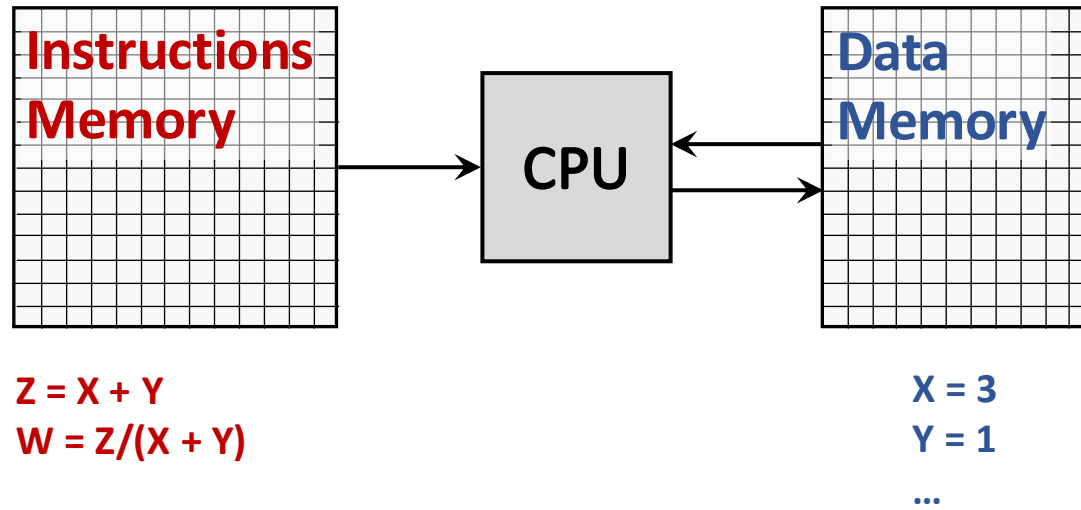
Harvard Computer Architecture



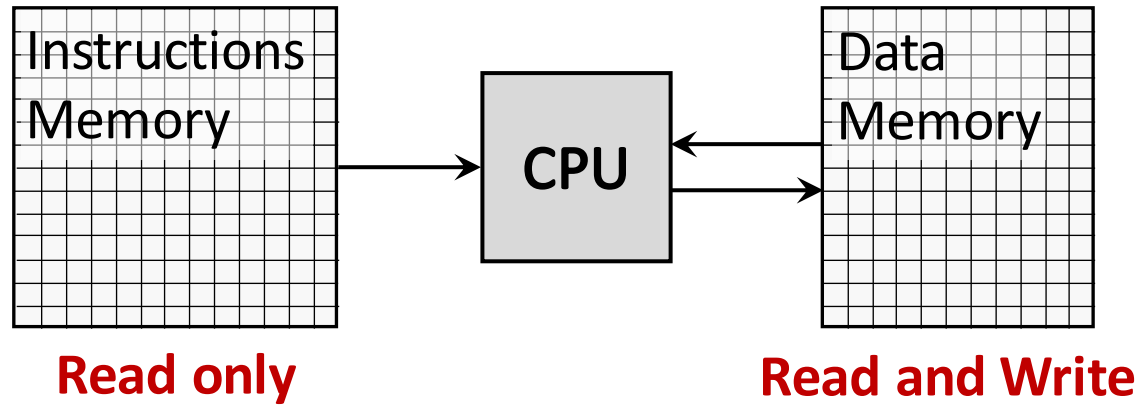
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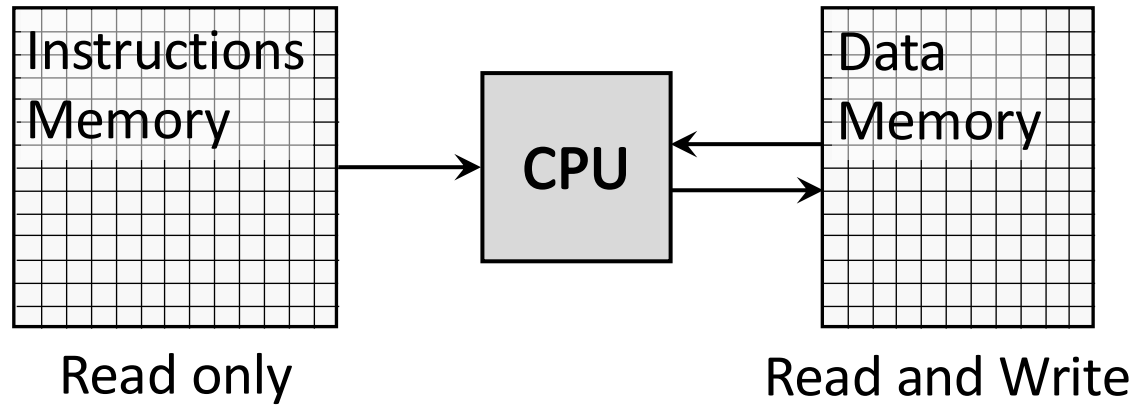
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$Z = X + Y$
 $W = Z / (X + Y)$

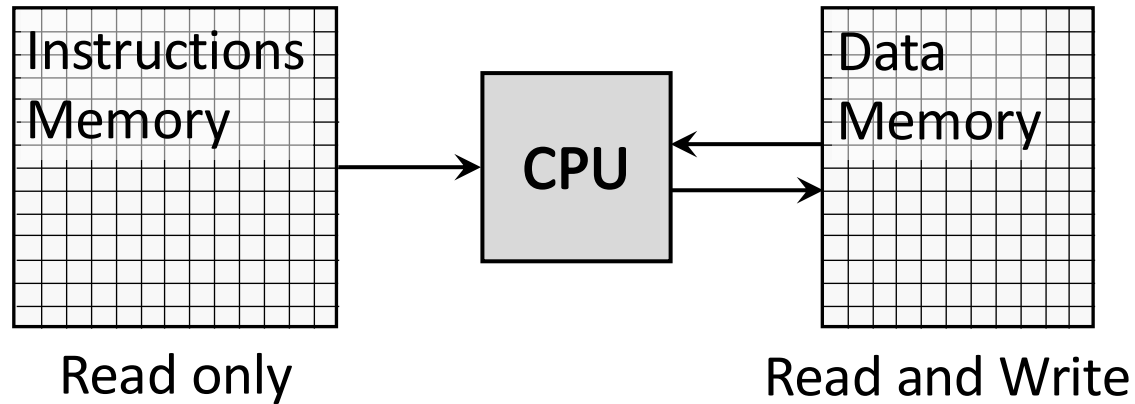
$X = 3$
 $Y = 1$
...

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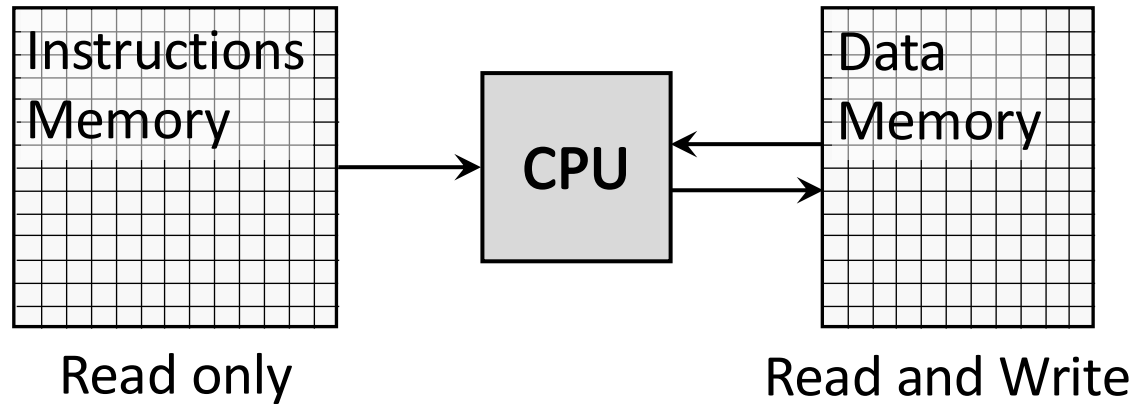
Principle	Instructions and data are in different physical memory units (or address spaces with dedicated buses)
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Harvard Architecture



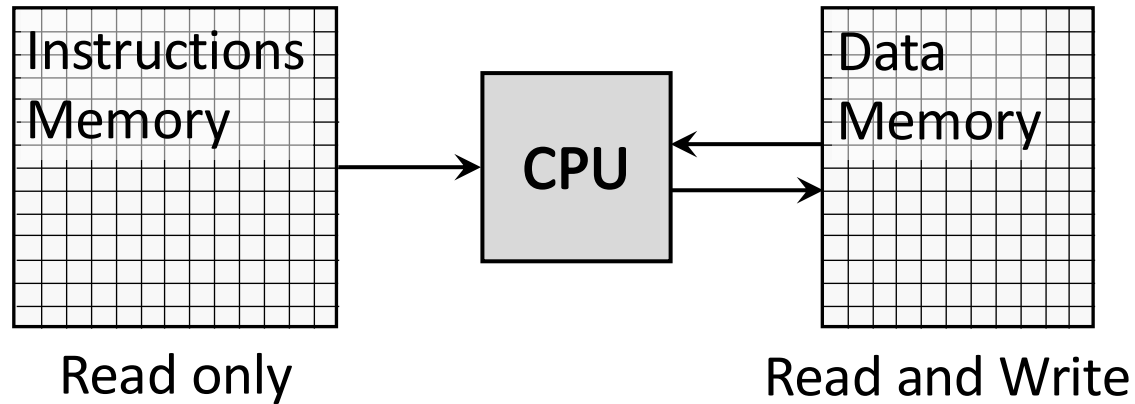
Principle	Instructions and data are in different physical memory units
Pros	+ Lower performance overheads: Instructions and data are fetched concurrently

Harvard Architecture



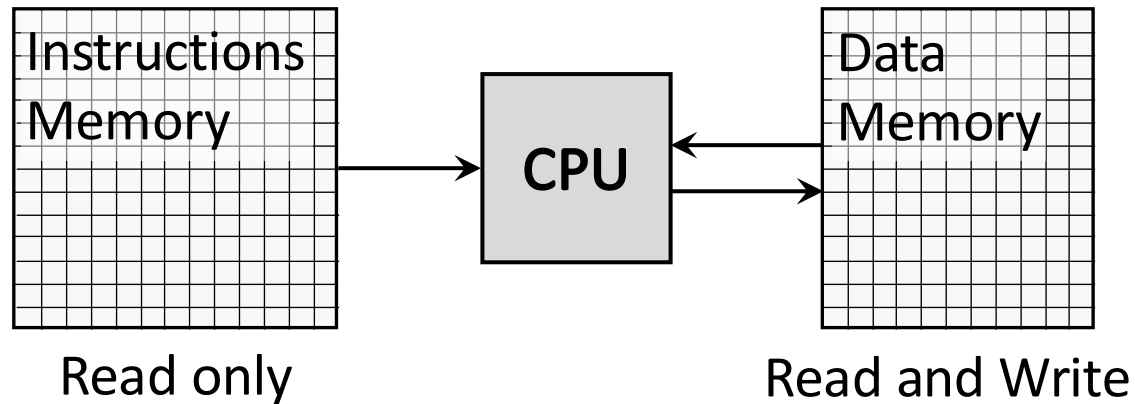
Principle	Instructions and data are in different physical memory units
Pros/Cons	+ Lower performance overheads - Complex hardware implementation

Harvard Architecture



Principle	Instructions and data are in different physical memory units
Pros/Cons	+ Lower performance overheads - Complex hardware implementation
Usage	Embedded systems

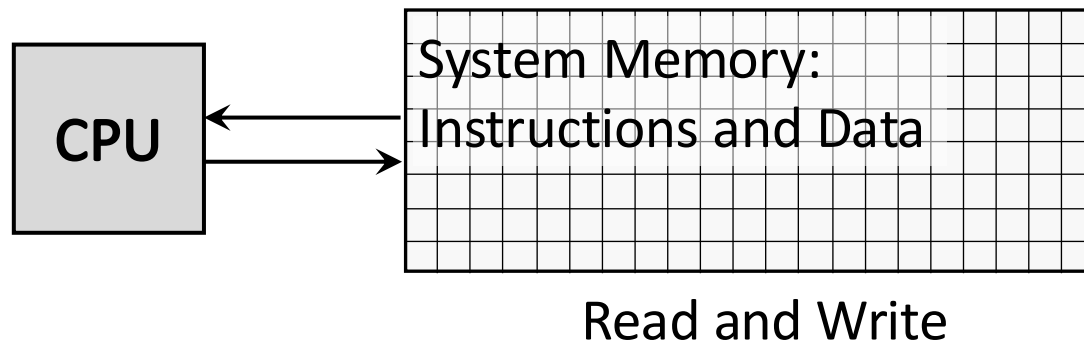
Harvard Architecture



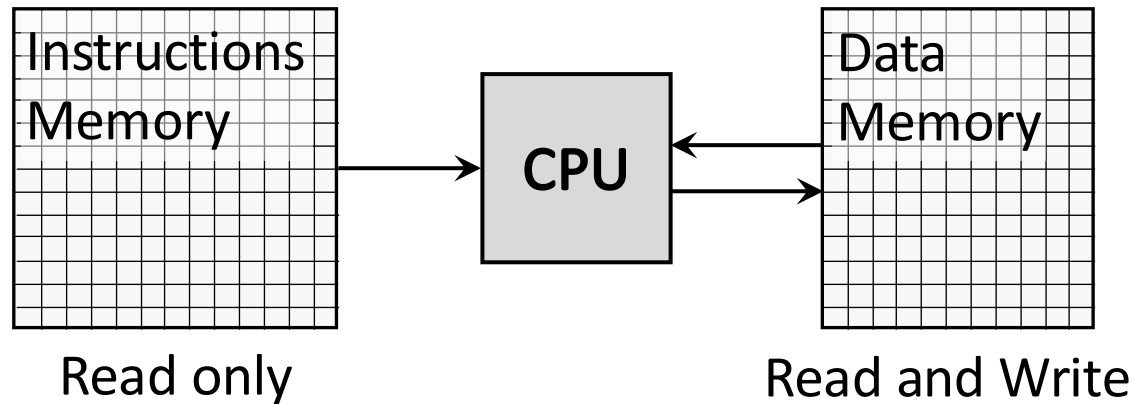
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Von Neumman Architecture

(or Princeton/Stored-Program)

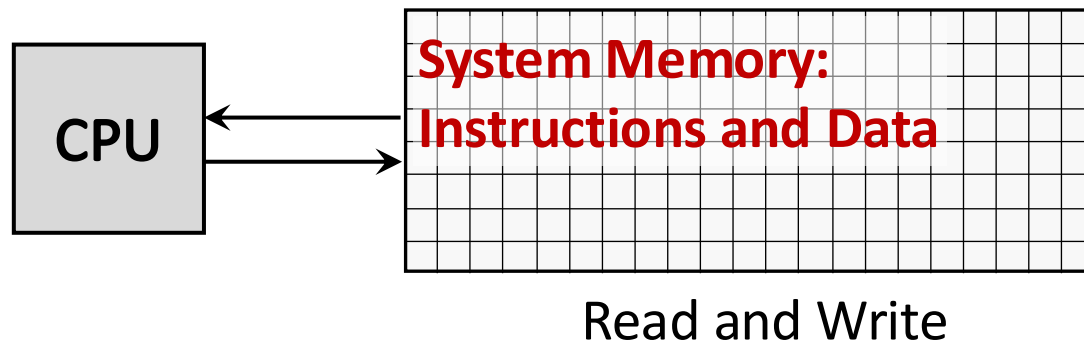


Harvard Architecture



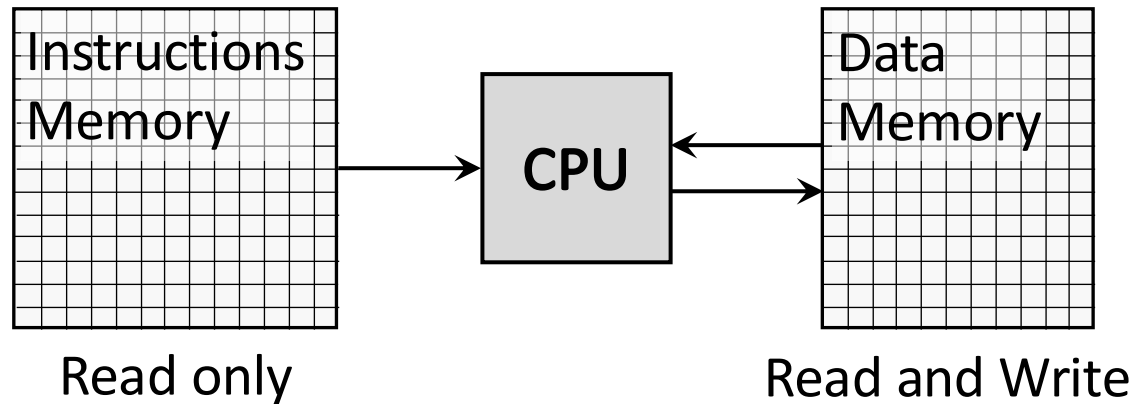
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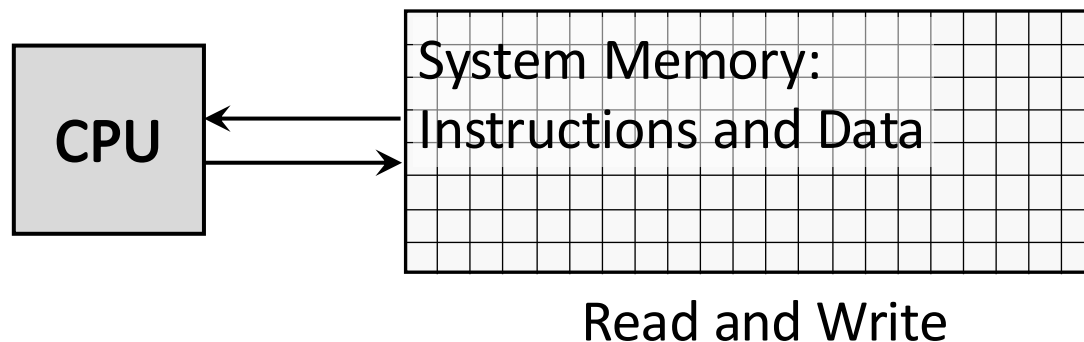
Principle	1) Instructions and data are stored in System Memory
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Harvard Architecture



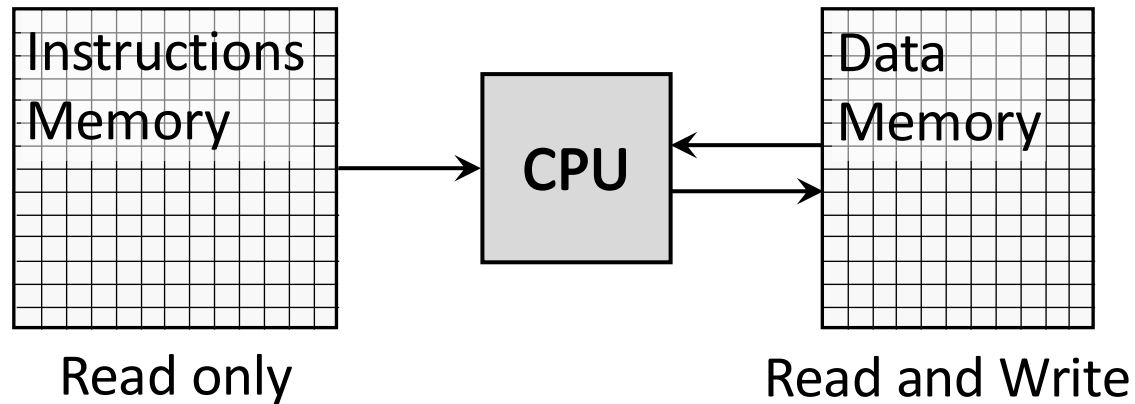
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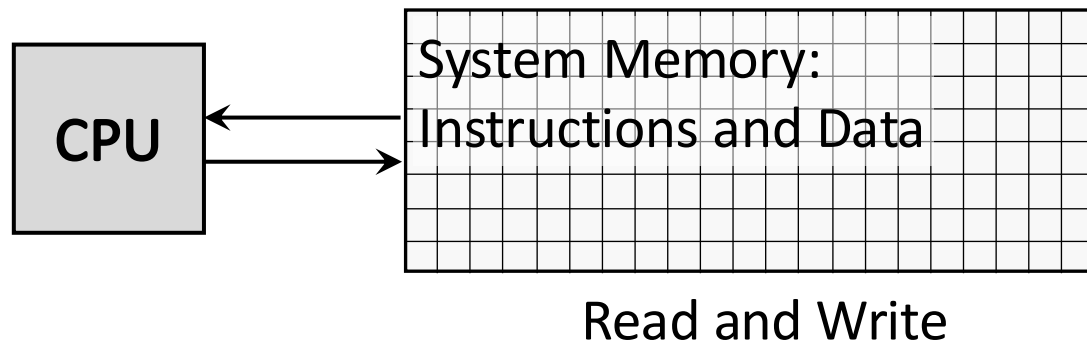
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Harvard Architecture



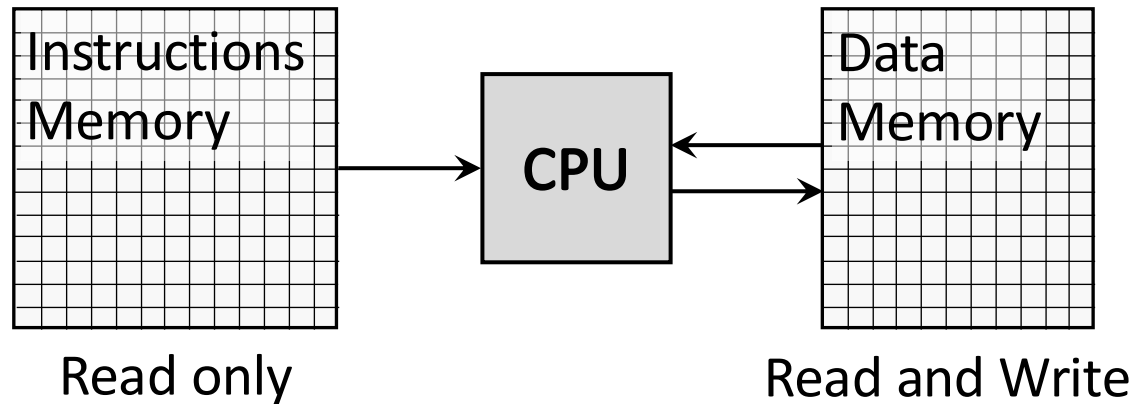
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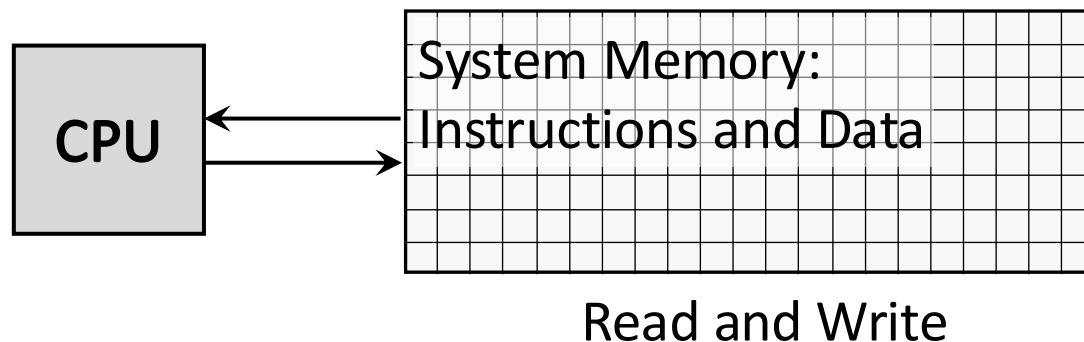
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Harvard Architecture



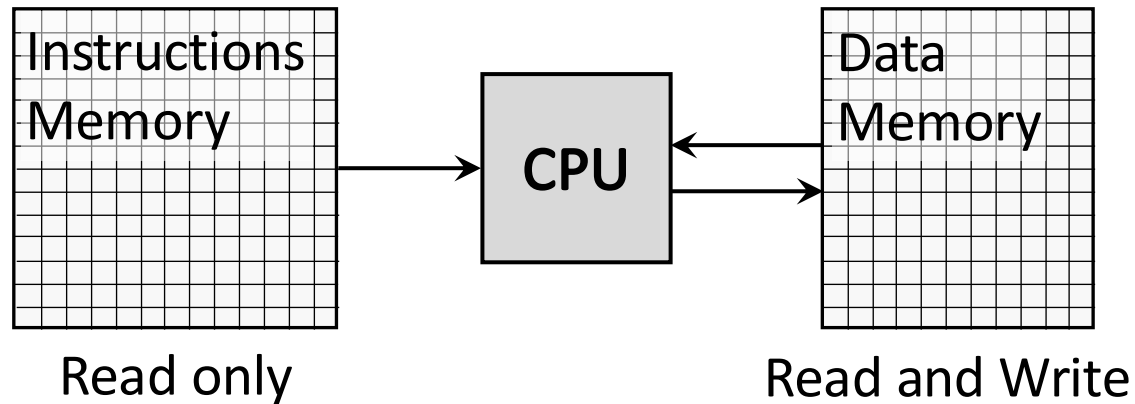
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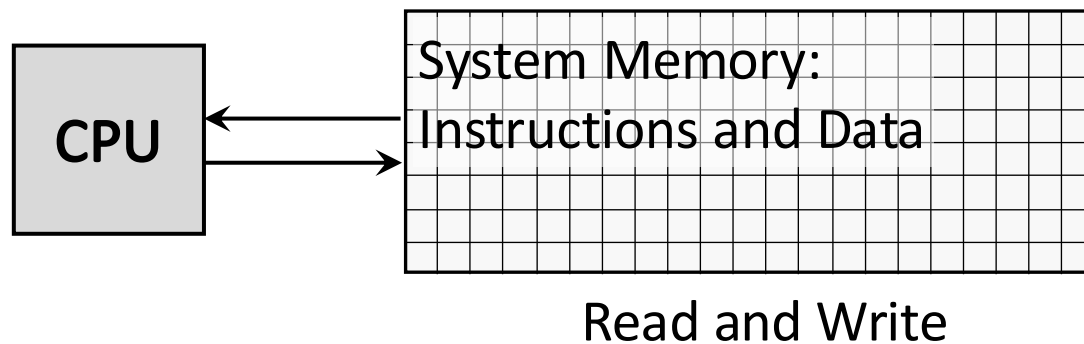
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Harvard Architecture



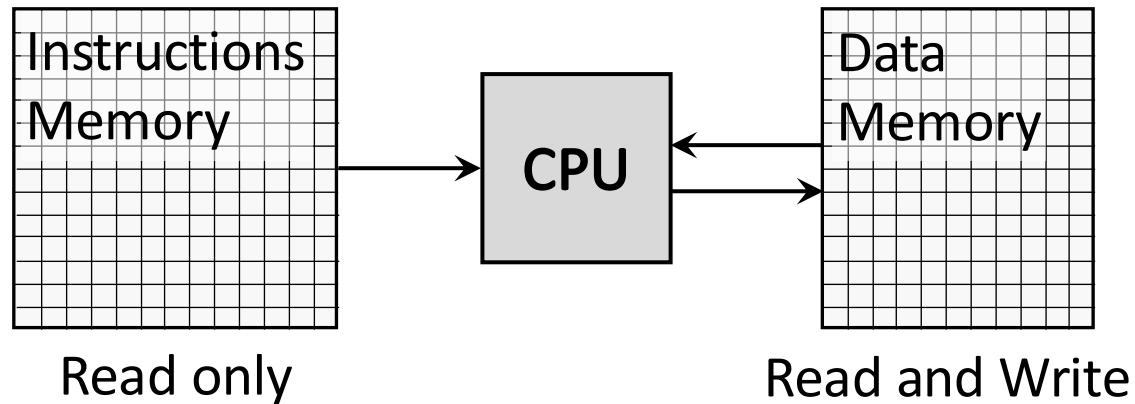
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Von Neumman Architecture (or Princeton/Stored-Program)



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Pros/Cons	+ Simpler memory management + Simpler hardware implementation - Higher performance overhead
Usage	All general-purpose computers

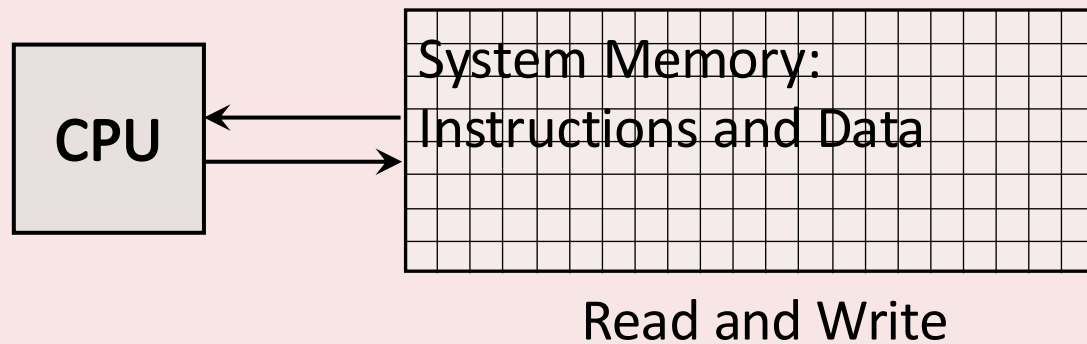
Harvard Architecture



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Dominant

Von Neumman Architecture (or Princeton/Stored-Program)



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