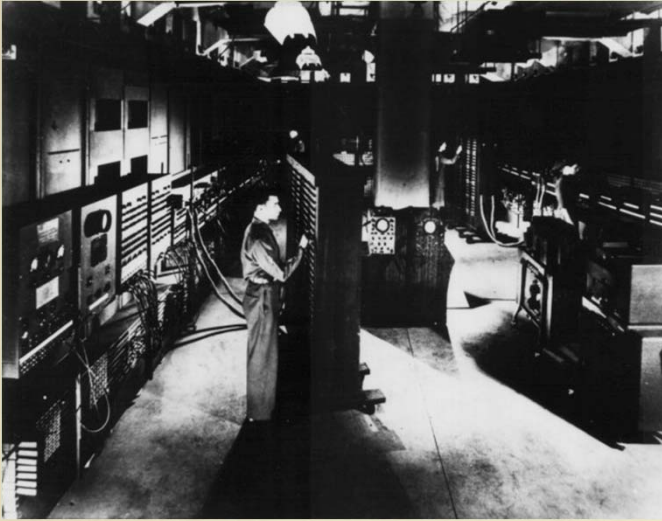


Introduction to Computer Architecture and Digital Logic I

Fall 2013

Carola Wenk

What's In There?



1940s



1980s



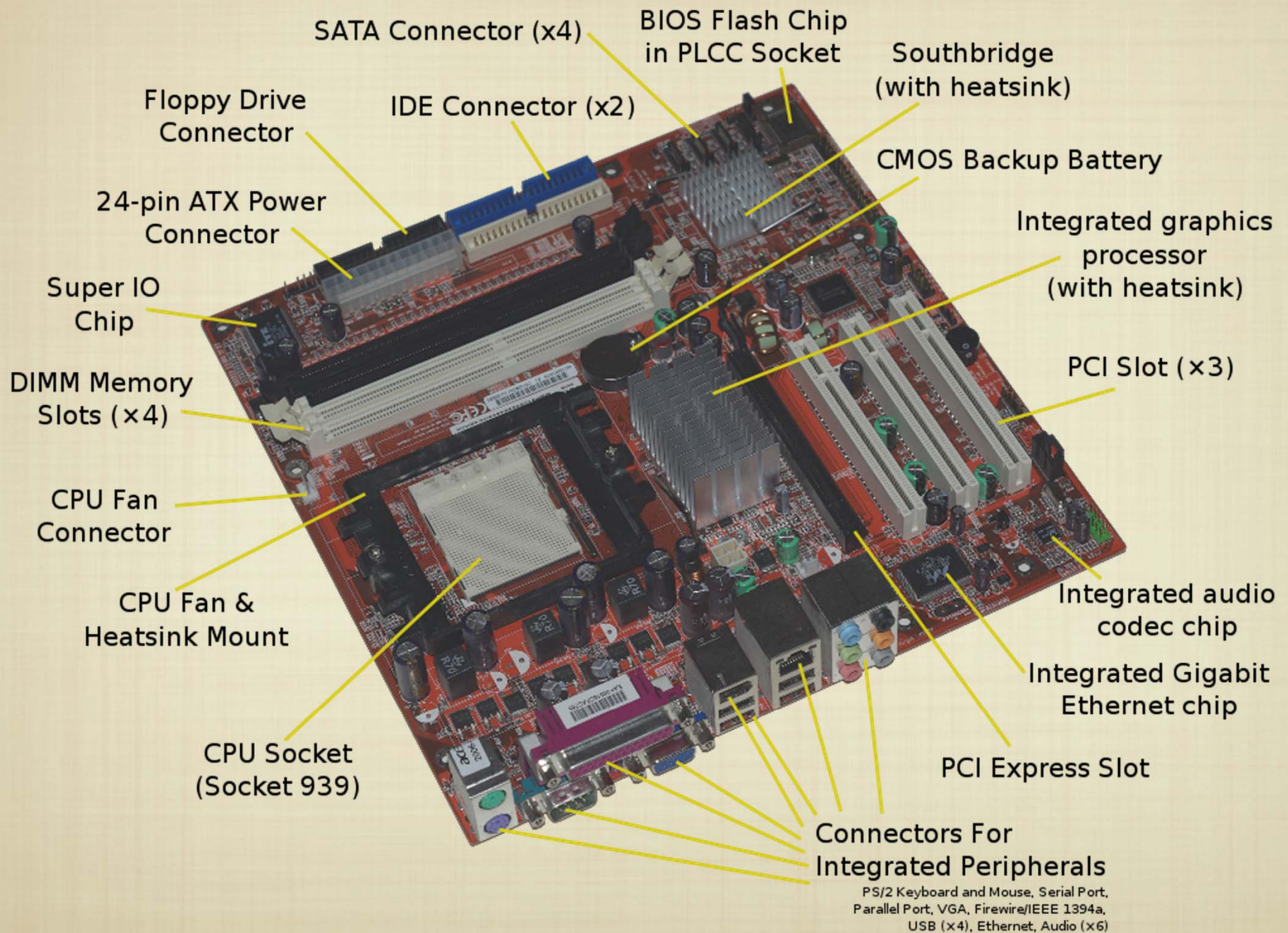
1990s



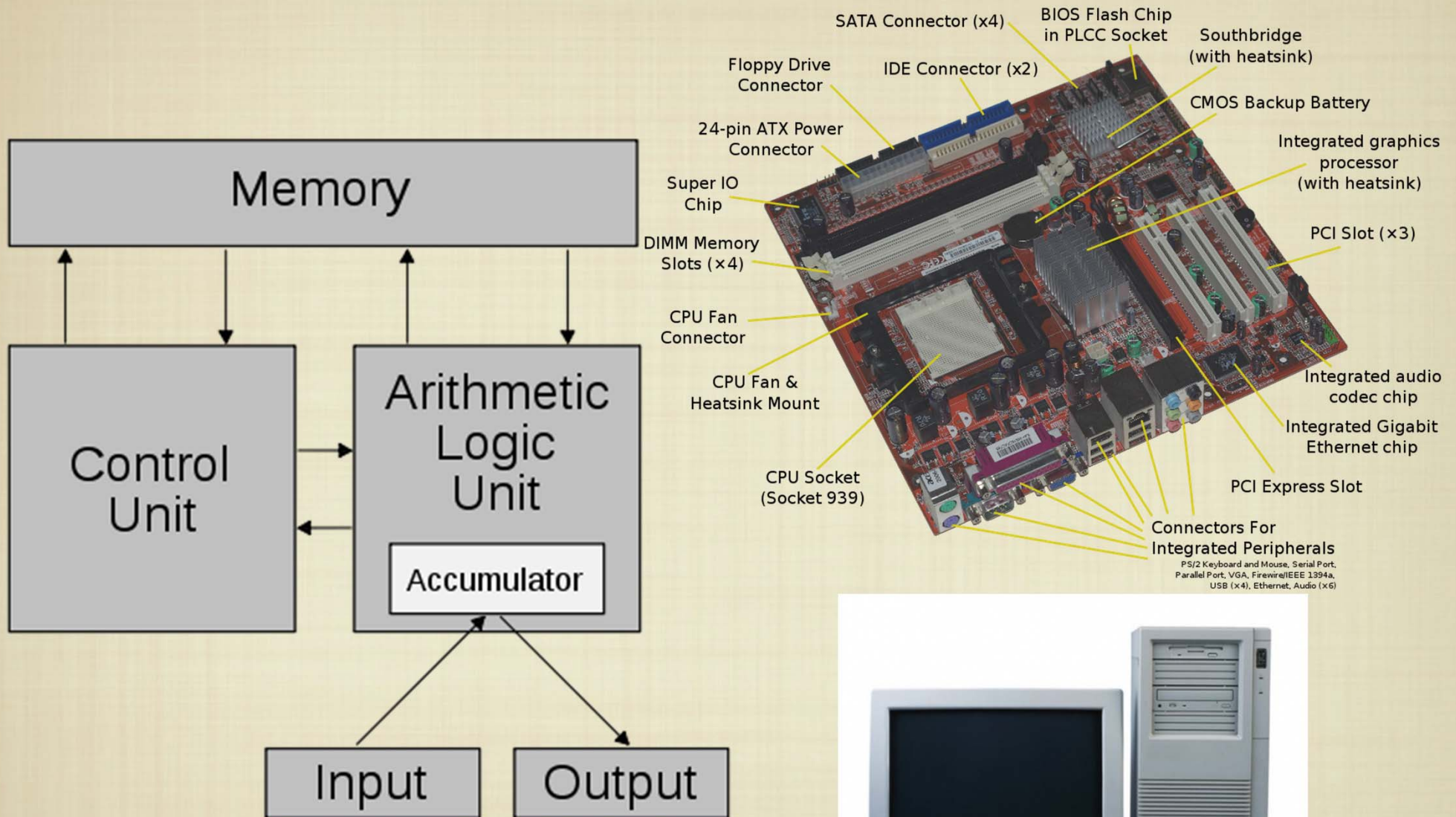
Present-day

Every modern computational device has a von Neumann architecture.

What's In There?

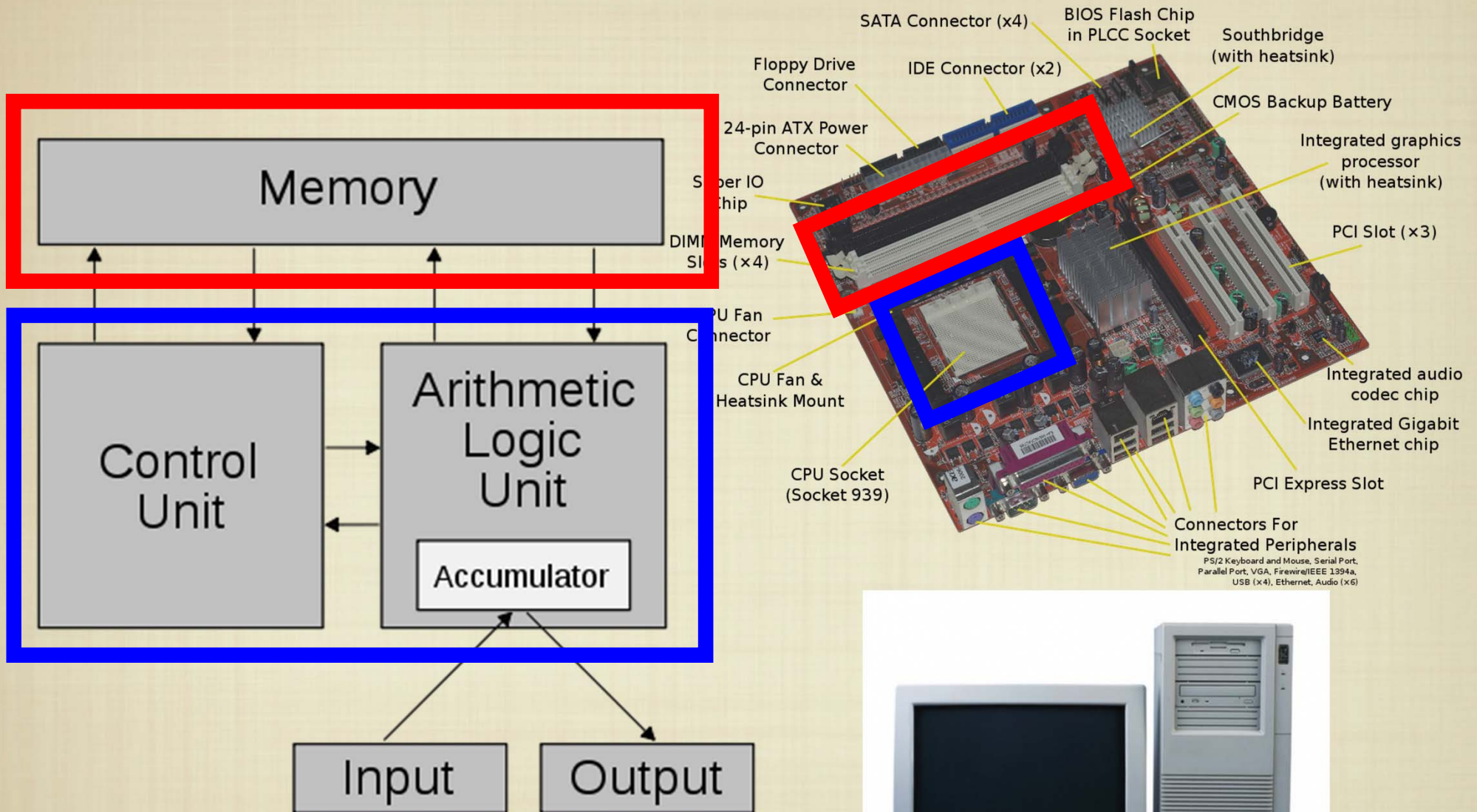


von Neumann Architecture



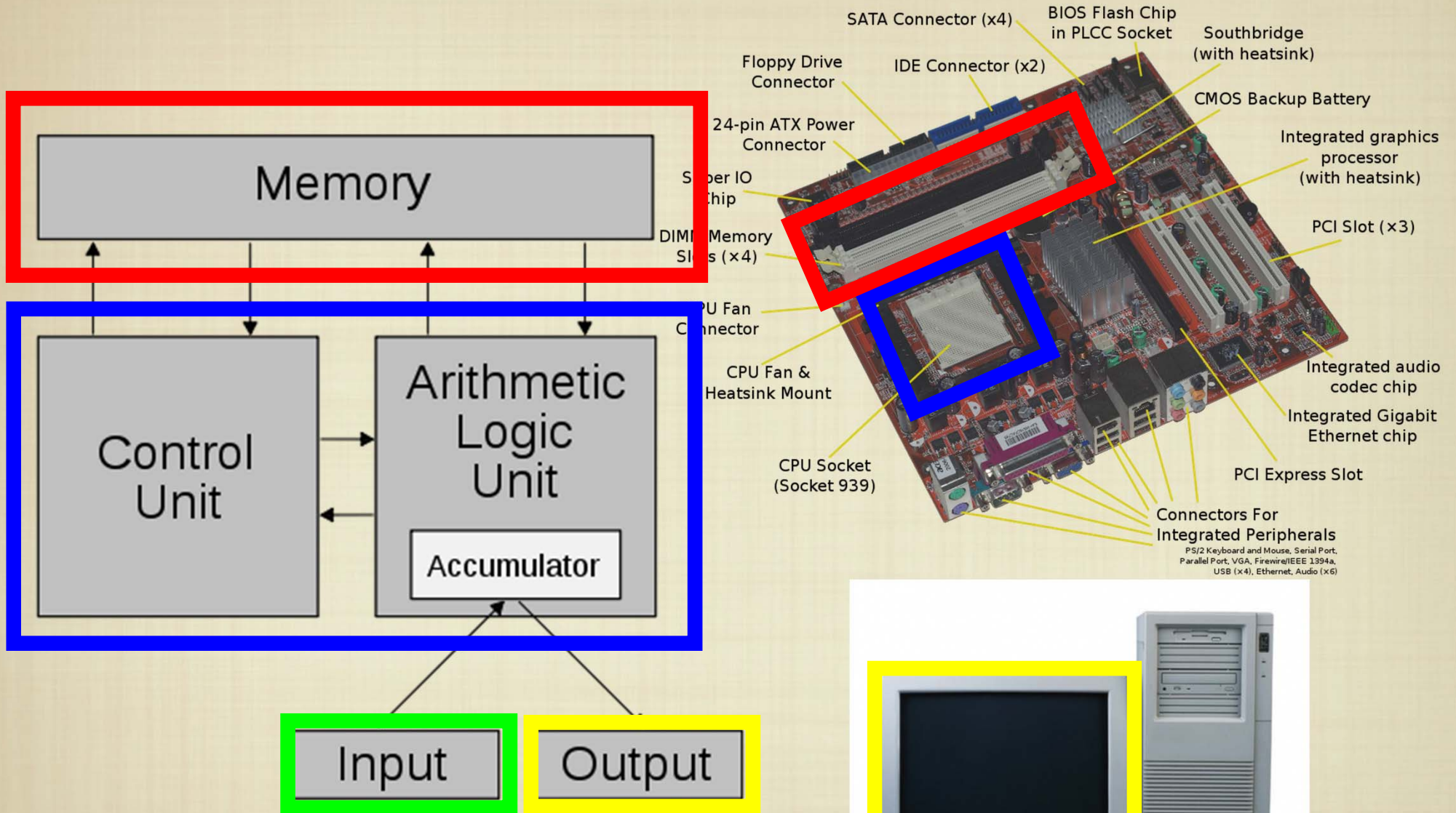
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von Neumann Architecture



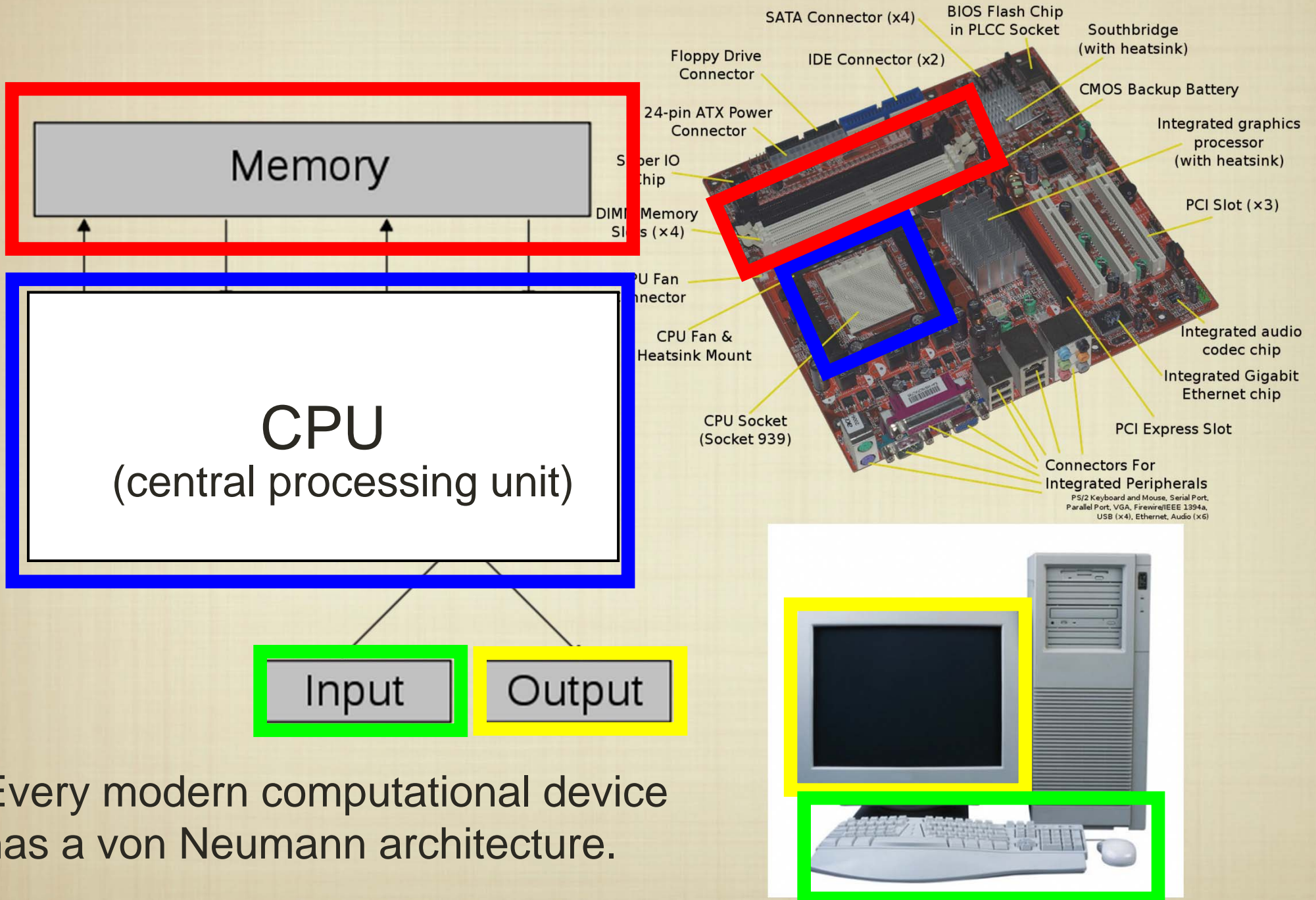
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von Neumann Architecture



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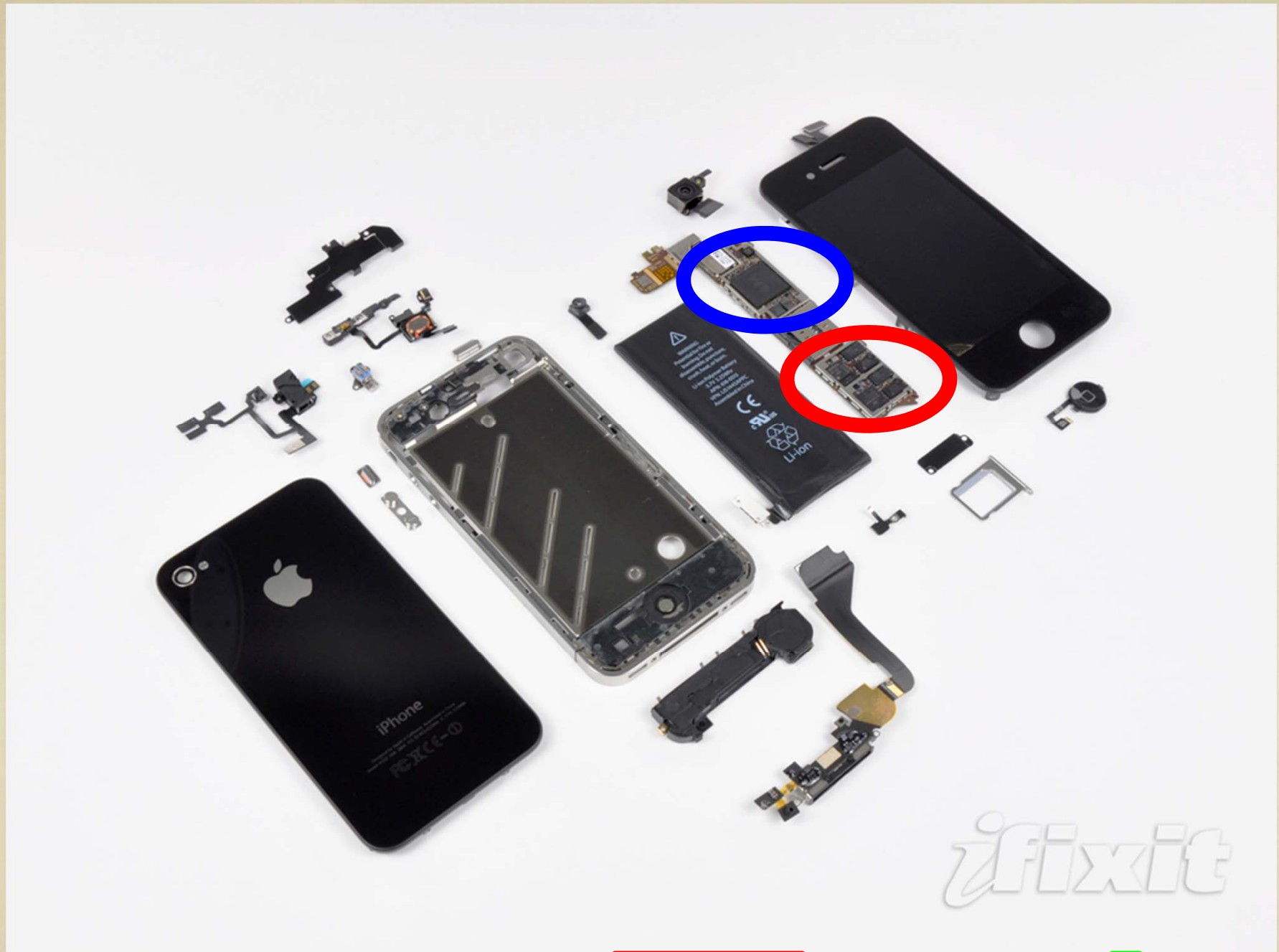
von Neumann Architecture



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Where is the CPU? Where is the memory? What are the I/O devices?



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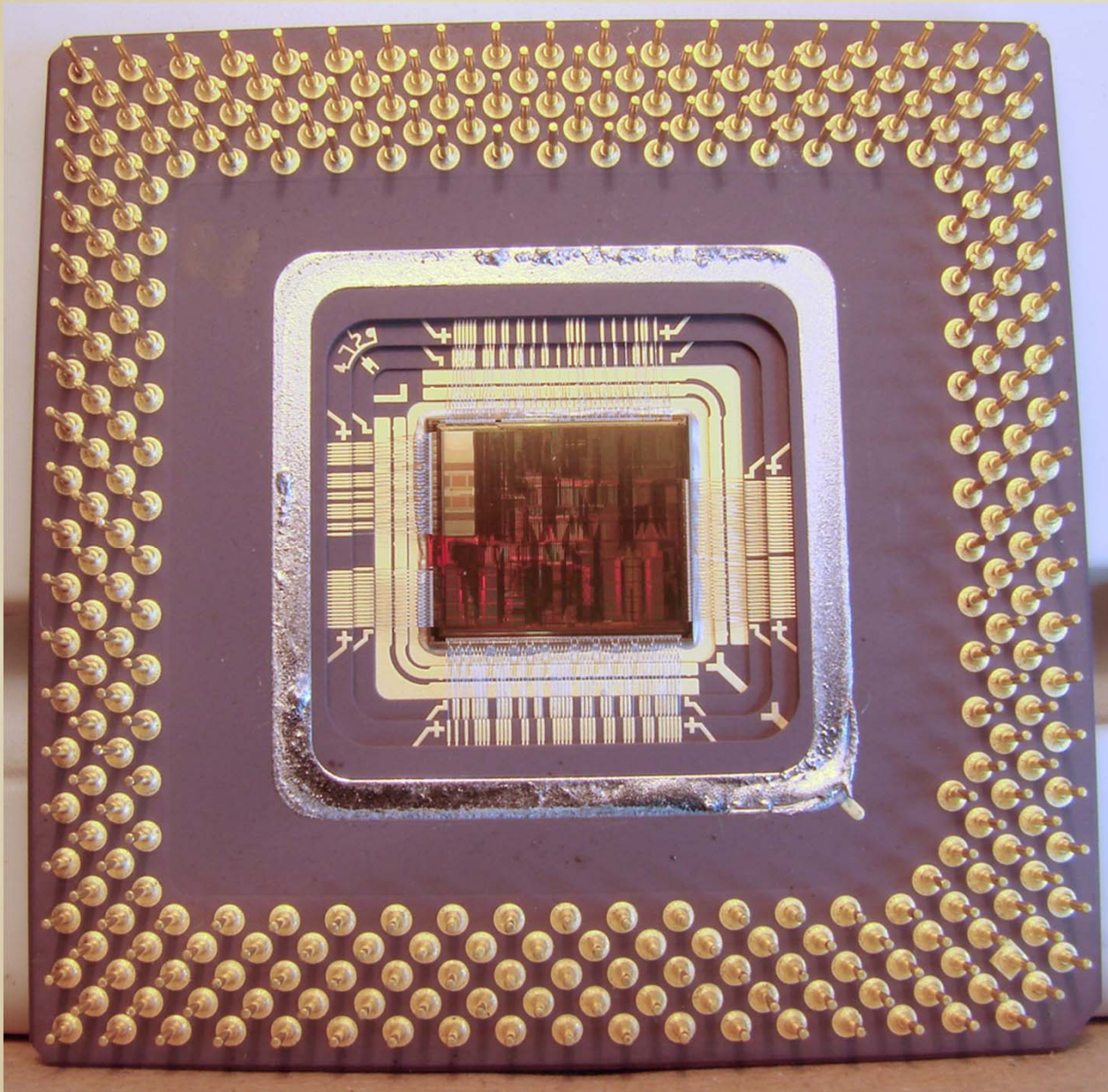


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What's in a CPU?

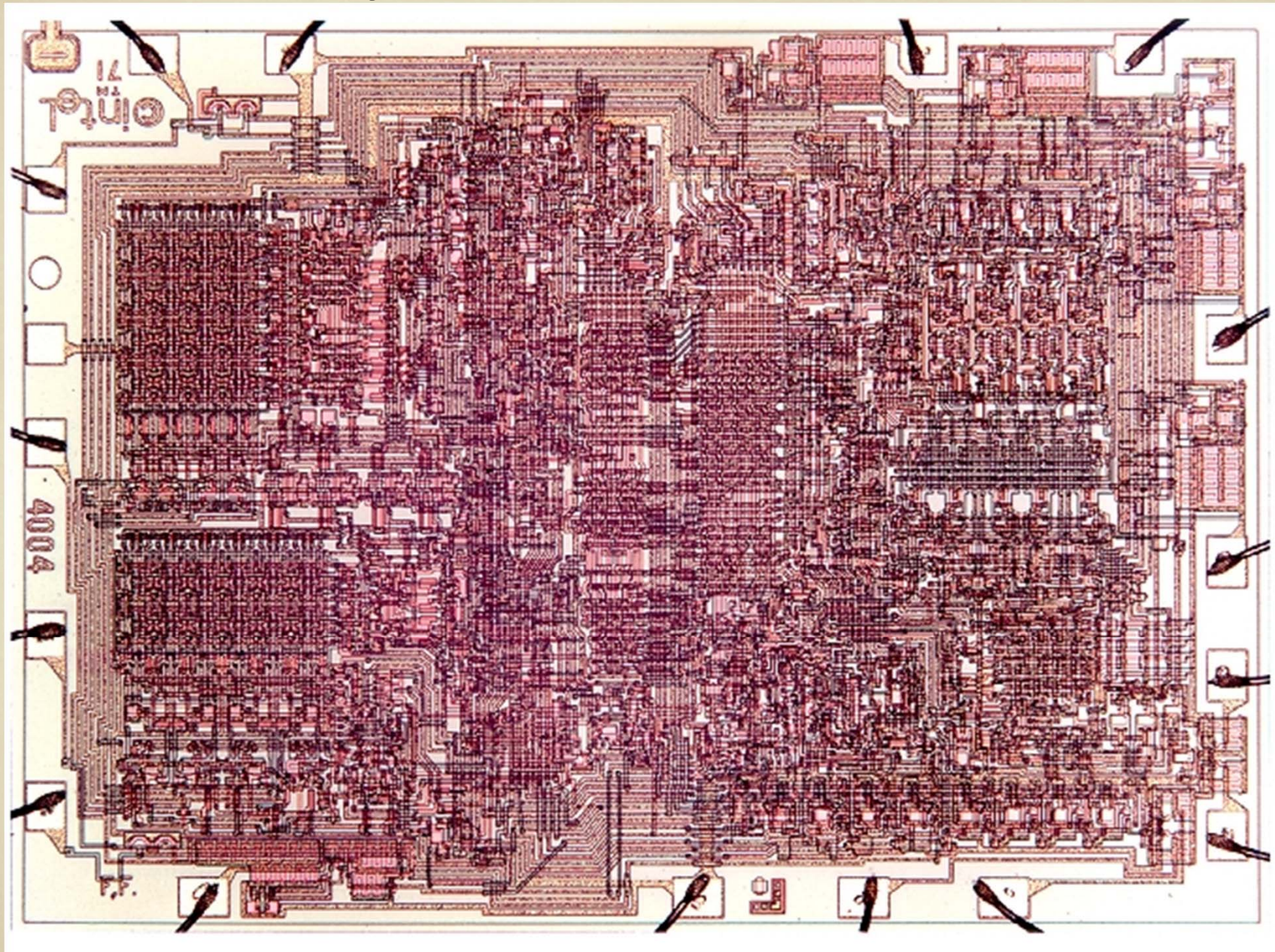


← Input

→ Output

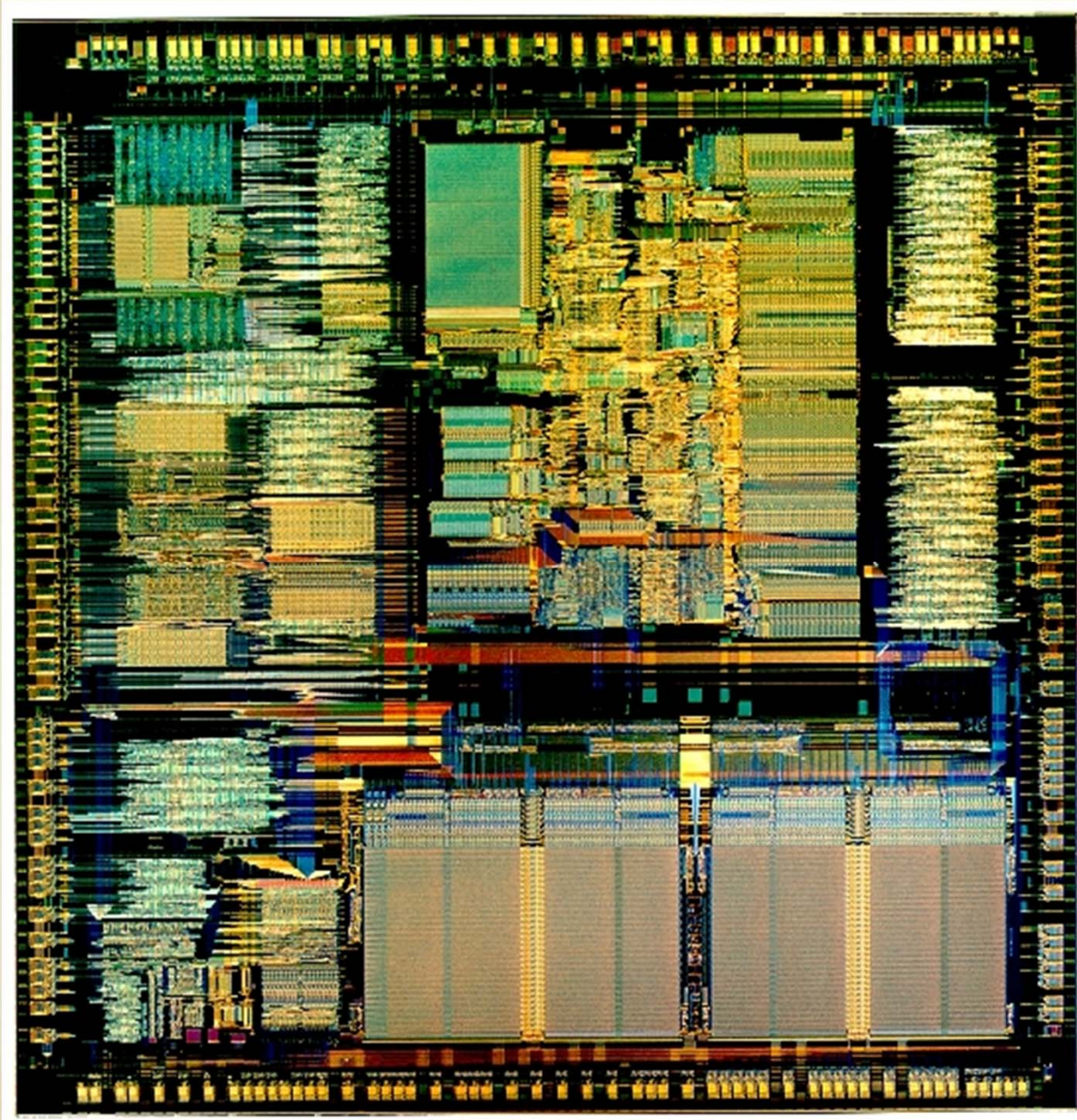
Intel Pentium MMX (1990s)

CPU History



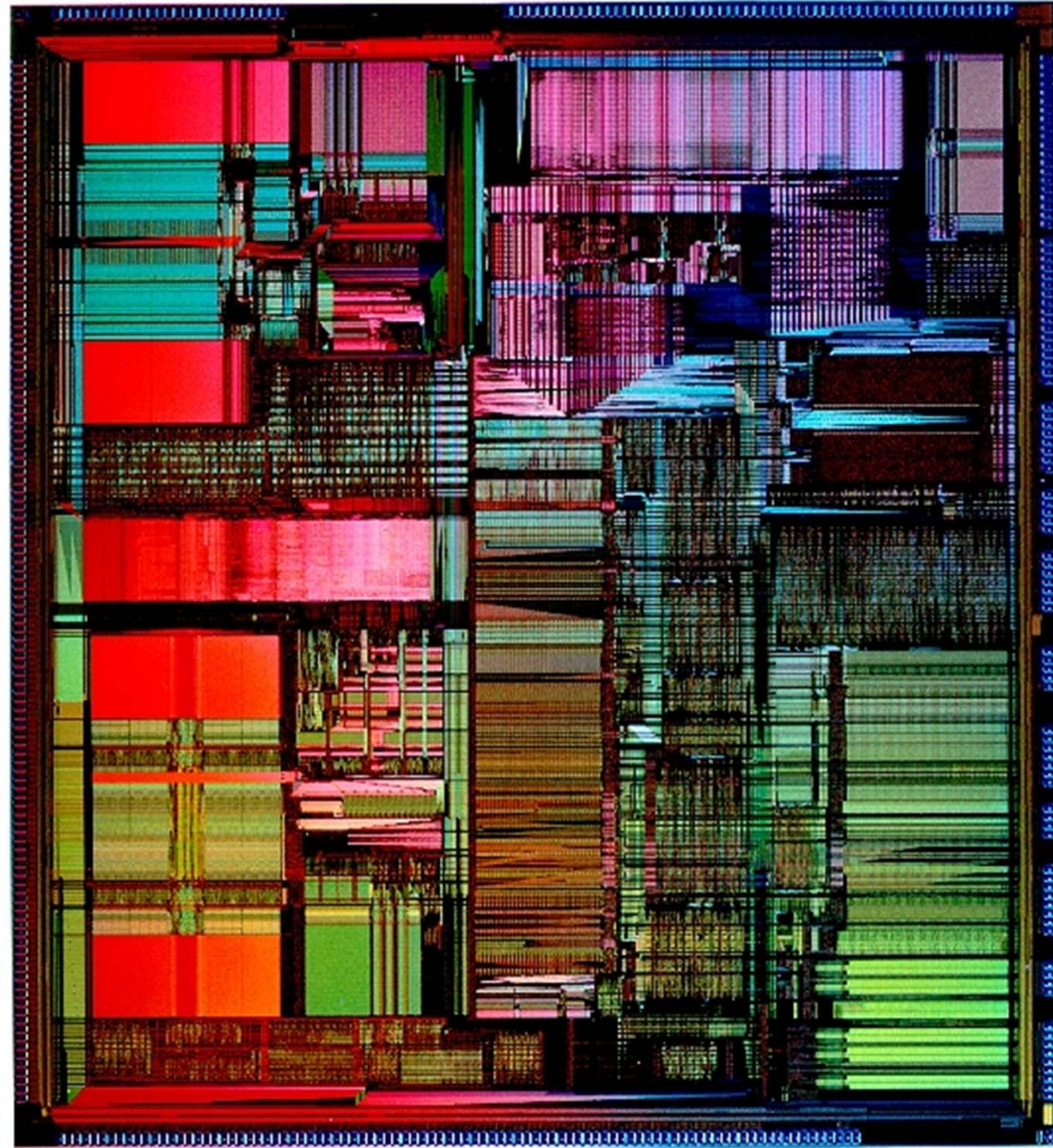
Intel 4004 (1971)

CPU History



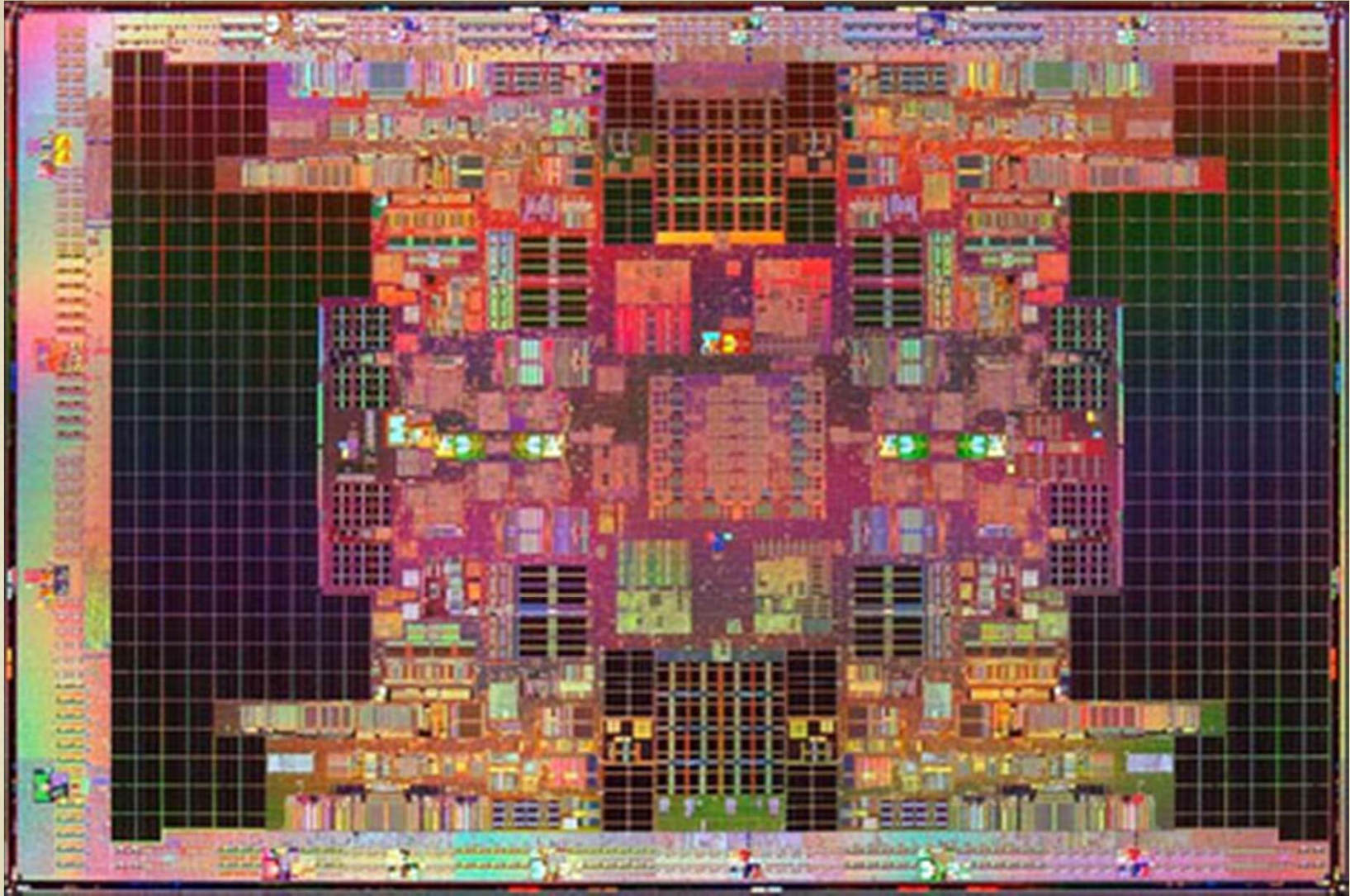
Intel 386 (1985)

CPU History



Intel Pentium (1993)

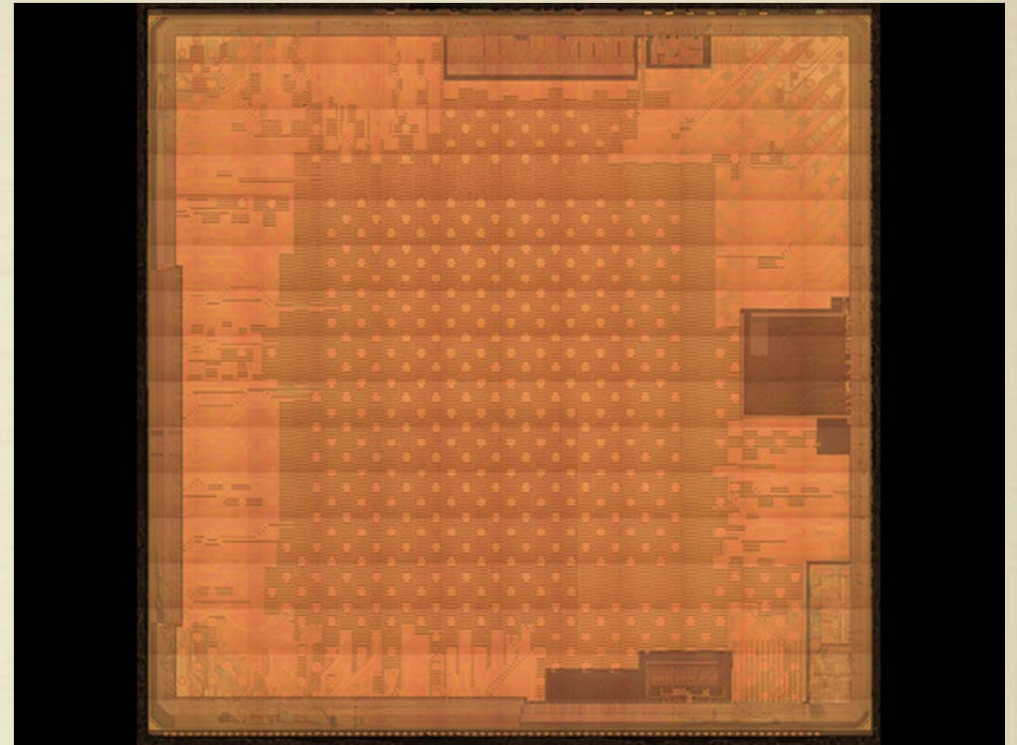
CPU History



Intel Itanium (2001)

CPUs have gotten smaller, but what is actually being miniaturized?

Modern CPUs

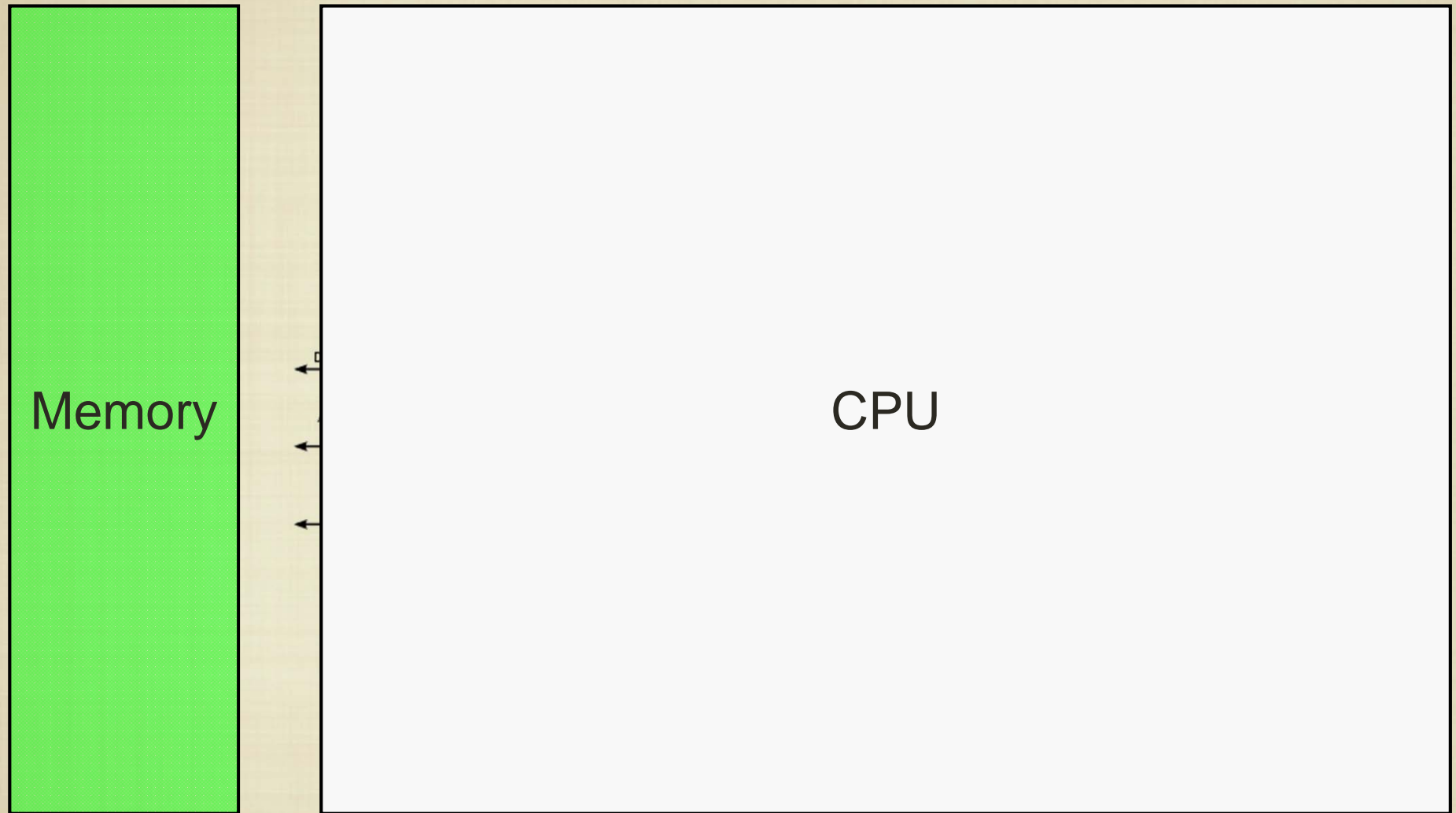


Memory
Processor

Top-view of processor layer

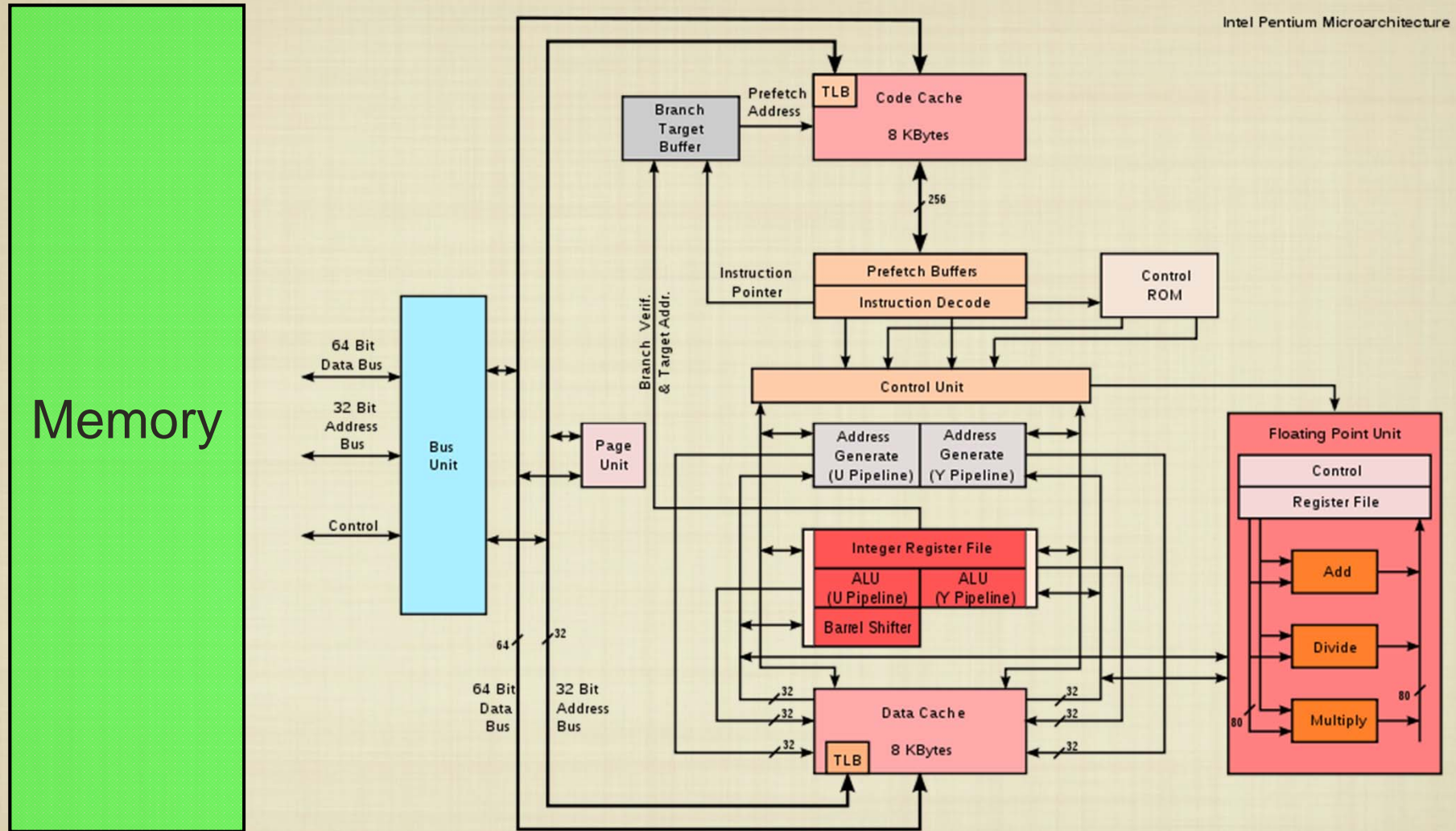
Side-view of ARM A4

CPU Architecture



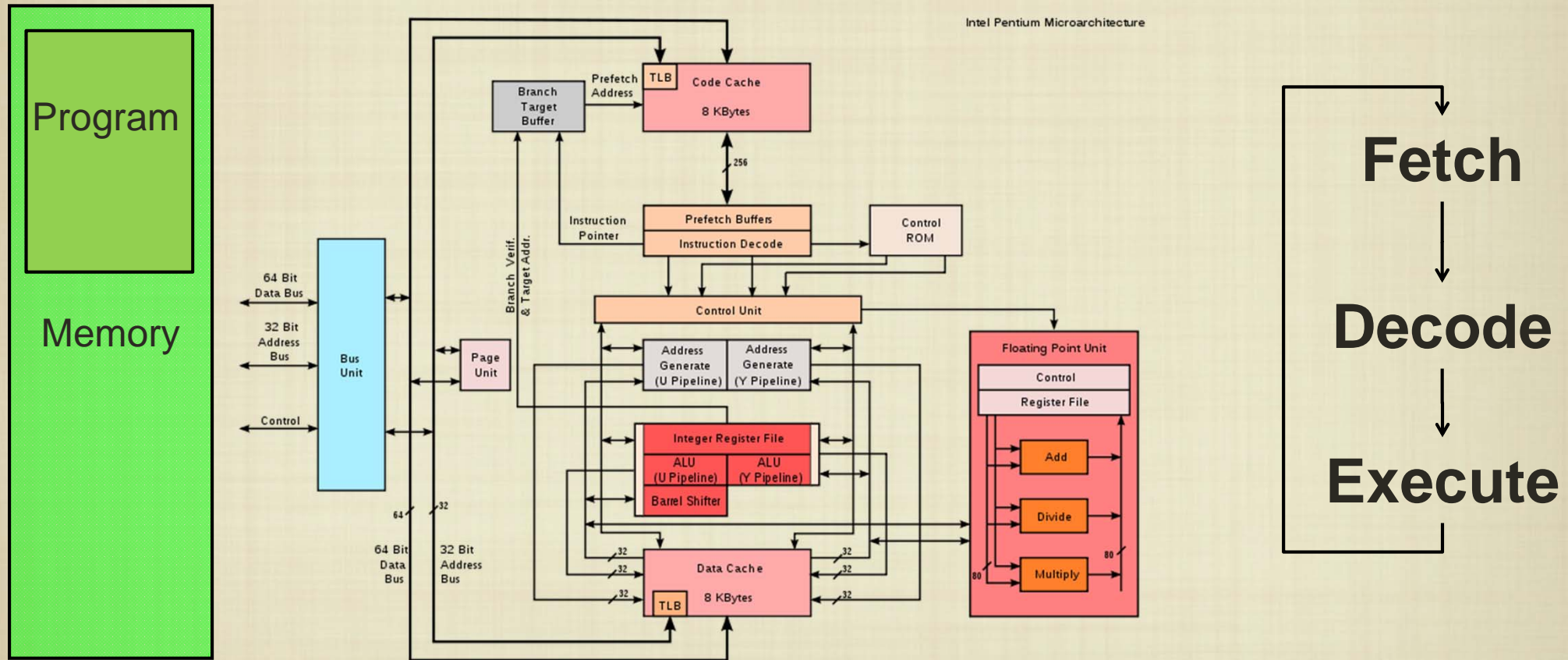
Every CPU has an **instruction set**; a computer program consists of a **sequence** of these instructions. Programs are loaded into the CPU and instructions are executed **one at a time**.

CPU Architecture



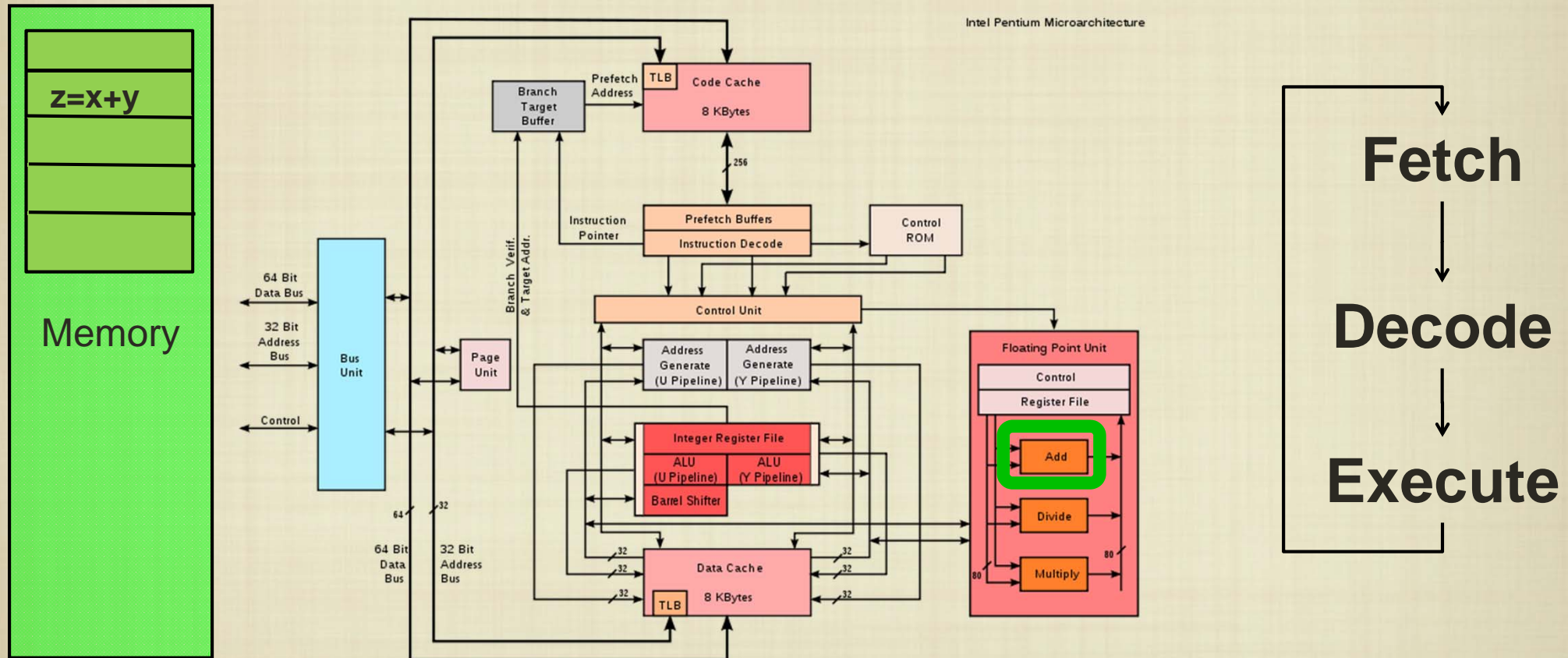
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CPU Architecture



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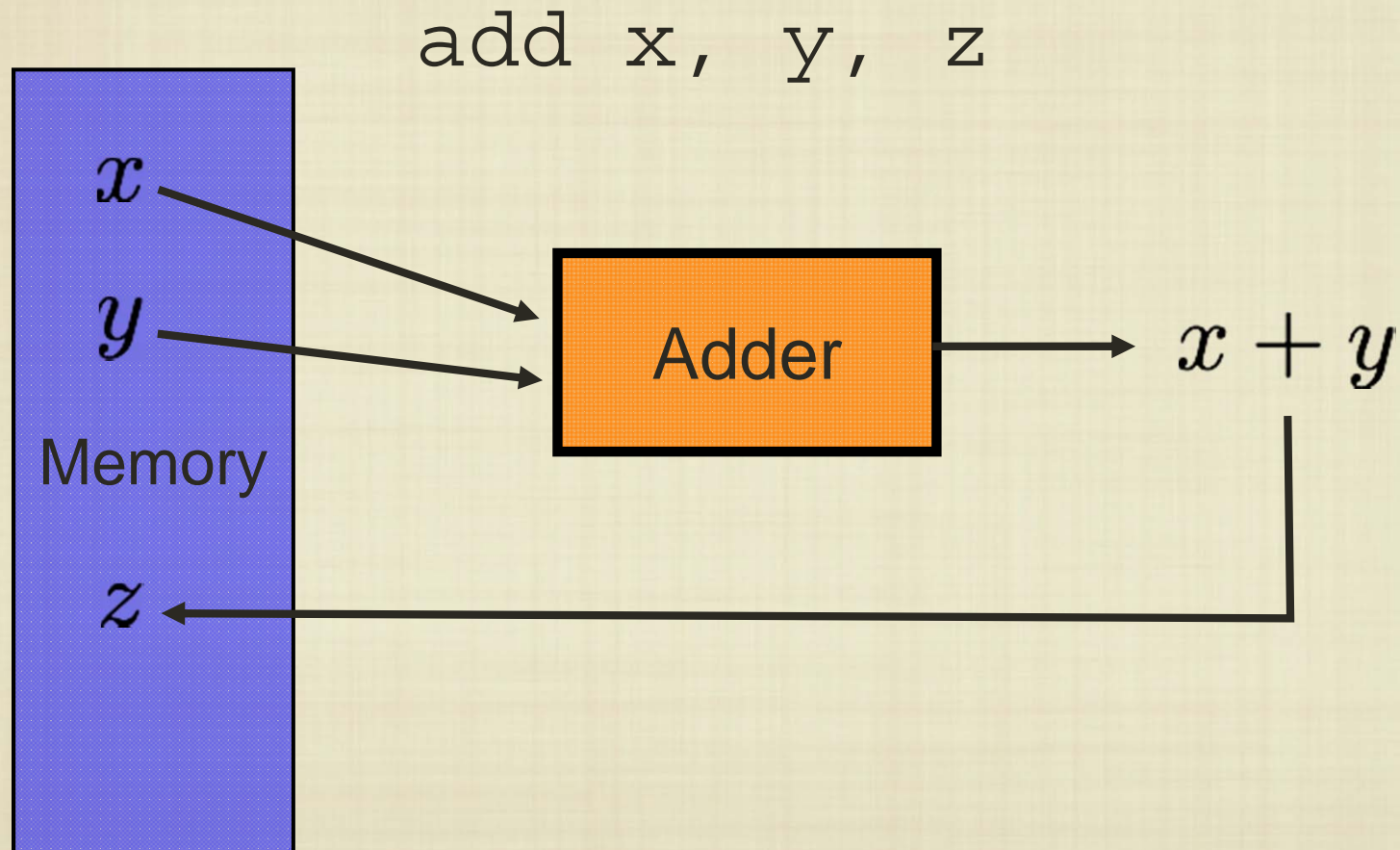
CPU Architecture



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What is an “Instruction”?

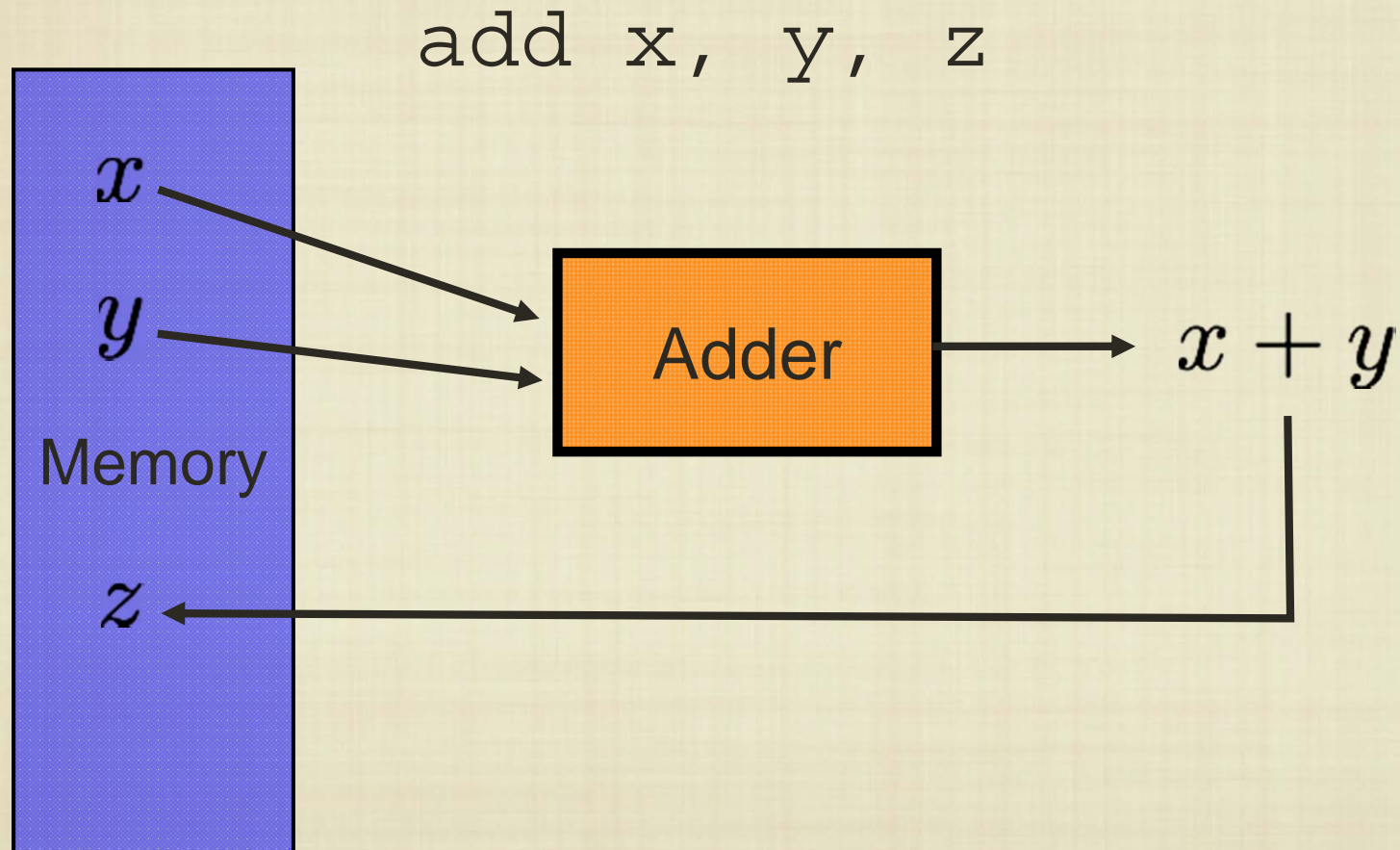
Let's consider the simple operation of adding two numbers.



We retrieve two numbers, add them, and store the result.
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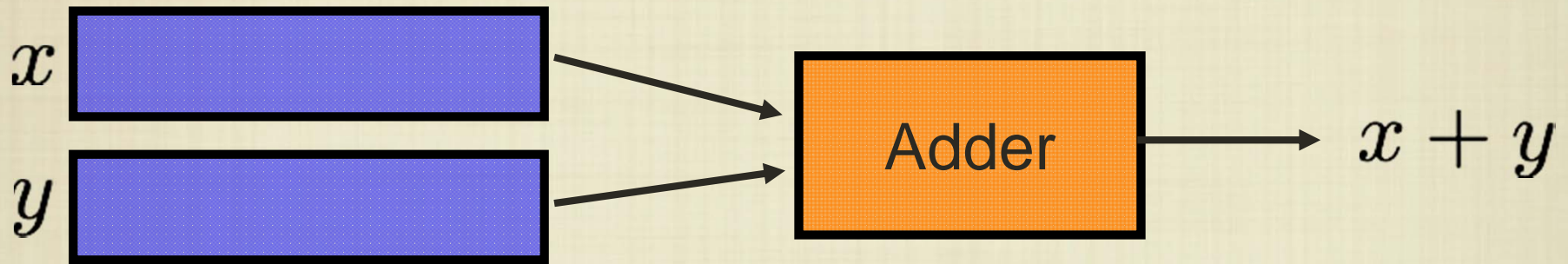


We retrieve two numbers, add them, and store the result. How do we add them? What does the circuit look like?

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Let's consider the simple operation of adding two numbers.

`add x, y, z`

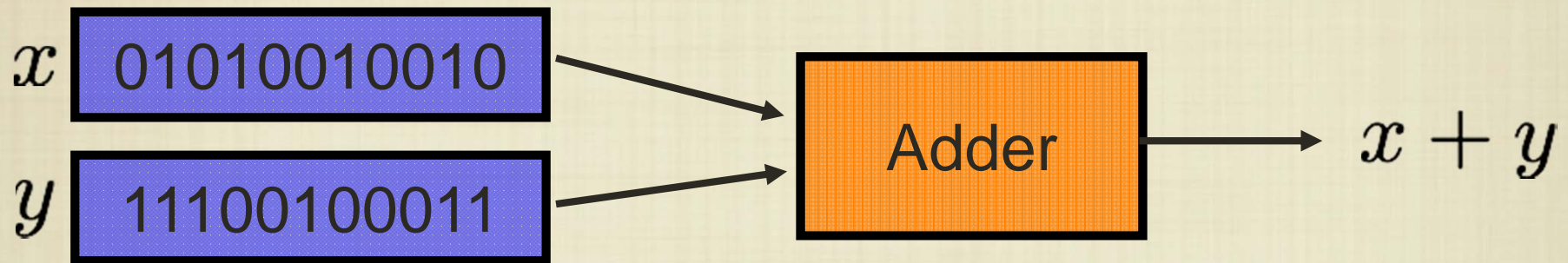


What is the representation of numbers in a computer?

What is an “Instruction”?

Let's consider the simple operation of adding two numbers.

`add x, y, z`



Why are numbers represented in binary? How would we add binary numbers?