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Computer Organization and Architecture
8th Edition

Chapter 1: Introduction

Chapter 2: Computer Evolution and Performance

Watch these cool videos…

- The Von Neumann Architecture

https://www.youtube.com/watch?v=5BpgAHBZgec

- How a CPU works

https://www.youtube.com/watch?v=VYwv-yl_JZ4

- How a CPU is made

https://www.youtube.com/watch?v=qm67wbB5GmI

Architecture & Organization 1

- Architecture is those attributes visible to the programmer
  - Instruction set, number of bits used for data representation, I/O mechanisms, addressing techniques.
  - e.g. Is there a multiply instruction?
- Organization is how features are implemented
  - Control signals, interfaces, memory technology.
  - e.g. Is there a hardware multiply unit or is it done by repeated addition?

Architecture & Organization 2

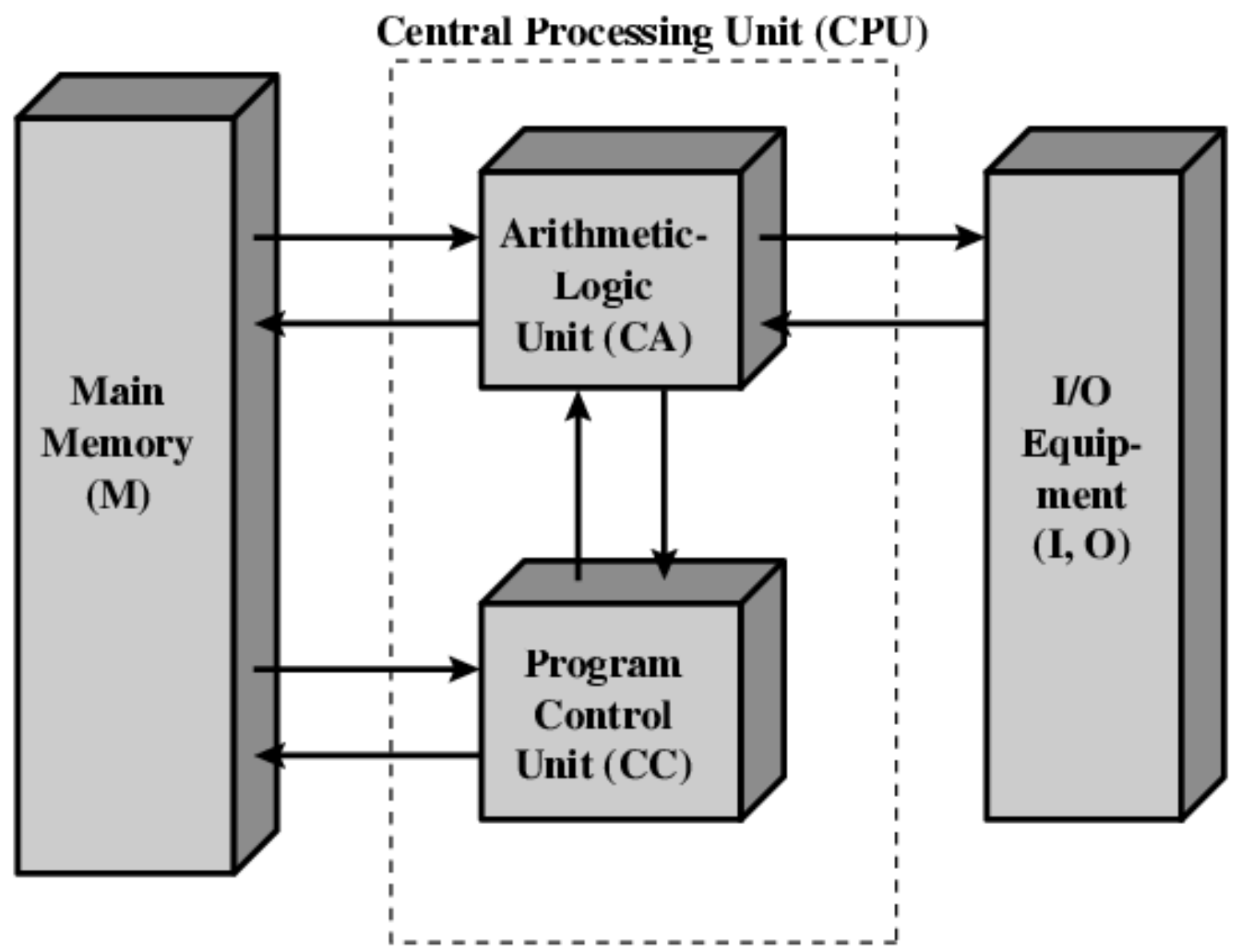
- All Intel x86 family share the same basic architecture
- The IBM System/370 family share the same basic architecture

- This gives code compatibility
  - At least backwards
- Organization differs between different versions

von Neumann/Turing

- Stored Program concept
  - —Main memory storing programs and data
- ALU operating on binary data
- Control unit interpreting instructions from memory and executing
- Input and output equipment operated by control unit

Structure of von Neumann machine



Transistors

- Replaced vacuum tubes
- Smaller
- Cheaper
- Less heat dissipation
- Solid State device
- Made from Silicon (Sand)
- Invented 1947 at Bell Labs
- William Shockley et al.

Microelectronics

- Literally - “small electronics”
- A computer is made up of gates, memory cells and interconnections
- These can be manufactured on a semiconductor
- e.g. silicon wafer

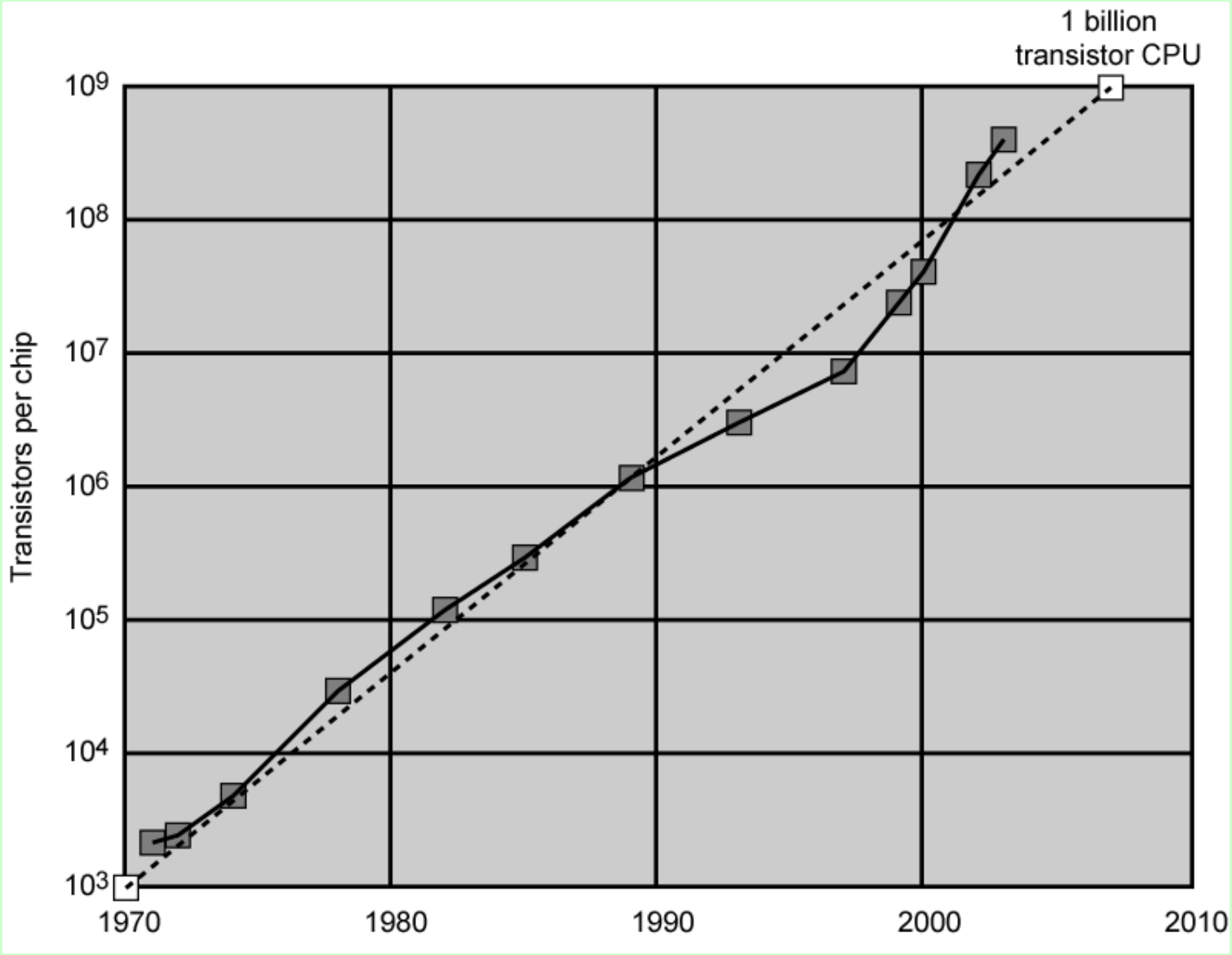
Generations of Computer

- Vacuum tube - 1946-1957
- Transistor - 1958-1964
- Small scale integration - 1965 on
  - —Up to 100 devices on a chip
- Medium scale integration - to 1971
  - —100-3,000 devices on a chip
- Large scale integration - 1971-1977
  - —3,000 - 100,000 devices on a chip
- Very large scale integration - 1978 -1991
  - —100,000 - 100,000,000 devices on a chip
- Ultra large scale integration – 1991 -
  - —Over 100,000,000 devices on a chip

Moore's Law

- Increased density of components on chip
- Gordon Moore – co-founder of Intel
- Number of transistors on a chip will double every year
- Since 1970's development has slowed a little
  - Number of transistors doubles every 18 months

Growth in CPU Transistor Count



Implications of Moore's Law

- Cost of a chip has remained almost unchanged
- Higher packing density means shorter electrical paths, giving higher performance
- Smaller size gives increased flexibility
- Reduced power and cooling requirements
- Fewer interconnections increases reliability