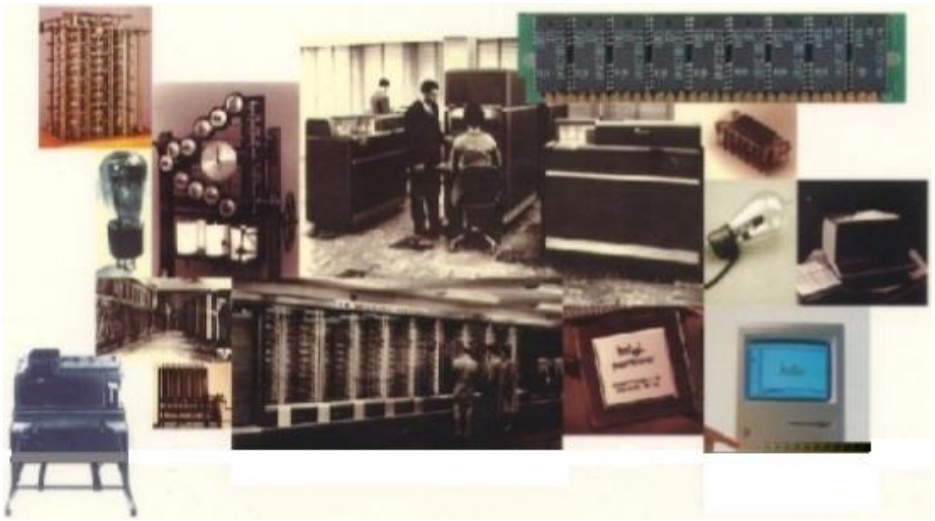
ساختار و زبان کامپیوتر

فصل اول

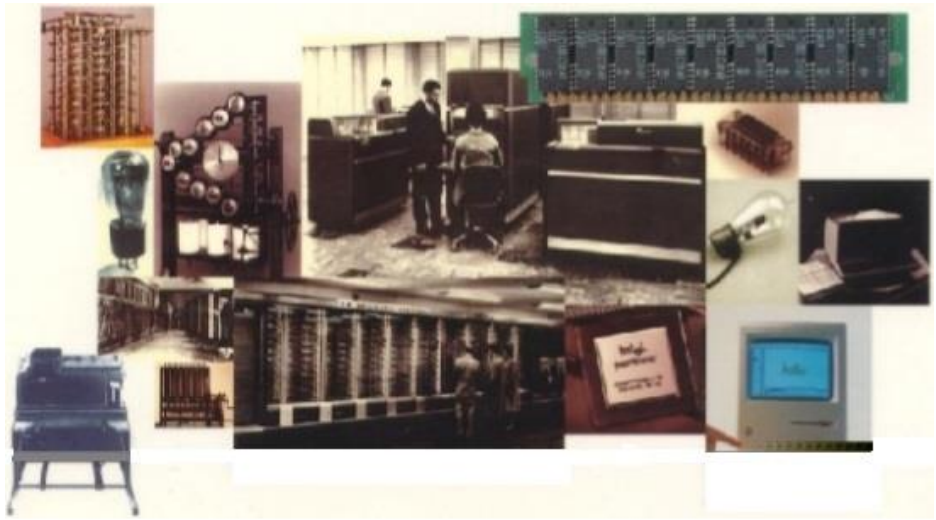
مقدمه: تصویری از گذشته و حال



Computer Structure and Machine Language

Chapter One

A Brief History of Computers



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Parts (text & figures) of this lecture are adopted from:

- A. Tanenbaum, "Structured Computer Organization", 5th Ed., Pearson, 2006
- D. Patterson & J. Hennessey, "Computer Organization & Design, The Hardware/Software Interface, MIPS Edition", 6th Ed., MK publishing, 2020
- M. M. Mano, C. R. Kime & T. Martin, "Logic & Computer Design Fundamentals", 5th Ed., Pearson, 2015
- Slatter, R·: Portraits in Silicon, Cambridge, MA: MIT Press, 1987

The First Calculating Tool

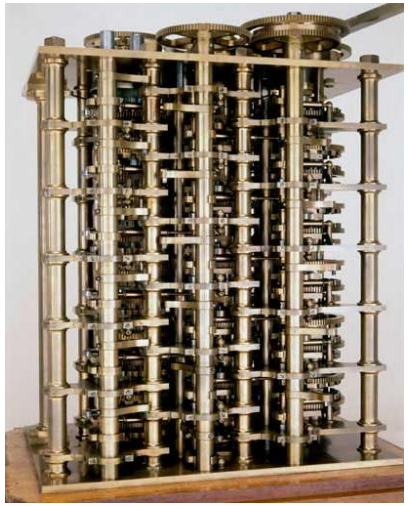
Computer Generations

- The Zeroth G: Mechanical Computers (1642-1945)
- The 1st G: Vacuum Tubes (1945-1955)
- The 2nd G: Transistors (1955-1965)
- The 3rd G: Integrated Circuits (1965-1980)
- The 4th G: Very Large Scale Integration (1980-present)
- The 5th G: Low-Power and Invisible Computers

Mechanical Computers

Pascal's Machine (1642)

Ada Lovelace

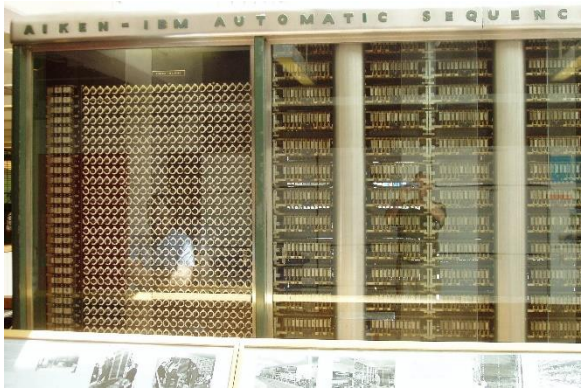


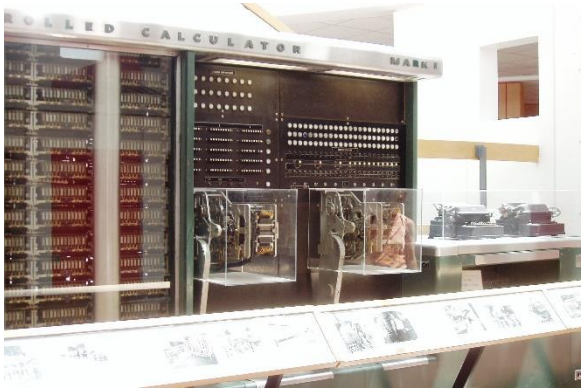
A part of the Analytical Engine, built by Charles Babbage (1832)

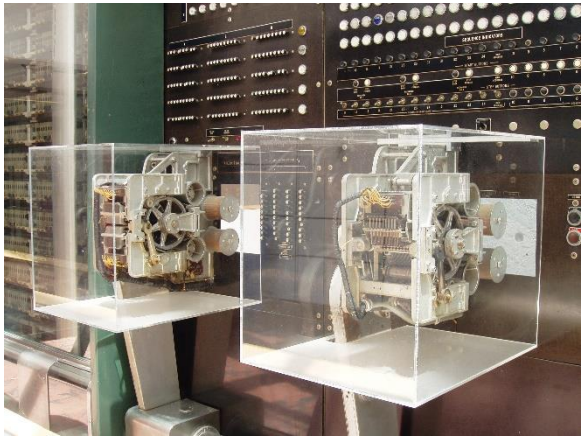
Konrad Zuse and the world's 1st relay-based programmable computer (1935)

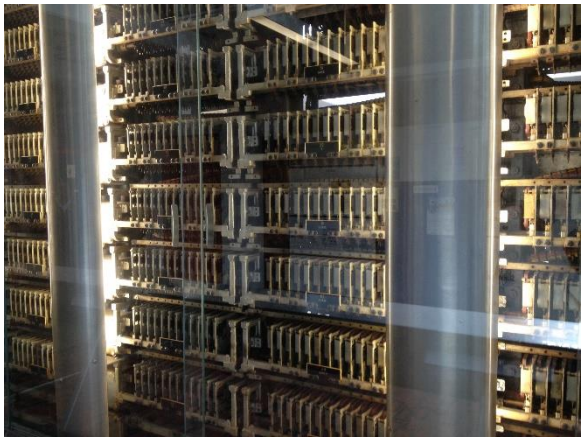
Electro-Mechanical Computers

Harvard Mark I (1937)

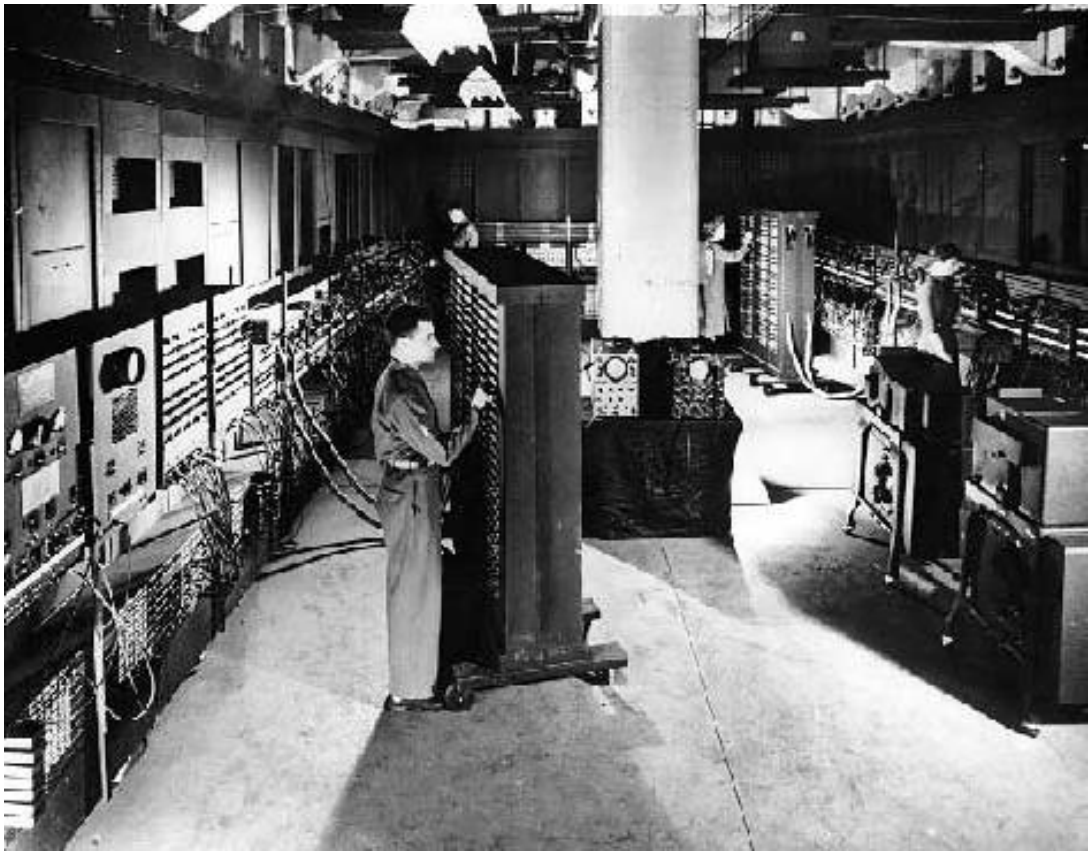








The First Electronic Computer



Electronic Numerical Integrator and Computer (ENIAC)

Second Generation Computers

The 6600 computer

Second Generation Computers

Control Data Cyber 70 (CDC 70)

Third Generation Computers

IBM System/360 computers: models 40, 50, 65, and 75

a.

c.

b.

d.

Third Generation Computers

DEC PDP-11/70 MiniComputer

Fourth Generation Computers

Fifth Generation Computers

GRiDPad (1989)

Apple Newton (1993)

Smart Phones

Invisible Computers!

The History Of Microprosessors

4 bits

Intel 4004

8 bits

Intel 8080/8085

Zilog Z80

Motorola 6800

16 bits

Intel 8086/8088

Intel 80286

Motorola 68000

32 bits

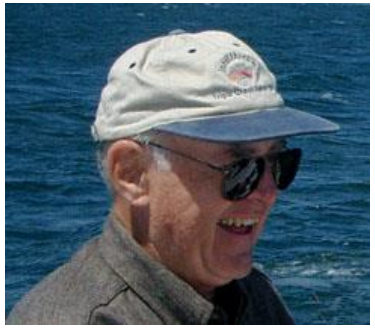
Intel 80386/486

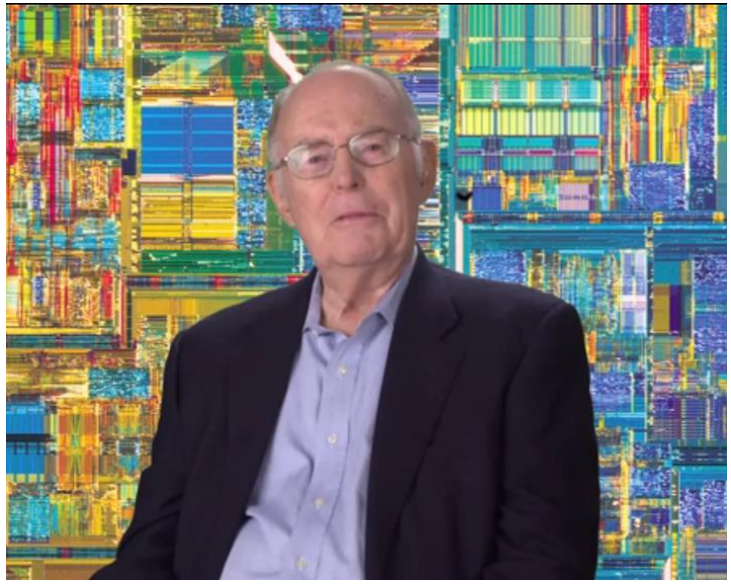
Motorola 68020/30/40

Intel CPU Family

Chip	Date	MHz	Trans.	Memory	Notes
4004	4/1971	0.108	2300	640	First microprocessor on a chip
8008	4/1972	0.108	3500	16 KB	First 8-bit microprocessor
8080	4/1974	2	6000	64 KB	First general-purpose CPU on a chip
8086	6/1978	5–10	29,000	1 MB	First 16-bit CPU on a chip
8088	6/1979	5–8	29,000	1 MB	Used in IBM PC
80286	2/1982	8–12	134,000	16 MB	Memory protection present
80386	10/1985	16–33	275,000	4 GB	First 32-bit CPU
80486	4/1989	25–100	1.2M	4 GB	Built-in 8-KB cache memory
Pentium	3/1993	60–233	3.1M	4 GB	Two pipelines; later models had MMX
Pentium Pro	3/1995	150–200	5.5M	4 GB	Two levels of cache built in
Pentium II	5/1997	233–450	7.5M	4 GB	Pentium Pro plus MMX instructions
Pentium III	2/1999	650–1400	9.5M	4 GB	SSE Instructions for 3D graphics
Pentium 4	11/2000	1300–3800	42M	4 GB	Hyperthreading; more SSE instructions
Core Duo	1/2006	1600–3200	152M	2 GB	Dual cores on a single die
Core	7/2006	1200–3200	410M	64 GB	64-bit quad core architecture
Core i7	1/2011	1100–3300	1160M	24 GB	Integrated graphics processor

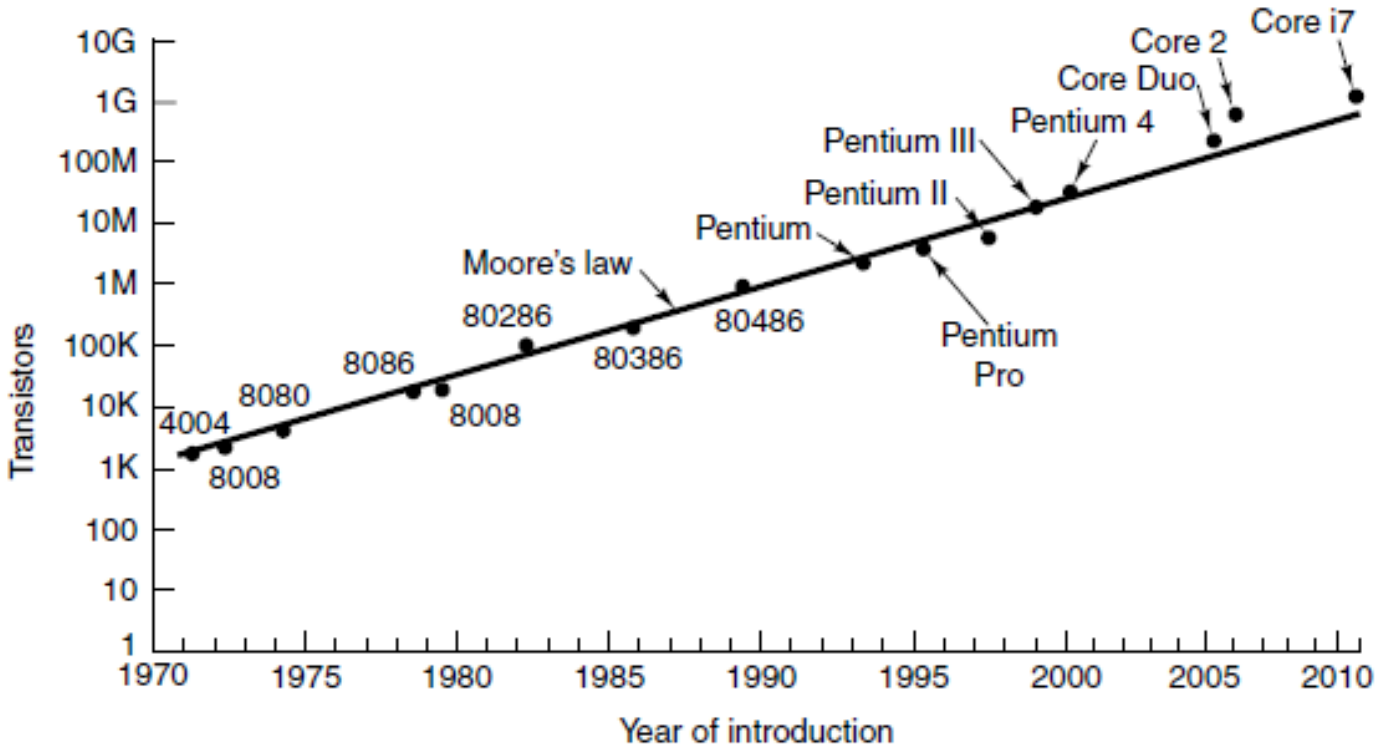
Gordon Moore (a co-founder of Intel)





Moore's Law

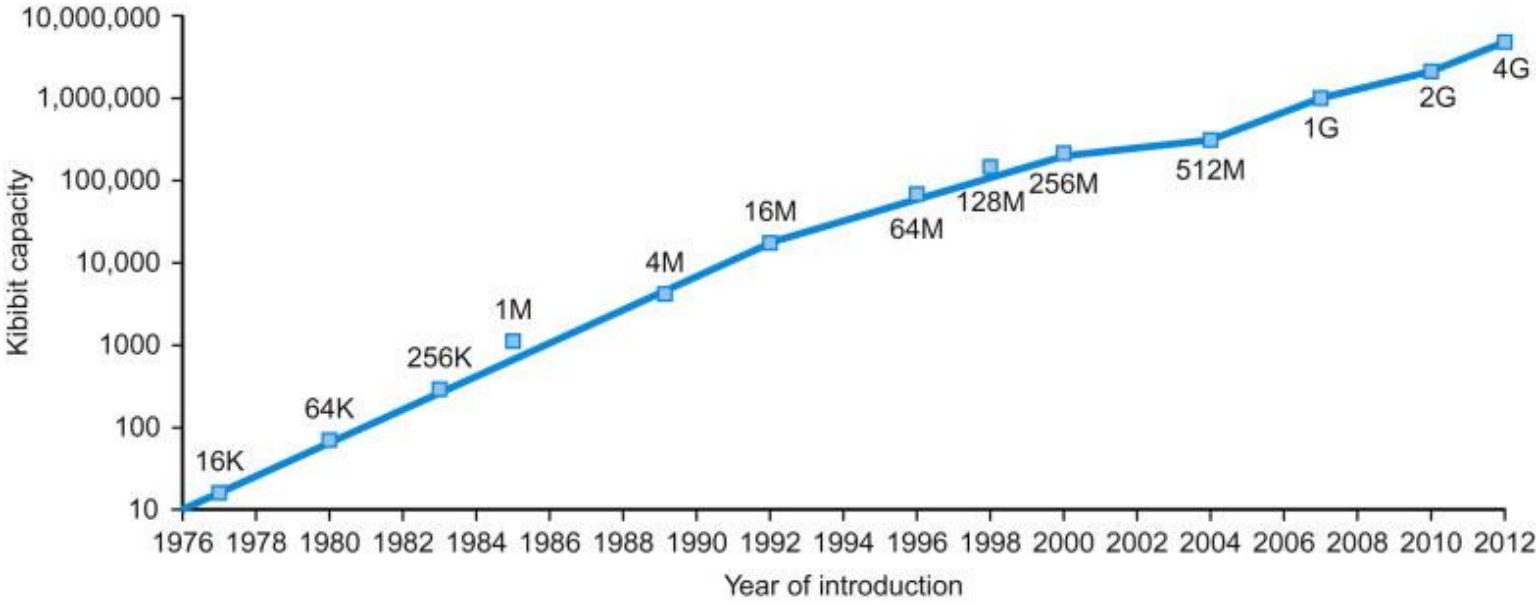
Transistor count doubles every 18 to 24 months



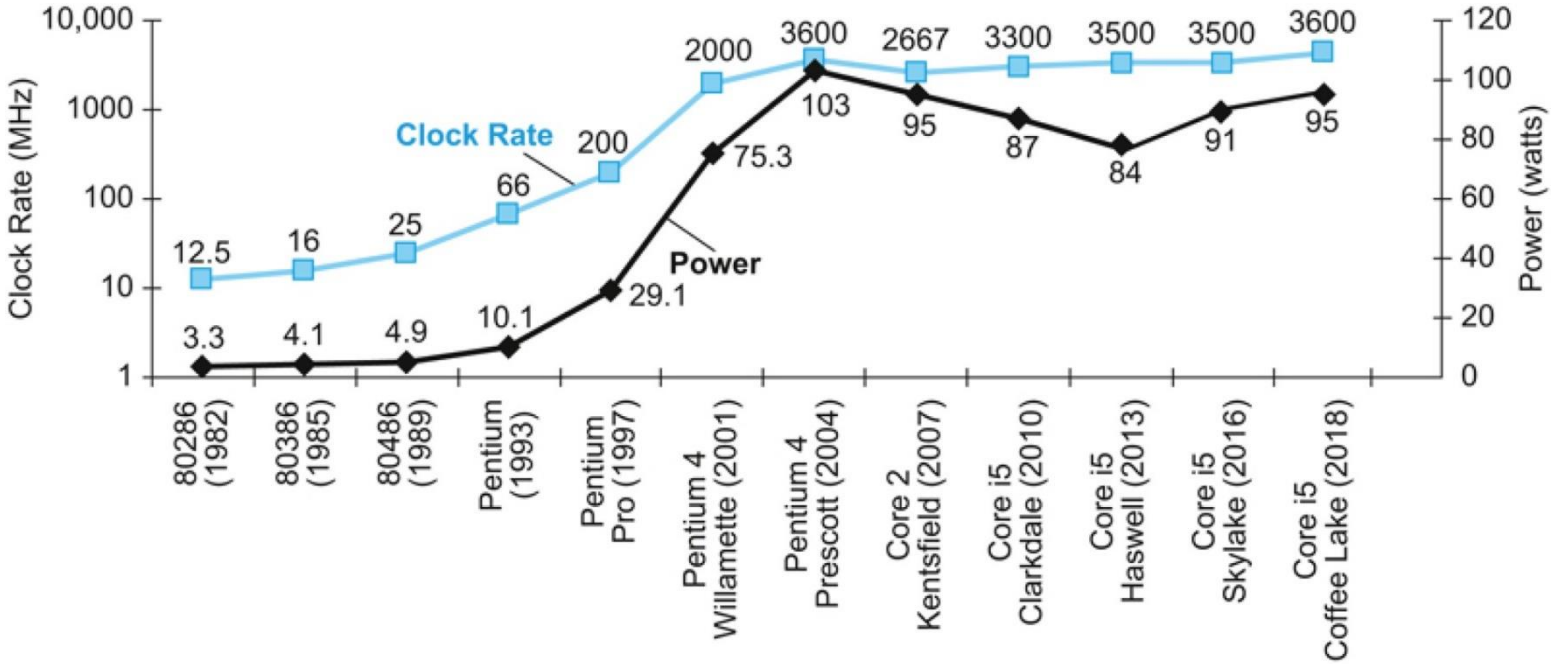
Corollaries of Moore's Law

- Computer performance doubles every 24 months
  - Per unit cost
- Power consumption doubles every 18 months
  - Per unit area
- Hard disk & RAM storage capacity doubles every 24 months

Memory Capacity Growth



The Power Wall



Computer Systems Classes

- Desktops

- Servers

- Embedded Systems

- Personal Mobile Devices

Desktop Computers

- General purpose computers
- Variety of software
- Designed for use by *individuals*
- PCs, Notebooks

Servers

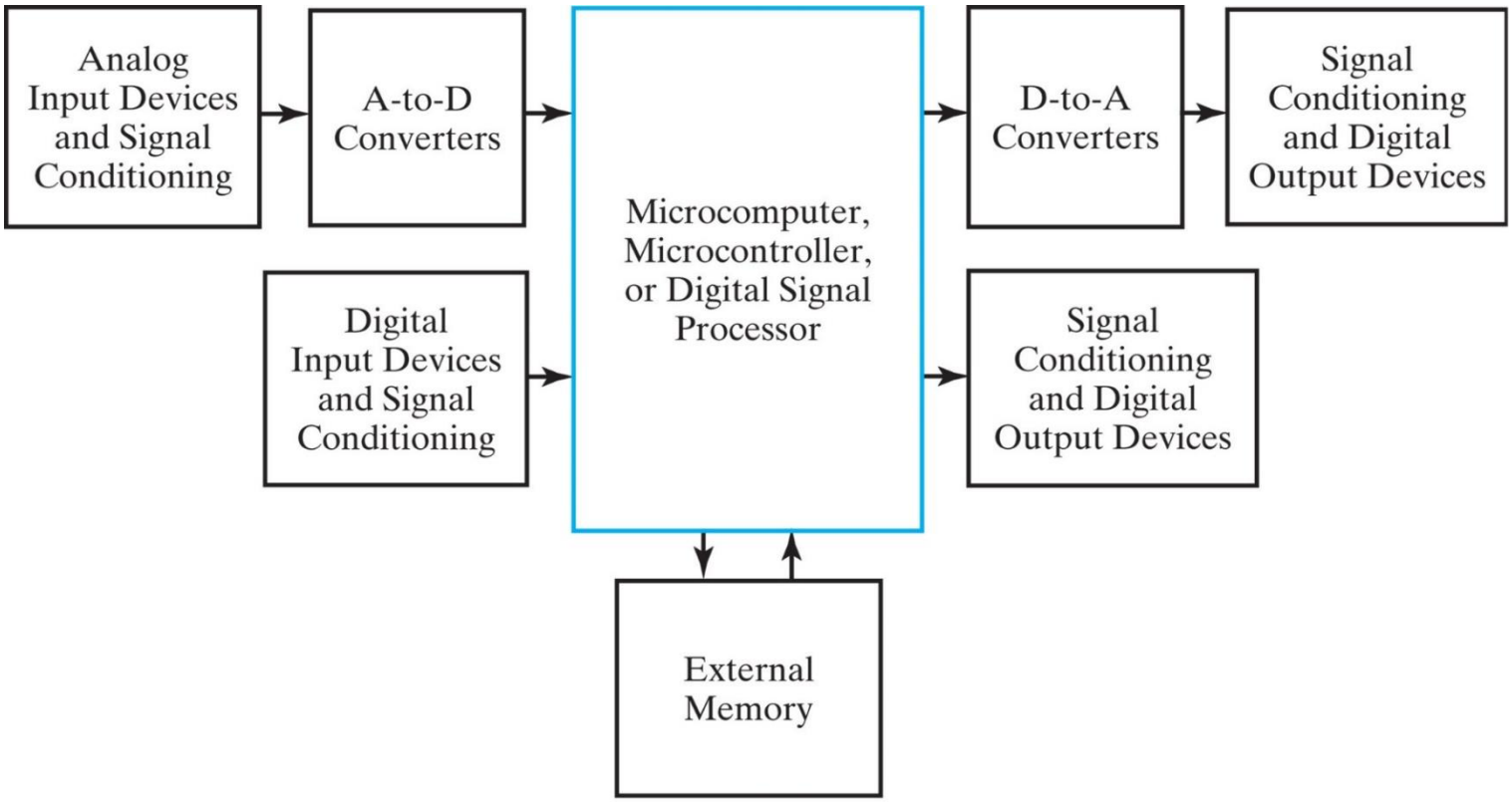
- High-end computing systems
  - Consists of several CPUs
- Used by multiple users
- Networked based
- High capacity, performance, reliability
- Range from small servers to building sized
- Supercomputers highest performance servers
  - hundreds of CPUs, TBs of memory, PBs of storage

Servers (cont.)

Embedded Computers

- Designed to perform one or a few dedicated functions
- Specific Constraints
  - Real-time response
  - High reliability
  - Low power
  - Low cost
  - Small size/weight
- Hidden as components of systems

Block Diagram of an Embedded System



Application Area	Product
Banking, commerce and manufacturing	Copiers, FAX machines, UPC scanners, vending machines, automatic teller machines, automated warehouses, industrial robots, 3D printers
Communication	Wireless access points, network routers, satellites
Games and toys	Video games, handheld games, talking stuffed toys
Home appliances	Digital alarm clocks, conventional and microwave ovens, dishwashers
Media	CD players, DVD players, flat panel TVs, digital cameras, digital video cameras
Medical equipment	Pacemakers, incubators, magnetic resonance imaging
Personal	Digital watches, MP3 players, smart phones, wearable fitness trackers
Transportation and navigation	Electronic engine controls, traffic light controllers, aircraft flight controls, global positioning systems

Personal Mobile Devices (PMDs)

- Small wireless devices to connect to the Internet
- Rely on batteries for power
- Software is installed by downloading apps
- Touch-sensitive screen or speech input
- e.g., smart phones and tablets

What About the Future …