Computer Organization

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Lecture0 - Chih-Wei Liu
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Course Information

• Lecture:
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Course Information

• Text

• One semester course, which might include Chapters 1~8
  - To learn what, why, and how the processor and computer are designed and developed
  - To learn the hardware and software concepts of current computers

• Prerequisites:
  - Logic Design
  - Assembly Language Programming
Course Grade (tentative)

• Lectures and Homework 25%
  - Adapted from Prof. Patterson’s class notes
  - Please avoid arriving late or leaving early.
  - At least one problem sets with respect to each lecture
  - Homework should be handed in on time

• Project 15%

• Midterm and Final Exams. 60%

• Extra points 5%
  - 5-page summary report of Chap. 9 Multiprocessors and Clusters
Computer? 電腦？？？ 計算機？？
Abacus, the first calculating tool...

Why we do not call it "電腦"?

A computer?
Computer?

• A device that computes, especially a programmable electronic machine that performs high-speed mathematical or logical operations or that assembles, stores, correlates, or otherwise processes information

• A computer is a machine that manipulates data according to a list of instructions
  --- from *Wikipedia, the free encyclopedia*

• The History …
The First 「電」腦

- ENIAC (Electronic Numerical Integrator and Calculator)
- Work started in 1943 in Moore School of Electrical Engineering at the University of Pennsylvania, by John Mauchly and J. Presper Eckert
- Completed in 1946
- 約25公尺長、2.5公尺高
- 20 10-digit registers, each 2 feet
- 使用18,000個真空管 (electronic switches, 1906年發明)
- 每秒執行1900個加法
- Programming manually by plugging cables and setting switches
ENIAC

The world's first electronic digital computer

ENIAC (1946)

EDVAC (1951)
Von Neumann
John Louis von Neumann (1903~1957)

Von Neumann Architecture 1947: use a single storage structure to hold both instructions and data
The First 「電晶體」

- AT&T Bell Labs, 1947
  - Point connect transistor

Source: http://www.rpi.edu/~schubert/Educational%20resources/Educational%20resources.htm

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Then, we have computing devices ...

UNIVAC (Remington-Rand, 1951)

主要用途為商務、辦公室自動化
其次為科學計算

IBM 701 (IBM, 1952)
使用電晶體的電腦也跟著出現

- Ex.: IBM 1401 (IBM, 1959)

This is how IBM is called “Big Blue”!
電腦元件的另一大突破是IC

- 1958年德州儀器公司的Jack Kilby: integrated a transistor with resistors and capacitors on a single semiconductor chip, which is a monolithic IC
Intel 4004, 1971

- The first microcontroller
  - 108 KHz, 0.06 MIPS
  - 2300 transistors (10 microns)
  - Bus width: 4 bits
  - Memory addr.: 640 bytes
  - For Busicom calculator
    (original commission was 12 chips)
微處理器造就了...

- 1977年Apple II: Steve Jobs, Steve Wozniak
  Motorola 6502 CPU, 48Kb RAM
以及 PC

- 1981年 IBM PC: Intel 8088, 4.77MHz, 16Kb RAM, two 160Kb floppy disks
When compared to the 0.18-micron process, the new 0.13-micron process results in less than 60 percent the die size and nearly 70 percent improvement in performance.

The 90-nm process will be manufactured on 300mm wafers.

NEC devises low-k film for second-generation 65-nm process.
Computers

Today, less than 1,000 US dollars will purchase a personal computer that has more performance, more memory, and more disk storage than a computer brought in 1980 for 1,000,000 dollars

More performance
+
Less money

IC technology
Processor design
Course Outline

- Computer abstractions and technology
- Language of the computer
- Arithmetic for computers
- Assessing and understanding performance
- Datapath and control
- Midterm
- Enhancing performance with pipelining
- Memory hierarchy
- Storage, network, and other peripherals
- Final