



Computing: Its Nature, Power, and Limits

Lecture 1: Introduction



Goal of this course

Help you understand

- how computer works
- how Internet works

Staffs and Course Setting

- Instructor: Yuqing Tang
- Email: ytang@gc.cuny.edu
- Course webpage:
<http://web.cs.gc.cuny.edu/~tang/teachings/cis10/cis10.html>
- Lectures, labs, homework (20-25%), two midterms (20-30%), final (50-60%)

Some Interesting Movies of Today's AI Researches in Computer Science ☺

■ Robotics

- Roomba, a vacuuming cleaning home robot
- Robocup [[4-leg AIBO](#)] [[2-leg Humanoid](#)]

■ Automatic Driving [[Grand Challenge](#)]

■ Internet links

- Robocup [[4-leg league videos](#)] [[Humanoid](#)]
- Grand Challenge [[link](#)]

Stanley of Stanford Univ.

- Based on 2004 Volkswagen
- 6 Pentium-M based computers
- Drive itself through 132 miles in 6 hours 53 minutes



Inside Stanley



Modern Computer

■ One view

- Store series of human's instructions
- Execute the instructions step by step

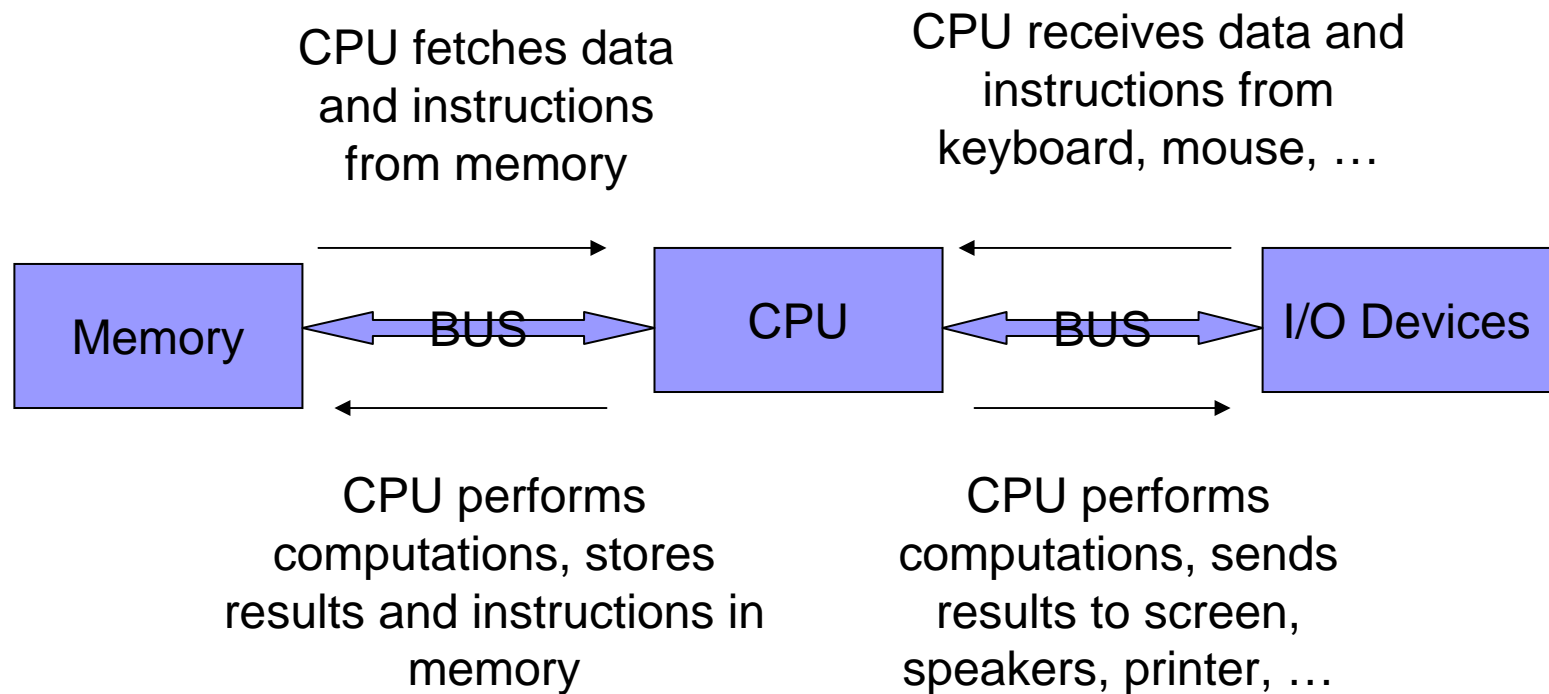
■ Another view (state-transition machine)

- Keep a memory of the input and instructions
- Refresh the memory (when an instruction is executed)
- Display (part of) the memory to human

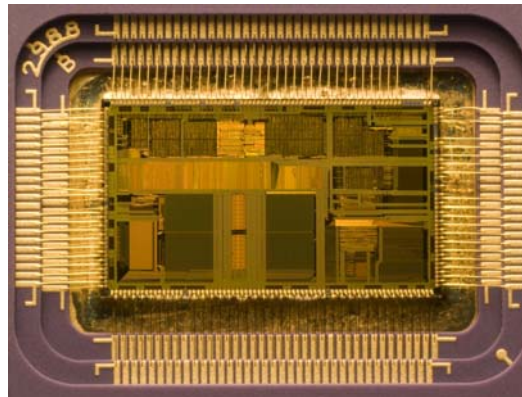
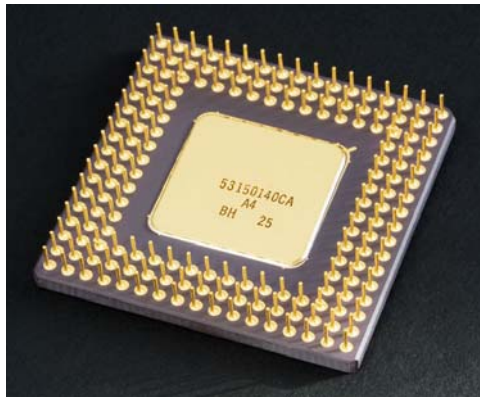
Computer Components

- CPU (Central Processing Unit)
 - Arithmetic operations: $A + B$, $A - B$, $A * B$, A / B
 - Make judgment: $A = B?$, $A > B?$, $A < B?$
 - Manipulate the memory
 - Load A from memory
 - Store A to memory
 - Load an instruction from memory
- Memory
 - RAM: temporary memory (small and fast)
 - Hard drive: permanent memory (large and slow)
- Input/Output devices
 - Input: keyboard, mouse, microphone, scanner, camera, etc.
 - Output: monitor, printer, speaker, etc.

The von Neumann Architecture



CPU views



From wikipedia [[link](#)]

Ram chips



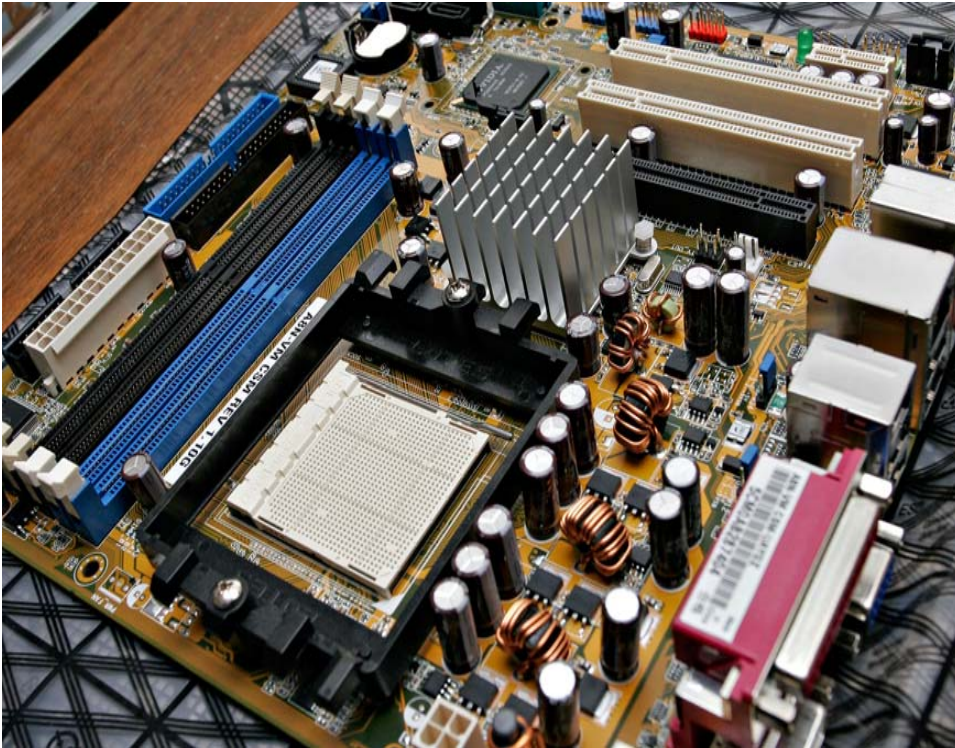
From wiki [[link](#)]

Hard drive



From wiki [\[link\]](#)

How do the components come together?



From [[wiki](#)]

How computer works?

■ Human

- Develop series of instructions (by some programming languages: e.g. machine language, assembly language, PASCAL, C, C++, etc.)
- Prepare a set of input data
- Store instructions/data into computer's memory through I/O devices

■ Computer

- Fetch instructions from memory
- Execute the instructions (1.8 billion simple instructions per second with an 1.8GHZ Pentium 4 CPU)
- Modify its memory according to the execution
- Output part (the human-interesting portion) of its memory to the monitor, printer, etc.

Software

■ Components

- Computer instructions
- Associated data

■ Software examples

- Operating system: controls how CPU, memory, I/O devices work together
 - E.g. MS Windows, Unix, Linux, Mac OS etc.
- Application software: MS word, Internet explorer, TAX preparation software, ICQ, MSN, etc.

Computer Networks

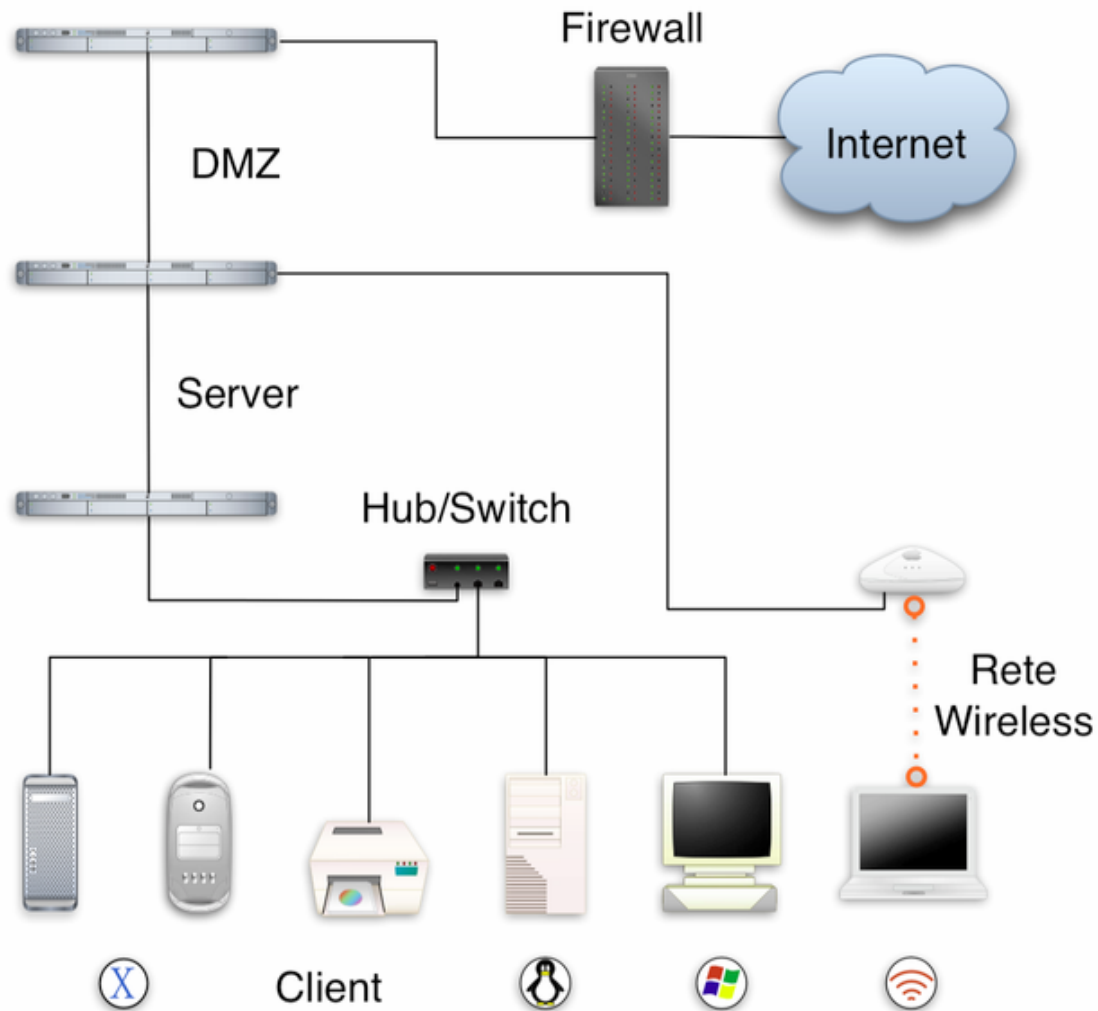
- Computers get connected
- Computers exchange information (in their memories)
- Through the local computer
 - People get access to the information in remote computers
 - Combine information from all accessible computers



Network components

- Connection Devices: hub, switches, modems, routers, etc.
- Software
 - Protocols
 - Network applications: Web servers, Web Browsers, etc.

An example of LAN



From [\[wiki\]](#)

Syllabus [[link](#)]

- Introduction to computer
- Networks (Internet, LANS, WANS, TCP/IP)
- Algorithmic thinking
- Computer Languages
- HTML
- Javascript programming (just a little bit)
- Machine architecture
- Limitation of computer: unsolvability, nonfeasibility
- Security, privacy, and encryption



Summary

- Basic Computer concepts
- Computer components, hardware
- Software
- Networks
- Syllabus