Background

Reading:
CHAPTER 1: (Computers and Systems)

Typical Computer

- Is the device fast enough to run necessary programs?
- Is the device cost-effective?
- Will it be obsolete in 6 months?
- Will some applications run better on one device or another?
- Do you know the implications of different features and measures?
- Are you proficient enough in the terminology of the specifications to ask questions?

	iPhone 4	Droid X
Network	AT&T	Verizon
Operating System	iOS 4	Android 2.1 with Motoblur 2
Screen Size	3.5-inch IPS @ 960x640	4.3-inch TFT@480x854
Processor	Apple A4 (@ 1GHZ?)	TI OMAP 3630 @ 1GHZ
Memory	512MB RAM	512MB RAM
Storage	16GB / 32GB internal	8GB (app storage)
Data Speed	EDGE (2.5 G) / HSPA 7.2 (Quad band)	1x RTT/ EVDO Rev. A (3G)
microSD Card	Never	16GB included (up to 32GB)
Rear Camera	5MP 1.75 micro, flash	8MP with autofocus, dual flash
Max. video recording resolution	720p 30fps	720p (fps?)
Front Camera	Yes, VGA	None
Second mic	Yes, noise canceling	Yes, noise canceling
Third mic	None	Yes, video recording
Adobe Flash	Never	Coming with Froyo
Bluetooth	2.1 + EDR	2.1 + EDR
WiFi	802.11b/g/n Wi-Fi (802.11n 2.4GHz only)	802.11 b/g
MiFi-like hotspot	None	Yes
GPS	aGPS	aGPS
FM Radio	No	Yes
TV out	Apple AV cables	via HDMI
Size	4.5 x 2.31 x 0.37 inches	(pending)
Weight	4.8 ounces	
Battery	1420mAh	1570mAh
Price	$199/$299 with 2-year contract on AT&T	$199.99 with 2-year contract, rebate
SIM	MicroSIM	None

Why Study Computer System Architecture?

- User
  - Understand system capabilities and limitations
  - Make informed decisions
  - Improve communications with information technology professionals
- Programmer
  - Create efficient application software for specific processing needs
- Systems Architect or Systems Analyst
  - Specify computer systems and architecture to meet application requirements
  - Make intelligent decisions about system strategy

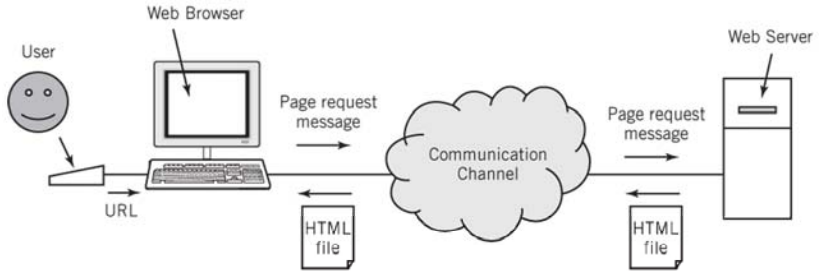
What IS related job do you expect to have after graduation?

Why Study Computer System Architecture?

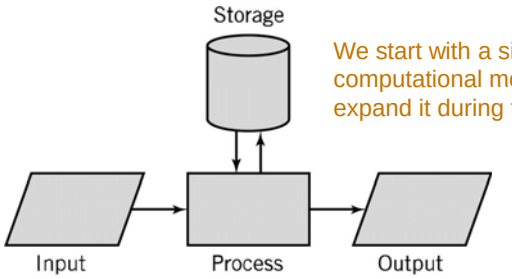
- System Administrator / Manager
  - Install, configure, maintain, and upgrade computer systems
  - Maximize system availability and efficiency
  - Optimize system performance
  - Ensure system security
- Web Services Designer
  - Optimize customer accessibility to Web services
  - Optimize web system configurations
  - Select appropriate data formats, page designs and scripting languages
  - Design efficient Web pages

Web Browser Application Use

Demonstrates a computer system that contains more than one computer



Input-Process-Output Model (IPO)

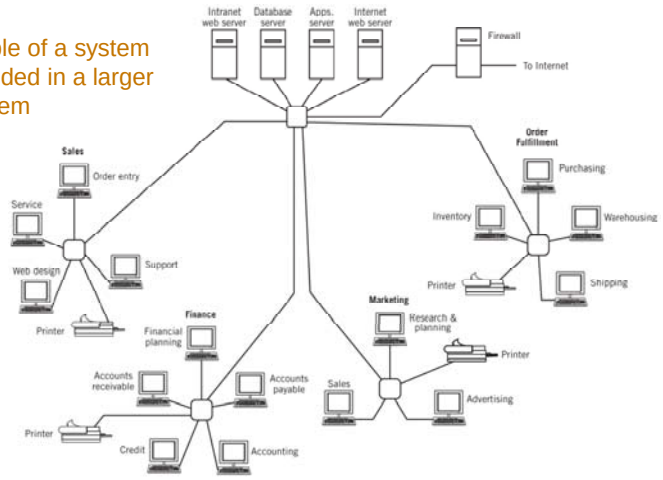


We start with a simple computational model, and then expand it during the semester

- Input: keyboard, mouse, scanner
- Processing: CPU executes the computer program
- Output: monitor, printer, fax machine
- Storage: hard drive, optical media, diskettes, magnetic tape

Simplified IT Computer System Layout

Example of a system embedded in a larger IT system



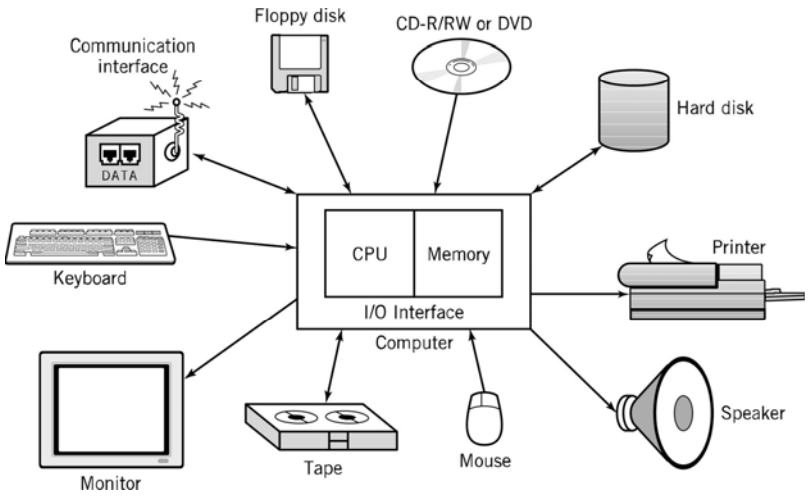
Computer System Components

- *Hardware*
  - Processes data by executing instructions
  - Provides input and output
  - Control input, output and storage components
- *Software*
  - Applications and system software
  - Instructions tell hardware exactly what tasks to perform and in what order
- *Data*
  - Fundamental representation of facts and observations
- *Communications*
  - Sharing data and processing among different systems

Hardware Component

- Input/Output devices
- Storage Devices
- CPU – Central Processing Unit
  - ALU: arithmetic/logic unit
  - CU: control unit
  - Interface unit
- Memory
  - Short-term storage for CPU calculations

Typical Personal Computer System



CPU: Central Processing Unit

- ALU: arithmetic/logic unit
  - Performs arithmetic and Boolean logical calculations
- CU: control unit
  - Controls processing of instructions
  - Controls movement of data within the CPU
- Interface unit
  - Moves instructions and data between the CPU and other hardware components
  - *Bus*: bundle of wires that carry signals and power between different components

Memory

- Also known as *primary storage*, *working storage*, working storage, and *RAM (random access memory)*
- Consists of bits, each of which hold a value of either 0 or 1 (8 bits = 1 byte)
- Holds both instructions and data of a computer program (*stored program concept*)

Usually implemented as a memory hierarchy

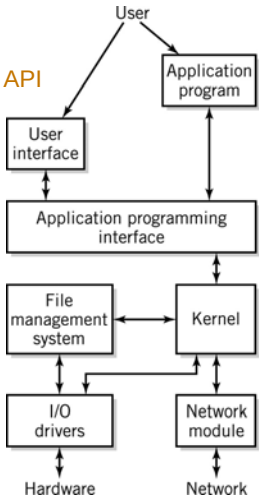
Volatile and non-volatile memory

Software Component

- Applications
- *Operating System*
  - API: application program interface
  - File management
  - I/O
  - Kernel
    - Memory management
    - Resource scheduling
    - Program communication
    - Security
  - Network Module

Issue of disclosure of API

OS Interface: command line or GUI



Communications Component

- Hardware
  - Communication *channels*
    - Physical connections between computer systems
    - Examples: wire cable, phone lines, fiber optic cable, infrared light, radio waves
  - Interface hardware
    - Handles communication between the computer and the communication channel
    - Computer external interfaces (e.g., network interface)
- Software
  - Establish connections
  - Control flow of data
  - Directs data to the proper applications for use

What are the important characteristics of communications channels?

Computer Systems

All computer systems, no matter how complex, consists of the following:

- At least one CPU Von Neumann architecture
- Memory to hold programs and data
- I/O devices
- Long-term storage

Computer Systems Examples

IBM System z10 EC Mainframe

HP Laptop Computer

Virtualization

- Virtual (American Heritage Dictionary
  - Existing or result in essence or effect though not in actual fact, form or name
  - Created, simulated, or carried on by means of a computer or computer network
- Computer systems examples
  - Virtual memory
  - Virtual networks
  - Java Virtual Machine

What do you think these mean?

What is the advantage of virtualization?

Protocols

- Common ground rules of communication between computers, I/O devices, and many software programs
- Examples
  - HTTP: between Web servers and Web browsers
  - TCP/IP: between computers on the Internet and local area networks
  - SATA: between storage devices and computers

Importance of universal protocols (e.g., IP)

Standards

- Created to ensure universal compatibility of data formats and protocols
- May be created by committee or may become a de facto standard through popular use
- Examples: Industry standards vs. vendor standards
  - Computer languages: Java, SQL, C, JavaScript
  - Display standards: Postscript, MPEG-2, JPEG, GIF
  - Character set standards: ASCII, Unicode, EBCDIC
  - Multimedia standards: MPEG-2, MPEG-4, DivX, MP3

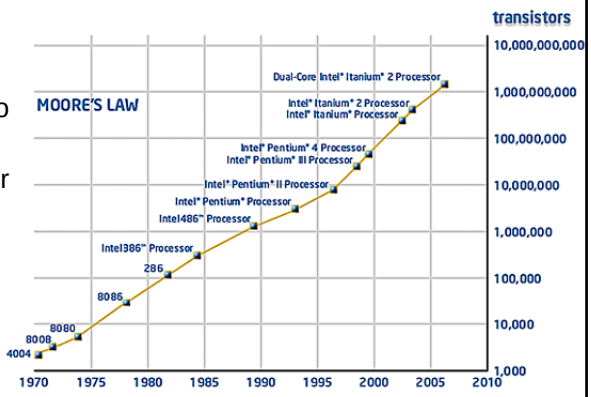
Standards with exceptions/extensions

Computer Fabrication

- Moore's Law
- Increasing chip integration
- Reduction in variation in architectures
- Importance of regularity
- Chip fabrication
  - Investment cost
  - Product cost

Trends Due to Moore's Law

- Lower cost/performance
- Additional processing added to chip
- Increased capital for fabrication plants
- Limited number of processor architectures
- Multi-processor chips



Graph from greentechmedia.com

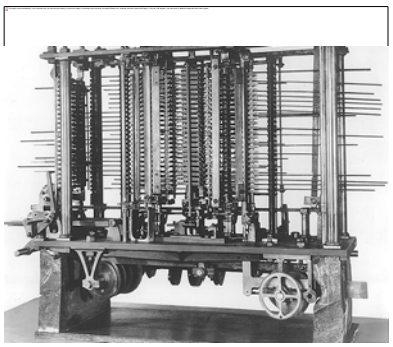
Early History

- 1642: Blaise Pascal invents a calculating machine
- 1801: Joseph Marie Jacquard invents a loom that uses punch cards
- 1800's:
  - Charles Babbage attempts to build an analytical engine (mechanical computer)
  - Augusta Ada Byron develops many of the fundamental concepts of programming
  - George Boole invents Boolean logic.

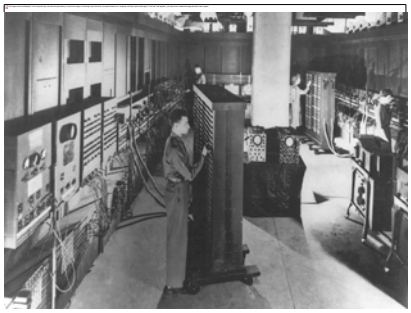
Modern Computer Development

- 1937: Mark I is built (Aiken, Harvard University, IBM).
  - First electronic computer using relays.
- 1939: ABC is built
  - First fully electronic digital computer. Used vacuum tubes.
- 1943-46: ENIAC (Mauchly, Eckert, University of Pennsylvania).
  - First general purpose digital computer.
- 1945: Von Neumann architecture proposed.
  - Still the standard for present day computers.
- 1947: Creation of transistor
  - (Bardeen, Shockley, Brattain, Bell Labs).
- 1951-2: EDVAC and IAS

Early Computers



Babbage's Analytical Engine



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System Software History

- Early computers had no operating systems and were single user systems
  - Programs were entered using switches for each bit or by plugging wires into a panel
- 1953-54: First operating system was built by General Motors Research Laboratories for their IBM 701 computer
- Other early systems
  - FORTRAN Monitor System (FMS)
  - IBSYS
  - Share Operating System (SOS)

Operating System Development

- 1963: Master Control Program (MCP) by Burroughs. Included many modern OS features.
- 1964: OS/360 by IBM. First general processing computer.
- 1962: MIT Project MAC created a time-sharing OS called CTSS. Shortly afterwards, MIT, Bell Labs, and GE developed Multics (Multiplexed Information and Computing Services).

UNIX

- After Bell Labs withdrew from the Multics project, Ken Thompson developed a personal operating system called UNIX using assembly language.
- Dennis Ritchie developed the programming language C which was used to rewrite much of UNIX in a high-level language.
- UNIX introduced
  - A hierarchical file system
  - The shell concept
  - Document production and formatting
  - Tools for networked and distributed processing

Graphical User Interfaces

- 1960s: Doug Englebart (Stanford Research Institute)
  - Invented windows and a mouse interface
- 1970s: Xerox PARC
  - Creates a practical windowing system for the Dynabook project
- 1980s: Steve Jobs (Apple)
  - Developed the Apple Lisa and MacIntosh

IBM PC

- 1982: Stand-alone, single user computer
- PC-DOS, MS-DOS (disk operating system)
- Later versions of DOS added
  - Hierarchical directory file storage
  - File redirection
  - Better memory management
- Windowing systems
  - Windows 2.0, Windows 3.1, Windows 95
  - Windows NT, Windows XP, Windows Vista
  - Windows 7

Communications

- 1960s and 1970s: users communicated on multiterminal computer systems using talk and email facilities
- 1971: Ray Tomlinson creates the standard username@hostname email standard
- Modems permitted users to login to office systems, electronic bulletin board systems, Compuserve, AOL, and Prodigy
- 1969: ARPANET begun
- 1985: First TCP-IP wide area network
- 1991: Tim Berners-Lee develops the concepts that become the World Wide Web
- 1993: Marc Andreessen develops Mosaic, the first graphical browser

Importance of fiber optic communications