

Technology, History, Issues

- Advances of Computer Technology
- Today's Ubiquitous Computing Landscape
- Dramatic Impacts –
New Social, Legal, and Ethical Issues

Sources:

Baase: A Gift of Fire,
Quinn: Ethics for the Information Age
Pictures from Wikipedia
Slides from Prof. Jingke Li

Textbook: Chapter 1

History of Computers

It's a story of hardware advances:

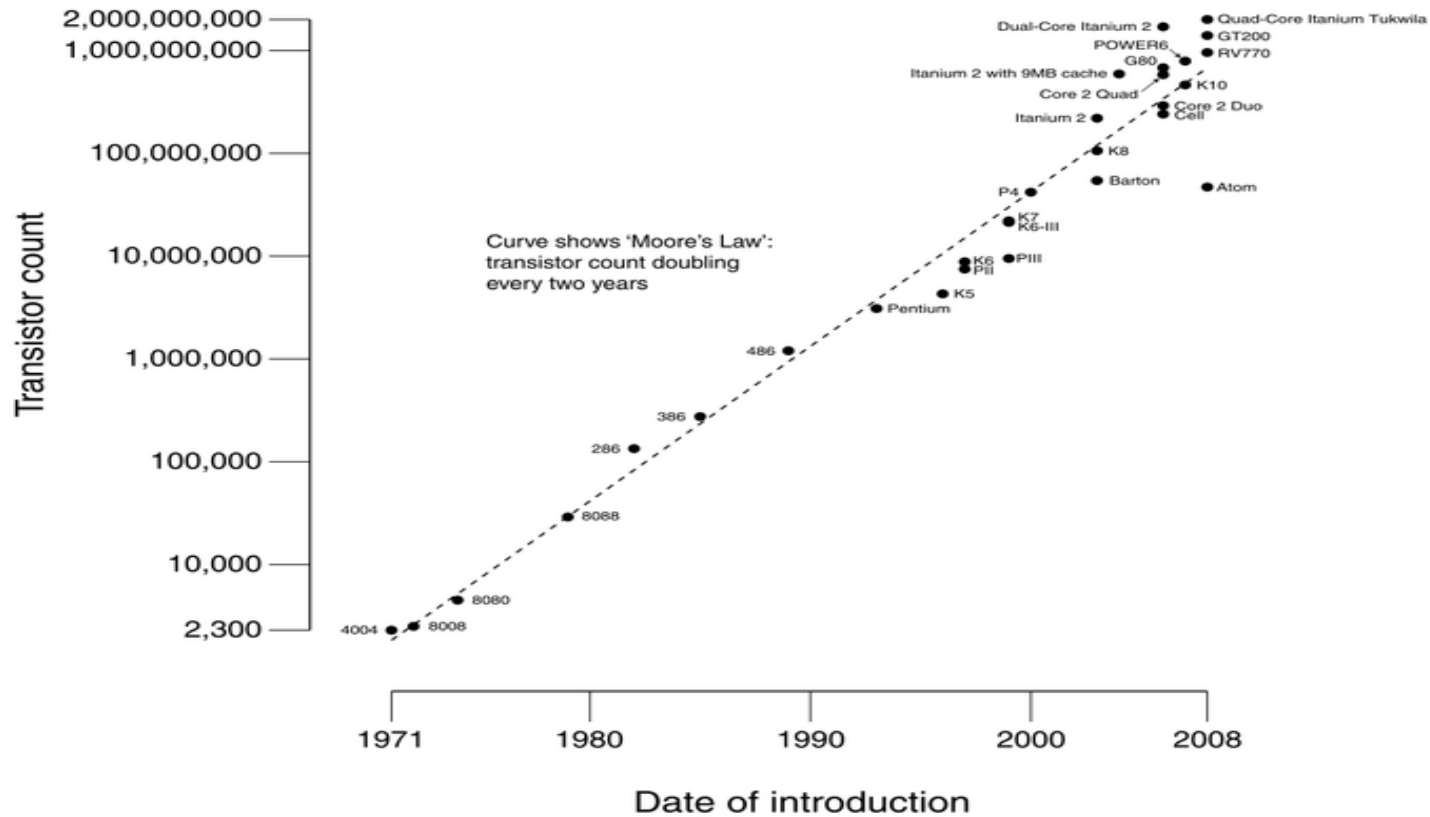
- Pre-Generation (40s & before) --- *Mechanical*
- 1st Generation (late 40s) --- *Vacuum Tubes*
- 2nd Generation (late 50s) --- *Transistors*
- 3rd Generation (60s) --- *Integrated Circuits*
- 4th Generation (since 70s) --- *VLSI*
- 5th Generation --- *?*

Rapid Advances

- *Components*
 - CPUs
 - Hard Drives
 - Memory
- *Computer Systems*
 - ENIAC
 - Mainframes → Servers
 - Supercomputers
 - Microprocessors → PCs

Advances of CPUs

CPU Transistor Counts 1971-2008 & Moore's Law



Advances of Hard Drives

IBM 350 Disk Storage Unit:

- The first hard-disk drive, introduced in 1956 as data storage for the IBM accounting computer, 305 RAMAC
- 5ft long, 5ft 8in high, and 2ft 5in deep; weighed 600lbs
- Capacity: 5 million characters (~5MB)

Today: 1TB portable drive



Advances of Memory

- Drum memory (50s)
- Core memory (60s)
- Integrated silicon RAM chips (70s)



2K core mem, 16×16cm

Today:

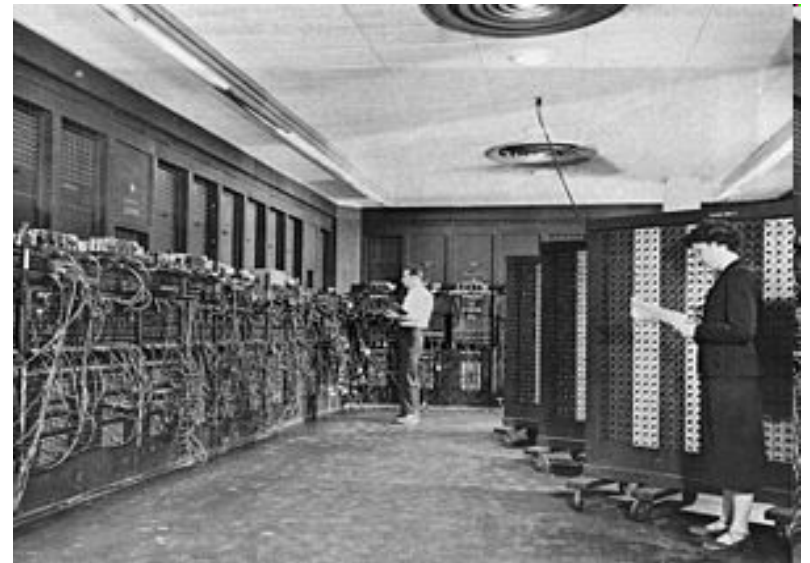
4GB RAM is common place



ENIAC

The first general-purpose, programmable digital computer.

- Built in 1946
- Contained 17,468 vacuum tubes, 7,200 crystal diodes, 1,500 relays, 70k resistors, 10k capacitors and ~5 million hand-soldered joints
- Roughly 8.5ft x 3ft x 80ft, weighed 27 tons, and consumed 150kW of power
- Could perform 5,000 addition or subtraction operations on 10-digit numbers per second



IBM System/360

The world's first mainframe.

- Built in 1965
- Consists of a family of compatible models
 - Model 20: 4K core mem
 - Model 75: upto 1M mem
- Introduced the 8-bit byte standard
- Price: \$2.5-\$3 million



Cray-1

A very successful, first-generation supercomputer.

- Built in 1975
- Weighed 5.5 tons, consumed about 115 kW of power
- 2MB of RAM
- Its theoretical performance was 160 MIPS



IBM Blue Gene/Q (Sequoia)

World's fastest supercomputer (2011)

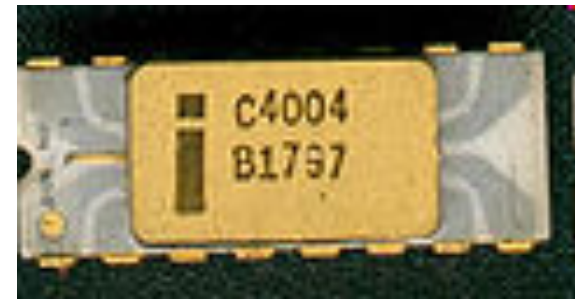
- *Peak Speed:*
20 petaFLOPS
- *1.6 million cores*
- *Size: 3,000 sq ft*



Intel 4004

World's first microprocessor.

- First available in 1971
- Size: 1/8" x 1/6"
- 2,300 transistors
- Max CPU clock 740kHz
- Same computing power as the ENIAC



The Original IBM PC

- Released August, 1981
- *CPU:*
Intel 8088, 4.77MHz
- *Memory:*
16~256KB
- *Software:*
BASIC/DOS1.0



Today's PCs

- A full range of designs:
 - From light-weight netbooks
 - To super-powerful gaming PCs
- PC designs are also being used as components in supercomputers
 - Sony PlayStation 3 processors are used inside the IBM Roadrunner



Today's Computing Landscape

Today's computing is ubiquitous!

- *Connections:*
 - Cell phones
 - The Internet and the Web
 - Email, Blogs, Wikipedia, e-commerce
- *Digital World:*
 - Books, music, pictures, videos
 - TVs, home appliances
 - ATMs, credit cards

New Technology Brings Impacts

- *Both Positive and Negative:*
 - Positive: e.g. convenience
 - Negative: e.g. computer-assisted crimes
- *Broad Scope:*
 - Social, Legal, Ethical, Economical, Environmental
 - ...

Cell Phones

- In 2006, 208 million people in the US and one billion worldwide used cell phones
- Became a common tool not only for conversations, but also
 - Messaging, taking pictures, downloading music, checking email, playing games, accessing the Web, watching videos, ...

Cell Phones Impacts

While useful for so many applications, there are also new problems:

- *Intrusion:*

 - Cell phone ring in movie theater

- *Safety:*

 - Talking on cell phone while driving

- *Privacy:*

 - Cell phone cameras

The Internet

- Internet connects millions of computers
 - Powerful computational resource
 - Even more powerful communication medium
- Network utility grows as #users squared
 - 10 users → 90 sender-receiver combinations
 - 100 users → 9900 sender-receiver combinations

Email

- As fast as phone call, yet non-intrusive
- Can embed pictures and videos

New Problems:

- *Spam* – Unsolicited email
 - Effective for marketers: More than 100 times cheaper than “junk mail”
 - Amount of spam has increased:
 - 2000: 8% → 2009: 90%
- Viruses, Worms, Trojan Horses
- Scams, societal changes ???



The World Wide Web

- *Huge amount of free info at our finger tips*
- *Platform for creativity*
- *Social networking*
- *Collaboration*
- *Online Education*
- *E-commerce*
- *...*

Free Information and Stuff

- Free Search Engines: Google, Yahoo
- Free Encyclopedia: Wikipedia
- Free Classified Ad: Craigslist
- Free News and Other Articles
- Free Games: chess, bridge, Lego
- Free Phone service: Skype
- ...

Free Stuff Problems

- Hidden Agenda:
 - Search engine's ranking algorithm
 - Tracking consumer behavior
 - Infomercial vs. hard news
 - Biased or incorrect articles in Wikipedia
- Harmful Information:
 - Instructions for bomb making
 - Political attacks

Blogs

- Began as outlets for amateurs who want to express ideas or creativity
- Appealing because present personal views, are funny and creative, and present a quirky perspective on current events
- Popular blogs have up to several million views per day

Problems:

- Hard to tell good blogs from bad ones

Video Sharing

- Rise of amateur videos on the web
- Boom of websites like YouTube and MySpace

Problems:

- Many videos on the web can infringe copyrights owned by entertainment companies

Collaboration

- Information Depots:
 - Wikipedia, Open Directory Project (ODP)
- Cloud Computing
- Telemedicine

Problems:

- Quality control
- Reliability

Social Networking

- First online social networking site was www.classmates.com in 1995
- Myspace, founded in 2003 had roughly 100 million member profiles by 2006
- Facebook was started at Harvard as an online version of student directories
- The Twitter phenomenon: founded in 2006, the fastest growing site --- 1,382% per month

Online Education

- Web-assisted school administration:
 - Student application and admission
- Web-assisted teaching:
 - Course information, teacher-student interaction
- Online courses and online university:
 - The University of Phoenix

E-Commerce

- Amazon started in 1994 and 10 years later annual sales reached \$8.5 billion
- Online shopping become a top choice for many people – price comparison, instant transaction, often free shipping
- Online Banking

Problems:

- Security
- Privacy

Summary of Ethical Issues

- Intellectual property
- Information collection
- Spam
- Differences between personal choices, business policies, and law

Summary of Social Issues

- Out-sourcing and unemployment
- Working hours and work evaluation
- Computerized customer service
- Increased possibility of identity theft

Summary of Legal Issues

- Intellectual properties
- Security vs privacy
- Security vs freedom of speech
- Cyber crimes

Discussion Questions

- Some say that no technology is inherently good or evil; rather, any technology can be used for either good or evil purposes. Do you share this view?
- “Thanks to a communications and software revolution, we are more ‘connected’ than ever before — by cell phone, email, and video conferencing — yet more disconnected than in the past from social interaction”. Do you agree?

Discussion Questions

- What do you think are the main driving forces behind technology advances? Are you happy with the fast pace of the changes, or do you wish it were slower?
- Do you tend to acquire new technological devices before or after the majority of your friends? What are the pros and cons of being an early/late adopter of a new technology?