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

Curve shows ‘Moore’s Law’: transistor count doubling every two years
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)

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 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?