The University of Texas at Dallas

Erik Jonsson School of Engineering and Computer Science

ECS 3361: Social Issues and Ethics in ECS

Lecture 1 Catalysts for Change
Chapter 1

Credits:

Dr. Michael J. Quinn, Author of “Ethics for the information age

The Free Encyclopedia, http://en.wikipedia.org

YouTube

Today's Learning Objectives

- Introduction
- Milestones in Computing
- Milestones in Networking
- Milestones in information storage and retrieval
- IT social issues
- Homework 1

History is useful

- We use history (knowledge of past events) to:
  - Learn from it. Do not repeat other's mistakes.
  - "Not re-invent the wheel". Most innovations are improvements.
  - Appreciate what you have

- Information Technology
  - Devices used in development, storage, manipulation and distribution of data, sound and images.
  - People improving and making greater use of IT tools.

Information Age

- Widespread access to information made possible by:
  - Low cost computers
  - High speed communication networks

- Good but raises social and ethical issues
  - Smartphones are products of the information age

Advances in last 20-years

- Cell phones
- Digital photography
- Email
- World Wide Web (none when I started working in 1989)

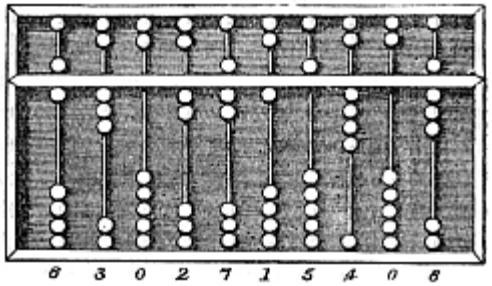
- Technology solves problems but creates new issues
  - Information reliability, SPAM
  - Dependence on technology (ATM, cell phone..)
  - Crime (identity theft, international scams…)

Control over New Technologies

- Control over adoption
  - Nuclear energy: Can have a moratorium in one place (US in 1979 after Three Mile Island accident) and advances somewhere else (France…)
  - The Amish picking and choosing which technology to adopt
  - I do not have a Facebook account
- Control over rate of change using
  - Funding
  - Laws (Tax, Regulations)

Milestones in Computing
From Manual calculations to complex microprocessors

- Tablets: From clay and wax to paper to ipad's
- Abacus: Used since 500 BC.



The number represented in the picture is 6,302,715,408

- Mathematical tables used for hundreds of years: from tables of logarithms (17th century) to tax tables.

Milestones in Computing

- Early Mechanical Calculators:
  - Manual calculations and tables are tedious and prone to errors.
  - Need for a machine (Pascal's calculator built in 1640 to add whole numbers up to 6 digits)
- Social Change → Market for Calculators
  - Economic Expansion late 19th Century
  - Need for reliable, affordable INFORMATIOM
  - First commercial production of calculators in 1890.
- Calculator Adoptions → Social Change
  - Increased productivity – lower wages for bookkeeping

Milestones in Computing

- Cash Register (1883)
  - Need for accurate sales records
  - Prevent embezzlement from clerks
    - Created printed receipts and log of transactions
    - Rang bell every time drawer is opened

- Punched Card Tabulation (1890)
  - Cards could be sorted allowing computation of subtotals
  - Early Adopters were US Bureau of the Census, heavy industries and retail organizations

Milestones in Computing

- **Tabulators → Data-processing Systems (1896)**
  - **System receives input, perform calculation, output data**
  - **Punched cards stores data and programs**
  - **My first programming class used punched cards!!!**

- **Precursors of Commercial Computers**
  - **Atanasoff-Berry Computer: vacuum tubes, not programmable**
  - **ENIAC (Electronic Numerical Integrator and Computer): Externally programmed with wires in 1946. Weighed 30 Tons!**
  - **EDVAC (Electronic Discrete Variable Automatic Computer): Program stored in memory**

Milestones in Computing

- First Commercial Computers
  - Remington-Rand: Delivered UNIVAC I (UNIVersal Automatic Computer) in 1951 to US Bureau of the Census
  - Predicted winner of 1952 Presidential Election

- IBM entered the commercial computer market in 1953.
  - Large organization with large investment in R&D
  - Large customer base and sales/marketing organization
  - Dominated mainframe computer market in 1960's

Milestones in Computing

- Programming Languages
  - Assembly language: Simple representation of machine instruction
  - FORTRAN (FORmula TRANslating): First high level language in 1957 (shorter programs for scientific applications)
  - COBOL (COmmon Business Oriented Language): Led by US department of Defense (designed for business applications)
  - BASIC (Beginner's All-purpose Symbolic Instruction Code): Simple language developed at Dartmouth College (popular for teaching programming)
- Time-Sharing Systems
  - Single computer shared by many people connected via terminals

Milestones in Computing

- Transistor
  - Invented by Bill Shockley (Bell Labs, 1948) to replace the vacuum tube.
  - Uses Semiconductor material (faster, uses less energy)
- Integrated Circuit
  - Invented at Fairchild Semiconductor (Robert Noyce) and Texas Instruments (Jack Kilby) in 1958.
  - Smaller, less expensive, more reliable
- IBM System/360
  - Early mainframe computers were not compatible. Have to rewrite programs for each new computer
  - Series of 19 computers that are software compatible in 1964.

Milestones in Computing

- Microprocessor
  - Invented at Intel in 1970. Computer on a chip. Intel 4004 with 2,300 transistors in 1/8 x 1/6 inch package.
  - Made personal computers practical.
  - Today, a microprocessor is in every appliance…
- Antecedents to the Personal Computer
  - People's Computer Company: Educate people on using computers and software
  - Homebrew Computer Club in 1975: Hobbyists interested in building personal computers.

Milestones in Computing

- Personal Computer
  - Altair 8800: used BASIC interpreter created by Gates and Allen, pirated by Homebrew Computer Club
  - Steve Wozniac designed what became Apple 1 and together with Steve Jobs launched APPLE Computer
  - Apple II computer and Tandy Corp.'s TRS 80 became Popular in late 1970's
    - Introduction of VisiCalc spreadsheet program- killer application for PC's
  - IBM launched IBM PC in 1981 with an open architecture (others can build it with off-the-shelf components). Microsoft provided software.

Milestones in Networking
From Telegraph to Social Media

- Optical Telegraph system used in France and Europe in 1790
- Electricity and Electromagnetism
  - First electromagnets built in 1825 and used for communication in 1830.

- Telegraph
  - First built by Samuel Morse in 1844 (40 miles line funded by US government)
  - Private networks spread fast with first transcontinental line in 1861.
    - Pony Express goes out of business
    - Introduction of fire alarm and police call boxes

Milestones in Networking

- Telephone
  - Constructed in 1876 by Alexander Graham Bell.
  - Social impact included first “online” communities, reduced privacy and social hierarchies. Public/Private life boundary blurred
- Typewriter and Teletype
  - First typewriter produced in late 1873
  - First typed documents common in offices in 1890’s
  - Typewriter is connected to a telegraph line to make a teletype
    - Transmission of news stories and stock transactions in 1920’s.

Milestones in Networking

- Radio
  - Electromagnetic waves discovered in 1885 proving Maxwell's theory.
  - Marconi put Hertz discovery into practice by inventing the Radio in 1895.
  - First used in business as wireless telegraph and to transmit voices
  - Became an entertainment medium by 1930's
- Television
  - First demonstrated in 1927. Early TV's cost as much as cars.
  - Became popular in 1950's as price came down.
  - Social effects include Worldwide audiences and misinformation (2000 presidential election)

Milestones in Networking

- Remote Computing
  - Complex number calculator built at Bell Labs
  - Teletype hooked to calculator to be used by remote operators
  - Long distance demo between New Hampshire and New York city in 1940.

- ARPANET (Advanced Research Projects Agency NETwork)
  - Department of Defense (DoD) started ARPA in late 1950's
  - Decentralized design (message traffic can be changed) to improve survivability (Cold War time. Loss of one computer or link will not stop communication)

Milestones in Networking

- Email
  - Tomlinson writes software to send/receive email messages in 1972
  - Roberts invents email utility (killer app for the network)
  - Today, it is used worldwide with billions of messages every day!
- Internet
  - Cerf and Kahn conceived open architecture networking and designed TCP/IP protocol (Transmission Control Protocol/Internet Protocol to route data from computer to computer)
  - TCP/IP enabled networking of computers from different manufacturers and running different operating systems
  - A network of networks using TCP/IP as a communication protocol

Milestones in Networking

- NSFNET
  - Built by National Science Foundation
  - Gave access to Universities and banned commercial traffic on its backbone
  - Shut down by NSF in 1995 after private networks established
- Broadband
  - At least 10x faster than dial up connections (cable, DSL)
  - Enabled fast transfer of files making file sharing popular
  - Average speeds: Japan: ~11 Mbites/s, South Korea: 14 Mbits/s, US: ~7 Mbits/s
- Wireless Networks (cell phones and Wi-Fi) and Social Media sites

Milestones in Information Storage and Retrieval From Alphabet to WWWeb

- Greek Alphabet
  - Letters for both consonant and vowel sounds in 750 BC.
- Codex and Paper
  - Rectangular pages of sheepskin sewn together as way of storing books
  - Paper was introduced in 15th century.
  - More durable and quicker access to particular sections
- Gutenberg's Printing Press
  - Powerful mass communication tool based on movable metal type in 1455
  - Church was primary customer of early publishers

Milestones in Information Storage and Retrieval

- Newspapers
  - Encouraged free expression. Helped unify colonies in the US.
  - Controlled through licensing and censorship
  - Influenced public opinions toward independence

- Hypertext
  - Vannevar Bush envisioned memex (memory and index) out of need for information retrieval based on associations.
  - First use of hyperlinks was proposed by Ted Nelson, a sociology major, in 1967.

Milestones in Information Storage and Retrieval

- Graphical User Interface
  - Bit-mapped display, keyboard/mouse developed at Xerox PARC in Palo Alto in 1970.
  - Steve Jobs visited Xerox PARC in 1979 and developed Macintosh in 1984
  - Microsoft Windows released in May 1990 and became popular
- World Wide Web
  - Early Browsers: Mosaic, Netscape Navigator, MS Internet Explorer

Milestones in Information Storage and Retrieval

- Search Engines (1990's)
  - Crawler-based search engines such as Google and AltaVista use Spider programs to generate web page databases.
  - Human-assisted engines: Humans build more accurate but smaller databases such as Open Directory.
  - Hybrid systems like MSN Search

- What's next?

Information Technology Issues

- Email
  - SPAM
  - Viruses
  - Privacy
  - Scams
- Web
  - Harmful content
  - Outsourcing easier
  - Globalization
- CD's, MP3s, DVD's
  - Piracy
- Credit Cards
  - Identity Theft
  - Privacy
- Telecommuting
  - Can lead to longer work hours
  - May result in fewer chances for promotion

Summary

- Amazing progress in last 100 years! http://www.youtube.com/watch?v=wfUGMMJw&list=PL98AEF3CD6A34614F
- Government can promote or slow down new technologies.
- Most innovations are evolutionary.
- Information Technology lead to social change and issues

- Ethics awareness is increasingly needed to help us decide:
  - The right technology to promote
  - The right way to use new technologies

Homework 1

- **On e-Learning (covers lectures 0 and 1).**