The Beauty and Joy of Computing
Lecture 13
Applications That Changed the World
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FLEXIBLE DISPLAYS ON THE WRIST!
Imagine a flexible display you could wear and wouldn’t drain batteries or break. The US Army is playing with such a display using Organic LEDs for soldiers to wear (e.g., to view maps and videos).

www.technologyreview.com/computing/26537/

The Computer (1940s)
- Early Inventions
  - Bell Labs: CNC ’39
  - Konrad Zuse’s Z3 ’41
  - Harvard’s Mark I ’44
  - Eckert & Mauchly’s ENIAC ’46

- Early Theoreticians
  - Shannon’s theories
  - Turing’s computability, AI

- History: entire museum
- Lots of incremental progress
- Early ones size of house
- Everything today owes its success to this

www.computahistory.org/timeline

The Transistor (“born” 1947-12-23)
- Semiconductor device to amplify or switch signals
  - Key component in all modern electronics
- Who?
  - John Bardeen, William Shockley, Walter Brattain

- Before that?
  - Vacuum Tubes
- After that?
  - Integrated circuit, microprocessor

en.wikipedia.org/wiki/History_of_the_transistor

The Internet (1962)
- Founders
  - JCI Licklider, as head of ARPA, writes on “Intergalactic network”
  - 1963: ASCII becomes first universal computer standard
  - 1969: Defense Advanced Research Projects Agency (DARPA) deploys 4 “nodes” at UCLA, SRI, Utah, & UCSD
  - 1973: Robert Kahn & Vint Cerf invent TCP, now part of the Internet Protocol Suite

- Internet growth rates
  - Exponential since start

www.computahistory.org/internet_history

Email (1965)
- Fundamentally changed the way people interact!
  - 1965: MIT’s CTSS
  - Compatible Time-Sharing Sys
  - Exchange of digital info
    - Model: “Store and forward”
    - “Push” technology

- Pros
  - Solves logistics (where?)
  - Synchronization (when?)

- Cons
  - “Email Fatigue”
  - Information Overload
  - Loss of Context

en.wikipedia.org/wiki/Email

Applications that Changed the World
- Lots of applications changed the world
  - Electricity, Radio, TV, Cars, Planes, AC, ...

- We’ll focus on those utilizing Computing
- Important to consider historical apps
  - Too easy to focus on recent N years!
The Personal Computer (1970s)
- First PCs sold as kits to hobbyists
  - Altair 8800 (1975)
- Early mass-produced PCs
  - Apple I, II (Jobs & Woz)
  - Commodore PET
  - IBM PC
- Microprocessor key
- Laptops → portability
- Created industry, wealth
  - Silicon Valley
  - Bill Gates worth $50 Billion

The Laser Printer ('69), Postscript ('82)
- Gary Starkweather @ Xerox invented it
  - Modified an existing Xerox laser printer
  - Laser beam projects image onto electrostatic charged rotating drum
- Picture is commands!
  - John Warnock, founder of Adobe, invented Postscript
  - Turing-complete language
  - The processor on the printer rasterized the image
  - Commands → image bits on/off
- Professional-quality output in hands of people

The Spreadsheet (1961, 1980)
- Grid of rows and columns, with each cell a formula or data
- Simulates a paper worksheet
  - Commonly used for financial information & grades!
- History
  - Richard Matthew's 1961 paper
  - "Budgeting Model & System Simulator"
- VisiCalc by Dan Bricklin
  - Helped drive the sales of Apple II in 1980
- Lotus 1-2-3 with DOS in 1981
  - Excel the current market leader
- Now online (Google Docs)

Audio/Videoconferencing (1980s)
- History
  - 1936: closed-circuit TV
  - 1968: Englebart's "Mother of All Demos"
  - 1980s: Digital Telephony (via ISDN)
  - 1990s: Internet Protocol (IP) based videoconferencing
- Impact
  - For some businesses, essential (e.g., Dreamworks)
  - Big with grand parents, sign language communication
  - Telemedicine
  - Education impact huge

- "System of interlinked hypertext documents on the Internet"
- History
  - 1945: Vannevar Bush describes hypertext system called "memex" in article
  - 1989: Tim Berners-Lee proposes, gets system up '90
  - ~2000 Dot-com entrepreneurs rushed in, 2001 bubble burst
- Wayback Machine
  - Snapshots of web over time
- Today: Access anywhere!
WWW Search & Browser (1993)

- **Browser**
  - Marc Andreessen and Eric J. Bina at NCSA create Mosaic, 1st popular WWW browser
  - First Internet “Killer App”
  - Later: Netscape Navigator
  - Now IE (68%), Firefox (22%)

- **Search**
  - Before engines, there was a complete list of all servers!
  - 1993 Martin Koster Alweb is 1st web search engine
  - 1997 Stanford Sergey Brin and Larry Page develop Google’s search, based on PageRank (each $12 billion)


- “…web development & design that facilitates interactive information sharing, interoperability, user-centered design and collaboration on WWW”
  - Users change content via “architecture of participation”

- **Examples**
  - Web communities, apps, social networks, video & photo sharing, wikis, blogs, tweets, …

“Take back the web!”

“You” – Time’s 2006 Person of the Year

Google Docs, SW as a Service (2006)

- Free, web-based word processor, spreadsheet, presentation and form application
- Single source of truth!
- Fundamentally changing the way people collaboratively author documents
  - No more attachments and versions!!
  - Much better than Wikis, which are not WYSIWYG, so folks grab local temp copy

Web Mapping (1993)

- “Designing, implementing, generating and delivering maps on the WWW”
- **Advantages**
  - Mobile computing + GPS means you’re never lost again!
  - Real-time traffic!
  - Collaborative maps have lots of potential (L, Wikimapia)
  - Street view can allow you to see what it looks like on the ground
  - Can have hyperlinks, yet another way to connect to web
  - Can layer content, many uses!

Texting (short messages)

- Most popular mobile service
- Has affected language... 

The Mobile Phones, PDA & Texting

- **History of Cell Phones**
  - 1908: Nathan Stubblefield patents wireless telephone
  - 1945: 0G introduced
  - 1983: Motorola DynaTAC 1st FCC-approved phone

- **PDA: handheld computer**
  - 1983: First PDA (Casio)
  - Phones become “smart”

- **Texting (short messages)**
  - Most popular mobile service
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Summary

- **How many of the 21st century engineering achievements are happening today?**
- **What’s the next big thing?**
  - Natural language processing
  - 3D displays
  - Robotics! Self-driving cars?
  - Optical or quantum computing?
  - Personal air vehicle?
  - Space travel?
  - Computer displays in glasses?
  - Flexible displays?
  - Brain machine interfaces?
  - Energy?