

CS10
The Beauty and Joy of Computing

Lecture #18: Applications That Changed The World
2012-07-19

UC Berkeley EECS
Summer Instructor
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COURSERA GOES BIG
Now 16 schools including Caltech and UPenn as investors. Online education is gaining legitimacy and research focus (see also Udacity and edX).

<http://huff.to/NGAUws>



Lecture Overview

- What counts?
- For each application
 - Historical context
 - What world was like before
 - On what shoulders does it stand?
 - Key players
 - Sometimes origins fuzzy
 - How it changed world
- Summary




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www.greatachievements.org

Applications that Changed the World



- Lots of technologies 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!



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When did the 1st computer debut?

- a) ~1930
- b) ~1940
- c) ~1950
- d) ~1960
- e) ~1970


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www.computerhistory.org/timeline

The Computer (1940s)


- **Early Inventions**
 - Bell Labs' CNC '39
 - Konrad Zuse's Z3 '41
 - Harvard's Mark-1 '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**




CNC



Z3



Mark-1



ENIAC


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en.wikipedia.org/wiki/History_of_the_transistor

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



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www.computerhistory.org/internet_history

The Internet (1962)

- Founders**
 - JCR 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" @ UCLA, SRI, Utah, & UCSB
 - 1973 Robert Kahn & Vint Cerf invent TCP, now part of the Internet Protocol Suite
- Internet growth rates**
 - Exponential since start!

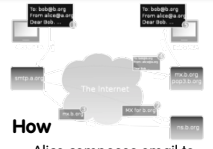


www.greatachievements.org/?id=3736
en.wikipedia.org/wiki/Internet_Protocol_Suite
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en.wikipedia.org/wiki/Email

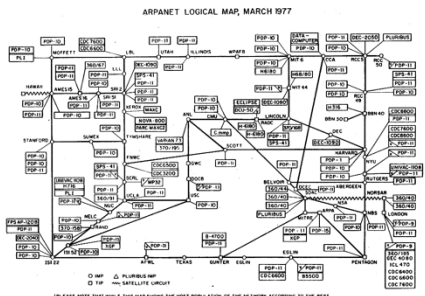
Email (1965)

- 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
- How**
 - Alice composes email to bob@b.org
 - Domain Name System looks up where b.org is
 - DNS server with the mail exchange server for b.org
 - Mail is sent to mx.b.org
 - Bob reads email from there



www.greatachievements.org/?id=3989 www.blinkenlights.com/pc.shtml
en.wikipedia.org/wiki/Personal_computer
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ARPANET in 1977




en.wikipedia.org/wiki/ARPANET
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www.greatachievements.org/?id=3989 www.blinkenlights.com/pc.shtml

The Personal Computer (1970s)

- First PCs sold as kits to hobbyists**
 - Altair 8800 (1975)
- Early mass-prod PCs**
 - Apple I, II (Jobs & Woz)
 - Commodore PET
 - IBM ran away w/market
- Microprocessor was key**
- Laptops → portability**
- Created industry, wealth**
 - Silicon Valley!
 - Bill Gates worth \$60 Billion

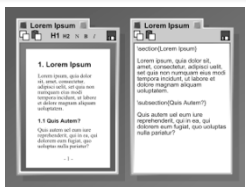


en.wikipedia.org/wiki/Personal_computer
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en.wikipedia.org/wiki/{Wysiwyg, WIMP_(computing)}

WIMP, WYSIWYG Interface (1973)

- WIMP: Window, Icon, Menu/Mouse, Pointer**
 - Dominant style of Human-Computer Interaction (HCI)
 - Contrast with a command-line interface it replaced
 - Both developed at Xerox PARC 1973, popularized by Apple's Mac computers 1984
- WYSIWYG: What You See Is What You Get**
 - Display shows printed result
 - Before this, commands →
 - Even today, both WYSIWYG and non- available



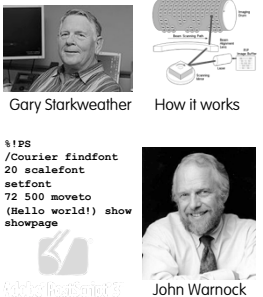
"The program on the left uses a WYSIWYG editor to produce a document. The program on the right contains LaTeX code, which when compiled will produce a document that will look very similar to the document on the left."

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en.wikipedia.org/wiki/Laser_printer

The Laser Printer ('69), Postscript ('82)

- Gary Starkweather @ Xerox invented it**
 - Modified an existing Xerox
 - Laser beam projects image onto electrically 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**

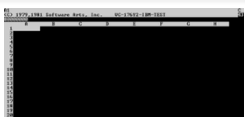


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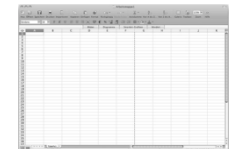
en.wikipedia.org/wiki/Spreadsheet

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 Mattessich 1961 paper
 - "Budgeting Models & System Simulation"
 - VisiCalc (by Dan Bricklin) helped drive the sales of Apple II ~1980
 - Lotus 1-2-3 with DOS in 1981
 - Excel the current market leader
- Now online (Google Docs)



VisiCalc, the first PC spreadsheet (1970s)



Microsoft Excel (2008)

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en.wikipedia.org/wiki/Videoconferencing

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 grandparents, sign language communication
 - Telemedicine
 - Education impact huge



First demo of videoconferencing in 1968



Cisco T3 ultra-high resolution telepresence


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en.wikipedia.org/wiki/History_of_the_World_Wide_Web

The World Wide Web (1989)


- "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
 - Late 1990s: Dot-com boom
 - 2001 bubble burst
- Wayback Machine
 - Snapshots of web over time
- Today : Access anywhere!



Tim Berners-Lee



World's First web server in 1990



www.archive.org


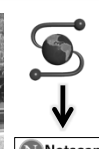
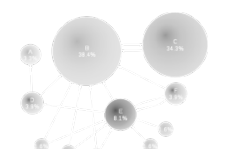
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www.evolutionoftheweb.com

WWW Search & Browser (1993)

- Browser
 - Marc Andreessen and Eric Bina @ NCSA create Mosaic, 1st popular WWW browser
 - First Internet "Killer App"
 - Later: Netscape Navigator
 - Now IE (23%), Firefox (30%)
- Search
 - Before engines, there was a complete list of all servers!
 - 1993 Martijn Koster Aliweb is 1st web search engine
 - 1997 Stanford Sergey Brin and Larry Page develop Google's search, based on PageRank (each: \$18 Billion)



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en.wikipedia.org/wiki/Web_2.0

Web 2.0 : The Social Network (2004)

- "...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



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en.wikipedia.org/wiki/{Web_mapping, Gps}

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 (E.g., WikiMapia)
 - Street view can allow you to see what it looks like on the ground
 - Can have hyperlinking, yet another way to connect to web
 - Can layer content, many uses!

Different views of Soda Hall


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en.wikipedia.org/wiki/Google_Docs

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



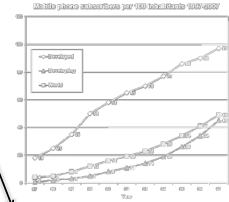

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en.wikipedia.org/wiki/{Personal_digital_assistant, Mobile_phone, Texting}

The Mobile Phone, 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 became "smart"
- Texting (short messages)**
 - Most popular mobile service
 - Has affected language...brb

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What's the most important in your life?





- Cell Phone
- Videoconferencing
- Email
- Facebook
- Web search

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Summary

- How many of the 21st cent engineering achievements are happening today?
- What's the next big thing?
 - Natural language processing?
 - 3D displays?
 - Robotics? Self-driving cars?
 - Optical or quantum computing?
 - Computer displays in glasses?
 - Flexible displays?
 - Brain machine interfaces?
 - Energy/climate sim?
 - Education?
- CS is an entry point!



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