The History of Computers

You will learn about the developments in computing and other related technologies that were made from the 1940's onward.

James Tam

History Part II: The Electronic Computers

- The ABC
- The ENIAC
- The British code breaking computers
- Stored program computers

James Tam

The People Behind The ABC (*A*tanasoff-*B*erry-*C*omputer)

- John Atanasoff
  - A professor at Iowa State College (now Iowa State university)
- Clifford Berry
  - A graduate student studying under Atanasoff

Images from "A history of computing technology" by Michael R. Williams (IEEE Press 1997)

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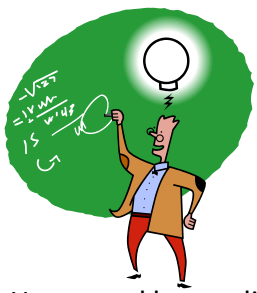
Motivations For Developing The ABC

- Atanasoff was researching methods of solving complex mathematical equations.



- He started by modifying the small IBM calculator that was leased to the college to see if it could solve these problems.

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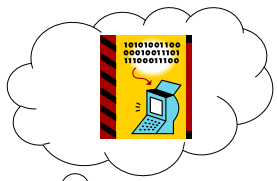
Motivations For Developing The ABC (2)

- His modifications were extensive
- The folks at IBM weren't happy with the modifications

James Tam

Motivations For Developing The ABC (3)

- Atanasoff then decided to build his own machine.
- Unfortunately this proved to be more of a daunting task than he first anticipated.
- After a particularly frustrating night he decided to take a break from the lab.



- This lead to an astonishing break through!

Wav file from "James Tam"

James Tam

The First Electronic Computer: The ABC

- After enlisting the aid of Berry and several years of hard work the ABC was *nearly* completed at a cost of $6000 (including the $450 paid to Berry) in 1942.
- It was the first *prototype* electronic computer!

Photo of replica ABC credit to: Bob Elbert / Iowa State University

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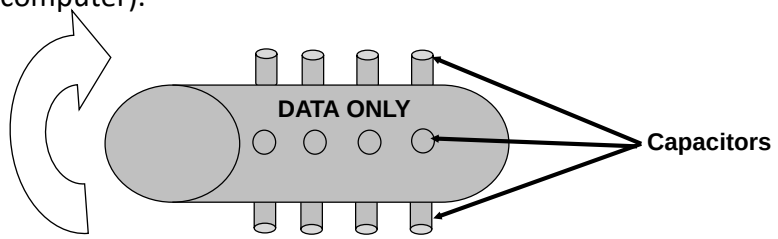
The First Electronic Computer: The ABC (2)

- It used a form of regenerative memory that was similar to the kind used in modern RAM.
- But it was not a stored program computer (not modern computer).



- The machine was never fully completed

+/-

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The Moore School Of Electrical Engineering

- It was a major provider of technical and computing resources for the US arm (Ordinance department, ballistics research lab)

www.ciipartbest.com

- Current approaches to calculate trajectories were too slow and work on the ENIAC was began to solve these problems.

James Tam

The People Behind The ENIAC

- John Mauchly
  - A Physics professor at Ursin College.
  - Produced the overall design of the ENIAC


From www.computermuseum.li

- J. Presper Eckert
  - A lab instructor at the Moore School
  - Designed the individual circuits of the ENIAC


Image © Michael Denning from www.computerhistory.org

- Joseph Chedaker
  - Supervised the construction team

James Tam

Second Electronic Computer: The ENIAC (Electronic Numerical Integrator Calculator)

- Completed in 1949 for $500,000
- The machine was huge and required a great deal of resources
  - Filled a room (x100 times bigger than comparable machines of the time)
  - 30 tons
  - 140,000 watts

Image © University of Pennsylvania

  - "…the most complex bit of electronic ever put together" (Michael R. Williams "A history of computing technology").
    - ~ wiring of the US telephone network

James Tam

Second Electronic Computer: The ENIAC (2)

- Many of the components were just electronic equivalents of the mechanical version.
- E.g., to store a single digit:

Mechanical approach

Image of Leibniz's "stepped drum" calculating machine: courtesy of James Tam

ENIAC approach

Image © University of Pennsylvania (from http://www.library.upenn.edu)

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The ABC And The ENIAC

- The ABC was the first *prototype* electronic computer (not quite completed): 1942.
- The ENIAC was the first *fully operational* electronic computer (finished): 1949.

James Tam

World War II: Code Breaking And Computing

The Allies

- British code breaking machines/projects
  - The machines of Bletchley Park ('bombs')
  - The Robinsons
  - The Colossus (and the Colossi!)

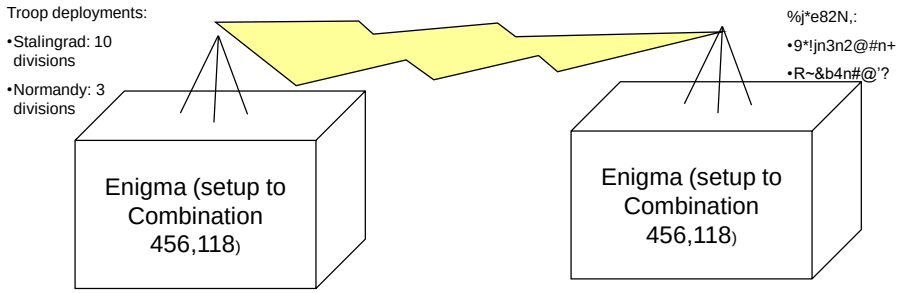
The Axis

- Germany: the enigma machines

James Tam

German Enigma Machines

- The Enigma machines: used before and during WWII by Germany as an encryption device.
- There were two version: one for the military and one for business.
- The sheer number of possible combinations (100 billion!) made mere possession of the machines useless.



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An Enigma Machine

Image courtesy of James Tam (Imperial War museum: London England)

James Tam

The British Code And Cipher School

- Worked on deciphering the German codes at Bletchley Park outside of London:

WHERE IS BLETCHLEY PARK?

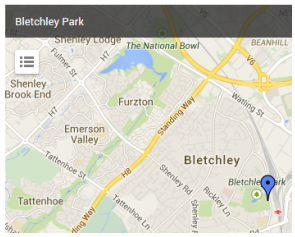
The full address is: **The Mansion, Bletchley Park, Sherwood Drive, Bletchley, Milton Keynes, MK3 6EB**

When using a sat-nav please enter Sherwood Drive, Bletchley, as the postcode may take you to the wrong location.

Visiting Bletchley Park by Public Transport

Visiting Bletchley Park By Road

View Bletchley Park in a larger map



- Intelligence work involved a great deal of secrecy:
  - Information was strictly on a "need to know basis" for the people working there.
  - Even now much of the information is still classified "Official Secrets Act": http://www.legislation.gov.uk/ukpga/1989/6/contents

Alan Turing

- A distinguished British Mathematician from Cambridge.
- He worked at Bletchley Park as a code-breaker (contributed to the design of the machinery as well as applying his Mathematical knowledge).
- A serious athlete!
  - "Alan Turing achieved world-class Marathon standards. His best time of 2 hours, 46 minutes, 3 seconds, was only 11 minutes slower than the winner in the 1948 Olympic Games. In a 1948 cross-country race he finished ahead of Tom Richards who was to win the silver medal in the Olympics."

    --

  From: http://www.turing.org.uk

Image from the History of Computing Technology by Michael R. Williams (Original: National Physical Laboratory)

James Tam

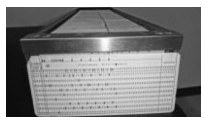
British Code Breaking Machines

- The 'bombs' were the first set of devices and were based on machines produced by the Poles.
  - The combination of secrecy surrounding the work at Bletchley Park and the code names used, 'work on bombs' resulted in a great deal of confusion.
    - "…but the only thing these bombs destroyed was the German Air Force message security" (Michael R. Williams "A History of Computing Technology").
- (Heath) Robinson machines
  - Unreliable
  - 'Proof of concept': showed that high speed electronic devices could still aid in the decoding process (Enigma)
- The Colossus (eventually "the colossi")
  - Addressed the reliability problem of the Heath Robinson machines
  - Miraculously the first one was completed in less than a year.
  - "Many more" were soon requested (1944)

Before The First Stored Program Computers

- Before these computers were developed existing machines received their instructions from:
  - Punch card

Punch card/tape images courtesy of James Tam



  - Punch tape

  - Complex re-wiring

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Stored Program Computer (SPC): Originator?

- Why it's important.
  - It's a fundamental part of modern computers and many electronics
- The answer
  - It's shrouded in a great deal of controversy.
- The location where the idea was developed
  - The Moore School (the team that developed the ENIAC)
- The person most widely credited with coming up with the idea
  - John Von Neumann

Image © Alan Richards from www.computerhistory.org

  - He received so much notoriety that modern computers are sometimes referred to as "Von Neumann machines".

James Tam

First SPC: The Manchester Machine

- After the end of the war many of the people who worked at Bletchley Park obtained jobs at Manchester university.
- In 1948 the Manchester machine was the first fully electronic machine that operated based on the instructions stored in it's memory.
- However the initial machine was extremely limited in it's capabilities:
  - The instruction set consisted of subtractions, conditional branches and a 'stop' instruction.

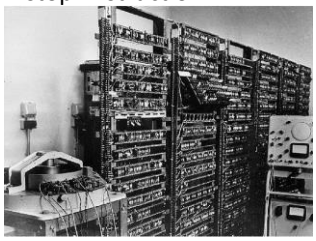

Image © University of Manchester from www.computerhistory.org

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History Part III: Modern Times

- History of the microcomputer
- History of the Internet
- User interfaces: command line, graphical user interfaces (GUI), the mouse

James Tam

History Of The Microcomputer

- The microprocessor
- The first popular microcomputer for home users: Altair
- Microsoft and it's influence on Microcomputers
- The IBM-PC
- History of Apple computers
- The attack of the clones and the rise of Microsoft

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Recall: Computers Before The Microprocessor

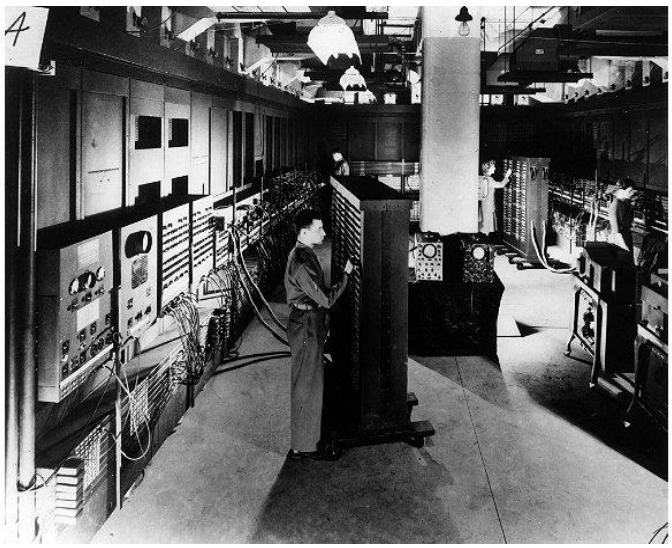

Image © University of Pennsylvania

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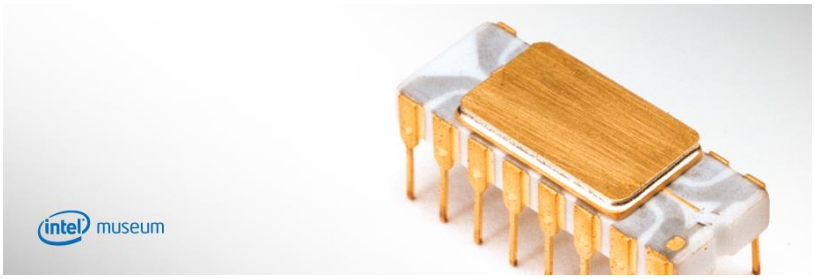
The First Microprocessor

- Produced by Intel in the early 1970's
- It's development revolutionized computers by allowing computers to be more widely used.



From the "Intel museum" www.intel.com

James Tam

What Is A Microcomputer?

- Sometimes it's referred to as a 'PC' (Personal Computer)

Image courtesy of James Tam

James Tam

The First Popular Computer For Home Users: The Altair

Images © Mark Richards from www.computerhistory.org

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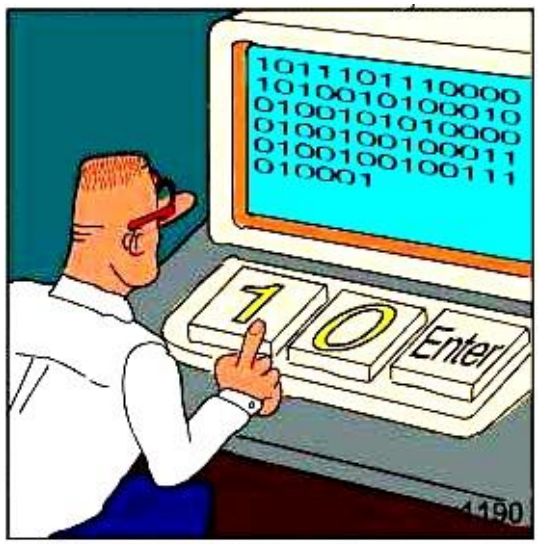
Note: Most Computer Users At The Time Were Extremely Technically-Oriented

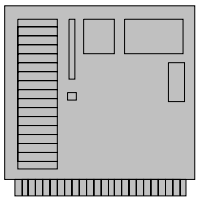


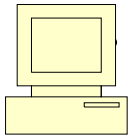
REAL Programmers code in BINARY.

Image by Chris Kania
http://www.kaniamania.com/

ames Tam

Microsoft's Influence On Microcomputers





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Microsoft's Influence On Microcomputers (2)

- IBM approached two companies as possible vendors of an operating system to run it's computers:
  - Digital Research
  - Microsoft
- IBM and Microsoft worked out an arrangement to have a version of Microsoft's DOS (*D*isk *O*perating *S*ystem) run IBM computers: PC-DOS.

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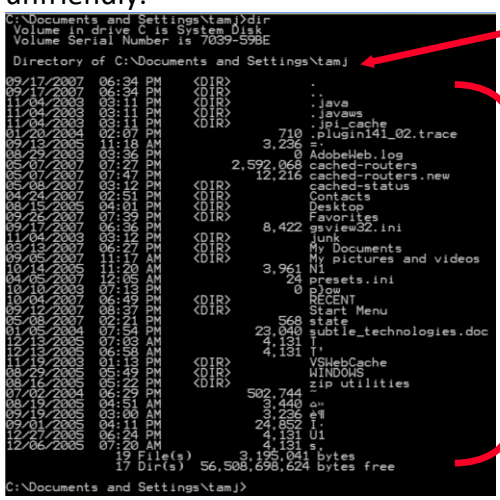
Microsoft's Influence On Microcomputers (3)

- The interface of PC/MS-DOS has been criticized as being user-unfriendly.



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Microsoft's Influence On Microcomputers (4)

- However the interface of PC/MS-DOS was a significant improvement over other operating systems of the day.

Digital Research Inc.: CP/M operating system

James Tam

Microsoft's Influence On Microcomputers (4)

- However the interface of PC/MS-DOS was a significant improvement over other operating systems.

PC/MS-DOS operating system

James Tam

The IBM PC (Personal Computer: 1981)

www.computerhistory.org

- IBM was a large company but a late comer into the microcomputer market.
- As mentioned the IBM PC used an operating system produced by Microsoft.

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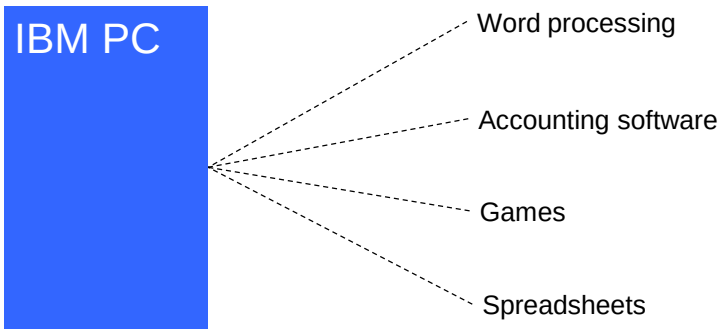
The IBM PC (Personal Computer: 1981): 2

- With the entry of IBM in the microcomputer market, many developers produced a plethora of software.



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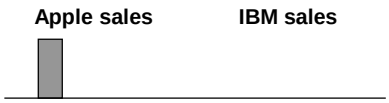
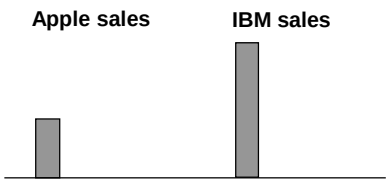
The IBM PC (Personal Computer: 1981): 3

- Apple entered the microcomputer market sooner and already had an established market when IBM began to first market the PC.



- Because of the prevalence of so much software the IBM-PC soon overtook the Apple in sales.



There many other important microcomputer manufacturers (omitted for breviy)

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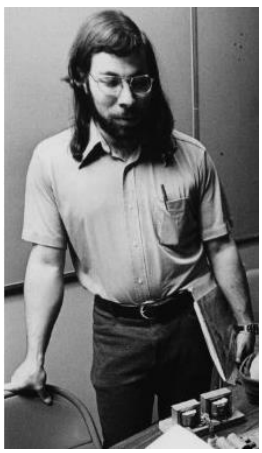
The History Of Apple Computers: Steve And Steve

- Apple was founded by Steven Jobs and Steve Wozniac in Silicon Valley garage.



Steven Jobs

Steve Wozniac

Images © Apple Computer, Inc. from www.computerhistory.org

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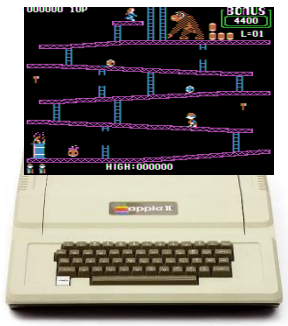
The Apple I Computer (1976)

- It was far from the standard of a modern computer

James Tam

The Apple II Computer (1977)



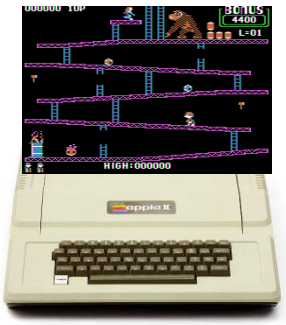
- It was a simpler and more powerful design than the Altair
- The color graphics were superior to larger and more expensive computers
- Strong selling points
  - Name
  - Appearance

Images
Apple II:
www.computerhistory.org

Donkey Kong:
www.donkeykong.gamebub.com

James Tam

The Apple II Computer (1977): 2



- The storage device was primitive by today's standards but actually sufficient to meet the needs of the time
- VisiCalc: "*It was the software tail that wagged the hardware dog*"[1]

Images
Apple II:
www.computerhistory.org

Donkey Kong:
www.donkeykong.gamebub.com

1 "*Just for Fun*" (Chapters 2,3) by Torvalds and Diamond

James Tam

First Graphical Interface

- Contrary to popular belief it was not invented by Apple.
- Xerox star: pioneered the GUI in 1981:

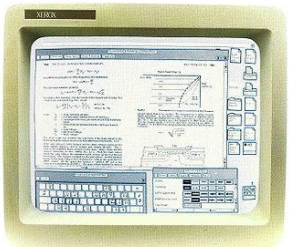


Image of Xerox Star screen from Xerox brochure

- Other GUI-based computers: Apple {Lisa (1983), McIntosh (1984)}, the Commodore Amiga 1000 (1985).
- Although it was a technical innovation the Star was regarded as a business failure.
- It was Apple (and others such as Commodore) who successfully mass marketed a GUI-based computer.

Xerox star hardware picture: www.flickr.com/photos/mwichary

James Tam

The Apple Lisa (1983)

Image © Mark Richards from www.computerhistory.org

- The first GUI-based computer produced by Apple: the Lisa incorporated many of the features of the Xerox Star.
- Like the Star it was expensive ($10K) and sales were weak.

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The Apple Macintosh (1984)

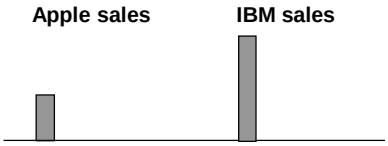
Image © Mark Richards from www.computerhistory.org

- Apple's next computer was the Macintosh
- It incorporated the best features of the Lisa but was sold at a substantially lower price ~$2.4K
- Compared to the IBM-PC it was a price/performance vs. ease of use tradeoff

James Tam

The Attack Of The Clones

- Although it was a late entry into the microcomputer market IBM eventually dominated.



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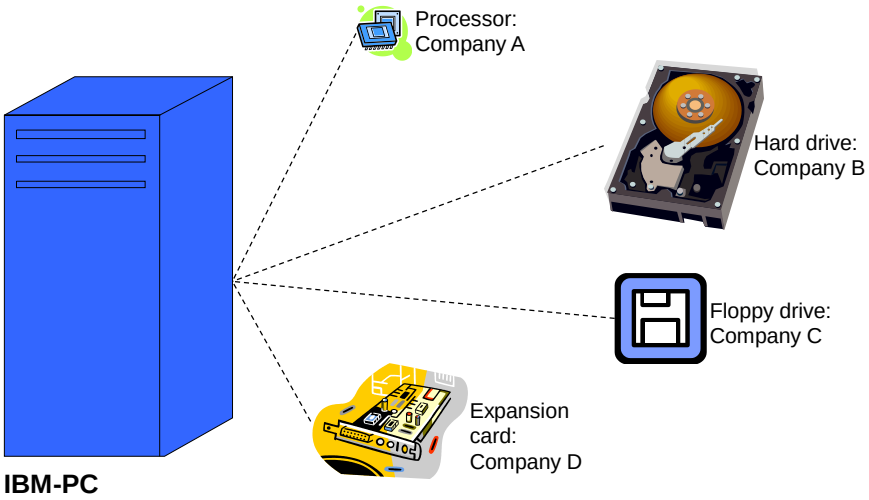
The Attack Of The Clones (2)

- Although the IBM-PC was marketed and sold under the IBM brand most of the parts were not manufactured in-house.

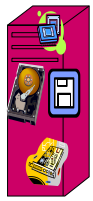


James Tam

The Attack Of The Clones (3)

- The parts manufacturers were free to sell their components to other companies.
- About the same time that the IBM-PC was sold, three ex-employees of Texas Instruments founded their own company: Compaq.
  - They conceived of the idea of producing their own copy of the IBM-PC under their own brand name.
  - It would run under MS-DOS and be 100% compatible with application software written for the PC.
  - The first IBM-PC clone was delivered by Compaq in 1983.

IBM-PC

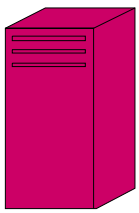


Compaq clone

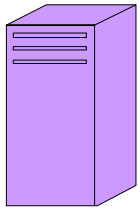
James Tam

The Attack Of The Clones (4)

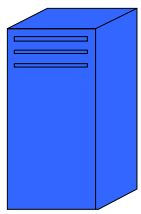
- This opened the flood gates for other computer manufacturers to produce their own clone computers.



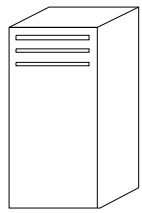
Compaq clone



Dell clone



IBM-PC

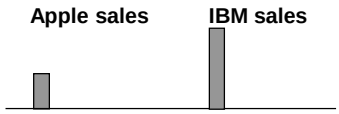


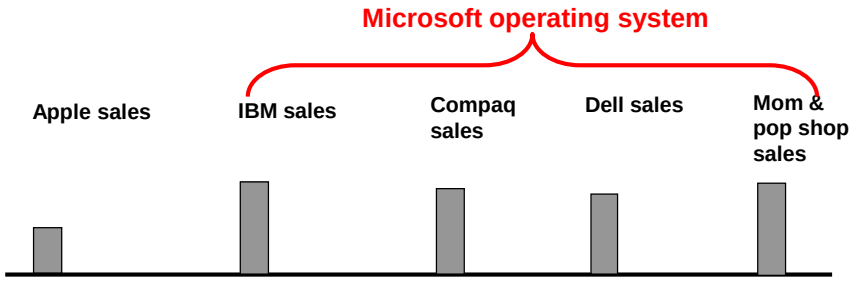
Mom and pop shop clone

James Tam

The Attack Of The Clones (5)

- The result was that IBM eventually lost control over the computer architecture that it was the first one to market.

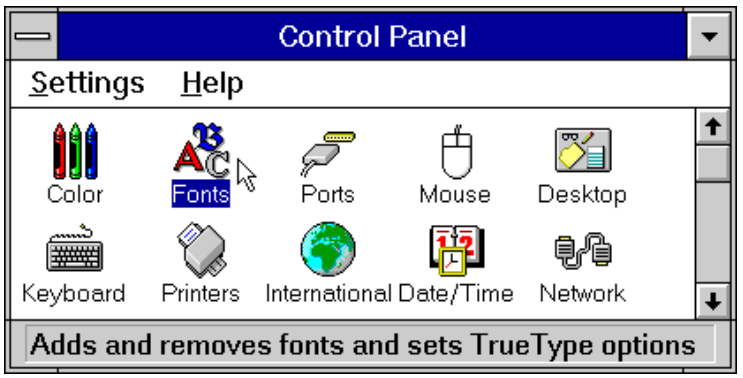




James Tam

The Attack Of The Clones: The Rise Of Microsoft

- The loser of the clone war was IBM.
- The real winner of the clone war was Microsoft.
- By the 1990's Microsoft developed an interface for MS-DOS that incorporated some of the features of the MAC GUI.



Windows 3 image from www.microsoft.com

James Tam

Origins Of The Internet

- What was happening in the 1950's

The Cold War

James Tam

The Cold War And The Space Race

- At the same time that each side (USSR-USA) was trying to be dominant on the ground they also wanted to be dominant in space.
  - Both sides tried to be the first to send a satellite into space.
- In the 1950's it appeared that the USSR had a technological edge:
  - Americans in 1957: A sophisticated three stage rocket was planned as the first human-made vehicle to be spent into space.
  - The USSR in 1957: surprised the world by launching Sputnik I (first artificial satellite).

http://astroprofspage.com

- The launch of Sputnik helped motivate the creation of ARPA (Advanced Research Projects Agency) in the US.

The Cold War And The Space Race (2)

- Later in 1957 the USSR launched another satellite carrying the dog Laika "bark/barker" on a one way trip into space :'(

http://news.bbc.co.uk

ARPA

- APRA was a branch of the ministry of defense.
- The focus was on:
  - Getting different types of computers communicating

James Tam

ARPA (2)

- In the early days of ARPA there 3 separate and incompatible networks to communicate with the 3 different research centers that worked with ARPA.

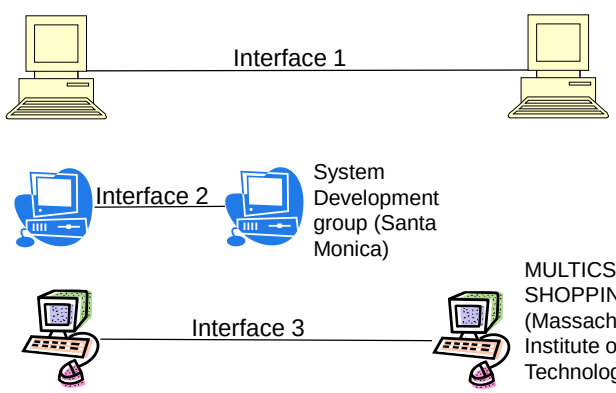
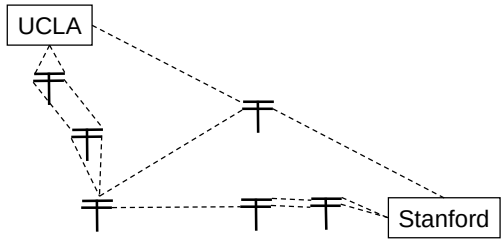


Image credits: Microsoft

1 "A History of the Internet and the Digital Future" (Johnny Ryan, Reaktion

ARPANET

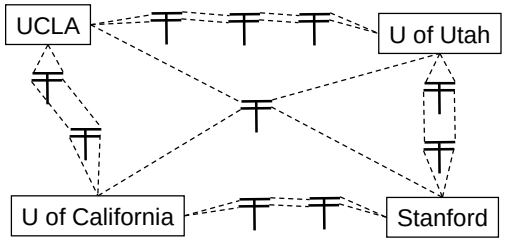
- The first computers were connected via ARPANET (Advanced Research Projects Agency Network).
- The initial ARPANET consisted of 2 host computers which were connected at the start of 1969 (birth of the early Internet!) from the following locations:
  - UCLA
  - Stanford
  - A standard protocol was used so the computers could communicate



James Tam

ARPANET (2)

- Later additional hosts were added to the network (end of 1969) from:
  - The University of California (Santa Barbara)
  - The University of Utah



James Tam

The First Data Sent On The Internet[1]

- Originally the message 'login' was to be transmitted.
- But the transmission stopped (i.e., it "died" after the first two characters).
  - …and thus 'LO' the Internet was born!

1 "On the Way to the Web" (Michael A. Banks, Wiley)

Important Milestones Of The Internet

- In 1972
  - The first "hot application" was introduced by Ray Tomlinson.

- 1989:
  - The ideas behind the World Wide Web were first described in a paper.
- 1990:
  - The ARPANET was shut down.
  - The first "Internet" search program Archie was developed at McGill university.
- 1991:
  - The World Wide Web was released to the public.

James Tam

The History Of The World Wide Web

From www.computerhistory.org (2012)

- Designed in 1989 by Tim Berners-Lee and scientists in Geneva who were interested in making it easier to share research documents.
- Documents could be linked through a protocol called http (hyper text transfer protocol).
- Documents were made available for free browsing and downloading from the web (*substantially* easier than the alternative).
- 1990:
  - The first web browser "WorldWideWeb" (later renamed 'Nexus'[1] was written.
- 1993:
  - Mark Andreessen of NCSA (National Center for Super Computing Applications) launched Mosaic X the first popular web browser.

Source http://www.w3.org/People/Berners-Lee/WorldWideWeb.html

James Tam

The History Of The World Wide Web (2)

From www.computerhistory.org

- Prior to the advent of the WWW the Internet was largely used by a niche user group.
- The advent of the WWW drastically changed that.
  - Now some people even equate the World-Wide-Web with the Internet itself!

James Tam

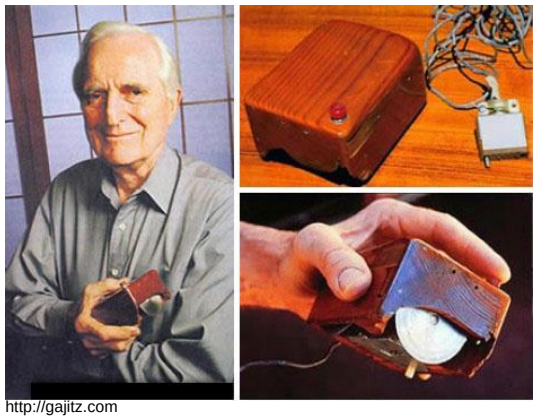
The Mouse

- 1962: ARPA (under JCR Licklider) provided a special fund to realize the vision of a "mechanically enhanced man".
  - It came out of a paper published by Licklider (before he joined ARPA) where he "…forecast a future that will involve a very close coupling between the human and electronic members of the [human-technology] partnership."[1]
- Douglas Engelbart applied for funding.

1 "A History of Modern Computing" (Paul Ceruzzi: MIT Press 2003)

The Mouse (2)

- Engelbart spent his time studying an experimenting with ways to improve communication between people and computers.
- 1967: he described (his most famous) invention, the mouse.



http://gajitz.com

You Should Now Know: History Part II

- When were the different categories of computers completed and what were some of their distinguishing features:
  - The computers of the electronic revolution
  - The first SPC (stored program computer)
- Who were the people who were involved in the creation of these machines.

James Tam

You Should Now Know: History Part III

- How the invention of the microprocessor revolutionized computing
- What was the first computer that was successfully targeted specifically for the home user
- What was the influence of Microsoft on microcomputers
- The history of the IBM-PC
- The foundation of Apple Computers
- The history of some of Apple's early computers: Apple I, Apple II, Lisa, Macintosh
- How IBM lost control over a computer architecture that it developed through the rise of clone computers
- How the rise of clone computers lead to the market dominance of Microsoft in the microcomputer market

James Tam

You Should Now Know: History Part III (2)

- What was the first GUI-driven computer: Xerox Star
- The early history of the Internet
  - When did it first become operational
  - How it works
  - What were some major milestones and when did they occur
  - When was the WWW invented and who was behind its creation
- Computer Mouse
  - Who invented the device
  - When was it invented
  - What was the motivation for its creation