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 Bletchley Park computers

James Tam

The People Behind The ABC (Atanasoff-Berry Computer)

•John Atanasoff

- A professor at Iowa State College (now Iowa State university)

•Clifford Berry

- A graduate student studying under Atanasoff

James Tam

Motivations For Developing The ABC

•Atanasoff was researching methods of solving complex mathematical equations.

$$\varepsilon_0 \oint E \cdot dA = \sum q$$

$$\oint B \cdot ds = \mu_0 \int J \cdot dA + \mu_0 \varepsilon_0 \frac{d}{dt} \int E \cdot dA$$

$$\oint E \cdot ds = -\frac{d}{dt} \int B \cdot \cdot dA$$

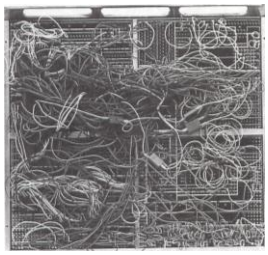
$$\oint B \cdot dA = 0$$

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

James Tam

Motivations For Developing The ABC (2)

•His modifications were extensive



•The folks at IBM weren't happy with the modifications

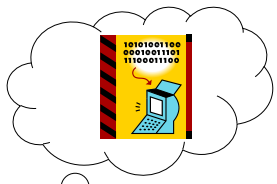
James Tam

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.



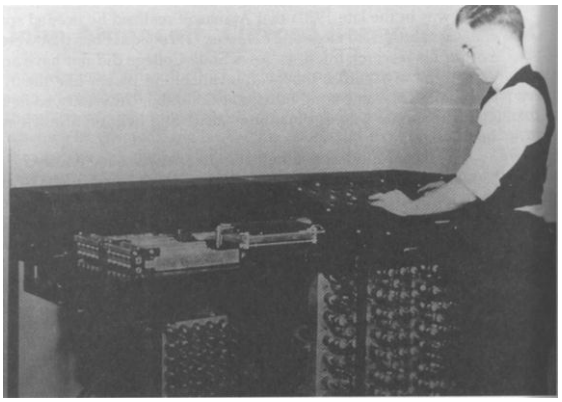
•This lead to an astonishing break through!

Wav file from "The Simpsons"

James Tam

The First Electronic Computer: The ABC

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

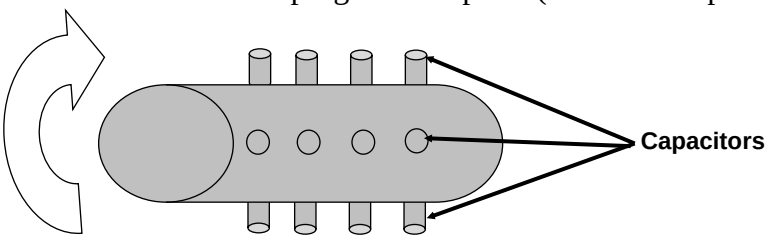


A photo of Clifford Berry and the ABC, courtesy of Dr. Atanasoff

James Tam

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 (modern computer).



James Tam

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)

- 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.
  - Developed the designs for the ENIAC

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

- Joseph Chedaker
  - Supervised the construction team

James Tam

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

- It was completed in 1949 at a cost of $500,000
- The machine was huge and required a great deal of resources
  - 8’ high x 3’ deep x 100’ long
  - 30 tons
  - 140,000 watts to power
  - 18,000 vacuum tubes

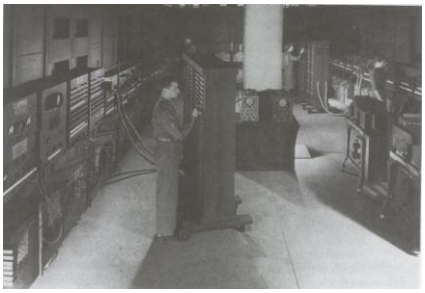


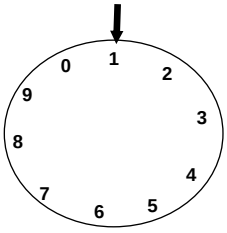
Image from the History of Computing Technology by Michael R. Williams

James Tam

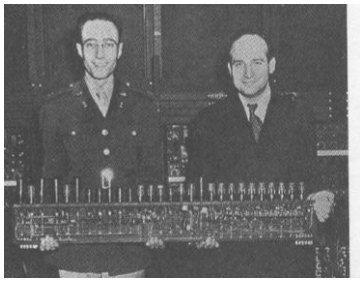
The Second Electronic Computer: The ENIAC (2)

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

Mechanical approach



The approach used in the ENIAC



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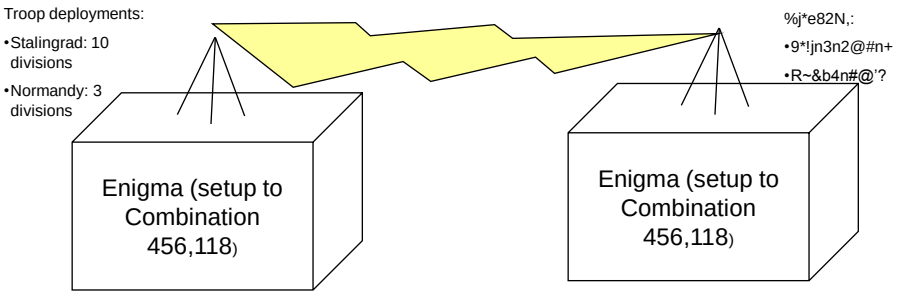
The ABC And The ENIAC

- 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

The Machines At Bletchley Park: Colossus 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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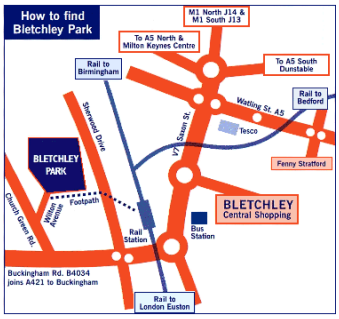
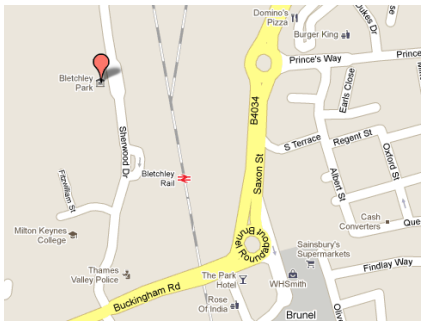
The Machines At Bletchley Park: Colossus Machines (2)

•The British code breaking group, the Code and Cipher School worked on deciphering the German codes at Bletchley Park outside of London:





•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

James Tam

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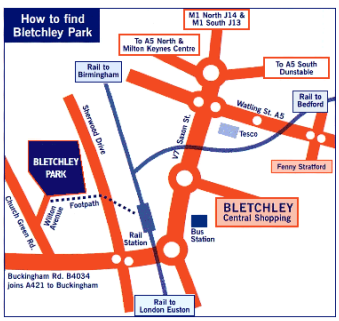

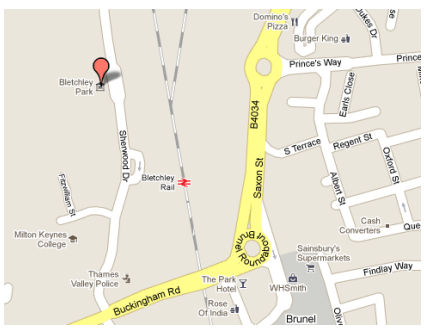

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Top secret

James Tam

An Enigma Machine

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

James Tam

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).

Image from the History of Computing Technology by Michael R. Williams

James Tam

The Third Set Of Electronic Computers: The Machines At Bletchley Park

- Heath Robinson machines (1942)
  - Used a combination of mechanical relays and electronic vacuum tubes
  - Their exact function is still unknown but they were probably used for deciphering the German codes
  - Unreliable
- The Colossus (1943)
  - Developed to replace the Heath Robinson machines
  - Addressed the reliability problem by replacing the relays with vacuum tubes
  - The produced a remarkable increase in speed over the previous machines.
  - Miraculously the first one was completed in less than a year.

James Tam

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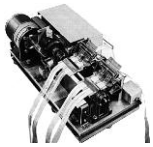
James Tam

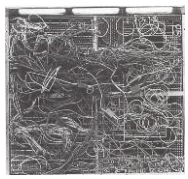
Before The First Stored Program Computers

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

  - Punch tape



  - Complex wiring and rewiring techniques.



James Tam

Who Came Up With The Concept Of The Stored Program Computer?

- Why it's important.
  - It's a fundamental part of modern computers.
- 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

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

James Tam

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.

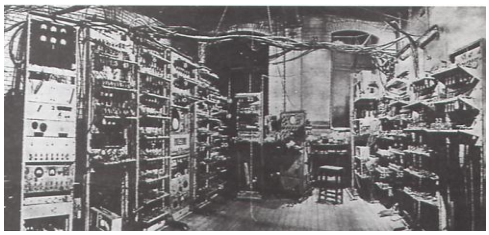


Image from the History of Computing Technology by Michael R. Williams

James Tam

History Part III: Modern Times

- History of the microcomputer
- History of the Internet

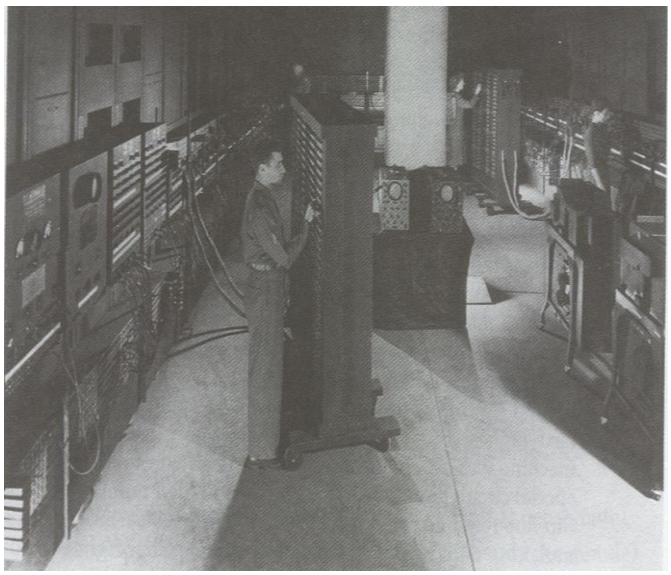
James Tam

History Of The Microcomputer

- The microprocessor
- The first 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

James Tam

Recall: Computers Before The Microprocessor



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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.

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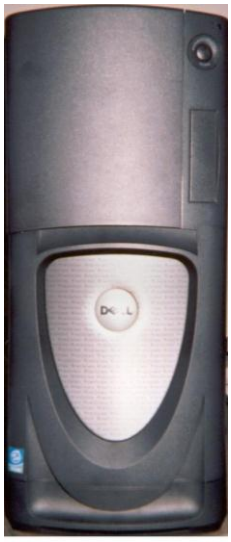
What Is Microcomputer?

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



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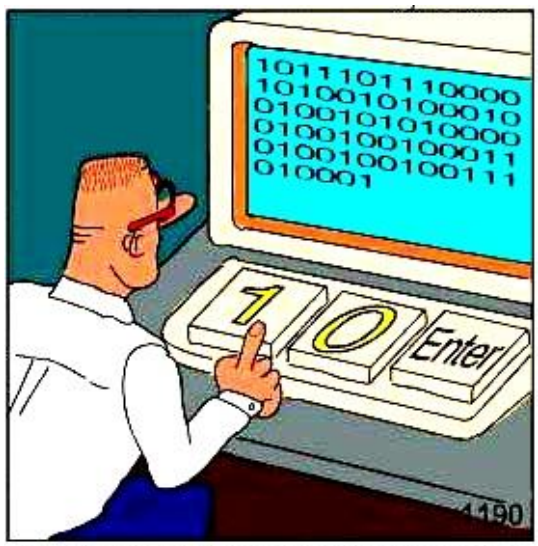
The First Computer For Home Users: The Altair

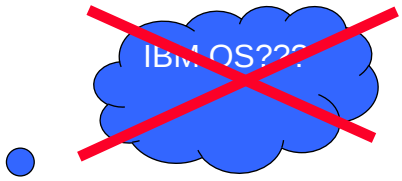
Note: Most Computer Users At The Time Were Extremely Technically-Oriented



REAL Programmers code in BINARY.

James Tam

Microsoft's Influence On Microcomputers



James Tam

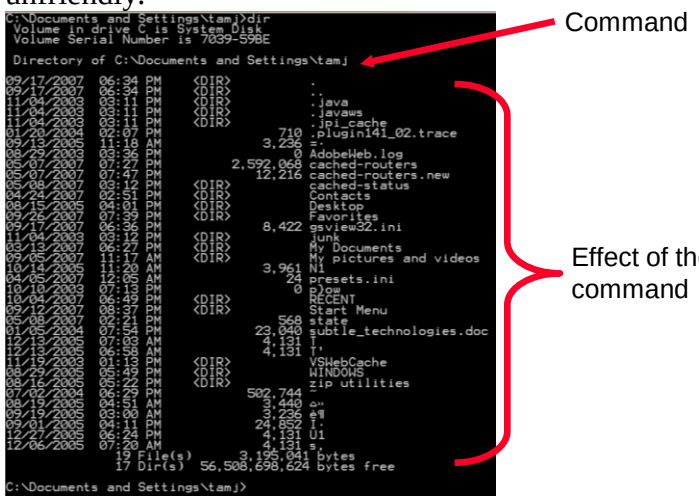
Microsoft's Influence On Microcomputers (2)

- 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.

James Tam

Microsoft's Influence On Microcomputers (3)

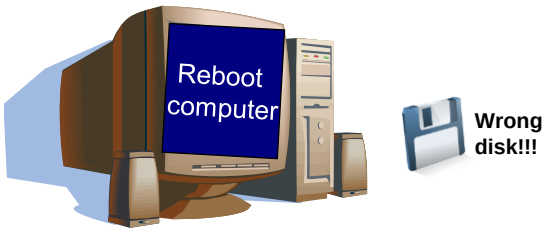
- The interface of PC/MS-DOS has been criticized as being user-unfriendly.



Microsoft's Influence On Microcomputers (4)

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

CP/M operating system



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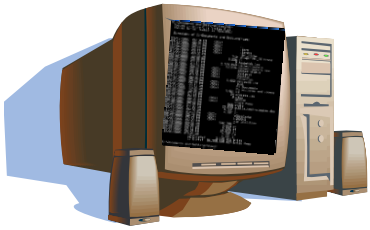
PC/MS-DOS operating system



Wrong disk!!!

Correct disk

```
Not ready reading drive A
Abort, Retry, Fail?_
```

James Tam

The IBM PC (Personal Computer: 1981)

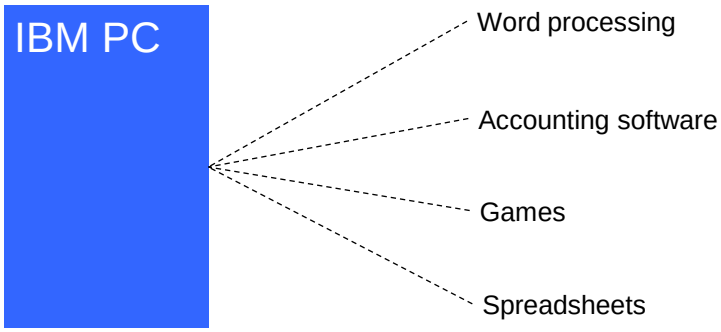
•IBM was a large company but a late comer into the microcomputer market.

•As mentioned its machines used an operating system produced by Microsoft.

James Tam

The IBM PC (Personal Computer: 1981): 2

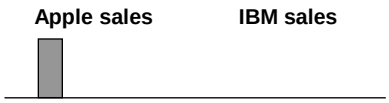
•With the entry of IBM in the microcomputer market, many developers produced a plethora of software.



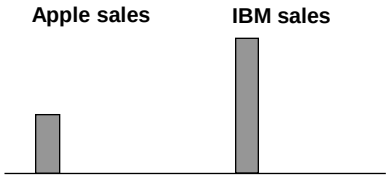
James Tam

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.



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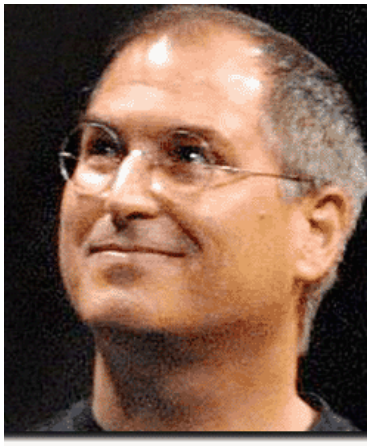
The History Of Apple Computers: Steve And Steve

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



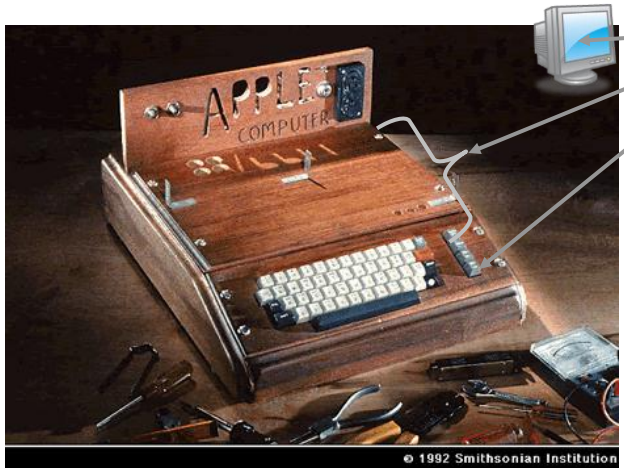
Steven Jobs

Steve Wozniac

James Tam

The Apple I Computer (1976)

Extras



- Purportedly built under extreme conditions
- 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

James Tam

The Apple II Computer (1977): 2

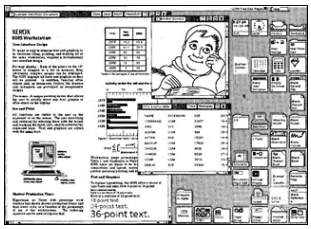
- The storage device was primitive by today's standards but actually sufficient to meet the needs of the time
- VisiCalc: "*It was the software tail that wagged the hardware dog*"

James Tam

First Graphical Interface

•Contrary to popular belief it was not developed by Apple.

•Xerox star: pioneered in early '80s, copied by almost everyone



- Simulates desktop with icons
- In and out baskets
- File folders and documents
- Calculators
- Printers
- Blank forms for letters and memos

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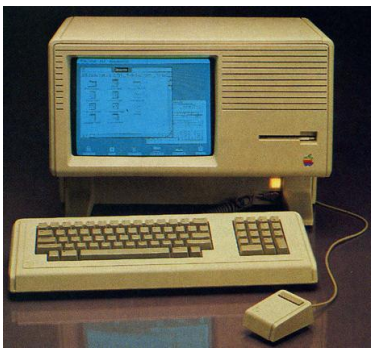
The Apple Lisa (1984)



•The Lisa (1983) incorporated many of the features of the Xerox Star.

•Like the Star it was expensive ($10K) and sales were weak

James Tam

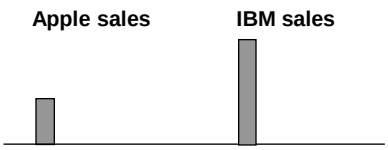
The Apple Macintosh (1984)

- Apple's next computer was the Macintosh
- It incorporated the best features of the Lisa but was sold at a substantially lower price.
- Also features not present in the Lisa were added to the Macintosh
- Compared to the IBM-PC it was a speed 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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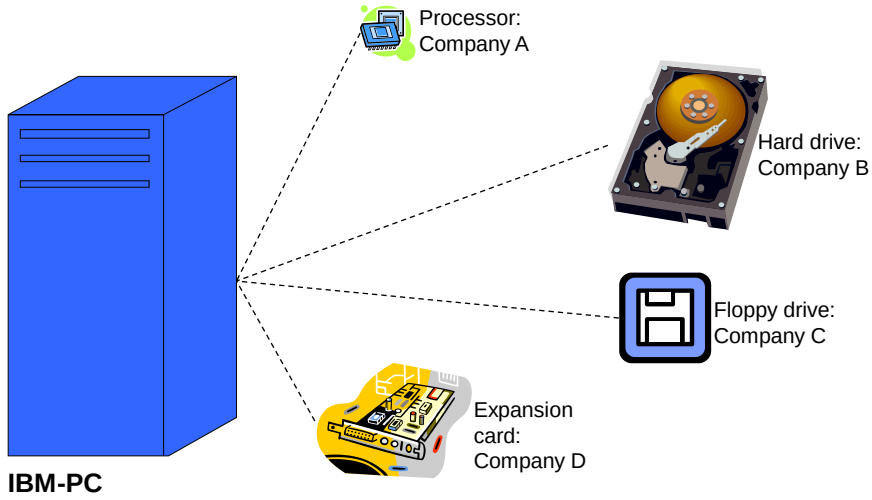
The Attack Of The Clones (2)

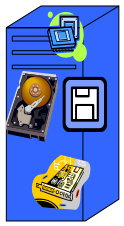
- Although the IBM-PC was marketed and sold under the IBM brand most of the parts were not manufactured in-house.



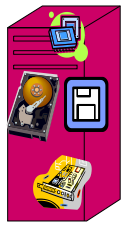
James Tam

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 producing their own copy of the IBM-PC under their own brand name.
  - It would run under MS-DOS and be 100% compatible with other software
  - The first IBM-PC clone was delivered by Compaq in 1983.



IBM-PC

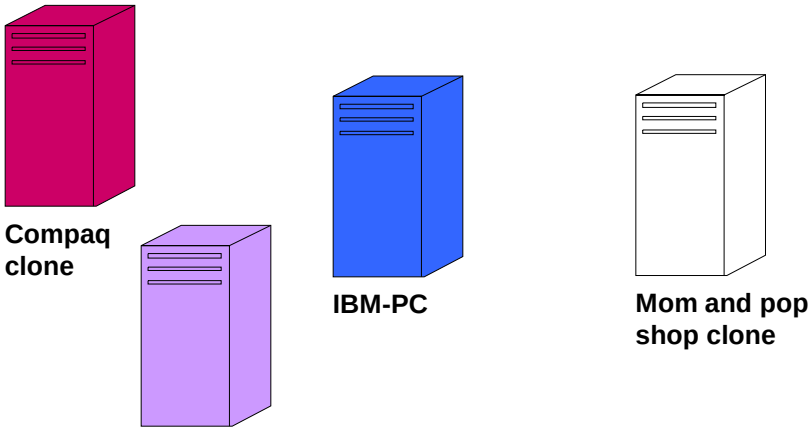


Compaq clone

James Tam

The Attack Of The Clones (4)

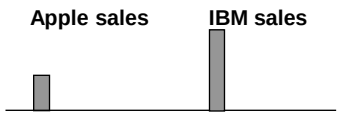
•This opened the flood gates for other computer manufacturers to produce their own clone computers.

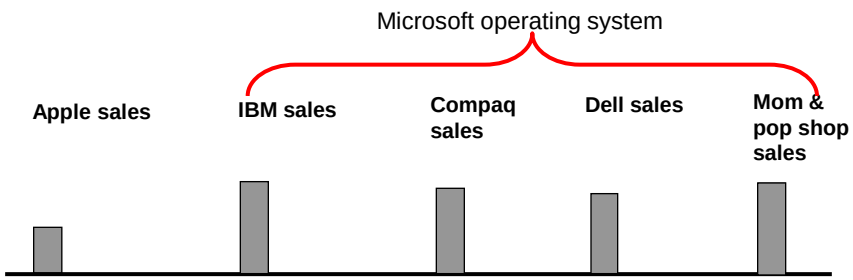


James Tam

The Attack Of The Clones (5)

•The result was that IBM eventually lost control over the computer architecture that it marketed.

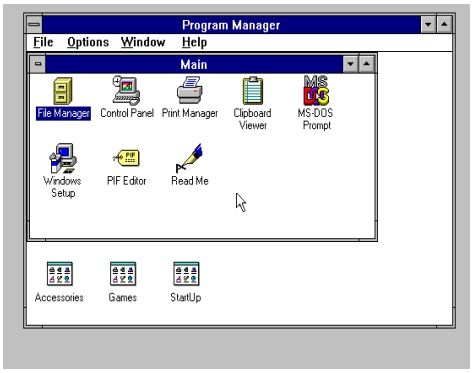




James Tam

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 3.1 © Microsoft

James Tam

Versions Of Microsoft Operating Systems

- PC/MS-DOS (many versions): text based command line
  - Windows 1.X, 2.X, 3.X
- Windows 95, 98, ME: GUI interface, MS-DOS operating system
- Windows NT: 2000, XP, Vista, 7: newer more secure and stable operating system (Windows NT)

James Tam

Origins Of The Internet

•History: what was happening in the 1950's

Rock and roll was in its infancy

The Cold War was on

James Tam

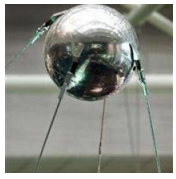
Origins Of The Internet (2)

•The cold war competition spilled over into space exploration.

•Both sides tried to be the first to send a satellite into space.

•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).



•The launch of Sputnik motivated the creation of ARPA (Advanced Research Projects Agency) in the US.

James Tam

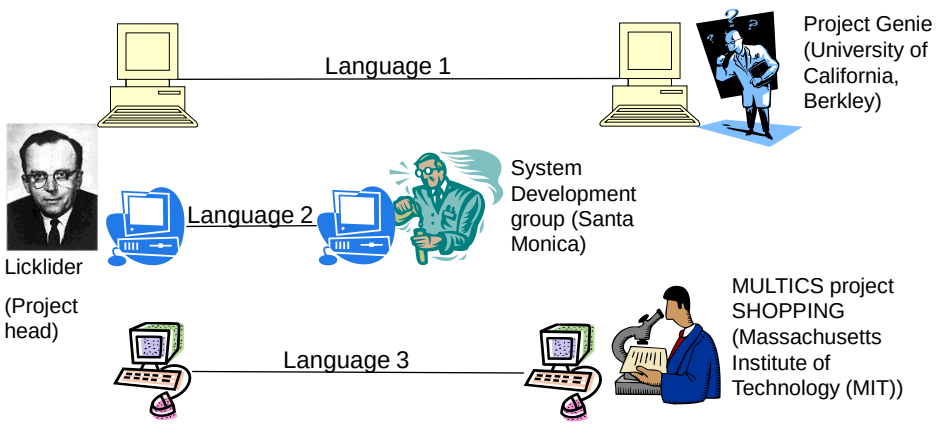
ARPA

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

James Tam

Getting Computers To Communicate

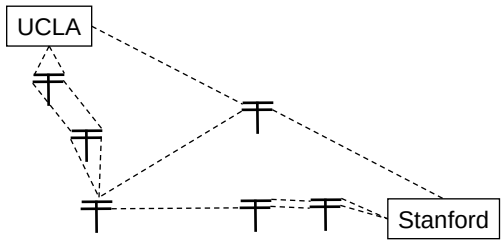
- Researchers working for ARPA needed computers to communicate and to share information.
- Current approaches weren't satisfactory.



James Tam

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 from the following locations:
  - UCLA
  - Stanford



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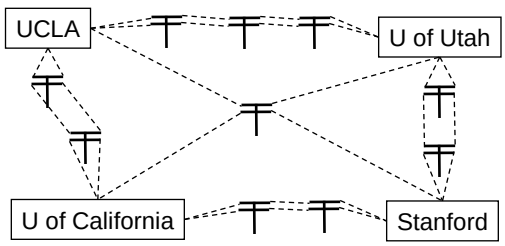
ARPANET (2)

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



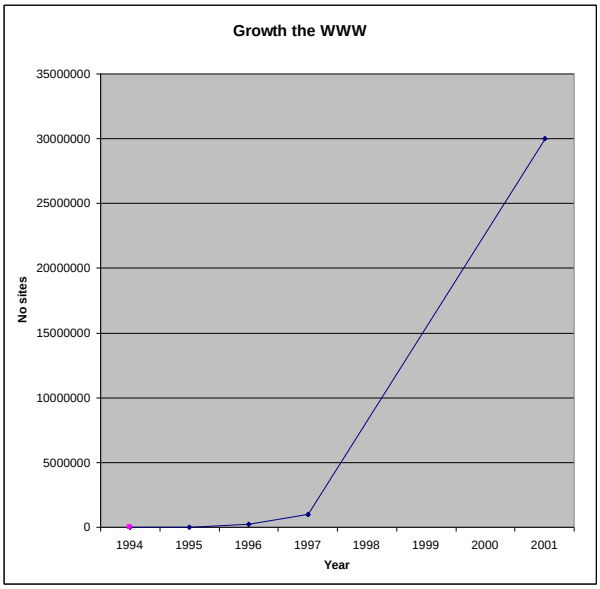
James Tam

Important Milestones Of The Internet

- In 1972
  - The first "hot application" (something that really caught on) 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 Growth Of The World Wide Web



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The History Of The World Wide Web

- 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 (rules of communication) 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" was written.
- 1993 Mark Andreesen of NCSA (National Center for Super Computing Applications) launched Mosaic X the first popular web browser.

James Tam

The History Of The World Wide Web (2)

- 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.

James Tam

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 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