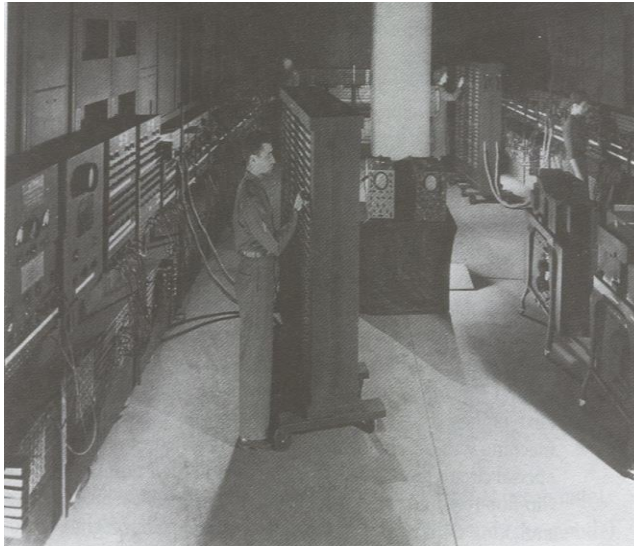


# Technology Companies

Hardware and software houses of the  
microcomputer age

James Tam

## Recall: Computers Before The Microprocessor



James Tam

Image: "A History of Computing Technology" (Williams)

## The Microprocessor<sup>1, 2</sup>

- Intel was commissioned to design a special purpose system for a client.
  - Busicom (client): A Japanese hand-held calculator manufacturer
  - Prior to this the core money making business of Intel was manufacturing computer memory.
- “Intel designed a set of four chips known as the MCS-4.”<sup>1</sup>
  - The CPU for the chip was the 4004 (1971)
  - Also it came with ROM, RAM and a chip for I/O
  - It was found that by designing a general purpose computer and customizing it through software that this system could meet the client’s needs but reach a larger market.
    - Clock: 108 kHz<sup>3</sup>

1 <http://www.intel.com/content/www/us/en/history/museum-story-of-intel-4004.html>

2 <https://spectrum.ieee.org/tech-history/silicon-revolution/chip-hall-of-fame-intel-4004-microprocessor>

3 <http://www.intel.com/pressroom/kits/quickreffam.htm>

James Tam

## The Microprocessor<sup>1,2</sup> (2)

- Intel negotiated an arrangement with Busicom so it could freely sell these chips to others.
  - Busicom eventually went bankrupt!
  - Intel purchased the rights to the chip and marketed it on their own.

James Tam

## The Microprocessor (3)

- 8080 processor: second 8 bit (data) microprocessor (first was 8008).
  - Clock speed: 2 MHz
  - Used to power the Altair computer
  - Many, many other processors came after this:
    - 80286, 80386, 80486, Pentium Series I – IV, Celeron, Core
- The microprocessors development revolutionized computers by allowing computers to be more widely used.
  - Compact
  - Cheap (eventually)

James Tam

## What Is Microcomputer?

- A computer that uses a microprocessor as it's main processor.
- Sometimes it's referred to as a 'PC' (Personal Computer).
  - Designed for use by only one person at a time.
  - Unfortunately this term has taken on multiple meanings.
    - PC = IBM PC (a model produced by IBM)
    - PC = A computer running a Microsoft operating system.
- Consequently the less ambiguous term 'microcomputer' will be used.



Image courtesy of James Tam

James Tam

## The Altair 8800

- Created by Ed Roberts in 1974.<sup>1</sup>
- The Altair was one of the most popular of the first set that was targeted towards home users.



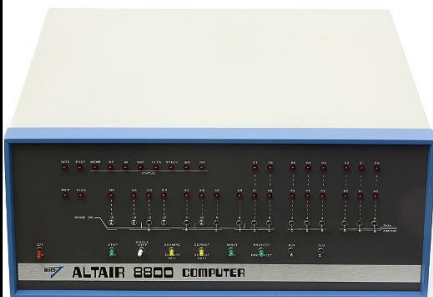
<http://www.guardian.co.uk>

- It was marketed as a mini-computer (less than a expensive mainframe) but Roberts was often credited as “... the inventor of the personal computer” (Ceruzzi p. 226).

James Tam

<sup>1</sup> “A History of Modern Computing” (2<sup>nd</sup> Edition) Paul E. Ceruzzi

## The Altair (2)



Images © Mark Richards from [www.computerhistory.org](http://www.computerhistory.org)

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

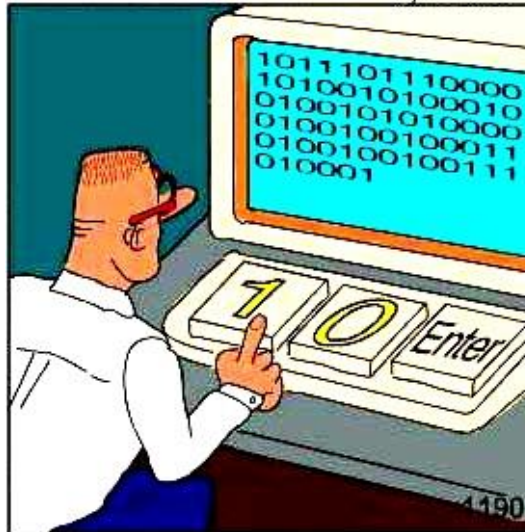


Image by Chris Kania  
<http://www.kaniamania.com/>

**REAL Programmers code in BINARY.**

James Tam

## Bill Gates



<http://www.syllablesoup.com/>

- His family was successful.
  - Banking
- His family with also involved in the community and government.
  - Philanthropy e.g., United Good Neighbors (pred. United Way).
- William Henry Gates III born October 28, 1955.
  - Nicknamed 'Trey' by his father.
- Avid reader:
  - World book (A-Z) at age 7 or 8
- Known mannerism



[www.colourbox.com](http://www.colourbox.com)

James Tam

## Bill Gates (2)

- Known for his tenacity, even as a child.



- First use of a computer was in school.
  - A teletype connected to mini computer.
  - Young Bill typed in a command.
  - Seconds later the computer responded.
  - “It was better than science fiction [for Bill]”<sup>1</sup>

James Tam

<sup>1</sup> “Hard Drive: Bill Gates and the making of the Microsoft Empire” (Jim Wallace & Jim Erickson: Harper Business 1993)

## Bill Gates (3)

- His other classmates were similarly excited, among which was a young Paul Allen (who along with Bill) would found Microsoft.



[www.digitaltrends.com](http://www.digitaltrends.com)

James Tam

## Steve Ballmer



Image copyright unknown

- Hired by Microsoft in 1980 after dropping out of the MBA program.<sup>1</sup>

<https://www.forbes.com/profile/steve-ballmer/?sh=1e30632e4818>

James Tam

## Steve Ballmer, Bill Gates

- Both Ballmer and Gates were very intense.
- They would often engage in heated debates about various topics well into the night.
  - “High bandwidth communication” (- Bill Gates)
  - They were described by others as being like “...two computers connected by modem”<sup>1</sup>
- They were inspired by the sight of the Altair computer in Popular electronics.

James Tam

<sup>1</sup> “Hard Drive: Bill Gates and the making of the Microsoft Empire” (Jim Wallace & Jim Erickson: Harper Business 1993)

## Steve Ballmer & Bill Gates (2)

- Their first project was to create a BASIC translator for the 8080-driven Altair.
  - They were still undergraduate students (Harvard).
  - It was believed to be impossible to cram the complexity of this language into such limited hardware (limited memory - 4 KB! -for the interpreter plus room was needed for application programs to run).
  - It also had to run fast.
  - They didn't have access to an Altair (emulated on another computer PDP-10).
  - They worked at a frantic pace in the lab often with only a hour of sleep for eight weeks.
  - They succeeded!
  - "It was the coolest program that I ever wrote."<sup>1</sup>
  - First instruction given to Microcomputer BASIC:  $2 + 2 = 4$
- It eventually became Microsoft Basic.

James Tam

<sup>1</sup> "Hard Drive: Bill Gates and the making of the Microsoft Empire" (Jim Wallace & Jim Erickson: Harper Business 1993)

## Microsoft: Beginnings

- Microcomputer-software.
- Because Gates completed most of the work on BASIC there was a 64/36 split in ownership of the new company.
- Initial funds: royalties from the use of their version of BASIC (included with each Altair computer).
  - \$30/computer (4 KB)
  - \$35/computer (8 KB)
  - \$60/computer (extended version of BASIC, required external storage)
- Also funds came from licensing of the BASIC source code.
  - Developers could modify the translator as they saw fit (!!!)



James Tam



## Microsoft: Beginnings (2)

- The company had humble beginnings: a section of the office was given to Microsoft by MITS (manufacturer of the Altair).
  - Gates still continued his workaholic coding schedule.



James Tam

## Microsoft: Beginnings (4)

- To help promote the Altair (and the BASIC that came with it) Gates toured with MITS to meet with computer clubs which included: engineers, technicians, hobbyists, hackers, electronicphilles etc.
  - Eventually BASIC became the standard for computers.

James Tam

## Microsoft: Beginnings (5)

- One of these computer clubs (“Homebrew”) started in garage in Menlo Park (next to Palo Alto and Stanford university).
- More than 30 people came out for the first meeting including Steve Wozniak (who was then working in the calculator division of Hewlett-Packard).
  - Within a year of this first meeting: Wozniak along with Steve Jobs would build a personal computer of their own: Apple I.
- Although Microsoft got its start through its relationship with MITS it eventually was hobbled by it.
  - Microsoft could not license BASIC to MITS competitors.
  - At first there were no competitors (no problem).
  - In a few years dozens of other companies manufactured their own microcomputers: Commodore (PET), Radio Shack (TRS-80), Apple (Apple I).

James Tam

## Microsoft: Beginnings (6)

- After a long and complex legal proceedings Microsoft won the rights to sell BASIC as they saw fit.
- BASIC was licensed to many other computer manufacturers: Radio Shack (TRS-80), Apple (Apple II)
- But throughout the legal battle the company still worked on other programming languages: COBOL, FORTRAN as well as developing BASIC for chips other than the 8080.
- Gates and Ballmer were frequently underestimated by their business rivals (“who are these kids?”)



<http://www.syllablesoup.com/>

- But they were more than able to hold their own.

James Tam

## Microsoft: Beginnings (7)

- However Gates still made time for programming:
  - Competitions were held with employees to see who write a program in the fewest lines of code.
  - In the early years Gates himself indicates that he was heavily involved in all projects and there wasn't a line of code that he didn't personally look over (or even recode).

James Tam

## Commodore Business Machines



- Founded by Jack Tramiel
- Around 15, Jack Tramiel (then named Idek Tramielski) and his parents were shipped with other Jews from Lodz, Poland to Auschwitz in 1939
- He and his mother survived the months till Auschwitz' fall in 1944.
- After emigrating to America, Jack Tramiel enlisted and served four years in the U.S. Army.
  - At Fort Dix, Jack showed a talent for un-jamming typewriters.
- When Tramiel left the army, he started work at a typewriter repair shop and then later set up his own typewriter repair business in the Bronx.

James Tam

Image: <http://www.commodore.ca>

## Commodore Business Machines (2)

- 1955: Jack moves to Toronto, Canada and founds Commodore International Limited to assemble typewriters in Canada.
- C. Powell Morgan, the head of the Atlantic Acceptance Company financially back his business.
- 1965: Atlantic goes bankrupt and C. Powell Morgan is indicted by the Canadian government amid charges of fraudulent financial statements, dummy companies, and propped stock prices.
  - Tramiel was considered suspect as well, but was never charged.
  - 1966: To keep the struggling Commodore afloat, Jack gave partial control (17%) of Commodore to a new investor, Irving Gould for \$400,000.

James Tam

## Commodore Business Machines (3)



[www.awesomepet.me](http://www.awesomepet.me)

- 1976:
  - Commodore sets up shop on Palo Alto California
  - Commodore unveils the Commodore PET microcomputer.
  - About the same time the Apple II and TRS-80 are also unveiled.
  - 4 KB or 8 KB of 8 bit RAM.
  - Unlike many of the companies Commodore is able to start world wide distribution in months instead of years.



[www.commodore.ca](http://www.commodore.ca)

James Tam

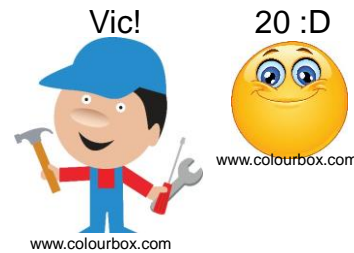
## Commodore Business Machines (4)

- 1981:
  - Commodore unveils the Commodore VIC-20 aka "the Friendly Computer" the first color microcomputer to sell for under \$300 (299.95).
  - Specification:
    - 5k RAM expandable to 32k
    - A 22 column x 23 row 8/16 color display



[www.gamesgroundbase.com](http://www.gamesgroundbase.com)

**Vic20?**



[www.colourbox.com](http://www.colourbox.com)

James Tam

## Commodore Business Machines (5)

- 1982:
  - Commodore introduces the VIC Modem, a 300 baud cartridge modem for US\$110.
  - Commodore 64: 64KB RAM & Microsoft BASIC \$600
- 1985: [July]
  - Commodore unveils the new Amiga 1000.
  - It features a multitasking, windowing operating system.
  - Specifications 7.14 MHz 68000 CPU, 256KB RAM, and 880KB 3.5-inch disk drive (\$1300).
  - 4096 color display



[www.obsoletecomputermuseum.org](http://www.obsoletecomputermuseum.org)

James Tam

## Commodore Business Machines (6): HAM Graphics (Simulation)

- Commodore (4096 color) HAM graphic



en.wikipedia.org

- Microsoft VGA/EGA (256/16 color) graphic



256 colors



16 colors

James Tam

## Commodore Business Machines (7)

- 1987:
  - Commodore launches its first IBM PC-compatible machines.
- 1990:
  - NewTek releases the Video Toaster, a professional quality hardware/software video effects tool for the Commodore Amiga 2000 (1 MB RAM), for US\$1600.
  - The toaster allowed for professional quality video editing and the creation of special effects.



Babylon 5 © Warner Brothers

Other notable uses of the VideoToaster:

- The Tonight Show
- SeaQuest DSV

•A later version was co-developed by actor Wil Wheaton



Star Trek ©  
Paramount

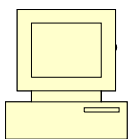
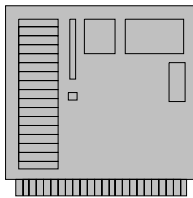
James Tam

## Commodore: Market Share

- Apple Computer shipped 600,000 Apple II computers
- Commodore:
  - Commodore has shipped 750,000 VIC-20 computers .
  - Commodore 64 sales 17-22 million (total) units, the most sales for a particular model of computer.

James Tam

## Birth Of The Microsoft OS



Clipart: Microsoft

James Tam

## Birth Of The Microsoft OS (2)

- IBM approached two companies as possible vendors of an operating system to run its computers:
  - Digital Research (CP/M operating system was standard for Intel 8080 based systems)
    - (There soon to be a 16 bit extension coming but not far enough in development).
  - Microsoft (never wrote operating system software just a BASIC interpreter).
    - Microsoft: 7 million in annual sales
    - IBM: 30 billion in yearly revenues.
- IBM and Microsoft worked out an arrangement to have a version of Microsoft's DOS (Disk Operating System) run IBM computers: PC-DOS.
- MS-DOS was based on 86-DOS an OS written by Tim Paterson of Seattle Computer products (later Q-DOS)

James Tam

## Birth Of The Microsoft OS (3)

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

```
C:\Documents and Settings\tam>dir
Volume in drive C is System Disk
Volume Serial Number is 7039-598E

Directory of C:\Documents and Settings\tam\
09/17/2007 06:34 PM <DIR> .
09/17/2007 06:34 PM <DIR> ..
11/04/2003 09:11 PM <DIR> .java
11/04/2003 09:11 PM <DIR> .javaws
11/04/2003 09:11 PM <DIR> .jpl_cache
01/20/2004 02:07 PM      710 .plugin141_02.trace
05/29/2005 11:10 AM      3,236 .
05/07/2007 07:27 PM      2,592,068 AdobeWeb.log
05/07/2007 07:47 PM      12,216 cached-routers
05/08/2007 03:12 PM      <DIR> cached-routers.new
04/24/2007 02:51 PM      <DIR> cached-status
05/15/2005 04:51 PM      <DIR> Contacts
05/26/2007 07:39 PM      <DIR> Desktop
05/17/2007 06:36 PM      8,422 Favorites
03/13/2007 06:27 PM      <DIR> junk
05/05/2007 11:10 AM      <DIR> My Documents
10/10/2003 07:19 AM      3,961 My pictures and videos
04/05/2007 12:05 PM      24 .NET
10/10/2003 07:19 AM      0 .NET
05/12/2007 08:39 PM      <DIR> Start Menu
05/08/2004 07:44 AM      56 Start Menu
05/08/2004 07:44 AM      23,040 start
12/13/2005 07:00 AM      4,131 sukie_technologies.doc
12/13/2005 07:00 AM      4,131 .
11/19/2003 01:13 PM      <DIR> VSWebCache
08/29/2005 05:49 PM      <DIR> WINDOWS
08/29/2005 05:49 PM      <DIR> zip utilities
07/02/2004 06:29 PM      502,744 .
08/19/2005 04:50 AM      440 .
08/19/2005 04:50 AM      24,632 .
05/01/2005 04:11 PM      24,632 .
12/27/2005 04:13 PM      4,131 .
12/06/2005 07:30 PM      4,131 .
19 File(s)      3,195,041 bytes
17 Dir(s)        56,508,698,624 bytes free

C:\Documents and Settings\tam>
```

Effect of the command

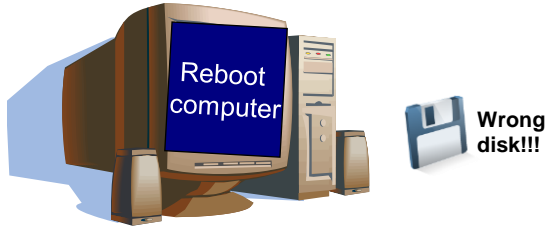
James Tam



## Birth Of The Microsoft OS (4)

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

CP/M operating system



Clipart: Microsoft

James Tam

## Birth Of The Microsoft OS (5)

- 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)



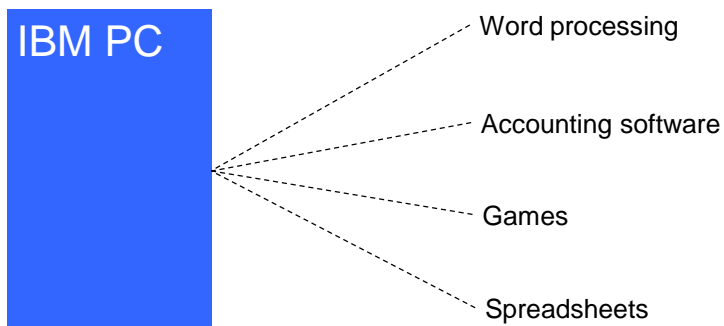
[www.computerhistory.org](http://www.computerhistory.org)

- 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

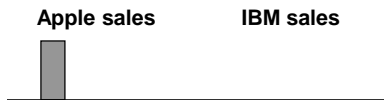
- With the entry of IBM in the microcomputer market, many developers produced a plethora of software.



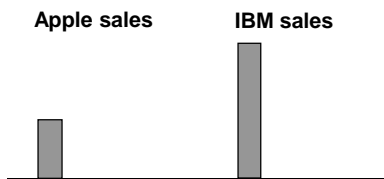
James Tam

## 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 Apple (and other vendors) in sales.



James Tam

## Radio Shack (TRS Computers)<sup>1</sup>

- TRS-80 (1977)
  - ROM: startup routine and (non-Microsoft) Basic
  - Programs could be loaded from cassette or disk into RAM



[www.pc-history.org](http://www.pc-history.org)

- One version of TRS-80 was an early laptop



<http://www.pugo.org>

James Tam

<sup>1</sup> "A history of modern computing (2<sup>nd</sup> Ed)" Paul E. Ceruzzi pp. 263 - 264

## The History Of Apple Computers: Steve And Steve

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

Steve Wozniac



Steven Jobs



James Tam

Images © Apple Computer, Inc. from [www.computerhistory.org](http://www.computerhistory.org)

## Apple: Steve And Steve

- Bill Fernandez (Wozniac's neighbour in Santa Clara California) introduced the 'Steves'.<sup>1</sup>
  - Stephen Gary Wozniak (16)
  - Steven Paul Jobs (21)
- They built their first computer out of parts that were discarded (for 'cosmetic' reasons) by computer manufacturers.
  - Named after their favourite drink: "The Cream Soda computer".
  - Jobs was marketing, Wozniac was the Engineer,

James Tam

<sup>1</sup> "Corporations that changed the World: Apple Inc." (Jason D. O'Grady: Greenwood Press 2009)

## Steve Jobs

- Born Feb 24, 1955 in San Francisco.
- Age 23: Made his first million
- Age 25 (1980): Worth approximately 100 million
- 2009: Worth approximately 6 billion
- Even at an early age he showed an aptitude for business and people over engineering.
  - “...he wasn't interested in getting his hands dirty”, “...he was more interested in wondering about the people that owned the cars.”<sup>1</sup>

James Tam

<sup>1</sup>“The little kingdom: The private story of Apple Computer” (Michael Moritz: William Morrow p. 38)

## Steve Wozniak

- Born August 11 1950
- Commonly known by an abbreviation of his surname “The Woz”
- “Prolific tinkerer”<sup>1</sup>
- “From a technical standpoint, Woz was literally Apple Computer”<sup>2</sup>

James Tam

<sup>1</sup>“Corporations that changed the World: Apple Inc.” (Jason D. O’Grady: Greenwood Press 2009)

<sup>2</sup>“iWoz: From Computer Geek to Cult Icon: How I Invented the personal computer, Co-founded Apple, and had Fun Doing It” (Steve Wozniak with G. Smith: W.W. Norton 2006)

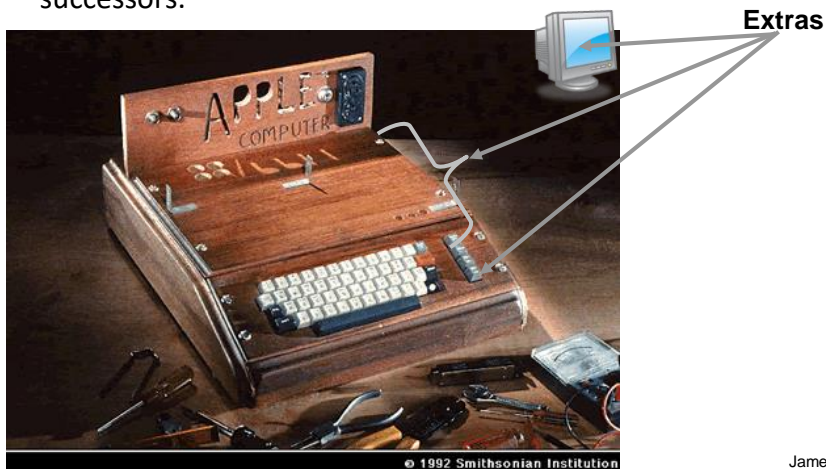
## Apple I

- 1976: Wozniak completed a prototype and took it the Homebrew Computer club.
- Jobs saw its immediate potential.
- It used a standard TV as a monitor.
- Due to Wozniak's design genius it used a minimal number of chips (to keep costs and complexity down).
- Boot code was in ROM.
- Data was saved on cassette tapes.

James Tam

## Apple I (2)

- The first Apple computer: significantly different from its successors.



James Tam

Clipart: Microsoft

## Apple I: Marketing

- A local electronic shop owner immediately put in for an order of 50 computers.
- Cash was so tight for `Apple` that payment for the parts had to be made on credit.
  - Even then personal sacrifices had to be made.



- Wozniak`s friend: Ronald Wayne helped him assemble the computers in Wozniak`s living room.
  - Even this preassembly process the machine still required some assembly by the end customers.

James Tam

Clipart:www.colourbox.com

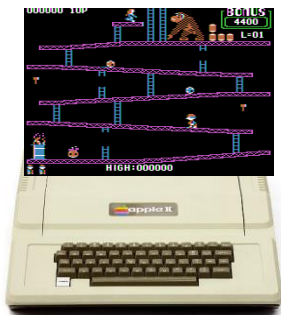
## Apple II

- Proceeds from the sale of the predecessor machine financed the construction of its successor.
- At this point Wayne sold his stake in company.
- The `Steves` had trouble raising money.
  - Banks would not grant loans because they were skeptical of the marketability of a computer for the average person.
  - Finally after another person agreed to co-sign the bank loan (\$250,000) there was enough capital to fund production of the Apple II and Apple Computer was formed April 1, 1976.
- Released in 1977.
- Initially it ran a version of BASIC written by Wozniak.
- Later it used a licensed version of Microsoft BASIC.
  - The \$10,000 fee was said to have saved Microsoft from insolvency.<sup>1</sup>

James Tam

<sup>1</sup> "A History of Modern Computing" (Paul Ceruzzi: MIT Press 2003)

## The Apple II (2)



### Images

Apple II:  
[www.computerhistory.org](http://www.computerhistory.org)

Donkey Kong:  
[www.donkeykong.gamebub.com](http://www.donkeykong.gamebub.com)

- 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

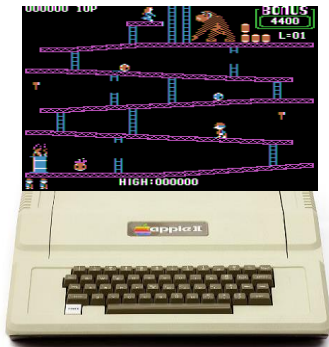
## Side Note: VisiCalc

- Visible Calculator was the first electronic spreadsheet.
- Dan Brickling conceived of the idea while he was a first year student at Harvard Business school.
- Enlisted the aid of a Harvard graduate and using a borrowed Apple II computer a working version was produced in 1978.

James Tam



## The Apple II & VisiCalc



- VisiCalc: *"It was the software tail that wagged the hardware dog"*

James Tam

## Apple Goes Public

- IPO: December 12, 1980 (Open \$22 per share, close at \$29)
  - Apple raised more money that day than any company except for Ford.

James Tam

## Apple III



- Customers flocked to (the IBM PC):
  - Apple became known for poor reliability.
- The Apple III failed as a product:
  - IBM ‘smelled blood’ and quickly released the IBM PC (Personal Computer).
  - The PC design opened up the market for clones (more later).
- Wozniak claimed it was a failure because marketing rather than engineering had designed it.

James Tam

image: [www.vintage-computer.com](http://www.vintage-computer.com)

## Jacky Scully

- Recruited from Pepsi to work as CEO for Apple in 1983 by Steve Jobs.
  - At Pepsi he spearheaded a successful marketing campaign to challenge Coke: the “Pepsi challenge”
    - It was reputed however that Scully picked Coke over Pepsi in the challenge.
    - What finally motivated the transfer was a plea by Jobs.
    - "Do you want to sell sugared water for the rest of your life? Or do you want to come with me and change the world?"<sup>1</sup>
- He was responsible for many changes:
  - A decision to compete directly against IBM in the business computer market (Apple III)
  - Removing Steve Jobs from development of an Apple microcomputer project.

James Tam

<sup>1</sup> Triumph of the Nerds: The Transcripts, Part III

## Lisa



Image © Mark Richards from [www.computerhistory.org](http://www.computerhistory.org)

- (1983).
  - 5 MHz 68000 processor
  - 1 MB RAM
- Unlike other Apple computers which were text-based, this one would employ a GUI.
  - It was inspired by a tour of the Xerox PARC (Palo Alto Research Center) laboratories.
    - It cost \$1 million in Apple stock for a 3 day tour of Xerox.
    - It was a failure but laid the ground work for the successful Macintosh.
      - 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)



Image © Mark Richards from [www.computerhistory.org](http://www.computerhistory.org)

- Apple's next computer was the Macintosh
- It incorporated many of 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

## Macintosh



- To prevent a repeat of the failures with the Apple III Jobs was diplomatically removed from this project.<sup>1</sup>
  - He eventually resigned and formed his own computer company NeXT
- Goal: produce an easy to use, inexpensive computer with all the features could need all in one package.
- Specifications:
  - Processor: ~7 MHz 68000 Motorola
  - Memory: 128 KB (upgradable – with some difficulty - to 512 KB)

James Tam

<sup>1</sup> "Corporations that changed the World: Apple Inc." (Jason D. O'Grady: Greenwood Press 2009)

## Macintosh (2)

- It incorporated the best features of the Lisa but was sold at a substantially lower price.
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- Compared to the IBM-PC it was a speed vs. ease of use tradeoff

James Tam

## Xerox Star

- 1981: Xerox introduced a microcomputer, 8010 Star Information System (Short form: Xerox Star).

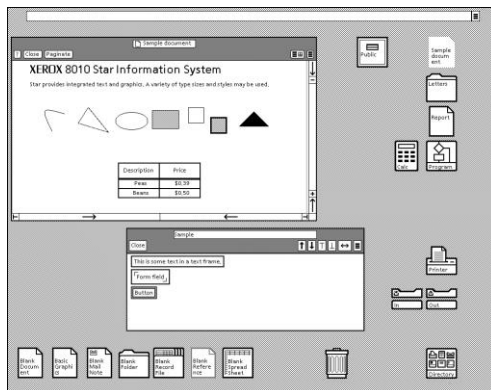


<http://www.digibarn.com>

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## Xerox Star (2)

- The first GUI-driven microcomputer (1981 for the Xerox Star vs. 1984 for the Apple McIntosh and 1985 for the Commodore Amiga 1000).

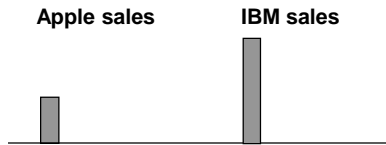


<http://www.aresluna.org>

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## The Attack Of The Clones

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

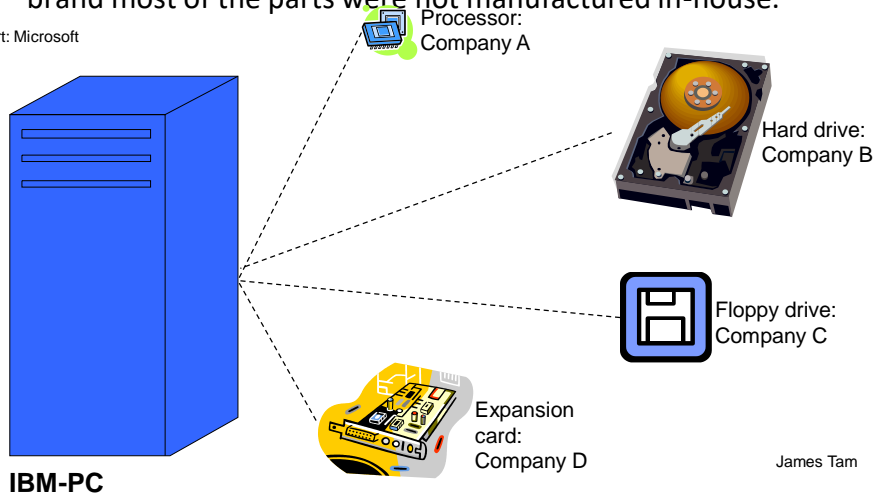


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## The Attack Of The Clones (2)

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

Clipart: Microsoft



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## 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**

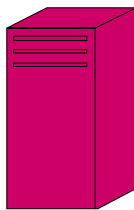


**Compaq clone**

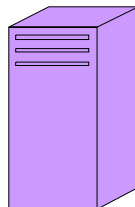
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## The Attack Of The Clones (4)

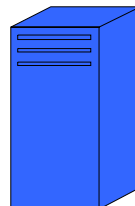
- This opened the flood gates for other computer manufacturers to produce their own clone computers.



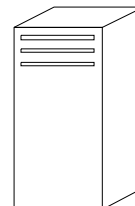
**Compaq  
clone**



**Dell  
clone**



**IBM-PC**

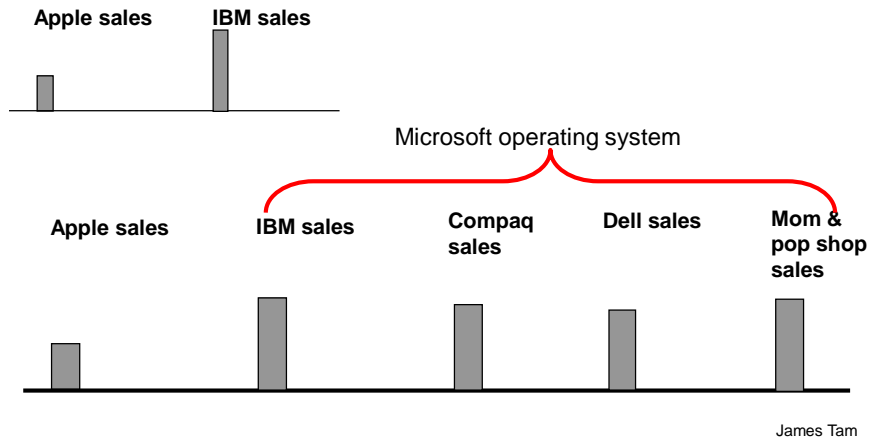


**Mom and pop  
shop clone**

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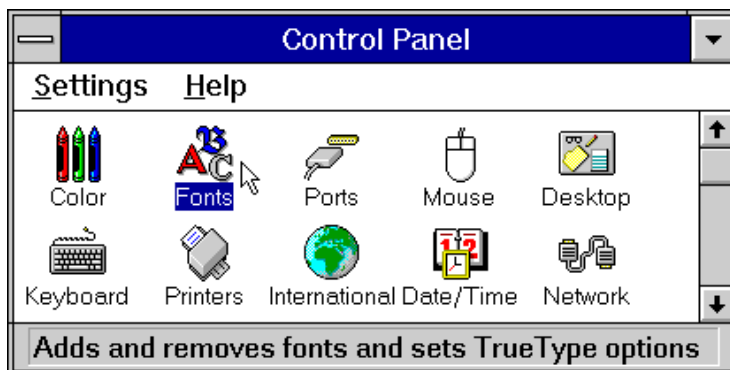
## The Attack Of The Clones (5)

- The result was that IBM eventually lost control over the computer architecture that it developed and marketed.



## 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 1990s Microsoft developed an interface for MS-DOS that incorporated some of the features of the MAC GUI.





## Steve Jobs: Redux

- Jobs eventually returned to Apple after Apple bought NeXT in 1996.
- The NeXT operating system would become the foundation for Mac OS8.
- Apple sales and share prices continued to drop.
- Finally Steve Jobs was reappointed CEO.

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## Changes Under Jobs II

- Changes that turned Apple around:
  - A (much-needed) infusion of \$150 million from Microsoft.
    - Microsoft Office for MAC
  - Discontinuing of license agreements of Apple ROM and Apple OS to clone makers.
  - Release of the iMac computer.
    - All in one (like the Macintosh that he designed earlier).
    - A bright eye catching design (computers were not just beige clones).



[www.imacworld.com](http://www.imacworld.com)

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## Changes Under Jobs II (2)

- (Changes that turned Apple around continued)
  - Release of the iBook (first Mac with wireless support).
  - Release of a new professional desktop computer: Power Mac G4.
- Major changes which are regarded as leading to Apple's resurgence:
  - Mac OS X
  - Apple retail stores
  - iPod (JT: and the whole 'eye' series that followed and preceded it).

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## Timelines

- 1974
  - MITS: Altair 8800
- 1976
  - Commodore: PET
  - Radio Shack: TRS-80
  - Apple I
- 1977
  - Apple: Apple II
- 1981
  - Commodore VIC-20
  - IBM PC

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## Some Important Microcomputer Timelines

- 1983
  - Compaq IBM-clone
- 1984
  - Apple Macintosh
- 1985
  - Commodore Amiga 1000

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## References

- The Intel website: <http://www.intel.com>
- “A History of Modern Computing” (2<sup>nd</sup> Edition) Paul E. Ceruzzi
- Hard Drive: Bill Gates and the making of the Microsoft Empire” (Jim Wallace & Jim Erickson: Harper Business 1993)
- Corporations that changed the World: Apple Inc.” (Jason D. O’Grady: Greenwood Press 2009)
- “The little kingdom: The private story of Apple Computer” (Michael Moritz: William Morrow p. 38)
- “iWoz: From Computer Geek to Cult Icon: How I Invented the personal computer, Co-founded Apple, and had Fun Doing It” (Steve Wozniak with G. Smith: W.W. Norton 2006)

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## References (2)

- Triumph of the Nerds: The Transcripts, Part III

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## After This Section You Should Now Know

- General knowledge
  - The general time that significant events (such as the creation of different computer models or technologies) occurred
  - The people and organizations/companies behind these events/technologies and their background
  - What companies produced which computers
  - The names, general appearance and basic technical specifications of the computers of this time
  - What were the specifications of the technologies of the day (such as the number of colors available with different graphical modes)
  - What (if any) were the distinguishing feature or features of a computer
  - How were these technologies or computers used

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## After This Section You Should Now Know (2)

- 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

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## After This Section You Should Now Know (3)

- How the rise of clone computers lead to the market dominance of Microsoft in the microcomputer market
- When the Xerox Star was made available as well it's influence on microcomputers

James Tam