From Whence Cometh PCs?

Lorrin R. Garson

OPCUG & PATAACS
August 18, 2012
To Set the Tone…

Computers are useless. They can only give you answers. Pablo Picasso

A picture is worth a thousand words but it takes 3,000 times the disk space. Unknown

Applying computer technology is simply finding the right wrench to pound in the correct screw. Unknown
Pre-Computer Technology
The First Computer

Results in the decimal number system (base 10)
Oog Meets Saber-Tooth Tiger...

Octal number system (base 8) invented
Pre-Computer Technology: Abacus

- Mesopotamian (2700—2300 BC)
- Egyptian
- Persian
- Greek
- Roman
- Chinese
- Indian
- Japanese
- Russian
Human Computer

- <15\textsuperscript{th} – 20\textsuperscript{th} century
- Manually calculated:
  - Financials - commerce
  - Log tables
  - Trigometric tables
  - Navigation tables
  - Artillery ballistic tables

Dryden Flight Research Center 1949
Edwards, California
Pre-Computer Technology: Blase Pascal’s Pascalanine

- 1642-1652
- The first calculator...
  - Used in an office
  - To be commercialized
  - To be patented
  - Sold by a distributor
- For detailed information click here ➔ 📚

1623–1662
Pre-Computer Technology: Slide Rule

Numerous Inventors

Edmund Gunter (1620?)
Edmund Wingate (1624)
William Oughtred (1632)
Henry Coggeshall (1677)
John Warner (1722)
Edward Roberts Everard (1755)
Peter Mark Roget (1815)
Nathaniel Bowditch* (1821)
Amédée Mannheim (1859)

*Bowditch’s *The American Practical Navigator*, 2002 Bicentennial Edition (Click here ➔)
Pre-Computer Technology: Lorrin’s Slide Rules

Robert Du Bois
Keuffel & Esser

Lorrin Garson
Post

Fred Geiger
Dietzgen
Pre-Computer Technology: Charles Babbage

- British mathematician, philosopher, inventor and mechanical engineer
- Designed (and almost built) mechanical calculating machines
  - Difference Engine
  - Analytical Engine

1791-1871
Pre-Computer Technology: Difference Engine #1

Assembled by Babbage’s son after the death of his father using parts found in Babbage’s laboratory
Pre-Computer Technology: Difference Engine #1

- 2008 The first Difference Engine built
- Constructed from Babbage’s plans
- Designed to build log and trig tables using polynominal functions

\[ p(x) = 2x^2 - 3x + 2 \]

London Science Museum
Pre-Computer Technology: Analytical Engine

- 1837-1871
- Design for first general-purpose computer
  - Arithmetic logic unit
  - Control flow
  - Conditional branching
  - Loops
  - Memory
  - Used punch cards
1815 Flat-Foot Luis Ponders His Toes

Hexadecimal number system (base 16) results
Early 1920s
Veterans Bureau office workers computing bonuses for World War I veterans

Burroughs Electric Adding Machines
Pre-Computer Technology: Friden Model STW-10 Electro-Mechanical Calculator

- 1920s – 1960s
- Largely used in commerce
- Used in science and engineering when greater than 3 figure accuracy needed
- Slow and noisy
Pre-PC Technology: Hewlett-Packard “Cal-Tech” Calculator

- 1967
- Four function…
  - Addition
  - Subtraction
  - Multiplication
  - Division
- 12 Decimal places
- Printed output
- Click here ➔ for details
Pre-PC Technology: Hewlett-Packard HP-35s Calculator

- 1972
- Slide rule killer
- $395 ($1,169 in 2012)
- RPN 📈 or Algebraic
- User’s Guide: click here ➔ 📖
Pre-PC Technology: Texas Instruments Calculator

- 1976
- TI-30
- $25 ($101 in 2012)
Today — In the Computer Age

- 2012
- TI-30Xa
- $9.99
Early Enabling Technologies
The Fear of New Technology

"It's a great invention, but it'll probably mean the end of civilization as we know it."
Steam replaces human, animal and water power
Pre-Computer Technology: Jacquard’s Programmable Textile Loom

- 1801
- Joseph Marie Jacquard
  - Bookbinder
  - Weaver
  - Inventor
- Loom uses punched cards
- Wove complex patterns of textiles
- In use ~150 years
Pre-Computer Technology: Herman Hollerith’s Tabulating Machine

- Processing U.S. Census Data
  - 1880 — 8 years to process
  - 1890 — 1 year to process
- Electromechanical tabulation
- Factory at 31st St & C&O Canal, Georgetown
- One of his companies, the Computer-Tabulating-Recording Co., evolved into IBM in 1924. Click here ➔ for details
Herman Hollerith’s Tabulating Machine
Hollerith Pantograph (keypunch)
Pre-Computer Technology: Herman Hollerith’s Punch Card

- 12 rows
- 20 columns
“Modern Day” Punch Card
20th Century Enabling Technologies
20th Century Enabling Technologies
Vacuum Tubes

- 1904 John Ambrose Fleming invents the diode
- 1906 Robert von Lieben receives a patent for the triode
- 1907 Lee De Forest improves (invents?) the triode
- 1913 AT&T buys De Forest’s patent for $50,000
- 1915 First U.S. coast-to-coast telephone call facilitated by vacuum tube amplifier. $21/3-min ($477 in 2012)
Ad from 1933 newspaper

FOUR TUBES ARE NOT ENOUGH!

YOU can’t catch ether waves right with only four tubes—it’s been tried but never with much success. So the finest radio in the land—the sturdy, full-voiced Clarion Jr.—comes to you with one more tube, with the extra circuit that means real selectivity and sensitivity. When you look at Clarion Jr.’s newer-style cabinet and listen to its last-word “Super-het” performance you marvel that such a radio can be yours for only $19.95! Call on one of the dealers listed below and discover that miracles still happen!

5-tube Super-heterodyne Clarion Jr.

$19.95 COMPLETE

- Modern cabinet
- 5 latest type tubes
- 3-gang condenser
- Full super-heterodyne circuit
- 3-knob control
- Vernier dial

OTHER CLARION RADIOS: 6-tube Model $51.95; 8-tube Midget, $41.95; 10-tube console, $52.95; 12-tube console, $73.95; 14-tube de luxe console, $129.50. Complete.

SAMPSON ELECTRIC COMPANY

$352.16 (2012)
Ad from 1933 newspaper

14-tube De Luxe Console, $129.50

$2,285.95 in 2012
20th Century Enabling Technologies
Transistors

• 1947
• Invented by John Bardeen, William Shockley and Walter Brattain at Bell Labs*

• 1956 Nobel Prize in physics 📖
• Click here ➔ 📖 for information on the transistor

*The Idea Factory: Bell Labs and the Great Age of American Innovation by Jon Gertner
20th Century Enabling Technologies
Integrated Circuits

- 1958
- Invented by Jack Kilby at Texas Instruments
- An electronic circuit manufactured by lithography Click here ➔ for details
- Kilby received the 2000 Nobel Prize in Physics
Jack Kilby’s Original Integrated Circuit
20th Century Enabling Technologies

Microprocessors

- 1971 Intel 4004, 4-bit
- 1972 Intel 8008, 8-bit
- 1974 Intel 8080, 8-bit
- 1975 National Semiconductor PACE, 16-bit
- 1979 Motorola MC68000, 32-bit
- 2003 Advanced Micro Devices AMD64, 64-bit
- 2005 Multicore processors for workstations and servers
The number of transistors doubles every 1.5 to 2 years.

6.8 Billion Transistors (Oct 2011)
Types of Computers

Supercomputers
Servers
Minicomputers
Workstations
Laptops
Netbooks

PCs
Tablets
E-Book Readers
Game Consoles
Embedded Computers
Smartphones
PDAs

Computers
“It's tough to make predictions, especially about the future.”

Yogi Berra, 1925–
Baseball Player
Philosopher
“Malaprop-er”
Predicting the Future

“I think there is a world market for maybe five computers.” (1943)

Thomas J. Watson, Sr., 1874-1956
Chairman & CEO of IBM
Troublesome Public Relations

- Deutsche Hollerith Maschinen Gesellschaft (GmbH)
- DEHOMAG
- IBM owned 90%

IBM and the Holocaust by Edwin Black
Nazi Nexus by Edwin Black
A Selection of Historical Computers

Two 54-minute videos on history of computers
Generations of Computers

- 1\textsuperscript{st} Generation (1946-1958). The Vacuum tube years
- 2\textsuperscript{nd} Generation (1959-1964). Era of the transistor
- 3\textsuperscript{rd} Generation (1965-1970). Era of integrated circuits
- 4\textsuperscript{th} Generation (1971-today). The microprocessor
Atanasoff–Berry Computer (ABC)

- Conceived 1937; tested 1942
- John Atanasoff & Clifford Berry at Iowa State University
- 280 triode vacuum tubes
- 700 lbs
- Used binary digits
- Performed calculations electronically
- Computation and memory separate
- Specific purpose machine: solution to simultaneous linear equations

\[
\begin{align*}
4x + y &= 17 \\
2x + y &= 9
\end{align*}
\]

Click here 🎥 for a 11 min video
Konrad Zuse

1910-1995

- 1941 The first programmable, automatic computer
- Zuse Z3 computer
  - Programmable
  - 2,000 relays
  - 22 bit word length
  - 5-10 Hz clock speed
  - Program code and data stored on punched film
- Statistical analysis of wing flutter for the Luftwaffe
- Zuse models from Z1 to Z43
- Founded company Zuse KG (sold to Siemens in 1967)
Zuse Z3 Replica
Deutsches Museum
München
Alan Turing

- British mathematician, logician, cryptanalyst and computer scientist
- The father of computer science and artificial intelligence
- During World War 2, attacked codes of:
  - Germany (Enigma)
  - Japan
  - Italy

1912-1954
German Enigma

- Developed 1918-1919
- Used in commerce 1920s
- Used by German military 1926 to 1945
- Quite secure if used properly
- Click here for more information

Replica
Turing-Welchman Bombe

- Operational March 18, 1940
- Named after Polish bomba kryptologiczna
- Used to decipher German Kriegsmarine Enigma messages
The Italian Codes
(How tough can it be?)

Cracking the Italian codes was something you did at the pub over a beer. It was both relaxing and enjoyable...

Peter Hilton
WW2 British codebreaker
British Colossus

- Operational 1944
- First electronic, digital, programmable computer
- Designed by Tommy Flowers
- Used to decrypt German Lorenz encrypted messages (12 rotor)

Colossus Mark 2 Computer
ACE—Automatic Computing Engine

- 1946
- Designed by Alan Turing
- Early (first?) stored-program computer
- National Physical Laboratory (England)
- Used by Dorothy Hodgkin* (structures of vitamin B12 and insulin)

* Nobel Prize in Chemistry, 1964
Harvard Mark 1

- 1944
- Designed by Howard Aiken & Grace Hopper
- Built by IBM
- 760,000 components
- U.S. Navy Bureau of Ships
- Gunnery and ballistic calculations
- 23 decimal places
Admiral Grace Hopper

• AKA “Amazing Grace”
• Computer scientist and U.S. Navy officer (41 years service)
• One of first Harvard Mark I programmers
• Developed first compiler for a computer language
• Conceptualized machine-independent programming (lead to COBOL)
• Coined “computer bug” 🐞

1906 - 1992
The Original Computer Bug

- 0800: Antennas started
- 1000: System - antennas.

- 1100: Started cosine tape (sine check)
- 125: Started multi-attack
- 154: Started multiaversal

- Relay #70 Panel F
- (moth) in relay

- First actual case
- Antennas started
- Cloud down
ENIAC

- 1946
- Designed by John Mauchly & J. Presper Eckert (University of Pennsylvania)
- Used at Aberdeen Proving Ground 1947-1955
- General purpose computer
- Calculating ballistic tables
Back panel of ENIAC computer (17,468 vacuum tubes)
The Future of Computers

Computers in the future may have only 1,000 vacuum tubes and perhaps only weigh 1 1/2 tons.

Popular Mechanics (1949)
IBM and the Seven Dwarfs

1. IBM
2. Burroughs
3. UNIVAC
4. NCR
5. Control Data
6. Honeywell
7. General Electric
8. RCA

The 1950s going forward…
IBM Mainframes: 1950s – 1960s

- **1401 Data Processing System**
  - 1401 (1959) *
  - 1410 (1960) *
  - 1440 (1962) *
  - 1460 (1963)

- **1620 Data Processing System**
  - 1620 (1959) *
  - 1620 Model II (1963)

- **7000 Data Processing System Series**
  - 7090 (1958) *
  - 7030 (1960) *
  - 7040 (1961)
  - 7044 (1961)
  - 7094 (1962) *
  - 7094-II (1963)
  - 7070 (1958)
  - 7080 (1960)
  - 7074 (1960)
  - 7072 (1961)
  - 7010 (1962)
### IBM Mainframes: 1960s (cont.)

**System/360 Series (1964)**
- Model 20 (1964)  IBM 2020 processing unit
- Model 40 (1964)* IBM 2040 processing unit
- Model 30 (1964)* IBM 2030 processing unit
- Model 50 (1964)* IBM 2050 processing unit
- Model 60 (1964)  IBM 2060 processing unit
- Model 62 (1964)  IBM 2062 processing unit
- Model 70 (1964)  IBM 2070 processing unit
- Model 92 (1964)  IBM 2092 processing unit
- Model 44 (1965)* IBM 2044 processing unit
- Model 57 (1965)  IBM 2057 processing unit
- Model 65 (1965)  IBM 2065 processing unit
- Model 67 (1965)  IBM 2067 processing unit
- Model 75 (1965)* IBM 2075 processing unit
- Model 91 (1966)* IBM 2091 processing unit
- Model 25 (1968)* IBM 2025 processing unit
- Model 85 (1968)  IBM 2085 processing unit
- Model 95*        (Offered on special government contract & shipped 2/68)
- Model 195 (1969)* IBM 2195 processing unit
- Model 22 (1971)* IBM 2022 processing unit
## IBM Mainframes: 1970s

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Model 155 (1970)*</td>
<td>3031 (1977)* Models 1-6</td>
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<tr>
<td>Model 145 (1970)*</td>
<td>3031 (1979) Models 7, 8, A7 &amp; A8</td>
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<td>Model 135 (1971)*</td>
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<td>Model 195 (1970)*</td>
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<td>Model 158 (1972)*</td>
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<td>Model 168 (1972)*</td>
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<td>Model 125 (1972)*</td>
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<td>Model 115 (1973)*</td>
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<td>Model 115-2 (1975)</td>
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<tr>
<td>Model 125-2 (1975)</td>
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<tr>
<td>Model 158-3 (1976)</td>
<td>3032 (1977)* Models 2, 4 &amp; 6</td>
</tr>
<tr>
<td>Model 168-3 (1976)</td>
<td>3032 (1979) Model 8</td>
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<tr>
<td>Model 135-3 (1976)</td>
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<tr>
<td>Model 145-3 (1976)</td>
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<tr>
<td>Model 138 (1976)*</td>
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<td>Model 148 (1976)*</td>
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<td>Model 158-AP (1976)</td>
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<tr>
<th>System/370 Compatible - 3032 Processor Complex (1977)</th>
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<tbody>
<tr>
<td>3032 (1977)* Models 2, 4 &amp; 6</td>
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<tr>
<td>3032 (1979) Model 8</td>
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</tbody>
</table>

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<thead>
<tr>
<th>System/370 Compatible - 3033 Processor Complex* (1977)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3033U (1977) Uniprocessor models 1, 4, 6 &amp; 8</td>
</tr>
<tr>
<td>3033MP (1978) Multiprocessor models 4, 6 &amp; 8</td>
</tr>
<tr>
<td>3033 (1978) Models U12 &amp; U16 and M12 &amp; M16</td>
</tr>
<tr>
<td>3033 (1979) Attached processor models 4, 8, 12 &amp; 16</td>
</tr>
<tr>
<td>3033N (1979) Models N4 &amp; N8</td>
</tr>
<tr>
<td>3033N (1980) Models N4, N8, N12 &amp; N16</td>
</tr>
<tr>
<td>3033 (1981) Models S4 &amp; S8</td>
</tr>
<tr>
<td>3033 (1981) Models S12 &amp; S16</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>4300 Processing Systems (1979)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4331 (1979)* Models I1 &amp; J1</td>
</tr>
<tr>
<td>4341 (1979)* Models K1 &amp; L1</td>
</tr>
</tbody>
</table>
# IBM Mainframes: 1980s

## System/370 Compatible - 3084 Processor Complex (1982)
- 3084 (1982)*
  - Models Q32, Q48 & Q64
- 3084 (1983)
  - Model Q96
- 3084X (1984)

## System/370 Compatible - 3090 Processor Series (1985)
- 3090 (1985)*
  - Models 200 & 400
- 3090 (1986)
  - Models 150 & 180
- 3090E (1987)
  - Models 150E, 180E, 200E, 300E, 400E & 600E
- 3090 (1987)
  - Model 120E
- ES/3090 (1988)
  - Model 600S
- 3090E (1988)
  - Models 280E & 500E
- ES/3090 (1989)
  - Multiprocessor and entry level models

## System/370 Compatible - 3081 Processor Complex (1980)
- 3081 (1980)*
  - Models D16, D24 & D32
- 3081K (1981)
  - Models K16, K24 & K32
- 3081 (1982)
  - Models GG16, G24 & G32
- 3081 (1983)
  - Models G48 & K48

- 3083 (1982)*
  - Models E8, E16, B8, B16, B23, B32, J8, J16, J24 & J32
- 3083E (1983)
  - Models E24 & E32
- 3083CX (1984)
  - Models CX0, CX1 - CX3

- 4331 (1980)
  - Models J2, K2, KJ2 & L2
- 4341 (1980)
  - Models K2, L2 & M2
- 4321 (1981)
  - Model J11
- 4331-2 (1981)
  - Models J11 & K11
- 4341 (1981)
  - Models N2 & P2
- 4341 (1981)
  - Models K10, L10, K11, L11 & M11
- 4341 (1982)
  - Model Groups 9 & 12
- 4361 (1983)*
  - Model Groups 4 & 5
- 4381 (1983)*
  - Model Groups 1 & 2
- 4361 (1984)
  - Models N4 & N5
- 4381 (1984)*
  - Model Group 3 (M3, P3, Q3 & R3)
- 4381 (1984)
  - Models Q2 & R2
- 4381 (1986)
  - Model Groups 11-14
- 4381 (1987)
  - Model Groups 21-24
- 4381E (1988)
  - Models 91E & 92E
- ES/4381 (1989)
  - Entry level models
IBM Mainframes: 1990s

- **System/390 Series (1990)**
  - ES/9000 (1990)* 18 models
  - ES/9000 (1991) Seven models
  - ES/9000 (1992) Two entry-level models
  - ES/9000 (1993) 18 new models including Model 982
  - (1994) Parallel Sysplex and Parallel Query Server
  - ES/9000 (1994) Model 9X2
  - ES/9000 (1994) Five air-cooled processor
  - (1994)* Six models of S/390 Parallel Enterprise Server
  - (1995) 12 models of the S/390 Parallel Enterprise Server
  - (1996) Third generation (G3) of S/390 Parallel Enterprise Server
  - (1997)* S/390 Parallel Enterprise Server G4
  - (1998)* S/390 Parallel Enterprise Server G5
  - (1999)* S/390 Parallel Enterprise Server G6
  - (1999)* Multiprise 3000
IBM Mainframes: 2000s

- IBM eServer zSeries (2000)
  - (2000)*  900
  - (2002)*  800
  - (2003)*  990
IBM Mainframes: z990

- 2003-present
- 32 processors
- z/OS operating system
- 256 GB memory
- 9,000 MIPS
- Clusters up to 64 (?) machines
- Click here ➔ 📚 for a technical guide
Modern mainframes are defined by:

- Redundant internal engineering, high availability
- Backward compatibility with older software
- Host multiple operating systems
- Handle very high volume of input/output
- Fault tolerant computing
Minicomputers

Apollo Computer
DEC/Digital
Data General
Hewlett-Packard
IBM
NCR
Prime Computer
Sun
Wang

DEC PDP-11
Minicomputers

- Evolved in the mid-1960s
- Much less expensive than IBM mainframes and mid-size computers
- Priced at < $25,000 ($147,859 in 2012)
- Input/output device such as a teleprinter
- Minimum 4K memory
- Capable of running programs in a higher level language such as Fortran, COBOL or Basic
The Future of Computers

There is no reason why anyone would want a computer in the home.

Ken Olson (1977)
Founder & CEO Digital Equipment Corporation (DEC)

In June 1998 DEC was acquired by Compaq, which Merged with Hewlett-Packard in May 2002
Alpha Microsystems

- 1977
- Minicomputer, multiuser, multitasking
- S-100 bus
- Western Digital WD16 CPU, 3.3 MHz
- AMOS operating system*
- Alpha- BASIC, FORTRAN, LISP, PASCAL, C
- Vertical markets: medicine, dentistry, pharmacy, law, etc.

*Similar to DEC PDP-11
A Selection of Historical PCs

Now, that's a Hard Drive!
IBM 610

- 1957
- First “personal computer”
- Designed to be used by one person
- Price: $55,000 ($449,156 in 2012)
Kenback-1

- 1971
- The first PC (?)
- $750 ($4,250 in 2012)
- TTL chips for CPU
- 8-bit architecture
- 256 bytes memory
- 1 MHz clock speed

*TTL = Transistor-transistor logic circuit*
Xerox Alto

- 1973
- First GUI
- First mouse
- From Xerox Parc
- Not a commercial product
- Thousands built and used internally
SCELBI-8

- 1974
- First microprocessor based hobbyist PC
- $500 ($2,330 in 2012)
- 1 KB RAM
- Intel 8008 CPU
MITS Altair 8800

- 1975
- First S-100 bus machine*
- First widely popular PC
- $439 as kit ($1,870 in 2012)
- $621 assembled ($2,650 in 2012)
- 1K or 2K or 4KB RAM
- Intel 8080 CPU
- CP/M operating system
- 8-in floppy disk drive

*AKA The “Altair bus” which was widely copied
IMSAI 8080

- 1975
- $400+ as kit ($1,700 in 2012)
- $600+ assembled ($2,560 in 2012)
- 64 K memory
- 2 MHz clock speed
- CP/M operating system & others
- 8 or 5¼-in floppy disk drive
- ~18,000 produced 1975-78
Cromemco Z-1

- 1976
- 8K memory
- Z80 CPU
- CDOS operating system (CP/M-like); later UNIX
- Produced ~ dozen models
- Company survives as Cromemco AG (Switzerland)
Apple I

- Designed & built by Steve Wozniak
- Steve Jobs suggested selling them
- $2,684 in 2012
First Apple Manufacturing Plant

2066 Crist Drive, Los Altos, California (Google Earth)
Homebrew Computer Club
Palo Alto, California

- Instrumental in creating the technological culture of Silicon Valley
- First meeting March 1975
- Focus of meetings on Altair 8800 and other technical topics
- Members include:
  - John Draper — (AKA Captain Crunch), software developer
  - Bill Gates — Microsoft, Inc.
  - Steve Jobs & Steve Wozniak — Apple, Inc.
  - Jerry Lawson — founder Videosoft (game developer)
  - Bob Marsh — Sol-20 computer
  - Adam Osborne & Lee Felsenstein — Osborne 1 computer
Sol-20

- 1976
- First integrated machine with keyboard
- $995 as a kit ($4,012 today)
- 4 to 32 K memory
- Intel 8080 CPU
- 2 MHz clock speed
- CP/M operating system
- ~10,000 produced 1977-79
Commodore Pet 2001

- 1977
- First fully integrated “Appliance” computer
- MOS Technology 6502 CPU
- $995 as a kit ($4,012 today)
- 4, 8, 16, 32 K memory
- BASIC in ROM operating system
- Several ports
- 1 MHz clock speed
TRS 80 Model 1

- 1977
- Very popular and successful machine
- Zilog Z80 CPU
- $600 ($2,270 today)
- 32 or 64 K memory
- BASIC language (3 versions)
- TRS-DOS operating system (and others)
- 1 MHz clock speed

2012—35th Anniversary
For more information click here ➔ & here ➔
Apple II Series

1977 to 1988

Apple II
Apple II Plus
Apple II Europlus and J-Plus
Apple IIe
Apple IIc
Apple II GS
Apple IIc Plus
Apple IIe Card

Succeeded by Apple Macintosh in 1984
Atari 400

- 1979 to 1992
- Atari 400, 800, XL and XE
- Two 400/800 models named after two attractive secretaries
  - Colleen—the computer
  - Candy—the game machine
- Sales of 4 million units
Apple III

- 1980 to 1984
  - A business oriented PC
  - Many stability issues and numerous recalls
  - A failure in the market, selling 65,000-75,000 units

It was a bomb!
Osborne 1

- 1981
- First portable at 23.5 lbs. ("Luggable")
- $1,795 ($4,530 in 2012)
- A commercial success — victim to the “Osborne Effect”, i.e., premature announcement of new models that kills sales of current products
- Bankruptcy 1983
A Good Selection of Software (Osborne Computers)

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Version</th>
<th>Published by</th>
<th>Program Type</th>
<th>Date</th>
<th>Part Number</th>
<th>Number of Disks</th>
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<tbody>
<tr>
<td>CBASIC2</td>
<td></td>
<td>Digital Research</td>
<td>Language compiler</td>
<td>1979</td>
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<td>MBasic</td>
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<td>Microsoft</td>
<td>Language interpreter</td>
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<td>301002-02D</td>
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<tr>
<td>Colossal Cave</td>
<td></td>
<td></td>
<td>Game</td>
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<td>Deadline</td>
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<td>Infocom</td>
<td>Game</td>
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<td>dBase II</td>
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<td>Ashton-Tate</td>
<td>Database</td>
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<tr>
<td>dBase II Tutor</td>
<td></td>
<td>Ashton Tate</td>
<td>Training for database</td>
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<tr>
<td>Nominal Ledger</td>
<td>2.7</td>
<td>PeachTree Software</td>
<td>Business Software</td>
<td>1983</td>
<td>2X09200-04</td>
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<td>Purchase Ledger</td>
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<td>1983</td>
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<td>Sales Ledger</td>
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<td>Business Software</td>
<td>1983</td>
<td>2X09200-04</td>
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<tr>
<td>SuperCalc</td>
<td></td>
<td>Sorcim</td>
<td>Spreadsheet</td>
<td>1981</td>
<td>301002-03</td>
<td>1</td>
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<tr>
<td>Wordstar</td>
<td>2.26</td>
<td>MicroPro</td>
<td>Word processor</td>
<td></td>
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</tbody>
</table>
Apple Lisa

One month after the Lisa is discontinued, Steve Jobs leaves Apple to form the NeXT Computer company.
Tim Berners-Lee at CERN (a sidebar)

- 1990-1991
- NeXT computer used for:
  - First Web server
  - Developing first Web browser named “WorldWideWeb”
  - Defined URL
  - Defined HTML
  - Defined HTTP
- In collaboration with Robert Cailliau
Epson HX-20

- 1981
- First portable notebook computer (3.5 lbs.)
- $795 ($2,000 in 2012)
- Full keyboard
- Ni/Cd batteries
- 120 x 32-pixel LCD monitor (20 characters, 4 lines)
- Printer
- BASIC interpreter

See [here] for manuals
IBM PC 5150

- 1981–IBM gets into the PC business
- PC line 1981-1987
- Intel 8088 CPU (4.77 MHz)
- Optional 8087 floating-point coprocessor
- 16 to 256 KB RAM
- BASIC (licensed from Microsoft)
## The IBM PC Line (1981-1987)

<table>
<thead>
<tr>
<th>Model name</th>
<th>Model #</th>
<th>Introduced</th>
<th>CPU</th>
<th>Features</th>
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<tbody>
<tr>
<td>PC</td>
<td>5150</td>
<td>August 1981</td>
<td>8088</td>
<td>Floppy disk or cassette [15] system</td>
</tr>
<tr>
<td>PC</td>
<td>5160</td>
<td>March 1983</td>
<td>8088</td>
<td>First IBM PC to come with an internal hard drive as standard.</td>
</tr>
<tr>
<td>XT/370</td>
<td>5160/388</td>
<td>October 1983</td>
<td>8088</td>
<td>5160 with XT/370 Option Kit and 3277 Emulation Adapter</td>
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<tr>
<td>3270 PC</td>
<td>5271</td>
<td>October 1983</td>
<td>8088</td>
<td>With 3270 terminal emulation, 20 Function Key Keyboard</td>
</tr>
<tr>
<td>PCjr</td>
<td>4860</td>
<td>November 1983</td>
<td>8088</td>
<td>Floppy-based home computer, Infrared interface board</td>
</tr>
<tr>
<td>Portable</td>
<td>5155</td>
<td>February 1984</td>
<td>8088</td>
<td>Floppy-based portable</td>
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<tr>
<td>AT</td>
<td>5170</td>
<td>August 1984</td>
<td>80286</td>
<td>Faster Processor, Faster ISA bus (6 MHz, later 8 MHz, vs 4.77 MHz), New Desktop Configuration, Real Time Clock</td>
</tr>
<tr>
<td>AT/370</td>
<td>5170/599</td>
<td>October 1984</td>
<td>80286</td>
<td>5170 with AT/370 Option Kit and 3277 Emulation Adapter</td>
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<tr>
<td>3270 AT</td>
<td>5281</td>
<td>June 1985 [16]</td>
<td>80286</td>
<td>With 3270 terminal emulation</td>
</tr>
<tr>
<td>Convertible</td>
<td>5140</td>
<td>April 1986</td>
<td>8088</td>
<td>Microfloppy laptop portable</td>
</tr>
<tr>
<td>XT 286</td>
<td>5162</td>
<td>September 1986</td>
<td>80286</td>
<td>Slow hard disk, but zero wait state memory on the motherboard. This 6 MHz machine was actually faster than the 8 MHz ATs (when using planar memory) because of the zero wait states</td>
</tr>
</tbody>
</table>
IBM sells PC Line to Lenovo
(December 2004)

IBM sells its PC division to China-based Lenovo Group and take a minority stake in a deal valued at $1.75 billion ($2.13 billion in 2012)
Commodore 64

- 1982-1994
- Most sold PC ever (~20 million*)
- $595 ($1,410 in 2012)
- KERNA, GEOS & other OSs; 1 MHz
- 64 KB RAM
- BASIC language

*Estimates range from 12-30 million
Apple Macintosh

- 1984
- AKA “The Mac”
- $2,495 ($5,510 in 2012)
- Mac OS 1 through 3.2*
- 128 KB RAM
- Motorola 68000 CPU; 4, 6, 8, 10, 12.5, 25 & 50 MHz

*Called simply “System Software; for more information see [link]
“Macs”

128
- Macintosh 128K
- Macintosh 512K
- Macintosh 512Ke
- Macintosh Plus

Lisa
- Macintosh XL

SE
- Macintosh SE
- Macintosh SE FDHD
- Macintosh SE/30

Classic
- Macintosh Classic
- Macintosh Classic II

Color Classic
- Mac. Color Classic
- Mac. Color Classic II

LC 500 series
- Macintosh LC 520
- Macintosh LC 550
- Macintosh LC 575
- Macintosh LC 580
- Macintosh TV

Power Macintosh 5000 series
- Power Mac 5200
- Power Mac 5300
- Power Mac 5400
- Power Mac 5500

20th Anniversary Mac.
- 20th Anniversary Mac.
“Macs” (cont.)

- **Power Macintosh G3 AIO**
  - Power Mac G3 AIO

- **iMac[^3]**
  - iMac G3
  - iMac G3 (slot loading)[^4]

- **iMac (flat panel)**
  - iMac G4[^5]

- **eMac**
  - eMac

- **iMac G5[^6]**
  - iMac G5
  - iMac G5 (Ambient Light Sensor)

- **iMac with iSight[^7]**
  - iMac G5 (iSight)
  - iMac Core
  - iMac Core 2

- **Aluminum iMac[^8]**
  - iMac Core 2
  - iMac Core i5
  - iMac Core i7
“Big Macs”

- **Quadra 900**
  - Macintosh Quadra 900
  - Macintosh Quadra 950
  - Workgroup Server 95
  - Workgroup Server 9150

- **Quadra 800**
  - Macintosh Quadra 800
  - Mac Quadra 840AV
  - Workgroup Server 80
  - Power Mac 8100
  - Power Mac 8200
  - Power Mac 8600

- **Power Mac 9500**
  - Power Mac 9500

- **Performa 6400**
  - Power Mac 6400
  - Power Mac 6500

- **Power Macintosh 9600**
  - Power Mac 8600
  - Power Mac 9600

- **Power Mac G3 MT**
  - Power Mac G3 MT

- **Power Mac G3 B&W**
  - Power Mac G3 B&W

- **Power Mac G4 Original**
  - Power Mac G4 "PCI Graphics"
  - Power Mac G4 "AGP Graphics"
  - Power Mac G4 "Gigabit Ethernet"
Top 10 Computer Manufacturers—Worldwide*

1. Hewlett-Packard
2. Acer
3. Dell
4. Lenovo
5. Toshiba
6. IBM
7. Fujitsu
8. NEC
9. Apple
10. Gateway (subsidiary of Acer)

*April 7, 2012
Apple in 3rd Place Among U.S. Mfg*

<table>
<thead>
<tr>
<th>Company</th>
<th>1Q12 Shipment</th>
<th>1Q12 Market Share (%)</th>
<th>1Q11 Shipment</th>
<th>1Q11 Market Share (%)</th>
<th>1Q12–1Q11 Growth (%)</th>
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<tbody>
<tr>
<td>HP</td>
<td>4,494</td>
<td>29.0</td>
<td>4,213</td>
<td>26.2</td>
<td>6.6</td>
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<td>Dell</td>
<td>3,460</td>
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<td>3,588</td>
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<td>-3.6</td>
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<td>Apple</td>
<td>1,641</td>
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<td>9.8</td>
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<td>Acer</td>
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<td>1,913</td>
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<td>-25.9</td>
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<td>Toshiba</td>
<td>1,350</td>
<td>8.7</td>
<td>1,670</td>
<td>10.4</td>
<td>-19.2</td>
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<tr>
<td>Others</td>
<td>3,158</td>
<td>20.3</td>
<td>3,126</td>
<td>19.4</td>
<td>1.0</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>15,520</strong></td>
<td><strong>100.0</strong></td>
<td><strong>16,091</strong></td>
<td><strong>100.0</strong></td>
<td><strong>-3.5</strong></td>
</tr>
</tbody>
</table>

*Gartner's Preliminary U.S. PC Vendor Unit Shipment Estimates for 1Q12 (Thousands of Units)*
Things have evolved...
...into the typical user!
Users We Have All Met...

And bring me a hard copy of the Internet so I can do some serious surfing.  Scott Adams

Back up my hard disk?  I can't find the reverse switch!  Unknown

The cup holder in my laptop is broken!  Unknown
The Price of Computers

The newest computer, 16-bit, with high-tech monitor… including mouse.

It is not worth it—in six months it will cost you half as much!
3 TB Disk Drive

- 2012
- Price $162.99*
- Storage cost:
  - $54.33 per TB
  - $0.05433 per GB
  - $0.0000543 per MB (5.43 x 10^{-5})
- 3 TB will hold 1 million photos (3 MB each)

*Western Digital Caviar Green, 3 TB, SATA III, 64 MB Cache. Amazon.com
75 MB Disk Drive—for Alpha Microsystem

- 1979
- $12,500 ($39,500 in 2012)
- Storage cost (2012 dollars):
  - $526.67 per MB*
  - $526,666.67 per GB
- 75 MB drive will hold 25 photos (3 MB each)

*In 1979, 3TB storage have would cost: $1.58 billion

*In 2012: $0.0000543 per MB (5.43 x 10^{-5})
Imagine

If the price of cars had followed the price of disk drives...
2012 Mercedes-Benz SL63 AMG Roadster

2012 Price: $170,000

1979 Price: $54,000

$1.75

If cars had paralleled the price of disk drives, how much would this car cost today?
But Wait...
Yesterday Only!

3 for $5.00

CONDITIONS: Only good in the U.S.A. and Greenland. Offer valid until August 17, 2012. No more than six cars per customer. Fleet purchases available at further discounts. Maximum allowed for trade-in on your vehicle in excellent condition is 1¢. A full tank of gasoline for each vehicle purchased is an additional $263. Does not include applicable taxes, license fees, transportation from Stuttgart, or insurance. Offer invalid where illegal.
Thanks for your Attention!

Paul?