“The Innovators”
The Age of the Digital Revolution

“How a Group of Hackers, Geniuses and Geeks Created the Digital Revolution.”

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Session 5

Session 5

- **The Personal Computer**

In the Beginning ….

- **Dr. Vannevar Bush, building on his earlier analogue computer effort at MIT, in a 1945 article in Atlantic Monthly envisioned a Memsis, a personal computer for the individual to keep records, correspondence and pictures.**
- **Further it would be linked to other data files containing encyclopedias of data.**
- **He was 50 years ahead of his time, for computers then were huge hulking stand alone machines.**

Tribalism, the Intersection of Counter-cultures and the Birth of the Personal Computer, 1960s Bay Area, CA

- Isaacson devoted significant space to many of the founding "Hackers" who individually, sometimes collectively and sometime collaboratively advanced the computer and the software that it utilizes.
- The peace movement, drugs, rock music pervaded their lives.
- Lee Felsenstein: "If you encourage people to tamper with the equipment, you will be able to grow a computer and a community in symbiosis.
- "The roots of the personal computer can be found in the free speech movement that arose at Berkeley in 1964 and in the *Whole Earth Catalogue,* which did the marketing for the do-it-yourself ideals behind the personal computer movement."

The Kenbak-1 is considered by the Computer History Museum and the American Computer Museum to be the world's first "personal computer"

Only 40 machines were ever built and sold. It was designed and invented by John Blankenbaker of Kenbak Corporation in 1970, and was first sold in early 1971. The system first sold for US$750.

Since the Kenbak-1 was invented before the first microprocessor, the machine didn't have a one-chip CPU but instead was based purely on small-scale-integration TTL chips. To use the machine, one had to program it with a series of buttons and switches, using pure machine code. Output consisted of a series of lights.

Altair 8800 Computer

http://www.computerhope.com

A computer kit for $400

- The Altair 8800 was the brain child of Ed Roberts. An Air Force veteran in Albuquerque NM in 1968. He forms MITS, as it sounded impressive.
- Roberts, thou a EE, was an entrepreneur and wanted to make $$, he had none of the "community anarchist" drive found the SF Bay crowd.
- His luck occurred when Les Solomon a writer for Popular Electronics needed an article on a computer kit. The exposure in the magazine, the most popular of its type at he time saved him from bankruptcy.
- His daughter came up with the name as the star Altair was the destination of the Star Trek Enterprise.

Linkage and Timing

- **Two Altair 8800 are purchased by a Steve Dompier, who was a member of a Bay Area group the Homebrew Computer Club.**
- **The club members were unimpressed with the Altair. But one night while tinkering with it; his low frequency weather radio starts to buzz and hiss. But manipulating the code and creating static he eventually got it to play music. The static was repeatable.**
- **Dompier wrote an article about Altair music in a local newsletter, *Peoples Computer Company*. It finds its way to a young Harvard dropout who is writing some software for MITS — Bill Gates.**

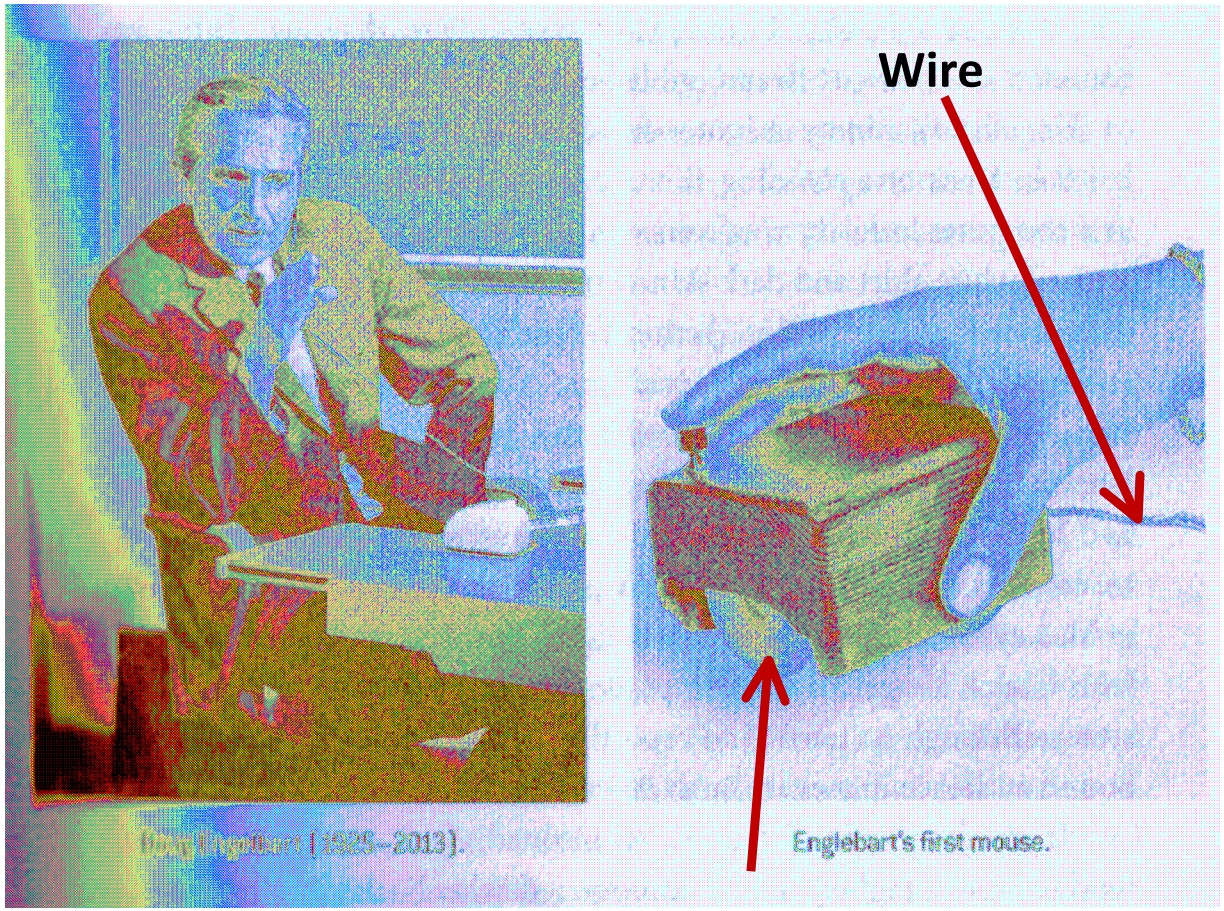
Bay Area Homebrew Computer Club

- A “Hyde Park” collection of all types of personages in the Bay Area that would gathered to talk, argue, demonstrate, exchange knowledge covering all things hardware and software; get drunk; get high, organize protests, rock concerts and publish flyer, newsletter, bulletin boards, etc…
- The Altair 8800 was first shown there.
- Many PARC ideas were floated there.
- Their motto re: software: if it can be copied, it is free/open source. Someone reversed engineered the Altair 8800 BACIC OS and gave it away. It provoked Bill Gates’ Ayn Rand style letter on his labor and ownership of the OS and that they were stealing his labor.

Doug Engelbart and the 

- **Englebart was a visionary and worked at SRI.**
- **He was deep into the ARPANet's development.**
- **In 1962 after years of writing and rewriting "*Augmenting Human Intellect*." He was describing the intuitive talents in the human mind coupled with a computer's power to interact with the mind.**
- **He received an ARPA grant and NASA funding and proceed in developing a computer human interface that pointed, dragged, highlighted by means of a device that resembled a mouse, with a wire for a tail.**
- **Six years was spent in development. Another example of Federal support and entrepreneur development.**

Doug Englebart, SRI with his first wooden mouse.



- One of his collaborators at SRI was Alan Kay, who moved down the road to Xerox PARC where he started working on the Personal Computer.

- He refined and developed the mouse and the on screen GUI.

- Xerox blew the PC revolution and in the end gave away the mouse and the GUI a to any on who wanted it. Steve Jobs was first to realize their capabilities and ran off and built it into his third model, the Lisa.

- Interesting Englebart and Kay wanted to have 10 buttons on it. PARC Human factors reduced it to 2 or 3. Jobs didn't want any, but had to live with one.

Xerox's PARC (Palo Alto Research Center)

- **Xerox PARC, has a distinguished reputation for its contributions to information technology and hardware systems.**
- **Founded in 1970 as a division of Xerox Corporation, PARC has been responsible for many well known and important developments.**
- **Xerox structured the Palo Alto Research Center as a wholly owned subsidiary in 2002.**

Xerox's PARC and the Alto

- Xerox has been heavily criticized (particularly by business historians) for failing to properly commercialize and profitably exploit PARC's innovations.
- A favorite example is the GUI, initially developed at PARC for the Alto and then commercialized as the Xerox Star by the Xerox Systems Development Department.
- Although very significant in terms of its influence on future system design, the Xerox Star is deemed a failure because it only sold approximately 25,000 units.
- In a common action by individuals in the Computer world a small group from PARC led by David Liddle and Charles Irby formed Metaphor Computer Systems.
- They extended the Star desktop concept into an animated graphic and communicating office-automation model and sold the company to IBM.

PARC Contributions

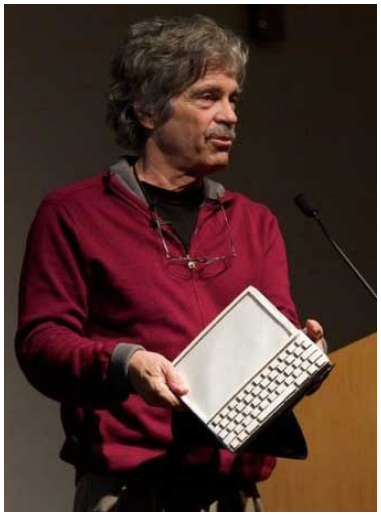
Xerox PARC has been the inventor and incubator of many elements of modern computing in the contemporary office work place:

- **Laser printers,**
- **Computer-generated bitmap graphics**
- **The Graphical User interface, featuring windows and icons, operated with a mouse**
- **The WYSIWYG text editor**
- **Interpress, a resolution-independent graphical page-description language and the precursor to PostScript**
- **Ethernet as a local-area computer network**
- **Fully formed object-oriented programming in the Smalltalk programming language and integrated development environment.**
- **Model–view–controller software architecture,**
- **Amorphous silicon (a-Si) applications, and advancing very-large-scale-integration (VLSI) for semiconductors.**

PARC Contributions

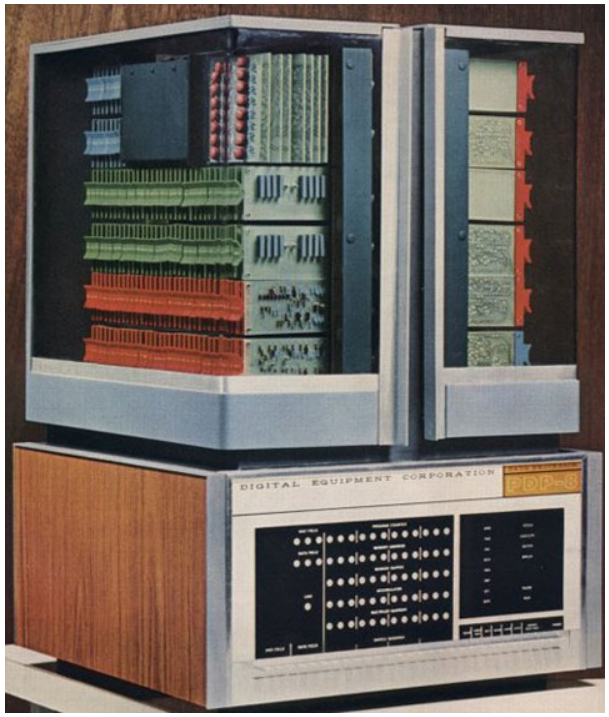
- Most of these developments were included in the Alto, which added the now familiar Stanford Research Institute - developed mouse, unifying into a single model most aspects of now-standard personal computer use.
- Through all of these features the modern personal computer with desktop paradigm and ubiquitous computing developed as a commodity.
- To this was added the integration of Ethernet which prompted the development of the PARC Universal Packet architecture, much like today's Internet.

Alan Kay and the PARC Laptop



Visionary! The Dynabook with Smalltalk software. A personal notebook computer with easy rechargeable battery and local drive memory, price some $500, multimedia capabilities, wireless network access, Internet, flat screen, GUIs etc.

This was a concept and it was the late 1960s and beginning of 1970s, when under "personal computer," people recognize something like DEC PDP-8 machine) wardrobe-size box, which cost $18,000, and didn't have any of the above described features.



Kay coined the PARC Credo:
"The way to predict the future is to invent it."

The technology doesn't exist; so, go develop it.

Computer Timeline - 13

The first microprocessor

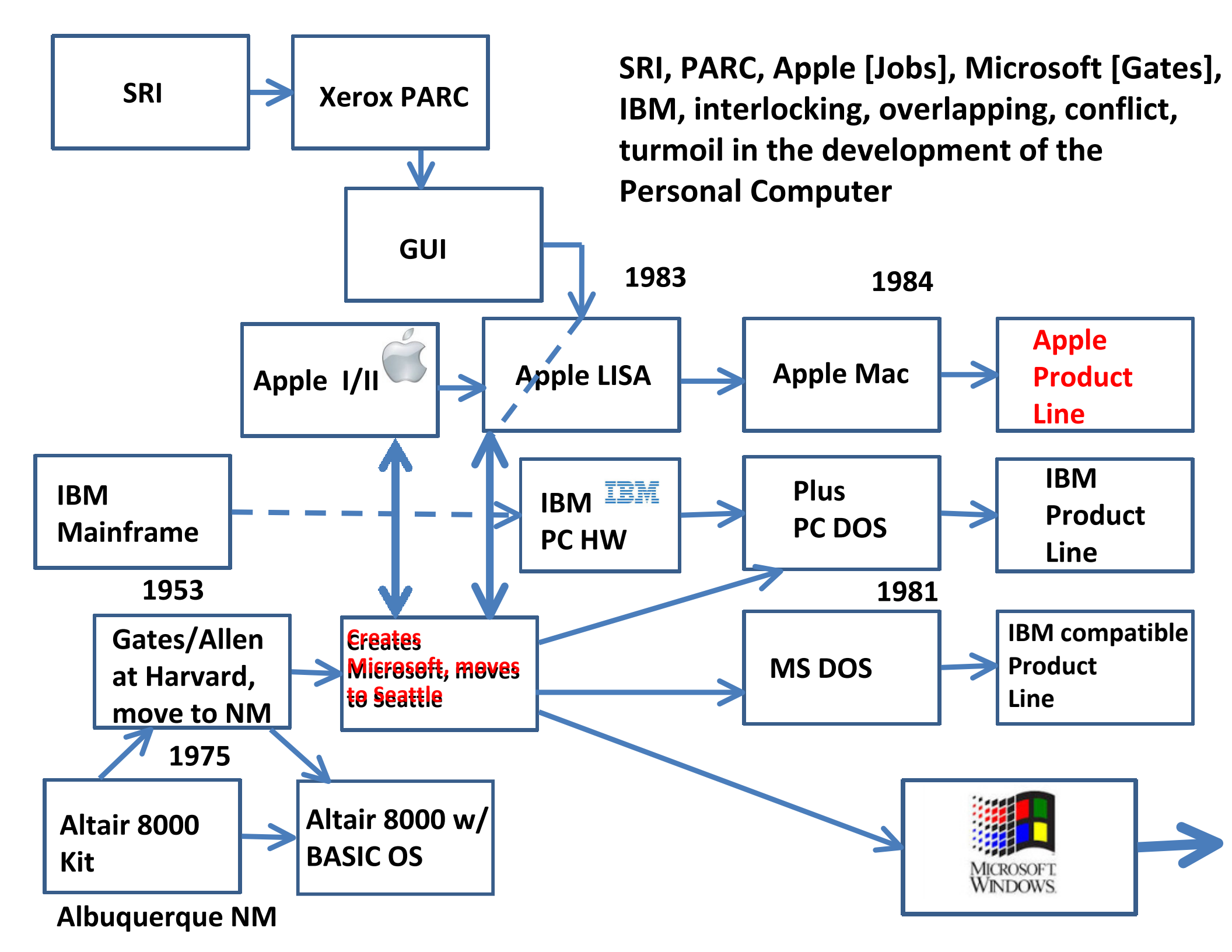
- Intel introduces the first microprocessor, the Intel 4004 on Nov, 1971.

The first personal computers

- In 1975, Ed Roberts coined the term "personal computer" when he introduced the Altair 8800 computer kit for $400.00
- The computer relied on a series of switches for inputting data and output data by turning on and off a series of lights.
- Although the first personal computer is considered by many to be the KENBAK-1, which was first introduced for $750 in 1971.
- The Micral is considered the be the first commercial non-assembly computer. The computer used the Intel 8008 processor and sold for $1,750 in 1973.

PARC's Fatal Flaw

- **PARC was intended to develop the business office of the future.**
- **"The copier will be far more important to society that the computer."**
  - **Head of Xerox Research, back in Rochester NY**
- **They gave away their inventions. Steve Jobs was on the scene to take them.**


SRI, PARC, Apple [Jobs], Microsoft [Gates], IBM, interlocking, overlapping, conflict, turmoil in the development of the Personal Computer
SRI
Xerox PARC
GUI
1983
1984
Apple I/II
Apple LISA
Apple Mac
Apple Product Line
IBM Mainframe
1953
IBM PC HW
Plus PC DOS
IBM Product Line
1981
Gates/Allen at Harvard, move to NM
1975
Creates Microsoft, moves to Seattle
MS DOS
IBM compatible Product Line
Altair 8000 Kit
Albuquerque NM
Altair 8000 w/ BASIC OS
MICROSOFT WINDOWS

Personal Computers

- The first 1981 IBM PCs were klutzy, not flexible, not intuitive to use and big. Their initial 8.5 inch "floppy" memory discs were bigger than the 3.5 inch shirt pocket size memories later used in the Mac.
- But, they were cheaper.
- Almost all PC brands, Wang being a notable exception, used the Microsoft DOS operating system. Apple built both HW and SW.
- The PCs were a hardware driven competitive product. The Apple products were technology driven products.
- When my work place Mac was threatened in the 1990s, I used a Charlton Heston comment that I would be lying dead at my desk, clutching my Mac before it would be replaced with a Gateway PC using DOS!

The IBM PC and Microsoft

- **IBM had a lock on the large mainframe computer business with its 360 series and "dumb terminals."**
- **DEC and Wang had captured the mini-computer market. If Bureaucratic IBM did not move; it could lose the potential PC market. The IBM Board took a risk that its FL Research Center could produce/market a PC in a year.**
- **The PC was a vendor-product-based-assembly effort. IBM's software centers' processes were not structured to build a PC OS especially against a 9 month deadline.**
- **IBM knew of Gates/Microsoft and the Altair 8800 BASIC OS. They gambled that Microsoft could deliver. They did!**
- **But Gates negotiated the contract to read that he was giving IBM a non-exclusive license to use PC-DOS that he would develop. But, he could sell MS-DOS to others. Ultimately making PC hardware a cost driven commodity.**

No Invitation

- **When IBM unveiled the PC in 1981, Microsoft and Gates were not invited the event.**
- **They were just vendors.**

Personal Computer

Although IBM's launch of the Personal Computer (IBM 5150) in 1981 set the industry standard for what would be personal computing, IBM had introduced a variety of small computers for individual users several years before that.

IBM Personal Computer model 5150 with IBM CGA monitor (model number 5153), IBM PC keyboard, IBM 5152 printer and paper stand.

Type:	Personal computer
Released:	August 12, 1981
Discontinued:	April 2, 1987
Cost:	$1600
Operating system:	IBM BASIC / PC DOS 1.0
	CP/M-86
UCSD:	p-System
CPU:	Intel 8088 @ 4.77 MHz
Memory:	16 kB ~ 256 kB
Sound:	1-channel PWM

Computer Timeline - 15

The first laptop or portable computer

- The IBM 5100 is the first "portable computer," which was released on September 1975. The computer weighed 55 pounds and had a five inch CRT display, tape drive, 1.9MHz PALM processor, and 64KB of RAM.
- The first "truly portable computer" or laptop is considered to be the Osborne I, which was released on April 1981 and developed by Adam Osborne. The Osborne I weighed 24.5 pounds, had a 5-inch display, 64 KB of memory, two 5 1/4" floppy drives, ran the CP/M 2.2 operating system, included a modem, and cost $1790.

Computer Timeline – 16 Some Firsts

- The IBM PC Division (PCD) later released the IBM portable in 1984, it's first portable computer that weighed in at 30 pounds. Later in 1986, IBM PCD announced it's first laptop computer, the PC Convertible, weighing 12 pounds. Finally, in 1994, IBM introduced the IBM ThinkPad 775CD, the first notebook with an integrated CD-ROM.

The first Apple computer

- Steve Wozniak designed the first Apple, known as the Apple I, in 1976.

The first PC clone

- The Compaq Portable is considered to be the first PC clone and was release in March 1983 by Compaq. The Compaq Portable was 100% compatible with IBM computers and was capable of running any software developed for IBM computers.

IBM 5100 is the first portable computer. The picture is from an ad of the IBM 5100 taken from a November 1975 issue of Scientific America.

In-between the Massive Mainframe and the PC
The Massachusetts 1980-1990s Computer Miracle

Digital Equipment Co

Ken Olsen

MIT

- **DEC's series of PDP mini computers.**
- **Dropped the prices so that the PDP series could be afforded by vast communities in business, academia and industry.**
- **Initially an almost totally self contained company.**
- **Did not anticipate and respond the PC and workstation wave.**
- **Merged with Compaq, then HP**

Wang Laboratories

An Wang

Harvard

- **Office automation products built on small computers.**
- **Advanced and early word processor.**
- **In early years had 80% of US market.**
- **Initially an almost totally self contained company.**
- **Products were non standard and sales began to fade as PCs and stand alone-less expensive printers came to the market.**

All That Is Left:
The Digital Federal Credit Union

Computer Timeline – 17 The Commodore 64

The Model T of Personal Computers

Commodore 64c with 1541-II floppy disk drive and 1084S monitor displaying television-compatible S-video

It was an 8-bit home computer introduced in January 1982 for $595. It is noted as the highest-selling single computer model of all time, with independent estimates placing the number sold between 10 and 17 million units.

The C64 has 64 kilobytes (65,536 bytes) of RAM, and had technologically superior sound and graphical capabilities with multi-color sprites and a more advanced sound processor, when compared to other earlier systems, such as the Apple II and Atari 800,

The C64 dominated the low-end computer market for most of the 1980s. For a substantial period (1983–1986), the C64 had between 30% and 40% share with two million units sold per year, outselling the IBM PC compatibles, Apple Inc. computers, and the Atari 8-bit family of computers.

Approximately 10,000 commercial software titles were made for it including office productivity applications, games, and development tools including a BASIC interpreter written by Bill Gates that allowed users to write code. The C64 is also credited with popularizing the computer demoscene. Sergey Brin cut his "teeth" on one.

Computer Timeline - 18

The first multimedia computer

- In 1992, Radio Shack becomes one of the first companies to release a computer based on the MPC standard with the M2500 XL/2 and M4020 SX computers.
- The **Multimedia PC (MPC)** was a recommended configuration for a personal computer with a Compact Disc-ROM drive. The standard was set and named by the "Multimedia PC Marketing Council," a working group of the Software Publishers Association. The MPMC comprised companies including Microsoft, Creative Labs, Dell, Gateway, and Fujitsu. Any PC with the required standards could be called an "MPC" by licensing the use of the logo from the SPA.
- **Microsoft Windows overtook it as a standard.**

Other major computer company firsts

- Compaq - In March 1983, Compaq released its first computer and the first 100% IBM compatible computer the "Compaq Portable."
Dell - In 1985, Dell introduced its first computer, the "Turbo PC."
Hewlett Packard - In 1966, Hewlett Packard released its first general computer, the "HP-2115."
NEC - In 1958, NEC builds its first computer the "NEAC 1101."
Toshiba - In 1954, Toshiba introduces its first computer, the "TAC" digital computer.

Apple Macintosh Computer

Apple Macintosh

Model:	**M0001**
Introduced:	**January 1984**
Price:	**$2495**
CPU:	**Motorola 68000, 7.83 MHz**
RAM:	**128K, later 512K**
Display:	**9-inch monochrome screen**
	512x342 pixels
Ports:	**Two DB9 serial ports**
	Printer port
	External floppy port
Storage:	**Internal 400K SSDD floppy**
	optional external floppy,
$495 OS:	**Macintosh GUI**
	(graphical user interface)
Pointing Device:	**Mouse**

1984 Super Bowl Commercial

- **The Macintosh was introduced by the now famous $900,000 television commercial by Ridley Scott, "1984," that most notably aired on CBS during the third quarter of Super Bowl XVIII on January 22, 1984**
- **“On January 24th Apple Computer will introduce the Macintosh computer so 1984 will not be (Orwell’s) 1984”**

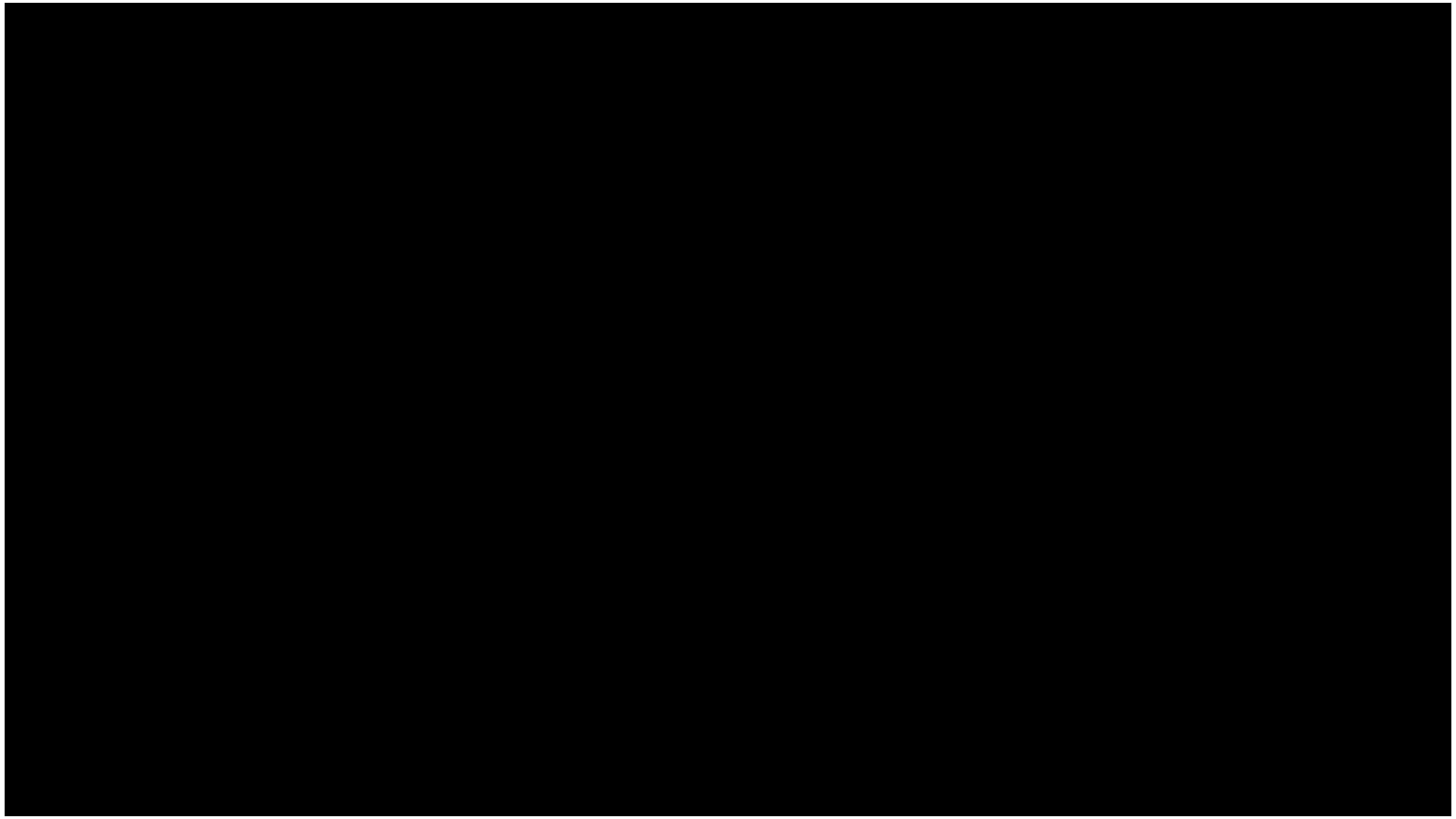
1984 Super Bowl Commercial

www.youtube.com/watch?v=axSnW-ygU5g

back_to_work_after_thirty_years.wmv

- **The shortest video you've ever seen so pay attention... A woman goes back to work after thirty years.**
- **Watch carefully, the video is only 5 seconds long, but, you'll get it.**
- **If you're younger than 40 years old, you probably won't understand it.**

- https://youtube.com/embed/qteu4ld_SCE?rel=0



The Rise of Apple and the Decline of the Hobbyist Culture

- Radio Shack collapses after nearly 90 years.
- The Ham radio builder and the electronic modelers Rubicon probably was crossed when the Japanese began flooding the markets with cheap semiconductors and then chips.
- Early on, young inventors played with early radios, that were designed to be fixed. They were engulfed in clouds of solder smoke.
- Tubes and early semiconductors fit into sockets and were wired and soldered. This was the joy of building and then using. But chips had to be factory soldered because sloppy solder temperatures would destroy them.
- The thrill of construction was gone. Now was the time to explore, code and hack.
- You could buy components and build a computer, but the prices kept dropping. So, why bother?
- Apple made it almost impossible to get into their product for repair.

How RCA Lost the LCD, Who Knew?

- Fifty years ago RCA filed for its first patent on a new form of display that relied on a then obscure class of compounds called liquid crystals.
- Engineers at RCA's Princeton, N.J., research facility had spent several years tinkering with these materials, but prior to that point, nobody was quite sure what to do with them.
- It seemed like RCA, the company responsible for the commercialization of both black-and-white and color television, was again poised to revolutionize the field of electronic displays by turning these liquid crystal displays into commercial products.
- Yet in 1976, RCA sold off its liquid crystal operation, abandoning what eventually became one of the most widespread technologies of the information age and the foundation of a multibillion-dollar industry overseas.

Isaacson Doesn't Extend the PC Discussion Beyond the Early Years

The computer becomes a just commodity under going competitive product improvement:

- **Morse" Law and competition drive down the size, weight, power requirement and price of computer hardware.**
- **The Innovators are somewhat replaced by teams of product designers, logic design teams and bean counters always looking over their shoulder at what the competition's designs and prices will be.**
- **Apple, with and for a time without, Steve Jobs is an exception. Apple is driven by packaging design and neat features. They have almost a cult following.**
- **Apple succeed with smaller volumes at higher prices.**
  - **The iPOD is a breakthrough in sales.**

Laptops/Notebooks

- Laptops were made possible by the emergence of flat LCD panels, the micro processor, solid state memory advances and battery technology that could sustain operation for > 4 hours.
- A laptop is a light weight portable PC with a clamshell form factor, designed for mobile use.
- A laptop has the components and inputs as a desktop computer system, including display, speakers, usually a smaller keyboard a touchpad or a trackpad and a DVD R/W unit integrated into a single device.
- Laptops are now ubiquitous: work, education and personal use at home often replacing the Desktop.
- Most modern-day laptops also have integrated webcams and a microphone. Laptops can be powered either from a rechargeable battery, or by an AC wall outlet via an adapter.
- Laptops are now truly portable through the use of wireless links.

A Key Laptop Driver was the Development of the LC Flat Display Panel

- For decades computer monitors were heavy glass vacuum tubes. Essentially TV sets.
- The used a lot of electricity, got hot, were heavy, large and awkward.
- They had a lot of mercury in them and were hard to get rid of.
- A problem crying for a solution.
- The LCD came on the market in the early 2000s followed by the touch screen display.

The Laptop →Tablet/iPad/Slate™

- The tablet was conceptualized in the late 1990s. It was prototyped and developed in 2000s. It awaited technology.
- In 2010 the first modern tablet, the iPad, was released. In March 2012, *PC Magazine* reported that 31% of U.S. Internet users owned a tablet, used mainly for viewing published content such as videos and news
- A tablet computer is self contained mobile computer with a touchscreen display, circuitry and battery in a single unit.
- Tablets come equipped with sensors, including cameras, a microphone, GPS , an accelerometer, and the touchscreen display that uses finger or stylus gestures substituting for the use of computer mouse and keyboard.
- Tablets usually feature on-screen, pop-up virtual keyboards for typing. Tablets may include physical buttons for basic features such as speaker volume and power, and ports for computer network communications and battery charging.
- Tablets are typically larger than smartphones at 7 inches or larger, measured diagonally. They do not have DVD R/W
- They communicate via wireless links.

Next!

How Intel's *Compute Stick* Is Once Again Redefining the PC, 2015*

eWEEK

* eWEEK, April 10,2015

How Intel's Compute Stick is Once Again Redefining the PC 2015*

1984

2015

* eWEEK, April 10,2015

How Intel's *Compute Stick* Is Once Again Redefining the PC

- Intel's *Compute Stick* is one of the most interesting new computer designs to arrive on the market.

- The device is little more than an HDMI dongle, like Google's Chromecast or Amazon's Fire TV Stick, but unlike those products, which offer streaming services, the *Compute Stick* is a self-contained PC.

- The *Compute Stick* is part of Intel's plan to expand the definition of a PC. It demonstrates the level of miniaturization that has come to the computer industry.

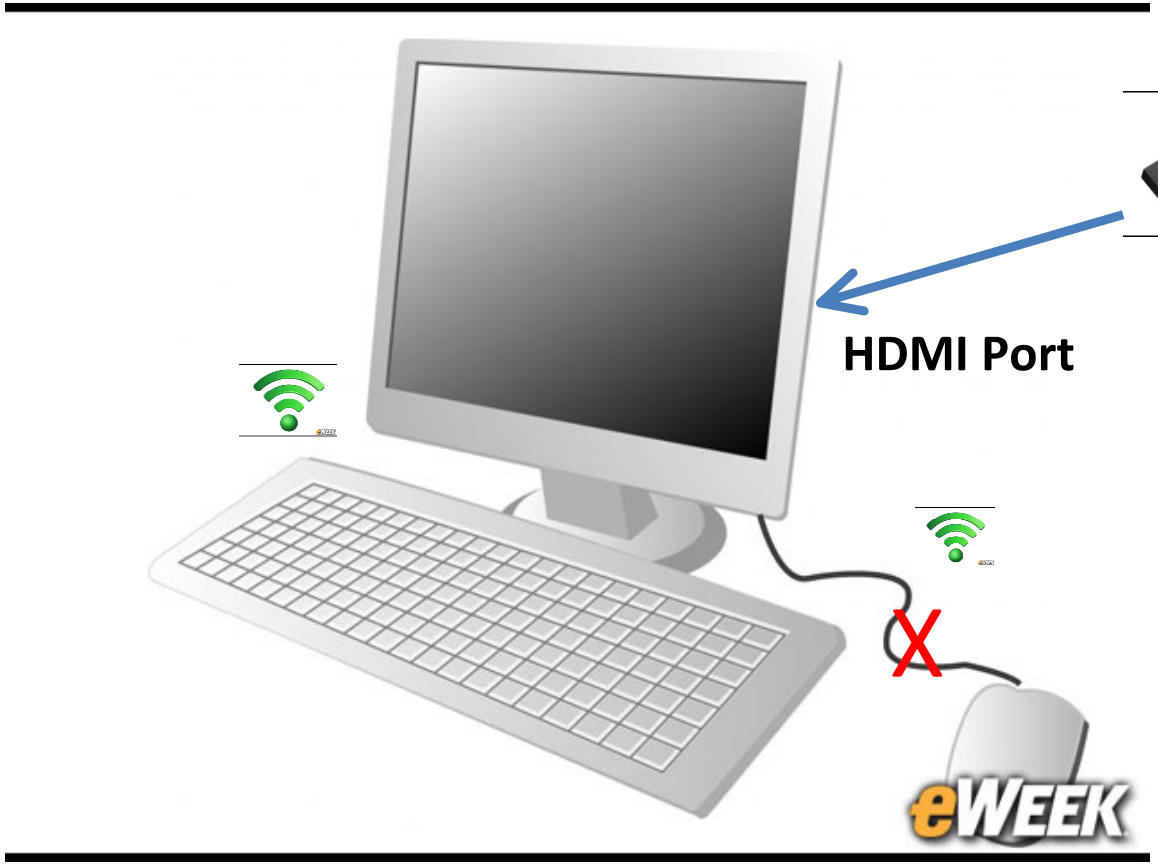
- The *Compute Stick* has several processors that can run in a wide range device formats.

- The *Compute Stick* showcases the combination of mobile-friendly components in a surprisingly versatile computer.

- Best of all, it's an extremely cheap way [$99] to get computing power into the hands of anyone who needs to get some work done.

Bring Your Own Keyboard and Mouse. Maybe a monitor.

- This may seem obvious, but the Compute Stick requires users to bring along their own keyboard and mouse.
- And since it plugs into an HDMI port, everything from a TV to a regular computer monitor can be used for the display.
- That will add some cost to owning a Compute Stick, but considering how cheap it is, that's not necessarily a big deal.



Wireless Router at Home

These local routers broadcast at 1Billion bps

Wi-Fi in the community

Download