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Fire in the Valley, Third Edition

The Birth and Death of the Personal Computer

The Pragmatic Bookshelf

Dallas, Texas • Raleigh, North Carolina

The Pragmatic Programmers

*"If you're going to read one history book this decade, **read this one**."*
— John Perry Barlow, co-founder, Electronic Frontier Foundation

Third Edition

Fire in the Valley

The Birth and Death of the Personal Computer

Michael Swaine and Paul Freiberger

Foreword by John Markoff, *The New York Times*

Edited by Brian P. Hogan

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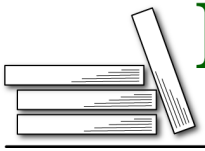

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The HP Way and the Xerox Worm

> *One of the things [Hewlett-Packard] learned is that closed architectures aren't going to work, that you really have to depend on third-party suppliers.*
> –Nelson Mills, project manager, Hewlett-Packard

Osborne was among the last pioneers to open new territory before civilization arrived. After the Osborne 1 appeared in 1981, the big companies really did begin to enter and transform the market. Soon IBM, DEC, NEC, Xerox, AT&T, and even Exxon and Montgomery Ward were thinking about producing a personal computer. Some companies, like Hewlett-Packard, had started much earlier, though.

Project Capricorn

Hewlett-Packard hadn't rejected Steve Wozniak's Apple I design because it didn't believe in the idea of a personal computer. It did. HP built large computers as well as calculators, so it understood how to sell relatively inexpensive, personal technology products. There are many reasons why HP may have turned Wozniak down. One is that his machine did not lend itself to mass production. As Jobs later acknowledged, "it was designed to be built in a garage." It was also true that the Apple I was not a machine for the engineers and scientists who made up HP's primary market. Woz was clearly told that the Apple I was more appropriate for a start-up company than for HP. He may also have even been turned down because he had no university degree, which would not have been surprising at any established computer company at that time. Those reasons aside, HP had another reason to reject a personal-computer design in 1976: it was already working on one of its own.

In early 1976, a crew of engineers at HP's Cupertino, California, facility began to coalesce around a project with roots in its calculator technology. Chung Tung, the engineer in charge of Project Capricorn, brought in engineer Ernst Ernie along with Kent Stockwell to direct the hardware design and George Fichter to oversee software. There was no shortage of talent at HP, and Capricorn was a significant project.

Initially, Capricorn was intended to be a computerlike calculator but more elaborate than any of HP's small machines. HP already made highly specialized calculators. The calculator-market war that had driven Ed Roberts to create the Altair had not hurt HP as much as it had other calculator manufacturers because HP had concentrated on scientific calculators that did more and sold for more than the less expensive commercial versions. Capricorn was at first intended to have a liquid crystal display, like a calculator, but with several

lines instead of one. It would be a desktop BASIC-language calculator. By summer the project had redefined itself, and Capricorn was ornamented with a cathode-ray tube, a significant change both in terms of manufacturing costs and the potential market for the machine. Capricorn was gradually turning into a computer.

HP was perhaps better suited to develop a personal computer than any other established computer company—with the possible exception of Xerox. HP was headquartered in Silicon Valley, near most of the semiconductor companies and in the midst of the growing micro mania. Some of the Capricorn engineers were actually hobbyists like Woz, working on their own homebrewed systems. HP also had far more resources to devote to creating such computers than the garage start-ups. By the time they finally designed a machine, the Capricorn staff had grown to more than a dozen engineers and programmers.

This computer was becoming quite distinctive. It was to have a small built-in printer, a cassette-tape recorder for data storage, a keyboard, and a display, all in one desktop package that was smaller than the Sol (which had not appeared yet and would not include an integrated display or data storage—let alone a built-in printer—when it did). Its chip was also ahead of its time—but this was not necessarily an advantage. In 1976, the only microprocessor that looked feasible was the Intel 8080, the Altair's chip, but the Capricorn team wanted one better adapted to its purposes, and turned the problem over to another HP division. Hence, Capricorn got its own HP-designed proprietary microprocessor. It was a decision some members of the team later regretted.

Another problem soon emerged. In the fall of 1976, in a corporate-level decision, the project was moved out of Silicon Valley to HP's offices in sleepy Corvallis, Oregon, a shift that played havoc with the schedule and damaged morale. Woz, who more than anything else wanted to design computers at HP, seriously considered joining the Capricorn team and moving to Corvallis. He thought he would like living in Oregon, and he wanted to get in on the project. But HP turned him down.

Then in October, Mike Markkula made his first visit to Steve Jobs's garage, and Woz began being pulled into Jobs's plan to start a company. Unlike Woz, many other Capricorn engineers felt that Corvallis was exile, that they were being asked to leave the center of the universe and move into the void. Some elected not to move and dropped out of the project. When others did make the move, they found the plant wasn't ready for them. At first, programmers had to commute 70 miles to do software development on the nearest mainframe computer.

Missing the Window

For all the delay, however, the Capricorn team was progressing. By November they had developed a prototype. It had no tape drive, printer, or display yet, and the CPU chip and certain other microprocessors the engineers wanted for controlling peripherals were still in the layout stage. In 1977 they solved the tricky problems of mixed technologies that were posed by building a printer into the computer. Finally, the chips began to appear. During a visit of the corporate brass, one executive vice president told the engineers that the machine needed more I/O ports on the back to connect it with other HP devices or to allow future capabilities to be added. It was a little late to suggest significant design modifications, but the changes were made. Together, the move and the modifications helped Capricorn slip a full year behind schedule.

When project became product in January 1980, it was an attractive, solidly engineered machine, but relatively expensive—even given its capabilities—at $3,250. It was called the HP-85 and had a 32-character display, almost as wide as the 40 characters on Wozniak's Apple II.

Although the HP-85 sold well enough for HP's purposes and led to a series of related machines, it did not set cash registers ringing as the Apple II did. Then again, it wasn't designed to—HP sold it not as a business machine but as a scientific and professional one. Nevertheless, HP's sluggish pace in completing and marketing the product unquestionably hurt sales. By the time this machine with its built-in cassette-tape drive came out, the field was moving toward using floppy disks, which were more reliable than tape cassettes and stored much more information. Moreover, the HP-85 cost more than some of these floppy disk–based systems.

In the long run, though, the HP-85's greatest flaw may have been its closed system design that required HP software and HP peripherals. When the Apple II was released in 1977, the Capricorn team believed their machine would compete well with it. But by the time the HP-85 appeared three years later, some Capricorn programmers were privately conceding the general and business market to Apple. There was real irony here because the Apple II's 40-column, lowercase display was clearly inappropriate for basic applications like word processing and report generation, and its 6502 processor was no number cruncher. Apple machines eventually got 80-column upper- and lowercase display capabilities, but only because Wozniak left the architecture open and others created the necessary boards and software. Third parties were continually improving the Apple II, whereas they were shut out of the HP-85. HP soon concluded that the closed architecture had been a mistake.

Still, HP had beaten the other established computer companies into the market by more than a year, and the HP-85 and its successors carved out a solid market niche for themselves. The next big manufacturer to introduce a personal computer fared less well.

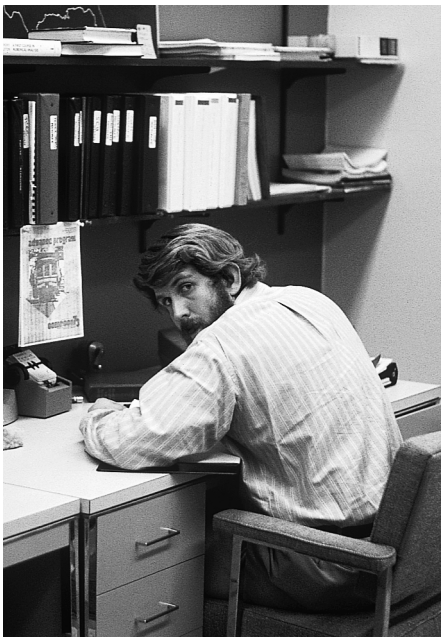
The Alto

Xerox had made its name in photocopying machines, but the company had flirted with computers as well, and maintained close ties with Silicon Valley. After acquiring Scientific Data Systems, a computer company in El Segundo, California, and renaming it Xerox Data Systems (XDS), Xerox became one of the dwarfs—the seven mainframe computer companies living in IBM's shadow. XDS, however, was a financial millstone, and Xerox finally sold it, although it retained the El Segundo facility itself for some integrated circuit and electronics design and systems programming.

Xerox purchased Shugart, the disk-drive manufacturer, in the winter of 1977—1978. Don Massaro, president of Shugart through the early 1970s, recalled that in the days before Apple soared to its zenith, young Steve Jobs was in his office nearly every week nagging him to devise a disk drive that personal-computer users could afford. Massaro and his colleague James Atkinson did just that, helping make Apple and Shugart leaders in their fields. When Xerox bought Shugart, it acquired that wedge in the personal-computer market, and it also got Massaro, who proved instrumental in Xerox's foray into the market some years later.

At PARC, its research center in Palo Alto, Xerox had attracted some talented people. Hungarian-born Charles Simonyi, who had learned programming on a Russian vacuum-tube computer and had degrees from Berkeley and Stanford, worked there. Also working at PARC was John Shoch, who finished his PhD at Stanford while helping get PARC started, and the fiercely independent but farsighted Alan Kay, who adorned his desk with a cardboard model of his dream computer—a machine that Kay called Dynabook, powerful and yet small enough to fit in a book bag. Larry Tesler brought the newest programming techniques to his PARC software. Bob Metcalfe was involved in a technique for networking computers.

Over several years these engineers and programmers, building in part on the revolutionary work of Douglas Engelbart, created an impressive workstation computer called the Alto. The Alto boasted an advanced language called Smalltalk, an input device borrowed from SRI called the mouse, and that networking technique of Bob Metcalfe's called Ethernet for connecting individual Altos for communication and cumulation of effort, as if they were one big computer. Xerox referred to the whole arrangement as the "office of the future," and it was both visionary and technically sound. Xerox marketed Altos to government agencies, placing them in the White House, the Executive Office Building, the National Bureau of Standards, the Senate, and the House of Representatives, where they were used to print the Congressional Record.



Bob Metcalfe: *While working at Xerox PARC, Metcalfe cocreated Ethernet, which became the standard for networking computers.* (Courtesy of Richard Shoup)

The Alto was 20 times more computer than the original Altair. Not only did it have impressive speed and display graphics, but the Smalltalk language was a generational leap beyond BASIC. Because work on it was completed in 1974, some people, particularly those at Xerox, claim it as the first personal computer ever. But the Alto was never a commercial product. No more than 2,000 were ever built, and its cost removed it from the category of a personal computer, even if it was a self-contained machine for one individual's use. It was priced as a minicomputer.

The Alto took two years to develop—from 1972 to 1974—and was used for three more years before Xerox decided to develop it further into a marketable product. In January 1977, David Liddle was put in charge of this task, and Charles Simonyi came to work for him. Liddle had joined PARC in 1972 after having worked on computer display systems in a project funded by the Defense Advanced Research Projects Agency. But the project proceeded slowly. Many researchers at PARC, attracted by the freedom to design technologically dazzling innovations, were growing frustrated that their creations remained

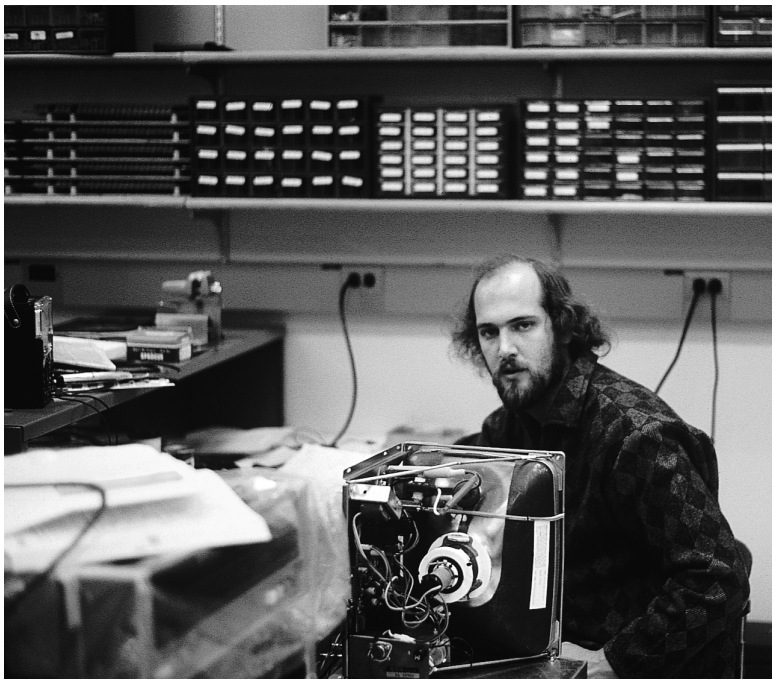
Charles Simonyi and Bill Gates: *Simonyi came from Xerox PARC to oversee development of Microsoft's most profitable products. He became a billionaire and was the first space tourist.* (Courtesy of Microsoft)

sequestered in the lab. They could see things happening in quickstep around them, particularly at Apple, while Xerox dawdled. Before Xerox got a personal-computer product to market, several key people left, with others departing soon afterward. Tesler went to Apple, Kay to Atari, and Simonyi to Microsoft.

The Worm

Meanwhile, Xerox released its Ethernet network and began linking personal computers. In 1981, four years after it started, Xerox announced the 8010 Information System (nicknamed Star). It was an impressive machine, using much of the advanced Alto technology that Jobs had seen in 1979. But at $16,595 the Star was not really a personal computer either. Nor did Xerox try to convince people it was. For example, the company did not try to sell the machine in computer stores. If HP's laggardly development of the HP-85 had caused it to miss its commercial window by offering a tape-based machine in a disk-based world, the Xerox Star missed the market altogether.

A month later, though, Xerox introduced a true personal computer. The Xerox 820, announced in July 1981, was code-named The Worm during development,



David Liddle: *Liddle headed up the Star computer project at Xerox, which attempted to turn the revolutionary Alto into a marketable product.* (Courtesy of Richard Shoup)

perhaps because Xerox had dreamed it would eat into Apple's market. Like many existing personal computers, the Xerox 820 used the Z80 chip. Xerox also offered Kildall's CP/M and the two BASIC languages, one written by Gates and Allen and one by Eubanks.

Don Massaro led the 820 project. The 820s would be inexpensive, individual workstations on Ethernet systems in Fortune 500 corporations, the same market the Star sought. Development took only four months, and the machine quickly went into manufacture. "All we wanted to do was reserve those desks for Stars later on," Massaro said. Given that target market, Xerox's next move didn't make much sense.

"It was designed to go after the end-user market through our direct sales organization," Massaro explained. "Xerox has always sold through its own sales organization. Xerox had 15,000 salespeople worldwide, and that was one of the real strengths of Xerox." But ComputerLand waved huge purchase orders before Xerox corporate eyes, and "in a moment of weakness, we went to that channel."

digital intel XEROX

From: dave of digital at DEC node BLUE

Message: where is dave liddle?

]

Sent at 3-MAY-1981 13:44:14 via the 10MB Ethernet.

Ethernet: *This is a printout of the first message, other than some within Xerox PARC, ever sent via Ethernet.* (Courtesy of David Liddle)

Mass marketing was a mistake. Xerox fared poorly in the developing shelf-space war in ComputerLand stores. Perhaps it was the paucity of technological innovation in the 820, or Xerox's failure to learn from the lesson of open architecture. Or perhaps the competition was simply getting too heavy even for Xerox by that point. In Bill Gates's view, the company misunderstood the market. "Xerox was aiming a little too high and trying to do something very difficult and didn't see the opportunity," said Gates. "When they did, they threw something together in a couple of months, and it was too little too late."

"We got creamed," Massaro admits. And it was IBM that did it.