



Michael Dertouzos set the mold by spinning off the computer graphics company Computek and leading “two lives.”



Joseph C.R. Licklider, founder of LCS forerunner Project MAC, headed a team that launched Infocom. The company failed; its intellectual legacy lives.

Fountain of Ideas

A reservoir for computing innovation, LCS has provided a haven for startups—and a place for researcher/entrepreneurs to regroup and begin again.

MANY ACADEMICS SEE RESEARCH AS AN END IN ITSELF. AFTER ALL, the purpose of a university is to develop knowledge—not to make a profit. But the researchers who have worked at the MIT Laboratory for Computer Science (LCS) since its inception 35 years ago have shown a keen sense of market potential.

Floating on a secure base of defense funding, the laboratory has over the decades served as a reservoir of technical creativity. LCS researchers have frequently found the Lab a comfortable base from which to launch companies that commercialized their MIT work while maintaining their academic connections.

LCS Director Michael Dertouzos, who started Computek in 1968 to commercialize a graphics device he had invented, sums up the appeal of this dual existence. “I had these two lives,” recalls Dertouzos. “When I got bored [at LCS] I went to the company and got stimulated with real engineering. And when I got bored there with real engineering, which was often,” he came back to MIT. Computek grew to 120 employees before Dertouzos sold the company in 1977 and returned full time to academia—a pattern that was to be followed by many LCS spinoffs through the years.

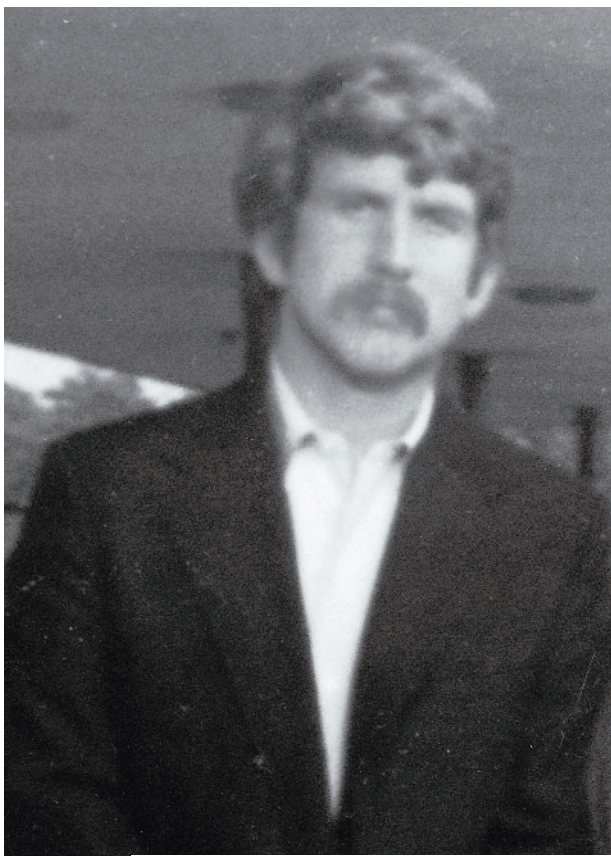
Infocom: The Legacy of Zork

MANY NEW BUSINESSES FAIL, AND THOSE FROM LCS ARE NO EXCEPTION. But while one measure of success is financial, another is the intellectual legacy that a company leaves behind. And along this dimension, LCS spinoffs have few equals.

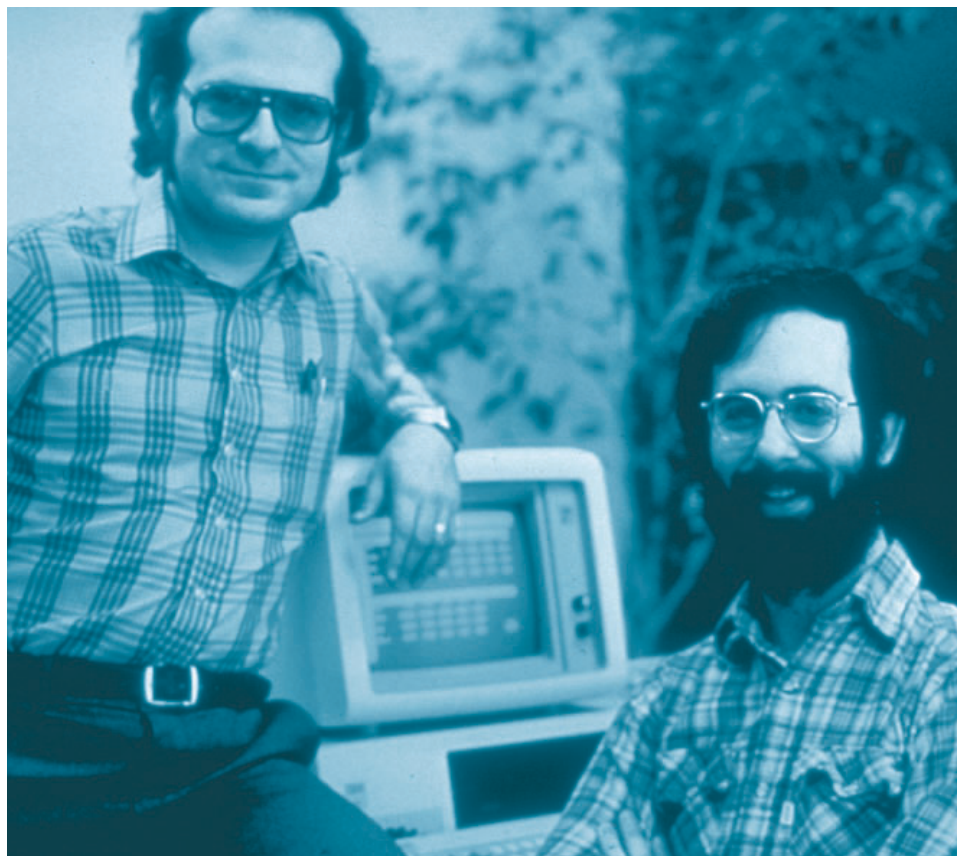
Consider Infocom, the company created in 1979 by Project MAC founder Joseph C. R. Licklider and nearly a dozen other LCS researchers. Infocom sold a peculiar kind of computer game known as “interactive fiction.” Best exemplified by Zork, the games were puzzles: The computer would print a description of the “room” that you were in, and sitting at the computer you would type back instructions on where to move and what actions to take.

Though its product may have seemed frivolous, Infocom was a technological pioneer. To accommodate the many different kinds of computer systems in use at the time, Infocom created a virtual computer called the Z Machine. The Z Machine served as a kind of buffer between the programmers and the outside world of mul-

BY SIMSON L. GARFINKEL



Bob Metcalfe learned packet-switching at MIT and launched the Ethernet bandwagon.



Bob Frankston and Dan Bricklin invented the electronic spreadsheet—software that helped businesses see the value of PCs. Their product, VisiCalc, fueled sales of the Apple II.

tiple, incompatible computer formats. The first copy of Zork sold in November 1980 and ran on Digital's PDP-11 minicomputer. A month later, the company was selling Zork for Radio Shack's new TRS-80 microcomputer. In February 1981, Infocom made a version that ran on the popular Apple II—and proceeded to sell 6,000 copies of the game over the next eight months. Infocom ultimately created 35 different games, and in 1984 had sales of \$10 million.

Infocom couldn't sustain its growth, though, largely because the company was divided against itself. Although games supplied the revenue, Infocom's management was determined to develop a corporate database tool called Cornerstone. By June of 1985 more than half of the company's 110 employees were working on Cornerstone. The project became a black hole, sucking up development dollars but never yielding a finished product. In December, Infocom finally shut down its business product division and laid off its staff, but it was too late. In June 1986, with just 40 employees left, the company was sold to California-based video-game maker Activision for \$9 million. Three years later, all but five of Infocom's 26 employees quit or were laid off, and the tattered remnants of the company were absorbed into Activision's operations. Licklider stayed at LCS, becoming its director. He retired from MIT in 1985 and died in 1990.

While Infocom failed as a business, the company broke important new ground that is still being explored today. Infocom enthusiasts have created Z Machine interpreters for more than 25 different systems—systems as diverse as Windows 95 and the 3Com Palm Pilot. Infocom's philosophy of making programs that run on any type of computer system stood in dramatic contrast to the prevailing way of doing business at the time. But this idea of a "portable environment" has, in the era of the Internet, taken hold in the form of the Perl and Java programming languages.

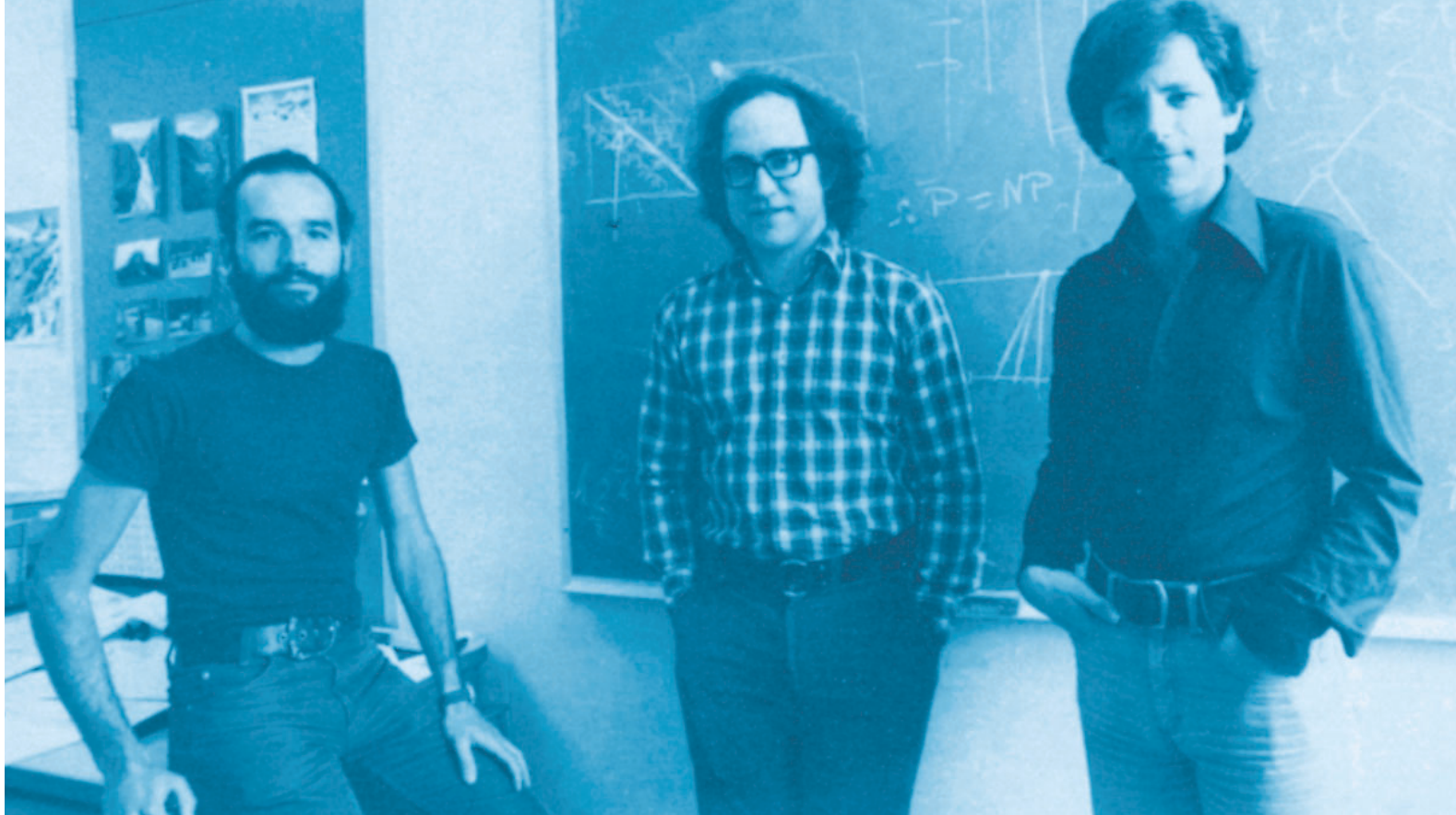
3Com: Messages Through the Ether(net)

ANOTHER LCS PROGENY WAS NOT ONLY PROFOUNDLY INFLUENTIAL, it also found dramatic commercial success. Bob Metcalfe gained his first exposure to packet-switching techniques while working at Project MAC in 1970. How he found himself at Project MAC is a story in itself: After graduating from MIT in 1969, Metcalfe entered a PhD program up the river at Harvard University. But Harvard didn't have the money to pay Metcalfe's fellowship. To make ends meet, he took a job at Project MAC building a packet-switched network interface card.

Packet-switching is a way of transmitting data that breaks a stream of bits into short segments, called packets; each packet is labeled with instructions for where to go. Packet-switching has caught on in a big way: It is the basis of the Internet.

After leaving Harvard and Project MAC in 1972, Metcalfe migrated west to Xerox's Palo Alto Research Center (PARC), which was pioneering the first personal computers. In 1973, Metcalfe applied the principles of packet-switching to the invention of a local area network technology called Ethernet. Metcalfe convinced Xerox that to be successful, Ethernet would have to be made readily available to all players in the computer industry. Meanwhile, Metcalfe still felt the gravitational tug of MIT. In 1979, he took Dertouzos up on an invitation to return to Boston and work for LCS as a consultant. Metcalfe enlisted Digital Equipment Corp., Intel and Xerox to start the "Ethernet bandwagon"—a commitment to make Ethernet a standard of the Institute of Electrical and Electronics Engineers (IEEE). "IEEE forced Xerox to make its Ethernet patents available for \$1,000 per company forever," says Metcalfe.

With the patents available at bargain-basement prices, and with Xerox still unwilling to push the technology into the general mar-



Adi Shamir, Ron Rivest and Leonard Adleman used “public keys” to keep data private. Their instructional demos became hot products.

ketplace, Metcalfe seized the opportunity. He started a company and licensed the Ethernet technology. Metcalfe’s new company—3Com—built network interface cards for all kinds of computers. 3Com went public in March 1984; it now has a market capitalization of roughly \$16 billion.

Metcalfe, who eventually left the company he started to become vice president for technology at the International Data Group (IDG) and a columnist in IDG’s weekly trade publication, *InfoWorld*, says that the MIT lab “had a great deal to do with the success of 3Com.” It’s not just that Project MAC was a pioneer in research on packet-switching, the technology at the heart of Ethernet. Equally important was the way LCS functioned as a base for Metcalfe to return to after leaving Xerox. It is doubtful that Metcalfe would have been able to enlist major companies to join his “bandwagon” were he not at an impartial institution.

Software Arts: The First Killer App

IT’S EASY TO FORGET THAT WHEN THE FIRST PERSONAL COMPUTERS arrived in the late 1970s, many people questioned what value such machines would have beyond entertainment and diversion for hobbyists. After a few years, nobody asked that question anymore—thanks largely to the pioneering work of Dan Bricklin and Bob Frankston, who met during the early 1970s while working together in Project MAC and then went on to co-found Software Arts.

“Dan and I had been talking since our MIT days about doing a business,” recalls Frankston. Bricklin, who had gone off to get a master’s degree at Harvard Business School, discovered firsthand a problem that was ripe for solution by personal computers. Confronted with the typical kind of repetitive calculations that come from the school’s case studies, Bricklin devised a program that would automate the work: the electronic spreadsheet. In 1978, Bricklin and Frankston started playing around with a prototype,

which they called VisiCalc. They thought at first that VisiCalc would be a “nice home accounting program,” says Frankston. “I started working on the real implementation in late November and we were able to demo it in January 1979. It took only a few more weeks—about 40 of them—to start a company, find a real office, buy a Prime 550 [minicomputer], hire some staff, finish the program and ship the product.”

VisiCalc is credited with bringing personal computers to the attention of businesses and fueling the sales of the Apple II computer, the machine on which it first ran. Many of Apple’s first customers bought the machines specifically to run VisiCalc; it was the first “killer app.” The program let business managers manipulate numbers with undreamed-of flexibility.

Today, alas, Software Arts is no more. Following the introduction of the IBM PC in 1981, domination of the spreadsheet market slipped away from Bricklin and Frankston. The new champion was Lotus Development Corp., with a more advanced PC spreadsheet called 1-2-3. Eventually, Lotus bought Software Arts. Frankston went on to work in high positions at Lotus and Microsoft and is now an advisor to many companies. Bricklin is founder and chief technology officer of Waltham, Mass.-based Trellix, which is developing tools for publishing documents on the Web.

RSA: Masters of Encryption

LIFE ON COMPUTING’S CUTTING EDGE CAN BE A DISADVANTAGE, as it accentuates the difficulty in establishing a market niche. Sometimes, in fact, the technology turns out to be a solution looking for a problem, at least for a while. RSA Data Security—a pioneer in commercializing an ultra-secure form of data encryption known as “public key”—is a case in point.

“We put together a business plan thinking that secure telephones would be the place to start the business,” remembers Ron



Tom Pinckney (right) and the rest of the Exotech crew live at the office—literally. They're part of the next generation of LCS spinoffs.

Rivest, who founded the company in 1983 along with LCS colleagues Adi Shamir and Leonard Adleman. While the company tried to finance and build a prototype, Rivest started working on a software implementation of the RSA encryption system that would demonstrate the technology. In those days, he recalls, “one of the problems with encryption was that nobody understood it at all. So we were developing demonstration software for education purposes—to illustrate what public key could do.” After a few years of failing in the secure telephone market, RSA’s management realized that secure telephones “were not the best place to start the market.” Meanwhile, those “educational” software demos turned into real products, which found a ready market.

RSA’s path to riches was not through selling either hardware or software, it turned out, but by marketing “tool kits” that other companies could use easily to build the RSA algorithms into existing products. RSA’s first big customer was Iris Associates, which built RSA’s technology into a “groupware” program called Notes that it was creating for Lotus. Its second licensee was Novell, which built the technology into its Netware software for running local area networks.

Although Shamir and Adleman soon ended their affiliation with RSA, Rivest stayed with the company, which was sold to Security Dynamics in 1996 for \$250 million. Rivest now divides his attention between RSA and his teaching and administrative duties at MIT. He is an assistant director of the LCS—another case of the Lab’s ability to nurture and sustain innovators after (or between) their entrepreneurial exploits. Rivest continued to invent cryptographic algorithms, many of which RSA commercialized.

Exotech: The End of Operating Systems?

IN A CRAMPED APARTMENT LESS THAN A MILE FROM MIT, SOME OF the latest crop of LCS-bred entrepreneurs are burning with the

same mix of business ambition and technical acumen that has fueled so many previous spinoffs. They have formed a company, called Exotech, whose mission it is to commercialize a high-performance server for the World Wide Web based on the “exokernel” developed by LCS professor M. Frans Kaashoek.

Exokernels are a fundamentally new direction for operating systems—the first break with the original timesharing paradigm perfected by Project MAC 35 years ago. An exokernel, explains Kaashoek, does away with the conventional notion of an operating system altogether. Instead, the idea is for application programs to interact directly and securely with the computer’s hardware, without the intermediary of something like Unix or Windows.

Exotech was started by four of Kaashoek’s students. They’re using the MIT exokernel to build servers for Internet service providers. To launch the business, the group borrowed \$90,000, mostly from the parents of company president Tom Pinckney. Then, to cut cost, they all moved to Pinckney’s four-bedroom flat in Cambridge.

Today, the need to grow is putting a financial pinch on the company. Says Pinckney: “We have people from MIT, undergraduates, who have summer jobs, part-time jobs, who are interested in full-time jobs. We have one really experienced guy. But we don’t have the money to pay them, and we don’t have the office space for them to work in. So we have to beg.”

The begging may soon be over. In January, Exotech started shaping up to be a real business. It delivered beta software to a customer that Pinckney identifies only as a major Internet service provider serving the Northeast United States. A final version of the product should be on the market in July, he says. With the wind filling their sails, Pinckney and his partners will have an easier time raising money. And the Lab for Computer Science will be able to put another pin on the grand map of computer technology. ■