FEBRUARY 2002

CORE 3.1

A PUBLICATION OF THE COMPUTER HISTORY MUSEUM
WWW.COMPUTERHISTORY.ORG

OUR ACTIONS TODAY

The achievements of tomorrow must be rooted in the actions we take today. Many exciting and important events have happened since our last *CORE* publication, and they have been carefully chosen to strategically shape where we will be in five years.

First, let me officially introduce our new name and logo to everyone who has not seen them before. The Computer Museum History Center has become the Computer History Museum (CHM). We have adopted the wonderful new logo that you see here and will use it everywhere in our institutional communications and designs. It symbolizes the strengths we have in an artifact-rich collection, the digital age of the Museum's present and future, and people and communities worldwide—those who build our organization, the public we serve, and the lessons of history we pass on to future generations. We are very grateful to Museum Trustee Peggy Burke and her team at 1185 Design who worked so enthusiastically to help us create our new look.

A huge thank you to everyone who contributed generously and early to our Annual Fund campaign. In today's environment of public benefit corporations, annual fundraising is perhaps the most difficult task, yet one of the most important to sustained success. Our growth path is steep, and we need everyone to help make our organization successful. If you forgot to renew by calendar year-end, please do so right now as you read this. It makes a big difference.

In early December, we held a press conference to announce many exciting things—our growing relationship with NASA, construction of the "Beta Building" scheduled to open in early fall, our new name and logo, appointment of our new Head Curator Mike Williams, and our future plans. In my opinion, it was an outstanding success, and I hope you caught the impact of these announcements that have heightened awareness of our enterprise in the community. I'm very grateful to Harry McDonald (director of NASA Ames), Len Shustek (chairman of our Board of Trustees), Donna Dubinsky (Museum Trustee and CEO of Handspring), and Bill Campbell (chairman of Intuit) who participated as panelists. We were fortunate to receive good media coverage and were honored with special guests that included Dan Goldin, former NASA administrator; Zoe Lofgren, US Congresswoman for the Santa Clara Valley; Don Knuth; Gene Amdahl; Randy Katz; and Jeff Hawkins; among others.

COMPUTER HISTORY MUSEUM

Our announcements, taken together, created much more than just a "typical" press event. It was also the "virtual groundbreaking" of a new organization ready to meet the challenges of its future. With pride, I looked at about 100 people attending from all over Silicon Valley; viewed the great artifact display symbolic of one of the world's finest collections; listened to Mike Williams' passion and excitement while giving his tour; smiled at the awe and interest of people who met us for the first time; and saw the work of a dedicated staff who created a highly professional event.

We are building a community with passion, enthusiasm, and the commitment to build something that simply doesn't exist anywhere else in the world. With your sustained help, our actions have been able to speak much louder than words, and it is my goal to see that we are able to follow through on our dreams!

This issue of *CORE* is loaded with technical content and information about our organization—from a wonderful perspective on the first mobile experiments in the SRI van and an assessment of computing in Switzerland, to our new buildings and our emerging CyberMuseum project. Our international presence is growing with real content. I hope you see all of these elements as actions we are taking to meet the challenges of our future plans.

Because NASA's gates are moving back, making us accessible by all, a sustained public presence will now be possible for us. You also should have heard about us at the public environmental impact hearings for the NASA Research Park. They are now completed, and have also raised our visibility in the community. Finally, our programs continue to grow—we've got a great series of lectures and events for this year. Enjoy the Museum in every way you can.

There are still many incredible challenges ahead, and it will take lots of hard work and support. Our new Beta Building, being constructed next to our proposed permanent location, will grow to be a Silicon Valley icon, and is symbolic of lots more to come for the entire community. Help us build a great institution and enjoy the steps along the way to celebrate computing history.

JOHN C TOOLE
EXECUTIVE DIRECTOR & CEO

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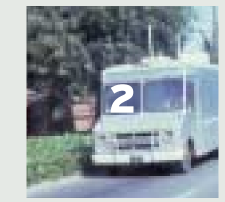
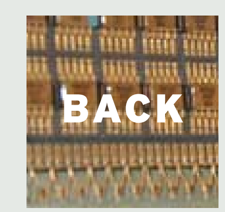
February 2002
A publication of the Computer History Museum

MISSION
TO PRESERVE AND PRESENT FOR POSTERITY THE ARTIFACTS AND STORIES OF THE INFORMATION AGE

VISION
TO EXPLORE THE COMPUTING REVOLUTION AND ITS IMPACT ON THE HUMAN EXPERIENCE





IN THIS ISSUE

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Cover: Stanford Research Institute (SRI) Van, X1590.99, Gift of SRI International (see page 2)

THE SRI VAN
AND COMPUTER INTERNETWORKING

BY DON NIELSON

Stanford Research Institute (SRI) Van, X1590.99, Gift of SRI International

(left) Packet Radio van with antennas atop. Deliberately left unmarked over its years of service, the van was often full of expensive equipment and in some cases also full of Army generals. SRI was trying to not attract attention…and, except for one curious San Francisco police officer, it didn't.

(right) The inside of the van with a DEC LSI-11 running TCP at the top of the rack and two packet radios lower down. A Datamedia terminal sits to the right of the rack on the workbench.

Since the days when it was a stagecoach stop between San Francisco and Monterey, Rossotti's was a well-known San Francisco mid-peninsula "watering hole" nestled in the second bank of foothills west of San Francisco Bay. In the 1970s, it had a casual atmosphere and some outdoor seating—a good location for the small ceremony about to take place. No one would mind if we parked SRI's "bread truck" van alongside the courtyard and ran a few wires to one of the tables. It was far enough from SRI (Stanford Research Institute) to qualify as "remote," but close enough to have good radio contact with them through a repeater station atop a hill above Stanford.

So it was that this venue was chosen to mark the occasion of the first internet transmission on August 27, 1976.[1] The van was an SRI-outfitted mobile radio lab that contained the equipment needed to make it a portable node on the emerging Packet Radio Network (PRNET). PRNET was sponsored at SRI by ARPA (Advanced Research Projects Agency) and started in 1973 or so. Placing a terminal on one of the wooden courtyard tables and connecting it to the van, a number of SRI people who had gathered for the celebration filed a normal weekly Packet Radio Program report—representing the work of all the Program's contractors—to ARPA. While the testing of such a connection had been going on for several months, this long e-mail report was, in a ceremonial sense, the first internet transmission; that is, the first formal use of the internet protocol known as "TCP."[2]

TCP was designed to carry information over dissimilar networks, in this case the PRNET, through a gateway at SRI, then across the ARPANET to a set of hosts distributed around the United States. This small, virtually unknown, but deliberate episode became a milestone in mobile digital radio and the flexible integration of digital communications networks. But let's back up a bit and review in more detail the emergence of internetworking and the role the SRI van played in it.

In the early 1970s, the ARPANET was growing rapidly. Universities, or their close affiliates, were the main players connecting to the network. Under inducement from the sponsors at ARPA, and through their own inventions of new and useful network services such as electronic mail, network traffic began to grow. In the meantime, the notion of a radio version of the wired ARPANET had come to Larry Roberts at ARPA. When Roberts left, first Bob Kahn and then Vint Cerf pursued that same idea at ARPA. Both Roberts and Kahn had seen the military need for a mobile, wireless version of the embryonic ARPANET. SRI and ARPA had also discussed the possibility of a transportable, possibly handheld, terminal or switching node for such a network rather than the massive, seemingly nuclear-hardened early IMPs (see back cover for more on the IMP) of the fixed network. Following that instinct, ARPA formed a team of contractors in what came to be called the Packet Radio Program. The team's mission was to create a wireless adjunct to the evolving ARPANET. Members of the new Packet Radio Program were Bolt Beranek and Newman (BBN) in Boston, Collins Radio in Dallas, Network Analysis on Long Island, University of California Los Angeles, and SRI. Because it had a good understanding of radio and systems integration, SRI was chosen as system engineer and technical director (SETD) of the program as well as integrator for ARPA's packet radio effort, a position it maintained for over a decade.

It should be pointed out that the introduction of a radio segment to supplement the ARPANET came from simply following the military context in which this and a great deal of research in the United States is done. If the military were to ultimately employ this new interactive digital technology, there would have to be allowances for the military's inherent mobility and possible deployment to any point on earth. So a radio network, particularly one that served a mobile population, was needed. It turned out to be intrinsically different from the existing fixed, wired one. This clear difference, along with the need for the two networks to work well in tandem, led to the notion of a communication software structure that would effectively bind these disparate networks together as though they were one.

One technical insight needs to be inserted here to understand how disparate packet networks can easily function together. In most communications networks it is only the source and destination terminals that are visible to network users. The resources that lie in between are normally of little interest to them as long as they fulfill their role. In circuit switching, once chosen, the same physical pathway is maintained for the whole session. When circuits are leased, the connection may even be "hardwired."

In packet switching, where sub-units of a single message may travel entirely different routes from source to destination, the exact role of intervening resources would not even normally be known. Thus, there arose the concept of a "virtual circuit," where the only defining network nodes lay at the ends and in which the intervening nodes are neither specified nor known by either network users or providers. This switching concept had been part of the basic ARPANET design and was now to be extended to this amalgam of wire and radio networks and thus to the world of internets.

It was the clear differences between the wire-based ARPANET and the radio-based packet radio (and eventually satellite networks) that led Kahn, then heading the networking efforts at ARPA, and Cerf at Stanford University, to design the first end-to-end protocol that could span dissimilar packet networks. The essence of such a construct began to emerge when Kahn addressed the problem posed by these dissimilar networks at a seminar held by Cerf in the summer of 1973.[3] After some airing in the internet community, the rudimentary elements of such a protocol came together for them on an October 1973 weekend at the Palo Alto Rickey's Hotel.[4] They published the design in May 1974,[5] and named it the TCP, or Transmission Control Protocol. With some modifications, it is still in use as the basis for transport in the worldwide Internet.

Following the introduction of TCP, ARPA contracted for three separate implementations: Stanford University, BBN, and University College in London. The first, clearly "buggy" specification to appear was in December of 1974 when Stanford produced RFC 675. BBN had an in-house version working reliably about a year later and began exchanging TCP traffic with Stanford on an intranet basis. Jim Mathis, a student of Cerf's at Stanford, started to implement their protocol in 1975. He came to SRI in the summer of 1976, where he completed a version that would run on the much more modest hosts of the packet radio network (Digital Equipment Corporation LSI-11 microcomputers). In the meantime, Cerf, now a program

Photo by Don Nelson

Photo by Don Nelson

(top) The site of the first two-network internet transmission on August 27, 1976 (from the left: Don Cone, (unknown), Nicki Geannacopulos, Dave Retz, Ron Kunzelman, Jim McClurg, and Jim Mathis).

(bottom) Nicki Geannacopulos compiles and sends online the packet radio weekly report.

manager at ARPA, was trying his best to inculcate the Department of Defense with the virtues of packet switching and TCP for their future data networks.

As a part of this emerging digital radio network, SRI foresaw the need for a mobile laboratory. A lot of design work lay ahead regarding the notions of nodal power and reach, the size of packets and the functions they were to perform, and the routing and reliability strategies in a network characterized by packet loss rates much higher than that seen on wire-based networks. Then there were the critical choices of radio frequencies and the signal processing strategies for the propagation and noise environments in which such a packet-switched radio network would operate. Since computers are notoriously intolerant of errors, how could a vulnerable radio environment be made to transport perfect data?

The SRI van was first used to characterize the radio frequency channel on which a packet radio system would be expected to operate. This was to be a fault-tolerant, dynamically-adaptable network. And so, a tough urban setting, with its shielding, reflective buildings, and electrical noise, was chosen. Radio modulation was designed that was tolerant of multipath distortion and noise. Packets were encoded for error detection and re-transmission when received inaccurately. Noise and the propagation patterns were characterized. When it came time to transport information across the packet radio network, a subnet was installed in the Bay Area and the van became a mobile node in that network. The PRNET became a self-organizing network, with addressing and routing, capable of accommodating the transmission challenges imposed by mobile users. It was the first mobile packet network.

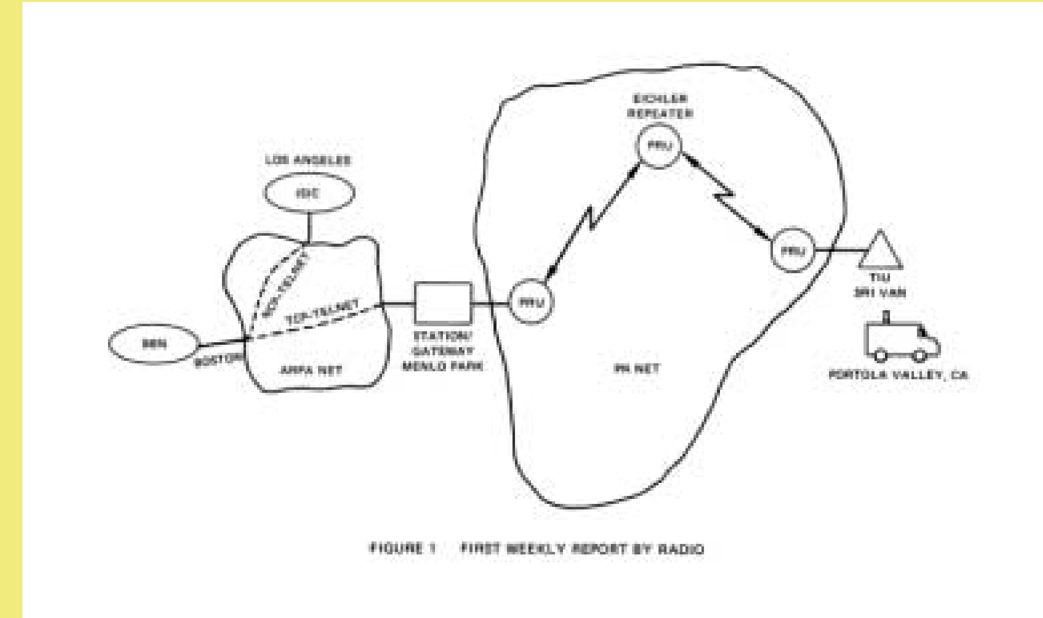
Given the difficulty of the radio environment, a couple of interesting demonstrations were often used at the time to illustrate the robustness of this new concept of networking. To illustrate the flow of traffic between a terminal in the mobile van and some distant network host, a character generator would grind out continuous alphanumeric sequences that formed patterns on a CRT in which errors would be obvious. While moving at high speed in the SRI van, the signal would sometimes be interrupted due to shielding of the radio signal (as when going beneath an underpass). The flow would stop momentarily but no errors were observed. Error-detecting cyclic redundancy checks, applied at the end of each transmitted packet, were used to verify reception accuracy. These checks plus the end-to-end ordering and re-transmission properties of TCP would not permit delivery of altered packets even though packets were frequently lost! Another similar procedure was to withdraw the synthesizer card from the packet radio. This would terminate the character flow, but re-inserting it would start it again. Thus, traffic would stop, then resume, but no errors were ever observed. Those demonstrations were splendid evidence that each packet could have sanctity, even in a tough environment of intermittent propagation and noise. This was an exciting consequence and certainly foreign to those circuit-oriented engineers who saw mobile digital radio systems as some sort of oxymoron.

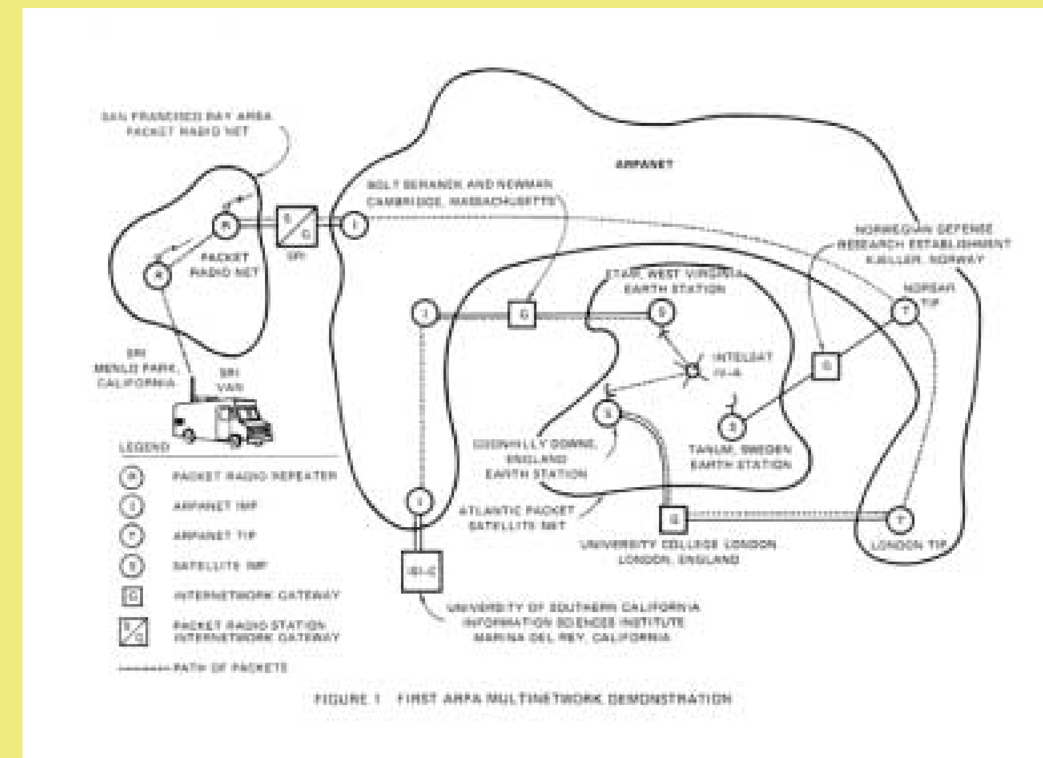
The first testing of TCP across dissimilar networks started in the summer of 1976. The first trials stayed one radio hop from the Packet Radio station (the PRNET's controlling node) where the bidirectional ARPANET gateway software, built by Ginny Strazisar at BBN, was located. During July and August the SRI team tested and tuned Mathis' version of TCP for better accuracy and speed. It was in August of 1976 that a terminal, attached to an LSI-11 "host" running TCP that was in turn attached to the PRNET, proceeded through a gateway to first access an ARPANET host. For the first time, at least in a ceremonial sense, dissimilar networks were bridged by TCP, thus clearly creating a two-network internet connection. That specific network configuration is shown in the figure at the top right, which is copied from a packet radio progress report written at that time.[6] The occasion was the aforementioned distribution via TCP of the normal, long weekly Packet Radio Program report.

(Those SRI people present are also shown in the pictures on the left page.) Other two-network TCP connections would soon follow.[7]

Within a year, and fulfilling the assumed need for a network of global reach, ARPA moved to include its third packet network, one that was satellite-based. It was then time to demonstrate all three networks together. On November 22, 1977, what has come to be more generally regarded as the first internet transmission occurred between the SRI mobile packet radio van and a host computer at USC by way of London! The route is shown on the bottom right.[8]

So internetworking was born of necessity, to demonstrate at ARPA that the innovations of packet switching were indeed relevant to the military's mode of operation. No matter where deployed, they could move about as needed and still be tethered to the powerful computing hosts kept safely away from the fighting. The robustness of the networks, be they fixed or mobile, was, of course, not just a military feature. Packet switching was sensible from the point of view of high network utilization and for offering a soft failure in the presence of moderate network congestion or even limited node failure. To be sure, the PRNET was a collective effort of many people, just as were the first workings of the internet. But the SRI van, purchased by SRI as a piece of capital equipment and designed to be used in a wide variety of experimental roles, found its major role in these first internetworking experiments.





(top) Diagram of the first two-network internet transmission on August 27, 1976. (Original illustration from an SRI technical report "Progress Report on Packet Radio Experimental Network" published in September 1977.)

(bottom) Diagram of the first three-network internet transmission on November 27, 1977, comprised of three physical and four logical networks, the ARPANET being used twice. (Original illustration from an SRI technical report "Progress Report on Packet Radio Experimental Network" published in February 1978.)

AFTERWORD

The possible importance of “the van” began to surface sometime in 1996 when an *IEEE Spectrum* editor called and mentioned that Vint Cerf had said in an interview that “SRI was the site of the first internet transmission.” I said I would look into it and began digging through old PRNET documentation to verify a couple of events that I vaguely remembered.

After the November 1977 date was confirmed and defined accurately and had been promulgated a bit, the next call came from The Computer Museum History Center (now the Computer History Museum) about celebrating the 20th anniversary of the Internet at the Supercomputer Conference in San Jose in 1997. I offered that the van was still at SRI but had languished unused for perhaps 10 years on the back lot. When it was clear there was interest in putting it on the convention floor, Don Alves of SRI and I began the job of getting it running, dressing it up as best we could, trying to replenish the almost non-existent radio and internet equipment that had been in it, getting it re-licensed, and coaxing it to San Jose. While not beautiful, it did seem to carry some symbolism for many who saw it. So, rather than returning it to certain deterioration and scrap, SRI offered it to the Museum, where it lives today. ■

Don Nielson has been at Stanford Research Institute, now SRI International, for 40 of its 55-year history. During the events associated with the internet transmissions mentioned above, he was the SRI principal investigator for ARPA in the early stages of the packet radio program. While that program was unfolding, he became director of SRI’s Telecommunication Sciences Center (1975), the center at SRI for computer networking. To better align its work with the future of computing, this group was permitted by SRI to join the Computer Science Division, which Don came to head from 1983 until his retirement as an SRI vice president in 1998. Since then he has been writing a book on SRI’s major innovations, from which this segment about the SRI van was drawn.

1 Identifying the first of anything that is created in a collaborative way is somewhat arbitrary. Certainly, experimental trials had been conducted prior to this time. Then there is the question of how many networks it takes to qualify as an “internet.” In this case we have chosen first the minimum number—two—and then about a year later—three. In all this we are of course referring to just the transport aspects of internetworking. The terminology of “packets” arises from how message traffic is packaged in modern digital networks. A packet is a fixed-length, individually-addressed subunit of a message. Its fixed length simplifies buffering hardware at all the intermediate nodes and its addressing permits both packet accountability and diffusion across unused portions of a network.

2 TCP is the acronym for Transmission Control Protocol, network software that establishes, operates, and closes a reliable virtual circuit across dissimilar networks. While still in use today, the overhead for this type of connection was deemed excessive for some types of traffic. This soon led to a companion transaction protocol called the Internet Protocol (IP). Together they comprise the transport system of today’s Internet.

3 Abbate, Janet. *Inventing the Internet*, MIT Press, 1999, page 127.

4 Communication with Vinton Cerf, January 15, 2002.

5 Cerf, Vinton G, and Robert E. Kahn. “A Protocol for Packet Network Interconnection,” *IEEE Transactions on Communications*, Vol. Comm-22, No. 5, May 1974.

6 From “Progress Report on Packet Radio Experimental Network,” by R.C. Kunzelman, M.A. Placko, and R.T. Wolfram. Quarterly Technical Report 5, SRI Project 2325, Contract DAHC15-73-C-0187, ARPA Order 2302, September 1977.

7 An expected part of the ARPA work was to demonstrate progress and give evidence of this new networking capability. So TCP, spanning the PRNET and the ARPANET, would be demonstrated in May 1977 between the SRI van and hosts at ISIC and SRIKL. On August 11, 1977, a TELNET connection was demonstrated between the van and the Naval Ocean Systems Center in San Diego for Admiral Stansfield Turner (Dir. CIA) and William Perry (DDR&E). On September 19, 1977, a single LSI-11 microcomputer, running a multi-connection TCP, multiplexed four terminals through a packet radio to four different ARPANET hosts, essentially all of the ones running TCP servers at the time.

8 From “Progress Report on Packet Radio Experimental Network,” by R.C. Kunzelman, V.D. Cone, K.S. Klemba, J.E. Mathis, J.L. McClurg, and D.L. Nielson. Contract MDA903-78-C-0126, ARPA Order 2302, February 1978.

THE SRI VAN AND EARLY PACKET SPEECH

When the ARPANET was perhaps five years old and before the development of internet protocols, Bob Kahn at ARPA set a group of contractors exploring how the new network could handle normal telephone traffic. Given the initial focus on reliable data transmission, it was not clear whether the variability in interpacket delay would permit the smooth flow required by a voice call. In 1974, Kahn initiated the Network Speech Compression Program because of the narrow bandwidth of the initial circuits comprising the net. This program resulted in the choice of some compression algorithms and these were first tried over the ARPANET. In 1976, SRI’s Earl Craighill and Tom Magill, both of whom had been working on the speech program, convinced ARPA to let them try speech on the Bay Area PRNET. By this time the internet protocol, TCP, was also being tested and so speech experiments began also on an internet basis.

Because the SRI van was an easily outfitted facility and already had packet radio and internet equipment installed, it became the first mobile node for packet speech experiments. In addition to the challenges of mobile data transport, transporting natural-sounding speech focused on the importance of delay variance. Innovations were needed in variable rate encoding, new buffering strategies, and rapid rerouting of packets whenever the route in use failed. All these were to help smooth the flow of speech. Importantly, these requirements for packet speech influenced the decomposition of the protocol into reliable or guaranteed (TCP) and non-guaranteed (IP) services.

Thus, internet speech connections were being conducted as early as 1977-1978, about the same time as the Internet itself was becoming a reality. ■

(top) SRI’s Speech Packet Project Leader Earl Craighill in the SRI van, which housed the speech encoding and packetizing equipment.

(bottom) SRI’s Jan Edl demonstrating speech transmission over the Internet. The Mickey Mouse phone was deliberately used to illustrate that the speech equipment hardware and software was designed to accommodate a standard, off-the-shelf telephone.

COMPUTERS MADE IN SWITZERLAND

BY DOMINIK LANDWEHR

1 The Swiss Federal Insitute of Technology (ETHZ) in Zurich opened the first Swiss computing department (called the Institute for Applied Mathematics) in January, 1948, where the earliest Swiss computer, the ERMETH, was developed under the direction of Eduard Stiefel.

2 After an extensive survey of (primarily U.S.) computers existing at the time, Stiefel and his team developed the ERMETH—Elektronische Rechenmaschine der Eidgenössischen Technischen Hochschule (ETH)—which was of simple design, built to perform reliable scientific calculations, and which ran for the first time in July 1956.

3 In the late 1970s, Zurich computer specialist Niklaus Wirth was inspired by the "workstation" concept he discovered at Xerox PARC. He returned to Switzerland to build the Lilith machine, which had a screen of higher resolution than the contemporary Apple II, and made use of a mouse.

4 Wirth built the Lilith computer between 1977 and 1980. The powerful workstation was one of the first to have a mouse, a high-resolution monitor, and a graphical user interface—well configured for graphics creation. By comparison, at this time, the Apple II was equipped with just a keyboard for input.

5 The Dépraz mouse, the first computer mouse "made in Switzerland," was manufactured by precision engineering expert André Guignard for Wirth's Lilith workstation.

6 A bottom view of the Dépraz mouse.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INTRODUCTION

Over the past 150 years, products such as instant coffee and soups, precision tools and machinery, pharmaceuticals, and medicines have elevated Switzerland to a leading position among the world's industrialized nations. One might therefore expect Switzerland to have equally made a name for itself in the development and marketing of computers. Despite some brilliant computer pioneers, such is not the case, however, and Swiss products don't hold as prominent positions in the world computer market as they do in textile machinery and gas turbines. But who knows what will happen in the future?

EARLY COMPUTING AND THE LILITH COMPUTER

The best place to begin our search for innovative computer products is at the Swiss Federal Institute of Technology in Zurich (ETHZ), one of the few universities in Europe that could stand comparison with the elite universities of the United States. Between 1954 and 1959, electrical engineer and Professor Eduard Stiefel and two of his assistants (later professors themselves), Heinz Rutishauser and Ambros Speiser, developed a science-oriented computer, the ERMETH. This early computer has indeed been seen as a significant advancement, but it was rapidly overtaken by other computing developments. In particular, as noted by Ambros Speiser: "The real importance of data processing in the commercial field was not recognized until these applications began to overtake those of a scientific nature."

In 1976, Niklaus Wirth, a Zurich computer specialist who at the time regarded himself as an electrical engineer, traveled to the Xerox Palo Alto Research Center (PARC) in California. There he saw a "workstation" for the first time: a machine capable of dialogue with the user that would make possible an entirely new approach to computing. At the end of a year in California, Wirth made the return journey to Switzerland with a computer mouse in his suitcase and an improved workstation design in his head. Developed under the name Lilith, the workstation had a high-resolution graphical screen (592 x 768 pixels, compared to the alphanumeric display of 24 lines of 40 characters of the contemporary Apple II) and made use of a mouse as well as rudimentary windowing technology. This computer was nevertheless not yet based on a microprocessor but rather on relatively low-integration level circuits.

When its commercialization started in 1982, the Lilith machine was sold as a pure research computer. A first batch of 10 was built in the USA at a unit price of 20,000 Swiss Francs. The first "outsider" to discover this Swiss machine was Heinz Waldburger who, as head of computer services at Nestlé, was looking for a high-performance solution for his corporation. Waldburger was already looking ahead to the concept of a multimedia computer capable of processing not just data but also images and sounds. His specifications helped provide a name for the new company that would market the Lilith: DISER (Data-Image-Sound-Processor and Emitter-Receiver system). The line included two "Modula Computers"—an MC 1 and an MC 2. DISER had ambitious objectives and it opened sales offices in Zurich, Lausanne, Orem, Atlanta, Chicago, Dallas, and Paris. But a total of only 140 machines were manufactured, of which 120 were sold. The company misjudged its market and after six months it was already at the end of the road. Cheap memory chips and high performance microprocessors had ushered in a new era.

LOGITECH–KING OF THE COMPUTER MOUSE

When Wirth set out to build his Lilith workstation in 1978 he found himself in need of a computer mouse. His colleague, Jean-Daniel Nicoud of the Swiss Federal Institute of Technology in Lausanne, managed to get the precision engineering expert André Guignard interested in the project. The result was the first computer mouse "made in Switzerland," which was built by the Dépraz company and used for the Lilith workstation.

Roughly at the same time another Swiss, Daniel Borel, a physicist and graduate student at Stanford, discovered the Alto workstation, the new interface technologies—mice, menus, and windows—as well as America's entrepreneurial spirit. That provided him with inspiration to found his own company. He began thinking hard about exciting products on which to base a new company. In 1981, Daniel Borel, Pierluigi Zappacosta, and Giacomo Marini founded Logitech.

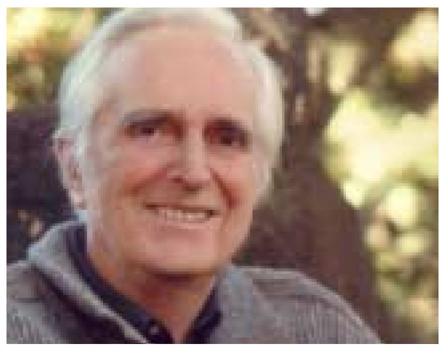
Logitech eventually took over the mouse concepts and products from Nicoud and Dépraz, developed prototypes suitable for mass production and showed these to potential clients in the computer industry. "Various companies including Hewlett-Packard immediately showed an interest. But they told us our products were too costly," remembers Borel. The next step was decisive for the ultimate survival of the company: they managed to create a subsidiary in Taiwan and to transfer production there. Because dozens of Taiwanese competitors soon arose, Logitech had to react quickly and always work hard to undercut them. This was only made possible because the subsidiary was managed locally from Taiwan, whereas business could not have been conducted out of Switzerland or California. Today Logitech is a leader not only in the computer mouse field but more generally in computer-human interfaces (touchpads, keyboards, trackballs, joysticks, webcams, etc.).

7 Daniel Borel was inspired by "new" interface technologies—mice, menus, and windows—and ultimately co-founded Logitech in 1981. He is now president of this successful company.

8 Doug Engelbart pioneered the mouse in the 1960s at SRI.

9 In 1994, Supercomputing Systems (SCS) founder Anton Gunzinger was highlighted in a *Time* magazine special issue as one of 100 figures who will influence events in the 21st century. SCS then delivered the promising, but commercially unsuccessful, GigaBooster supercomputer to the market.

7



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While the Logitech head office remains in Switzerland, the company's operational headquarters are in Fremont, not far from Stanford University. It is no coincidence that the same building also houses an organization by the name of Bootstrap, the consulting firm of the inventor of the mouse, Doug Engelbart. Engelbart pioneered the mouse and a number of other developments at the Stanford Research Institute (SRI) in the 1960s. Engelbart did not become rich from his inventions, and indeed the recognition of his achievements was late in coming. But as a guest of Logitech, Bootstrap pays no rent. It is Borel's way of saying thank you to the researcher who made it all possible.

BYE-BYE SUPERCOMPUTER

It was not that long ago that the name of Anton Gunzinger, a Zurich computer specialist, was very popular. In a 1994 *Time* magazine special issue, Gunzinger was named one of 100 people who will inluence events in the 21st century. Gunzinger had succeeded in developing a very promising new computer that not only improved performance significantly while consuming less energy, but more importantly, cost a mere fraction of the "supercomputers" then on the market. Gunzinger and his team created a design based on 170 processors, all working in parallel, which in practice achieved a speed of 10 gigaflops, i.e., 10,000 million floating-point operations per second, with the maximum possible speed at that time being between 100-200 gigaflops. Encouraged by his achievements, Gunzinger founded the company Supercomputing Systems (SCS) in 1993. The new start-up was built on a dream: "We shall make supercomputers in Switzerland and earn a living at it." The company's presentation included the trendy tag line: "because it's fun."

Switzerland's first commercial supercomputer hit the market in 1995 with the combative name "GigaBooster." But just 10 units were sold. Today Gunzinger coolly analyzes the flop in the following terms: "At a time when PCs were becoming more powerful with each passing year, we were competing in the wrong market and research funds from the state and other sources simply dried up." There was another problem too: the software had to be frequently updated and the costs soon exceeded the capabilities of such a small firm, which brought production to a halt.

Gunzinger's SCS did, however, overcome this hardship and is still going strong today, employing some 60 people. As Gunzinger says, "We have learned from our mistakes and we now stick to what we are good at, namely developing computer systems." SCS is now active in a wide variety of fields, and has developed, for instance, a digital sound mixer based on up to 126 processors, making use of Gigabooster technology, as well as a new encryption system that is able to encode and decode at a rate of 155 megabits per second.

CONCLUSION

One out of these three ventures became a worldwide and widely-respected player in the computer business. Not a bad percentage overall, although one could have dreamed of a more prominent role for Switzerland in the hardware field. On the other hand, in niches like knowledge management, secure banking transactions, cryptography, etc., many Swiss pioneers and companies are key players, and venues like biocomputing are just beginning to be explored.

The discovery of this mostly unknown role in computer history has also paved the way for various conservation initiatives. The Museum of Communication in Bern displays the most important milestones of the PC's history worldwide in its temporary exhibition, "Control-Alt-Collect: Computers in Retirement," which will last until Spring 2003. Various private collections have been made accessible to the public. A private initiative led by the Association of Friends of the Swiss Computer Museum, which aims at better understanding the increasing influence of information and communication technologies on society, plans to create a museum which will gather large Swiss collections of calculating and typing machines as well as computers. Finally, in October 2001, the enthusiastic donation of more than 3.5 tons of computers from Switzerland to the Computer History Museum is yet another sign of the increased interest in this global technology revolution. ■

10 SupercomputingSystems' GigaBooster hit the market in 1995 as a promising supercomputer that greatly increased performance for a fraction of the cost. Yet only 10 units were sold.

11 Jean-Daniel Nicoud facilitated the donation of a significant portion of the items listed on page 13. A foremost developer of microprocessor-based computers in Switzerland, Nicoud spent hours documenting the donation for the Museum.

12 This logic module from the ERMETH computer now resides in the collection of the Computer History Museum. The first computer ever built in Switzerland, the ERMETH is currently on display at the Technorama in Winterthur, Switzerland.

10

11

12

Dominik Landwehr is the head of the Science and Future Department at the Migros Culture Percentage, a private Swiss benefactor that is designed to give the general public access to cultural and social events. Landwehr is running a number of educational and artistic programs in the field of technology. He regularly contributes articles to a number of publications, including the renowned *Neue Zürcher Zeitung,* which covers a wide array of topics about technology and society. At present he is doing research into the use of the German cipher machine Enigma, which was widely used in Switzerland during World War II. Landwehr graduated from Zurich University and has worked for various Swiss newspaper, radio, and television agencies. A number of missions for the International Committee of the Red Cross (ICRC) brought him to Thailand, Romania, and the Afghan border in Pakistan.

RECENT DONATIONS

TO THE COMPUTER HISTORY MUSEUM COLLECTION

ARTIFACTS AND SOFTWARE

Computer Displays, Inc., Mechanical Mouse (c. 1970), X2322.2002, Gift of Richard Fryer

Data General/One Notebook computer, printer, software, documentation, and carrying case (c. 1983), X2297.2002, Gift of William Geiger

DEC VLSI VAX microcode and documentation CD-ROM archive, X2350.2002, Gift of Bob Supnik

ETH Zurich Switcherland (1993-98), X2323.2002, Gift of Hans Eberle

Fairchild Semiconductor 1/2-inch wafer of planar transistors (1958), X2351.2002, Gift of Art Zafiropoulo

Fairchild Semiconductor first working planar transistor (1957), X2352.2002, Gift of Art Zafiropoulo

Hewlett-Packard HP110 portable computer (1984), X2338.2002, Gift of Allen Chalmers

IBM 026 keypunch print wheel (c. 1960), X2243.2002, Gift of Lee Schur

IBM 10SR MODII 14-inch hard drive assembly (HDA), X2344.2002, Gift of Will Galloway

IBM Model 604 Electronic Calculating Punch (1948), X2294.2002, Gift of Robert Garner

Marchant Calculating Machine Company "Figuremaster" calculator (1948), X2320.2002, Gift of George William Bolton

Non-Linear Systems Kaypro 4 portable computer, documentation, and software collection (1984), X2333.2002, Gift of Ronnie Sue Helzner

Punch card equipment and book collection (c. 1958), X2281.2002, Gift of Alfred C Hexter

DOCUMENTATION

Applied Computer Techniques Apricot Software collection (1985), X2332.2002, Gift of Michael Kimball

Automatic Digital Calculators (1965), X2324.2002, Gift of Allen Baum

Basic Programming Concepts and the IBM 1620 Computer (1962), X2282.2002, Gift of Derek Peschel

Computer book collection (various dates), X2299.2002, Gift of Harry Stewart

Early computing texts collection (various dates), X2354.2002, Gift of L Peter Deutsch

Operating Principle of the Belgrade Hand Prosthesis Mechanism, X2293.2002, Gift of Tom Callahan

Preliminary description of the UNIVAC (1950), X2292.2002 A, Gift of Robert Garner

RCA 301 documentation collection (c. 1965), X2339.2002, Gift of Allen Chalmers

RCA 301 salesmen's model (c. 1960s), X2337.2002, Gift of Allen Chalmers

Texas Instruments Advanced Scientific Computer internal memo collection and machine descriptions (c. 1968), X2347.2002, Gift of William Kastner

Two early programming texts by Kristen Nygaard (c. 1965), X2336.2002, Gift of Kristen Nygaard

UNIVAC Maintenance Manual (1958), X2292.2002 B, Gift of Robert Garner

UNIVAC Solid-State 90 bound manual set (1959), X2292.2002 C, Gift of Robert Garner

Xerox PARC technical report collection (70 publications) (1970s-1980s), X2353.2002, Gift of James Mitchell

Xerox PARC technical report collection (c. 1970s-1980s), X2295.2002, Gift of Mike Rutenberg

GIFTS OF MICHAEL PLITKINS

Apple Computer, Inc., Apple II GS Woz Edition personal computer system (c. 1989), X2415.2002

Apple Computer, Inc., Lisa II System including four profile external hard drives, an AppleWriter printer, an ImageWriter II printer, an Apple Modem 1200, and assorted PCBs (c. 1990), X2431.2002

Apple Computer, Inc., Lisa/Mac XL personal computer system (1984), X2410.2002

Apple Computer, Inc., Newton Message Pad 100 (1993), X2405.2002

Atari Computer Corporation Atari 400 home computer (c. 1980), X2422.2002

Atari Computer Corporation Atari 400 home computer (c. 1980), X2423.2002

Atari Computer Corporation Atari 800 home computer (c. 1982), X2424.2002

Atari Computer Corporation Atari 800 home computer (c. 1982), X2427.2002

Atari Computer Corporation Atari 810 home computer disk drive (c. 1982), X2425.2002

Atari Computer Corporation Atari 810 home computer disk drive (c. 1982), X2426.2002

Atari Computer Corporation Portfolio 16-bit personal computer (1989), X2407.2002

Canon Cat V777 Work Processor (1987), X2402.2002

Commodore Business Machines Amiga 1060 personal computer (c. 1985), X2419.2002

Commodore Business Machines Commodore 16 (c. 1983), X2417.2002

Commodore Business Machines Commodore 64 (c. 1978), X2418.2002

Commodore Business Machines PET 2001 Personal Computer (1977), X2400.2002

Commodore Business Machines plus/4 Personal Computer (c. 1983), X2416.2002

Convergent Technologies, Inc., Workslate (1983), X2406.2002

Convergent Technologies, Inc., Workslate microprinter (c. 1985), X2428.2002

Hewlett-Packard Integral Personal Computer (1985), X2412.2002

IBM Vacuum Tube Logic Trainer (c. 1955), X2411.2002

Mindset Corporation MINDSET personal computer system (1983), X2408.2002

Mindset Corporation MINDSET personal computer system (1983), X2409.2002

Motorola, Inc., Envoy Personal Wireless Communicator (c. 1994), X2405.2002

Osborne Computer Corporation Executive Portable Computer (1982), X2401.2002

Osborne Computer Corporation Vixen portable computer (1987), X2403.2002

Radio Shack TRS-80 64K Color Computer 2 (c. 1985), X2414.2002

Radio Shack TRS-80 Micro Color Computer (c. 1984), X2413.2002

Sinclair Research Ltd. QL microcomputer (c. 1984), X2429.2002

Sony Corporation Hit Bit HB-75AS home computer (c. 1983), X2428.2002

Sun Microsystems Sun-3/80 workstation system (1990), X2420.2002

Symbolics, Inc., 3620 LISP workstation system (c. 1990), X2430.2002

Texas Instruments Homecomputer 99/4A (c. 1979), X2421.2002

If you would like to update the Museum regarding your artifact donation, please contact Registrar Jeremy Clark at +1 650 604 1524 or clark@computerhistory.org.

COMPUTING IN SWITZERLAND ITEMS

Bobst Graphic Lausanne Scrib portable computer (1977), X2310.2002, Gift of Bobst Group SA

Convex Computer Corporation, C3820 Gallium Arsenide Supercomputer System (1994), X2301.2002, Gift of the Swiss Center for Scientific Computing

Convex Computer Corporation, C3820 manual collection (c. 1991), X2327.2002, Gift of the Swiss Center for Scientific Computing

Crocus manual collection (c. 1976), X2328.2002, Gift of Jean-Daniel Nicoud

Epsilon-System, SA, Crocus microcomputer system kit (1977), X2313.2002, Gift of André Thalmann

Epsitec Smaky manual collection (1986-1994), X2325.2002, Gift of Jean-Daniel Nicoud

Epsitec Systems Belmont/Lausanne Smaky 324 single board computer (1987), X2302.2002, Gift of Epsitec SA

Epsitec Systems Smaky 100 personal computer (1984), X2307.2002, Gift of Jean-Daniel Nicoud

Epsitec Systems Smaky 130 personal computer system (1990), X2308.2002, Gift of Jean-Daniel Nicoud

Epsitec Systems Smaky 300 personal computer (1990), X2311.2002, Gift of Epsitec Systems SA

Epsitec Systems Smaky 400 single board computer (1996), X2312.2002, Gift of Epsitec Systems SA

Epsitec Systems Smaky 6 Microcomputer and Stoppani Electronic SA MICROLERU Smaky 6 microcomputer paper tape reader (1978), X2309.2002, Gift of Jean-Daniel Nicoud

ETH Zurich Ceres-1 (1987), X2321.2002, Gift of Hans Eberle

ETH Zurich Ceres-3 personal computer system (1990), X2318.2002, Gift of Nicklaus Wirth and ETH Zurich

ETH Zurich ERMETH logic module (c. 1956), X2314.2002, Gift of Ambros Speiser

LCD-EPFL Novasim Virtual Data General NOVA peripheral (1972), X2306.2002, Gift of Jean-Daniel Nicoud

LCD-EPFL Stoppani, Ltd. Travers Dolphin (Dauphin) System "Club" development system (1977-1980), X2304.2002, Gift of Jean-Daniel Nicoud

LCD-EPFL Stoppani, Ltd. Travers Dolphin (Dauphin) System "Industry" development system (1977-1980), X2305.2002, Gift of Jean-Daniel Nicoud

LCD-LAMI-EPFL OMS Data Aquisition System (1972), X2303.2002, Gift of Jean-Daniel Nicoud

Microscope journal collection (1975-1980), X2326.2002, Gift of Jean-Daniel Nicoud

Supercomputing Systems GigaBooster (1992), X2316.2002, Gift of Supercomputing Systems

Supercomputing Systems MUSIC (Multiprocessor System with Intelligent Communication) (1994), X2317.2002, Gift of Supercomputing Systems

Supercomputing Systems Swiss TNet crossbar switch and connectors (1999), X2315.2002, Gift of Supercomputing Systems

Swisscom AG Swiss public telephone booth containing a working Teleguide electronic telephone directory (c. 1997), X2319.2002, Gift of Swisscom AG

EXPANDING THE COLLECTION

The Computer History Museum often receives support from friends of computing history who work with our collections team to expand the collection in important ways. Individual donors may contribute their own collections, as with the items listed on the opposite page that were donated by **Michael Plitkins**, a senior staff engineer in advanced telephony at TellMe. A quick scan through the list reveals Plitkins to be a collector of both popular and obscure computing artifacts—including rare prototypes—with a real nose for the important details of computing history as well. It is an honor that he chose the Museum to be the recipient of his devoted and personal collecting efforts.

The items listed on this page reflect another such effort, when several people and organizations made a group donation this past fall of artifacts related to computing in Switzerland. Over the course of many months, the Swiss Science and Technology Office at the Swiss Consulate in San Francisco helped pull together a donation of computers, peripherals, documentation, and stories by several key players. The items were then shipped (courtesy of PRS Presence Switzerland) to the Museum (most were shipped from Switzerland), and were exhibited at a reception prior to the Fellow Awards Banquet on October 23, 2001. This exhibit of a truly "international" flavor was much appreciated by donors and friends of the Museum, since many of them had never had the opportunity to see Swiss-made computing innovations, except Logitech mice, of course!

One of the "key players" in this particular donation was **Jean-Daniel Nicoud**, a leader in Swiss microprocessor-based computing and micro-robotics and professor emeritus at the Swiss Federal Institute of Technology in Lausanne. Not just a prolific inventor, Nicoud was also a favorite with students because of his interactive and creative teaching style, as well as the variety of robot-building contests he set up over time. In 1974, he organized the first International Conference on Microprocessors and coordinated 10 other conferences over the years. Nicoud indicates that miniaturization and human interaction have always held an attraction for him, and he continues to develop small mobile robots, with particular interest in defusing landmines and in the development of autonomous flying robots. As a co-developer of the first Swiss mouse and of several subsequent Logitech mice, Nicoud also developed the Scrib, the first portable computer for journalists, and built the line of Smaky personal computers, which were the only Swiss-made computers that sold in significant numbers. In the course of this "Swiss" donation, Nicoud spent hours religiously documenting the machines and their development processes so that the Museum could have appropriate materials through which to understand and exhibit the items.

As an institution, the Museum is grateful for the time and dedication of people like Plitkins and Nicoud who truly value preserving the stories and artifacts of the information age. Indeed, it is only because of people like these that the Museum exists and will continue to grow.

BEYOND VIRTUAL

BY MIKE WALTON

HOW BIG A BOX DO YOU NEED?

What would you do if you wanted to present the entire history of computing and had limited square footage in which to put it? This is the challenge that the Computer History Museum faces, and for us the answer is clear: We need to present online the wealth of knowledge contained in our Museum.

You have probably heard of the great progress toward our permanent home in 2005, but another important innovation has been developing in our back rooms. As part of our critical mission, we are going to preserve much of computing history using today's computers and present it across the networks of tomorrow. While the physical Museum is being carefully crafted and planned to inhabit 120,000 square feet in the future, the Museum online is free to expand beyond the space restrictions of the "real" world.

We are calling this project the **CyberMuseum**. The name is derived from the term "Cyberspace," first coined by science-fiction author William Gibson in 1984 in his book *Neuromancer*:

> Cyberspace. A consensual hallucination experienced daily by billions of legitimate operators in every nation, by children being taught mathematical concepts....A graphical representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the non-space of the mind, clusters and constellations of data. Like city lights, receding...

Cyberspace was thus defined as a place where the world's information could be visualized. In the CyberMuseum, our goal over time is to visualize and access the entirety of computing history, making the institution an exciting place for the novice and serious researcher alike, enabling the gathering of authentic information at all levels of interest. This vision becomes powerful and challenging when coupled with the magnitude and quality of artifacts in our collection.

"GOING" ONLINE

An enterprising company today would probably never consider whether or not to have a website. The Internet has arrived, and if you're not there, it's like being cut out of the phone book. In many cases, "going" online usually means representing the physical institution with a phone number, address or driving directions—information that ties the website to the physical.

Our CyberMuseum will most certainly do this, but this "virtual" facsimile of the real world will inhabit only a portion of the overall CyberMuseum. Both the physical Museum and the CyberMuseum will benefit from shared research, overlapping exhibit design, and ever-increasing data about the collection. CyberMuseum projects can build tools to help manage our Museum data internally. Such tools can help the Museum develop, use, modify, and expand data in a centralized manner.

The CyberMuseum can go beyond the normal "virtual" museum, allowing our collection, media library, and other resources to be accessed through one easy-to-navigate portal. Exhibits online can provide multiple levels of experience, allowing any depth of research. The challenges of this vision, of course, are also great—to rapidly adapt and present consistent data in different views to a world-wide audience while keeping it simple enough to navigate by novice users, all on a small budget!

PRESERVING BITS AND PIECES

Experiments currently underway are exploring the possibilities outside the "virtual museum" box. The initial approach is to systematically convert the wealth of knowledge in our library, collections, and media stores into digital format while indexing what we have to increase depth and completeness of our data. By digitizing our collection, we are fulfilling multiple purposes: we preserve the information, and at the same time we make it usable for the web and other projects such as physical exhibit design.

Meanwhile, we are trying various ways to display, exhibit, and update this information. We are investigating ways to enrich video with other content, such as running transcripts or closed captioning. It is possible to create hyperlinks within the media to access material outside of the video presentation and thus enrich the experience.

To get through just a portion of the large collection we have acquired at the Computer History Museum would take years. So to begin, we identified some of the most significant subjects and objects, and are working with them in limited digital conversion exhibit experiments. Together with the exhibit design teams for the physical building, we are streamlining the process. By getting the "recipe" right for the many types of materials, we can begin the task of automating the lengthy process of working through the rest of the collection.

Some of the issues that arise as these experiments are carried out are: What formats will have longevity? How can the complex hyperlinks of interrelated information be managed? How detailed do these records actually need to be? How do you reconcile conflicting and missing information in such a complex environment? How do you best instill the "human factor" into digital reporting?

Chair of the CyberMuseum Committee Gordon Bell (right) and Director of Cyber Exhibits Mike Walton discuss the next set of project goals. The CyberMuseum will not only communicate the physical Museum to web visitors but will also present computing history in a dynamic and inventive way.

CYBERMUSEUM CHAMPIONS

The CyberMuseum project is not just about web objects, but is also about people and communities. Gordon Bell, an original founder and current Trustee of the Museum and a senior researcher at Microsoft, is a major champion of the CyberMuseum. He has dedicated a lot of personal time and resources to help bring the Computer History Museum's mission and vision to Cyberspace.

Bell has been performing a number of interesting personal explorations over the last few years in a project he calls MyMainBrain. Partly experiment in data representation, partly personal librarian, and right now, all about Gordon, MyMainBrain contains digitized documentation, images, media, and minutiae from his long career. He hopes to make the process available as a software tool for others to organize and catalog their own lifetime achievements or as a memory assistant and productivity aid.

The experiments and experience from MyMainBrain have already helped the CyberMuseum project by laying some of the groundwork for storage methods and data acquisition.

Bell also was a pioneer earlier in his career, among other places, as vice president of research and development at Digital Equipment Corporation. Digital led the revolution that empowered end users to interact directly with computers, forever abolishing the idea of computers as untouchable by inexperienced hands. Cyberspace is advancing in this same spirit, and a CyberMuseum goal is to put the history of computing directly into the hands of the public.

CAPTURING ORAL HISTORIES

A picture and list of specifications might be an adequate display for a specific computer, but presenting personal histories with stories and media is a much more complex endeavor. The CyberMuseum is conducting experiments in capturing stories on video in a number of oral history projects. One of the fortunate facts about computing history today is that many of the early pioneers are alive to tell their stories. Some of the best information comes from the individuals who were on the front lines of computing history. Recording a story "straight from the horse's mouth" can capture not just basic statistics of the era but also a sense of the participant's world view, interpretation of events, and the emotions of actually being there.

Oral histories are often done by interviewers who are experts in the field and with highest production values wherever possible. The Computer History Museum is treating oral histories with the great care expected of a historical collecting museum, yet is also experimenting with new methods. We are also moving forward in our "pro-casual" video collection. By creating a portable recording studio, we can be on the spot for impromptu interviews.

The CyberMuseum plans to organize the oral histories online, posting past and present interviews along with statistics, artifact information, and materials from other sources to create an information-rich environment. Our monthly lectures are also videotaped and can be added to our permanent display on the web. Soon you might be able to watch our lectures streamed live from location.

At this stage, the role of the CyberMuseum project is to experiment, evaluate the technologies, provide recipes, and ensure the preservation of materials in formats that can be used online.

FOSTERING AN INTERNATIONAL COMMUNITY

Perhaps the greatest potential for the CyberMuseum project lies in reaching a much larger audience than the physical Museum could expect to reach. People who may never see us in person will be able to get much of the experience and information online. While nothing can replace the visceral experience of seeing the collection first-hand, the CyberMuseum will bring as much of it to life as possible.

We hope our efforts will bring together many outside sources of research in a multilateral preservation effort. A fortune in data and research is already at risk of disappearing for lack of funding or interest. The CyberMuseum can link researchers, user communities, universities, and collectors, while enrolling them whenever possible to participate in the common mission of presenting and preserving the stories of computing history.

If you would like to get involved with the project or contribute your stories or insights to the Museum, please contact us and become a part of our community.

Mike Walton is the Director of Cyber Exhibits at the Computer History Museum.

REAL DESIGN, REAL BUILDINGS

BY KIRSTEN TASHEV

SELECTING OUR TEAM

The Museum's building plans have passed some key milestones in the last several months, including our plans for both the permanent building and an exciting temporary facility. Last spring, after completing a five-month "ideas competition" with three outstanding architectural firms, the Museum selected Esherick Homsey Dodge & Davis (EHDD) of San Francisco, California, to design the new building. Museum Trustee and Building Committee Chairman Grant Saviers explained, "the purpose of the competition was not to choose a design for the new building, but to select the best architect for the project going forward." (Excerpts of the competition can be seen on our website). With the competition behind us, we are very pleased to be collaborating with the EHDD team on the design of the Museum's permanent facility.

"We are thrilled to work with the Computer History Museum board and staff to design one of the first Silicon Valley landmarks of the 21st Century," said Chuck Davis, senior design principal, EHDD. "Our goal is to capture the unique character of the Computer History Museum and to create an inspiring environment where people can learn and study computing history and innovation." Founded in 1946 by legendary architect Joseph Esherick, EHDD has become a leader in the architecture field, with a wide breadth of cultural institution experience including aquariums, museums, zoos, and libraries. EHDD has designed recognized facilities such as the Monterey Bay Aquarium in Monterey, California; the National Museum of Marine Biology/Aquarium near Kaohsiung, Taiwan; the Exploris interactive museum in Raleigh, North Carolina; and the east wing of the New England Aquarium in Boston, Massachusetts.

The Museum selected another first-class firm to develop the exhibitions for the new building. After an intensive interview process with eight qualified firms from across the United States as well as visits to the finalists' recent projects, we selected Van Sickle & Rolleri (VSR) of Medford, New Jersey. VSR is recognized for its work on the Experience Music Project in Seattle, Washington; the Gerald R. Ford Museum in Grand Rapids, Michigan; and the Intrepid Sea-Air-Space Museum in New York, New York. VSR has also received several awards including the Southeastern Museum Conference Curator's Committee Exhibition Competition Award and The American Association for State and Local History Award of Merit in 2000. Dennis Van Sickle, VSR principal, said, "We look forward to working on this most prestigious project and believe the time has come to create a museum that captures the rich stories of an industry that has truly changed the world."

CREATING COLLABORATION

From the beginning, the Computer History Museum purposefully set out to create a collaborative team relationship between architecture and exhibits in order to foster a process by which each discipline would inform the other. The goal is to create a building that seamlessly integrates the architecture and exhibits, so that they support and enhance each other. Towards this end, over the past summer, EHDD and VSR worked very closely with Museum representatives in the "programming" phase of the new building.

The purpose of the programming phase has been to clearly identify the scope of the building and to systematically refine the needs of the new facility in order to meet the Museum's mission, budget, and programs. Discussions have focused on the overall visitor experience as well as defining specific requirements including size, function, character, adjacency, and quality of each space (see chart on opposite page), while allowing enough flexibility in the design to accommodate future growth and change. As you read this article, the team is well into the next phase—"schematic design"—that will result in a more refined building program in terms of architectural amenities and exhibit spaces, as well as a signature building design.

PHASING THE APPROACH

In the "programming" phase, the team developed a strategy to build the new facility in two phases: Phase I, scheduled to open in late 2005, will initially include 32,000 sf (square feet) of gallery space with 23,000 sf of exhibits fully installed. Phase I also includes administrative offices, a retail store, a small café cart, a research reference library, a multi-purpose room for events, and other spaces for a total of 72,000 sf. The remaining 9,000 sf of exhibits within Phase I are scheduled to open in 2007.

In Phase II, an auditorium will be added as well as a larger restaurant. The exhibits will be expanded, as will the administration, library, and multi-purpose events spaces. Phase II will add approximately 48,000 sf and is slated to open in 2010. This strategy gives us flexibility with our program and budget and brings us remarkably close to our first estimates and goals made before the programming phase began. Together, Phases I and II equal approximately 120,000 sf.

BENCHMARKS

During the programming phase, Museum representatives and the design team conducted various information-gathering tours of local museums, including the San Francisco Museum of Modern Art, the San Jose Museum of Art, the Tech Museum of Innovation in San Jose, and the Children's Discovery Museum of San Jose. In the fall, the team was also fortunate to visit some outstanding international museums that display computer history exhibits, including the Science Museum in London, England; the Deutsches Museum in Munich, Germany; and the Heinz Nixdorf MuseumsForum in Paderborn, Germany. These are fantastic institutions and we are honored to be building strong relationships with them. Their hospitality was wonderful and greatly contributed to making the trip an overwhelming success.

BETA BUILDING UNDERWAY

Other exciting news currently in the works is our plan to construct a temporary building to be located less than 500 feet south of Moffett Field's landmark Hangar One, and adjacent to our future permanent building site. Scheduled to open in the fall of 2002, the temporary space is being dubbed the "Beta Building," both a nod to the computer industry's term for a product in testing phase and an indication that more is on the way with the Museum's permanent home opening in 2005. When the temporary space is completed, it will contain 41,000 sf of usable space, including 22,500 sf for artifacts storage; 9,000 sf for exhibits and event space for more than 200 people; and 9,500 sf for office space and a catering prep kitchen. It will be used for Museum functions, additional artifact storage, and will bring together staff now housed in three separate buildings at Moffett Field. The Beta Building will provide the Museum with the necessary space to grow, hold events, and stage and organize our artifact collection, and will allow us to explore new ideas as we plan our permanent facility.

The Beta Building will be located at Moffett Field, just south of the historic Hangar One and will provide the Museum with much-needed space for operations and exhibits during the process of building the new Museum building, scheduled to be completed in the fall of 2005.

The Beta Building is being designed by Daniel, Mann, Johnson and Mendenhall Holmes & Narver (DMJMH+N), an architecture, engineering, and construction services firm with offices in San Francisco and around the world. DMJMH+N's other recent public projects include the United States Botanic Garden Conservatory in Washington, DC; the School of Social and Behavioral Sciences at California State University in San Bernardino, California; and the Performing Arts Center at California State Polytechnic University in San Louis Obispo, California.

As you can see, we are moving forward rapidly to create critically important facilities necessary for us to achieve our goals and become the great institution we are striving to be. Our building plans—coupled with our CyberMuseum (see article on page 14), our active programs, and the communities of people who are helping us—will allow us to evolve and serve the public for many years to come. ■

Kirsten Tashev is the Building and Exhibits Project Manager at the Computer History Museum.

NEW BUILDING—AMENITY BREAKDOWN/PHASING PLANS (NET SF)

AMENITY	PHASE I (2005)	PHASE II (2010)	TOTALS
EXHIBITS (INCLUDES CIRC.)	32,500 sf	20,000 sf	52,500 sf
VISITORS SERVICES	7,230	0	7,230
CAFÉ (IN LOBBY AREA)	0	1,700	1,700
RETAIL	1,600	0	1,600
MULTIPURPOSE	1,600	9,000	10,600
ADMINISTRATION	6,560	5,000	11,560
LIBRARY	1,500	3,000	4,500
LOADING/SERVICES	4,200	0	4,200
BUILDING SERVICES	1,750	0	1,750

REPORT ON MUSEUM ACTIVITIES

BY KAREN MATHEWS

Karen Mathews is Executive Vice President at the Computer History Museum

Revolutionary Linus Torvalds spoke on September 18th about the extraordinary and accidental Linux phenomenon.

In his lecture last fall, Dan Ingalls discussed Smalltalk, the software environment meant to support the Dynabook computer, and which evolved into the current-day object-oriented Squeak.

An October panel called "Early Mouse Encounters" featured (left to right) Doug Engelbart, Bill English, Jean-Daniel Nicoud, Stuart Card, Niklaus Wirth, and Daniel Borel (not shown) on the earliest developments of the mouse user interface.

Fred Brooks addressed an audience the day after his induction as a Fellow of the Museum (see page 20).

A crowd of 250 people heard Fred Brooks explore "What is the Real Virtue in Virtual Reality?"

Each new issue of *CORE* serves as a marker of our steady progress in building a solid institution "to preserve and present for posterity the artifacts and stories of the information age." I am always amazed and gratified to see how much there is to relay to you. Among many other topics throughout this issue, we can tell you about our successful year-end solicitation effort, seven recent lectures, further collections activities including a large donation and exhibit of computing artifacts from Switzerland, the 2001 Fellow Awards event, Museum participation in the CRN Industry Hall of Fame event, and a major press announcement with NASA.

YEAR-END CONTRIBUTORS ENABLE MUSEUM GROWTH

Thanks to the generosity of so many of you who responded to our year-end fund-raising appeal, we are well on our way to meeting the ambitious financial goals set forth at the beginning of the fiscal year. We are grateful for the many people who, in spite of recent financial and political challenges in our country and world, have demonstrated their commitment to our mission. Heartfelt thanks to all of you.

We still have $359,000 to raise by the end of our fiscal year on June 30, and we hope that those of you who have not yet given will make a pledge or a gift as soon as possible before we close the year. Your support will make a real difference!

PUBLIC PROGRAMS AT THE MUSEUM

We were proud to offer a rich set of lectures and events last fall. The average attendance for Museum lectures was 250 people, which speaks volumes about the intellectual curiosity and vigor of our community. I encourage you to attend these wonderful events and to get the word out to others who would enjoy hearing the inside stories from the innovators of the information technology revolution. Feel free to make suggestions for speakers and topics you would like us to include. And please talk to us about sponsorship of the lecture program—a terrific opportunity to show your support of our growing public presence. Among other things, this would accelerate our ability to offer videos of these lectures to our public. Stay tuned for Charlie Sporck on semiconductor industry history; Jeff Hawkins, Donna Dubinsky, and Ed Colligan on the creation of the handheld computer; Charlie Bachman on the origins of the database; and Al Shugart on early storage developments.

LINUS TORVALDS
THE ORIGINS OF LINUX

To an audience of 350 on September 18th at Space Camp, Linus Torvalds, creator of the operating system phenomenon Linux, provided an inside look at how he went from writing code as a graduate student in Helsinki in the early 1990s to becoming an icon for open source software by the end of the decade. At the age of 11, Torvalds started using a Vic-20 computer as a "classic geek with BASIC." Early on, he believed that UNIX was better than everything else; however, in Finland it was difficult to find UNIX for the hobbyist. Why did he write his own operating system? He said, "Because, hey, that was what you did." He added, "When you don't have anything to start with, you can't see the progress you are making—it's just one instruction set at a time." Twice he had been about to give up, but persevered just the same. Currently, Torvalds is a working member of the software team developing Transmeta's Code Morphing™ chip software and Mobile Linux.

DAN INGALLS
FROM SMALLTALK TO SQUEAK

Smalltalk-80, the language from which the Squeak programming environment is derived, traces its roots to the famous beanbag chair culture of Xerox PARC (Palo Alto Research Center) in the 1970s. Developed by a team headed by Dan Ingalls, Smalltalk was to be the supporting software environment for Alan Kay's visionary portable and networked Dynabook computer—a concept that remains compelling today. Though the original Dynabook never came into being, Smalltalk took root and continued on. Ingalls told the story at Xerox PARC on October 11th to an audience of over 200 Museum guests of how the forward-looking Smalltalk concepts and capabilities have evolved into a modern environment called Squeak. Ted Kaehler (who worked with Dan at Xerox PARC, Apple, Apple again, Disney, and Viewpoints Research Institute) attended the talk and said, "There are many attitudes and stances in object-oriented software that are completely accepted now. Dan reminded us of how hard they were to think of and defend 30 years ago."

EARLY COMPUTER MOUSE ENCOUNTERS

The Museum, together with the San Francisco Swiss Science & Technology Office, hosted a panel discussion on October 17th at Xerox PARC with Daniel Borel, Stuart Card, Doug Engelbart, Bill English, Jean-Daniel Nicoud, and Niklaus Wirth. These early developers and proponents of the computer mouse relayed insider stories of how the concepts came about and were implemented. This event was made possible with the support of PRS Presence Switzerland. Zurich Network sponsored the reception and Spotlife is providing web streaming.

Throughout the 1960s and 1970s, Doug Engelbart and his lab at SRI pioneered an elaborate hypermedia-groupware system called NLS (oNLine System), most of whose now-common features were conceived of, fully integrated, and in everyday operational use by the early 1970s. NLS was first demonstrated in public at the 1968 Fall Joint Computer Conference in a remarkable 90-minute multimedia presentation, in which Engelbart used NLS to outline and illustrate his points, while others of his staff linked in from his lab at SRI to demonstrate key features of the system. This was the world debut of the mouse, hypermedia, and on-screen video teleconferencing. Engelbart said, "It isn't the human-computer interface I was looking at, it's the... human's interfacing with [an] augmentation system." He explained that "humans have certain basic sensory, perceptual, mental, and motor capabilities, and we get approached with various challenges such as language and social issues. We have to adapt and learn, and things [like the mouse] essentially augment us so that we can be capable within that environment."

Stuart Card is a Xerox research fellow and manager of the User Interface Research group at Xerox PARC. His study of input devices led to the Fitts's Law characterization of the mouse and was a major factor leading to the mouse's commercial introduction by Xerox. Daniel Borel co-founded Logitech, whose first commercially-available product was the computer mouse in 1982. Bill English was the first person to ever use a mouse. In 1963, while he was chief engineer for Engelbart's Augmented Human Intellect Research Center, English built the first mouse based on an idea in Engelbart's early notes. He later developed the "Hawley" mouse that was used with the Xerox PARC Video Terminal System and early Alto computers.

ETH Zurich Professor Emeritus Niklaus Wirth spent two years on sabbatical at Xerox PARC, where he became an enthusiastic user of the workstation Alto, which heralded a new era of computing with its high-resolution display and the mouse. Back in

Museum Fellow Don Knuth calls on an inquirer in his lecture, "Questions Answered," that drew almost 300 attendees.

Audience members pose questions in an "ask the professor" style lecture by Don Knuth.

David Stork addressed friends of the Museum before previewing "HAL's Legacy," his documentary film that investigates similarities and differences between the 1968 vision of technology in the year 2001, and technology as it actually evolved.

In December, Google, Inc. Chairman and CEO Eric Schmidt discussed lessons learned from his experience in the technology trenches.

Museum volunteer and donor Robert Garner acquired and donated a 1948 IBM 604—a punched card calculator whose speed performance was due to its implementation with electronics (vacuum tubes), rather than IBM's traditional relay technology.

Museum supporter Ned Chapin examines the Switcherland and MUSIC artifacts at the "Computing in Switzerland" exhibit reception prior to the Fellow Awards Banquet on October 23rd.

Switzerland, he used the mouse for the workstations Lilith and Ceres, which he designed in conjunction with the programming languages Modula-2 and Oberon. Jean-Daniel Nicoud is professor emeritus of ETH Zurich in Lausanne, Switzerland. Among many other inventions, he developed the Dépraz Mouse, initially sold by Logitech.

FRED BROOKS
WHAT IS THE REAL VIRTUE IN VIRTUAL REALITY?

Hewlett-Packard Company, with the help of its Chief Science Officer Stephen Squires, generously hosted this October 24 event, which included a lovely reception. Fred Brooks addressed an enthusiastic crowd of 250 people about work since 1990 in virtual reality at the University of North Carolina, Chapel Hill. In that year, virtual reality was hyped by the press and by a professional association conference panel, unfortunately designed to "wow" people rather than inform them. Brooks reminded us that "a lily needs no gilding—the plain truth is exciting enough." He posited that the research challenge of virtual reality is to make it "look real, sound real, feel real, and interact realistically." Even in today's world, Brooks said, "virtual reality barely works." Advancement in virtual reality technology consists of making strides in four dimensions: fast, pretty, handy, and real. Brooks said, "We figure out which one hurts worse, work on it, then move on to the next loudest problem." Currently, the greatest inhibitor is "swimming" due to lag (latency). Other problems include poor registration with the real world, ergonomics, cables (and wireless), and the tedium of building models. Brooks assured us that virtual reality technology will one day fulfill its promise as a useful tool in areas such as vehicle simulation, molecular medicine and structure, and more. "Computer scientists are toolsmiths," he said. "Is this tool dangerous?" he asked. "Sure! All tools are dangerous. The danger lies not in our tools, but in ourselves."

DONALD KNUTH
QUESTIONS ANSWERED

Nearly 300 people gathered at Xerox PARC on November 8th to try to "stump the professor," a rare opportunity to ask *The Art of Computer Programming* author Don Knuth anything and everything about computer programming. Knuth is professor emeritus of The Art of Computer Programming at Stanford University where, since 1968, he supervised the Ph.D. dissertations of 28 students. The author of numerous books, Knuth's software systems, TeX and MF, are used extensively for book publishing throughout the world. His numerous awards include the Turing Award, the National Medal of Science, the Steele Prize, the Adelsköld Medal, the Harvey Prize, the John von Neumann Medal, and the Kyoto Prize. He holds honorary doctorates from Oxford University, the University of Paris, the Royal Institute of Technology in Stockholm, the University of St. Petersburg, the University of Marne-la-Vallee, Masaryk University, St. Andrews University, Athens University of Economics and Business, the University of Tübingen, and 16 colleges and universities in the USA.

Attendee Bob Zeidman said, "It was great to be able to hear Don Knuth, one of the many pioneers that the Computer History Museum is able to bring in each month. Professor Knuth is a living legend for his developments in computer science. He is also, I found out, a quiet guy of towering height with a good sense of humor who is quick to point out his own shortcomings. I particularly agreed with his call for better communication skills among programmers, and I'm looking forward to examining his CWEB language for 'literate programming.'"

2001: HAL'S LEGACY DOCUMENTARY

Museum members and guests enjoyed a pre-broadcast preview on November 20th of the 90-minute version of a PBS documentary by David Stork comparing state-of-the-art technology today with the computer capabilities depicted in the 1968 epic film, "2001: A Space Odyssey." Now that 2001 has come and gone, we can compare the film's computer science "visions" with current technological fact—in particular those related to its central character, the HAL 9000 computer, which could speak, reason, see, play chess, plan, and express emotions. In some domains, reality has surpassed the vision in the film. In numerous others, reality has fallen far short. In the documentary, Stork navigates between scenes from the film and interviews with Arthur C. Clarke, Marvin Minsky, Gordon Moore, Rodney Brooks, Larry Smarr, Daniel Dennett, Raymond Kurzweil, Doug Lenat, and others. These contributors to "HAL's Legacy" have given us more than a scorecard for the film and novel. They have shown the reasons for the way things developed—and may continue to develop—to 2001 and beyond. The film was produced by David Kennard and InCA and funded by the Alfred P. Sloan Foundation.

Event attendee Ellen Spertus, assistant professor of computer science at Mills College, Oakland, commented, "Even people who say they don't like computers are fascinated by robots, real or imaginary, making them a great way to draw people into computer science. HAL's Legacy, which I plan to show my students, uses people's fascination with HAL, an imaginary artificial intelligence, to introduce them to the even more fascinating real world of artificial intelligence."

ERIC SCHMIDT
UNWINNABLE WARS: PERSONAL PERSPECTIVES ON TECHNOLOGY LEADERSHIP

On December 6th at Xerox PARC, Eric Schmidt, chairman and CEO of Google Inc., examined unwinnable battles he was involved with or witnessed during his rich and varied 20-year career in the computer industry. He recollected trying experiences at Sun Microsystems attempting to replicate its initial standardization victory with NFS (Network File System) in the company's long-standing battle to prevail over other UNIX companies and later, over Microsoft itself. He looked at the futile UNIX user-interface wars (such as Open Look vs. XOpen), the calamitous merging of Sun's UNIX (SunOS) and AT&T's UNIX (System V), and the failure of UNIX to unify behind a single version.

He observed the importance of understanding history, and that, "each and every generation makes the same mistakes." An example that surfaced during the talk was that some of the old battles found during the UNIX wars might be reemerging on today's Linux stage. Lively discussion followed in the question-and-answer period on topics such as competing against a behemoth (such as Microsoft), and why cooperative consortia don't work. Schmidt made the point that the best progress is often made when academia or egos not interested in monetary profit are able to form useful standards (such as the Internet standards created by Vint Cerf and the IETF).

Prior to his post at Google, Schmidt was chairman and CEO of Novell, chief technology officer and corporate executive officer at Sun Microsystems, a member of the research staff at Xerox PARC, and held positions at Bell Laboratories and Zilog.

COLLECTIONS HIGHLIGHTS

The report of items acquired in recent months is on page 12. Here are a few highlights: Richard Fryer donated an early CDI mouse, circa 1970, an excellent example of an early commercial mouse intended for use with minicomputers and larger mainframes. Former Marchant employee George William Bolton donated a "Figuremaster" mechanical calculator and allowed the Museum to record his thoughts on his years working with Marchant. And, longtime Museum supporter and friend, Robert Garner


The “Computing in Switzerland” exhibit showed artifacts related to computing in Switzerland, including much of the line of Smaky personal computers.


Banquet attendees enjoy the Fellow Awards program.


Museum Trustees Len Shustek and Donna Dubinsky relax after the Fellows banquet.

acquired an IBM 604 Electronic Calculating Punch for the Museum. The 604, a vacuum tube-based machine, was announced by IBM in 1948 and was probably the company’s first attempt at a wholly electronic machine targeted at the emerging commercial computing market.

SPECIAL EXHIBIT OF COMPUTING ARTIFACTS FROM SWITZERLAND

A reception prior to the Fellow Awards banquet and ceremony on October 23rd featured an impressive exhibit of artifacts donated to the Museum by various Swiss individuals and organizations. The exhibit displayed a series of artifacts related to computing in Switzerland, including: a 1956 ERMETH pluggable unit, 1972 Novasim, 1976 Crocus, 1977 Dauphin, 1978 Scrib, 1978 Smacky 6, 1986 Ceres-1, 1990 Ceres-3, 1991 MUSIC microcomputer, 1993 Convex C3820, 1994 GigaBooster supercomputer, and the 1999 TNet switch. Additionally, a Swiss public telephone booth equipped with a functioning Teleguide electronic phone directory (donated by Swisscom AG) demonstrated how intertwined computers have become with our daily lives.

Donors Hans Eberle, Jean-Daniel Nicoud, and Niklaus Wirth were present and spoke to the audience. Other donors include Ambros Speiser and André Thalmann, The Bobst Group, Epsitec SA, ETH Zürich, Supercomputing Systems AG, Swisscom AG, and the Swiss Center for Scientific Computing.

Swiss chocolatiers Albert Uster Imports, Nestlé Switzerland, Lindt, and others donated delicious chocolates for exhibit viewers. The artifact donation was initiated and coordinated by Christian Simm and his staff at the Swiss Science and Technology Office in San Francisco, and shipped courtesy of PRS Presence Switzerland.

THE 2001 FELLOW AWARDS–A SUCCESS BY ANY MEASURE

Over 400 Silicon Valley entrepreneurs, computer scientists, business leaders, academics, and other friends of computing history supported the Museum at this year’s Fellow Awards Banquet at the San Jose Fairmont Hotel on October 23rd. Master of Ceremonies and 2000 Museum Fellow Vint Cerf led the evening to celebrate the achievements of honorees Frederick P. Brooks, Jean E. Sammet, and Maurice Wilkes.

Hewlett-Packard Company was the Lead Sponsor for the event. Patron Sponsors were 1185 Design, Allegro Networks, Citigate Cunningham, eBay, Intel, and Mid-Peninsula Bank. Hosts for the evening were Donna Dubinsky, Len Shustek, Suhas Patil, Jayashree Patil, Elaine Hahn, Eric Hahn, Peter Hirshberg, Angela Hey, and John Mashey. Following are a few highlights from the evening.

Len Shustek cited John Brockman’s work with a group of experts from various fields to identify the most important inventions of the past 2000 years. Only three inventions got more than five votes each. Second on the list was the invention of the computer (to find out the other two you can buy Brockman’s book!). Shustek pointed out that for 5,000 years of recorded civilization, there were no computers, and suddenly computers appeared. Now and forevermore, computers will be everywhere, affecting what we do, how we live, how we work, how we play. He said, “We need to preserve the structure of how that happened, so that looking back from 500 years from now, it doesn’t look like a point event—that computers suddenly arose, with no recognition of who did it, and why they did it, and how they did it, and how it came to be. That’s what the Museum is here to preserve.”

Maurice Wilkes (via videotape) told us that it took around three years before the first computers were working, and how, while development was going on, it seemed interminable. “When pressed, I


New Fellow Jean Sammet enjoys a moment at the banquet table during the award ceremony.


New Fellow Maurice Wilkes, who resides in the UK, delivered an acceptance speech by videotape.


The 2001 Fellow Awards went to: **Frederick P. Brooks**, for his contributions to computer architecture, operating systems, and software engineering; **Jean E. Sammet**, for her contributions to the field of programming languages and its history; and **Maurice Wilkes**, for his lifelong contributions to computer technology, including early machine design, microprogramming, and the Cambridge Ring network.

used to tell people that I hoped to have a machine working in the summer. But I did not say *which* summer,” he said, and added, “No doubt as time goes on we will see many more changes. And this is where the Museum comes in. As I see it, an important function of the Museum is to record changes as they occur, and to collect artifacts that will illustrate those changes for the benefits of posterity.”

Fred Brooks said, “I remember at age 13 reading *Time* magazine; it had a cartoon on the front of the Harvard Mark I [computer] looking like a kind of a beast. The article described this computer. I knew at age 13 that that was what I wanted to do.”

Vint Cerf pointed out after hearing our 2001 Fellows speak, “It illustrates how their insights and their perspectives are still incredibly valuable to every one of us today. It is by knowing and understanding the past that we can shape and guarantee the future.”

CRN INDUSTRY HALL OF FAME

The Computer History Museum participated as a co-host of the CRN Industry Hall of Fame event on November 12 in Las Vegas. Honorees were Doug Engelbart, Judy Estrin, Mort Rosenthal, Phil Zimmerman, the late Robert Noyce, and the late Grace Hopper. Thanks to CRN for recognizing the accomplishments and determination of such wonderful people in computing. John Toole spoke at the event about the Museum and its plans. I was pleased and honored to accept the award for Grace Hopper on behalf of the Museum and to give a short tribute to her memorable contributions, which include the time- and error-saving compiler.

JOINT NASA/COMPUTER HISTORY MUSEUM PRESS ANNOUNCEMENT

On Friday, December 7th, the Museum and NASA co-hosted a press tour and special announcement for nearly 100 people who gathered to hear about the Museum’s partnership with NASA for a presence in the NASA Research Park, the Beta Building (see page 16), the appointment of Head Curator Michael R. Williams, and the Museum’s new name and logo. Panelists included NASA Ames Research Center Director Henry McDonald; Museum Executive Director & CEO John Toole; Chairman of the Museum’s Board of Trustees Len Shustek; Museum Trustee and CEO of Handspring Donna Dubinsky; and Intuit’s Chairman of the Board Bill Campbell. The press responded with great enthusiasm and coverage included KLIV, KGO, KTVU, KICU, the *San Jose Mercury News*, and the *San Jose Business Journal*.

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THE ELEMENTS ARE HERE: artifacts, photographs, videos and audiotapes, marketing materials, documentation, and gigabytes of historic software.

THE VISION IS HERE: knowledgeable and dedicated Trustees, Advisors, and staff members are implementing the dream: to build, endow, and operate a landmark facility where the Museum's collection can be adequately displayed and researched.

THE OPPORTUNITY IS HERE: the Museum is part of the proposed NASA Research Park at Moffett Field, California, destined to become a world-class, shared-use education and R&D campus, partnering with local communities, academia, industry, nonprofits, and government agencies.

BECOME AN INVESTOR IN THE MUSEUM
Join this eminent community of people—including collectors and historians, software and hardware engineers, computer scientists and theorists, entrepreneurs and investors, visionaries and inventors, and the general public—who share a passion for preserving computing history for generations to come.

For pioneers at the forefront of the computing industry, supporting the Museum preserves the contributions that you made.

For industry professionals, researchers, and scholars, supporting the Museum ensures access to unique and valuable resources that shed light on the evolution and significance of computing history.

For those simply curious, interested, or excited by computing history, supporting the Computer History Museum will allow everyone a better understanding of the impact of the information age.

UPCOMING EVENTS

Please RSVP for all events and activities by calling +1 650 604 2714 or visiting www.computerhistory.org/events. Thank you!

TUE, FEBRUARY 26
THE PALMPILOT STORY
Donna Dubinsky, Jeff Hawkins, and Ed Colligan of Handspring, Inc. along with Andrea Butter, co-author of *Piloting Palm*
MEMBER RECEPTION: 6:00 PM
Bldg 126, Moffett Field
LECTURE: 7:00 PM
Moffett Training & Conference Center, Bldg. 3

TUE, APRIL 16
THE INTEGRATED DATA STORE (IDS)—THE PROBLEMS AND THEIR SOLUTIONS
Charlie Bachman
MEMBER RECEPTION: 6:00 PM
Bldg 126, Moffett Field
LECTURE: 7:00 PM
Moffett Training & Conference Center, Bldg. 3

TUE, MAY 21
THE HISTORY AND FUTURE OF ELECTRONIC PHOTOGRAPHY
Carver Mead, Foveon, Inc.
Please check our website for location and time

THU, SEPTEMBER 5
HALF A CENTURY OF DISK DRIVES AND PHILOSOPHY: FROM IBM TO SEAGATE
Al Shugart, Al Shugart International
Please check our website for location and time

THU, SEPTEMBER 26
VON NEUMANN: FROM STORED PROGRAM CONCEPT TO THEORY OF COMPUTING
Bill Aspray, Computing Research Association
Please check our website for location and time

VOLUNTEER OPPORTUNITIES
The Museum tries to match its needs with the skills and interests of its volunteers and relies on regular volunteer support for events and projects. Monthly work parties generally occur on the 2nd Saturday of each month, including:

MARCH 9, APRIL 13, MAY 11, JUNE 8, JULY 13, AUGUST 10

Please RSVP at least 48 hours in advance to Betsy Toole for work parties, and contact us if you are interested in lending a hand in other ways! For more information, please visit our volunteer web page at www.computerhistory.org/volunteers

MUSEUM ARTIFACTS
ON LOAN AT THE FOLLOWING EXHIBITS

FEB 8–MAY 27, 2002
BRAINS TO BYTES—THE EVOLUTION OF INFORMATION STORAGE
The Museum of American Heritage (MOAH)
Palo Alto, California
www.moah.org

APRIL–SEPT 2002
WORLD'S FAIRS
San Francisco International Airport
Terminal C3
San Francisco, California
www.sfoarts.org

MAY–SEPT 2002
GAME ON!
(THE WORLDWIDE CULTURE AND HISTORY OF VIDEO GAMES)
Barbican Gallery, London, United Kingdom
www.barbican.org.uk

SEPT 2002
THE COMPUTING REVOLUTION
Museum of Science
Boston, Massachusetts
www.mos.org

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WWW.COMPUTERHISTORY.ORG

Current staff openings can be found at www.computerhistory.org/jobs.

MYSTERY ITEMS

FROM THE COLLECTION OF THE COMPUTER HISTORY MUSEUM

Explained from CORE 2.3

The Interface Message Processor (IMP) was the packet switching node of the ARPANET, which connected computer systems, beginning in the early 1970s, into a nationwide research network for computer resource sharing. This ARPANET originally consisted of only four nodes (UCLA, SRI, UCSB, and the University of Utah) and eventually grew to over 100 nodes. It was connected via "gateways" (now called routers) to two other networks (packet radio and SATNET) that were also supported by DARPA (Defense Advanced Research Projects Agency). These three interconnected networks ultimately evolved into today's Internet with its tens of millions of nodes.

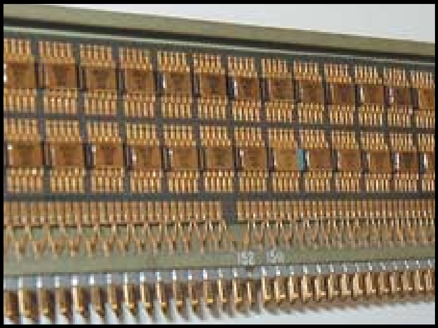
The IMP (Interface Message Processor), X105.82, Gift of Bolt Beranek and Newman, Inc.

During an early ARPANET planning session, engineer Wesley Clark suggested developing a standard minicomputer interface in order to avoid creating separate hardware and software for every different time-sharing system that would be connected. The IMP was thus a communications "switch" accepting packets and relaying them to other IMPs or locally-connected host computers. In December 1968, DARPA selected Bolt Beranek and Newman (BBN) to develop the IMP. Frank Heart led the team, with Severo Ornstein as lead hardware developer and Bill Crowther as lead programmer. MIT professor Bob Kahn, who had taken a leave of absence in 1966 to join BBN, was responsible for the system design.

Shortly before the planned delivery date of September 1, 1969, the first IMP arrived at the laboratory of Professor Len Kleinrock at UCLA. A month later, the second IMP arrived at SRI and, soon thereafter, the first characters were transmitted between SRI and UCLA. In November and December, IMPs number three and four were installed at University of California Santa Barbara and the University of Utah. The network quietly expanded to 13 sites by January 1971 and 23 by April 1972. ■

WHAT IS THIS?

THIS ITEM WILL BE EXPLAINED IN THE NEXT ISSUE OF CORE.



Please send your best guess to mystery@computerhistory.org before 04/15/02 along with your name, shipping address, and t-shirt size. The first three correct entries will each receive a free t-shirt with the new Museum logo and name.

COMPUTER HISTORY MUSEUM

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