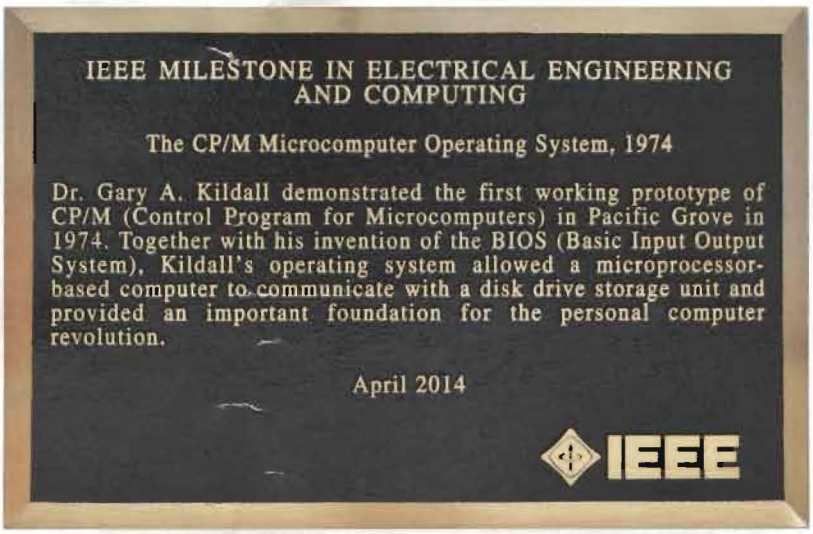
Computer History Museum

IEEE MILESTONE
IN ELECTRICAL ENGINEERING AND COMPUTING

CP/M – MICROCOMPUTER OPERATING SYSTEM, 1974



Milestone Dedication Events - April 25, 2014

2:00 PM Pacific Grove City Chambers, 300 Forest Ave.
Welcome: Mayor Bill Kampe
About the Milestone program: IEEE President-Elect Howard E. Michel
A conversation with former DRI Vice-Presidents Gordon Eubanks and Tom Rolander
with commentary from Brian Halla and John Wharton.
Moderator David Laws, Computer History Museum

4:00 PM 801 Lighthouse Ave.
Former DRI Headquarters Office
Street side plaque unveiling and remarks by representatives of the
City of Pacific Grove, IEEE, DRI, and the Kildall Family

4:30 PM 734 Lighthouse Ave.
Carmel Pine Cone office, former DRI Engineering building
Reception hosted by the IEEE, Santa Clara Valley, Monterey Bay Subsection

Digital Research, Inc. artifacts and memorabilia are on display during
the month of April in the Pacific Grove Library, 550 Central Avenue, Pacific Grove, CA 93950

This IEEE Milestone event is also supported by alumni and friends of Digital Research, Inc. (DRI), the Asilomar Microcomputer Workshop (AMW) and the Carmel Pine Cone

Biographies

Brian Berg will serve as MC for today's presentations. He is a member of the IEEE Santa Clara Valley History Committee and the AMW Organizing Committee, and specializes in storage and flash memory at his Berg Software Design consultancy in Saratoga, CA.

Gordon Eubanks received an MS in Computer Science from the Naval Postgraduate School where Gary Kildall was his thesis adviser. He founded Complier Systems Inc. to commercialize the subject of his thesis, a BASIC language compiler for CP/M. After DRI acquired his company in 1981, he served as VP of Languages and Tools until joining Symantec in 1984 where he rose to CEO. He later worked as CEO at Oblix and as an adviser to venture capital and software security firms.

Brian Halla was Intel's interface to Gary Kildall when Gary first worked as a microprocessor software consultant to the company. He served as Executive VP at LSI Logic Corporation and CEO of National Semiconductor until he retired in 2009.

Bill Kampe is Mayor of Pacific Grove. He spent 35 years with Hewlett-Packard Company and Agilent Technologies in senior engineering and management roles.

David Laws is semiconductor curator at the Computer History Museum. He worked in Silicon Valley semiconductor companies, including Fairchild, AMD, Altera & QuickLogic, in roles from engineer to CEO.

Dr. Howard E. Michel is the President-Elect of the IEEE. He retired from the U.S. Air Force as an engineering manager after an 18-year career and is currently an engineering consultant and Associate Professor of Electrical and Computer Engineering at the University of Massachusetts Dartmouth, North Dartmouth, MA.

Tom Rolander spent two years at Intel before joining fellow University of Washington alumnus Gary Kildall at DRI in 1979 where he designed multi-tasking (MP/M) and network (CP/NET) operating systems. Tom was VP of Engineering before cofounding KnowledgeSet with Kildall in 1985 to create the first CD-ROM encyclopedia for Grolier. Subsequently, he founded and served as CTO for several software companies.

John Wharton served as Intel's technical liaison to DRI in 1980-81 and as a contractor to DRI in 1982-86, and co-authored several technical papers with Gary Kildall. He is a Consultant in Palo Alto, CA, and a member of the AMW Organizing Committee.

The History of CP/M - as told by Gary Kildall in 1980

1973. . .

I was sitting quietly at my desk when Masatoshi Shima hurried into my office at Intel and asked me to follow him to his laboratory down the hall. In the middle of his work bench, among the typical snaggle of jumpers, oscilloscopes and multimeters, sat a binocular microscope with spider-leg probes, all of which were subjecting a minute piece of silicon to helpless investigation. I peered through the microscope at the enlarged regular patterns with particular interest. As a consultant, my job was to design and develop certain software tools for Intel. One was Interp/80, a program which simulated Intel's newly evolved 8080 microprocessor to be used by Intel customers on timesharing systems. As I searched for something recognizable, I hoped my simulation resembled the operation of Shima's first 8080 chip which had finally come to life.

My proposal to Intel had been simple: I would provide them with a language, called PL/M, to replace serious systems programming in assembly language. The compiler would first be written in FORTRAN for operation on timesharing computers and "cross compile" to the eight-bit processors. Next, we would write a PL/M compiler in PL/M and "bootstrap" from the timesharing computer to a resident compiler operating on Intel's new Intellec-8 development system. The first part was complete. PL/M cross compilers and Interp simulators were implemented for the now-best-forgotten 8008, as well as the 8080. Programs had been written and tested by Intel's software group, consisting of myself and two other people, and we were ready for the real machine. Things were going well: the resident compiler would be the next step.

Unfortunately, nearly all small computer systems in 1973 used paper tape as the backup storage device, with the ubiquitous model 33 Teletype serving as the nerve-shattering I/O device. It was readily apparent that resident development systems could not compete with timesharing services when considering throughput, resources, and services. Still the notion of a personal computer for software development interested everyone.

I became intrigued with a new device, called a floppy disk, which, though designed by IBM to replace punched cards, appeared to have much greater potential. The device was ideal: over 3,000 times the data rate of a Teletype, each $7 diskette could randomly access the equivalent of 2000 feet of paper tape. Best of all, the drive was priced at a low $500. Due to a slight problem of undercapitalization, I found this incredibly low price still a bit high. At that time, a smallish company called Shugart Associates was in operation a few miles up the road from Intel. Dave Scott, then marketing manager at Shugart Associates, donated one of their 10,000- hour test drives to the cause, complete with worn-out bearings and a bearing repair kit. It was only later, as I sat in my office at home, staring at the naked disk drive, that I realized I had no cabinet, no cables, no power supplies, no controller, and most distressing of all, no hardware design experience. To make matters worse, no controllers were commercially available, even if I could afford one.

After several abortive attempts at constructing an interface to my Intellec-8, it became readily apparent that my efforts would be better directed toward the software aspects.

Between projects I put together the first CP/M file system, designed to support a resident PL/M compiler. The timesharing version of PL/M, along with the Interp simulator, allowed me to develop and checkout the various file operations to the level of primitive disk I/O. A simulation is, after all, just a simulation, and the inability to make that 10,000 hour drive work for just one more hour was frustrating.

Shortly thereafter, in the fall of 1974, John Torode became interested in the project. I offered as much moral support as possible while John worked through the aberrations of the IBM standard to complete one of my aborted controllers. Our first controller was a beautiful rat's nest of wirewraps, boards and cables (well, at least it was beautiful to us!) which, by good fortune, often performed seeks, reads, and writes just as requested. For agonizing minutes, we loaded the CP/M machine code through the paper tape reader into the Intellec-8 memory. To our amazement, the disk system went through its initialization and printed the CP/M prompt at the Teletype.

Anyone who has brought -up CP/M on a homebuilt computer has felt this moment of elation. A myriad of connections are properly closed; bits are flying at lightning speeds over busses and through circuits and program logic, to produce a single prompt. In comparison to our paper tape devices, we had the power of a S/370 at our fingertips. A few nervous tests confirmed that all was working properly, so we retired for the evening to take on the simpler task of emptying a jug of not-so-good red wine while reconstructing battles, and speculating on the future of our new software tool.

In the months that followed, CP/M evolved rather slowly. Intel was experiencing enormous growth and all software development was halted while new mangement structures were instituted. Intel expressed no interest in CP/M, nor in continuing any resident compiler work. Nearly two years passed before Intel again took interest in resident software tools, with their introduction of the ISIS operating system and later, the resident PL/M -80 compiler.

Meanwhile, John Torode redesigned and refined our original controller and produced his first complete computer system, marketed under his company name, Digital Systems (which later became Digital Microsystems). The first commercial licensing of CP/M took place in 1975 with contracts between Digital Systems and Omron of America for use in their intelligent terminal, and with Lawrence Livermore Laboratories where CP/M was used to monitor programs in the Octopus network. Little attention was paid to CP/M for about a year. In my spare time, I worked to improve overall facilities, and added an editor, assembler, and debugger which were predecessors of the current ED, ASM, and DDT programs. By this time, CP/M had been adapted for four different controllers.

In 1976, Glenn Ewing approached me with a problem: Imsai, Incorporated, for whom Glenn consulted, had shipped a large number of disk subsystems with a promise that an operating system would follow. I was somewhat reluctant to adapt CP/M to yet another controller, and thus the notion of a separated Basic I/O System (BIOS) evolved. In principle, the hardware dependent portions of CP/M were concentrated in the BIOS, thus allowing Glenn, or anyone else, to adapt CP/M to the Imsai equipment. Imsai was subsequently licensed to distribute CP/M version 1.3 which eventually evolved into an operating system called IMDOS.

By coincidence, Jim Warren and I were both consulting at Signetics Corporation during this time. Jim was then the editor of *DDJ,* and pushed for sale of CP/M to the general public. There was, at the time, a pervading paranoia among software vendors who felt that any and all loose software would be immediately "ripped-off' by this immoral group of computer junkies. Jim's faith in the industry, however, led me to introduce the CP/M 1.3 system for sale on the open market at $70 per copy. In the months that followed, the nature of the computer hobbyist became apparent. In most cases he was, like myself, in the computer industry and merely wanted a personal computer for his own endeavors. CP/M gradually gained popularity through a "grassroots" effect and, to the amazement of the skeptics, the rip-off factor was practically nil. A new company called Digital Research was formed to support CP/M, develop new products, and provide administrative functions.

It's been nearly three years since CP/M's initial introduction, with several revisions and improvements. Although floppy disks maintain their popularity, CP/M 2.0 is now offerred to manage larger capacity hard disks which are becoming more readily available. Customer needs and demands have also led to the recent introduction of MP/M, a CP/M compatible multiterminal multiprogramming system for more sophisticated applications.

More important, however, is that CP/M provides a manufacturer independent basis for an evolving software market. We all know that software is expensive to develop and support, with numbers quoted in the hundreds of thousands of dollars over the product lifetime. In a classical computer marketplace, these costs are amortized over a few installations, resulting in seemingly outrageous prices. Active CP/M users, however, number in the tens of thousands and can be reached through any number of popular magazines. Thus, marketeers reduce their prices substantially to interest a much larger customer base. Software is sold profitably as an independent commodity by a large number of responsible companies, and the benefits to the consumer are clear. Competition forces low prices and quality control, with selection among a wide variety of software products. Currently, CP/M compatible products range from word processing programs through business systems to a variety of language processors for BASIC, FORTRAN, COBOL, PASCAL, and others. All are priced in the $100 to $700 range. The future is, without doubt, optimistic for producers and customers alike.

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Vol.5, No.1, (January 1980)

The CP/M Walking Tour - Pacific Grove, CA

Adapted from: "Digital Dialogue", Vol.1, No.1, August 1982

781 Bayview Avenue. Private residence.

Gary Kildall worked in his backyard playhouse with the hummingbird feeders outside the door, thinking and tinkering with his first version of CP/M -- and, at just the right time, he got a little help from a friend. "John Torode came to my aid with a home-built disk drive controller. We loaded up the first version of CP/M from the paper tape reader of an ASR-33 Teletype into the Intelec memory. With the first CP/M prompt appearing on my used ASR-33 Teletype in 1974, we were both aware that a new computer generation was in progress", Gary recalled.

Photo mid-1970s. Courtesy Scott Kildall

716 Lighthouse Avenue. Commercial offices.

Dorothy and Gary filed their first fictitious business name statement in June 1976, and were incorporated in August 1977. In April 1977, the tiny new company had rented a set of offices above what was later "Charlie's Restaurant" at 716 Lighthouse Avenue. They began marketing CP/M to computer hobbyists through magazines like "Dr. Dobb's Journal" and to OEMs through licensing agreements The price of the system to the hobbyist market was just $70. Dorothy remembered going down to the Post Office at Box 759, hoping to find a few checks that would keep them going a while longer.

Photo 2014. Courtesy David Laws

801 Lighthouse Avenue. Private residence.

There were nine employees when DRI moved to 801 Lighthouse in November 1978. The Victorian building was semi-converted into offices. The previous tenant, a dentist, had built railings in the former dining room to separate his waiting room from his dentist's chair. This became Digital Research's conference room. However, at times, more conference space was needed and groups of dark-suited business men could be found conferring around picnic tables in the backyard. The programmers were out in the carriage house then, and the shipping and disk making was all done inside.

Photo late 1970s. Courtesy John Pierce

734 Lighthouse Avenue. Carmel Pine Cone Editorial Office.

In August 1980, the programmers moved to the Victorian duplex at 734 Lighthouse. According to Frank Holsworth "One Friday Gary came in and said, 'Anyone who works this weekend will get a raise!'" The building was raised about 6 feet on jacks in order to get the DEC VAX equipment installed, and to add a better foundation. The programmers had to climb a ladder to get in because there were no outside stairs, at the time. Reportedly, the whole house shook on its unsteady pilings whenever anyone inside moved about.

Photo early 1980s, after the "raising". Courtesy John Pierce

More information on Gary Kildall and Digital Research

"Gary Kildall and the 40th Anniversary of the Birth of the PC Operating System" Laws, David *@CHM Blog*, Computer History Museum, February 2014. [www.computerhistory.org/atchm]

"Digital Research Inc." Corporate Histories Collection
Computer History Museum, November 2005 [corphist.computerhistory.org/corphist/]

"Digital Research"
Links to DRI articles and videos [www.digitalresearch.biz/]

They Made America: Two Centuries of Innovators from the Steam Engine to the Search Engine Evans, Harold (2004) ISBN 0-316-27766-5 [www.sirharoldevans.com/librarypage.html]