

Personal Computers, FidoNet, and STEM

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Decisions. We are always making decisions. Trivial decisions: What to wear today, what to have for lunch, which movie to stream. Bigger decisions: where to go on vacation, buying a car. My career defining decisions: choosing a high school (Bronx Science), college and major (CCNY, physics), grad school (NYU, Columbia). A brilliant decision in 1955: marrying Helen Rothermel, my partner of 67 years. A casual decision in 1983 - buying a personal computer - turned out to be a transformative decision, defining my professional life and Helen's for decades.

Some background. I worked at Bell Aircraft outside Buffalo in 1954 between college and grad school and learned how to program an analog computer. Those ancient machines used electrical circuits, for example, to mimic Newton's equations of motion and guide a ballistic missile. I wrote a report on a program I created as a pedagogic exercise for a helicopter training simulator. Four years later I was at Columbia and shared this report with the professor who ran the advanced lab, which was dreaded by my fellow theoretical physics students. Someone had donated an analog computer, and she had no idea what to do with it. She was delighted to have my document as an example and waived the lab requirement.

My first and rather challenging exposure to digital computers occurred in January 1957, between semesters at Columbia. I attended a minicourse in programming an IBM 650, the first commercial IBM mainframe. It used vacuum tubes, not transistors, weighed over 5000 pounds and stored programs and data on a magnetic drum. The programs were strictly machine language, with operation codes, addresses, etc. No symbolic computer languages had yet been developed. It took about 300 lines to program the assigned homework exercise that today would take less than a dozen lines.

I knew the approximate answer since one of the students had worked it out using tables of functions and a desk calculator. Getting it right on the computer was much harder. I reserved three-hour time slots for the machine and an operator. The program was typed in, run, and I corrected errors until time expired. I gave up after a few sessions when the new semester started. With one notable exception, so did all the other two or three dozen grad students and faculty members. That exception was Professor Charles Townes, a brilliant physicist who would win the 1964 Nobel Prize. He got the program to work.

In 1961, as a postdoc at Brookhaven National Laboratory, I quickly learned FORTRAN after a few lessons from a Columbia colleague and future research partner, Elliot Auerbach. FORTRAN is a symbolic language whose name derived from FORMula TRANslation. I started using mainframe computers extensively for physics research. A highlight of my early computer experience at Brookhaven was tracing absurd results for an atomic physics calculation to an error in one of the standard computer math functions.

I continued to use mainframes when I arrived at UMass in 1965 for research and also for keeping track of grades in large classes. In 1983 I had some funds in a research grant that were budgeted for my summer salary. I opted instead to use the money to buy a personal computer. I thought it would be useful in my research. Little did I know what that decision would lead to.

The first question was which computer to buy. There were a lot to choose from including Commodore, HP, Tandy (Shack), Apple, IBM, and some others. The last two were most popular. The Apple II had been introduced in 1977, the IBM PC had appeared four years later. Both had several upgrades. Based on what I could glean from colleague magazines, I opted for the IBM PC.



I ordered a fully equipped model. It came with two 5.25-inch floppy disk drives and probably weighed about 50 pounds, thanks to its sturdy steel case. The disks each held 360 kilobytes of data and software. Today's personal computers have internal drives that store over a million times as much information, and one digital photograph image file is much larger than the capacity of a floppy disk. A green monochrome monitor displayed 80 columns of text; a second monitor showed color graphics at a lower resolution. A painfully slow Epson black dot matrix printer completed the system. The overall cost was about \$3500, roughly \$10,000 in today's dollars. Now you can buy a powerful computer for less than \$500, and a color printer for under \$100, complete with a scanner, copier, and fax.

Learning to make effective use of a PC in 1983 was not easy. The operating system was PC-DOS, not the Windows graphical interface which appeared years later, and you had to know a bunch of commands. There were no Dummies books, no computer center help desks, no web sites, and no Google. Your friends and neighbors were unlikely to be able to help. You were on your own.

A users group was one partial solution. Jeffrey Kane, a UMass business school faculty member, posted a notice looking for people to create one. I got in touch with him and helped to locate a nucleus of members. The group would grow in time to include 600 people, a remarkable number.

It's been almost four decades, so my memories have faded. I recall spending a lot of time in our early meetings discussing a name for the group, eventually settling with the infelicitous Pioneer Valley PC Users Group, or PVPCUG. Fortunately, my late friend Claude Penchina has given me a loose-leaf notebook containing about ten issues of our group's newsletter which have helped me recall some details. Jeff was elected Chairman, and I was chosen to be Vice-Chairman. After two years, Jeff declined to be reelected, and I became Chairman, a post I was stuck with until the group dissolved many years later.

Our monthly meetings followed a standard format. During the first hour, Helen and I would offer for sale disks with public domain programs and shareware, programs you could freely try out, but which requested a small fee if you were going to use them. The disks offered programs such as word processing, database, income tax, and games. For example, the August 1986 newsletter introduced Disk # 35: Pianoman (how to play a piano); #36: Batch file Tutorial; and #37: Pc-touch (typing tutorial) and Book Index. Member paid \$5 a year in dues, and \$6 for a disk. The income supported our programs, including equipment, telephones, and scholarships for high school students. Six Special Interest groups or SIGs met during that first hour. A plenary session followed, featuring a speaker or panel. Membership grew from a handful of people to over 600, an impressive number.

Some months after our start, a programmer named Pat Ryan moved into town. He had been active in a users group in Connecticut and pointed out that we needed a newsletter and an electronic bulletin

board service, or bbs. The bbs would allow members to post messages on an online forum and transfer files. We were happy to have Pat volunteer for both jobs. Unfortunately, a year later, Pat found a new job and left town, ending his contributions. Mike Walker agreed to take over editing the newsletter, which he renamed A Byte At A Time, and I would manage a bbs. This decision turned out to be transformative and would result in a career change.

The owner of a local computer store donated a computer and a telephone line for the bbs, and Michael Callahan installed a new bbs program called Fido. (Michael was an extraordinary high school student who published research with a UMass math professor and is now someplace in Silicon Valley after studying at Harvard and Oxford.) Our bbs was a node in what grew to an international network of 30,000 FidoNet bbs. These would exchange personal email, echomail or discussion groups, and provide the latest shareware. I was the system operator or sysop of our board and later served a year as chairman of the entire international network.

Soon after we started our bbs, an extension service worker asked me to set one up for farmers that would offer daily updated prices for their crops. At that point I realized the potential for high school physics teachers. Typically, there was one physics teacher in our small town and regional schools, and they would have no colleagues for support. A bbs would allow them to connect with each other and with UMass faculty. Fortunately, the UMass President's office was offering telecommunications demonstration grants, and I received \$10,000 to start the Physics Forum bulletin board. We purchased equipment, located physics teaching resources, and mailed out flyers. Helen was hired to provide user support.

The initial response was underwhelming. Research physicists had been among the first users of mainframe computers and electronic communications. However, in the high schools, it was not the physics teachers, but the math teachers who taught BASIC, a streamlined version of FORTRAN, and ran the computer labs. Physics teachers were seldom into computers and generally lacked the requirements to use a bbs: computers, modems, telecommunications software, and telephones.

The Physics Forum went online in May 1987. Not long after, we came to the attention of Mary Alice Wilson, then the Director of the Five Colleges Western Massachusetts Public School Partnership. She encouraged us to make the bbs available to all teachers, which we did. Helen and I attended teacher conferences and workshops to do demonstrations. We got a batch of old acoustic modems and located Apple and PC terminal shareware programs which we distributed at a nominal price. We received a \$20,000 state grant to provide statewide free 800-number telephone access. Gradually usage increased.



Mary Alice and I applied to the National Science Foundation to fund teacher professional development science and technology programs. We received two three-year grants, SPACEMET (1989-92, \$650,000) and 5C5E (1992-95, \$850,000). (I do not remember what the acronyms stood for.) Both programs supported summer and school year workshops and included bbs training. Toll-free network access spanned the region via three Fidonet nodes. We also placed bbs for occasional use in some classrooms. Students were able to share writeups of their original research with enough

detail for peers at another school to attempt to replicate their results. Teachers reported greater than usual improvements in writing skills for students who frequently posted messages.

SPACEMET used space exploration to motivate basic science, and 5C5E centered on the environment. Teacher professional development funding eventually totaled over \$16,000,000, and the creation of the UMass STEM Education Institute, but that is another story.

By 1992 the World Wide Web and the internet had exploded on the scene. Academics and big business employees had internet and Web access, but not the general public or teachers. We provided access for over 2000 teachers using a variety of servers and programs. That is also another story.

The growth of the Web, a plethora of self-help books and websites, and friendlier operating systems and applications led to a gradual lack of interest and membership in users groups. I cannot recall the exact years, but ultimately, we shut down the bbs and ended regular PVPCUG meetings. A small group met occasionally for several more years with a very informal agenda.

Buying a personal computer today still involves decisions. We can buy Macs, many generation descendents of the Apple II, or Windows computers, IBM PC offspring. There is a multitude of options depending on intended application and budget. My latest purchase a few years ago was an HP laptop. It cost \$500, has a 15.6 inch screen with beautiful high definition color graphics, and weighs about five pounds. I use it for word processing, spreadsheets, and email. I stream old movies and football games.



A lot has changed in four decades.