Personal Computing—A little past and a lot of future

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INTRODUCTION

We are incredibly lucky! When I look back in time, I see no time more exciting than now! When I look forward in time, I see no time more exciting than now! For now, we are privileged to witness the dawn of the era of personal information processing. Few people have ever lived at such a time of technological change. Perhaps only those who were present when the first book was printed have, before us, had a similar opportunity to observe the birth of a technology-derived tool having the power of the personal computer to improve our quality of life. We are presently witnessing what is probably the most significant of all technology-based revolutions surpassing in importance the printing press, the automobile and the assembly line.

Low-cost abundant computing brings us to the dawn of a new era. A new era in which information processing power will no longer be the exclusive tool of government and large business. Rather we will have computers for people to use in a near limitless variety of ways in our work, our play, and all aspects of our daily lives.

THE COMPUTER HOBBY

Five years ago, and even before, those of us involved with microprocessors were making rather accurate predictions as to the declining cost of computing resources based on our knowledge of the new microprocessor technology. We did not predict, however, the absolutely incredible growth of hobby computing.

Although there had been some activity previously by really enterprising do-it-yourselfers, the computer hobby really took off in January, 1975, when the MITS Altair Computer appeared on the cover of Popular Electronics magazine. The computer was available in kit form for about $400. A new hobby and a new industry were born.

In July, 1975, Dick Heiser opened the first retail computer store. Many others were to follow. The computer store started making its place in the computer industry as a new way to market and service low-cost computers and related equipment.

In the summer of '75, MITS was driving its van all over the country demonstrating the Altair computer. In city after city computer hobby clubs were born at the MITS van, which brought the computer hobbyists in each geographic area together for the first time. Now computer hobby clubs number more than 300, with several in other countries. One of these clubs has membership numbering in the thousands and hundreds is very common. Soon these clubs will join together to form an international amateur computer society.

What sort of person is this computer hobbyist? He or she is a hardware or software tinkerer—an experimenter. The computer hobbyist comes complete with clubs, conventions, magazines, T-shirts, and bumper stickers. Hobby computing will surely become the elite of the technological hobbies. Who is this computer hobbyist? He or she is an engineer, a programmer, an electronics buff, an amateur radio enthusiast, a lawyer, a small business person. Most actually have surprisingly serious intended uses for their computers. In fact, a surprising number are depreciating their computers on their income tax returns.

Personal computing is not only hobby computing. The fact that hobby computing has received so much publicity is really misleading. The graph in Figure 1 illustrates this point. Discussions with several computer stores indicate that the personal computing equipment sold over the past year has gone, for the most part, to business, industry and educational institutions. Only about 20 percent of the personal computers sold this past year have been sold to hobbyists. To further illustrate this point, customers of my computer store include: oil companies, universities, hospitals, trucking companies, security companies, public schools, personnel agencies, power and light companies, manufacturing companies, and electronics companies.

Personal computers are replacing time-sharing services in businesses large and small. Personal computers are replacing mini computers in process control applications. Additionally, personal computers are finding their way into new applications where the new low cost of computing makes possible the use of computing where before it was too expensive. One way to view personal computing is that it is simply low-cost computing. And this new low-cost computing will compete with all other traditional forms of computing resources.
A NEW INDUSTRY

A new industry has emerged to support the personal computing market. There are more than 100 companies manufacturing personal computing products. There are more than 500 computer stores selling and servicing these products. There are 10 major magazines dedicated to personal computing.

The new computer industry differs in several important respects from the computer industry that preceded it. These differences include fierce competition around a standard internal bus and a new way of marketing and servicing computers.

The standard bus

Fundamental to this difference and to the development of the personal computing industry itself has been the S-100 bus standard. The S-100 bus is a set of electrical and logical specifications for the connections between the various printed circuit cards that may share the bus. These printed circuit cards can include: a CPU card, memory cards, keyboard and video-display interface cards, audio cassette interface cards, floppy disk interface cards, music synthesis cards, voice recognition cards, joy stick control cards, and so on. The S-100 bus was originally the MITS Altair bus. Now there are at least twenty companies manufacturing S-100 bus computers. There are more than 150 different products including computers, memories, disks, printers, graphics displays, joy sticks, music synthesis equipment, voice recognition boxes, voice generation boxes, and home electrical system controls presently being manufactured for the S-100 bus. The broad range of available S-100 bus equipment greatly exceeds the offerings of any one manufacturer.

The most important aspect of the S-100 bus standard has been its impact on the evolution of the personal computing industry. Up to this time most of the companies manufacturing personal computing products have been small companies, including many garage-type operations. Few of these companies could afford to manufacture and market an entire computer system and most of them offer only one or two types of boards. The S-100 bus standard has created a marketplace large enough to enable a small company to be successful in the market on a low budget offering only a single board that provides some nice option for a S-100 bus computer.

The small entry cost to the S-100 bus market has made the competition fierce. If a product can be manufactured and marketed for less, it will be. Products are priced very close to the manufacturing cost. This is quite unlike the traditional computer industry which is well-known for prices that have little relation to the manufacturing cost but rather have been priced by looking at what the market will bear.

The computer store would not have been nearly so viable a concept without the standard bus. Virtually all the personal computing manufacturers have been under capitalized, resulting in long waits for products. In many cases stores have been forced to buy essentially the same product from several different manufacturers in order to be assured of an adequate and timely supply. Additionally, since many of the products in a computer store are interchangeable, inventories of particular brands can be reduced. A store can choose a product such as an S-100 bus memory board from among a large number of possible suppliers, using consideration such as delivery time and margin as primary parameters rather than being forced to take whatever the CPU manufacturer cares to offer. This kind of competition has enabled stores to get nearer the kind of margin and service they need.

The retail computer store

The new low-cost computer products require a new way of marketing and servicing these products. It no longer makes sense for a salesperson or field engineer to call on the individual customer when his computing system costs only a few thousand dollars. The retail computer store fills this need. Computer stores offer a place to test drive several computing systems before buying one. Stores try to offer off-the-shelf delivery of computers and associated equipment and software. Computer stores offer advice on configuring a system for a particular application from the wide variety of personal computing products available. Most stores repair the equipment that they sell. Some stores offer hardware and software consulting. Most offer a wide assortment of computer books and magazines. Some stores hold classes in using and programming personal computers. The computer store plays a new and essential role in the new computer industry.
THE HOME COMPUTER REVOLUTION

In late 1977 we saw the first signs of the real home computer revolution. The fully assembled complete computer was offered by two different companies, Radio Shack and Commodore, for under $600. These computers include the CPU, memory, a keyboard, video display, and read-only-memory Basic language interpreter. So now we have the hardware in the right price range for the massive home market, but still missing are the huge libraries of programs that will make these computers really useful. This software will come. Eventually we’ll buy programs like we buy stereo records—from a wide selection—where some program can be found to satisfy nearly any taste or requirement. When these program libraries are available, millions of home computers will be sold.

Now what would motivate millions of people to buy home computers? The two primary reasons are entertainment and education.

Do not underestimate the sales appeal of the computer game as an entertainment form. Look carefully at the computer as a new form of personally available, intellectually challenging, interactive entertainment. Of course, the computer offers simple games like pong, target, and guess-the-number. Much more importantly, the computer offers the opportunity for simulated experiences without risk. For example, the well-known Star Trek game provides the player the experience of being a star ship captain—the opportunity to make monumental decisions on which rests the fate of the universe. Other games let us pretend to be a ruler of a country or the president of a company. The simulated experience-type of computer game is a powerful new entertainment form. A $600 price tag seems very small for just this one function of the home computer.

Education is the other major reason computers will be sold to millions. The home computer coupled with well-known computer assisted instruction techniques will offer an interactive personalized form of instruction for the home. CAI programs will be available for instruction in subjects as far ranging as arithmetic drills, French grammar, and driver education. This new home educational medium may eventually have a dramatic impact on our educational systems.

When the computer-assisted home education center has evolved to its full potential using such technologies as video disks and two-way electronic communication links to schools, the home could very well become the center for educational activity. The school’s function would be to prepare instructional materials and certify levels of achievement.

Entertainment and education will surely be reasons enough for many people to buy home computers. Of course, the home computer will have many other uses including: personal financial management, astrological forecasting, keeping inventories of collections such as stamp or beer can collections, centralized control of home physical systems, maintaining address lists, and use as an artistic medium in graphics and music. In fact, the uses of computers are as varied as the individuals who apply them. Applications of the home computer have little limit other than the imagination.

COMPUTER INDUSTRY CHANGES

The new low-cost computing will cause many changes in the traditional computer industry. Some of the changes are starting now. Some will not reach their full impact for years to come. The very structure of the data processing organization will be impacted. Additionally, the individual data processing professional may find his or her role changing significantly.

Personal computers are replacing and are competing with mini computers in low-end applications including process control and small business. In order to understand why personal computers are able to successfully compete with minis in many applications, it must be understood that personal computers are not small—they are just inexpensive. A recent article compared the performance of an IBM S/360 Mod 30, the work-horse business data processing computer of the late 1960’s, to the personal computer. According to some parameters the personal computer actually exceeds the S/360 Mod 30 in computing capability.

As personal computers move into the mini computer low-end market, minis will be forced to look upward for more applications. They have already started eyeing the strongholds of the large mainframes.

Personal computers are replacing time-sharing services. Time-sharing was devised as a means of bringing computing resources to the individual. Now that the individual can own an entire computer, there is simply little need to time-share a large computer. The advantages of a 16-user personal computer laboratory over a 16-user time-sharing system were recently documented. They include the fact that the personal computers are half the price of the time-sharing system, the personal computing laboratory can be built incrementally with a very low entry cost, personal computers offer the latest in technology, the personal computing laboratory is more reliable and available more of the time, and the individual can typically have more disk storage space.

Disadvantages of the personal computing laboratory include the lack of large software libraries and the fact that very large programs that might use the entire time-sharing computer during non-time-sharing hours cannot be run. In many cases the personal computer offers a better way than time-sharing of bringing computing resources to the individual.

The data processing center will soon find itself losing control of the corporate data processing function. This has already happened to a certain extent as mini computers first meant for process control applications were found useful as general purpose data processing machines. Departments within corporations found that by buying their own small computer they could spend significantly less on data processing than if they bought computing services from the data processing center. This trend will be greatly accelerated by the still much lower cost of the personal computer. The eventual result of this type of pressure on the centralized
data processing facility will be pressure on the large mainframe manufacturer to lower prices to compete with the low-cost computers. Ultimately personal computers will force lowering of prices by the large mainframe manufacturers.

A major change for the computer professional will be the fact that the public will be computer literate. The public will have a much better understanding of computers and software. No longer will they be awestricken and unquestioning about a computerized process. They will understand the role of the programmer and demand that programs interfacing with the public offer reasonable human interfaces and consideration.

Today society's view of the computer programmer is with considerable awe and respect. Other departments in a corporation view the data processing person as the practitioner of the black art of computer magic. Most of us in computing have at one time or another used our technological jargon to our advantage in cutting short a discussion. All this will change when computing and programming become household activities. The computing profession will not be viewed with quite the splendor it once was. This author occasionally reflects on the fact that a Ph.D. in Computer Science will have the same social prestige as a Ph.D. in refrigerator science when the computer becomes just another household appliance.

It is well-known that one of the biggest problems in the computer industry today is the high cost of software. Low-cost computing may eventually help solve that problem in an indirect way. Low-cost computing will lead to widely available computer education at all levels. Now that the cost of a computer is not much different than the cost of a typewriter, the major block to widely available computer education is gone. With computer education abundant there will be a flood of qualified entry level programmers. The effect may ultimately be more competition for data processing positions and ultimately lower salaries for programmers.

The result: a decline in software costs. A possible weakness in this scenario is that at the same time the number of computer trained people is increasing, the amount of software needed by new low-cost computing applications is also increasing. Perhaps the need for programmers will be adequate to absorb the higher production.

CHANGES IN OUR WAY OF LIFE

Predicting the future is always a risky venture at best. However, we can take a few peeks at what the effects of abundant low-cost computing may be. We have already discussed the fact that to our homes the computer will bring powerful and exciting new forms of entertainment and education.

For those skeptical about the magnitude of the potential impacts of the home computer a simple scenario usually removes any doubts. What if a million people, or a thousand, or even just a hundred all owned the same type of computer; all used the same stock market analysis program, and—based on predictions of the program—all made the same moves in the market? Chaos!

Probably the largest contributing factor to change is that now computer-inventiveness is in the public domain. No longer can only large business and well-endowed universities invent devices having computers in them, computers themselves or computer-related equipment. Now because of the new low cost of computing, the average person can use computers as components in inventions giving them a new dimension—intelligence. History tells us that many of our most personally useful inventions were not invented by large corporations or universities, but rather by an individual with a problem to solve. Now that same kind of motivation and inventiveness will be applied to computer products. In fact, from the present computer hobby movement will come gizmos too numerous to mention. We are now on the threshold of a gizmo age in which we will be surrounded by intelligent devices supplying services that would be impossible to imagine at this time.

All is not good, however. For example, it is now possible to build a computer-based device that will place telephone calls, play a recorded message, record the verbal response, and even accept the touch-tone input of a credit card number. This device can be very persistent and devious in placing calls. For example, it can either place calls against a provided list of numbers or it can generate the numbers within a given prefix which, of course, corresponds to a geographic area. Notice your unlisted telephone number is of no help. The call-placing device can remember that you didn’t answer and place the call periodically until you do. It could even remember that you hung up! The devastating truth is that a device can be built to place junk telephone calls for about 24¢ per call compared to 7¢ per letter in postage alone for junk mail. The only answer is probably legislation. In the meantime a low-cost device can be built that will answer your telephone and require entry of a touch-tone password before the household is notified of the call.

Over the long range the abundant computer will add a new and rewarding dimension to our lives. We have a new fundamental tool, a new medium for expression and experience. We are indeed incredibly lucky to be present at the dawn of the era of personal information processing.

REFERENCES