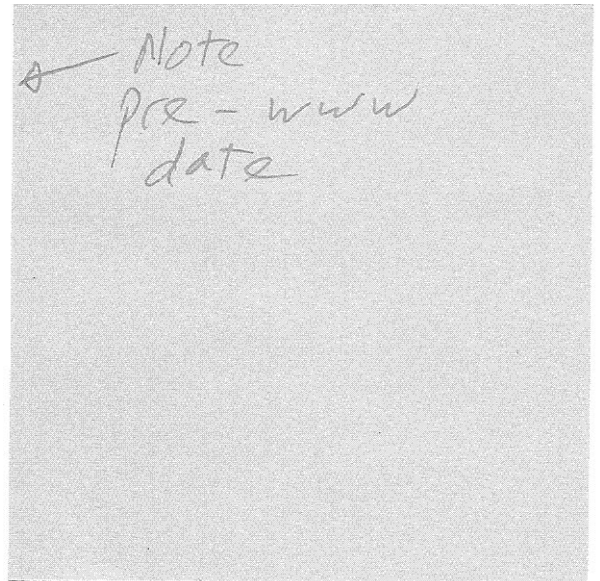# Networking on the VolksComputer: the Wave of the Future

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**By Steven M. Potter**
**Student ID #70427406**
**856-3476**
x4723
**3-29-92**

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# Networking on the VolksComputer: the Wave of the Future

W e are at the very beginning of a revolution that I predict will dramatically change the world for the better. It will transform our present world of widely scattered, separate nations, divided by political boundaries, cultural barriers, and thousands of miles, into a coherent cooperative unit: the Global Village. It will bring people of all types closer together, and break down the main impediment to understanding and peace: a lack of communication. I am referring to the revolution of computer networking.

Since the late 1970's I have been friends with computers. I love programming and use computers every day for many different things in the course of my research in brain biochemistry. It is odd, then, that only in the last two years or so have I become involved in this revolution. I did a small amount of e-mailing before that, and looked at the Usenet newsgroups a couple of times, but because my free account on Orion was allotted a limited amount of computer time, I restricted my activities to the bare essentials. When I found out that the School of Biological Sciences has a whole network of Sun workstations, on which I could have unlimited computer time, I was delighted. Now I was free to really explore the network (Internet) and see what is out there. I was soon overwhelmed by just how many amazing things I have access to. Now I am a network zealot, trying to get everyone I know hooked up and tuned in to the Network Revolution.

At present, however, there are a number of reasons why the whole world is not as excited about this revolution as I am, and this essay serves to point out these stumbling blocks, and to propose some innovations that could help us along the path to the Global Village.

## The revolutionary medium of the network

Internet is the primary computer network used by academic and research institutions across the world. Such networks have no central controller or switching station through which all information passes. Instead, all the the computers or "nodes" connected to them spend some of their computer time passing messages on to their final destination, pony-express style. That such cooperation and organization could occur without a central controller is incredible, and as with brain architecture, this allows a very fast and flexible system that can quickly adapt to changing needs and to failures that are bound to occur at individual nodes on occasion.

The more I use the computer network the more useful things I discover hidden in its tortuous structure (sometimes called *cyberspace)*. Here are some of my own activities on the net: Daily, I receive news from a *mailing list* I belong to, consisting of fellow hang-glider pilots all over the world. We exchange messages about new equipment, flying sites, safety tips, and experiences we have had flying. Another mailing list I belong to consists of researchers interested in neural networks, i.e., computer models of the brain. From this list, I learn about current research projects, conferences, job opportunities, and simulation techniques. I have made many friends through these lists, some in places clear across the globe. I have even used e-mail to work out problems with my girlfriend, even

though I could have just called her up. Somehow, the act of composing an e-mail letter helps me organize my thoughts and present my feelings in a coherent form. I love exploring the Usenet newsgroups, a set of several hundred special-interest forums in which people exchange messages about almost any topic one can imagine. Many of these newsgroups contain or point the way to files containing useful software (in the public domain) that I can download to the computers in my lab and use. For my research, I make use of centralized genetics databases (e.g., GenBank) which can tell me immediately if the protein sequence I have found has already been found by another researcher. This saves me from doing a huge amount of library research and eliminates duplicated efforts.

Many individuals not affiliated with academic institutions have purchased a link to the network, through a commercial on-line service such as CompuServe. This allows them to pay their bills electronically, send e-mail to others on the net, do credit-card shopping, exchange messages on bulletin boards like Usenet, meet people with similar interests, play computer games, refer to on-line encyclopedias and databases, and help their children learn with educational programs, games, and services. Many corporations have links to the net that allow some of their employees to do work at home by modem.

The phenomenon of *shareware* would not have come to exist without the network. Programmers, often amateurs working from their home computers, have written shareware applications and put them on the public domain, free of charge. Those who find the programs useful or enjoyable are encouraged to donate a small fee to the programmer. Without the net, it would be impossible for these programs to be widely distributed, and the programmers would not be encouraged to continue producing such useful and professionally executed software,

Clearly, computer networks have something to offer everyone. Just within the Usenet alone, anyone can find several exciting newsgroups. Networking is more addictive than even crack cocaine; once a person sees how fun it can be, it becomes virtually impossible not to use the net. But unlike drugs, networking is a positive, constructive thing. It builds friendships, promotes understanding, educates, and makes far away strangers seem near and not so strange.


## Why isn't everyone on the net?

### 1. Lack of exposure —*What's a network?*
The main problem, evidenced my own all-too-recent entry into the world of cyberspace, is that the average person doesn't even know about this new medium, or if they do, they have no idea just how expansive it already is. It is time for computer companies to realize that their computers are not for "computing" anymore, except for a few of us nerdy scientists. Communication should be emphasized as the primary function of new computers, The average person should be exposed to the network and its many offerings in the mainstream media: radio and TV advertisements, magazine articles and blurbs on news shows, billboards, t-shirts, you name it. It sure worked for Nintendo; there are only a handful of 9-year-olds in the country that don't have a GameBoy—yet.

2. Lack of a **computer**—*I can't* afford *a pc,* and who needs one anyway?

Again, most people don't have computers because they don't think they have anything that needs computing. The price of a personal computer is still too high for everyone to have one, but many more people would feel that it is worth the money if they knew how much networking could benefit them. However, before the general populace runs out to buy computers for networking, the whole concept of a computer has to be reworked, and I will present my opinions about what needs changing in the following paragraphs.

Last year, I bought a **1965** VW Bug that is in great shape, for only **$950.** The VW Bug is an anomaly in the auto industry. Even though they have not been sold in the US for over a decade, we see them all over the road, usually in excellent condition. The reason for this is that it is such a cheap, sensible, and simple car that they keep getting restored by their devoted owners instead of being sent to the junk yard. The whole reason VolksWagen ("People's Car") started was to provide a sensible and economical vehicle for everyone. There needs to be a VolksComputer.

3. Fear of the **unknown**—*I hate* computers.

The reason why Macintoshes became so popular so quickly is that they provided the user with a computing environment that is cute and friendly. The mouse/window/icon (MWI) environment was intuitive and comfortable even to people who had little or no experience with computers. The idea of encouraging applications designers to use the common interface toolbox, with pull-down menus and dialog boxes, was a brainstorm. It made learning to use a new program as easy as finding the bathroom at a party in the tract-housing neighborhood you live in; all the applications have the same look and feel. Now all computers have MWI environments; Windows is probably the only reason IBM is still in business.

But the "cute and friendly" MWI environment is scary and strange to Grandma, who has no idea what" computers are even for. She likes telephones and has no trepidations about learning to use the remote on her new TV set, but computers are just not part of her world.

One way to make computers less scary to the computationally illiterate is to merge them with existing, familiar gadgets. The VolksComputer I envision has no monitor. Everyone already has a pretty good color monitor in their living room; why should they pay for another one? A radio-frequency encoder would be built into the VolksComputer, and it would simply be hooked up to the TV with a coaxial cable, just like the VCR.

Because VolksComputers would be used mostly for networking, and always hooked up to the phone line, it would be foolish not to make them into telephones and answering machines as well. Phone companies could initiate protocols that allow regular phone calls to gracefully interrupt any ongoing networking without loss of important data. Having that much computing power in your answering machine would allow all sorts of useful advances in answering-machine technology, such as private messages to one member of the household, optional outgoing messages based on buttons pressed by the caller, and who knows what else. Ten years ago, most of us didn't even think we needed an answering machine (we certainly do now!) and felt awkward talking to the machine at the other end of the line. In the not too distant future, I predict that this **terminal/phone/computer**

device will be considered as "necessary" as answering machines, VCRs, and Nintendo are today.

### 4. *Fear of keyboards — Typing is not fun. I can't even type.*

Unfortunately, almost everything done on computers these days requires typing on a keyboard. As the instant popularity of mouses (mice?) showed, people would rather not type if they don't have to. I personally enjoy the anonymity provided by typing e-mail messages. E-mail is judged by its content, not by quality of paper, handwriting, or other aspects of "snail mail" that often bias the reader.

However, voice-mail is already gaining popularity on phone systems, and on some computers, like the Next. The VolksComputer will have a built-in microphone (possibly also used for its telephone function) and digitizing hardware, to allow not only recording of voice messages, but more importantly, voice-activated control of its functions. The user should be able to move effortlessly through cyberspace by merely uttering commands to the VolksComputer.

The AI researchers have been working for years on algorithms for parsing and decoding spoken language, with only meager success. Neural networks researchers, on the other hand have had tremendous success with a totally new approach to the speech recognition problem. This involves having a neural network (simulated on a computer) learn to recognize words and to understand grammar merely by hearing lots of examples, the way babies learn. No explicit algorithms about how phonemes work are necessary. Soon after buying the VolksComputer, with its built-in neural network hardware, the user would speak to it for a couple of hours, tuning it to his or her own personal tone of voice, accent, intonation, etc. Later, while networking, the VolksComputer would once in a while ask the user to repeat a word that was spoken in a way it doesn't recognize. When new commands become available, the user would teach these to the neural network by repeating them a few times, as prompted by the device's pleasant voice.

### 5. *Bad operating system — I can't find the first thing in this horrible maze.*

Even though I do a fair amount of networking, I still often get frustrated when I find myself unable to accomplish some function that I know must be possible. On my journeys through cyberspace, I routinely make use of a number of different operating systems, each of which has its own set of commands and fussy quirks. This is because the nodes of the network are different types of computers, running all sorts of different software; there is no accepted standard user interface.

The most labor-intensive part of my plan is the programming of an extremely user-friendly, voice-activated interface that would help the user accomplish whatever networking task he or she wishes. Icons and graphical metaphors for various activities and virtual objects will be a large part of this interface, with little necessity for reading text, and even less for typing text. The interface should be "smart" enough to recognize various operating systems it might encounter at distant nodes, and transform them into the standard, friendly interface the user expects. It is imperative that the interface be designed to encourage random exploration; the user must not fear that some action might be irreversible or cause some damage or get them stuck in some mode from which the only escape is the power switch.

**6. Lack of access to the network**—*I don't work for a university and I'm not going to pay for an on-line service.*

Although I think the price of a subscription to an on-line service is well worth the money, the unindoctrinated may not agree. Some communities are establishing freenets, with free links to the network available to anyone in the community. It is only a matter of time before funding from local, state, and federal governments is diverted to providing freenets for everyone in the country. In the mean time, we must fork out the money to the commercial on-line services. Some of these services charge by the minute, like a long-distance phone call. These companies need to realize that, like the limited CPU time allotted to my old Orion account, this policy discourages the user from exploring the network, finding out what is available, and using it even more often.

There are some small networks or bulletin board services (BBS's) run entirely by individuals from their home computers. Often the only charge for using a BBS is the toll you pay for calling it up with your modem. My roommate, who had an Amiga computer, found that Orange County is a hotbed of Amiga activity, with a number of individuals dedicating their computers to BBS's, and filling their hard disks with shareware free for the downloading. They usually ask that you upload something to them at least once in a while, and this way the service grows and diversifies. Unfortunately, the only way to find out about most private bulletin boards is by word of mouth, or on the net itself. They need to start taking out ads in the yellow pages, perhaps paid for by donations from the BBS users.

### Obstacles to be overcome

### 1. Price

The "volks" must be able to afford a VolksComputer, or else networking will remain an avocation pursued only by those who can bum computer time off others (like me), or who have spare cash on hand. The device must be stripped down to the bare essentials, possibly designed in a modular way, so that new capabilities could be added by the user when the technology improves or when he or she can afford an upgrade. As a bare minimum, a simple keyboard, a modem, an rf encoder, and a small amount of memory must be present in the basic unit. Substituting one's own television for a new monitor will greatly reduce the price. Virtual disks on removable RAM cards could eliminate the need for a costly disk drive.

The main change, however, will be in the marketing strategy. At present, computers are sold only by computer specialists, unnecessary middlemen who skim off a huge profit margin selling the overpriced product to the consumers who have no other choice but to pay. Actually, most of them choose not to buy at all—and that's the problem. The VolksComputer needs to be sold in all sorts of stores, from Sears to Save-On, at a very small profit, so that the average person will be able to afford one. Seeing them everywhere will make them curious and want to buy one. The places where they are sold should have VolksComputers hooked up to the network, so shoppers can explore for free and see what networking is all about. On-line help will substitute for costly salespeople, but the user interface should be so intuitive that little help is necessary.

## 2. Technology

The only technological gimmick the VolksComputer has that has not already been road tested in some other form is the voice-driven user interface. Voice recognition is admittedly a big technological jump from the mouse and keyboard input we are used to. However, the neural networks literature shows that we already have the necessary techniques and VLSI hardware (for example, see Unnikrishnan et al., 1991; Waibel & Hampshire, 1989). The neural networks merely need to be transported from the laboratory to the commercial sector, and customized for the purposes of steering the VolksComputer through cyberspace. Initial versions will retain the MWI interface, with minimal voice recognition capabilities. But these must be designed not for planned obsolescence, like the computers and automobiles of today, but with expandability in mind. This way, consumers will be excited about buying their new machine, confident that they will be able to plug in more advanced voice recognition neural networks as they become available, instead of trashing the whole device.

## 3. Digital gridlock

When everyone rushes out to get a VolksComputer and hooks into the network, won't the network get bogged down with all of the bytes they want to send and receive? Perhaps not. More and more fiber-optic lines are being laid across the globe, solely because they are more efficient and maintenance-free than copper cables. The bandwidth provided by digital optical fiber technology is increasing rapidly, with advances in frequency encoding and error-checking, and new data compression algorithms. Plus, current research in laser-pumped repeaters promises to increase fiber-optic data capacity by two orders of magnitude in the near future (Desurvire, 1992).

Hopefully, we will make expanding and improving the network a national priority, and devote more federal resources to new high-speed satellite links, new optical networks, and especially to research and development that will advance these technologies.

## 4. Too many nets

Currently there are too many different networks that are not communicating well with each other. This is because they were originally set up for a specific set of users, with specific uses in mind. For example, my mother uses e-mail all the time at her work to communicate with her co-workers, but I can't seem to reach her via Internet. The UC system has a tremendously useful on-line database, including its card-catalog (MELVYL), Medline, and other reference services. In order to use this from my lab, I must connect to the MELVYL server directly, not through Internet. The special-interest groups on the Prodigy on-line service are limited to Prodigy users. If these were merged with the Usenet newsgroups, the subscribers would have a much richer set of postings to read and to respond to, and would be in touch with users with different backgrounds from distant places.

For the Global Village to become a reality, all networks must be interconnected to form a single Super Network, on which any user can easily get in touch with any other user or service.

## Conclusion

In the last decade or so, we have seen overnight mail, automatic tellers, fax machines, answering machines, beepers, and car phones move from obscurity to "absolute necessity" in many situations. Why all this emphasis on urgent messages? This is at least in part because information itself is becoming a valuable commodity. And it is a commodity whose value changes greatly with time, as those who play the stock market well know. This trend toward an "information society" is causing the popularity of networks to increase by leaps and bounds, as everyone races to get that competitive edge by knowing something their competitors don't know.

What this means is that even without the involvement of the average person, networking primarily for recreation, the Revolution will occur. The VolksComputer is merely a catalyst to speed the process along, and to provide it with a more person-oriented emphasis than a corporate or institutional emphasis.

One scenario I can imagine is the following: A small slice of our present military budget (which is far too large for a country without any real "enemies") could pay for research, development, and production of VolksComputers by several competing contractors. The devices would be mass-produced and provided, absolutely free of charge, to anyone who wants one. Another small slice of the Pentagon's pie would support a nationwide freenet, which would hopefully be hooked up to the freenets of countries across the globe. Suppose, then, that we could get all sorts of information on the net about what our congress was doing. Even better, suppose that our congresspeople actually solicited opinions from their constituency on the network. We could even go so far as to require that all voting be done electronically. This would allow us to greatly simplify the whole governmental structure, and could be implemented at many governmental levels, from local to federal. If the people actually cared enough to actively participate in the operations of government, which they could do more easily now than ever before in history, we might transform this republic into a true democracy.

My somewhat pessimistic guess is that people will remain as politically apathetic as they are now. The real benefits to society caused by the Computer Network Revolution will come about without any overt effort by the network users. It will come just from hearing and talking to people that we have always been isolated from because communication or travel was too difficult. In the Global Village, no one is too far away to talk to.

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