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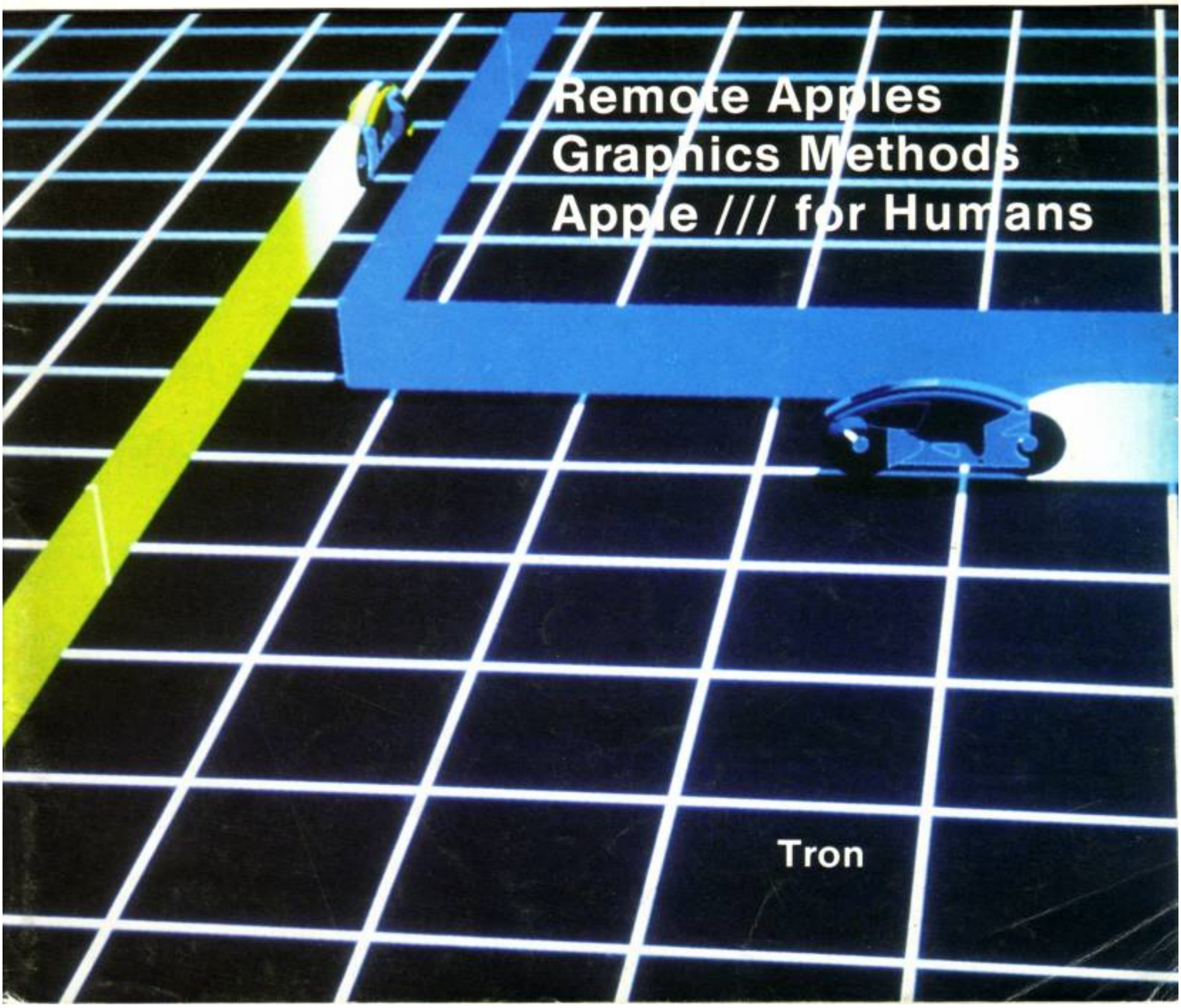
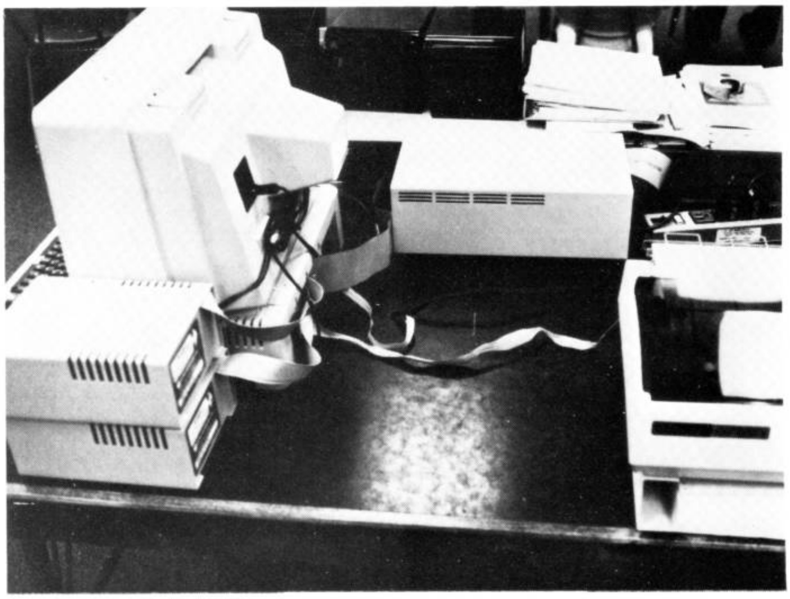


APPLES and an ROS FOR THE TEACHER

Allan L. Rogers

How do you get the most effective computing power for your $50,000? That was the happy question facing us last June when we received notice from the Chula Vista City School District that our application for a Federal grant had been approved and funded.



Our story began in 1979 when Tiffany Elementary School was directed by the School District to develop a plan for a "Magnet School". This would be part of Chula Vista's plan to implement voluntary integration by attracting children of all backgrounds to various special programs in the community: fine arts, remedial reading, special programs for gifted children, bi-lingual programs, etc. Tiffany School had been using computers since we soldered together our first S-100 kit in 1976. We had acquired five Commodore Pets in 1978, and had been teaching computer literacy and programming to children in grades 4 to 6 for some time. Consequently, it seemed natural that Tiffany should develop a plan for a "Computer Magnet School".

Federal funds were available through the Emergency School Aid Act (ESAA) to help school districts in their efforts to integrate schools, and so we wrote an application for a grant. Using the best strategies, we "shot for the moon". After re-writing and re-submitting the proposal under two separate categories in 1980, we were hopeful that from our "Cadillac" proposal we might receive enough funds to at least equip us with a "sub-compact" computer center.

Finally, in June 1981, we learned that we had received funding. As expected, the grant request had been pared down. But as we *didn't* expect, both categories were approved, and we had our "Cadillac". Not only did we receive $50,000 for the computer center, but my salary for the next year as well, so that I could devote full time to setting up and developing the magnet school program. What a happy hacker I was!

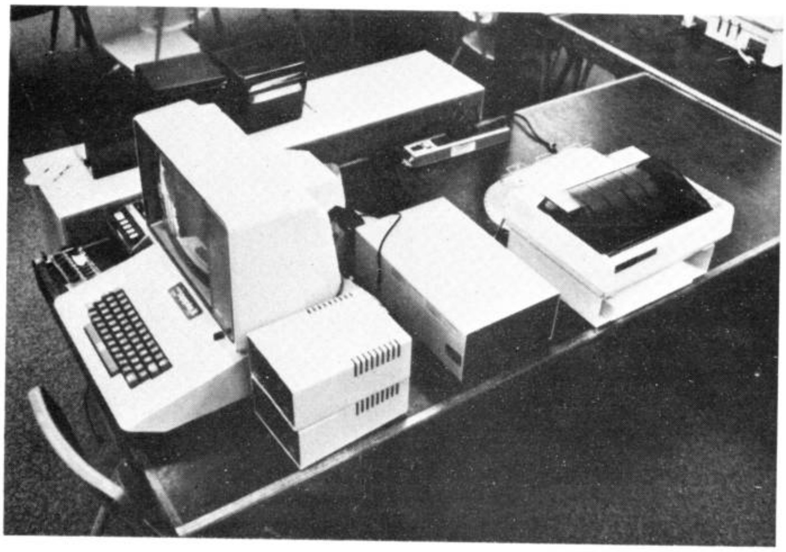
Program Outline

Where to begin? First was the selection of a computer. Tiffany Elementary School serves Kindergarten through Sixth Grade. Whatever we chose needed to be compatible with that range of children. We needed a durable, reliable computer, capable of producing color and sound, with plenty of readily available educational software. We wanted one with enough flexibility to easily add a variety of peripheral equipment, such as graphics tablet, light pens, joysticks, printers, and eventually a hard disk system. And we wanted a system expandable to 64K of RAM and able to run Pascal, Pilot, and the "new" computing language for children, Logo. Finally, we wanted a computer which would be compatible with our older CP/M system. When we wrote the specifications for competitive bid, only the Apple met all of our criteria.

Since we wanted to create a computer center which housed all 21 Apples together, we realized we had more than one choice regarding disk storage. Although we could have purchased a Disk II for each computer, there were several problems with that approach. Expense, the need for multiple copies of disks, the security of disks, the carelessness of young children, and all those mechanical devices waiting to break, were factors which intimidated us. The available local-network systems seemed very attractive to us, and with the number of satellites we had, we hoped they would be cost-effective; what we purchased could cost no more than the cost of 19 or 20 Disk II's, or about $11,000.

Nestar and Corvus seemed to be the only contenders in the Summer of 1981 as we were exploring our options. Nestar and the Corvus Omninet were both too expensive for our budget, but the Corvus Constellation seemed a good bet. It allowed up to 64 satellite computers to share the resources of the Corvus Winchester disk which was integral to the system. It promised the best of both worlds; disk capability without the problems we faced with individual disk drives. However, a major flaw we saw with such a system was its total dependence on the single Winchester drive. What would we do if it failed? Would the system be useless until it was repaired? How reliable were hard disks? How fast was the turn-around on repair? These were crucial questions we felt needed answers before we could make such an expensive commitment.

Consequently, when we ordered 20 Apple II Plus computers in October



1981, the issue of disk drives went unresolved while we studied these questions. I proceeded to scrounge all of the old, crusty, cassette tape recorders I could find around the school district, and when our computers arrived in November, I jumped into teaching computer literacy beginning with Third Grade classes. Although the children loved coming to the computer center, we *all* grew frustrated with the limitations imposed on us by the cassette players. Obtaining disk capability rapidly became a high priority.

Meanwhile, a small article titled "The Diskless Apple" in the October 5 issue of *InfoWorld* had given us our first clue to the existence of an inexpensive local network for the Apple. It was described as a low-cost alternative to the sharing of disk drives by up to 128 Apples. Eureka!! Well, maybe. The system was what we were looking for, but what we couldn't find was the *manufacturer*. The name "Softworks" was mentioned, along with a cryptic reference to "ROS", but there was no clue as to their location.

We were frustrated because we felt that we couldn't make a decision until we evaluated this new product. We finally discovered that there was a "Softworks" in Phoenix; a call to 602 - 555 - 1212 gave us a phone number, and we made our first call regarding the "Remote Operating System" (aha!).

Bob Gabriel and Bob Benton of Softworks helpfully answered my questions and, at my request, sent a system manual for ROS to help me in my evaluation of the network. The manual proved to be attractive, simple, and informative. It even had an index and a glossary of computer terms in the back, presumably for people who were new to the computing business.

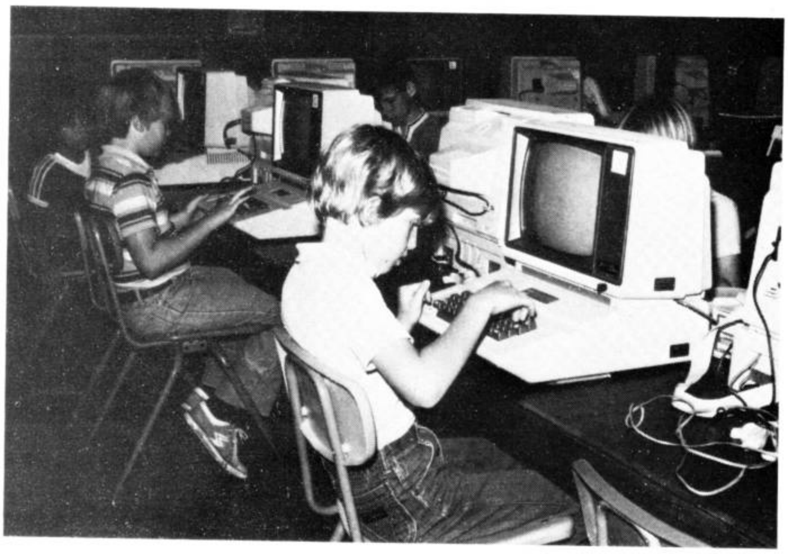
The ROS System

ROS seemed to be a well-designed concept. There are two kinds of interface boards required for the network: one "Central" board, and as many "Remote" boards as are needed for the remaining Apple computers. The Central board is installed in Slot 2 of the "Central" Apple. This Apple acts as the "host" computer, performing all of the physical disk accesses and arbitrating the demands for disk use among all of the "remote" computers. During periods of intense activity, the Central unit would be a dedicated host. At other times it can be used for other purposes and even, if needed, be disconnected from the network.

A Remote card is installed in Slot 7 of each remote Apple. The remotes are connected serially to one another by 10-wire ribbon cables in a "daisy chain", with only one connection made to the central unit. ROS is described as an active network; unlike passive networks, if the power at a remote is off or a cable is removed, the physical link between central and all remotes beyond the bad link will be lost.

Installation and connections appeared simple and straightforward. The documentation clearly illustrates the proper installation, and with the ribbon cable connectors fixed to ensure proper orientation of pins and sockets, the process looked simple and foolproof.

Each of the interface boards uses a simple design consisting of only seven integrated circuits, one of which is the bootstrap ROM. It seemed that troubleshooting and repair would be simple. With several identical boards and so few IC's, a malfunctioning IC could be discovered easily by swapping chips with a good board. We felt that hardware problems would be negligible.

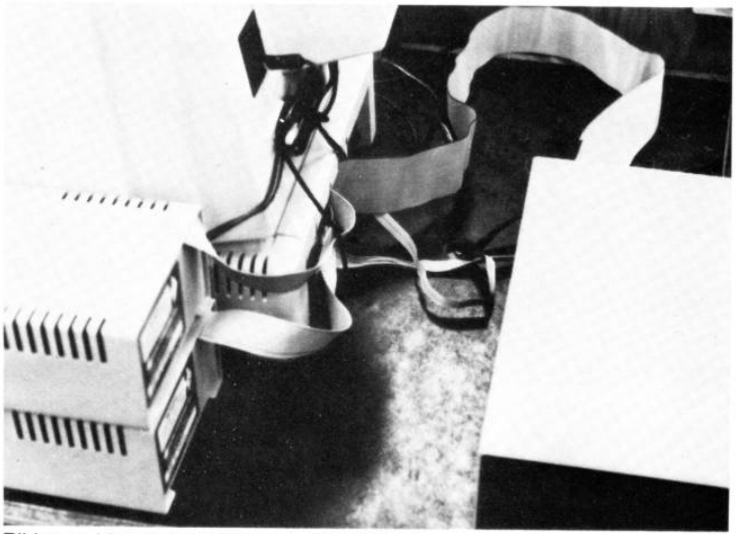


An important consideration was cost. "Inexpensive" was the word used in the magazine article. The Central board with system software lists at $309, while the remotes list at $189 each. With the 5 per cent discount Softworks offers for multiple purchases, we were looking at a complete local network for 21 computers for less than $4000. ROS was designed to use standard Apple II disk drives, so they could be replaced easily in case of trouble. Further, ROS was designed to be compatible with several hard disk drives; additional storage could be added later. Things were looking better all the time.

Of course, one consideration not to be overlooked was performance. The manual we received described Softworks' claims for ROS. But what did they *actually* deliver? In January, George Wright (Tiffany's Principal) and I attended a conference at Arizona State University, and experimented with the ROS system. To make a long story short, we placed an order for a central and 20 remotes.

When we installed ROS in January of this year, we found that installation was indeed simple. The system operated almost perfectly from the beginning. Of 21 cards, we found one which failed to operate. A few minutes of chip-swapping revealed an IC which had one pin folded under. A quick straightening and re-insertion gave us a 100 per cent functioning system. It has so far proven to be reliable.

In February we added an XCOMP ten-megabyte Winchester hard disk to the system. Installation of the hard disk consisted of plugging the controller card into an empty slot, running a simple configuration program, and loading some of our software onto it. When we fired up ROS, it didn't mind in the least if we were reading or writing to a floppy or the hard disk. Of course, response time with the hard disk is considerably faster.



Ribbon cables can connect up to 127 Apples.

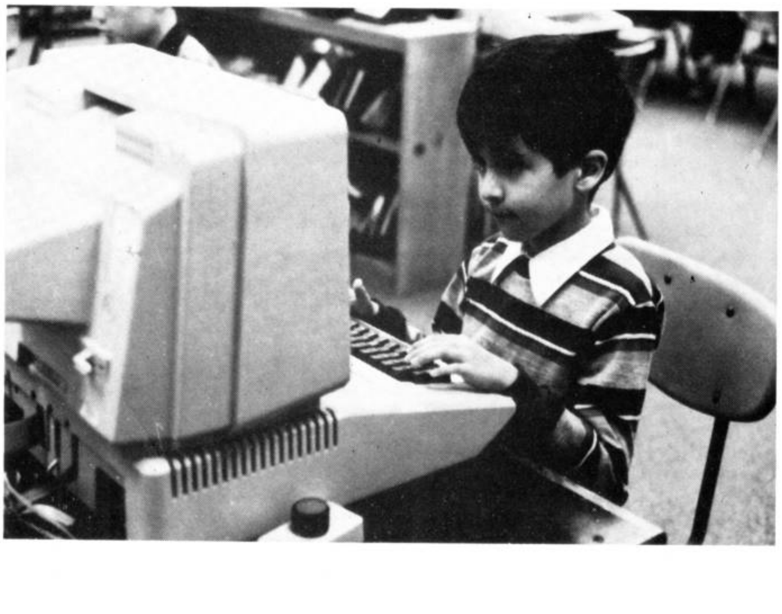
Advanced Software

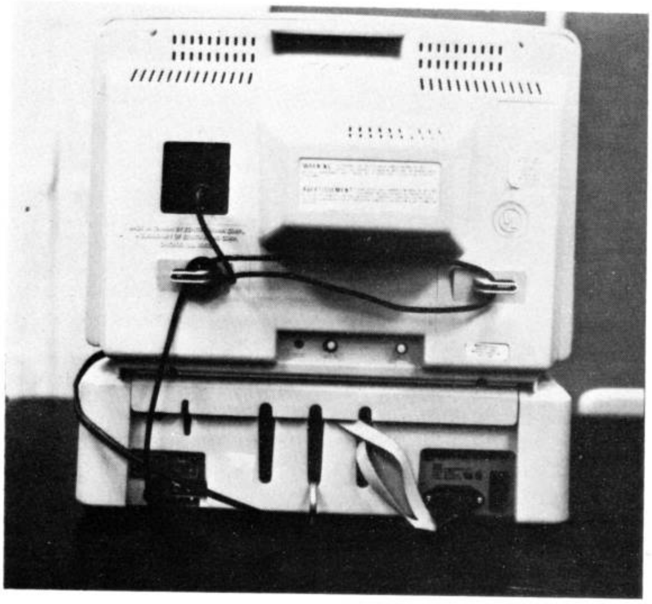
Softworks has improved the operating system; they now call it AROS, the A for "advanced". We've been using AROS Version 2.02+ since March, and are even happier with it.

AROS permits each remote to access the central disk with virtually every standard DOS command, either in immediate execution mode or as a command imbedded in a program. The only exception, for good reason, is **INIT**; the remotes neither need to (or should!) initialize a disk. We have had children running programs which use almost all of the DOS commands, and each has functioned perfectly. *(That may not be a valid test, as many adults have discovered after being amazed by skillful youngsters —PCW).*

Additional commands provided by AROS include **KAT**, **FEED** and **BYE**. **KAT** displays the most recent catalog, which has been stored in memory, and prevents duplicate disk access. **FEED** permits the central system to send a single program simultaneously to two or more remote computers. **BYE** releases the remote from the network, protecting users from unauthorized use of their accounts by others.

Passwords, "tags", and "drive configurations" are used to allow the system operator to maintain file security and assign various levels of access to remote users. The **pass-**





word, which a remote user enters when he boots into AROS, prevents unauthorized use of the network. It consists of up to eight characters and is unique for each separate user. The **tag** is a unique three-letter combination which is used to identify the owner of user files or programs saved on a disk. The tag is automatically appended to a remote user's catalog entry when the file is written to the disk. When the remote user catalogs a disk or volume, he can see, load or modify only those files which have his unique tag. Although he may be physically sharing a disk with an entire class, the other users' files will be invisible to him. Of course, the central unit can see and access every file.

The **drive configuration tables** permit the central operator to control access to the disk drives and hard disk volumes. A remote user may be granted or denied access to a variety of floppy disk and hard disk volumes, and any volumes can be protected from remote access. The configurations are maintained by the AROS Password utility, and can include name and reference number of each user along with class, period or section.

Operation

The central computer operates on an interrupt basis. When a remote accesses AROS, the central computer halts its processing and services the request. If several concurrent requests occur, it serves each in turn on a "round robin" polled basis. If remote disk requests during any given time are not too frequent, the central system can be used as a non-dedicated terminal to perform other processing tasks, such as print spooling, word processing, and program entry. When a request for service from a remote arrives, processing halts at the central to serve the remote. It is also possible to disconnect the central system from the network temporarily so that certain jobs can be completed without danger of interruption from a remote computer.

For those times when there is more intensive disk access occurring, AROS includes a utility called SPEED, which buffers up to 96 sectors of data in the Central memory. If a remote requests a sector so buffered, the request is answered from RAM, without accessing a disk. The screen displays the number of requests answered from RAM and from disk, which helps to select the most frequently-used sectors for RAM storage. This feature demonstrated to us the importance of such buffering in a classroom environment where numbers of children may be working on identical or similar activities. We have often found that more than half of the requests are handled from RAM, thus reducing disk drive wear and tear, and greatly improving data transfer time.

Under AROS, each user has access to both "public" and his own private files (those saved with the user's unique three-letter tag). A public file (including program, text and binary files) can be loaded and used by all users sharing that disk or volume. In order to protect everybody, the remote user may not execute the DOS commands **DELETE**, **RENAME**, **SAVE**, **BSAVE**, **LOCK** or **UNLOCK** on any public file. Public text files can be written to, however. AROS has a lockout feature to prevent simultaneous writing to the same text file; the first user to write to a text file retains exclusive read/write access until he closes that file.

The FEED utility and TURNKEY command are also useful. FEED allows the operator to send the same program simultaneously to two or more remotes. TURNKEY allows the central operator to designate what will happen automatically after a remote logs in. A selected program may be RUN or BRUN, a catalog may be sent, or Integer or Applesoft BASIC may be loaded automatically after the password is entered.

Although we have been pleased with AROS and have found it to function reliably and well, the rose is not without a few thorns. As would be the case with any network consisting of 20 or more remotes sharing a central disk system, highly disk-intensive sessions can result in noticeable delays at each remote. This has not been a problem except with very young children who do not have the patience or understanding to wait quietly while the central computer is servicing all of the requests.

Perhaps the biggest problem at this time is that because of their recent appearance, networks have not yet become a widely recognized commodity in the software industry. ROS, as well as the other networks, require the standard Apple DOS format to function. The increasingly common copy-protected disks, which use nonstandard DOS, will not work on ROS at this time. Softworks informs us, however, that they are receiving inquiries from software producers regarding ROS, and are working with some vendors toward compatibility. As more and more institutions acquire networks as an alternative to disk drive capacity, there will surely be more licensing agreements for some of the better or more popular software. *(The survivors are likely to be the vendors who are least greedy; one objection to networks by software people is that fewer copies of a program will be purchased for a network than for a group of standalone systems. —PCW).*

In the several months during which we have been using AROS, we have had the opportunity to put it through its paces. As a budget saving alternative to individual disk drives, it effectively lives up to its claims. Of course, as with every other decision in the purchase of computers and peripherals, no single approach meets every situation or need. Each decision involves tradeoffs of capabilities *vs.* limitations. Numerous factors need to be considered in making the decision to use a local network as opposed to separate disk drives. However, if you're considering a network, certainly the Remote Operating System from Softworks deserves to be among the systems which you evaluate to meet your needs.