Optical Drives for MS-DOS

Write-once and erasable optical disk drives provide vast storage on removable media

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Within just a few short years, a host of optical drive technologies has burst into the marketplace. Each of these technologies—read-only, write-once, and erasable—offers a unique set of advantages and disadvantages when compared to traditional magnetic storage.

Publishers and users of huge databases have been enamored with CD-ROM systems that use compact disc recording technology to put over 500 Mbytes of data on a single 4.7-inch disc. The primary advantage of CD-ROM is cost: in some cases, CD-ROMs can be produced for less than $5 each, and a CD-ROM subsystem for a PC-compatible computer can be had for less than $1000. The disadvantages of these read-only systems are that they are relatively slow to access (seek times are measured in tenths of seconds) and are, well, read-only.

At the other end of the spectrum are new erasable optical disk systems, like the one at the heart of the NeXT computer. Erasable disks typically offer between 256 and 326 Mbytes of storage on each side of a 5¼-inch cartridge. The advantage of erasable systems is that the cartridges are removable. The disadvantage is that these systems are much slower than conventional hard disks.

Then there are the write-once systems—devices that can record new information on laser disks but do not allow information, once stored, to be changed in any way. Write-once optical systems (also called WORM, for "write once, read many") write information onto the surface of the polycarbonate disk using a highly focused laser beam. The information is read back with the same laser beam, only at a much lower power.

For this review, I evaluated five WORM drives. The drives were from Information Storage (ISI), N/Hance, Laser Magnetic Storage (LSMI), Storage Dimensions, and Maximum Storage. I also looked at Advanced Graphics Applications' (AGA) Discus erasable subsystem with drives from Ricoh and Sony.

Common Sense with WORMs

WORM drives have always occupied a funny place in the optical hierarchy. Because information recorded on WORM drives is indelible, conventional operating systems must be specifically modified to work with WORM disks. Operating systems assume that certain blocks on a disk (like the blocks containing the disk's directory) can be rewritten and updated when data on the disk is changed. This assumption doesn't hold up when using a WORM drive. Because write-once disks are different in character from magnetic disks, they require special file systems that dictate how information is stored on the physical blocks of the disk.

With this problem in mind, why would anybody want to use a WORM drive in the first place? One reason is the ability to have hundreds of megabytes of information online in removable, easy-to-transport cartridges. Permanence is another strong argument for WORM: information on a write-once disk is protected against nearly anything short of physical destruction of the media. This includes computer viruses, malicious employees, or simply word processing operators with slippery fingers. Since information is burned into a write-once disk with a laser beam, write-once cartridges are impervious to magnetic fields.

Write-once systems also provide audit trails that cannot be forged—an important feature for financial and medical applications. Finally, write-once media costs substantially less than the rewritable version, a price difference that is likely to remain for the forseeable future.

Since everything written to the WORM is permanent, a WORM disk would make a poor choice for storing temporary files, such as those produced by the operation of a compiler. On the other hand, WORM makes a very attractive candidate for storing working copies of documents in a word processing environment. The WORM disk could hold a copy of every version of a document. If a paragraph was accidentally deleted from a document and not noticed for days or even weeks, it should be possible to find it as long as the media has not been discarded.

For large databases, the idea of putting a 40- or 80-Mbyte DBASE file onto a 300-Mbyte WORM disk might have a lot of attraction—especially if most of the information in the file is static. On the other hand, if records were routinely inserted or deleted from the database, or if the database were routinely sorted according to different keys, storing it on a WORM disk would be a bad choice—every time one of those operations is performed, the entire database has to be rewritten.

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Designing a Write-once File System

In principle, there are two ways to use a WORM drive with a conventional operating system. The first is to implement a full-blown write-once file system that understands the laws of "write once" and arranges data on a disk to take advantage of them.

A write-once file system should present the user with the appearance of a regular magnetic disk. It should let the user arbitrarily create, change, delete, or rename files and directories. The illusion should be perfect—until the user makes a mistake and wishes to retrieve a file that has accidentally been erased or changed. Then the WORM file system should make it easy to peruse all the previous versions of a file and select the desired one. Ideas for such file systems have been bouncing around the academic community since the early 1980s. Indeed, I developed a research version of such a file system in 1985 at the Media Lab at the Massachusetts Institute of Technology.

To incorporate such a write-once file system into an already existent operating