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THE COMPUTER CORNER

CD-ROMs – Smoke and Mirrors

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Well, maybe not so much smoke, but mirrors, for sure. That is how CD-ROMs work.

A standard CD-ROM disk is made by stamping at the factory, much as the process used for stamping phonograph records in the past. The stamping creates a single spiral track that starts at the outside and ends near the hole in the center. That is right! A single, spiral track, just like a phonograph record. Thus, they are totally unlike a floppy disk or hard disk. These devices hold their magnetically encoded data in a series of concentric circles.

The CD-ROM's track (on the bottom, called the bright side) consists of a series of depressions called **pits** and non-depressed areas called **lands.** The patterns of pits (each a zero) and lands (each a one) encode the data, just like the pattern of depressing or releasing a key encodes the data in the CW that some of us hams send out over the airwaves. A laser beam is focused on the track. When it hits a pit, no light is reflected and a photocell records the binary number: zero. When it hits a land, the metallic layer embedded in the disk just above the track reflects the beam. The reflected beam strikes the photocell, which records the binary number: one. Simple. On/off, just like CW, and the metallic layer acts just like a mirror.

CD-ROMs are now the standard way to distribute software, and "burners" (drives that can write CD-ROMs) are commonplace. What properties make them so popular? First, they can hold a huge amount of data. The usual CD-ROM today has a capacity of 650 megabytes, which means that a single disk can hold the equivalent of over 450 1.44-megabyte floppy disks!

Another advantage is that CD-ROMs last a long time. Floppies should never be used to store data more than a year or two at the outside. The magnetic domains that were written on them by the read/write head in the disk drive begin to dissipate with time. When CD-ROMs were first developed (about 1980), they did not last much longer than floppies. The metallic (aluminum) layer would oxidize and become transparent, instead of mirror-like. Today, however, technology has greatly improved the stability of the metallic reflective coating, and the life expectancy of a manufactured CD-ROM has increased to about 100 years, with premium disks being readable for as long as 200 years! (Surf around at http://www.kodak.com if you don't believe those numbers.) However, that time span is for manufactured disks. The kind you "burn" at home are a bit iffier. Why?

There are two kinds of disks you can burn at home. CD-R disks (the R stands for recordable) are the kind you can write just once. They contain a layer of dye under the track that is almost clear before writing, which means that almost all the light coming from the reading laser is reflected back to the photocell, thus representing all ones. When you "burn" the CD, a special high-power writing laser (about ten times the power of the reading laser) breaks down the dye both physically and chemically into darkened goo. Later when the CD is read, the darkened dye in that spot absorbs the light of the reading laser so none is reflected back to the photocell. Voila. A zero. This dye darkening process is not intentionally reversible. However, if you leave a CD-R disk on a desk, bright side up for several days, there is a risk of the dye fading. Add a sunny window and the risk increases. Best keep them in an acrylic "jewel case" away from direct sunlight! Putting the jewel case inside a lightproof enclosure would be even better. Kodak claims a 200-year life

span for CD-R disks kept in the dark under moderate storage conditions, and 3-M research indicates 100 years under similar conditions!

The CD-RW disk (RW stands for rewritable) is very similar to the CD-R disk, with two important differences. First, the dye used is different indeed, in that the darkening process can be reversed. This means that old data can be overwritten (many times), just like a floppy. Again, the same precautions are necessary. Don't leave it in the sun if you want to keep the data. The other important difference is that not all CD-ROM drives can read this type of disk. Some older drives will simply not be able to read the data. How can you tell which drives will and which will not be able to read the data? You can't. The only way to tell is to try it. Therefore, if you are burning data to send to a friend, the safest policy is to use a CD-R disk. They are cheaper, anyway.

Are you sitting down? Now that we have examined this amazing storage device, let me reflect that it is already obsolete! Some of you may own the CD-ROM's successor already. It is the DVD disk. The first DVDs hold 4.7 gigabytes of data, roughly the equivalent of 7 CD-ROMs or over 3,000 floppies! The drives are able to play over two hours of full-motion video (movies!), including top quality audio and additional data tracks. Moreover, the manufacturers are making the drives backward compatible, able to read CD-ROM disks as well as DVDs. A very nice touch, indeed, for which we all thank you, manufacturers! Also in the works are double-sided DVDs (data is recorded on both surfaces) that will hold 17 Gb of data – more than 8 hours of video storage! Will it ever cease? Of course not! Happy computing.