



# High Noon for CD-ROM

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Usually, when Apple, IBM, Sony, or Matsushita get together at high noon in the marketplace, they wind up shooting each in the foot. Late last year, however, these Hatfields and McCoys of the electronic world and at least nine other companies joined hands at the Lake Tahoe gambling resort of Stateline, Nev., in the High Sierra mountains to begin work on a document that could guarantee the success of the most dramatic technology since the personal computer.

The document is a proposed standard for formatting data stored on CD-ROMs (compact disc read-only memory). A draft version of the document, known as the High Sierra standard, was submitted last July to a subcommittee of the American National Standards Institute (ANSI). Official ANSI adoption is currently expected by the fall of 1987.

Widespread use of the standard officially or not, would enable software publishers and providers of data services to distribute their products on uniform compact discs. These optical storage discs, in turn, would be readable by CD-ROM players connected to any number of different computers, from micros to mainframes.

### **PC Users Benefit**

Users of personal computers are expected to benefit most from this small-sized technology. CD-ROM is a phenomenal storage medium that can store up to 550 MB of data, the equivalent of 1,200 floppy disks or 150,000 printed pages.

Finding a common encoding format was probably the most important issue in assuring both users and sellers that CD-ROM will be more than a laboratory success. Indeed, some computer industry observers say they see swarms of the 120 mm (4.72 inch) silvery plastic platters on the horizons. Even usually conservative market experts believe that the technology could in the decades ahead, unleash a meteor shower of new applications. Computer manufacturers hope the CD-ROM will do as much for their industry as the IBM PC did.

Meanwhile, skeptics, particularly in the publishing industry recall the galactic failures of videotex, Selectavision and other promising “gee whiz” technologies that never got off the ground. Despite growing evidence to the contrary, these skeptics are waiting to see if CD-ROM, like Halley’s Comet, will become an overplayed media event that is more flash than substance.

For MIS managers, however, a primary concern will be the impact of CD-ROM on their use of online databases. CD-ROM enables users to browse through a massive database, currently available only online, without the pressure of perfecting search routines to reduce hourly costs. A question remains, however, just which kinds of databases will remain online and which will be adapted for distribution on CD-ROM discs. There is also a concern that CD-ROM’s average access time of approximately one second might impair and frustrate users who are used to the quicker retrieval rates of magnetic media.

CD-ROM uses the same metal-coated clear plastic platters that are now used for digital audio recordings. As with audio CDs, the digital information is burned onto the CD-ROM platter by a laser. In fact, a CD-ROM player is nothing more than an audio compact disk player with an added layer of error correction.

## **Part 2: Two Billion Pits**

Under microscopic examination, the disk resembles a continuous spiral comprised of small circular indentations, or pits, molded onto one side. The playing surface is coated with a thin film of aluminum, which reflects the scanning laser beam of a CD-ROM player, and a second protective layer of clear resin. A single disk has 2 billion pits, each measuring 12 micrometers deep and 0.6 micrometers wide. The platter has a density of 16,000 tracks per inch, hundreds of times, the density of a 96-tpi floppy — greater even than the typical 300-tpi Winchester disk.

CD-ROM is likely to benefit from the commercial success that has been achieved by audio discs and players. Audio compact disk recordings, introduced widely just two years ago, now represent 10% of all audio titles in production. A few enterprising electronics companies are already introducing gadgets to update existing compact disk audio players into CD-ROM players. These fledgling firms are also coming out with devices that will allow the same compact disk players to both the stereo and the PC.

CD-ROM was pushed into the forefront by the combined efforts of Sony in Japan and Philips in Holland. Both electronics giants quickly recognized that all players in the digital audio market had to agree on a single standard for laser-scanning technology, mastering (which involves the conversion of raw data into pits of the optical disk) and disk replication. This drive for uniformity is behind the High Sierra effort, which will standardize the file structures used in CD-ROMs, enabling them to be processed in any operating system environment.

### **No Standards Exist**

File structures determine how data and disk directories are arranged on a CD-ROM disk. The requirements of the various mainframe, minicomputer, and microcomputer environments vary. As a result, manufacturers of first generation CD-ROM players have had to make up individual file format standards for the most common environments: MS/DOS for micros, VAX for minis, and VMS for mainframes.

Among the companies represented at the original September 1985 meeting in Nevada were Laser Data (Cambridge, Mass.) Xebec Corp. (San Jose, Calif.) TMS Inc. (Stillwater, Okla.), all of which manufacture optical disk players. Also in attendance were computer hardware and software firms like Microsoft (Redmond, WA), 3M (St. Paul,) Apple, Digital Equipment Corp., Hitachi and Philips. In April 1986, IBM joined in the High Sierra discussions.

John Einberger, a systems technology manager at Reference Technology Inc. (Boulder, Colo.) organized the talks. He says the draft of the High Sierra standard that was submitted last July to the National Information Standards organization, an ANSI subcommittee has so far met no serious opposition, so he feels confident that things are on track for final ANSI adoption by next fall.

Meanwhile, vendors of CD-ROM technology continue to forge ahead (see Fig.1 ) Nearly a dozen hardware manufacturers are already delivering CD-ROM players that interface with everything from huge mainframes to small desktop systems. So far, software has been limited to a few large databases that were formerly delivered online but the High Sierra standard may change all that. “The momentum is definitely on” says Einberger. “The players represented in this standard have enough market share to assure its success.”

Just how big is that market? The entire optical storage market, which also includes conventional laser disks is currently estimated at approximately \$200 million. The New York research firm Frost & Sullivan predicts that with the advent of CD-ROM technology, the market for optical storage products will skyrocket to between \$2.5 billion and \$4.5 billion by 1990.

The usually conservative Disk-Trend Report in Mountain View, Calif., calls CD-ROM a “valuable technology” that by itself is expected to amount to a \$108 million market by 1988. That translates into 350,000 players. Presently the players range in price from \$500 to \$2,600.

Robert Gaskin, a memory industry analyst at Dataquest Inc., a San Jose Calif. Market research firm believes that 1986 will see an acceleration in CD-ROM shipments compared to 1985. Dataquest has not yet released official market projections on CD-ROM, however.

### **Part 3: Price Drop?**

Many industry watchers agree that for really widespread distribution, CD-ROM players must drop in price before they can become a part of every PC comparable to today’s floppy disk drives. Mass production would eventually bring CD-ROM hardware to these levels. Mass production, of course can not develop without a mass market.

The introduction of compact disk-interactive (CD-I) by Sonny and Philips could potentially push down prices for CD-ROM players, because CD-I machines, Like audio CD players, share many parts with CD-ROM players.

The hardware world is also playing its typical wait and see game to determine what course IBM will take on this technology. The growth of CD-ROM players would be greatly increased if IBM were to enter the market with either its own or a purchased products, says Robert Katzive, of Disk-Trend Report.

### **Big Blue Paying Attention**

IBM’s participation in the High Sierra negotiations is an indication that Big Blue has some interest in the technology. However, Dataquest’s Gaskin believes that even a late entry by IBM will not overshadow the dominant role in both hardware and media played by Philips.

Considering design concepts, mergers, manufacturing, standards activity and capital equipment development, Philips is consolidating its position as the leading force in the CD-ROM marketplace.” Maintains Gaskin.

Microsoft, developer of the MS/DOS and PC/DOS software that has become a microcomputer standard, is positioning itself as another early leader in the CD-ROM field. Microsoft has created an internal business group specifically “to focus on this opportunity,” according to founder and chairman William H. Gates.

Last March, Microsoft sponsored a CD-ROM conference in Seattle that drew over 1,000 participants who were charged \$980 apiece. At the four-day meeting, which one observer called “The Woodstock of CD-ROM” manufacturers and users saw a demonstration of Microsoft’s Multi-Media Encyclopedia, which gave them a glimpse of some of the new technology’s potential.

The encyclopedia demonstrated how the enormous storage capacity of CD-ROMs makes possible

applications that marry sight and sounds. Manufacturers and users listened and watched in awe as the sounds of music and cannon fire were mixed with color graphics portraying the story of America's Civil War. On the enlarged image of the IBM-AT monitor, the push of a mouse on a highlighted word brought forth cross references to subjects like Gettysburg, Robert E. Lee and Abraham Lincoln. Each of these was accompanied by its own sound. Instead of picking up a volume of an encyclopedia and reading bland text with sparse illustrations and then following up on cross references, the reader is instantly beamed into the center of a particular subject. Among other things, the encyclopedia can whistle "Dixie."

But even as the last strands of the demonstration faded, some members of the audience remained cautious. "It's still too early to go head over heels about this," warned T. Richard Halberstadt, a design specialist for the management systems division at Proctor & Gamble in Cincinnati, Ohio.

"It's straight economics," Halberstadt noted, "It would be foolish to spend \$10,000 a year on something you can get for 10 % of the cost."

Economics is not the only roadblock in the way of CD-ROM's passage into the fast-growth lane. While the conference attendees watched the multi-media demonstration on a projection screen, every day users would see the image on an ordinary PC monitor, not exactly an eye-opening experience. "Desktop machines make very poor viewing machines," says Robert Carr, director of the Forefront Development Center at Ashton-Tate, one of the largest publishers of PC software.

#### **A Word Equals a Thousand Pictures**

"There are times when one word is worth a thousand pictures," asserts Philippe Kahn, president of PC software company Borland International Corp., in Scotts Valley, Calif. But Kahn notes that for some people, illustrations can be distracting. For others, reading text on a computer screen can be equally distracting.

Stan Cornyn, president of the Record Group, a division of Warner Communications in Burbank, Calif., the first company contracted to produce software for a new consumer version of CD-ROM players, agreed. He says watching a multi-media experience on a PC "conjures up an image of packing up the family into the car, going to the neighborhood theater and reading 'Gone With the Wind' on the screen."

Nothing has more effectively proved the disadvantage of reading text on a terminal than the late great videotext experience. The experiment of bringing the printed newspaper page to the electronic screen proved a multimillion dollar fiasco for its major boosters, Times-Mirror and Knight Ridder. These companies learned that it is not enough to simply convert the printed page to the instantly updated electronic screen.

#### **Part 4: Challenging User Interface**

Since engineers have figured out how to make reading text on a PC screen bearable, they must then find ways to make the experience less of a challenge to non-engineers. When small Winchester disks dramatically increased the storage capacity of the desktop computer from hundreds of kilobytes to megabytes, operating system developers had to create new directory structures.

Applications developers had to fit their applications to these directory structures, which organized the information on a disk. Still, thousands of inexperienced hard-disk users remain willfully ignorant of confusing commands such as PATH, TREE, and SUBDIRECTORY. With the advent of CD-ROM, a

new level of organization will be required in order to direct the user to specific data on a disk. "CD-ROM interfaces must allow their users to move freely and quickly through information, always aware of context and style, explains Ashton-Tate's Carr, who had experience in user interfaces when he developed Framework.

If the CD-ROM user interface succeeds in making information access less challenging than today's generation of online databases, CD-ROM may create a new market for database providers, which in some cases may require considerable expertise from customers. In addition, the very nature of CD-ROM as an optical medium makes it a natural storage device for large subscription databases. Unlike the less dense magnetic media, this early generation of optical media can be encoded only once and is not erasable. While that may be a drawback for many applications, it is a great benefit for databases that require less frequent updates, such as an industrial credit ratings, legal code revisions, and even the Yellow Pages. Most of these services are now available at a premium cost.

### **Database on Disk**

CD-ROM could make its biggest advance into this area of huge databases that are now the exclusive property of a growing number of online services. Instead of paying several hundred dollars of connect time, users could pay a one-time cost to purchase an entire database and use it at leisure — with no meter running on a CD-ROM player. The amount of information on a single disk — which can be mailed in a standard manila envelope — would take a 1200-baud modem more than a week of 24 hour days to deliver.

That does not necessarily mean, however, that online services will suffer as a result, says Rick Meyer, product Manager for the Advanced Technology Group at DIALOG Information Services Inc. in Palo Alto, Calif. DIALOG is the nation's largest depository of online databases. Meyer says CD-ROM will compliment online services much as in-house libraries compliment specialized reference libraries.

Jane Brown, director of Business Development for BSR Information Technologies, another online service, says the online industry has had reason to be concerned before. "We were told at one time that microfiche would one day threaten our online business," she recalled. "Microfiche hasn't hurt our industry, and neither will CD-ROM." Online services, including DIALOG, BRS, Dun & Bradstreet and Dow Jones are taking steps to make some of their own databases available on CD-ROM. "DIALOG is likely to be among the first providers of CD-ROM databases," Meyer contends. D&B has already put together a prototype of its annual "Million Dollar Directory" on CD-ROM, according to Richard Schwarz, of Dun's Marketing Service. No decision has been made on whether or not the directory will become a delivered product, Schwarz says.

In addition to complementing online services, there are some dramatic possibilities for CD-ROM players in the corporate environment. CD-ROM discs make otherwise ungainly databases convenient. A lawyer, for instance, could instantly have access to legal precedents on the screen while preparing a brief. A designer could have a huge repository of icons that could be inserted into a drawing. The possibilities appear limitless.

Nonetheless, software publishers seem to be approaching the CD-ROM market with caution so far. Part of the problem for publishers waiting to deliver their product on CD ROM is that no royalty structures or pricing calculations have been established. The situation recalls the early days of VCR's, when the movie and television industry were rocked by strikes and disputes between various crafts people and broadcast and studio management. Everyone wanted a piece of the enriched royalty pie

that the fledgling VCR market would bring in. The same is likely to happen in the CD-ROM industry as publishers discover new outlets for their various works

### **Media Prices Expected to Drop**

In the first days of video cassette sales, most tapes sold at prices near the \$100 mark. As a result, most video cassettes were rented, rather than sold, establishing an entirely new retail industry. More recently, the tapes have dropped in price to between \$20 and \$30, as manufacturers seek to encourage sales rather than rentals. The same experience is likely to occur with CD ROM products. There are also large differences in considerations between publishers aiming at the mass consumer market and those aiming at the business market. "It is generally accepted that the must-know business information market is not price sensitive," says DIALOG's Meyer.

Publishers will have to figure out just what is a fair royalty is. That will, for the most part, determine what the price of their CD-ROM products will be. The actual costs of producing CD-ROM wares are likely to fall well below the cost of publishing books. Media costs currently range between \$2 to \$5 per disk, and will probably be reduced farther with high volume production. The cost of duplicating the discs is likely to drop to the same levels as this generation's floppy disk. A new European replication process now in development will bring down the cost of duplication of CD-ROM discs to about 25 cents each, according to Edward Rothchild, of Rothchild Consultants in San Francisco.

Any new technology also brings out new concerns for copyright protections. As CD-ROM emerges, it is a far more secure technology for software distribution than floppy disks, since duplication of CD-ROM discs requires much more technical ability and costly hardware. That security, however, is also likely to pose a challenge for the thousands of technical gurus who will eventually find a way to duplicate the discs. The sheer volume of information available on a CD ROM disk is also likely to make pirating more profitable than ever before. It also brings out another problem in the security of the discs. "Today, if a disgruntled, fired employee were to leave with a box of floppy disks holding sensitive company data, it might be upsetting," says Ashton-Tate's Carr, "If that same employee walked out with just one CD ROM disk holding sensitive data, it could be catastrophic."

The High Sierra effort inspires hope that the industry will be able to settle secondary standards issues quickly. Already the Association of American Publishers, for instance, has settled on Standard Generalized Markup Language that will enable any electronic manuscript to be stored as a searchable database and processed on any computer. And despite the many challenges facing the technology, CD-ROM has some powerful supporters among vendors, some of whom are expressing hope, even positive passion, that CD-ROM will soon become the white knight that saves the personal computer industry. "The combination of CD-ROM with a microcomputer creates a medium that potentially is more interactive than any previous consumer product," predicts Microsoft Gates.

Still, the habits of users are difficult to change. As Stuart Flexner, Editorial Director at Random House observed at the Seattle conference, "Despite the presence of all of the high technology here and the people who developed it, I still see a lot of yellow note pads in the audience."