Comparing Oranges and Mangoes: Another View of the Emerging Digital Videodisc

By Philip V. W. Dodds

At press time it looks like there is hope that the two rival digital videodisc camps might reach agreement on one common format. Competing specifications from Sony/Philips and from Time Warner/Toshiba may yet be "harmonized," thus avoiding a possibly bloody format war over the next several years. This is good news for the movie industry, but what does it mean to those in the interactive multimedia industry?

Most people expect that the next-generation digital videodisc will replace both VHS videotape and 12-in. laserdiscs and become the primary distribution medium in the consumer market. It follows, most also assume, that this same format will form the basis for future interactive multimedia applications. However, those who have designed applications using analog laserdiscs may be in for an unpleasant surprise — at least in the near term.

The "Gang of Seven"

Earlier this year, representatives (originally seven companies) from the computer industry formed an ad hoc technical working group and formulated a nine-point set of recommendations to both videodisc camps, urging the consumer companies to also consider the needs of the computer industry. In summary, they advocated:

1. A single interchange standard for TV and computers
2. Backward compatibility with existing CD-ROMs
3. Forward compatibility with recordable discs
4. A single file system for all applications
5. Low cost
6. No caddy or cartridge-type container
7. Reliable data storage and retrieval
8. High capacity that is extensible
9. High-performance read/write for movies and data

A recent report issued by this group indicated that they feel most of the issues they have raised appear to be addressed by both proposals (except item 1, of course). And, now that the competing consumer groups are talking to one another, it looks like the computer industry members might end up being very happy campers after all. Problem solved, and everyone is satisfied. Right?

It's Not That Simple

Digital videodiscs, regardless of the version, are built in layers (Fig. 1). The physical disc is made of plastic and some form of reflective foil with pits. The construction of the disc and the depth and number of pits determines such factors as capacity and access times. This surface medium is an unstructured bin of bits that could — in theory — hold any kind of information, including analog audio or video information.

The next layer is the digital format. Specifications that define precisely how and where different types of bits are to be stored are needed so that a movie player or computer can identify and locate the contents of the disc. This format layer must describe where the "start" of the disc is, and then abide by some type of data structure that allows the content bits to be delivered off the disc in the correct order. For example, CD-ROMs have used the ISO-9660 standard to define a mostly compatible file structure with computers; the computer technical work group wants to see instead a subset of ISO 13346, in order to be compatible with recordable discs in the future. Note that the format layer is silent about what kind of data is put on the disc; it only describes where bits are to be found.

The final layer is the one of keen interest to the IMA: the content layer. Once you have the first two layers, any digital file containing either data or media streams may be put on the disc. The competing consumer electronics companies have agreed that for movies the media stream will almost certainly be MPEG-2. Computer users, of course, say they are agnostic about the encoding means so long as the files are computer-readable. Few have stopped to realize that MPEG-2 streams, or any compressed digital video data for that matter, are not at all like analog video and cannot be controlled on a frame-by-frame basis. Therefore, the performance of operations, such as searching or traversing through digital media streams for interactive applications, is uncertain. In addition, both

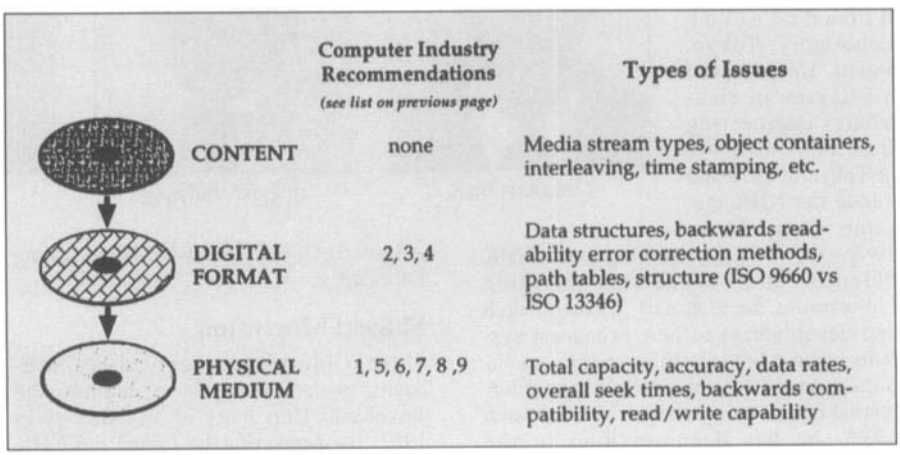

Figure 1. Digital videodisc layers.

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data and media streams are housed on the same medium — requiring sequential operations to fetch both.

How It Used to Be

In old laserdisc-based computer systems, software applications were distributed using two types of storage media: one for the computer (usually floppy diskettes), and one for the laserdisc player (one or more 12-in. laserdiscs). It is important to note that the analog signals from the laserdisc were never actually processed by the computer. Instead, the computer exerted control over the video media stream by telling the player exactly what to play and when. The computer also told the overlay card what to display and when, but the computer was never able to access or process the video or audio signal at any time.

The separation of the media stream from the control stream in early interactive video systems enabled robust multimedia applications (Fig. 2) using relatively low-performance computers (e.g., 8088 and 80286-based computers). Also, the still image and video/audio quality for laserdisc-based systems was very high (full-screen, 30 frame/sec full-motion video, stereo sound), regardless of the specific performance of the computer. This, of course, was because the computer didn't have to process the media streams from the player.

When data streams are reconstructed in a videodisc player, the resulting signal is analog (continuously varying). The audio CD and CD-ROM, however, store only digital information (binary ones and zeros). Signals from CD players are a stream of bits that must then be processed through a digital-to-analog (D/A) converter before being sent to the amplifier and speakers. With digital videodiscs, video streams must be processed through a compute-intensive decoder (usually a dedicated chip or chip set) and then processed through the computer's graphics subsystem — at the same time other interactive processes are being managed.

Getting From There to Here

Will those who have existing libraries of laserdisc-based applications be able to convert their courses to digital videodiscs without fundamental changes in functionality or performance? Right now, no one can say for sure. The differences in managing digital media streams between analog and digital, combined with the incredible increase in required bandwidth and computing, suggests that the next generation of videodiscs probably won't behave the same as laserdisc-based systems.

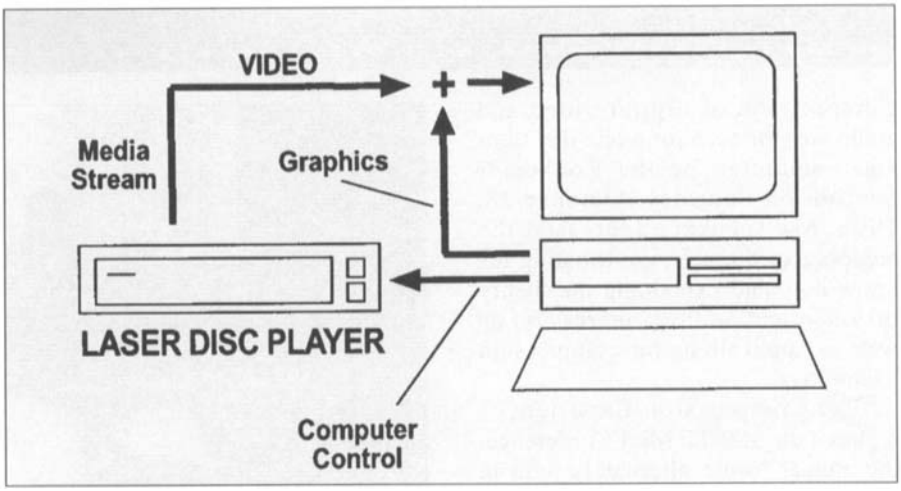

Figure 2. Separation of control and media paths in laser videodisc-based multimedia systems.

IMA's DVD Special Interest Group

Much of the preceding about digital videodiscs is speculation based upon assumptions, since these issues are still being debated among many industry players. The IMA established the Digital Video Disc Special Interest Group (DVD SIG) in order to articulate the requirements for the "content" layer of digital videodiscs from an interactive multimedia applications perspective.

If you are a multimedia developer, or have developed laserdisc applications in the past that you wish to migrate to the next format, we want to hear from you. Tell us how your product worked and what made it unique. We'll try to reduce that to specific recommendations to both the consumer disc designers and the computer industry. Fortunately, both camps are IMA members and have agreed to listen!

THE AUTHOR

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Philip V. W. Dodds is president of the interactive Multimedia Association (IMA), having served as a member of the Board of Directors and an elected officer of the IMA at its inception in 1987. He has held various positions within the association and began full-time involvement as the IMA Compatibility Project director in March 1992.

In 1983 Dodds founded Visage, Inc., in Framingham, Mass., a developer and manufacturer of multimedia products. He served as president, chairman, and CEO of Visage before joining Randall Associates in 1989. Prior to 1983, Dodds held the position of vice-president, engineering, at Kurzweil Music during the development of its first digital keyboard products. Before joining Kurweil, Dodds was vice-president of engineering for ARP Instruments, Inc., which produced the first electronic keyboard that connected to Apple and IBM personal computers, a forerunner of the MIDI standard. After the sale of ARP to CBS, Inc., Dodds became director of engineering, Music Division, at CBS.

Dodds is the editor of *The Digital Multimedia Cross-Industry Guide*, published by Focal Press in 1995.