
Video CD

What is Video CD?

Andrew Davidson & Lucy Lediae
Philips Interactive Media

THE TECHNOLOGY

Video CD is a new technology that allows you to play linear video material from a compact disc. Compressed video and audio data are stored on a Video CD and can be played back on several platforms. The technology is described in detail in a functional specification commonly known as the "White Book."

One of the attractions of Video CD as a publishing format is the ability to play these discs on multiple play-back platforms. This ensures a large installed base of devices on which Video CD titles will play. Video CD lends itself to delivery of motion pictures, music videos, and professional and training applications. Video CD is independent of broadcast standards (NTSC and PAL), and a single disc plays on any Video CD platform worldwide.

How Does Video CD Work?

Video CD uses an international standard for video compression—MPEG-1 (ISO standard - IEC 11172).^{*} This compression technology allows you to store over 70 minutes of VHS-quality video material on a standard compact disc. The audio, although also compressed, is near the quality of Compact Disc-Digital Audio.

A Video CD disc is a "CD-i Bridge disc". That means that it can play on a number of devices but must always contain a CD-i application so that it can be played on any CD-i player. The Bridge format assures multi-platform compatibility. Target platforms for Video CD discs are dedicated Video CD players, computer systems configured to support Video CD, and CD-i players with Digital Video cartridges.

Video CD players. A dedicated Video CD player is designed to play only Video CDs and is not a general purpose multimedia machine. This kind of player might be likened to a VCR for compact discs. The play-back application for Video CD is contained in the player hardware and allows play back of the linear video material on the disc. Several hardware manufacturers will release players later this year.

Computer systems. A computer system that features a CD-ROM/XA drive, an MPEG-1 decoder, and a host play-back application can also be used to play Video CD discs. The application can be included in the hardware (for instance, on a special board) or as a software application on the compact disc or on the

^{*} MPEG stands for Motion Picture Expert Group.

host computer system's hard disk. This platform can provide more functionality than a dedicated Video CD player.

CD-i player with Digital Video extension. Video CD discs can also be played on any CD-i player that has the Digital Video extension. Philips players currently offer this extension via a plug-in cartridge, but this capability may be built into future CD-i players. Like computer systems, CD-i players can allow the user to have more interactive control of play-back behavior through the use of features like on-screen, graphical tables of contents and supplemental material, such as behind-the-scenes interviews, commentaries, discographies, etc.

Comparing CD-i DV and Video CD

A CD-i DV disc is a single platform format. It must be played on a dedicated CD-i player or on computer hardware that fully emulates the capabilities of a CD-i player. As mentioned earlier, Video CDs can be played on several devices. CD-i allows up to 32 MPEG audio channels, which may be used for multilingual and other applications, and only two audio channels are possible with Video CD. There are also differences in the video frame size and rate between the two formats, but the user of the disc is not aware of these differences. It is possible to add features to a Video CD that can be accessed by a CD-i player, but not by a dedicated Video CD player. For example, a Video CD could contain on-screen graphics, menus, and other features that would increase its interactivity and, thus, its perceived value when played on a CD-i player.

Why publish in the Video CD format?

Because Video CD is an international, open standard, it is a desirable delivery method for content publishers. The multi-platform compatibility assures a large installed base of prospective customers. The publisher can also offer a range of features on one compact disc; addressing several platforms that allow a different sets of features related to the target hardware platforms within one disc-based product. Production of a Video CD is relatively simple and inexpensive, and replication and distribution costs are much lower than those for VHS.

PRODUCTION

Specification

The first step in the Video CD production task is to specify the layout and contents of the title. This includes defining the track/chapter breakdown, planning the audio tracks, and defining platform-specific additions. The producer must decide how to break a movie or other material into chapters or, in the case of music videos, into tracks. For motion pictures, the chapter organization is usually subject to approval by the film's original director. Video CD allows use of one or two sound tracks; these tracks can be used to provide a single stereo sound track or two mono sound tracks. Based on the capabilities of the delivery platform, it may be possible, as in the case of CD-i, to add chapter headings and other on-screen graphical elements or reference material, such as discography or biographical sketches.

Encoding

The video source material must be encoded, or converted, via compression techniques into the MPEG 1 format.

There are number of MPEG encoding systems currently available, and, among those systems, there is a very wide range in both quality and cost. In deciding which encoding system to use, you need to ask yourself several questions. Should you install a desktop system at your site or use a service bureau with a high-end encoding system? Will you get better results from a real-time or non real-time system? Are you preparing material for a consumer application or for a professional application. You will need to examine the cost versus quality trade offs to make these decisions. For example, you may be able to sacrifice quality to keep the price down on MPEG data intended for a professional application, such as a training disc. On the other hand, a movie studio that has made a multi-million dollar investment in the production of a major motion picture will demand the highest quality product of the encoding process.

Following are the steps involved in the encoding process. If you are undertaking this part of the produciton yourself, you will need to be aware of these issues. If you are using a service bureau, you will want to be conversant with them, at the least.

- Grabbing is the process of capturing the data from the videotape and moving it to a computer hard disk for processing. In general, digital source gives better results than analog source material.
- Some preprocessing of the video material may be required to reduce electronic noise and to correct aspect ratios to assure the best possible images on the target play-back system.
- Filtering processes may also be performed that automatically detect the cuts from one scene to another and that adjust the frame rate from videotape to one of the three choices for frame rates in MPEG—24, 25, or 30 frames per second. One of these methods is known as "inverse 3:2 pull down."
- There are fewer pixels in a Video CD image than on a standard videotape frame (D1, for instance), so the image must be reduced in size, or subsampled. The way this is done depends on a number of factors including the picture rate (film or video), broadcast standard (NTSC or PAL), and play-back system.
- The actual process of compressing data successfully is as much an art as it is a science. Years of experience and an aesthetic sense are required to make sure that all of the appropriate "knobs" in the process are fine tuned. For the best results, it is extremely important to have the services of an experienced video post-production house or a person with extensive post-production experience. Using all of the techniques available, it is possible for a skilled video technician to optimize the results of the encoding process.

There are some basic rules of thumb for getting the best results from the encoding process in conjunction with MPEG:

- Stay as close to the original source as you can. Each additional (analog) generation degrades the quality. This is axiomatic.
- Component source is better than composite. Digital source is better than analog. Component versus composite is a more important factor in quality than is the digital versus analog factor. Thus, the order of preference among common formats is D1, Beta SP, D2, and then any other format. Avoid letting anyone talk you into using D2 instead of Beta SP (if the Beta system is a high quality component one.) Here's a summary chart:

	Digital	Analog
Component	D1 Digital Betacam	Beta SP
Composite	D2	1", 3/4", VHS

- Garbage in—worse compressed garbage out! Remember that VHS, Umatic, Beta, etc., are all forms of compression when the original medium was film. Compression magnifies any artifacts in the source; it doesn't conceal them. If you have a compressed intermediate source, you are compressing your data two (or more) times.
- Avoid standards conversions. Conversion of source material from NTSC to PAL, or vice versa, automatically induces artifacts that just get worse during compression.

Following these guidelines and adhering to standard high-quality post-production practices will help in preserving the quality of your source material during MPEG encoding.

Graphics

The services of a graphic artist are required to create the table of contents, menus, and any additional material desired on the disc. The artist needs to be aware of the constraints of the graphical display on each of the target hardware platforms and to take those in to account. The amount of graphical material accessible from a dedicated Video CD player is limited to a rudimentary table of contents and controls. The producer can, if desired, take advantage of the features of the CD-i player or of a computer application and provide additional material for play on those platforms.

Assembly

The disc building process consists of assembly of all of the elements and creating a script that generates the disc image for the title. Philips and others have developed software tools that automate the assembly and building processes.

Once the disc image is made, it is sent on tape to a disc manufacturing plant for mastering and replication. It is also common practice to create one-off discs on a WORM burner so that the disc can be tested internally before replication.

FOR MORE INFORMATION

The contents of a Video CD disc are described completely in the specification. Adherence to the standard is the only way to ensure that a Video CD disc will

play on any of the target platforms. If any of the required files is missing or contains incorrect data, the disc may not play on some players.

The Video CD Specification (and other Philips-licensed optical disc specifications) may be obtained from:

Bert Gall
Philips Consumer Electronics
Coordination Office Optical & Magnetic
Media Systems
PO Box 80002
5600 JB Eindhoven
The Netherlands
Phone: +31 40 736409
FAX: +31 40 732113

For information on development tools or on obtaining the CD-i application provided by Philips, write to Philips Interactive Media Systems at the address above or call:

Phone: +31 40 735932

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