

# The Interactive Engineer



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## ■ Editorial

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We finally got IE trough. The transients are longer than expected, but we are all working on it to get them damped.

This time we have a very interesting article giving an overview of what we can expect of Digital Versatile Disc (DVD). It looks very promising at this time. We also found a paper from Philips Media Systems about the position of CD-i in the Professional market. If you haven't heard much positive news during the last weeks, this article will certainly make your day. It seems that CD-i is the easiest and far most the cheapest platform to implement applications like kiosks or training courses, especially when the application has to be distributed worldwide to end-users that are not familiar with complex multimedia computer usage.

We also went surfing to the 'support' webside. It was so interesting we decided to take over one or two articles in each IE issue. The two articles we selected are really practical stuff and probably a 'must have' for anyone using MediaMogul.

*IE editorial staff*



## ■ Authoring DVD

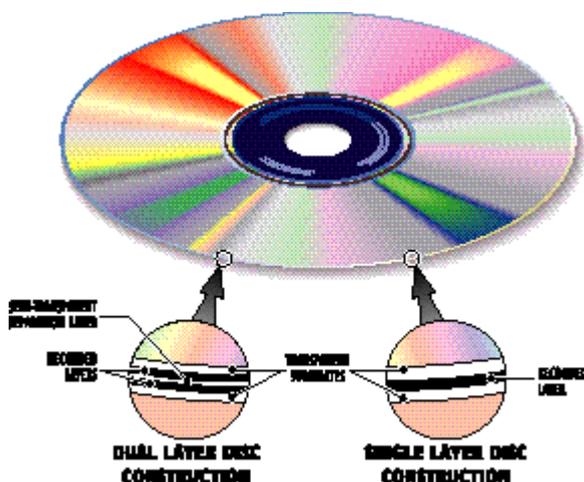
DVD represents a quantum leap forward in digital media. DVD-ROM offers the consumer many times more capacity than available on CD-ROM, and in its DVD-Video form, also enables spectacular interactive audio and visual entertainment for the home.

The advanced technologies that DVD employs, together with the medium's extensive functionality, mean that authoring discs is comparatively much more complex than is the case for CD. This article gives a brief overview of DVD-Video and the processes used in creating a disc.

### DVD Disc Structure

DVD discs look similar a conventional CD, but has the capacity to hold up to 26 times more information. Not only that, but DVD runs at a much faster data rate, enabling stunning graphics, widescreen video, surround sound, interactivity, multiple language soundtracks, multiple language subtitles.... the list goes on.

The vast increase in data storage capacity is achieved by reducing the size and space between the individual storage elements, allowing much more data to be fitted into a given area. In addition to this, DVDs can have two layers of information in a single side of a disc. The two layers are separated by a transparent bonding layer, allowing both layers to be read by the player. The laser reading the disc focuses to read the appropriate layer. The dual layer gives an almost twofold increase in information capacity compared to a single layer disc.



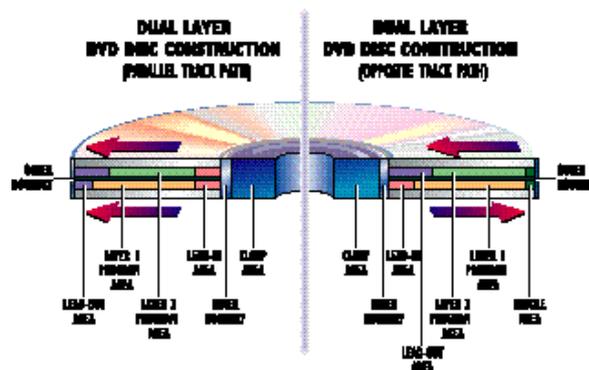
CD has a maximum storage capacity of around 730 MB. DVDs can be produced with eight different capacities. They can have one or two layers of data, and can be single or double sided. Like CD, DVD can also be produced in two diameters; 8 cm and 12 cm. DVD players will be able to read all of the disc types, and existing CDs.

8 cm	12 cm	Disc Type
1.40 Gb	4.70 Gb	Single sided, single layer
2.60 Gb	8.50 Gb	Single sided, dual layer
2.90 Gb	9.40 Gb	Double sided, single layer
5.30 Gb	17.0 Gb	Double sided, dual layer

DVD has a Lead-in area which acts in the same way as on a CD, supplying the player with information about the disc contents. The user information is contained in the Program area. At the end of the recorded information a Lead-out area, which signifies to the player the disc is finished, fills the rest of the disc.

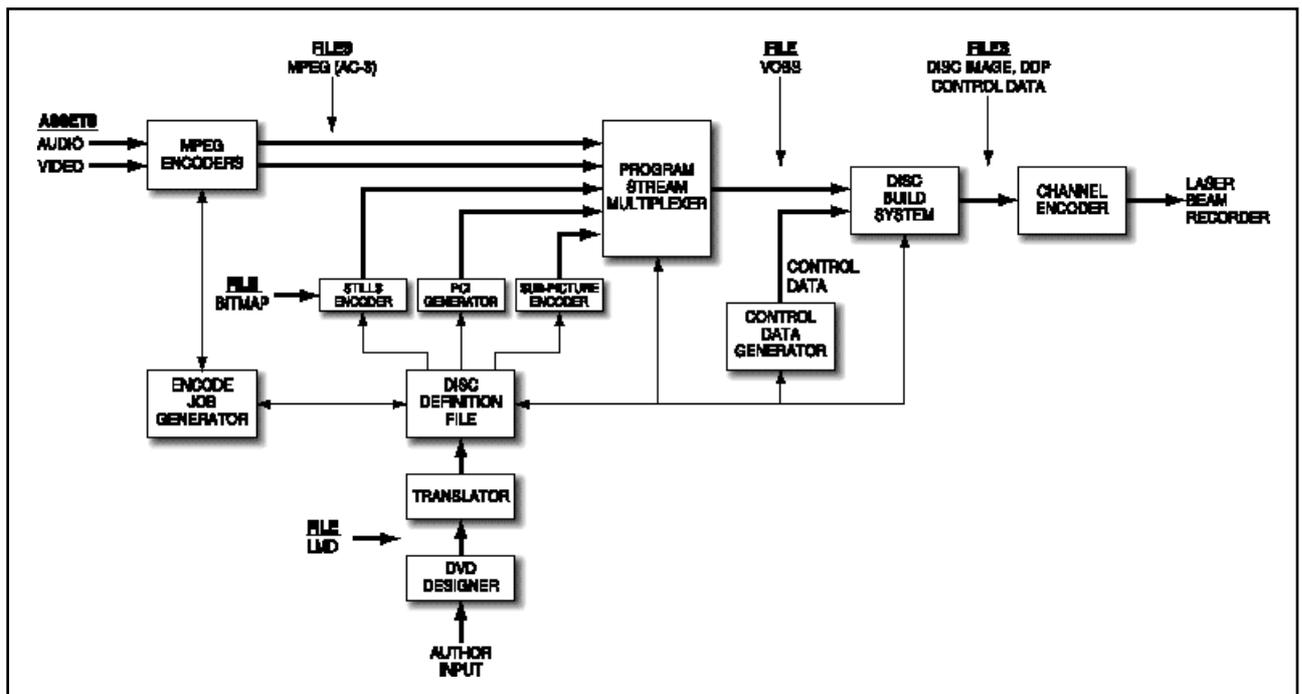
Dual layer discs can be constructed in one of two ways: Opposite track path and Parallel track path. In Parallel track path discs, the first layer is read from the inside of the disc to the outside, then the second layer is read in the same direction.

Opposite track path discs also have a Middle area, which bridges the point where the first layer ends and the second layer starts. The second layer is read from the outside of the disc to the inside.



### DVD-Video Authoring

DVDs increased complexity means additional authoring processes have to be carried out compared to CD. Philips DVD-Video authoring system is outlined in the following diagram:



Philips have long been involved in digital media technology, and DVD is no exception. Philips Components business unit Mastering and Duplication have developed a line of PC-based DVD authoring tools designed for professional production studios. At their premises in Eindhoven, they have set up a complete DVD authoring facility using their range of authoring products. This facility is for demonstration and instruction purposes, and is also used for providing a DVD authoring service for external parties. In association with the Optical Disc Technology Centre, also based in Eindhoven, DVD glass masters can be produced.

### Disc Definition

Disc definition is a central part of Philips DVD authoring system, and is performed in software called Disc Designer. Disc Designer is used to build up a complete definition of a DVD-Video disc. This includes definitions about the playback order of each section of audio and video, how and where the disc can be played, disc navigation and so on. In addition, menu screens can be generated, with control buttons etc., which are used in disc playback. Designer is also used to define physical information about the disc (disc type, video frame rate and format, language code, parental levels, audio channel mapping etc.). Designer uses graphical editors to build the disc description, all of which is written in to a single file called the disc definition file. This file does not contain any program data itself, just information about it,

which is used in the following authoring processes.

### MPEG2 Video

Video for DVD is encoded (compressed) using MPEG1 or MPEG2, because uncompressed digital video is extremely demanding on memory. For example, a CD can only hold around 5 minutes of uncompressed video.

Movement in video pictures is created by displaying a series of still images that change at a rate higher than the human eye is able to detect. Although effective, much of the information is repeated from image to image. In simple terms, MPEG video works by retaining the parts of an image that change and discarding repeated parts, which it already knows.

At the decoder, each image is reconstructed from the information that is retained, combined with the repeated information from other images stored in a buffer.

DVD-Video can use variable bit rate video encoding, which is particularly efficient because more complex scenes, which contain a lot of movement, receive more bits than relatively simple scenes. In view of the fact that multiple camera angles and storylines can be included on the disc, any saving in storage space is a bonus.

Philips MPEG2 Variable Bit Rate Video Encoder uses D1 or Digital Betacam tape as its input. The encoding process requires two passes of the video

source, each pass in real time. During the first pass of the tape an analysis is made of the complexity of the program. During the second pass the video is encoded based on the information obtained during the first pass, plus any alterations made for bit rate optimisation. At the end of the encoding pass a graphical report is generated. Based on this report, encoding can be repeated (if necessary) using different parameters to obtain better quality or a smaller output file.

### MPEG2 Audio

A range of audio formats can be included on a DVD disc. It can be linear (uncompressed) PCM audio or, for more efficient use of disc space, compressed audio. In this case, the linear data is encoded using either MPEG1, MPEG2 or Dolby AC-3 compression (For multichannel audio, MPEG2 is the standard for PAL/SECAM countries and AC-3 the standard for NTSC countries; each is also an option for the other). MPEG2 encoded audio can be:

- mono
- stereo
- five independent channel all round sound with low frequency enhancement (5.1)
- seven independent channel all round sound with low frequency enhancement (7.1)

Efficient audio encoding for DVD is important to maximise the available space for high video quality. MPEG audio in DVD, unlike other audio encoding formats, can use a variable bit rate to obtain highly efficient encoding. This allows high quality audio to be encoded using the minimum amount of information. Using a variable bit rate can produce a reduction in the eventual amount of audio information by up to 30% compared to a fixed bit rate. The advantages of using variable bit rate encoding are the same for audio as for video.

Audio source material for the Philips MPEG2 audio encoder must be in AES/EBU digital format with SMPTE time codes. Between one and seven channels of PCM digital audio (16 to 24-bit, 48 kHz sample rate) can be used as audio input. The optional low frequency enhancement channel has a much smaller bandwidth and uses a much lower sample rate. The audio source can be from Tascam DA-88 for multichannel audio, or from the digital video master tape (D1 or Digital Betacam).

Unlike video, audio encoding requires only one pass of the source, in real time.

### DVD Authoring Toolset

The Disc Definition File generated by Disc Designer is used as input to software called the DVD Authoring Toolset. This is a fully automatic integrated solution which controls a number of important processing functions. It can control the MPEG2 program stream encoding, as previously described, or it can accept pre-encoded audio and video files. The encoded program data streams, and other program data like subpictures and stills, along with generated Presentation Control Information, are multiplexed into a single bitstream. Control information is generated prior to the creation of the disc image. The disc image is built by combining information such as file structures, synchronization timing codes, disc branching details for interactivity, multiplexed disc program content etc., as specified in the disc definition file.

### Verification

For pre-production checking, before the the volume pressing of the discs is carried out, software which mimics a DVD player simulates disc playback of the disc image, to verify that the disc operates correctly.

### Mastering DVD

Once the disc image has been created, error correction data must be added to the disc image, and it must also be encrypted and EFM+ modulated. This process is carried out by Philips' DVD Channel Encoder, which writes the DVD formatted disc image to a Laser Beam Recorder to cut the glass master.

The glass master is used to manufacture the DVD in volume production. A substrate (disc blank), made from transparent polycarbonate, is pressed onto a stamper created from the glass master, then coated with a layer of reflective material. This layer is then bonded with another substrate layer. For dual layer discs, the reflective layer is pressed first, then a second semi-reflective layer is added, with a transparent adhesive space layer in between.

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*Jim Cross*

## ■ Facts & Figures

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This article isn't technical, but we couldn't resist the temptation to publish a summary of the "Facts & Figures" about the professional CD-i market from the business group Philips Media Systems. After reading this, you'll agree that there is still a lot of work in the CD-i business, even with DVD coming and CD-ROM already on the coast.

### Philips facts

- At this moment Philips has installed 50.000 CD-i based info-kiosks worldwide: 50% in the US and 50% in Europe.
- In the training market Philips has installed another 50.000 units (based on CD-i): 50 % in the US and 50 % in Europe.
- In the presentation market 10.000 sales representatives use portable CD-i solutions : 60% in the US and 40 % in Europe.

In comparison to other multimedia kiosk solutions (mainly based on the PC), it is estimated Philips' market share is 25 % in the US and 50 % in Europe.

### Trends / Survey's

According to a survey from Video Arts in the UK in Autumn 1996, training managers expect an increase of the use of video in training from last years' 89% to a this years' 95 %. The use of CD Rom is expected to double, whereas the use of CD-i is expected to grow from 6 % to 23 %.

Another survey —in the US this time— points out that most organisations that currently use CD-i, had previous experiences with CD Rom. It is indicated that experience with other technologies

and infrastructures enhances the reputation of CD-i!

In yet another survey on post-production houses in the USA, Matt Peterson (Scenic Wonders / Phillips - Business Information) describes that out of 221 respondents 35 % is offering multimedia services in order to maintain a full-service position for their customers. 13 % of this group is making CD-i productions and 12 % is active for Interactive TV. Not really surprising when looking at the figures above.

Also interesting to know is the statement of communication consultant Ogilvy & Mather in Germany: reporting that 70 % of purchase decisions are being made in the store.

### Philips customers

Philips has a list of hundreds of companies and organisations using CD-i for communication purposes (see: <http://www.philips.com/sv/cdiprof>). Known customers include Asics, Black & Decker, BMW, Bristol Myers Squibb, Chrysler, McDonald's, Fischer, Henkel, ICI, Lancaster, 3M, Merck Sharp & Dome, Mercedes-Benz, L'Oreal, Toyota, Volvo, etc., etc.

CD-i technology is primarily being used for 'Point-of-Sale or Point of information', 'presentations and sales support' and 'training'.

It is remarkable that many of the customers come from specific market segments as there are automotive industry, background music, cosmetics, dental, driving schools, fast food sector, financial institutes, health care (patient information), hotel/motel industry, kitchen appliances, pharmaceuticals, police, retail, sports, telecom companies, tobacco industry and much more.

### Customer quotes

The most interesting things to read are what the customer thinks about CD-i. The customer has a problem and he wants a cost effective and stable solution. But how? Read it for yourself:

*L'Oreal*

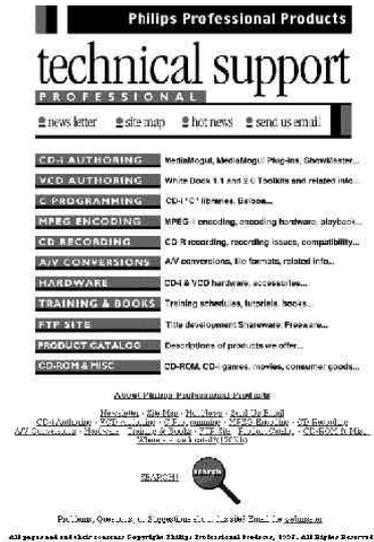
How best to put "Praxicolor" into action? After extensive experiments with PC-based systems using CD-ROM, L'OREAL decided that the ideal tool for getting the story across to both hairdressers and their clients had to be CD-i. Patrick Canivet, director of L'OREAL Coiffure's Technical Pedagogical Centre, explains why: "*To use CD-ROM, a computer is needed. If the salon*

has one, it is generally for its accounting, and not available for other tasks. In our milieu, computers have an austere image that does not invite playing. In any case, for "Praxicolor", more computer power would be needed, together with the latest multi-speed CD-ROM drive, in a multimedia PC. Also, video cards have only recently become available as add-ons. Such computers are difficult to install - if a layman succeeds at all! And lets not even talk about keyboard operation, because it's a fact constantly being proven that even experienced operators can get stuck or lost. CD-i, on the other hand, is a real invitation to play, and the video quality is perfect, with no degradation in the course of time. CD-i's purchase price is much more attractive than that of a multimedia PC with comparable performance. And last but certainly not least, CD-i is a universal international standard, as opposed to the assortment of different standards used for computer systems". On this basis, L'OREAL chose a combination CD-i player and touch-screen TV for its CD-i system. A supreme "Plug-and-Play" system, with the minimum of hassle installation-wise and the simplest of operating procedures. The idea of touching different parts of the screen to run through the program quickly becomes intuitive, even to the totally non-technical staff

3M

"Our company thrives on innovation and creative thinking, subjects in which we wanted to train our employees. We required a training course which could fit in with staff's daily schedules," states Dr Judith Parker, Technical Education Manager at 3M's Corporate Technical Planning and Co-ordination Department in St. Paul, Minneapolis. "The key challenge lay in finding a medium that would work equally well for all of our 8,000 technical staff, of varying levels, in 61 different countries. We wanted to offer this course to employees at remote locations, and therefore had to ensure they'd have the facilities to use it. We also had to be certain that staff around the globe would understand all of the course material, as for most of them English is a second language, and that the material would be relevant to their different cultures", adds Dr. Parker. The company had never previously achieved this, mainly because of its focus on computers and lack of uniformity in technologies available at different locations.

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## Faster is Better

Many MediaMogul titles are scripted for function, without much attention to optimizing performance. In many titles, the symptoms of "slow branching", "menus slow to get a cursor", "slow plug-ins" and other performance issues are often due to what we call "loose" scripting. Many times, too much time is given for still images to load, for menus to load, plug-ins to load and become active, etc. There are a number of things that can be done to improve performance. Here are a few of the top "improvers"

The first line in the script should start at 00:00. As simple as this may sound, we have seen a fair number of titles where the first line in a script was inadvertently at 00:20, 01:00, and even 04:00. Since MediaMogul takes time LITERALLY, it quickly enters the script, only to be told to sit and wait.

Good Example:

```
00:00 Cut /h0/VIDEO/booboo.d
00:00 Play /h0/MUSIC/boo.cm
```

Bad Example:

```
00:20 Cut /h0/VIDEO/booboo.d
00:20 Play /h0/MUSIC/boo.cm
```

When presenting menus or other sequences where the user is waiting to interact, use the SHORTEST load times that pass analysis.

Note that the load table (laminated card) is based on DYUV or CLUT images that are about 100k bytes. For Run-Length images, the load times

can be significantly shorter. We use the rule of one frame (00:01) for every 5k for an audio level of NONE or C, or two frames (00:02) per 5k up through ASTEREO. A 20k RL7 image with no audio would need just 00:04 to load.

*Good Example:*

```
00:00 Cut /h0/VIDEO/booboo.rl7
00:04 Background /h0/MUSIC/booback.rl7
00:04 Wait /h0/MENUS/boomenu.m
```

*Bad Example:*

```
00:00 Cut /h0/VIDEO/booboo.rl7
00:20 Background /h0/MUSIC/booback.rl7
01:10 Wait /h0/MENUS/boomenu.m
```

The "LoadTime" for a command and asset is in the column PRECEDING (Script Writer).

MediaMogul must have sufficient time to load the asset BEFORE the desired presentation time. For example, a DYUV still image that is to begin a dissolve at 04:00, must begin loading into the machine by 03:13. An that's if there was no audio playing WHILE the still was loading (not during the dissolve). MediaMogul looks ahead in the script to assure things arrive on time, but it must be given sufficient time by YOU to accomplish this.

*Example:*

00:00	00:02	00:22	00:27	00:27
00:02	00:20	00:05	00:00	00:00
Cut baithouse.d		Cut townfor.cl7	Background townbck.rl7	
Play cool_strm.cm				
	change_crsr mycursor.c		Wait mymenu.m	

**Script File Produced:**

```
00:00 Cut /h0/VIDEO/baithouse.d
00:02 Change_crsr /h0/CURSORS/mycursor.c
00:22 Cut /h0/VIDEO/townfor.cl7
00:27 Background /h0/VIDEO/townbck.rl7
00:27 Wait /h0/MENUS/mymenu.m
```

baithouse.d is at the front of the script, so Mogul just waits until it's loaded before starting the timer. cool\_strm.cm requires no load time. mycursor.c is a small file (under 10k), so we allowed 00:02 of time for it to load from the CD. Note that the 00:02 was specified in the column BEFORE mycursor.c.

townfor.cl7 is loaded after mycursor.c

loads, and is allowed 00:20 to get off the CD, given its size (about 100k) and the fact that CMONO audio is now playing while it's loading. Again, the 00:20 is specified in the column BEFORE.

Lastly, townbck.rl7 and mymenu.m are loaded, one after the other. Since townbck.rl7 is smaller (less than 20k), it only needs about 00:05 after townfor.cl7 to get off the CD. mymenu.m has all the time in the world, since it's at the end. That's why it can be scripted at the same start time as townbck.rl7.

"Hide" subroutine loading, if possible. Call Customer Support if you are unsure how to accomplish any of the following.

- Load as many background plug-ins as possible (Call\_bg) in an init or splash-screen script when the title is started.
- If memory permits, make often used plug-ins "sticky" so they do not have to be loaded over and over again.
- Some plug-ins may be scripted as background calls (Call\_bg), even though the documentation recommends a foreground call.
- If you can anticipate where plug-ins are going to be used, you may be able to script them as background calls during preceding scripts.
- Many plug-ins can be scripted back-to-back with NO time between columns (Script Writer). This especially applies if the plug-ins are not related or related but not dependent on each other.
- When the documentation recommends that a background plugin be given a certain amount of time to load and "wake-up" (00:20 is common), you can script it just before a branch and use the branch delay for wake-up.

Any script command that does not load an asset (audio, video, menu or data file), can be scripted for a COLUMN duration time of 00:00.

*Example:*

00:00	00:00	00:00	00:05	00:05
00:00	00:00	00:05	00:00	00:00
Cut baithouse.d			Background townfor.cl7	
Play cool_strm.cm				
	set_var R 1	cursor_off	Wait mymenu.m	

**Script File Produced:**

```
00:00 Cut /h0/VIDEO/baithouse.d
```

```
00:00 Set_var A 1
00:00 Cursor_off
00:05 Background /h0/townfor.cl7
00:05 Wait /h0/MENUS/mymenu.m
```

Note that `set_var` and `cursor_off` require nothing from the CD, and are set to execute at the same start time as the cut to `baithouse.d`. Mogul will execute them in order, without any scripted time delays between them. `townfor.cl7` however, is loaded from the CD and requires about 00:05 to load.

Menu files require no additional SCRIPTED time to load. For example, for a menu with a foreground, background and menu file, the background and menu file can be loaded in the same column (same time).

Calls do NOT require load time, but may require "wake-up" time. During a branch, MediaMogul scans the upcoming script for `Call` and `Call_bg` commands. It preloads the plugin(s) needed BEFORE time 00:00 in that script commences. The individual plugin is not attached and RUN until the appropriate `Call` command is reached in the script. Once called, the plug-in may or may not require a wake-up period to prepare for work—follow documentation recommendations.

A script demonstrating many of the above techniques might look like:

```
00:00 Dissolve /h0/VIDEO/mine.d 00:15
00:00 Skip_off
00:00 Call_bg /h0/SUBROUT/cdi_sgmn
00:00 Play /h0/AUDIO/mine.cm
00:00 Cursor_pos 300 200
00:00 Set_var A 3
00:10 Call_bg /h0/SUBROUT/cdi_dimr 20 30
00:18 Background /h0/VIDEO/mineback.d
00:18 Wait /h0/MENUS/mine.m
```

In this example a number of asset-less commands are hidden during the dissolve and audio play. The foreground and background pictures are enough apart to still pass analysis. Notice that `cdi_sgmn` (signal manager for plug-ins) and `cdi_dimr` (screen dimmer) are 00:10 apart to permit proper wake-up for the signal manager. The dimmer is started up 00:08 before the menu is loaded to permit to wake-up in time and see that a menu is active.

*From the web*

#### Interactive Engineer

is a publication of Philips Media Systems  
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on CD-i technology to all supported developers  
and PMS software engineers.

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