



Performance Media Industries, Ltd.

How Films Are Transferred to DVD
4/2003

by A. Grimani

What is it? How did it get here? What do I do with it? What is it saying? These are questions you might ask about Stitch, the adorable Disney uberdoggie/alien genetically-engineered creature. But, in fact, they should be asked about DVDs. Ever wondered how the picture and sound content of a film ends up on a shiny little disc? This mystical transformation is accomplished through a complex set of operations referred to as *telecine*. The term “telecine” was coined to describe the practice of projecting a film image directly into the lens of a television camera in order to broadcast the film on TV. These days telecine is way more sophisticated!

Transferring an image from film to digital video begins with a high-quality interpositive print of the film being put up on a machine that scans one frame at a time and spits out a digital video representation of each frame. This machine is actually still called a telecine. It is carefully aligned to capture each frame with utmost accuracy, minimum noise, and minimum weave. The scanning is actually done in high definition these days at 1920 x 1080 resolution. Any scratches, dust, or other minute blemishes in the video content are cleaned up digitally. Then it is color corrected. This process is the most time-consuming portion of the image transfer. Color correction involves several things. First, it compensates for the dynamic range and color range differences between film and video. Video is not able to handle the range that film has to offer. The film must be “squished down” without losing the director’s intent for the look of the film. A good colorist will know exactly how to do this. Sometimes, the film director or director of photography will even be on hand during the transfer process to offer guidance. Another thing the colorist does during the transfer process is to correct the picture’s color character from scene to scene using digital video adjustments, so that the movie has a smooth and continuous look throughout. In fact, a colorist has much more adjustment capability with video than a director does with film release prints. The director can only roughly balance the color difference between scenes through changes in the chemical development process and the amount of time each piece of film stays in the developer. Hence, the process is called *color timing*. In some cases, the director can only fully achieve the desired colorimetry for a movie with its video release. (Aren’t we home theater guys lucky!?) However, recent developments in digital technology are

allowing directors to color time the theatrical releases of their films in much the same way as they do the video releases. By transferring the pre-release film into high definition video, they are able to use a sophisticated process called digital grading to create the exact look they want for their films. After digital grading, the high definition video is transferred back to film for wide release. (For a demonstration of the digital grading process, check out Special Features Disc 2 of *The Lord of the Rings: The Fellowship of the Ring* box set.)

So, how are all the decisions made for dynamic range and color adjustments? By looking at video display monitors and judging subjectively that this or that looks right. Thus, the display devices had better be tuned up right on the standards set forth and agreed upon by those propeller heads working around the video transfer facilities in Hollywood. Some of the standards and methods are laid out in specification documents from the Society of Motion Picture and Television Engineers (SMPTE), and others are passed on through oral history and methods practiced by individual groups. The THX Digital Mastering Program is one such group. They oversee, from a third-party perspective, that the telecine machines, video monitors, and video recorders all work right and are tuned to the industry standard before a film is transferred. Many other industry expert consultants also provide calibration services, and some of them show up in CEDIA conference lecture programs. What experts like Joe Kane preach is that, if you set up your video monitoring device the same way that the director had his or hers set up during telecine, you will get to see exactly what he or she intended for the image to look like – a simple but powerful concept! Given the right room design, equipment selection, and calibration method, you can have a video setup that matches Hollywood industry standards and enjoy a movie exactly as the director intended.

Once the high definition digital video master tape is created (usually on a tape format called D5 video) it is down-converted to 480i resolution and recorded onto a standard definition component recorder in D1, D5, or Digital Betacam digital video formats. Next, it is transformed into the compressed format found on DVDs: MPEG2. The compression process is so wild that I won't even try to describe it here. Suffice it to say that the encoder device is a powerful machine that looks at the video picture and compares multiple sequential frames to find ways to reduce redundant information and picture data that isn't visible to the typical humanoid. The result is a drastic reduction in data rate, while maintaining a picture performance that sometimes rivals the local multiplex. The compression process is usually closely monitored by the colorist, the director, and other individuals concerned with picture quality. The compressed data file is then assembled into a DVD master, along with the audio and other ancillary data, during a process called *authoring*.

For the soundtrack of a movie, things are usually much simpler, but somehow prone to all kinds of errors – probably because most folks in *video* transfer facilities know about

video, and look at audio as second-rate content that can be treated without specific care! The audio transfer process begins with an analog or digital master tape of the final multi-channel mix from the dubbing stage being copied over to a medium compatible with video time synchronization. The format of choice is usually a DA88 digital multi-track recorder, which prints data onto a video Hi-8 tape. Then, the digital master copy is put through Dolby Digital AC-3 encoding to conform to DVD coding standards. The encode processor operates pretty much in real time, and there's no intervention from the operator, other than setting a number of control flags before launching the encoding. Some of the relevant controls are:

1. The dialog normalization value (a.k.a. DialNorm), which automatically controls the volume level of the playback controller to compensate for different dialog-to-peak levels.
2. The surround level value, which compensates for the fact that the surround channel reference level in cinemas is 82dB for each channel, while at home it is 85dB for each channel.
3. The large/small room flag, which indicates the type of room in which the sound mix was prepared and is useful for automatic setting of the Re-Equalization in THX-certified A/V controllers.
4. The bit rate, which is most often set at 448 kbps, but can be adjusted up or down.

The bottom line is that the DVD soundtrack is pretty much a direct copy of the film sound master, which was originally destined for use in a cinema. Because the sound systems and calibration methods in a cinema are pretty different from what you find in a home theater, there is a need for some massaging and post-processing before a home theater will yield the same experience as a cinema or dubbing stage. Enter processes like Home THX, which adapt the soundtrack for playback in a home theater.

With the right knowledge and the right test and measurement tools, you can get to within a decibel of the sonic utopia heard in a dubbing stage. Again, several of the heavyweights that hang around film and video studios can be found teaching their craft at CEDIA conferences. Just go listen to them!

Once the Dolby Digital AC-3 data stream is created, it is recorded onto a hard drive and sent over to an authoring house to be combined with the compressed MPEG2 image. At this point, the DVD authoring programmer goes to work. These folks often package the movie content with tons of special features, navigation keys, control functions, and fun little hoops you have to jump through to watch the movie. They can be a video game junkie's heaven! The authoring house will ultimately generate a serial data stream that corresponds to the continuous track that spirals along a DVD. The data is put on a Digital Linear Tape (DLT), and sent over to the pressing plant to be made into the little polycarbonate wonders we call DVDs.

And there you go; that's the journey of how a big film becomes a little DVD. Hope you enjoyed it!

This article is based on a column published by A. Grimani in Residential Systems magazine April 2003.