SONIC®

USER GUIDE

PUBLISHER STUDIO / PRO EDITIONS

SCENARIST®

THE PROFESSIONAL AUTHORING STANDARD

Scenarist Publisher Studio and Professional Editions User Guide, Sonic Part Number 800316 Rev A (03/07)

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Contents

1 Introduction

Welcome to Sonic Scenarist Publisher Studio and Professional Editions, the industry standards for form-based DVD authoring. Scenarist Publisher Studio and Professional Editions allow you to conveniently create DVDs from dynamic, Windows-based forms, thereby reducing cost, production overhead and turnaround time. In addition, Publisher's algorithmic processing greatly reduces common authoring errors.

By utilizing Scenarist Publisher and its powerfully accessible forms, you are provided with a simple data interface that is highly interoperable with Sonic Scenarist's formats, file structure and source code.

What is Form-Based Authoring?

Form-based authoring offers a standard interface to those seeking a simple, highly automated solution to DVD authoring. By utilizing forms with step-by-step prompts and defined input constraints, users may achieve high levels of reproducibility and efficiency, without encountering common errors associated with repeated data entry. Once Scenarist Publisher has been installed and a form has been created, users may easily select video, audio, still-image and subtitle data.

About the Documentation

Sonic Scenarist Publisher includes the following documentation:

Sonic Scenarist Publisher Studio and Professional Editions User Guide
Documents how to use Scenarist Publisher to automate the authoring of titles for the DVD production process. The guide includes workflow structure and work areas, asset preparation and importing, building projects, and managing the multiplexer.

Sonic Scenarist Publisher Studio and Professional Editions Form-Building Guide
Documents Scenarist Publisher's Form Builder, with a detailed description of available features. The guide includes information on creating a reference project, building a user interface (UI) and setting up the form.

Sonic on the Web

Sonic's Web site (www.sonic.com) contains a wealth of information about Sonic products and DVD authoring. White Papers, providing additional background on Sonic products and technology, are available at:

http://www.sonic.com/support/whitepapers.htm

If you have specific questions about using Scenarist that aren't answered by the documentation, a *Support Knowledge Base* is available at:

http://support.sonic.com/kb.htm

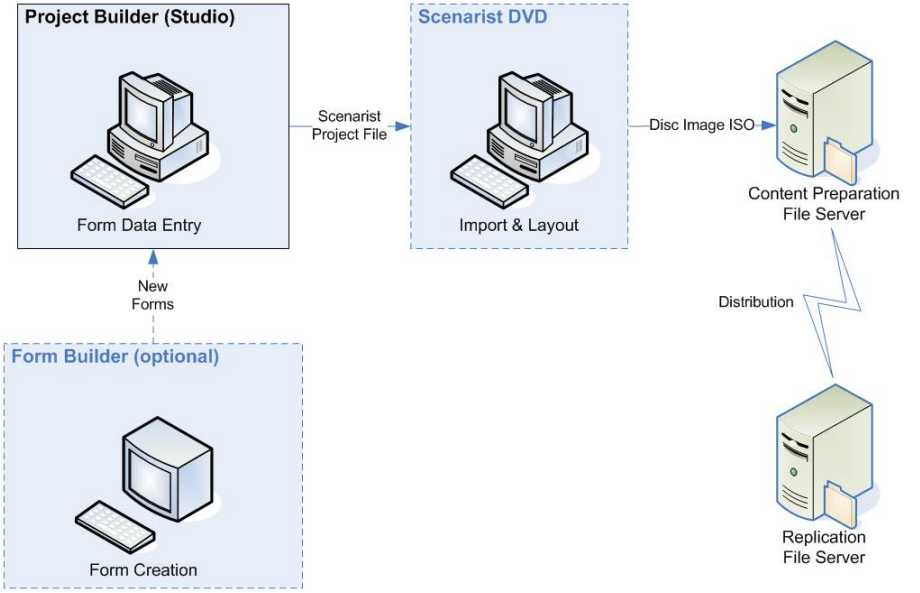
2 Workflow and Work Areas

This chapter documents the basic workflow for form-based DVD authoring in Scenarist Publisher Studio and Professional Editions and provides an overview of the different work areas in the applications. It includes the following topics:

Work Areas

Scenarist Publisher Studio Edition

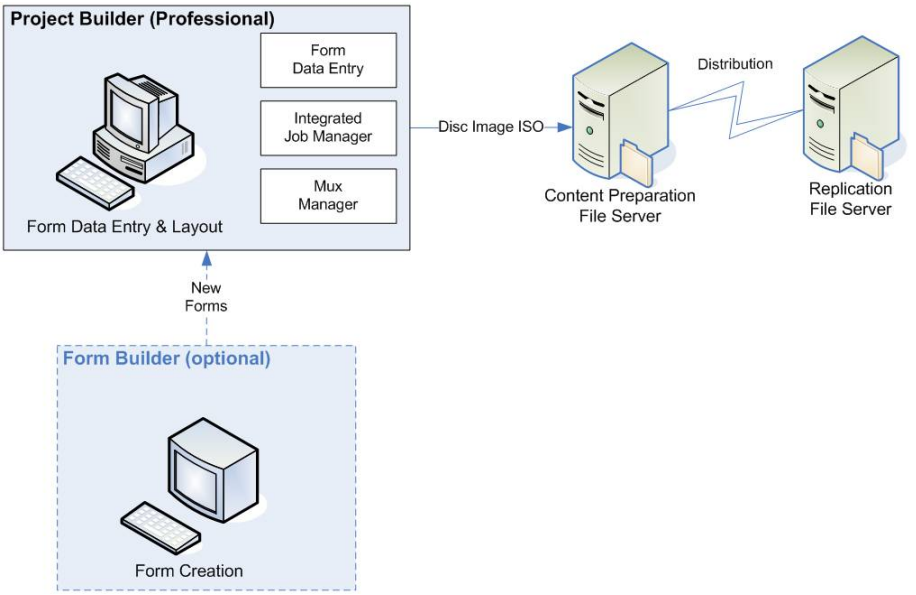
Sonic Scenarist Publisher Studio Edition employs the Project Builder to provide the front-end user interface for working with existing forms to create DVD titles. Once a form has been completed within the Project Builder, it can be imported into Sonic Scenarist to create a DVD.



Work Areas for Scenarist Publisher Studio Edition

Scenarist Publisher Professional Edition

Sonic Scenarist Publisher Professional Edition is composed of two primary applications: the Project Builder and the Multiplex (Mux) Manager. The Project Builder provides the front-end user interface for working with existing forms to create DVD titles. Once a form has been completed within the Project Builder, it is processed by a service called the Mux Manager. The Mux Manager, in turn, processes the job through the steps necessary for multiplexing.



Work Areas for Scenarist Publisher Professional Edition

Workflow

Form-Based Authoring in Scenarist Publisher includes the following steps:

1. Prepare and encode any assets required for the project, including video, audio, still images and subtitles.
2. Select a form from the Project Builder.
3. Fill out the form, specifying project parameters:
   - Disc information, head-build sequence, audio/subtitle options, etc.
   - Location of project assets
4. Form logic generates an authored project file.

Note: Steps 5 and 6 apply to Scenarist Publisher Professional Edition *only*

5. Project Manager submits the job to the Mux Manager for layout.
6. Mux Manager manages the job and performs the following operations:
   - Converts project files to SCN format.
   - Replaces placeholders.
   - Multiplexes projects.
   - Creates disc images.
   - Creates DDP file sets with Plant Direct.

3 Preparing Assets

Before they can be used in Scenarist Publisher, video and audio assets must be encoded using DVD-compliant parameters, and still image assets must be saved in the proper file formats.

This chapter documents the encoding and file requirements for video, audio, and still image assets. It includes the following topics:

Preparing Video Assets

After the number and format of audio tracks is known, it is possible to determine how much bandwidth is left for video (see "The Bit Budget" on page 24). Depending on the length of the video material and the capacity of the disc (for example, 4.7 GB for a single-side single-layer disc), the video bit rate is generally set as high as possible without exceeding the remaining available bandwidth.

The DVD-Video format uses a subset of the MPEG standards, requiring specific image resolutions, frame rates, aspect ratios, and other parameters. Scenarist only lets you import DVD-compliant MPEG files, so when you encode video, you must make sure that you set the parameters correctly. Table 1 lists the encoding requirements for the supported video formats.

Table 1: *Scenarist video stream requirements*

Format		Frame Rate	Frame Size	Aspect Ratio	Encoding Bit Rate	GOP Size
MPEG-1	NTSC (525/6)	29.97 fps	352 x 240	4:3	1.856 Mbps max.	18 frames max.
	PAL (625/50)	25 fps	352 x 288	4:3	1.856 Mbps max.	15 frames max.
MPEG-2	NTSC (525/60)	29.97 fps	720 x 480	4:3,16:9	9.80 Mbps max.	36 fields/ 18 frames max.
	PAL (625/50)	25 fps	720 x 576	4:3,16:9	9.80 Mbps max.	30 fields/ 15 frames max.

The DVD Specification requires that video content within a single volume be set to the same parameters for the following options:

- Format (MPEG-1 or MPEG-2)
- TV system (NTSC or PAL)
- Aspect ratio (4:3 Standard or 16:9 Widescreen)
- Frame size (352 x 240 or 720 x 480 for NTSC; 352 x 288 or 720 x 576 for PAL)

Preparing Assets for Multi-Angle Play

When preparing video assets that will be used for multi-angle play, the following requirements must be observed:

- Each video angle must have the same duration.
- Each video angle must contain the same GOP structure (same number of fields, frames, and pattern of I, B and P-frames).
- Each video angle must contain the same number of GOPs.
- Each video angle must be encoded at the same bit rate.
- Each video angle must be encoded with the same type of bit rate (constant or variable).
- Each video angle must be encoded with closed GOPs.
- If video has been encoded at a constant bit rate, each video angle must have the same vbv_delay initial value.
- The combined bit rate of video, audio, and subpicture data must not exceed 8.0 Mbps per angle stream. This bit-rate ceiling can decrease by as much as 1.2 Mbps as the number of video angles increases.

Preparing Assets for Seamless Play

When preparing video assets that play seamlessly, the following requirements must be observed:

- Each video asset must be encoded at the same bit rate.
- Each video asset must be encoded with the same type of bit rate (constant or variable).

Note: The physical order of video tracks cannot be changed in Scenarist Publisher. To change the physical placement of video tracks on the disc, see the **Sonic Scenarist User Guide**.

Preparing Audio Assets

Supported audio formats in Scenarist include PCM (WAVE and AIFF), MPEG-1 Layer 2 (PAL titles only), Dolby Digital (AC-3), and DTS (Digital Theater System). When preparing audio for DVD-Video titles, you must balance the disc space and audio bandwidth against the video quality and play time. Table 2 lists the encoding requirements for the supported audio formats.

Table 2: *Scenarist audio stream requirements*

Audio Format	NTSC	PAL	Channels	Rate	Bits	Encoding Bit Rate
PCM	yes	yes	Mono	48 kHz	16	.768 Mbps
			Mono	48 kHz	20	.960 Mbps
			Mono	48 kHz	24	1.152 Mbps
			Mono	96 kHz	16	1.536 Mbps
			Mono	96 kHz	20	1.920 Mbps
			Mono	96 kHz	24	2.304 Mbps
			Stereo	48 kHz	16	1.536 Mbps
			Stereo	48 kHz	20	1.920 Mbps
			Stereo	48 kHz	24	2.304 Mbps
			Stereo	96 kHz	16	3.072 Mbps
			Stereo	96 kHz	20	3.840 Mbps
			Stereo	96 kHz	24	4.608 Mbps
MPEG-1 Layer 2	no	yes	Stereo	48 kHz	–	64–384 kbps
Dolby Digital (AC-3)	yes	yes	Stereo	48 kHz	–	192 kbps (228 kbps for extended frequ. response)
			5.1	48 kHz	–	384 kbps or higher (448 kbps recommended)
DTS (Digital Theater System)	yes	yes	5.1	48 kHz	–	768–1536 kbps
			6.1	48 kHz	–	768–1536 kbps

A brief description of the supported audio formats is include below:

PCM Audio Uncompressed audio format, from one to eight channels, recorded with Pulse Code Modulation. The DVD Specification supports PCM sample rates of 48 kHz and 96 kHz with resolutions of 16, 20, or 24 bits. While PCM audio yields higher fidelity than other formats, its higher bit rates (see Table 2 on page 15) leave less available bandwidth for video.

Note: To use PCM audio at a sample rate of 96 kHz, you must have Scenarist Professional.

Note: Although the DVD Specification supports up to 8 channels of PCM audio, currently, there are no DVD players that support multi-channel PCM.

MPEG-1 Layer 2 Audio Perceptual coding system by the Moving Picture Experts Group that delivers compressed two-channel audio. MPEG-1 (along with Dolby Digital) is one of the mandatory audio compression systems for PAL titles.

Dolby Digital (AC-3) Perceptual coding system by Dolby Laboratories that delivers compressed multi-channel audio, in a range of formats, at reduced bit rates with acceptable fidelity. Dolby Digital is perhaps the most common audio format used for DVD-Video, and is the mandatory audio compression system for NTSC titles. It is also (along with MPEG-1) one of the mandatory audio compression systems for PAL titles.

DTS Perceptual coding system by Digital Theater Systems that delivers compressed multi-channel audio in 5.1 and 6.1 formats. DTS was initially developed for theater surround sound but has also been used in consumer systems.

Preparing Still Image Assets

Scenarist supports the following still image file formats and sizes, which can be used for still menus, still shows and slide shows, subpictures, and subtitles.

File Formats	BMP, GIF, JPEG, PICT, PCD (Photo CD), PSD (Photoshop), SGI, TGA (Targa), TIFF, and YUV
NTSC Image Sizes	720 x 480, 704 x 480, 352 x 240
PAL Image Sizes	720 x 576, 704 x 576, 352 x 288

Note: Scenarist does not support LZW-compressed TIFF files.

Note: Still images that are not of the required size are automatically scaled when imported in Scenarist, which can lead to unwanted stretching, shrinking, or artifacts.

Adjusting for Television Overscan

Television monitors are designed to *overscan* the screen area, meaning that the outer 5–10% of the picture on all sides (top, bottom, left and right) is not actually visible to the viewer. The degree of overscan varies depending on the individual television. Overscanning is not a concern for projects intended for viewing only on computer monitors.

To avoid losing important visual information due to overscan, key graphical elements should remain within the Action Safe and Title Safe boundaries, which are described below:

Action Safe Area within which action should be confined to ensure it is visible on most televisions (typically a 5% margin from each edge).

Title Safe Area within which to place a title or graphical element so that none of it falls outside the visible region on most television sets (typically a 10% margin from each edge).

Still Images for 16:9 Widescreen

When creating still images for a 16:9 Widescreen project, special steps are required to ensure that the images are displayed correctly. You should create the images initially at a resolution of 960 x 480 for NTSC and 960 x 576 for PAL. Then, just before importing the image into Scenarist, resize the image to 720 x 480 for NTSC and 720 x 576 for PAL, therefore recreating the anamorphic *squeezing* effect that is performed on widescreen video. When the content is played back, it will be stretched back to its original widescreen aspect ratio.

Preparing a YUV File

YUV image files (images created using the YUV color space, which is used by the NTSC and PAL color video standards) lack the information headers and file extensions that exist in JPEG, TIFF, BMP, and other graphics file formats. Without an information header, Scenarist cannot read a YUV file. However, Scenarist can handle a YUV file if you perform the following steps:

- Add a .yuv extension to the file name.
- Adjust the image size to 720 x 480 for NTSC and 720 x 576 for PAL.

Scenarist supports the YUV color space in the ratio 4:2:0 in the sequence, Y data (luma) followed by U data (color) followed by V data (color). If the original ratio is 4:2:2, it must be converted to 4:2:0 before Scenarist can use it.

Preparing Subpicture Assets

A menu consists of a motion or still video background with a subpicture and highlight layer. When creating a menu subpicture, the following guidelines must be observed:

- Create subpicture images in a graphics program such as Photoshop.
- Use a maximum of four colors.
- Disable anti-aliasing.
- Create subpicture lettering in pure black, red, or blue, where the RGB values are set to 255. The background color should be white.
- Save the subpicture in BMP, GIF, JPEG, PCD (Photo CD), PICT, PSD (Photoshop), SGI, TIFF, TGA (Targa), or YUV format.
- A subpicture can be any size (horizontal and vertical resolution) as long as it is smaller than the video or still image it will overlay.

Note: JPEG compression is a lossy algorithm and is, therefore, not recommended for subpicture assets.

Preparing Subtitle Assets

A subtitle stream is a sequence of subpicture overlays that play over a background video or still image. Subtitles can utilize digital effects such as fade in, fade out, scroll, and wipe.

There are two ways to handle subtitles in Scenarist, either by creating them with Scenarist's built-in subtitle generator, or by preparing them in an another application and then importing them to a scenario. This section provides information on how to prepare subtitle assets outside Scenarist. For detailed information on the subtitle import procedure and how to create subtitles with the subtitle generator, see the **Sonic Scenarist User Guide**.

Use the following guidelines when preparing subtitle assets:

- Create subtitle images in a graphics program such as Photoshop.
- Save subtitle images in BMP, GIF, JPEG, PCD (Photo CD), PICT, PSD (Photoshop), SGI, TIFF, TGA (Targa), or YUV format.
- Use a maximum of four colors.
- Image size should not exceed 720 × 480 (NTSC) or 720 × 576 (PAL) pixels.
- Save the image files for a stream of subtitles in the same format and in the same directory.
- Keep a record of subtitle names, stream numbers, and corresponding start and end timecodes.

Once you have settled on the parameters for your subtitle images, you must name the images, then identify the colors used in them. Refer to the **Sonic Scenarist User Guide** for a description of this procedure.

Naming Subtitle Images

Subtitle names identify the image, its location within the subtitle sequence, and the type of image it is.

Use the following convention for naming subtitle images:

ImageName.subpicture#.ImageFormat

For example, if a motion video clip with the filename Twilight has one subpicture stream, a series of 150 subtitles, and the images have been saved in the TIFF image format, the subtitles would be named:

Twilight.1.tif

Twilight.2.tif

Twilight.3.tif

…and so forth.

The 150th image would be named Twilight.150.tif.

Creating a Subtitle Script File

To determine which subtitle settings to use for a particular sequence of subtitle images, Scenarist looks at a subtitle script file (.sst). You can create the script in any text editor. A typical subtitle script file is shown in Figure 1.

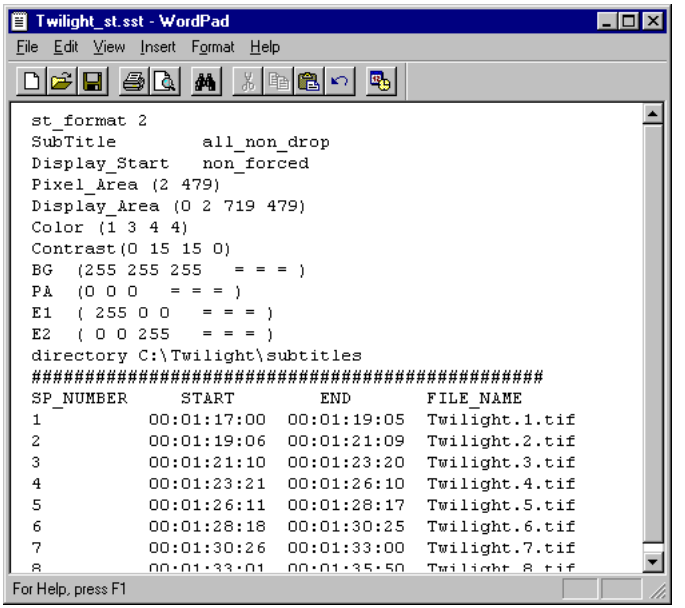


Figure 1: *Subtitle script file format*

Below are the definitions for the script file settings:

st_format The Identifying number of the subtitle data stream. Scenarist supports subtitle format 2 only, which allows you to adjust a subtitle's location.

SubTitle The name of the subtitle data folder as it appears in Data Editor.

Display_Start When set to Forced, the subtitles are always On. When set to Non_Forced, subtitles can switched on and off by the viewer with the remote control.

Pixel_Area The size of the background area for the subtitle image. For NTSC, set to (2 479). For PAL, set to (2 574).

Display_Area The location of the subtitle image within the background area. For NTSC, set to (0 2 719 479). For PAL, set to (0 2 719 574).

Color The color codes for the four colors available for the subtitle images. The numbers range from 1–16 and reference the color number in the current color palette (see the **Sonic Scenarist User Guide**).

Contrast The degree of transparency for the four subtitle colors. The range is 0–15, where 0 is transparent and 15 is opaque.

BG, PA, E1, E2 The RGB color values for Background, Pattern, Emphasis 1 and Emphasis 2.

Directory The path to the subtitle image files. If the directory path is changed after the subtitle script file is created (if the subtitle folder is moved to a new location), Scenarist will not be able to locate the subtitle folder. In that case, you will need to change the directory path in the subtitle script file to the correct path.

Separator The separator line separates the settings from the list of subtitles. You must use at least two # signs in this line.

Subtitle List The actual list of subtitles that Scenarist imports into the subpicture stream. START and END times should not overlap, and subtitles should not cross chapter breaks in the video track.

SP_NUMBER	The number of the subtitle in the subtitle stream.
START	The start time of the subtitle. 00:01:05:00 = hour:minute:second:frame
END	The end time of the subtitle. 00:01:07:05 = hour:minute:second:frame
FILE_NAME	The name of the subtitle image.

The Bit Budget

To determine the bit rates you will use when encoding video and audio, you can calculate the *Bit Budget*.

There are two factors that constrain your choice of bit rates. One factor is the type of disc you will use and, therefore, how many bits are available for each second of the content. The other factor is the maximum bit rate allowed by the DVD-Video format. This is 9.8 MBps (millions of bits per second) and must be divided between the video and audio streams.

This section includes the following topics:

Calculating the Bit Budget

The bit budget calculation produces two values that you must use when encoding video:

- Maximum video bit rate
- Average video bit rate

Since video usually requires the largest bandwidth, the best way to calculate a bit budget is to subtract the audio requirements from the available bandwidth to get the maximum and average video bit rates. The bit rate for audio depends on the number of audio channels and the type of audio.

To calculate the bit budget:

1. Calculate the combined average bit rate for video and audio (see "Media Capacities" on page 26 for DVD disc sizes):

   Disc size: _____ Mbits ÷ Total length of presentation: _____ seconds

   Average bit rate = _____ Mbps

   Note: If you are creating a hybrid DVD, you must reduce the Disc size by the size of the ROM content.

2. Calculate the average video bit rate by subtracting the audio requirements (see Table 2 on page 15 for the bit-rate requirements for different types of audio):

   Average bit rate: _____ Mbps – Audio bit rate: _____ Mbps

   Average video bit rate = _____ Mbps

3. Calculate the maximum video bit rate (for variable bit-rate (VBR) encodes only):

   9.8 MBps – Audio bit rate: _____ Mbps

   Maximum video bit rate = _____ Mbps

See "Sample Bit Budget Calculation" on page 28 for an example of this calculation.

Media Capacities

Scenarist can output projects to a wide variety of media. The choice of media is driven by the project's purpose, length, and budget. Table 3 on page 27 lists the available media and explains how to best use each type.

Refer to the Disc Size in Mbps column when calculating encoding bit rates. When calculating how much data will fit on a DVD-ROM, refer to the Computer Disc Size column.

For hybrid DVDs, subtract the size of the ROM content (in bits) from the Disc Size, then use the resulting value as the disc size in the bit-rate calculation.

Note: The Actual Disc Sizes are somewhat misleading in that they do not follow the conventions used for other digital media. For DVDs, 1 GB is 1,000,000,000 (10^9) bytes, whereas for computers, 1 GB is 1,073,741,824 (2^{30}) bytes. Therefore a 4.7 GB computer hard drive contains about 330 MB more data than a 4.7 GB DVD.

Table 3: *Media capacities*

Media	Actual Disc Size in GB	Computer Disc Size in GB	Disc Size in Megabits (less 4% for headroom)	Program Length in Min.	Usage Notes
DVD-R	3.95 4.7	3.68 4.38	30,336 36,096	100 120	Good for small production runs, test and demo discs. The discs work with most set-top players and DVD-ROM drives. Some replication plants can accept DVD masters on DVD-R discs. 3.95 GB discs seem to be more compatible with older players, but are becoming rare.
DVD-RW	4.7	4.38	36,096	120	Same as DVD-R, but discs are rewritable, like CD-RW.
DVD+RW	4.7 GB	4.38	36,096	120	Same as DVD-RW, but you can overwrite part or all of the existing content, rather like recording on videotape.
DVD-5	4.7	4.38	36,096	120	Mass-produced from a DVD master sent to a replication plant. The discs work with all set-top players and DVD-ROM drives.
DVD-9	8.54	7.95	65,587	240	Singled-sided dual-layer disc mass-produced from two DVD masters sent to a replication plant. Requires two projects, one for each layer. The viewer is not required to turn the disc over to play the second layer.
DVD-10	9.4	8.75	72,192	270	Double-sided disc mass-produced from two DVD masters sent to a replication plant. Requires two projects, one for each side. The viewer must turn the disc over to play the other side.
DVD-RAM	4.7 5.2	4.38 4.84	36,096 39,936	120 140	Can be used only in computers with DVD-RAM drives, although set-top players may become available in the future. 5.2 GB discs are double-sided (2.6 GB per side). A project must fit on one side; to use both sides you need two projects.
CD-R/RW	682 MB 734 MB	650 MB 700 MB	5,238 5,637	15 18	Suitable for very short projects. Playable on almost all computers with a DVD-ROM or CD-ROM drive.

Sample Bit Budget Calculation

If you have a 100-minute (6000-second) presentation with Dolby Digital stereo audio and you want to write it to a DVD-5 disc, here's how you determine the bit budget:

1. Calculate the average bit rate for both video and audio:

   Disc size: 36096 Mbits ÷ Total length of presentation: 6000 seconds

   Average bit rate = 6.0 Mbps

2. Calculate the average video bit rate by subtracting the audio requirements:

   Average bit rate: 6.0 Mbps – Audio bit rate: 0.192 Mbps

   Average video bit rate = 5.808 Mbps

3. Calculate the maximum video bit rate:

   9.8 MBps – Audio bit rate: 0.192 Mbps

   Maximum video bit rate = 9.608 Mbps

Note: Although in this case you could set the maximum video bit rate to 9.608 Mbps, it is recommended that you always set the maximum to less than or equal to 9.0 MBps.

4 Building Projects

This chapter provides an overview of form-based DVD authoring in Scenarist Publisher Studio and Professional Editions, and describes the user interface for building projects. It includes the following topics:

Form-Based DVD Authoring

Scenarist Publisher Studio and Professional Editions are form-based authoring systems that enable users to quickly and effectively manage the data needed to build DVD projects. The interface for both systems was created as a simple, easy-to-understand tool for entering project information, such as the type of disc, number of elementary streams, chapter stops, region encoding, etc.

The design of the user interface is intended to guide users of all skill levels easily through inputting DVD project information, regardless of whether or not they have a technical background in DVD production. As new forms are created for various types of discs, the user interface may be easily adapted to display relevant fields. Once all Project Builder information has been entered, the form's built-in logic validates the data and creates an authored script file, which, in the case of Scenarist Publisher Professional Edition, is then submitted to the Mux Manager for layout.

Project Builder Features

Feature	Description
Form-based Data Entry	Designed for simple and efficient data-entry
Dynamic User Interface	Forms and input fields are adjustable for new DVD projects
Full DVD Feature Support	Supports all DVD functions compatible with Sonic Scenarist
Output to Scenarist Project File	Outputs project files that can be opened by Sonic Scenarist
Reduced User Operations	Fewer operations and faster cycle times than normal authoring—thus fewer errors with greater efficiency

Building a Project

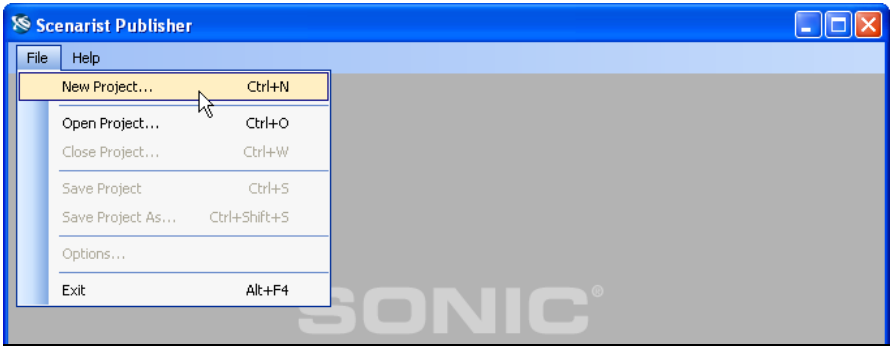
To run Scenarist Publisher Studio or Professional Editions, you will need:

- Scenarist Publisher Studio or Professional Edition software
- Sonic security dongle and corresponding activation code
- A prepared project form file (.JTD) to use for data entry

Note: The security dongle must be plugged into your USB port to operate Scenarist Publisher.

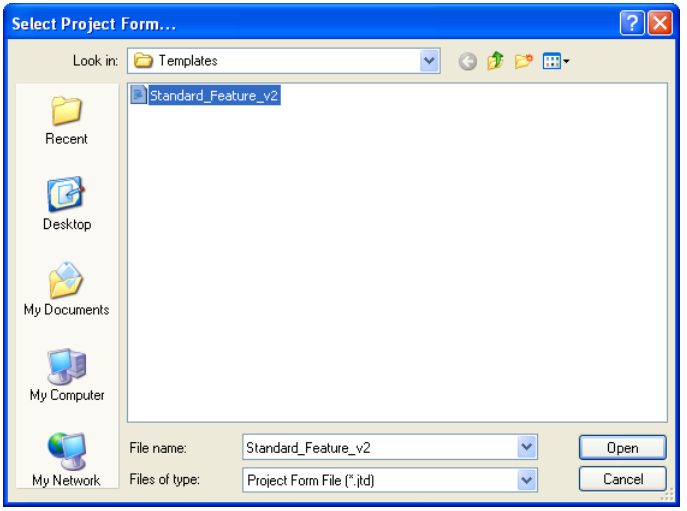
1 Upon launching Scenarist Publisher Studio Edition or Professional Edition and successfully inputting the activation code, a splash screen will announce whether Studio or Professional Edition is operating on your machine.

2 To select a form file for your new project, click **File** within the Project Builder toolbar and select **New Project...**

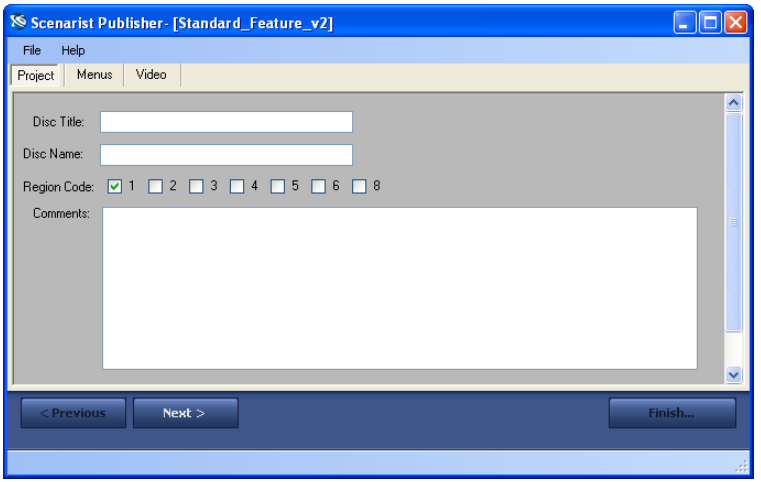


Note: You may also open a saved project (PPJ format) from the Project Builder toolbar by selecting **Open Project...**. If you are currently running Scenarist Publisher Professional Edition, please see "Options (for Professional Edition only)" on page 37 for details on the **Options...** menu item.

3 From the browsing window that appears, select the appropriate form file for your project.

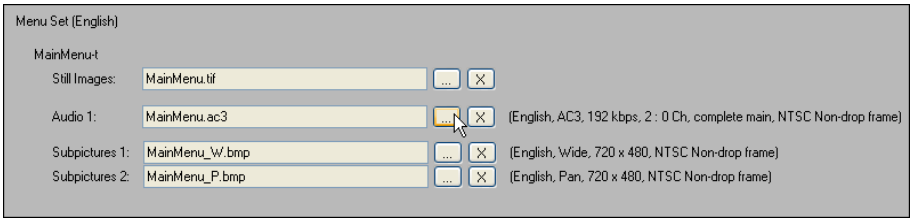


4 Complete the form by filling out empty fields and browsing to assets prepared for the project (which could include video, audio, still images and subtitle data). You may toggle between data sections (e.g. Project, Menus, Video, etc.) by either selecting them from the gray toolbar or clicking the "< Previous" and "Next >" buttons.

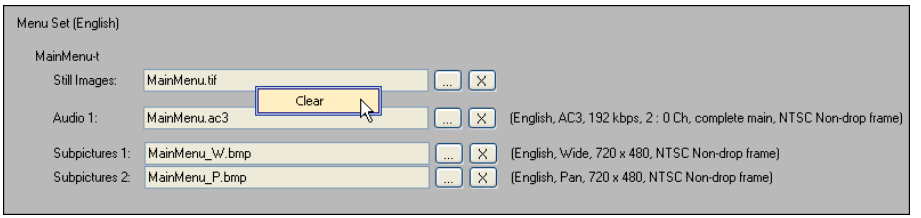


5 Within any data section (e.g. Project, Menus, Video, etc.) that requires browsing to an asset, click the button corresponding to [...] located to the right of the empty field. You will be prompted to select an asset from the **Select File** window that appears

Tip: For slide shows and still shows, you may select more than one still image by holding down the Ctrl button while selecting items in the open file dialog box with your mouse..



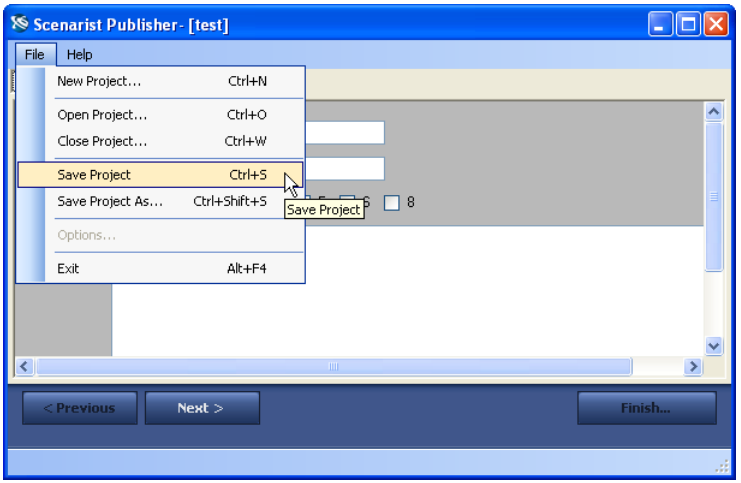
To delete an asset that has already been selected, right-click the asset's name and select **Clear** or click the [x] button corresponding to the asset's input box.



When editing a project's video assets, audio assets and subtitles/subpictures, the form will display additional information. Located on the right-hand side of each video, audio and subpicture/subtitle file selector, the additional "labels" provide specific details about the asset being replaced (e.g. language, aspect ratio, size, timecode type, etc.). When running the form in Scenarist Publisher, you must verify that selected assets match the configuration parameters indicated by the displayed labels.

If an asset is available for replacement in the form, and you opt *not* to select a replacement, the original asset reference will be used.

6 To save the project at any time, click **File** within the Project Builder toolbar and select **Save Project** or **Save Project As...**. The project will be saved as a Publisher Project File (.PPJ) once a filename and destination directory are specified.



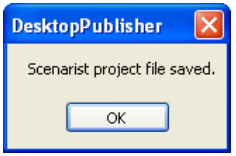
Note: **Save Project** defaults to **Save Project As...** the first time that the project is saved.

7 To finish the project, complete all required fields and click the **Finish...** button. The **Finish...** button will not become active until you have toggled to the final data section.

8 In the browsing window that appears, select your destination directory and input the filename for your project file. The project file will be saved as an SCP file (SCP is the project file format recognized by Sonic Scenarist).

In addition to the SCP file, a log file with the same name will be saved to the destination directory. If errors are encountered during the process, they will generally be reported within the log file.

Note: Users of Scenarist Publisher Studio Edition will receive confirmation after the file has been saved successfully.

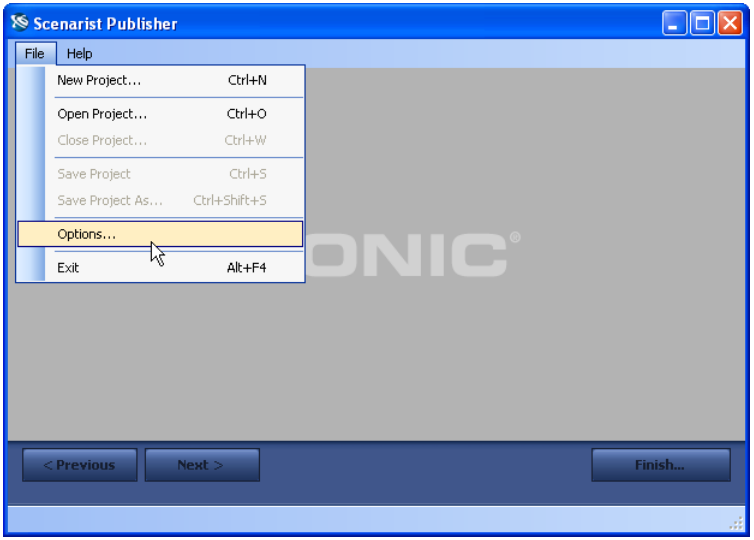


Stop! For users of Scenarist Publisher Studio Edition, your project is now complete. You may import the SCP file into Sonic Scenarist for layout, content preparation and distribution. If you are currently running Scenarist Publisher Professional Edition, please continue reading. See “Options (for Professional Edition only)” on page 37 and “Mux Manager (for Professional Edition only)” on page 38.

Options (for Professional Edition only)

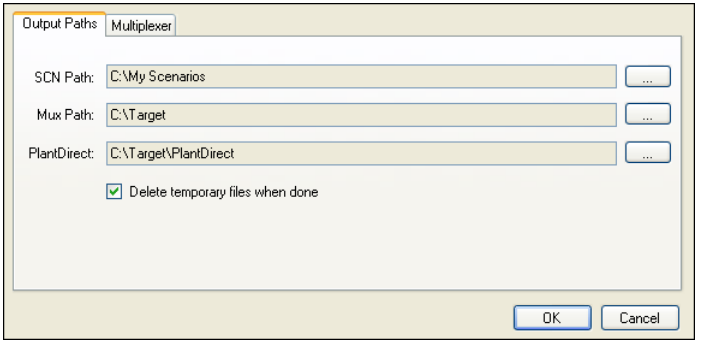
Note: The **Options...** menu item is only available in Scenarist Publisher Professional Edition.

1 To view or change options for your project, click **File** within the Project Builder toolbar and select **Options...**

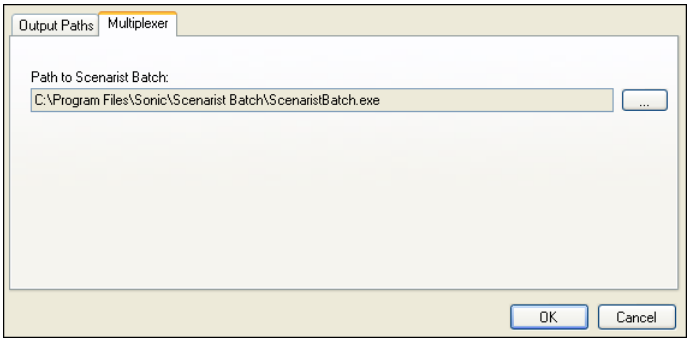


2 In the window that appears, you may change the default output paths for SCN, Mux and Plant Direct; choose to delete temporary files after the muxing process; and change the default path to Scenarist Batch (the multiplexing engine).

Output Paths:



Path to Scenarist Batch (for multiplexing):



Mux Manager (for Professional Edition only)

Note: The Mux Manager is only available in Scenarist Publisher Professional Edition.

The Mux Manager manages the job once the SCP file has been created and performs the following operations:

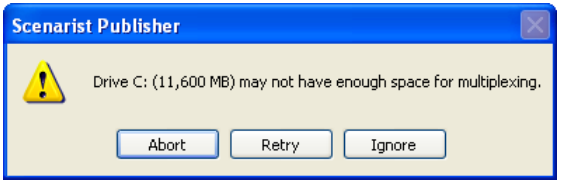
- Converts project files to SCN format.
- Replaces placeholders.

- Multiplexes projects.
- Creates disc images.
- Creates DDP file sets with Plant Direct.

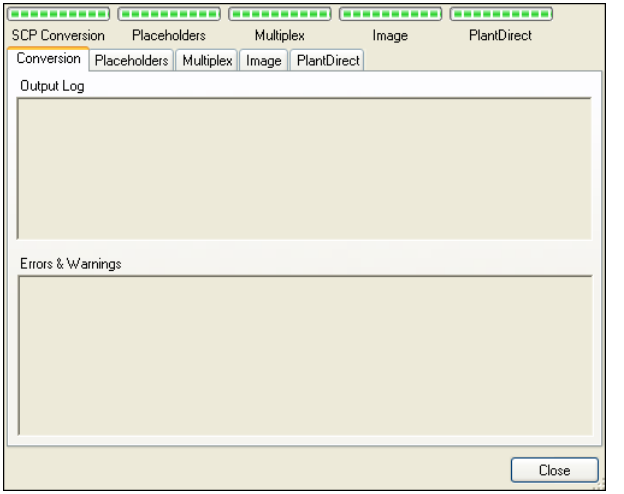
The following steps outline the muxing process:

1 Once the SCP file has been saved, Scenarist Publisher will automatically launch the Mux Manager.

Note: Scenarist Publisher Professional Edition checks available space on the C: drive before muxing. It compares the available space to a project's *maximum possible* size. In the event that the available space is less than a project's maximum possible size, the alert "You may not have enough space" is displayed on the screen.



2 If there is enough space on the C: drive for the project, the mux window will appear and muxing will commence. A status bar displays progress for each stage of the process.



During the muxing process, a log file is generated and saved to its target directory. Additionally, the SCN, placeholder, multiplex, image and Plant Direct (DDP) files are saved to the output paths specified under **Options**....

Note: The **Cancel** button becomes active during muxing, whereas the **Close** button activates once muxing has completed.

A Video Standards and DVD Regions

This appendix documents the TV systems used in most countries and territories. You can use it to decide which TV standard to use when encoding video files and creating a project. It includes the following topics:

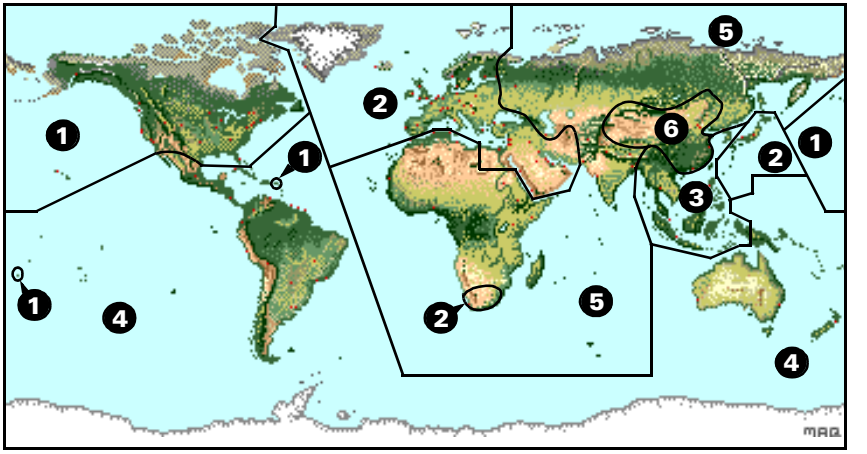
Television Video Standards

Countries use different video standards for television broadcasts. The United States, Japan, and several other countries use the NTSC standard; the rest of the world uses PAL (or SECAM, which is very similar to PAL). NTSC video uses 525 scan lines at 29.97 frames/59.94 fields per second; PAL video uses 625 scan lines at 25 frames/50 fields per second.

NTSC DVD players usually cannot play PAL discs, whereas most PAL DVD players and all software players can play both formats. DVD and VCD discs can contain either NTSC or PAL video, but not both.

DVD Regions

The DVD Forum Committee divides the world into six DVD regions, and specifies one transnational region (8) for such applications as in-flight entertainment. DVD players sold in one region are set for playback in that region only, to discourage DVD piracy.



DVD regions

Video Standards and DVD Regions for Countries/Territories

Table 1 lists the DVD regions and television video standards for the world's countries/territories. It is recommend that you always check which television standard is currently in use for the target countries before beginning a project. This information is provided in good faith and believed to be correct at the time of printing, but Sonic cannot be held responsible for errors or omissions.

Note: If a country is listed as using both video standards, it means that both systems are used in different areas. For example, Greenland uses PAL except on U.S. military bases.

Note: Brazil and Laos use both NTSC and PAL-M, a video standard that uses 525 scan lines at 59.94 fields per second, the same as NTSC. When creating projects for Brazil and Laos, use NTSC.

Table 1: *DVD regions and TV systems*

Country/Territory	DVD Region	Television Video Standard
Afghanistan	5	PAL
Albania	2	PAL
Algeria	5	PAL
Andorra	2	PAL
Angola	5	PAL
Anguilla	4	NTSC
Antigua and Barbuda	4	NTSC
Argentina	4	PAL
Armenia	5	PAL
Aruba	4	NTSC
Australia	4	PAL

Table 1: *DVD regions and TV systems*

Country/Territory	DVD Region	Television Video Standard
Austria	2	PAL
Azerbaijan	5	PAL
Bahamas	4	NTSC
Bahrain	2	PAL
Bangladesh	5	PAL
Barbados	4	NTSC
Belarus	5	PAL
Belgium	2	PAL
Belize	4	NTSC
Benin	5	PAL
Bermuda	1	NTSC
Bhutan	5	PAL
Bolivia	4	NTSC
Bosnia	2	PAL
Botswana	5	PAL
Brazil	4	NTSC/PAL-M
British Indian Ocean Territory	5	NTSC
Brunei	3	PAL
Bulgaria	2	PAL
Burkina Faso	5	PAL
Burundi	5	PAL
Cambodia	3	PAL
Cameroon	5	PAL
Canada	1	NTSC

Table 1: *DVD regions and TV systems*

Country/Territory	DVD Region	Television Video Standard
Cape Verde	5	PAL
Cayman Islands	4	NTSC
Central African Republic	5	PAL
Chad	5	PAL
Chile	4	NTSC
China	6	PAL
Colombia	4	NTSC
Comoros	5	PAL
Congo, Democratic Republic of (formerly Zaire)	5	PAL
Congo, Republic of	5	PAL
Cook Islands	4	PAL
Costa Rica	4	NTSC
Croatia	2	PAL
Cuba	4	NTSC
Cyprus	2	PAL
Czech Republic	2	PAL
Denmark	2	PAL
Djibouti	5	PAL
Dominica	4	NTSC
Dominican Republic	4	NTSC
East Timor	3	PAL
Ecuador	4	NTSC
Egypt	2	PAL

Table 1: *DVD regions and TV systems*

Country/Territory	DVD Region	Television Video Standard
El Salvador	4	NTSC
Equatorial Guinea	5	PAL
Eritrea	5	PAL
Estonia	5	PAL
Ethiopia	5	PAL
Falkland Islands (Malvinas)	4	PAL
Faroe Islands	2	PAL
Fiji	4	PAL
Finland	2	PAL
France	2	PAL
France (Metropolitan)	4	PAL
Gabon	5	PAL
Gambia	5	PAL
Georgia	5	PAL
Germany	2	PAL
Ghana	5	PAL
Gibraltar	2	PAL
Greece	2	PAL
Greenland	2	NTSC/PAL
Grenada	4	NTSC
Guadeloupe	4	PAL
Guam	4	NTSC
Guatemala	4	NTSC
Guiana (French)	4	PAL

Table 1: *DVD regions and TV systems*

Country/Territory	DVD Region	Television Video Standard
Guinea	5	PAL
Guinea-Bissau	5	PAL
Guyana	4	NTSC
Haiti	4	NTSC
Honduras	4	NTSC
Hong Kong	3	PAL
Hungary	2	PAL
Iceland	2	PAL
India	5	PAL
Indonesia	3	PAL
Iran	2	PAL
Iraq	2	PAL
Ireland	2	PAL
Israel	2	PAL
Italy	2	PAL
Ivory Coast (Côte d'Ivoire)	5	PAL
Jamaica	4	NTSC
Japan	2	NTSC
Jordan	2	PAL
Kazakhstan	5	PAL
Kenya	5	PAL
Kiribati	4	PAL
Korea (North)	5	PAL
Korea (South)	3	NTSC

Table 1: *DVD regions and TV systems*

Country/Territory	DVD Region	Television Video Standard
Kuwait	2	PAL
Kyrgyzstan	5	PAL
Laos	3	NTSC/PAL-M
Latvia	5	PAL
Lebanon	2	PAL
Lesotho	2	PAL
Liberia	5	PAL
Libya	5	PAL
Liechtenstein	2	PAL
Luxembourg	2	PAL
Macau	3	PAL
Macedonia	2	PAL
Madagasgar	5	PAL
Malawi	5	PAL
Malaysia	3	PAL
Maldives	5	PAL
Mali	5	PAL
Malta	2	PAL
Marshall Islands	4	NTSC
Martinique	4	PAL
Mauritania	5	PAL
Mauritius	5	PAL
Mayotte	5	PAL
Mexico	4	NTSC

Table 1: *DVD regions and TV systems*

Country/Territory	DVD Region	Television Video Standard
Micronesia	4	NTSC
Moldova	5	PAL
Monaco	2	PAL
Mongolia	5	PAL
Montserrat	4	PAL
Morocco	5	PAL
Mozambique	5	PAL
Myanmar (Burma)	3	NTSC
Namibia	5	PAL
Nauru	4	PAL
Nepal	5	PAL
Netherlands (Holland)	2	PAL
Netherlands Antilles	4	NTSC
New Caledonia	4	PAL
New Zealand	4	PAL
Nicaragua	4	NTSC
Niger	5	PAL
Nigeria	5	PAL
Niue	4	PAL
Northern Mariana Islands	4	NTSC
Norway	2	PAL
Oman	2	PAL
Pakistan	5	PAL
Palau	4	NTSC

Table 1: *DVD regions and TV systems*

Country/Territory	DVD Region	Television Video Standard
Panama	4	NTSC
Papua New Guinea	4	PAL
Paraguay	4	PAL
Peru	4	NTSC
Philippines	3	NTSC
Pitcairn Islands	4	PAL
Poland	2	PAL
Polynesia (French)	4	PAL
Portugal	2	PAL
Puerto Rico	1	NTSC
Qatar	2	PAL
Réunion	5	PAL
Romania	2	PAL
Russia	5	PAL
Rwanda	5	PAL
Samoa (American)	1	NTSC
Samoa (Western)	4	PAL
San Marino	2	PAL
São Tomé and Principe	5	PAL
Saudi Arabia	2	PAL
Senegal	5	PAL
Seychelles	5	PAL
Sierra Leone	5	PAL
Singapore	3	PAL

Table 1: *DVD regions and TV systems*

Country/Territory	DVD Region	Television Video Standard
Slovakia	2	PAL
Slovenia	2	PAL
Solomon Islands	4	PAL
Somalia	5	PAL
South Africa	2	PAL
South Georgia and the South Sandwich Islands	4	PAL?
Spain	2	PAL
Sri Lanka	5	PAL
St. Helena	5	PAL
St. Kitts and Nevis	4	NTSC
St. Lucia	4	NTSC
St. Pierre and Miquelon	1	PAL
St. Vincent and the Grenadines	4	NTSC
Sudan	5	PAL
Suriname	4	NTSC
Svalbard (Spitzbergen)	2	PAL
Swaziland	2	PAL
Sweden	2	PAL
Switzerland	2	PAL
Syria	2	PAL
Taiwan	3	NTSC
Tajikistan	5	PAL
Tanzania	5	PAL

Table 1: *DVD regions and TV systems*

Country/Territory	DVD Region	Television Video Standard
Thailand	3	PAL
Togo	5	PAL
Tokelau	4	PAL
Tonga	4	NTSC
Trinidad and Tobago	4	NTSC
Tunisia	5	PAL
Turkey	2	PAL
Turkmenistan	5	PAL
Turks and Caicos Islands	4	NTSC
Tuvalu	4	PAL?
Uganda	5	PAL
Ukraine	5	PAL
United Arab Emirates	2	PAL
United Kingdom	2	PAL
United States	1	NTSC
Uruguay	4	PAL
Uzbekistan	5	PAL
Vanuatu	4	PAL
Venezuela	4	NTSC
Vietnam	3	PAL

Table 1: *DVD regions and TV systems*

Country/Territory	DVD Region	Television Video Standard
Virgin Islands (American)	1	NTSC
Virgin Islands (British)	4	NTSC
Wallis and Futuna Islands	4	PAL
Western Sahara	5	PAL
Yemen	2	PAL
Yugoslavia (Serbia, Montenegro, Kosovo)	2	PAL
Zambia	5	PAL
Zimbabwe	5	PAL

B Video Compression

This appendix provides a brief explanation of digital video and how the MPEG algorithm compresses digital video. It includes the following topics:

Note: Digital video compression is a highly complicated process and it is beyond the scope of this user guide to provide a full explanation.

Digital Video Components

This section documents the following digital video components:

Frame Rate

Frame rate is the number of frames that display per second. There are different standards for different regions of the world. North America and Japan use NTSC, which is 30 frames per second (film is 24 frames per second); Europe and some parts of Asia use PAL, which is 25 frames per second. When encoding video, you must specify whether the material is NTSC or PAL so that the correct number of frames are processed.

Resolution

Screen resolution is the size of the picture. There are different standards for different regions of the world. NTSC countries display video at 720 × 480 and PAL countries have a slightly larger display with 720 × 576. It is important that you specify the correct resolution when encoding video.

Color Space

A color space is a mathematical representation of a set of colors. There are three main color models:

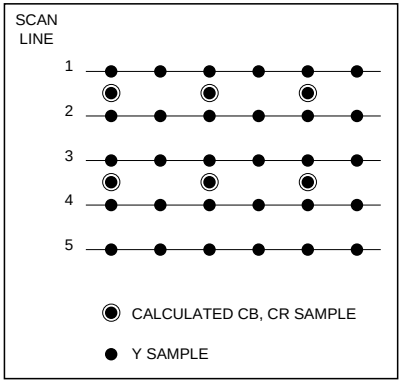
- RGB (used in color computer graphics and color television)
- YIQ, YUV, and YCbCr (used in broadcast and television systems)
- CMYK (used in color printing)

When working with computer graphics, you are only concerned with RGB and YCbCr. Computer monitors display *RGB* (red-green-blue) color; where every color is a mixture of red, green, and blue. YCbCr is the standard for DVD video and is somewhat more complicated.

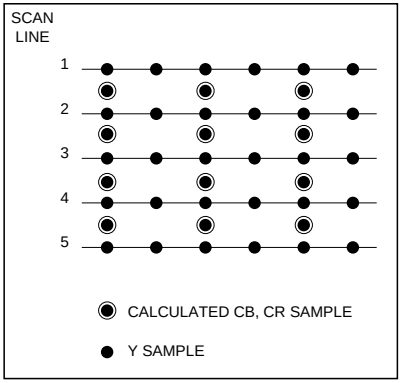
YCbCr is the color space defined by Recommendation ITU-R BT.601 (formerly know as CCIR-601), where Y is the luminance component and Cb and Cr are the chrominance (color difference) components. When encoding with MPEG-2, the 4:2:2 digital video signal is sub-sampled down to 4:2:0.

4:2:2 YCbCr means that Y has been sampled at 13.5 MHz, while Cb and Cr were each sampled at 6.75 MHz. Thus, for every two samples of Y, there is one sample each of Cb and Cr. 4:2:0 YCbCr means that Y has been sampled at 13.5 MHz, while Cb and Cr were each sampled at 6.75 MHz. Thus, for every four samples of Y, there is one sample each of Cb and Cr.

The difference between 4:2:2 and 4:2:0 is their method of vertical sampling. 4:2:0 YCbCr samples every other line vertically (between lines 1 and 2, skips the space between lines 2 and 3, and then samples again between lines 3 and 4):



4:2:2 YCbCr, on the other hand, samples every line vertically:



Note: The 4:2:2 and 4:2:0 numbers refer to the amount of color data shared between groups of four pixels. YCbCr video does not provide as much flexibility as RGB in determining exactly what color each pixel is. YCbCr does, however, provide a lot of colors with fewer bytes required for each pixel (two bytes per pixel for YCbCr, three bytes per pixel for RGB, a 30% reduction in data size).

Image Quality

The encoder's ultimate objective is compressed video that looks as close to the source as possible. For DVD, this is full screen (720 × 480 for NTSC and 720 × 576 for PAL), full frame rate video (24 or 30 frames per second), at 24 bits per pixel (16.7 million colors). Image quality should be the factor that you consider most. Go with what looks best and meets the data storage and transmission requirements.

Factors Affecting Video Compression

Determining compression needs requires an understanding of how video factors (see "Digital Video Components" on page 56) affect encoding results. Generally, there is a price to pay for quality. With more colors, higher resolution, faster frame rates, and better quality, the more horsepower you will need and the more storage space your video will require. By adjusting these factors, you can dramatically change the digital video compression requirements.

Filtering video noise and removing frame redundancy are two areas in which the source video can be improved or modified to make compression more successful. This section includes the following topics:

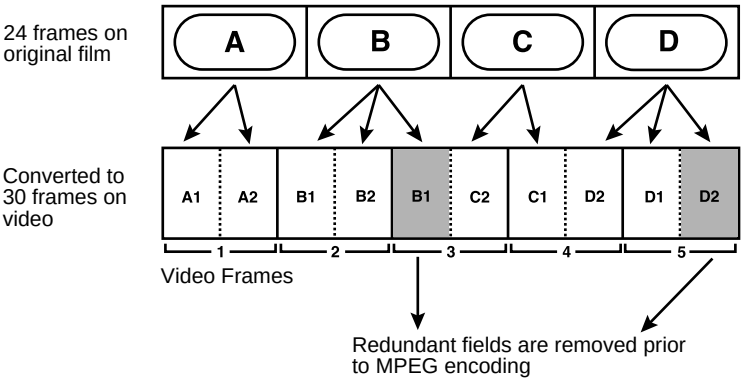
Prefiltering

Noise in video streams is basically random information. Since MPEG-2 is based on detecting similar information between frames, noise represents a problem because it can be totally random on a frame-by-frame basis. Noise can come in the form of grainy film, dust, snow, or extremely detailed textures such as a white stucco wall or a waterfall. By applying a digital noise reducer or low-pass filter prior to encoding, high-energy noise can be reduced, resulting in a video stream with less random information that is easier to encode.

Inverse Telecine

Frame redundancy is an area in which preparation prior to encoding can improve the resulting MPEG-2 video. When film (24 fps) is transferred to NTSC video (30 fps), fields must be added to bring the 24 fps material up to 30 fps. This is done by duplicating fields and is called the *telecine* process.

During the telecine process, individual frames of film are duplicated at regular intervals during the 3:2 pull-down process. Two fields derived from film frame A are followed by three fields from film frame B, and so forth, and two video fields are derived from each frame of film. The ordering of fields is alternated, resulting in a unique pattern that repeats every five video frames.



MPEG-2 decoders, such as those on DVD players, have the ability to function with 24 fps MPEG video streams, turning them back into 29.97 video on output. This unique property of converting 24 fps MPEG-2 video back into 29.97 video means that before encoding, 29.97 video can be turned back into the original 24 fps film frame sequence. This removal, called *inverse telecine*, has several benefits: it eliminates redundant fields, allowing the compression system to allocate more bits to the remaining unique frames, and eliminates encoding artifacts resulting from motion between fields in a single frame.

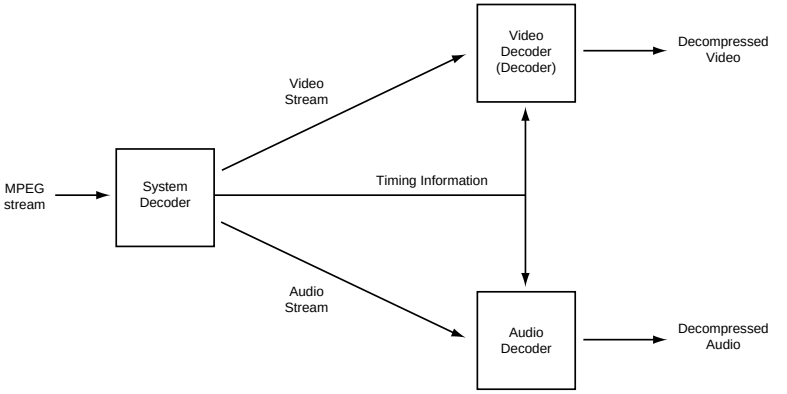
MPEG Overview

MPEG is the compression standard endorsed by the DVD Forum. This section provides an overview of MPEG video compression and includes the following topics:

- "MPEG Stream Structure" on page 62
- "MPEG Compression Schemes" on page 66

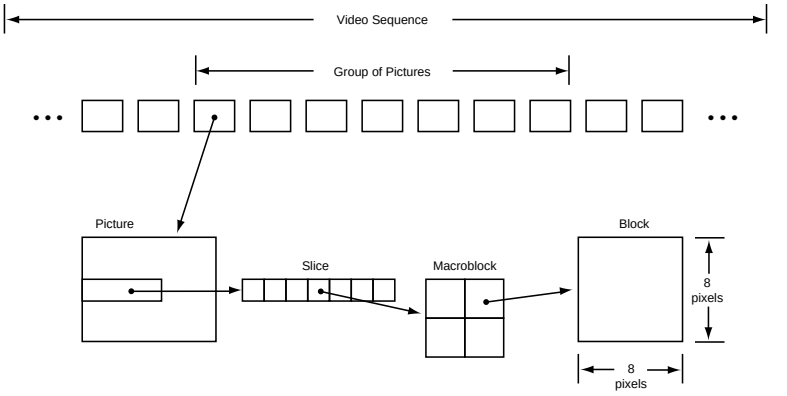
MPEG Stream Structure

When an MPEG stream is played back or decoded, the system decoder extracts the timing information from the MPEG stream and sends it to the other system components:



Video Stream Data Hierarchy

Within the MPEG stream structure, there is a hierarchy of data structures:



Video Sequence Consists of a sequence header, one or more groups of pictures, and an end-of-sequence code. The video sequence is another term for video stream.

Group of Pictures An optional syntax layer in the MPEG specification that divides series of pictures along I-picture boundaries. It is defined to aid random access within an MPEG stream. An I-picture always starts a GOP but there can be more than one I-picture in a GOP.

Picture The primary coding sequence of a video sequence. A picture consists of three rectangular matrices representing luminance (Y) and two chrominance (CbCr) values. The Y matrix has an even number of rows and columns. The Cb and Cr matrices are half the size of the Y matrix in each direction (horizontal and vertical).

Note: MPEG terminology uses "picture" rather than "frame" because a picture can be one or more fields (every frame consists of two fields).

Figure 1 shows the relative x-y locations of the luminance and chrominance components. For every four luminance values, there are two associated chrominance values: one Cb value and one Cr value. The location of the Cb and Cr values is the same, so only one circle is shown in Figure 1.

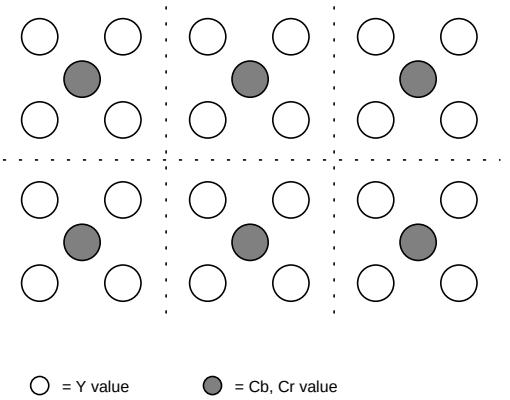


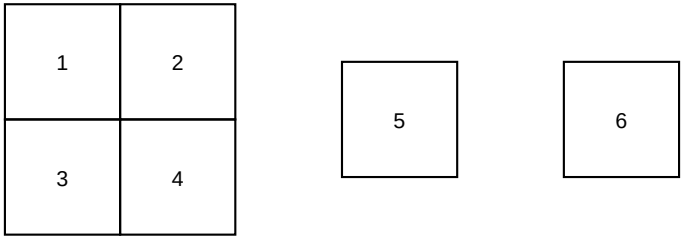
Figure 1: *Luminance and chrominance*

There are three picture types: I, P, and B (see “Interframe Compression” on page 66).

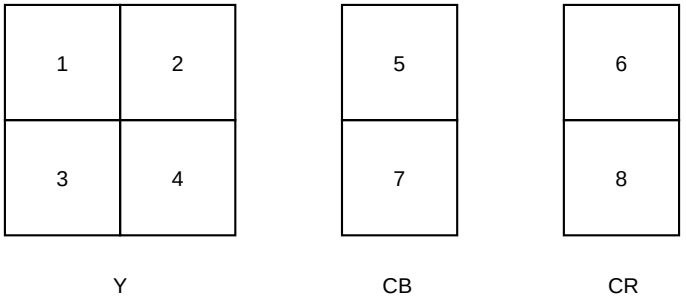
Slice One or more contiguous macroblocks. The order of the macroblocks within a slice is from left to right and top to bottom. Slices are important in the handling of errors. If the bitstream contains an error, the decoder can skip to the start of the next slice. Having more slices in the bitstream allows better error concealment, though uses bits that could otherwise be used to improve picture quality.

Macroblock Three types of macroblocks are available with MPEG-2:

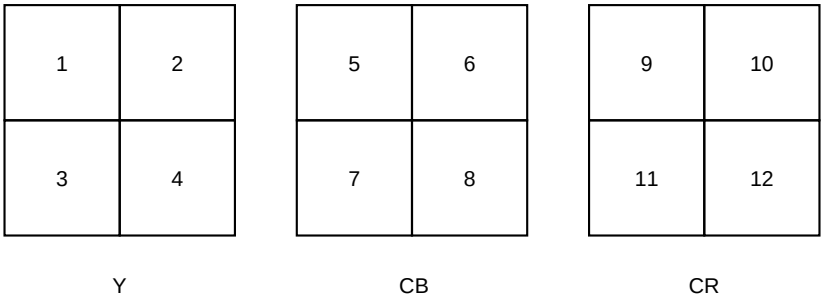
- The 4:2:0 macroblock consists of four Y blocks, one Cb block, and one Cr block:



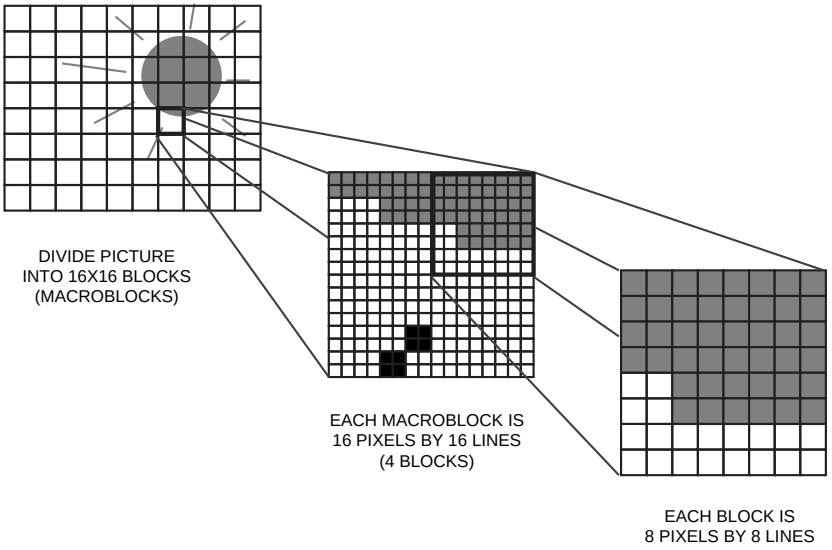
- The 4:2:2 macroblock consists of four Y blocks, two Cb blocks, and two Cr blocks:



- The 4:4:4 macroblock consists of four Y blocks, four Cb blocks, and four Cr blocks.



Block Each macroblock is comprised of four blocks:



MPEG Compression Schemes

The MPEG algorithm uses two main compression strategies: interframe and intraframe.

Interframe Compression

Much of the information in a picture within a video sequence is similar to information in a previous or subsequent picture. The MPEG standard takes advantage of this temporal redundancy to represent some pictures in terms of their differences from a reference picture. This section describes the picture types and explains the techniques used in *interframe* compression.

Picture Types The MPEG specification defines three types of pictures:

- I-pictures (Intra-pictures), coded using only information present in the picture itself. I-pictures provide random access points into the compressed video data. I-pictures typically use about 2 bits per coded pixel.
- P-pictures (Predicted pictures), coded with respect to the nearest previous I- or P-pictures. This technique is called forward prediction and is illustrated in Figure 2. Predicted pictures provide more compression and serve as a reference for B-pictures and future P-pictures.

- B-pictures (Bidirectional pictures), use both past and future pictures as a reference. This technique is called bidirectional prediction and is illustrated in Figure 2.

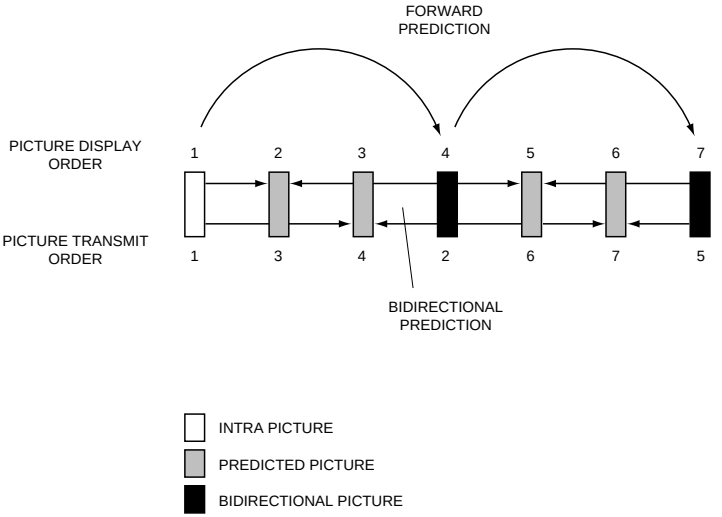
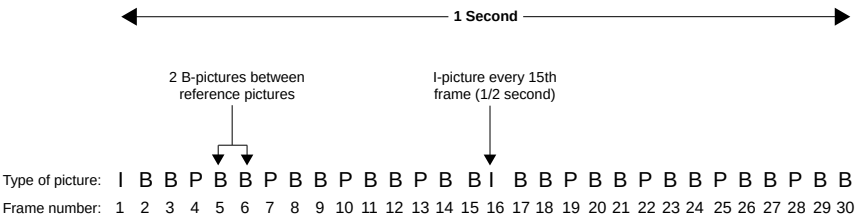


Figure 2: *Forward and bidirectional prediction*

Group of Pictures A group of pictures (or GOP) typically has 15 pictures in the following order: I-B-B-P-B-B-P-B-B-P-B-B-P-B-B-I. 15 represents the interval at which I-pictures repeat.



When encoding video, you can usually adjust the size of GOPs depending on storage requirements, thereby affecting the placement of I-pictures and the location of scene cuts.

Motion Compensation Within a scene, much of the display information remains the same from frame to frame. The only difference between Frame 1 and Frame 2 in Figure 3 is the counter that changes from :01 to :02. Much of the information needed to draw the pixels for Frame 2, therefore, can be eliminated. It can simply refer to Frame 1 and contain the information needed to draw the single pixel that changed between the two frames. Frames that reference other frames are called *P-pictures* and *B-pictures*.

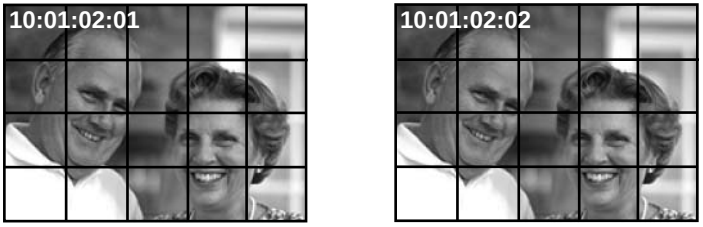


Figure 3: *Frame-by-frame changes*

Intraframe Compression

While interframe compression reduces redundancy between pictures, *intraframe* compression reduces redundancy within one picture. Intraframe encoding includes the following three steps:

Discrete Cosine Transformation (DCT) Both image blocks and prediction-error blocks have high spatial redundancy. To reduce this redundancy, the MPEG algorithm transforms 8×8 blocks of pixels or 8×8 blocks of error terms to the frequency domain with the Discrete Cosine Transform (DCT).

Quantization The MPEG algorithm quantizes frequency coefficients. Quantization is the process of approximating each frequency coefficient as one of a limited number of allowed values. The encoder chooses a quantization matrix that determines how each frequency coefficient in the 8×8 block is quantized. Human perception of quantization error is lower for high spatial frequencies, so high frequencies are typically quantized more coarsely (with fewer allowed values) than low frequencies.

Run-Length Encoding The combination of DCT and quantization results in many of the frequency coefficients being zero, especially the coefficients for high spatial frequencies. To take maximum advantage of this, the coefficients are organized in a zig-zag order to produce long runs of zeros.

The coefficients are then converted to a series of run-amplitude pairs, each pair indicating a number of zero coefficients and the amplitude of a non-zero coefficient. These run-amplitude pairs are then coded with a variable-length code, which uses shorter codes for commonly occurring pairs and longer codes for less common pairs.

Some blocks of pixels need to be coded more accurately than others. For example, blocks with smooth intensity gradients need accurate coding to avoid visible block boundaries. To deal with this inequality between blocks, the MPEG algorithm allows the amount of quantization to be modified for each 16×16 block of pixels. This mechanism can also be used to provide smooth adaptation to a particular bit rate.

Glossary

1394 See *IEEE-1394*.

16:9 Aspect ratio of a widescreen television screen (also expressed as 1.78:1 or 1.78). DV cameras can record 16:9 widescreen video.

4:3 Aspect ratio of a standard television screen (also expressed as 1.33:1 or 1.33).

AC-3 See *Dolby Digital*.

AIFF (Audio Interchange File Format) Uncompressed or compressed digital audio file format developed by Apple Computer, Inc. Files have the extension *.aif* or *.aiff*.

analog Representation of an object that resembles the original. Film, VHS videotape, and LP records are examples of analog storage media. The term exists only in contrast to *digital*.

anamorphic Widescreen (16:9 aspect ratio) image that has been squeezed horizontally to fit into a 4:3 frame. When played back on a widescreen television or on a PC, the image is stretched to the correct proportions. On a standard television, the image may be displayed in its squashed form, *letterboxed*, or using *pan and scan*, depending on how the viewer has set up the DVD player.

aspect ratio The shape of an image, described as the ratio of the width to the height. For example, a 4:3 image is 1/3 wider than it is tall. This ratio is usually expressed in whole numbers (for example, 16:9 or 4:3). Compare with *pixel aspect ratio*.

asset Audio, video, and image files used to build a DVD presentation.

ASCII (American Standard Code for Information Interchange) Code standard for representing alphanumeric information.

ATIYUY2 See *YUY2*.

AUDIO_TS File directory on a DVD disc (or in a DVD Volume folder) where DVD-Audio data is stored. In a pure DVD-Video disc, this directory is always empty. Compare with *VIDEO_TS*.

authoring The processes in which encoded audio and video files are linked, subtitles imported, chapter points and navigation introduced, and menus and buttons designed.

Authoring Media Recordable DVD disc that is designed for use in professional DVD recorders. Authoring discs let the DVD author write encrypted DVD files to the disc. Compare with *General Media*.

AVI (Audio Video Interleave) File format for digital video and audio data that is defined by Microsoft Corporation. Files have the extension *.avi*.

B-picture (Bi-Directionally Predictively Coded Picture) MPEG video picture that contains only the information that is different from previous and subsequent frames or fields. See also *GOP*, *I-picture*, *P-picture*.

bit Binary digit. The smallest unit of digital information. Eight bits make one *byte*.

bit depth Number of bits used to represent the color and brightness of each pixel in a bitmap image, expressed in bits per pixel. A 1-bit image has two (2^1) colors (black and white), a 2-bit image has four (2^2) colors, and so on. Full-color images are 24 or 32 bits per pixel; 24-bit images can contain 16,777,216 (2^{24}) colors, whereas 32-bit images can contain 4,294,967,296 (2^{32}) colors. Also known as *color depth*.

bit rate Quantity of data measured in bits over a period of time (usually, one second). Equivalent to *data rate*.

bitmap Digital image that is represented by a two-dimensional grid of pixels. There are many bitmap file formats, including Windows bitmap, JPEG, and TIFF.

bps (Bits per Second) Unit of measurement for data rates.

BUP file Backup copy of the *IFO file* on a DVD-Video disc.

button Graphic object on a DVD menu that links to a video clip or another menu. When a viewer selects and activates the button, the DVD player displays the linked material.

In DVD menus, a highlight indicates which button is selected—the viewer uses the remote control to move the highlight to the desired button and presses ENTER to display the linked clip or menu. In VCD menus there is no highlight; the viewer selects a button by pressing its button number on the remote control.

byte Unit of data containing eight *bits*. Digital data storage is usually measured in bytes, whereas digital data rates are usually measured in bits (per second). See also *KB*, *MB*, *GB*.

capturing Process of recording video or images onto digital media such as a hard drive or DVD.

CBR encoding (Constant Bit-Rate Encoding) Method of encoding MPEG video streams by allocating the same number of bits to every second of video, regardless of its complexity. Redundant data is added to the stream when there is little action, and greater compression is applied (resulting in lower quality) as the video complexity increases. Compare with *VBR encoding*.

CD (Compact Disc) Optical disc storage format developed by Philips and Sony, originally for digital audio only. The CD format was extended to include computer files (CD-ROM) and video (VCD).

CD-R (Recordable Compact Disc) Compact discs that can be recorded once.

CD-RW (Rewritable Compact Disc) Compact discs that can be recorded and erased up to 1,000 times.

channel Component of an audio track containing information that is heard through a particular loudspeaker—for example, the left or right channel in a stereo soundtrack.

chapter selection menu DVD menu containing buttons that link to chapter points in the video. Also known as a scene selection menu.

chapter point Marker in the video track that can be navigated to by pressing NEXT or PREVIOUS on the remote control, or by choosing a menu button that has been linked.

clip File containing a video or audio stream.

closed GOP Group of pictures whose B- and P-pictures can reference other pictures only within the same GOP. MPEG streams with closed GOPs can be edited. Compare with open GOP.

codec Software or hardware used to compress video, audio, and image files to save space, and to decompress the files for playback.

color depth See *bit depth*.

component video Analog or digital video system where the picture information is maintained as three separate components—for example, red, green, and blue (see *RGB*), or brightness and two color components (see *YUV*). Component video is considered superior to *composite video* and *S-video*.

composite video Video system where all picture information is mixed into a single signal. Compare with *component video*, *S-video*.

compression Method of making data files smaller. There are two forms of compression: lossless and lossy. Lossless compression, such as that used in PNG image files, does not change the data; it only removes redundancies. Lossy compression involves removing some of the data, based on knowledge of how humans perceive images and sound. Examples of lossy compression include MPEG video, JPEG images, and Dolby Digital audio.

D1 Uncompressed component digital videotape format used for professional-quality video.

data rate Rate at which data is transmitted or retrieved. Measured in bits per second (bps). Equivalent to *bit rate*.

DDP (Disc Descriptor Protocol) Report that provides information about the disc that will be created from the DVD master.

decode To process digital data to reconstruct the original (analog) source.

digital Represented by discrete numbers (digits). In general, digital is synonymous with binary because computers store and process information coded as combinations of binary digits (bits). Compare with *analog*.

DirectShow Software standard developed by Microsoft Corporation for playing digital video and audio on Windows-based computers.

DLT (Digital Linear Tape) Standard tape format required by disc replicators.

DMA (Direct Memory Access) Method for transferring data directly to a device such as a hard drive without using the CPU. This greatly speeds up applications that need to write large amounts of data to the device.

Dolby Digital (AC-3) Audio codec, developed by Dolby Laboratories, that uses perceptual coding to deliver low-bandwidth audio. Dolby Digital is supported by all DVD players. Dolby Digital bit rates for DVDs typically range from 192 kbps for mono and stereo to 384–448 kbps for 5.1 surround sound.

drop frame, non-drop frame NTSC-format video can contain either drop-frame timecode or non-drop-frame timecode.

The NTSC frame rate is 29.97 fps. Timecode counters cannot count anything less than a whole frame, so NTSC timecode counters increment the second count after every 30 frames; therefore, one second on the timecode counter is slightly longer than a real second (0.03 frames, or about 1/1000 of a second longer). This does not sound like much, but over time, the timecode counter gradually becomes more inaccurate. This is the effect of non-drop-frame timecode.

Drop-frame timecode keeps the timecode count accurate. In drop-frame video, frames 0 and 1 are omitted (dropped) from the timecode count at the start of every minute, except 0, 10, 20, 30, 40, and 50 minutes, so that, for example, the timecode count jumps from 00:00:59:29 to 00:01:00:02 instead of to 00:01:00:00. This is enough to keep the timecode count synchronized with a 24-hour clock.

Since the PAL frame rate is a whole number of frames (25 fps), PAL timecode counters are always accurate.

DV (Digital Video) Compressed component digital videotape format.

DVD master Final output, including all audio, video, and other files as well as the DDP report, that is sent to a replicator to create DVD discs.

DVD Volume Logical container for all of the data on a DVD disc. In a DVD-Video disc, the DVD Volume contains the VIDEO_TS and AUDIO_TS folders, as well as any data files and folders that the author added to the disc. The DVD Volume can be created on a computer for testing with a software DVD player before it is written to disc.

DVD-R A write-once format for DVD discs sanctioned by the DVD Forum. There are two types of DVD-R discs: DVD-R for Authoring, used for mastering at a duplicating house, and DVD-R for General, used for creating only a few copies of the discs without using a duplicating house.

DVD+R A write-once format developed by the DVD+RW Alliance. These discs can be accessed by set-top DVD players and computers with DVD-ROM drives.

DVD-RAM Rewritable DVD disc that can be recorded and erased up to 100,000 times. DVD-RAM is designed for faster access to random areas of the disc. These discs can only be accessed by DVD-RAM devices.

DVD-ROM The basic format of DVD, from which all other formats are derived. DVD-ROM discs can contain any type of digital data.

DVD-RW A rewritable DVD disc that can be recorded and erased up to 1000 times. These discs can be accessed by set-top DVD players and computers with DVD-ROM drives.

DVD+RW A rewritable DVD disc developed by the DVD+RW Alliance. This format was designed to allow for real-time video recording and editing. These discs can be accessed by set-top DVD players and computers with DVD-ROM drives.

DVD-Video Standard for storing and playing high-quality video with audio. Discs can be played either on set-top players or in computers that have a DVD-ROM drives and player software.

elementary system Single digital stream of either video or audio. Compare with *program stream*.

encode To transform an analog signal into digital data. This often involves some type of *compression*. See also *decode*, *transcode*.

field Set of scan lines. Two fields make a complete *frame*. One field contains the odd-numbered lines (top field); the other field contains the even-numbered lines (bottom field). The fields can be displayed *interlaced* on a standard television or in *progressive* sequence on a computer monitor or high-definition television.

FireWire Standard created by Apple Computer, Inc. for transmitting digital signals between various devices, including DV cameras and computers. Now known formally as *IEEE-1394*.

FOURCC (Four-Character Code) Method developed by Microsoft Corporation to allow software and hardware to identify the format of a video data stream. Examples of FOURCC codes include *YUYV* and *I420*.

fps (Frames per Second) Rate at which video or film images are displayed to produce the illusion of movement.

frame Single complete image in video or film. In interlaced video, a frame consists of two *fields*.

frame rate Rate at which video or film images are displayed, measured in frames per second (fps). Film has a frame rate of 24 fps, the NTSC video frame rate is 29.97 fps, and the PAL video frame rate is 25 fps.

frame size The size of the video frame, measured in pixels. Also known as *resolution*.

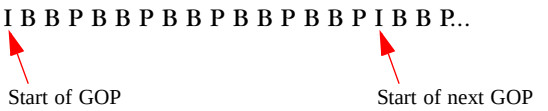
G Standard abbreviation for giga (billion). When used in units of measurement such as bits or Hertz, it means one (American) billion (1,000,000,000 or 10^9). When used for measuring bytes of computer data, it means 1,073,741,824 or 2^{30}.

GB (Gigabyte) In a computer, this is 2^{30} (1,073,741,824) bytes. In a DVD disc, this is 10^9 (1,000,000,000) bytes.

General Media Recordable DVD that is designed for use in consumer DVD recorders. You cannot record DVD data that has been encrypted with the Content Scrambling System (CSS) onto General discs (almost all Hollywood DVDs are CSS-encrypted). Compare with *Authoring Media*.

GHz (Gigahertz) 1,000,000,000 cycles per second. Unit of measurement for frequencies.

GOP (Group of Pictures) Unit of MPEG video, the GOP is a block of video frames of different types. Every GOP begins with an I-picture, followed by a repeating pattern of P-pictures and B-pictures, such as this:



In MPEG-2 video, the I-, B-, and P-pictures can contain either frames or fields. In MPEG-1 video, they contain only frames.

The I-picture (also known as a *key frame*) contains all the image information for a single frame or field, and is thus only moderately compressed. B-pictures and P-pictures contain only information that is different from the previous or next frame/field, and reference the nearest I-picture for the remaining information. This means they are much more highly compressed than I-pictures.

See also *B-picture, chapter point, I-picture, P-picture, sequence header*.

GOP size Number of frames in a group of pictures (GOP). For example, a GOP size of **10** looks like this if the I-, B-, and P-pictures contain whole frames:

I B B P B B P B B P

and like this if the I-, B-, and P-pictures contain fields:

I P B B B B P P B B B B P P B B B B P P

See also *field, frame*.

GOP structure The number of B-pictures before each P-picture in a group of pictures. Typical GOP structures are I B P (one B-picture) and I B B P (two B-pictures).

Hz (Hertz) Cycles per second. Unit of measurement for frequencies.

I-picture (Intra-Picture) MPEG video picture that contains all of the information necessary to create a single frame or field. Every GOP in an MPEG video stream starts with an I-picture, which provides a reference point for the B- and P-pictures in the GOP. See also *B-picture, GOP, P-picture*.

i.link Sony Corporation's term for the *IEEE-1394* standard.

I420 The *FOURCC* code for a compressed *YUV* color format developed by Intel Corporation. Identical to IYUV.

IEEE-1394 Standard for transmitting digital signals between various devices including DV cameras and computers. Also known as *FireWire* or *i.LINK*.

IFO file One of the files on a DVD-Video disc. The IFO file contains instructions that tell the DVD player how to play the *VOB files* on the disc. Because the disc could become unplayable if the IFO file is damaged, a backup copy with the extension *.BUP* is always included in a separate location on the disc.

interleaved scanning Method for displaying an analog video signal on a television screen. This method was developed because video images flicker when displayed on televisions at 25 or 29.97 frames per second, where each frame fades away before the next one appears.

To prevent flickering, each video frame is divided into two fields. One field contains the odd-numbered scan lines in the frame (the "top" field); the other contains the even-numbered scan lines (the "bottom" field). The television displays one field (one set of lines), followed by the next, at 59.94 fields per second for NTSC or 50 fields per second for PAL. At these frequencies, human persistence of vision causes the fields to be perceived as a single image.

Compare with *progressive scanning*.

ISO 9660 Specifies the naming convention for computer filenames. Level 1 limits filenames to eight characters plus a three-character extension using uppercase A to Z, digits 0 to 9, and the underscore "_" character; known as the "8.3" or MS-DOS format. Level 2 allows names of up to thirty characters, using all ASCII characters.

IYUV See *I420*.

Joliet Extension to the ISO 9660 file system that allows long file names, and filenames with spaces and international characters. Available with Windows 95 (or later) and Windows NT.

JPEG *Lossy* compressed bitmap image file format developed by the Joint Photographic Experts Group. Files have the extension *.jpg* or *.jpeg*.

k Standard abbreviation for kilo (thousand). Used as a prefix in units of measurement such as kbps (kilobits per second) and kHz (kilohertz).

K Standard abbreviation for 1,024 (2^{10}). Used as a prefix in measurements of computer bytes.

KB (Kilobyte) 1,024 (2^{10}) *bytes*.

kbps (Kilobits per Second) Unit of measurement for data rates.

key frame MPEG video picture containing the entire contents of a single frame (or field). An *I-picture* is a key frame.

kHz (Kilohertz) 1,000 cycles per second. Unit of measurement for frequencies.

letterbox Method for displaying widescreen (16:9) material on a standard (4:3) television screen. The entire image is displayed in its proper aspect ratio across the center of the screen. Horizontal black bars (mattes) are added to the top and bottom of the image to fill the gaps between the image and the top and bottom edges of the screen. Compare with *pan and scan*.

lossless Compression methods that do not discard any data. Compare with *lossy*.

lossy Compression methods that discard some data to achieve high compression levels.

M Standard abbreviation for mega (million). When used in units of measurement such as bits or Hertz, it means one million (1,000,000 or 10^6). When used for measuring bytes of computer data, it means 1,048,576 or 2^{20}.

MB (Megabyte) 1,048,576 (2^{20}) bytes. Unit of measurement for computer data.

Mbps (Megabits per Second) Unit of measurement for data rates.

menu Screen containing buttons that link to specific locations in a DVD-Video presentation. The viewer must select a button, then activate it to display the linked material.

MHz (Megahertz) 1,000,000 cycles per second. A unit of measurement for frequencies.

MPEG Set of standards for compressing video and audio, developed by the Moving Pictures Expert Group. The DVD-Video standard is based on MPEG-2 video compression; the standard also permits the use of MPEG-1 video.

multiplex To combine separate video and audio streams together into a single data stream. Often abbreviated to *mux*.

NTSC (National Television Systems Committee) Television standard used in the United States, Canada, Japan, and other countries. NTSC television uses 525 scan lines (480 lines contain picture information) transmitted at 29.97 frames (59.94 fields) per second. Compare with *PAL*.

open GOP Group of pictures whose B- and P-pictures can reference pictures from another GOP. MPEG streams with open GOPs cannot be edited. Compare with *closed GOP*.

P-picture (Predictively Coded Picture). MPEG video picture that contains only the information that is different from previous frames or fields. Each P-picture provides a reference point for B-pictures and subsequent P-pictures in a GOP. See also *B-picture*, *GOP*, *I-picture*.

PAL (Phase Alternate Line) Television standard used in Europe and most of the rest of the world. PAL television uses 625 scan lines (576 are used for picture information) transmitted at 25 frames (50 fields) per second. Compare with *NTSC*.

pan and scan Method for displaying widescreen (16:9) video on a standard (4:3) television screen. The widescreen image is cropped to fit the 4:3 aspect ratio. Compare with *letterbox*.

PCM (Pulse Code Modulation) Uncompressed digital audio format. The quality of PCM audio depends both on the *sample rate* (a 48 kHz sample rate is better than 44.1 kHz) and on the *sample size* (16-bits per sample is better than 8-bits).

PICT Image file format developed by Apple Computer, Inc.

pixel One of the dots that makes up a digital image. The *resolution* of an image is measured in pixels (width x height).

pixel aspect ratio Ratio between a single pixel's width and its height. This is usually expressed as a decimal number.

Pixels on a computer monitor are square and have a pixel aspect ratio of 1. Pixels on a television screen are rectangular: on a standard NTSC television, each pixel is slightly taller than it is wide, with an aspect ratio of 0.9; on a standard PAL television, each pixel is slightly wider than it is tall, for a pixel aspect ratio of 1.0666. This is why standard NTSC and PAL televisions have the same 4:3 aspect ratio even though they use a different number of scan lines.

For widescreen (16:9) televisions, the pixel aspect ratios are 1.2 for NTSC and 1.4222 for PAL.

PNG (Portable Network Graphic) *Lossless* compressed bitmap image file format. Files have the extension *.png*.

program stream Stream containing multiplexed video and audio. Compare with *elementary stream*.

progressive scanning Method for displaying a video signal on a computer monitor (and on high-definition television). In a progressive scanning system, each scan line is displayed in sequence. To prevent flicker, the scanning frequency must be twice that of a standard television, but this produces a higher quality picture. Compare with *interlaced scanning*.

project file See *scenario*.

QuickTime Software standard for playing compressed, full-motion video with synchronized audio. Developed by Apple Computer, Inc.

resampling Process of converting a digital image from one resolution (size) to another.

resolution Size (width by height) of a digital image, measured in pixels.

RGB The red-green-blue color model used in computer monitors. The color of each pixel in an image is made up of a red component, a blue component, and a green component, because these are the three colors that the human eye can perceive. In a full-color (24 bits per pixel) image, each component can be one of 256 values, from zero (darkest) to 255 (lightest). If all three components have a value of zero, the pixel is perceived as black. If all three components have a value of 255, the pixel is perceived as white. Compare with *YUV*.

rip To extract music from an audio CD to a computer hard drive.

sample rate Number of times per second that a digital sample is taken of an analog audio source. Expressed in kHz. The sample rate for audio CDs is 44.1 kHz; for DVD-Video, the sample rate is 48 kHz. Higher sample rates result in a more accurate reproduction of the original sound.

sample size Number of bits allocated to each digital sample of an analog audio source. Larger sample sizes result in greater dynamic range and better reproduction of the original sound. DVD-Video uses sample sizes of 16, 20, or 24 bits.

scenario The file that tells Scenarist where the video, audio, and still images in a DVD project are located, and how to assemble and process them to create a DVD disc. This file has the extension *.scn*.

SECAM (Sequential Color with Memory) A television transmission standard similar to PAL. The DVD-Video standard does not support SECAM, so DVD players in SECAM countries play PAL-format discs and *transcode* the signal to SECAM.

sequence header Part of an MPEG video stream. Contains information about the video stream, such as aspect ratio, bit rate, picture resolution, and frame rate. The DVD Specification requires a sequence header before every GOP.

set-top player Consumer DVD player designed for use with a television as part of a home theater system.

stream Data that must be read and processed in a linear sequence, such as digital video and audio. Also known as a track.

S-video Video connection standard that has separate brightness and color signals and uses a four-pin mini-DIN connector. S-video quality is better than *composite video* but not as good as *component video*.

Targa Bitmap image file format developed by Pinnacle Systems, Inc. Files have the extension *.tga*, *.vda*, *.icb*, or *.vst*.

thumbnail Small picture representing the contents of a video or still image file.

TIFF (Tagged Information File Format) A versatile bitmap image file format. Files have the extension *.tif* or *.tiff*.

timecode Location of a video frame relative to the start of the video clip. Timecode values generally use the format hh:mm:ss:ff (hours:seconds:minutes:frames).

See also *drop-frame timecode, non-drop-frame timecode*.

Title menu Highest-level menu in a DVD menu hierarchy. Viewers can display the title menu at any time during playback by pressing the TITLE button on the remote control.

track See *stream*.

transcode To convert digital video or audio data from one format to another, for example, from AVI to MPEG.

transition The change from one video clip to another. This can be abrupt—one clip finishes and the other one starts—or can involve digital effects such as fading the end of the first clip into the beginning of the second clip.

trim To edit a video or audio clip to remove unwanted material from the beginning or end.

UDF (Universal Disc Format) Standard developed by the Optical Storage Technology Association for creating discs that can be used in any computer or digital device.

USB (Universal Serial Bus) Standard for transmitting digital signals between various devices.

UYNV See *UYVY*.

UYVY FOURCC code for a YUV color format used by many video capture cards.

V422 See *YUY2*.

VBR encoding (Variable Bit-Rate Encoding) A method of encoding MPEG video streams by allocating more bits to complex sections of video and fewer bits to less-complex sections. This results in higher quality video than CBR encoding at the same overall bit rate, or the same level of quality as CBR encoding at a lower overall bit rate. Compare with *CBR encoding*.

VCD (Video-CD) Digital videodisc format that preceded DVD. VCD is based on MPEG-1 video and audio compression and is especially popular in Asia. Video quality is similar to VHS videotape, but audio quality is superior.

VCD Volume Logical container for all the data on a VCD disc. The VCD volume contains MPEGAV, SEGMENT, and VCD folders, as well as any data files and folders that the author added to the disc. The VCD volume can be created on a PC, and the video files played with a software player, before it is recorded onto a disc. See also *DVD Volume*.

video capture device Device that converts an analog video signal to digital data.

VIDEO_TS File directory on a DVD disc (or in a DVD Volume folder) where DVD-Video data is stored. Compare with *AUDIO_TS*.

VOB file (Video Object File) Basic media file, containing video and audio, of the DVD-Video format.

WAVE audio Uncompressed or compressed digital audio format developed by Microsoft Corporation. Files have the extension *.wav*.

widescreen Video displayed at a 16:9 ratio.

Y411 FOURCC code for a YUV color format.

YUV Color model used in analog or digital video; this model was developed to enable both black-and-white and color televisions to use the same video signal. The video signal is made up of a brightness (Y) component and two color (U and V) components. The Y component is the black-and-white signal. The U component contains the difference between blue and the Y component (blue – Y), whereas the V component contains the difference between red and the Y component (red – Y). This color model is also often abbreviated as YCbCr.

YUNV See *YUY2*.

YUY2 FOURCC code for an uncompressed *YUV* color format used by many video capture cards. Developed by Microsoft Corporation.

YUYV FOURCC code for a compressed YUV color format. Developed by Canopus Corporation.

YV12 The FOURCC code for a YUV color format. Developed by Intel Corporation.

YVYU FOURCC code for a YUV color format.

ZORAN422 See *UYVY*.

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