

Video Compression Guidelines

The key to achieving great compression results is understanding the codec and how the options affect the finished output. This section discusses the options and decisions that determine how video is compressed when using Sorenson Video 3, Sorenson Spark, Sorenson MPEG-4, RealMedia, and Windows Media.

As with any tool, there are some basic guidelines that help you get the most from your Sorenson codecs. This section starts off with some general guidelines that apply to all types of video and then discusses compression of several specific types of video.

General Video Considerations

As you prepare to compress a video clip, there are several factors that have a significant affect on your compression configuration. The method you plan to use for delivering the video influences many of the options available to you. In addition to the delivery mechanism, you must also consider your playback audience. What type of systems do they have and how are they going to receive the video? All of these factors influence one of your first compression choices, the compressed Data Rate.

Data Rate

The Data Rate maximizes the video quality for the targeted delivery channel. For example, if you are delivering video from CD-ROM, the Data Rate can range anywhere from 200 KB/second or less. However, if you are delivering video over the Internet, the Data Rate can range anywhere from 1.5 KB/second to as high as 50 KB/second, depending on the connection speed of your target audience.

One of the most common mistakes with new users is setting a Data Rate that is too high. Generally, quality improves as the Data Rate increases and clips with more movement require higher Data Rates to maintain the quality. However, the Sorenson codecs do have a "quality ceiling." Beyond a certain Data Rate, the clip looks almost uncompressed and the quality doesn't get any better. Fortunately, Sorenson's "quality ceiling" is reached with a much lower Data Rate than many other codecs.

As a starting point, use the following formula to establish your compression range with Sorenson Video 3 and Sorenson Spark.

$$\text{Datarate} = \frac{\text{Width} \times \text{Height} \times \text{FPS}}{48000}$$

Depending on your video type, Sorenson Video 3 looks good and performs well when the Data Rate is greater than 1/2 and less than double the result of the Data Rate Formula. For example, a 320x240 30 fps clip yields the following results:

$$\text{Datarate} = \frac{320 \times 240 \times 30}{48000} = 48\text{KB/s}$$

The general target Data Rate is 48 KB/second for a 320x240, 30fps clip.

A talking head clip with little motion can compress as low as 24KB (about 1/2). However, a sports action clip might need as much as 96 KB/second (double) or higher to look good.

Note: High action clips might require a Data Rate above the 96 KB/s target for a standard 320x240 clip. However, the higher Data Rate can make playback difficult on lower-end machines. Be sure to test all compressed video on your target playback platforms.

The target Data Rate Formula discussed above gives you a starting point. The actual Data Rate you use depends largely on the video content and the target playback platforms. Use the formula as a guide and try several Data Rates within the range, testing them for clarity and playback on your target platforms. If you need to improve the image quality at your target Data Rate (without increasing the Data Rate), try reducing the Frame Rate or using a smaller Frame Size.

Delivery Mechanism

An important part of compressing your video is knowing the distribution method of the final product. The distribution channel often places restrictions on the video compression. For example, if you plan on delivering the finished video across the Internet, you need to take into account the different download speeds and options.

Multimedia video has two common delivery channels:

- CD-ROM
- Internet/Intranet

CD-ROM

CD-ROM delivery carries the least possible restrictions. With CD-ROM delivery, you can balance the size and quality of the video with the amount of video you want to deliver. Large video at higher Data Rates takes up more space. Smaller video and/or lower Data Rates allows you to put more minutes of video on the CD. The following table shows how much video you can put on a CD at various Data Rates.

Data Rate (KB/s)	Minutes/CD
180 KB/s	63 minutes
90 KB/s	124 minutes
75 KB/s	149 minutes
60 KB/s	186 minutes
30 KB/s	372 minutes

Internet/Intranet

The main restrictions of Internet/intranet delivery are based on the available bandwidth of your network. For example, if you are delivering video over the public Internet, many people in your target audience might use 56k modems. However, if you are delivering video over a company intranet, the connection rate is usually much higher.

The key to selecting the correct Data Rate is to know your audience. After you define your audience, you have three main options:

- Create all video at 56k dial-up rates (approximately 4 KB/s video plus audio).
- Create the video at higher Data Rates and assume that users with slower connections will have the patience to download the video. (Many business users have network connections to the Internet and are not limited by slow modem speeds.) This option also works well for intranets where most users are using the company network to access the information.

- Use QuickTime's Movie Alternates features (QuickTime only). Using Movie Alternates, you can create a movie for the three main Data Rate categories (dial-up, ISDN, and T1 network). When the user requests the movie, QuickTime automatically selects the appropriate movie for the user's connection rate. This is a very good option when you cannot control the connection rate of your users.

If you compress at a higher Data Rate and do not want to use Movie Alternates, keep your clips short so that the maximum download time is not too burdensome for your audience. It is always best to experiment and make sure the performance is what you expect.

After you select your Data Rate, you have two delivery options, HTTP and RTSP. Both methods are considered "streaming" technologies (the video plays as it downloads). However, while both types might appear very similar to the user, there are some significant differences.

HTTP—HTTP delivery is when you place a compressed QuickTime or Flash video on a Web page. When a user visits the Web page and selects the video link, the video plays. There are several advantages to HTTP delivery:

- Uses standard Web server and pages
- Guaranteed video quality
- No firewall problems

RTSP—RTSP delivery also has links on a standard Web page, but the video files themselves must reside on a special server, not the standard Web server. You can use RTSP to deliver stored video files much like HTTP streaming or live broadcasts. However, RTSP delivery has several significant differences from HTTP delivery:

- RTSP is not available for Flash movies
- Requires a special media broadcast server
- No guaranteed quality
- Firewall issues (some firewalls block this type of streaming)
- Capable of streaming live events
- Very long streams (file is not stored on local computer)
- Property protection (because the video is not stored anywhere by the end user)
- Capable of random access

For a more detailed description of streaming options, see "Streaming Media."

Encode Performance Considerations

The Sorenson codecs take longer to encode than to decode (it is asymmetrical). The main consideration in compression time is the amount of data the codec has to analyze. The following table shows average Frame Rates achieved compressing moderate motion clips on a Pentium class 700 MHz computer with the fixed quality set at 50.

Frame Size	Average Frame Rate Achieved
320x240	15 fps
160x120	35 fps

As you change the amount of data processed, make sure the compression time matches the change. For example, a 160x120x15fps movie is 1/4 the size of the 320x240x15 clip. The compression time is about 1/4. If you increase your Frame Size, or Frame Rate, the compression time increases.

If you want to encode faster, you have several options:

- Reduce the Frame Size.
- Reduce the Frame Rate.
- Change your Encode Rate option.

If you use the Variable Bit Rate (VBR) options the compression rate is roughly twice as long. VBR actually analyzes the video clip prior to compressing it, requiring two passes through the clip. **The results are significantly better, but it also takes more time.**

On a much smaller scale, the complexity of the video and the target Data Rate do affect the amount of time required to encode. However, the differences are much less noticeable than with different Frame Sizes and Frame Rates.

Playback Considerations

Playback is generally only an issue with CD-ROM distribution. A CD-ROM handles Data Rates much higher than the Sorenson codecs need (see the Data Rate section). In general, if you use the target Data Rate formula, the playback on most systems is acceptable.

If you are targeting lower end Pentiums and Power PCs, you normally see good performance at 320x240x15 at 70KB/s or less. Smaller Frame Sizes and lower Data Rates increase your playback range while larger Frame Sizes or higher Data Rates might require faster processors to play. Video targeted for Internet and network distribution is not normally a problem because the Data Rates are usually below 70 KB/s.

The key here is the same as when selecting your Data Rate, know your audience. If your target playback audience has more powerful computers, you can safely use higher Data Rates. **If you are targeting more universal playback, stay below the 70 KB/s line or consider some of the following options.**

Video Doubling (QuickTime Only)

To maintain playback capability on lower-end machines, do not compress video at full-screen (640x480). If you need full-screen display, **one option is to use QuickTime's doubling feature.** Doubling with Flash is possible, but it is less effective.

One of the great features of the Sorenson codecs is the ability to scale in "doubled" mode and still look good. When scaling by two, most codecs simply fill each 2x2 block with the value of an original single pixel. Sorenson Video 3 takes advantage of a QuickTime conversion mode that provides a smooth scaling algorithm (bicubic for those familiar with Adobe® Photoshop®) that looks much better. Using QuickTime's doubling feature is a great way to play 640x480 Sorenson Video 3 movies without the large Data Rate overhead of a 640x480 movie.

Pixel doubling is also very useful for Web movies, where a frequent complaint is the small size. Double a 160x120 Web movie and suddenly you have 1/4 screen video played over the Internet, without lengthy download times. With very low Data Rates, reducing the native Frame Size and then doubling the movie often yields better quality than extreme compression.

To save a movie to automatically play back doubled:

1. Open the movie in QuickTime Player.
2. From the Movie menu, choose Double Size.
3. From the File menu, choose Save.

Now, each time you open the movie, it automatically displays doubled.

Doubling the video can still place a strain on some older computers. The difficulty is caused by older graphics cards that lack hardware acceleration. Machines without hardware accelerated video cards might have trouble displaying doubled video simply because they cannot send the data to the screen fast enough.

CPU Alternates (QuickTime Only)

QuickTime 4 introduced a new option to the Movie Alternates feature: CPU alternates. Using the CPU alternates option, you can create several versions of a movie at different Data Rates and Frame Sizes, specifying each version for a CPU range.

The CPU alternates option allows you to produce great-looking video for today's more powerful computers, but still provide a scaled-down version for the older installed base.

Playback Scalability

Another option for increasing the playback range with low-end computers is to use the Sorenson playback scalability option. **When you select the scalability option during compression, the clip is configured to drop frames evenly for computers that cannot keep up.**

For example, if you create a 320x240x30 fps movie clip at 70 KB/s, some slower computers cannot decode the clip at the full Frame Rate. Without playback scalability, the computer simply stops decoding video until the next keyframe (then the audio continues). This makes for very "jerky" playback.

However, if you encode the video with playback scalability turned on, the decoder sees that option and automatically drops every other frame, decoding at 15 fps instead of 30 (1/2 the encoded Frame Rate). The quality of the movie is the same as if encoded at 15 fps instead of 30 fps and the user experiences smooth playback.

Summary

In summary, as you prepare video for distribution understand the following playback considerations and options:

- Data Rate—70 KB/s or less if you require playback on lower-end machines
- Frame Size—320x240 or less recommended for all machines
- Frame Rate—15 fps or less for low end machines
- Doubling—Display full-screen, but is dependent on the computer graphics cards (might have trouble on older machines)
- CPU alternates—Extends your playback range with lower-end computers while still providing higher Data Rate or larger clips for today's more powerful computers.
- Playback scalability—Lets the decoder smoothly drop every other frame for smooth playback on slower computers.