



Flash Video Primer

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CHAPTER 1

Introducing Flash Video

Macromedia Flash Video lets you easily put video on a web page in a format that almost anyone can view.

This guide provides an introduction to Flash Video, including information on how to create and publish Flash Video.

This chapter provides some background information about video in general and about Flash Video in particular.

Checklist for creating Flash Video

The following steps describe how to create Flash Video content and publish it online. For more information, see other topics later in this guide.

If you already understand how to complete a particular step on your own, you can skip the corresponding chapter of this guide.

The procedures for creating and publishing on-demand (pre-recorded) video are different from those for creating and publishing live video. For information on live video, see [Chapter 5, “Broadcasting Live Video.”](#)

To create on-demand Flash Video:

1. Acquire some video. You can do this either by capturing it yourself or by obtaining it from someone else.
2. Encode the video in the Flash Video (FLV) format. See [Chapter 2, “Capturing and Encoding Video.”](#)
3. Decide on a delivery mechanism. See [Chapter 3, “Delivery Options for Flash Video.”](#)
4. Add the video to your web pages, and publish the pages to the web. See [Chapter 4, “Adding Flash Video to Your Website.”](#)

About video and the web

Video and the Internet seem ideally suited to each other. Video is the medium that most closely echoes our day-to-day visual experiences, and the Internet is a boundless playground filled with interesting content. You might expect, therefore, that thousands of compelling websites would integrate video with data, content, and interactive controls to create rich experiences that go beyond what is possible with video on a television set.

Unfortunately, early video content on the web has often been simply a rectangle of content playing back on your computer monitor, usually in a separate pop-up window covering the website page that spawned it. The video images are often small and ugly, and the overall experience is poor.

Several technical challenges have kept designers from using video content to its full potential, including the following:

Bandwidth limitations Video is a data-intensive format, requiring megabytes of data to display even short video clips. The growth of broadband has greatly reduced this technical obstacle, and increasingly large numbers of site visitors have the bandwidth required to receive video content via the web, but file size is still a problem for many visitors.

Complexity of authoring video for the web There have been no standard tool sets for creating interactivity, navigation control, and fusion of video with other rich media content. Furthermore, most video playback clients are not pre-installed on most visitors' systems, so many visitors must pause to download a plug-in or application before they can view video.

Lack of compelling integration of video and other web content Most video formats for the web offer no rich media capabilities beyond playback of video in a rectangular window.

Fortunately, Flash Video (which presents video content in a form that site visitors can view using Flash Player) lets you avoid these issues.

Note: For technical information about video, see [Appendix, "Technical Overview of Video Standards."](#)

About Flash Video

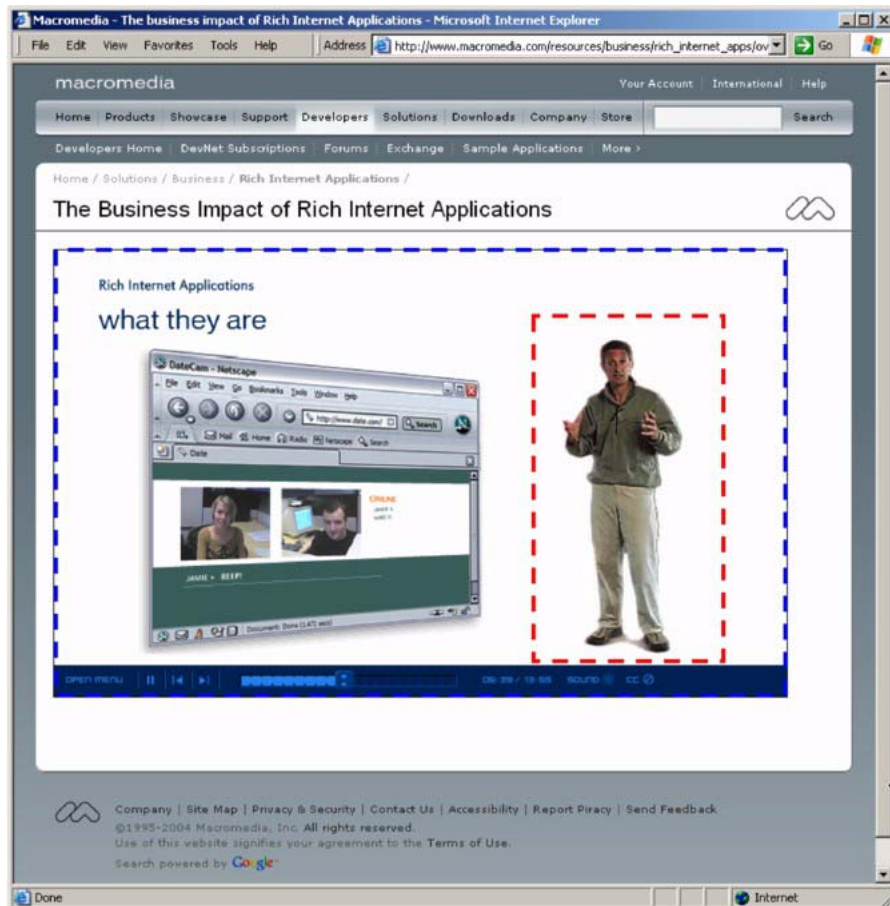
Flash Video offers technological and creative benefits that allow designers to create immersive, rich experiences that fuse video together with data, graphics, sound, and dynamic interactive control. The advantages of using Flash to present video online include:

Ubiquity Since the 2002 introduction of Flash Video, Macromedia Flash Player has become the most widely installed Internet video client, running on over 94% of all Internet-connected personal computers. Also, Flash Player runs on a wide variety of platforms and operating systems. The ubiquity of Flash Player ensures that most visitors can view Flash Video without needing additional plug-in downloads, so you can reach more people with lower development, testing, and support costs.

Full creative control Flash Video integrates seamlessly into your website, and you can put a new "skin" on it to supply custom branding and unique controls. You can also set the size and aspect ratio of your video, and the video can dynamically change based on a data source.

Rich, interactive, contextual video Flash Video starts playing quickly, and provides immersive and interactive experiences. Because Flash treats Flash Video as simply another media type, you can layer, script, and control video just like any other object in a SWF file. Flash Video is an integral part of the viewing experience, as opposed to a separate pop-up window that interrupts the experience.

The following image shows a sophisticated example of a web page containing Flash Video synchronized to text and graphics. The superimposed dotted blue outline shows the boundary of the area where the SWF file is displayed; the dotted red outline shows the boundary of the area where the Flash Video (FLV) file is displayed, as part of the SWF content. A SWF file can contain graphics, text, and client logic (for creating video controls, for example). It can refer to an external FLV file, and it plays in Flash Player. An FLV file contains primarily audio and video, and it plays inside a SWF file.



The following is a list of Macromedia products you can use to create and deliver compelling Flash Video experiences. For information on how to choose which products to use, see [“Choosing options” on page 8](#).

Flash Video Exporter is a plug-in for use with third-party applications that lets you encode audio and video into the FLV file format.

Flash MX 2004 lets you author Flash Video for your website.

Flash MX Professional 2004 (an advanced version of Flash MX 2004) provides more video tools, including media components, a set of components that enables users to incorporate external FLV files and to connect to Flash Communication Server video streams.

Flash Video Kit includes a Flash Video extension for Macromedia Dreamweaver MX 2004, which lets you quickly and easily integrate Flash Video into your websites without using the Flash authoring tool. It also includes a copy of Sorenson Squeeze, for converting all major video file formats to FLV.

Flash Communication Server is a Macromedia streaming media server that streams audio and video to Flash Player 6 or later.

Flash Video Streaming Service, Flash Video Streaming Service Live, and Flash Video Streaming Service Lite are cost-effective monthly subscription services from third parties that use Flash Communication Server to provide hosted streaming video with high performance requirements and worldwide scalability. If you can't or don't want to set up your own Flash Communication Server, you can use a hosted service.

Flash Player plays Flash Video and other Flash content.

Choosing options

Before you can use Flash Video on your site, you need to decide whether to deliver the video as a progressive download or as a streaming video.

For help deciding which delivery option to use, see the following table. Find your situation in the left column, and then see which delivery options are recommended. If two options are marked, then either one is recommended.

	Embedded	Progressive	Streaming
Clip is under 5 seconds long	x	x	
Clip is 5 to 30 seconds long		x	x
Clip is over 30 seconds long			x
Low viewership expected		x	
Medium to high viewership expected			x
Instant start			x
Intellectual property protection			x
Live video streams			x
Variable streaming rates based on visitor's bandwidth			x

For more information about delivery options, see [Chapter 3, "Delivery Options for Flash Video."](#)

After choosing a delivery option, choose which authoring tool to use: Flash or Dreamweaver (with the Flash Video extension).

The Flash Video Extension for Dreamweaver is ideal for situations where you want to put video onto your site quickly and easily, with no interactive elements beyond simple video controls (play, stop, pause, skip ahead, and skip backward).

If you need to build a more interactive experience or need to heavily customize the look and feel of the video, you must use the video features in Flash MX Professional 2004.

For more information about authoring options, see [Chapter 4, “Adding Flash Video to Your Website.”](#)

CHAPTER 2

Capturing and Encoding Video

Before you can add on-demand (pre-recorded) video to your web page, you must acquire the video and encode it, which involves converting it to the Macromedia Flash Video (FLV) format.

This chapter provides information on how to encode on-demand video, including background information about how Flash Video is encoded and about how to get best results when capturing video.

This chapter assumes that you already have some video in a format other than FLV. Many leading video editing tools allow you to capture video directly from your digital video camera. For some tips on capturing video, see [“Capturing good video” on page 11](#).

For information on how to convert (encode) your existing video to FLV format, see [“Best practices for encoding on-demand video” on page 13](#) and [“Encoding on-demand video” on page 14](#).

To capture and publish live video, use Macromedia Flash Player and Macromedia Flash Communication Server. For more information, see [Chapter 5, “Broadcasting Live Video.”](#)

Capturing good video

In addition to the physical properties of your video there are a variety of factors that affect the efficiency of the encoder and, ultimately, the user experience of the video playback. Two factors play a significant role in the encoding process: source quality and frame motion.

Source quality

You determine the source quality of your video as soon as you press the recording button on your camera. The following are some basic guidelines for getting great source video quality and maximizing quality in your final compressed video.

Use a tripod to reduce camera movement If your camera is not steady, most of the image moves, causing a high percentage of pixels in the video to change from frame to frame. A steady camera reduces the number of pixels that change from frame to frame, giving you better quality at higher compression rates (lower data rates).

Use good lighting techniques A high-end camera resting on a tripod can still produce a low-quality image if there is not enough light. Low-light or light-*gain* filters produce video noise on the image. This noise is different for each frame of video and makes it difficult for the codec to compress the file at a good quality. You may need to use or exceed your maximum data rate to compensate for video noise.

Use the best camera possible Low-grade cameras—specifically consumer-based ones that record an analog signal on magnetic tape (VHS, Hi-8, and so on)—produce much video analog noise. Still digital cameras in movie mode also have limited quality and generally produce high-noise video clips. Even if the camera is on a tripod, with excellent light, it will produce noise.

Do the best you can with what you have to work with High-end digital cameras, digital Betacam camcorders, and 35mm film cameras produce a clean image if the scene is well-lit and they are stabilized by a tripod. Such a scenario produces the best compression ratio and lets you reduce the data rate while maintaining excellent quality. However, you may not have access to professional equipment, a tripod, and excellent lighting conditions. Just remember: the higher the quality of your video source, and the less noise in that source, the lower the data rate required to render a good playback file.

Whenever possible, always encode a file from its uncompressed form If you convert a precompressed digital video format into the FLV format, the previous encoder can introduce video noise. The first compressor has already performed its encoding algorithm on the video and has already reduced its quality, frame size, and rate. It may have also introduced some of its own digital artifacts or noise. This additional noise affects the FLV encoding process and may require a higher data rate to play back a good-quality file.

Frame motion

Frame motion is another factor to consider in your encoding formula. It is the percentage of the pixels that change from one frame to another. This change can result from a person or object moving, camera effects, or post-production effects, such as the following:

- People and objects moving can include someone walking past the lens, tree leaves blowing in the wind, cars driving by, or an extreme close-up of a face.
- Camera effects such as camera panning, zooming, or hand-holding result in almost 100% pixel change from frame to frame.
- Postproduction effects such as dissolves, fades, wipes, or complex video effects result in a high percentage of pixel changes from frame to frame.

The greater the motion within your video clip, the more information the encoder has to compress. If your clip is relatively still (such as a talking head video), there isn't much pixel change from frame to frame. The video compressor uses a method of dropping frames and then encoding a series of fully uncompressed frames. These uncompressed frames, called keyframes, are used to calculate and “rebuild” the missing frames during playback.

Best practices for encoding on-demand video

When you encode on-demand video, you must balance a variety of factors, including amount of motion depicted, file size, target bandwidth, frame rate, keyframe interval, and the pixel dimensions of the video.

You can specify values for some of those factors when you encode Flash Video. A few of these settings are discussed in general terms in this section; for technical details on some of the other settings, see [Appendix, “Technical Overview of Video Standards.”](#)

For detailed information about specific values to use for various settings, see the article “Best Practices for Encoding Flash Video” at the Macromedia Developer Center at www.macromedia.com/go/flv_bestpractices_encoding. The Developer Center also provides an interactive Video Settings Calculator at www.macromedia.com/go/flv_settings_calculator that you can download and to choose your settings.

The following are some general guidelines to follow when compressing video to Flash Video for delivery over the Internet.

- A higher target bandwidth (also known as data rate) allows for more motion in the video, larger files, better frame rates, and larger pixel dimensions.
- The less motion there is in your video, the smaller the file size, and the lower a target bandwidth you can reach.
- As the target bandwidth decreases, reduce the keyframe rate. A lower keyframe rate (such as one keyframe every six seconds) will result in a softer or blurrier image but reduces the bandwidth demand.
- As motion increases, you must increase the keyframe rate, the frame rate, and the data rate. High-motion clips require more information to flow to the player. They are not good for low-bandwidth delivery because they require additional uncompressed keyframes to be encoded in the file.
- Reduce frame size when bandwidth is limited and frame rate and quality are important.
- If the video source you are encoding comes directly from a video camera, always enable de-interlacing and set the Flash Video encoder to the upper field. If your video is interlaced, selecting this option increases the performance of the video encoding and playback.

About bit rate

Bit rate is the amount of data transferred per second. When you encode Flash Video, you specify a bit rate for the encoding. Choose a bit rate appropriate to your audience; for example, if most of your visitors are likely to be using 56kbps modems, don't provide video encoded at a bit rate of 2Mbps.

About encoding methods

Two encoding methods are available for most streaming packages, including those that encode the FLV format: constant bit rate encoding and variable bit rate encoding.

- Constant bit rate (CBR) encoding enforces the specified data rate over the whole video clip. Use CBR if your clip contains a similar motion level throughout its duration.
- Variable bit rate (VBR) encoding adjusts the data rate within limits you set, based on the data required by the compressor. VBR takes longer to encode but may produce better results.

Many compression packages support a two-pass VBR. The first pass allows the compression package to analyze the video and store information about it before it starts the encoding process in the second pass. This option increases the time it takes to compress the video but yields much better results. Both the Flash Video Exporter and Sorenson Squeeze support two-pass VBR encoding.

About keyframes

Flash Video is encoded as a sequence of keyframes (full-frame uncompressed images taken from the video at regular intervals), each of which is followed by information about how to change the pixels of the keyframe to produce the “delta frames” between that keyframe and the next. During playback, the decoder recreates the delta frames based on the keyframes.

The keyframe interval is the number of delta frames between keyframes. The greater the interval between keyframes, the harder it is for the decoder to recreate the missing frames. Also, if your keyframe interval is too great, you may not have a large enough data rate to compress and transmit the data bits. Therefore, a high-motion video clip with a large keyframe interval results in the perception of poorer quality.

With Flash Video, keyframes are particularly important if your presentation approach provides a seek or scrub feature, which allows a user to advance the stream during playback. (To allow seeking and scrubbing in a video, you must stream the video with Flash Communication Server or Flash Video Streaming Service.)

Encoding on-demand video

There are a variety of tools you can use to encode Flash video by converting an existing source video to FLV format.

For example, the Flash Video Kit includes a copy of Sorenson Squeeze, a compression application that can encode FLV files. If you have the Flash Video Kit, you should use Sorenson Squeeze for FLV encoding, unless you want to encode FLV directly from your video editor. For specific instructions on using Sorenson Squeeze, see the documentation included with the Flash Video Kit.

Another option for encoding is Flash Video Exporter, a plug-in that enables third-party nonlinear editing systems and encoder applications to export FLV files. The following section describes how to use the Flash Video Exporter.

Using Flash Video Exporter

Flash MX Professional 2004 includes Flash Video Exporter, which enables many third-party applications to encode video and audio directly into the FLV file format. This ability to prepare FLV files from within third-party applications improves the workflow between video applications and your Flash project.

Flash Video Exporter achieves its seamless integration with third-party applications by using the QuickTime export plug-in architecture. Flash Video Exporter is a plug-in to QuickTime that you can use with third-party applications that support exporting to the QuickTime file format. However, instead of producing QuickTime movies, Flash Video Exporter exports FLV files that contain Flash Player-compatible video and audio streams.

After you install the Flash Video Exporter plug-in on your system, applications that can export to the QuickTime file format will show Movie to Macromedia Flash Video (FLV) in their list of QuickTime export options. However, not all applications that can export to QuickTime support exporting to QuickTime Export Components. For a summary of leading third-party tools that support the Flash Video Exporter plug-in, see [“Supported third-party applications” on page 16](#). For full details on using each of these third-party tools, refer to the individual product manuals.

The Flash Video Exporter dialog box enables you to specify the video and audio quality of your FLV file during export from third-party editing and encoding applications. For details about the options in the dialog box, see [“Using the Flash Video Exporter Plug-In”](#) at the Macromedia Developer Center.

For the Flash Video Exporter plug-in to work properly, you must have a valid Flash MX Professional 2004 license installed and activated on your computer. If you are using Flash MX Professional in evaluation mode, or if you do not have a valid Flash MX Professional license installed, you can still use Flash Video Exporter in demo mode. In demo mode, you can use all of the features of the plug-in, but the FLV files created will show two one-pixel diagonal lines running across the resulting video, as shown in the following image:



Supported third-party applications

Editing and effects applications that support Flash Video Exporter include the following:

- Adobe After Effects 5.5 and 6.0
- Apple Final Cut Express
- Apple Final Cut Pro (3.x and 4.x)
- Apple QuickTime Player 6.3
- Avid Media Composer
- Avid Xpress DV and Avid Xpress Pro

Batch encoding applications that support Flash Video Exporter include the following:

- Anystream Agility
- Canopus ProCoder
- Discreet Cleaner
- Discreet Cleaner XL

CHAPTER 3

Delivery Options for Flash Video

There are a variety of options for delivering your Macromedia Flash Video content to visitors to your site. You must choose a delivery option before you can add the Flash Video to your site.

This chapter describes the options. [Chapter 4, “Adding Flash Video to Your Website,”](#) describes how to implement the option you’ve chosen.

Summary of delivery options

The Macromedia Flash MX 2004 products enable you to deliver on-demand video in any of the following ways:

- Using embedded video within SWF files. See [“Embedding video within SWF files” on page 17.](#)
- Using progressive download FLV files. See [“About progressive download” on page 18.](#)
- Streaming video from your own Flash Communication Server or from a hosted server using Flash Video Streaming Services. See [“About streaming video” on page 19.](#)

Note: For live video, you must use streaming. For more information about live video, see [“Detailed comparison of delivery options” on page 20.](#)

For more details about the options, see [“Detailed comparison of delivery options” on page 20.](#)

Embedding video within SWF files

Since the introduction of Flash 5 and Flash Player 5, multimedia developers have been able to embed video within SWF files by importing video and placing it on the Timeline in the Flash authoring tool. When the SWF file is published, the video is fully contained in that file. This approach requires only a normal web server to deliver the video.

However, embedded video is recommended only when you want visitors who have Flash 5 to be able to view your video, or when you must have one single file that encapsulates the video and the Flash content, or when your video clip is under 5 seconds long. In all other cases, embedded video is not recommended.

There are some benefits to using embedded video, such as the ability to see the individual video frames on the Flash Timeline and create overlays and interactions with the aid of the Flash design tools.

However, embedded video has some limitations:

- If your video content changes, you must re-open Flash, re-embed the video, recheck and possibly rework any navigation and or associated content, and then republish the SWF file to make the change.
- During authoring, each time you want to preview or test part or all of your Flash content, you must publish the entire video file. This can add significant time to the authoring process.
- For web delivery, the entire video file must be downloaded from the web server in order for playback to begin.
- At runtime, the entire video file must fit into the local memory of the playback system.
- After approximately 120 seconds of continuous video playback, users may experience audio synchronization problems.
- File length is limited to a maximum duration of no greater than 16,000 frames.
- The video frame rate and Flash Timeline frame rate must be the same (because they share the same time base).
- The codec that encodes the video when you import it into Flash is of lower quality than the codec used in other approaches.

Therefore, the embedded-video approach is recommended only in specific cases as described above; and even in those cases, you should use it only when you want to deploy very short clips of video, when the quality of that video is not very important, and when the video content is unlikely to change very often.

About progressive download

Flash Player 7 introduced a new technique called progressive download, which enables developers to use ActionScript commands to feed external FLV files into a SWF file and play them back at runtime. More specifically, you can use the `netConnection` and `netStream` commands to set the FLV file to play back, and to control the Play, Pause, Seek (to a timecode), and Close behaviors and the buffertime and size for a given video file.

In this method, the video content (FLV file) is kept external to the other Flash content and the video playback controls. Because of this, it's relatively easy to add or change content without republishing the SWF file.

Flash MX Professional 2004 also includes a set of components called media components that you can use to quickly add a full-featured FLV or MP3 playback control to your Flash project. Media components provide support for both progressive download and streaming FLV files. Flash MX Professional 2004 also includes a set of behaviors that can be used in conjunction with media components to create automated interactions between video sequences and slides in a project. (For details on using ActionScript and media components, see the reference guide, which you can view using the Flash MX 2004 Help panel.)

Using progressive FLV files has the following advantages over using embedded video:

- During authoring, you need to publish only the SWF interface for previewing or testing part or all of your Flash content. This results in faster preview times and quicker turnaround on iterative experimentation.
- For delivery, video begins playing as soon as the first segment has been downloaded and cached to local disk.
- At runtime, video files are loaded from the local disk into the SWF file, with no limitation on file size or duration. There are no audio synchronization issues or memory restrictions.
- The frame rate of the video file can be different from the frame rate of the SWF file, allowing for greater flexibility in setting up a project.

About streaming video

The most complete, consistent and robust delivery option is to stream video and audio files from a server running Flash Communication Server. In streaming, each client opens a persistent connection back to the video server, and there is a tight relationship between the video being delivered and the client interaction. This approach lets you deliver features such as bandwidth detection to serve up the right size video, quality of service metrics, detailed tracking and reporting statistics, and a whole range of interactive features along with the video experience.

As with progressive download, with this method the video content (FLV file) is kept external to the other Flash content and the video playback controls. It is, therefore, relatively easy to add or change content without the need to republish the SWF file. Further, because there is a persistent connection between client and server when streaming, the FLV content can be changed based on feedback from the user or the application. For example, you can switch to a lower bit rate video if you notice quality-of-service degradation.

This approach also has other advantages, such as the following:

- The video starts playing sooner than it does using other approaches.
- Streaming uses less of the client's memory and disk space, because the clients don't need to download the entire file.
- It makes more efficient use of network resources, because only the parts of the video that are viewed are sent to the client.
- It provides more secure delivery of media, because media does not get saved to the client's cache when streamed.
- It provides better tracking, reporting, and logging ability—important features for industries such as video ad serving.
- It lets you deliver live video and audio, or capture video from a client's webcam or digital video camera.
- It enables multiway and multiuser streaming for creating video chat, video messaging, and video conferencing applications.

- It provides programmatic control of streams (server scripting) for the creation of server-side playlists, synchronization of streams, smarter delivery adjusted to client connection speed, and application creation.
- It provides advanced monitoring and reporting on traffic and throughput.

Customers who do not want the difficulty and expense of buying and maintaining server hardware and Flash Communication Server software can get all the benefits of streaming Flash video and MP3 files with the Flash Video Streaming Service. This service is a load-balanced, redundant deployment of Flash Communication Server, hosted by a Macromedia-authorized Content Delivery Network partner. For more information about the Flash Video Streaming Service, please visit the Macromedia website at www.macromedia.com/go/fvss. The following image shows three steps of the Flash Video Streaming Service setup wizard.

A lower-cost alternative is Flash Video Streaming Service Lite, which also allows you to stream Flash Video from a hosted service. However, if you use Flash Video Streaming Service Lite, you can author only using the Flash Video extension for Dreamweaver. In other words, you can't author in Flash for Flash Video Streaming Service Lite, so you can't create new skins, add interactivity, or synchronize your video with text and graphics. These features are available in the full version of Flash Video Streaming Service. For more information about authoring with Dreamweaver, see [“Authoring with Dreamweaver and the Flash Video extension” on page 24](#).

Detailed comparison of delivery options

The following table provides a comparison of the characteristics of Flash Video delivery techniques:

	Embedded video	Progressive FLV	Streaming FLV
Encoding	Video and audio is encoded on import into Flash using the Sorenson Spark codec. Alternatively, FLV files (encoded elsewhere) can be imported and placed on the Flash Timeline (re-encoding is not necessary).	FLV files are encoded during export from various professional editing and encoding applications. Requires Flash Video Exporter, which is available only with Flash MX Professional 2004. FLV files can also be created by exporting the files from the Flash Timeline.	Same as Progressive FLV. In addition, bandwidth detection capabilities in streaming enable you to detect client connection and feed the appropriately encoded video. You can capture live video feeds from client-side webcams or Digital video (DV) cameras and control live encoding variables programmatically.
File size	SWF files contain video and audio streams and the Flash interface, resulting in a single, larger file size. SWF files can load each other, enabling you to break up individual video clips into multiple files.	SWF and FLV files are kept separated, resulting in a smaller SWF file size.	Same as Progressive FLV.

	Embedded video	Progressive FLV	Streaming FLV
Timeline access	When embedded in the Flash Timeline, video appears on individual keyframes and can be treated like any other object on the Stage. Ideal for creating interactions based on individual keyframes of video.	Video is played back only at runtime. Individual keyframes are not visible on the Flash Stage.	Same as Progressive FLV.
Publishing	Each time the Flash content is published or tested the entire video file is re-published. Changes to video files require manually re-importing the files into the Flash Timeline.	FLV files are only referenced at runtime. Publishing does not require referencing the video file directly, and is much faster than the embedded video approach. FLV files can be updated or modified without changing the SWF files for a project.	Same as Progressive FLV. You can dynamically pull FLV from virtual locations, such as your SAN or the Flash Video Streaming Service CDN.
Frame rate	Video frame rate and SWF frame rate must be the same.	The FLV video file can have a different frame rate than the SWF file, allowing for separate timings between video and the other Flash content.	Same as Progressive FLV. Live video capture has programmable control over frame rate.
ActionScript access	Video playback and control is achieved by controlling the SWF content's playback on the Flash Timeline. Flash MX 2004 includes several behaviors for controlling video and audio playback.	You can use the netStream command to Load, Play, Pause, and Seek through multiple external FLV files.	Same as Progressive FLV. You can also use server-side ActionScript to provide additional functionality such as synchronization of streams, server-side playlists, smart delivery adjusted to client connection speed, and more.
Components	No video-specific components.	You can use media components (Flash MX Professional 2004 only) to set up and display external FLV files together with transport controls (Play, Pause, and Search).	You can use media components (Flash MX Professional 2004 only) with video streamed from Flash Communication Server or Flash Video Streaming Service. Also, you can use Flash Communication Server communication components for streaming live and multiway video.

	Embedded video	Progressive FLV	Streaming FLV
Web delivery	The entire SWF file must be downloaded to the client and loaded into memory in order to play back video.	FLV files are progressively downloaded, cached, and then played from the local disk. The entire video clip need not fit in memory.	FLV files are streamed from Flash Communication Server, played on the client's machine, and then discarded from memory in a play-as-you-go method.
Performance	Audio and video synchronization is limited after approximately 120 seconds of video. Total file duration is limited to available RAM on the playback system.	Improved performance over embedded SWF video, with bigger and longer video and reliable audio synchronization. Provides best image quality, which is limited only by the amount of available hard drive space on the playback system.	Improved efficiency from a web delivery perspective, with optimal bit rate delivery on an as-needed basis to as many customers as necessary. Image quality limited to bit rates that can be delivered in real time.
Usage	Shorter video clips (less than 1 minute) that are smaller (less than 320 x 240), and have a lower frame rate (12 frames per second (fps)).	Longer video clips that are larger (720 x 480 and greater) and have a higher frame rate (up to 30 fps).	Large quantities of video, very long video clips, and live and multiway streaming (such as webcam chat and live event broadcasts).
Compatibility	Flash Player 6 and later	Flash Player 7	Flash Player 6 and later

CHAPTER 4

Adding Flash Video to Your Website

There are two general approaches to adding Flash Video to your web pages: using Macromedia Dreamweaver and using Macromedia Flash.

Note: Before you can add video to your pages, you must decide which delivery mechanism to use: progressive download or streaming. For more information, see [Chapter 3, “Delivery Options for Flash Video.”](#)

You can use Dreamweaver and the Flash Video extension to quickly add video to your web page without having to use Flash. For more advanced capabilities—such as adding interactivity, adding a custom interface, layering video with other Flash animation, and synchronizing the video with text and graphics—use Flash.

When you add Flash Video to a page, you should also add a behavior to the page to detect plug-ins. In particular, you should check that any visitor trying to view the page has a version of Macromedia Flash Player that lets them view the content you’re providing. For details on detecting plug-ins, see the TechNote “How to detect the presence of the Flash Player” at www.macromedia.com/support/flash/ts/documents/uber_detection.htm.

Authoring with Dreamweaver and the Flash Video extension

The Flash Video extension allows you to create and publish simple Flash Video within Dreamweaver, without using Flash.

The following procedure describes how to add Flash Video to a web page within Dreamweaver. For details, see the Flash Video extension help.

To add Flash Video to a web page using Dreamweaver:

1. Capture and/or encode an FLV file. For details, see [Chapter 2, “Capturing and Encoding Video,”](#) on page 11.
2. Upload the FLV file to the web using one of the following options:
 - If you’re using progressive download FLV, upload the FLV file to your web server.
 - If you’re using streaming FLV on your own Flash Communication Server, upload the FLV file to an application on your FCS server.
 - If you’re using the hosted Flash Video Streaming Service or Flash Video Streaming Service Lite, upload the FLV file to your account on the Flash Video Streaming Service or Flash Video Streaming Service Lite server.
3. Install the Flash Video extension from the Flash Video Kit. See the QuickStart guide for details.
4. Start Dreamweaver.
5. Create a blank HTML or XHTML document.
6. Using the Flash Video extension, insert a Flash Video component into your page. Set options as appropriate.
7. Add plug-in-detection behavior to your page, in case visitors don’t have an appropriate version of Flash Player. For more information, see the TechNote “How to detect the presence of the Flash Player” at www.macromedia.com/support/flash/ts/documents/uber_detection.htm.
8. Upload the HTML file and the SWF file to your web server.

Authoring with Flash

You can use the Flash authoring environment to build a rich interface for playing your video in the browser.

The following procedure describes how to use components to author Flash Video. For information on hand-coding your video controls using ActionScript, go to the Macromedia website at www.macromedia.com/go/as_controls.

To add Flash Video to a web page using Flash:

1. Capture and/or encode an FLV file. For details, see [Chapter 2, “Capturing and Encoding Video,”](#) on page 11.
2. Upload the FLV file to the web using one of the following options:
 - If you’re using progressive download FLV, upload the FLV file to your web server.
 - If you’re using streaming FLV on your own Flash Communication Server, upload the FLV file to an application on your FCS server.
 - If you’re using the hosted Flash Video Streaming Service, upload the FLV file to your account on the FVSS server.
3. Start Macromedia Flash MX Professional 2004.
4. Create a new Flash document.
5. Set the properties of your SWF content as desired.
6. Add the MediaPlayer component to your Stage. When the document is published, this component displays your video and its controls.

Note: The MediaPlayer component is available only as part of Macromedia Flash MX Professional 2004.

7. Configure the MediaPlayer component as desired, including providing the URL of your FLV file.

Note: For progressive download, specify a URL of the form `http://www.example.com/video_name.flv`. For streaming, specify a URL of the form `rtmp://www.example.com/application_name/instance_name/video_name.flv`.

8. Test the video.
9. Publish the video.

Flash generates a SWF file and an accompanying HTML template.

10. Upload the HTML file and the SWF file to your web server.

CHAPTER 5

Broadcasting Live Video

The basic idea of broadcasting a live video stream using Macromedia Flash Video is the same as the basic idea of streaming on-demand (pre-recorded) Flash Video: you provide a video stream to Macromedia Flash Communication Server, which streams it to people who visit your site, and those visitors view the stream using Macromedia Flash Player.

However, the way you provide the video stream for live video is very different: you need a source of live video, and that video feed must be encoded in real time as it is captured. Unlike the procedure for on-demand video, with live video the capturing, encoding, and publishing steps all happen at the same time.

Checklist for capturing and publishing live video

The following procedure explains how to capture and publish live video.

To capture, encode, and publish live video:

1. Using the Flash authoring tool, create a SWF file that captures and transmits live video, also known as a broadcast application. See [“Encoding live video” on page 28](#).
2. Create a live streaming application on your Flash Communication Server, or sign up for a live video streaming account on the Flash Video Streaming Service.
3. Create another SWF file that plays streaming video, and publish this SWF file to your website. See [Chapter 4, “Adding Flash Video to Your Website.”](#)
4. Connect a digital video camera or web camera to your computer, and then open the broadcast application that you created.
5. Publish the live stream from your camera to your Flash Communication Server or Flash Video Streaming Service. For more information, see [“About streaming video” on page 19](#).

When visitors to your site browse to the SWF file on your website, Flash Player displays the live video stream for them.

Encoding live video

For a Flash Video live video stream, the live video source can come from any camera connected to a computer. It could be a webcam connected to your laptop's USB port or a digital video camera connected to a high-end video capture card.

Note: Live video can only be streaming video. The other options available for on-demand video (embedded video and progressive-download FLV files) are not available for live video.

Flash Player 6 and later contains an audio and video encoder that lets you capture audio and video directly from any camera or microphone connected to your computer. You run a particular kind of SWF file, also called a broadcast application, on the computer that the camera is connected to. The broadcast application contains all of the settings which are required to encode the video in real time. Many of these settings are conceptually the same as those discussed in the on-demand sections of this document, such as bit rate and keyframes. For more information, see “Best practices for encoding on-demand video” on page 13.

Note: Capture cards and other live video encoding hardware improve the quality of live video by sending a better video signal to the broadcast application and moving much of the encoding processing from Flash Player to the hardware. However, such hardware is not necessary for basic live video streaming.

The broadcast application sends the live video to your Flash Communication Server or to a Flash Video Streaming Service server, which re-publishes the live video to be viewed by anyone who connects to the stream.

The live video capabilities in Flash Communication Server include audio push, record, and record-append. In addition to live video streaming, Flash Communication Server lets you produce video chat, video messaging, webcasting, video conferencing, stop-motion capture, and so on. For information on using live video with advanced streaming features, visit the Macromedia website at www.macromedia.com/go/flashcom.

The details of how to create a broadcast application are outside the scope of this document. However, Flash Communication Server includes several sample applications and components that let you capture and broadcast live video. For information on specific settings to use, see “Producing Live Video” at the Macromedia Developer Center at www.macromedia.com/go/flv_bestpractices_live.

In addition to the broadcast application, you must create a web page that allows visitors to view the broadcast. The process for creating such a page is similar to the process for creating any page for viewing a video stream; for more information, see Chapter 4, “Adding Flash Video to Your Website.”

APPENDIX

Technical Overview of Video Standards

This appendix explains the basic concepts and usage of video parameters and standards.

Video Standards: NTSC and PAL

The video that you see on your television screen follows standards established in the 1950s when color television was first introduced. The leading formats in use today are NTSC (National Television System Committee) and PAL (Phase Alternating Line). Generally speaking, NTSC is the standard used in the Americas and Japan, whereas PAL is used in Europe, Australia, the Middle East, and Asia.

Neither video standard is optimal for presentation on computer monitors; each poses different challenges when you are trying to optimize video for web delivery:

- **Frame Size:** NTSC and PAL have different image sizes, both of which differ from the available image sizes of computer monitors.
- **Frame Rate:** NTSC and PAL have different frame rates for the display of images, both of which differ from those used by computer monitors.
- **Pixel Aspect Ratio:** NTSC and PAL share a pixel aspect ratio (referred to as D1 Aspect Ratio, which is essentially rectangular), but this ratio is different from that used by computer monitors (which is square).
- **Display:** NTSC and PAL consist of two separate “interlaced” fields, while computer monitors display “progressive” images.

The following table summarizes these differences:

	Image Size	Frame Rate	Aspect Ratio	Display
NTSC	720 x 480	29.97	D1	Interlaced
PAL	720 x 576	25	D1	Interlaced
Computer	Varies (much larger)	--	Square	Progressive

Frame size

Conventional television screens are made up of horizontal lines, while computer monitors consist of a series of horizontal and vertical pixels. The standard line resolution for an NTSC television is 525 lines; for PAL, it is 576 lines. Most modern computer monitors have much higher vertical resolutions (measured in pixels), such as 768 or 1024, requiring vertical upscaling during playback in order to fill the monitor.

For NTSC video images, the SMPTE 259M professional standard specifies that the 525 lines be represented as 720 x 486—that is, 720 horizontal pixels by 486 vertical pixels. This default video size is commonly known as D1. Capturing footage with most modern video capture cards from a professional BetaSP or Digital Betacam source results in a D1-sized frame. Capturing footage from a DV (digital video) source, however, yields a 720 x 480 frame. The difference between the D1 spec and the DV spec is only 6 vertical pixels. Many compression algorithms, including DV compression, work best with pixel dimensions that are multiples of 16. By removing 6 pixels from the D1 resolution, the DV format achieved a native resolution with a multiple of 16.

For PAL video images, frames are always 720 x 576 pixels, regardless of video source. Because PAL's vertical resolution, 576, is a multiple of 16, no change is necessary for DV compression.

Frame rate

Video is essentially a sequence of images flashed on the screen in rapid succession, giving the illusion of motion. The number of frames displayed every second is known as the frame rate, and it is measured in frames per second (fps). The higher the frame rate, the more frames per second will be used to display the sequence of images, resulting in smoother motion. The trade-off, however, is that higher frame rates require a larger amount of data to display the video, and therefore more bandwidth.

NTSC video is usually said to run at 30 fps, and PAL runs at 25 fps. Actually, NTSC runs at 29.97 fps. The reason for the odd frame rate dates back to the transition from black and white television to color TV signals, where the 29.97 fps rate was chosen to ensure backwards compatibility with existing television sets. There are still 30 frames, but they run 0.1 percent slower than actual time, resulting in a frame rate of 29.97 fps.

When working with compressed video in a format like Flash Video, the more frames that have to be displayed in a second the higher the file size. To reduce the final file size, you must lower either the frame rate or the data rate. If you lower the data rate and leave the frame rate unchanged, the image quality is reduced to yield a smaller file size. If you lower the frame rate and leave the data rate unchanged, the file size is reduced but the video may appear to stutter and motion may look less fluid than desired.

Whenever the frame rate is reduced, it is always a good idea to use an evenly divisible ratio of the original frame rate. If your source has a frame rate of 24 fps, then reduce the frame rate to 12 fps, 8 fps, 6 fps, 4 fps, 3 fps, or 2 fps. If the source frame rate is 30 fps, in most cases you can adjust the frame rate to 30 fps, 15 fps, 10 fps, 6 fps, and so on. If your video is more than 10 minutes long, then audio will drift noticeably out of synch if you do not adhere to the 29.97 fps rate or an accurate even division for lower frame rates (such as 14.98, which is half of 29.97).

Pixel aspect ratio

The D1/DV NTSC and PAL specifications specify non-square pixels (often called D1 aspect ratio), while computer monitor pixels are square. D1 pixels are vertically shorter. For this reason, when you look at a D1 video image on a computer monitor, the images appear to be squashed vertically—making actors appear to be shorter. When this image is displayed on a broadcast monitor, the pixels are wider than they are tall and appear normal, as shown in the following image.

The image on the left is displayed on a video monitor; the image on the right is displayed on a computer monitor. Note that the image looks vertically compressed on the computer monitor, but normal on the video monitor.



For this reason video images that are intended for display on computer monitors must be pixel-aspect-corrected by scaling the image to a valid 4:3 aspect ratio. For NTSC, the full square pixel resolution is 720 x 540 (vertical compensation), and for PAL it is 768 x 572 (horizontal compensation). Commonly used final video display resolutions on the Internet include 640 x 480, 512 x 384, 320 x 240, and 160 x 120.

Most video editing applications compensate for the pixel aspect ratio discrepancy by scaling the video image in real time while rendering it on the computer monitor. This is done because eventually the images are intended to return to television monitors for final display, and scaling the actual pixels in the video file would needlessly introduce a subtle distortion from the scaling operation. However, for web display, this real-time compensation is not a valid approach, given that the video sequence is destined to be displayed on a square pixel monitor, and as such should be hard-rendered to compensate for the discrepancy.

Interlaced and progressive video

Video images consist of two interlaced fields that together make up a frame. This approach was introduced when TV was first invented, due to a technical limitation that prevented a full frame from being “progressively” drawn on the monitor (from top to bottom) without a noticeable visual shuttering; as an image was being displayed, it appeared as though it was being wiped on the screen. By breaking up the image into two fields (halves) and displaying one after the other this artifact was eliminated. This legacy technique has been a tremendous obstacle in the digital age of video and computers, and has been eliminated from newer video standards for High Definition television, which are progressive (images are drawn in one pass from top to bottom). A single group of lines is known as a field. The two fields are referred to as the upper field and the lower field, or Field 1 and Field 2, or odd and even, or top and bottom; unfortunately there is no standard nomenclature.

The following image shows two fields and the frame that results from interlacing them:



With real video footage, the two interlaced fields often look very similar to each other, and no visible artifacts appear when looking at a video frame on a computer monitor. However, with video footage that includes high motion material that changes quickly (such as movement of the camera or of people in the frame) very noticeable field artifacts appear when the fields are displayed together on a computer monitor, giving the image a ghost-like quality. This is due to the composition of two moments of time together in one frame.

Therefore, to display crisp video on a computer monitor, video frames must be de-interlaced by eliminating one of the fields. Half the information of each frame is discarded and the remaining information doubled or interpolated. For NTSC, this results in 30 frames of 30 distinct points in time.

In the following pair of images, the image on the left is an interlaced frame; in the image on the right, one of the fields has been eliminated to produce a “de-interlaced” frame.



Modern video standards for digital television have eschewed interlacing in favor of progressive scan display techniques. Progressive scan video cameras usually have the ability to switch back from progressive scan to interlaced video, and most of these cameras have a variety of frame rates with and without interlacing. Typical frame rates are described as 60p (60 fps progressive), 30i (30 fps interlaced), 30p (30 fps progressive), and 24p (24 fps progressive). When working with progressive images there is no need to de-interlace footage before deploying to the web.

