Flash Article

Delivering Flash Video: Understanding the Difference Between Progressive Download and Streaming Video

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Embedded Video (SWF)

Since the introduction of Flash MX and Flash Player 6, multimedia developers have been able to embed video within Flash movies by importing video and placing it on the Timeline using the Video Import wizard. When the Flash movie is published, the video is fully contained in the SWF file. This requires only a normal web server to deliver the video.

In this method, the video content is placed on the Flash Timeline and "baked in" the SWF file with any other Flash content. Since the video is on the Timeline, the Flash Timeline Control API can be used to control video playback. Other content in the SWF file, events, and interactivity can all be synchronized with the video through the Timeline.

Pros and Cons

Perhaps the biggest benefit of this method is that the traditional Flash designer, who is very familiar with the Flash Timeline, can understand it easily. However, when you deliver video using this method, users are likely to experience the following limitations:

- **Lower video quality:** A lower quality codec is used to encode video when it is imported into Flash, so your video may not have the best quality.
- **Large SWF files and long download times:** This method dramatically increases the size of your SWF file, resulting in long publishing times and poor viewing experiences because users have to wait a considerable time to download the SWF before playback.
- **Difficult-to-change content:** Making a change to the video can be tedious because you must reimport the video, possibly adjust your Timeline effects, and then republish the SWF file.
- **Audio sync issues:** The frames-per-second (fps) rate of the video and the Flash movie must match or else the audio and video will be out of sync.
- **Lack of support for long video clips:** There is a limit to the number of frames that Flash can accept, so you may not be able to import larger videos.

When to Use Embedded Video

Because of these limitations, this method is only recommended in niche cases when you absolutely need the video to be in the same file as the SWF file and the video is short and small.

Progressive Download (FLV)

Macromedia Flash MX 2004 and Flash Player 7 introduced a new technique called progressive download for delivering video in Flash. This method enables developers to use ActionScript commands to feed external FLV files into a Flash movie and play them back during runtime (see Figure 1).

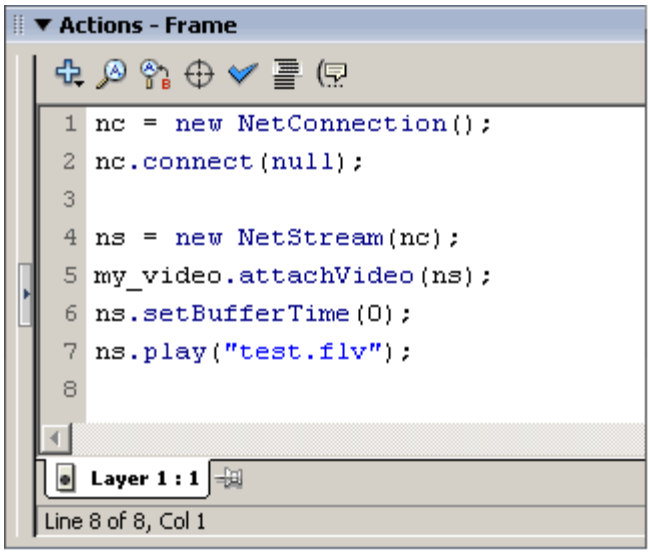

Figure 1. ActionScript commands for progressively downloading external FLV files from a Flash movie

In this method, the video content (FLV file) is kept external to the other Flash content and the video-playback controls (the video player) in the SWF file.

When the video is played, the video file is downloaded to the client's computer (hard drive) before playback. The file is served from a normal web server through an HTTP request just like a normal web page or any other downloadable document.

Unlike traditional download-and-play methods of video delivery, however, the file starts playing before it has completely downloaded when you use progressive download.

Pros and Cons

Keeping the video external and separate to the SWF file offers a number of benefits over embedded video, including the following:

- **Easy to update:** It's relatively easy to add or change content independently of the video player and without the need to republish the SWF file.
- **Small SWF file size:** Your SWF file can remain very small for fast page loads and the video can be delivered when the user requests it.
- **Better performance:** Because the FLV and SWF files are separate, the performance and results of your video playback will typically be better. Issues such as the lack of sync between the fps rate of the video and the fps rate of the SWF file will no longer be a problem.

These benefits apply to both progressive download and streaming video. They are compelling enough to warrant that embedded video should only be used as a last resort.

When comparing progressive download to streaming video, there's really only one benefit to progressive download: You don't need streaming server software to deliver the video. Progressive download video can be served from any normal web server. For example, it can be served off the same machine that is running Apache or IIS and serving your HTML pages.

While the progressive download approach is nice in that respect, you should note the following potential issues:

- **Limited seek and navigation capabilities:** Viewers cannot seek forward through the video before it is completely downloaded. Viewers need to wait until the video is downloaded before they can navigate to a particular portion of the video. Because of this, streaming video will probably be a better choice than progressive download when you are delivering long video files in which you want to let viewers skip around, such as lengthy

symposia or training materials.

- **User-accessible content:** Because the file is downloaded, the media physically resides on the viewer's machine. Savvy users will be able to search their browser caches or temporary Internet files and access the content. This is not necessarily a bad thing if the content owner has no concerns about rights management for his or her content. In fact, in that case it may actually be useful—if the user decides to view the same video clip again before the browser cache is cleared, the file plays back from the local cache without the user having to access the web again. However, if digital rights are a concern, streaming video is a better option.

When to Use Progressive Download

Progressive download is a perfect use for hobbyists or websites that have low traffic requirements and only need to deliver short videos. Customers who need advanced features and control over their video delivery—not to mention displaying video to large audiences (for example, several hundred simultaneous viewers), tracking and reporting video viewing statistics, or offering the best video experience—should consider streaming video.

Streaming Video (FLV)

The ability to stream Flash Video was first available with the introduction of Flash MX, Flash Player 6, and Flash Communication Server MX.

As is the case with progressive download, when you use streaming video, FLV files are kept external to the other Flash content and developers can use ActionScript commands to feed those external FLV files into a Flash movie and play them back during runtime (see Figure 2). In fact, the ActionScript code needed for streaming video is almost identical to that for progressive download.

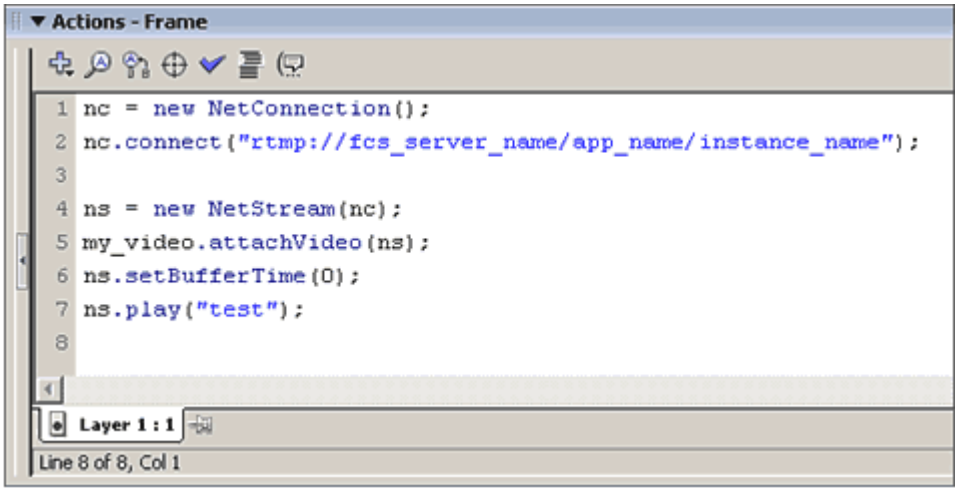

Figure 2. ActionScript commands for streaming external FLV files from a Flash movie

However, that's where the similarities end. In the case of streaming video, each client opens a persistent connection to the streaming server and the server streams the video bits to the requesting client. Those bits are consumed by the viewer and then immediately discarded.

This tight connection between the server and client, and the server's ability to precisely control and deliver any portion of stream at will, enables the developer to take advantage of a number of very advanced capabilities:

- Determining the client bandwidth and serving up the correct bit rate stream
- Measuring and tracking the quality of service of the stream and switching to a lower (or higher) bit rate stream if needed—for example if network congestion increases
- Automatically generating thumbnails or playing short previews of video clips without having to create separate image or video clips
- Automatically creating "chapters" (with appropriate thumbnails) that users can navigate to in one very long video

without having to break up the video into shorter pieces

- Switching midstream from one camera angle to another without missing a beat
- Editing together a full video based on portions of other video clips—for example, playing the first 10 seconds of Clip 1 followed by the content between the 30 and 40 second marks of Clip 2, followed by the last 20 seconds of Clip 3
- Webcasting live or recorded events where everyone sees the same thing at the same time

If progressive download is a very dumb way to deliver video with very little control—it's basically a simple HTTP download call—streaming video is a very smart way to deliver media because it enables publishers to control every aspect of the video experience.

Pros and Cons

The advantages of streaming Flash Video from Flash Communication Server are numerous:

- **Fast start:** Streaming FLV files is the fastest way to start playing any video on the web.
- **Advanced video control:** Features such as bandwidth detection, quality-of-service monitoring, automatic thumbnail creation, and server-side playlists can only be found in streaming video.
- **More efficient use of network resources:** Customers who pay for their video hosting or bandwidth by the amount that is transferred benefit from streaming video because only the bits that the client views are transferred.
- **Secure media delivery:** Because the streamed media is not saved to the client's cache, users cannot rifle through their temporary Internet files folder to get the video or MP3 file. In addition, Flash Communication Server supports SSL encryption of streams, providing the tightest security possible.
- **Minimal use of client resources:** Streaming reduces memory and disk space significantly because the client does not need to download the entire file.
- **Tracking, reporting, and logging capabilities:** Because progressive download is just a "hit on a file," you cannot extract any statistics about video usage—for example, how long the video was viewed; whether the user navigated backward, forward, or paused the video; how many times the user played the video; whether the user left the web page before the video completed playing; and so on. Streaming enables you to capture these important statistics.
- **Full seek and navigation:** Viewers can immediately seek to any point in the video and have it start playing immediately. The streaming server immediately delivers the requested video and the user doesn't have to wait until the entire video is downloaded before navigating to a particular mark. This makes streaming a great solution for longer playing videos or applications such as video blogging, where you may want to jump into the video at a specific point rather than requiring the viewer to watch it from the beginning.
- **Deep interactivity:** The precise stream control found in streaming video enables developers to create extensive interaction in their videos. For example, streaming video provides the ability to switch camera angles, have one video spawn another video, or switch seamlessly to alternate endings.
- **Live video:** Streaming provides the ability to deliver live video and audio from any connected webcam or digital video camera.
- **Video capture and record:** In addition to live streaming, Flash Communication Server gives you the ability to record video either in conjunction with the live stream (for example, archiving an event) or on its own (for example, video messaging).
- **Multiuser capabilities:** In addition to live one-to-many streaming, Flash Communication Server enables multiuser streaming of audio and video for the creation of video communication applications.

Although streaming video may be perceived as being more difficult than progressive download, both methods are actually extremely similar: They both use the same components and the same ActionScript commands. The key difference is that streaming video helps developers enjoy greater control over the video stream.

The only potential drawback with streaming video is that it requires special server software. Just as a robust data

application requires you to install an application server in addition to your web server, robust media delivery applications require a streaming server in addition to the web server. For streaming Flash Video you must use Flash Communication Server. It is the only software that can stream audio, video, and real-time data to Flash Player.

Customers who do not want the hassle and expense of buying and maintaining server hardware and Flash Communication Server software can get all the benefits of streaming Flash Video with Flash Video Streaming Service. This service is a load-balanced, redundant deployment of Flash Communication Server over a reliable content delivery network.

When to Use Streaming
Streaming video with Flash Communication Server should be used in any situation where you want or need to do the following:

- Deliver long files—for example, video clips over 10 minutes long
- Deliver video to many viewers—for example, a hundred or more simultaneous viewers
- Have advanced features such as bandwidth detection or quality-of-service monitoring for delivering the best possible experience
- Provide interactivity to your video experiences
- Stream live video
- Capture video

In short, if your website relies heavily on video for delivering your message you will want to present it in the best possible manner and use Flash Communication Server.

Flash Video Delivery Techniques at a Glance

The following table compares the three Flash Video delivery techniques.

	Embedded Video	**Progressive Download**	**Streaming Video**
Encoding	Video and audio is encoded on import into Flash using the Sorenson Spark codec. Alternately, FLV files (encoded elsewhere) can be imported and placed on the Flash Timeline (re-encoding is not necessary).	FLV files are encoded externally from the Flash authoring system either through the Flash Video Exporter and a third-party nonlinear editing or encoding product or a stand-alone video encoding application such as Sorenson Squeeze.	Same as progressive download. In addition, you can capture and record live video feeds from client-side webcams or DV cameras and control live encoding variables such as bit rate, fps, and video playback size programmatically.
File Size	SWF files contain both the video and audio streams as well as the Flash interface, resulting in a single, larger file size.	SWF and FLV files are kept separate, resulting in a smaller SWF file size.	Same as progressive download.
Start Time	Heavy SWF files often require users to wait a long time before seeing any video. Horrible user experience.	Starts pretty fast.	Immediate. The fastest way to go from Play to actually seeing the video.
Timeline Access	When embedded in the Flash Timeline, video appears on individual	Video is played back only at runtime. Individual keyframes are not visible on the Stage.	Same as progressive download.

	keyframes and can be treated like any other object on the Stage.	Timeline events can be triggered at selected times of video playback.	
Publishing	Each time the Flash movie is published or tested, the entire video file is republished. Changes to video files require manually reimporting files into the Timeline.	FLV files are only referenced during runtime. Publishing to the SWF format is much faster than with embedded video. FLV files can be updated or modified without changing the SWF files for a project.	Same as progressive download. You can dynamically pull FLV files from virtual locations, such as your storage area network or the Flash Video Streaming Service content delivery network.
Frame Rate	Video frame rate and SWF movie frame rate must be the same.	FLV files can have a different frame rate than the SWF files.	Same as progressive download. Live video capture has programmable control over the frame rate.
ActionScript Access	Video playback and control is achieved by controlling the movie's playback on the Timeline. Flash MX 2004 includes several behaviors for controlling video and audio playback.	The `netStream` command can be used to load, play, and pause through external FLV files.	Same as progressive download. Server-side ActionScript can also be used 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.	Media components (Flash MX Professional 2004 only) can be used to set up and display external FLV files together with transport controls (Play, Pause, and Search).	Same as progressive download. Also you can use Flash Communication Server communication components for streaming live and multiway video.
Seek and Navigation Ability	Requires the entire SWF file to be downloaded before the user can seek or navigate the video.	User can only seek to portions of the video that have been downloaded.	User can seek anywhere at any time.
Web Delivery	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 sync 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.
Video Stream Control	None.	None.	Full control over what gets delivered when to clients.

Live Video Support	No	No	Yes
Compatibility	Flash Player 6, 7	Flash Player 7	Flash Player 6, 7

About the author

Chris Hock is director of product management at Macromedia. In this role he manages various products related to Flash Video including Flash Media Server and Flash Video Streaming Service. Prior to Macromedia, Chris spent 10 years at Autodesk, Inc. focusing on 3D design applications, Internet publishing, and enterprise collaboration solutions.