

RealFlash and RealAudio[®] Content Creation Guide

Beta 5.0

RealNetworks, Inc.

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Introduction

The Internet has rapidly evolved into the next mass medium. This explosive growth is matched by an emerging wealth of online content. Rapid technical innovations have enabled the creation of more compelling content delivered over the web.

To take advantage of this growth, content providers must have the ability to reach the entire Internet audience with the widest variety of information and entertainment. Users accustomed to traditional media will not tolerate delays caused by large downloads or incompatible technologies. Producers seeking to create the most compelling content cannot be constrained by the type of media currently suitable for online use.

Macromedia Flash and RealAudio have come together to provide you with RealFlash, streaming animation that is synchronized with RealAudio. RealSystem 5.0 delivers:

One Player/Plug-in For Animation, RealAudio, and RealVideo

With RealSystem 5.0, the end user can view animation and listen to audio with the same player/plug-in/activeX control. There are also over 20,000,000 RealPlayers already in place, ready to view your content.

Flexible and Superior Audio

A wide range of audio Codecs are now available for content authors to make choices regarding bandwidth and quality not previously available.

Reliable Delivery

Guaranteed delivery of RealFlash presentations over the Internet at bit rates of 28.8 and higher.

Real-time Streaming

Files play back on demand without download wait. Synchronized RealAudio and RealFlash presentations can stream effectively over 28.8 Internet connections.

Improved User Experience

The user experience is significantly improved with functionality such as seeking, pausing, or rewinding not available via HTTP pseudo streaming without download waits.

Overview

This guide will help you create a synchronized, streaming RealFlash and RealAudio multimedia presentation and will assist you in authoring Flash content that is optimized for use with RealSystem 5.0.

RealAudio and RealFlash Content Creation Guide is intended for people who are familiar with the World Wide Web, RealNetworks technology, and Macromedia Flash Authoring Tool. You do not need previous experience using RealEncoder or RealPublisher, but you do need to know how to create directories or folders, copy files, and open text files.

Presentation Planning

Your initial planning requires you to develop and understand some basic questions:

- What do I want to create?
- Why is it being created?
- What is the message to be conveyed?
- Who is the audience for the presentation?

With RealAudio and RealFlash Animation, understanding the answers to these questions will help you create the highest impact and most widely viewed presentations.

Note: It is important to read through the “Optimizing Animation” section of this guide before you begin your presentation.

Reaching the Largest Audience

Every computer network connection has an upper limit or bottleneck on the amount of data that can pass through it in a given second. This data limit is called *bandwidth*. The data rate (also called “bit rate”) of a file is the amount of data that must transmit in a given second for the whole file to be viewed and heard.

The majority of Internet users have 28.8K modems. Providing content that meets the delivery needs of this target audience ensures the largest audience possible to view your presentation. For 28.8K presentations, you should use an optimal total bit rate no greater than 20 Kbps. For example:

20 Kbps total bit rate = 6.5 Kbps audio file + 13.5 Kbps animation file

In a RealFlash/RealAudio animation, the data rate equals the sum of the audio bit rate and the RealFlash bit rate.

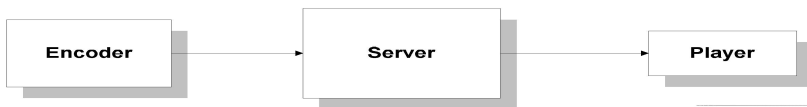
Hardware Requirements

The minimum hardware requirements for presentations are computers equipped with at least:

Minimum Hardware Requirements for Creating RealFlash and RealAudio Presentations	
Processor	Intel Pentium 90 CPU or equivalent MacPPC
Memory	16MB RAM

Components of RealSystem 5.0

To achieve the best results in streaming synchronized RealFlash and RealAudio files, we strongly recommend using RealNetworks' RealSystem 5.0. RealSystem 5.0 is an end-to-end streaming media solution that is the most widely deployed and field-tested system for delivering real-time animation, audio, and video over the Internet. RealSystem includes Encoders, Servers, and Players.



Product	Use	Customer
Encoders	Prepare audio and animation for streaming; create files to put on server	Web developers and Internet audio and animation producers
Servers	Send data to players using protocols	Corporations and Web developers who want to broadcast audio and video
Players	Play audio and animation streams	End users

RealAudio and RealFlash Files and Metabytes

The RealSystem 5.0 uses several file types, each identified by a specific file extension. The files and their file extensions are:

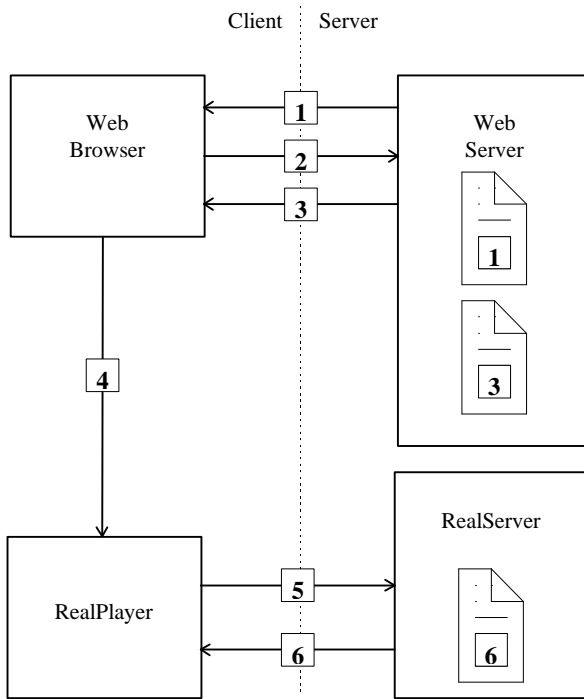
RealMedia clip (.rm)- Audio or video encoded to RealAudio and RealVideo formats. This file is created with RealEncoder or RealPublisher and delivered by the RealServer streaming media server. The .rm files can contain multiple streams, including audio, video, image maps, and events. Video files can contain audio and video or video only and can be played with RealPlayer. Audio only files can be played by RealPlayer and RealAudio Player.

RealMedia metafile (.ram)- The file that connects a Web page to one or more RealAudio or RealFlash clips. The metafile is located on a Web server and is linked by a Web page. The metafile contains the URL of one or more clips located on a RealServer streaming media server.

RealPlayer Plug-in metafile (.rpm)- The same as a metafile, but used with RealPlayer Plug-in for Netscape Navigator and Internet Explorer 3.0 and later.

Delivering a RealAudio and RealFlash Animation Clip

The following figure shows the process flow and components of The RealSystem used to deliver a typical RealAudio and RealFlash Animation. The numbers in the figure match the numbered steps following the figure.



RealVideo Delivery System

1. The Web browser displays a Web page that contains a link to a metafile.
2. The user clicks the link. The Web browser requests the metafile from the Web Server.
3. The Web server delivers a metafile to the Web browser.
4. The Web browser starts RealPlayer as a helper application and passes it the metafile.

5. RealPlayer reads the first URL from the metafile and requests it from RealServer.
6. RealServer begins streaming the requested presentation clip to RealPlayer.

Creating RealFlash

You create RealFlash animation in Macromedia Flash much as you would when creating a Shockwave Flash file for delivery by a Web server. You add audio tracks and synchronize them to the animation layer, saving the file in the Flash Movie (**.fla**) format.

When your presentation is ready, though, you export two files. The first is a Shockwave Flash video layer (the animation) without audio. The second is a video file (**.avi**) that contains the audio track. You then use RealNetworks tools to distill the audio portion of this video file into the RealAudio format. The resulting presentation comprises two files:

- Shockwave Flash file (**.swf**)—Created with Flash Authoring tool
- RealAudio file (**.rm**)—Created with Real Encoder or RealPublisher

Target and Total Bit Rate

When deciding the parameters to set for your RealFlash files and RealAudio files, consider the total bit rate, which is the combined bit rate of the RealFlash and RealAudio files. The following are the recommended total bit rates for common modem bandwidths.

Target Modems	Total Bit Rate
28.8 Kbps	20 Kbps
56.0 Kbps	35 Kbps
64.0 Kbps	56 Kbps
128.0 Kbps	105 Kbps

As shown in the table above, the total bit rate is reduced by 25% to compensate for connection and packet overhead that occurs during transmission. So if the target modem speed is 28.8 Kbps, the total bit rate should be 20 Kbps.

Remember, 28.8K modems are by far the most common means of delivery on the Internet. To reach the widest audience, therefore, keep the combined bandwidth of the Shockwave RealFlash file and the RealAudio file to 20 Kbps or less.

Exporting RealFlash and RealAudio Files

Follow the steps below to convert your Flash file (both animation and audio) into a RealFlash presentation.

Exporting a Shockwave File

1. Open the Flash file (**fla**) in Macromedia Flash.
2. Select **File→Export Movie**
3. In the dialog box, choose ***.swf** (Shockwave) as the file type.
4. Enter a file name that uses the **.swf** extension and click OK.
5. From the “Export Shockwave Flash” dialog box, set JPEG Quality between 30 and 50. (You may have to export the file several times with different settings before finding the best JPEG quality.)
6. From the “Audio Stream” and “Audio Event” drop-down boxes, choose **Disable** to turn off the native Flash audio.
7. Click OK to create the Shockwave file, which consists of animation only. Leave the Flash file open to export the audio as described in the next section.

Creating a RealAudio File

1. With your Flash file open, select **File→Export Movie**
2. In the dialog box, choose AVI (***.avi**) as the file type.
3. Enter a file name that uses the **.avi** extension and click OK.
4. In the “Export Windows AVI” dialog box, select dimensions of 32x32 regardless of the movie’s true dimensions. This minimizes file size and creation time.
5. Click OK to create the AVI file. Once the file is created, you can close the Flash application.
6. Open Real Encoder or RealPublisher.
7. Choose **File→Open Session**
8. On the **Source** panel, click **File**, and add your AVI file to the list box. On the Destination panel, click **RealMedia** and specify an output file name with the **rm** extension. Click **OK**.

9. In the **Templates** panel, click **Advanced** and deselect video. Then select an audio Codec. This tells Encoder/Publisher to save only the synchronized audio portion of the AVI file.
10. Enter a template name and click **Save**. Then click **Close**.
11. In the **Templates** panel, click **Start** to create your audio file. You can then close RealEncoder or Real Publisher.

RealFlash and RealAudio Playback

There are two ways of using RealPlayer to play audio and animation files:

1. As a stand-alone player, launched from a link in a Web page.
2. Embedded in a Web page using our Active X and Netscape plug-in.

The first requires less design and allows you to deliver your presentation files using the RealPlayer Helper Application. Embedding RealPlayer controls in a Web page offers seamless multimedia presentation within your page.

To play both the .swf and .rm file back locally, you need to create a metafile. This metafile has the extension, .ram and rpm for Netscape Plug-in and Active X controls. The function of a .ram file is to tell the RealPlayer where both the .swf and .rm file are located.

To create a metafile:

1. Open **Notepad** (or a text editor of your choice).
2. Type the location of the .swf and .rm files. Example: file:c:\temp\foo.swf+foo.rm
3. Save your file with a .ram extension in the same directory as your .swf and .rm files. Example: foo.ram.

Note: All file name and directory structures can follow long file name format. However, directory and file names cannot contain spaces.

To play back your local files using RealPlayer 5.0:

1. Open up RealPlayer 5.0.
2. Under the File menu, choose **Open File**.
3. Select a metafile to open.
4. Click **Open**.
5. Your files will now be played back in RealPlayer.

To play back files located on a RealSystem Server:

1. Follow steps 1-5 for playing back local files in the RealPlayer 5.0, except replace file file:c:\temp\foo.swf+foo.rm with pnm://servername.com/foo.swf+foo.rm.

Performance Improvement Tips

There are several ways to optimize Flash files and audio files before converting them to RealFlash and RealAudio.

Optimizing Flash Content before RealFlash Conversion

1. Import all audio into Flash. Typically, each line of dialog is a unique sound file.
2. Lay sounds into the Flash timeline. Make sure sounds are placed as *streaming* sounds.
3. Add enough frames during and between sounds so that timing is correct.
4. Place images into the Flash movie, synching to the sound timeline you've just created.
5. In the Sound dialog box, set the **Synchronization** option to **Stream**. This will synchronize the audio with the master timeline.

Files with Interactive Components

The Flash Play, Stop and GoTo actions correspond to the RealPlayer 5.0 play, pause and seek commands. Interactivity is accomplished with seeks along the timeline.

Modifying File Bandwidth with `swftune.exe`

Swftune is a DOS command-line utility that lets you change the available bandwidth of a RealFlash file delivering a smoother presentation with minimal spikes in bandwidth consumption.

For example, if your .swf file is streaming at 9.5 Kbps and you are using a 6.5 Kbps audio file, the presentation's total bandwidth is 16 Kbps. If your bandwidth limit is 20 Kbps, you can still use an additional 4 Kbps in your presentation. With **swftune** you can change the stream rate of your 9.5 Kbps file to 13.5 Kbps. This lowers the amount of preroll that occurs and minimizes the amount of buffering. As well, the amount of rebuffering that may occur during playback will decrease. This results If `swftune` is used to decrease the bitrate of a Shockwave Flash file, then it will increase the amount of preroll that occurs at the beginning of playback.

To use **swftune**, First download the “optimization kit” available with the RealFlash Content Creation Guide and extract the contents to you `C:\Real` directory. To run `swftune`, change to you `C:\Real` directory and type in the appropriate flags listed below.

Usage: `swftune [options] filename`

<code>-b</code>	[New Bitrate]	Set the bitrate of the file
<code>-c</code>		Report characters size & info
<code>-d</code>		Report bandwidth usage info
<code>-o</code>	[Filename]	Output to a different Filename
<code>-u</code>		Write changes back to swf file

For Example, type in the following at the `C:\Real`:

```
swftune -b 13500 -o output.swf -u input.swf
```

The above example will change the bitrate `input.swf`, to 13.5 Kbps and write the changes to `output.swf`.

- The `-o` flag allows you to specify a name for the output file. If this flag is not used, then `input.swf` will be overwritten.
- The `-u` flag must be used if you wish to write out the changes to the `.swf` file. If the `-u` flag is not used, then no changes will be written out to the file.
- The `-c` flag will print out a report to the screen detailing the size and character information about the objects in the `.swf` file.
- The `-d` flag will print out a report to the screen detailing the bandwidth usage information.

Optimizing Animation

Once files are converted into Shockwave, the files may still require optimization. A RealFlash movie will play smoothly only if RealPlayer can receive data over the network at about the rate the RealFlash movie is set to play in frames per second.

Making your .swf file very low bit rate

- **Simplify elements drawn in Flash or imported from other drawing applications**
Under the Modify menu, the Curves pop-up menu contains the Smooth, Straighten and Optimize commands. The Smooth and Straighten commands automatically smooth or straighten the currently selected lines and curves. Optimize allows you to control the amount of smoothing and straightening of lines and curves, whether multiple passes are used to accomplish the optimization. It also reports the amount of optimization that has occurred with each pass. Use Optimize when you want to preserve as much of the original appearance of the lines and curves as possible. The goal is to strip away unneeded point and path information to reduce the amount of stored data to the minimum required to render your object on the screen. Because screen resolution is substantially lower than common print resolutions, minute details can often be eliminated from the drawing without compromising the overall appearance.
- **Use symbols instead of groups when you repeat elements**
Symbols are stored once in the file and may be referenced many times, adding very little data to the file for each reference to the original symbol. Groups are stored in the file every time they are used. So, if you have a group of items that is used three times, you store the same data in the file three times. If you use a symbol in this instance instead of a group, then you are storing the data once and adding three very small references to that data in the file. Ultimately, the advantage of using symbols instead of groups can reduce the size of your movie file significantly.
- **"Preload" symbols when too much data is needed all at once**
As mentioned above, RealFlash must have a symbol fully downloaded before it can render a frame that contains it. Use the size report and a visual inspection of the movie to pinpoint areas where performance begins to suffer because too much data is suddenly needed for a frame. If your movie has smaller symbols, you can preload them by placing them on a layer beneath an item that hides them from view. This technique can be used to load some symbols ahead of time (while hiding them from view) so they are ready for use later in the timeline when downloading them might cause a delay in playback.
- **Lower the number of key frames and simplify the objects on the screen**
Rapid scene changes and high frame rates (rates greater than 7 fps) increase bandwidth and processor requirements and dramatically impact presentation performance. To minimize this impact, lower the number of key frames and simplify the objects on the screen. If too much bandwidth is consumed, the player will pause the presentation and rebuffer.

- **Keep JPEG quality below 50 when exporting.** When exporting .fla files to .swf files, the JPEG quality should be no greater than 50, possibly even as low as 30. Experimenting with these values is strongly recommended as they also greatly impact the bit rate of the .swf file.
- **Put all movement into one local display area to minimize window redrawing.** If objects are localized to one area on the screen, RealPlayer has to redraw only the portion of the window in which movement occurs.
- **Do not front-load the presentation with high bit rate frames.** Delay the introduction of high bit rate sequences by inserting low bandwidth frames in the beginning of the presentation. Display high bit rate sequences near the end.

Make your entire presentation work on low end PC machines

- **Avoid using too many CPU intensive features at the same time.** Flash's vector based animation system differs from raster (bitmap) animation systems in that the host CPU is required to perform calculations with the vector data before rendering the images on the screen. Tweening multiple symbols in a frame, tweening color effects, changing large areas of the screen between frames, and using gradient fills are all CPU intensive operations requiring further calculations on top of the normal load RealFlash places on the processor. Playback may slow down when too many CPU intensive features are in use. Although some improvement in speed may occur when the file is exported to Shockwave Flash format, results may vary with your design.
- **Localize motion to one area.** File size remains the same, but only one portion of the screen needs to be redrawn.
- **Turn off anti aliasing** to minimize CPU usage
- **RealFlash content should be linear. Branching is not recommended.**
- **Do not place actions in the first frame** because they will not always work. This is an anomaly of Flash.
- **The amount of animation bandwidth available to a RealFlash developer depends on which audio Codec is selected for the RealAudio track.** As a result, it is important for the RealFlash animator to determine before they start the animation process, which Codec they are going to use.

Example: If you choose the 6.5 audio Codec, you have 13.5 Kbps available for your RealFlash animation, which translates into you having 1.68K per second available for your RealFlash animation.

Measuring the Presentation Bit Rate: The Movie Report

To determine the size of each frame of your animation, you can generate a size report when you export your Flash file into Shockwave Flash. When the animation is exported, a text file is created with the same name as the Flash file and is stored in the same directory. For example, if your file is **foo.swf**, then **foo.txt** will be the name of the Movie Report file.

To generate a size report:

1. Export the Flash file (.fla) to an Shockwave Flash file (.swf)
2. Choose **Generate Size Report** in the Export dialog box.
3. Open **Size Report** in Word
4. Select the Frame Bytes column by holding down the Alt key and highlighting the Frame Bytes column.
5. Go to the Edit menu and choose **Copy**.
6. Start Excel and open **Flash Template**
7. Paste the data into the Bytes column.

This enters the actual Frames Per Second and Delivery K Rate values into the Movie Report.

Movie Report Example			
Frame #	Frame Bytes	Total Bytes	Page
1	1203	1203	Scene 1
2	2	1205	2
3	2	1207	3

Notice that Frame 1 is about 1K. It is small enough to load quickly so viewers don't have to wait a long time to see something appear on the screen. Frame 2 is very small (2 bytes) because it doesn't need any more data to display it as it has everything it needs from Frame 1.

Open the Movie Report text file and look under the Frame # column to ensure that the value in the 'Frame Bytes' column is less than 3000. Ideally, the bit rates at the beginning of the presentation should be low (less than 3000) to allow for optimal streaming. If the 'Frame

Bytes' value is greater than 3000, try to increase the time between scene changes to lower the Frame Bytes value.

If you look at the Movie Report generated by Flash, the second column, titled 'Frame Bytes' tells you how many bytes each Flash frame consumes.

Note: For more detailed information on your presentation bitrate, download the "optimization kit" from the site you downloaded the RealFlash Content Creation Guide.

Total Bandwidth =		Audio (Kbps)	+	Animation (Kbps)
20	=	5	+	15
20	=	6.5	+	13.5
20	=	8	+	12
20	=	8.5	+	11.5
20	=	12	+	8

Kilobits per second	=	bits per second	=	bytes per second
15	=	15000	=	1875
13.5	=	13500	=	1687
12	=	12000	=	1500
11.5	=	11500	=	1435
8	=	8000	=	1000

Note: 8 bits equals 1 byte

bytes per second = bits per second / 8 bits per second.

Optimizing Audio Files

- Use high quality source files.
- When possible, digitize the sound to a supported file format. Then pre-process the file with a sound editing program. Set the amplitude of your input signal to maximize the use of the available dynamic range.
- Eliminate any DC offset either while recording content or later with an audio editor. This removes low frequency noise.

Use a CD-quality sampling rate (44.1 kHz), sampling width (16-bit), and two channels when creating an input file that you intend to encode using multiple audio Codecs.

In general, we recommend:

- 6.5 Kbps Codec for speech or for video-based content with speech and background music (frequency response: 4khz). Using the 6.5 Kbps RealAudio Codec, leaves 13.5 Kbps available for a RealFlash file targeted to 28.8 Kbps modems.
- For music-based content, use the 8.5 Kbps Music Codec to translate the audio file to the RealAudio format (frequency response: 4khz). The 8.5 Kbps RealAudio Codec leaves 12.0 Kbps available for a RealFlash file aimed at 28.8 Kbps transmission.

Audio files should have the following properties to ensure optimal audio quality when the audio file is converted to RealAudio format:

Sample Rate:	22050 Hz
Channels:	Mono
Resolution:	16-bit resolution

Please refer to <http://www.real.com/help/content/audiohints.html> for further tips on encoding audio.