

## WWW Information Pack

### Factsheet 24: How can I put sound and video into my web pages?

*Topics covered: Uses of audio and video on the web, file formats, creating audio and video files, placing audio and video into web pages: linking and embedding, streaming technologies, protocols, metafiles.*

#### 24.1 How can I make use of sound and video in my web pages?

One of the strengths of the web is its ability to distribute a variety of different information types. A single web page can combine text and images with audio and video clips. This has many potential applications:

- on-line educational materials can be enriched by including "virtual lectures" or digitised instructional videos (Figure 24.1)
- language learning can be enhanced by audio clips to illustrate pronunciation
- students can be given demonstrations of equipment and locations that are too expensive or dangerous for them to experience at first hand
- information about buildings or locations can be supplemented with "virtual tours"; a modified form of video can also allow the user to scroll around inside a 360-degree "virtual reality" panorama (Figure 24.2)
- web-based radio stations are now commonly found on the Internet, broadcasting music and information beyond the geographical limits of conventional radio stations (and in some cases circumventing political censorship and jamming of more traditional broadcasts)



Figure 24.1 - A tutorial video about statistics, playing inside a web-based virtual learning environment



Figure 24.2 - A web-based interactive "virtual tour" of the Cruickshank Botanic Gardens implemented in Apple's QTVR (QuickTime Virtual Reality) video format. The small controls beneath the image allow the user to zoom in and out. See: [www.abdn.ac.uk/diss/ltu/pmarston/vr/cruickshank.html](http://www.abdn.ac.uk/diss/ltu/pmarston/vr/cruickshank.html)

## 24.2 What are the major audio and video file formats?

Web-based multimedia has become considerably more popular and sophisticated over the past few years, with the result that there are now many alternative file formats and methods of delivery. However, before a user can play a downloaded audio or video file, they must have the appropriate software for that file format installed on their computer (see [Factsheet 6](#)). So it is advisable to provide multimedia content in a popular, standard format that will be accessible to the maximum number of users.

The following list highlights some of the most popular formats:

File format	Description
<p><b>MPEG</b> - <i>filename.mpg</i></p>	<p>MPEG stands for <b>Moving Picture Experts Group</b>, and is the name of a <b>family</b> of standards used for encoding and compressing audio-visual data. There are currently four major MPEG standards (MPEG-1, MPEG-2, MPEG-4 and MPEG-7) which have been developed for various different types of multimedia delivery system.</p> <p>For example, MPEG-1 is commonly used for storage of video and audio on CD-ROM; MPEG-2 is used for DVDs, satellite, cable and other digital broadcasts, although MPEG-4 will soon be playing a greater role in this area.</p> <p>On the web, MPEG video files generally have the extension <i>.mpg</i> whilst MPEG Audio files generally have the extension <i>.mp2</i>, <i>.mp3</i> or <i>.m4a</i> (see next item below).</p> <p>For more details about MPEG, see <a href="http://www.chiariglione.org/mpeg/index.htm">www.chiariglione.org/mpeg/index.htm</a></p>
<p><b>MP3</b> - <i>filename.mp3</i> <b>M4A</b> - <i>filename.m4a</i></p>	<p>The MP3 file format has become extremely popular in recent years for Internet-based audio file distribution, because it allows near-CD quality sound to be compressed into a reasonably small file size.</p> <p>(Strictly speaking, the MP3 format is really just the audio "layer" (layer 3) of the MPEG-1 and MPEG-2 standards above.)</p> <p>MP3 format audio can also be <b>streamed</b> over the web (see Section 24.5 below) to provide high-quality "internet radio" - e.g. <a href="http://www.shoutcast.com">www.shoutcast.com</a></p> <p>A new standard format called <b>M4A</b> (MPEG-4 Audio layer) is intended as a replacement for</p>

	<p>MP3 format, containing various improvements - see <a href="http://www.m4a.com">www.m4a.com</a>.</p>
<p><b>Real Audio &amp; Real Video</b> - <i>filename.ram</i></p>	<p>Real Networks (<a href="http://www.real.com">www.real.com</a>) have developed this proprietary commercial format for delivering streaming audio and video via the web. Several major sites have used Real technology to deliver clips of news footage or "internet radio" - see for example <a href="http://news.bbc.co.uk">news.bbc.co.uk</a>.</p> <p>Before you can play Real format files on your computer, you will need to download and install the Real Player, which is free for individual non-commercial use from <a href="http://www.realaudio.com">www.realaudio.com</a>. (Note that there is also a more sophisticated version of this software, which <i>does</i> require payment of a license fee, and is heavily promoted on the Real site - you will need to be persistent in order to locate the link to download the free version!)</p>
<p><b>QuickTime</b> - <i>filename.mov</i></p>	<p>Developed by Apple, QuickTime is a popular cross-platform multimedia architecture that can be used to deliver both sound and video. The QuickTime architecture forms the basis on which the MPEG-4 industry standard was developed.</p> <p>A modified form of QuickTime called <b>QTVR</b> enables the creation of 360-degree "virtual reality" panoramic images, which the user can navigate by using their mouse (Figure 24.2).</p> <p>QuickTime files require extra (free) viewer software to be installed before they can be played on a Windows or Linux computer. For more details, see <a href="http://www.apple.com/quicktime">www.apple.com/quicktime</a>.</p>
<p><b>AVI</b> - <i>filename.avi</i></p>	<p>"Audio Video Interleave" - Developed by Microsoft, this is a very popular format particularly amongst PC users, but is beginning to be superseded by more modern Microsoft streaming formats (see the next two items below).</p>
<p><b>ASF</b> - <i>filename.asf</i></p>	<p>"Advanced Streaming Format" - a Windows format specially designed by Microsoft for web streaming - it can contain audio, video, or slide shows.</p>

<p><b>Windows Media Audio</b> - <i>filename.wma</i></p> <p><b>Windows Media Video</b> - <i>filename.wmv</i></p>	<p>Compressed streaming formats designed by Microsoft for playback in Windows Media Player. (Note that Windows Media Player can be downloaded for various platforms, including Sun Solaris and Macintosh.)</p>
<p><b>WAV</b> - <i>filename.wav</i></p>	<p>A common sound file format, on all platforms. WAV files are not compressed, so their file sizes tend to be very large. They can be written directly onto audio CDs.</p>
<p><b>MIDI</b> - <i>filename.mid</i></p>	<p>Musical Instrument Digital Interface format, is an electronic digital music format, which can be produced by computers, electronic keyboards and synthesizers. Strictly speaking, it is a set of <i>instructions</i> to control the playback of music, from any compatible device.</p> <p>Most of the clips of annoying "background music" commonly used to enliven web pages are in MIDI format (they usually bear little resemblance to any conventional musical instrument, because most computers' sound cards have only a very limited set of responding "instruments").</p>
<p><b>Ogg Vorbis</b> - <i>filename.ogg</i></p>	<p>An Open Source audio compression and streaming format that provides a better quality alternative to MP3. See <a href="http://www.vorbis.com">www.vorbis.com</a>.</p>
<p><b>AU</b> - <i>filename.au</i></p>	<p>Sun Audio format, originally designed for use on UNIX systems</p>
<p><b>Flash</b> - <i>filename.swf</i> and <i>filename.flv</i></p>	<p>Macromedia's Flash format has recently improved its support for audio and video (in Flash MX 2004). Clips in many of the formats above can now easily be embedded into Flash movies, and exported in the Flash (SWF) format, or as a Flash Video (FLV) file. The free Flash Player 6 plug-in is required in order to view such Flash-based content - although this is currently the most widely distributed player of any media type.</p> <p>See: <a href="http://www.macromedia.com/devnet/mx/flash/video.html">www.macromedia.com/devnet/mx/flash/video.html</a></p>

## 24.3 How can I create my own audio and video files?

### 24.3.1 - Audio recording

On any modern computer fitted with a sound card, it should be possible to record audio input from a CD source, or from a microphone, connected to the appropriate input socket. Microsoft Windows comes with built-in sound recorder software (usually found under the **Accessories/Entertainment** section of the main **Programs** menu). However its editing capabilities are fairly limited, so you may find it easier to purchase some more flexible and user-friendly recording software such as:

Goldwave (Figure 24.3) - [www.goldwave.com](http://www.goldwave.com),

Adobe Audition - [www.adobe.co.uk/products/audition/main.html](http://www.adobe.co.uk/products/audition/main.html)

Sound Forge - [mediasoftware.sonypictures.com](http://mediasoftware.sonypictures.com).

Most recording software will allow you to choose the quality of your recording. You can usually choose between:

- mono or stereo recording
- 8-bit or 16-bit resolution (8-bit may sometimes be sufficient for spoken voice recording, but 16-bit is necessary for true-fidelity music recording)
- sampling frequency (between 8 kHz and 44 kHz)

In general, it is recommended that you do not use less than 22 kHz, 16-bit mono for narration in an educational context. CD quality audio generally requires 16-bit recording in stereo at 44.1 kHz. However, the higher the quality of your sound recording, the larger will be the size of your finished sound file. Remember that you cut the size of your sound file by 50% when you record in mono, rather than stereo.

Most good audio software will also allow you to save your recording in a variety of audio formats. For example, Goldwave allows you to save your audio recording as WAV format (for highest quality but large file size) or as MP3 (with the aid of an external encoder called LAME).

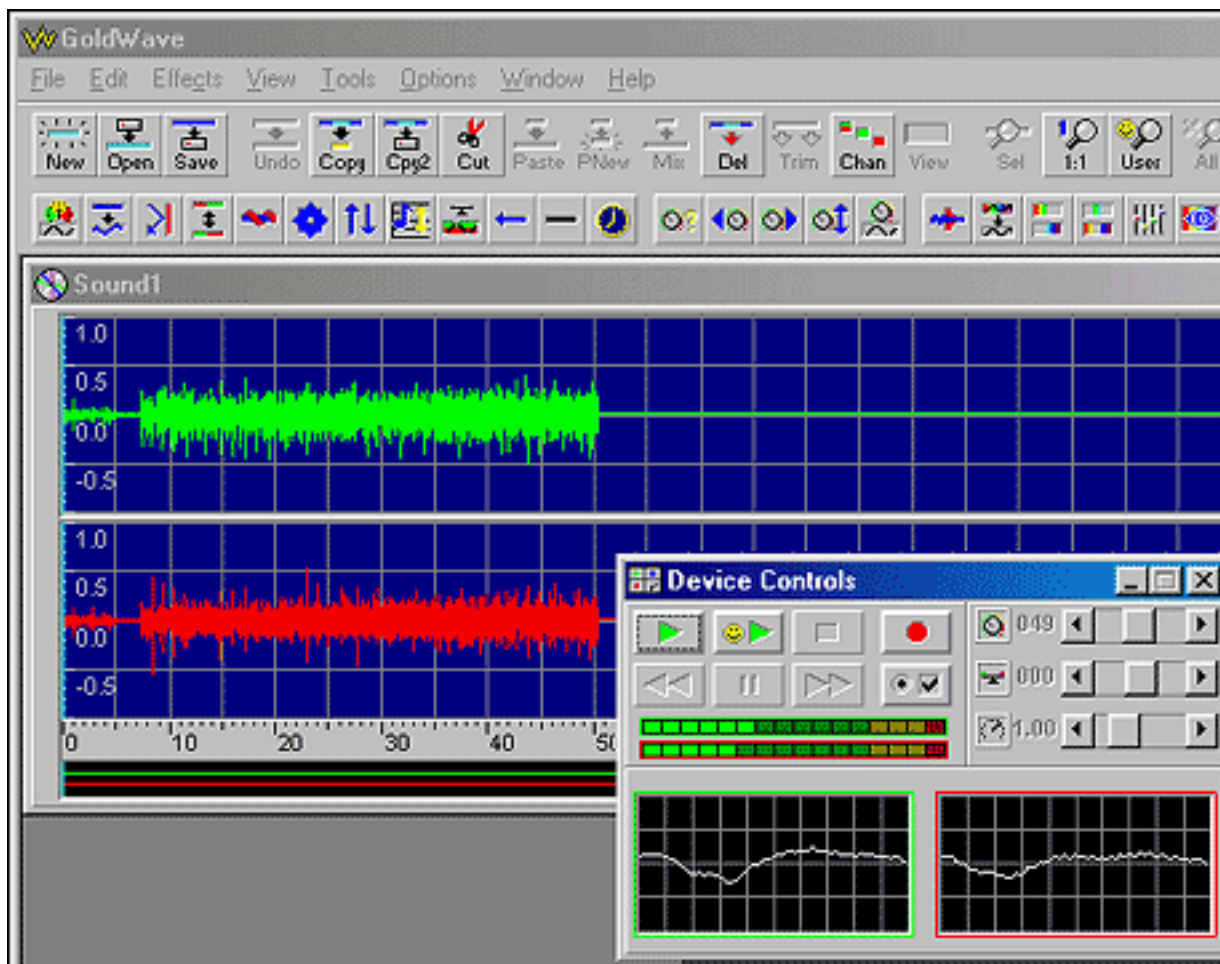


Figure 24.3 - Recording an audio source in Goldwave.

### 24.3.2 - Video recording

In order to record professional quality video files, one option is to install an additional board in your computer, called a **video capture card**. You can then use a conventional VCR video recorder or analog video camera, connected up to your video capture card, as your source of images.

Alternatively, video cameras which can record directly into digital format (rather than onto video tape) are becoming increasingly affordable. Such cameras may record in a wide range of different formats (e.g. MPEG-1, MPEG-4, AVI or QuickTime). If you own one of these, you should be able to download the video files from your camera directly onto your computer. If your camera uses a **Firewire/iLink** output, you will need to install a Firewire/iLink card in your computer in order to use this method of transfer.

Finally, you will need specialised software to edit and compress your captured video (see for example [www.avid.com/freeDV/](http://www.avid.com/freeDV/) )

Remember that you will also require a reasonably powerful computer, with sufficient hard disk space, processing power and RAM to store and manipulate the video files that you produce.

## 24.4 How can I place audio and video files into my web pages?

**Note:** before publishing any audio or video clips on your web site, you should make sure that you are legally entitled to do so, by having obtained the formal permission of the copyright holder. Converting your CD collection to MP3 files and making these files available over the web is, of course, a breach of copyright!

### 24.4.1 - Linking to media files

The simplest way of making an audio or video file available on the web is to provide a simple link to it:

```
<a href="filename.mp3">Hear a sound sample (250kb MP3 file) </a>
```

```
<a href="filename.mov">Play movie clip (700kb QuickTime movie) </a>
```

It is good practice to indicate the size of the file to be downloaded (so that users on slow modem connections are forewarned!).

Remember that your audio or video file must be published in the same way as any other web file ([Factsheet 10](#)). When the user selects this link, they will be able to download and play the file (provided that the user's computer is equipped with the correct application to play that specific media file type).

### 24.4.2 - Embedding a media player into a web page

Alternatively, you may wish to **embed** an audio or video player directly into your web page. This has the advantage that the user can control the playback of the file from controls which are actually a part of the displayed page itself (see Figure 24.1). This can help to create a consistent and unified experience for the user (rather than requiring them to switch back and forth between a separate player application and the web browser).

Embedding a player into a web page can be a complex undertaking, particularly if you wish to support a range of different browsers. Until recently, the most common method of embedding a media player into a web page was to use the `<embed>` tag:

```
<embed type="video/quicktime" width=320 height=240 src="video.
mov" autoplay="true" controller="true" loop="false"
pluginspage="http://www.apple.com/quicktime/download/"></embed>
```

The `autoplay` attribute may be set to `true` or `false`, depending on whether you want the media file to start playing automatically when the page is downloaded. Similarly, the `controller` attribute specifies whether to hide or to show the panel of controls (Figure 24.1). The `loop` attribute determines whether playback should stop at the end of the file, or alternatively whether the file should be played over and over again. The `pluginspage` attribute supplies the URL from which a user may download the appropriate player software for this file.

However, the preferred modern method of embedding media into a web page (as recommended by the [W3C](#)) is to use the rather more complex `<object>` tag:

```

<object id="quicktimeplayer" width="320"
height="240" classid="clsid:02BF25D5-8C17-4B23-
BC80-D3488ABDDC6B"
codebase="http://www.apple.com/qtactivex/
qtplugin.cab">
<param name="src" value="video.mov" />
<param name="controller" value="true" />
<param name="autoplay" value="true" />
<embed src="video.mov" width="320"
height="240" autoplay="true" controller="true"
pluginspage="http://www.apple.com/quicktime/
download/">
</embed>
</object>

```

### Example 24.1 - XHTML code used to embed a QuickTime movie inside a web page

In this example, Microsoft's **ActiveX** technology is being used to embed a copy of the QuickTime player into a web page. This is then told to play the file *video.mov*. The complex `classid` attribute is a number that uniquely identifies each Microsoft ActiveX object. So if you wanted to embed a copy of Microsoft's MediaPlayer into the page (rather than Apple's QuickTime player), you would need to quote its particular classid number:

```

<object id="MediaPlayer" width="320" height="240"
classid="clsid:22d6f312-b0f6-11d0-94ab-0080c74c7e95">
<param name="FileName" value="tutorial.wmv" />
...etc,

```

Note also in Example 24.1 that the older `<embed>` tag has been included inside the `<object>` tag, for the benefit of old browsers that do not support the `<object>` tag.

For more details of this complicated technique, see:

[www.apple.com/quicktime/tools\\_tips/tutorials/activex.html](http://www.apple.com/quicktime/tools_tips/tutorials/activex.html)

[www.oreillynet.com/pub/a/javascript/excerpt/learnwebdesign\\_chap22/](http://www.oreillynet.com/pub/a/javascript/excerpt/learnwebdesign_chap22/)

[www.w3.org/TR/xhtml2/mod-object.html](http://www.w3.org/TR/xhtml2/mod-object.html)

### 24.4.3 - SMIL

**SMIL** stands for **Synchronised Multimedia Integration Language** and is an **XML**-based method for delivering multimedia content via the web. Its main strength is the ability to synchronise the playing of many separate objects - for example you could time the display of a sequence of images to fit in with a spoken narrative. Both Apple's QuickTime player and RealNetworks' RealPlayer can play SMIL presentations.

SMIL also forms the basis of **Multimedia Messaging Service (MMS)** - a technology that allows users of modern mobile 'phones to send and receive multimedia messages - see: [www.mobilemms.com](http://www.mobilemms.com).

[com/mmsfaq.asp](http://www.abdn.ac.uk/diss/webpack/factsheet24.shtml)

For more detailed discussion of SMIL, and XML in general, see [Factsheet 27](#).

## 24.5 What is streaming and how can it be used?

Streaming is a popular and important new method of delivering audio and video materials over the Internet. It offers the following advantages over non-streamed methods of delivery:

### 24.5.1 - Rapid start to playback

To play smoothly on a user's computer, audio and video data needs to be available continuously without gaps or interruptions. Before the advent of streaming, audio and video files needed to be downloaded in their entirety before they could be played. Because of their typically large file sizes, this resulted in a considerable delay before the user could see or hear anything at all.

The development of streaming has removed this restriction. Streamed audio and video data is sent progressively by the hosting server to the user's computer, where a small proportion of the data is stored (or **buffered**). After a short delay, the user's computer can then start to play the first part of the file, even though the rest of it has not yet been sent by the server.

### 24.5.2 - Adaptation to network conditions

Streaming media servers can adapt their rate of data delivery dynamically, according to the user's local network speed. On a slow, congested network, the media can be delivered in a more compressed (lower quality) data stream.

### 24.5.3 - Data security

Streaming servers can be configured so that the underlying data stays on the server, and cannot easily be captured on the client side. This can make it more difficult (but still not impossible) for the end user to capture unauthorised copies of the materials being delivered.

### 24.5.4 - Control of playback

The viewer can interact with the audio or video stream (e.g. moving forwards or back) even if the file has not been fully downloaded.

## 24.6 How is streaming audio and video delivered over the web?

Any properly-configured web server should be able to deliver audio and video in a **non-streamed** manner. In fact, many modern playback applications (e.g. QuickTime Player and Microsoft Windows Media Player) can begin to play an audio/video file before it has fully downloaded, which creates the *impression* that it is being streamed (this is known as **pseudo-streaming**). Only certain media file formats support this type of progressive playback, e.g. Microsoft's Advanced Streaming Format

(ASF) and Macromedia Flash.

However, conventional web servers cannot deliver *true* streaming (with the other advantages described above) - for this you need a specialised **streaming server** application. Many of these are costly, and require specialist technical skills to install on a hosting web server.

Some leading media streaming server applications are:

- **Apple QuickTime Streaming Server**

This is available as part of the Macintosh OS-X Operating System, and there is a free version (called Darwin Streaming Server) for Unix and Linux servers: [developer.apple.com/darwin/projects/streaming/](http://developer.apple.com/darwin/projects/streaming/)

QuickTime format is known for its high quality, and is often used on higher-speed networks. It can stream both QuickTime and MPEG-4 media types.

[www.apple.com/quicktime/tools\\_tips/tutorials/](http://www.apple.com/quicktime/tools_tips/tutorials/)

- **Macromedia Flash Communication Server**

This server application is designed specifically to allow streaming of Flash-based media (i.e. FLV format Flash Video files).

[www.macromedia.com/devnet/mx/flashcom/](http://www.macromedia.com/devnet/mx/flashcom/)

- **Real Networks' Helix Universal Server**

This is a commercial application from [www.real.com](http://www.real.com)

It may cost several thousands of pounds, depending on the version, but can deliver a wide range of different media formats.

- **Microsoft Windows Media Services**

This is an optional component which can be installed as a part of the Windows Server 2003 server operating system.

At the time of writing, it can stream only Microsoft media format files.

[www.microsoft.com/windows/windowsmedia/compare/webservvstreamserv.aspx](http://www.microsoft.com/windows/windowsmedia/compare/webservvstreamserv.aspx)

[www.microsoft.com/windows/windowsmedia/howto/articles/introhosting.aspx](http://www.microsoft.com/windows/windowsmedia/howto/articles/introhosting.aspx)

## 24.7 Some technical complexities of streaming servers [advanced topic]

Streaming server applications often make use of special Internet communication protocols and unusual connection ports on the delivering server, rather than the normal combination of **HTTP** and **port 80** which is used for delivery of conventional web pages. This is because streaming media needs to be able to carry on regardless of "lost" packets of data - whereas the HTTP protocol attempts to re-send such lost data, thereby potentially breaking the data stream.

Some protocols commonly used for streaming are:

- **RTP** (Real Time Transfer Protocol) - a one-way data transfer protocol used by Real Networks and Apple QuickTime
- **RTSP** (Real Time Streaming Protocol) - a two-way data transfer protocol used by Real Networks and Apple QuickTime
- **RTMP** (Real Time Messaging Protocol) - used by Macromedia Flash Communication Server
- **UDP** (User Datagram Protocol) - one of the protocols for data transfer that is part of the TCP/IP suite of protocols. QuickTime Streaming Server can (optionally) use UDP packets to send

its data

- **Microsoft Media Server\*** - Microsoft's proprietary network streaming protocol  
\*not to be confused with MMS: Multimedia Messaging Service - see Section 24.4.3 above

Because of these unusual delivery methods, streaming media may sometimes be blocked by corporate security firewalls. Many firewalls are configured to block UDP, for example. It may therefore be necessary to reconfigure such firewalls before streaming media can be delivered across them.

Linking from a web page to a video/audio item on a streaming server is also more complex than on a non-streaming system. You may need first to create a **metafile** (a small text file containing a reference to the actual audio/video stream), and then link from your web page to that metafile.

For example, when working with Real Networks streaming, you will need to make a metafile with the extension *.ram*

For more details, see:

[www.law2.byu.edu/HelpDesk/software\\_instruction/miscellaneous/media/06.htm](http://www.law2.byu.edu/HelpDesk/software_instruction/miscellaneous/media/06.htm)

[tltcdev.shu.edu/test/shiffman/Streaming%20and%20RAM%20files.htm](http://tltcdev.shu.edu/test/shiffman/Streaming%20and%20RAM%20files.htm)

When using Windows streaming, your metafile may have the extension *.wvx*, *.wax* or *.asx*.

For more details, see:

[134.193.15.25/vu/course/it222/notes/sound/audio-streaming.html](http://134.193.15.25/vu/course/it222/notes/sound/audio-streaming.html)

[www.microsoft.com/windows/windowsmedia/serve/basics\\_wm4.aspx](http://www.microsoft.com/windows/windowsmedia/serve/basics_wm4.aspx)

QuickTime supports a type of metafile called **Reference Movies**. These usually have the extension *.qtl*. They can contain a lot of detailed information, for example specifying different movie streams optimised for different network speeds. Here is a very simple example of the syntax of a Reference Movie:

```
rtsptext
rtsp://hosting.server.com/mymovie.mov
```

Apple provides a free tool for making Reference Movies at [developer.apple.com/quicktime/quicktimeintro/tools/](http://developer.apple.com/quicktime/quicktimeintro/tools/)

For further details, see [www.apple.com/quicktime/tools\\_tips/tutorials/refmovies.html](http://www.apple.com/quicktime/tools_tips/tutorials/refmovies.html)

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## Further information

There is a useful general guide to sound and video for the web at [cit.duke.edu/resource-guides/tutorial-web-multimedia/](http://cit.duke.edu/resource-guides/tutorial-web-multimedia/)

Apple provides an excellent set of documentation pages about all aspects of the QuickTime format at [developer.apple.com/documentation/QuickTime/](http://developer.apple.com/documentation/QuickTime/)

The audio and video capabilities of Macromedia Flash are thoroughly described at [www.macromedia.com/devnet/mx/flash/video.html](http://www.macromedia.com/devnet/mx/flash/video.html)

Phil Marston from the Learning Technology Unit provides excellent guides to using PanoramicVR and using Video


<http://www.abdn.ac.uk/diss/ltu/pmarston/PanoramicVR/>

<http://www.abdn.ac.uk/diss/ltu/pmarston/video/>

The book [Web Design in a Nutshell](#) by Jennifer Niederst, published by [O'Reilly](#), contains two good chapters on audio and video for the web. It is currently in its second edition, but be sure to check for more recent versions.

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