Web Radio Blueprint

Michael P. Moran

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WEB RADIO BLUEPRINT

By

Michael P. Moran

A thesis submitted in partial fulfillment of the requirements for the degree of

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Web Radio Blueprint

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Abstract

WEB RADIO BLUEPRINT

By Michael P. Moran

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The Internet is one of the most significant technological developments in our lifetime, and its impact affects many established technologies and media. Radio is one of the established media revolutionized by the Internet because of the expanding multi-media capabilities, leading the way to a more focused medium when compared to traditional terrestrial radio broadcasting. Radio transmissions over the Internet (Web Radio) offers the opportunity to provide content focused to a "niche" audience, while providing an opportunity for broader operator participation than terrestrial radio.

Web Radio is an Information Technology that offers a viable alternative to commercial radio, which has become increasingly consolidated since the Passage of the Telecommunications Act of 1996. Commercial radio consolidation into ten major owners has resulted in less localism, diversity, and competition in radio. Web Radio can restore these elements to the radio industry, assuming policies implemented support the goals of localism, diversity, competition, and interaction.

Web Radio is at a critical stage in its development as an Internet supported information technology. Web Radio content providers are facing several significant issues in the economic and regulatory components of their businesses.
Web Radio represents a unique opportunity for entrepreneurs and producers to establish viable conduits for the content that they are able to create. It is critical that policies concerning the technical, legal, and operational issues be determined in a way that does not cripple the development of the industry.

This thesis provides a blueprint for individuals or organizations that are new to the technology of Web Radio, or would like to review the current state of affairs in the technical and legal components of webcasting. This “Web Radio Blueprint” will assist individuals or organizations with the implementation of webcasting as a way to communicate their music or message to an interested listener. It provides a blueprint for an organization attempting to become an Internet Broadcaster, or add an Internet Broadcasting function to an e-commerce site, by presenting three key areas that should be considered in the organization’s plan. These areas include infrastructure technologies used in webcasting, legal obstacles imposed by the 1998 “Digital Millennium Copyright Act” and other rulings, and operational concerns that an e-commerce organization should address.
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CHAPTER 1

INTRODUCTION

Music, the greatest good that mortals know, And all of heaven we have below.

The Internet is one of the most significant technological developments in our lifetime, and its impact affects many established technologies and media. Radio is one of the established media revolutionized by the Internet because of the expanding multi-media capabilities, leading the way to a more focused medium when compared to traditional terrestrial radio broadcasting. Radio transmissions over the Internet (Web Radio) offers the opportunity to provide content focused to a "niche" audience, while providing an opportunity for broader operator participation than terrestrial radio.

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Web Radio is at a critical stage in its development as an Internet supported information technology. Web Radio content providers are facing several significant issues in the economic and regulatory components of their businesses. Web Radio represents a unique opportunity for entrepreneurs and producers to establish viable conduits for the content that they are able to create. It is critical
that policies concerning the technical, legal, and operational issues be determined in a way that does not cripple the development of the industry.

This thesis provides a blueprint for individuals or organizations that are new to the technology of Web Radio, or would like to review the current state of affairs in the technical and legal components of webcasting. This “Web Radio Blueprint” will assist individuals or organizations with the implementation of webcasting as a way to communicate their music or message to an interested listener. It provides a blueprint for an organization attempting to become an Internet Broadcaster, or add an Internet Broadcasting function to an e-commerce site, by presenting three key areas that should be considered in the organization’s plan. These areas include infrastructure technologies used in webcasting, legal obstacles imposed by the 1998 “Digital Millennium Copyright Act” and other rulings, and operational concerns that an e-commerce organization should address.

A stated goal of the 1996 Telecommunications Act was “fostering innovation and competition in radio .... we also seek to promote diversity in programming and diversity in viewpoints ....” according to FCC Chairman Reed Hundt. However, an extensive report issued by the Future of Music Coalition (FMC) on 18 November 2002 concluded that deregulation has not achieved these goals, and in fact has had the opposite effect on terrestrial radio. The report states that:

- A small number of companies control the news Americans hear on the radio

- Format consolidation leads to fewer gatekeepers, with a small number of companies controlling what music is played, developing shorter playlists that reduce opportunities for musicians to get radio airplay and for citizens to enjoy diversity in programming.
A "twin bottleneck" has emerged, as the ten parent companies dominating radio interact with five major recording companies (these comprise the RIAA, which will be discussed in detail in the context of Web Radio legal issues) reducing access for independent musicians and reducing program diversity for listeners.

The complete FMC report can be downloaded from:

http://www.futureofmusic.com/research/radiostudy.cfm

The opportunity exists for Web Radio to meet the goals of diversity in programming and viewpoints that post-consolidation terrestrial radio has not. No longer in an embryonic or infant stage, Web Radio has evolved steadily over the last 5-6 years and currently offers more than 25,000 radio operations on the web. However, it is still in an early stage of development as technical parameters such as the bandwidth of the listener's connection to the Internet, the streaming ability of the servers, the variety of competing formats, and legal issues concerning royalty payments and copyrights have constrained the adoption of Web Radio by Internet users.

Concern over the royalty payments for the use of copyrighted music is a significant hurdle, and forced many existing stations to shut down their streams after copyright rulings over the last few years. Chapter Three examines a new agreement developed during the writing of this thesis, which included significant parties from all sides of the issues.
In spite of all the issues surrounding web radio, it remains a relatively painless process to initiate a broadcast, as we shall see, and continues to offer many advantages to an organization or an individual seeking to reach a greater audience for their particular message. Such an organization might be a faith-based organization, such as the Christian Music Ministry Godsound, www.godsound.com; a public radio station such as www.wxpn.com; or an individual with a particular musical interest and a desire to make that available to a wider public. An example of this application is Beatles-A-Rama available at http://www.live365.com/stations/184315, (featured in an article describing the process of setting up a station at http://radio.about.com/library/weekly/aa080403a.htm). Organizations of this type may have a non-profit classification, but nonetheless are able to generate revenue to cover operating expenses by selling sponsorships and offering subscriptions, operating very much as a commercial operation would.

Webcasting also offers commercial opportunities ranging from large commercial operations to small commercial operators that seek to operate a web radio station as a small for-profit business. Many of these types of stations are members of the Webcaster Alliance and can be located through www.webcasteralliance.com; a sample of this type of member station may be found at http://www.houndogradio.com/.

Another category of commercial broadcaster is the traditional terrestrial broadcaster (AM or FM broadcaster) that seeks to extend listenership by simulcasting their free to air signals over the Internet: or offering access to archived versions of content previously aired. While this would seem a natural extension for a terrestrial broadcaster, as we will see, there are many conflicting aspects of the process that force broadcasters to abandon an on-air stream until these issues are resolved.
Therefore, although the precedence is established and thousands of stations are operating at this time, a confusing array of technical, legal, and operational issues confront the start-up organization seeking to begin Webcasting. Given the state of affairs within the terrestrial radio marketplace, careful consideration of policies that develop Web Radio into a diverse universe of both large and small webcasters is critical. Policies that allow webcasters offering mainstream, commercial, and independent narrowcast programming to thrive will provide economic benefits, cultural diversity, and lots of great music, benefiting the citizens and economy of the USA and other countries.

This thesis addresses the issues inherent in three basic categories.

TECHNICAL OVERVIEW

The technical model for Internet Radio is the client/server model that evolved as a preferred architecture for distributed data networks during the 1990’s. As Ethernet became the dominant protocol for network communications, it became obvious that a more distributed network approach than the established centralized model dominated by UNIX computers offered substantial advantages for many applications. Nowhere was this more evident than in Internet applications.

The Web introduced the first client applications as web browsers, rather ubiquitous now, but early on were adaptations of the distributed information systems architecture. Web radio is one of the applications made available by the extension of the web browsers multimedia capabilities, as additional clients were developed that became generally known as media players.

The media player is well established in early 2004, as Microsoft and Apple offer versions with their operating systems. Commercial companies such as RealNetworks have evolved from their start as pioneers in web streaming to their
status as a market leader in streaming technologies, offering media player, encoding, and streaming server technologies to the marketplace.

As the client piece of the model, the media player resides on the user/listener’s computer. Available bandwidth from the listeners’ connection to the Internet plays a major role in the effectiveness of the media player. This may vary among a basic dial-up telephony connection at 28.8 kBps, a DSL connection at 512-1000 kBps, a cable modem connection @ 1.5 mBps, an ISDN basic rate line at 128 kBps, an ISDN primary rate line or T1 connection at 1.54 Mbps. Bandwidth considerations and decisions regarding what bandwidth to allow for stream delivery are always key components of the Web Radio operation.

While it the client side of the model that initiates the distribution of the multimedia content, the server remains the heart of the system, as it must distribute the content in a stream format recognized by the player. Competition among strong players in the streaming field such as Microsoft, RealNetworks, Apple, and others has led to multiple standards and requirements for dedicated servers for each format. The Streaming Server Section discusses the emergence of multi-standard servers capable of supporting multiple formats. These allow the webcaster to reach players operating on different standards.

Streaming technology has led to the development of “the streaming server”, although applications can be run on traditional Web servers and Microsoft has a good deal of information available on this topic from http://www.microsoft.com/windows/windowsmedia/howto/articles/webserver.aspx. However, the streaming server is the optimum method of establishing a Web Radio transmission.

While the streaming server is the key component in a Webcasting system, it does not necessarily need to be owned and/or operated by the webcaster. As we shall
see, there are a great number of service providers that allow personal, hobbyist, non-commercial, and commercial webcasters to provide streams to users without operating the streaming server themselves. Appendix A lists many services available at the time this thesis was created, and a good example of this type of service can be viewed at Live365, http://www.live365.com/, one of the largest web radio hosting sites on the Internet.

The server is responsible for the delivery of the content streams to the listener, but it does generally perform the function of "encoding" the content into the proper format for delivery to the client media player. A CODEC accomplishes this task before the server distributes the content.

Again, there is an almost dizzying array of technologies and proprietary CODECs available for this purpose, which we will consider under the broader topic of Authoring Technologies within Chapter 2. Also to be considered here are tools available not only for encoding music into digital formats, but also for editing the raw uncompressed files, as well as the automation tools available to control the playback of the content desired for the web radio broadcast.

LEGAL OVERVIEW

There is no escaping the swirling storm of copyright issues as you launch or navigate your Web Radio station in the current environment. The issue is so timely that the most recent agreement occurred 6 February 2004 as this thesis was being prepared. The US Copyright Office approved an earlier agreement submitted to them regarding royalty rates for on-line or Web Radio. Agents for the webcasters and the Recording Industry, seeking to avoid the costly arbitration process brought upon the emerging Web Radio industry during 2002, reached agreement in early April of 2003 and submitted a proposal to the Copyright Office. The ratified proposal sets royalty rates and terms applying to commercial
subscription and non-subscription services offered by webcasters and Internet radio stations. This is the most recent in a long line of copyright agreements that influences Web Radio.

The basis for current legal issues faced by webcasters is the Digital Millennium Copyright Act (DMCA) signed into law by President Clinton on October 28, 1998. Also important are subsequent rulings such as the Librarian of Congress Final Rule relating to the Determination of Reasonable Rates and Terms for the Digital Performance of Sound Recordings and Ephemeral Recordings (the Determination), released in July of 2002. Following “the Determination” were additional rulings such as the Small Webcasters Settlement Act (SWSA) of 2002, followed by an additional agreement reached in June of 2003 between the recording industry and educational and other non-commercial broadcasters that addressed the needs of non-commercial broadcasters with regards to streaming audio content over the Internet.

The DMCA was not the first law to address digital transmissions, earlier legislation named the DPRA (Digital Performance Rights in Sound Recordings Act of 1995), offered limited public performance rights for sound recordings that included digital transmissions. The DPRA was enacted to specifically address the concerns raised by copyright owners of musical works and sound recordings. This important legislation made two significant, but distinct, changes affecting the licensing of musical works under U.S. copyright law, one to address the questions raised by Webcasting, and the other to address the questions raised by downloadable music files. However, the emergence of digital transmissions of sound recordings over the Internet did not fall squarely in any of the three categories addressed in the DPRA.

In June of 1998, the Records Industries Association of America (RIAA) began notifying Web Radio stations that they did in fact require licenses to Webcast
their sound recordings over the Internet. They base this assertion on the language of the DPRA. Although a complete discussion of the copyright law is beyond the scope of this thesis, a primer on the subject is available through Kohn Music @

http://www.kohnmusic.com/articles/newprimer.html

The primer discusses this in detail, and includes Attorney Robert Kohn’s arguments as to why the DPRA did not preclude the Webcasting of non-interactive, non-subscription digital audio transmissions of sound recordings, such as those produced by Internet radio stations.

Since the DPRA fell short of addressing all the issues related to digital technology and recorded musical content, the DMCA amended the DPRA to include Webcasts, and further instructed that arbitration panels should be convened to set the royalty rates at fair market value. The led to the establishment of CARP (Copyright Arbitration Royalty Panel) and a period of chaos within the emerging Webcasting industry. Uncertainty dominated the Webcasting environment, as “fair market value,” and its application to the various types of webcasters (commercial, large medium or small, non-commercial, educational etc.) was debated. A concise statement of the substance of some objections is contained within a document submitted by Live365, after the release of the CARP findings, their Petition to Modify or Set Aside the Determination of the CARP, is available at http://www.kurthanson.com/Live365.htm (Filed March 6, 2002, note that per the Copyright Office Final Rule, Live365 withdrew its objections early in the process).³

The unfortunate result of this period of chaos was the silencing of many streams as webcasters and terrestrial broadcasters with Webcasts abandoned their Web Radio stations in the face of potential unmanageable cost structures. Even today,
the Webcaster Alliance contends that many of its members are operating in non-compliance with current royalty agreements. Flash forward to 2004, and we see a more successful effort to reach an agreement palatable to at least the larger commercial Web Radio operators.

The current agreement between the recording industry and online radio broadcasters spells out the royalty rates for webcasters ranging from Internet-only webcasters to subscription services to non-commercial radio broadcast simulcasts for the 2004-2024 period. Chapter 3 addresses this agreement and some of the financial guidelines developed.

Although this agreement represents a step forward due to the diverse companies supporting it, it may not completely settle the issue for small webcasters. Before this recent agreement, the Webcaster Alliance filed a lawsuit against the recording industry (RIAA) in an attempt to obtain terms that are more equitable for small commercial broadcasters. Since the large commercial webcasters developed this agreement through negotiations with the RIAA, it is doubtful that it will appease the small webcaster membership of the Webcaster Alliance. Thus, we will have to see what occurs because of their lawsuit against the RIAA.

Perhaps the bright side of licensing concerning Web Radio is that it is mainly an issue between webcasters and copyright holders, and stations are not subject to the licensing process required for terrestrial broadcasts. The limited bandwidth of terrestrial radio forces regulation of the allocation of available frequencies, whereas this type of bandwidth allocation is not a component of Web Radio.

Chapter 3 highlights the development of licensing and royalty agreements as they impact webcasters, and outlines some of the things that can be done to minimize the impact of ongoing legislation and changes.
OPERATIONAL OVERVIEW

The DMCA discussed in the Legal Overview also extends its reach into the operations of the Web Radio station, and the payment of copyright royalties is a prime consideration in the cost structure of a Web Radio station. Chapter 4 discusses the operational restrictions mandated by law for the Webcasting operation. The Chapter also presents the costs associated with the technology platforms discussed in Chapter 2, and the costs of the various classes of webcaster covered under the current legislation.

Although there are stringent playlist requirements imposed by the DMCA, there are also software solutions to implement the requirements. Included within the cost tables for the technology platforms, are the software solutions and server hosting solution that offer solutions to meet the DMCA requirements.

Also included within this chapter is a discussion of the implications of bandwidth on the operations and economic structure of the Web Radio station. Conversely, this could be stated as the implications of operational decisions on the bandwidth required, and the costs associated with bandwidth. One of the unfortunate anomalies of the current technology is that bandwidth costs increase as the success of the stations grows. Because each listener receives a dedicated stream, (at least in the current "Unicast" mode of transmitting) and the bandwidth requirements increase as you offer higher quality audio streams, the required bandwidth to Webcast increases in proportion to the total number of concurrent listeners. Although this is a technological issue as well as an operational one, it bears directly onto the costs associated with the Web Radio operation, and for this reason is included within Chapter 4.
Bandwidth requirements lead directly to costs required to establish the “pipes” used to transmit the Web content to listeners. The cost implications of some of the available options, such as the establishment of your own server, the use of a Web Hosting Service, or a Streaming Service provider such as Live 365 are also discussed within this chapter.

In addition to these important facets of Web Radio operations, there are some minor aspects, which need to be considered at start-up. These include items such as the filing of the initial notice, and the required notifications to the collection agencies for the payment of royalties.

Once again, the intention of the chapter is to provide an overview of technology and operational costs that cover the range of large, medium and small webcasters. The concluding chapter of this thesis will focus on one real world example, and try to examine the optimum structure for a typical start-up organization to employ.
CHAPTER 2

WEB RADIO TECHNOLOGY PLATFORMS

Infrastructure is to information as a bottle is to wine; the technology is the packaging that allows the information to be delivered to end consumers.6

Client/server computing technology provides the platform upon which Web Radio is built, where a client, such as one of the many types of media players resident on a user computer, connects to a media server via an Internet connection. More specifically, it is a streaming server that is capable of taking the audio from either a static pre-processed file or a continuous live feed (such as an ongoing Internet "radio" station, and sending the audio over the Internet connection to the user's media player.

At the heart of the system is the streaming server, which as is common in the client/server model, provides the requested service to the client. The requested service in this case, is a real-time audio stream that constitutes the Webcast.

Many companies are providing the streaming servers necessary for Webcasting. In order to develop an understanding and blueprint for developing a Webcast, we will explore several of the options available for the server piece of the Webcast platform.

While the server is the interface to the user or listener in the case of an Internet Radio Webcast, it receives a feed from an authoring computer that digitizes, encodes, and delivers the content (in a variety of streaming formats) to the streaming server for delivery to the audience.7 Again, there are many software options available, depending on the streaming format selected, and we will examine several of the more popular options available.
The client in this model is the piece of software resident on the end user/listener’s PC, whether it is RealPlayer, Windows MediaPlayer, WINamp, QuickTime, FLASH, or any of the many players available. Regardless of the format used, the media player interrogates the server based on the selection choices of the user and initiates the delivery of the stream to the user. Compatibility with the media players that have the highest popularity, or are resident on the largest number of computers is important to the webcaster, and is a factor in the choice of streaming server and format.

Often, players are compatible with a proprietary standard such as RealPlayer, as well as the open standards format of MP3. An example of the desire to be compatible with a popular media player is the use of FLASH as a media player. Although not offered as a streaming player, the fact that the FLASH player is resident on 98% of Internet connected computers makes it a compelling option for webcasters to consider as a client device for their service.

A webcaster needs to consider which technologies will offer the best options for high quality audio over various bit rates, will provide for the maximum number of potential listeners to their streams, and will offer economical options for both the webcaster and the listener. The balance of this section explores these options in the three key areas of Streaming Server, Media Player, and Authoring/Encoding.

A great video presentation that demonstrates the process of establishing a Webcast beginning from the client side of the equation is available at: http://www.fezguys.com/. Select the Dec 2002 appearance on Tech TV and you will see an archive of an appearance by authors Luini and Whitman of Streaming Audio: The FetzGuys' Guide, one of the resources used to support the writing of this thesis. The video takes you through the establishment of a Webcast using the technology of the WINamp media player and SHOUTcast
server, but provides a greatly simplified overview of the entire process of Webcasting.

STREAMING SERVER TECHNOLOGIES

SHOUTCAST TECHNOLOGY

MP3-encoded audio is by far the most popular encoding method used to transfer sound across the Internet. Technically, it is not a format, but a compression technique that allows for a reduction in the amount of data and subsequent transmission rates. Since it actually an encoding method, we will discuss it again in the context of authoring content streams and delivering content to the server. However, the first server technology we will consider is a very popular and free server for the streaming of live and on-demand MP3 encoded files.

SHOUTcast is an MPEG layer 3 technology (MP3) that provides an audio homesteading solution for anyone connected to an IP network. Listeners tune to SHOUTcast broadcasts by using a media player compatible with streaming MP3 audio, such as WINamp. The SHOUTcast system provides the technology to create a Webcast through the SHOUTcast Distributed Network Audio Server (DNAS). This software runs on a server attached to an IP network with lots of bandwidth, and is responsible for receiving audio from a webcaster, updating the SHOUTcast directory about what the webcaster is sending, and sending the Webcast out to the listeners.

Nullsoft's SHOUTcast server is an application that runs on supported operating systems such as Windows 98, NT, 2000, FreeBSD, Linux, and Solaris.
Once a stream has begun, the SHOUTcast server will only accept connections from other copies of WINamp in order to broadcast that source stream to each listener. The server creates a micro-broadcast system that delivers content in any of the formats that WINamp supports.

The SHOUTcast Server accepts connections via a SHOUTcast DSP Plug-In that is part of the WINamp player, which provides a source stream for the Webcast. What this means is that the webcaster simply has to have the WINamp player on his system, then download a plug-in for the media player, allocate MP3 files to be used as content for the Webcast, and then stream the MP3 files to interface with the SHOUTcast server.

Using specialized SHOUTcast Webcasting plug-ins, audio from a microphone as well as any device attached to the Line-In port on the webcasters' soundcard can also be streamed via SHOUTcast server. The SHOUTcast server is the key to connecting many people to one another via WINamp.

The “streaming server,” in this and most other cases, is a software application run on a PC. This software can be loaded directly onto the broadcaster's PC where the MP3 authored content is resident, loaded onto a separate PC that is co-located with the authoring computer, or it can be loaded onto a third party computer that provides the service of operating the server for the broadcaster.

The client media player recommended for Windows users is WINamp, and is discussed within the Media Player section in detail. WINamp supports MP3 audio, SHOUTcast Radio, Windows Media Audio, and offers customization tools for users. WINamp is a free player. One of the advantages of using the SHOUTcast server technology to encode MP3 streams is that a great percentage of streaming players can hear it.
SHOUTcast DNAS server technology can be accessed from a third party site, which will usually involve fees for the webcaster, or it can be downloaded and installed onto a PC owned by the webcaster. After downloading, there is an installation and configuration process to be followed, but the configuration to get up and running can be minimal. However, if desired, the webcaster can also get involved in configurations that are more complex.

A detailed systematic guide is available on the SHOUTcast web site at http://forums.winamp.com/showthread.php?threadid=35635, and as noted an overview of the SHOUTcast system is provided by http://www.fozguys.com/.

ICECAST TECHNOLOGY

Icecast is the name for both a project that encompasses several technologies required for streaming using the Internet, and a program that actually streams audio data to listeners. The program icecast is identified by lowercase letters. This explanation is offered online:

After years in development and years in alpha testing, The Icecast development team has released version 2.0.0 of its streaming media server. icecast2 supports Ogg Vorbis and MP3 streaming and has many features and functions you would expect from a world class streaming media server. "

The Icecast project includes several modules that used together allow Webcasting. The system can be broken down into the following modules:

Streaming Server Software: icecast2. Software that actually streams the audio to the listener. It is actually also compatible with the SHOUTcast technology already described.

Client Software: Vorbis Tools, WINamp, foobar2000, or any Ogg compatible Media Player. Software that resides on the listener computer and is compatible with the Ogg Vorbis format used by icecast2 to encode and deliver the stream.
**Source client software:** libshout. libshout is a library for communicating with and sending data to an icecast server. It handles the socket connection, the timing of the data, and prevents bad data from getting to the icecast server.

**Source client software:** IceS is a program that sends audio data to an icecast server to broadcast to clients. IceS can either read audio data from disk, such as from Ogg Vorbis files, or sample live audio from a sound card and encode it on the fly.

One advantage of icecast is compatibility with the open standard CODEC Ogg Vorbis, which does not require the copyright payments that MP3 CODEC's require. Designed to completely replace all proprietary, patented audio formats, Ogg Vorbis claims higher quality performance than MP3, even rivaling advanced MPEG4 algorithms.

Brian Zisk, currently Technology Director for The Future of Music Coalition, had this to say about icecast during the early days if the development process (20 April 2000). “So then we had a platform for running Internet radio which we used. Suddenly hundreds of other stations and bands began to use this software as well. So the technology evolved and Jack was able to make it better. Whereas originally the software just streamed to MP3 players, eventually we figured out how to make it work on the Real Audio Players and the Windows Media Player, and now it works on most other players. So now, you can use our software to stream an unlimited number of streams to the Real Audio player. It sounds better than streaming using the Real Audio software, and it's free.” ¹¹

For more information on the Icecast project and to download the server and other third party software applications compatible with icecast, refer to:

http://www.icecast.org/index.php
A detailed systematic guide for the installation and implementation of Icecast is available from: http://melmoth.dyndns.org/stream/doc/index.html

REALNETWORKS HELIX UNIVERSAL SERVER TECHNOLOGY

RealNetworks is a company involved in all aspects of streaming media, and this singular focus has allowed them to become a leader in the technology. RealNetworks recently released their "ninth generation media delivery system," which incorporates the Helix Universal Server, Helix Universal Gateway and the Helix Producer.

In contrast to an open source project like the one Icecast already discussed, RealNetworks is a commercial enterprise that generates profits from the sale and application of their products. The company's reliance on Intellectual Property as a key business driver leads to the development of many proprietary protocols, and thus they do not necessarily rely on open source code or standards for product development. This approach has changes somewhat with the introduction of the Helix platform, which is built on Helix DNA source code, which is offered to the development community.

Therefore, they do offer a viable commercial alternative for a start-up enterprise that has sufficient funding to consider the purchase of their streaming media products. The large market share of their media player and other products in the marketplace make them one of the leaders in the area of streaming media technology. The extension of their technology to embrace competing technologies and to provide their technology in an open source environment is an exciting development that offers much potential value to a webcasting operation.

The Helix server technology has embraced formats other than the well-established RealMedia and RealAudio formats that formed the backbone of the
company since their original release in 1995. In fact, RealNetworks has attacked the Microsoft Windows Media 9 series not only based on the superior performance of Helix, but also on Media 9’s proprietary nature. Helix developers included compatibility with other formats such as Windows Media, QuickTime, Macromedia FLASH, and MPEG1, MP3, MPEG4, and a complete list of 55 data types. 12

Although the original protocols of the RealMedia products delivered streams over proprietary formats, the new server products have embraced a universality that provides many advantages to a streaming operation, including an Internet Webcasting operation. In fact, the Helix server runs on the Unix/Linux platform based on open standards.

The advantage for the Internet broadcaster is a single server application that can provide streams to many of the deployed players in the marketplace. The Helix server accepts both live and on-demand connections from a variety of encoders, including: Windows Media Encoder, Microsoft Digital Media types (.wmv, .wma, .asf), QuickTime Broadcaster Encoder, MPEG1, MPEG2, MP3, and MPEG4 Encoders.

As an example, just considering two of the more widely deployed media players, Windows Media Player and RealPlayer, you are looking at two proprietary delivery systems. This means two server systems and associated software to make sure that listeners can be reached on both of these media players. Yet, you are still not reaching them on some of the other less deployed but still valuable players such as QuickTime, even if you have built an infrastructure that includes both of these server technologies. Helix Server eliminates the need for two proprietary systems by incorporating support for Windows Media and RealNetworks, along with QuickTime and the other popular formats already mentioned.
Compatibility with Macromedia FLASH enables the possibility of a media player based on FLASH technology deployed on 98% of personal computers (source).

Some additional features of the Helix Server platform include:

- **Compatibility with multiple operating systems.** Helix Universal servers are available on a number of operating systems including: Unix, Linux, HP/UX, IBM/AIX, and Solaris just to name a few.

- **Compatibility with multiple protocols.** Supports Real Time Streaming Protocol (RTSP) for standards based media players, Microsoft Media Service (MMS) proprietary protocol for the Windows Media Player, and Hypertext Transfer Protocol (HTTP) for non-streaming activates such as server configuration.

- **Improved scalability and reduced bandwidth costs with an integrated content networking system specifically designed to provision live and on-demand content reliability across distributed networks.**

- **Reduce delivery costs and increase audience size with industry leading performance, reaching 10,000 simultaneous users on a single entry level server.**

Additional information on the Helix Server can be found at:


Also included with the RealNetworks Helix system are two additional products, the Helix Gateway systems, and the Helix Producer. The Gateway is intended for commercial enterprise deployments that might benefit from not only the ability to receive content on the edge of the network as a subsystem of the server, but also to cache content that is viewed frequently. Eliminating much of the transmission traffic back to the primary server preserves valuable bandwidth.
Internet webcasters would not appear to need this capability in order to deliver content to individual Media Players. The Helix Producer will be discussed in detail within the Authoring Technologies section of this blueprint.

An excellent overview of the entire Helix system is available from the RealNetworks web site in the form of a streaming presentation that runs on the RealOne player, so it is recommended that this player be loaded onto the viewer’s PC. Click on the Online Seminar: Helix Products Overview available for download from http://www.realnetworks.com/products/index.html.

**WINDOWS MEDIA TECHNOLOGIES**

Windows Media is Microsoft’s streaming media system, and Windows Media Services 9 Series is considered by them as the ideal way to stream Windows content. Windows Media Services 9 Series is the server component of the Windows Media 9 Series platform. It works in conjunction with Windows Media Encoder and Windows Media Player to deliver audio and video content to clients over the Internet or an intranet. These clients might be other computers or devices that play back the content using a player, such as Windows Media Player, or they might be other computers running Windows Media Services 9 Series (called Windows Media servers) that proxy, cache, or redistribute content. Clients can also be custom applications that have been developed using the Windows Media 9 Series SDK (software development kit).  

Microsoft intends the Windows Media system to be the one and only system riding in tandem with its operating system, and thus offers much of the software free of charge. Outside of the Windows Media Player, which is available for almost all platforms, the Windows systems has not provided tools for other operating systems to author and serve Windows Media content.
The only operating systems considered to run the Windows Media Services component are the different configuration offered by Microsoft. Windows Server 2003, Standard Edition meets the minimum requirement, however Windows Server 2003 Enterprise Edition, or Windows Server 2003 Datacenter Edition are actually recommended.  

Microsoft also offers the capability to stream Windows Media encoded content via a standard Web server, although with some limitations in comparison to streaming content on the Windows Media Server. The architecture of a streaming server optimizes it for the delivery of a steady stream of content, where a standard web server is optimized for the bursty delivery of HTML content via web pages. Still it may be a viable alternative for the start-up organization that has a standard web server deployed to use that server to stream to Windows Media Player users, while developing customized servers to handle other media players and formats.

Some of the limitations of utilizing a web server in place of the Windows Media Server are as follows:

- The web server sends data to the client as quickly as possible, sending data in chunks in order to be ready to handle the next incoming request. It does not maintain a predictable delivery rate, as does the streaming server.

- Web servers cannot use the User Datagram Protocol (UDP), which is the preferred protocol for streaming. If the client requests content from a Web server, the delivery of the stream is more likely to be interrupted by periods of silence because the player must collect and temporarily store or buffer data from the server.
• Web servers do not support live or multicast streaming.

• Web servers do not provide many of the playback options that media servers can support.

• Web servers cannot stream content at multiple bit rates, which can be useful when you need to stream content to a number of clients who are accessing your server at various connection speeds.

Given these limitations on the webcaster, particularly the limitation on streaming to multiple bit rates, utilizing a web server in place of a streaming server would certainly be a short-term approach that might be considered for a quick launch, but should not be viewed as a long term or permanent solution.

The Media Player and Media Encoder will be addressed in the sections dealing with those elements of a Webcasting system. A detailed guide for the deployment of the Windows Media Server is available from:


QUICKTIME SERVER TECHNOLOGY

QuickTime (QT) is a multimedia format originally developed by Apple for its MAC OS as a file transfer tool, but has evolved into a premium technology for the creating, playing, and delivering (streaming) of digital media over the Internet. QuickTime Streaming Server 5 is currently included as part of the Mac OS X Server v10.3 Software from Apple. It is also compatible with the Darwin open source project, which offers ready-made versions of Darwin Streaming Server available for the Linux, Windows, and Solaris platforms, based on code like the QT server.
The QuickTime technology differs slightly from the technologies previously discussed. The encoding process involves two pieces of software that will be discussed within the Authoring Chapter. Encoded audio files will carry a .mov file type (movie file), which has remained the file type since the early days when QT was used primarily for visual content. The streaming audio is either pre-recorded in the QT movie format for on-demand storage, or streamed as a live feed.

After the encoding computer has captured the sound in the QT format and processed it with Sorenson Broadcaster to establish compression and output options, the stream is sent to the QuickTime Streaming Server than can be operated on a variety of server platforms, and is not proprietary to just the MAC operating system.

QuickTime Streaming Server delivers hinted QuickTime (.mov), hinted MPEG4 (mp4), and hinted 3GPP (.3gp) files in real time over the Internet via the Real-time Transport Protocol/Real-Time Streaming Protocol (RTP/RTSP). It can also deliver MP3 files via Icecast-compatible protocols. It delivers both video on demand (VoD) and, when combined with broadcasting software, live streams. It is perfect for serving live events over the web, when partnered with broadcaster software, or for creating a 24x7 video or radio station with the included Playlist Broadcaster, or delivering long-form media. It is also perfect for those concerned with customers downloading files locally; real time streaming means the data is "consumed" as it is delivered, leaving no file to play back locally.16

As with the other systems discussed, the QT Streaming Server technology accepts streams encoded into the format, and then processes them for delivery to a third party client resident on a listener computer. It represents the ideal way to reach Macintosh users, as it is native to their operating system, as the QT player is pre-installed in all recent Mac computers sold. In addition, there is a version of the
player available for Windows users, extending the system's cross-platform capability all the way to the desktop.

The Helix server from RealNetworks, already discussed, offers compatibility with QT streams, so this format can be implemented in concert with the other proprietary formats discussed. While implementation of all the features and functionality of QT Streaming Server (QTSS) will require dedication of a server to the MAC OS X v 10.3 platform, QT format compatibility can be achieved through the use of the free Darwin Server technology, or implemented through the Helix server. Because of QT's superior performance characteristics and compatibility with advanced video (MPEG4) and Advanced Audio Coding (AAC) and MP3 formats, compatibility of the webcaster with this format should not be overlooked.

A detailed guide for the deployment of the QuickTime Streaming Server is available from the QTSS Admin Guide available at:


LIVE365

Live365 is an interesting hybrid between a server and the type of hosting service offered by the type of companies listed in Appendix A of this thesis. Early on, it was referred to as an "audio homesteading service" repeating the signal sent from a single broadcaster so more people can listen to it. A similar model was used by the developers of the SHOUTcast server with a companion site called Shoutcast.com that aggregates the various online webcasters using the SHOUTcast server system and gives listeners a chance to select the various streams that appeal to their tastes.
Live365 offered the early SHOUTcast webcasters (circa 1999) the ability to send them encoded streams, which they would then rebroadcast and aggregate via the servers that they owned and operated. Live365.com provided an interface for both listeners and webcasters.

Still operating and growing in 2004, Live365 does not function as a content provider, but still functions as a rebroadcast of content streams created by both personal and professional broadcasters. Use of the Live365 servers as well as a software package to assist in uploading the audio content to Live365 is the basis of the site. Live365 offers a proprietary media player, but can also direct streams to the other MP3 capable players discussed in the Media Player Technology section.

Live365 now operates as a for-profit company, and includes a subscription offering for both listeners and webcasters. A free to listen basic service is available to listeners, but it does not include all possible station options, and does not prevent the listener exposure to pop-up ads, in-stream audio ads, banner ads, and sponsor buttons. A Preferred membership sold for $3.65 eliminates all these forms of advertising and increases the number of Live365 stations accessible by the listener. In addition, either it now offers the capability for a higher audio quality stream using the MP3PRO format, requiring the download of the Live365 player, or a player compatible with this advanced audio format.

Service for the webcaster are no longer free, but there is a variety of plans and payment options to choose from, depending on the amount of storage and concurrent listeners desired or anticipated for the service. Personal broadcaster packages range from $7.45 month to $37.35 per month. A professional broadcaster has a variety of pricing options available to them, in part based on their preference concerning the required royalty payments for the various organizations that represent the copyright holders of specific pieces of music.
While we will cover the various responsibilities toward these organizations in Chapter 3, Live365 offers professional broadcasters a fee that includes royalty payments or one that does not include these payments. Within these subcategories are options that depend on total monthly hours, streaming bandwidth, and storage space. These rates can be reviewed at:

http://www.live365.com/pro/pricing.html

For more information on the Live365 service, refer to:

http://www.live365.com/index.live

MEDIA PLAYER TECHNOLOGIES

The media player is the client device that actually initiates the contact with the server requesting activation of the web radio transmission. A media player is a standard feature of current operating systems, whether it is a Windows Media Player, or a QuickTime player for MAC Users. Despite the advantage that Microsoft gains with this ubiquitous delivery of their media player, competing media players have established a significant presence in the marketplace, and we will consider several of the available media players.

WINAMP MEDIA PLAYER

WINamp media player is a free player for Windows users developed and offered through Nullsoft as a client device compatible with the SHOUTcast Streaming Server platform. WINamp is generally defined as an MP3 player, so although developed by Nullsoft and used in conjunction with the SHOUTcast platform, it will play an MP3 stream originated from a source other than SHOUTcast.
Recently released version 5.02 offers the basic free version and an upgraded version for $14.95.

The free version is all a listener would require to receive the stream from a webcaster, as it includes integrated Internet Radio and TV support as well as the ability to play downloaded audio/video files, and select files from a multimedia library. The upgraded version offers the ability to function as an encoder and rip/encode songs from a raw audio source such as a CD, into an MP3 formatted file for incorporation into a radio stream.

With the Nullsoft DSP Plug-In, the WINamp player becomes the interface to the SHOUTcast server, so that Webcasting can be a simple process. Required steps include converting the audio source into MP3s through WINamp, establishing a connection to the SHOUTcast server (which can be downloaded and installed for free as already described), and Webcasting your stream of MP3 files so that your radio station can be selected through the SHOUTcast Showcase list available at http://www.shoutcast.com/. All this can be done at no charge, and offers a great introduction to the Webcasting process.

Also available for WINamp are Plug-Ins offered by another privately held company called Spacial\Audio that really take WINamp from media player to encoder. Spacial\Audio offers a suite of products that really fall more into the authoring/encoding technology realm, and we will look more closely at the capabilities of WINamp with the Encoders DSP Plug-In within that section.

The SHOUTcast or MP3 player recommended for MAC users is Audion, now offering version 3, player and encoder. Audion 3.0 offers more than just player capability, it will play MP3 streams, CDs, NET audio, but also includes encoding capability, CD burning, MP3 stream recording, and many other user customization tools. Audion is not offered in a free basic version as WINamp is,
so essentially you are buying an encoder that also serves as a player. For additional information on the Audion Player/Encoder, refer to http://www.panic.com/audion/index.html

The comparable player recommended for Linux/X Windows users is XMMS. XMMS is modeled after the WINamp player, but was written from scratch for the Unix platform. X Multi-Media System (XMMS) can play media files such as MP3, MOD, WAV and others with the use of Input plug-ins.

This is also a free player that can be researched and downloaded from: http://www.xmms.org/about.php

REALONE PLAYER (V 10.0)

RealNetworks has been an innovator in the media player space since approximately 1995, and has recently introduced its ninth generation media player as part of the Helix digital media suite of products, called the RealOne Player. The RealOne Player provides an interactive multimedia platform that now provides a three-pane viewing window that allows the viewer to access the streaming media, as well as HTTP delivered contextual and browser information. In essence, you can view or listen to the audio/video content, while having text information to augment it, and have links to additional related URL's in the third pane.

The size and priority of these panes are controllable by the user, so they can really customize the media player to meet their unique requirements and needs for different types of media. The basic player continues to deliver the features that users have become accustomed to such as starting and stopping the stream, viewing artist and album information for Web delivered music, or functioning as the Radio Tuner for Web Radio (Webcasts).
In addition, the player provides additional features to the user such as CD burning, CD ripping, and MP3 encoding.

RealNetworks also uses the RealOne player as a gateway to offer more advanced services through a subscription model that attracts users seeking more services, control, or content than the basic player can deliver. There is also a version of the player that designed for the Enterprise network, which has essentially removed many of the features just described, thus rendering it unusable for the reception of a Webcast.

WINDOWS MEDIA PLAYER 9

The WM9 series media player offers a great many features for the playback of rich media, as do the other players discussed. Already pre-loaded is a large selection of Web Radio stations, most not affiliated with Microsoft but offered as part of the Radio Tuner Interface. Many of these stations are listed as Net Only offerings, while others are show the location of the over the air station that originates the Webcast. For those stations that are pre-loaded, this is a plus since a listener is likely to try some of these options. They also have the option to customize the Radio Tuner by adding some of their own station selections.

The player offers many features for the control and manipulation of media downloaded into the local PC, such as music mixing with cross fading, auto volume control, and variable speed playback. Additional features of interest for the webcaster streaming to the player are a “Fast Streaming” feature that eliminates the buffering required on many older players.

The ability to present a great deal of additional information to the user is also built in to the player, additional info to enhance the listening experience such as album art, music videos, downloads, biographies, discographies, reviews, news, related artists, and much more can be streamed along with the audio content.
With the Windows Media Series Microsoft is aggressively trying to expand licensing agreements to a wide range of portable devices, and claims to offer better licensing terms than formats such as MPEG4. Developers, manufacturers, and others interested in developing and deploying Windows Media across their platforms can obtain licensing rights and Software Developers Kit to extend the source code of the Windows Media platform. This may be of interest to some webcasters that would like to use Software Development as a way to customize their station and develop the unique identity necessary to stand out in a rapidly developing area.

The standard format for the Windows Media platform is Windows Media Audio and Video 9 Series that takes advantage of Variable Bit Rate (VBR) audio and new compression techniques that deliver MP3 quality audio at half the size so streaming is utilizing less bandwidth. Users running Windows XP can take advantage of the player’s support of an advanced audio format through the use Windows Media Audio 9 Pro 5.1 playback. This will require the listener PC to have a 5.1 compatible sound card and 5-piece PC speaker system. For details on the set up of a 5.1 audio system with Windows XP, refer to:


Since the media player is shipped with each operating system loaded onto a PC, it is available to a large percentage of the PC universe. The Series 9 player can also be downloaded free of charge to older PCs. Therefore, support for this player by the webcaster should be considered, through either the Windows Media Server or the RealNetworks Helix server.

For more details on the Windows Media platform, refer to:

QUICKTIME PLAYER

The latest version of the QuickTime player is 6.5, and in its basic form it meets the requirements of the media player to allow streams of audio/video information that are encoded in a compatible format to be received and played back. Although originally developed by Apple for MAC users, the QT player has become an established cross-platform player with Apple reporting 10 million downloads a month of the software. Operating systems supported include Mac OS X, Windows 98, Windows Me, Windows 2000, and Windows XP.

The free player also includes additional modules, Browser Plug-Ins for viewing media within a web page, and a PictureViewer that allows Windows users to work with still images (Preview is available already on the MAC OS). The player offers a long list of advanced features and compatibility with some of the most advanced audio/video standards out there, including MPEG4, AAC audio format, 3GPP and 3GPP2 wireless standards, as well as the more established MP3, MPEG2, previous QT formats and others.

It provides many controls that enhance the listener/viewer experience including easy-to-use controls, an enhanced interface, separate bass and treble controls, a balance control, and streaming media support. Combined with its advanced capabilities, and its newly introduced capability to extend the reach of rich multimedia to a new generation of wireless handheld devices, a webcaster would be well served by compatibility with the QT format.

In addition to the advanced features of the QT player, it also provides an easy gateway into the authoring environment with an upgrade to QuickTime Pro. The upgrade is accomplished by the purchase of a $29.95 software “key” directly from Apple.
The user now has now opened up a full-featured authoring/encoding environment that allows for the creation of content to be fed to a QT Streaming server for Internet distribution. QT Pro also provides some enhancements to the player capability, allowing the use of a full screen mode as well as some archival and editing capabilities. Refer to the section on QuickTime Pro in Authoring/Encoding Section of this chapter for additional detail.

Personal experience with the use of the QT player revealed some difficulty streaming certain video clips on the Apple download site with the older version of QT 5.0. Although this was corrected by an upgrade to 6.5, unfortunately the upgrade also defeated the functionality of an older version of QT Pro purchased several years earlier; this required an upgrade to the new version if I wanted to restore the capabilities that QT Pro provided.

I elected to upgrade the player anyway, and was very impressed with the sound quality of several downloads available from Rhino records site. (http://www.rhino.com/fun/listeningparties/78042_PartyPlayer.lasso).
Listening with QT 6.5 over a broadband cable modem connection was very close to listening to CD quality audio, as promised.

AUTHORING/ENCODING TECHNOLOGIES

The authoring/encoding step is the actual preparation of content submitted to the streaming server for transmission to the client media player. It implies or requires a certain amount of bandwidth through some type of network connection between the authoring computer and the streaming server. The streaming server can be co-located with the authoring computer, but often is not, and connects through a service designed to provide sufficient bandwidth (T1, ISDN, Cable TV backhaul, etc.).

A nice three step overview of the encoding process is presented with the Windows Media Encoder Overview, and is general enough to serve as an introduction to the process before we consider several of the available encoding systems.

Steps Involved in Encoding

Using the encoder consists of three basic steps:

Choosing a source. You can encode live content in real time, audio or video files, or you can capture screens. Real-time sources include anything that you can plug into your audio or video card, including a CD player, microphone, VCR, video camera (both analog and digital), video tape recorder (VTR), video player, or NTSC television signals. You can also capture screens directly from your desktop, and insert script commands while encoding. The encoder supports sourcing from most common file types such as AVI and WAV (Note: referring to Windows
Media Encoder, but many other file types are generally supported by other platforms.

Choosing your target destination and quality settings. Are you creating files for downloading? Do you plan to stream the content? Or are you creating a high-quality archive? The encoder includes many predefined destination, video, and audio settings that enable you to easily target your content for delivery to a variety of destinations, including set-top boxes, personal digital assistants (PDA), CD and DVD, and, of course, the Internet. You can also customize the default settings to meet your needs.

Selecting the distribution method. Encode content to a file or broadcast it live, either directly from the encoder or from a Windows Media (or other) server. Encoding to a file supports on-demand scenarios such as making music available for download from the Web, radio rebroadcasts, pay-per-view video, and video production and editing. A live broadcast enables streaming scenarios, such as Internet-based radio/TV stations, executive broadcasts, and live video distribution (point to point). Live broadcasts can be streamed directly from the encoder, or you can stream from a Windows Media (or other) server, using either push or pull distribution. [Note: highlights mine for added words or emphasis].

Each of the authoring/encoding systems considered will offer some techniques for managing the bit rate to deliver a manageable stream, employ some type of compression to minimize bandwidth concerns, and provide some format for the delivery of high quality audio and video to the streaming server.
REALPRODUCER 10 (FORMERLY HELIX PRODUCER)

Content creation is accomplished in the RealNetworks system using the RealProducer 10 Software. This next generation digital media production tool enables both broadcast streaming and content download. This tool creates RealMedia audio and video files and streams them to the Helix Server for download to the RealOne player.

Helix producer can accept inputs of baseband video and audio files (such as from a video camera or microphone from a live performance) and through its integrated CODECs encode the signal into a digital format for transmission. In addition, it can accept the input of a wide range of already encoded file formats, including AIFF, MPEG, .WAV, .MOV, and others and output them to the Helix Server as well. Incorporated into RealProducer are the RealVideo 10 and RealAudio 10 CODECs that encode various input formats into one of several commonly used formats. As our focus is really on audio transmission through Web Radio, we will focus our attention on the capabilities of the RealAudio 10 CODEC.

RealAudio 10 has a capability of significant importance to the webcaster, as it has the ability to provide a scaleable output. That is to say, that it can adjust itself to the available bandwidth of the listener. Should the listener be connected over a dial-up connection, capable of only low to mid bit rates (say < 128 kbps) then the CODEC relies on established RealNetworks SureStream encoding techniques developed over the first 9 generations of products to compress the audio file sizes while maintaining an acceptable level of quality. Where higher bit rates are possible, over connections using a cable or DSL modem, then the RealAudio 10 incorporates the MPEG4 AAC CODEC.

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According to the RealNetworks website, AAC encoded audio is superior to MP3, and beats MP3 at a lower bit rate of 96 kbps, compared to MP3 at 128 kbps. Higher quality at lower bit rates is always valuable, and translates into lower costs, as well as better reception for the end user. For more information on the RealAudio 10 CODEC, refer to http://www.realnetworks.com/products/codecs/realaudio.html

For detailed information on RealProducer setup and configuration, refer to: http://service.real.com/help/library/guides/Helixproducer/Producer.htm

WINDOWS MEDIA ENCODER 9 SERIES

The Windows Media Encoder is a powerful tool to produce content that is compatible with all the elements of the Windows Media platform. The encoding options are significant, allowing the author to employ techniques such as CBR (constant bit rate) or VBR (variable bit rate) encoding, offering a combined voice and music CODEC, a digital surround sound CODEC, and the high quality progressive streaming required for Web Radio. The feature most applicable to the Webcasting application is obviously the ability to capture content, whether live or pre-recorded as a raw audio file, and stream it to a streaming server.

An additional development provided by the Windows Media Encoder is MBR (multiple-bit-rate) encoding, which provides users with better quality content during times of network congestion. The MBR format streams multiple bit rates and matches the appropriate bit rate to the client media player based on the bandwidth at the time the stream is being received.

The Windows Media Encoder is available as a free download from Microsoft, and offers an impressive array of capabilities, many outside the scope required by a webcaster. Although a streaming site should allow for the possibility of delivering videos as a way to differentiate itself within the competitive landscape.
For more details on the Windows Media Encoder, refer to:


QUICKTIME PRO (QT PRO)

QT Pro is a bit different in several ways from other encoding software, one of which is that it is available as an upgrade to the basic QT player. By purchasing a software key for $29.95 from Apple, the media player becomes an authoring/encoding station capable of creating content in an MPEG4 format that streams directly to the QT Streaming or RealNetworks Helix servers. Advantageous to the webcaster is the CODECs compliance with the MPEG4 AAC audio standard. This standard provides advanced compression resulting in smaller bit-rate transmissions with higher quality than MP3.

QT Pro also provides compatibility with the new worldwide wireless standards 3GPP and 3GPP2 for the creation, delivery and playback of multimedia over 3rd generation, high-speed wireless networks. This capability will extend the webcasters reach to portable cell phones, PDAs and digital music (currently MP3) players, essentially mimicking the capability of terrestrial broadcasts to be received by mobile devices (radios). These standards are based on MPEG4, which incorporates the QuickTime architecture by choice of the standards committees responsible for their development. Therefore, QT Pro offers a quick and inexpensive entry point into an interesting development area for the webcaster.

Another component of the QT Authoring/Encoding suite is QT Broadcaster, which allows the encoding of live content into the QT platform as an MPEG4 stream. Broadcaster integrates with both the QT Streaming and Darwin (Windows based) servers, and allows the delivery of a live MPEG4 stream, a live 3GPP stream to wireless users, archival of an on-demand stream for later
viewing/listening to the millions of QT players available. The broadcaster component is available as a free download, but runs on the MAC OS system exclusively at this time.

For more information of QT Broadcaster, refer to:


For more information on the authoring/encoding capabilities of QT PRO, refer to: http://www.apple.com/quicktime/upgrade/

SAM2 BROADCASTER

Streaming Audio Manager (SAM) was originally developed in 1999 to be used in conjunction with programs like SHOUTcast that would allow the broadcaster to produce, manage, and track the elements of a radio program. This program evolved into a powerful multi-format encoding and radio automation package now called SAM2 (v 2.7.9), with encoder technology that powers several Spacial\Audio products of interest to webcasters.

SAM2 Broadcaster software is the main Spacial\Audio engine for the encoding capabilities of their products. However, compared to the SimpleCast product, the advanced features offered improve the Webcasting process. SAM2 integrates Internet broadcast automation along with its powerful multi-format, multi bit rate, multiple server capabilities to offer a very strong package that augments and automates the Webcasting process.

This professional broadcaster package supports and facilitates the online broadcast. It differs from other encoding software considered in that it provides broadcast automation tools as well as the encoding capability. The automation tools enable the webcaster to: comply with DMCA and RIAA standards
concerning the rotation and selection of the audio content, fully automate the broadcast, develop real-time listener statistics, develop content rotation schedules automatically, and use tools to deliver a more professional sound for your station.

The encoding features of the software allow the webcaster to stream using the advanced MP3PRO CODEC for increased audio quality at half the bit rate of standard MP3 codes. Also supported are standard MP3, Ogg Vorbis, and advanced Windows Media 9 encoders. One of the powerful features of the software is the ability to use a combination of encoders simultaneously, even mixing in multiple bit rates. This allows the webcaster to cover a wider range of potential listeners, as there is great diversity in bandwidth and media player formats within the Web radio audience. As an example, you can run a 24 kb/s MP3PRO stream, a 56 kb/s MP3PRO stream, and 56 kb/s Windows Media stream simultaneously, and they can all come from the same audio source files.

In addition to this streaming flexibility, you can also direct your automated streams to a number of the servers already discussed, including SHOUTcast, Live365, Windows Media, icecast2, and P2P Streamer. The software also provides some additional key features that are important elements of the Web Radio experience, namely the addition of a text message displaying CD/song titles, artists, and album art that updates as the songs play in their rotation. Other Meta data is streamed as well the Windows Media format and MP3PRO and MP3 formats.

A final feature that can provide an important source of revenue is the integration of "Buy CD" links within the package that can enable the webcaster to sell the CD being used for the broadcast to an interested listener. For a site like our model [www.godsound.com](http://www.godsound.com) that already is based on the sale of CDs, and easy link between the listener experience through the radio station and the CD store is an important feature.
For more information on the SAM2 Broadcaster package, refer to:

http://www.spacialaudio.com/products/sam2/

**OTSDJ**

OTSDj also falls into the classification of Webcast/broadcast automation software, similar to SAM2. Running from a Windows based platform, the software allows a professional component to be added to the mixing process of creating a playlist to be Webcast. Some of the functions the software provides to deliver a more polished and professional stream include mixing, dynamics (volume management), EQ, pitch control and a real-time pitch-preserving tempo control. In addition to a graphic equalizer, a dynamics processor is an important feature for audio processing.

The dynamic processor allows you to control the level or volume of all the audio tracks to be combined into your stream. Because of variations in the recording process from one CD to another, it is unlikely that all the MP3s copied from source material will be of an equal volume, and thus when delivered in a stream, level inconsistencies detract from the listening experience. The dynamics processor functions of OTSDj solve this problem. OTSDj provides a full-fledged, pro-quality dynamics processor including AGC, compressor and limiter functions, allowing full control of the characteristics of each processor section.

The encoding capabilities are limited to MP3 files, which are supported by the LAME encoder, an open source development project that now provides an effective MP3 encoder. The advanced versatility of OTSDj is in the additional processing it provides of the source MP3 files. Through a feature called Ots album files, the MP3 files are further compressed to reduce file size, while also adding the capability to encapsulate multiple MP3s in the same album file.
Ots Studio allows you to create Ots albums, which for example can include an original CD with all of its songs, correct titles and artists, genres, copyright information, and original cover art - all in one compact file.

Alternatively, you use it to create your playlist of compilation tracks, which can then be easily imported and mixed in OtsDJ as individual songs or as albums.

OTSdj will handle the mixing of CDs along with the digital audio files, but this will be of limited value as the streams will need to be fully encoded into MP3, but should allow encoding on the fly if the CD track is not previously encoded. It also provides for processing of a direct line in, so that microphone inputs for DJ voice-overs are feasible, and able to be professionally processed.

OTSdj also offers compatibility with the SHOUTcast plug-in, so that the professionally manages files can them be streamed to a SHOUTcast server, which may be of interest to both personal/hobbyist webcasters as well as more professional ones.

Although the basic 1.0 package does include a playlist generator package, to obtain the advanced scheduling capabilities that are attractive to webcasters to assure compliance with DMCA playlist regulations, an advanced Scheduling and Logging module, is offered as an upgrade to the OTSdj 2.0 package. The web site currently offers package 1.0 with a free upgrade to the 2.0 package with the S&L module, as well as some additional consulting support, as 2.0 is still under development. Information on the OTSdj software system is available from: http://radio.about.com/gi/dynamic/offsite.htm?site=http%3A%2F%2Fotsdj.com

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SIMPLECAST

SimpleCast is an authoring/encoding solution also offered by SpacialAudio that allows audio content from several sources such as audio files, a microphone or "line-in" inputs to be sent to a streaming server for delivery over the Internet. Of particular interest is the use of a CODEC for MP3PRO, and advanced compression format that provides a higher quality audio signal at half the bandwidth of MP3. In addition to this format, SimpleCast will encode to standard MP3, open standard OGG Vorbis, and Windows Media 9.

In addition to the powerful encoding support that allows multiple bit rate streaming in multiple formats, SimpleCast offers automation and metadata transmission capabilities that provide album information, album art, and support for links to purchase CD products from the webcaster site.

SimpleCast will stream to multiple servers for content delivery, including SHOUTcast, LIVE365, Windows Media Server, and P2P Streamer. SimpleCast is a stripped down version of SAM2, but may offer the right mix of capabilities for the personal, non-profit, or small webcaster at a more affordable cost than the full features SAM2 product.

For more information on SimpleCast, refer to:


WINAMP ENCODER PLUG-INS

The WINamp media player discussed earlier in Chapter 2 can also be upgraded with SAM2 encoding capabilities by the use of a Plug-In offered by SpacialAudio. The Plug-In offers the same encoding capabilities already discussed, and thus can turn the PC that has the WINamp player module and audio content in the correct format into a powerful streaming radio station.
In addition to the Encoder Plug-In, a Statistics relay Plug-In is also available that will provide statistics from all the servers on a particular network that are SHOUTcast, Live365, Windows Media, icecast2 and/or P2P Streamer so you know exactly how many people are listening at any given time. The webcaster can also view graphs of statistics over a period of time, view current, high and maximum listeners counts for a single relay or all the relays combined, and see which relays are up and running and which are reporting errors.

For more information on the WINamp Plug-In Encoder, refer to:

CHAPTER THREE

WEB RADIO COPYRIGHT AND LICENSING CONCERNS

"We think that the natural tendency is for producers to worry too much about protecting their intellectual property. The important thing is to maximize the value of your intellectual property, not to protect it for the sake of protection."  

COPYRIGHT BASICS

Digital technology enables Web Radio by providing the ability to easily create, produce, transmit, stream, store, and copy musical works. While to the user or listener all these capabilities are great, to the creators, songwriters, and music publishers some aspects of digital are not so great. The ability to copy, store and share copyrighted works through digital means allows users access to high quality copies without the need to purchase an original copy. The double-edged sword nature of digital technology has been made abundantly clear recently by the activities of the RIAA and their lawsuits versus Napster and private individuals intended to stop song swapping via peer-to-peer networks.

While clearly different from song swapping over peer-to-peer networks (i.e., Napster), Web Radio cannot escape the laws of copyright, as it primarily uses copyrighted musical content streamed to the listener. Terrestrial radio established many of the rights and processes to deliver musical content to interested listeners using "sound recordings" created by artists and their creative teams. The transition from analog RF technology that allows terrestrial radio broadcasts, to digital technology that allows Web Radio, opened a window of opportunity for significant changes in the control afforded copyright holders.
There are two aspects of copyright that need to be understood. The creator or author of the musical work, the person that puts the notes or words down first on paper or some other media is afforded a copyright on the material. This “musical work” copyright extends to the music publisher, and includes a public performance right, which allows the creator to perform the work, and to be compensated by others seeking to perform the work.

The second aspect is the recording of the work (sound recording) where a copyright is now afforded to the recording company. The “sound recording” did not originally include a public performance right, meaning that broadcasters did not need to pay recording companies for the right to broadcast this piece of music. The record companies, such as the five major ones comprising the RIAA, usually hold this copyright, although there are exceptions. It is this second aspect of copyright that is impacted by digital technology, and led to the implementation of the Digital Millennium Copyright Act (DMCA), benefiting business interests tied to the creation and development of this and many other types of intellectual property.

The first aspect of copyright falls under the domain of the creator and the organization selected to publish the creative work, the music publisher. This copyrighted material has been acknowledged through law since the beginning of broadcasting. Early radio broadcasters negotiated agreements with the music publishers’ representatives to pay a very small fee to each publisher every time a station broadcast one of their songs. To make the collection of these performance rights fees (or royalties) manageable, broadcasters now pay agreed blanket fees to their national performing rights organization, which exists to trace the publishers and distribute fees in proportion to the number of plays their client stations list.21
In the US, three major agencies oversee the collection of royalties on behalf of the artists and music publishers, ASCAP, BMI, and SESAC.

Royalties are paid on each play of a copyrighted song by a commercial broadcaster to one of these three agencies, and they in turn pay a portion of collected revenue to the artists. The webcaster (in most cases) likewise needs to have an arrangement to make payments to these organizations in order to be compliant with the law.

The second aspect is less clear-cut, as broadcasting did not establish a precedent to pay royalties for recorded works to the recording companies. Not because this was overlooked, but because it was anticipated that broadcast airplay would amplify and accelerate record sales, the recording companies did not enter into an agreement that broadcasters pay for the rights for airplay of a song. (Payola scandals indicate that the opposite often occurs, where broadcasters are paid to play certain records by the record companies, but that is a topic for another thesis).

Digital music technology opened up a second window of opportunity for the record companies to revise the US policy where broadcasters did not pay royalties for the material they broadcast. Despite the precedent established by the policy regarding terrestrial radio, (the RIAA went so far as to call it a "historical accident" that this did not occur), the DMCA established a system that would compensate record companies directly, based on Web Radio on-line play of their copyrighted material.

Commenting on this drastic change in policy, author Chris Priestman stated, "A rather surprising casualty of the crossfire is that, as a result, the "loss of sales" argument has gained the upper hand over the "promotional benefits of music radio" in the US, the home of the free market in broadcasting. The DMCA
brings all digital transmissions originating from there, whether on the Internet or any other platform, into line with most of the rest of the world: royalties become payable for the first time to the record company as well as to the music publisher."

Priestman uses "Imagine" by John Lennon as an example to illustrate the differences in the two types of copyrights. The song was authored by Lennon and published by Lenono Music, so both are holders of the first type of copyright, the publishing copyright.

Each time Imagine is played on the airwaves, and now on Web Radio, one of the three collection agencies is paid and passes on a portion of that payment to Lenono Music. However the song was recorded by EMI recording, and they hold the rights to the "sound recording" made by Lennon of his copyrighted work.

Under terrestrial radio law, EMI does not receive a royalty based on the broadcast of Lennon’s song. They also cannot preclude other artists from recording their own version of Lennon’s song, and receive no compensation if that occurs, although Lenono Music (the publisher) does receive a royalty.

A contrary view is included within an excerpt of a forthcoming book by Lawrence Lessig, in which he examines the issues of "piracy" as it applies to copyrighted material used in film, music, and broadcasting. It is Lessig’s view that some piracy is inevitable and can be helpful in the continuation of innovation. Addressing radio specifically he says, “Imagine you compose a piece of music. You own the exclusive right to authorize public performances of that music. So if Madonna wants to sing your song in public, she has to get your permission.
Imagine she does sing your song, and imagine she likes it a lot. She then decides to make a recording of your song, and it becomes a top hit. Under today's law, every time a radio station plays your song, you get some money. But Madonna gets nothing, save the indirect effect on the sale of her CDs. The public performance of her recording is not a "protected" right. The radio station thus gets to pirate the value of Madonna's work without paying her a dime. No doubt, one might argue, the promotion artists get is worth more than the performance rights they give up. Maybe. But even if that's the case, this is a choice that the law ordinarily gives to the creator. Instead, the law gives the radio station the right to take something for nothing.23

Clearly Lessig's statements are not in full agreement with the "promotional value of music" argument. He goes on to say that policies developed to control file sharing should be implemented to protect the artist and in my opinion that should apply to continued development of Web Radio policies as well. While different from file sharing, Web Radio shares a common digital platform, and continues a legacy of innovation in media development. Policies need to support the innovation of Web Radio operators, as well as reward the innovation and artistic contribution of composers and recording artists, even if that has to first be filtered through companies that employ tactics like the RIAA.

Through the implementation of the DMCA, the RIAA sought to change the practice of not receiving a performance royalty for their recorded musical works. Negotiations conducted before the creation of the DMCA with large commercial webcasters, led to the creation of a statute that eventually gave them the licenses they sought, a clear break from the precedent of terrestrial radio.

A third aspect, also addressed in legislation under the term of "ephemeral recordings", is the ability to make a second copy of a work for the purpose of back-up, storage, or creation of playlists for on-demand delivery of a stream.
Referred to as a Mechanical Copyright, it also covers tracks, or samples recorded for advertisements, trailers, and similar uses. These types of copyrights are administered in the US through the Harry Fox agency, and are well established in the analogue world that preceded Web Radio. What is new is the extension to collect royalty payments for the creation of copies that are essential to the delivery of a web based service, as content can be lost due to crashed servers and other malfunctions in the delivery system. Web Radio operators are required to pay for the right to do this.

DIGITAL MILLENNIUM COPYRIGHT ACT OF 1998 (DMCA)

The DMCA, introduced in the Legal Overview of Chapter 1, was the first globally significant move to interpret the WIPO treaties and reframe the copyright laws to make any unlicensed digital transfer of music illegal. In defining what was illegal activity, it also sought to encourage legal distribution of digitally encoded audio and video content through such means as Web Radio. The statute enacted a compulsory license that allowed non-subscription Internet radio stations to perform copyrighted sound recordings. Royalty rates for the performance of this copyrighted material were to be established through voluntary agreement between the copyright holders and the webcasters, (including terrestrial broadcasters seeking a Web Radio presence). Failing this, a Copyright Arbitration Royalty Panel (CARP) would be established to set these rates.

While allowing for the development of Web Radio, the US Copyrights Office ruling that broadcasters are liable for phonographic performance copyrights for streaming their terrestrial signals on the Internet, part of the DMCA findings, was an extremely significant departure from established terrestrial radio laws.
One could certainly argue that the developing industry of Web Radio would have been better served by a continuation of the precedent of terrestrial radio that this license was not required. At least there could have been some more specific guidelines established for compensation that went beyond the vague concept of "fair market value," and that the concept of "fair use" could have been more strongly supported for digital technologies. Jessica Litman provides a detailed description of the process of copyright development in her work "Digital Copyright," and one paragraph on the development of the DMCA is helpful to keep in mind as you assess how to deal with it as a webcaster (or "new upstart industry").

"I described the process in mind numbing detail because it appears to be inexorable. Copyright legislation written by multiparty negotiations is long, detailed, counterintuitive, kind to the status quo, and hostile to potential new competitors. It is also overwhelmingly likely to appropriate value for the benefit of major stakeholders at the expense of the public at large. There is no overarching vision of the public interest animating the Digital Millennium Copyright Act. None. Instead, what we have is what a variety of different private parties were able to extract from each other in the course of an incredibly complicated four-year multi party negotiation. Unsurprisingly, they paid for that with a lot of rent-seeking at the expense of new upstart industries and the public at large."

So, with this type of process resulting in legislation designed to favor the status quo, the process moved into the second stage of determining the effective rates for Web Radio’s use of copyrighted material. The CARP proceedings convened and ultimately delivered an agreement to the Librarian of Congress (LOC) that established the royalty rates for Internet Radio for the period of October 28, 1998 to December 31 2002. The process at this point in time essentially included only
the five member companies of the Recording Industry Association of America (RIAA), and large webcasters such as Yahoo, and the agreement they reached with the three-member CARP panel was based on a private earlier agreement reached between Yahoo and the RIAA on this matter.

Following the CARP agreement, by late June of 2002, LOC slashed the rates established by CARP, reducing the per-performance fee from 0.14 cents per performance to 0.07 cents for Internet-only broadcasts. CARP had originally established a two-tiered rate structure of 0.14 cents per performance for Internet-only retransmissions, and 0.07 cents for retransmissions of AM/FM radio broadcasts. Because of this, and due to the fact that the rates originally established by the CARP proceeding were based on this one agreement, small webcasters reacted negatively to the CARP agreement. In addition to what they considered artificially high rates, the inclusion of the payment of back-royalties for the period beginning in October of 1998 threatened to drive them out of business.

It should be noted that the RIAA also reacted negatively to the LOC rate reduction, stating that did not reflect the fair market value of music as promised by law. This “fair market value,” as has been noted, was determined based on one agreement with one of the largest webcasters available, Yahoo.

Beginning in July of 2002, one group of small webcasters formed a new trade association, Voice of Webcasters, (VOW), and sought to negotiate a new agreement that better supported their interests. Many other Web Radio outlets were silenced in the wake of this agreement, unsure that they would be able to both raise the retroactive payments required, and continue to fund their ongoing operations.
This group of eight small webcasters negotiated directly with the RIAA and reached an agreement that led to the creation of the Small Webcaster Settlement Act of 2002 (SWSA). This legislation was intended to create a financial model more suited to the cost structure of small webcasters. An agreement negotiated between the RIAA and a limited group of small webcasters became a statute under the SWSA, thus an industry wide deal for all small webcasters.

The SWSA included, among other things, a royalty rate based on a percentage of revenue, as well as extensive record keeping requirements. The SWSA can be read in full at the Federal Register web site located at


The Future on Music Coalition Website presents this summary of the SWSA. The Act:

- allowed copyright owners (labels represented in negotiations by SoundExchange) to offer webcasters a percentage-of-revenues royalty rate, essentially allowing the parties to mutually agree to override the "per-performance" rate handed down by the Copyright Office in June 2002.

- suspended all royalty payments due from noncommercial webcasters until June 30, 2003, giving both sides time to work out a new voluntary royalty structure.

- added a new definition of "noncommercial" that permitted webcasters who were for-profit entities to file for nonprofit status, as long as they had a "commercially reasonable expectation that such exemption shall be granted."
permitted "hobbyist" webcasters to make a choice of whether they would like to classify themselves as a for-profit business or a nonprofit.

Despite the intentions of the SWSA to offer a compromise to small webcasters, a large number of them saw it as a flawed agreement. In the opinion of the Webcaster Alliance, representing over 30 small webcasters, SWSA still contained unreasonably high rates, and provisions on revenue that excluded many of the members from coverage under the SWSA, and forced them back to the previous determination by the LOC.

For these reasons and others, the Webcaster Alliance addressed a letter to the RIAA on 8 July 2003 outlining their concerns with both of the agreements negotiated with the RIAA that led to the respective statutes. The letter (available for review at


concludes with a statement that a legal remedy will be sought if the Alliance concerns are not addressed. The suit was actually filed in August of 2003,


and continues to move forward, despite the recent agreements reached for Webcasting rates for the period of 2003 to 31 December 2004 by the participating organizations. The full text of the complaint offers a comprehensive review of the developments discussed here, and can be downloaded from:

Although the SWSA was controversial, the legislation was accepted with relief by many small Webcasting organizations, and allowed many small college radio broadcasters to continue to offer their streams via Web Radio. College radio stations (sometimes referred to as “educational entities”) ratified an additional agreement under the SWSA. These comments at the time of the original settlement back in June of 2003 were typical of many college radio administrators:

“It represents a great relief for us because it will allow many stations like ours to continue streaming and new stations to begin streaming,” said Joel Willer, assistant professor of Mass Communications at the University of Louisiana at Monroe and general manager of the school’s station, KXUL. Willer went on to say that current on-air royalty costs were between $700-$800 dollars. If the station had the same audience on the web, the costs would have been about $18,000 if a proposed plan by the LOC to charge stations a fee for each song they played had passed.27
The LOC recently ratified an agreement reached among many of the large commercial interest in Webcasting in early April of 2003, with an announcement posted on 6 February 2004 on the Federal Register. Organizations representing the Large Commercial webcasters collectively known as DiMA, and the RIAA, which represents the five major record companies, originally developed this agreement. The agreement was submitted to the Copyright Office in early April of 2003 for acceptance and ratification, which occurred on 6 February 2004.

The rates agreed upon are not considered a significant change from the 1999-2002 LOC rates. However, it will save all parties the millions of dollars spent on the CARP proceedings that resulted after the previous round of negotiations failed to deliver an agreement. As discussed, the original CARP agreement was subsequently slashed by the LOC and became the statute for large webcasters to follow.

Large commercial operators with non-subscription services pay 0.0762 cents per listener per song, or 1.17 cents per aggregate tuning hour. Minimum fees increase from $500 per year used for the 1998-2002 period to a minimum of $2,500 per year. The new deal now includes terms for new subscription-based models, which can pay the same rates as non-subscription webcasters, or instead can pay 10.9% of the subscription revenues. However, they must pay at least .27 cents per month per subscriber, with a $5,000 per year minimum for webcasters electing the percentage of subscription-revenue rate.

Although not originally included in the agreement submitted to the copyright office, a group of Large Commercial AM/FM Broadcasters with a Web Radio
Simulcast of their terrestrial programming quickly followed the original submission with one of their own that largely followed the original proposal with some exceptions. The following is a breakdown of the differences allowed for by re-broadcasters in the original proposal from the Radio and Internet Newsletter (RAIN) site.

First, music broadcasts are allowed a 25% discount on royalties should they elect to pay per "aggregate tuning hour," as compared to rates proposed for Internet-only stations and "business establishment" services, due to a presumption that they play fewer songs per hour. (This would, of course, be due to the higher level of "non-music" content (commercials, news, etc.) on AM and FM stations.

Second, AM and FM broadcasts "reasonably classified" as non-music (news, talk, etc.) can pay 0.0762c per aggregate tuning hour, or basically the cost of one "performance" per hour.

Should the proposal be adopted for the industry, commercial broadcasters would pay 0.88c per aggregate tuning hour (a tuning hour being one listener listening for one hour) of music programming, as compared to the proposed 1.17c per aggregate tuning hour for eligible Internet-only webcasters and business establishment services (e.g., Music Choice).

The main benefits of these agreements go to the large established webcasters, who avoid the costly arbitration process and have stable rates for the short term, while other initiatives can be advanced to obtain rates that are more favorable.

Non-Commercial/Non-Profit Webcasters, including members of the Intercollegiate Broadcasting System (IBS), the Collegiate Broadcasters Inc., the National Religious Broadcasters Music License Committee (NRBMLC), the Harvard Radio Broadcasting Company, and the American Council on Education
(ACE), and other eligible webcasters operating under the SWSA agreements are not impacted by this new agreement.

WHAT IS A WEBCASTER TO DO?

The DMCA, in addition to the financial stipulations it contains, also places stringent restriction on the webcaster concerning media content, and the reporting of content offered by the station. These regulations will be discussed in detail within Chapter 4, which presents the operational and economic considerations of Webcasting. However there is one important concept that drives most of the legal and operations standards of the DMCA. “The intention of the legislation- and this is an important thing to grasp- is obviously to make it difficult for a web station to provide a service from which a private individual with a broadband connection can obtain perfect copies of released singles or whole albums off air.”

The restrictions placed by the DMCA seek to make it difficult to obtain high quality digital copies of content without paying for it directly (via CD purchase or download purchase). While they may not eliminate every act of copying, they seek to emulate some of the safeguards developed in the early days of terrestrial radio to eliminate copying, such as disc jockeys talking over record intros to discourage recording of the song.

With that concept in mind, the webcaster should keep in mind the following items.

- Consult with legal authorities on Copyright issues to determine if the policies you are planning to implement are sufficient to meet the requirements of the DMCA.
• Remember that there are actually three aspects of copyright that the webcaster must deal with regarding royalty payments, the "musical work" (author/music publisher), the "sound recording" (record company), and the "ephemeral recording" (copy of work saved onto hard drive for transmission, payable to Harry Fox agency).

• Much of the discussion here is primarily oriented towards stations planning to Webcast musical content or sound recordings. Stations operating in this mode can clear copyright issues easier with live streams, as they more closely resemble terrestrial broadcasts. However there are economic and other advantages to offering archived streams through your web interface.

• An archived stream can be a valuable resource to the station listeners, which will generate more traffic for the station. However, there are limits on the use of the stream, and the archived material means it is easier to determine if any copyright provisions have been violated.

• Many webcasters seek to differentiate themselves from mainstream radio but offering the works of independent, local, and potentially unsigned artists. These groups will undoubtedly be more flexible on copyright issues, as they tend to still value the airplay and exposure it provides, even if it is less than anticipated from terrestrial radio.

• Reasonably priced radio automations software is available that will help the webcaster meet the stringent playlist requirements of the DMCA, and it would be beneficial to explore the economic and copyright implications of this software.
• Streaming server companies have to be careful that they do not put themselves in the position of aiding copyright infringement, or they will be subject to fines themselves. Therefore, they have started to build in protections and safeguards within the server software that should be explored.

• “Streaming hosts” such as Live365, and many others included on the list in Appendix A are integrating the fees required for copyright payments into their cost structures. This provides an attractive option to the webcaster to reduce the concerns and potential liabilities of copyright infringement.

• The offering of a subscription service will generate some revenue that can be used to directly offset the royalty payment. While it is not advisable at this time to view Webcasting as something that will definitely be accepted with a subscription fee and thus the free to air aspect can be eliminated, it may make sense to offer an upgraded stream as a “version” of the service and collect revenue to offset copyright costs.
The process of getting your Web Radio station on the air, despite all the technical and legal considerations, is simple in one aspect. It does not have all the red tape and paperwork associated with obtaining a broadcasting license, even if that is a Low Power FM license. Like Web Radio, Low Power FM offers the potential for narrowcasting to specific audiences, but is hampered by the limited spectrum available, competition for licenses, a more involved licensing procedure, and greater start-up costs including construction of a tower site.

The webcaster starts simply with a filing of the "Initial Notice" as it is called (Initial Notice of Digital Transmissions of Sound Recordings Under a Statutory License), with the Copyright Office. Instructions on the filing of the form are available on the RIAA or Copyright Offices web sites, but it only requires a $20.00 filing fee. Full instructions and copies of the form are available for download from http://www.copyright.gov/. Once filed the webcaster is free to start streaming.

The most recent notice I could find on the site pertaining to the Initial Notice and record keeping requirements for webcasters (Notice and Record keeping for Use of Sound Recordings Under Statutory License) was dated 8 October 2003. The US Copyright Office is in the process of revising the requirements for record keeping, but to date has not issued a final ruling. As an example of the type of information that must be supplied to the copyright office now, we can look at the interim requirements.

1. Name of the service submitting the report
2. The transmission category of the service (e.g., eligible nonsubscription transmission by webcaster of terrestrial radio broadcast, other eligible nonsubscription transmission by a webcaster, eligible nonsubscription transmission by commercial broadcaster of terrestrial radio broadcast, eligible nonsubscription transmission by non-CPB, noncommercial broadcaster, etc)

3. Submit for each sound recording transmitted by the service during the relevant period: recording artist, sound recording title, name of the record album, marketing label of the sound recording, and the total number of performance during the reporting period.

The reporting process is not a trivial matter of the operations of the station, as it impacts both the time of station personnel, and the budget of the station. Certain classifications of webcasters, such as the non-commercial, educational webcasters, have negotiated the payment of a one-time fee in lieu of record keeping, and provides a good reason to consider setting up your station in a category that has this exemption.

In addition to the reporting aspects of the station, there are many operational guidelines to be followed in developing your playlists, also arising from the DMCA. The DMCA operational guidelines address items such as: how often playlisted tracks can be repeated within a 3-hour period, places a prohibition on the pre-announcement of tracks to be streamed, limits the number of tracks that can be played in close proximity from the same album, obligates the webcaster to identify song, artist and album. A more complete list of the requirements a webcaster has in order to qualify to operate under the statutory license can be obtained from: http://www.ria.com/issues/licensing/webcasting_faq.asp
The requirement to display the artist, song title and album title are apparently still in place at this time. This means that stations must present this information to the end user. Many pre-existing stations do not have this capability due to limited resources, but could over time. Such stations need a waiver of this requirement until they gain the resources to meet the legal obligation.

Keep in mind that the point of it all is to make it difficult for the web station to provide a service that facilitates the copying of copyrighted material, and you can see how the restrictions came into being.

CATEGORIES OF SERVICE

The statutory licenses for digital audio services covers five different categories of service:

Eligible Non-subscription Services (i.e., non-interactive webcasters and simulcasters that charge no fees). This group is further broken down into five sub-categories:

• Commercial webcasters/broadcast simulcasters,
• Small commercial webcasters/broadcast simulcasters,
• Noncommercial webcasters/broadcasters simulcasters,
• Non-commercial educational entities, and
• NPR/CPB member stations.

Preexisting Subscription Services (i.e., residential subscription services).

New Subscription Services (i.e., non-interactive webcasters and simulcasters that do charge a fee).
Preexisting Satellite Digital Audio Radio Services (i.e., XM and SIRIUS satellite radio services).

Business Establishment Services (i.e., background music services that are exempt from paying public performance royalties under section 114 of the DMCA).

Royalty rates vary for the five sub-categories depending on the agreement under which they participate, whether it is the LOC royalty agreement, the SWSA, or the business establishment service (background music service). A business establishment service is granted an exemption from the “sound recordings” provisions of the DMCA, if these sound recordings are used on the premises of the business. However, they are subject to the Section 112 statutory license for making “ephemeral recordings” used to facilitate those transmissions. Currently, only three major services are included in this agreement, as shown in Table 4.1

Each licensee is required to submit a Statement of Account, based on a selection of the appropriate category. The SOA forms are Excel spreadsheets that help with the calculation of royalties due.

Keep in mind however, that a start-up organization (beginning operation after 31 January 2003) will be required to file a Notice of Election in order to participate in the SWSA with the first payment. A new subscription service will also file a Notice of Election for the 1998-2004 time period, and will indicate their preference for a per-performance rate, an aggregate tuning hour rate, or a % of revenue rate. A Non-subscription service will file a Notice of Election for the 2003-2004 term and indicate a preference for a per-performance rate, or an aggregate tuning hours rate.

All of these forms are available on the SoundExchange Web Site at

http://www.soundexchange.com/licensee/forms.html#additional
The 2003-2004 rates for the Web Radio categories of Eligible Non Subscription and Eligible Subscription Services are summarized in Table 4.1. Following the summary of the 2003-2004 rates is a summary of the various software technologies described in Chapter Two and the costs associated with the different options. In the final Chapter of the thesis, we will examine these options and present a real world case study to illustrate best how to set up the Web Radio station.
<table>
<thead>
<tr>
<th>Type of Broadcaster</th>
<th>Represented by</th>
<th>Eligibility Requirements</th>
<th>CARP/LOC Royalty Rates</th>
<th>Minimum Fee</th>
<th>Subscription Service Fees</th>
<th>Playlist restrictions</th>
<th>Reporting requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Commercial Internet Only Webcasters</td>
<td>DiMA</td>
<td>Non-Subscription Services</td>
<td>&quot;Standard&quot; royalty rate for Internet-only Webcasters is either 0.0762 cents ($0.000762)/performance with 4% royalty rate exclusion, or 1.17 cents ($0.0017)/listener hour</td>
<td>$2,500.00</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Large Commercial Internet Only Webcasters</td>
<td>DiMA</td>
<td>Subscription Services</td>
<td>Can choose either of Non-Subscription Options or an additional option of 1% of revenues</td>
<td>27 cents per month per subscriber and $5,000/year</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Type of Broadcaster</td>
<td>Represented by</td>
<td>Eligibility Requirements</td>
<td>CARP/LOC Royalty Rates</td>
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<tr>
<td>Large Commercial Terrestrial Radio broadcast simulcasts</td>
<td>Clear Channel, Susquehanna Bonneville</td>
<td>Non-Subscription, or Subscription</td>
<td>Same Options in Large Internet-only agreement, additional options only for broadcasters, including a 25% rate reduction due to less musical content per hour (due to commercials and other content), and a lower royalty rate for “non-music” programming: 0.0762 cents/Aggregate Tuning Hour for news, talk, sports or business programming; 0.88 cents/Aggregate Tuning Hour for AM and FM music broadcasts</td>
<td>$2,500 or $500 per channel or station (excluding archived programs, but in no event less than $500 per Licensee), whichever is less.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
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<tr>
<td>Small/Medium Internet Only Commercial Webcasters</td>
<td>VOW, covered under SWSA</td>
<td>&lt; $500,000 in 2003 revenues and &lt; $1,250,000 in 2004</td>
<td>10% of gross &lt;$250k and 12% of gross &gt; $250k, or 7% of Expenses</td>
<td>&lt;50k/annum =50000/annum &gt;50K&lt;5000K /annum=$5000/annum (NOTE: was only $500 for first year of 1998)</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<th>Type of Broadcaster</th>
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<tbody>
<tr>
<td>Small/Medium sized, non-commercial Webcasters</td>
<td>IBS, CBI, NRBLMC, agreement under the SWSA</td>
<td>&lt;200 average concurrent listeners, educational</td>
<td>N/A</td>
<td>$250/annum (1 stream)</td>
<td>N/A</td>
<td>Yes</td>
<td>Record keeping exclusion fee of $50.00 for 2003, $25.00 for 2004</td>
</tr>
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<td></td>
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<td>&lt;200 average concurrent listeners, non-educational</td>
<td>N/A</td>
<td>$500/annum (&gt;1 stream)</td>
<td>$500/annum</td>
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<td>&gt;200 concurrent average listeners either educational or non-educational</td>
<td>$0.002/song/listener</td>
<td>Stated flat rate plus royalty shown</td>
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<td>Webcasters exceeding 146,000 ATIH/month in 2004 pay an additional 0.02176 cents/performance or 0.251 cents/ATIH for listening above threshold, (non-music Webcasters pay additional 0.02 cents/ATIH).</td>
<td>Ephemeral Recording Fee: 8.8% of performance fees due</td>
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<tr>
<td>Small Commercial Webcasters</td>
<td>Webcaster Alliance</td>
<td>Able to file under SWSA, but choose not to accept agreement</td>
<td>Lawsuit pending to reduce both LOC and VOW agreements, no determination as of 02/27/04</td>
<td>Open</td>
<td>Open</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Large non-commercial Webcasters</td>
<td>NUCB</td>
<td>Left out of agreements with RIAA as of 2003, not qualify under SWSA</td>
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<tr>
<td>Other Webcasters</td>
<td>Live365, RadioIO</td>
<td>Direct negotiations or CARP Rates</td>
<td>Yes</td>
<td>All Services are subscription now</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Personal or Hobbyist Webcaster</td>
<td>No one really</td>
<td>Can establish non profit basis for hobby</td>
<td>Can subscribe to Live365 for $7.45/month</td>
<td>N/A</td>
<td>Yes</td>
<td>Yes</td>
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<td>Business Establishment Services (Background Music service, In store play)</td>
<td>Music Choice, DMX Music, Muzik, L.P.</td>
<td>Only those three services covered by current agreements</td>
<td>Strenuously Exempt from LOC Rates</td>
<td>$10,000</td>
<td>Yes, fees shown include subscription services</td>
<td>Yes</td>
<td>Yes</td>
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<td><a href="http://www.phonex.com">www.phonex.com</a></td>
<td>SHOC Texas</td>
<td>Personal Broadcaster,</td>
<td>Unlimited use license content stored in MP3 format. Only WINamp media player used. Encoding in an webcast.</td>
<td>Windows 98, NT, 4, 2000, Linux, FreeBSD 3.x, 4.x, BSDr</td>
<td>WINamp for Windows, Andora for Macintosh, XMMS for Linux, Samba X Windows</td>
<td>32, 64, 96</td>
<td>128</td>
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<tr>
<td><a href="http://www.icecast.org/index.php">www.icecast.org/index.php</a></td>
<td>Icecast2</td>
<td>Personal Broadcaster,</td>
<td>Open Source software platform supporting MPV and Ogg Vorbis, compatible with many</td>
<td>5 streaming Hat 9 x 128Kbps, Windows 95, NT 4.0</td>
<td>foobar2000 (mp3 + egg) voilin, xine,</td>
<td>32, 64, 96</td>
<td>128</td>
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<td>Non-Commercial Broadcaster,</td>
<td>2nd party applications such as Icecast, SAM2</td>
<td></td>
<td>winamp 2.x, 5.x, mp3 + egg, vorbis, XMMS (mp3 + egg, vorbis), Xine,</td>
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<td>Commercial Broadcaster</td>
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<td>winamp 3 + egg, vorbis, Xine,</td>
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<td><a href="http://www.realnetworks.com/products/server/radex.html">www.realnetworks.com/products/server/radex.html</a></td>
<td>RealNetworks HELIX Server rStandard</td>
<td>Real-Commercial Webcaster, Server for Real-Commercial Webcaster</td>
<td>Server accepts and delivers content formatted for Windows, MacOS, QuickTime, Macromedia Flash, and MPV2, MP3, MPEG4, and a complete list of 35 data types: Suitable for 2-4 Mbps throughput.</td>
<td>Windows NT 4.0/2000 (Workstations or Servers), 1.193.2.2, 1.3.2.1.6, and 1.3.2.1.7.</td>
<td>RealOne Player, Windows Media Player, QuietTime Player, MP3 players</td>
<td>32, 64, 96</td>
<td>256</td>
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<td>RealCommercial Webcaster,</td>
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<td>Commercial Webcaster</td>
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<tr>
<td><a href="http://www.realnetworks.com/products/server/radex.html">www.realnetworks.com/products/server/radex.html</a></td>
<td>RealNetworks HELIX Server Basic</td>
<td>Personal Webcaster</td>
<td>Suitable for less than 2 Mbps throughput, which equates to a very limited number of streams.</td>
<td>Windows NT 4.0/2000</td>
<td>RealOne Player</td>
<td>32, 64, 96, 128 kbps</td>
<td>1,990</td>
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<tr>
<th>WEB LOCATION</th>
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<tr>
<td><a href="http://www.microsoft.com">www.microsoft.com</a></td>
<td>Windows Media Server</td>
<td>Non Commercial, Commercial Webcasters</td>
<td>Servers accepts and delivers content for Windows Media, includes many upgrades for streaming delivery, valuable for operations heavy into Windows platforms and software development;</td>
<td>Windows 98, NT, 2000</td>
<td>Windows Media Player</td>
<td>32, 64, 96</td>
<td>Included with Windows Standard Server for $999.00, Windows Enterprise Server for $3,995.00, Datacenter Edition only available through OPEM licensing agreements with hardware providers like Dell, HP etc.</td>
</tr>
<tr>
<td><a href="http://www.quicktime.com">http://www.quicktime.com</a></td>
<td>QuickTime Streaming Server</td>
<td>Proprietary Broadcasters, Non Commercial Broadcasters, Commercial Broadcasters</td>
<td>Server accepts and delivers content formatted for QuickTime (mov), MPEG (mp4), and H.264 (mp4) file formats supported, MP3 files via separate player required.</td>
<td>Windows 98SE, Mac/2000 with QuickTime Player available for Windows, Macintosh and Linux operating systems</td>
<td>QuickTime Player available for Windows, Macintosh and Linux operating systems</td>
<td>32, 64, 96</td>
<td>Unlimited client $999.00, 10 Clients $499.00</td>
</tr>
<tr>
<td><a href="http://www.live365.com">www.live365.com</a></td>
<td>Live365</td>
<td>Proprietary Broadcasters, Non Commercial Broadcasters, Commercial Broadcasters</td>
<td>Provides streaming services for MP3 streams by allowing access to servers, aggregating and rebroadcasting streams to listeners.</td>
<td>N/A</td>
<td>Proprietary player offered, all MP3 players, Winamp, Real Player, Windows Media, QuickTime</td>
<td>24K, 64K, 96K, and 128K stream options available</td>
<td>Personal Broadcasting Rates Range from $7.45 to $999.95 in monthly, Professional Broadcasting Rates Range from $40 to $999/month</td>
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<tr>
<td>MEDIA PLAYER TECHNOLOGIES</td>
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<td><strong>COMPATIBLE SERVER TECHNOLOGIES</strong></td>
<td><strong>COMPATIBLE FORMATS</strong></td>
<td><strong>COST</strong></td>
<td><strong>COMMENTS</strong></td>
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<td><a href="http://www.panic.com/audion/index.html">www.panic.com/audion/index.html</a></td>
<td>Audion</td>
<td>MAC OS</td>
<td>SHOUTcast, icecast2, QT Server</td>
<td>MP3, Ogg Vorbis, QT</td>
<td>$ 29.95</td>
<td>RECOMMENDED FOR MACINTOSH</td>
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<tr>
<td><a href="http://www.xmms.org">www.xmms.org</a></td>
<td>XMMS</td>
<td>Linux, Unix</td>
<td>SHOUTcast, icecast2</td>
<td>MP3, MOD's, WAV and others with the use of input plugins.</td>
<td>FREE</td>
<td>RECOMMENDED FOR UNIX</td>
<td></td>
</tr>
<tr>
<td><a href="http://zinf.sourceforge.net/about.php">http://zinf.sourceforge.net/about.php</a></td>
<td>ZINF</td>
<td>Windows 98/ME/NT/2000 as well as Linux 2.x.</td>
<td>SHOUTcast, icecast1, icecast2</td>
<td>Windows 98SE/ME/2000 with Service Pack 2 or later, or Windows XP</td>
<td>FREE</td>
<td>SUPPORTS LINUX</td>
<td></td>
</tr>
<tr>
<td><a href="http://www.real.com">www.real.com</a></td>
<td>RealOne Player v. 10</td>
<td>Windows 98/ME/2000/XP.</td>
<td>RealNetworks, SHOUTcast, icecast2, WMA</td>
<td>RealMedia</td>
<td>FREE</td>
<td>BASIC PLAYER FREE, SUBSCRIPTION UPGRADE OFFERED</td>
<td></td>
</tr>
<tr>
<td><a href="http://www.ultraplayer.com">www.ultraplayer.com</a></td>
<td>UltraPlayer 2.112</td>
<td>Windows 98/ME/2000/XP.</td>
<td>SHOUTcast, WMA, RealAudio</td>
<td>MP3, WMA, RealAudio, WAV, MIDI, CD Audio, Internet radio,</td>
<td>FREE</td>
<td>COMPARABLE TO WinAmp, SUPPORTS MORE FORMATS</td>
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<th>COST</th>
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<tr>
<td>SAME AS ABOVE</td>
<td>Real Producer 10 Basic</td>
<td>Personal Broadcaster,</td>
<td>Encode Content to Real Media format only</td>
<td>Windows 98SE/ME/NT4/2000/XP &amp; Various Linux systems</td>
<td>RealPlayer</td>
<td>Helix Server</td>
<td>FREE</td>
<td>LIMITED TO 3 STREAMS, RECOMMENDED FOR TESTING PURPOSES</td>
</tr>
<tr>
<td><a href="http://www.apple.com/quicktime/upgrade/">www.apple.com/quicktime/upgrade/</a></td>
<td>Quicktime Pro (Encoder Upgrade)</td>
<td>Personal Broadcaster, Non-Commercial Broadcaster, Commercial Broadcaster</td>
<td>Upgrade QT Player with encoding capabilities</td>
<td>Windows ME</td>
<td>QT</td>
<td>QT Server</td>
<td>$ 29.95</td>
<td>ENCODE TO MPEG4 AS WELL AS WIRELESS FORMATS 3GPP, 3GPP2</td>
</tr>
<tr>
<td><a href="http://www.spacialaudio.com/products/simplecast/">www.spacialaudio.com/products/simplecast/</a></td>
<td>SIMPLECAST/ Multiple Bit Rates, Multiple Formats, Multiple Server Types</td>
<td>Personal Broadcaster, Non-Commercial Broadcaster, Commercial Broadcaster</td>
<td>Encodes content to MP3, MP3PRO, OGG, VORBIS, WM9</td>
<td>Windows 98/NT/2000</td>
<td>WINamp, Windows Media Player, RealPlayer</td>
<td>SHOWcast 1, 3GPP, 3GPP2, WM9, Helix Server</td>
<td>$ 59.95</td>
<td>SPATIAL AUDIO ENCODER, VERY REASONABLE COST</td>
</tr>
<tr>
<td><a href="http://www.spacialaudio.com/products/sam2/">www.spacialaudio.com/products/sam2/</a></td>
<td>SAM2 BROADCASTER</td>
<td>Non-Commercial Webcaster, Commercial Webcaster</td>
<td>Encodes content to MP3, MP3PRO, OGG, VORBIS, WM9</td>
<td>Windows 98SE/ME/2000 with Service Pack 2 or later, or Windows XP</td>
<td>WINamp, Windows Media Player, RealPlayer</td>
<td>SHOWcast 1, 3GPP, 3GPP2, WM9, Helix Server</td>
<td>$ 199.95</td>
<td>DI MIXING/AUTOMATION SOFTWARE ASSURES DMCA COMPLIANCE</td>
</tr>
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<td><a href="http://www.specialaudio.com/products/winamp/index.html">http://www.specialaudio.com/products/winamp/index.html</a></td>
<td>WINamp Plugin Bundle</td>
<td>Personal Broadcaster, Non-Commercial Broadcaster, Commercial Broadcaster</td>
<td>Encodes content to MP3, MP3PRO, OGG VORBIS, WM9</td>
<td>Windows 98 SE/XP</td>
<td>WINamp, Windows Media Player, RealPlayer</td>
<td>SHOUTcast, LIVE365, icecast1, icecast2, WM9, Helix Server</td>
<td>$ 59.95</td>
<td>TURNS WINAMP INTO A STREAMING ENCODER SIMILAR TO SIMPLECAST</td>
</tr>
<tr>
<td><a href="http://www.otsdj.com/">http://www.otsdj.com/</a></td>
<td>OTSdj</td>
<td>Non-Commercial Webcaster, Commercial Webcaster</td>
<td>Uses LAME MP3 encoder</td>
<td>Windows 98/NT/2000</td>
<td>WINamp or other MP3 player</td>
<td>SHOUTcast, LIVE365, icecast1, icecast2, WM9, Helix Server</td>
<td>$ 399.95</td>
<td>DJ MIXING/AUTOMATION SOFTWARE, OFFERS MP3 ENCODING</td>
</tr>
<tr>
<td><a href="http://mediasoftware.sonypictures.com/products/">http://mediasoftware.sonypictures.com/products/</a></td>
<td>SoundForge 7.0, (Digital Audio Editor)</td>
<td>Non-Commercial Webcaster, Commercial Webcaster</td>
<td>Encodes content to MP3, WAV, and WMA formats.</td>
<td>Windows 2000/ XP</td>
<td>WINamp, Windows Media Player, RealPlayer</td>
<td>WMA 9, RealNetworks, QT 6.0</td>
<td>$ 400.00</td>
<td>FULL FEATURED AUDIO EDITOR OFFERS MUCH MORE THAN JUST ENCODING, CONSIDERED BEST EDITOR FOR WINDOWS PLATFORM</td>
</tr>
<tr>
<td><a href="http://mediasoftware.sonypictures.com/products/">http://mediasoftware.sonypictures.com/products/</a></td>
<td>Screenblast SoundForge 7.0, (Digital Audio Editor)</td>
<td>Personal Broadcaster, Non-Commercial Broadcaster, Commercial Broadcaster</td>
<td>Encodes content to MP3, WAV, and WMA formats.</td>
<td>Windows 2000/ XP</td>
<td>WINamp, Windows Media Player, RealPlayer</td>
<td>WMA 9, RealNetworks, QT 6.0</td>
<td>$ 69.95</td>
<td>STREAMLINED VERSION OF AUDIO EDITOR, GOOD CHOICE FOR WEBCASTERS</td>
</tr>
<tr>
<td><a href="http://www.macromedia.com/software/sound/">http://www.macromedia.com/software/sound/</a></td>
<td>SoundEdit 16 (Digital Audio Editor)</td>
<td>Personal Broadcaster, Non-Commercial Broadcaster, Commercial Broadcaster</td>
<td>Sound editor compatible with QT, WAV, and AIFF formats.</td>
<td>MAC OS</td>
<td>QT SERVER</td>
<td>QT SERVER was $349.95, no cost shown on website</td>
<td>MACINTOSH BASED AUDIO EDITOR</td>
<td></td>
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<tr>
<th>AUDIOGRABBER v. 1.83</th>
<th>Personal Broadcaster, Non-Commercial Broadcaster, Commercial Broadcaster</th>
<th>Converting CD audio formatted files, or analog source recordings into .WAV or .mp3 files for digital processing</th>
<th>Win9x/NT/2000/XP</th>
<th>uses LAME MP3 Encoder</th>
<th>FREE</th>
<th>CONSIDERED BY MANY TO BE THE PREMIERE RIPPER</th>
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<tr>
<td>CD Copy v. 4.950</td>
<td>Personal Broadcaster, Non-Commercial Broadcaster, Commercial Broadcaster</td>
<td>Converting CD audio formatted files, or analog source recordings into .WAV or .mp3 files for digital processing</td>
<td>Windows 98/NT/2000</td>
<td>MP3, MP3-wav, RealAudio, WMA, VQF, AAC, WAV, AU, RAW</td>
<td>SHAREWARE</td>
<td>UPGRADE TO REAL PLAYER V 10.0 THAT REQUIRES MONTHLY SUBSCRIPTION FEE, BUT OFFERS MUCH MORE THAN JUST RIPPING CAPABILITIES</td>
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<tr>
<td>Real Player Plus</td>
<td>Personal Broadcaster, Non-Commercial Broadcaster, Commercial Broadcaster</td>
<td>Converting CD audio formatted files, or analog source recordings into .WAV or .mp3 files for digital processing</td>
<td>Windows 98SE/Me/2000 with Service Pack 2 or later, or Windows XP</td>
<td></td>
<td>$9.95/month</td>
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</tr>
<tr>
<td>EasyMP3</td>
<td>Personal Broadcaster, Non-Commercial Broadcaster, Commercial Broadcaster</td>
<td>Converting CD audio formatted files, or analog source recordings into .WAV or .mp3 files for digital processing</td>
<td>Windows 98/NT/2000</td>
<td>MP3 Encoder compatible with UltraPlayer and WINamp Players</td>
<td>$ 19.95</td>
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</tbody>
</table>

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CHAPTER FIVE

CONCLUSIONS

'Cause music was the scenery. Jimi Hendrix played loud and free, Sergeant Pepper was real to me. Songs and poems were all you needed. Which way did the sixties go? Now Ramona's in Desolation Row, And where I'm going I hardly know ...." 

Where Web Radio is going is as elusive to determine as Al Stewart's fate post World War 2. However, we will move forward with many new models for content distribution, and Web Radio will surely be one of them. The advancements move almost faster than one can keep up with, as new rulings and guidelines are established regularly.

A recent one eliminates the CARP panel in favor of a copyright judge, and many more are still to come. As of this writing, a lawsuit is still pending that will determine the fate of many small webcasters. Continued hearings on the reporting obligations will see changes there, and royalty payments are determined on a two-year cycle, so these are also subject to change.

One thing that will remain constant is the need for bandwidth, and the demand for more and more bandwidth. Therefore, I would like to provide some additional comments on this aspect of Web Radio. After a brief discussion of some aspects of bandwidth, we will examine some recommendations for a start-up, using an organization such as Godsound.com referenced throughout the thesis, as an example.
BANDWIDTH

Bandwidth is a key concept for Web Radio Operators, as it limits the number of concurrent listeners that an operator can support, as each request for a stream requires some portion of the available bandwidth. Particularly in the prevalent unicast mode, where listeners get their own stream, bandwidth is cumulative. (i.e., 100 listeners at 28 kbps = 2.8 Mbps total bandwidth required). Bandwidth requirements are largest between streaming server and listeners. As the number of streams increases, and the demand for higher bitrates (i.e., 128 kbps) continues with the continuing deployment of high speed connections, bandwidth becomes a precious commodity that will impact costs as bigger pipelines from the servers are required to support all the listeners.

A consistent bitrate of 128 Kbps gives a sound quality above the best FM stereo, close to CD quality, and is an attractive "version" of the service for broadband users. The Leichtman Research Group found that, as of the end of 2003, the leading US cable television operators and DSL providers (primarily regional telephone operators like Verizon) accumulated over 24.6 million high-speed Internet subscribers. The year also saw record growth for broadband as the twenty largest cable and DSL providers in the US-representing about 98% of the market-added a combined 7.4 million high-speed Internet subscribers in 2003. 31 Web radio popularity only stands to gain from this increased adoption of broadband connections, as the quality of the service improves with increased bandwidth. A good marketing and business plan will include a version of the service marketed toward this segment of the population.

A start-up service should estimate the number of concurrent listeners it wants to support, and the bandwidth options it would like to provide. For a project like the godsound.com project that has been discussed, it is estimated that from 80-100 listeners may access the service concurrently. My recommendation for a
start-up like godsound.com is to offer listener streams in three variations: 28K, 56K, and 128K. This allows the station to reach the highest installed base of on-line users via dial-up (28K for Dial-Up), while allowing for adoption by broadband users by offering a CD quality version of the service (128K).

Continued evolution of the delivery architectures will lead to a growth of "multicast" transmission where bandwidth is more efficiently used. Multicast represents a "one to many" approach, with a single live stream being distributed down a network of "replicating servers," but not across the entire Web. The individual requests for streams are delivered from the nearest replicating server, rather than the originating server as in a unicast approach. This significantly reduces the bandwidth demand from the originating server. It currently has limitations, particularly regarding firewalls protecting Intranets, but does offer potential for bandwidth savings.

The following offers a look at some broadband offerings that might apply to listeners, but also offers some possibilities for an uplink to a server-hosting site or other remote server location.

<table>
<thead>
<tr>
<th>STREAMING OPTIONS</th>
<th>BANDWIDTH PROVIDED</th>
<th>MONTHLY SERVICE COST</th>
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<tbody>
<tr>
<td></td>
<td>DOWNSTREAM</td>
<td>UPSTREAM</td>
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<td>CABLE- RESIDENTIAL</td>
<td>3MBPS</td>
<td>256 kbps</td>
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<tr>
<td>COMCAST WORKPLACE ENHANCED</td>
<td>5M</td>
<td>512K</td>
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<td>COMCAST WORKPLACE STANDARD</td>
<td>4M</td>
<td>384K</td>
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<td>DSL - RESIDENTIAL</td>
<td>768 Kbps</td>
<td>18K</td>
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<td>DSL - BUSINESS BASIC</td>
<td>1.5M</td>
<td>128K</td>
</tr>
<tr>
<td>DSL - BUSINESS BASIC</td>
<td>1.5M</td>
<td>384K</td>
</tr>
<tr>
<td>DSL - BUSINESS BASIC</td>
<td>7.1M</td>
<td>768K</td>
</tr>
</tbody>
</table>
START-UP TECHNICAL RECOMMENDATIONS

With regard to the Technical parameters of the Web Radio operation as outlined in Chapter Two, I would recommend the following be considered:

Stream Formats

- Initial Phase: MP3, Ogg Vorbis with SHOUTcast or icecast2 server

- Second phase: Real Media, Windows Media, QuickTime (and many others) with Helix Universal Server

Server Deployment Strategies

- Start-Up with SHOUTcast for MP3 streaming on Windows/Linux Platform – Free

- Start-Up with icecast2 for MP3, Ogg Vorbis Streaming for Linux platform -- Free

- Migrate to Real Networks Helix Server to reach broader universe of media players, including top three formats of Real Media, Windows Media, and QuickTime. –
Authoring/Encoding Technologies

As discussed, an encoding technology places raw audio content into a compressed format suitable for streaming, therefore an ideal strategy is to cover multiple formats, multiple bit rates, multiple servers at lowest cost.

- SimpleCast – offers multiple bit rates, multiple formats, and multiple server support at a reasonable cost. Although designed for a live stream, program can be used for archived on-demand content as well.

- Streams to MP3, MP3PRO, Ogg Vorbis, WM9.

- Runs on Windows platform on an encoding or production computer, separate from server.

- Provides reasonable cost option of $59.95.

Encoding/Authoring Upgrades

- SAM2 Broadcaster – offers the encoding capabilities of SimpleCast and adds radio automation, playlist management, and presentation of Metadata (album, artist title) to listener. -- $199.95

- Screenblaster Sound Forge Editor – Offers encoding capability, but recommended more as a basic sound editor that can help create high quality raw content from various analog sources for encoding. -- $69.95

- Sound Forge editor Full Version is $400.00
Streaming Server Security

- While not discussed within the thesis, I would like to acknowledge that standard policies and procedures to protect the server from outside attacks should be implemented. In addition, privacy and data security need to be considered as servers will hold Metadata regarding listeners.

START-UP OPERATIONAL RECOMMENDATIONS

There are a group of Web Radio classifications recognized by current agreements regarding royalty payments and other issues. Classifications include:

- Commercial webcasters/broadcast simulcasters
- Small commercial webcasters/broadcast simulcasters
- Noncommercial webcasters/broadcasters simulcasters
- Non-commercial educational entities; and
- NPR/CPB member stations

A start-up like godsound.com could elect to structure as either a profit or non-profit entity, and a summary of the implications discussed within the thesis is as follows.
Godsound.com Classification – Non Profit (Recommended)

- Small Noncommercial Webcaster

- <200 average concurrent listeners, non-educational -- $500/annum

- >200 concurrent average listeners, non-educational, -- Stated flat rate plus royalty fee of $0.002/song/listener

- Ephemeral Recording Fee: 8.8% of performance fees due

- ASCAP, BMI, SESAC Fee of 1-2%

- Opt-out of reporting requirements for nominal fee of $50.00

Godsound.com Classification – Commercial (Optional)

- Small Commercial Webcaster

- < $500,000 in 2003 revenues

- 10% -12% of gross revenue or 7% or expenses for Sound Recording Copyright Fees

- Ephemeral Recording Fees of 8.8%

- ASCAP, BMI, SESAC Fee of 1-2%

- Minimum fee of $2,000, possibly $5000, if over 50K revenue

- No opt-out of reporting requirements
Clearly for an organization serving a community need like the proposed godsound.com organization, classification as a non-profit or non-commercial entity offers significant royalty and operational savings. Non-profit status will have no impact on their ability to employ paid professionals as required to run their operation, to generate profits to cover operational expenses as required, or to function in a manner similar to a commercial entity. It is necessary to make the proper filings with the IRS to establish the entity as a non-profit one.

**Godsound.com Start-Up Procedures**

- File Initial Notice Form with Copyright Office with $20.00 fee.
- OK to begin streaming.
- Establish business as Non-Profit Entity for Tax Purposes.
- Submit Notice of Election in order to participate in the SWSA with the first payment, include information requested relative to non-profit status.
- Submit a SOA form when payment is due

While the intent of the thesis was not to present a complete business plan for the start-up Web Radio operation, but to highlight areas of interest in three major areas, I would like to conclude with a brief overview of the some of the cost and revenue items that might appear on a high-level income statement for the operation.
Web Radio Cost Categories

- LOC/CARP Sound Recording Royalties, including ephemeral recording fees
- ASCAP/BMI/SESAC Publisher Royalties
- Bandwidth Costs, representing one of the trickiest areas of the Web Radio cost structure, as they can increase rapidly with an increase in listenership
- Server/Server Hosting Costs, can vary depending on type of agreements selected such as server co-location site, contracts with stream host such as Live365 or other provider, and selection of hardware if purchasing server
- Technology Platform Costs, presented in detail within Table 4.2 of the thesis.
- Marketing/Distribution Fees - can be significant, but there are free to low-cost options such as Shoutcast.com or Live365, or any other number of radio aggregators that increase market presence.

Web Radio Revenue Opportunities

- Direct Listener Donations, used now by some Web Radio operators though a service such as PayPal.
- Business Sponsorships often used by non-commercial operations and community broadcasters.
• Subscription-Based Service, used by 13% of content providers in recent survey

• Advertising based services, used by 66% of content providers in recent survey (Includes in-stream advertisements)

• Banner Advertising - used by 21% of content providers in survey, no use of subscription or in-stream or other ads used

Finally, in conclusion, I would say that despite some Industry predictions that Web Radio growth may have peaked, I believe that we are just at the beginning of the growth curb for Web Radio. The continued adoption of broadband connections, plus the growth of wireless connections as standards in that area improve, will lead to a more ubiquitous dispersal of information appliances capable of receiving Web Radio transmissions. As we continue to move forward with royalty and operational agreements, stability will be restored to the Web Radio Industry. Implementation of some of the following procedures will assist the growth of an individual Web Radio station.
Web Radio Growth Opportunities

- Use Radio aggregators or relay services where cost effective
  
  - Shoutcast.com – FREE Access to upload radio stream to listeners already accessing site
  
  - LIVE365 provides range of cost options, including DMCA royalty fees.
  
  - Many other aggregator programs available.

- As base of Internet users increases, Web Radio Audience Increases

- Strategic Use pf Metadata provided through streaming servers and other software that allows for statistics on listener growth and other metrics important to advertisers

- Growth of broadband connectivity through DSL and CATV provides listeners interested in high quality audio content

- Expansion to music videos, FLASH animation and other forms of multimedia content is possible over the Web Radio platforms discussed.
GLOSSARY

AAC: (Advanced Audio Coding) one of several audio coding systems specified in the MPEG2 standard (ISO/IEC 13818-7). AAC can be used for streaming and downloading music via the Internet. See MPEG4-AAC.

.AIFF: (Audio Interchange File Format) a high-quality uncompressed (raw) audio format developed by Apple, and most commonly used on the Macintosh operating system.

.ASF: a streaming media file format used by Windows Media for encoded files

ATH: (Aggregate Tuning Hour) total hours of programming that the Licensee has transmitted during the relevant period to all listeners within the United States from all channels and stations that provide audio programming consisting, in whole or in part, of eligible nonsubscription transmissions or noninteractive digital audio transmissions.

Authoring: process of choosing audio content and digitizing, encoding, and delivering the content (in any variety of streaming formats) to the streaming server for delivery to your audience.

Bandwidth: 1. width of a channel in telecommunications, typically measured in bits per second (bps) for digital communications, cycles per second or Hz for analog. 2. In the realm of data transmission, the amount of data that can be sent through any digital connection. Used to measure the speed of a connection to the Internet.

Broadband: transmission facility that has a bandwidth (capacity) greater than a voice grade line of 3 kHz, generally used to refer to coaxial cable and DSL Internet connections.

Buffer: temporary storage location for data or information being sent and received. Usually located between two devices that have different abilities or speeds for handling the data.

Buffering: the process of storing the data commonly transmitted during streaming so that the transmission will "play" continuously during a real time stream.
CARP: (Copyright Arbitration Royalty Panel) three-person panel convened under direction of the Librarian of Congress for the purpose of determining the rates and terms for the statutory licenses required by DMCA.

CBR: (Constant Bit Rate) the bit rate remains fairly constant and close to the target bit rate over the course of the stream, designed to work effectively with streaming scenarios. Disadvantage is that the quality of the content is not constant, as some portions are more difficult to compress.

Client/server: a model for structuring a distributed system that consists of two types of processes: clients, which generate requests for service, and servers which receive requests, execute one or more operations and send a result back to each client.

Client: computer that requests information or services from another computer.

CODEC: 1. used in PC technology to mean COmpression/DECompression. Using techniques for representing repeated bit patterns reduces the amount of data to be transmitted or stored. When data is received or accessed, it is decompressed into its original form. 2. Radically shrinks multimedia files for storage or transfer before either returning them to their normal size or restructuring them to an approximation of their original state.

Download: either the act of transferring a multi-media or other data file from a remote source such as a web server to a local hard drive or other storage device where it can be played or viewed by associated software/hardware at the users discretion (verb), or the actual content itself after it has been stored. (noun)

Decoder: Software or hardware that turns encoded information back into its original pre-encoded form or a close approximation.

Digital Audio Broadcasting: (DAB) both a generic term and the proprietary name given to a transmission system for radio that uses part of the upper end of the VHF spectrum. Around eight stations are bundled together into "multiplexes" of simultaneous transmission on a given receiving frequency.

Digital Millennium Copyright Act: (DMCA) 1998 US law that implemented two international treaties addressing copyright issues, containing provisions pertinent to online service providers, Webcasting and distance learning among others. (see WIPO)
Digital Performance Right in Sound Recordings Act of 1995: (DPRA): created for the first time in US copyright law, a limited public performance right in sound recordings (as distinguished from musical works). Forerunner of the DMCA.

DSP: Digital Signal Processor

Ephemeral recordings: recordings made in order to facilitate a transmission, allows radio stations to record a set of songs rather than rely solely on original CDs or other source media. Term used in the context of the DMCA and other statutes.

Encoder: software or hardware designed to convert raw, uncompressed audio into a highly compressed format for quick transfer over a network.

Encoding: process of converting data into code or analog signals (voice, music etc.) into digital signals.

Format: technology to encode and stream audio over the Internet. Major formats include MP3, Windows Media, RealMedia, QuickTime, Ogg Vorbis, and Beatnik

Fair use: long standing legal privilege to make unauthorized use of a copyrighted work for a good reason. A benefit extended to the purchaser of copyrighted materials, and to researchers and libraries as well.

Hint tracks: files (movies) that are intended for streaming via QuickTime Streaming Server must be hinted—that is, they need a hint track for every streamable media track. The hint tracks tell the server exactly how to package the media data for the network.

HTTP: Hyper Text Transfer Protocol is the actual protocol used by a web server (including streaming media servers) and the client browser (or media player) to communicate over an Internet connection.

HTTP streaming: see progressive streaming

Icecast: a project that encompasses several programs enabling a streaming server system that streams audio content in the Ogg Vorbis format, available under the terms of the GNU GPL.
icecast: a program that provides streaming media server capability and is one of the programs encompassed by the Icecast project. The current version, icecast2, supports streaming in the Ogg Vorbis and MP3 formats. As with other streaming media server technologies it requires a streaming application to input the stream to the server.

IP: The Internet Protocol is a standard describing software that keeps track of the Internet addresses for different nodes, routes outgoing messages, and recognizes incoming messages. The protocol works in conjunction with TCP and is usually identified as TCP/IP

LAME: the source code developed through an the open source model to improve the psycho acoustics, noise shaping and speed of MP3, now considered an effective MP3 encoding engine.

Live stream: (live content) source audio enters an authoring computer (authoring software/encoder) and exits as an encoded live stream. The live stream is forwarded by the server directly to listener’s client software over the Internet. Used for applications such as live concerts, radio simulcasts, web radio transmissions in real-time, or live sporting events. See on-demand stream.

Media Player: client software device capable of interacting with a streaming media or web server for the purpose of providing playback and control capabilities for multi-media content

Media Server: file server that contains files containing voice, images, pictures, video, audio etc. They provide storage, network interfaces, and memory. (Newton)

Metadata: information included with a file that describes the files contents, such as artist, title, and other CD information

Metafile: a file that contains a pointer to the actual streaming content

Multicast: media server transmits only one stream that is picked up by all the clients on the network, therefore has less stringent network demands but requires more complex networking.

MPEG: (Motion Pictures Expert Group) commonly known as a series of hardware and software standards to reduce the storage requirements of digital video and audio.
MPEG1: standard is a three-part compression standard that addresses video and audio compression techniques for synchronized video and audio at a total bit rate of about 1.5 Mbit/s.

MPEG2: ISO standard for the compression of video and audio assets that builds on MPEG1 and extends it to handle the highest-quality video applications. Now a common standard for digital video transmission used in all parts of the distribution chain, including broadcast, Cable TV, satellite, and streaming media applications.

MP3: MPEG1, Layer III, an open standard CODEC that provides the greatest audio quality and greatest compression, and not specifically a streaming audio format. Although an ISO standard, MP3 requires royalty payments to Fraunhofer, Coding Technologies and Thomson. Streams effectively down to speeds of 28.8 kbps, and is an almost universal audio format.

MP3PRO: enables broadcasters/Webcasters to deliver CD quality audio using half the bandwidth of standard MP3 files. MP3PRO is a combination of MP3 and Coding Technologies proprietary SBR (Spectral Band Replication) technology and provides backward compatibility with standard MP3 files. SBR enable the CODEC to deliver the same quality at half the bit rate, thus reducing bandwidth requirements.

MPEG4: standard designed to cover the entire digital media workflow, including authoring, editing, encoding, transmission, distribution, playback, and archiving using the QuickTime file format as the container to hold the various media types. Represents the new frontier of media services, with many different vendor implementations that will need to be integrated in the future.

MPEG4 ACC: standard incorporates MPEG2 AAC, forming the basis of the MPEG4 audio compression technology for data rates above 32 kbps per channel. Additional tools increase the effectiveness of MPEG2 AAC at lower bit rates, and add scalability or error resilience characteristics. Compresses more effectively than older standards, including MP3, while offering quality rivaling uncompressed CD audio.

.MOV: original Apple QuickTime file format for video, now used for audio files as well.

Multi-Media: combination of multiple forms of media in the communication of information. Current use implies combination and integration of digital
technologies of video, audio, images, with PC processing over telecommunications networks.

**Multimedia Information System:** one which supports a variety of media types into a single system framework thus enabling users to share, communicate and process a variety of forms of information in an integrated manner.

**MBR:** (Multiple Bit Rate) provides users with better quality content during times of network congestion. Content is encoded at several specified bit rates and then delivered to player (client) based on available bandwidth.

**Narrowcast:** programming developed and/or delivered to a “niche” audience, a specific set of recipients, rather than broadcast to many recipients.

**Narrowband:** connection over a computer or telephone network with a relatively low bit rate, e.g., 64 kBps.

**Nullsoft:** private company that is the driving force behind streaming using the MP3 format by developing and supporting the SHOUTcast server technology as well as media players, WINamp, Audion (for Macintosh listeners) and XMMS for UNIX, or MusicMatch for all three platforms.

**Ogg Vorbis:** new audio compression format. Ogg Vorbis is a fully open, non-proprietary, patent-and-royalty-free, general-purpose compressed audio format for mid to high quality (8kHz-48.0kHz, 16+ bit, polyphonic) audio and music at fixed and variable bit rates from 16 to 128 kbps/channel. This places Vorbis in the same competitive class as audio representations such as MPEG4 (AAC), and similar to, but higher performance than MPEG1/2 audio layer 3, MPEG4 audio (TwinVQ), WMA and PAC. ([http://www.xiph.org/ogg/vorbis/](http://www.xiph.org/ogg/vorbis/))

For a more complete description of Ogg Vorbis, refer to [http://www.vorbis.com/faq.psp#names](http://www.vorbis.com/faq.psp#names)

**On-demand stream:** (on-demand content) streaming audio files are authored and then uploaded to a streaming server for redistribution to multiple listeners. Allows use of third-party software tools such as encoders or DJ automation tools that export to the desired audio streaming format and offer advanced processing features. Web radio stations accessing archived MP3 or other formatted files are considered on-demand. See live stream.

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Open Source: Open source promotes software reliability and quality by supporting independent peer review and rapid evolution of source code. To be OSI certified, the software must be distributed under a license that guarantees the right to read, redistribute, modify, and use the software freely. (http://www.opensource.org/advocacy/faq.php)

Performance: ("per performance") each instance in which any portion of a sound performance is publicly performed to a listener via an Internet-only transmission or an AM/FM retransmission

Progressive Streaming: An on-demand file or live broadcast that will play in the user's player application during the download process instead of waiting for the entire file to download in order to play. Commonly served by a Web Server via HTTP. Also called progressive download and FastStart.

QuickTime: streaming software originally developed by Apple as a software toolset that allowed MAC OS 6.0 to transfer large media files, but has become an effective tool for creating and listening to multimedia across platforms.

Real Time: no perceived delay in the transmission of a message or file, the receiver acts upon the transmitted file immediately. A voice telephone conversation is conducted in real time, and similarly a multimedia transmission can be conducted in real time.

Real Time Transfer Protocol/Real Time Streaming Protocol: RTP/RTSP.
1. Developed by IETF (Internet Engineering Task Force) to address problems when real-time interactive exchanges such as video or audio are transported over LANs designed for data by adding a layer to the Internet Protocol. (Newton).
2. a standard non-proprietary protocol for real-time streaming of multimedia on a network, the RTP protocol is used for the outgoing stream, and RTSP is used for the interactive requests from the client (receiver or media player).

Real Time Streaming: two-way conversation between streaming audio player and server that provides additional stability and features.

Scalable: Something can be made larger or smaller with relative ease.

Scalability: has the ability to be upgraded or possibly downgraded to meet actual system requirements with less operational and economic impacts than a replacement of the system or process would incur.
Server: computer on a network that supplies information to a client computer on request. Also refers to the software that performs these functions. Also, see Web server.

SHOUTcast: Nullsoft's Free WINamp based distributed streaming audio system

SimpleCast: encoding software offered by SpacialAudio that encodes in multiple formats (MP3, MP3PRO, OGG) and streams to multiple servers (SHOUTcast, Live365, Windows Media, Icecast)

Simulcast: distribution of radio/TV content over more than one outlet simultaneously (at the same time), now applied to terrestrial broadcasts, which are also Webcast.

Statute: a legislative enactment, established law, or regulation

Statutory license: automatically granted by operation of law to all parties that meet the conditions of the license (which are set forth in the DMCA). Parties operating under a statutory license are required to pay royalties rates that are established by law or regulation and comply with reporting requirements, restrictions and various other terms established by law.

Stream: either the process of transmitting digitized audio or video over the internet so that it can be used in real-time (verb), or the actual content that is received (noun)

Streaming Audio: 1. Similar to traditional radio broadcasting except that the Internet is used to send and receive audio instead of just using the airwaves, streaming audio is listened to in real-time. 2. Transferring audio between hardware devices across a network in which the audio data causes the audio to start playing on the client computer or device as the data begins to arrive at the client computer or device

Streaming Media: simultaneous transfer of digital media (video, voice and data) so that it is received as a continuous real-time stream.

Streaming Server: media server that takes the audio from either a static pre-processed file or a continuous live feed (such as an ongoing Internet “radio” station, and begins sending the audio over the Internet connection to the user's
media player or other client device. This type of server maintains a constant connection with the client or player in order to send data at predictable rates.

**Subscription transmission:** transmission that is sold, controlled and limited to particular recipients, those who have subscribed to the service in question

**3G:** (third generation) generic wireless industry term for high-speed mobile data delivery over cellular networks. 3G networks allow users to send and receive bandwidth-intensive information such as video, video conferencing, high quality audio and web data on-demand, virtually anytime and anywhere.

**3GPP/3GPP2:** complete set of globally applicable Technical Specifications for a Third Generation Mobile System based on the evolved GSM (3GPP) or CDMA (3GPP2) core networks and the radio access technologies supported by partners of both wireless formats.

**Unicast:** one to one Webcasting where each listener requests his or her own single stream from the server for the duration of the transmission.

**VBR:** (Variable Bit Rate) encoding method where fewer bits are automatically allocated to less complex portions of the content, leaving enough bits available to produce good quality for more complicated ones. Useful for downloading for CD or DVD playback, or when working with a mixed media file.

**.WAV:** high-quality audio format developed by Microsoft and the most common raw audio format used on the Windows platform

**Waveform audio:** 1. digital representation of actual sound waves created by sampling the analog sound waveform at regular intervals. 2. graphic representation of the shape of a sound.

**Waveform editor:** software that allows the editing of sound, much like a word processor does. Software allows user to edit (i.e. change, replace, amplify, echo, fade in or out, cut out noise, cut/paste from other files, etc.) sound.

**Web server:** Similar to network server except transmission is via the Internet, and transmissions are done as quickly as possible in order to handle the next request, data is sent in chunks in order to minimize delay.

**WINamp:** Free media player offered by Nullsoft that allows streaming to SHOUTcast server with proper plug-ins
**WIPO** (World Intellectual Property Organization): United Nations organization responsible for two international treaties used as models for international copyright agreements.

**WIPO Copyright Treaty** (WCT): applies broadly to songwriting and the authorship of music and other content.

**WIPO Performances and Phonograms Treaty** (WPPT) applies broadly to the performers, performance rights, record companies, and musical content.

**.WMA**: high quality audio format developed by Microsoft and used on the Windows operating system.

**.WMV**:

**Xiph.org**: collection of open source, multimedia related projects. The most aggressive Xiph.Org effort, the Ogg project, works to put the foundation standards of Internet audio into the public domain. ([http://www.xiph.org/about.html](http://www.xiph.org/about.html))
ON-LINE RESOURCES

TECHNICAL RESOURCES

SHOUTcast Online Documentation
Downloaded 6/7/03 from:
www.shoutcast.com/support/docs/

Icecast Online Documentation
Downloaded 01/24/04 from:

Online Seminar: Helix Products Overview: Downloaded 02/06/04 from:

Compare REALNETWORKS Data Support to Windows Media
Downloaded 01/28/04 from:
http://www.realnetworks.com/industries/resources/advantage/datasupport.htm

Gill, Tricia. Getting Started With Windows Media 9 Series. Downloaded 01/24/04 from:

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Birney, Bill. Streaming from a Web Server. Downloaded 02/01/04 from:

Windows Media 9 Downloads page:
http://www.microsoft.com/windows/windowsmedia/download/default.asp
QuickTime Streaming: Downloaded 01/28/04 from:

Darwin Streaming Server. FAQ from:

Darwin Streaming Server. Available from:
http://www.opensource.apple.com/apsl/

MPEG4 FAQ. Downloaded 02/08/04 from:

Bouthillier, Larry. The MPEG Video Standards from 1 to 21. Downloaded 02/18/04 from:
http://www.streamingmedia.com/article.asp?id=8569

QuickTime Broadcaster. Available from

QuickTime Player 6.5. Downloaded 01/31/04 from:

QuickTime Pro. Available from:
http://www.apple.com/quicktime/upgrade/

TechTV. Make a Radio Station. Recorded 26 December 2002. Downloaded 12/2003 from:
http://www.feazguys.com/

Luini, Jon R. Whitman, Allen E. Streaming for Dollars. Downloaded 02/27/04 from:
http://hotwired.lycos.com/webmonkey/00/42/index3a.html

Brown, Janelle. Everyone’s a DJ. Salon.com 09/04/99. Downloaded 02/14/04 from:

Radio Guide. How to Create Your Own Internet Radio Station. Downloaded 01/30/04 from:
http://radio.about.com/library/weekly/aa013003c.htm
Reuters. Internet Radio Makes Bigger Waves. 4/25/03. Downloaded 09/24/03 from:
http://www.wired.com/news/digiwood/0.1412.58626.00.html

Kahney, Leander. Last.fm: Music to Listeners’ Ears. Wired, 7 July 2003. Downloaded 09/04/03 from:
http://www.wired.com/news/culture/0.1284.59522.00.html

Batista, Elisa. Internet Radio’s Biggest Geek. Wired, 31 March 2003. Downloaded 09/04/03 from:
http://www.wired.com/news/business/0.1367.58231.00.html

Radio Guide. Beatles Fan Creates His Own Internet Radio Station. Downloaded 01/30/04 from:
http://radio.about.com/kbraty/weeklv/aa080403a.htm

Holt, Rob. Mandra, Chris. How NPR webifies its programming — and you can, too. Current, 10/30/00. Downloaded 02/27/04 from:
http://www.current.org/stteam/stream/stream020npr.html

Radio and Internet Newsletter (RAIN). Downloaded regularly from:
http://www.kurthanson.com/

LEGAL RESOURCES

Library of Congress Copyright Office. Summary of the Determination of the Librarian of Congress on Rates and Terms for Webcasting and Ephemeral Recordings. Downloaded 9/28/03 from:
http://www.copyright.gov/carp/webcasting_rates_final.html

Library of Congress Copyright Office. Notification of Agreement Under the Small Webcaster Settlement Act of 2002. Downloaded 02/20/04 from:

Library of Congress Copyright Office. Notice and Record keeping for Use of Sound Recordings Under Statutory License. Downloaded 2/29/03 from:
http://www.copyright.gov/carp/114

Wired News. RIAA Foes Know How to Sue, Too. Associated Press, 28 August 2003. Downloaded 02/27/04 from:
http://www.wired.com/news/digiwood/0.1412.60223.00.html


Webcaster Alliance pleading against the RIAA. Downloaded 01/28/04 from http://webcasteralliance.com/docs/WA_complaint.pdf


Future of Music Coalition Testimony Submitted to Senate Judiciary Committee. *Copyright Royalties: Where is the Right Spot on the Dial for Webcasting?* 05/05/02. Downloaded 02/27/04 from: http://www.futureofmusic.com/news/briefs.cfm


Electronic Frontier Foundation. *Unintended Consequences: 5 years under the DMCA.* Downloaded 02/25/04 from http://www.eff.org/IP/DRM/DMCA/unintended_consequences.php

Black, Jane. *After Napster, a New Net Target.* Businessweek Online. Downloaded 09/04/03 from: http://www.businessweek.com/bwdaily/dnflash/apr2002/nf2002044_0133.htm


**OPERATIONAL/ECONOMIC RESOURCES**


Dean, Katie. *College Radio Will Stream On.* Wired, 06/05/03. Downloaded 09/04/03 from: http://www.wired.com/news/print/0,1294,59105,00.html


SoundExchange Licensing categories. Downloaded 02/27/04 from:
http://www.soundexchange.com/licensee_home.html

SoundExchange Forms Download.
http://www.soundexchange.com/licensee/forms.html#additional

Van Putten, Karolyn. *Get Set to Stream: A Comprehensive Guide to Putting Audio on Your Web Site*. Downloaded 02/27/04 from:
http://www.nfcb.org/publications/streamingmanual.jsp

Save Our Streams.
http://www.ruf.rice.edu/~wilk/cb/sos/

Leichtman Research Group. Broadband Internet Grows to 25 Million in the U.S.
Press release. Downloaded 03/03/04 from
www.leichtmanresearch.com/press/030804.html
BOOKS:


ADDITIONAL MATERIALS:


Legal Memorandum. *Summary of Certain Legal Requirements for Webcasters.*

APPENDIX A

THIRD PARTY STREAMING PROVIDERS/WEBCASTING HOST SITES

For a comprehensive list of providers, refer to:
http://www.streamingmedia.com/directory/category.asp?id=7

Some specific providers are as follows:

Audio Realm: http://www.audiorealm.com/streams

Bean-Net: www.bean-net.net

Communicast: http://communicast.com/


Limelight Networks: http://www.limelightnetworks.com/

MediaCast: www.mediacast.com

Play Stream: http://www.playstream.com/

SHOUTcast: www.Shoutcast.com


StreamAudio: http://www.streamaudio.com/

StreamGuys: www.streamguys.com
APPENDIX B

MISCELLANEOUS WEBCASTING RESOURCES

Audio Soundcard Comparison Table
http://cssvc.pcworld.compuserve.com/computing/cis/article/0,aid,113750,pg,3,00.asp

ARBITRON Top 15 Internet Broadcasters and Sales Networks (January 2004)
http://www.arbitron.com/newsroom/archive/WCR02_19_04.htm

Radio and Internet Newsletter (RAIN).
http://www.kurthanson.com/

Helix Community Development Site
https://helixcommunity.org/
APPENDIX C

AREAS NOT FULLY EXPLORED IN THE THESIS, SUITABLE FOR FUTURE RESEARCH

Server Architectures: Clustering, Peer-to-Peer Networks

Server technologies: Macromedia,

Player technologies: FLASH

Authoring/Encoding Technologies: Cooledit, Beatnik

Web Radio Business Plans
ENDNOTES


3 Future of Music Coalition. *Radio Deregulation: Has It Served Citizens and Musicians*. 11/18/02. Downloaded 09/04/03 from:

http://www.futureofmusic.com/research/radiostudy.cfm

4 Kohn, Bob. *A Primer on the Law of Webcasting and Digital Music Delivery*. Downloaded 02/20/04 from:

http://www.kohnmusic.com/articles/newprimer.html


10 Icecast Online Documentation. Downloaded 01/24/04 from:


11 Toomey, Jenny. *Music in the Digital Age*. Future of Music Coalition. Downloaded 02/27/04 from:

http://www.futureofmusic.com/articles/quizinterview.cfm

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14 Windows Media 9 Series Deployment Guide. Downloaded 01/28/04 from:


15 Gill, Tricia. *Getting Started With Windows Media 9 Series*. Downloaded 01/24/04 from:


16 QuickTime Streaming Server FAQ. Downloaded 01/30/04 from:


18 QuickTime FAQ. Downloaded 02/09/04 from:

19 Winters, Jennifer. Getting Started with Windows Media Encoder. Downloaded 02/09/04 from:
http://www.microsoft.com/windows/windowsmedia/howto/articles/IntroEncoding.aspx#link


27 Dean, Katie. College Radio Will Stream On. 06/05/03. Downloaded 9/04/03 from http://www.wired.com/news/print/0.1294.59105.00.html


