

FreedomStreamer

The Digital Audio Streaming Jukebox

from Volutum LLC

Stream your media your way to your devices on your home network
“Let Freedom Stream”



* Stream Your Music to Any Device

- * HTTP Live Streaming (HLS)
 - => Streams digital audio directly to most Web Browsers (on computers, tablets, smartphones, etc.)
 - => No software to install, no reliance on iTunes® or other Apps (but easily works with iTunes® Music Libraries)
- * RTP Streaming (Realtime Transport Protocol over UDP)
 - => Streams to popular Apps like VLC®, Supports Broadcast and Multicast
- * Direct Play feature for HTML5 Audio in any modern Web Browser
- * Direct Link feature for the ultimate in connectivity, accessibility and flexibility
- * Audio Line Out connects to audio equipment (control your music from any web browser, listen on your home stereo)

* Works with Your Music Collection in Any Format

- * Works with USB drives, most iPods®, micro-SD cards, Windows® and MacOS® shared folders, Samba shares, FTP and SSH (SFTP)
 - => Wherever your music is stored and however your music is shared, FreedomStreamer can stream it
- * Compatible with MP3, AAC, M4A, WAV, FLAC, APE, OGG, also plays audio from video files like MPG, AVI, VOB, MP4
 - => Too many more to list here, over 50 supported file formats
- * No need to import all your music
 - => FreedomStreamer can access your media and stream it *right now, no matter where it is or how it is encoded*
- * Includes Analog Microphone Input to stream live events, or use like a Baby Monitor

* Easy Setup, Great Features, Fun to Use

- * Initial setup takes 5 minutes
- * Inconspicuous hardware with small footprint and low power requirements can be placed nearly anywhere
- * Leave it on 24 hours a day, 7 days a week, 365 days a year
- * Select songs from your web browser and they stream-and-play in order like a Jukebox
- * Connect to your home stereo and control your music (and most iPod®s) with any web browser
- * Easily adjust the order of tracks or re-play tracks that were played earlier – you're in control
- * 10-band equalizer, Microphone Input level control, 250 track memory
- * 2 built-in Jukeboxes can independently stream different music collections – great for families with different musical interests

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Software License Information

Links to the actual verbiage for software licenses (GPL, LGPL, BSD, MIT, etc.) can be found in **Appendix II** of this manual. The FreedomStreamer software license can be found in the section **Warranty and Technical Support** of this manual.

FreedomStreamer runs on Wandboard[®], using open-source software based on Linaro[®]'s distribution of Ubuntu[®] Linux. Information about obtaining source code for the baseline Ubuntu[®] Linux image for Wandboard[®] can be obtained from www.wandboard.org. More information can be obtained from www.linaro.org. Even more from www.ubuntu.com.

Beyond the baseline image, `apt-get` was used to obtain binaries for (1) `smbnetfs`, (2) `libav-tools`, (3) `mediainfo`, (4) `afpfs-ng-utils`, (5) `gststreamer0.10-plugins-bad`, (6) `gststreamer0.10-plugins-ugly`, (7) `curlftpfs`, (8) `expect`, and (9) `apache2`. Source code for (1)-(9) above can be obtained from the usual open-source locations (GitHub[®], Apache[®], SourceForge[®], Debian[®]/Ubuntu[®]/Linaro[®] repositories, etc.), or search with any search engine. `libwebsockets` is from git.warmcat.com/cgi-bin/cgit/libwebsockets/

FreedomStreamer itself is currently not open-source. FreedomStreamer does not modify any open source software, and does not link to any GPL software. FreedomStreamer links to LGPL software libraries (`gststreamer` and `libavformat`). FreedomStreamer also runs binary executable files (`avconv`, `mediainfo`, and others) via `system()`.

The source code and/or binary files for FreedomStreamer may be licensed for use in other products. For more information, please send email to sales@freedomstreamer.com.

Safety Information

FreedomStreamer is a tiny computer, so treat it like a computer. Don't use the device outdoors. Don't use it in high-temperature or high-humidity conditions. Don't get it wet. Plug the power supply into a reliable power outlet. Don't throw the device or drop it. Don't put it in a blender or hit it with a hammer. Don't take the device apart while it is powered-on and then poke at it with parts of your body. Don't eat anything inside of the device. Only attach items to the inputs and outputs of the device that are supposed to be attached. Keep the device away from small children who might not treat it properly. Don't let your dog use the device as a chew-toy. The list of “Don'ts” above is not all-inclusive: please use common sense.

Installation and Setup

Introduction

The FreedomStreamer package includes:

- [1] a single-board computer in a black plastic case (approx 4" x 4" x 1.5")
- [2] a 5 volt 2 amp universal AC adapter power supply (a “wall wart”)
- [3] a WiFi antenna

To use FreedomStreamer in its most basic configuration, **you will need to supply:**

- [1] *Your own home network* – typically with WiFi so wireless devices can access it
- [2] *Accessible audio files* – (MP3, WAV, FLAC, etc.) in a shared folder on your home network, or stored on an external USB device (like a disk drive or thumb drive), or stored on a micro SD card
- [3] *An ethernet cable* (optional, but recommended)
- [4] *A microphone or other analog audio source* (if you wish to use the Microphone Input)
- [5] An audio cable with a standard 3.5 mm stereo plug (if you wish to use Line Out)

You might also wish to use the following, but they are not strictly necessary:

- [1] an HDMI cable and a monitor (or TV) with HDMI input capability
- [2] a USB hub, USB keyboard and USB mouse

Installation and Setup of FreedomStreamer can almost always be accomplished without those last two items, but you may find it convenient to have them on hand in case you need them.

Note also that for certain types of error recovery (especially after drastic configuration mistakes or power loss during a firmware upgrade) the last two items above may be necessary. See the section titled **Solving Initial Setup Problems** further below for basic information. There is more detailed information in the **Troubleshooting** section of this manual.

Initial Setup

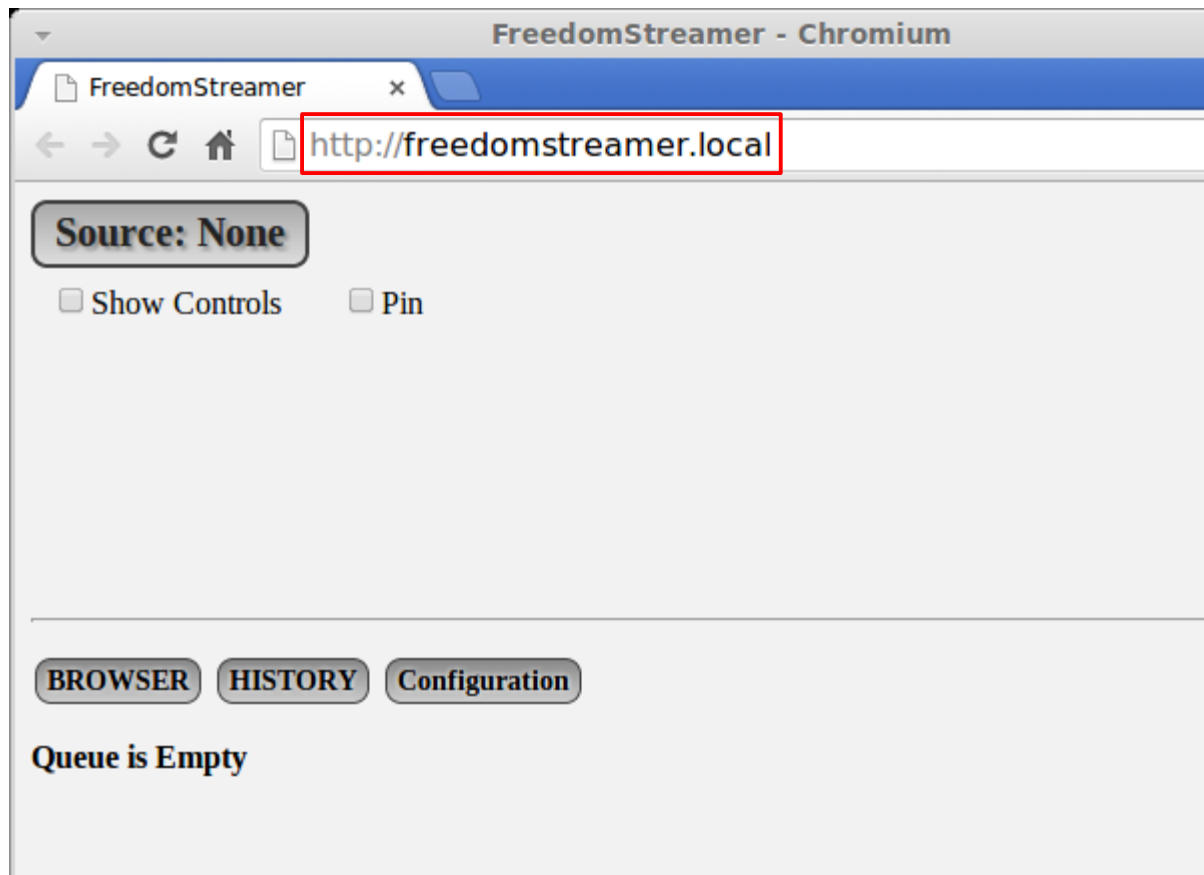
From the factory (or after restoring factory settings), FreedomStreamer obtains a TCP/IP address dynamically (via DHCP), and has the Host Name `freedomstreamer.local`

In the simplest case, using FreedomStreamer is very straightforward:

- [1] Connect an ethernet cable from FreedomStreamer to your home network
- [2] Plug one end of the supplied power cable (the 3.5 mm round plug) into FreedomStreamer, and plug the other end (the “wall wart”) into a power outlet
- [3] After 60 to 90 seconds, use any web browser on your home network and simply type in the following URL:

`http://freedomstreamer.local`

When you see the following screen, you're ready to start streaming your music:



If You Have Setup Problems

If the simple steps above don't work, consider the following:

* FreedomStreamer takes 60 to 90 seconds to “boot up” and initialize, so you have to be patient after step [2], wait a couple minutes before trying step [3]

* If you waited a couple minutes between steps [2] and [3] and still get no connection, it is possible some kind of power glitch or network glitch occurred, and FreedomStreamer may need to be re-booted – simply unplug the power connector, wait at least 30 seconds, and plug it back in to try again (be sure to wait 60 to 90 seconds again before trying your web browser after re-applying power)

* If rebooting several times still results in no connection, then you'll need to connect FreedomStreamer to a TV or monitor with an HDMI cable, and use a keyboard and mouse:

Remove power from FreedomStreamer.

Plug a keyboard and mouse into the USB port on FreedomStreamer (use a USB hub if the keyboard and mouse you are using are not integrated together).

Plug an HDMI cable into the HDMI port on FreedomStreamer, and plug the other end of the HDMI cable to your TV or monitor.

Be sure the ethernet cable is still connected to your home network.

Apply power to FreedomStreamer, then after 60 to 90 seconds the Ubuntu® Linux desktop will be displayed on your TV or monitor.

Start the Firefox® web browser by clicking on the Firefox® icon (3rd icon from the top) on the left-hand-side of the screen. FreedomStreamer is setup to be the homepage, and should display automatically (the address will appear as localhost).

If the Firefox® web browser does not automatically display the web page for FreedomStreamer, then type `http://localhost` into the Firefox® URL field, and press the return key on your keyboard.

* If using your TV or monitor and a USB keyboard and mouse still does not appear to work, consult the **Troubleshooting Guide** in this manual.

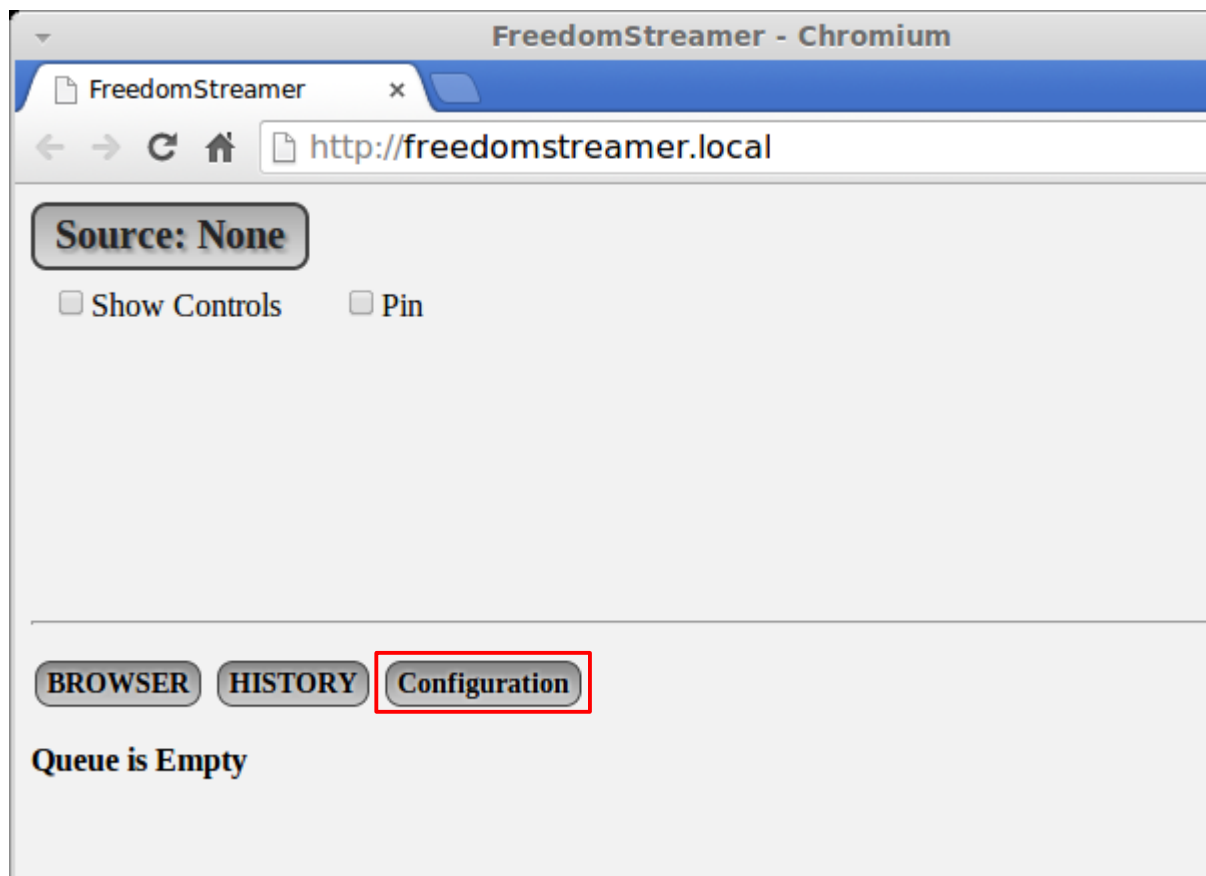
Advanced Setup

Advanced Setup is usually not necessary. You can always come back later and change things.

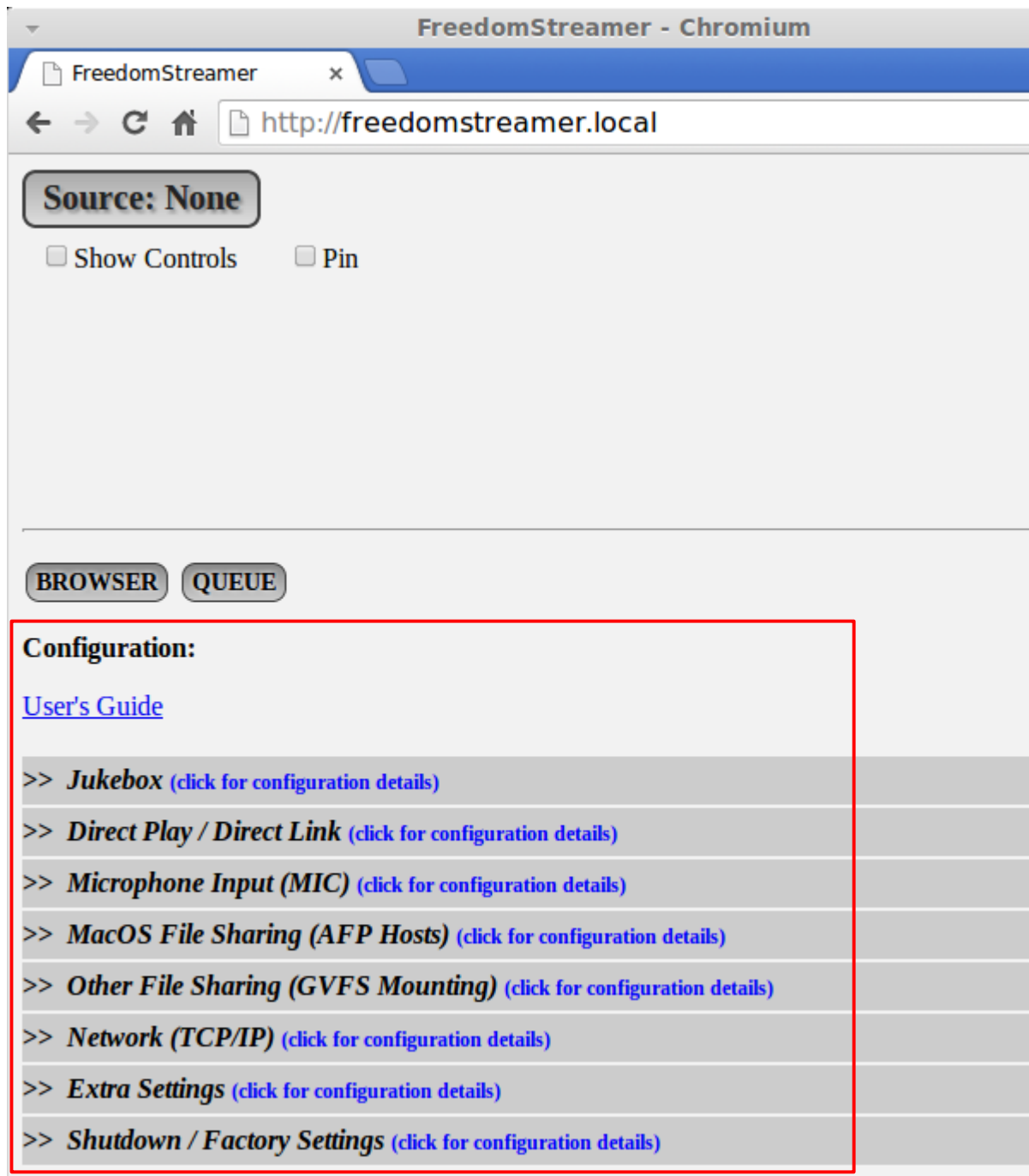
You can generally skip to the section **Using FreedomStreamer** unless:

- (a) you want to use the supplied antenna and a WiFi connection with FreedomStreamer
- (b) you want to use a static TCP/IP address with FreedomStreamer (recommended)
- (c) you are currently using your TV or monitor and a USB keyboard and mouse because you had setup problems (you'll need to use a static TCP/IP address in this case)
- (d) you want to change the Host Name

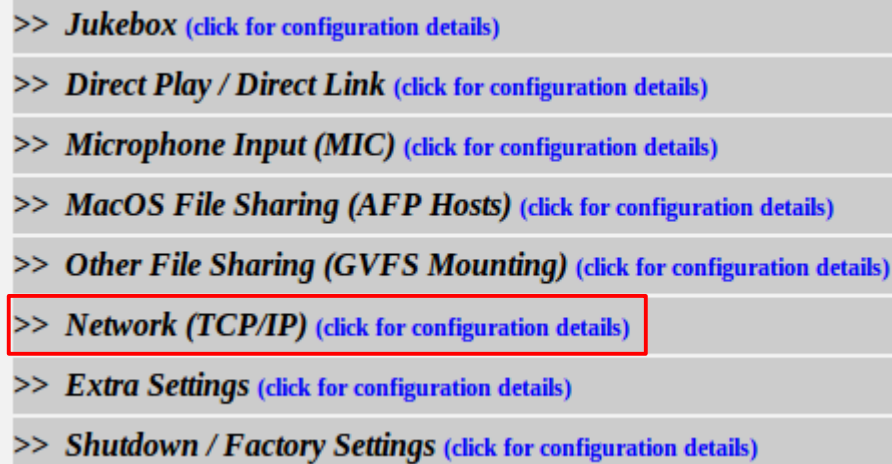
If you need to perform Advanced Setup because of one of the reasons above, click on the **Configuration** button to see the **Configuration** screen:



The **Configuration** screen looks like this:

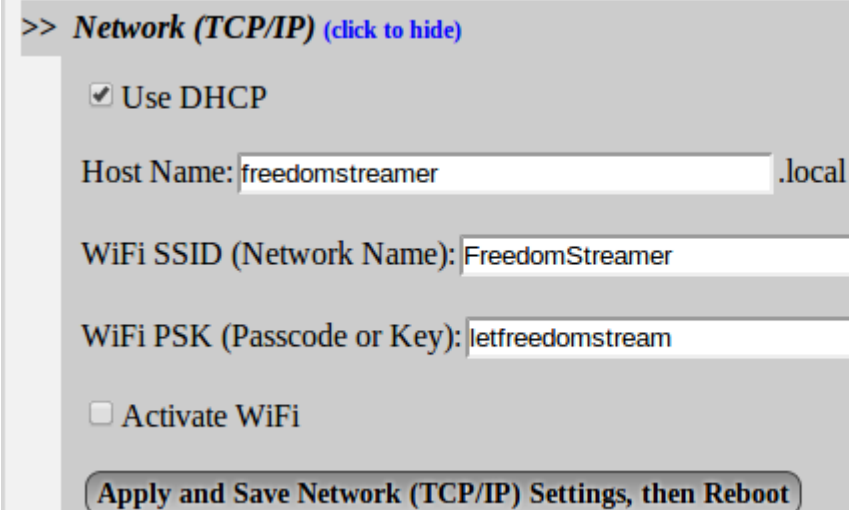


Click on the tab named **Network (TCP/IP)** to show configuration details:



>> **Jukebox** (click for configuration details)
>> **Direct Play / Direct Link** (click for configuration details)
>> **Microphone Input (MIC)** (click for configuration details)
>> **MacOS File Sharing (AFP Hosts)** (click for configuration details)
>> **Other File Sharing (GVFS Mounting)** (click for configuration details)
>> Network (TCP/IP) (click for configuration details)
>> **Extra Settings** (click for configuration details)
>> **Shutdown / Factory Settings** (click for configuration details)

The configuration details for **Network (TCP/IP)** look like this:



>> **Network (TCP/IP)** (click to hide)

Use DHCP

Host Name: .local

WiFi SSID (Network Name):

WiFi PSK (Passcode or Key):

Activate WiFi

Apply and Save Network (TCP/IP) Settings, then Reboot

Setup for WiFi

- (1) Be sure to attach the included antenna
- (2) Change **WiFi SSID (Network Name)** to your WiFi network name
- (3) Change **WiFi PSK (Passcode or Key)** to your WiFi passcode or key
- (4) Check the **Activate WiFi** checkbox (and read the notes that pop up)
- (5) Click the **Apply and Save Network (TCP/IP) Settings, then Reboot** button

FreedomStreamer will reboot, and in 60 to 90 seconds (after reboot is complete), the WiFi setting should be active. You can test this by removing the ethernet cable. If WiFi appears to be inactive, re-attach the ethernet cable, and then check the spelling of the **WiFi SSID** and the **WiFi PSK** – be sure they match what is required for your home's WiFi network.

Setup for Static TCP/IP Address

- (1) Un-check the **Use DHCP** checkbox
- (2) Enter a unique static Address, your home network's Netmask, and your home network's Gateway. See Appendix I for more details
- (3) Click the **Apply and Save Network (TCP/IP) Settings, then Reboot** button

FreedomStreamer will reboot, and in 60 to 90 seconds (after reboot is complete), the static TCP/IP address settings should be active. You can test this by entering the static Address you specified in step (2) above into any web browser.

Changing the Host Name

You might need or wish to change the Host Name from *freedomstreamer.local* to something else of your choosing.

If you have 2 FreedomStreamer devices, you'll have to change the host name on at least one of them. Additionally, even if you only have one FreedomStreamer device, if you prefer some other name that you can type into your web browser for access, you can easily change the Host Name to whatever you wish:

- (1) Change **Host Name** from *freedomstreamer* to whatever you desire (you cannot change the *.local* part of the name), using only letters [A-Z, a-z], numbers [0-9], the underscore [_] character, the dash [-] character, and/or the period or dot [.] character
- (2) Click the **Apply and Save Network (TCP/IP) Settings, then Reboot** button

FreedomStreamer will reboot, and in 60 to 90 seconds (after reboot is complete), the new Host Name should be available to use in your web browser.

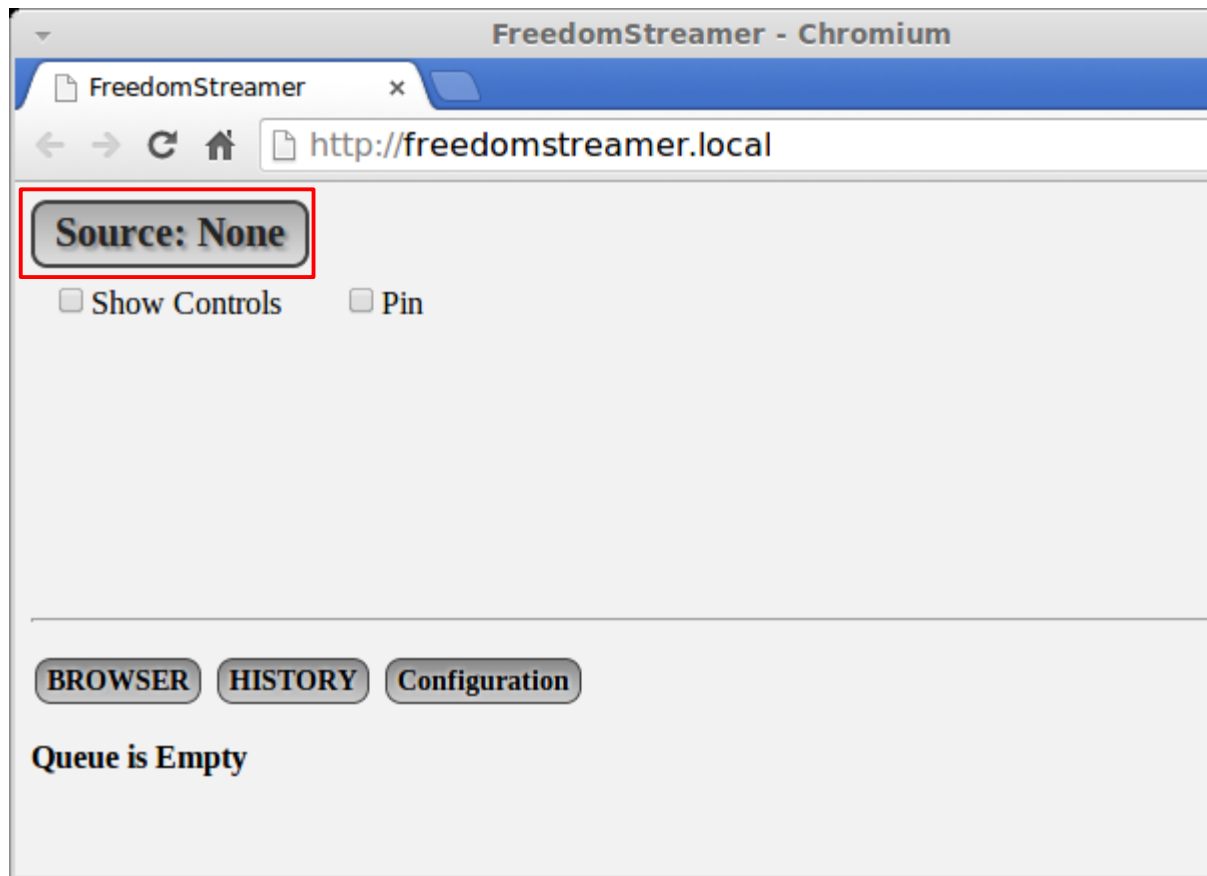
For best performance, use wired ethernet to connect FreedomStreamer to your home network. *The quality of WiFi performance depends on many variables. Using WiFi can lead to stalls or glitches in the streaming audio, depending on these variables.*

For best performance, use a static IP address for FreedomStreamer. *When DHCP is used and the DHCP lease expires, your home network's router will assign a new address to FreedomStreamer. FreedomStreamer can deal with this, but it sometimes results in a stall in the streaming audio – sometimes for up to several minutes – depending on your router and other variables.*

Using FreedomStreamer

Audio Sources

When you first connect to FreedomStreamer (or when you use the re-load feature of your web browser to re-load the FreedomStreamer web page), you'll see **Source: None**. You can click on the **Source** button to cycle through all of the available audio sources, depending on which audio sources you have enabled in the **Configuration** screen:



If **Source: None** is visible as shown above, you can check the **Show Controls** checkbox to display the **Jukebox** controls (if you don't want to hear the **Jukebox** in your web browser, but wish to control it, for example when using Line Out). You can also check the **Pin** checkbox to keep the **Jukebox** controls “pinned in place” – so it will not scroll when browsing, for example.

Only web browsers supporting HTTP Live Streaming (HLS) can hear the **Jukebox** through the web browser. HLS works on Safari® for iOS® and MacOS®, and also Chrome® for Android®.

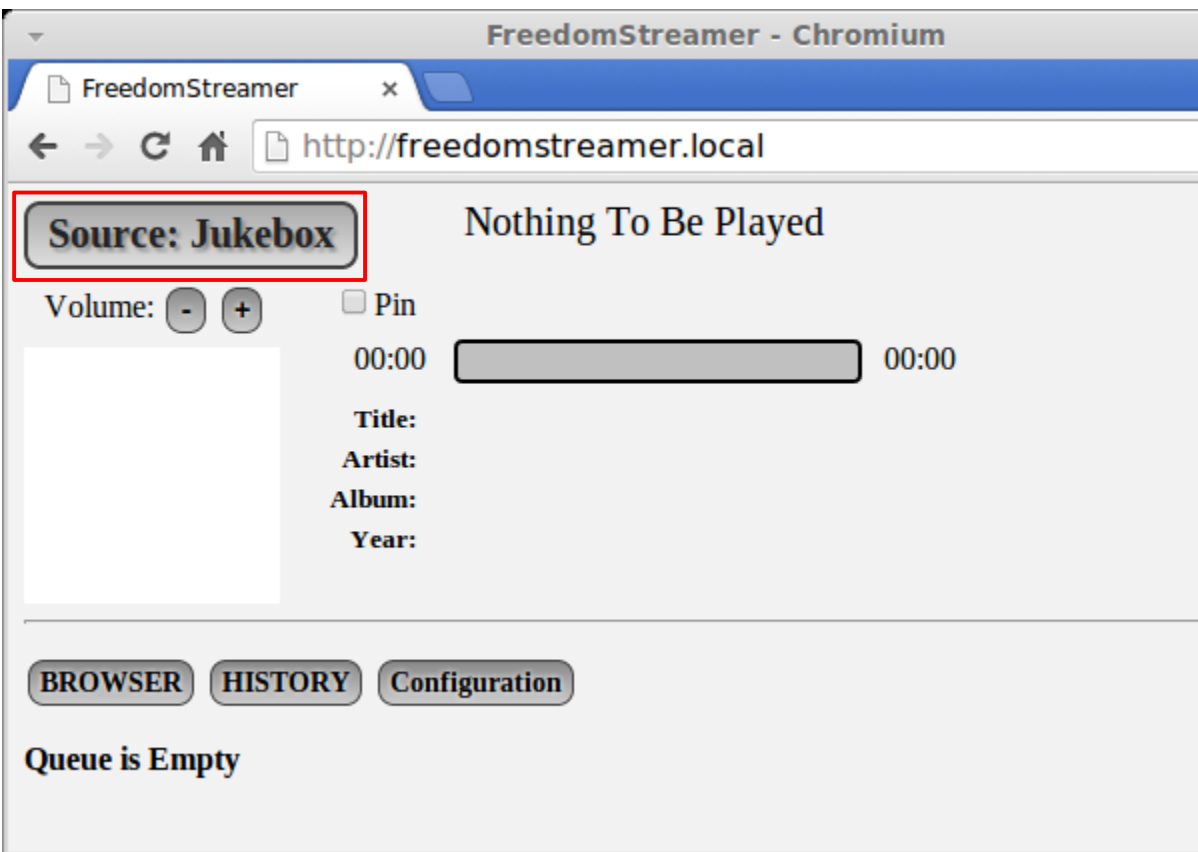
Note that Chromium® and Firefox® on Linux are not well-supported (due to the lack of an MP3 decoder, even though both browsers claim HLS support). Also note that the base Android® web browser does not support WebSockets, so if you use Android®, you will want to install the

Chrome® browser if you wish to hear streaming music on your Android® device.

If your device cannot make use of a web browser that supports HLS and WebSockets, you can always use an RTP client, like VLC®, to listen to the **Jukebox**. You can also use the **Direct Play** and/or **Direct Link** features to play back your music in your device's web browser (The **Direct Play** and **Direct Link** features operate separately and independently from the **Jukebox**).

In general, when you click the **Source** button, you'll see other audio sources.

Shown below is the **Jukebox** source, when there is nothing to be played. Later in this manual you'll see how to use the **BROWSER** to select audio files to be played:

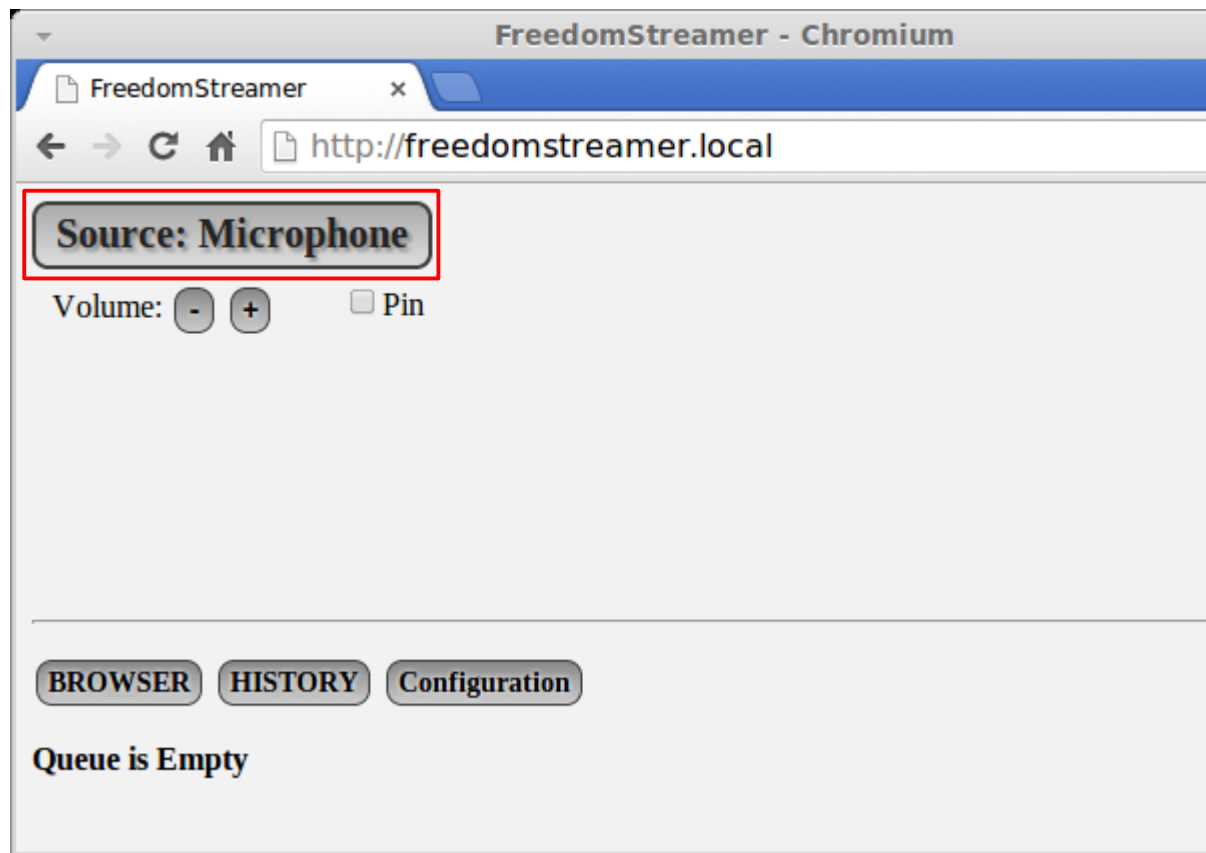


If you don't see the **Jukebox** source, you need to enable it in the **Configuration** screen.

The **Configuration** button allows you to set up and configure FreedomStreamer. The **Network (TCP/IP)** settings were previously discussed, and other settings and configuration options are discussed in other sections later in this manual.

More details about the **Jukebox** are in later sections of this manual.

The next source is the **Microphone** (MIC input):



If you don't see the **Microphone** source, you need to enable it in the **Configuration** screen.

The **Configuration** button allows you to set up and configure FreedomStreamer. The **Network (TCP/IP)** settings were previously discussed, and other settings and configuration options are discussed in other sections later in this manual.

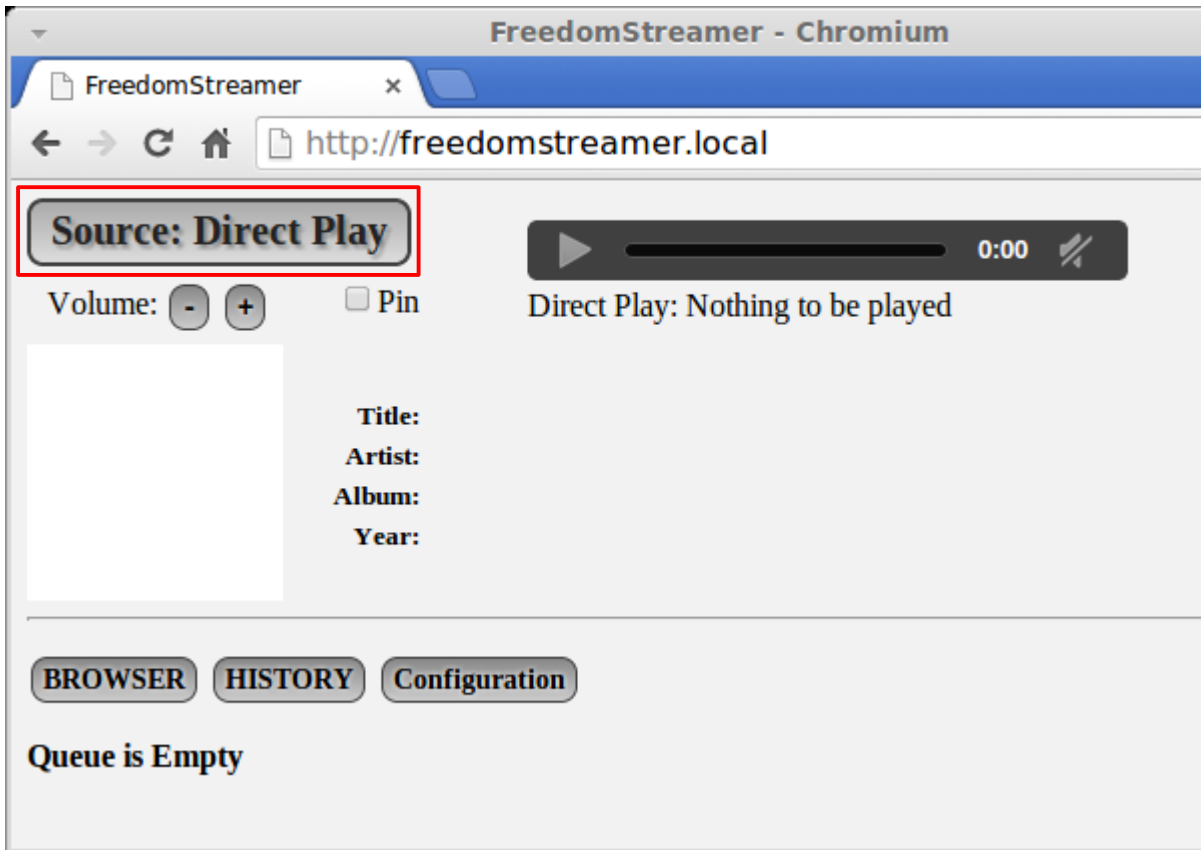
More details about the **Microphone Input** are in later sections of this manual.

Only web browsers that support HTTP Live Streaming (HLS) can play the **Microphone** input through the web browser. HLS has been well tested on Safari® for iOS® and MacOS®, and also Chrome® for Android®.

Note that Chromium® and Firefox® on Linux are not well-supported (due to the lack of an MP3 decoder, even though both browsers claim HLS support). Also note that the base Android® web browser does not support WebSockets, so if you use Android®, you will want to install the Chrome® browser if you wish to hear the **Microphone** input streaming to your device.

If your device cannot make use of a web browser that supports HLS and WebSockets, you can always use an RTP client, like VLC®, to listen to the **Microphone** input.

The last source is **Direct Play**:



If you don't see the **Direct Play** source, you need to enable it in the **Configuration** screen.

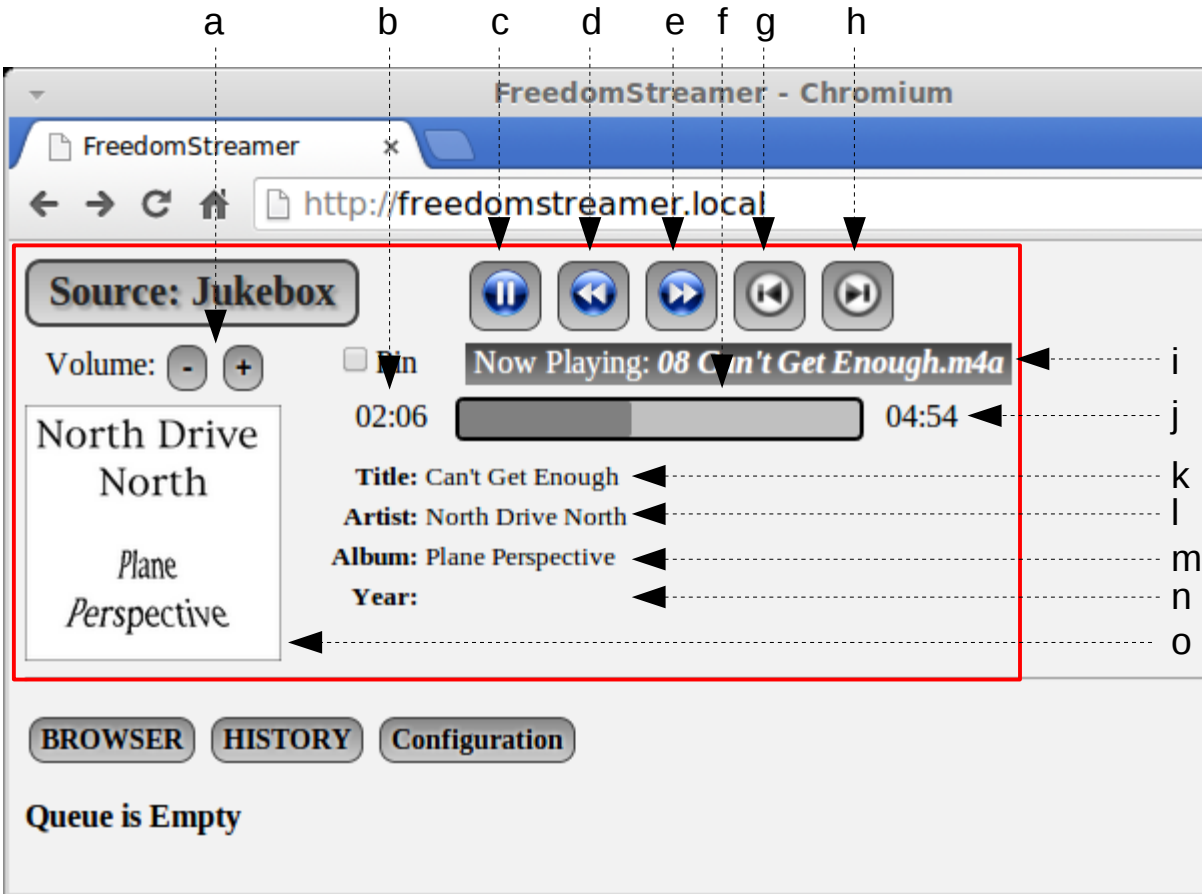
The **Configuration** button allows you to set up and configure FreedomStreamer. The **Network (TCP/IP)** settings were previously discussed, and other settings and configuration options are discussed in other sections later in this manual.

More details about **Direct Play** are in later sections of this manual.

If you click the **Source** button again, it takes you back to **Source: None**. Essentially, repeatedly clicking the **Source** button results in cycling through all the enabled sources.

Jukebox Overview

Shown below is a screen picture of the **Jukebox** area with a legend showing all the various parts you can see when there is an audio file playing:



- a Volume controls
- b Elapsed Time (for the currently playing audio file)
- c Pause/Resume Button: **click this** to pause or resume the Jukebox
- d Seek Back Button: **click this** to go backwards 10 seconds
- e Seek Forward Button: **click this** to go forward 30 seconds
- f Progress Bar: **click this** to seek anywhere within the currently playing audio file
- g Replay Button: **click this** to re-play the currently playing audio file, or previous audio file
- h Next Button: **click this** to go to the next audio file in the Queue
- i File Name (of the currently playing audio file)
- j Duration Time (for the currently playing audio file)
- k Track Song Name (for the currently playing audio file)
- l Track Artist Name (for the currently playing audio file)
- m Track Album Name (for the currently playing audio file)
- n Track Year (for the currently playing audio file)
- o Album Art (for the currently playing audio file)

NOTES:

- (a) has no effect on iOS® devices (iPad®, iPod®, iPhone®)
- (a) only affects HTTP Live Streaming in the Web Browser
- (a) operates relative to the device's hardware volume setting
- (a) is independent from the EQ and Volume Boost feature discussed later
- (a) is not stored or remembered between web page re-loads
- (c) pause icon changes to resume icon when paused
- (d) (e) (g) and (h) are not available when paused
- (j) could be slightly mis-calculated for variable bit rate audio files
- (k) (l) (m) (n) and (o) will be empty or blank when the audio file is missing metadata

It is important to note that FreedomStreamer streams digital audio, and there is a slight but noticeable delay (about 5 seconds for HTTP Live Streaming, and about 2 seconds for RTP Streaming). The delay is between what you see on the screen and what you ultimately hear.

For example, when a track changes to a new track, the elapsed time will show 5 seconds before you actually hear the audio from the new track begin to play in your HTTP Live Streaming enabled web browser.

Another example is transitioning between pause and play. When you click the pause button, the icon will change immediately and the elapsed time will stop incrementing, but you'll hear 5 more seconds (for HTTP Live Streaming) or 2 more seconds (for RTP Streaming) of audio before it “sounds like it is paused”. Similarly for resume, the icon will change immediately and the elapsed time will begin to increment, but it will take 5 seconds or 2 seconds before you'll actually hear the resumed audio.

This is the nature of streaming audio. Specifically, there are buffers and transmissions times involved, and so the delay is unavoidable.

The delay takes some getting used to, and can be disorienting, so beware, and be patient.

Whatever is playing on the **Jukebox** is also sent to the **Line Out** jack on FreedomStreamer. The **Line Out** jack can be connected to an audio amplifier (“Stereo System” or “Receiver”). In this way you can control the **Jukebox** with a web browser, and listen to it on Hi-Fi audio equipment.

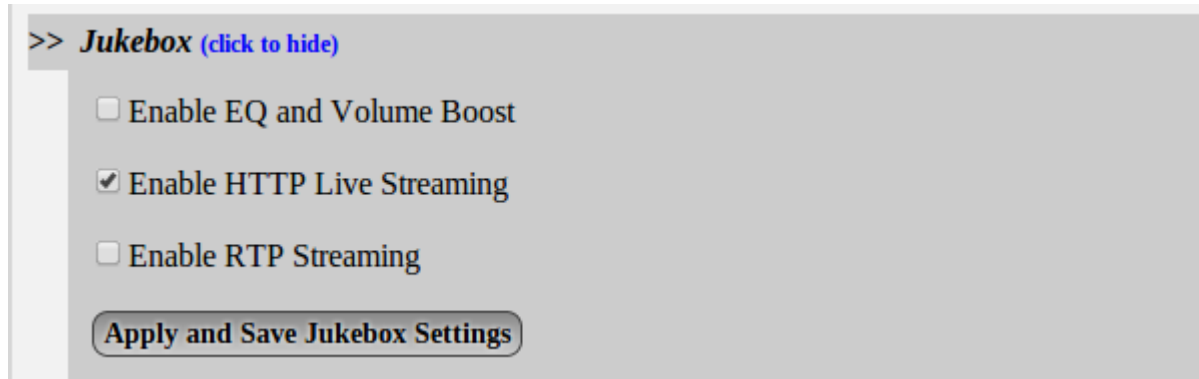
Configuration

Clicking on the **Configuration** button will take you to the **Configuration** screen.

The first tab at the top of the **Configuration** screen is for the **Jukebox**:



See later sections in the User's Guide for details about each setting, and refer to the following screen picture, which shows the default **Factory Settings** for the **Jukebox**:



Enable EQ and Volume Boost allows you to set equalization (10 band EQ) and extra amplification to the **Jukebox** audio. **Factory Settings** default to have this setting disabled.

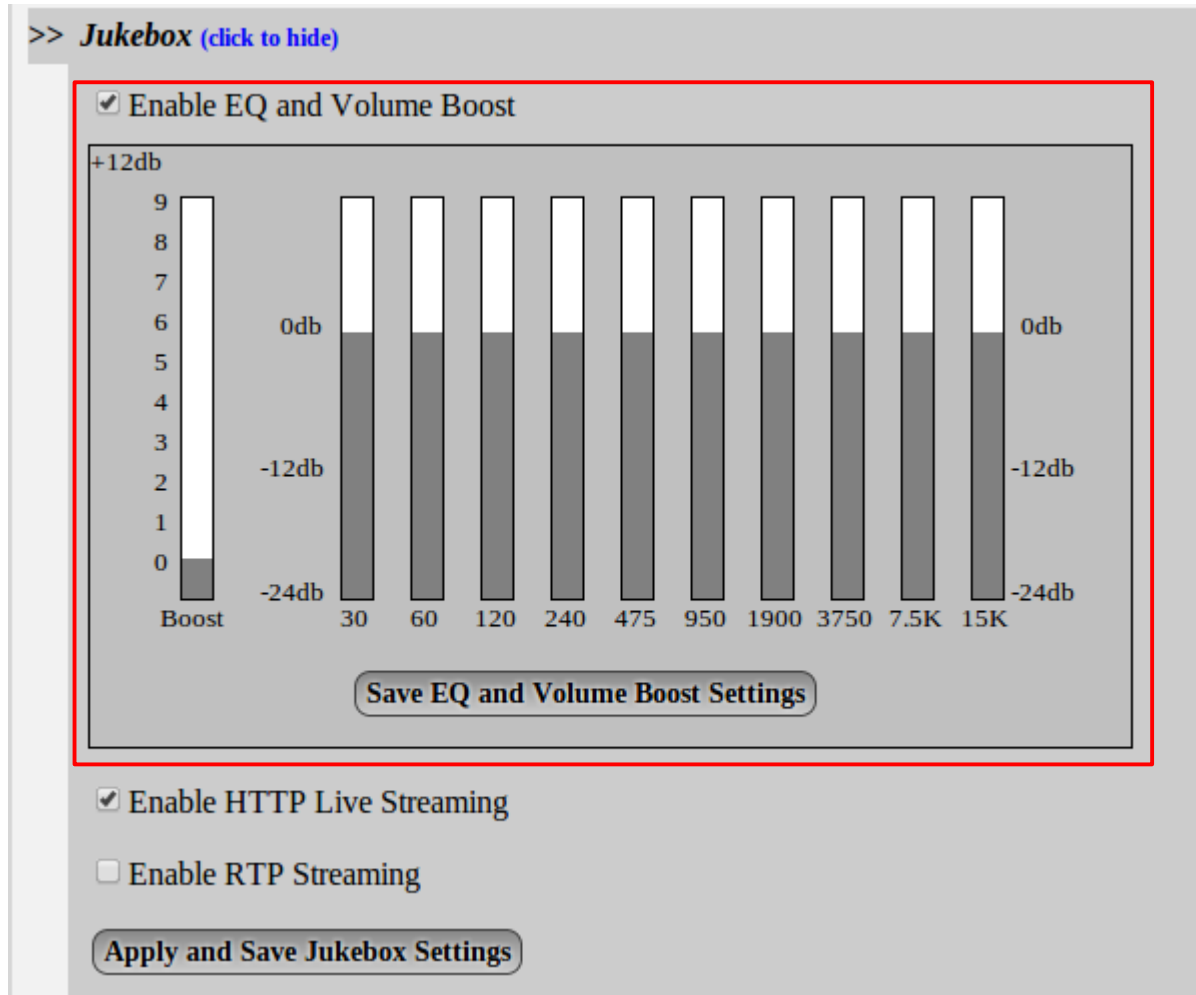
Enable HTTP Live Streaming enables and disables **Jukebox** audio over HLS. **Factory Settings** default to have this setting enabled.

Enable RTP Streaming enables and disables **Jukebox** audio over RTP (Realtime Transport Protocol over UDP). This can be used to stream audio to other applications, like VLC®. **Factory Settings** default to have this setting disabled.

Please note that *changes do not take effect until you click the **Apply and Save Jukebox Settings** button* at the bottom of the tab.

EQ and Volume Boost

When you click the **Enable EQ and Volume Boost** checkbox (and then click the **Apply and Save Jukebox Settings** button), the 10-band EQ and Volume Boost controller is displayed:



To change the settings, simply click in the bars to adjust the settings to your liking.

NOTES:

- As mentioned earlier, there will be a noticeable delay (5 seconds for HLS, 2 seconds for RTP) before you will hear the changed EQ or Volume settings take effect – be patient
- Using Volume Boost with the EQ bands at settings of 0db or higher will likely cause distortion above a Volume Boost setting of about 3 or 4
- Volume Boost works most effectively when the EQ bands are attenuated (set down in the negative dB range), **so for best results, reduce the EQ bands to get the sound you want, and only then use Volume Boost to bring the volume up to a reasonable level**
- *Be sure to click the **Save EQ and Volume Boost Settings** button if you want FreedomStreamer to remember your EQ and Volume Boost settings the next time you connect to it*

HTTP Live Streaming

You can enable or disable HTTP Live Streaming (HLS) by clicking the **Enable HTTP Live Streaming** checkbox (be sure to click the **Apply and Save Jukebox Settings** button for changes to take effect).

When HTTP Live Streaming is enabled, whatever is playing on the Jukebox can be listened to by any MP3 HTTP Live Streaming enabled web browser on your home network.

So, for example, you can use a web browser on your iPad® in your living room to add audio files to the **Jukebox** (and listen to them on that iPad®), then use a different web browser on your Android® phone in the kitchen to listen to the **Jukebox** as well. At the same time your Macintosh® in the basement can use Safari® to listen, too.

More than one web browser can simultaneously listen to HTTP Live Streaming, but all web browsers will hear the same content. There is only one audio file being played (and all web browsers receive it). Likewise, there is only one **Jukebox Queue** (and all web browsers can make changes to it).

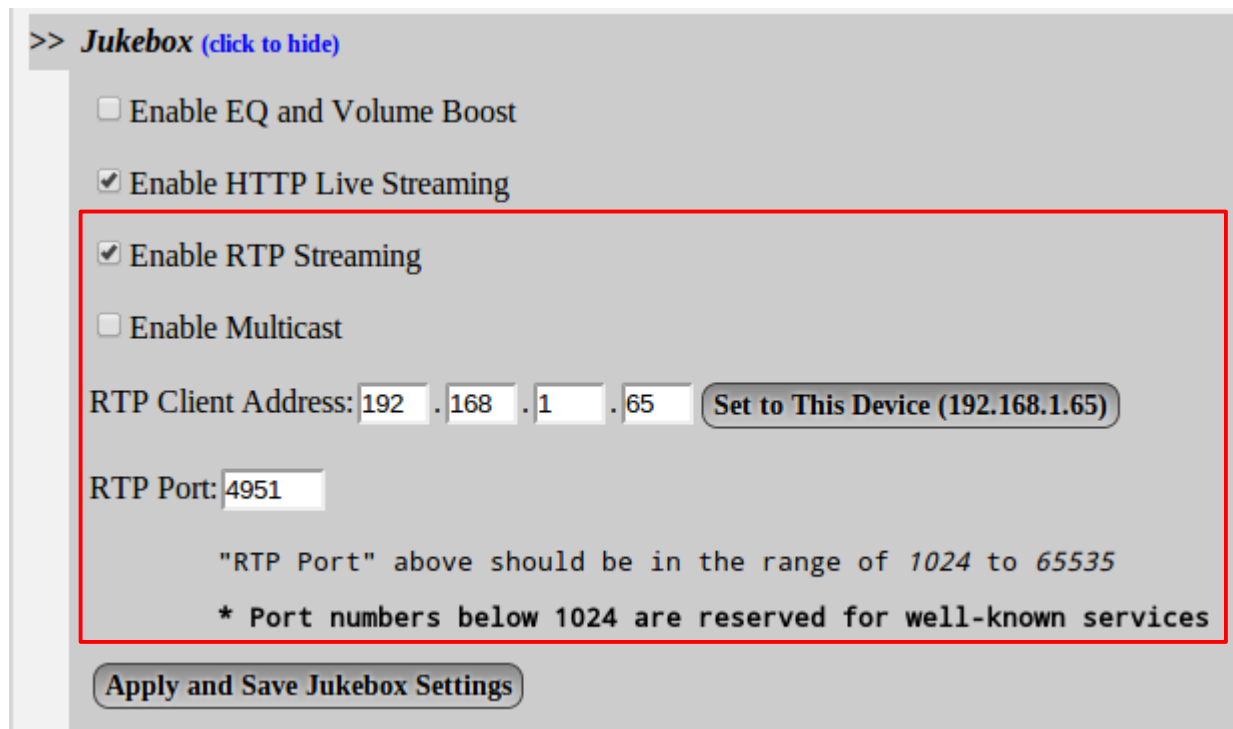
To listen to (that is, *to actually hear*) an HTTP Live Stream in your web browser, *be sure the audio Source is set to Jukebox.* Each web browser will need to have its own audio **Source** set to **Jukebox** in order to hear the **Jukebox** playing.

Also remember, whatever is playing on the **Jukebox** is also sent to the **Line Out** jack on FreedomStreamer. The **Line Out** jack can be connected to an audio amplifier (“Stereo System” or “Receiver”). In this way you can control the **Jukebox** with a web browser, and listen to it on Hi-Fi audio equipment.

RTP Streaming

The **Enable RTP Streaming** checkbox enables or disables RTP Streaming (be sure to click the **Apply and Save Jukebox Settings** button for changes to take effect).

When RTP Streaming is enabled, whatever is playing on the **Jukebox** can be listened to by an RTP client (like VLC[®], which runs on Windows[®], MacOS[®], Android[®], etc.) on your home network. By using broadcast or Multicast, multiple RTP clients on your home network can listen to the same stream simultaneously.

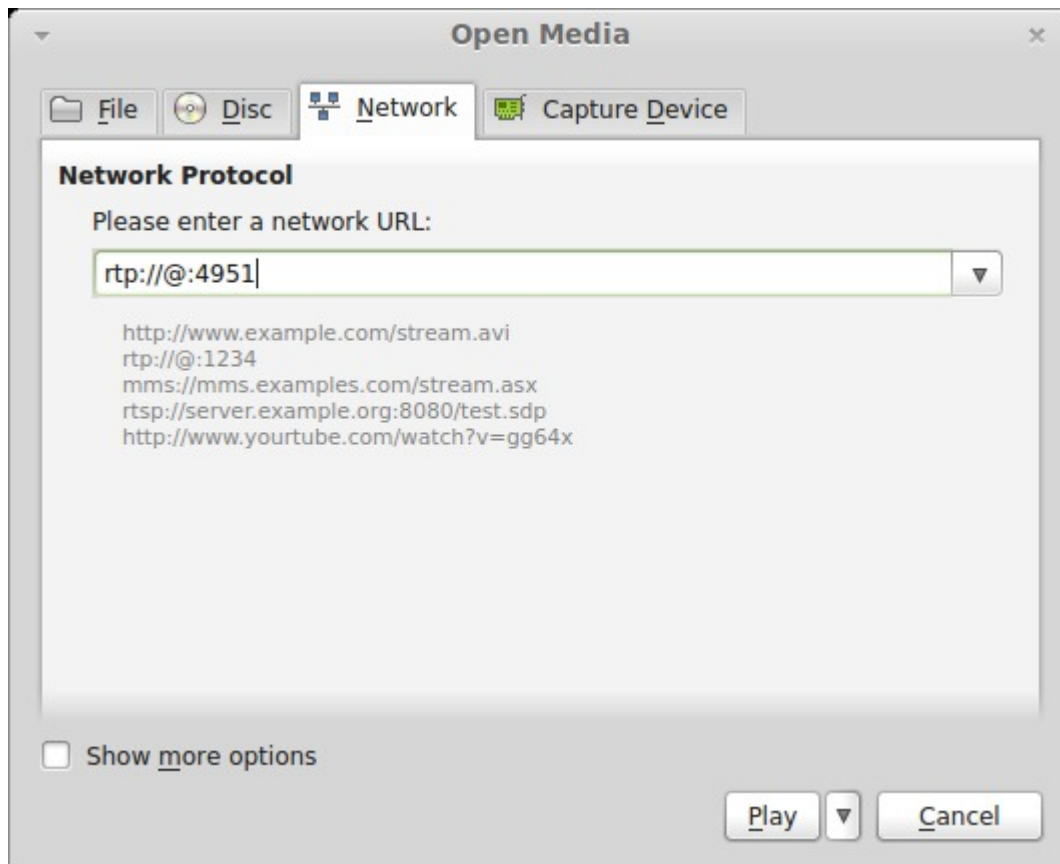


The screenshot shows a settings panel for a Jukebox. At the top, it says '>> Jukebox (click to hide)'. Below this are several checkboxes: 'Enable EQ and Volume Boost' (unchecked), 'Enable HTTP Live Streaming' (checked), 'Enable RTP Streaming' (checked), and 'Enable Multicast' (unchecked). The 'Enable RTP Streaming' checkbox is highlighted with a red border. Below the checkboxes are two input fields: 'RTP Client Address' with the value '192 . 168 . 1 . 65' and a button 'Set to This Device (192.168.1.65)', and 'RTP Port' with the value '4951'. Below these fields is a note: '"RTP Port" above should be in the range of 1024 to 65535' and '* Port numbers below 1024 are reserved for well-known services'. At the bottom of the panel is a button 'Apply and Save Jukebox Settings'.

To allow a single client to listen, enter the client's TCP/IP address in the **RTP Client Address** field (or use the convenient **Set to This Device** button to send the RTP stream to the device you are currently working with).

To allow multiple clients to listen, change the last number of the **RTP Client Address** field to 255 (for example, 192.168.1.255). 255 is the *Broadcast Address*.

In an RTP client like VLC[®], choose **Open Network Stream...** from the **Media** menu, then enter `rtp://@:` followed by the **RTP Port** you have configured (4951 is the default) – NOTE: *the following is a screen picture from VLC[®], not FreedomStreamer:*



When you click the **Play** button, you will begin to hear the streaming audio in a second or two on your RTP client (VLC[®], or a similar RTP Client App).

Enable Multicast is available for routers that support IGMP. Some older home routers have trouble with Multicast. If your router “locks up”, you’ll have to reboot it by removing and then re-applying power to it.

Using Broadcast as described above (using the .255 address) is an alternative, and might be more compatible (unless you have multiple sub-nets on your network, or are overly concerned about unnecessarily broadcasting through all your switches and hubs).

If you **Enable Multicast**, you *must* have a router that supports IGMP (look it up on wikipedia if curious, and check with your router's manufacturer) for Multicast to work properly.

If you are adventurous and feel like you just have to enable Multicast, you'll see the following warning:

For Multicast to work, "RTP Client Address" below should be in the following range:

`224.1.1.0 to 239.255.255.255`

*** Some routers do not handle Multicast robustly**

If you proceed with using Multicast, it is recommended you do some research (internet searching or reading) to learn more about it.

Start off by trying **RTP Client Address** `224.1.1.1`.

Using the Browser to Select Audio Files

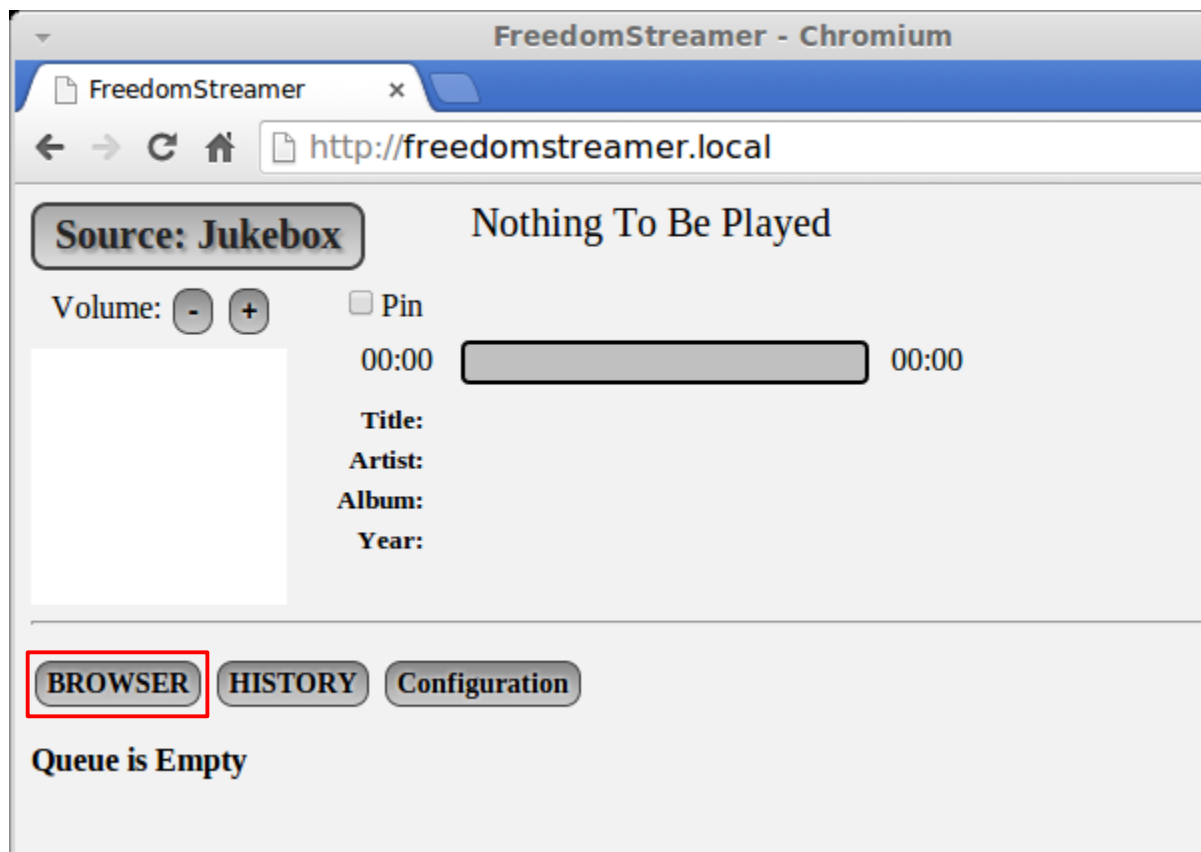
Before you can browse and select audio files to play in the **Jukebox**, they have to be accessible to FreedomStreamer in at least one of the following ways:

- 1) Windows[®] Shared Folders or Linux Samba Shares from other computers on your network – any Shares with “guest” access (typically no user ID or password) will be automatically discovered with no user interaction required. This is the simplest and quickest way to access audio files from all the devices on your home network.
- 2) MacOS[®] Shared Folders – See the section titled **MacOS File Sharing (AFP Hosts)** for more information. To summarize here: MacOS[®] Computers are automatically discovered, and you can connect to one or more MacOS[®] Shared Folders by entering the Shared Folder name, your MacOS[®] user ID, and your MacOS[®] password.
- 3) Other Shared Folders – See the section titled **Other File Sharing (GVFS Mounting)** for more information. To summarize here: password protected Windows[®] and Samba shares, FTP shares, and SSH (SFTP) shares are all supported.
- 4) FreedomStreamer has a single USB 3.0 port. You can plug in a USB hard disk drive (even a 2 TB drive, filled with tens of thousands of audio files) or a USB thumb drive. Or you can use a USB hub to connect multiple USB storage devices.
- 5) FreedomStreamer also has a single micro-SD port. So you can fill a micro-SD card with audio files and place the micro-SD card into the port.

Audio files can be in nearly any format. Following is an alphabetical list of all file extensions recognized by FreedomStreamer. If you feel something is missing, please contact Volutum LLC:

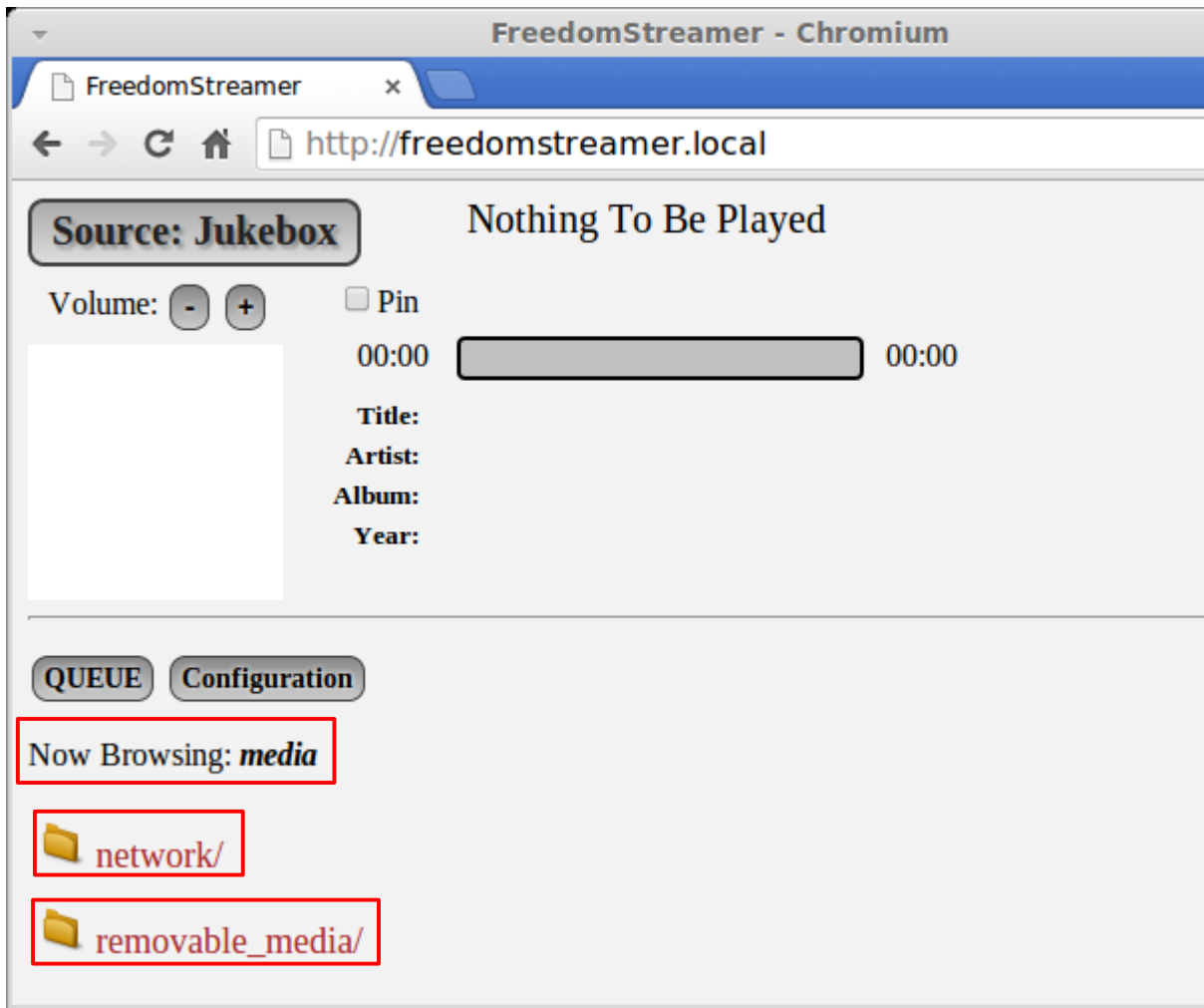
.3g2, .3ga, .3gp, .3gp2, .3gpp, .3p2, .a52, .aac, .ac3, .acp, .aif, .aiff, .aifr, .alaw, .ape, .asf, .avi, .cda, .cdda, .cdr, .divx, .dts, .dv, .dvx, .f4v, .fla, .flac, .flv, .h264, .mla, .m2a, .m2p, .m3a, .m4a, .mlv, .m2v, .m4v, .mjp, .mjpg, .mka, .mkv, .mov, .moov, .mpl, .mp2, .mp2v, .mp3, .mp4, .mpeg, .mpga, .mpg, .mpu, .mpv, .oga, .ogg, .ogm, .ogv, .ogx, .ps, .ra, .rm, .rv, .swf, .ts, .ulaw, .vob, .wav, .wv, .wave, .wma, .wmv

To browse for audio files to play in the Jukebox, click the **BROWSER** button:



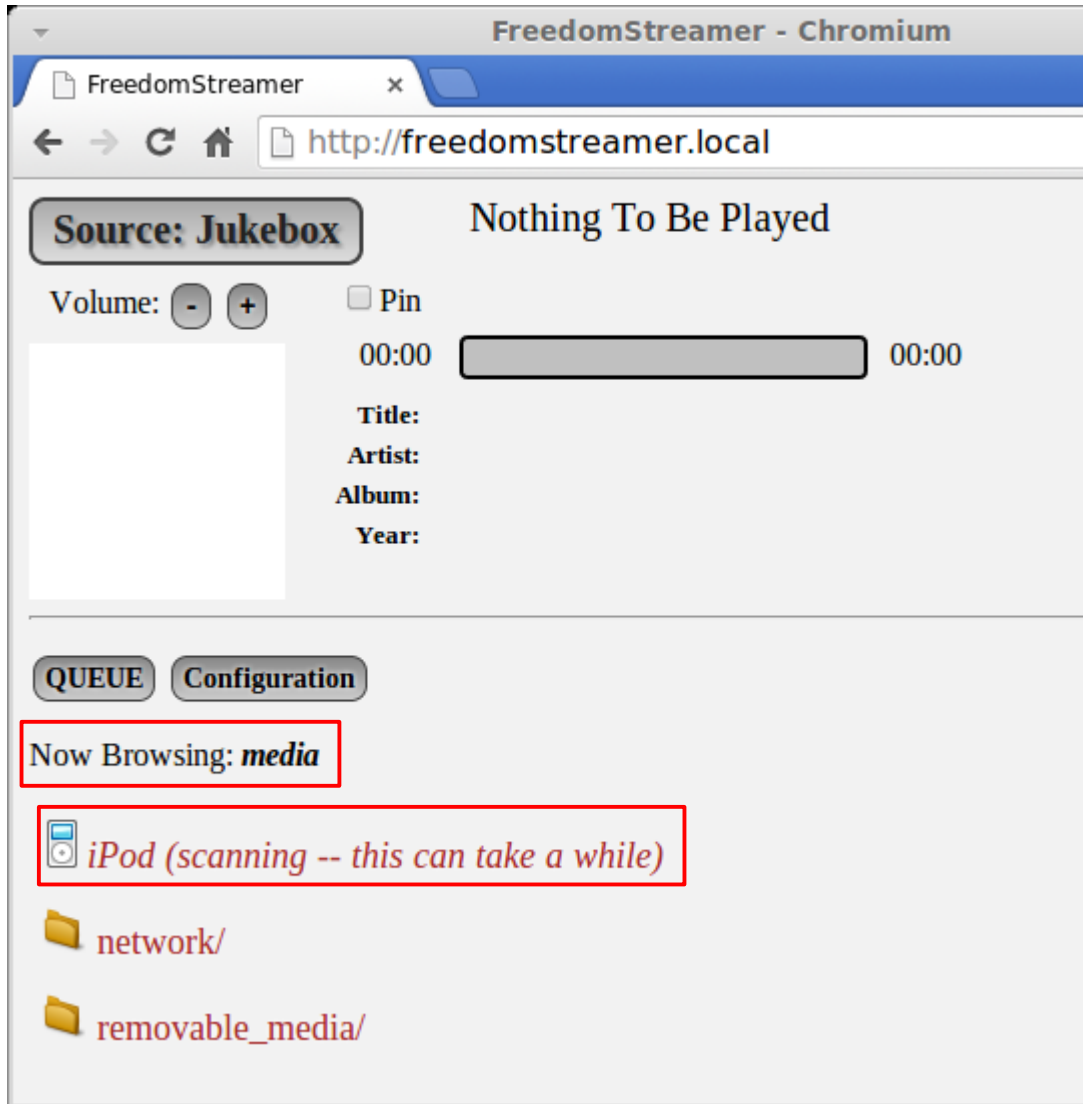
The **Jukebox** area at the top of the screen will remain visible, but the buttons below the horizontal line will change. You'll also see **Now Browsing: media**. Under that, you'll see the 2 main browsing areas: **network/**, and **removable_media/**. See the screen picture on the next page.

To browse shared folders from other computers on your home network, click the **network/** link. To view content from a USB device or the micro-SD card, click the **removable_media/** link. To return to the **Queue** and see any audio files that were added, click the **QUEUE** button.



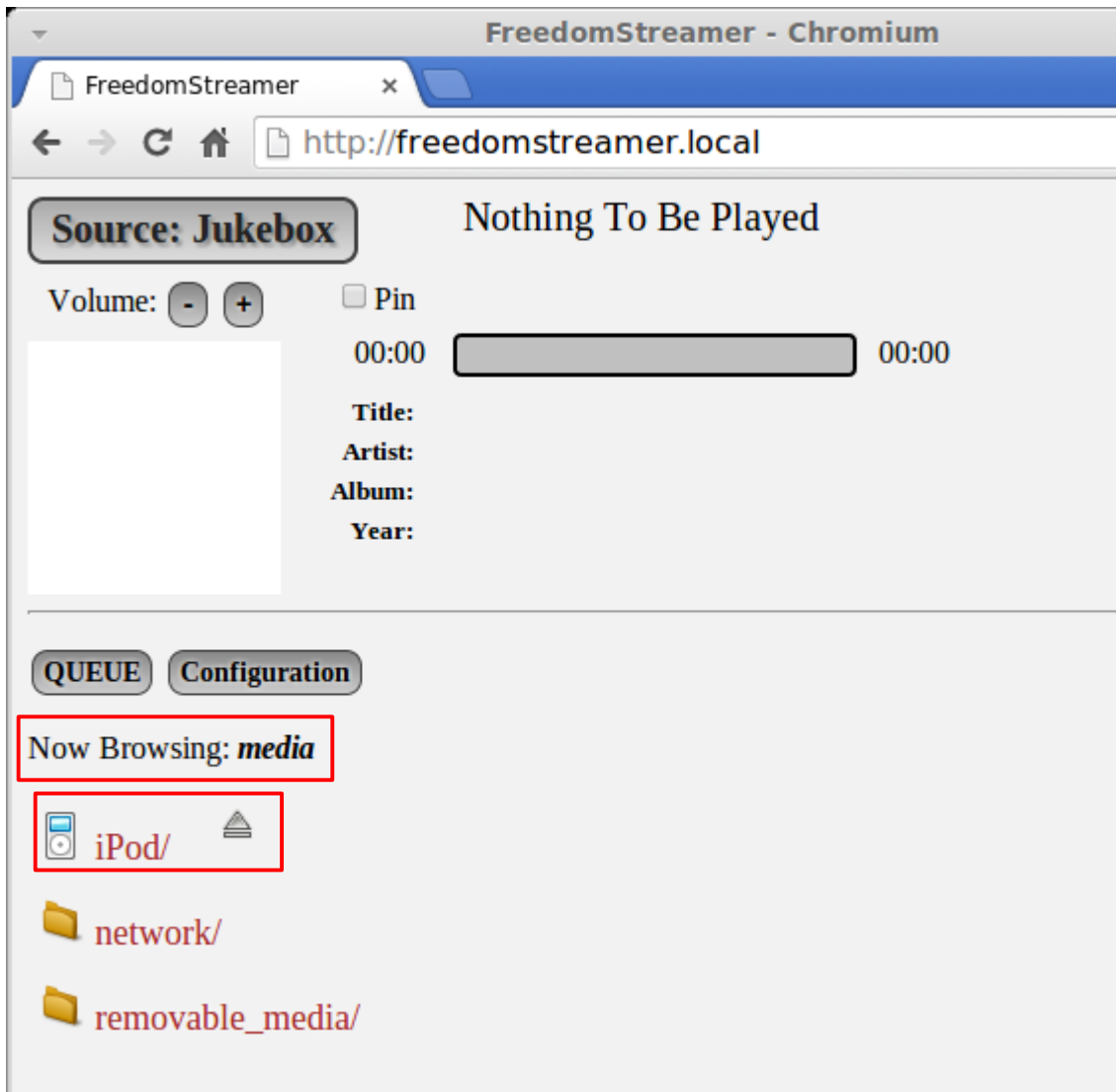
FreedomStreamer doesn't care or have any limitations on how you organize your audio files. You can have them organized by your mood, or alphabetically, or by year-of-release, or whatever makes you happy. Since you organize your own music, it makes it easy for you to find it with the **Browser**.

If you plug an iPod® into the USB port, FreedomStreamer will scan the iPod®:



Depending on the amount of storage on the iPod[®], scanning can take a significant amount of time. On a smaller iPod[®] of 4GB or 8 GB, maybe only 30 seconds or a minute, on a 160 GB iPod[®] filled with music, it can take several minutes.

When scanning is complete, it looks like the screen picture shown on the next page. The iPod[®] can be ejected by clicking on the arrow on the right:



To see the contents of an iPod®, or the contents of a folder, simply click on it.

When you find some audio files you want to listen to, you can click on the ones you want to add to the **Queue** to be played by the **Jukebox**. You can click the **Add All Visible Tracks** button to add everything you see in the order you see them. You can click the **Home** button to go “back to the beginning” (where you'll see **network/** and **removable_media/** again). You can click the **Up** button to go up one level. See the screen picture on the next page.

The **Now Browsing** header at the top shows you where you are in the hierarchy of folders you use to organize your audio files:

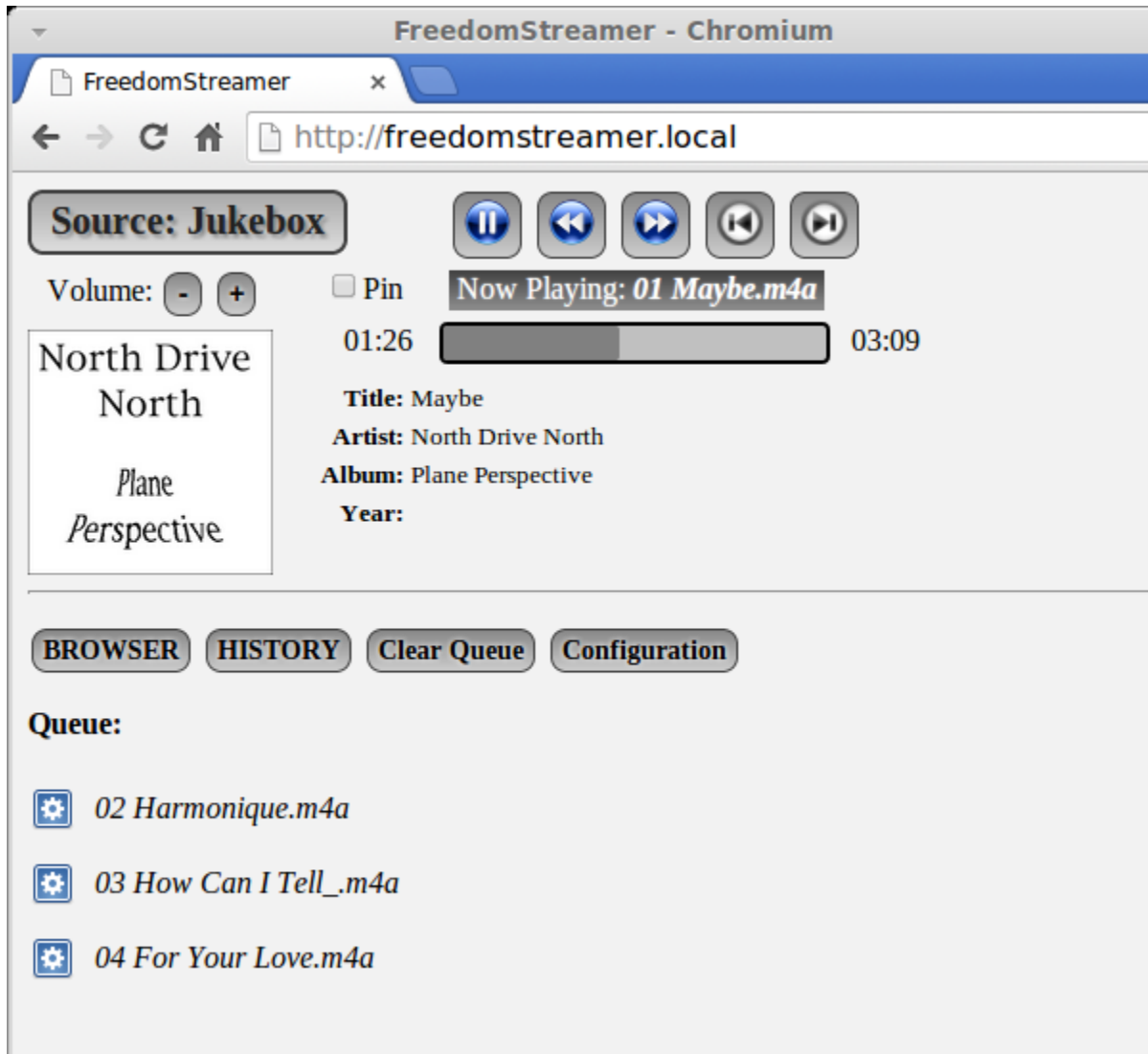


When you add the first audio file (by simply clicking on the filename), it will start playing immediately. When you add more audio files, they will be added to the **Queue**. When you are done adding audio files (you can always add more later...), you can click on the **QUEUE** button and see the list of audio files that will be played in the order you selected them. From the **Queue** screen (discussed in the next section directly below), you can re-arrange or delete items that are in the **Queue** to be played.

Whenever an audio file that is currently playing finishes, the next audio file in the **Queue** will begin playing automatically, until there are no more items left in the **Queue**. The **Queue** can store over 250 audio files.

Displaying and Managing the Queue

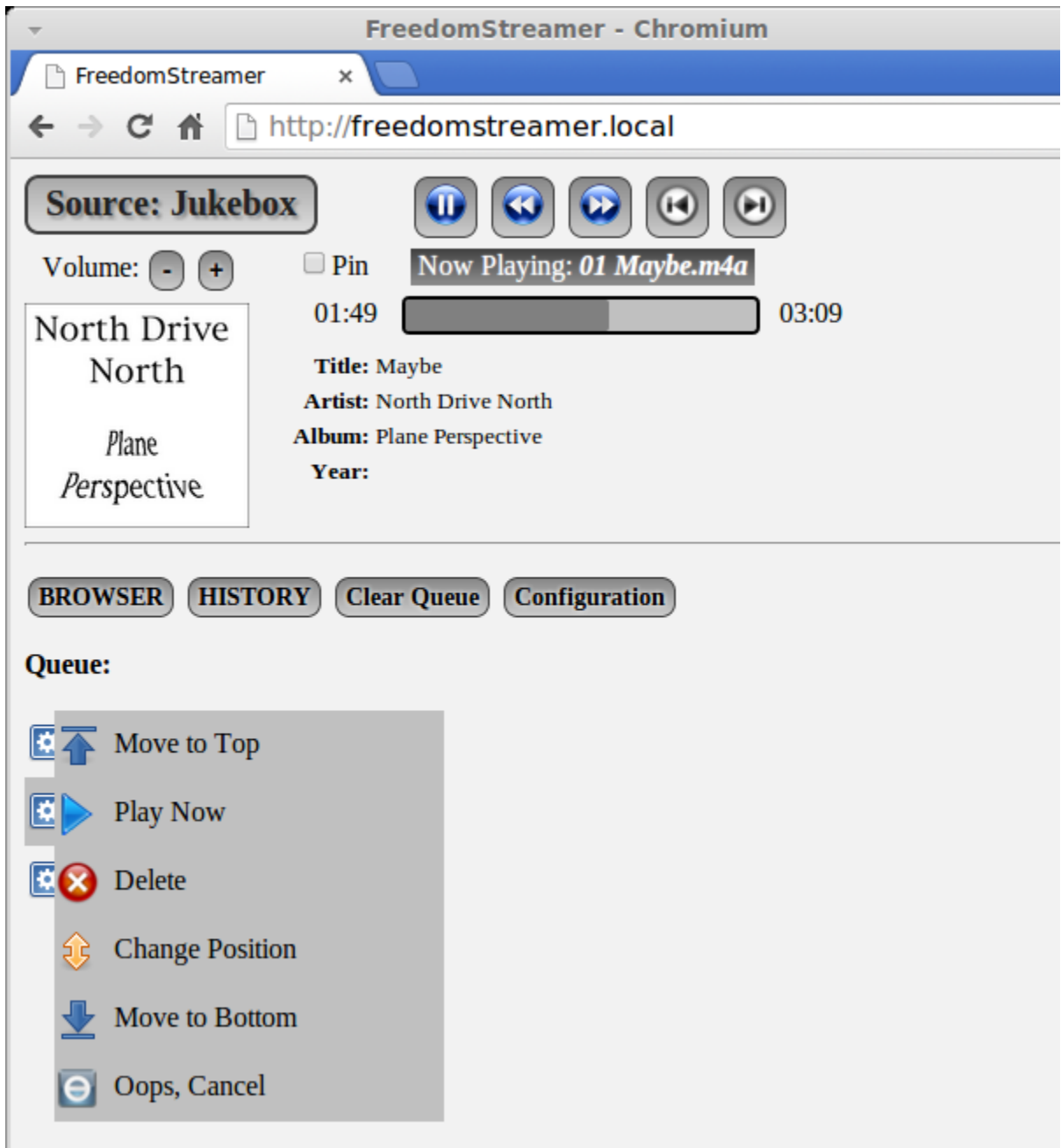
Once you have used the **Browser** to add some audio files to the **Queue**, you can see those audio files in the **Queue** (click on the **QUEUE** button to see the **Queue**, if it is not visible):



Above the **Queue**, you can see the **Now Playing:** filename in the **Jukebox**, as well as all of the **Jukebox** controls described earlier in this manual.

Note there is a **Clear Queue** button you can use to remove everything you see in the **Queue**.

For each audio file in the **Queue**, you can click on the blue “gear” icon to the left of it to manipulate that audio file in various ways. In the screen picture shown below, the second audio file in the **Queue** is the the audio file selected to be manipulated (the blue “gear” icon for the second audio file was clicked-upon):



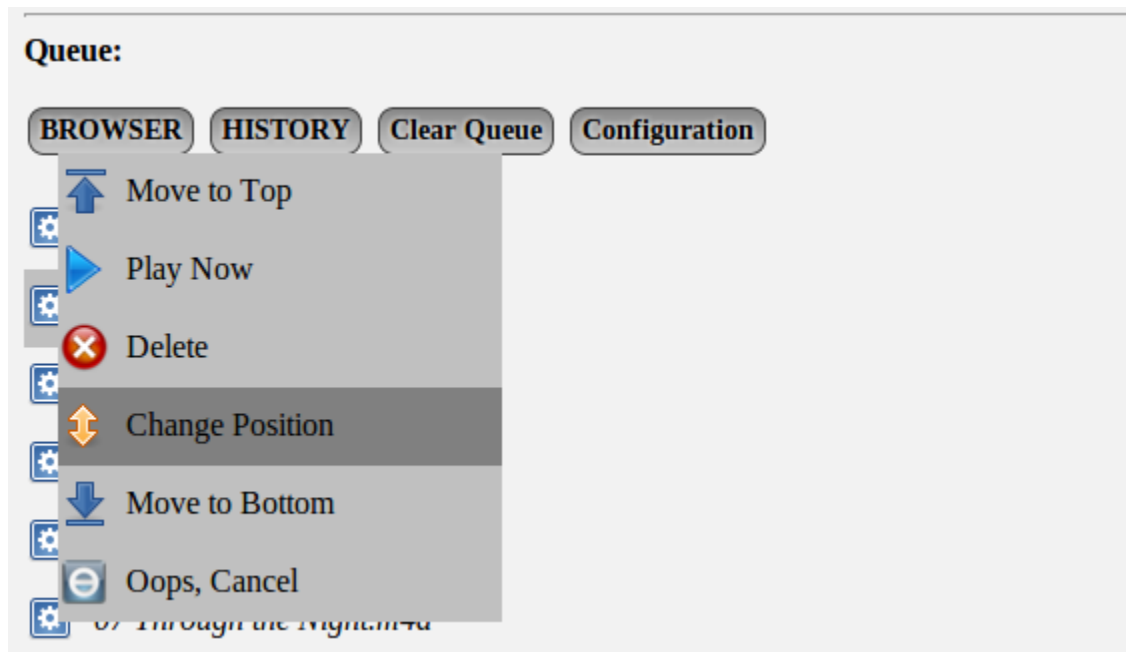
For the selected audio file, you can **Move to Top** or **Move to Bottom** of the **Queue**, **Play Now** or **Delete** the audio file from the **Queue**, or **Change Position** of the audio file in the **Queue**. If you accidentally click on the blue “gear” icon, or if you change you mind about manipulating the audio file you selected, then you can use **Oops, Cancel** to close the popup menu without taking any action or manipulating the audio file in any way.

The actions in the popup menu shown in the screen picture above are mostly self-explanatory. Just try them out to see what they do if it seems unclear – you can always return to the **Browser** by clicking the **BROWSER** button. From the **Browser**, you can add more tracks, or re-add the same tracks again.

Change Position is the one option that is a little different: it takes multiple steps.

Step 1: click the blue “gear” icon for the audio file you want to move. The popup menu will appear as discussed previously

Step 2: select **Change Position**, as shown in the screen picture below:

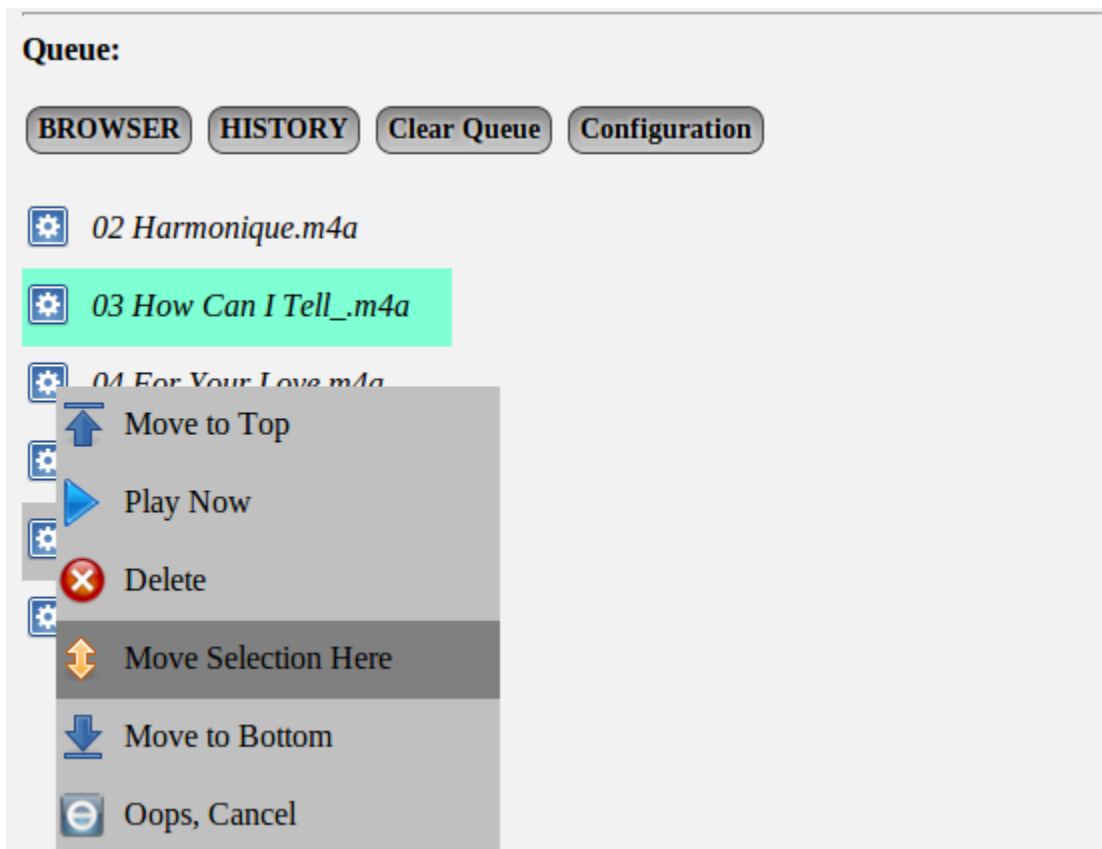


After you click **Change Position**, the audio file you selected to be moved will be highlighted in an aqua color. Now you can proceed to move that audio file (selected in aqua) to a different position in the **Queue**.

Step 3: click on the blue “gear” icon for the audio file *in the position of the Queue you want move the selected (aqua) audio file to*, and then select **Move Selection Here**.

If you change your mind and decide you don't want to change the audio file's position in the **Queue**, then you can once again click on the blue “gear” icon for the selected (aqua) audio file, and choose **Move Selection Here** (i.e., move it to the same place it is already in, which essentially results in canceling the operation).

The screen picture at the top of the following page shows what you would see if you want to move the audio file named “03 How Can I Tell_.m4a” downwards a few positions in the **Queue**. This shows what to do *after* the audio file you want to move has already been selected (the audio file to be moved is highlighted in an aqua color):



Displaying and Managing History

If you click on the **HISTORY** button, you can see another list – very similar to the **Queue** – of audio files that have already been played. You can use the blue “gear” icon in the **History** list, too. *This allows you to add audio files that have already been played back into the **Queue**.* You can also “Play Now” any **History** list audio file. But you can't delete or move **History** list audio files (after all, *they are history*, and “you can't change history”).

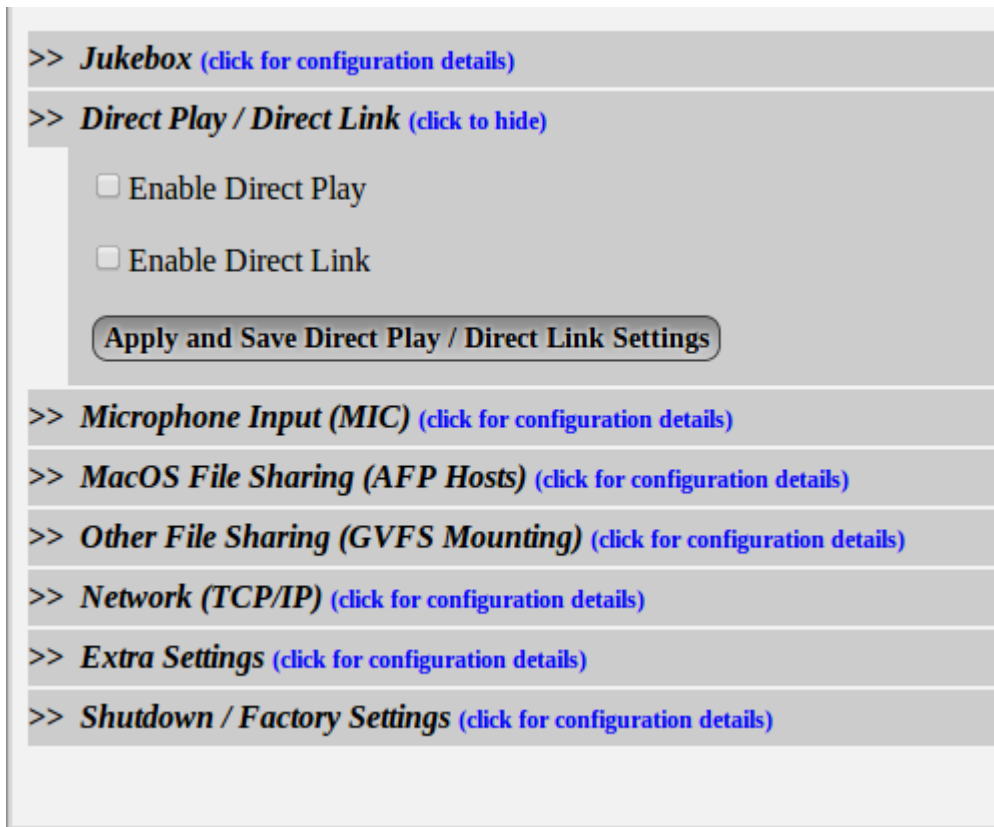
The **Queue** and **History** list together can remember and hold a *combined total* of just over 250 audio files. If the **History** list gets full and then you add more items to the **Queue**, the oldest items will be lost from the **History** list. Even if the **History** list is not full, if you fill up the **Queue**, there will be no room in the **History** list to remember any previously played audio files.

Similarly, if you try to select more audio files in the **Browser** when the **Queue** is full, those audio files will not be added to the **Queue**.

In general, 250 audio files is typically well over 8 hours of music, but your mileage may vary.

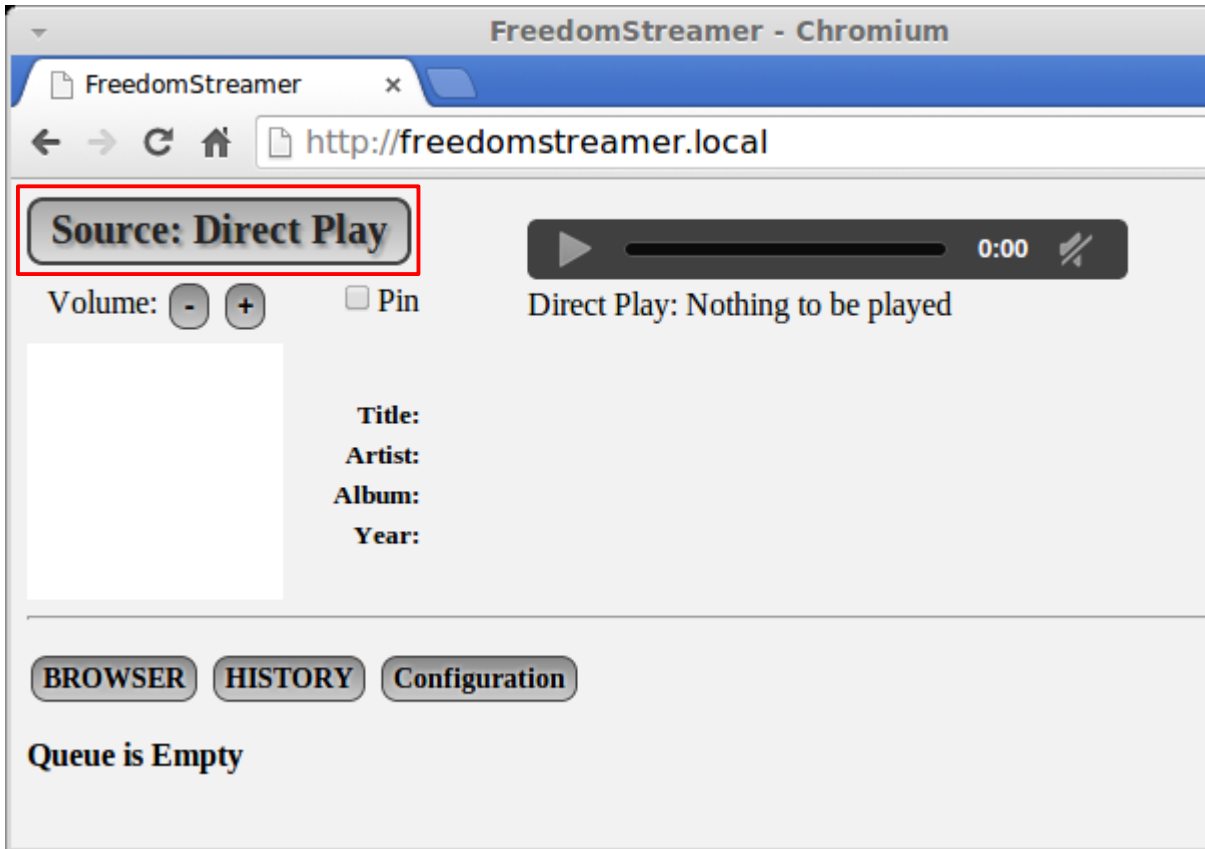
Direct Play and Direct Link

From the Configuration screen, **Direct Play** and/or **Direct Link** can be enabled or disabled:



Changes take effect when the **Apply and Save Direct Play / Direct Link Settings** button is clicked.

When **Direct Play** is enabled, the **Jukebox** looks like the screen picture shown below:



Additionally, audio files in the **Browser** have an extra button: **Direct Play**. Clicking on the **Direct Play** button causes the audio file to be copied in memory, and converted to a WAV file (which nearly any web browser can play), see the screen picture on the next page:

FreedomStreamer - Chromium

FreedomStreamer

[←](#) [→](#) [↻](#) [🏠](#)

Source: Direct Play

Volume: Pin

Converting for Direct Play: 02 Harmonique.m4a

North Drive
North

Plane
Perspective

Title: Maybe
Artist: North Drive North
Album: Plane Perspective
Year: 1999

[QUEUE](#) [Home](#) [Up](#) [Add All Visible Tracks](#) [Configuration](#)

Now Browsing: *media/network/Music on Kellys Mac mini from AFP/iTunes/iTunes Music/North Drive North/Plane Perspective*

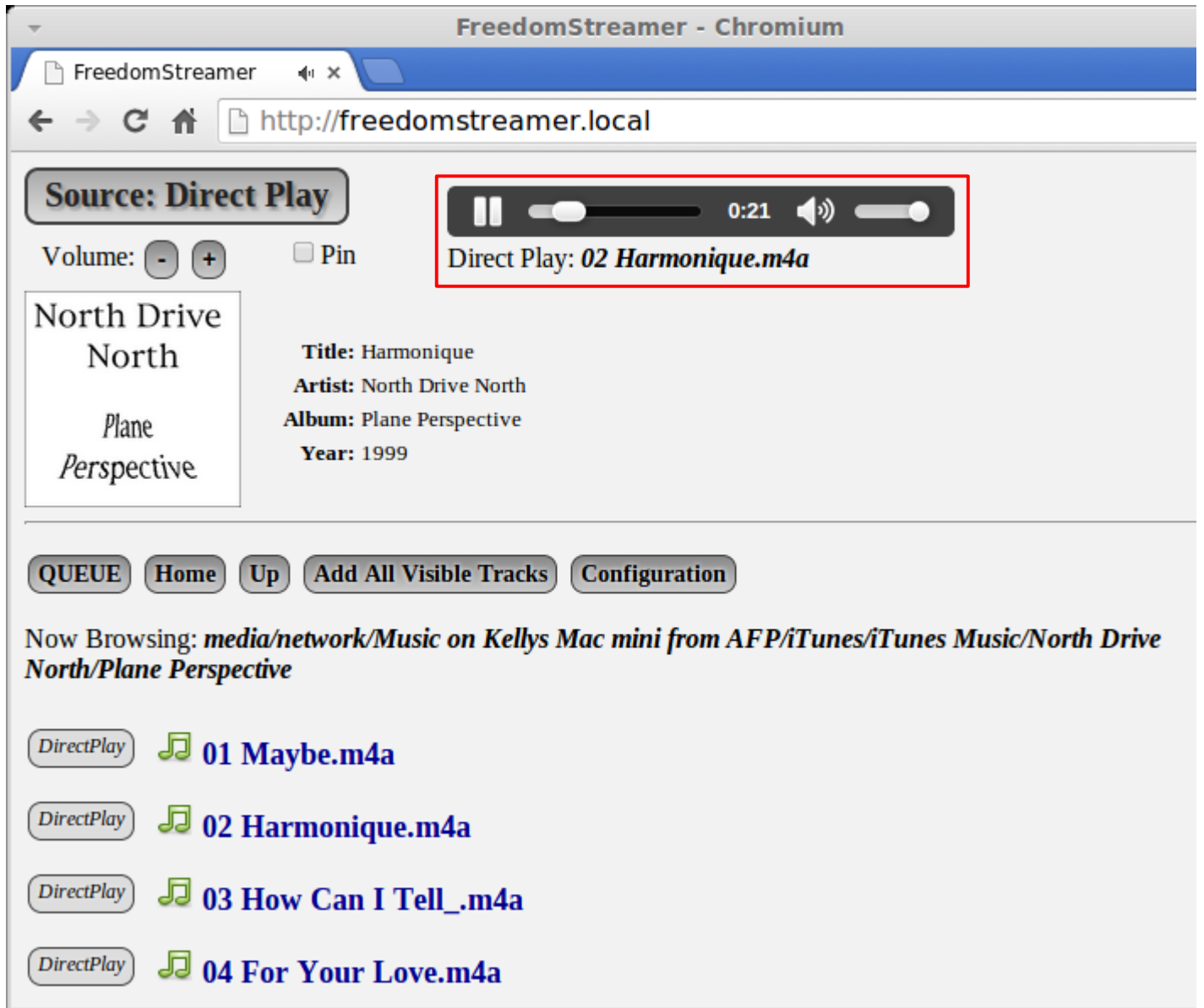
[DirectPlay](#) **01 Maybe.m4a**

[DirectPlay](#) **02 Harmonique.m4a**

[DirectPlay](#) **03 How Can I Tell_.m4a**

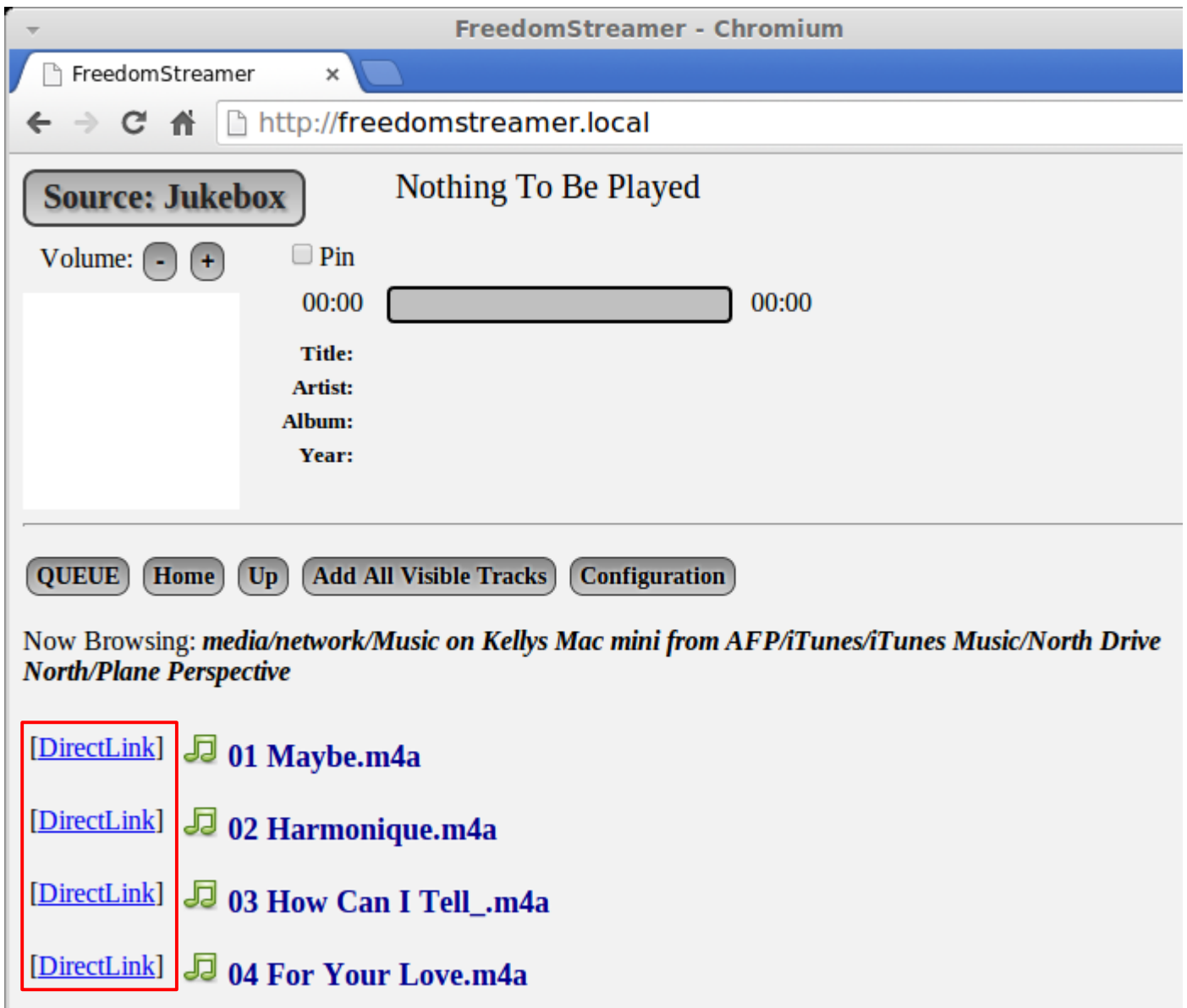
[DirectPlay](#) **04 For Your Love.m4a**

After conversion, the converted WAV file automatically begins to play (so it might be best to pause the **Jukebox** if it is currently playing something). The audio from **Direct Play** can be controlled with the **Direct Play** HTML5 audio control:



When **Direct Link** is enabled, audio files in the **Browser** have an extra link: [**Direct Link**]. Clicking on the [**Direct Link**] causes the web browser to directly open the file. Depending on the web browser, it may play the file directly, play the file with a plug-in, or prompt you to save or download the file.

In most browsers, right-clicking on the link allows you to download the file (make a copy of the file at a location of your choosing):



When **Direct Link** is enabled, non-audio files are also displayed in the **Browser**. This allows opening and/or downloading .jpg, .png, .gif, .pdf, .doc, and any other files of any type that are available. FreedomStreamer does not play or stream these non-audio files in any way – your web browser does it all via the **Direct Link** Feature. FreedomStreamer only provides the **Browser** with the **Direct Links**.

Clicking on a [**Direct Link**] usually causes your web browser to open a new web page, and try to play the audio file directly with no conversion. Remember, you can always right-click on any [**Direct Link**] to download the file to a location of your choice.

Not all **Direct Link** audio files can be played by all web browsers. It depends on the web browser, the plug-ins that are installed, and the audio codecs that are supported.

Using the *Microphone Input*

To use the **Microphone Input**, first plug an analog audio source into the Mic input of FreedomStreamer (check the bottom of the case, it is labeled **Mic**). This can be a microphone (you might need a pre-amplifier), or the headphone output of your stereo or iPod[®], for example.

Be sure **HTTP Live Streaming** and/or **RTP Streaming** is enabled in the **Microphone** section of the **Configuration** screen, depending on how and where you want to stream the **Microphone Input**.

If you use the headphone output of some other device, or if you use a pre-amplifier, you will probably have to adjust the headphone or pre-amplifier volume. If you do adjust the volume, **remember there is a 5 second delay (for HTTP Live Streaming) or a 2 second delay (for RTP Streaming)**. Adjust the volume slowly, and be patient. Once you get the headphone or preamplifier volume set, you might want to make a note of it so you can remember to set it the same way the next time you use the **Microphone Input**.

For HTTP Live Streaming in a web browser, just click on the **Source** button until you see **Source: Microphone**. The **Jukebox** will stop playing, and the **Microphone Input** will be audible instead. You can switch back to **Source: Jukebox** (or **Source: None**) by clicking the **Source** button one or more times.

For **RTP Streaming**, See the **Jukebox Overview** documentation labeled **RTP Streaming** (in a previous section of this manual) for details on how to get started. The same advice, instructions, and techniques apply to the **Microphone Input** and the **Jukebox**.

If you use RTP Streaming on both the **Jukebox** and the **Microphone Input**, *be sure to assign different RTP port numbers to each stream*.

MacOS® File Sharing (AFP Hosts)

See the **MacOS® File Sharing (AFP Hosts)** section in the **Configuration** screen:

>> **Jukebox** (click for configuration details)

>> **Direct Play / Direct Link** (click for configuration details)

>> **Microphone Input (MIC)** (click for configuration details)

>> **MacOS File Sharing (AFP Hosts)** (click to hide)

Re-Scan Network

Kellys Mac mini (192.168.1.101)

Share Name:

User Name:

Password:

Connect Remember

BONADUCE (192.168.1.84)

Share Name:

User Name:

Password:

Connect Remember

No Remembered Connections

>> **Other File Sharing (GVFS Mounting)** (click for configuration details)

>> **Network (TCP/IP)** (click for configuration details)

>> **Extra Settings** (click for configuration details)

>> **Shutdown / Factory Settings** (click for configuration details)

In the screen picture example shown above, there are two (2) servers that support MacOS® File Sharing: (1) *Kellys Mac mini*, and (2) *BONADUCE*.

Click the **Re-Scan Network** button if a server was recently powered on and does not appear. After the server is fully powered-on and file sharing has successfully started, clicking the **Re-Scan Network** button should cause it to appear.

Clicking the **Re-Scan Network** button also automatically mounts **Remembered** connections.

For each server, you can fill in the **Share Name**, and a **User Name** and **Password**. Click the **Connect** button to connect to the server *this time only*. Click the **Remember** button to *always try to connect to the server*.

Servers that have been **Remembered** are displayed at the bottom (see the screen picture above – *Music on Kellys Mac mini* has been **Remembered** in this example). Click the **Forget** button to stop always connecting to the server. At any time later, you can **Connect** to it again, or you can **Remember** it again at a later time if you wish to *always try to connect to the server*.

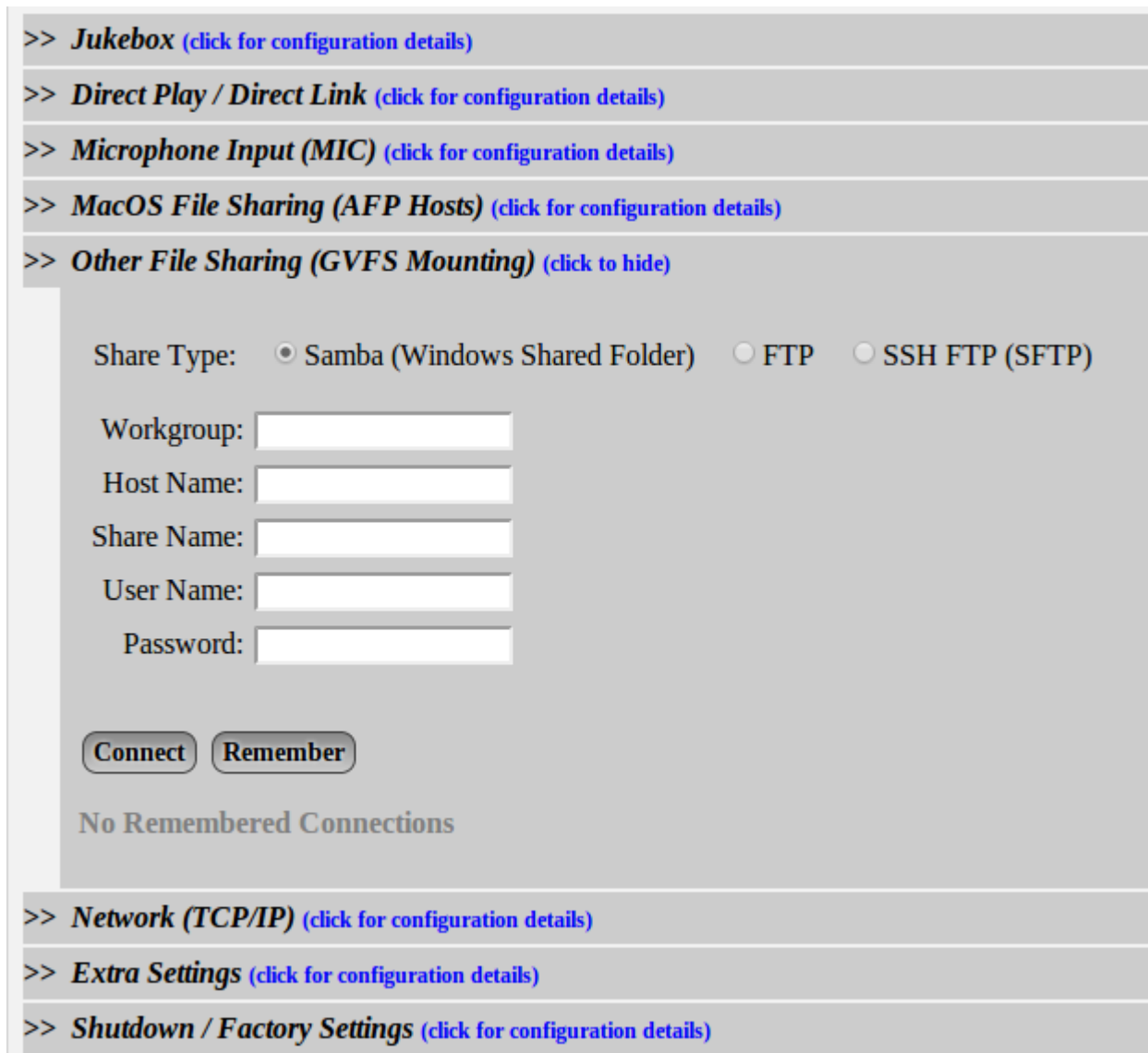
To get the **Share Name**, check the File Sharing Control Panel (in System Preferences) on the MacOS® computer. The **User Name** and **Password** are also set up and maintained on the MacOS® computer.

To share an iTunes® Library music with FreedomStreamer, use the File Sharing Control Panel (in System Preferences) on the MacOS® computer, and set the **Music** folder on the Macintosh® computer (in your home folder) to be a shared folder. The **Music** folder in your home folder on the Macintosh® computer is generally where iTunes® stores its music libraries.

NOTE: FreedomStreamer cannot play AAC protected content (DRM protected .m4p files), but those haven't been sold at the iTunes® store for many years now. Still, if you have some of those older encrypted files, they won't even show up in the **Browser** in FreedomStreamer.

Other File Sharing (GVFS Mounting)

See the **Other File Sharing (GVFS Mounting)** section in the **Configuration** screen:



>> **Jukebox** (click for configuration details)

>> **Direct Play / Direct Link** (click for configuration details)

>> **Microphone Input (MIC)** (click for configuration details)

>> **MacOS File Sharing (AFP Hosts)** (click for configuration details)

>> **Other File Sharing (GVFS Mounting)** (click to hide)

Share Type: Samba (Windows Shared Folder) FTP SSH FTP (SFTP)

Workgroup:

Host Name:

Share Name:

User Name:

Password:

No Remembered Connections

>> **Network (TCP/IP)** (click for configuration details)

>> **Extra Settings** (click for configuration details)

>> **Shutdown / Factory Settings** (click for configuration details)

In screen picture shown above, you can connect to a Samba or Windows Shared Folder. If the shared folder has guest access, the shared folder is automatically mounted, and there is no reason to use **Other File Sharing**. However, if the shared folder needs a password, you can specify it here. **Workgroup** is optional, and usually may be left blank.

For **FTP** and **SSH FTP (SFTP)** File Sharing, there is no Workgroup, but instead there is an optional **Port** entry. The **Port** entry may generally be left blank if using the default ports for FTP or SFTP. The **Share Name** entry can usually be left blank as well:

>> **Jukebox** ([click for configuration details](#))

>> **Direct Play / Direct Link** ([click for configuration details](#))

>> **Microphone Input (MIC)** ([click for configuration details](#))

>> **MacOS File Sharing (AFP Hosts)** ([click for configuration details](#))

>> **Other File Sharing (GVFS Mounting)** ([click to hide](#))

Share Type: Samba (Windows Shared Folder) FTP SSH FTP (SFTP)

Host Name:

Share Name:

User Name:

Password:

Port Number:

No Remembered Connections

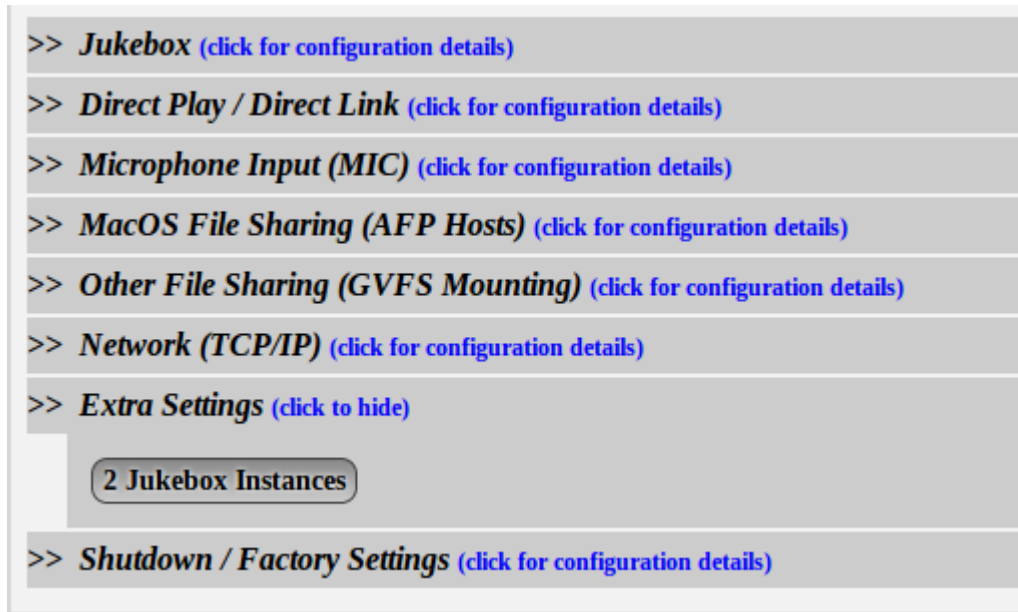
>> **Network (TCP/IP)** ([click for configuration details](#))

>> **Extra Settings** ([click for configuration details](#))

>> **Shutdown / Factory Settings** ([click for configuration details](#))

Extra Settings – Two Independent Jukeboxes

See the **Extra Settings** section in the **Configuration** screen:



With **Factory Settings**, FreedomStreamer supports a single **Jukebox**. It is possible to use two independent **Jukeboxes**, but this results in slower performance (browsing is slower, retrieving album art is slower, etc.). Using both **Jukeboxes** with **HTTP Live Streaming** and **RTP Streaming** while also using the **Equalizer** on both, and also using the **Microphone** input with **HTTP Live Streaming** and **RTP Streaming** at the same time, and using Direct Play and Direct Link playback all simultaneously could possibly result in audio glitches. If this happens, disable the features that are really not needed.

Click on the **2 Jukebox Instances** button to switch to two independent **Jukeboxes**. You'll be prompted to confirm and reboot. After reboot, you can select between the 2 Jukeboxes from the configuration screen, or you can switch back to a single **Jukebox**. This is shown in the screen picture on the following page:



After clicking on **Switch to Jukebox #2**, your browser will be connected to the second **Jukebox**, independent from **Jukebox #1**. From **Jukebox #2**, not all of the Configuration screen options are available – **Jukebox #1** is the “Master”. See the screen picture on the next page:

Source: None

Show Controls Pin

BROWSER **QUEUE**

Configuration:

[User's Guide](#)

[Switch to Master](#)

>> **Jukebox** [\(click for configuration details\)](#)

>> **Direct Play / Direct Link** [\(click for configuration details\)](#)

>> **Shutdown / Factory Settings** [\(click to hide\)](#)

Restart Server Software

Firmware Upgrade

Upgrading (or downgrading) the firmware is a simple process:

- 1) Download the desired firmware version from <http://freedomstreamer.com> – Click on the **Downloads** link, select **Firmware**, and select the desired firmware version to download
- 2) Copy the downloaded `fsupdate.tgz` file onto a USB device, or a micro-SD card (copy it to the “top” or “root” or “base” directory or folder of the USB device or micro-SD card – *don't put the file inside of any other folder or FreedomStreamer won't be able to find it*)
- 3) Insert the USB device or micro-SD card into FreedomStreamer
- 4) Using a web browser, go to the **Configuration** screen for FreedomStreamer, scroll to the bottom, and click the **Reboot** button
- 5) After 60 to 90 seconds, re-load the FreedomStreamer page in a web browser, and the new version should be available to use
- 6) Remove the USB device or micro-SD card, and be sure to delete the `fsupdate.tgz` file from it - - *if this file is not removed, FreedomStreamer will re-install the firmware each time it re-boots with the USB device or micro-SD card inserted*
- 7) **Reboot** one more time from the **Configuration** screen (see step 4 above), this allows the newest version of the bootloader and the debugging logger to run as well
- 8) After 60 to 90 seconds, re-load the FreedomStreamer page in a web browser, and optionally verify the new firmware version by visiting <http://freedomstreamer.local/log.txt>

IMPORTANT NOTE: *It is VERY IMPORTANT not to remove power during the firmware upgrade process!* If that happens, see the **Troubleshooting Guide** in the next section of this manual for assistance.

Troubleshooting Guide

Warranty and Technical Support

Hardware Warranty

1. FreedomStreamer's hardware components (Wandboard[®], Antenna Assembly, and Power Supply) are warranted by Volutum LLC for 90 days after delivery under normal usage. Misuse of FreedomStreamer in any way voids this warranty.
2. If the customer wishes to execute the warranty described in (1) above, the Customer must email service@freedomstreamer.com for a Return Material Authorization (RMA).
3. Once an RMA is obtained, the customer must return the defective components to Volutum LLC at customer's expense (for example, UPS[®], FedEx[®], USPS or similar shipping costs).
4. When Volutum LLC receives the defective components, Volutum LLC will send replacement components to the customer at Volutum LLC's expense. Replacement components are warranted for 90 days after delivery under normal usage. Misuse of replacement components in any way voids this warranty.

Software License Agreement

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3. Licensee will not distribute copies of the Software or allow copies of the Software to be made by others. Licensee may make copies of the Software for backup purposes only.
4. The Software is subject to a limited warranty. Licensor warrants to Licensee that the physical medium on which this Software is distributed is free from defects in materials and workmanship under normal use. This limited warranty lasts for a period of 90 days after delivery. To the extent permitted by law, THE ABOVE-STATED LIMITED WARRANTY REPLACES ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND LICENSOR DISCLAIMS ALL IMPLIED WARRANTIES INCLUDING ANY IMPLIED WARRANTY OF TITLE, MERCHANTABILITY, NONINFRINGEMENT, OR OF FITNESS FOR A PARTICULAR PURPOSE. No agent of Licensor is authorized to make any other warranties or to modify this limited warranty. Any action for breach of this limited warranty must be commenced within one year of the expiration of the warranty. Because some jurisdictions do not allow any limit on

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Technical Support

Send email to support@freedomstreamer.com for technical support questions.

About The Technology

The hardware is an unmodified Wandboard[®], see <http://wandboard.org>.

The base software image is from the same website. See the **Software License Information** section for more details of what was added over and above the base software image.

The full technology stack is C + Websockets + HTML5/javascript.

There are three (3) C programs: `Governor` acts as a “bootloader”, allowing firmware updates (only runs a script, does not update the entire image). `FilteredLogger` logs to `/var/www/log.txt`. `Jukebox` is where all the FreedomStreamer work is done.

`Jukebox` sends Websocket messages to the javascript (see `/var/www/index.js` and see `/var/www/index.html` for the HTML). `Jukebox` dynamically generates all of the HTML for the Browser, Queue, and History lists (and sends many other “fill-in-the-blanks” data messages, and many other control messages as well). `Jukebox` receives information from `/var/www/index.js` in response to user actions and events.

`Jukebox` uses GStreamer pipelines to stream audio.

The front end decodes audio from the Queue using `decodebin`. EQ and Volume Boost are optionally applied. Ultimately the audio is re-sampled to 16-bit, 44.1kHz stereo and sent to the back end. The back end takes the normalized audio and encodes it (using the iMX.6 hardware encoder in the Wandboard[®]) as MP3, then packs it up as an MPEG transport stream. From here, the MPEGTS is piped to an HTTP Live Streaming “segmenter”, and/or packaged as an RTP payload to be streamed over UDP, depending on the settings.

The 90 kHz MPEGTS pts/dts timestamps overflow after about 26 hours, so some consideration had to be given to recovering from that. If streaming is constant, then after about 26 hours it resets. Users have to press the “Listen” button again in their HLS browsers if this happens while they are connected and listening. RTP streaming only experiences a 2-second audio drop out – it is almost not even noticeable. In the more likely case, when nothing is streaming and no users are connected, the reset happens every 4 hours (in anticipation of someone connecting soon, and maybe for a very long time).

HTML display text, HTML direct links, HTML href's, javascript parameters in HTML, commands sent using the `system()` call, and avahi's server names (used for MacOS file sharing) are all escaped differently and require unique treatment.

Hacking FreedomStreamer

Since FreedomStreamer is a linux computer, you can generally do anything with it you can do with a linux computer. See <http://wandboard.org> for all kinds of ideas. The username and password are unchanged from the defaults: `linaro` / `linaro`. It is basically a distribution of Ubuntu[®], which is a pretty easy to use linux.

Startup:

When FreedomStreamer boots up, it runs `/var/www/start.sh`.

You can modify this script to do additional things at startup. Just add your modifications, and *don't change the existing commands unless you are really sure you know what you are doing!*

The last line:

```
(/var/www/Governor 2>&1) | /var/www/FilteredLogger &
```

is what actually “starts up” the Jukebox and Microphone streaming. The lines before that backup previous log files, adjust the priority of the sd card daemon, turn off virtual memory and create a folder in `/tmp` (i.e., in RAM) for HLS segments to be placed.

For example, if you have other file servers with audio files on them that FreedomStreamer doesn't automatically recognize (that is, if you have servers that *don't use guest-access Samba or AFP/MacOS File Sharing*), you can probably get them to mount by adding the appropriate commands to `start.sh` just before the last line.

You can even have `start.sh` call your own script that you maintain in some other directory.

Networking:

Networking uses the standard debian `/etc/network/interfaces` file. Networking as delivered from the factory does *not* use the Ubuntu[®] NetworkManager or wicd.

Turn off Wifi with: `sudo ifdown wlan0`

Turn on Wifi with: `sudo ifup wlan0`

Turn off wired ethernet with: `sudo ifdown eth0`

Turn on wired ethernet with: `sudo ifup eth0`

`/etc/hosts` and `/etc/hostname` are written to when Network Settings on the Configuration

screen are updated. The name in `/etc/hostname` is typically `freedomstreamer.local`, but can be changed, and `avahi` will override this automatically by appending a `.2` or `.3` (etc., etc.) if there are multiple hosts with the same name.

Performance decisions:

- 1) virtual memory has been turned off (see the first line of `start.sh`, shown above)
- 2) `aptdaemon` was removed (with `sudo apt-get remove aptdaemon`)
- 3) Some daily and weekly cron jobs were disabled in `/etc/`
- 4) power management on the WiFi driver was disabled – see `/etc/pm/power.d/wireless` if you feel you must turn it back on (or if you find a USB WiFi device that you think may behave better in the face of WiFi power management).
- 5) There are no CSS files, but there are CSS style directives in the HTML

HTML and Javascript:

See `/var/www/index.html` and `/var/www/index.js`.

The HTML for the Browser, Queue, and History are all dynamically generated by the C code in the `Jukebox` binary, and sent to the Javascript world with WebSockets, there is not much you can change about it. The Javascript file is documented with some detail of the WebSocket messages.

All of the icon images are in `/var/www/`, change them if you like, but they have to fit into a 32x32 pixel table data area.

Some interesting system information (output from `top`, `df`, `avahi`, `dmesg`, `free -m`, `mount`, `ifconfig`, and `iwconfig`) is available at `http://freedomstreamer.local/segments/`. The output from `ifconfig`, and `iwconfig` are only produced once at startup. The `avahi` output is produced at startup, and also whenever the Re-Scan Network button is pressed. The rest are updated periodically – generally at least once every minute or so.

If you reload `http://freedomstreamer.local/segments/` you should see the segment numbers increasing every second on `MICpart-XXXXX.ts` and `QUEUEpart-XXXXX.ts` files.

Appendices

Appendix I: Determining Static TCP/IP Address Settings

Step 1: Determine Your Home Network's *Gateway* and *Netmask*

This information will be needed in Step 4, so write it down. The procedure to determine this information is different depending on if you use Windows® vs. MacOS® or Linux:

- If you have a Windows® computer connected to your home network, open a command prompt and type `ipconfig`. You'll see your own computer's IP Address, Subnet Mask, and Default Gateway. **Make a note of the Subnet Mask and Default Gateway values, you'll need them later.**

```
C:\> ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection:

IP Address. . . . . 192.168.1.100
Subnet Mask. . . . . 255.255.255.0
Default Gateway. . . . . 192.168.1.1

C:\>
```

- If you have a MacOS® or a Linux computer connected to your home network, open a terminal window and type `ifconfig`. You'll see your own computer's `inet addr` and (subnet) Mask. Next, type `route`. You'll see the default Gateway. **Make a note of the (subnet) Mask and default Gateway values, you'll need them later.**

```
$ ifconfig
eth0      Link encap:Ethernet  HWaddr 8c:89:aa:88:33:11
          inet addr:192.168.1.100  Bcast:192.168.1.255  Mask:255.255.255.0
          inet6 addr: fe80::8e89:a5ff:fe80:3501/64  Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1

$ route
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
default        192.168.1.1    0.0.0.0         UG    100   0      0 eth0
link-local     *              255.255.0.0     U     1000  0      0 eth0
192.168.1.0    *              255.255.255.0   U     0     0      0 eth0

$
```

Step 2: Obtain a *Unique Static TCP/IP Address*

Before you can continue, you'll need to determine a unique static TCP/IP address that you can permanently assign to FreedomStreamer for its exclusive use. There is not a set procedure to determine this. It depends on what addresses other devices already connected to your home network use, as well as how your Router is configured.

In general, you should first check your Router setup to see what range of TCP/IP addresses it uses for DHCP (Dynamic Host Configuration Protocol). This range of TCP/IP address should be avoided (FreedomStreamer needs a *static* TCP/IP address, not a *dynamic* TCP/IP address) – so plan to select a static TCP/IP address that is *not in the DHCP range*. You may need to consult the manual for your Router to see how to determine this range. Typically you use a Web Browser to connect to your Router to view this information.

Once you know the range of DHCP addresses to avoid, you need to find out what other TCP/IP addresses to avoid. Definitely avoid the Router's address (the Gateway address determined in Basic Initial Setup). It is best to avoid any “broadcast” addresses that end in “255”. Also generally avoid any address that ends in “0”.

Beyond that, *avoid addresses used by other computers on your home network*. You can use `ipconfig` and `ifconfig` as discussed in Basic Initial Setup to find out the TCP/IP addresses of existing Windows®, MacOS®, and Linux computers on your home network – as you do this, add them to the list of addresses to avoid. Some computers may be set up to use DHCP, which is already on the list of addresses to avoid.

There may be other devices like web cameras (no need to worry about USB webcams, but rather so-called “IP webcams”), TVset-top boxes, DVD or Blu-Ray players, ...you don't have a toaster or a refrigerator connected to your network, do you? ...etc., etc. Most of these have a web page or a screen and a remote control you can use to find out the TCP/IP address they use. Add these addresses to the list of addresses to avoid. Most of these devices probably use DHCP, which is already on the list of addresses to avoid.

Finally, *pick a TCP/IP address that is not on the list of addresses to avoid*. Then open a command prompt (on Windows®) or a terminal window (on MacOS® or Linux) and use the `ping` command to see if the TCP/IP address you picked appears to be available. In the first example below, suppose we `ping 192.168.1.50`:

```
$ ping 192.168.1.50
PING 192.168.1.50 (192.168.1.50) 56(84) bytes of data.
64 bytes from 192.168.1.50: icmp_req=1 ttl=64 time=1.02 ms
64 bytes from 192.168.1.50: icmp_req=2 ttl=64 time=0.503 ms
```

...since we got several 64-byte replies from a device at 192.168.1.50, we know some other

device must be using that TCP/IP address, so add it to the list of addresses to avoid.

In this next example, maybe try ping 192.168.1.66:

```
$ ping 192.168.1.66
PING 192.168.1.66 (192.168.1.66) 56(84) bytes of data.
From 192.168.1.65 icmp_seq=1 Destination Host Unreachable
From 192.168.1.65 icmp_seq=2 Destination Host Unreachable
```

...since we got *Destination Host Unreachable*, **that means 192.168.1.66 appears to be an address we can use** – it must not be used by any other device, or that device would have replied to the ping command. **Either that, or some device that uses that address is powered-off and so it cannot reply!** So as a general rule: **before doing the ping test, be sure to turn all your networked devices on.** Otherwise you risk selecting an address that will not be unique when the device does eventually get turned on at some time in the future.

Step 3: Configure FreedomStreamer with Information Obtained in Steps 1 and 2

To change the TCP/IP address of FreedomStreamer from the web browser:

Step 3a: Click the **Configuration** button, and scroll down near the bottom of the page to the section labeled **Network (TCP/IP)**:

Step 3b: Enter the new unique static TCP/IP **Address** you obtained in **Step 2** above – *be sure to remember this address – it is used to connect to FreedomStreamer from other devices on your network!*

Step 3c: If necessary, change the **Netmask** (Netmask rarely needs to change – if you don't know what it is, leave it set at 255.255.255.0)... Obtaining the Netmask (or Subnet Mask) was discussed in **Step 1** above

Step 3d: If necessary, change the **Gateway**. Most often, *the first 3 numbers of Gateway* match the first 3 numbers of **Address**, (typically 192.168.x where x is either 0 or 1) and most often the *last* number of **Gateway** is 1... Obtaining the default Gateway was discussed in **Step 1** above

Step 3e: Click the **Apply and Reboot** button at the bottom of the section named **Network (TCP/IP)** NOTE: FreedomStreamer takes 60 to 90 seconds to power on completely after rebooting

Step 3f: Start your web browser, and enter: `http://<Address you obtained in Step 2 and set in Step 3b above>`

Step 3g: When you see the FreedomSteamer® screen in the web browser, click the **Configuration** button again, verify the **Network (TCP/IP)** settings are what you want them to be, and then scroll down to the very bottom to the section labeled **Quit**

Step 3h: Click on the **Shutdown** button

Step 3i: Wait 60 to 90 seconds and then remove power from FreedomStreamer

Step 3j: FreedomStreamer is now ready to use, so move it wherever you want, and power it on again... This time you can leave it powered-on for as long as you wish – you'll probably never have to mess with cables and TCP/IP configurations again

Static TCP/IP address setup is complete!

60 to 90 seconds after you apply power, you can use FreedomStreamer. From any web browser on any device connected to your home network, just enter the address from Step 2 or Step 3b into your web browser. In your web browser, you will most likely want to add a bookmark for the FreedomStreamer web page, because you will use it often.

Appendix II: Links to Software Licenses

GPL and LGPL licenses:

```
< https://www.gnu.org/licenses/old-licenses/fdl-1.1.html >  
< https://www.gnu.org/licenses/old-licenses/fdl-1.2.html >  
< https://www.gnu.org/licenses/old-licenses/lgpl-2.0.html >  
< https://www.gnu.org/licenses/old-licenses/lgpl-2.1.html >  
< https://www.gnu.org/licenses/old-licenses/gpl-1.0.html >  
< https://www.gnu.org/licenses/old-licenses/gpl-2.0.html >  
< https://www.gnu.org/licenses/gpl.html >
```

Other licenses:

```
< http://opensource.org/licenses/Apache-2.0 >  
< http://opensource.org/licenses/BSD-3-Clause >  
< http://opensource.org/licenses/BSD-2-Clause >  
< http://opensource.org/licenses/MIT >  
< http://opensource.org/licenses/MPL-2.0 >  
< http://opensource.org/licenses/CDDL-1.0 >  
< http://opensource.org/licenses/EPL-1.0 >
```

Large list of still more licenses, sorted by name:

```
< http://opensource.org/licenses/alphabetical >
```

IBID, sorted by category:

```
< http://opensource.org/licenses/category >
```

Icons are from The Open Icon Library:

AEM Pictorial Database (aem)

```
link: http://www.aem.org/Technical/PictorialDatabase/index.asp  
license: PD  
license link: http://en.wikipedia.org/wiki/Public_domain  
format: eps -> svg, png  
subdirectory: open_icon_library-devel/icons/aem
```

app-install-data (app-install)

```
link: http://packages.debian.org/lenny/app-install-data  
licenses: Various, see docs/AUTHORS_app-install  
license link: see docs/AUTHORS_app-install  
format: xpm, svg, png  
subdirectory: open_icon_library-devel/icons/app-install
```

Creative Commons (cc)

```
link: http://creativecommons.org/about/downloads  
license: CC-BY 3.0  
license link: http://creativecommons.org/licenses/by/3.0/  
formats: svg, png  
subdirectories: open_icon_library-devel/icons/cc  
open_icon_library-devel/icons_by_subject/cc
```

Crystal Clear (crystal_clear)

```
link: http://commons.wikimedia.org/wiki/Crystal_Clear  
license: LGPL-2.1  
license link: http://creativecommons.org/licenses/LGPL/2.1/  
formats: png  
subdirectories: open_icon_library-devel/icons/crystal_clear  
open_icon_library-devel/icons_by_subject/crystal_clear
```

Crystal Project (crystal)

link: <http://everaldo.com/crystal/>, CrystalXp.net
license: LGPL-2.1
license link: <http://creativecommons.org/licenses/LGPL/2.1/>
formats: png, ico
subdirectory: open_icon_library-devel/icons/crystal

Technische Regeln für Arbeitsstätten (DIN Standard) (din)
link: http://www.baua.de/nn_56926/de/Themen-von-A-Z/Arbeitsstaetten/ASR/pdf/ASR-A1-3.pdf
license: Public Domain
license link: http://en.wikipedia.org/wiki/Public_domain
format: pdf -> svg, png
subdirectory: open_icon_library-devel/icons/din

FAMFAMFAM Flag Icons (famfamfam-flag)
link: <http://www.famfamfam.com/lab/icons/flags/>
license: Public Domain
license link: http://en.wikipedia.org/wiki/Public_domain
formats: png
subdirectory: open_icon_library-devel/icons/famfamfam-flag

FAMFAMFAM Silk Icons 1.3 (famfamfam-silk)
link: <http://www.famfamfam.com/lab/icons/silk/>
license: CC-BY-2.5 or CC-BY-3.0
license link: <http://creativecommons.org/licenses/by/3.0/>
<http://creativecommons.org/licenses/by/2.5/>
formats: png
subdirectory: open_icon_library-devel/icons/famfamfam-silk

fineicons (fineicons)
link: <http://www.fineicons.com/en/free-icons/credit-cards/>
license: CC-BY-SA-2.0-UK
license link: <http://creativecommons.org/licenses/by-sa/2.0/uk/>
formats: gif -> png
subdirectory: open_icon_library-devel/icons_by_subject/webpage/fineicons

UNECE GHS of Classification and Labeling of Chemicals (ghs)
link: <http://www.unece.org/trans/danger/publi/ghs/pictograms.html>
license: PD
license link: http://en.wikipedia.org/wiki/Public_domain
format: eps -> svg, png
subdirectory: open_icon_library-devel/icons/ghs

Gimp 2.6 (gimp)
link: <http://www.gimp.org/>
license: GPLv2
license link: <http://creativecommons.org/licenses/GPL/2.0/>
formats: png
subdirectories: open_icon_library-devel/icons_by_subject/gnome

GNOME Icon Theme 2.26.0 (gnome)
link: <http://art.gnome.org/>
license: GPLv2
license link: <http://creativecommons.org/licenses/GPL/2.0/>
formats: svg, png
subdirectories: open_icon_library-devel/icons/gnome
open_icon_library-devel/icons_by_subject/gnome

GNOME-Colors (gnome_colors)
link: <http://code.google.com/p/gnome-colors/>
license: GPLv2
license link: <http://creativecommons.org/licenses/GPL/2.0/>
formats: svg, png
subdirectories: open_icon_library-devel/icons/gnome-colors
open_icon_library-devel/icons_by_subject/gnome-colors

Inkscape (inkscape)
link: <http://www.inkscape.org/>
license: GPLv2
license link: <http://creativecommons.org/licenses/GPL/2.0/>
format: svg
subdirectories: open_icon_library-devel/icons_by_subject/inkscape

Intrigue Icon Set 0.6.2 [Green] (intrigue)

link: <http://simpleinnovation.net/index.php?page=22&source=2&id=2>
license: GPLv2
license link: <http://creativecommons.org/licenses/GPL/2.0/>
formats: png
subdirectory: open_icon_library-devel/icons/intrigue

Nuvola 1.0 (KDE 3.x icon set) (nuvola)
link: <http://www.icon-king.com/projects/nuvola/>
license: LGPL 2.1
license link: <http://creativecommons.org/licenses/LGPL/2.1/>
formats: png
subdirectory: open_icon_library-devel/icons/nuvola

Map Symbols & Patterns for NPS Maps (nps)
link: <http://www.nps.gov/hfc/carto/map-symbols.htm>
aquired: 27 Dec 2009
license: Public Domain
license link: http://en.wikipedia.org/wiki/Public_domain
format: pdf -> png, svg
subdirectory: open_icon_library-devel/icons/nps

Open Clip Art Library (open_clip_art_library)
link: <http://openclipart.org>
license: Public Domain
license link: http://en.wikipedia.org/wiki/Public_domain
format: svg -> png
subdirectory: open_icon_library-devel/icons/open_clip_art_library

Open Icon Library (homemade)
link: <http://openiconlibrary.sourceforge.net/>
license: Public Domain
license link: http://en.wikipedia.org/wiki/Public_domain
format: svg -> png
subdirectories: open_icon_library-devel/icons/homemade
open_icon_library-devel/icons_by_subject/homemade

OpenOffice.org default theme 3.2 (openoffice)
link: <http://www.openoffice.org/>
license: GPLv3
license link: <http://creativecommons.org/licenses/GPL/3.0/>
format: png
subdirectories: open_icon_library-devel/icons_by_subject/openoffice

Oxygen Icons 4.3.1 (KDE) (oxygen)
link: <http://www.oxygen-icons.org/>
license: Dual: CC-BY-SA 3.0 or LGPL
License link: <http://creativecommons.org/licenses/by-sa/3.0/>
<http://creativecommons.org/licenses/LGPL/2.1/>
formats: svg, png
subdirectory: open_icon_library-devel/icons/oxygen

Tango Icon Library 0.8.90 (tango)
link: http://tango.freedesktop.org/Tango_Icon_Library
license: Public Domain
License link: http://en.wikipedia.org/wiki/Public_domain
formats: svg, png
subdirectory: open_icon_library-devel/icons/tango

Tango harm-on-icons (tango-harm)
link: <http://gnome-look.org/content/show.php/Tango+mine?content=76316>
license: CC-BY 3.0
License link: <http://creativecommons.org/licenses/by/3.0/>
formats: svg->png
subdirectory: open_icon_library-devel/icons/tango-harm

Warthan's Stuff: Sovereign State Flags of the World (warthan)
link: http://warthan.org/nation_flags.html
license: GPL
License link: <http://creativecommons.org/licenses/GPL/2.0/>
formats: png
subdirectory: open_icon_library-devel/icons/warthan

Wikimedia Commons
link: http://commons.wikimedia.org/wiki/Main_Page

license: CC, GPL, PD, MIT, BSD (in separate directories)

License link:

format: svg, png

subdirectory: open_icon_library-devel/icons/wiki_commons_bsd

subdirectory: open_icon_library-devel/icons/wiki_commons_mit

subdirectories: open_icon_library-devel/icons/wiki_commons_cc

open_icon_library-devel/icons_by_subject/wiki_commons_cc

subdirectories: open_icon_library-devel/icons/wiki_commons_gpl

open_icon_library-devel/icons_by_subject/wiki_commons_gpl

subdirectories: open_icon_library-devel/icons/wiki_commons_pd

open_icon_library-devel/icons_by_subject/wiki_commons_pd

See AUTHORS_wiki_commons* for details on each image with license info

WPClipart (wpclipart)

link: <http://www.wpclipart.com/>

license: PD