ON YOUR DISCS, SET, GO!

Interested in listening to yesterday's music with today's technology? This article describes how to convert LPs and cassettes into a format that you can play back on your computer. **BY ERIK BÄRWALDT**

L inux offers users more or less everything they need to digitize legacy audio recordings on LPs or cassettes. To enjoy your golden oldies on your PC in the very near future, follow this simple guide.

LP … Many audiophiles still get goose bumps when they hear this word. Friends of popular music look back fondly at the artistic design of LP covers, pristine white inlays, and the click of the needle hitting the vinyl. Reality is typically far more prosaic: old vinyl is typically condemned to a life of neglect on the bottom shelf because the legacy record player has long lost its place in the hi-fi rack to a modern CD player or even an MP3 player.

It's a pity about the music though; after all, many LP and cassette collections contain rare recordings that have never been digitized and never been heard by the post-analog generation. At the same time, time gnaws relentlessly at the material, making it high time to protect analog treasures against dissolution. All you need for this is a record player or tape deck – depending on what you want to convert – an equalizer/pre-amp, and a normal Linux PC.

Linux as a Recording Studio

The equalizer/pre-amp processes the frequency spectrum of the LP recording while amplifying the weak signal output by the analog pickup so that you can record it directly at your sound card's line in jack.

Devices of this kind, often referred to as phono pre-amps, are available for prices between US$ 50 and 500. But if you have an even older system, with a

Figure 1: A neat interface with many buttons: Despite the control overload, recording with Audacity is simple.

crystal or ceramic pickup, you can do without the pre-amp.

If you already have a record player or tape deck attached to an audio amplifier, all you need to do is connect the line out connector on your amp to the line in on your sound card. You don't have a record player? No problem! Many companies offer high-quality equipment that includes an equalizer/pre-amp especially designed for digitizing legacy records [2].

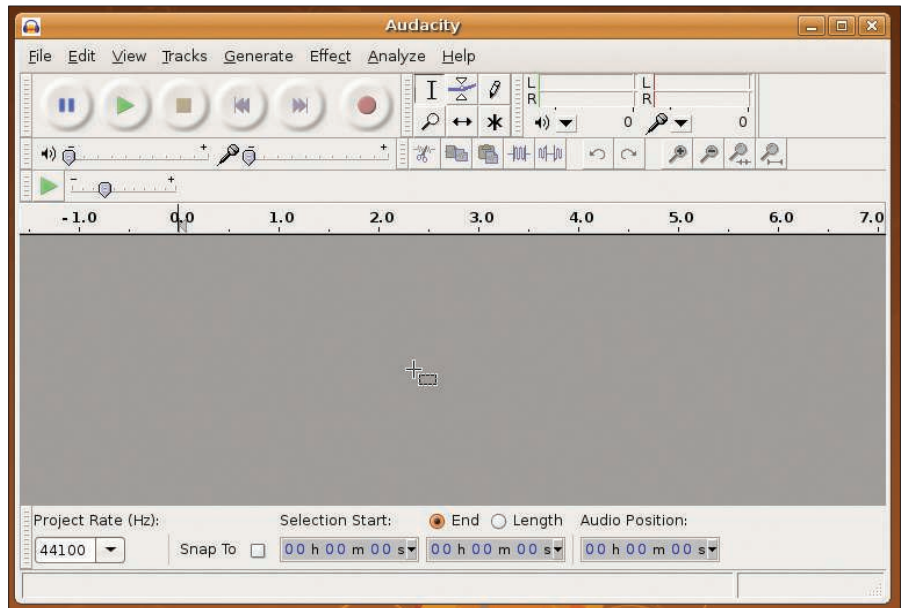That takes care of the hardware. From a software point of view, you should have a fairly professional program to record and post-process your material. Linux distributions have several likely candidates, with Audacity shining above the rest. Audacity has been included with popular distributions for many years and gives you (nearly) everything you need for digitizing.

Launch

To launch the audio recorder on Gnome, select *Applications | Sound and Video*. This simple program lets you make uncomplicated recordings from various sources, such as line in or the microphone input: Just attach the player to the PC, select the recording input source in the program, set the output format, and start digitizing. The Gnome audio recorder does not have any features for processing your recordings; however, that brings me to Audacity.

Installing Audacity

To install Audacity on Ubuntu Hardy Heron, simply type *sudo apt-get install audacity*. The program's homepage [3] offers plugins for the program, such as effects for post-processing your recordings.

Your First Recording

After the installation, you can launch Audacity from the *Applications | Sound and Video* menu; just accept the default language setting, and don't worry about the empty window or the collection of buttons and sliders at the top of the program window (Figure 1). Recording is not as difficult as you might expect at first glance.

First, set the sampling frequency and sample format in *Edit | Preference | Quality*. For an audio recording in CD quality, you will need a frequency of *44100 Hz*. The *16-bit* default format is fine. Then select *Edit | Preference | Audio I/O* to select recording and output devices and set the channels for the recording.

To digitize mono recordings from cassette or vinyl, you need just one channel – two channels for stereo recordings. Multi-track recordings on multiple channels are more interesting in (semi)professional applications. If your analog source includes monophonic voice recordings, make sure you select the *1 (Mono)* option for *Channels* to avoid annoying interference from the unused channel.

To start recording, click the red record button or press *R* (Record). The peak

Backing up Your 78s

If you want to digitize your older 78s as well, one thing you will need is a record player that can play back at 78 rpm. Also, the record deck should have a quick-change pickup system because 78s have a far rougher surface than later records and would ruin a diamond stylus in next to no time. Various manufacturers, such as Ortofon [1], still have two-stylus systems in their portfolio.
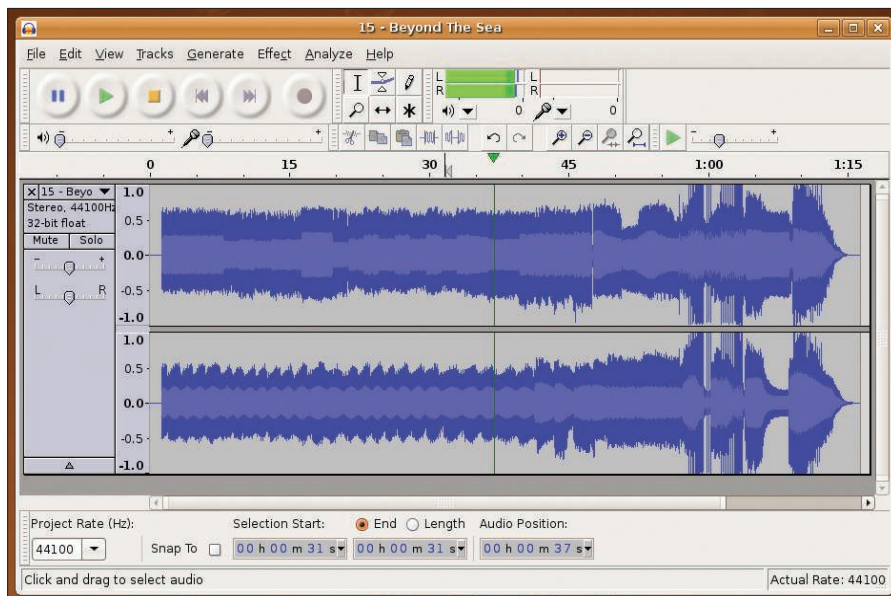
Figure 2: Recording: Audacity processing analog material.

display monitors the progress of the recording. In the case of stereo recordings, the right and left channels each have a display. At the same time, a sound track for each channel is shown in the larger window.

Volume Control

If the peak displays cross the red line too often for your liking, you will need to reduce the recording volume: Push the slider (top right next to the small microphone icon) to the left until the recording level drops down to the green band for the track in question. The reason for an excessive recording volume with distortion to match could be an incorrect input source setting. For example, if you connect the line out output on your amplifier to the microphone input on your PC sound card, the recording is bound to be overamplified. The best thing to do is perform a couple of trial recordings to find the right connector and the right level (Figure 2).

Click the olive green stop button or press *S* to stop recording. The recording position returns to zero. If you now start a new recording by pressing *R*, this would restart from scratch. However, if you press Pause (*P*), the recording stops at the current position and can be restarted by pressing *P* again.

Applause

A group will expect applause during and after a good concert, but this makes life difficult for the budding recording engineer. Applause starting or ending suddenly during a live concert will make a smooth transition to the next track almost impossible.

To mitigate the effect, you can hold down the left mouse button, and mark a small area at the start and end of the audio tracks you recorded. Then select *Effect* and *Fade in* (Figure 3), or *Fade out*. This gives you a smooth start and end to the track.

The *Effect* menu gives users many options for enhancing recordings. For example, you can *amplify* tracks that are too quiet or use the *Equalizer* to raise or lower individual frequency bands and

thus change the sound of a track. The basic principle for the use of effects is to select the complete audio track with Ctrl + A or hold down the left mouse button to select a certain range. The effect is only applied to your selection.

The effects department has a lot of amusing and even useful gimmicks that you can try out whenever you have time to do so: *Change Tempo* lets you change a slow waltz into a Viennese waltz with just a click. *Change Pitch* converts a D-flat toccata to A-flat. Things like this make sense if you are compiling a sampler and want to synchronize the individual tracks. But remember, your audience is only likely to enjoy the results if you use effects sparingly and avoid insane input values.

Before you start to experiment, remember that Audacity uses a non-destructive approach. If you apply an effect but don't like the results, you can just select *Edit | Undo*, or press Ctrl + Z to discard it.

The function that allows you to string tracks together seamlessly is also useful: Select *Tracks* or *Project | Align tracks* to remove undesirable gaps between contiguous audio tracks. This effect is useful if you need to paste recordings together because you had to flip a cassette when making the original recording.

Saving and Exporting

After processing your recorded material, it makes sense to save it. To do so, select
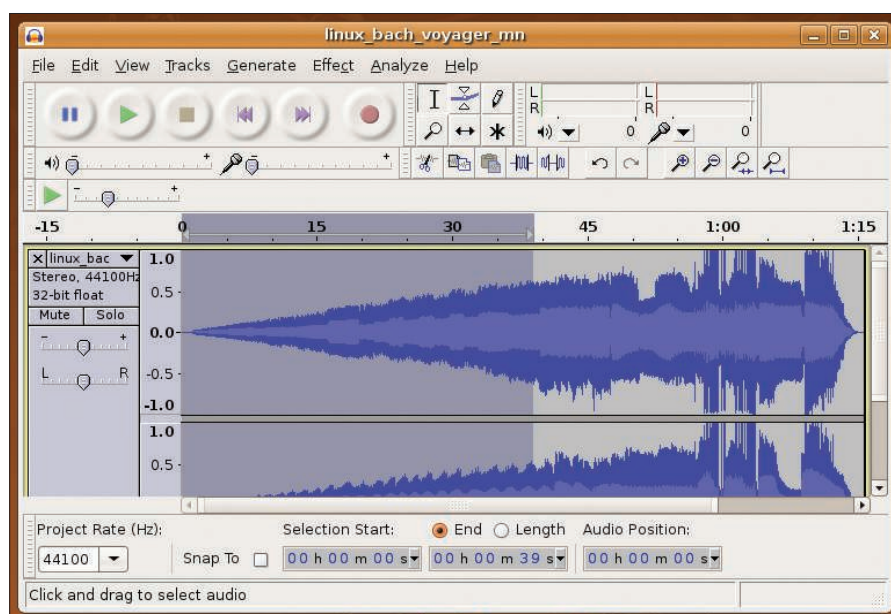

Figure 3: To avoid abrupt transitions between individual tracks, Audacity effects let you fade the music in or out.

```
                              erik@amabilidade: ~/Music
erik@amabilidade:~/Music$ normalize-audio --peak -v *
Computing levels...
Level for 02 - Mack The Knife.wav: -12,3588dBFS (-0,3912dBFS peak)
Level for 03 - Chancon D'Amour.wav: -17,6779dBFS (-3,5188dBFS peak)
Level for 10 - Where Or When.wav: -9,6856dBFS (0,0000dBFS peak)
Applying adjustment of 0,39dB to 02 - Mack The Knife.wav...
 02 - Mack The Kni 100% done, ETA 00:00:00 (batch  32% done, ETA 00:00:02)
Applying adjustment of 3,52dB to 03 - Chancon D'Amour.wav...
 03 - Chancon D'Am 100% done, ETA 00:00:00 (batch  67% done, ETA 00:00:01)
10 - Where Or When.wav already normalized, not adjusting...
erik@amabilidade:~/Music$
```

Figure 4: All done: Normalize has just normalized three audio files.

File | Save project (as), and Audacity will suggest its own AUP format by default. Next, enter a name for your project and press *Save*. This gives you the advantage of full access to all your recording tracks and parts, meaning that you can edit them at any later time. For multi-track recordings, the AUP format gives you full access to the raw material.

Saving to the Audacity file format has one tiny disadvantage: No usual media player is capable of playing AUP files. In other words, to listen to the music you recorded anywhere outside of Audacity, you will need to export your finished audio tracks.

The free OGG format is a good choice, both for space and quality reasons, assuming you only want to play back on your PC. If you want to use a CD player, exporting to WAV format is your best option. Many legacy CD players do not support either MP3 or the OGG format.

Audacity's export formats are listed when you click *File | Export*. First, accept the default format *WAV, AIFF, and other uncompressed types*, then select one of the options and click *Save*.

Normalizing Recording Levels

If you use audio material from various sources to create a "Best of" sampler, you are likely to encounter the problem of different signal levels in different tracks. One track is virtually inaudible, whereas another threatens to burst your eardrums.

As a general rule, analog tracks processed for use on computers tend to be too quiet, whereas digital recordings have a far greater dynamic range.

To avoid jumps and fluctuations in recordings, you need to raise or lower the volume of the individual tracks to about the same level.

Audacity has a *Normalize* function for this, but I experienced program crashes time and time again when I tried to process large audio files. This prompted me to look around for a different tool for normalizing, and I ended up choosing a command-line program called Normalize [4]. This tiny utility handles normalization tasks reliably at the blink of an eye.

Ubuntu users will find the program in the Universe Repository or, alternatively, on the Ubuntu [8] website. The package name on Ubuntu is *normalize-audio*. In addition to the program package, you need the Libaudiofile library, which is also available from the Ubuntu page. This library helps Normalize handle different file formats.

After installing, you can launch the program in a terminal by typing *normalize-audio* (for WAV files), *normalize-mp3*, or *normalize-ogg*, depending on the audio file format.

A detailed description of the program's options is available via the man page (*man normalize*).

The *--peak* and *--mix* options are useful for normalizing volume. The first option lets you set the file with the loudest volume as the standard (Figure 4).

Be careful when you raise the volume: If you do this with older audio files, you will also amplify the noise. To compensate for this, I would suggest trying the *--mix* option. Normalize first analyzes all the files and calculates the mean volume level. The program then sets all the files to this level in a second pass.

Although the analysis procedure and the process of normalizing the volume require considerable computational power, Normalize is a fast performer: In our lab, I normalized a considerable number of audio files on an ancient 486er system running at 100MHz in just a couple of minutes.

Because Normalize also supports wild cards, it makes sense to store the audio files you want to normalize in a subdirectory and let Normalize process these files at a single pass.

Conclusions

Audacity and Normalize help you convert your PC into a powerful recording studio that lets you save and archive legacy audio material.

With the exception of Audacity's failure to normalize large files, the programs are stable and reliable, and they give you options for digitizing your vinyl treasures and preserving them for future generations.

None of the programs I looked at requires too steep a learning curve. Thanks to its graphical interface, Audacity lends itself to intuitive use, without a need to read the manual; Normalize comes with complete documentation and Help that explains the syntax and functionality sufficiently to allow a normal user to run the tool. Additionally, both tools will run quickly and reliably on older machines. What more could you ask for? ■

INFO

[1] Ortofon: *http://www.ortofon.com/*

[2] Record player with pre-amp: *http://www.phonophono.de/index_e.php3?Kennung=*, *http://www.lenco.de/en/products/7/Turntable/*

[3] Audacity: *http://audacity.sourceforge.net/download/*

[4] Normalize: *http://normalize.nongnu.org*

[5] Normalize binaries RPM format: *http://rpmseek.com/*

[6] Normalize binaries for Gentoo: *http://packages.gentoo.org/ebuilds/?normalize-0.7.7*

[7] Normalize binaries for Slackware: *http://packages.slackware.it*

[8] Normalize binaries for Ubuntu: *http://packages.ubuntu.com*.