

# Free software for the digital musician

Linux audio applications overview

**Christoph Eckert**

Graf-Rhena-Straße 2

76137 Karlsruhe, Germany

mchristoph.eckert@t-online.de

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## Free software applications for the digital musician

During the last three years the Linux audio community has grown a lot. For almost every musical purpose there is now free software available. Linux gets meanwhile used by hobbyists as well as by professional grade studios. This document will introduce some of the most important applications used by musicians. There are many more applications, so this document certainly is not exhaustive, but it will give a good starting point for users who aren't familiar to Linux audio yet.

### 1 Terminology

When working with audio on a Linux box, there are some terms which should be known so documentation can be easily understood.

#### 1.1 Drivers for audio hardware

The Open Sound System[1] (OSS in short) is the older sound system. In the 2.6 Linux kernel series, it is now marked as deprecated and therefore should not get used. The Advanced Linux Sound Architecture (ALSA in short) is the newer and more powerful audio subsystem for Linux driven machines. ALSA does not only provide a set of drivers for various audio cards. It also contains the ALSA sequencer to handle MIDI data between different MIDI applications and the MIDI ports of the computer. Via the ALSA sequencer, it is very easy to route MIDI data from one application to an other.

#### 1.2 Realtime & Low Latency

The term »Realtime« is misleading. Low latency is just better because it gives an immediate idea what it means. When connecting an instrument to the computer and using it as an effects processor, the audio signal needs to be processed as fast as possible to avoid too large delays between the signal appearing on the computer input and reappearing on its outputs. To ensure this, JACK can be run in realtime mode. Unfortunately this requires to patch the kernel and to use a module which grants normal users realtime capabilities. This can lead to a security leak.

#### 1.3 JACK Audio Connection Kit

JACK[3] is a specialized audio server to make a Linux powered machine ready for professional use. When used in conjunction with realtime capable kernels, JACK can act as a soundserver with very low latencies. To configure and drive JACK, it is recommended to use qjackctl[4].

#### 1.4 JACK transport

JACK transport is a timing information sent out by JACK. Applications aware of this mechanism can be a client of the timing, so it is possible to use JACK as a timing master for all other applications. Stopping JACK transport can therefore also stop the sequencing application as well as a drum machine.

#### 1.5 Plugins

On Linux there exist two native plugin types. Besides those even VSTI plugins can be used after some setup work.

### 1.5.1 LADSPA

LADSPA[5] is the acronym for »Linux Audio Developers' Simple Plugin API«. These are plugins to be used in host applications to provide effects like reverb, chorus and many others. LADSPAs do not have a graphical user interface of their own, so the host application is responsible to create the user interface for the plugin.

### 1.5.2 DSSI

DSSI is the acronym for »Disposable Soft Synth Interface«. It's the successor of the LADSPA plugins. One advantage over LADSPA is that a DSSI plugin can have its own user interface, so the host application does not need to create it for the plugin. Furthermore, the plugin developer can create a user interface that fits the plugin best. To drive a DSSI plugin, it is necessary to have an application which can embed DSSI plugins.

### 1.5.3 VSTI

VSTI is the acronym for »Virtual Studio Technology Instrument«. These are plugins for the commercial sequencing software »Cubase« created by Steinberg [41]. Via helper applications, some VSTI plugins can even be used on Linux driven machines. Especially the application Wine, a tool which makes it possible to execute Windows applications on a Linux machine, must be installed before VSTIs can be used. For starters it is not very easy to get VSTIs running on a Linux driven machine. Especially the setup of WINE needs some computing knowledge.

## 2 Requirements

Before you start using Linux as an audio machine, some requirements should be fulfilled. Not every distribution and kernel is optimal for audio use. Finally there is hardware which isn't supported by Linux yet.

### 2.1 Distributions & Packages

Due to the fact that free audio software is currently developed very rapidly, it is useful

to choose a distribution which can be easily upgraded without reinstalling a new version and which provides recent and ready to use packages of audio software.

#### 2.1.1 AGNULA/DeMuDI

AGNULA[7] is short for the »A GNU Linux Audio Distribution« project. It creates an audio distribution based on Debian which is called »Debian Music Distribution«, also known as »DeMuDi«. Its advantage is that it is a distribution especially created for musicians. The Debian[42] base makes it easy to keep the whole distribution up to date.

#### 2.1.2 Planet CCRMA

Planet CCRMA[8] originally provided audio software packages for Red Hat respectively Fedora based operating systems. Meanwhile it is a complete distribution of its own based on Fedora, so it can now be completely installed from one source medium.

#### 2.1.3 Studio to go

Ferventsoftware created a commercial audio distribution called »Studio to go«[9]. The main advantage is that there are helper scripts which can make the life of Linux audio starters easier. On the other hand, it is a commercial distribution and therefore it is not used much by Linux audio community members.

#### 2.1.4 Gentoo

Gentoo Linux[10] is a very flexible distribution with a huge amount of recent software packages in its repository. If you are already familiar with Linux basics, it can be a good base for an audio machine. One of the advantages of Gentoo is that there are not that hard release brakes. You can update your machine at any time to the current distribution via the internet. Therefore Gentoo is a perfect system to be set up once and then to be kept up to date without any reinstallation. The disadvantage is that Gentoo needs more manual setup. Unlike others Gentoo is a source distribution and every package to

install will be compiled from the source on your machine. This needs knowledge about system details and leads in long compile times.

## 2.2 Hardware

For audio work hardware is needed to get MIDI and audio in or at least out of the computer. Many of the cheap on board sound cards use a standard AC '97 chipset and therefore can be used with ALSA. Most PCI cards should work, but before buying a new one it is useful to consult the ALSA card matrix[11] or to ask in the linux audio user list if the device is supported. For external USB cards there is an ALSA kernel module called snd-usb-audio. It can handle a huge amount of USB devices, both audio and MIDI. Again consult the ALSA card matrix or the community before buying a new one. Firewire cards are not supported well yet. There is the FreeBob[12] project which already drives an amount of at least 20 cards of different manufacturers. These drivers are currently in alpha status and the latency is about 50msecs. Therefore, it is not recommended to use firewire cards as a normal user. Audio developers are invited to contribute to the FreeBob project.

## 2.3 Kernel

Since the 2.6.10 Kernel series, it is not necessarily needed to patch and install a self prepared kernel. On the other hand, vanilla kernels from kernel.org[13] still have no realtime module included. So, if using a stock 2.6.10 kernel, it is not possible to run JACK in realtime mode to achieve low latencies. If you do not care about latency, a 2.6.10 kernel will be the right thing for you.

### 2.3.1 MM Kernels

The MM kernels[14] from Andrew Morton include lots of additional features which cannot be found in the vanilla kernel. Advanced Linux audio users therefore prefer the MM kernel and apply realtime patches to it. Of course, not every audio user is able and willing to learn how to build and install a custom kernel.

### 2.3.2 Realtime Patches

Ingo Molnar is the maintainer of the »Voluntary Preemption« kernel patch [15]. This patch is recommended for serious low latency work.

## 3 Helper Applications

There are some useful helper applications to control the audio behaviour of the system. It is strongly recommended to install these applications.

### 3.1 Mixers

Mixer applications control the behaviour of the soundcard like selecting the input device or adjusting the main volume. Various tools are available to do this. Besides the classical command line tool alsamixer and others you can use kmix for KDE or gmix for Gnome.

### 3.2 Qjackctl

Qjackctl[4] is an GUI frontend to control the JACK audio server as well as to manage audio and MIDI connections. It can simplify your work a lot.



Fig. 1: The main window of qjackctl

### 3.3 Vkeybd

Vkeybd[16] is a small application which lets you create note, controller and program change events. It can be connected via an ALSA patchbay like qjackctl to any other MIDI application or to the MIDI output of the computer.

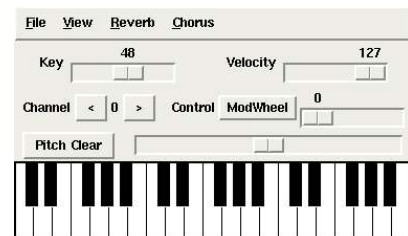


Fig. 2: The main window of vkeybd

### 3.4 aseqview and kmidimon

aseqview[16] and kmidimon[17] are applications to control and monitor MIDI events. This is useful to debug a setup. Maybe MIDI gets not recorded when using a sequencer. To check if there is any MIDI input via the soundcard, one of these applications can be connected to the MIDI in port to check if there are any incoming MIDI events.

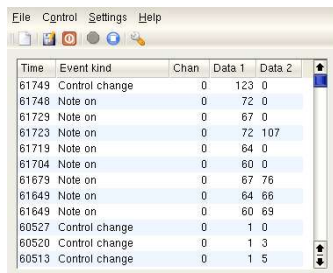


Fig. 3: The main window of kmidimon

## 4 SysEx & Librarians

SysEx is a special kind of MIDI data which usually is used to exchange the memory contents of synthesizers between the device and the computer. This way, it is possible to make backups of a synthesizer's memory and even to create applications which can edit settings on the synthesizer via MIDI.

### 4.1 SysExxer

SysExxer[18] is a small tool to exchange sysex data with synthesizers. It is based on KDE and acts as an ALSA sequencer client, so it also can be used to exchange sysex data with softsynths. Especially softsynths emulating an real hardware synthesizer often offer the possibility to receive sysex files created for the original device.



Fig. 4: The main window of SysExxer

### 4.2 JSynthLib

JSynthLib[19] is a librarian and editor tool for synthesizers. It is based on the Java programming language.

## 5 Effects Plugins

Effects are the spice in a musicians kitchen. In Linux, mainly LADSPA and DSSI plugins can be easily used as effects using a host application. The DSSI plugins have two advantages over the older LADSPA implementation. These can receive MIDI data via the ALSA sequencer and can include a graphical user interface.

### 5.1 JACK RACK

JACK RACK[20] is a tool which can host multiple LADSPA plugins, so it can be used as an effects processor.

### 5.2 JACK DSSI host

The JACK DSSI host[6] is a command line tool which gets installed with the DSSI package. It can be used to run DSSI plugins like hexter or DSSI-VST. The last one can be used to run VST plugins embedded in DSSI-VST.

### 5.3 Alsa Modular Synth

Even ams[21] can be used to host LADSPA plugins. Due to the fact it also offers an audio input it is the right effects machine as soon as you want more flexible signal routings as can be done using JACK RACK. Alsa Modular Synth itself will be discussed later.

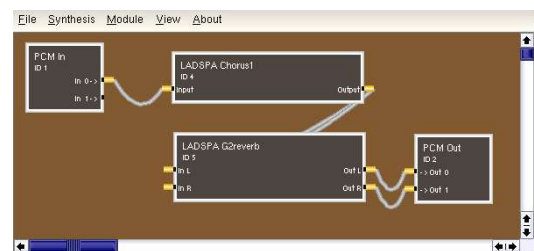


Fig. 5: ams used as an effects rack

## 6 Sampling & wave editing

Sampling is a well known method for imitating sounds of natural and analog instruments. For

Linux, there are some applications to playback and even to create samples.

### 6.1 kwave

kwave[22] is a wave editor for KDE. It can not only edit wave files but even record audio.

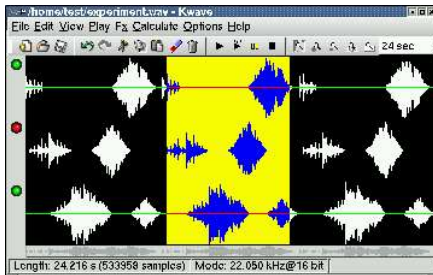


Fig. 6: Kwave

### 6.2 Audacity

Audacity[23] is a very powerful cross platform wave editor. It is available for Linux, Macintosh and Windows operating systems. It includes a huge amount of tools to edit waveforms. It is also possible to load more than one file at once.

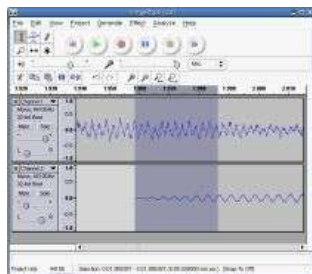


Fig. 7: The main window of Audacity

### 6.3 Fluidsynth

Fluidsynth[24] is a command line application which can load sample files in the soundfont format. qsynth[25] is a graphical frontend to control fluidsynth.

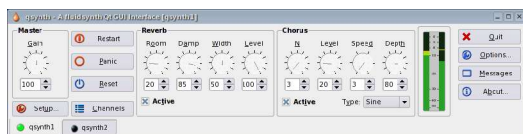


Fig. 8: Qsynth as frontend to fluidsynth

## 6.4 Specimen

Specimen[26] is a sample player and can even be used to create and edit samples by loading wave files.

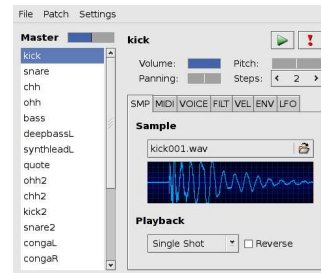


Fig. 9: Specimen

## 6.5 Linuxsampler

Linuxsampler[27] can play back sample file formats like Gigasampler, Akai and DLS. Linuxsampler is commandline based, so it is recommended to use qsampler[28] as a graphical frontend for it.

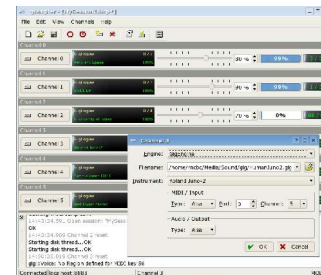


Fig. 10: qsampler, multiple giga files loaded

## 7 Emulators & Software Synthesizers

### 7.1 ZynAddSubFx

ZynAddSubFx[29] is one of the best sounding synthesizers available. It creates living and moving sounds even when being played very polyphonic. It is available for Linux as well as for Windows operating systems.

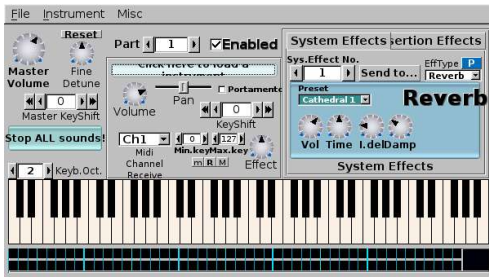


Fig. 11: ZynAddSubFX main window

## 7.2 Also Modular Synth

Also Modular Synth[21] (ams in short) is a synthesizer which emulates the old style modular synthesizers. In the main window various modules can be placed and connected. ams even has a LADSPA browser so it can include LADSPA plugins in its signal path. ams offers the possibility to bind MIDI controller events to any parameter, so external controllers can be used to control its sound.

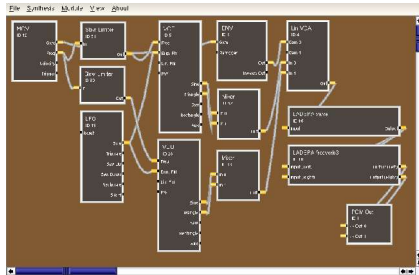


Fig. 12: ALSA Modular Synth

## 7.3 Aeolus

Aeolus[30] emulates the sound of classical pipe organs. It is not based on samples but computes the sound on the fly. Therefore, the sound is much more authentic than sample based simulations.

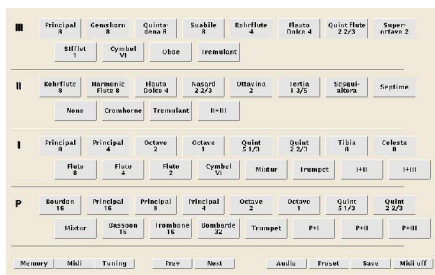


Fig. 13: Pipe organ emulator aeolus

## 8 Drum Machines

Drum machines are one of the most basic applications in a virtual studio to easily create drum tracks.

### 8.1 Hydrogen

Hydrogen[31] is an easy to use but powerful pattern based drum machine. Hydrogen can be synced to JACK transport.



Fig. 14: The main window of Hydrogen

## 9 Score printing

For score printing, there exist two different ideas. The first idea is to base scores on MIDI events. If included into Sequencers, it is easily possible to create scores based on the recorded MIDI data. It is not possible to create high-quality scores from such tools but for creating simple lead sheets for co-musicians it is the right thing. Other score editors are stand alone editors. The layout is done manually so the user has an exact control over the score.

### 9.1 Notedit

Notedit[32] is a score editor for the K Desktop Environment[43].

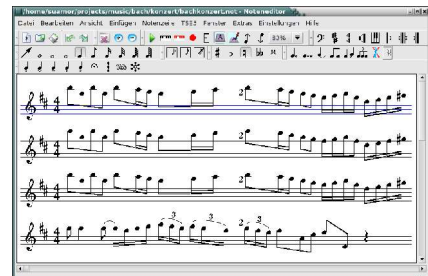


Fig. 15: The main window of Notedit

## 9.2 MuSEscore

MuSEscore[33] has originally been the built-in score editor of the sequencing software MuSE. Meanwhile, it is a standalone application comparable to Nootedit, but QT based instead of KDE.



Fig. 16: »Pictures at an exhibition« (mscore)

## 9.3 Lilypond

Lilypond[34] is a professional grade score editor. It uses a special syntax to describe the score. It is very powerful and can even create unconventional scores. Beginners tend to think it is complicated to use, but learning the syntax isn't that difficult.



Fig. 17: A complex score created by Lilypond

## 10 Sequencing

Sequencing is most often used to arrange MIDI data. Most often these tools include much more features up to embedding software synthesizers and audio processing.

### 10.1 Rosegarden4

Rosegarden4[35] is a complete sequencing solution for MIDI and audio. It also includes a score editor. Rosegarden4 is based on KDE.

### 10.2 MuSE

MuSE[36] also is a complete sequencing solution. Unlike Rosegarden4, it is based on QT. The score editor has been excluded from MuSE and is now known as MuSEscore.



Fig. 19: MuSE in action

### 10.3 SEQ24

SEQ24[37] is a loop based midi sequencer to edit and playback MIDI loops. It is useful especially in live situations where you do not need a complex tool.

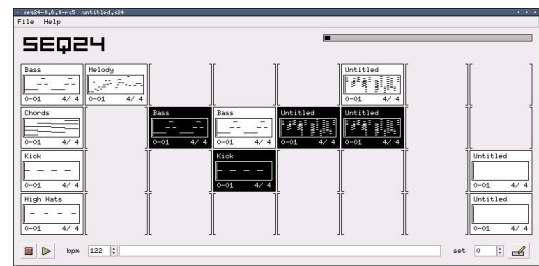


Fig. 20: The main window of SEQ24

## 11 Harddisk Recording & Mastering

For harddisk recording and mastering there are two major professional grade applications available.

### 11.1 Ardour

Ardour[38] is a digital audio workstation (DAW in short) software for Linux. It is used to record multiple audio tracks at once to the hard drive and can even be used to record live acts.



Fig. 21: A project in Ardour

## 11.2 Jamin

Jamin[39] is an audio mastering tool. Besides others, it features linear filters, equalizers, a spectrum analyser and compressors.

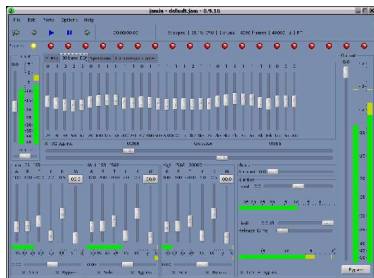


Fig. 22: Jamin in action

## 12 Support and participation

There are three central mailing lists concerning Linux audio[40]: Linux audio user, Linux audio developer and Linux audio announce. It is recommended to join the Linux audio user mailing list when starting with Linux audio. Besides this list, there is a list for Linux audio developers and a list for developers to announce new software releases. Participation can be done by simply using free software, by filing bug reports and feature requests, contributing documentation or translations or even program code.

## 13 Summary

For almost any need and distribution there exist free software applications. For audio users new to Linux it is recommended to use one of the specialized distributions. Advanced users can build a custom kernel to get an audio system with low latencies. Everyone is invited to become a member of the free software audio community and to contribute, even non-programmers.

## 14 Credits & Licence

Credits to all who work on free software. This includes developers as well as documentation writers, translators and even users who contribute bug reports and feature requests to the various projects.

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## 15 Resources

- [1] <http://opensound.com>
- [2] <http://alsa-project.org>
- [3] <http://jackit.sourceforge.net>
- [4] <http://qjackctl.sourceforge.net>
- [5] <http://www.ladspa.org>
- [6] <http://dssi.sourceforge.net>
- [7] <http://www.agnula.org>
- [8] <http://ccrma.stanford.edu>
- [9] <http://www.ferventsoftware.com>
- [10] <http://www.gentoo.org>
- [11] <http://alsa-project.org/alsa-doc/>
- [12] <http://freebob.sourceforge.net>
- [13] <http://www.kernel.org>
- [14] <http://kernel.org/pub/linux/kernel/people/akpm/>
- [15] <http://people.redhat.com/mingo/>
- [16] <http://www.alsa-project.org/~iwai/alsa.html>
- [17] <http://kmetronome.sourceforge.net/kmidimon/>
- [18] <http://sysexxer.sourceforge.net>
- [19] <http://www.jsynthlib.org>
- [20] <http://arb.bash.sh/~rah/software/jack-rack/>
- [21] <http://alsamodular.sf.net>
- [22] <http://kwave.sf.net>
- [23] <http://audacity.sourceforge.net>
- [24] <http://www.fluidsynth.org>
- [25] <http://qsynth.sourceforge.net>
- [26] <http://www.gazuga.net>
- [27] <http://www.linuxsampler.org>
- [28] <http://qsampler.sourceforge.net>
- [29] <http://zynaddsubfx.sourceforge.net>
- [30] <http://users.skynet.be/solaris/linuxaudio>
- [31] <http://hydrogen.sourceforge.net>
- [32] <http://noteedit.berlios.de>
- [33] <http://mscore.sourceforge.net/>
- [34] <http://lilypond.org/web/>
- [35] <http://www.rosegardenmusic.com>
- [36] <http://muse.serverkommune.de>
- [37] <http://www.filter24.org/seq24/>
- [38] <http://linuxaudiosystems.com>
- [39] <http://jamin.sourceforge.net>
- [40] <http://www.linuxdj.com/audio/lad/>
- [41] <http://www.steinberg.de>
- [42] <http://www.debian.org/index.en.html>
- [43] <http://www.kde.org>