



Various Ramblings on the state of

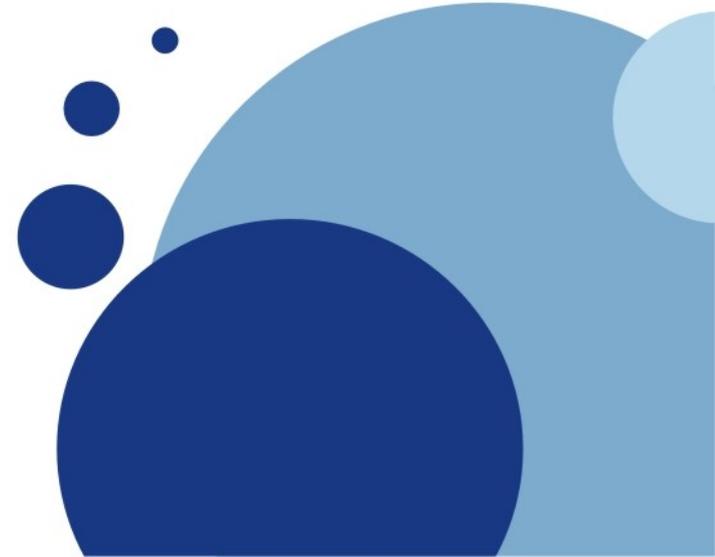
Linux DAW

(Digital Audio Workstation)

Christoph Doerbeck

Last modified

May 15, 2008

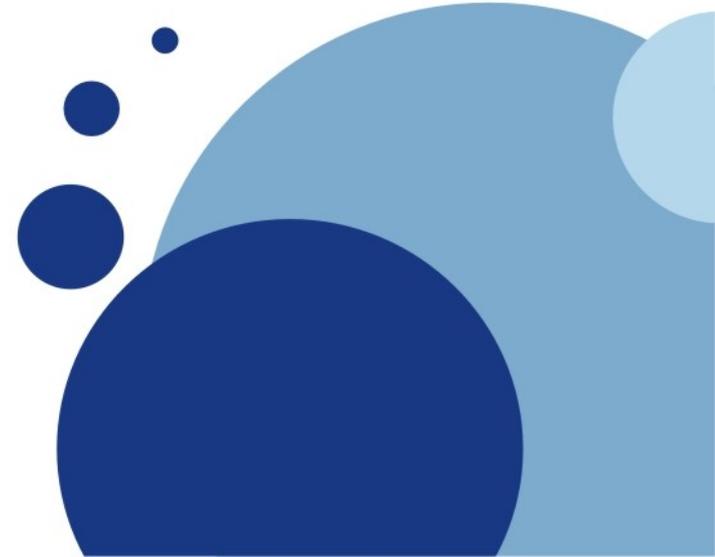




Disclaimer

Although I try pretty darn hard to research and present interesting material, I make no claim that what I report is entirely accurate. This document & presentation is intended for consumption by responsible individuals in the spirit of sharing knowledge about Linux and Open Source Software (OSS). If you wreck you system(s) and/or data based on materials discussed here, you can't hold me or those I work for responsible.

-christoph



Background

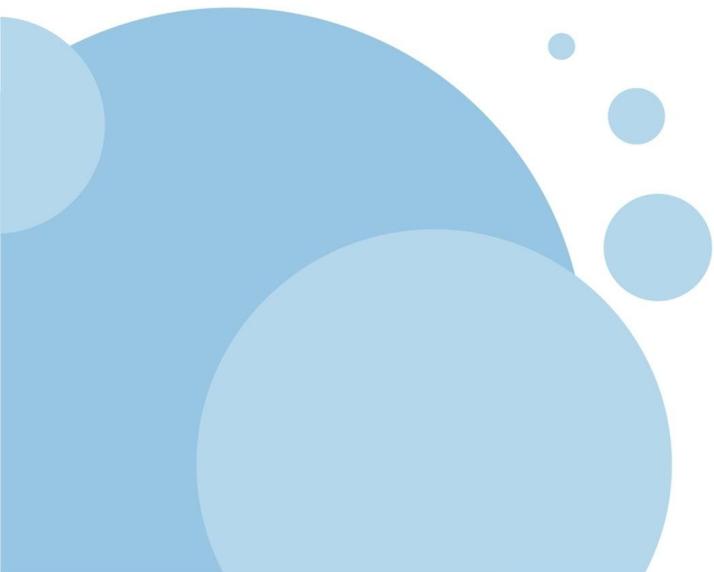
- UNIX Admin (15+ yrs)
- Ultrix,HP/UX,AIX,Linux,Solaris
- Education, R&D, Retail, Financial
- Instructor (corporate education)
- BLU member/contributor 9+ yrs
- BS Computer Science Engineering

- Currently:
 - Solutions Architect (Sales Engineer)
 - Red Hat



Presentation History

- March 2008 – BLU / Boston Linux & UNIX
<http://www.blu.org>
- May 2008 – GNHLUG / Greater New Hampshire
<http://www.gnhlug.org>
- May 2008 – BLU / Boston Linux & UNIX (Part 2)
<http://www.blu.org>



Digital Audio Workstation

DAW

The term "DAW" refers to a general combination of audio multitrack software and high-quality audio hardware — the latter being a specialized audio converter unit which performs some variety of both analog-to-digital (ADC) and digital-to-analog (DAC)

System designed to record, edit and play back digital audio.

Freely manipulate recorded sounds, much like a word processor manipulates typed words.

-wikipedia



Sequencing

Making Noise

Using a software sequencer application (like Rosegarden), you first create/edit a song.

Then you play the song, at which time the sequencer sends the MIDI events to the various instrument(s) and/or devices.

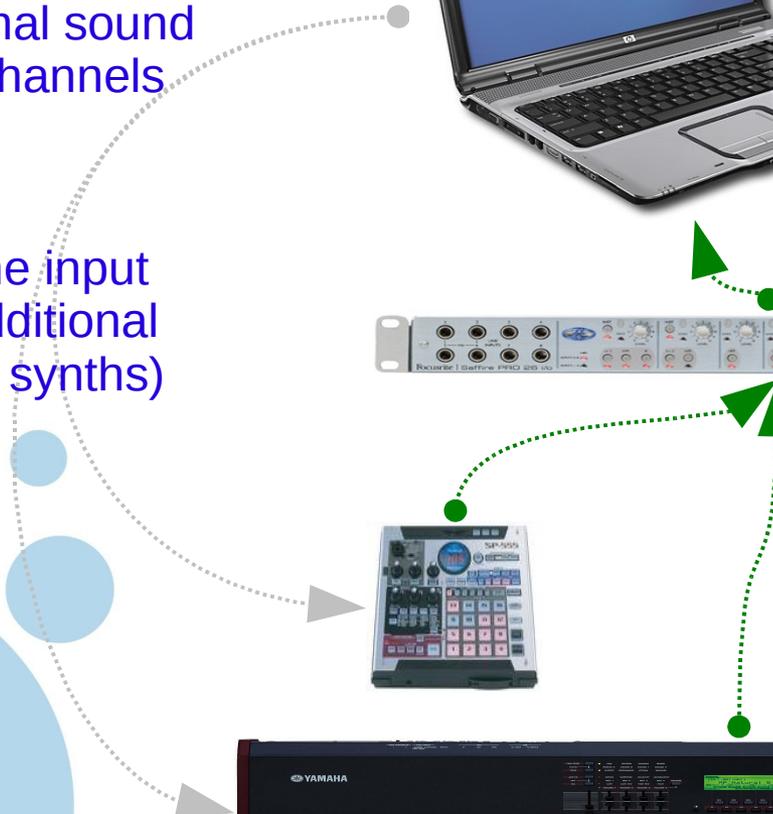


Effects & SoftSynth

Modifying Noise

Using an analog-to-digital device (like the Focusrite Saffire Pro/26) the instrument(s) output is delivered to the PC via firewire, usb, or traditional sound card input on multiple channels (multi-track)..

Using jack, you route the input from your sources to additional effects processors (soft synths)

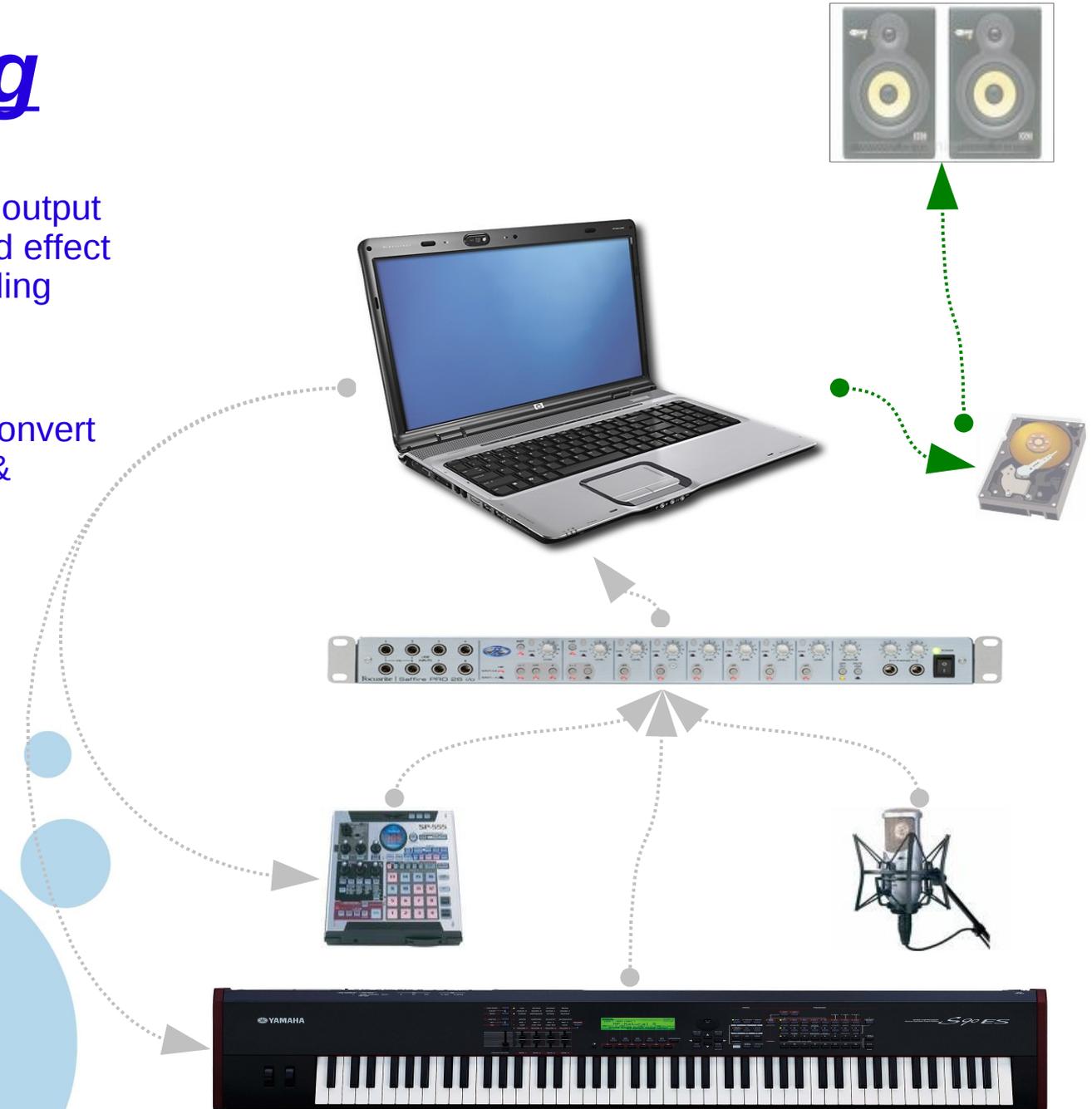


Recording

Saving Noise

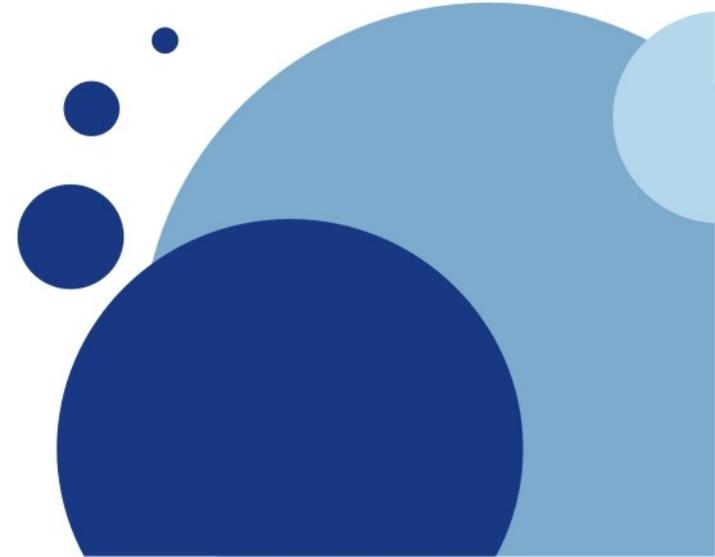
Using jack, you route the output from your instruments and effect processors to your recording application (like Ardour).

Save your work to disk, convert to ogg, mp3, wav, etc... & amaze your friends



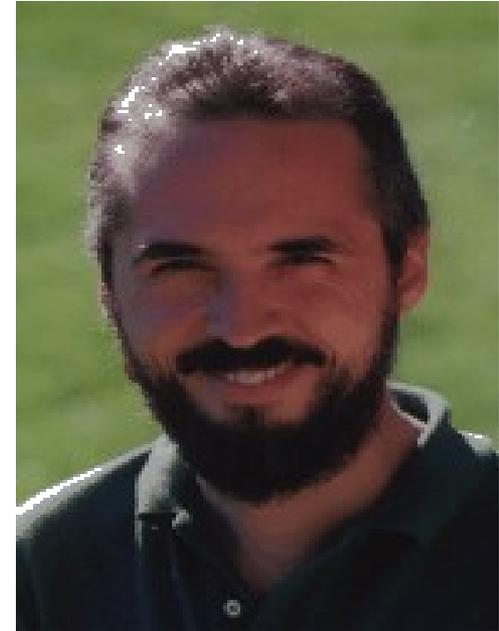


CCRMA
&
Fedora Audio SIG



A Word on CCRMA (karma)

- <http://ccrma.stanford.edu/planetccrma/software/>
- For a number of years audio applications for Red Hat Linux and Fedora have been packaged by Fernando Lopez-Lezcano in the Planet CCRMA repository.
- **Planet CCRMA is a third party repository that specializes since 2001 in transforming a stock Fedora (originally Red Hat) workstation into a low latency audio machine.**
- It includes a low latency patched kernel, assorted utilities to get everything working without manual configuration and a fairly complete collection of up to date open source sound, midi and music applications geared towards musical content creation.



Fernando Lopez-Lezcano

Lecturer, Composer and System
Administrator

CCRMA, Stanford University

Fedora Audio SIG

Special Interest Group

- <http://fedoraproject.org/wiki/SIGs/AudioCreationDay>
- Today I am using Fedora 8
- **Fedora 9 was released May 13th, 2008**
- Recently a Fedora SIG has been created for audio, along with a mailing list. This has led to a number of audio packages appearing in the Fedora repositories and a growing cooperation with Fernando regarding the future direction of audio package creation and distribution
- Essentially what this means is that the Fedora distribution now includes a significant share of applications required to do typical DAW operations.
- **The CCRMA repo continues to augment Fedora for newer versions of apps and specialized kernels.**

For example:

- Ardour 2
- realtime kernel extensions
- firewire raw device support



Legal Considerations

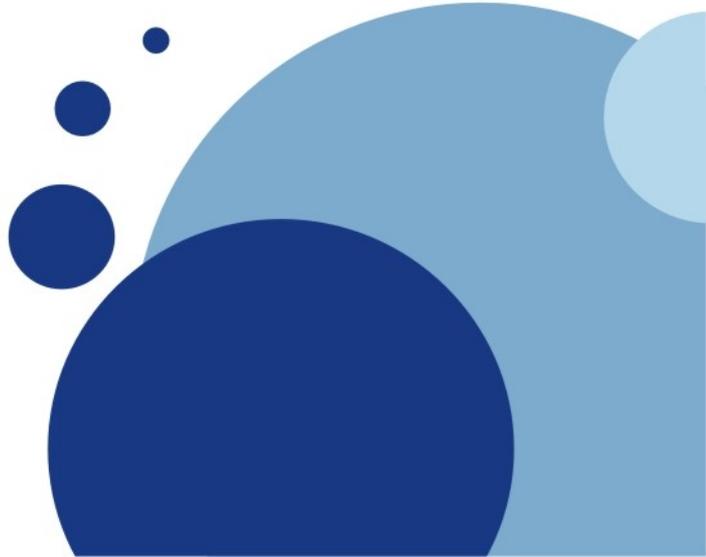
Who owns what

- I'm not a subject matter expert
- This is speculation designed to create discussion on appropriate usage.
- Things to consider:
 - Protocols (MIDI) are open and documented
 - Implementations (MIDI) are not
 - (?) Soundfonts
 - (?) Firmware for devices
- When you are downloading audio files, other things to consider:
 - Laws governing copyright
 - Laws governing privacy



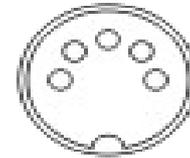


MIDI 101



MIDI 101

- MIDI (Musical Instrument Digital Interface) is an industry-standard protocol that **enables electronic musical instruments, computers, and other equipment to communicate, control, and synchronize with each other.**
- **1981 Dave Smith** audio engineer and synthesizer designer of Sequential Circuits, Inc. proposed the MIDI standard in a paper to the Audio Engineering Society.
 - He is generally regarded as the "Father of MIDI"
- **August 1983** MIDI Specification 1.0 was published.
- MIDI technology has been standardized and is maintained by the MIDI Manufacturers Association (MMA).
- All MIDI compatible instruments have a built-in MIDI interface. Some computers' sound cards have a built-in MIDI Interface, whereas others require an external MIDI Interface which is connected to the computer via the game port, the newer DA-15 connector, a USB connector or by FireWire or ethernet.
- MIDI connections include traditional MIDI cables, USB and Firewire.



MIDI 101 – Protocol Theory

- When a musical performance is played on a MIDI instrument (or controller) it **transmits MIDI channel messages** from its MIDI Out connector. A typical MIDI channel message sequence corresponding to a key being struck and released on a keyboard is:
 - The user presses the middle C key with a specific velocity (which is usually translated into the volume of the note but can also be used by the synthesiser to set characteristics of the timbre as well). ---> The instrument sends one Note-On message.
 - The user changes the pressure applied on the key while holding it down - a technique called Aftertouch (can be repeated, optional). ---> The instrument sends one or more Aftertouch messages.
 - The user releases the middle C key, again with the possibility of velocity of release controlling some parameters. ---> The instrument sends one Note-Off message.
 - Note-On, Aftertouch, and Note-Off are all channel messages. For the Note-On and Note-Off messages, the MIDI specification defines a number (from 0–127) for every possible note pitch (C, C#, D etc.), and this number is included in the message.
- Other performance parameters can be transmitted with channel messages, too.

MIDI 101 – Protocol Example

- MSB of status byte is always 1
- MSB of data byte is always 0
- A 3 byte MIDI note-on might look as follows:

	status byte	data byte	data byte
description	status/channel #	Note #	Attack Velocity
binary	1001.0100	0100.000	0101.1001
numeric value	Note on/CH#5	64	89

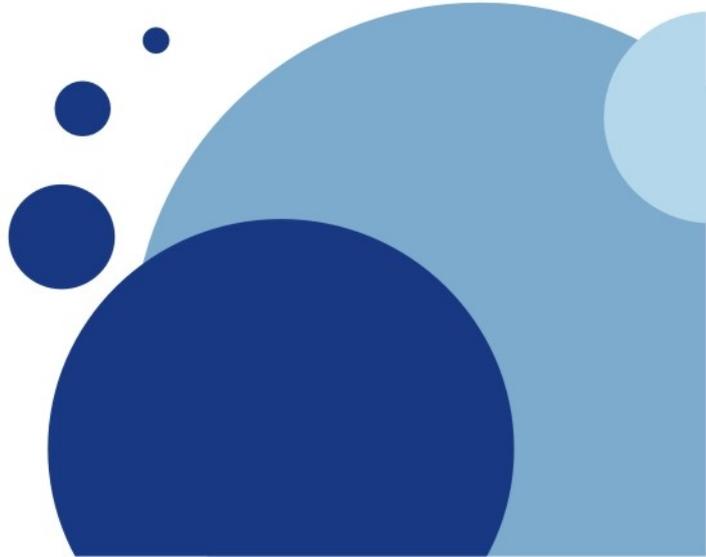
- Notice the channel nibble is 4 bits
- thus 16 channels max per cable, or port

MIDI 101

- Other ramblings:
 - Timing Synchronization (master/slave)
 - MIDI pass-thru (chaining)
 - Ports, Banks, MSB, LSB
 - Status byte – identifies type of MIDI operation
 - Data byte – associates value to a status byte
 - Instrument vs. Percussion banks
 - PRE vs USER Banks
 - MIDI control surfaces (for audio & video editing!!!!)
- Just when you think you got it, now you're an electrician:
 - ground loops
 - unbalance wires vs. balanced wires
 - tracking down that hum
 - everyone has an opinion, nothing is easy, and nothing is free
- And ... NO it's still not all working harmoniously just yet. I have yet more to learn/do.



Tool Belt Summary

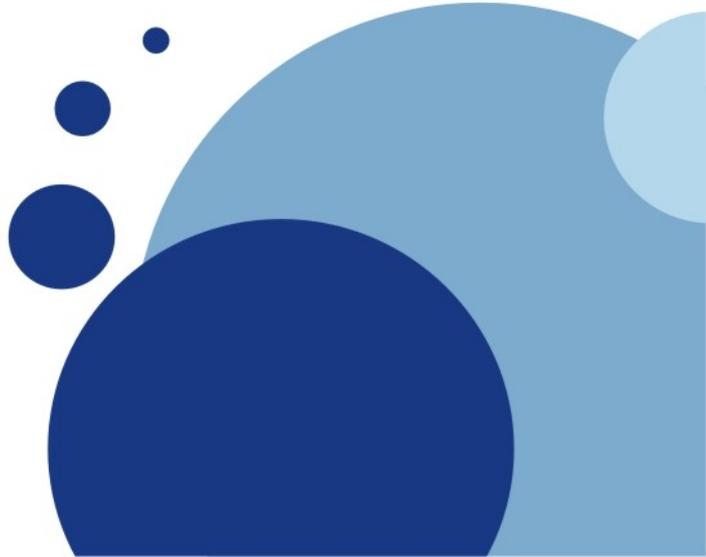


All the Bits & Pieces

- Laptop w/ Fedora 8
 - Alsa, Jack, Qjackctl, Rosegarden, zynaddsubfx, vkeybd
 - Ramblings on Pulse audio
- Things I will need later from Fedora 8
 - Ardour
 - Libraw1394
- CCRMA
 - Cutting edge software versions
 - Ardour2
 - Realtime kernel (Ingo Molnar)
 - Raw Firewire (FFADO)
- MIDI Keyboard
- Firewire Audio Device
- Lots of spare time!

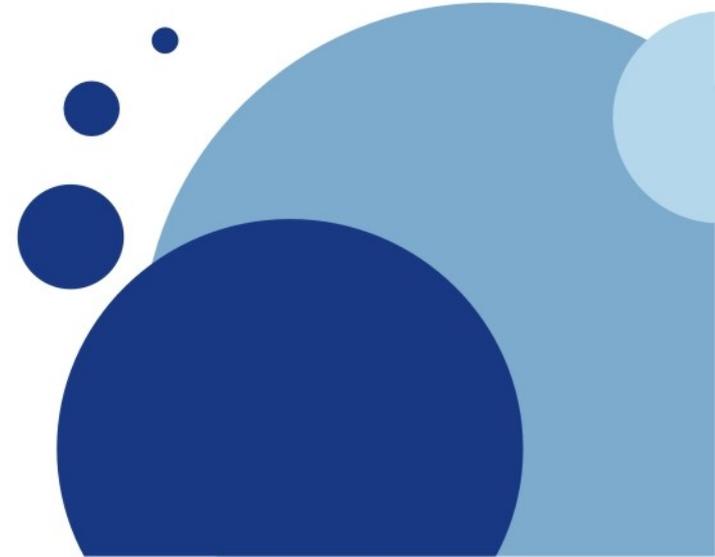


Rosegarden (demo)



Rosegarden Demo Outline

- What I needed to install (add) outside of Fedora 8 repo
 - Midisport (sourceforce): M-audio usb->midi gadget
- Demo:
 - jackd / qjackctl startup
 - Configuring Audio & Midi connections
- Rosegarden
 - startup
 - MIDI management
 - MIDI patch/implementation config file
 - interface high level overview
 - standard matrix editor
 - percussion matrix editor
 - notation editor
 - controllers
 - Play a simple song



Competitive Landscape

Competitive Landscape

- Proprietary
 - Cubase (Steinberg)
 - Cakewalk Sonar (Roland)
 - ProTools (Digidesign)
 - Reaper
 - Ableton Live



- OSS
 - Muse
 - Rosegarden
 - Ardour
 - Audacity
 - Lilypond



- HINT: check out youtube.com for product demos



Resources

- The MIDI Manual (3rd Edition), David Miles Huber, Focal Press 2007 [ISBN-13: 978-0-240-80798-0]
- http://en.wikipedia.org/wiki/General_MIDI/
- <http://en.wikipedia.org/wiki/Soundfont/>
- <http://tldp.org/HOWTO/MIDI-HOWTO.html>
- <http://www.ffado.org/>
- <http://freebob.sourceforge.net/>

Articles:

- Michael Tiemann (2005 - Fedora Core 5)
<http://www.redhat.com/magazine/023sep06/features/rosegarden/>
- Keith Sharp (2006 - Fedora Core 6)
<http://www.redhatmagazine.com/2007/02/15/professional-audio-with-fedora-core-6/>
- I haven't read this article yet
<http://hubpages.com/hub/Recording-in-Linux-aka-Free-and-Open-Source-Digital-Audio-Workstation>
- Another relatively new article I haven't read
<http://www.passback.org.uk/music/fedora-music-intro/>