Ardour 3 — a users' guide

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Chapter 1

Introduction

Hello, and welcome to Ardour!

1.1 What is Ardour?

Ardour is an open-source digital audio workstation (DAW) for Linux and Mac OS X.

1.2 Typographical conventions

This manual uses special symbols to denote sections which contain advanced material. The reader can skip these sections without any great loss.

Tricky parts of the text are formatted like this. They contain extra information which may be of interest to advanced users.

1.3 About this manual

This manual is a work-in-progress. In other words, it is not even close to being complete. Any suggestions for improvements, content, or comments on parts that do not make sense are welcome to cth@carlh.net.

For those familiar with 'git', the manual's DocBook source can be obtained from the git repository linked from http://carlh.net/ardour. Patches to the manual are most welcome.

1.3.1 Licence

1.4 Getting help with Ardour

There are several places that you can get help with using Ardour.

1.4.1 The website

Ardour's website (http://ardour.org) contains many useful resources, including a list of frequently-asked questions, a forum and a bug and feature request tracker.

1.4.2 IRC

Ardour's core developers and several key users are usually to be found on Internet Relay Chat (IRC) on irc.freenode.net in #ardour and #ardour-osx at pretty much any hour of the day or night. This is a live chat system that is great for dicussing Ardour's development, design, and also user problems. There are IRC clients for most operating systems, or you can join in directly from your web browser by choosing Chat from the Ardour's Help menu.

If you join the IRC rooms, here are a few tips:

- *Don't ask to ask, just ask* — rather than saying 'Is it ok if I ask a question?', just ask your question — it is not considered rude to do so. Then wait: your answer may come in seconds, minutes, hours or never, depending on who is around and what time of the day it is wherever they happen to be in the world. In particular, make sure you *do* wait; do not get upset if you don't get an answer straight away.
- *Don't be offended if no-one replies* — although other users may be logged into the channel, they may well be coding Ardour, cooking, reading XKCD, cleaning their ostrabagalous devices, or any number of other things.
- *Don't paste large amounts of text into the channel* — if you have more than a couple of lines of output from some command that you want to show everyone, use a site like pastebin.com You can copy your text into that site, and it will give you a web address that you can paste into the channel.
- *Be as detailed as possible* — if you have a problem, tell us what version of Ardour you are using, and what operating system you are running on (Linux, OS X or Windows).

1.4.3 Mailing lists

There is a Ardour users mailing list, where various discussions about Ardour (and recording in general) take place. There are links to join the list on Ardour's website.

1.4.4 Support expectations

As Ardour evolves, it becomes a serious alternative to commercial products for more and more people. We see the download counts increase for each new release, and the volume of traffic on the mailing lists is growing. That's lovely, of course. We work on Ardour without the accoutrements of a 'normal' software corporation, so whenever a new user finds our work useful and worthwile, it makes what we do seem meaningful and worth continuing with.

Unfortunately, it's not all roses we receive. With wider public interest and more users, there's bound to be people who are disappointed in Ardour. We believe, however, that it's only because most newcomers do not realize what to expect.

1.4.4.1 The development team

Many users probably don't realize it, but the development team driving Ardour forward is very small for the amazingly complex piece of software that is a contemporary DAW.

At this time, the main force behind Ardour is delivered by one person, with core aid from two others, and contributions from on the order of a dozen others. Consider that we do support, web site maintenance, documentation, feature enhancements, debugging, as well as development.

There are more people (perhaps another dozen) pitching in with translation, release engineering (preparing Ardour for users), Mantis triaging ('Mantis' is the bug database used to keep track of known problems, 'triaging' the process of prioritizing and verifying bugs) and other necessary tasks.

So we are always looking for new people to help, and while (unfortunately) a common misconception is that a project like Ardour would only benefit from more programmers, it is not the case! Whatever your ability, we can use it. If you are interested in spending a little time making Ardour a better DAW, please don't hesitate to join the developer mailing list and offer your services.

1.4.4.2 Ardour features and polish

As Ardour is getting more powerful and usable, we attract more and more users who expect the same feature set and product polish as they'll find in a commercial product such as DigiDesign's ProTools or Steinberg's Nuendo. This isn't the right way to think about Ardour at this time.

Not that we don't want to get there, you understand, but it's simply not a reasonable comparison. DigiDesign has spent who knows how many man-hours worth of development on ProTools and can spend a lot on getting good documentation written, new features, debugging, installation process made smooth and generally polish the thing till it shines. In comparison, Ardour development is driven primarily by the interests of just a few people. Development is a full time job for the lead developer, who also raises a three kids, fixes up his house, has friends and even a relationship with a gorgeous woman.

Do not read that as an excuse for why Ardour lacks in comparison with other products. Do read it as an explanation for why you should expect nothing more from Ardour than it actually delivers. And rest assured that the developers want and expect it to rival, or better yet, beat the proprietary DAWs. That's why we're so committed to this development model — because we believe it's the best way to get there.

1.4.4.3 Releases

Ardour releases are also put together by volunteers. This means that there's usually only prebuilt binaries available for a few select platforms. While we would like to see Ardour prebuilt for all the platforms (and operating system versions) Ardour runs on, it's simply not possible since the volunteers doing the release only have access to a subset of those platforms.

With specific regards to library dependencies: depending on the volunteer's machine configuration, the Ardour binary may require you to install additional or newer libraries before it will work. If so, the installation instructions should contain the necessary information for you to find those libraries. Please do not complain about the need for these libraries — just as you might dislike installing/upgrading the libraries, the volunteer doing the release may dislike removing/downgrading the libraries on her machine.

If you find that there are no prebuilt binaries for your platform/configuration, and are willing to help provide packages for coming releases, please join the developer mailing list and offer your services. It is not a requirement that you are a programmer, but there may be a requirement for (commercial) development tools which not everyone would have access to. If you have the time and tools, we can probably guide you through the process, even if you don't have the knowledge.

1.4.4.4 Support

You can join both the user and developer mailing lists and ask questions there. You can also ask for help on IRC, and you can file bug reports and feature requests in Mantis. However, since support is also provided on a volunteer basis, you must be careful not to have unreasonable expectations: you cannot demand your questions to be answered or bugs to be fixed. In short: the people volunteering time to Ardour only have so much time available, and they alone decide how to spend it. Please respect their choice.

When that is said, you should know that the mailing list and the IRC channel are friendly places — few requests go without reply. And we also do our best to fix all bugs reported, just as we strive to implement requested features. But as should be evident from the number of open bugs in Mantis, there's not enough hours in the day to allow us to address all issues in a timely manner.

Chapter 2

Overview

As one might expect, Ardour is similar in many ways to many other DAWs and also has its fair share of differences. This chapter gives an overview of Ardour.

2.1 JACK

Ardour is built on another piece of software called JACK [1]. JACK has two main functions; first, it moves audio and MIDI to and from a sound card, and second, it allows audio and MIDI to be routed between different applications.

JACK provides a great deal of flexibility and power, especially when running other applications (such as soft-synthesizers or samplers) at the same time as Ardour. It is somewhat similar to Steinberg's Rewire technology, though broader in scope. It is even possible to use JACK to route audio and MIDI over network connections.

JACK must be running when Ardour is, though it is possible (if you wish) to almost ignore its existance. At first we will let Ardour start JACK, and not get too involved in its complications. Chapter 17 gets into more detail for those that are interested.

2.2 Ardour concepts

Ardour has its own names for the usual set of common DAW concepts. This section briefly describes some of these concepts.

2.2.1 Sessions

An Ardour *session* is a container for an entire project. A session may contain an arbitrary number of tracks and busses consisting of audio and MIDI data, along with information on processing those tracks, a mix of levels, and everything else related to the project. A session might typically contain a song, or perhaps an entire album or a complete live recording.

Ardour sessions are held in directories; these directories contain one or more *session files*, some or all of the audio and MIDI data and a number of other state files that Ardour requires. The session file describes the structure of the session, and holds automation data and other details.

Ardour's session file is kept in XML format, which is advantageous as it is somewhat human-readable, and human-editable in a crisis. Sound files are stored in one of a number of optional formats, and MIDI files as SMF (standard MIDI format).

It is also possible for Ardour sessions to reference sound and MIDI files outside the session directory.

[1]JACK stands for the JACK Audio Connection Kit; a pleasingly recursive acronym.

Ardour has a single current session at all times; if Ardour is started without specifying one, it will offer to load or create one.

2.2.2 Tracks

A track is a concept common to most DAWs, and used also in Ardour. Tracks can record audio or MIDI data to disk, and then replay it with processing. They also allow the audio or MIDI data to be edited in a variety of different ways.

In a typical pop production, one might use a track each for the kick drum, another for the snare, more perhaps for the drum overheads and others for bass, guitars and vocals.

Ardour can record to any number of tracks at one time, and then play those tracks back. On playback, a track's recordings may be processed by any number of plugins, panned, and its level altered to achieve a suitable mix.

A track's type is really only related to the type of data that it stores on disk. It is possible, for example, to have a MIDI track with a synthesizer plugin which converts MIDI to audio. Even though the track remains 'MIDI', in the sense that its on-disk recordings are MIDI, its output may be audio-only.

2.2.3 Regions

A track may contain many segments of audio or MIDI. Ardour contains these segments in things called *regions*, which are self-contained snippets of audio or MIDI data. Any recording pass, for example, generates a region on each track that is enabled for recording. Regions can be subjected to many editing operations; they may be moved around, split, trimmed, copied, and so on.

2.2.4 Playlists

The details of what exactly each track should play back is described by a *playlist*. A playlist is simply a list of regions; each track always has an active playlist, and can have other playlists which can be switched in and out as required.

2.2.5 Busses

Busses are another common concept in both DAWs and hardware mixers. They are similar in many ways to tracks; they process audio or MIDI, and can run processing plugins. The only difference is that their input is obtained from other tracks or busses, rather than from disk.

One might typically use a buss to collect together the outputs of related tracks. Consider, for example, a 3-track recording of a drum-kit; given kick, snare and overhead tracks, it may be helpful to connect the output of each to a bus called 'drums', so that the drum-kit's level can be set as a unit, and processing (such as equalisation or compression) can be applied to the mix of all tracks.

2.2.6 Plugins

Ardour allows you to process audio and MIDI using any number of *plugins*. These are external pieces of code, commonly seen as VST plugins on Windows or AU plugins on Mac OS X. Generally speaking, a plugin is written using one (and maybe more) standards. Ardour's plugin support is for the following standards:

- LADSPA[2] — the first major plugin standard for Linux. Many LADSPA plugins are availble, mostly free and open-source.
- LV2 — the successor to LADSPA. Lots of plugins have been 'ported' from LADSPA to LV2, and also many new plugins written.

[2] An acronym of "Linux Audio Developers' Simple Plugin API"

- VST — Ardour supports VST plugins that have been compiled for Linux.
- AU — Mac OS X versions of Ardour support AudioUnit (AU) plugins.

Ardour has some support for running Windows VST plugins on Linux, but this is rather complicated, extremely difficult for the Ardour developers to debug, and generally unreliable. If it is at all possible, you are strongly advised to use native LADSPA, LV2 or Linux VST plugins on Linux, or AU on Mac OS X.

2.3 The Ardour interface

This section gives an overview of Ardour's main interface elements.

2.3.1 The editor window

The first of Ardour's two main windows is the *Editor*. A typical editor window is shown in Figure 2.1.

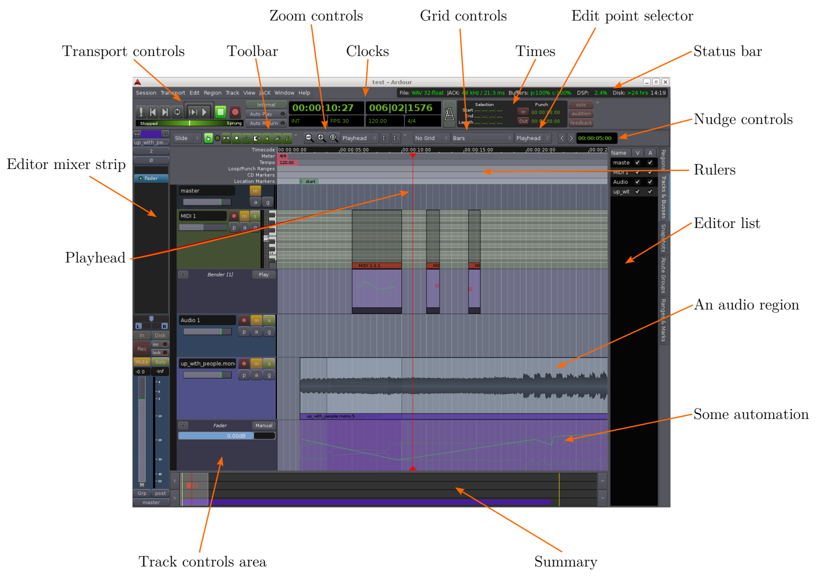


Figure 2.1: A typical editor window

The main bulk of the window is taken up with the timeline; this is the area in which regions and automation are displayed, with time moving from left to right. The track controls area gives a set of controls for each track, for basic operations such as solo, mute and so on. The (optional) editor mixer is a single mixer strip which handles the currently-selected track, and is useful for tweaks to the mix without the need to move to the full mixer window. At the bottom of the window is the 'summary', which displays the whole session in a reduced-size form. At the top right is a bar of useful information about the state of the system.

The operation of the editor window is described in more detail in Chapter 4.

2.3.2 The mixer window

The other main Ardour window is the *Mixer*. A typical mixer window is shown in Figure 2.2.

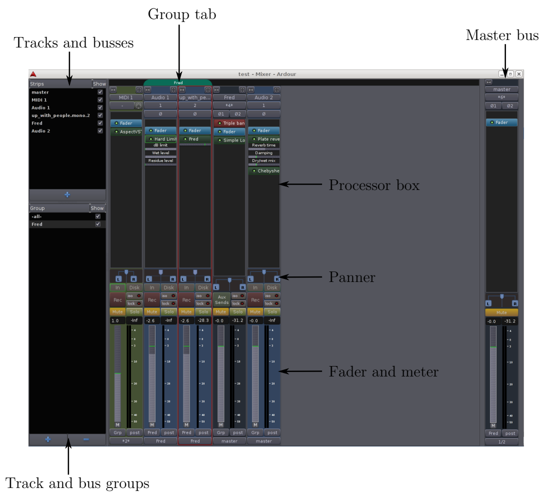


Figure 2.2: A typical mixer window

The main part of the window is taken up with *mixer strips*, one for each track or bus in the session, which correspond roughly to the channel strips on a conventional mixing desk. This window allows you to process audio, route signals around and balance your mix.

The operation of the mixer window is described in more detail in Chapter 6.

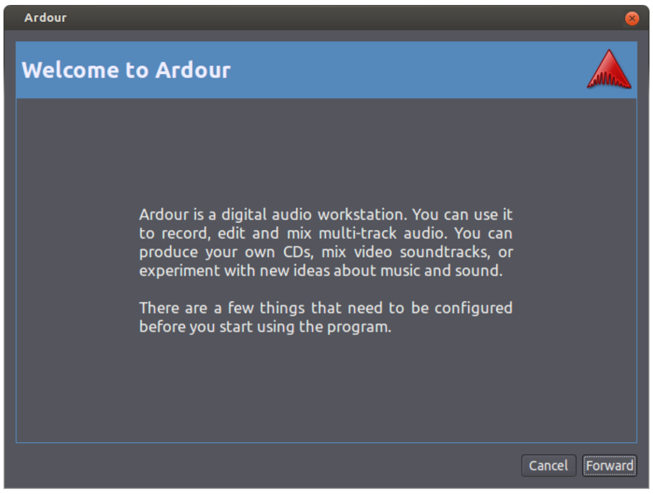
Chapter 3

Quick start

This chapter blithely assumes that you just want to use Ardour to make a basic audio recording from a sound card, and describes how that can be achieved. We assume that you have some sound source (such as a microphone, guitar or whatever) plugged into one of your sound card's inputs, and a monitoring system (speakers or headphones) connected to its outputs.

3.1 Starting Ardour and creating a session

When Ardour is run for the first time, it starts with the dialogue box shown in Figure 3.1. Click Forward to continue.

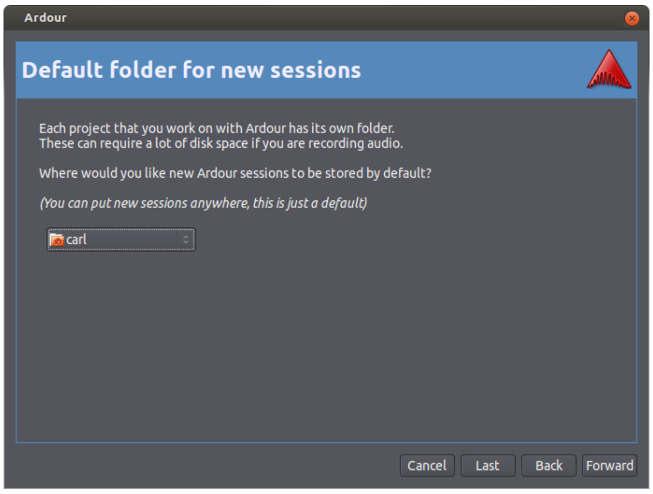


Ardour is a digital audio workstation. You can use it to record, edit and mix multi-track audio. You can produce your own CDs, mix video soundtracks, or experiment with new ideas about music and sound.

There are a few things that need to be configured before you start using the program.

Figure 3.1: Welcome to Ardour!

As it is the first run, Ardour now asks a few basic questions about how it should be set up. Its first question is about where to put sessions by default, as shown in Figure 3.2. The initial choice will be the your home directory; other locations can be selected by clicking on the button and selecting an alternative directory.


Ardour

Default folder for new sessions

Each project that you work on with Ardour has its own folder.
These can require a lot of disk space if you are recording audio.

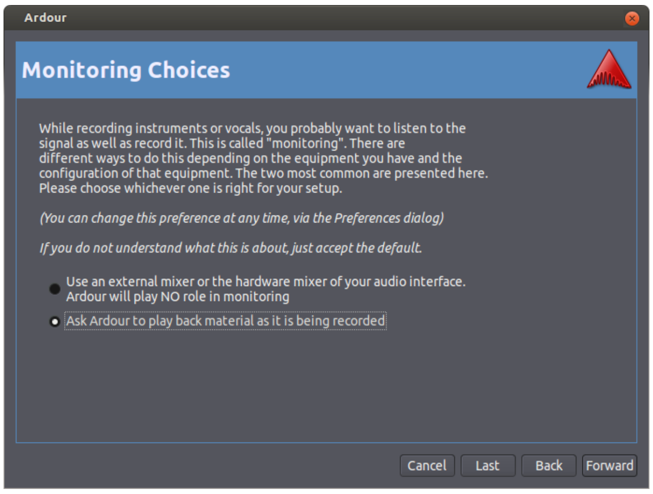
Where would you like new Ardour sessions to be stored by default?

(You can put new sessions anywhere, this is just a default)

carl

Figure 3.2: Default folder for new sessions

The next choice governs how Ardour will handle monitoring, as shown in Figure 3.3. For the purposes of this test, choose ‘Ask Ardour to playback material as it is being recorded’; this is probably the most widely-useful of the options. More detail on monitoring options can be found in Section 6.1.5.


Ardour

Monitoring Choices

While recording instruments or vocals, you probably want to listen to the
signal as well as record it. This is called "monitoring". There are
different ways to do this depending on the equipment you have and the
configuration of that equipment. The two most common are presented here.
Please choose whichever one is right for your setup.

(You can change this preference at any time, via the Preferences dialog)

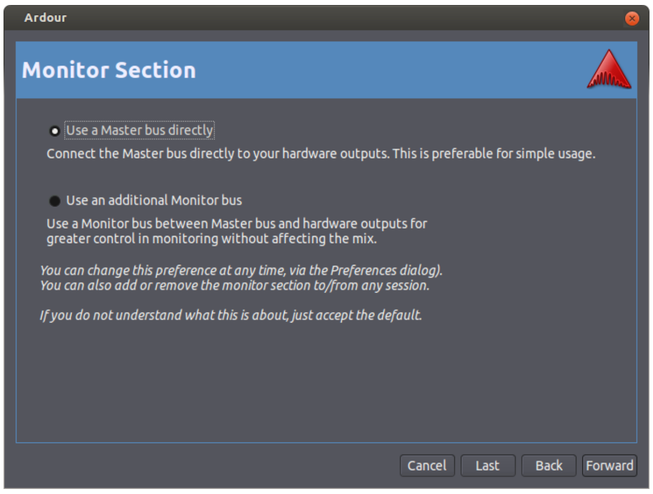
If you do not understand what this is about, just accept the default.

Use an external mixer or the hardware mixer of your audio interface.
Ardour will play NO role in monitoring

[✓ Ask Ardour to play back material as it is being recorded]

Figure 3.3: Monitoring choices

Following this, Ardour asks for a choice with respect to a monitor section (see Figure 3.4). This is explained in more detail in Section 6.2.3; for now, just choose the default ‘use a master bus directly’.



Monitor Section

Use a Master bus directly

Connect the Master bus directly to your hardware outputs. This is preferable for simple usage.

Use an additional Monitor bus

Use a Monitor bus between Master bus and hardware outputs for greater control in monitoring without affecting the mix.

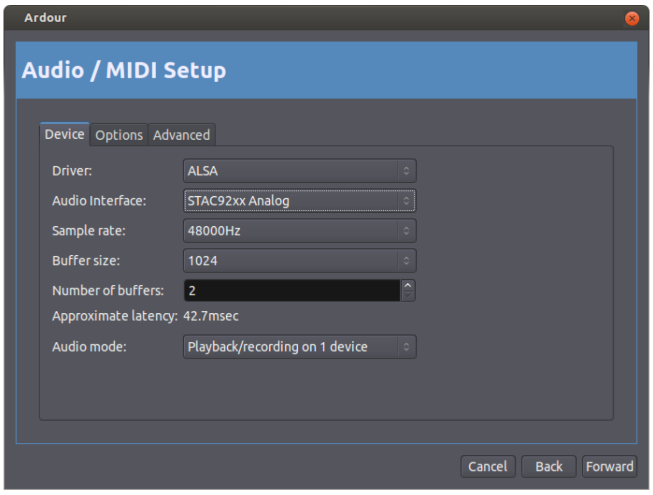
You can change this preference at any time, via the Preferences dialog). You can also add or remove the monitor section to/from any session.

If you do not understand what this is about, just accept the default.

Figure 3.4: Monitor section

At this point, if JACK has not already been started, Ardour will try to do it for you. In order to do that, it asks about how JACK should be set up (Figure 3.5).

There are three pages to the Audio / MIDI setup dialogue; the first is 'device', which allows selection of the sound card that Ardour will use, the sampling rate at which it will operate, and the buffer size. For now, select the interface that you are using for recording and leave other options as they are. For more information on the options here, consult Chapter 17.

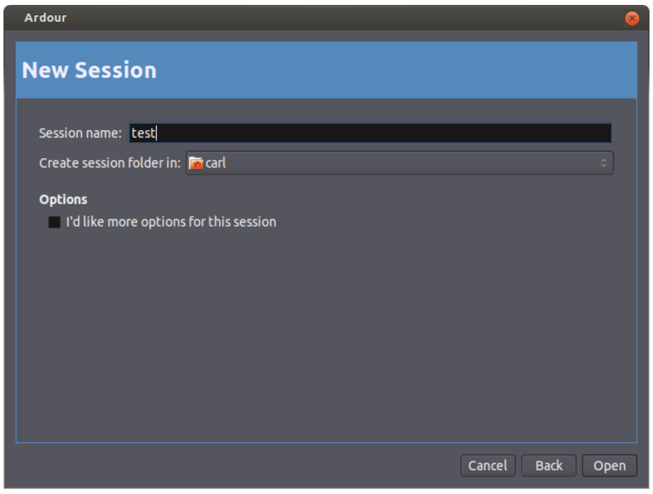


Audio / MIDI Setup

Driver: ALSA
Audio Interface: STAC92xx Analog
Sample rate: 48000Hz
Buffer size: 1024
Number of buffers: 2
Approximate latency: 42.7msec
Audio mode: Playback/recording on 1 device

Figure 3.5: Audio/MIDI setup — device

The final step in creating our session is to give it a name, as in Figure 3.6. Enter something like 'test' and click Open. At last, the reward should be the editor window (Figure 3.7). The session is created!



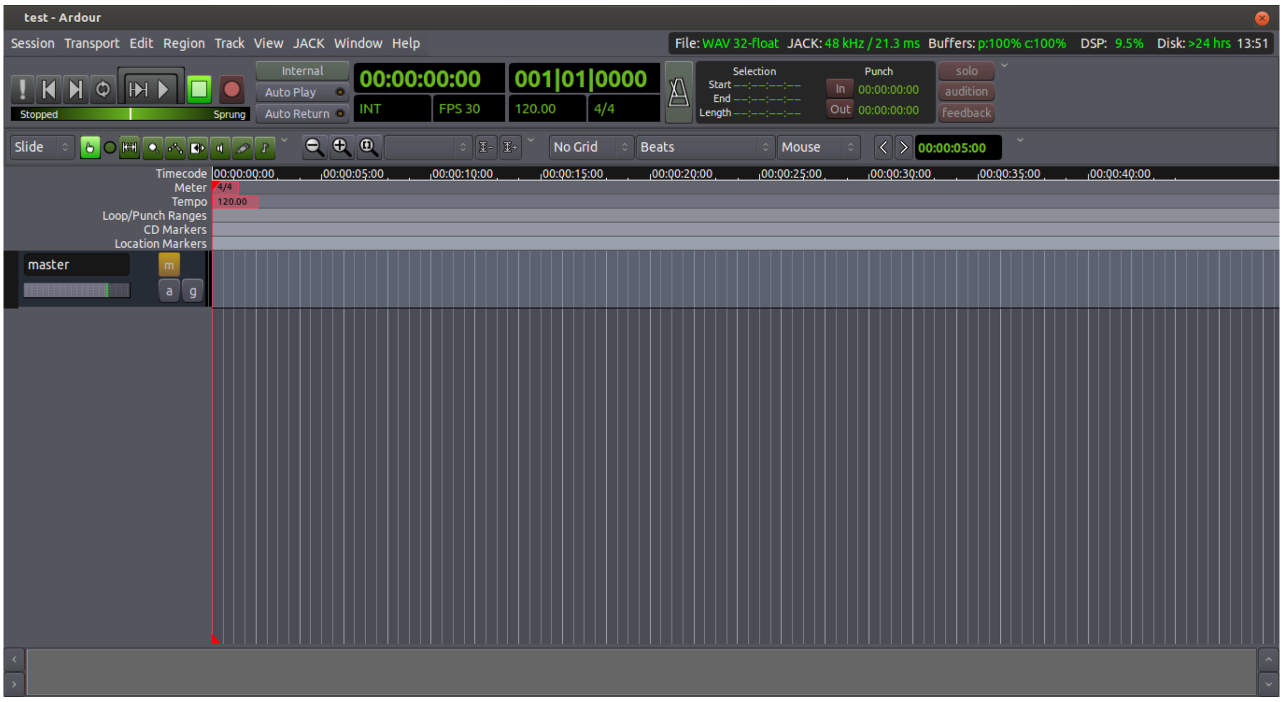
Session name: test

Create session folder in: carl

Options

I'd like more options for this session

Figure 3.6: New session



File: WAV 32-float JACK: 48 kHz / 21.3 ms Buffers: p:100% c:100% DSP: 9.5% Disk: >24 hrs 13:51

00:00:00:00 001|01|0000

INT FPS 30 120.00 4/4

Selection Start End Length

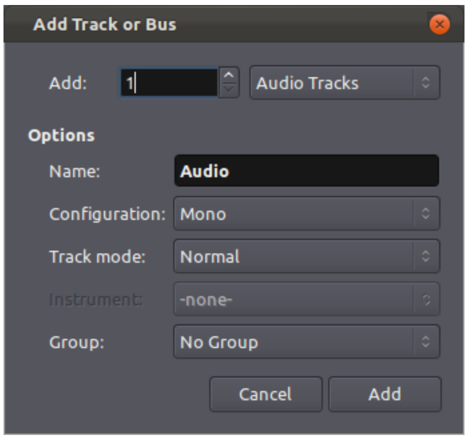
Punch In 00:00:00:00 Out 00:00:00:00

00:00:05:00

Figure 3.7: And finally: the editor!

3.2 Adding a track and connecting it up

The next step is to add a track to our session so that we have something to record onto. Choose Add Track or Bus... from Track at the top of the editor window. This will bring up a dialogue box, as shown in Figure 3.8.


Add Track or Bus

Add: 1 Audio Tracks

Options

Name: Audio

Configuration: Mono

Track mode: Normal

Instrument: -none-

Group: No Group

Figure 3.8: Add Track or Bus dialogue

For now, leave the options as they are; this will create a single monophonic audio track. This track must now be connected to the sound card so that it can record incoming audio.

Perhaps the easiest way to connect up this new track is to open its editor mixer strip. Do this now by pressing Shift-E or choosing Show Editor Mixer from the View menu. The top of the mixer strip that appears looks like that in Figure 3.9.

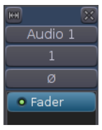


Figure 3.9: Top part of a mixer strip

At the top of this mixer strip there are three main buttons. The first, labelled 'Audio 1' (the name of the track) can be clicked on to open a menu of options for the track. The second, marked '1' is the input selector, and the third, marked φ, is a button to invert the track's signal.

In order to look at the connections to the input of this track, left-click on the button marked '1' to open the input *port matrix*, as shown in Figure 3.10.

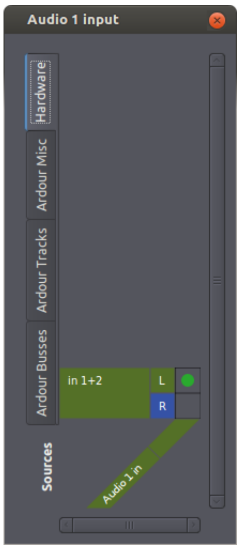


Figure 3.10: Input port matrix

The port matrix is the main interface that Ardour offers for connecting things together. In our example matrix, the left-hand side shows a set of ports that generate audio data; these correspond to the sound card inputs, outputs of Ardour busses and tracks, and other things that may exist on the system. Different groups of these ports can be seen by choosing one of the tabs on the far left-hand side of the dialogue.

At the bottom of the dialogue is the input to our track.

In the example matrix, there is a green dot at the intersection of the ‘L’ part of ‘in 1+2’ and the ‘Audio 1 in’ port. This means that the input of the ‘Audio 1’ track is connected to hardware input 1. Change this connection, if necessary, by clicking on the square which corresponds to the input to record from.

3.3 Recording

At this point, Ardour should be receiving a signal from some external sound source via the sound card. It is now possible to make a test recording. Click the record-enable button (red button with a pink circle) in the ‘Audio 1’ track controls area (shown in Figure 3.11). At this point, the Audio 1 meter should display any signal that is being sent into the sound card. If this is not working, something has gone wrong. Next, click the record-enable button in the main transport controls (shown in Figure 3.12); this will record-enable the session. Finally, click ‘Play’ to start the transport.

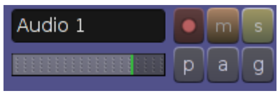


Figure 3.11: Track controls area

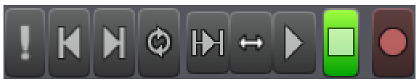


Figure 3.12: Main transport controls

Ardour is now recording; the playhead will move, and a red rectangle will be drawn where the recording is taking place. Make a noise with your external sound source! When you have finished recording, click the Stop button in the transport controls area. You should now have a region containing your recording on the 'Audio 1' track, as in Figure 3.13.

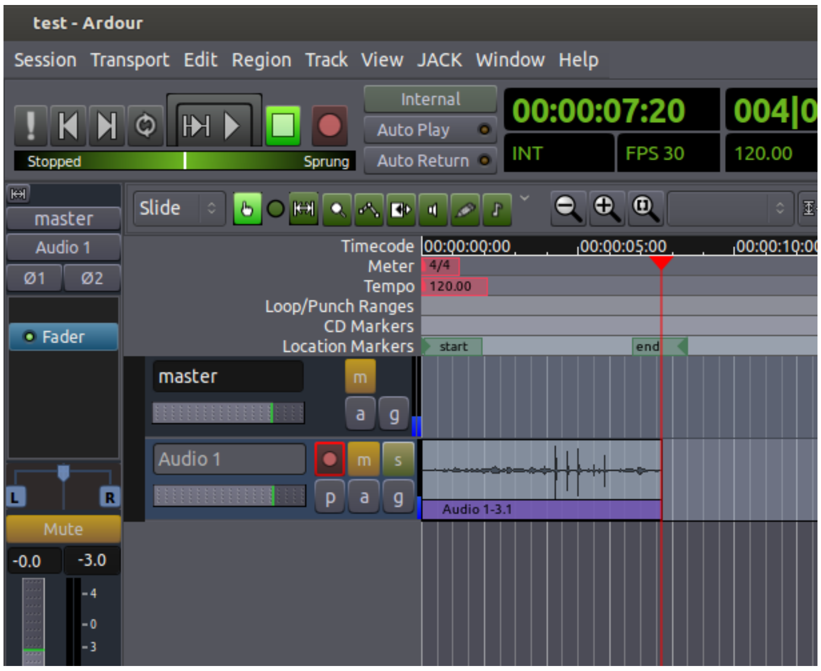


Figure 3.13: Editor window after recording a region

3.4 Playing back your recording

Now we can play back the audio that you have just recorded. First, you will need to move the playhead back to a point before your recorded region. Perhaps the easiest way to do this is to click somewhere within the rulers area of the editor window (as shown in Section 2.3.1).

Once the playhead is located before your recording, click the 'Play' button (or press the spacebar on the keyboard) to start playback. You should hear your recording through your monitor speakers or headphones.

3.5 Adding another track as an overdub

Now we can experiment further by adding an overdub to the first recording. First, add a new track, as we did before, and connect it up to the input on your soundcard which your source is connected to.

Now, record-enable the new track and record-disable the first track, move the playhead to before the previously recorded region, make sure the session is record-enabled and start the transport (by clicking 'Play' or pressing the spacebar). You should hear the previously-recorded audio on your monitor system while the new recording is in progress. Record something suitable over the top of your first region.

We now have two tracks of recorded data; you might like to add some more!

3.6 Mix-down

We will now assume that you want to do a mix-down of your magnum opus into a stereo WAV file. Such a file could later be converted to an MP3, or burned to CD, or simply played-back as-is by some other media player on your computer.

First, we need to mix the tracks that you have recorded so that they sound as you want them to. We will cover much more advanced mixing and processing later, but for now we will just set the relative levels of the two tracks. The easiest way to do this is to open the *mixer* window, either by selecting Mixer from the Window menu or by pressing Alt-M. The mixer window is shown in Figure 3.14.

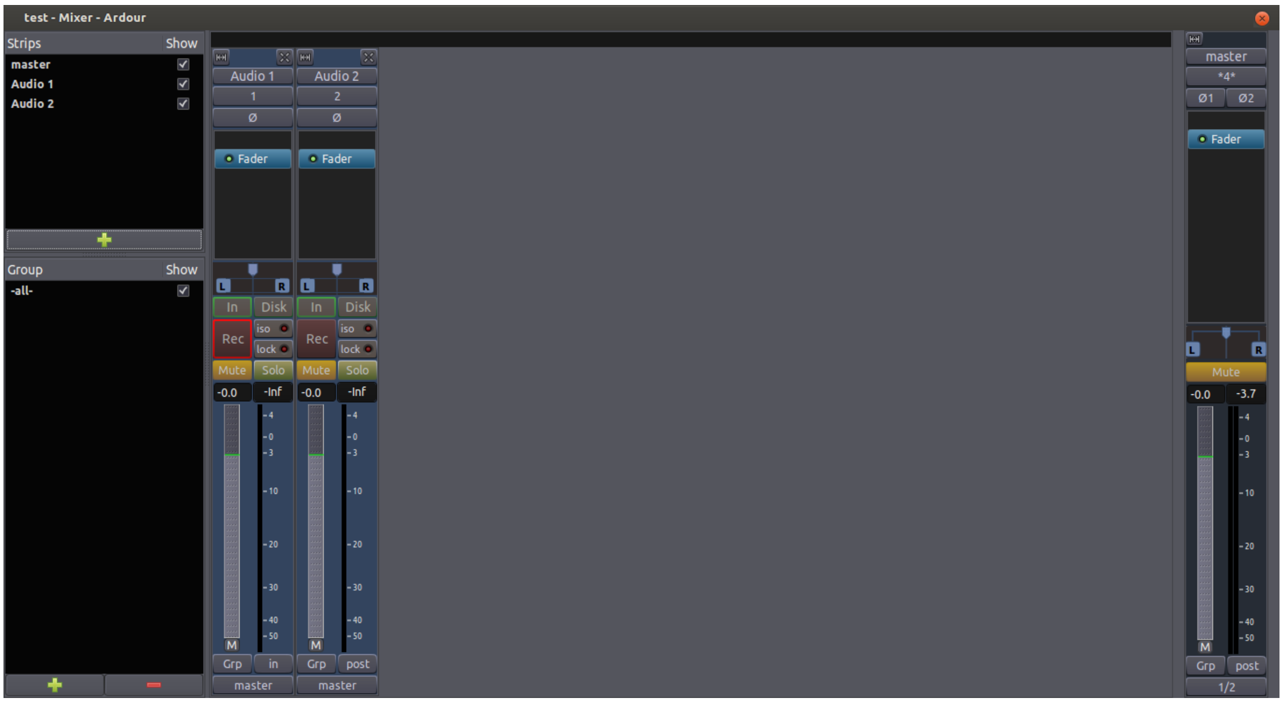


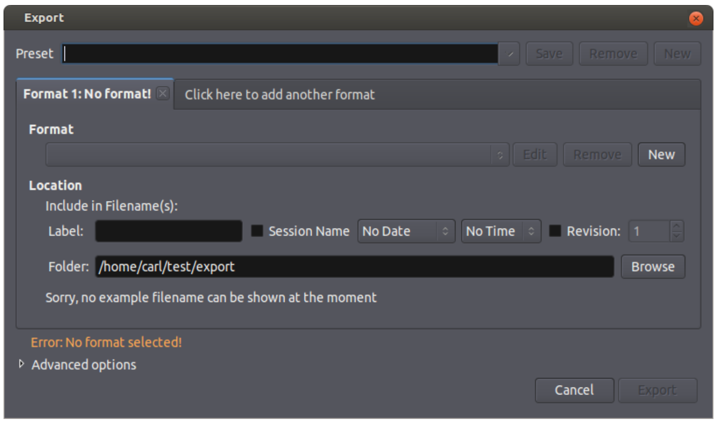
Figure 3.14: The mixer window

Here you will see a mixer strip for each track that you have recorded, and a 'master' strip. The signals for each track flow from the recordings on disk, through the appropriate strip, and they are then mixed together and passed through the master strip. The bottom half of each mixer strip contains a *fader*; this controls the level of each track. You can adjust the levels of each of your recordings by dragging the fader; the green marker indicates 0 dBFS ('unity gain'), at which the level of the track will be unaltered from the recording.

Play back your recordings from the editor window, and experiment with the levels in the mixer window until you have a sound that you are happy with.

3.7 Export

The final step is to export our recording into a stereo WAV file. Ardour's export options are extensive, but for now we will keep it simple. Choose Export to Audio Files from the Export submenu of the Session menu, and the Export dialogue will open, as shown in Figure 3.15.



Sorry, no example filename can be shown at the moment

Error: No format selected!

Figure 3.15: The export dialogue

First, we have to specify the format that we will export in. Fill in the preset label field with some name like 'WAV for CD', then click the New button beside the Format entry in the dialogue, and click on CD, Lossless (linear PCM), WAV and 44.1kHz entries. Then click Save to save the export preset. Enter some label for the export in the *Location* section, then click Export. Ardour will mix your session down to a WAV file and save it in the `export` subdirectory of your session folder.

Chapter 4

The editor window

A typical Ardour editor window is shown in Figure 4.1.

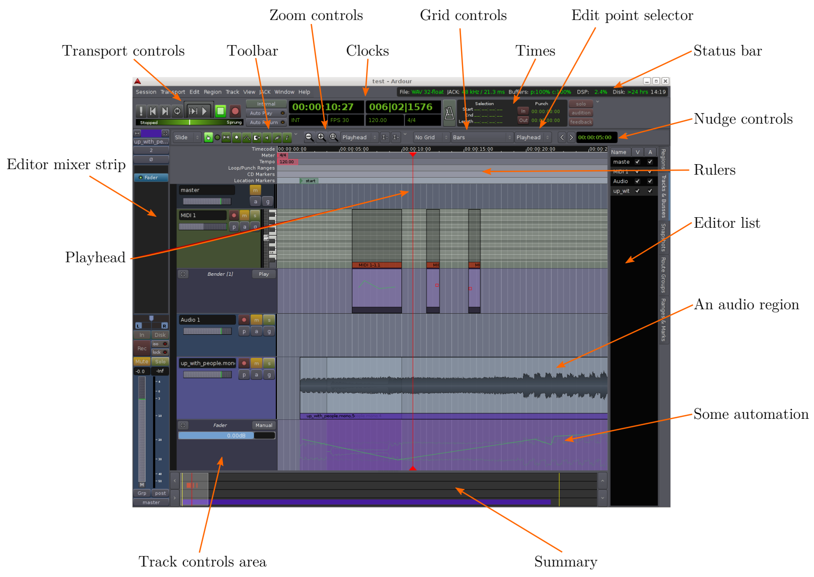


Figure 4.1: A typical editor window

This window is where audio and MIDI material can be viewed, edited and manipulated. It offers a view of your session as it progresses in time, and allows the constituent parts (tracks, regions, playlists and so on) to be manipulated. The contents of the main body of the window represent the session's tracks and busses, the functionality of which is discussed in Chapter 5.

The remainder of this chapter discusses the other parts of the editor window.

4.1 The playhead

The red vertical line with arrow heads at either end is the called the 'playhead'. The playhead position is used in a few different ways, but the most obvious is that it lies at the point in time at which Ardour is currently playing back or recording (or would be, were play or record to be started). It is also used in some editing operations, as we will discuss later.

4.2 The toolbar

The toolbar is a set of buttons that change the way the mouse and keyboard interact with the regions on the tracks, in order to perform different tasks.

Figure 4.2 shows the buttons on the toolbar.

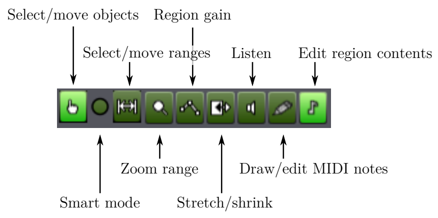


Figure 4.2: The Ardour toolbar

We will examine the broad function of these tools here, and go into more detail on their operation later.

- *Select/move objects* (**o**) — used to mark regions or MIDI notes as 'selected', and to move them around (in time, or to a different track, or to a different note in the case of MIDI).
- *Smart mode* — this provides a combination of the functionality of 'select/move objects' and 'select/move ranges' which may be familiar to users of Pro Tools.
- *Select/move ranges* (**r**) — used to mark ranges of time and to manipulate them.
- *Zoom range* (**z**) — this provides a mode whereby a time range can be dragged with the mouse, and the editor window will zoom to show that time range.
- *Region gain* (**g**) — used to edit audio gain curves on regions.
- *Stretch/shrink* (**t**) — allows stretching or shrinking of regions in time (using time-stretching / pitch-shifting algorithms) or MIDI notes.
- *Listen* — used to listen to regions at varying speed and in both directions.
- *Draw/edit MIDI notes* — used to draw new MIDI notes into MIDI regions, or change the length of those that are already there.
- *Edit region contents* (**e**) — this is a kind of 'modifier' for the other tools. When selected, it means that the other tools will operate on region contents rather than the regions themselves. For example, the select/move tool will select and move MIDI notes rather than the regions that the notes are in.

4.3 Rulers

The rulers section of the editor gives the option of several views; some time indications, in different units, details of tempo and meter (time signature) changes, and a display of various types of marker.

Right-clicking over the marker area offers a menu from which the displayed rulers can be chosen.

4.3.1 Time displays

The time rulers that can be displayed are:

- *Min:Sec* — time in hours:minutes:seconds:millseconds.

- *Timecode* — time in hours:minutes:seconds:frames.
- *Samples* — time in audio samples.
- *Bars:Beats* — time in bars and beats.

4.3.2 Meter and tempo

Ardour provides support for considering a piece of music as having tempo and meter. This is optional in the sense that you can happily ignore tempo and meter settings if they are not relevant to your recording situation. Use of tempo has two main effects; firstly, Ardour can provide a metronome 'click' which can be used as reference to record to. Secondly, tempo will affect the speed at which MIDI data is played back, so you can change how your records will sound by changing the tempo. Meter (time signature) also affects the metronome click, as the click will emphasise the sound of the first beat of the bar. It has no effect on the *playback* of MIDI, but adjusting time signature to match the music may make things more intuitive to work with. Both tempo and meter affect the grid that is displayed (and, optionally, snapped to) which shows bars and beats. The grid will adjust itself to zoom level, so the finer details of the session may not be visible if you are zoomed too far out.

4.3.3 Markers

Ardour supports a variety of markers for various purposes. Markers can either be a single point in time or a range of time.

The basic marker types for general purpose use are *location markers* and *range markers*. Location markers are a point in time, and range markers represent, as one might expect, a time range.

The 'start' and 'end' location markers are special. They mark the start and end of the session, and cannot be removed or renamed.

There are some other special marker types. CD markers are intended to indicate track marks for CD productions. If a session has CD markers at the start of each track, Ardour can generate a table-of-contents for use with audio exports to allow them to be burnt to CD correctly.

Two special range markers are the 'loop' and 'punch' ranges. The loop range can be played back in a loop when the *play loop range* button is clicked. The punch range will be used with punch-in recording.

4.4 Clocks

This area contains two clocks, the primary and secondary. They both show the location of the playhead, but can be set to different time representations. By default, for example, the primary clock shows position as a time-code, and the secondary shows bars, beats and ticks.

Right-clicking on a clock pops up a menu from which you can choose the time representation from one of the following:

- *Timecode* — shows time as hours:minutes:seconds:frames. The number of frames per second is set by the session property 'timecode frames-per-second' (see Section 15.2.1).
- *Bars:Beats* — shows time as bars|beats|text|ticks (there are 1920 ticks per beat).
- *Minutes:Seconds* — shows time as hours:minutes:seconds:milliseconds.
- *Samples* — shows time as samples (according to the sampling rate that JACK is using).

In addition to the time, the clock shows some other information.

When set to 'timecode', the clock also shows the timecode reference source; this defaults to 'INT' for internal, but can also be 'JACK' if JACK is the timecode reference, 'MTC' if Ardour is syncing to MIDI time-code or 'M-Clock' if

Ardour is synced to MIDI clock. To the right of the timecode reference is the number of frames per second (suffixed by ‘D’) if drop-frame is being used.

In ‘Bars:Beats’ mode, the area underneath the time shows the tempo (in beats per minute) and time signature that are currently in effect.

The clocks can be used to move the playhead. Click the clock and use the keyboard to enter the time that the playhead should move to, entering the most significant number first. For example, to move the playhead to timecode 00:00:14:00 (14 seconds), click a timecode clock and press **0 0 0 0 1 4 0 0**, and then press **enter**. As you start typing, the numbers appear from right to left.

Another way to move the playhead is to use the mouse-wheel. Point the mouse cursor at the clock numbers and use the mouse-wheel to move the playhead. The playhead will move by one unit of the number that you point to. For example, if you point to the seconds part of a timecode clock, it will move by one second for every scroll step. If you point to the beats part of a clock, it will move by one beat for every scroll step, and so on.

4.5 Times area

The times area of the editor window shows a few useful bits of information about any current selection and punch in/out range. The ‘selection’ area shows the start, end and length of anything that is currently selected (which may be a set of regions, a time range, or whatever). The ‘punch’ area shows the punch range, and also whether punch in and punch out are enabled; clicking ‘In’ or ‘Out’ will enable punch in and out respectively, and the buttons will turn red in colour to indicate that the corresponding punch is switched on.

4.6 Edit point selector

The ‘edit point’ is a point in time within the session that is used for a variety of different editing operations. The edit point selector is used to choose where the edit point should be; it can be either at the playhead, at the selected marker or at the mouse pointer position.

4.7 Zoom controls

The zoom controls are shown in Figure 4.3.

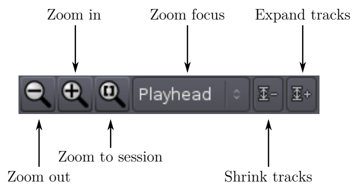


Figure 4.3: The zoom controls

The zoom in and out controls zoom the editor window in and out in terms of time; the ‘zoom to session’ button zooms the editor window so that the whole session is visible. The ‘zoom focus button’ selects a reference point to decide which part of the session the editor window should display after the zoom. These reference points are as follows:

- *Left* — the left-hand side of the editor window remains at the same point in time.
- *Right* — the right-hand side of the editor window remains at the same point in time.
- *Center* — the centre of the editor window remains at the same point in time.
- *Playhead* — the playhead will be kept in the centre of the editor window (where possible).

- *Mouse* — the point of the session that the mouse pointer is over will be kept at the same point in the editor window.
- *Edit point* — the current edit point will be used as a reference.

4.8 Grid controls

Ardour has an optional 'grid' which can be used to align things precisely in time. The grid can either be disabled (by choosing 'No Grid' from the drop-down box), fully enabled ('Grid') or 'Magnetic'. When the grid is fully enabled, any object that is moved (regions, MIDI notes or automation points, for example) will be forcibly snapped to the grid. In 'magnetic' mode, it is possible to move things off the grid, but when they get close to a grid intersection they will be snapped.

Next to the grid on/off drop-down box is a selector for the interval to snap to. There are a large variety of options here, most of which are self explanatory. 'Region starts/ends/syncs/bounds' snaps to various parts of existing regions, which can be useful when alignment needs to be relative to existing material rather than some arbitrary grid.

4.9 Nudge controls

The nudge controls allow objects to be 'nudged', or moved by a fixed amount backward or forward. The left and right buttons move currently selected things either backward or forward in time, and the small clock to the left of these buttons sets the amount of time to nudge by. As with all other clocks, you can right-click on the clock to choose the time representation you want to use.

4.10 The editor lists

At the right of the editor is an optional area which provides one of a range of useful lists of parts of your session. The list can be hidden or shown using the Show Editor List option from the View menu. The very right-hand side of the list gives a selection of tabs which are used to choose the list to view. The left-hand border of the list can be dragged to vary the width of the list.

4.10.1 Region list

The region list shows all the regions in the session. The left-hand column gives the region name, and there are a range of times given for information. At the right of the list are four columns of flags that can be altered:

- *L* — whether the region position is locked, so that it cannot be moved.
- *G* — whether the region's position is 'glued' to bars and beats. If so, the region will stay at the same position in bars and beats even if the tempo and/or time signature change.
- *M* — whether the region is muted, so that it will not be heard.
- *O* — whether the region is opaque; opaque regions 'block' regions below them from being heard, whereas 'transparent' regions have their contents mixed with whatever is underneath.

Hovering the mouse pointer over a column heading shows a tool-tip which can be handy to remember what the columns are for.

A handy feature of the region list is that its regions can be dragged and dropped into a suitable track in the session.

4.10.2 Tracks & Busses

This lists the tracks and busses that are present in the session. The list order reflects the order in the editor, and you can drag-and-drop track or bus names in the editor list to re-order them in the editor. The columns in the list can all be clicked to alter the track/bus state, and they represent the following:

- *V* — whether the track or bus is visible; they can be hidden, in which case they will still play, but just not be visible in the editor; this can be useful for keeping the display uncluttered.
- *A* — whether the track or bus is active; unactive tracks will not play, and will not consume any CPU.
- *I* — for MIDI tracks, whether the MIDI input is enabled; this dictates whether MIDI data from the track's inputs ports will be passed through the track.
- *R* — whether the track is record-enabled.
- *M* — whether the track is muted.
- *S* — track solo state.
- *SI* — track solo-isolated state.
- *SS* — solo safe state.

As with the region list, hovering the mouse pointer over a column heading shows a tool-tip which can be handy to remember what the columns are for.

4.10.3 Snapshots

This list gives the snapshots that exist of this session. Clicking on a snapshot name will load that snapshot.

4.10.4 Track & Bus Groups

This shows the track/bus groups that exist in the session. These groups allow related tracks to share various properties (such as mute or record enable state). For full details, see Section 5.2.

The columns in this list are as follows:

- *Col* — the colour that the group uses for its tab in the editor.
- *Name* — the group name.
- *V* — whether the tracks and busses in the group are visible.
- *On* — whether the group is enabled.
- *G* — ticked if the constituents of the group are sharing gain settings.
- *Rel* — ticked if shared gains are relative.
- *M* — ticked if the constituents share mute status.
- *S* — ticked if the constituents share solo status.
- *Rec* — ticked if the constituents share record-enable status.
- *Mon* — whether the constituents share monitor settings.
- *Sel* — whether the constituents are selected together.
- *E* — whether edits to the constituents are performed to all others.
- *A* — whether the constituents share active status.

4.10.5 Ranges & Marks

This lists the ranges and markers that exist in the session, and allows them to be edited. First, there is the current loop and punch range; there are three clocks, being the start of the range, the end of the range and the length of the range. The start and end points have a 'Use PH' button beside them, which you can click to set the corresponding position using the current position of the playhead. Following this is a list of the session's markers, and finally there is a list of the range markers. At the bottom of the list are buttons to add new markers or ranges. The - button beside each marker and range allows that particular mark to be removed.

4.11 Other buttons

The editor window contains a few other buttons, which are described here.

4.11.1 Solo

This button flashes red if any tracks are soloed; click it to turn off all solos.

4.11.2 Audition

This button flashes red if anything is being auditioned; click it to stop the audition.

4.11.3 Feedback

It is possible to connect things up so that there are feedback loops; a simple example might be connecting the output of a track to its input, but obviously there are much more convoluted arrangements possible. Ardour detects any feedback that exists, and will keep its signal processing pathways in the state they were in just before the feedback was introduced. If Ardour is doing this, it flashes the feedback button to let you know that the routing in effect may not be what the user interface is showing. You should remove the feedback path, upon which this light will stop flashing.

4.11.4 Metronome

Click the Metronome button to toggle the metronome on and off. When active, Ardour will generate an audible click on every beat whenever the transport is rolling. The first beat of each bar will have a different sounding click, so that the start of a bar can be recognized. The sound and volume of the click can be configured by right-clicking the metronome button and making changes in the Preferences dialog that is opened.

4.11.5 Positional sync button

The positional sync button is located to the left of the clocks, and initially marked Internal to indicate that Ardour is not synchronising to anything else. Clicking this button will enable synchronisation to the source configured in the Timecode tab of the Session Properties dialogue. See Chapter 12.

4.11.6 Auto Play

Clicking the Auto Play button will toggle Auto Play on or off. When Auto Play is on, the transport will start rolling whenever you move the playhead. If, for example, you click in the rulers area to move the playhead, the transport will start rolling from the point where the playhead was moved to.

4.11.7 Auto Return

Clicking the Auto Return button will toggle Auto Return on or off. If Auto Return is on and the transport is stopped, the playhead will return to the point it was at when the transport was started. Otherwise, the playhead will remain in the same position when the transport is stopped.

4.12 The transport controls

Ardour uses the term ‘transport’ in a sense that might be similar to those who have used tape machines. The transport is said to be ‘moving’ (or ‘rolling’, as with tape) when Ardour is playing back or recording, and ‘stopped’ when it is not. The transport can be controlled using the buttons shown in Figure 4.4.

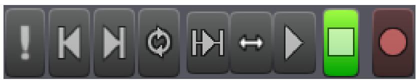


Figure 4.4: Main transport controls

From left to right, these controls are:

- — *MIDI panic* — click this to send note-offs and reset controller messages on all MIDI channels. This is useful if, for example, a MIDI synthesizer has a stuck note and you want to silence it.
- — *Start of session* — moves the playhead to the session start marker.
- — *End of session* — moves the playhead to the session end marker.
- — *Play loop* — this starts playback in looped mode, so that the current loop range will be played repeatedly.
- — *Play range or selection* — if there is a selected time range, it will be played back.
- — *Play* — this starts playback of the session from wherever the playhead currently is (in other words, it sets the transport ‘rolling’, or moving)
- — *Stop* — this stops playback or record.
- — *Record* — if this is clicked so that it flashes red, Ardour will record onto record-enabled tracks when the transport is moving.

Below the transport controls is the Shuttle Speed control. This can be used to roll the transport at varying speed and direction. Drag the shuttle control to control speed and direction. Right click will open the options menu.

4.13 The summary

The summary area of the editor window gives an overview of your entire session. No matter how long the session is, or how many tracks it has, the summary will arrange itself so that the entire session is drawn within it. Inside the summary tracks are represented as light-grey bars, regions as coloured bars, the playhead as a vertical red line and the session start and end markers as vertical yellow lines. On top of the summary is drawn a light-grey translucent box (the 'view box') which indicates the part of the session that is currently visible in the main part of the editor window.

The summary is intended for two main purposes: firstly, to get an idea of the whole session at a glance, and secondly to navigate around it easily. You can use the summary to do the following things:

- Dragging the view box around will move the view of the session in the main editor window.
- Resizing the view box (by clicking and dragging on its edges) will zoom into or out of the session.
- Clicking with **Alt** held down will move the playhead to the click position.
- Clicking with **Shift** held down will centre the editor's view at the click position.
- Moving the mouse's scroll-wheel will scroll the editor's view.
- Moving the mouse's scroll-wheel with **Ctrl** held down will zoom the editor's view in or out.
- Moving the mouse's scroll-wheel with **Alt** held down will scroll the editor's view left or right.

The left, right, up and down buttons to either side of the summary allow the editor window to be scrolled in each direction.

4.13.1 The status bar

This contains the following things:

- *File* — the type of file that Ardour is using to record audio; this can be change from the Media tab of the Session Properties dialogue (see Section 15.2.3).
- *JACK* — the sampling rate that JACK (and therefore Ardour) is using, and the duration of one JACK period.
- *Buffers* — how full the 'playback buffers' are (prefixed 'p'), and how empty the 'capture buffers' (prefixed 'c'). The playback buffers are areas of memory that Ardour uses to store audio and MIDI data while it is being passed from the disk to the audio outputs; Ardour tries to keep them full (so that there is always data available for playback), but if you have a lot of tracks and (or) slow disks, Ardour may not be able to keep up. The closer the playback buffer number is to 100%, the better. Similarly, as data is being captured for record, Ardour tries to write it to disk; if it cannot write the data quickly enough, the record buffers will fill and problems will occur.
- *DSP* — an estimate of the amount of time that Ardour is spending doing digital signal processing (DSP) of your session. If this gets near 100% it indicates that your system is being overloaded, and you may get glitches or 'pops' in your audio. First steps to fixing this are:
  - Reduce the number of plugins you are using (especially complicated ones like reverbs).
  - 'Freeze' some tracks.
  - Increase JACK's buffer size.
  - Get a faster computer!

Every time JACK calls Ardour, to give it audio from inputs and take away audio from outputs, Ardour has until the next JACK call to do its processing. The DSP load is the percentage of this available time that Ardour is taking up. More than 100% means that Ardour will not have performed one lot of processing before JACK asks it to do more, so the system is critically overloaded. As suggested above, one can increase Ardour's chances of getting everything finished by increasing the period between JACK's calls (by increasing the JACK buffer size), or by reducing the amount of time Ardour requires to do its work (by reducing plugin count, or using faster hardware).

  Note that DSP load will probably not vary predictably with CPU speed. Many other things are involved in the timing of the sound-card / JACK / Ardour interaction; including the real-time performance of your system and kernel, the details of your hardware, and in some cases blind (good or bad) luck.

- *Disk* — the amount of time for which you can record (on the tracks that are currently record-enabled) given the amount of disk space you have available. If no tracks are record-enabled, the time remaining is computed assuming that you are recording one track.
- And finally, the time (using the 24-hour clock), just in case you have somewhere to be.

The various parts of the status bar can be shown or hidden by right-clicking and choosing the elements that you want to see. This can be useful for reducing the editor window's width for use on small screens.

4.14 The editor mixer strip

An optional addition to the editor window is the editor mixer strip, to the left of the tracks area. This is a copy of a single strip from the mixer, discussed in Chapter 6, and represents the mixer strip of the currently selected track.

The mixer strip can be shown or hidden by pressing Shift-E or using the Show Editor Mixer option on the View menu.

Chapter 5

Tracks and busses

The basic building blocks of Ardour's sessions are *tracks* and *busses*.

Both are built on the same foundation; a bus' functionality is a subset of a track's. Both can pass audio and MIDI data, apply processing and perform various signal routing operations. The difference with a track is that can record and play back data.

5.1 Track and bus basics

5.1.1 Types

An Ardour track can be either 'audio' or 'MIDI'. The only real difference between the two is the type of data that the track will record and play back. Either type of track can *pass* either type of data. Hence, for example, one might have a MIDI track that contains an instrument plugin; such a track would contain MIDI data, but would produce audio, since the instrument would turn the one into the other.

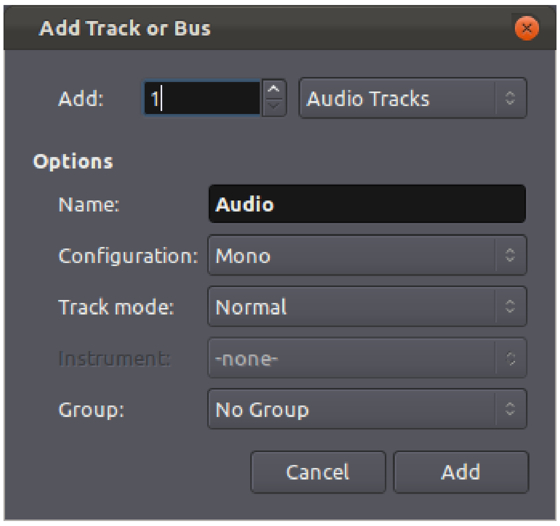
In Ardour 3 busses are only used for audio.

5.1.2 Adding and removing tracks

A track or bus can be added to a session in various ways:

- Choose Add Track or Bus... from the Track menu.
- Right-click in an empty part of the track controls area.
- Click the + button underneath the list of tracks in the mixer.

Any of these actions will open the *Add Track or Bus* dialogue, as shown in Figure 5.1.


Add Track or Bus

Add: 1 Audio Tracks

Options

Name: Audio

Configuration: Mono

Track mode: Normal

Instrument: -none-

Group: No Group

Figure 5.1: Add Track or Bus dialogue

From here, you can select firstly the number of tracks or busses to add, and the type; audio track, MIDI track or bus. There are also some options, which vary depending on the type of thing you are creating.

These options are:

- Configuration (for audio tracks and busses) — this is the number of input and outputs the track is set up with. You can always change these counts later.
- Track mode (for audio tracks) — this can be 'normal', 'non-layered' or 'tape'.
- Group — tracks and busses can be put into groups so that a selected range of operations are applied to all members of a group at the same time (selecting record enable, or editing, for example). This option allows you to specify an existing group to add the new track(s) or bus(ses) to, or to create a new group to put the new things in.
- Instrument (for MIDI tracks) — this is a short-cut to allow you to create a MIDI track with an instrument plugin already added to it. You can achieve the same effect by creating a MIDI track with no plugins and adding it yourself; this option just makes things slightly quicker.

Adding tracks will add them to both the editor and mixer windows; the editor window shows the timeline, with any recorded data, and the mixer shows just the processing elements of the track (its plugins, fader and so on).

Tracks and busses can be removed by selecting them, right-clicking and choosing 'Remove' from the menu. A warning dialogue will pop up, as *track removal cannot be undone*; use this option with care!

5.2 Track and bus groups

Tracks and busses can be put into *groups*. The members of a group can be set to share various settings, which can be useful for managing tracks which are closely related to each other. Examples might include tracks that contain multiple-microphone recordings of a single source (an acoustic guitar, perhaps, or a drum-kit).

You can put tracks and busses into groups in various ways. In the editor window, a track's controls might look like those in Figure 5.2.

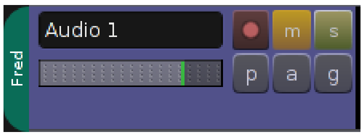
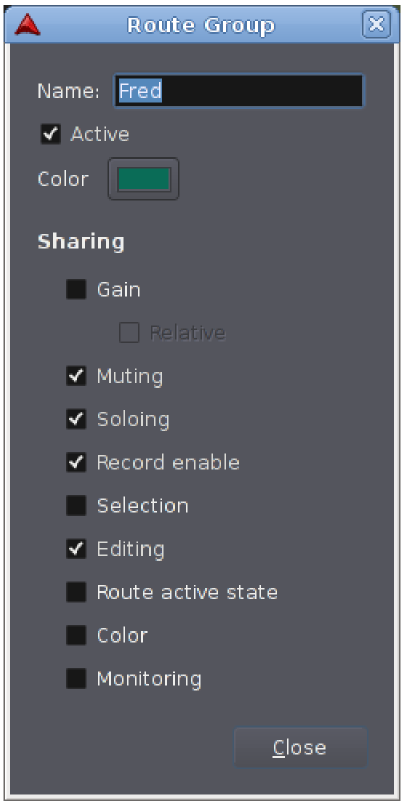


Figure 5.2: The header of a track in a group

The green tab to the left of the track header indicates that this track is in a group called 'Fred'. These tabs can be dragged in the editor window to add to or remove tracks from groups. Alternatively, clicking the 'g' button opens a menu which gives a list of the available groups; selecting one of these groups will add the track or bus to that group. This menu also allows a new group to be created.

The properties of a group can be edited by right-clicking on its tab and choosing Edit Group. . . . This will open the track/bus group dialogue, which is also used when creating new groups, as shown in Figure 5.3.


Route Group

Name: Fred

[✓] Active

Color

Sharing

- [ ] Gain
  - [ ] Relative
- [✓] Muting
- [✓] Soloing
- [✓] Record enable
- [ ] Selection
- [✓] Editing
- [ ] Route active state
- [ ] Color
- [ ] Monitoring

Close

Figure 5.3: The track/bus group dialogue

'Active' means that the group is being obeyed, so that the sharing of properties is applied to its members. The colour can be changed, and affects the colour of the group's tab in the editor and mixer windows.

Following these options are a list of the things that the members of the group can share. 'Gain' means that the track faders will be synced to always have the same value; 'Relative' means that the gain changes are applied relative to each member's current value. If, for example, there are two tracks in a group with relative gain sharing, and their faders are set to -3dB and -1dB, a change of the first track to a gain of -6dB will result in the second track having a gain of -4dB (so that the difference in gains is the same).

'Muting', 'soloing', 'record enable', 'route active state', 'colour' and 'monitoring' are all straightforward; they simply mean that all member tracks or busses will share the same settings in these respects.

'Selection' means that if a region is selected or deselected on one constituent track, corresponding regions on other member tracks will be similarly selected. Corresponding regions are those that are at the same position and have the same length. Similarly, 'Editing' means that edits applied to one track will be applied at the same place on other tracks in the group. These options are particularly useful for multi-microphone recordings, where you always want to apply the same edits to each track.

Clicking on a group tab will toggle the group between being enabled and disabled. Tabs for disabled groups are coloured grey.

Right-clicking on the group tab offers a further menu of group-related actions. Create a New Group does as its name suggests, and there is also an option to create a new group and automatically put particular tracks into it. *Collect Group* moves all the member tracks so that they are together in the editor window, and Remove Group removes the group (and only the group, not its members).

Add New Subgroup Bus creates a bus (giving it the name of the group) and connects the output of each member to the new bus. In a similar way, Add New Aux Bus adds a bus and gives each member a send to that bus. There are two options for this, specifying whether the sends should be placed pre- or post-fader.

Fit to Window will zoom the member tracks so that they fill the editor window.

Enable All Groups and Disable All Groups will enable or disable all groups, including any hidden groups.

5.3 Tracks and busses in the editor window

When a track or bus is added to a session it is given a representation in both the editor and the mixer windows. Broadly speaking, the editor window shows the track's timeline, and the mixer window its signal processing.

On the left of a track or bus in the editor is the controls area. The contents of this area are different for audio tracks, MIDI tracks and busses.

5.4 Busses

A typical control area for a bus is shown in Figure 5.4.

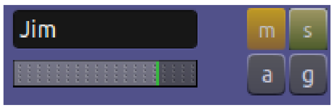


Figure 5.4: Controls for a typical bus

At the top-left of the controls is the name of the bus. This can be edited directly to whatever is suitable, although the name must be unique within the session. Underneath the name is a copy of the bus' main level fader. The control buttons to the right-hand side are:

- *'m'* — mute — left-click to mute the bus. Right-click to display a menu which dictates what particular parts of the bus should be muted.
- *'s'* — solo — solo the bus. The behaviour of the solo system is described in detail in Section 6.2.3.
- *'a'* — automation — click to open a menu related to automation for the bus. Automation is covered in Chapter 9.
- *'g'* — group — click to open a menu related to the bus group, as discussed in Section 5.2 above.

5.5 Audio tracks

A typical control area for an audio track is shown in Figure 5.5.

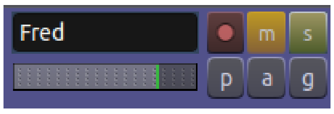


Figure 5.5: Controls for a typical audio track

An audio track has the same controls as a bus, with the addition of two extras. The red button with the pink circle is the track's *record enable*. When this is clicked it will gain a bright red outline, and the track will then be recorded onto when the main session record enable is turned on with the transport rolling.

The 'p' button below the record enable will open a playlist menu when clicked. The menu offers various operations related to the track's playlist. This, as you will recall, is simply a list of the regions that the track should play. Playlists may be swapped on a given track, and may be used by more than one track at the same time. They are often useful to keep different takes, for example, or to allow one set of regions to be played off two tracks with different processing.

5.6 MIDI tracks

A typical control area for a MIDI track is shown in Figure 5.6.

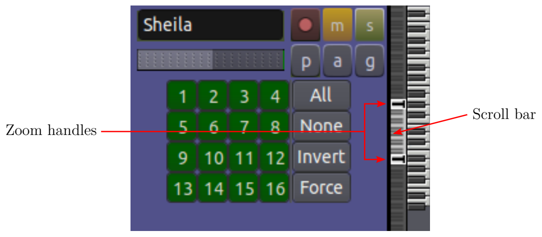


Figure 5.6: Typical MIDI track controls

The MIDI track example is shown at a greater height than the other examples, as with MIDI tracks there are some control elements which only appear when there is sufficient vertical space to fit them in.

A MIDI track has the same basic controls as an audio track, with the addition of two extra elements. The set of buttons below the main track controls controls the MIDI channels that should be visible in the editor. A MIDI track's data may span any number of the 16 available MIDI channels, and sometimes it is useful to view only a subset of those channels; different instruments may, for example, be put on different MIDI channels. Clicking on a channel number toggles its visibility.

To the right of the MIDI track controls is a representation of a piano keyboard called the 'scroomer'. This performs a couple of functions. Firstly, the scroll-bar controls the range of pitches that are visible on the track. Dragging the scroll-bar body up and down scrolls up and down through the visible pitches, and dragging the scroll-bar 'handles' zooms in and out, so that more or fewer pitches are visible. The piano keyboard gives a reference for the pitches that the track is displaying. In addition, clicking on the notes will generate the corresponding MIDI note in the track.

Chapter 6

Signal flow and the mixer

The second of Ardour's two main windows is the *mixer*. A typical mixer window is shown in Figure 6.1.

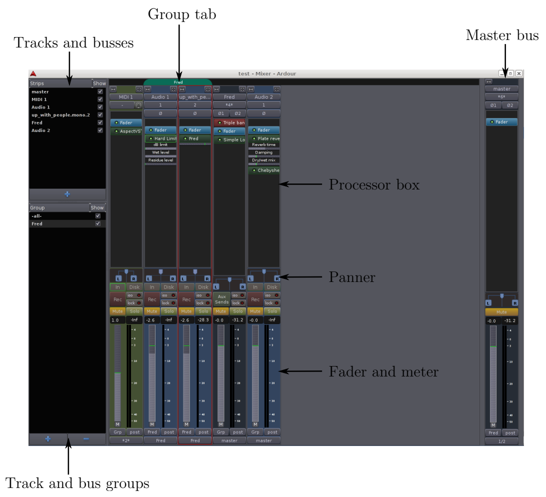


Figure 6.1: A typical mixer window

The mixer is roughly Ardour's equivalent of a physical mixing console with some outboard processing. It provides an overview of the signals present in the session, and allows them to be mixed and processed.

At the left hand side of the window there are two useful lists; at the top, a list of the session's tracks and busses, and at the bottom a list of the track and bus groups. Each track, bus and group has a corresponding 'show' tick-box which controls whether the corresponding item is visible in the mixer. These tick-boxes do not affect visibility in the editor window.

The main body of the mixer window is taken up with mixer strips. Each track and bus has one of these, and there is an extra one for the master bus. An annotated single mixer strip is shown in Figure 6.2.

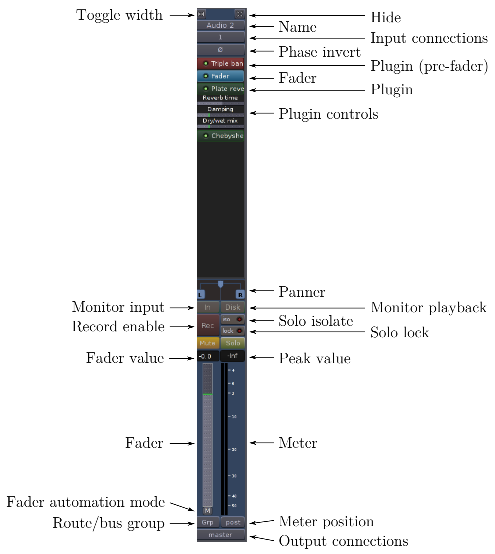


Figure 6.2: A typical mixer strip

6.1 Signal flow in the strip

This mixer strip represents the signal flow through a single track or bus. The input to the strip comes either from a set of JACK ports or from the regions in a track's playlist. The signal then flows through a set of *processors*, which may include *plugins* (which process the signal in some way) and a *fader* to control level. The signal is then *panned* to its output ports.

The basic signal flow for a track is shown in Figure 6.3.

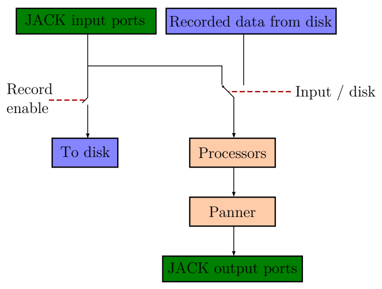


Figure 6.3: Basic track signal flow

6.1.1 Input

At the top of the figure we have two possibilities for input data; it can either come 'live' from some JACK input ports (so that it could have come from, for example, a sound card, or perhaps another application) or it can come from disk. If the track is record enabled, the data from the JACK inputs is stored as-is on disk (with no processing) when we are recording. The signal that goes into the actual strip can be chosen as either the live input or the disk; Ardour can usually make this decision for you depending on what is going on; alternatively, you can specify it manually. This signal heads into the strip's processors before being panned and passed to the JACK outputs.

A bus' signal flow is similar, except that there is no disk storage involved, so there is no input switching; the signal always comes from its JACK input ports.

Let us examine the mixer strip with reference to this signal flow. Towards the top of the strip you will see the *input connections* button. Left-clicking this button opens a connection editor, which allows you to set up the input connections from other JACK ports to the inputs for the strip. A typical connection editor is shown in Figure 6.4.

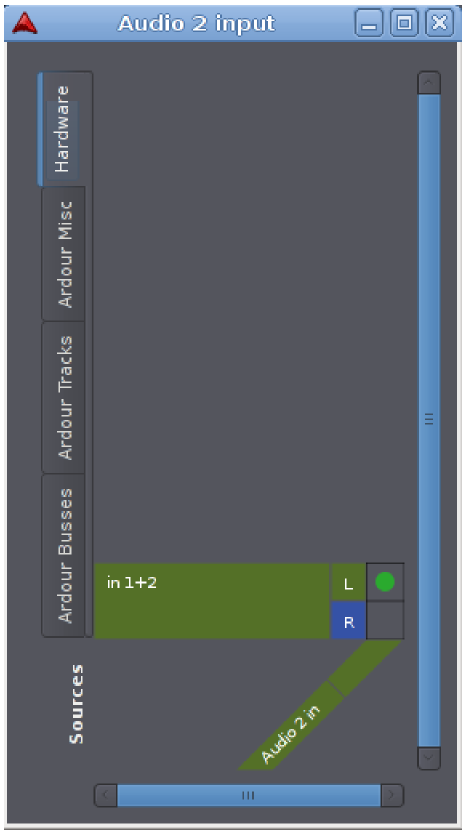


Figure 6.4: A mixer strip input connection editor

In this case, we have an audio track called 'Audio 2' which has a single input. At the bottom of the connection manager you can see a label of 'Audio 2 in', which represents this input. To the left of the window are the places that this input can come from. In the example screenshot, we can see that two JACK ports called 'in 1+2' are shown, and there is a green dot which represents a connection between the L channel of 'in 1+2' and our track input. The signal for 'in 1+2' is coming from a sound card in the computer that Ardour is running on. The connection manager's behaviour is discussed in detail in Section 6.3.2.

An alternative to using the connection editor is to right-click on the input button. This will offer a menu with what Ardour expects may be common choices for your strip's input ports.

6.1.2 Processors

A 'processor' is a thing which treats the signal in some way. Ardour provides several processors, some of which are for internal use and are not seen in the mixer strip. In addition, processors can also be plugins. The arrangement of processors is arbitrary, and there is no limit to how many there can be.

The main box in the top half of the mixer strip shows the processor list. Processors are shown as coloured rectangles, with a small 'LED' beside them; this indicates whether or not the plugin is enabled, and can be clicked to enable or disable a processor. The colour of the processor depends on its location in the sequence; processors that occur before the fader are coloured in red, and those after are coloured green.

The processor box will always contain a blue processor called 'Fader'. This indicates where in the processor chain the main volume fader is located — this is the fader in the bottom half of the strip.

6.1.2.1 Moving processors around

Processors can be moved around in the chain by dragging and dropping. You can also drag processors from other strips in the mixer to copy them into this strip.

6.1.2.2 Adding plugins

Perhaps the most common use for the processor box is to add *plugins*. These are self-contained pieces of code which perform some processing on the signal; typical examples of plugins might include compressors, equalisers, reverbs and so on.

Plugins must be installed onto your computer before they can be used. There are a variety of ways of doing this: on Linux, your distribution may well include packages of plugins. Alternatively, they can be downloaded from various places on the internet, or can be bought from commercial companies.

A plugin will be written to support one (or maybe more) plugin standards. These standards describe how the 'host' (Ardour) and the plugin interact with each other. Ardour supports three main standards, LADSPA, LV2, Linux VST (on Linux) and AU (on Mac OS X), so plugins will need to be written for one of them in order to work.

It is important to note that VST plugins written for Windows are not generally supported by Ardour. There is way in which it can be made to work, sometimes, and with varying results, but it is technically involved and essentially unsupported by the Ardour developers. It is strongly recommended that you look for alternatives to Windows VST plugins.

To add a plugin to a strip, right-click over the processor box and choosing 'New Plugin'. You can choose one straight from the menu, or open the 'Plugin Manager' which gives a few extra facilities for finding the right plugin. Note that the position of the right click in the processor box is the place where the plugin will be inserted; any existing processors underneath the click will move apart to indicate where the new one will be placed. Once a plugin is selected, it will appear in the strip and start processing the signals that flow down the strip. Double-clicking on a plugin's name in the processor box will open its editor window, which allows you to alter its parameters. Alternatively, right-clicking on the plugin and selecting Show All Controls from the Controls menu adds the plugins controls directly to the processor box. This may be convenient for plugins with few controls, such as the plate reverb shown in the example screenshot.

6.1.2.3 Instrument plugins

In Ardour, MIDI 'instrument' plugins (those that take some MIDI input and generate audio — samplers or synthesizers, for example) are treated the same as any other plugin. Most of the time it makes sense to add them as plugins to MIDI tracks; in this way, they will receive MIDI data (either from a MIDI input or from a recorded MIDI region on disk) and will generate audio output. Ardour will adapt the signal flow following an instrument, so that a MIDI track with an instrument plugin will appear like a MIDI track for its input and an audio track for its output. In other words, a MIDI track with an instrument plugin will have a panner and audio outputs, just as an audio track would.

6.1.2.4 Sends

Another type of processor that is available is the *send*. A send sits in the processor list, passing signals through untouched, but also splits off (or 'sends') the signal somewhere else. That 'somewhere else' can be a set of JACK ports or an Ardour bus. Sends are typically used for passing a track's signal to a reverb unit, or perhaps to set up a headphone mix for an artist.

If the send is to an Ardour bus, we refer to it as an 'Aux send'. Such a send can be added to a strip by right-clicking in the processor box and following the New Aux Send option. The submenu offers a list of the busses in the session, and you can choose the one that the send should push its signal to.

Alternatively, a send to a set of JACK ports (an 'external send') can be added using New External Send. On creating an external send, a connection editor opens so that you can connect the send to wherever it needs to go. This could be an audio card output (for sending to some headphones or to a hardware effects unit), another JACK-based application that you have running, or whatever.

Sends have a small fader in the processor box which controls the amount of the strip's signal that they will send to their destination.

6.1.3 Panning

After passing through the processors, our signal arrives at the panner. The panner has the task of arranging however many channels of audio we have at the end of our processor list to pass to the outputs. This is reasonably simple in some cases (for example if we have a mono track and stereo outputs), but can also be very complicated (it is not immediately obvious, for example, how one might pan a 14-channel track to 37 outputs).

Ardour will try to pick a good panner for each particular situation. Ardour 3 supports three different panners:

- *1-in 2-out* — this pans a mono signal to a stereo output. You can control the *position* of the signal within the stereo field, from 100% left (the mono signal comes out of the left speaker only) to 100% right (the mono signal comes out of the right speaker only).
- *2-in 2-out* — this pans a stereo signal to a stereo output. As with the 1-in, 2-out panner you can control the position of the signal within the stereo field, and also the *width*. This corresponds to the separation between the left and right input channels.
- *Vector-based amplitude panning (VBAP)* — this panner can map any number of inputs to any number of outputs.

The panner for each track will be selected by Ardour, based on the number of inputs and outputs that it has. The number of panner inputs is equal to the number of outputs of the last processor in the track's chain, and the number of panner outputs corresponds to the number of track outputs.

6.1.3.1 1-in 2-out panners

Figure 6.5 shows a 1-in, 2-out panner within a mixer strip.

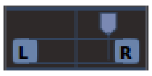


Figure 6.5: A 1-in, 2-out panner

In this example, the marker indicating the pan position is toward the right of the stereo field. Click and drag the marker to move it around. Double-clicking toward the left of the panner will pan the signal hard-left; similarly double-clicking to the right will pan hard-right, and double-clicking in the centre will move the marker to the centre of the stereo field. Shift-clicking resets the pan position to centre. Ctrl-right-clicking will open a dialogue box with which precise pan values can be set.

6.1.3.2 2-in 2-out panners

Figure 6.6 shows a 2-in, 2-out panner within a mixer strip.

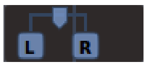


Figure 6.6: A 2-in, 2-out panner

Here we can see that a 2-in, 2-out panner has both a position and a width. The position represents the position of the input within the output stereo field, as before, and the width represents the stereo width that the input will have in the output. If, for example, width is set to 100% it will be not be possible to change position — there is nowhere for the input signal to 'go', as it is full-width.

If the width control is reduced, it is possible to alter the position. Width can be reduced down to 0, and can also be made negative — a negative width is the same as the corresponding positive width except that the left and right input signals are swapped.

Clicking and dragging in the top half of the 2-in 2-out panner will alter the position, and doing the same in the bottom half will alter the width. As with the 1-in panner, Shift-clicking resets the pan position to centre and the width to its maximum. Ctrl-right-clicking will open a dialogue box with which precise pan values can be set.

6.1.4 Output ports

Finally, the button at the very bottom of the strip sets where the output signal from the strip will go. Frequently, this will be the master bus (and Ardour may auto-connect new tracks and busses to the master, depending on its configuration). As with the input ports, a left-click on the output port button will open a connection editor, and a right-click will open a menu of common options.

6.1.5 Monitoring

As we discussed earlier, there are two places that a track's signal may come from: its JACK ports, or its files on disk. The choice of which to use at any given time is usually made automatically by Ardour, depending on the configuration of its monitoring options.

'Monitoring' in Ardour is the general term used for the frequent need to listen to signals that are coming into the computer, perhaps as they are being recorded. Often, for example, one might be playing an instrument for a recording and might want to hear what one is doing at the same time, perhaps along with some other existing tracks.

6.1.6 Different ways of monitoring

There are three basic ways in which monitoring may be approached:

- *External monitoring* — this is where Ardour plays no role in monitoring at all. Perhaps the recording set-up has an external mixer which can be used to set up monitor mixes, or perhaps the sound-card being used has some 'listen to the input'-style feature. This approach often has the advantage of zero or near-zero latency. On the other hand it requires external hardware, and the monitoring settings are not saved with the session. See Figure 6.7 for a simple example setup.

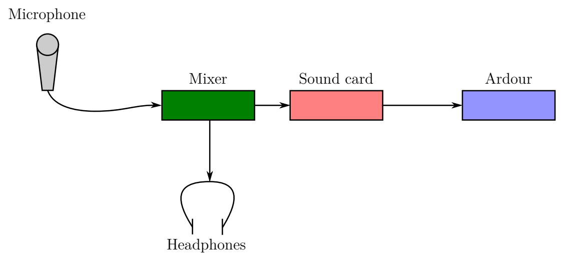


Figure 6.7: External monitoring

- *JACK-based 'hardware' monitoring* — some sound cards have the ability to mix signals from their inputs to their outputs with zero- or low-latency. Furthermore, on some cards these features can be controlled by JACK. This is a nice arrangement, if the sound card supports it, as it combines the convenience of having the monitoring controlled by Ardour with the low latency operation of doing it externally. See Figure 6.8.

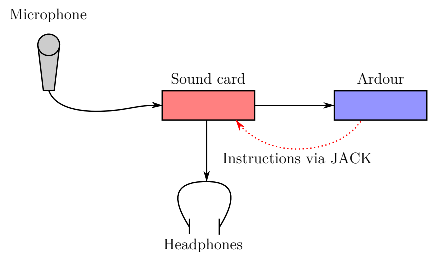


Figure 6.8: JACK-based 'hardware' monitoring

- *Software monitoring* — this where all monitoring is performed by Ardour; it makes track inputs available at track outputs, under the influence of various controls. This approach will almost always have more routing flexibility than JACK-based monitoring. The disadvantage is that there will be a latency between the input and the output which will depend mainly on the JACK buffer size that is being used.

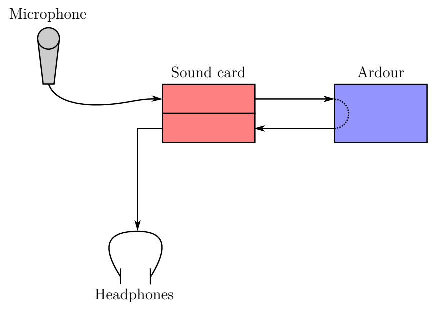


Figure 6.9: Software monitoring

6.1.6.1 Setting up monitoring

There are three main settings which affect how monitoring is performed. The first is 'Record monitoring handled by' in the Audio tab of the Ardour Preferences dialogue. There are two or three options here, depending on the capabilities of your hardware:

- *ardour* — Ardour handles monitoring itself (software monitoring).
- *audio hardware* — Ardour does no monitoring at all, and assumes you will do it yourself (external monitoring)
- *JACK* — Ardour will ask JACK to, in turn, ask the sound card to handle monitoring. This option is only available if it is supported by your sound card (hardware monitoring).

The other two settings are more complex; one is 'Tape machine mode', in the same dialogue, and the other is 'Monitoring automatically follows transport state ('auto-input')' setting in Session Properties.

Monitoring is also somewhat dependent on the state of the track's record-enable button, the session record enable button, and whether or not the transport is rolling.

6.1.6.2 Monitoring in software or hardware monitoring modes

If Ardour is set to 'external monitoring', the explanation of Ardour's monitoring behaviour is simple: it does not do any. In the other two modes, things are more complex.

6.1.6.3 Monitoring in non-tape-machine mode

This section describes what happens when Ardour is *not* set to tape-machine mode.

Consider first the case when a track is record-enabled. In this situation, it will always monitor the live input *unless* the session is *not* record-enabled, auto-input is enabled, and the transport is rolling.

When a track is not record-enabled, the track will play back its contents from disc *unless* the transport is stopped and auto-input is enabled. In this case, the track monitors its live input.

6.1.6.4 Monitoring in tape-machine mode

In tape-machine mode, things are slightly simpler; when a track is record-enabled, its behaviour is the same as in non-tape-machine mode: it will always monitor the live input *unless* the session is *not* record-enabled, auto-input is enabled, and the transport is rolling.

When a track is not record-enabled, however, the track will always just play back its contents from disk; the live input will never be monitored.

6.2 Overall signal flow and solo / mute

The previous section explores how signals flow within individual mixer strips. This section discusses the wider picture of signal flow within Ardour as a whole, particularly with regard to track soloing and muting.

6.2.1 The master bus

Ardour sessions always contain a special bus called the *master bus*. Mostly, this is like a normal bus, but it has some special properties:

- Ardour can be configured to connect other tracks and busses to the master bus automatically.
- The master bus' mixer strip is always displayed at the right-hand-side of the mixer window.

Typically, most of a session's tracks will send their output to the master bus, and the output from the master bus will be connected to some ports on a physical sound card so that the mix makes it out into the real world to be listened to.

6.2.2 The monitor bus

The monitor bus is an additional, optional, and more specialised type of bus. Ardour can configured to use a monitor bus by ticking the 'Use a monitor bus' option in the Audio tab of the Ardour Preferences dialogue.

The monitor bus provides a quite large degree of extra control, and is an approximation to the setup of a moderately complex mixing desk, which often has a separate *mix bus* and *monitor bus*. In a live situation, for example, it is common for the mix bus to be connected to the front-of-house speakers and the monitor bus to be listened to on headphones. In a studio, one might have the monitor bus connected to the control room outputs and the mix bus connected to a 2-track output recorder.

6.2.3 Mute and solo

Each track and bus has two buttons which have important implications for signal flow: *mute* and *solo*. The behaviour of these buttons is configurable in Ardour, so that they can behave in one of a few different ways to suit different studio set-ups.

6.2.3.1 Without a monitor bus

If you are using Ardour *without* a monitor bus, there is only one way in which mute and solo will work. Without a monitor bus:

- *Mute* on a track or bus will mute that track on the master bus, so that it will not be heard.
- *Solo* on a track or bus will solo that track or bus and mute all others *except that* soloing a bus will also solo any tracks or busses that feed that bus.

6.2.3.2 With a monitor bus

For setups *with* a monitor bus, you have more options, mostly governed by the setting of the 'Solo controls are Listen controls' option in the Solo / mute tab of 'Ardour Preferences'.

With 'Solo controls are Listen controls' unticked, behaviour is almost exactly the same as the situation without a monitor bus. Mute and solo behave the same, and the monitor bus is fed from the master bus, so it sees the same thing.

With 'Solo controls are Listen controls' ticked, things change; the master and monitor busses behave differently. In this mode, solo controls are more properly called 'listen' controls, and Ardour's solo buttons will change their legend from 'S' to either 'A' or 'P' (we'll come to that shortly) to reflect this.

Now, without any mute or listen, the monitor bus remains fed by the master bus. Also:

- *Mute* will mute the track or bus, so that it will not be heard anywhere (neither on the master nor monitor busses), much as before.
- *Listen* will disconnect the monitor bus from the master bus, so that the monitor bus now only receives things that are 'listened'. Listen will not perform any muting, and hence the master bus will not be affected by a listened track or bus.

There are further options with when solo controls are listen controls: the part of the track or bus from which the listen signal is obtained can be configured. Underneath the 'Solo controls are Listen controls' option in 'Ardour Preferences' is an option for 'listen position', which can be either After-Fade Listen (AFL) or Pre-Fade Listen (PFL). AFL, as its name suggests, obtains its signal from some point after the track or bus' fader, and PFL from before it. The precise point to get the signal from can further be configured using the 'PFL signals come from' and 'AFL signals come from' options.

The solo-mute arrangement with a monitor bus is shown in Figure 6.10.

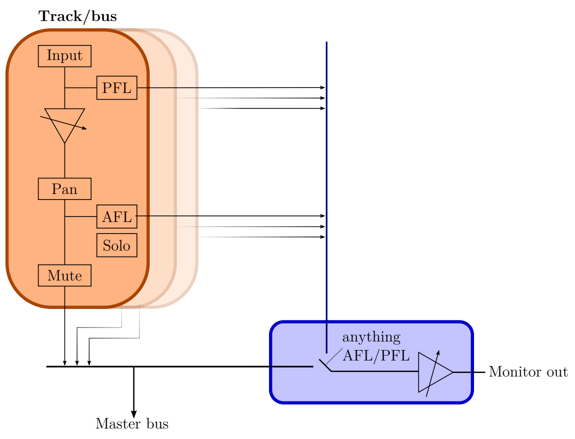


Figure 6.10: Solo and mute with a monitor bus

Here we have a number of tracks or busses (in orange). Each one has an output which feeds the master bus. In addition, each has PFL and AFL outputs; we have a choice of which to use. PFL/AFL from each track or bus are mixed. Then, whenever anything is set to AFL/PFL, the monitor out becomes just those AFL/PFL feeds; the rest of the time, the monitor out is fed from the master bus.

In this scheme Solo has no effect other than to mute other non-soloed tracks; with solo (rather then listen), the monitor out is fed from the master bus.

6.2.3.3 Other solo options

There are a few other configuration options related to the behaviour of solo. They can be found in the Solo / Mute tab of Ardour Preferences dialogue.

Solo-in-place mute cut

When using 'solo-in-place' (SiP), in other words when soloed tracks are being listened to on the master bus, this fader specifies the gain that will be applied to other tracks in order to mute them. Setting this level to ∞dB will mean that other tracks will not be heard at all; setting to some higher value less than 0dB means that other non-soloed tracks will be heard, just reduced in volume compared to the soloed tracks.

Exclusive solo

If this is enabled, only one track or bus will ever be soloed at once; soloing track B while track A is currently soloed will un-solo track A before soloing track B.

Show solo muting

If this is enabled, the mute button of tracks and busses will be drawn outlined to indicate that the track or bus is muted because something else is soloed.

Soloing overrides muting

If this is enabled, a track or bus that is both soloed and muted will behave as if it is soloed.

Mute affects...

These options dictate whether muting the track will affect various routes out of the track; through the sends, through the control outputs (to the monitor bus) and to the main outputs.

6.3 Connecting things

Ardour provides various ways of interconnecting the tracks and busses of a session with the outside world (your sound card and other JACK-enabled applications).

6.3.1 Automatic connections

There are some connections which are reasonably common and therefore fairly easy for Ardour to guess. It will make these connections automatically, if configured to do so. Auto-connection can be set up in the Audio tab of the Ardour Preferences dialogue.

Auto-connect master/monitor busses will instruct Ardour to connect the outputs of the master and monitor busses to the first N 'physical' JACK ports, where N is the number of channels in your master bus (e.g. 2 for stereo).

Connect track inputs sets how new track inputs should be set up; they can either be automatically connected to physical inputs or left alone for you to connect yourself.

Connect track and bus outputs sets how new track and bus outputs should be set up; they can either be connected automatically to physical outputs, or to the master bus, or can be left alone for you to connect manually.

6.3.2 Manual connections

You can, of course, also change connections manually. This is done using a connection manager dialogue, like the one in Figure 6.11.

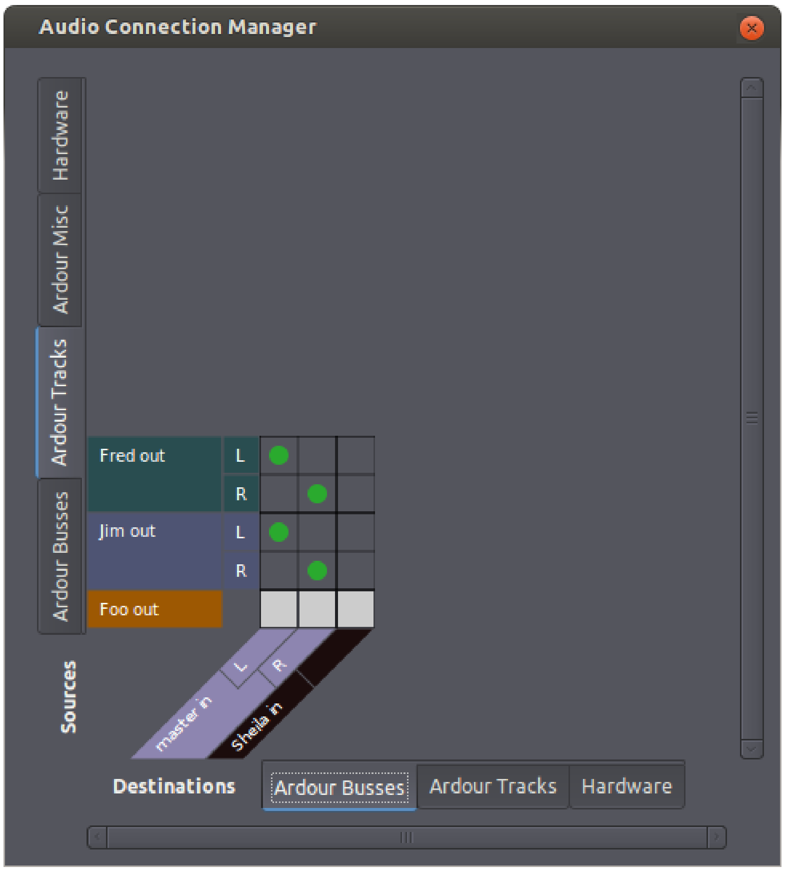


Figure 6.11: A connection editor

The connection manager presents two groups of ports; one set of sources (which produce data), and one of destinations (which consume data). Depending on the relative number of each, the sources will be placed on the left or the top of the dialogue, and the destinations on the right or the bottom. Thus, in general, signal flow is from top or left to right or bottom.

Both sources and destinations are divided up into groups, with each group being given a tab. Click on the appropriate tab to show the ports in each group ('Ardour Busses', 'Ardour Tracks' and so on).

The groups that are used are as follows:

- *Hardware* — ports which are connected to a physical piece of hardware (a sound card or MIDI interface).
- *Ardour Busses* — ports belonging to busses.
- *Ardour Tracks* — ports belonging to tracks.

- *Ardour Misc* — other ports that do not fit into the previous two categories; for example, the ports on which the metronome click is output, and MIDI ports for things like control surfaces and timecode.

The main body of the connection manager is a grid. Within this grid, green dots represent connections, and you can click in any of the squares to make or break connections. You can also click and drag to draw a line of connections, which is sometimes useful for making many connections at once.

In the example manager of Figure 6.11 we can note various things. We are using the 'Ardour Tracks' sources tab, so we see the output ports of the three tracks in our session: Fred, Jim and Foo. Our destinations are from the 'Ardour Busses' tab, so we have the inputs of a session bus, Sheila, and the inputs of the master bus. Fred and Jim have stereo outputs, so have L and R connections. Foo is a MIDI track, so it only has one connection, and its squares in the grid are coloured light grey to indicate that no connection can be made between Foo (a MIDI output) and our busses (which are all audio-input).

The green dots in the example show that both Foo and Bar are connected to the master bus, left to left and right to right.

6.3.2.1 Different connection managers

Slightly different versions of the connection manager are available from different places in Ardour. For a global view of all JACK audio connections, use the Audio Connection Manager which can be opened from the Window menu, or by using Alt-P. A corresponding MIDI Connection Manager can be opened using Shift-Alt-P.

There is also a connection manager available when connecting individual tracks; clicking on the input or output buttons of a mixer strip will open a connection manager which has the corresponding track input or output as the only destination or source, with all other ports available for connection to it.

6.3.2.2 Other connection manager features

Right-clicking on a port name in the connection manager opens a menu which provides a few handy options:

- *Add audio port* and *Add MIDI port* — these options add audio or MIDI ports to the thing that you opened the menu over, if this is possible. In this way, for example, tracks and busses can be extended to have more inputs or outputs.
- *Remove* — removes the given port, if possible.
- *Disconnect all from...* — disconnects everything from the given port.
- *Rescan* — Ardour will try to keep abreast of any changes to the JACK ports on your system, and reflect them in any connection managers which are open. If for some reason this fails, choosing Rescan will re-scan the list of ports and update the manager.
- *Show individual ports* — if you have a session which has lots of multi-channel tracks or busses, it may be an unnecessary detail that you have to connect left to left and right to right every time you make a connection. This obviously gets worse with higher channel counts (such as for 5.1 or ambisonics). To make life easier with such sessions, you can untick Show individual ports. After that, the channels of tracks and busses will be hidden, and any green dots you add in the connection manager will automatically connect each channel of the source to the corresponding channel of the destination (left to left, right to right and so on). In this mode, a half-circle in the connection grid indicates that some (but not all) of the source's ports are connected to the destination.
- *Flip* — this will flip the visible ports on the vertical axis with those on the horizontal. If, for example, the top of the connection manager is showing 'Ardour Busses' and the right is showing 'Hardware', *flip* will swap the view to the opposite so that the top of the manager displays 'Hardware' and the right 'Ardour Busses'. You can also make flip happen by pressing **F**.

Chapter 7

Recording

7.1 Basic recording

Basic recording in Ardour is pretty simple, both for audio and MIDI:

1. Record-enable the track or tracks that you want to record to using the button.
2. Record-enable the session using the button.
3. Put the playhead at the point at which you want to start recording.
4. Start the transport rolling using the button.
5. Stop the transport when you have finished using the button.

This will result in new regions being added to the record-enabled tracks, placed over the top of anything that is already there. Note that any previous regions are not deleted, simply hidden. The recorded data will be written to disk in the format configured in the Media tab of the Session Properties (see Section 15.2.3).

It is not necessary to set up record-enable status with the transport stopped; it can also be done while it is moving. So, for example, it is fine to start playback and then drop into record (either for the whole session or just for a particular track) by pressing the appropriate record enable. Note that both session and track record enable must be turned on (or 'armed') for recording to happen.

Ardour will always play back any non-record-enabled tracks while you are recording, so that you can listen to existing tracks whilst playing new ones. Ardour may also make the incoming audio and/or MIDI audible, depending on the monitoring setup (see Section 6.1.5)

7.2 Punch in/out

Often it is necessary to record over a small section of an existing recording, perhaps to fix a mistake, or re-do a solo. There are a few approaches to this. Most simply, you can start recording (or drop into record) a little before the section that you want to change, and stop a little after, then edit the resulting regions afterwards to fit the new section into the old.

An alternative it to use 'punch-in'. With this mode, Ardour will start and stop the recording for you. You can set a punch range, and then start the transport at any point before it. When the punch range starts, Ardour will start recording, and then it will stop at the end of the range.

To set up a punch recording:

1. *Set up the punch range* — first, make sure the 'loop/punch ranges' ruler is displayed; if not, right-click over the ruler bar and select Loop/Punch. Then, Ctrl-drag the punch range over the loop/punch ranges ruler. When you finish the drag, a menu will pop up; choose Set Punch Range. This will put a punch range marker into the ruler; you can drag either end of it to alter its position (see Figure 7.1).

2. *Enable punch in and out* — click the In and Out buttons in the Punch section towards the right of Ardour's top toolbar (see Figure 7.2). At this point the punch range will be coloured red in the editor window.

3. *Record-enable the session and the tracks you want to punch on.*

4. *Start the transport* at some point before the punch range — the session will roll toward the punch range with the session record-enable button flashing, and then go into record at the start of the punch range.

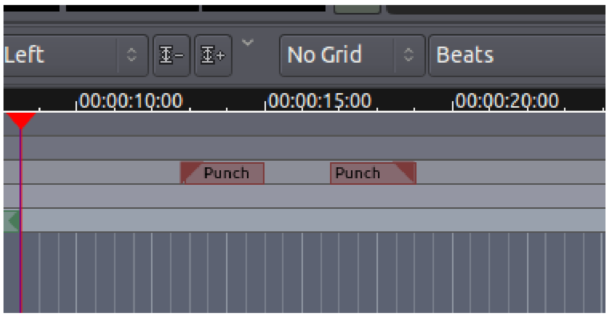
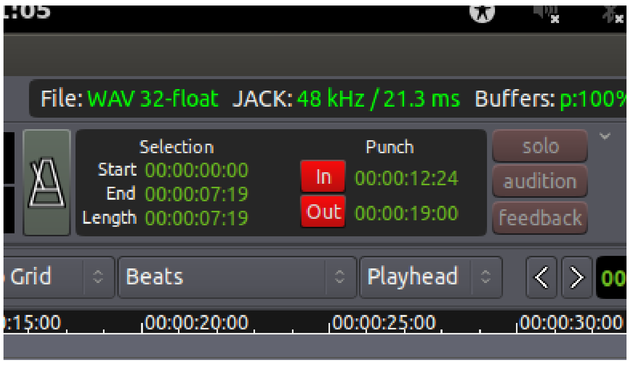


Figure 7.1: A punch range marker


File: WAV 32-float JACK: 48 kHz / 21.3 ms Buffers: p:100%

Selection
Start 00:00:00:00
End 00:00:07:19
Length 00:00:07:19

Punch
In 00:00:12:24
Out 00:00:19:00

Figure 7.2: The punch buttons set for a punch in and out

You can use punch in and out separately if you wish; if, for example, you have a definite punch-in point but are not sure how long the recording should go on for, simply turn off punch out and Ardour will keep recording.

7.3 Step entry

An alternative to recording MIDI with the transport rolling is *step entry*. This is a means of entering note data without having to worry about getting your timing right.

To enter step-entry mode for a MIDI track, right-click its record enable button and choose Step Entry from the menu that pops up. This will open the step entry dialogue, as shown in Figure 7.3.

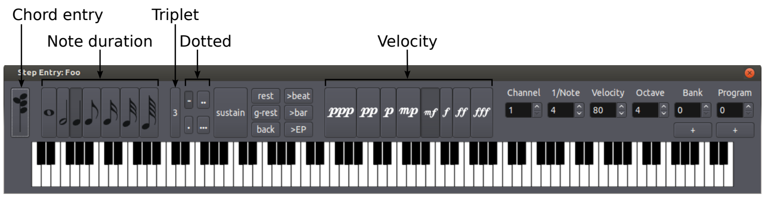


Figure 7.3: The MIDI step entry dialogue

Clicking one of the piano keyboard keys will put a note, of the appropriate pitch, at the edit point. The next note will be put after the first one in time, and so on. A step edit 'insert position' is displayed as a dark-red rectangle within the MIDI track to indicate where the next note will go, and how long it will be.

The buttons in the step entry dialogue change things about the note that will be entered. We have:

- *Chord entry* — if this is selected and you click on several notes one after the other, they will be placed at the same time (as a chord) rather than one after the other.
- *Note duration* — these buttons set the duration of the note to be entered, using musical symbols.
- *Triplet* — if this is selected, the selected note duration becomes a triplet so that now three notes fit into the time that two would previously have occupied.
- *Dotted* — makes the note one-and-a-half-times longer. The double-dot makes it 1.75 times longer, and the triple-dot 1.875.
- *Sustain* — if you have selected notes, this button extends them by the current note length.
- *Rest* — inserts a rest (an empty space) of the current note length.
- *G-Rest* — inserts a rest of for the length of a grid space.
- *Back* — move the step-edit insert position back by the current note length.
- *>Beat* — move the step-edit insert position onwards by one beat.
- *>Bar* — move the step-edit insert position onwards by one bar.
- *>EP* — move the step-edit insert position to the edit point.
- *Velocity* — set the velocity (volume) of the notes that will be inserted, using musical terminology (*ppp* being the quietest and *fff* the loudest).
- *Numerical entry* — these entries allow the setting of various parameters numerically.
- *Bank* — this allows you to insert a bank change; set the required bank number then click the + button.
- *Program* — this allows you to insert a program change; set the required program then click the + button.

Chapter 8

Editing

'Editing' is the name given to the process of manipulating recorded or imported audio and MIDI data. There is some common ground between the two, but of course there are also differences. This chapter discusses Ardour's editing facilities for the two types of data.

8.1 Basic region operations

The region is the basic component of Ardour that we are concerned with editing. Figure 8.1 shows a typical audio region.

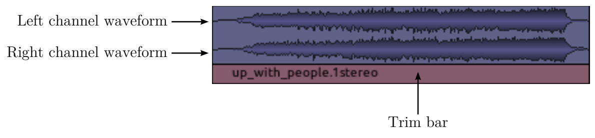


Figure 8.1: An audio region

In the region we can see a representation of the waveform of the audio data for both the left and right channels (since this is a stereo region). At the bottom is a coloured bar containing the name of the region.

There are few basic operations that can be performed on a region. Left-clicking and dragging will move the region; regions can be moved in time, or to a different track. Ctrl-dragging will make a copy of the region and start moving it.

Clicking and dragging towards the left or right side of the region, or anywhere within the 'trim bar', trims the start or end of the region. Figure 8.2 shows a trim in progress.

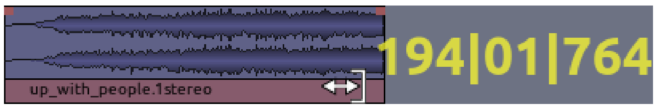


Figure 8.2: Trimming the end of an audio region

Right-clicking anywhere on a track (including over a region) displays the track menu. The top entry in this menu will be the name of the region that was clicked on, and this entry's submenu offers a large selection of operations which can be applied to the region. These operations are described in Chapter 14.

8.1.1 Splitting regions

Regions can be split into two or more new regions using the 'split' command. This is available from the region context menu's Split item from the Edit menu (or by pressing **S**). The split will happen at the edit point (see Section 4.6).

The way in which Ardour decides *which* regions to split is a little involved as it depends on the edit point that is being used.

If the edit point is 'mouse' and you are pointing at an unselected region, that region will be split; otherwise, regions on any tracks with selected regions will be split if they lie at the time that the mouse pointer is at.

If the edit point is 'playhead' or 'marker', any regions underneath the edit point on tracks that are either themselves selected, or contain selected regions, will be split.

This makes more sense in practice than it does written down! In general, the easiest approach to getting the split you want is often to select the regions that you want to split, put the edit point at the split, then hit **S**.

If tracks which have regions to be split are themselves members of groups (see Section 5.2) that have the 'share edit' property set, the other members of the group will also be examined for regions to split.

8.2 Duplicating regions

8.3 Overlapping regions

A track can have regions which overlap in time. When this happens, several factors determine what output the track will generate.

A track (or really, a playlist) is considered to have its regions in a stack. That is, they are ordered, as if they were placed in a pile. Thus, with overlapping regions, there are regions which are above or beneath others. With the default settings, Ardour will play the topmost region in the stack at any particular point in time. This is shown in Figure 8.3.

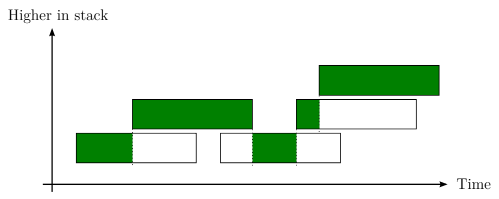


Figure 8.3: Some overlapping regions

The diagram shows a collection of regions, expanded so that you can see how they are stacked. The green areas show the bits that Ardour will play by default.

The initial stacking order of regions is simple: the more recently the region was added to the track (by whatever means: recording, importing, copying etc.) the higher in the stack it will be. If this intial stacking is not what you need, there are a few ways that it can be manipulated. Note that the initial stacking is just that: *initial*. Any modifications that you make to stacking order will be remembered by Ardour.

8.3.1 Raising and lowering overlapping regions

Most simply, regions can be raised or lowered in the stack using options in the region context menu under Layering; regions can be raised or lowered either by one level or right to the top or bottom of the stack.

Another option is to put a region's track into *stacked* mode. To do this, right-click on the track controls area and choose Stacked from the Layers menu. In this mode, rather than overlapping regions being drawn on top of each other, regions are drawn like those in Figure 8.3. This makes the arrangement of the track's regions a little more obvious. Areas of regions that will not be played back are shaded dark-grey to make things clearer.

In this mode, it is possible to move regions up and down in the stack just as you would move them around normally. Dragging a region makes all the regions on the track 'jump' apart on the display; at this point, the region that you are dragging can be moved anywhere within the stack.

8.4 Audio region fades

Audio regions have a few properties of their own, with respect to MIDI. One is that they have optional *fades* at their beginning and end. A fade is effectively a change in gain; the start of the region fades from -∞dB to 0dB and the end fades from 0dB out to -∞dB.

These fades can be of any length and a variety of shapes. Figure 8.4 shows some regions with some examples of fades.

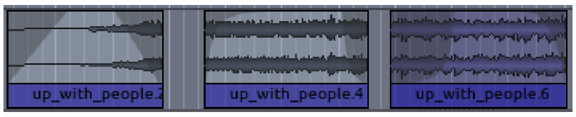


Figure 8.4: Some regions with fades

When the mouse pointer is over an audio region, fade handles will appear and the fades' lengths can be changed, as shown in Figure 8.5.

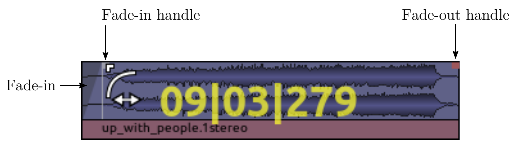


Figure 8.5: Dragging a fade-in

The shape of the fade can be changed by right-clicking over the fade; this will pop up a menu as in Figure 8.6.

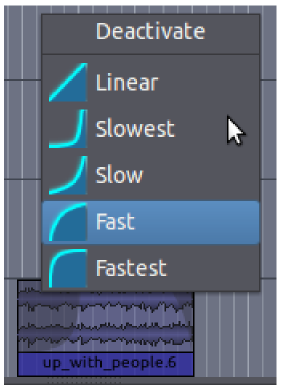


Figure 8.6: Fade shape menu

8.4.1 Cross-fading

Region fades have an important consequence in addition to fading their subject region. At the same time as providing a gain change to the target region, the fades also cause an *inverse* fade to any regions that lie beneath the target region in the stack.

Consider, for example, the simple case in Figure 8.7.

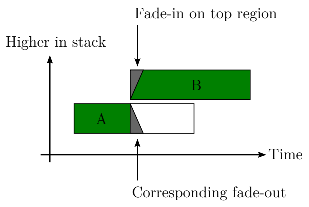


Figure 8.7: Simple cross-fade

We have two regions, A and B. For the first part of this time, region A plays (its area marked green). Then we have region B, which overlaps A, and has a fade-in. Ardour sees this fade-in and automatically performs a fade-out on region A which is the inverse of B's fade-in. During the period of B's fade in, both region A and B will be heard. This fade-in/fade-out arrangement has the important effect that no 'click' will be heard due to the discontinuity between the waveforms of regions A and B. This arrangement, where one thing is fading out at the same time that another is fading in, is called *cross-fading*.

So useful is this property that Ardour will arrange for cross-fades to be present whenever regions overlap. The Fades tab of the Session Properties dialogue contains some options to specify what form these automatically-generated crossfades will take described. The automatic crossfades can be set to span the entire overlap of the regions involved, or to be short. In general, if you want the basic property of 'de-clicking' region overlaps, crossfades should be set to be 'short'. The long-crossfade options are more useful for artistic use of fades, where two regions must merge slowly into each other.

8.5 Audio region gain

In addition to the fade-in and fade-out curves, there are two other ways to modify the gain of a region; as with fades, these modifications are non-destructive — they do not alter the data on the disk. Firstly, a region has an overall gain which is applied to the whole region. On top of this, regions can have *gain envelopes* which modify the gain over time.

Simple gain changes across the whole region can be made in a few ways:

- Using the Boost Gain and Cut Gain options on the Gain submenu of the region context menu; these adjust the overall gain in 1dB steps.
- Using normalisation (the Normalize... option on the Gain submenu); this will set the region's scale amplitude so that, when played back, its maximum level is just below 0dBFS.
- From the region properties dialogue box, accessible using Properties... from the region context menu.

For more involved changes to region gain, regions can also have their own variable gain envelopes. This overlaps somewhat with automation (discussed in Chapter 9), but can be useful to alter the sound of particular features within the region.

If you want to modify audio region gain, it is important to ensure that the option 'Show gain envelopes in audio regions' is ticked in the Editor tab of Ardour's preferences (see Section 15.3.3). This enables some useful functionality which is otherwise turned off.

To edit audio region gain, first go into 'draw region gain' mode by clicking the tool ( ). Now, moving the mouse pointer over an audio region will show the gain curve; initially this will be a straight green line with two red-square points, one at each end. The gain line can be edited in the following ways:

- Left-clicking in an empty area of the region will add a new region gain line point.
- Dragging a point will move it.

- Dragging a line segment will move points at each end of the segment.
- Right-clicking on a point will offer a menu from which you can delete the point or edit its value numerically.
- Ctrl-right-clicking on a point is a short-cut to opening its edit dialogue box.
- Shift-right-clicking on a point will delete it.

An example region with a gain line is shown in Figure 8.8.

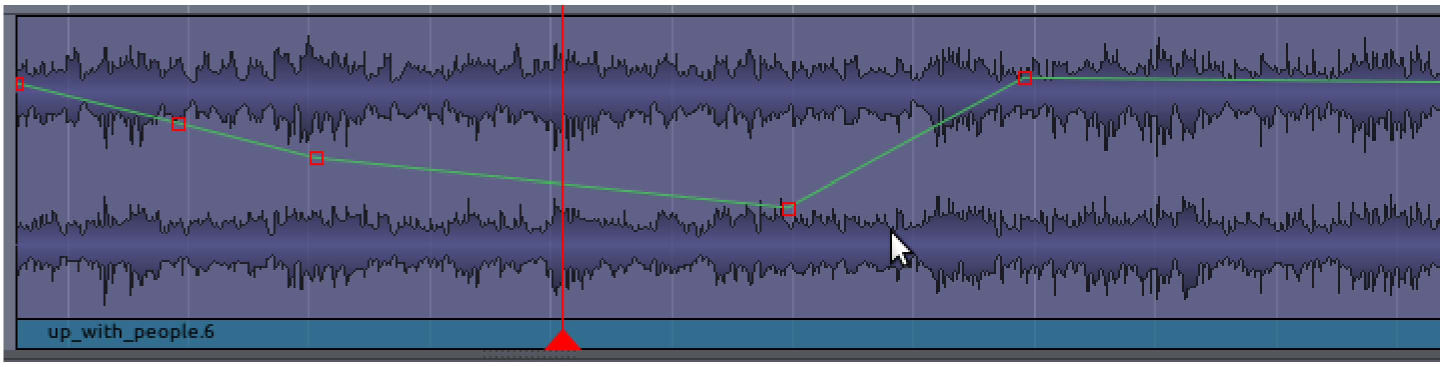


Figure 8.8: An audio region with a gain line

8.6 Pitch shifting

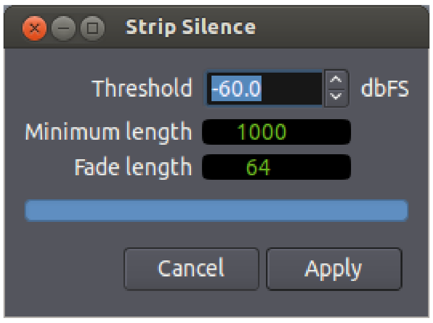
Ardour provides algorithms to do pitch-shifting of audio. As with any pitch-shifting method, the results can never be perfect, but they may be useful for correction or for artistic purposes. To pitch-shift a region, choose Pitch Shift... from the Edit submenu of the context menu. This will open the Pitch Shift Audio dialogue box, which allows you to specify the desired shift in octaves, semitones and cents.

8.7 Time stretching

Time-stretching in Ardour has its own special tool. Choose the stretch/shrink tool ( ). With this tool, you can click and drag the size of regions, much as you would do when trimming them. The difference is that after the drag, Ardour will time-stretch the region to the new size that you have requested. For audio regions, a dialogue box will appear so that you can set up the parameters of the time-stretching algorithm. For MIDI, of course, time-stretching is somewhat easier and requires no options.

8.8 Stripping silence

With some recordings, it is desirable to remove regions which are, or are nearly, silent. This can be done automatically using the Strip Silence... item on the region context's menu Edit item. Selecting this option will open the dialogue shown in Figure 8.9.


Strip Silence

Threshold -60.0 dbFS

Minimum length 1000

Fade length 64

Figure 8.9: The strip silence dialogue

In addition, your target regions will be overlaid with light-blue areas which represent the areas that the strip silence dialogue currently considers to be 'silence'. The main adjustment for this is the threshold; this is the level below which the region will be considered silent. In addition, the minimum length of a silent period can be specified, so that shorter below-threshold periods will be ignored.

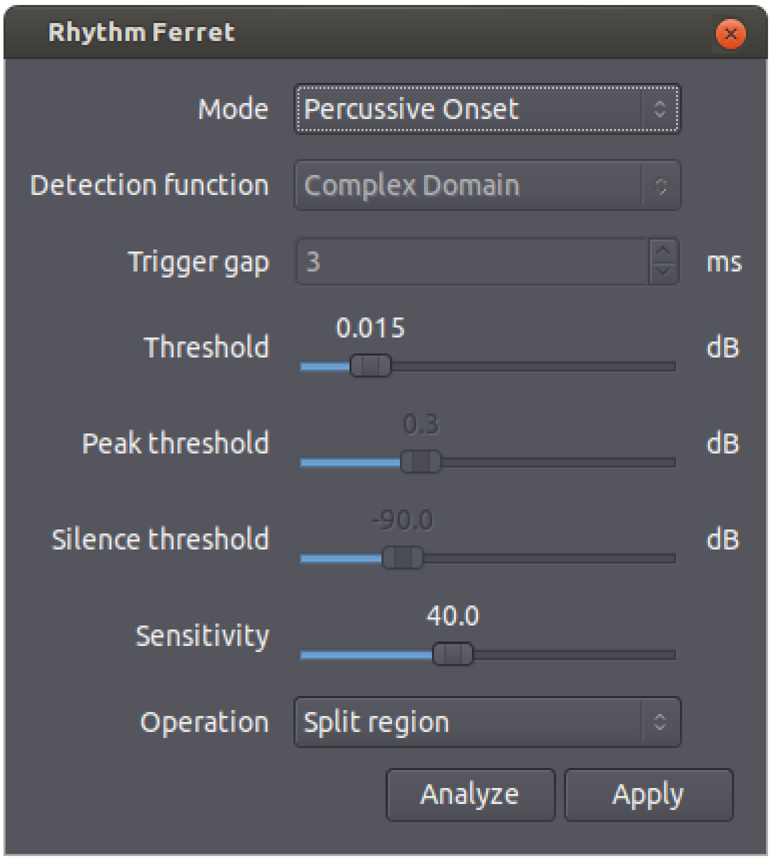
Finally, the dialogue offers a 'fade length' option which specifies what length of fade in and out will be applied if 'Apply' is pressed and some parts are stripped out of the region.

Clicking 'Apply' will split the target regions as required, leaving only those areas which it considers non-silent.

8.9 Rhythm Ferret

Rhythm Ferret is a tool which can analyse regions in a couple of different ways, looking for particular features (like note onsets or transients like percussion hits). It can then perform various operations on the region based on these features.

To open the Rhythm Ferret dialogue, choose Rhythm Ferret from the Edit menu. This will open the dialogue box shown in Figure 8.10.



Mode Percussive Onset
Detection function Complex Domain
Trigger gap 3 ms
Threshold 0.015 dB
Peak threshold 0.3 dB
Silence threshold -90.0 dB
Sensitivity 40.0
Operation Split region

Figure 8.10: The Rhythm Ferret dialogue

First, choose the features that you want to look for; either note onset or percussive onset. Then, clicking 'Analyse' will examine region and place light grey markers at the detected features in the region. If the features have been detected incorrectly, you can adjust the parameters and click 'Analyse' to try again. Once the correct features have been found, you can choose what to do with them using the 'Operation' drop-down:

- *Split region* — this will split the region into smaller regions at the feature points.
- *Snap region* —
- *Conform regions* —

8.10 Spectral analysis

Though not strictly an editing operation, Ardour provides a handy window which gives a spectral analysis of some part of your session. You can use this to see a spectral analysis of a region by choosing Spectral Analysis... from the region's context menu.

8.11 MIDI region editing

MIDI regions are somewhat different to audio regions in that Ardour allows you to edit their contents, as well as just their position and size. With a midi region's tools you can add, move, delete and modify notes, control changes and so on directly inside the editor window.

The first step to editing a MIDI region's contents is to click the 'edit region contents' tool (). On doing this, the bodies of the regions in the session will fade out to indicate that you are now editing their contents. You can also enter this mode by double-clicking on a MIDI region.

Figure 8.11 shows a region with 'edit region contents' disabled, and Figure 8.12 after 'edit region contents' has been switched on.

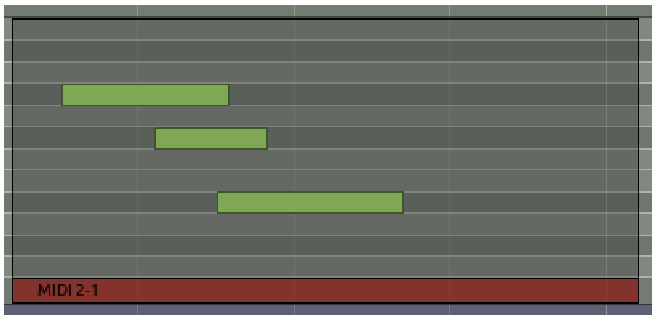


Figure 8.11: A MIDI region with 'edit region contents' switched off

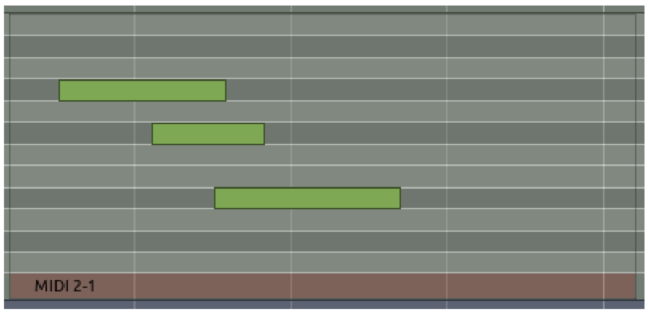


Figure 8.12: A MIDI region with 'edit region contents' switched on

Once in this mode, many of the tools for altering regions become tools for altering notes. With the 'select/move objects' tool () you can select notes, move them around and trim their starts and ends. Hovering the mouse over a note will display information about its note value, channel and velocity.

In addition to editing region contents, MIDI tracks can also have a variety of controls in the track header. If you increase the height of a MIDI track, various new controls will become available, as shown in Figure 8.13.

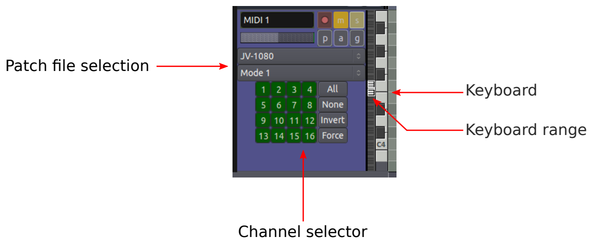


Figure 8.13: Extra MIDI track controls

The keyboard shows the pitches of notes in the region in terms of a piano keyboard. Dragging the keyboard range up and down will change the range of pitches that the track displays, and the ends of the keyboard range can also be dragged to show a wider or narrower range of pitches.

8.11.1 Channel selection

Right-clicking on a selected note will display a channel selector, as shown in Figure 8.14.

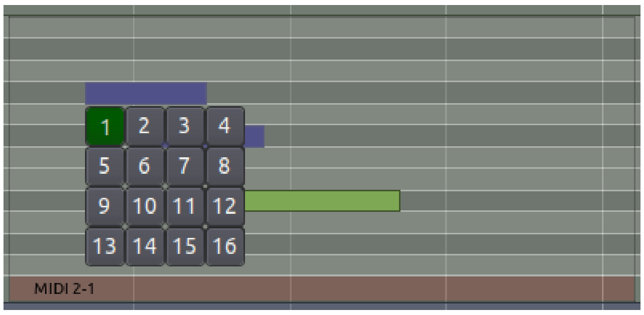


Figure 8.14: Altering a note's channel

Once this is displayed, click on the MIDI channel that you want the note to be played back on.

8.11.2 Full note details

The full details of a note can be edited numerically by Ctrl-right-clicking a selected note. This opens a dialogue box with all the notes details; modifying the values in the dialogue box will change the note.

8.11.3 Cutting, copying and pasting notes

Selected notes can be cut using **Ctrl-X**, copied with **Ctrl-C** and deleted with **Delete**, just as regions can. Once cut or copied they can also be pasted; pastes will be placed at the current edit point (see Section 4.6).

8.11.4 Adding notes

Notes can be added to MIDI regions using the 'draw MIDI' tool (). Select this tool, then click to add a note which is the same length as the current grid interval, or click and drag to add a note of any length.

Alternatively, if the 'select/move objects' tool () is selected, notes may be added by clicking or dragging with **Ctrl** held down.

8.11.5 Editing velocities of multiple notes

To change the velocities of several MIDI notes to the same value, select them and press **V** to open the small dialogue shown in Figure 8.15.

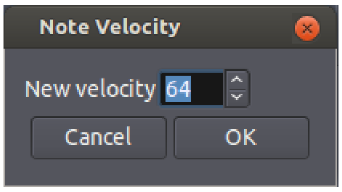


Figure 8.15: Setting note velocity

Choose the velocity that you want, then click OK to set all selected notes to that velocity.

8.11.6 Patch Changes

A ‘patch change’ is Ardour’s description for a combination of MIDI program change and bank select messages, that (typically) instruct a synthesizer or sampler to select a different sound to use on a particular channel.

Patch changes are shown within MIDI regions as small rectangles, as shown in Figure 8.16.

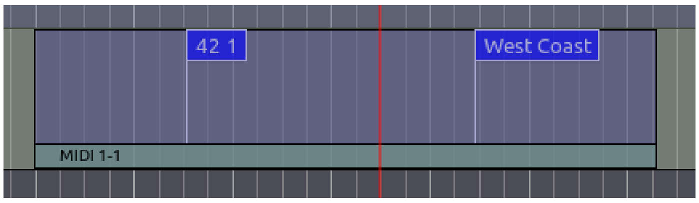


Figure 8.16: A couple of patch changes

This figure indicates a a couple of different ways that patch changes can be displayed. The first is shown with numbers; it is a change using program change 42 on bank 1. The second is shown using a name: ‘West Coast’

8.12 Other MIDI operations

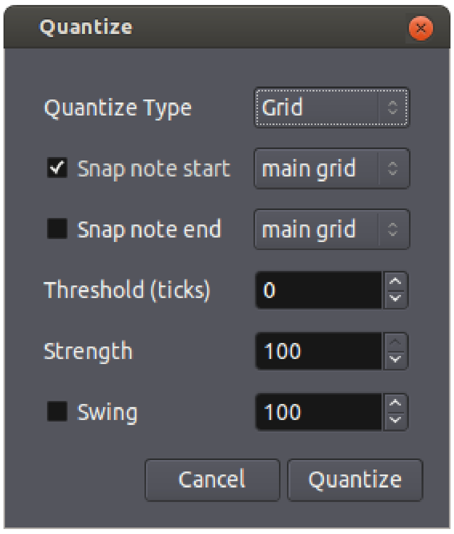
When outside of ‘edit region contents mode’, some other (region-wide) MIDI operations are available from the MIDI submenu of the region context menu.

8.12.1 Transpose

This opens a dialogue box to allow transposition (shifts in pitch) of the notes in the region.

8.12.2 Quantize

The Quantize feature allows notes in the region to be snapped to a grid, to make their timing more accurate. The Quantize... option opens the dialogue shown in Figure 8.17.


Quantize

Quantize Type: Grid

✓ Snap note start: main grid

☐ Snap note end: main grid

Threshold (ticks): 0

Strength: 100

☐ Swing: 100

Figure 8.17: The quantization dialogue

The quantization options are as follows:

- *Snap note start* — tick the box to quantize note starts, and select the grid that they should be snapped to.
- *Snap note end* — tick the box to quantize note ends, and select the grid that they should be snapped to.
- *Threshold* — if a note start or end is more than this threshold (in ticks) away from a grid line, it will not be snapped. There are 1920 ticks per beat.
- *Strength* — this is a percentage by which note starts or ends will be pulled towards the grid; if strength is set to 100, they will be snapped completely; any less, and they will be snapped less accurately. This can be used to maintain some of the 'human' inaccuracies in timing from a recording of a real player.
- *Swing* — if ticked, this option will attempt to quantize notes so that they 'swing'. Speaking mathematically, given two input notes as shown in Figure 8.18, the quantizer will put the second note at a time t where

  $$t = q + \frac{2}{3}\frac{F_S}{100}L \tag{8.1}$$

  where $\mathrm{F_S}$ is the swing factor specified in the Quantize dialogue box. Hence if $\mathrm{F_S}$ is positive, the note will be placed later than it would be with 'straight' timing, and if $\mathrm{F_S}$ is negative the note is placed earlier.

  This feature is probably most easily explored by listening!

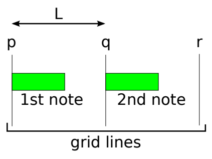


Figure 8.18: The mathematics of swing

8.12.3 Fork

By default, when a region is copied its contents are a 'clone' of the thing it was copied from. That is to say, if you copy some region A as region B, then edit region A, the same edits will happen to region B. This is not apparent for audio, since the actual contents of audio regions cannot be changed, but it is important for MIDI. If you copy a region which you then want to be independent of other regions in the session, select the region to make independent and choose Fork item from the MIDI part of the context menu.

8.12.4 List Editor

To look at the MIDI note events in a region numerically, select the region and choose List Editor… from the context menu's MIDI item. This opens a dialogue box containing all the region's note details, and edits you make to the numbers will be reflected in the region.

8.13 Non-note MIDI data

Ardour treats MIDI note data differently to other types of messages (control changes, pitch bends and so on). Most of the other types of data are represented as automation data, drawn with continuous lines. The resulting 'automation' is converted back to MIDI and played back in the same stream as the note data, and MIDI automation data is always attached to a region, so it moves in time and is copied and pasted with its region.

Automation is covered full in Chapter 9, with reference to audio as well as MIDI automation.

8.14 Undo and redo

Whenever you perform an operation which alters something on Ardour's timeline, a note is made so that it can be undone using Ctrl-Z or by choosing Undo from the Edit menu. The operation can then be redone using Ctrl-R or with the Redo menu option.

As well as being kept in memory, the record of previous operations is stored with the session file. This means that you can save and re-load a session and undo things that you did in the last session. Storing the undo information is very useful, but does require memory and disk space; you can set how many edits Ardour should remember using the Limit undo history to and Save undo history of options in the Misc tab of the Session Properties dialogue box.

In addition to the undo record, Ardour can also be set to make a periodic backup of the session file. This may be useful in the event that Ardour crashes, or your computer suffers a power failure. Ticking the make periodic backups of the session file in the Misc tab of the Session Properties will cause Ardour to make a backup copy of the session file every two minutes.

One notable operation that bypasses the undo system is Remove Last Capture. This cannot be undone, so there is the option to verify removal of last capture (again in the Misc tab) if you would like Ardour to check that you are sure.

Note that the undo system operates on *time-line* edits only. It does not, for example, remember changes you make to plugins, fader levels or any such like.

8.15 Time

Ardour has a few ways of expressing time on its timeline. The most fundamental is the *frame*. One frame is the duration of a single sample at whatever sampling rate the session is running at. In other words, a frame lasts $1/F_S$ seconds, where F_S is the sampling rate.

Use of frames makes sense in many situations, but sometimes it is more useful to think of time in terms of musical bars and beats. In this way, rather than having a region at, say, 176400 frames (4 seconds at 44.1kHz), we might want to think of the region as being at beat 1 of bar 2 (which is the same position if the tempo is 60 beats per minute and the time signature is 4/4). If the session has a fixed tempo, the representation does not make a lot of difference; using bars and beats is merely a different way of looking at the same thing.

Consider, instead, the case when a region is beat 1 of bar 2 with the tempo set at 60 beats per minute, as shown in Figure 8.19.

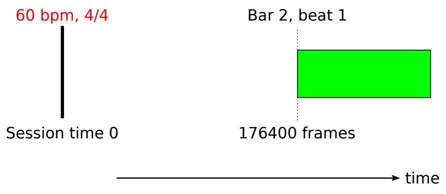


Figure 8.19: A region at one tempo

Here we have a region (the green box) at beat 1 of bar 2. At 44.1kHz this corresponds to 176400 frames. Now imagine that we change the tempo to 120 beats per minute, as in Figure 8.20.

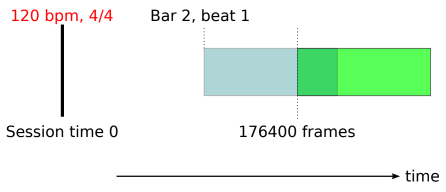


Figure 8.20: Possible region positions after changing tempo

Now there are two places where one might expect the region to end up, represented by the blue and green rectangles. If you are thinking in terms of music, the region should move as the blue rectangle in order to maintain its bar/beat position. This is half the number of frames as the original, as the tempo has doubled.

Alternatively one might equally want the region to stay where it is in terms of frames, in which case it would remain where the green rectangle is.

The choice of which option to take is represented in Ardour by a *glue bars to beats* option, which is available for regions and markers.

Chapter 9

Automation

Automation is the means by which many controls in Ardour (faders, plugin controls, mute and solo, and so on) can be 'automated', so that their values change over time. This is commonly used to assist with mixing a track; vocal levels may be brought up and down as required, for example. This chapter describes the ways in which automation may be set up and edited.

9.1 Adding an automation lane

By default, a track has no automation. To add some, the first step is to open an automation 'lane' for the track. This looks much like an additional track, but can be considered a 'child' of its parent track.

To create an automation lane for an audio track, click the 'a' button in the track controls area. A menu will open which contains a list of the things which can be automated for the track. By default, this will just be 'fader' and 'pan', but if the track has any plugins, their controls will also be listed in this menu.

Choosing, for example, 'fader' opens a new automation lane, as shown in Figure 9.1.

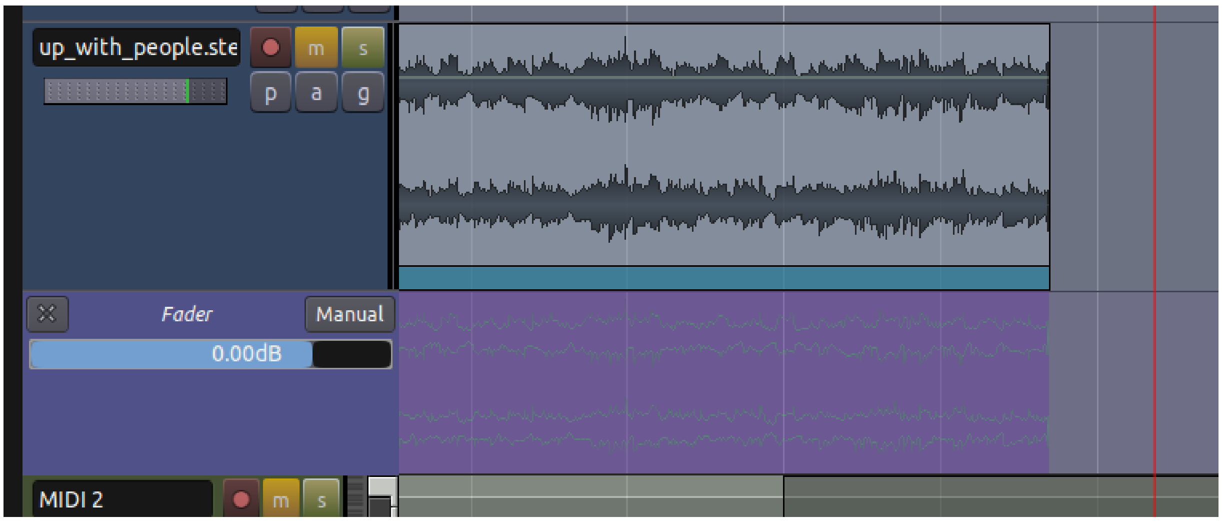


Figure 9.1: An automation lane

We now have an automation lane for the track 'up_with_people.stereo' which controls its fader level. The automation lane's controls area includes the name of the parameter being automated, a handy fader for adjusting the level of the parameter, a button to select the automation mode, and a 'cross' button to hide the automation lane. Hiding the automation lane merely removes it from sight; it does not have any effect on the automation that the lane contains.

9.2 Automation modes

Clicking on the automation lane's mode button (which initially says 'Manual') offers four options:

- *Manual* — in this mode the automation will be ignored on playback.
- *Play* — in this mode the automation will be 'played back'; in other words, when the session is playing back, the track's controls will be manipulated by any automation that has been set up.
- *Write* — when the session is being played back, any automation lanes in 'write' mode will store data from the current value of their parameter at each instant. In other words, one way to create automation data is to set 'write' mode, play the session back, then adjust the parameter (in this case the fader) of the track as required. Your movements will be recorded and written as automation.
- *Touch* —

9.3 Creating automation

There are two basic ways to create automation data. Firstly, one may use the 'write' mode, as discussed in the previous section. To see this in action for our example fader lane, simply select 'write', start the session, and move the track's fader around a bit. When you stop the transport, an automation line will appear on the lane to show you the moves that you made on the fader.

The other option is to draw the automation with the mouse. Clicking in an automation lane with in 'select/move objects' mode () will create a new automation point.

9.4 Editing automation

Automation may be edited using the mouse in the automation lane. Hovering the mouse over an automation line will put red squares at each node of the line; these can be dragged around to move them.

You can also Ctrl-right-click to display a dialogue box to change the precise value of an automation point, or Shift-right-click to delete a point.

Multiple points can be selected so that they can be moved as a group; either Ctrl-left-click to select additional points, or drag a 'lassoo' rectangle over a group of points to select several at once.

Finally, points may be cut, copied and pasted, just as regions, by selecting them and using the standard key shortcuts **Ctrl-X** for cut, **Ctrl-C** for copy or **Ctrl-V** for paste). Pastes are made at the edit point (see Section 4.6).

9.5 MIDI 'automation'

As discussed in Section 8.13, a variety of MIDI message types are presented in Ardour as automation. Lanes for these messages can be opened, just as with audio tracks, by clicking on the 'a' button in a MIDI track's control area and selecting a parameter. The menu is much more extensive for MIDI, since there is an option for each parameter on each MIDI channel. Note that because of the way MIDI automation is stored (with the region), it is not possible to draw MIDI automation in an area of the lane where its parent track does not have a region. If you want to add automation without any note data, simply create an empty region before adding the automation.

9.6 Thinning

When a session is loaded, the automation data is *thinned*. This is a process of removing automation points that are not particularly important. Consider the simple case in Figure 9.2.

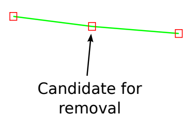


Figure 9.2: Thinning automation data

Here we can see that very little accuracy would be lost if the middle point were removed; the line is almost straight so it can be described well by just its end points.

The amount of thinning is configurable using the thinning factor control in the Misc tab of Ardour Preferences.

Chapter 10

Sessions

This chapter discusses Ardour sessions in more detail.

10.1 Sessions and session files

Generally speaking when we refer to a 'session' we mean a directory that Ardour has created which has a special structure. Sessions can be used to contain any amount of data; a song, an album, an live recording or whatever best suits you.

The two most important parts of a session are the *state files* and the audio / MIDI data. The state files are written by Ardour (in XML) and hold details of what is in the session; its tracks, busses, details of regions, automation, and much more. The state file does not, however, contain any actual audio or MIDI data. These data are held in separate files, in standard formats (typically WAV, AIFF and SMF[1]). It is possible for more than one state file to reference the same set of audio and MIDI data.

Figure 10.1 shows the structure of an Ardour session on disk.

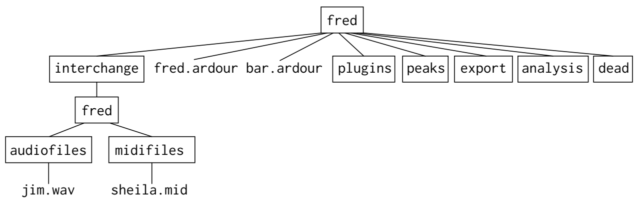


Figure 10.1: A session

Note first the two files suffixed `.ardour`. These are state files. They can have any names, but usually a session directory contains one state file with the same name as the directory.

The audio and MIDI data for the session is held within the `interchange` sub-directory, and Ardour will put any exported files from your session into the `export` sub-directory.

There are a few other directories within a session which you will usually not need to be concerned with:

- `plugins` — where data needed by plugins is stored.
- `peaks` — Ardour uses this directory to store 'peak files' these are representations of audio regions that it uses when displaying waveforms within regions. They are pre-computed and stored on disk to speed the response of the editor window.

[1]Standard MIDI File

- `analysis` — used to store spectral analysis data.
- `dead` — this is where Ardour will move unused files when you perform a session clean-up (see Section 10.4).

10.2 Snapshots and save-as

As mentioned above, a session directory can contain more than one state file. There will always be one 'active' state file that you are currently working with, but there may be others on disk. There are two ways to create new state files for a session: *snapshot* (the Snapshot… on the Session menu) and *save-as* (the Save As…).

Both of these options take a copy of the currently-loaded session's state and save it to a new state file. The difference is that *after* saving a snapshot, the session you are editing remains the same as the one you were editing before. After a save-as, you are editing the newly-created state file.

Snapshot is useful, for example, when you are about to try something drastic to a session which might not work; taking a snapshot before you start makes it easy to revert back to how things were.

To look at the snapshots of the current session, open the editor list and select the Snapshots tab. The list will show the existing snapshots, with a blue highlight on the current one. Clicking on an alternate snapshot will switch to it.

You can rename or remove snapshots by right-clicking on their names in the editor list and choosing an option from the menu.

10.3 Session templates

By default, Ardour starts with an empty session containing only a master bus. If you frequently find yourself setting up the same things when you create a new session, you may save time by using a session template. This is simply a session which can be used as a basis when creating other sessions.

To create a session template from the current session, choose Save Template… from the Session menu. You will be prompted to give a name for the template. From this point on, when creating a new session you will be offered the option to create it based on your new template. You can define as many templates as you wish.

Session templates are stored in `~/.config/ardour3/templates`.

Typical uses of templates might be to ensure that a particular session property is always set up how you like, or to set up for a particular recording situation; a 'live recording' template, for example, might have 32 numbered tracks set up, connected to your soundcard's inputs, and record-enabled.

10.4 Session clean-up

Generally speaking, Ardour is averse to deleting data. If you delete a region, the note Ardour has of the region's presence on its track is removed, but the audio or MIDI data itself is not deleted. This can be handy if you change your mind about a deletion, and is of course necessary to allow Ardour to offer undo. Keeping audio or MIDI data around does, however, require disk space. To recover disk space from unused audio and MIDI data by deleting them, you can use *session clean-up*.

Clean-up proceeds in two phases. First, select Clean-up unused sources… from the Clean-up submenu of the Session menu. This will search all playlists in all snapshots of the current session, looking for audio or MIDI files that are not being used. These files will be moved to the `dead` folder within the session folder, and Ardour will tell you which files it moved. Note that this operation destroys the undo record, as Ardour can no longer undo some things if it has no sound files to undo with.

On performing the clean-up, Ardour will tell you how much disk space can be recovered by permanently deleting the 'dead' sound files. To do this, re-start Ardour then choose Flush Wastebasket from the Clean-up menu. *This will permanently delete the files, with no hope of recovery!*

10.5 Renaming

Sessions can be renamed using the Rename… option on the Session menu. Both the session's directory and the current state file will be renamed.

Chapter 11

Locations and markers

Ardour provides a few ways to mark up specific times or ranges of time in your sessions. These are displayed, and can be edited from the rulers area of the editor window, as shown in Figure 4.1.

Markers are divided up into the following categories, each of which is allotted a separate line in the rulers area:

- *Location markers* — these mark a single point in time.
- *Range markers* — these mark a range of time.
- *Loop/punch ranges* — these also mark a range of time, but are specifically for use when looping (see Section 4.12 or punching (see Section 7.2).
- *CD markers* — these can mark either a single point in time or a range, and can be used to add track marks to compact disc (CD) images; see Section 11.3

11.1 Location markers

You can insert a location marker in a couple of ways; firstly, you can right-click on the location markers ruler to display the menu (as shown in Figure 11.1) and then select New location marker. Alternatively, choose Add Mark From Playhead from the Markers submenu of the Transport menu (or press **Enter** on the numeric keypad) to put a new location marker at the current playhead position.

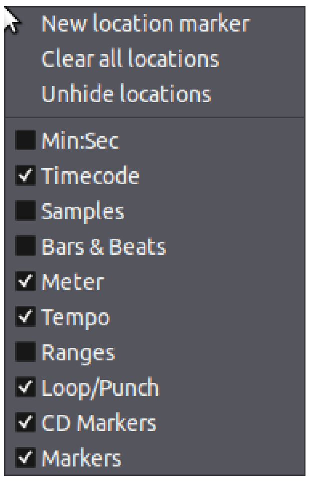


Figure 11.1: The location markers context menu

Markers can be selected by left-clicking on them; this will draw a blue line at the marker's position. Additional markers can then be selected by Ctrl-clicking. Selected markers can be dragged around in time.

Several operations on markers are available by right-clicking them to open the marker context menu. From this menu, you can:

- *Locate to Here* — move the playhead to this marker's position.
- *Play from Here* — start playback from this marker's position.
- *Move Mark to Playhead* — move this marker to the current playhead position.
- *Create Range to Next Marker* — create a range marker between this location and the next one along on the timeline.
- *Hide* — hide this marker from the view. It can be re-shown from the Locations window (see Section 11.4).
- *Rename* — change the name of the marker.
- *Lock* — if this is ticked, it will be impossible to drag the marker's position; useful if you want to prevent accidental movements.
- *Glue to Bars and Beats* — if this is ticked, the marker will maintain its position in bars and beats even if there are changes in tempo and meter (see Section 8.15).
- *Remove* — removes the marker.

There are also a few options on the Active Mark submenu of the Transport menu. These options apply to the currently selected location marker, and move it to a nearby region boundary, region sync point, or to the playhead or mouse.

11.2 Range markers

Range markers are somewhat similar to location markers, except that they cover a range of time. They might be useful for marking out areas of a song (a chorus, perhaps).

Create a range marker by Ctrl-dragging from one part of the range markers ruler to another; when you release the mouse button, a range marker will be created. Either end of this marker can be moved around with a drag. Ctrl-dragging one end of a range will move the other end in the same way.

As with location markers, right-clicking on a range marker will offer a menu of useful things that you can do with the marker. Some of the options operate on the range, and some on the start or end point (depending on which end of the marker you clicked on to open the menu).

- *Play Range* — play from the start to the end of the range, then stop.
- *Locate to Range Mark* — move the playhead to the start or end of the range.
- *Play from Range Mark* — start playback from the the start or end of the range.
- *Loop Range* — start looped playback of the range.
- *Set Range Mark from Playhead* — set the start or end of the range to the playhead position.
- *Set Range from Range Selection* — if you have selected a time range using the select/move ranges tool () this will set this range marker to cover the selected time range.
- *Zoom to Range* — this zooms in so that the time range of the marker (and a little either side) is displayed in the editor.
- *Export Range...* — this opens the export dialogue and sets it up to export the marker's time range.
- *Hide Range* — hide this marker from the view. It can be re-shown from the Locations window (see Section 11.4).

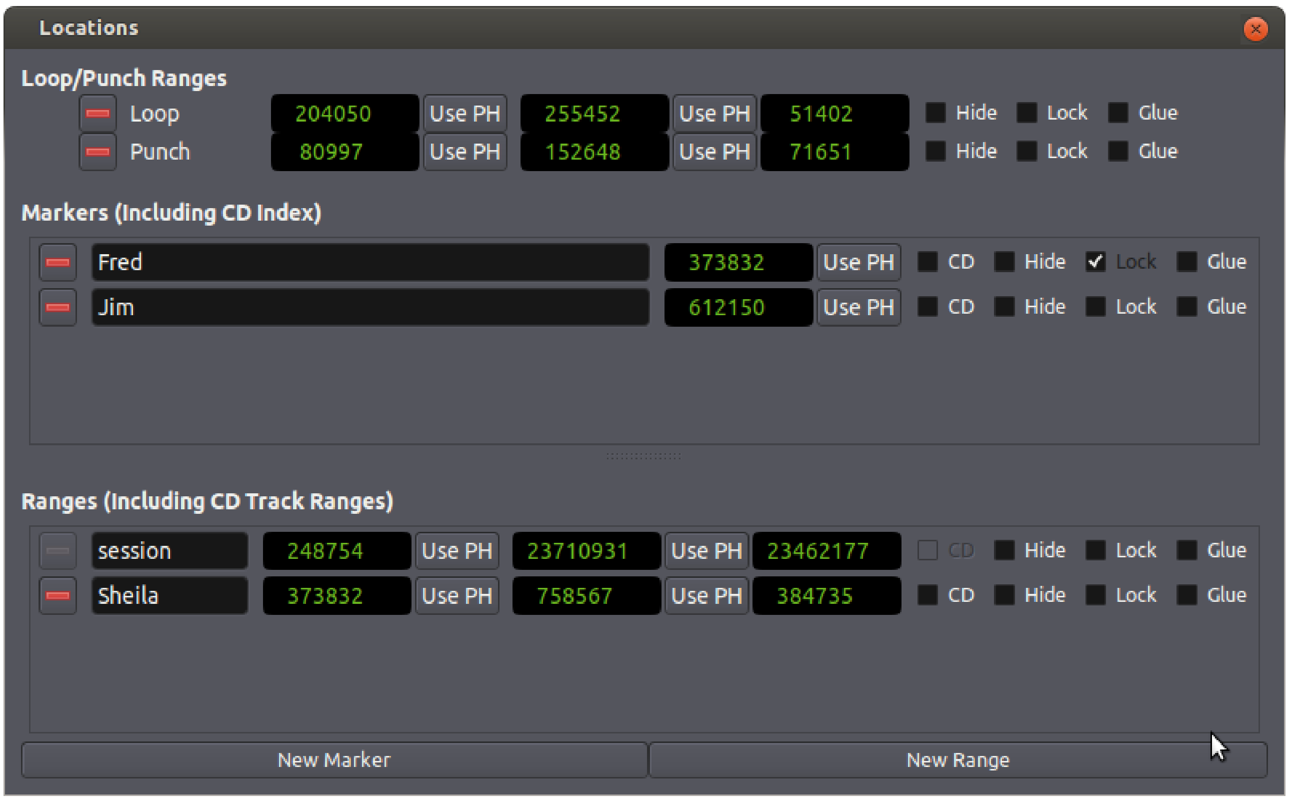
- *Rename Range. . .* — change the name of the marker.
- *Separate Regions in Range* — this will look at any selected tracks, and split regions on those tracks at the start and end of the range. This has the effect of 'chopping' the sound within the range so that it can be copied, perhaps, or moved elsewhere.
- *Select All in Range* — this selects all regions which lie wholly or partly within the marker's range.
- *Select Range* — this selects the time range of the marker, moving into select/move ranges mode ( ) if it is not already engaged.

11.3 CD track marks

If your session contains markers on the CD Markers ruler, Ardour can export these as a TOC or CUE file which can be used when burning a CD to indicate where the track marks should be. See [?] for more details on exporting.

11.4 The locations window

It may sometimes be useful to see details of a particular marker, or of all the markers in the session. This can be done in the Locations window, opened from the Window menu or by pressing Alt-L, as shown in Figure 11.2.



Locations

Loop/Punch Ranges

Loop	204050	Use PH	255452	Use PH	51402	Hide	Lock	Glue
Punch	80997	Use PH	152648	Use PH	71651	Hide	Lock	Glue

Markers (Including CD Index)

Fred	373832	Use PH	CD	Hide	✓ Lock	Glue
Jim	612150	Use PH	CD	Hide	Lock	Glue

Ranges (Including CD Track Ranges)

session	248754	Use PH	23710931	Use PH	23462177	CD	Hide	Lock	Glue
Sheila	373832	Use PH	758567	Use PH	384735	CD	Hide	Lock	Glue

Figure 11.2: The locations window

In this window we see three distinct areas; these contain details of the loop and punch ranges, the location markers and the range markers.

Each marker has a button to the left of its name which will remove the marker. The marker can be renamed by editing its name entry. Location markers have a single clock which show the marker's position. This clock can be edited to move the marker, or the Use PH button will move the marker to the playhead position. Range markers have three clocks, one each for start time, end time and length.

Markers can be set up to be hidden, locked, or glued to bars and beats using the appropriate checkboxes. Finally, the two buttons at the bottom of the window allow new location makers or ranges to be added to the session.

Chapter 12

Synchronisation

Ardour provides various facilities for synchronising itself with other programs or devices. There are a couple of slightly different approaches to doing this. Firstly, we may want to synchronise our transport speed with something else. Secondly, it is often useful to *also* synchronise time code, so that if the 'playheads' of all synchronised things are in the same place.

Ardour can synchronise both transport speed and time code using one of two methods:

- *MIDI time code (MTC)* — this is a protocol which communicates time code over MIDI; it is commonly used with external devices such as tape or digital recorders.
- *JACK transport* — JACK provides support to synchronise client applications, including Ardour.

If only speed synchronisation is required, there is the other option of MIDI clock. This is another MIDI protocol, but is much simpler (and less capable) than MIDI time code. It is often used by synthesizers to synchronise the speed of delays, and so on.

12.1 MIDI time code

Ardour can both transmit and receive (chase) MIDI time code. To transmit it, tick the Send MIDI Time Code option in the MIDI tab of Ardour Preferences. Ardour will then emit MTC from its 'MTC out' port. Use the MIDI connection manager (see Section 6.3.2) to connect this port to anything that should chase Ardour's MTC.

Ardour will stop transmitting time code when the transport speed is a certain percentage faster or slower than normal. The amount either side of normal speed to keep transmitting MTC is configurable in the MIDI tab of Ardour Preferences.

In order to chase incoming MIDI time code, set the external time code source to be 'MIDI Timecode' in the Timecode tab of the Session Properties dialogue. Note that if the positional sync button in the editor window (see Section 4.11.5 is already set to something other than internal, you will need to set it back to internal first. Connect your MIDI time code source to Ardour's 'MTC in' port using the MIDI connection manager. Then click the positional sync button to enable chase.

12.2 JACK transport

To enable synchronisation via JACK transport, set the external timecode source to 'JACK' in the Timecode tab of the Session Properties dialogue. Note that if the positional sync button in the editor window (see Section 4.11.5 is already set to something other than internal, you will need to set it back to internal first. Finally, click the positional sync button in the editor window (see Section 4.11.5) so that is says 'JACK'.

If you want Ardour to be the JACK 'time master', that is the program that dictates tempo and other information to the other applications, tick the 'Ardour is JACK Time Master' button at the bottom of the Timecode tab in Session Properties.

12.3 MIDI clock

To set Ardour to transmit MIDI clock, tick the Send MIDI Clock option in the MIDI tab of Ardour Preferences. Ardour will then emit MIDI clock from its 'MIDI clock out' port. Use the MIDI connection manager (see Section 6.3.2) to connect this port to anything that should listen to Ardour's MIDI clock.

In order to chase incoming MIDI clock, set the external time code source to be 'MIDI Clock' in the Timecode tab of the Session Properties dialogue. Note that if the positional sync button in the editor window (see Section 4.11.5 is already set to something other than internal, you will need to set it back to internal first. Connect your MIDI clock source to Ardour's 'MIDI clock in' port using the MIDI connection manager. Then click the positional sync button to enable synchronisation.

12.4 Timecode options

There are some other time code options in the Timecode tab of the Session Properties dialogue.

12.4.1 Timecode frames-per-second

This should be set to the frames-per-second count for the timecode that you are syncing to, or that you want Ardour to generate.

12.4.2 Subframes per frame

This should be set to the number of subframes per frame for the timecode you are syncing to, or that you want Ardour to generate.

12.4.3 Timecode source shares sample clock with audio interface

Enabling this option will make Ardour assume that the timecode is exactly synchronised with the audio sample clock; in this case, the two cannot drift apart.

12.4.4 Pull up/pull-down

This should be set to the pull-up or pull-down for the timecode you are syncing to, or that you want Ardour to generate.

12.4.5 Timecode offset (and timecode offset negative)

These options should be set to reflect any required offset between Ardour's session times and the timecode being received or generated.

If the timecode is 'ahead' of Ardour's timeline, the offset should be positive; otherwise, set it negative.

Chapter 13

Control surfaces

Whilst Ardour can be controlled using the keyboard and mouse, a *control surface* can make life a lot easier. This is some external piece of hardware that has some combination of buttons, knobs, faders and displays that you can use to control Ardour, mimicing to some extent the feel of having a real mixing desk or tape machine.

Ardour directly supports several different control surfaces, and some of those that are not ready-to-use can be set up if you are willing to spend some extra time configuring things.

The support for control surfaces is divided up into groups based on the protocol that the surface uses to communicate. The next two sections discuss these two groups.

13.1 Generic MIDI surfaces

'Generic MIDI surfaces' are those that have a fairly simple protocol based on MIDI. This covers quite a wide range of surfaces. A specific surface requires Ardour to have a *binding map*, which describes the MIDI messages that the surface sends when its controls are operated, and any messages it expects to receive in return.

Ardour's generic MIDI surface code has support for the following devices:

- Behringer DDX3216
- Behringer BCF2000
- EMU XBoard 61
- Korg nanoKONTROL
- M-Audio Axiom 25 (its transport controls)
- M-Audio Oxygen8 V2
- Roland SI-24

To set up a generic MIDI control, it is first necessary to connect it to your computer. This may be done with MIDI or USB. Those devices which use USB generally appear as MIDI ports to Ardour.

The next step is to enable the generic MIDI surface in Ardour and select the map that Ardour should use, based on the hardware that you have. Open the Ardour Preferences dialogue and select the User interaction tab. At the bottom of the window is a list of the available control surface groups. Tick the Enabled box for 'Generic MIDI'. If your device has motorised faders, or knobs or displays that indicate their status, Ardour can provide feedback so that the surface's state matches that of Ardour's mixer. To enable this, tick the Feedback checkbox.

Next, double-click the 'Generic MIDI' entry in the dialogue box, and a settings window will appear. Choose the device that you are using from the drop-down list.

Finally, you need to connect the MIDI ports of your device to Ardour. Open the MIDI connections manager and connect Ardour's 'MIDI control out' to the input port for your device, and Ardour's 'MIDI control in' to your device's output port. Some devices present a few different ports, and often the easiest way to find the correct one is to connect them all, verify that things work, and then disconnect them one by one to find the one that is required.

Chapter 14

Region operations

This chapter provides a reference to the operations that can be performed on regions, accessible from the region submenu of the track context menu.

- *Play* — start playback from the start of the region.
- *Loop* — set the loop range to cover the region and begin looped playback.
- *Rename. . .* — open a dialogue box to rename the region.
- *Properties. . .* — open a dialogue box to view (and edit) the properties of the region.
- *Edit*
  - Combine
  - Uncombine
  - *Split* — split the region at the current edit point; this will only work from the menu if the edit point is not 'mouse' (as if you are selecting a menu option, the mouse position at the time is not particularly relevant to where an edit point should be).
  - *Make Mono Regions* — given a multi-channel (stereo or more) region, this option creates a new region per channel and adds those regions to the session's region list. These regions can then be dragged from the editor region list (see Section 4.10.1) into mono tracks as required.
  - *Opaque* — tick to make the region 'opaque', so that regions underneath it on the playlist will not be heard. If the region is not opaque, its data will be mixed with regions underneath it.
  - *Mute* — tick to mute the region; it will not be heard
  - *Pitch Shift. . .* — open a dialogue box to pitch-shift the region.
  - *Reverse* — flip the region backwards in time.
  - Glose Gaps
  - Place Transient
  - Rhythm Ferret. . .
  - Strip Silence. . .
- Position
  - Move to Original Position
  - *Lock* — this will prevent the region from being moved.
  - Glue to Bars and Beats
  - Snap Position To Grid
  - Set Sync Position

  - Remove Sync
  - Nudge Forward
  - Nudge Backward
  - Nudge Forward by Capture Offset
  - Nudge Backward by Capture Offset

- Trim
  - *Trim Start at Edit Point* — trims the region so that it starts at the edit point, if that makes sense.
  - *Trim End at Edit Point* — trims the region so that it ends at the edit point, if that makes sense.
  - *Trim to Loop* — trims the region's start and end so that they are at the time of the loop range's start and end respectively.
  - *Trim to Punch* — much as 'Trim to Loop' except with reference to the loop range.
  - *Trim to Previous* — trims the region's start point so that it lies at the end point of the previous region in time (if possible).
  - *Trim to Next* — trims the region's end point so that it lies at the start point of the next region in time (if possible).

- Layering; manipulates region layers, as discussed in Section 8.3
  - *Raise to Top* — moves the region to the top layer of the stack.
  - *Raise* — moves the region one step closer to the top of the stack.
  - *Lower* — moves the region one step closer to the bottom of the stack.
  - *Lower to Bottom* — moves the region to the bottom layer of the stack.

- Ranges
  - Set Loop Range — this sets the loop range (see Section 4.3.3) so that it surrounds the currently-selected regions.
  - Set Punch — this sets the punch range (see Section 4.3.3) so that it surrounds the currently-selected regions.
  - Add Single Range Marker — this adds a single range marker (see Section 4.3.3) around the whole set of selected regions.
  - Add Range Marker Per Region — this adds an individual range marker around each selceted region (see Section 4.3.3). regions.
  - Set Range Selection — this sets the time range selection to surround all selected regions.

- Gain — these items adjust a region's gain property. This value is used only to modify the gain of the region during playback; it does not modify the data on disk.
  - *Normalize...* — examines the contents of the region and sets the region's gain so that the peak value of the region is scaled to just under 0dbFS; in other words, this makes the region as loud as it can be without introducing distortion.
  - Boost Gain — increases the region's gain by 1dB.
  - Cut Gain — decreases the region's gain by 1dB.
  - Reset Envelope — this resets the region's gain envelope to be a straight line at 0dB (see Section 8.5).
  - Envelope Active — if this option is ticked, the region's gain envelope is followed, otherwise it is ignored.

- Fades
  - Fade In — this is ticked if all regions in your selection have active fade-ins, and unticked if non do; selecting the menu option will toggle the active state of all selected regions' fade-ins.
  - Fade Out — this option behaves the same as Fade In, but for fade-outs.
  - Fades — this option behaves the same as Fade In and Fade Out, but applies to both fades at the same time.

- Duplicate

  - Duplicate — this option makes a copy of each selected region, and places the duplicate regions directly after the end of the latest selected region; if there is just one selected region, this means that a duplicate copy will be placed right after the original.
  - Multi-Duplicate... this makes duplicates as per the Duplicate option, but offers a choice of how many should be made. The count can be a fraction, in which case the last duplicated region will be truncated. If, for example, you choose 2.5 duplicates, this will make 2 complete duplicates and one futher duplicate which is half the length of the others.
  - Fill Track — this makes sufficient duplicates to fill the track up to the session end marker.

- Export...
- Bounce (without processing)
- Bounce (with processing)
- *Spectral Analysis...* — show a frequency spectrum of the region (see Section 8.10).
- Remove

Chapter 15

Configuration

This chapter gives a reference to the ways in which Ardour's behaviour can be customised. Many of the configuration options are described earlier in the manual; for those options we link back to the relevant sections.

15.1 Per-session and global options

Options are split into two groups: *session properties* (accessible from the Properties item on the Session menu and *preferences* (accessible from the Preferences option in Edit).

Session properties can be changed for each different session that you use. The intention is that these properties are those whose best setting depends on the type of session you are working on.

Preferences are options which apply to all sessions. They are options which depend on your general style of working, and the set up of your audio system.

15.2 Session properties

Session properties are arranged into five groups, whose contents are discussed below.

15.2.1 Timecode

See Chapter 12.

15.2.2 Fades

These options govern the properties of fades involving audio regions. See Section 8.4.

15.2.3 Media

The *audio file format* section governs the sample format, bit depth and file type that Ardour will use when recording audio. The sample format can be one of:

- 32-bit floating point — this is the format that Ardour uses internally for processing, and is the highest quality; it is, arguably, of higher quality than is required for recording things. The reason Ardour uses it internally is that processing 32-bit floating point signals is efficient on modern processors, and the high bit depth helps reduce potential problems caused by performing processing operations on audio.

- 24-bit integer — as the name suggests; this is a common recording format as it offers a very high dynamic range (144dB, without taking dither into account).
- 16-bit integer — the bit depth used by standard audio CDs.

The file format can be one of:

- Broadcast WAVE — an extension of the very common WAVE (`.wav`) file format, often used in broadcast, which adds some metadata to the standard WAVE format.
- WAVE — the Microsoft WAVE format (commonly given a suffix of `.wav`)
- WAVE-64 — a version of WAVE that can handle files of greater than 4Gb in size.
- CAF — Core Audio Format, as developed by Apple Computer for use on Mac OS X.

15.2.4 Monitoring

See Section 6.1.5.

15.2.5 Misc

15.2.5.1 MIDI region copies are independent

Enabling this option will result in all MIDI regions being 'forks' of their source regions; see Section 8.12.3.

15.2.5.2 Policy for handling overlapping notes

never allow them don't do anything in particular replace any overlapped existing note shorten the overlapped existing note shorten the overlapping new note replace both overlapping notes with a single note

15.2.5.3 Glue to bars and beats

These options, when enabled, will make new markers and/or new regions glued to bars and beats by default (see Section 8.15).

15.3 Ardour preferences

15.3.1 Misc

15.3.1.1 DSP CPU Utilization

If you run Ardour on a computer with more than one processor, or more than one core, Ardour can make use of all the cores. It does this by running the processing of different tracks and busses on different cores. This option allows you to specify the number of cores or processors that Ardour should use for signal processing. This setting will only take effect once you re-start Ardour.

15.3.1.2 Undo

See Section 8.14.

15.3.1.3 Session management

The *always copy imported files* option will force Ardour never to offer you the option to embed files that you import; they will always be copied into the session folder.

The *default folder for new sessions* is where Ardour will initially suggest that you create new sessions.

Maximum number of recent sessions dictates the number of recent sessions that Ardour will offer in the startup dialogue and also in Recent... from the Session menu.

15.3.1.4 Click

This section allows you to specify the sound files that will be used for the click; the 'emphasis' audio file will be used for the first beat of the bar. The *click gain level* adjusts the volume of the click.

15.3.1.5 Automation

See Section 9.6.

15.3.2 Transport

- *Keep record-enable engaged on stop* — selecting this option will mean that after a recording pass, the main session record-enable will remain switched on; otherwise it will be switched off when the transport stops.
- *Stop recording when an xrun occurs* — an xrun (see Section 17.3.1) during recording could well mean that the recording has been corrupted by a small (or not-so-small) pop or click. If this option is enabled, recording will stop if an xrun is detected, which may be useful to draw the fact to your attention. It may *not* be desirable on long or unattended recording sessions!
- *Create markers where xruns occur* — a less drastic option for observing xruns is to enable this option, which creates a marker wherever in a session an xrun occurs during recording. The marker makes it easy to check out the area later and inspect the damage.
- *Stop at the end of the session* — if this is enabled, the transport will stop at the end-of-session marker.
- *Do seamless looping* — this option enables code in Ardour to perform loops 'seamlessly'; that is, without any break at all between the end of the loop and the start.
- *Primary / secondary clock delta to edit cursor* — these options will, when enabled, set one or both of the two main clocks in the editor window to display the current transport position as a time delta (difference) from the edit point. That is, the clock displays the amount of time between the playhead and the edit point; if the playhead is ahead of the edit point, this time is positive, otherwise it is negative.
- *Disable per-track record disarm while rolling* — if this is enabled it will be impossible to disarm a track from recording while the transport is moving. This may be useful as a safety feature to prevent unwitting clicks on record enable buttons from dropping tracks out of record.
- *12dB gain reduction during fast-forward and fast-rewind* — fast-forward/rewind can, by their nature, generate unpleasant-sounding transients and high-frequency content which may be trying to tired ears. With this option enabled, Ardour will drop the output by 12dB when doing 'winds'.

15.3.3 Editor

- *Link selection of regions and tracks* — with this enabled, when a region is seleted its track will be too.
- *Move relevant automation when audio regions are moved* — when enabled, this means that moving a region will also move any automation at the same time as that region.

- *Show meters on tracks in the editor* — enable this to show meters next to the track controls area for each track. Disabling it will provide a slight drop in CPU load.
- *Use overlap equivalency for regions}* —
- *Make rubberband selection rectangle snap to the grid* — when selecting things by dragging a 'rubberband' or 'lassoo' rectangle, this option makes that rectangle snap to any active grid.
- *Show waveforms in regions* — this option draws waveforms within audio regions. Disable it to ease the load on your CPU a bit.
- *Show gain envelopes in audio regions* — enable this to display region gain lines (see Section 8.5)
- *Waveform scale* — this alters the scale used to plot audio waveforms within regions between linear and logarithmic (ie in dBs).
- *Waveform shape* — waveforms can either be plotted traditionally (so that negative excursions of the waveform are plotted as such), or rectified (so that negative excursions are drawn as positive ones).
- *Show waveforms for audio while it is being recorded* — disabling this will prevent Ardour from generating waveforms for regions during record; again, this will lighten the load on your CPU a bit.
- *Show zoom toolbar* — disable this to hide the zoom toolbar, which may help the editor window to fit better on small screens.
- *Color regions using their track's color* — this will draw the trim bar of each region using the same colour as has been assigned to its track.
- *Update editor window during drags of the summary* — if this option is on, as you drag the view rectangle in the summary (see Section 4.13) the editor will be updated instantly. This can be a bit slow for complicated sessions; turning this option off will mean that the editor only updates when you finish the drag.
- *Synchronise editor and mixer track order* — with this option enabled the order of the tracks in the editor window will match the order in the mixer; with it turned off, the track order can be different.
- *Synchronise editor and mixer selection* — with this option turned on, selecting a track in the editor will select it in the mixer, and vice-versa; otherwise selections are independent.
- *Name new markers* — if this is set, when you click on 'New Marker' in the *Locations* window (or the locations editor list), the newly-created marker's name will be set to get the keyboard focus so that you can name it easily.

15.3.4 Audio

15.3.4.1 Buffering

These options govern how much memory Ardour will use to buffer signals going out for playback, and coming in for record. Larger buffers provide more 'safety', in that there is more data prepared to cope with temporary slowness with your hard discs, but require more memory. It is not uncommon to set rather long capture buffer lengths (around a minute or more) to help ensure trouble-free recordings.

15.3.4.2 Monitoring

The options here are:

- *Use a monitor bus* — as discussed in Section 6.2.3, this instructs Ardour to use a monitor bus, allowing the AFL/PFL features and the more advanced 'monitor section' in the mixer window.
- *Record monitoring handled by* — this dictates how monitoring of incoming signals should be handled; this can be by the audio hardware (in which case Ardour does nothing), by JACK (in which case Ardour tells JACK how the monitoring should be) or by Ardour (in which case Ardour does things itself). See Section 6.1.5 for a full discussion.

15.3.4.3 Connection of tracks and busses

See Section 6.3.1.

15.3.4.4 Denormals

'Denormals' are very small floating point numbers which can be generated on occasion by Ardour and also by plugins. On some CPUs, in some situations, these can cause processing to slow down by a very large factor (10 times or more). This in turn can cause problems with high CPU loads and xruns.

The reason CPUs slow down is that in some cases they think it more important to maintain precision with very small numbers than to process them quickly. This is true for many applications, but not for audio. The numbers involved are so small (usually around the 10^{-16} range) that small errors in their processing are, in most cases, inaudible. For audio applications it is generally preferable to lose some precision in order to keep things moving quickly.

Ardour has a few strategies to deal with denormals, controlled by these settings:

- *Use DC bias to protect against denormals* — this adds a small DC value to strategic points in the signal processing chain. This is not the most efficient way to do things, but can be helpful in some circumstances.
- *Processor handling* — most modern (post year 2000) CPUs have configuration options themselves to help with denormals. These are called 'Flush to zero' and 'Denormals are zero'. If these options are available on your machine (they will be desensitized if not), it is worth enabling them both as they are likely to solve the problem efficiently.

15.3.4.5 Plugins

- *Silence plugins when the transport is stopped* — when enabled, this option will 'flush' all plugins when the transport is stopped. This will prevent plugins such as delays and reverbs from continuing to sound when stop is pressed.
- *Disable plugins during recording* — this will turn off all plugins during recording, which may help to ensure trouble-free recordings if you have a complicated session which is running on the limits of your CPU power.
- *Make new plugins active* — enabling this option will make newly-added plugins active by default.
- *Enable automatic analysis of audio* —
- *Replicate missing region channels* —

15.3.5 Solo / mute

See Section 6.2.3.

15.3.6 MIDI

The *Send MIDI clock*, *Send MIDI time code* and *Percentage either side of normal transport speed to transmit MTC* are discussed in Chapter 12.

The other options are:

- Obey MMC commands
- Send MMC commands
- Send MIDI control feedback

- Inbound MMC device ID
- Outbound MMC device ID
- Initial program change
- *Display first midi bank/program as 0* — if enabled, this will count MIDI bank and program numbers from 0; otherwise, they are counted from 1.
- *Never display periodic MIDI messages (MTC, MIDI Clock)* — it is somewhat pointless to display some MIDI messages inside regions. Display of MTC and MIDI clock messages can be disabled by ticking this option. Doing so will improve the speed of displaying MIDI regions which contain such messages.
- *Sound MIDI notes as they are selected* — enabling this option will transmit MIDI note messages corresponding to notes that are selected.

15.3.7 User interaction

15.3.7.1 Keyboard

This section sets up which combinations of keypress and mouse button operate various Ardour functions. Keys are chosen by picking the name from the drop-down list, and the mouse button is chosen by number; button 1 is the left mouse button, button 2 the middle and button 3 the right.

Key/button combinations can be set for the following functions:

- *Edit* — click on something with this combination to edit details using a dialogue box (regions, markers, control points, notes, route groups, plugins).
- *Delete* — clicking on something with this combination will delete it.
- *Insert note* — this combination can be used to add MIDI notes when in select/move objects mode with edit region contents enabled.
- *Toggle snap using* —

Keyboard; edit using +b, delete using +b, insert note using+b, toggle snap using, keyboard layout Control surfaces OSC Generic MIDI Mackie Control surface remote ID follows order of mixer / editor / assigned by user

15.3.8 Interface

Graphically indicate mouse pointer hovering over various widgets Font scaling Use plugins' own interfaces instead of Ardour's Mixer strip display Use narrow mixer strips by default Metering: meter hold time meter fall off

Chapter 16

Troubleshooting

Into each life a little rain must fall. This chapter discusses what to do if you are having problems with Ardour.

16.1 Starting Ardour from the terminal

Much troubleshooting is made easier if you start Ardour from a terminal such as 'GNOME Terminal' or 'kterm'. Ardour prints useful messages to the terminal when it starts, and as it runs, and they can give clues to your troubles. Once you have opened a terminal window you can often start Ardour with:

```
ardour3
```

If you are using a beta release of Ardour, try something like:

```
/opt/Ardour-3.0beta3_11482-dbg/bin/ardour3
```

replacing `Ardour-3.0beta3_11482-dbg` with the name of a folder in `/opt`.

16.2 Startup warnings

16.2.1 Your system has a limit for maximum amount of locked memory!

This warning can range in importance from minor to major, but is worth fixing anyway as it can cause very strange misbehaviours when you least expect them.

Modern operating systems use *swap files*, which are areas of hard disk used like extra (very slow) RAM. Swap files can improve overall system performance greatly, as if there are areas of memory that are not being accessed very much they can be kept (temporarily) on disk, and the memory used instead for more helpful things like caches. The use of swap files means, however, that an application may find that a simple access to its memory may lead to a potentially long disk access that it was not expecting. For many applications this is not a problem, but for audio software is is disastrous, as the delay in response may mean that time deadlines for processing audio are missed. To avoid this problem, Ardour tells the operating system that it should not swap any of its memory to disk. However, the ability to do this can be used for nefarious purposes by ill-behaved applications, so it is usually limited by the operating system. This warning means that your machine has a limit for the amount of locked memory. If Ardour asks for more than that limit, the operating system will refuse, potentially leading to problems. Usually the most practical answer to this is to set your machine to have a fairly large limit on locked memory (say, for example, three-quarters of your total RAM).

The fix for this warning is to edit a file which, on most Linux distributions, is called `/etc/security/limits.conf`. The bottom of this file will usually look something like this:

```
#<domain>      <type>  <item>         <value>
#

#*               soft    core           0
#root            hard    core           100000
#*               hard    rss            10000
#@student        hard    nproc          20
#@faculty        soft    nproc          20
#@faculty        hard    nproc          50
#ftp             hard    nproc          0
#ftp             -       chroot         /ftp
#@student        -       maxlogins      4
```

To set up a limit for locked memory for members of the `audio` group, add a line like this:

```
@audio - memlock 4121440
```

where the number at the end is the maximum amount of locked memory (in kilobytes). We suggest that you use three-quarters of the total, so work out this number M using

$$M = 786432T \tag{16.1}$$

where T is your total memory in gigabytes. So, for example for a machine with 2Gb of memory, add the line:

```
@audio - memlock 1572864
```

to the end of your `/etc/security/limits.conf`. Finally, add your user to the audio group using

```
sudo usermod -a -G audio fred
```

where `fred` is your username. Then log out and log in again so that the changes take effect.

Chapter 17

JACK

17.1 Introduction

JACK is the JACK audio connection kit. It is a piece of software that provides the low-level 'plumbing' which allows Ardour to work. Its setup is crucial to Ardour; Ardour will not work without it.

JACK's essential task is to route audio and MIDI data to and from a sound card, and also between applications. It manages a set of *ports*, which it can connect together in arbitrary ways. Figure 17.1 gives a diagram of a vaguely typical small JACK session.

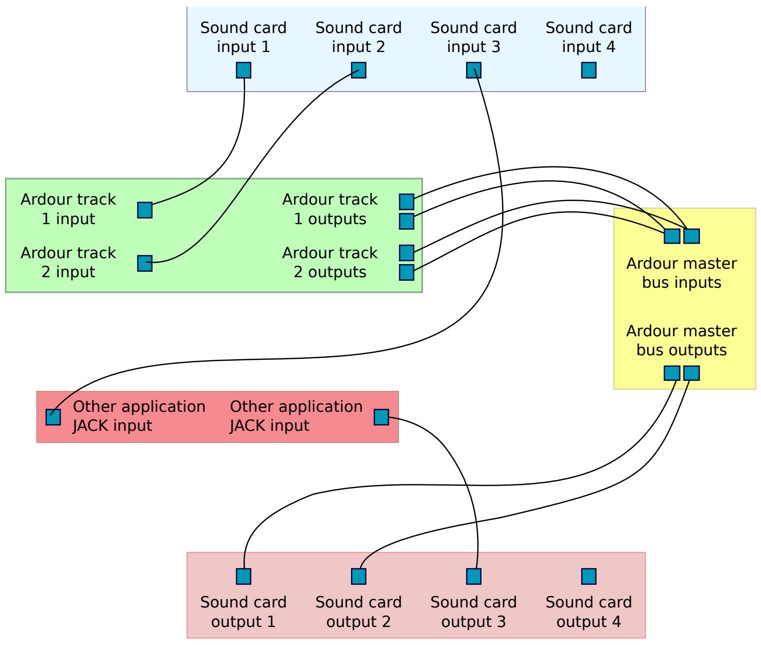


Figure 17.1: An example JACK session

In this diagram, the blue squares represent JACK *ports*. These are points which can be connected to, and are either input (they accept data) or output (they produce data). The black curved lines represent connections between these ports. The coloured boxes which group things together are just for ease of viewing: to JACK, everything is just a port.

The arrangement in the diagram shows some important features of JACK. Firstly, any input can be connected to any output, without restriction, and multiple inputs can be connected to a single output (or vice versa). Secondly, Ardour uses JACK for some of its 'internal' connections; we connect, for example, a track to the master bus using JACK. Thirdly, any JACK-supporting application can be connected to any other; Ardour is just one of many.

JACK is not limited to the standard concept of the 'sound card'. You may choose to have no sound card at all (in which case JACK can run in 'dummy' mode). It is also possible to send signals to and from JACK over TCP/IP networks using netjack. For simplicity, this manual will assume that the user has a sound card in the conventional sense.

17.1.1 JACK and other audio software

JACK is designed so that it uses a single sound-card, and has exclusive control of that sound-card while it is running. This is a couple of consequences. Firstly, if the sound card used to capture audio is different from the one used to play it back, complications arise. Secondly, other software which tries to obtain exclusive control of your sound-card, most notably 'pulseaudio', may interfere with JACK's operation.

17.1.1.1 JACK with multiple sound cards

If at all possible, it is a good idea to use JACK with a single sound card. Correctly using more than one card at the same time is difficult. The main reason for this difficulty is that JACK assumes that all sound cards and programs that it is connecting are running with synchronised sample clocks. Arranging this is not easy if there are two cards; there will be two unsynchronised sample clocks.

If you accept that using multiple sound cards is going to be difficult, and you want to do it anyway, there are a number of approaches. These are described in Chapter 18.

17.1.2 Will my sound card work?

For your sound card to work with JACK, must have a driver suitable for the operating system that you are running on. For Linux, this means that your card must be supported by ALSA or FFADO; ALSA supports drivers using a wide variety of interfaces, and FFADO is for firewire soundcards only.

The easiest way to check on ALSA compatibility is to visit http://www.alsa-project.org/main/index.php/Matrix:Main. This is the ALSA soundcard matrix and describes ALSA's support for a variety of cards. For FFADO, consult http://www.ffado.org/?q=devicesupport/list

For Mac OS X, any card that is supported by the operating system should work fine.

17.1.3 JACK versions

For historical reasons, there are two 'branches' of JACK that are both maintained, and can be used as drop-in replacements for each other. JACK1 has version numbers like 0.121.3, and JACK2 (also known as jackdmp) has version numbers like 1.9.8. Both implementations have their advantages and disadvantages. It does not matter a great deal which one you use.

17.2 Starting JACK

Ardour can start JACK automatically when it starts; and indeed many users will find that this works perfectly well. It is also possible to start JACK manually, either at the command line or using a tool such as QJackCtl[1] (on Linux) or JackPilot[2] (on Mac OS X).

[1]http://qjackctl.sourceforge.net
[2]http://www.jackosx.com/

17.2.1 Parameters

JACK has many parameters which affect its operation. Some of the more important ones are discussed here.

17.2.1.1 Sampling rate

This is the number of samples per second that JACK will process, and is important as it will govern the sampling rate that all audio applications will run at. The chosen rate must be supported by the sound card, so values such as 44.1kHz, 48kHz, 96kHz et. cetera are typical choices. The higher the sampling rate, the higher the theoretical audio frequency that the system can reproduce, but also the more disk space will be consumed by audio recordings, and the more CPU power will be required to run audio plugins.

The arguments about the best sampling rate are many, long and varied, but can (in the humble opinion of the author) be summarised as: ‘if in doubt, use 44.1kHz for projects going to CD, or 48kHz for projects going to film / video, as no-one can hear the difference between those and anything higher (although they probably think they can)’.

17.2.1.2 Frames per period

In a move necessary for efficiency, JACK does not process audio sample-by-sample, but in blocks of samples. The size of these blocks can be selected when starting JACK. A block is called a ‘period’, and samples are often known as ‘frames’ in the context of JACK. If the frames per period count is made smaller, the latency experienced by sounds going into and coming out of the computer will be reduced; on the other hand, smaller buffers make the computer work harder, and may result in other problems if the computer is not well set-up. It is usually difficult to get below 64 frames per period on a typical desktop computer, and values as high as 2048 frames per buffer are perfectly acceptable if you do not particularly care about latency.

The frames per period value governs how often JACK will talk to the sound card. If, for example, JACK is set to 64 frames per period, the sound card will tell JACK when it has 64 new frames ready; JACK (and therefore Ardour) must then respond before the next 64 frames arrives. This has the consequences that JACK and Ardour are awoken more often, causing a greater CPU load, and that the requirements for JACK’s response time are much more critical with smaller period sizes. Some systems will struggle to wake JACK up in time, making larger period sizes more reliable on those systems.

17.2.1.3 Number of periods

This value is related to the frames-per-period value above; 2 is typical, and will work for most sound cards and systems. It is worth trying 3 here if problems are experienced.

17.3 Troubleshooting JACK

17.3.1 I am getting lots of xruns!

An *xrun* is JACK’s way of saying that the sound card wanted attention, but JACK could not provide it quickly enough. The causes of xruns are many and various. The remainder of this section lists some common causes of xruns.

17.3.1.1 Buffer size or period count too small

The JACK ‘buffer size’, or number of frames per period, governs how often JACK has to talk to the sound card; smaller buffer sizes require JACK to communicate with the sound card more often and with tighter deadlines. Increasing buffer size can be a simple way to reduce xruns. Generally speaking, the more advanced the sound card, the lower the period size that it can be run with, but this does not universally hold true.

Similarly, if you have a lot of xruns, particularly with a USB device, try increasing JACK’s period count from 2 to 3.

17.3.1.2 JACK not running with real-time privileges

JACK will try, by default, to obtain *real-time* scheduling privileges when it starts. If it suceeds, it means that the operating system will treat JACK as higher priority than some other tasks when it needs to talk to the soundcard, which is very likely to reduce the incidence of xruns.

Some versions of Linux are careful about which tasks are allowed real-time priviledges, as there is potential for such tasks to cause problems with the system. As a result, JACK may fail to obtain real-time privileges, in which case your Linux configuration must be altered to allow JACK to get what it wants. For Debian- and Ubuntu-based distributions, the best way is usually to add your user to the 'audio' group using

```
usermod -a -G audio fred
```

where `fred` is your user ID. After this, configure the audio group to be allowed appropriate settings by editing `/etc/security/limits.conf` and adding

```
@audio - rtprio 99
@audio - memlock unlimited
```

to the bottom of of the file. This allows members of the audio group to start tasks with high real-time (RT) priority, and also allows them to lock their memory into 'real' memory; this is another step that improves real-time performance.

After making these changes you will need to log out and log back in again to see the effects.

17.3.1.3 CPU frequency scaling

Modern CPUs often have a feature called 'frequency scaling'. This is the ability to lower the CPU's clock rate when it does not have much to do, in order to save power. This is especially useful in laptops and mobile phones, as it can dramatically increase efficiency and therefore battery life.

It is, however, known to be problematic if you are attempting low-latency audio. You should turn off frequency scaling if in any doubt, and set your computer to run in a 'performance' mode, where the CPU is run at full speed constantly.

17.3.2 I can play back but I cannot record, or vice versa

This is commonly caused by JACK's prediliction for using only one sound card. If you are using different sound cards for playback and record (which will be the case even if you are doing playback via HDMI and recording via an on-board sound-card) you will need to set JACK up to use multiple sound cards, as discussed in Chapter 18.

Chapter 18

Advanced JACK

18.1 Using JACK with multiple sound cards

If you want to set up JACK to use multiple sound cards at the same time, there are a number of options:

1. Use the `alsa_in` and `alsa_out` clients (Linux and ALSA only)

   If you are using JACK on Linux and want to use additional devices that have ALSA driver support (i.e. most PCI, USB and Bluetooth devices), then this is the best option.

   `alsa_in` and `alsa_out` are two clients written by Torben Hohn that make a single ALSA device appear as a set of JACK ports. They both use Erik de Castro Lopo's libsamplerate library to do any resampling required to keep the audio in sync as the clocks of each device drift over time.

   To use them, you start JACK as normal. Then you start an instance of `alsa_in` or `alsa_out` for each additional device (and 'direction') that you want to use. `alsa_out` will create a set of ports representing the playback capabilities of the device, and `alsa_in` will represent the capture/recording capabilities. These two clients must be run inside a terminal window; there is no GUI for either of them. They both take arguments very much like those of the JACK ALSA backend, with some additional controls that affect the way that resampling is done. Full details are available in the manual pages for each client, which you can read in a terminal window with the command

   ```
   man alsa_in
   ```

   This page covers both clients, since their arguments are identical. Note that you can use these clients even if you are running JACK with a FFADO-supported device. The requirement for ALSA support only applies to the extra devices you want to use, not the one that JACK itself is using.

2. Use the JACK2 audio adapter(s) (Jack2 only)

3. Using OS facilities to merge devices into a single pseudo-device Both OS X and Linux provide ways to configure your machine so that it appears to have a new audio device that is actually a combination of one or more real devices. You can use this approach to create the configuration you want to use and then start up JACK using that new 'pseudo' device.

   - OS X You must perform these steps as a user with administrative privileges. The first thing to do is to open up Audio/MIDI Setup in the Utilities submenu of Applications. Go to the main menu bar, click on Audio and then select Open aggregate device editor. Follow the simple instructions to add the each desired playback or capture device to your new aggregate device. Then pick a name for the new device. This is the name you will also use to choose the device for use with JACK.

     Note that there are quite a few subtle bugs with Apple's 'aggregate device' facilities. Various things can happen that will cause the device to lose all of its playback channels or all of its capture channels, for example. If this happens, it is generally necessary to close all applications that are using any audio devices, and quite often a reboot is required.

Starting with JACK2 version 1.9.6, the CoreAudio backend can now dynamically create 'aggregate devices' when needed (like when the -C and -P arguments are used to specify the separated input and output devices).

- Linux You will need to use a text editor to create or add to your `~/.asoundrc` file. This file is read by any ALSA application (including JACK, if its using the ALSA backend) and can be used to define pseudo-devices of many different kinds. The key idea here is that you're going to define a new pseudo-device composed of 2 or more other devices. In our example, we'll just focus on 2 devices being merged into 1, where both devices have just 2 channels in and out. This is the text you need to make sure is in `~/.asoundrc` (below, we describe what this does):

```
pcm.merge {
    type multi;
    slaves.a.pcm hw:0
    slaves.a.channels 2;
    slaves.b.pcm hw:1
    slaves.b.channels 2;
    bindings.0.slave a;
    bindings.0.channel 0;
    bindings.1.slave b;
    bindings.1.channel 0;
    bindings.2.slave a;
    bindings.2.channel 1;
    bindings.3.slave b;
    bindings.3.channel 1;
}
```

Lets see what this does:

- It defines a new audio pseudo-device called 'merge'. You can use this name anywhere you might use the name of an ALSA audio device, such as `hw:0` or `hw:HDA` or `hw:DSP` or `plughw:1`.
- It names `hw:0` as the first component (or 'slave') of this pseudo-device (`slave.a.pcm`) and `hw:1` as the second component (`slave.b.pcm`)
- It states that the pseudo-device will use 2 channels from the first component and 2 channels from the 2nd component.
- The lines containing `binding.` list, in order, which channel of which component will correspond to the 4 channels of the pseudo-device. In the mapping shown above, the first channel comes from the first component, then the 2nd channel from the 2nd component, the 3rd from the first component and the 4th from the second component.

Note that numbering of devices and channels in ALSA starts at zero, not one.

The most important and complex part of the above definition is the channel mappings defined by the bindings lines. A full channel mapping definition consists of a pair of a lines of the following general form:

```
bindings.CHANNEL_OF_PSEUDO_DEVICE.slave SLAVE_DEVICE_THAT_WILL_PROVIDE_THIS_CHANNEL
bindings.CHANNEL_OF_PSEUDO_DEVICE.channel  ↩
    CHANNEL_OF_SLAVE_DEVICE_THAT_WILL_PROVIDE_THIS_CHANNEL
```

So the specific pair of lines:

```
bindings.0.slave a;
bindings.0.channel 0;
```

mean that 'channel 0 of the pseudo-device will correspond to channel 0 of the first slave device'. Obviously by playing with this definition you can create all sorts of wierd and wonderful mappings from the real physical device channels to the pseudo-device channels. You probably don't want to do that, though. The example above shows the most common example: take the first N channels from the first device, and the second M channels from the second device.

In theory, the above is enough to define a new pseudo-device, but many applications, including JACK's ALSA backend, also want to open a 'control device' associated with the audio playback device. This is where they can find out (and possibly control) various hardware parameters associated with the device. Unfortunately there is no way to merge these together in the same way, so we have to provide a 'dummy' control device definition that will keep such applications happy. This definition looks like this:

```
ctl.merge {
    type hw
    card 0
}
```

Notice that name following the `ctl.` text must be the same as the name following `pcm.` in the device definition above. The control device definition we've given here effectively means 'if you want to open the control device associated with 'merge', open the control device associated with the first installed audio/MIDI device'. This probably isn't right of course — 'merge' involves two cards — but it will generally work just fine.

You can use this same approach to merge more than 2 devices - the resulting `pcm.DEVICE-NAME` specification will obviously include more lines. You can also use different devices than we did above, where we just used the first and second installed card.

Note that you are likely to be better off using `hw:CARD` device names, rather than `hw:N` names, when defining a 'multi' pseudo-device, as explained here. But further note that if you are using multiple instances of the same type of audio hardware (say, 4 RME Multiface devices), you will have to use `hw:N` because every card will have the same `CARD` name. In fact, with such hardware, it may be very difficult to ensure that `hw:0` always refers to the same audio interface, because there is no ALSA name that uniquely defines a particular PCI slot. This is currently an unsolved problem when using multiple identical devices. If you use PCI (or PCIe or PCIx or other derivatives of PCI) devices, the chances are that the first card will always be the same one, and so forth, so its not likely to be an issue. If you use several identical USB devices, it may be a more significant problem.

4. Using the `-P` and `-C` arguments to a JACK backend

   Several JACK backends, including the ALSA, FFADO and CoreAudio versions, support the `-P` and `-C` arguments that can be used to specify two different devices, one for playback and one for capture/recording. You cannot use this to merge multiple devices for playback or capture. This approach will not do any clock drift correction, so as the two devices drift over time, you may get glitches in the audio stream. Nevertheless, it can be an easy if unreliable way to set up JACK so that, for example, it records from a USB microphone and plays back via a builtin audio device.

   When using `-P` or `-C` to specify different devices, do not use the `-d` argument (which specifies a single device) and do not use the `-D` argument (which tells JACK to configure a device for playback and capture).

Chapter 19

Unfiled miscellany

19.1 MIDI binding maps

MIDI binding maps provide a way to set up how a physical control surface (such as a Behringer BCF2000 or Mackie Control) interacts with Ardour. An XML file is created to describe the mapping, and Ardour loads it. Maps for several devices are supplied with Ardour:

- Behringer BCF2000 (in native and Mackie Control modes)
- Behringer DDX3216
- Korg nano-Kontrol
- M-Audio Oxygen 8 v2
- M-Audio Axiom 25
- Roland SI-24
- EMU Xboard61

This chapter describes the format of the maps and how to create your own.

19.1.1 File basics

MIDI bindings are stored in files with the suffix `.map` attached to their name. The minimal content looks like this:

```
<?xml version="1.0" encoding="UTF-8"?>
<ArdourMIDIBindings version="1.0.0" name="The name of this set of bindings">
</ArdourMIDIBindings>
</programlisting>
```

The remainder of the file gives the bindings themselves, describing the two parts of each binding: MIDI data that your controller sends, and things that Ardour does in response.

A binding is an XML node called `<Binding>`. The properties of the node give the details of the binding.

19.1.2 Finding out what your MIDI control surface sends

This is the most complex part of the job, but it's still not very hard. You need to connect the control surface to an application that will show you the information that the device sends each time you modify a knob, slider, button etc. There are a variety of such applications; most notably gmidimon and kmidimon. You can also use Ardour for this:

1. Select MIDI Tracer from the Window menu.
2. Choose 'MIDI Control In' from the Port selector.
3. Use the MIDI connection matrix to connect Ardour's MIDI Control In port to the MIDI port that your control surface is sending data in on.
4. Then watch the control surface's MIDI data appear in the MIDI Tracer window as you twiddle knobs or push buttons.

19.1.3 Describing MIDI in the binding file

The properties for specifying the MIDI data in a `<Binding>` node are as follows:

- `channel="c" ctl="m"` — a continuous controller message m arriving on channel c.
- `channel="c" note="n"` — a note-on message for note n arriving on channel c.
- `channel="c" pgm="p"` — a program change message to program p arriving on channel c.
- `channel="c" pb="0"` — a pitch bend message on channel c.
- `sysex="a b c ..."` — a sequence of MIDI bytes a, b, c and so on that make up a system-exclusive message (as hexadecimal bytes)
- `msg="a b c ..."` — an arbitrary sequence of MIDI bytes a, b, c and so on (as hexadecimal bytes)

19.1.4 Binding to Ardour

There are two basic kinds of bindings you can make between a MIDI message and something inside Ardour. The first is a binding to a specific parameter of a track or bus. The second is a binding to a function that will change Ardour's state in some way.

19.1.4.1 Binding to track/bus controls

A track/bus binding is a binding to an individual track or bus inside Ardour. Such a binding requires the name of the property to control, which can be one of:

- `/route/gain`
- `/route/solo`
- `/route/mute`
- `/route/recenable`
- `/route/send/gain`
- `/route/plugin/parameter`

It then requires an address. For track-level controls (solo, gain, mute, record-enable), the address is one of:

- A number — the remote control ID of a track or bus
- The letter *B* followed by a number — the remote control ID of a track or bus within the current bank
- One or more words — the name of a track or bus

For send, insert and plugin controls, the address consists of a track or bus address followed by a number identifying the plugin or send (starting from 1). For plugin parameters, there is an additional third component: a number identifying the plugin parameter number (starting from 1).

For solo and mute bindings, you can also add `momentary="yes"` after the control address. This is useful primarily for note-on bindings — when Ardour gets the note-on it will solo or mute the targetted track or bus, but then when a note-off arrives, it will un-solo or un-mute it.

The specification of a track or bus binding is put inside a `uri` property. For example,

```
<Binding channel="1" ctl="20" uri="/route/gain 2">
```

binds a control change on controller 20, channel 1 to the gain of track 2. As another example

```
<Binding channel="4" note="20" uri="/route/recenable B5">
```

binds a note-on for note 20 on channel 4 to the record-enable state of the 5th track in the current bank.

19.1.5 Binding to Ardour 'functions'

Rather than binding to a specific track/bus control, it may be useful to have a MIDI controller able to alter some part of Ardour's state. A binding definition that does this looks like this:

```
<Binding channel="1" note="13" function="transport-roll"/>
```

In this case, a note-on message for note number 13 (on channel 1) will start the transport rolling. The following function names are available:

- `transport-stop` — stop the transport
- `transport-roll` — start the transport 'rolling'
- `transport-zero` — move the playhead to the zero position
- `transport-start` — move the playhead to the start marker
- `transport-end` — move the playhead to the end marker
- `loop-toggle` — turn on loop playback
- `rec-enable` — enable the global record button
- `rec-disable` — disable the global record button
- `next-bank` — move track/bus mapping to the next bank (see 'banks' below)
- `prev-bank` — move track/bus mapping to the previous bank (see 'banks' below)

19.1.6 Binding to Ardour 'actions'

You can also bind a sysex or arbitrary message to any of the items that occur in Ardour's main menu (and its submenus). The best place to look for the (long) list of how to address each item is in your keybindings file, which will contain lines that look like this:

```
(gtk_accel_path "<Actions>/Editor/temporal-zoom-in" "equal")
```

To create a binding between an arbitrary MIDI message (we'll use a note-off on channel 1 of MIDI note 60 (hex) with release velocity 40 (hex)), the binding file would contain:

```
<Binding msg="80 60 40" action="Editor/temporal-zoom-in"/>
```

The general rule when taking an item from the keybindings file and using it in a MIDI binding is to strip the <Action> prefix of the second field in the keybinding definition.

19.1.7 Banks and banking

Because many modern control surfaces offer per-track/bus controls for far fewer tracks and busses than many users want to control, Ardour offers the relatively common place concept of 'banks'. Banks to allow you to relatively easily control any number of tracks and/or busses regardless of how many faders/knobs etc. your control surface has. To use banking, the control addresses must be specified using the bank relative format mentioned above ('B1' to identify the first track of a bank of tracks, rather than '1' to identify the first track).

One very important extra piece of information is required to use banking: an extra line near the start of the list of bindings that specifies how many tracks/busses to use per bank. If the device has 8 faders, then 8 would be a sensible value to use for this. The line looks like this:

```
<DeviceInfo bank-size="8"/>
```

In addition, you probably want to ensure that you bind something on the control surface to the next-bank and prev-bank functions, otherwise you and other users will have to use the mouse and the GUI to change banks, which rather defeats the purpose of the bindings.

19.1.8 Motorised controls

If your surface's controls are motorised, so that Ardour can move your physical controls, add

```
motorised="yes"
```

to your `<DeviceInfo>` node, so that it reads something like

```
<DeviceInfo bank-size="8" motorised="yes">
```

This will make Ardour more efficient in handling your controls.

19.1.9 A complete (though muddled) example

```
<?xml version="1.0" encoding="UTF-8"?>
<ArdourMIDIBindings version="1.0.0" name="pc1600x transport controls">
<DeviceInfo bank-size="16"/>
<Binding channel="1" ctl="1"   uri="/route/gain B1"/>
<Binding channel="1" ctl="2"   uri="/route/gain B2"/>
<Binding channel="1" ctl="3"   uri="/route/send/gain B1 1"/>
<Binding channel="1" ctl="4"   uri="/route/plugin/parameter B1 1 1"/>
<Binding channel="1" ctl="6"   uri="/bus/gain master"/>
```

```
<Binding channel="1" note="1"  uri="/route/solo B1"/>
<Binding channel="1" note="2"  uri="/route/solo B2" momentary="yes"/>

<Binding channel="1" note="15"  uri="/route/mute B1" momentary="yes"/>
<Binding channel="1" note="16"  uri="/route/mute B2" momentary="yes"/>

<Binding sysex="f0 0 0 e 9 0 5b f7" function="transport-start"/>
<Binding sysex="f0 7f 0 6 7 f7" function="rec-disable"/>
<Binding sysex="f0 7f 0 6 6 f7" function="rec-enable"/>
<Binding sysex="f0 0 0 e 9 0 53 0 0 f7" function="loop-toggle"/>

<Binding channel="1" note="13" function="transport-roll"/>
<Binding channel="1" note="14" function="transport-stop"/>
<Binding channel="1" note="12" function="transport-start"/>
<Binding channel="1" note="11" function="transport-zero"/>
<Binding channel="1" note="10" function="transport-end"/>
</ArdourMIDIBindings>
```

Please note that channel, controller and note numbers are specified as decimal numbers in the ranges 1-16, 0-127 and 0-127 respectively.

19.2 The processor list

Each track or bus in Ardour has a list of *processors* that operate on the audio or MIDI signal passing through it. The operation of the processor list is illustrated in Figure 19.1.

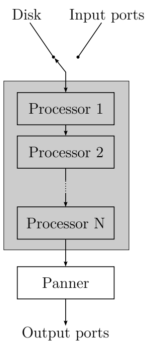


Figure 19.1: Basic structure of a track or bus

Audio or MIDI data arrives from a file on disk, or from the input ports, depending on the monitoring settings that are in effect. It is then passed through each processor in sequence, before being panned and sent to the output ports.

The term ‘processor’ is a very general one. It includes:

- Plugins (LADSPA, LV2, VST etc.)
- Sends and returns
- The fader
- The meter

Some processors are shown in the Ardour’s mixer strip, and some are hidden. Consider the example mixer strip shown in Figure 19.2.

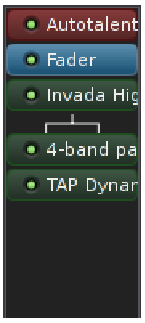


Figure 19.2: The processor box

Here we see five visible processors; they are:

1. 'Autotalent'; a plugin. This is coloured red to indicate that it is pre-fader.
2. The fader. This is where the mixer fader's gain is applied.
3. Invada High Pass; a plugin.
4. 4-band parameteric; another plugin. The symbol between the high-pass and the parametric indicates that the signal is being split from mono to stereo, as the parametric is a stereo plugin.
5. TAP dynamics; another plugin.

Some processors are not shown on this list:

- The meter; a processor which assesses the level of the signal at its point in the processor chain.
- A send to the main output.
- A send to the monitor bus, if one is being used.

19.3 Operations on the processor list

The processor list in each mixer strip can be manipulated in several different ways.

Firstly, processors can be re-ordered using drag-and-drop. Dragging a processor allows it to be moved around within the chain, or copied to another processor list on another track or bus.

Secondly, processors can be enabled or disabled. To the left of the name of each processor is a small LED symbol; if this is lit-up, the processor is active. Clicking on it will deactivate the processor. It will still pass audio or MIDI signals, but they will not be affected.

Finally, processors can be added to or removed from the chain. Right-clicking the processor list does three things:

- A gap is opened up to indicate the location of the click. The gap shows where any new processors will be inserted.
- The processor under the click is selected.
- A menu is presented giving options of what to do.

From the menu, some new processors can be inserted. These can be plugins, sends or internal sends. The selected processor can also be deleted or copied.

19.4 Tracks and busses in detail

This section goes into somewhat unhealthy detail about how tracks and busses operate internally. It may be of interest to almost nobody.

Tracks and busses in Ardour share a common basis; they are both pathways through which audio and MIDI data can pass, experiencing various processing and distribution along the way. The only real difference between a track and a bus is that a track can either obtain its input from a JACK port, or from files on disk; a bus has no disk files, so only processes signals coming from other parts of Ardour, or from other programs via JACK.

Internally, Ardour uses the term 'route' to describe a bus, with a track being a superset of the route's functionality (to include the parts which read from and write to disk). This chapter uses the word 'route' to indicate either a track or a bus, where the two have the same behaviour.

Not all of the processing that signals experience as they travel through routes is visible in the Ardour user-interface. The visible parts are the plugins, the fader, the meter and (if present) the panner. There are other invisible processes that happen to support Ardour's internal operation. Figure 19.3 gives a representation of the entire pathway of a route.

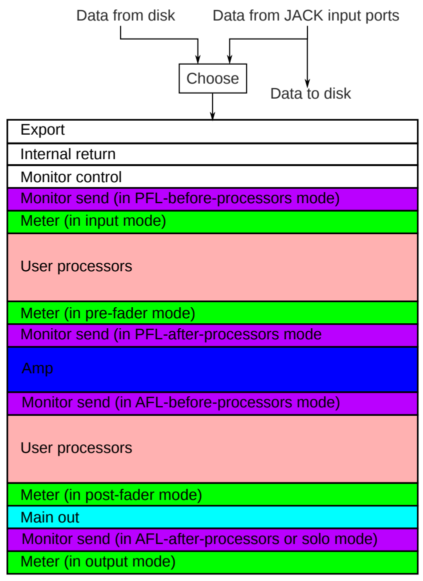

Data from disk
Data from JACK input ports
Choose
Data to disk
Export
Internal return
Monitor control
Monitor send (in PFL-before-processors mode)
Meter (in input mode)
User processors
Meter (in pre-fader mode)
Monitor send (in PFL-after-processors mode
Amp
Monitor send (in AFL-before-processors mode)
User processors
Meter (in post-fader mode)
Main out
Monitor send (in AFL-after-processors or solo mode)
Meter (in output mode)

Figure 19.3: Detailed view of a route

Audio or MIDI data starts from either a set of JACK ports or a disk file. Busses always take their initial data from JACK ports, and tracks can do either depending on monitoring settings. It is possible for tracks and busses to have no input, in which case the signal starts off as silence.

If a track is recording, data is taken straight from the JACK input ports and recorded; no processing on track will have any effect on the recorded signal.

The signal then enters the processing chain. Internally, this chain is a set of 'processors' connected in series. Some processors are put in place by Ardour, and some are at the whim of the user.

19.4.1 Export

19.4.2 Internal return

This is the point at which internal send signals from other routes appears in the route being sent to. This processor gathers signals from all its connected sends and mixes them with the signal in the route at that point.

19.4.3 Monitor control

19.4.4 Monitor send

The monitor send is an internal send which sends the route's signal, whever it is located, to the monitor bus. The monitor send is located in different places, depending on the settings for AFL and PFL.

19.4.5 Meter

The meter processor passes signals unaltered, but meters them on the way through. It can be moved around depending on the meter point settings.

19.4.6 User processors

These are the 'conventional' user-visible processors: plugins and internal sends to other tracks or busses.

19.4.7 Amp

This is a gain-control element which is controlled by the fader.

19.4.8 Main out

This processor takes the route's signal, optionally pans it, and then passes it to a set of JACK ports; this represents the main output of the route.

Chapter 20

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