

# **Ardour Export Redesign**

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## 1 Introduction

The basic purpose of Ardour's export functionality is to create mixdowns of multitrack arrangements. On the user interface side, this happens through a dialog.

I redesigned the layout of a few of Ardour's dialogs for the 2.0 release before, but here I saw some deeper issues and opportunities, calling for a much farther-reaching design process.

In many cases, exporting as it is currently implemented doesn't deliver the final result; additional steps and tools are needed. This is inefficient, and is more demanding on the user. Some functionality should be added, but a line needs to be drawn somewhere. For example, it's not feasible to turn Ardour into a CD / DVD authoring environment.

## 2 Insights From a Survey

I conducted a quick survey on the Linux Audio Users Mailing List to learn about the needs, wishes and problems of actual users. It's in the list's archive starting with

<http://lalists.stanford.edu/lau/2007/02/0665.html>.

### 2.1 Export When?

Exports are done not only at the end of a project, but also when creating snapshots of work in progress. This makes it even more important to streamline the process.

### 2.2 Channel Count

Besides the usual destinations (CD, DVD, Web), there are productions for concerts and theater, which demand flexible multichannel support. Typical channel counts:

- Stereo is the common case
- 6 channels for 5.1 surround
- any number for specific setups

### 2.3 Requested File Types

Primary: WAV and WAV64, FLAC, Ogg, MP3.

Secondary: AIFF, AAC.

WAV, WAV64 and AIFF are already supported. I would add WavPack as it's currently the only option for lossless compression of audio from and to Ardour's native sample format, 32 bit float.

Note that I failed to differentiate between container formats and encodings in my question and not one respondent objected. It seems to be very common to assume that an Ogg file contains Ogg-encoded audio, even though it might not, for example.

### 2.4 Sample Formats and Rates in Use

16 bit and 24 bit integer, 32 bit float.

44.1, 48, 96 kHz.

### 2.5 Wish List

#### 2.5.1 More than one format at once

It's common to want at least one uncompressed and one compressed format. Exporting to several formats at once would be a time-saver as it cuts out navigational overhead.

Still some respondents deem it unnecessary and point to using command line tools like lame, oggenc and flac. I think the user should not have to touch the command line. The knowledge to use said tools cannot be expected of all users.

#### 2.5.2 Files per Track / Bus

The ability to export tracks / busses to separate files. Only tracks have been mentioned explicitly, but there is no reason to exclude busses.

Archiving and exporting to other applications are the primary uses. Another very specific use would be to realize multichannel playback with several (stereo) devices.

Mapping tracks / busses to files is a different problem from mapping outputs to channels. So this should be taken care of separately.

#### 2.5.3 Optionally store timestamps

Storing time offset from session start. Only a few specific formats allow this. Broadcast Wave Format (BWF) and AIFF support this by different means, plain WAV doesn't. For BWF either the bext or the iXML chunk could be used.

There's no offset when exporting the whole session, so this is only of interest when exporting ranges or when exporting tracks / busses to separate files without including leading silence.

If a format that supports this capability is chosen, offset could be stored by default. If there are no negative consequences to be expected, it doesn't need to be optional.

## 2.6 General Problems

JACK applications that do not support freewheeling (processing audio not in realtime, but as fast as possible).

- The export dialog could have an option to not use freewheeling.
- All JACK applications supporting freewheeling would be the optimal solution.

## 3 Feature Requests

Relevant feature requests on [Ardour's tracker](#).

### 3.1 Multichannel

<http://tracker.ardour.org/view.php?id=725>

A request (with duplicates) for exporting to multichannel files, not just stereo files. This is a clear need to be addressed.

### 3.2 Individual Files

<http://tracker.ardour.org/view.php?id=1581>

Exporting tracks to separate files as in 2.5.2.

### 3.3 Realtime Export

<http://tracker.ardour.org/view.php?id=1552>

<http://tracker.ardour.org/view.php?id=1052>

Export in realtime instead of freewheeling mode to make use of outboard equipment or to just listen to the export. This can be done by recording the mix on a new track and exporting that, but realtime export has still to be considered as an option.

### 3.4 Range and File Export History

<http://tracker.ardour.org/view.php?id=1398>

Listing previous exports and using settings of a previous export. I see this as an indication of a need for presets or another way to recall settings.

### 3.5 Running a Script

<http://tracker.ardour.org/view.php?id=1352>

The ability to run a script on export. As long as no examples outside of conversion, tagging and upload are brought forward, it is better to add such functionality to Ardour itself. This way all users can benefit.

### 3.6 Export Markers as Text

<http://tracker.ardour.org/view.php?id=1142>

I assume CD marker files can be used for this.

## 4 The Current Dialog

Issues and recommendations, based on Ardour 2.0.2.

### 4.1 Time Span Selection

Pre-selection of session / range markers / range selection through a sub-menu is not optimal.

- The 3 options could be given in the dialog.

Preselecting *Selection* if one exists and otherwise remembering the last choice should be more efficient than requiring the user to select from a sub-menu each time. CD marker export being tied to exporting the whole session would be more obvious.

### 4.2 Ranges

No way to export a subset of ranges, to verify the extents of ranges or to rename them (range names are used as filenames).

- List ranges for selection. Allow easy selection / de-selection of all ranges. Make names editable.
- List start and end times of ranges. Allow display as Bars:Beats, Timecode or Minutes:Seconds.

### 4.3 File vs Directory Selection

Exporting the whole session requires a filename to be specified. Exporting ranges (range markers or selection) requires a directory because it will usually create several files.

But when exporting ranges, the “Save As” dialog with “Export to file” as window name implies that a filename has to be specified.

- The GTK File Chooser mode for selecting folders should be used with a proper window name (gtk.-FILE\_CHOOSER\_ACTION\_SELECT\_FOLDER).

### 4.4 Container Types

Container types are listed in random order.

- The more often used WAV, W64, AIFF should be listed above more obscure types (raw, PAF, AU, IR-CAM).
- Alternatively: List types alphabetically.

### 4.5 Endianness

For several container types, Endianness can be chosen, even though most applications expect a specific Endianness per container type.

- To avoid incompatibility and user confusion, and to save space, do not offer this option.

### 4.6 Channel Count

Only mono and stereo are supported.

- Allow as many channels as anyone would use. If one doesn't export channels to separate files, container formats set an upper limit (libsndfile doesn't allow more than 256 channels for any container).
- Allow exporting to several mono files at once.
- Assuming that a user would rather ask "*which container / encoding can I use if I need this many channels*" than "*how many channels can I have with this container / encoding*", channel count should act as filter on container and encodings offered, not the other way around.

### 4.7 Mapping Channels

Doing the common thing of mapping the channels of a stereo bus to the left and right channels of the export involves clicking 2 checkboxes.

- Consider using bus / Track selection, while having per channel mapping as a second and optional stage.



Only master outputs are listed initially. Clicking the “*Specific Tracks ...*” buttons reveals all other tracks and busses.

- List master outputs first, followed by all busses, and finally tracks. Busses are more likely to be used as sources. An option to show or hide parts of the list only takes up space than can be better used to show one item more, as the list must be scrollable, anyway.

#### 4.8 CD Marker Files

It's quite likely that a user wants to export the whole session with or without a CD marker file, or the marker file alone after moving range marks without changing anything else. The “*Export CD Marker File only*” option makes most of the export dialog useless when enabled. It's presented like a detail of low importance, while in fact it has a wide scope. The logic behind it is indirect.

Marker file export is not available when exporting ranges, as ranges are used for track marks. With selection among ranges it could be an option.

- Include “*Export CD Marker File*” in the session menu.

- Have a positive option for exporting a marker file in the dialog.
- Offer marker file export with ranges selected as time spans.
- Visualize which ranges are used as CD marks.

#### 4.9 Trimming

Reverb and delay tails make it necessary to leave some space at the end of a session. Trimming silence afterwards requires the use of external tools.

- Add a Trim Silence function. Make treatment of start and end separate options, as leading silence might be important for synchronisation. Allow setting durations of silence that will be left in or inserted as needed for controlled gaps.

#### 4.10 Filename Conflicts

The presence of older exports with identical names triggers an “*File already exists. Do you want to overwrite it?*” dialog on hitting *Export*. While this is an improvement over silently overwriting, the dialog is an annoying extra step. Users tend to form a habit of clicking away such dialogs without reading.

Old files could be moved out of the way, but exported files shouldn't be touched by Ardour again, as it would be rather surprising behaviour. Automatically attaching a number might frustrate the user.

There has been a suggestion to allow listing prior exports with their options. This would require a log regarding files that are not under Ardour's control and can reside anywhere on the system. It can be taken as an indication of a need for more informative filenames, though.

- Show a warning in advance, within the dialog, that files will be overwritten. Offer to append a number (counter) to ensure that the filenames are unique.
- Encourage the use of date and time in filenames.

#### 4.11 Peaks

To detect peaks above 0 dBFS, the user has to keep an eye on the editor or mixer window. Afterwards it can be hard to find the location where a peak occurred. Note that peaks above 0 dBFS will result in clipping in integer, but not in floating point encodings.

- Indicate peaks above 0 dBFS in the dialog. List locations of occurrences during export. (Side note:

tracks / busses should have peak logs and some means to navigate to the listed locations.)

- Offer normalization as an optional step prior to encoding.

#### 4.12 Blocking JACK

This is actually an infrastructure problem: During export, the JACK server goes into freewheeling mode and can not be used to listen to audio. For large sessions, this might become a problem. There are no ideas or plans to tackle this problem on the JACK side.

- Add an option for internal mix-down, bypassing JACK. Attached JACK clients can't be mixed-in then, but the server remains available.
- Allow exporting to be done as batch job.

#### 4.13 Does it have to be a dialog?

Tracks / busses could take files as output destinations. Freewheeling could be a transport option.

Setup wouldn't be any simpler. The need to enable or disable recording to files and freewheeling would make this approach more complicated to use.

If the layout can be kept rather narrow, it might fit on an export tab on the notebook to avoid having a dialog obstructing the view on the arrangement. That might lead to wrong expectations of full interactivity, though.

## 5 Track Export

Exporting tracks to files leads to partly different requirements and is thus better handled separately. But if there will be an “Export Tracks” in the menu, “Export” should perhaps be changed to “Export Mix-down”.

Just a few notes / wish list items.

- Export pre-fader, with or without plugins
- Store time offsets
- Trim or include leading silence
- Track / bus selection
- Time span selection
- Joint or split stereo / multichannel
- A switch to disable all panners

## 6 MIDI

The upcoming MIDI sequencing and editing support raises the question of how to deal with it regarding export.

Only the source selection part of exporting makes sense for MIDI. In this way, it's similar to CD TOC / CUE files. There could be a single option to export MIDI alongside audio, but this wouldn't cover the case where one wants to export only MIDI well. So I think there should be a separate export item in the menu.

MIDI is stored in SMF files. MIDI regions map to this files just like audio regions map to audio files. Because of this just copying the files isn't enough for exporting, the referenced parts need to be combined.

## 7 Steps After Exporting

Common or simply useful steps taken after exporting with the current limitations. Each one should be evaluated as candidate for inclusion of analogous functionality in Ardour.

### 7.1 Normalize

If the mix doesn't reach 0 dBFS by careful leveling, use of automation and compression, the user might want to normalize.

If there are peaks above 0 dBFS, normalization prior to leaving the floating point format is obviously better than clipping. Hence normalization should be an option to be applied prior to sample format conversion.

It has been reported that the Ogg Vorbis codec has problems with 0 dBFS peaks. While I can't confirm this, there might be other cases where the level has to be kept below 0 dBFS, so a normalize option should have a target value parameter.

## 7.2 Trim silence

Tails of effects like reverb and delay will often result in dead space left at the end of a session, because the end mark can't . Trimming silence saves space and allows gap-less playback. In some cases, it might be desirable to have a specific duration of leading or trailing silence.

This is a must if export is meant to create a finished product. Especially if encoding with compression is to follow, as compressed files can't easily be cut without re-encoding.

## 7.3 Encode

Encoding using lossless or lossy compression formats for archiving, mobile players or online use.

Currently one either has to use sound editors, which take time to load, or command line tools which are not an option for the uninitiated. So there's quite a lot to be gained in this area regarding efficiency and user friendliness.

## 7.4 Tag

Adding metadata like artist name or licensing information. Dealing with tagging in Ardour would be

of advantage where one session is exported to several formats. It's also an opportunity to encourage proper tagging, including specifying a license.

## 7.5 Upload

Transfer to a personal website or places like [archive.org](http://archive.org) or [ccmixter.org](http://ccmixter.org).

Direct uploads to remote hosts via standard protocols is a job for the underlying infrastructure.

Specialised upload tools could be started up automatically and given paths and meta-information as arguments if they support it. However, support of any single upload tool would be too specific to justify the development effort.

## 7.6 Burn CD / DVD

Burning an audio CD or DVD-A. For CDs, almost all information is inside Ardour already, so on the interaction level only hardware related options are missing. However, the need for such options and the CD as target dictating the format make it advisable to use a specialised dialog. A CD image could be offered as container in the normal dialog, but there would be the problem of it depending on / having to

set several options.

All I can find regarding DVD-A support on Linux is <http://dvd-audio.sourceforge.net/status.shtml>, which rather suggests it's incomplete and abandoned. So Ardour should make it easy to export suitable raw material but has to stop there.

### 7.7 Backup / Archiving

Storing on another partition, hard drive or removable media. General file management is not a task for Ardour.

However, archiving is another reason for exporting tracks to separate files, as it lessens or removes the dependency on Ardour (or a specific version of Ardour in case the session format changes).

### 7.8 Authoring

Using the exported audio in combination with other media. The only concern for Ardour here is compatibility, as extending Ardour to become an authoring environment is not feasible.

## 8 Container Formats

Ardour uses libsndfile, so it should be straightforward to add formats that it supports but Ardour currently doesn't. For other formats, it has to be considered to add them to libsndfile or to use other libraries alongside.

Everything relating to libsndfile is based on version 1.0.17. See <http://www.mega-nerd.com/libsndfile/> for more information.

A lot of time could be spend on researching and documenting container formats and encodings. I will focus on collecting just enough information for the design of the export dialog.

[Comparison of container formats on Wikipedia.](#)

### 8.1 libsndfile, currently offered for Export

These can and should be used with linear encoding exclusively.

- [AIFF \(Apple / SGI\)](#)
- [AU / SND \(Sun/NeXT\)](#)
- [IRCAM / SF \(Berkeley / IRCAM / CARL\)](#)

- PAF / FAP (Ensoniq PARIS)
- RAW / GSM / VOX (header-less)
- WAV (Microsoft)
- W64 (SoundFoundry WAVE 64, WAV with 64 bit header for longer recording times)

### 8.2 **libsndfile, also interesting**

CAF (Apple Core Audio File)

### 8.3 **libsndfile, rather exotic**

These shouldn't be supported unless requested by several users.

- SVX / IFF (Amiga IFF / SVX8 / SV16)
- VOC (Creative Labs)
- MAT4 (GNU Octave 2.0 / Matlab 4.2)
- MAT5 (GNU Octave 2.1 / Matlab 5.0)
- MAT4 (GNU Octave 2.0 / Matlab 4.2)
- PVF (Portable Voice Format)
- SDS (Midi Sample Dump Standard)
- SD2 (Sound Designer II)
- WAV (NIST Sphere) National Institute of Standards and Technology
- XI (FastTracker 2)

### 8.4 **Interesting**

- BWF – Broadcast Wave Format
- Matroska
- MBWF / RF64
- Ogg

### 8.5 **Problematic**

Problematic due to patent and / or licensing issues.

- ASF / WMA. Advanced Systems Format / Windows Media Audio. WMA files use ASF containers

### 8.6 **Not of further interest**

Audio / Video container formats that are not commonly used for audio only. As long as Ardour doesn't even import video, exporting it is out of question. Patent and licensing issues may also apply.

- 3GP – 3G mobile phones
- AVI – Audio Video Interleave
- DMF – DivX Media Format
- FLV – Flash Video
- MCF – Multimedia Container Format
- MPEG (1, 2, 4)
- NUT
- Ogg Media

- Quicktime
- RealMedia
- VOB – DVD-Video Object

## 9 Encodings

FLAC, MP3 and WavPack have their own container formats, but can be wrapped in Matroska.

See also: List of codecs on Wikipedia.

### 9.1 Libsndfile supported

- Linear (integer, float)

### 9.2 Interesting

- FLAC – Free Lossless Audio Codec
- Ogg Vorbis
- WavPack

### 9.3 Problematic

Problematic due to patent and / or licensing issues.

- AAC
- Apple Lossless. There's a reverse engineered open-source codec, but any of the truly open lossless codecs is a better choice by avoiding possible legal issues.
- Dolby Digital AC-3



- Monkey's Audio
- MPEG-Layer-3 (MP3). LAME could be used, though.

#### 9.4 Not of further interest

- iLBC. License free, aimed at VoIP.
- Musepack. Open source, but doesn't seem to be well established or offer compelling, unique features.
- Ogg Speex. Open source, aimed at speech.
- OptimFROG. No code or specification available.
- Shorten. Unclear license, doesn't compare well to newer lossless codecs.
- TTA. Evaluation like Musepack.

## 10 Tagging

Several container formats have their own tagging standard. The best known is ID3 as used with MP3.

APEv2 is used by Musepack, Monkey's Audio, OptimFROG and WavPack. Vorbis comment is used by FLAC, Speex and Vorbis.

WAV allows no tagging at all. BWF is an extension of WAV to add metadata. iXML is designed for file and project based metadata and can be embedded in BWF.

The need to store a specific piece of metadata can be a constraint on the choice of container. Ardour should store user and session related metadata and assist the user in tagging exports. This should include Creative Commons licensing, but also plain copyright notices.

## 11 Marker Files

Ardour currently supports CUE and TOC as CD marker files. Together with an exported audio file of the right format, both can be used to burn a CD with proper track and index marks. TOC is the most basic. CUE adds support for CD-Text.

There are 2 formats to store disc images with metadata: DDP and CMF. DDP can be used for CD, DVD, HD DVD-ROM and Blu-ray. DCA offers DDP licenses free of charge, but hasn't answered to requests from Nick Mainsbridge. CMF is a derivative targeted at DVD.

## 12 Elements

Elements that are involved in exporting. This serves as a checklist to make sure all aspects are covered.

### 12.1 Input

- Session
- Tracks
- Busses
- Outputs
- Routing
- Range marks (CD tracks)
- Location marks (CD Indexes)

### 12.2 Output

- Path
- Filename(s)
- Container Format(s)
- Encoding(s)
- Channels
- TOC / CUE
- Tags / Metadata

# 13 Requirements

## 13.1 Core

The central purpose of the export functionality is to render any aspect of a session to a file as fast as possible (or in realtime).

An aspect of a session is constituted by a selection along the time axis and a selection of track / bus outputs.

“As fast as possible” leads to the use of the JACK freewheeling mode.

Thus there need to be means of:

- Specifying the source(s)
  - Selecting one or more time ranges (session start to end marks, range marks, currently active range selection)
  - Selecting one or more Outputs
- Mapping source(s) to target(s)
  - Specifying the Channel count of file(s) to be created
  - Map Outputs to the Channels of file(s) to be created

- Further define targets:
  - Encoding and specific options
  - Conversion options (if resampling or sample format conversion are required)
  - Container type and specific options
- Selection of realtime or freewheeling mode and triggering the export process
- Cancelling

## 13.2 Layout

The layout should reflect the hierarchy and process flow. Follow the GNOME HIG.

## 13.3 Presets

- Default to settings suitable for CD production.
- Remember settings used last time.
- Allow loading and saving of all dialog-specific settings.

The same settings are likely to be reused. There might be reoccurring scenarios, hence a need for presets.

### 13.4 Speed

- Offer a realtime mode, but present freewheeling as default.

### 13.5 Time span

- Offer session, ranges, selection in the dialog, not in a submenu.
- Preselect *Selection* (ignoring the last used option) if one exists; otherwise disable it.
- List ranges for selection with start and end times (modes: Bars:Beats, Timecode, Minutes:Seconds) and editable names.
- Mark ranges that are used as CD track marks.

### 13.6 CD Marker Files

- Offer CD marker file export as an option, regardless of time span selection.
- Offer CUE and TOC as options.
- Place inside the time span area.
- Include *"Export CD Marker File"* in the session menu.

### 13.7 Mapping

- Have a means to specify channel count.

- Allow mapping of all outputs of an item to matching target channels at once. For this there should be a single representation of each bus / track.
- Default to mapping master outputs to Left and Right if applicable.
- Make it easy to swap channels.
- List the master bus first, followed by all other busses, and finally tracks.
- Offer a *"Split to mono files"* option.
- Consider having a means to reverse the order of the mapping.

### 13.8 Processing

- Offer normalization. Allow to set a target below 0 dBFS.
- Offer Trim Silence separately for start and end with an adjustable duration to leave in / add.

### 13.9 Container and Encodings

- The number of channels required should be a constraint on the available container formats.
- Bundle all container and encoding options in loadable / savable profiles. Ship with preset profiles for typical cases. Attach labels like *"Audio CD"* to

make clear what each preset profile is about.

- Rate and bit depth parameters for linear encoding need options to keep the session's native format (no resampling or conversion).
- Allow setting or narrowing down container, encoding, and options by choosing a destination and / or by specifying high level requirements.

We can not count on the user being familiar with technical details of container and encodings. But every user is likely to have a destination and / or high level requirements in mind.

### 13.10 Target Folder

- Default to one level above the session folder.
- Default to within the session folder if an equivalent path was used last time.

It might not be a good idea to encourage exporting to within a session folder, as it can be treated like an opaque entity otherwise. But if the user chose to do it last time, it's a good guess they will do it again.

Separate target folders per format would mean having many controls and no direct way to change the path for everything. Also, it's not clear if it should be bound to encoding, sampling rate or any

other option.

### 13.11 Filenames

Assist the user in adding any of the following to filenames:

- Session name
- A free label
- Date (filesystem time-stamps are not robust and don't help to avoid name clashes)

Some of the following will have to be added automatically if multiple files will be exported:

- Range Names
- Bus / Track names
- Encoding
- Encoding options

Giving the user complete control about every aspect of naming would be too complicated.

### 13.12 Multiplication

Allowing to export to several files with varying settings at once could be generalized to also allow multiple sources and mappings (going through all com-

binations). This might be expensive to implement, so there should be one proposal with and one without it.

### 13.13 To be left out

Things left out for now, which can be addressed in a later iteration:

- Batch mode
- Internal mixdown option, bypassing JACK
- Metadata. This needs a strategy reaching beyond the export dialog.
- CD-Text

## 14 Credits

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