LilyPond

The music typesetter

Contributor's Guide

The LilyPond development team

This manual documents contributing to LilyPond version 2.13.27. It discusses technical issues and policies that contributors should follow.

This manual is not intended to be read sequentially; new contributors should only read the sections which are relevant to them. For more information about different jobs, see Section "Help us" in *General Information*.

For more information about how this manual fits with the other documentation, or to read this manual in other formats, see Section "Manuals" in *General Information*.

If you are missing any manuals, the complete documentation can be found at `http://www.lilypond.org/`.

For LilyPond version 2.13.27

Table of Contents

1 Introduction to contributing

This chapter presents a quick overview of ways that people can help LilyPond.

1.1 Help us

We need you!

The LilyPond development team is quite small; we really want to get more people involved. Please consider helping your fellow LilyPond users by contributing to development!

Even working on small tasks can have a big impact: taking care of them let experienced developers work on advanced tasks, instead of spending time on those simple tasks.

Simple tasks

- Mailing list support: answer questions from fellow users.
- Bug reporting: help users create proper Section "Bug reports" in *General Information*, and/or join the Bug Squad to organize Section "Issues" in *Contributor's Guide*.
- Documentation: small changes can be proposed by following the guidelines for Section "Documentation suggestions" in *Contributor's Guide*.
- LilyPond Snippet Repository (LSR): create and fix snippets following the guidelines in Section "Adding and editing snippets" in *Contributor's Guide*.
- Discussions, reviews, and testing: the developers often ask for feedback about new documentation, potential syntax changes, and testing new features. Please contribute to these discussions!

Moderate tasks

> **Note:** These jobs generally require that you have the program and documentation source files, but do not require a full development environment. See Section "Working with source code" in *Contributor's Guide*.

- Documentation: see Section "Documentation work" in *Contributor's Guide*, and Section "Building documentation without compiling" in *Contributor's Guide*.
- Website: the website is built from the normal documentation source. See the info about documentation, and also Section "Website work" in *Contributor's Guide*.
- Translations: see Section "Translating the documentation" in *Contributor's Guide*, and Section "Translating the website" in *Contributor's Guide*.

Complex tasks

> **Note:** These jobs generally require that you have the source code and can compile LilyPond. See Section "Working with source code" in *Contributor's Guide*, and Section "Compiling" in *Contributor's Guide*.
>
> We suggest that new contributors using Windows or MacOS X do **not** attempt to set up their own development environment; instead, see Section "Using a Virtual Machine to Compile LilyPond" in *Contributor's Guide*.

- Bugfixes, new features: the best way to begin is to join the Frogs, and read Section "Programming work" in *Contributor's Guide*.

Projects

Frogs

Website and mailing list:

http://frogs.lilynet.net

The Frogs are ordinary LilyPond users who have chosen to get involved in their favorite software's development. Fixing bugs, implementing new features, documenting the source code: there's a lot to be done, but most importantly: this is a chance for everyone to learn more about LilyPond, about Free Software, about programming... and to have fun. If you're curious about any of it, then the word is: *Join the Frogs!*

Grand LilyPond Input Syntax Standardization

Website:

http://lilypond.org/~graham/gliss

GLISS will stabilize the (non-tweak) input syntax for the upcoming LilyPond 3.0. After updating to 3.0, the input syntax for untweaked music will remain stable for the foreseeable future.

We will have an extensive discussion period to determine the final input specification.

> **Note:** GLISS will start shortly after 2.14 is released.

Grand Organizing Project

Website:

http://lilypond.org/~graham/gop

GOP will be our big recruiting drive for new contributors. We desperately need to spread the development duties (including "simple tasks" which require no programming or interaction with soruce code!) over more people. We also need to document knowledge from existing developers so that it does not get lost.

Unlike most "Grand Projects", GOP is not about adding huge new features or completely redesigning things. Rather, it is aimed at giving us a much more stable foundation so that we can move ahead with larger tasks in the future.

> **Note:** GOP will start shortly before or after the 2.14 release.

1.2 Overview of work flow

> **Ultra-short summary for Unix developers**: source code is at `git://git.sv.gnu.org/lilypond.git`. Documentation is built with Texinfo, after pre-processing with `lilypond-book`. Send well-formed patches to lilypond-devel@gnu.org.

Git is a *version control system* that tracks the history of a program's source code. The LilyPond source code is maintained as a Git repository, which contains:

- all of the source files needed to build LilyPond, and
- a record of the entire history of every change made to every file since the program was born.

The 'official' LilyPond Git repository is hosted by the GNU Savannah software forge at http://git.sv.gnu.org. Although, since Git uses a *distributed* model, technically there is

no central repository. Instead, each contributor keeps a complete copy of the entire repository (about 116M).

Changes made within one contributor's copy of the repository can be shared with other contributors using *patches*. A patch is a simple text file generated by the `git` program that indicates what changes have been made (using a special format). If a contributor's patch is approved for inclusion (usually through the mailing list), someone on the current development team will *push* the patch to the official repository.

The Savannah software forge provides two separate interfaces for viewing the LilyPond Git repository online: *cgit* and *gitweb*. The cgit interface should work faster than gitweb in most situations, but only gitweb allows you to search through the source code using `grep`, which you may find useful. The cgit interface is at http://git.sv.gnu.org/cgit/lilypond.git/ and the gitweb interface is at http://git.sv.gnu.org/gitweb/?p=lilypond.git.

Git is a complex and powerful tool, but tends to be confusing at first, particularly for users not familiar with the command line and/or version control systems. Contributors who don't want to deal with Git directly are encouraged to use the `lily-git` graphical user interface instead.

Compiling ('building') LilyPond allows developers to see how changes to the source code affect the program itself. Compiling is also needed to package the program for specific operating systems or distributions. LilyPond can be compiled from a local Git repository (for developers), or from a downloaded tarball (for packagers). Compiling LilyPond is a rather involved process, and most contributor tasks do not require it.

Contributors can contact the developers through the 'lilypond-devel' mailing list. The mailing list archive is located at http://lists.gnu.org/archive/html/lilypond-devel/. If you have a question for the developers, search the archives first to see if the issue has already been discussed. Otherwise, send an email to lilypond-devel@gnu.org. You can subscribe to the developers' mailing list here: http://lists.gnu.org/mailman/listinfo/lilypond-devel.

1.3 Mentors

We have a semi-formal system of mentorship, similar to the medieval "journeyman/master" training system. New contributors will have a dedicated mentor to help them "learn the ropes".

> **Note:** This is subject to the availability of mentors; certain jobs have more potential mentors than others.

Contributor responsibilities

1. Ask your mentor which sections of the CG you should read.
2. If you get stuck for longer than 10 minutes, ask your mentor. They might not be able to help you with all problems, but we find that new contributors often get stuck with something that could be solved/explained with 2 or 3 sentences from a mentor.
3. Send patches to your mentor for initial comments.
4. Inform your mentor if you're going to be away for a month, or if you leave entirely. Contributing to lilypond isn't for everybody; just let your mentor know so that we can reassign that work to somebody else.
5. Inform your mentor if you're willing to do more work – we always have way more work than we have helpers available. We try to avoid overwhelming new contributors, so you'll be given less work than we think you can handle.

Mentor responsibilities

1. Respond to questions from your contributor(s) promptly, even if the reponse is just "sorry, I don't know" or "sorry, I'm very busy for the next 3 days; I'll get back to you then". Make sure they feel valued.
2. Inform your contributor(s) about the expected turnaround for your emails – do you work on lilypond every day, or every weekend, or what? Also, if you'll be unavailable for longer than usual (say, if you normally reply within 24 hours, but you'll be at a conference for a week), let your contributors know. Again, make sure thay feel valued, and that your silence (if they ask a question during that period) isn't their fault.
3. Inform your contributor(s) if they need to do anything unusual for the builds, such as doing a "make clean / doc-clean" or switching git branches (not expected, but just in case...)
4. You don't need to be able to completely approve patches. Make sure the patch meets whatever you know of the guidelines (for doc style, code indentation, whatever), and then send it on to the frog list or -devel for more comments. If you feel confident about the patch, you can push it directly (this is mainly intended for docs and translations; code patches should almost always go to -devel before being pushed).
5. Keep track of patches from your contributor. If you've sent a patch to -devel, it's your responsibility to pester people to get comments for it, or at very least add it to the google tracker.

2 Working with source code

New contributors should only read Section 2.1 [Using lily-git], page 5. Please ignore the rest of this chapter.

Advanced contributors will find the rest of this material quite useful, particularly if they are working on major new features.

2.1 Using lily-git

Install and Configuration

1. If you haven't already, download and install Git.
   - Windows users: download the `.exe` file labeled "Full installer for official Git" from:
     `http://code.google.com/p/msysgit/downloads/list`
   - Other operating systems: either install `git` with your package manager, or download it from the "Binaries" section of:
     `http://git-scm.com/download`
2. Download the lily-git script from:
   `http://git.sv.gnu.org/cgit/lilypond.git/plain/scripts/auxiliar/lily-git.tcl`
3. To run the program from the command line, navigate to the directory containing '`lily-git.tcl`' and enter:
   ```
   wish lily-git.tcl
   ```

1. Get source / Update source

When you click the "Get source" button, `lily-git` will create a directory called '`lilypond-git/`' within your home directory, and will download the source code into that directory (around 55Mb). When the process is finished, the "Command output" window will display "Done", and the button label will change to say "Update source".

Navigate to the '`lilypond-git/`' directory to view the source files. You should now be able to modify the source files using your normal text editor.

> Advanced note: The "Get source" button does not fetch the entire history of the git repository, so utilities like `gitk` will only be able to display the most recent additions. As you continue to work with `lily-git`, the "Update source" button will take any new additions and add it to whatever is currently in your repository's history.

2a. New local commit

A single commit typically represents one logical set of related changes (such as a bug-fix), and may incorporate changes to multiple files at the same time.

When you're finished making the changes for your first commit, click the "New local commit" button. This will open the "Git Commit Message" window. The message header is required, and the message body is optional. See Section 2.3.4 [Commits and patches], page 12 for more information regarding commits and commit messages.

After entering a commit message, click "OK" to finalize the commit.

2b. Amend previous commit

You can go back and make changes to the most recent commit with the "Amend previous commit" button. This is useful if a mistake is found after you have clicked the "New local commit" button.

To amend the most recent commit, re-edit the source files as needed and then click the "Amend previous commit" button. The earlier version of the commit is not saved, but is replaced by the new one.

Note that this does not update the patch **files**; if you have a patch file from an earlier version of the commit, you will need to make another patch set when using this feature. The old patch file will not be saved, but will be replaced by the new one after you click on "Make patch set".

3. Make patch set

Before making a patch set from any commits, you should click the "Update source" button to make sure the commits are based on the most recent remote snapshot.

When you click the "Make patch set" button, `lily-git` will produce patch files for any new commits, saving them to the current directory. The command output will display the name of the new patch files near the end of the output:

```
0001-CG-add-lily-git-instructions.patch
Done.
```

Send patch files to your mentor if you have one. Otherwise, write an email (must be less than 64 KB) to `lilypond-devel@gnu.org` briefly explaining your work, with the patch files attached. Translators should send patches to `translations@lilynet.net`.

The "Abort changes – Reset to origin" button

> **Note:** Only use this if your local commit history gets hopelessly confused!

The button labeled "Abort changes – Reset to origin" will copy all changed files to a subdirectory of '`lilypond-git/`' named '`aborted_edits/`', and will reset the repository to the current state of the remote repository (at `git.sv.gnu.org`).

2.2 Starting with Git

Using the Git program directly (as opposed to using the `lily-git` GUI) allows you to have much greater control over the contributing process. You should consider using Git if you want to work on complex projects, or if you want to work on multiple projects concurrently.

2.2.1 Setting up

TODO: Remove this note if incorporating Windows instructions throughout this section:

> **Note:** These instructions assume that you are using the command-line version of Git 1.5 or higher. Windows users should skip to Section 2.5 [Git on Windows], page 20.

Installing Git

If you are using a Unix-based machine, the easiest way to download and install Git is through a package manager such as `rpm` or `apt-get`—the installation is generally automatic. The only required package is (usually) called `git-core`, although some of the auxiliary `git*` packages are also useful (such as `gitk`).

Alternatively, you can visit the Git website (`http://git-scm.com/`) for downloadable binaries and tarballs.

TODO: add Windows installation instructions (or `@ref{Git on Windows}`).

Initializing a repository

Once Git is installed, you'll need to create a new directory where your initial repository will be stored (the example below uses '`~/lilypond-git/`', where `~` represents your home directory). Run `git init` from within the new directory to initialize an empty repository:

```
mkdir ~/lilypond-git/; cd ~/lilypond-git/
git init
```

Technical details

This creates (within the '`~/lilypond-git/`' directory) a subdirectory called '`.git/`', which Git uses to keep track of changes to the repository, among other things. Normally you don't need to access it, but it's good to know it's there.

Configuring Git

> **Note:** Throughout the rest of this manual, all command-line input should be entered from the top directory of the Git repository being discussed (eg. '`~/lilypond-git/`'). This is referred to as a *top source directory*.

Before downloading a copy of the main LilyPond repository, you should configure some basic settings with the `git config` command. Git allows you to set both global and repository-specific options.

To configure settings that affect all repositories, use the `--global` command line option. For example, the first two options that you should always set are your *name* and *email*, since Git needs these to keep track of commit authors:

```
git config --global user.name "John Smith"
git config --global user.email john@example.com
```

To configure Git to use colored output where possible, use:

```
git config --global color.ui auto
```

The text editor that opens when using `git commit` can also be changed. If none of your editor-related environment variables are set ($GIT_EDITOR, $VISUAL, or $EDITOR), the default editor is usually `vi` or `vim`. If you're not familiar with either of these, you should probably change the default to an editor that you know how to use. For example, to change the default editor to `nano`, enter:

```
git config --global core.editor nano
```

TODO: Add instructions for changing the editor on Windows, which is a little different, I think. -mp

Technical details

Git stores the information entered with `git config --global` in the file '`.gitconfig`', located in your home directory. This file can also be modified directly, without using `git config`. The '`.gitconfig`' file generated by the above commands would look like this:

```
[user]
        name = John Smith
        email = john@example.com
[color]
        ui = auto
[core]
        editor = nano
```

Using the `git config` command *without* the `--global` option configures repository-specific settings, which are stored in the file '`.git/config`'. This file is created when a repository is initialized (using `git init`), and by default contains these lines:

```
[core]
        repositoryformatversion = 0
        filemode = true
        bare = false
        logallrefupdates = true
```

However, since different repository-specific options are recommended for different development tasks, it is best to avoid setting any now. Specific recommendations will be mentioned later in this manual.

2.2.2 Downloading remote branches

Organization of remote branches

The main LilyPond repository is organized into *branches* to facilitate development. These are often called *remote* branches to distinguish them from *local* branches you might create yourself (see Section 2.3.3 [Using local branches], page 11).

The `master` branch contains all the source files used to build LilyPond, which includes the program itself (both stable and development releases), the documentation (and its translations), and the website. Generally, the `master` branch is expected to compile successfully.

The `lilypond/translation` branch is a side branch that allows translators to work without needing to worry about compilation problems. Periodically, the Translation Meister (after verifying that it doesn't break compilation), will *merge* this branch back into `master` to incorporate recent translations. Similarly, the `master` branch is usually merged into the `lilypond/translation` branch after significant changes to the English documentation. See Section 4.8 [Translating the documentation], page 52 for details.

LilyPond repository sources

The recommended source for downloading a copy of the main repository is:

```
git://git.sv.gnu.org/lilypond.git
```

However, if your internet router filters out connections using the GIT protocol, or if you experience difficulty connecting via GIT, you can try these other sources:

```
ssh://git.sv.gnu.org/srv/git/lilypond.git
http://git.sv.gnu.org/r/lilypond.git
```

The SSH protocol can only be used if your system is properly set up to use it. Also, the HTTP protocol is slowest, so it should only be used as a last resort.

Downloading individual branches

Once you have initialized an empty Git repository on your system (see [Initializing a repository], page 7), you can download a remote branch into it. Make sure you know which branch you want to start with.

To download the `master` branch, enter the following:

```
git remote add -ft master -m master \
  origin git://git.sv.gnu.org/lilypond.git/
```

To download the `lilypond/translation` branch, enter:

```
git remote add -ft lilypond/translation -m \
  lilypond/translation origin git://git.sv.gnu.org/lilypond.git/
```

The `git remote add` process could take up to ten minutes, depending on the speed of your connection. The output will be something like this:

```
Updating origin
remote: Counting objects: 235967, done.
remote: Compressing objects: 100% (42721/42721), done.
remote: Total 235967 (delta 195098), reused 233311 (delta 192772)
Receiving objects: 100% (235967/235967), 68.37 MiB | 479 KiB/s, done.
Resolving deltas: 100% (195098/195098), done.
From git://git.sv.gnu.org/lilypond
 * [new branch]      master     -> origin/master
From git://git.sv.gnu.org/lilypond
 * [new tag]         flower/1.0.1 -> flower/1.0.1
 * [new tag]         flower/1.0.10 -> flower/1.0.10

 * [new tag]         release/2.9.6 -> release/2.9.6
 * [new tag]         release/2.9.7 -> release/2.9.7
```

When `git remote add` is finished, the remote branch should be downloaded into your repository—though not yet in a form that you can use. In order to browse the source code files, you need to *create* and *checkout* your own local branch. In this case, however, it is easier to have Git create the branch automatically by using the `checkout` command on a non-existent branch. Enter the following:

```
git checkout -b branch origin/branch
```

where *branch* is the name of your tracking branch, either `master` or `lilypond/translation`.

Git will issue some warnings; this is normal:

```
warning: You appear to be on a branch yet to be born.
warning: Forcing checkout of origin/master.
Branch master set up to track remote branch master from origin.
Already on 'master'
```

By now the source files should be accessible—you should be able to edit any files in the '`lilypond-git/`' directory using a text editor of your choice. But don't start just yet! Before editing any source files, learn how to keep your changes organized and prevent problems later—read Section 2.3 [Basic Git procedures], page 10.

Technical Details

The `git remote add` command should add some lines to your local repository's '`.git/config`' file:

```
[remote "origin"]
        url = git://git.sv.gnu.org/lilypond.git/
        fetch = +refs/heads/master:refs/remotes/origin/master
```

Downloading all remote branches

To download all remote branches at once, you can `clone` the entire repository:

```
git clone git://git.sv.gnu.org/lilypond.git
```

Other branches

Most contributors will never need to touch the other branches. If you wish to do so, you will need more familiarity with Git; please see Section 2.7 [Other Git documentation], page 26.

- `dev/XYZ`: These branches are for individual developers. They store code which is not yet stable enough to be added to the `master` branch.

- `stable/XYZ`: The branches are kept for archival reasons.

Another item of interest might be the Grand Unified Builder, our cross-platform building tool. Since it is used by projects as well, it is not stored in our gub repository. For more info, see `http://lilypond.org/gub`. The git location is `http://github.com/janneke/gub`.

2.3 Basic Git procedures

2.3.1 The Git contributor's cycle

Here is a simplified view of the contribution process on Git:

1. Update your local repository by *pulling* the most recent updates from the remote repository.
2. Edit source files within your local repository's *working directory*.
3. *Commit* the changes you've made to a local *branch*.
4. Generate a *patch* to share your changes with the developers.

2.3.2 Pulling and rebasing

When developers push new patches to the `git.sv.gnu.org` repository, your local repository is **not** automatically updated. It is important to keep your repository up-to-date by periodically *pulling* the most recent *commits* from the remote branch. Developers expect patches to be as current as possible, since outdated patches require extra work before they can be used.

Occasionally you may need to rework some of your own modifications to match changes made to the remote branch (see Section 2.4.2 [Resolving conflicts], page 15), and it's considerably easier to rework things incrementally. If you don't update your repository along the way, you may have to spend a lot of time resolving branch conflicts and reconfiguring much of the work you've already done.

Fortunately, Git is able to resolve certain types of branch conflicts automatically with a process called *rebasing*. When rebasing, Git tries to modify your old commits so they appear as new commits (based on the latest updates). For a more involved explanation, see the `git-rebase` man page.

To pull without rebasing (recommended for translators), use the following command:

```
git pull    # recommended for translators
```

If you're tracking the remote `master` branch, you should add the `-r` option (short for `--rebase`) to keep commits on your local branch current:

```
git pull -r # use with caution when translating
```

If you don't edit translated documentation and don't want to type `-r` every time, configure the master branch to rebase by default with this command:

```
git config branch.master.rebase true
```

If pull fails because of a message like

```
error: Your local changes to 'Documentation/learning/tutorial.itely'
would be overwritten by merge.  Aborting.
```

or

```
Documentation/learning/tutorial.itely: needs update
refusing to pull with rebase: your working tree is not up-to-date
```

it means that you have modified some files in you working tree without committing changes (see Section 2.3.4 [Commits and patches], page 12); you can use the `git stash` command to work around this:

```
git stash      # save uncommitted changes
git pull -r    # pull using rebase (translators omit "-r")
git stash pop  # reapply previously saved changes
```

Note that `git stash pop` will try to apply a patch, and this may create a conflict. If this happens, see Section 2.4.2 [Resolving conflicts], page 15.

TODO: I think the next paragraph is confusing. Perhaps prepare the reader for new terms 'committish' and 'head'? -mp

> **Note:** translators and documentation editors, if you have changed committishes in the head of translated files using commits you have not yet pushed to `git.sv.gnu.org`, please do not rebase. If you want to avoid wondering whether you should rebase each time you pull, please always use committishes from master and/or lilypond/translation branch on `git.sv.gnu.org`, which in particular implies that you must push your changes to documentation except committishes updates (possibly after having rebased), then update the committishes and push them.

TODO: when committishes automatic conditional update have been tested and documented, append the following to the warning above: Note that using update-committishes make target generally touches committishes.

Technical details

The `git config` command mentioned above adds the line `rebase = true` to the master branch in your local repository's '`.git/config`' file:

```
[branch "master"]
        remote = origin
        merge = refs/heads/master
        rebase = true
```

2.3.3 Using local branches

Creating and removing branches

Local branches are useful when you're working on several different projects concurrently. To create a new branch, enter:

```
git branch name
```

To delete a branch, enter:

```
git branch -d name
```

Git will ask you for confirmation if it sees that data would be lost by deleting the branch. Use `-D` instead of `-d` to bypass this. Note that you cannot delete a branch if it is currently checked out.

Listing branches and remotes

You can get the exact path or URL of all remote branches by running:

```
git remote -v
```

To list Git branches on your local repositories, run

```
git branch     # list local branches only
git branch -r  # list remote branches
git branch -a  # list all branches
```

Checking out branches

To know the currently checked out branch, i.e. the branch whose source files are present in your working tree, read the first line of the output of

```
git status
```

The currently checked out branch is also marked with an asterisk in the output of `git branch`.

You can check out another branch *`other_branch`*, i.e. check out *`other_branch`* to the working tree, by running

```
git checkout other_branch
```

Note that it is possible to check out another branch while having uncommitted changes, but it is not recommended unless you know what you are doing; it is recommended to run `git status` to check this kind of issue before checking out another branch.

Merging branches

To merge branch *`foo`* into branch *`bar`*, i.e. to "add" all changes made in branch *`foo`* to branch *`bar`*, run

```
git checkout bar
git merge foo
```

If any conflict happens, see Section 2.4.2 [Resolving conflicts], page 15.

There are common usage cases for merging: as a translator, you will often want to merge `master` into `lilypond/translation`; on the other hand, the Translations meister wants to merge `lilypond/translation` into `master` whenever he has checked that `lilypond/translation` builds successfully.

2.3.4 Commits and patches

Understanding commits

Technically, a *commit* is a single point in the history of a branch, but most developers use the term to mean a *commit object*, which stores information about a particular revision. A single commit can record changes to multiple source files, and typically represents one logical set of related changes (such as a bug-fix). You can list the ten most recent commits in your current branch with this command:

```
git log -10 --oneline
```

If you're using an older version of Git and get an 'unrecognized argument' error, use this instead:

```
git log -10 --pretty=oneline --abbrev-commit
```

More interactive lists of the commits on the remote `master` branch are available at `http://git.sv.gnu.org/gitweb/?p=lilypond.git;a=shortlog` and `http://git.sv.gnu.org/cgit/lilypond.git/log/`.

Making commits

Once you have modified some source files in your working directory, you can make a commit with the following procedure:

1. Make sure you've configured Git properly (see [Configuring Git], page 7). Check that your changes meet the requirements described in Section 9.5 [Code style], page 82 and/or Section 4.4 [Documentation policy], page 47. For advanced edits, you may also want to verify that the changes don't break the compilation process.
2. Run the following command:

```
git status
```

to make sure you're on the right branch, and to see which files have been modified, added or removed, etc. You may need to tell Git about any files you've added by running one of these:

```
git add file  # add untracked file individually
git add .     # add all untracked files in current directory
```

After `git add`, run `git status` again to make sure you got everything. You may also need to modify '`GNUmakefile`'.

3. Preview the changes about to be committed (to make sure everything looks right) with:

   ```
   git diff HEAD
   ```

   The `HEAD` argument refers to the most recent commit on the currently checked-out branch.

4. Generate the commit with:

   ```
   git commit -a
   ```

   The `-a` is short for `--all` which includes modified and deleted files, but only those newly created files that have previously been added.

Commit messages

When you run the `git commit -a` command, Git automatically opens the default text editor so you can enter a *commit message*. If you find yourself in a foreign editing environment, you're probably in `vi` or `vim`. If you want to switch to an editor you're more familiar with, quit by typing `:q!` and pressing `<Enter>`. See [Configuring Git], page 7 for instructions on changing the default editor.

In any case, Git will open a text file for your commit message that looks like this:

```
# Please enter the commit message for your changes. Lines starting
# with '#' will be ignored, and an empty message aborts the commit.
# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
# modified:   working.itexi
#
```

Your commit message should begin with a one-line summary describing the change (no more than 50 characters long), and if necessary a blank line followed by several lines giving the details:

```
Doc: add Baerenreiter and Henle solo cello suites

Added comparison of solo cello suite engravings to new essay with
high-res images, fixed cropping on Finale example.
```

Commit messages often start with a short prefix describing the general location of the changes. If a commit affects the documentation in English (or in several languages simultaneously) the commit message should be prefixed with "Doc: ". If the commit affects only one of the translations, the commit message should be prefixed with "Doc-**: ", where ** is the two-letter language code. Commits that affect the website should use "Web: " for English, and "Web-**: " for the other languages. Also, changes to a single file are often prefixed with the name of the file involved. Visit the links listed in [Understanding commits], page 12 for examples.

Making patches

If you want to share your changes with other contributors and developers, you need to generate *patches* from your commits. You should always run `git pull -r` (translators should leave off the `-r`) before doing this to ensure that your patches are as current as possible.

Once you have made one or more commits in your local repository, and pulled the most recent commits from the remote branch, you can generate patches from your local commits with the command:

```
git format-patch origin
```

The `origin` argument refers to the remote tracking branch at `git.sv.gnu.org`. This command generates a separate patch for each commit that's in the current branch but not in the remote branch. Patches are placed in the current working directory and will have names that look something like this:

```
0001-Doc-Fix-typos.patch
0002-Web-Remove-dead-links.patch
```

Send an email (must be less than 64 KB) to `lilypond-devel@gnu.org` briefly explaining your work, with the patch files attached. Translators should send patches to `translations@lilynet.net`. After your patches are reviewed, the developers may push one or more of them to the main repository or discuss them with you.

See also

If your patch includes a significant amount of code, you may want to see Section 9.8 [Adding or modifying features], page 91, especially *Post patch for comments*.

2.4 Advanced Git procedures

> **Note:** This section is not necessary for normal contributors; these commands are presented for information for people interested in learning more about git.

It is possible to work with several branches on the same local Git repository; this is especially useful for translators who may have to deal with both `lilypond/translation` and a stable branch, e.g. `stable/2.12`.

Some Git commands are introduced first, then a workflow with several Git branches of LilyPond source code is presented.

2.4.1 Advanced Git concepts

A bit of Git vocabulary will be explained below. The following is only introductory; for a better understanding of Git concepts, you may wish to read Section 2.7 [Other Git documentation], page 26.

The `git pull origin` command above is just a shortcut for this command:

```
git pull git://git.sv.gnu.org/lilypond.git/ branch:origin/branch
```

where *`branch`* is typically `master` or `lilypond/translation`; if you do not know or remember, see Section 2.2.2 [Downloading remote branches], page 8 to remember which commands you issued or which source code you wanted to get.

A *commit* is a set of changes made to the sources; it also includes the committish of the parent commit, the name and e-mail of the *author* (the person who wrote the changes), the name and

e-mail of the *committer* (the person who brings these changes into the Git repository), and a commit message.

A *committish* is the SHA1 checksum of a commit, a number made of 40 hexadecimal digits, which acts as the internal unique identifier for this commit. To refer to a particular revision, don't use vague references like the (approximative) date, simply copy and paste the committish.

A *branch* is nothing more than a pointer to a particular commit, which is called the *head* of the branch; when referring to a branch, one often acutally thinks about its head and the ancestor commits of the head.

Now we will explain the two last commands you used to get the source code from Git—see [Downloading individual branches], page 8.

```
git remote add -ft branch -m branch \
  origin git://git.sv.gnu.org/lilypond.git/

git checkout -b branch origin/branch
```

The `git remote` has created a branch called `origin/branch` in your local Git repository. As this branch is a copy of the remote branch web from git.sv.gnu.org LilyPond repository, it is called a *remote branch*, and is meant to track the changes on the branch from git.sv.gnu.org: it will be updated every time you run `git pull origin` or `git fetch origin`.

The `git checkout` command has created a branch named `branch`. At the beginning, this branch is identical to `origin/branch`, but it will differ as soon as you make changes, e.g. adding newly translated pages or editing some documentation or code source file. Whenever you pull, you merge the changes from `origin/branch` and `branch` since the last pulling. If you do not have push (i.e. "write") access on git.sv.gnu.org, your `branch` will always differ from `origin/branch`. In this case, remember that other people working like you with the remote branch `branch` of git://git.sv.gnu.org/lilypond.git/ (called `origin/branch` on your local repository) know nothing about your own `branch`: this means that whenever you use a committish or make a patch, others expect you to take the latest commit of `origin/branch` as a reference.

Finally, please remember to read the man page of every Git command you will find in this manual in case you want to discover alternate methods or just understand how it works.

2.4.2 Resolving conflicts

Occasionally an update may result in conflicts – this happens when you and somebody else have modified the same part of the same file and git cannot figure out how to merge the two versions together. When this happens, you must manually merge the two versions.

If you need some documentation to understand and resolve conflicts, see paragraphs *How conflicts are presented* and *How to resolve conflicts* in `git merge` man page.

If all else fails, you can follow the instructions in Section 2.4.3 [Reverting all local changes], page 15. Be aware that this eliminates any changes you have made!

2.4.3 Reverting all local changes

Sometimes git will become hopelessly confused, and you just want to get back to a known, stable state. This command destroys any local changes you have made, but at least you get back to the current online version:

```
git reset --hard origin/master
```

2.4.4 Working with remote branches

Fetching new branches from git.sv.gnu.org

To fetch and check out a new branch named `branch` on git.sv.gnu.org, run from top of the Git repository

```
git config --add remote.origin.fetch \
  +refs/heads/branch:refs/remotes/origin/branch

git checkout --track -b branch origin/branch
```

After this, you can pull *branch* from git.sv.gnu.org with:

```
git pull
```

Note that this command generally fetches all branches you added with `git remote add` (when you initialized the repository) or `git config --add`, i.e. it updates all remote branches from remote `origin`, then it merges the remote branch tracked by the current branch into the current branch. For example, if your current branch is `master`, `origin/master` will be merged into `master`.

Local clones, or having several working trees

If you play with several Git branches, e.g. `master`, `lilypond/translation`, `stable/2.12`), you may want to have one source and build tree for each branch; this is possible with subdirectories of your local Git repository, used as local cloned subrepositories. To create a local clone for the branch named *branch*, run

```
git checkout branch
git clone -lsn . subdir
cd subdir
git reset --hard
```

Note that *subdir* must be a directory name which does not already exist. In *subdir*, you can use all Git commands to browse revisions history, commit and uncommit changes; to update the cloned subrepository with changes made on the main repository, cd into *subdir* and run `git pull`; to send changes made on the subrepository back to the main repository, run `git push` from *subdir*. Note that only one branch (the currently checked out branch) is created in the subrepository by default; it is possible to have several branches in a subrepository and do usual operations (checkout, merge, create, delete...) on these branches, but this possibility is not detailed here.

When you push *branch* from *subdir* to the main repository, and *branch* is checked out in the main repository, you must save uncommitted changes (see `git stash`) and do `git reset --hard` in the main repository in order to apply pushed changes in the working tree of the main repository.

2.4.5 Git log

The commands above don't only bring you the latest version of the sources, but also the full history of revisions (revisons, also called commits, are changes made to the sources), stored in the '`.git`' directory. You can browse this history with

```
git log     # only shows the logs (author, committish and commit message)
git log -p  # also shows diffs
gitk        # shows history graphically
```

> **Note:** The `gitk` command may require a separate `gitk` package, available in the appropriate distribution's repositories.

2.4.6 Applying remote patches

TODO: Explain how to determine if a patch was created with `git format-patch`.

Well-formed git patches created with `git format-patch` should be committed with the following command:

```
git am patch
```

Patches created without `git format-patch` can be applied in two steps. The first step is to apply the patch to the working tree:

```
git apply patch
```

The second step is to commit the changes and give credit to the author of the patch. This can be done with the following command:

```
git commit -a --author="John Smith <john@example.com>"
```

2.4.7 Sending and receiving patches via email

The default `x-diff` MIME type associated with patch files (i.e., files whose name ends in `.patch`) means that the encoding of line endings may be changed from UNIX to DOS format when they are sent as attachments. Attempting to apply such an inadvertently altered patch will cause git to fail with a message about 'whitespace errors'.

The solution to such problems is surprisingly simple—just change the default file extension of patches generated by git to end in `.txt`, for example:

```
git config format.suffix '.patch.txt'
```

This should cause email programs to apply the correct base64 encoding to attached patches.

If you receive a patch with DOS instead of UNIX line-endings, it can be converted back using the `dos2unix` utility.

Lots of useful information on email complications with patches is provided on the Wine wiki at http://wiki.winehq.org/GitWine.

2.4.8 Commit access

Most contributors are not able to commit patches directly to the main repository—only members of the LilyPond development team have *commit access*. If you are a contributor and are interested in joining the development team, contact the Project Manager through the mailing list (lilypond-devel@gnu.org). Generally, only contributors who have already provided a number of patches which have been pushed to the main repository will be considered for membership.

If you have been approved by the Project Manager, use the following procedure to obtain commit access:

1. If you don't already have one, set up a Savannah user account at https://savannah.gnu.org/account/register.php. If your web browser responds with an "untrusted connection" message when you visit the link, follow the steps for including the CAcert root certificate in your browser, given at http://savannah.gnu.org/tls/tutorial/.
2. After registering, if you are not logged in automatically, login at https://savannah.gnu.org/account/login.php—this should take you to your "my" page (https://savannah.gnu.org/my/).
3. Click on the "My Groups" link to access the "My Group Membership" page. From there, find the "Request for Inclusion" box and search for "LilyPond". Among the search results, check the box labeled "GNU LilyPond Music Typesetter" and write a brief (required) message for the Project Manager ("Hey it's me!" should be fine).

   Note that you will not have commit access until the Project Manager activates your membership. Once your membership is activated, LilyPond should appear under the heading "Groups I'm Contributor of" on your "My Group Membership" page.
4. Generate an SSH 'dsa' key pair. Enter the following at the command prompt:

   ```
   ssh-keygen -t dsa
   ```

When prompted for a location to save the key, press <ENTER> to accept the default location ('`~/.ssh/id_dsa`').

Next you are asked to enter an optional passphrase. On most systems, if you use a passphrase, you will likely be prompted for it every time you use `git push` or `git pull`. You may prefer this since it can protect you from your own mistakes (like pushing when you mean to pull), though you may find it tedious to keep re-entering it.

You can change/enable/disable your passphrase at any time with:

```
ssh-keygen -f ~/.ssh/id_dsa -p
```

Note that the GNOME desktop has a feature which stores your passphrase for you for an entire GNOME session. If you use a passphrase to "protect you from yourself", you will want to disable this feature, since you'll only be prompted once. Run the following command, then logout of GNOME and log back in:

```
gconftool-2 --set -t bool \
  /apps/gnome-keyring/daemon-components/ssh false
```

After setting up your passphrase, your private key is saved as '`~/.ssh/id_dsa`' and your public key is saved as '`~/.ssh/id_dsa.pub`'.

5. Register your public SSH 'dsa' key with Savannah. From the "My Account Configuration" page, click on "Edit SSH Keys", then paste the contents of your '`~/.ssh/id_dsa.pub`' file into one of the "Authorized keys" text fields, and click "Update".

   Savannah should respond with something like:

   ```
   Success: Key #1 seen Keys registered
   ```

6. Configure Git to use the SSH protocol (instead of the GIT protocol). From your local Git repository, enter:

   ```
   git config remote.origin.url \
     ssh://user@git.sv.gnu.org/srv/git/lilypond.git
   ```

   where *user* is your username on Savannah.

7. After your membership has been activated and you've configured Git to use SSH, test the connection with:

   ```
   git pull --verbose
   ```

   SSH should issue the following warning:

   ```
   The authenticity of host 'git.sv.gnu.org (140.186.70.72)' can't
   be established.
   RSA key fingerprint is
   80:5a:b0:0c:ec:93:66:29:49:7e:04:2b:fd:ba:2c:d5.
   Are you sure you want to continue connecting (yes/no)?
   ```

   Make sure the RSA key fingerprint displayed matches the one above. If it doesn't, respond "no" and check that you configured Git properly in the previous step. If it does match, respond "yes". SSH should then issue another warning:

   ```
   Warning: Permanently added 'git.sv.gnu.org,140.186.70.72' (RSA) to
   the list of known hosts.
   ```

   The list of known hosts is stored in the file '`~/.ssh/known_hosts`'.

   At this point, you are prompted for your passphrase if you have one, then Git will attempt a pull.

   If `git pull --verbose` fails, you should see error messages like these:

   ```
   Permission denied (publickey).
   fatal: The remote end hung up unexpectedly
   ```

If you get the above error, you may have made a mistake when registering your SSH key at Savannah. If the key is properly registered, you probably just need to wait for the Savannah server to activate it. It usually takes a few minutes for the key to be active after registering it, but if it still doesn't work after an hour, ask for help on the mailing list.

If `git pull --verbose` succeeds, the output will include a 'From' line that shows 'ssh' as the protocol:

```
From ssh://user@git.sv.gnu.org/srv/git/lilypond
```

If the protocol shown is not 'ssh', check that you configured Git properly in the previous step.

8. Test your commit access with a dry run:

```
git push --dry-run --verbose
```

Note that recent versions of Git (Git 1.6.3 or later) will issue a big warning if the above command is used. The simplest solution is to tell Git to push all matching branches by default:

```
git config push.default matching
```

Then `git push` should work as before. For more details, consult the `git push` man page.

Technical details

- On Firefox, to view or remove the CAcert root certificate, go to: Edit > Preferences > Advanced > Encryption > View Certificates > Authorities > Certificate Name > Root CA > CA Cert Signing Authority.
- The `git config` commands above should modify your local repository's '`.git/config`' file. These lines:

```
[remote "origin"]
        url = git://git.sv.gnu.org/lilypond.git/
```

should now be changed to:

```
[remote "origin"]
        url = ssh://user@git.sv.gnu.org/srv/git/lilypond.git
```

where *user* is your login name on Savannah.

- Similarly, the `git config push.default matching` command should add these lines to '`.git/config`':

```
[push]
        default = matching
```

Known issues and warnings

Encryption protocols, including ssh, generally do not permit packet fragmentation to avoid introducing a point of insecurity. This means that the maximum packet size must not exceed the smallest MTU (Maximum Transmission Unit) set in the routers along the path. This smallest MTU is determined by a procedure during call set-up which relies on the transmission over the path of ICMP packets. If any of the routers in the path block ICMP packets this mechanism fails, resulting in the possibility of packets being transmitted which exceed the MTU of one of the routers. If this happens the packet is discarded, causing the ssh session to hang, timeout or terminate with the error message

```
ssh: connect to host <host ip addr> port 22: Bad file number
fatal: The remote end hung up unexpectedly
```

depending on precisely when in the proceedings the first large packet is transmitted. Most routers on the internet have MTU set to 1500, but routers installed in homes to connect via broadband may use a slightly smaller MTU for efficient transmission over ATM. If this problem is encountered a possible work-around is to set the MTU in the local router to 1500.

2.5 Git on Windows

TODO: Decide what to do with this... Pare it down? Move paragraphs next to analogous Unix instructions? -mp

2.5.1 Background to nomenclature

Git is a system for tracking the changes made to source files by a distributed set of editors. It is designed to work without a master repository, but we have chosen to have a master respository for LilyPond files. Editors hold a local copy of the master repository together with any changes they have made locally. Local changes are held in a local 'branch', of which there may be several, but these instructions assume you are using just one. The files visible in the local repository always correspond to those on the currently 'checked out' local branch.

Files are edited on a local branch, and in that state the changes are said to be 'unstaged'. When editing is complete, the changes are moved to being 'staged for commit', and finally the changes are 'committed' to the local branch. Once committed, the changes (called a 'commit') are given a unique 40-digit hexadecimal reference number called the 'Committish' or 'SHA1 ID' which identifies the commit to Git. Such committed changes can be sent to the master repository by 'pushing' them (if you have write permission) or by sending them by email to someone who has, either as a complete file or as a 'diff' or 'patch' (which send just the differences from the master repository).

2.5.2 Installing git

Obtain Git from http://code.google.com/p/msysgit/downloads/list (note, not msysGit, which is for Git developers and not PortableGit, which is not a full git installation) and install it.

Note that most users will not need to install SSH. That is not required until you have been granted direct push permissions to the master git repository.

Start Git by clicking on the desktop icon. This will bring up a command line bash shell. This may be unfamiliar to Windows users. If so, follow these instructions carefully. Commands are entered at a $ prompt and are terminated by keying a newline.

2.5.3 Initialising Git

Decide where you wish to place your local Git repository, creating the folders in Windows as necessary. Here we call the folder to contain the repository `[path]/Git`, but if you intend using Git for other projects a directory name like `lilypond-git` might be better. You will need to have space for around 100Mbytes.

Start the Git bash shell by clicking on the desk-top icon installed with Git and type

```
cd [path]/Git
```

to position the shell at your new Git repository.

Note: if [path] contains folders with names containing spaces use

```
cd "[path]/Git"
```

Then type

```
git init
```

to initialize your Git repository.

Then type (all on one line; the shell will wrap automatically)

```
git remote add -ft master origin git://git.sv.gnu.org/lilypond.git
```

to download the lilypond master files.

> **Note:** Be patient! Even on a broadband connection this can take 10 minutes or more. Wait for lots of [new tag] messages and the $ prompt.

We now need to generate a local copy of the downloaded files in a new local branch. Your local branch needs to have a name. It is usual to call it 'master' and we shall do that here.

To do this, type

```
git checkout -b master origin/master
```

This creates a second branch called 'master'. You will see two warnings (ignore these), and a message advising you that your local branch 'master' has been set up to track the remote branch. You now have two branches, a local branch called 'master', and a tracking branch called 'origin/master', which is a shortened form of 'remotes/origin/master'.

Return to Windows Explorer and look in your Git repository. You should see lots of folders. For example, the LilyPond documentation can be found in [path]/Git/Documentation/.

The Git bash shell is terminated by typing `exit` or by clicking on the usual Windows close-window widget.

2.5.4 Git GUI

Almost all subsequent work will use the Git Graphical User Interface, which avoids having to type command line commands. To start Git GUI first start the Git bash shell by clicking on the desktop icon, and type

```
cd [path]/Git
git gui
```

The Git GUI will open in a new window. It contains four panels and 7 pull-down menus. At this stage do not use any of the commands under Branch, Commit, Merge or Remote. These will be explained later.

The top panel on the left contains the names of files which you are in the process of editing (Unstaged Changes), and the lower panel on the left contains the names of files you have finished editing and have staged ready for committing (Staged Changes). At present, these panels will be empty as you have not yet made any changes to any file. After a file has been edited and saved the top panel on the right will display the differences between the edited file selected in one of the panels on the left and the last version committed on the current branch.

The panel at bottom right is used to enter a descriptive message about the change before committing it.

The Git GUI is terminated by entering CNTL-Q while it is the active window or by clicking on the usual Windows close-window widget.

2.5.5 Personalising your local git repository

Open the Git GUI, click on

```
Edit -> Options
```

and enter your name and email address in the left-hand (Git Repository) panel. Leave everything else unchanged and save it.

Note that Windows users must leave the default setting for line endings unchanged. All files in a git repository must have lines terminated by just a LF, as this is required for Merge to work, but Windows files are terminated by CRLF by default. The git default setting causes the line endings of files in a Windows git repository to be flipped automatically between LF and CRLF as required. This enables files to be edited by any Windows editor without causing problems in the git repository.

2.5.6 Checking out a branch

At this stage you have two branches in your local repository, both identical. To see them click on

```
Branch -> Checkout
```

You should have one local branch called 'master' and one tracking branch called 'origin/master'. The latter is your local copy of the 'remotes/origin/master' branch in the master LilyPond repository. The local 'master' branch is where you will make your local changes.

When a particular branch is selected, i.e., checked out, the files visible in your repository are changed to reflect the state of the files on that branch.

2.5.7 Updating files from 'remote/origin/master'

Before starting the editing of a file, ensure your local repository contains the latest version of the files in the remote repository by first clicking

```
Remote -> Fetch from -> origin
```

in the Git GUI.

This will place the latest version of every file, including all the changes made by others, into the 'origin/master' branch of the tracking branches in your git repository. You can see these files by checking out this branch, but you must *never* edit any files while this branch is checked out. Check out your local 'master' branch again.

You then need to merge these fetched files into your local 'master' branch by clicking on

```
Merge -> Local Merge
```

and if necessary select the local 'master' branch.

Note that a merge cannot be completed if you have made any local changes which have not yet been committed.

This merge will update all the files in the 'master' branch to reflect the current state of the 'origin/master' branch. If any of the changes conflict with changes you have made yourself recently you will be notified of the conflict (see below).

2.5.8 Editing files

First ensure your 'master' branch is checked out, then simply edit the files in your local Git repository with your favourite editor and save them back there. If any file contains non-ASCII characters ensure you save it in UTF-8 format. Git will detect any changes whenever you restart Git GUI and the file names will then be listed in the Unstaged Changes panel. Or you can click the Rescan button to refresh the panel contents at any time. You may break off and resume editing any time.

The changes you have made may be displayed in diff form in the top right-hand panel of Git GUI by clicking on the file name shown in one of the left panels.

When your editing is complete, move the files from being Unstaged to Staged by clicking the document symbol to the left of each name. If you change your mind it can be moved back by clicking on the ticked box to the left of the name.

Finally the changes you have made may be committed to your 'master' branch by entering a brief message in the Commit Message box and clicking the Commit button.

If you wish to amend your changes after a commit has been made, the original version and the changes you made in that commit may be recovered by selecting

```
Commit -> Amend Last Commit
```

or by checking the Amend Last Commit radio button at bottom right. This will return the changes to the Staged state, so further editing made be carried out within that commit. This must only be done *before* the changes have been Pushed or sent to your mentor for Pushing - after that it is too late and corrections have to be made as a separate commit.

2.5.9 Sending changes to 'remotes/origin/master'

If you do not have write access to 'remotes/origin/master' you will need to send your changes by email to someone who does.

First you need to create a diff or patch file containing your changes. To create this, the file must first be committed. Then terminate the Git GUI. In the git bash shell first cd to your Git repository with

```
cd [path]/Git
```

if necessary, then produce the patch with

```
git format-patch origin
```

This will create a patch file for all the locally committed files which differ from 'origin/master'. The patch file can be found in [path]/Git and will have a name formed from the commit message.

2.5.10 Resolving merge conflicts

As soon as you have committed a changed file your local `master` branch has diverged from `origin/master`, and will remain diverged until your changes have been committed in `remotes/origin/master` and Fetched back into your `origin/master` branch. Similarly, if a new commit has been made to `remotes/origin/master` by someone else and Fetched, your local `master` branch is divergent. You can detect a divergent branch by clicking on

```
Repository -> Visualise all branch history
```

This opens up a very useful new window called 'gitk'. Use this to browse all the commits made by yourself and others.

If the diagram at top left of the resulting window does not show your `master` tag on the same node as the `remotes/origin/master` tag your branch has diverged from `origin/master`. This is quite normal if files you have modified yourself have not yet been Pushed to `remotes/origin/master` and Fetched, or if files modified and committed by others have been Fetched since you last Merged `origin/master` into your local `master` branch.

If a file being merged from `origin/master` differs from one you have modified in a way that cannot be resolved automatically by git, Merge will report a Conflict which you must resolve by editing the file to create the version you wish to keep.

This could happen if the person updating `remotes/origin/master` for you has added some changes of his own before committing your changes to `remotes/origin/master`, or if someone else has changed the same file since you last fetched the file from `remotes/origin/master`.

Open the file in your editor and look for sections which are delimited with ...

[to be completed when I next have a merge conflict to be sure I give the right instructions -td]

2.5.11 Other actions

The instructions above describe the simplest way of using git on Windows. Other git facilities which may usefully supplement these include

- Using multiple local branches (Create, Rename, Delete)
- Resetting branches
- Cherry-picking commits
- Pushing commits to remote/origin/master
- Using gitk to review history

Once familiarity with using git on Windows has been gained the standard git manuals can be used to learn about these.

2.6 Repository directory structure

```
Prebuilt Documentation and packages are available from:

    http://www.lilypond.org

LilyPond development is hosted at:

    http://savannah.gnu.org/projects/lilypond

Here is a simple explanation of the directory layout for
LilyPond's source files.


.                                                 Toplevel READMEs, ChangeLog,
|                          build bootstrapping, patches
|                          for third party programs
|
|-- Documentation/       Top sources for manuals
|   |
|   |
|   |   INDIVIDUAL CHAPTERS FOR EACH MANUAL:
|   |
|   |-- contributor/     Contributor's Guide
|   |-- essay/           Essay on automated music engraving
|   |-- extending/       Extending
|   |-- learning/        Learning Manual
|   |-- notation/        Notation Reference
|   |-- usage/           Usage
|   |-- web/             The website
|   |   `-- ly-examples/ .ly files for the "Examples" page
|   |
|   |
|   |   TRANSLATED MANUALS:
|   |     Each language's directory can contain...
|   |       1) translated versions of:
|   |          * top sources for manuals
|   |          * individual chapters for each manual
|   |       2) a texidocs/ directory for snippet translations
|   |
|   |-- de/              German
|   |-- es/              Spanish
|   |-- fr/              French
|   |-- hu/              Hungarian
|   |-- it/              Italian
|   |-- ja/              Japanese
|   |-- nl/              Dutch
|   |
|   |
|   |   MISCELLANEOUS DOC STUFF:
|   |
|   |-- css/             CSS files for HTML docs
```

```
|   |-- included/        .ly files used in the manuals
|   |-- logo/            Web logo and "note" icon
|   |-- misc/            Old announcements, ChangeLogs and NEWS
|   |-- pictures/        Images used (eps/jpg/png/svg)
|   |   `-- pdf/         (pdf)
|   |-- po/              Translated build/maintenance scripts
|   |-- snippets/        Auto-generated .ly snippets (from the LSR)
|   |   `-- new/         Snippets too new for the LSR
|   `-- topdocs/         AUTHORS, INSTALL, README
|
|
|   C++ SOURCES:
|
|-- flower/              A simple C++ library
|-- lily/                C++ sources for the LilyPond binary
|
|
|   LIBRARIES:
|
|-- ly/                  .ly \include files
|-- mf/                  MetaFont sources for Emmentaler fonts
|-- ps/                  PostScript library files
|-- scm/                 Scheme sources for LilyPond and subroutine files
|-- tex/                 TeX and texinfo library files
|
|
|   SCRIPTS:
|
|-- python/              Python modules, MIDI module
|   `-- auxiliar/        Python modules for build/maintenance
|-- scripts/             End-user scripts (--> lilypond/usr/bin/)
|   |-- auxiliar/        Maintenance and non-essential build scripts
|   `-- build/           Essential build scripts
|
|
|   BUILD PROCESS:
|   (also see SCRIPTS section above)
|
|-- make/                Specific make subroutine files
|-- stepmake/            Generic make subroutine files
|
|
|   REGRESSION TESTS:
|
|-- input/
|   `-- regression/      .ly regression tests
|       |-- abc2ly/      .abc regression tests
|       `-- musicxml/    .xml and .itexi regression tests
|
|
|   MISCELLANEOUS:
|
```

```
|-- elisp/                Emacs LilyPond mode and syntax coloring
|-- vim/                  Vi(M) LilyPond mode and syntax coloring
`-- po/                   Translations for binaries and end-user scripts
```

2.7 Other Git documentation

- Official git man pages: http://www.kernel.org/pub/software/scm/git/docs/
- More in-depth tutorials: http://git-scm.com/documentation
- Book about git: Pro Git

3 Compiling

This chapter describes the process of compiling the LilyPond program from source files.

3.1 Overview of compiling

Compiling LilyPond from source is an involved process, and is only recommended for developers and packagers. Typical program users are instead encouraged to obtain the program from a package manager (on Unix) or by downloading a precompiled binary configured for a specific operating system. Pre-compiled binaries are available on the Section "Download" in *General Information* page.

Compiling LilyPond from source is necessary if you want to build, install, or test your own version of the program.

A successful compile can also be used to generate and install the documentation, incorporating any changes you may have made. However, a successful compile is not a requirement for generating the documentation. The documentation can be built using a Git repository in conjunction with a locally installed copy of the program. For more information, see [Building documentation without compiling], page 34.

Attempts to compile LilyPond natively on Windows have been unsuccessful, though a workaround is available (see Section 3.9 [Using a Virtual Machine to Compile LilyPond], page 37).

3.2 Requirements

3.2.1 Requirements for running LilyPond

Running LilyPond requires proper installation of the following software:

- DejaVu fonts (normally installed by default)
- FontConfig (2.4.0 or newer)
- Freetype (2.1.10 or newer)
- Ghostscript (8.60 or newer)
- Guile (1.8.2 or newer)
- Pango (1.12 or newer)
- Python (2.4 or newer)

International fonts are required to create music with international text or lyrics.

3.2.2 Requirements for compiling LilyPond

Below is a full list of packages needed to build LilyPond. However, for most common distributions there is an easy way of installing most all build dependencies in one go:

Distribution	**Command**
Debian, Ubuntu	`sudo apt-get build-dep lilypond`
Fedora, RHEL	`sudo yum-builddep lilypond`
openSUSE, SLED	`sudo zypper --build-deps-only source-install lilypond`

- Everything listed in Section 3.2.1 [Requirements for running LilyPond], page 27
- Development packages for the above items (which should include header files and libraries).
  Red Hat Fedora:

```
guile-devel-version
fontconfig-devel-version
freetype-devel-version
pango-devel-version
python-devel-version
```

Debian GNU/Linux:

```
guile-version-dev
libfontconfig1-dev
libfreetype6-dev
libpango1.0-dev
pythonversion-dev
```

- Flex
- FontForge (20060125 or newer)
- GNU Bison
- GNU Compiler Collection (3.4 or newer, 4.x recommended)
- GNU gettext (0.17 or newer)
- GNU Make (3.78 or newer)
- MetaFont (mf-nowin, mf, mfw or mfont binaries), usually packaged with TEX.
- MetaPost (mpost binary), usually packaged with TEX.
- Perl
- Texinfo (4.11 or newer)
- Type 1 utilities (1.33 or newer recommended)

3.2.3 Requirements for building documentation

You can view the documentation online at `http://www.lilypond.org/doc/`, but you can also build it locally. This process requires some additional tools and packages:

- Everything listed in Section 3.2.2 [Requirements for compiling LilyPond], page 27
- ImageMagick
- Netpbm
- rsync
- Texi2HTML (1.82)
- International fonts

  Red Hat Fedora:

```
fonts-arabic
fonts-hebrew
fonts-ja
fonts-xorg-truetype
taipeifonts
ttfonts-ja
ttfonts-zh_CN
```

  Debian GNU/Linux:

```
emacs-intl-fonts
ttf-kochi-gothic
ttf-kochi-mincho
xfonts-bolkhov-75dpi
xfonts-cronyx-75dpi
xfonts-cronyx-100dpi
xfonts-intl-.*
```

3.3 Getting the source code

Downloading the Git repository

In general, developers compile LilyPond from within a local Git repository. Setting up a local Git repository is explained in Section "Starting with Git" in *Contributor's Guide*.

Downloading a source tarball

Packagers are encouraged to use source tarballs for compiling.

The tarball for the latest stable release is available on the Section "Source" in *General Information* page.

The latest source code snapshot is also available as a tarball from the GNU Savannah Git server.

All tagged releases (including legacy stable versions and the most recent development release) are available here:

`http://download.linuxaudio.org/lilypond/source/`

Download the tarball to your '`~/src/`' directory, or some other appropriate place.

> **Note:** Be careful where you unpack the tarball! Any subdirectories of the current folder named '`lilypond/`' or '`lilypond-x.y.z/`' (where *x.y.z* is the release number) will be overwritten if there is a name clash with the tarball.

Unpack the tarball with this command:

```
tar -xzf lilypond-x.y.z.tar.gz
```

This creates a subdirectory within the current directory called '`lilypond-x.y.z/`'. Once unpacked, the source files occupy about 40 MB of disk space.

Windows users wanting to look at the source code may have to download and install the free-software 7zip archiver to extract the tarball.

3.4 Configuring `make`

3.4.1 Running `./autogen.sh`

After you unpack the tarball (or download the Git repository), the contents of your top source directory should be similar to the current source tree listed at `http://git.sv.gnu.org/gitweb/?p=lilypond.git;a=tree`.

Next, you need to create the generated files; enter the following command from your top source directory:

```
./autogen.sh
```

This will:

1. generate a number of files and directories to aid configuration, such as '`configure`', '`README.txt`', etc.
2. automatically run the `./configure` command.

3.4.2 Running `./configure`

Configuration options

The `./configure` command (generated by `./autogen.sh`) provides many options for configuring `make`. To see them all, run:

```
./configure --help
```

Checking build dependencies

When `./configure` is run without any arguments, it will check to make sure your system has everything required for compilation. This is done automatically when `./autogen.sh` is run. If any build dependency is missing, `./configure` will return with:

```
ERROR: Please install required programs:  foo
```

The following message is issued if you are missing programs that are only needed for building the documentation:

```
WARNING: Please consider installing optional programs:  bar
```

If you intend to build the documentation locally, you will need to install or update these programs accordingly.

> **Note:** `./configure` may fail to issue warnings for certain documentation build requirements that are not met. If you experience problems when building the documentation, you may need to do a manual check of Section 3.2.3 [Requirements for building documentation], page 28.

Configuring target directories

If you intend to use your local build to install a local copy of the program, you will probably want to configure the installation directory. Here are the relevant lines taken from the output of `./configure --help`:

> By default, '`make install`' will install all the files in '`/usr/local/bin`', '`/usr/local/lib`' etc. You can specify an installation prefix other than '`/usr/local`' using '`--prefix`', for instance '`--prefix=$HOME`'.

A typical installation prefix is '`$HOME/usr`':

```
./configure --prefix=$HOME/usr
```

Note that if you plan to install a local build on a system where you do not have root privileges, you will need to do something like this anyway—`make install` will only succeed if the installation prefix points to a directory where you have write permission (such as your home directory). The installation directory will be automatically created if necessary.

The location of the `lilypond` command installed by this process will be '*prefix*`/bin/lilypond`'; you may want to add '*prefix*`/bin/`' to your `$PATH` if it is not already included.

It is also possible to specify separate installation directories for different types of program files. See the full output of `./configure --help` for more information.

If you encounter any problems, please see Section 3.7 [Problems], page 35.

Making an out-of-tree build

It is possible to compile LilyPond in a build tree different from the source tree, using the '`--srcdir`' option of `configure`. Note that in some cases you may need to remove the output of a previous `configure` command by running `make distclean` in the main source directory before configuring the out-of-tree build:

```
make distclean
mkdir lily-build && cd lily-build
sourcedir/configure --srcdir=sourcedir
```

3.5 Compiling LilyPond

3.5.1 Using `make`

LilyPond is compiled with the `make` command. Assuming `make` is configured properly, you can simply run:

```
make
```

'`make`' is short for '`make all`'. To view a list of `make` targets, run:

```
make help
```

TODO: Describe what `make` actually does.

3.5.2 Saving time with the '`-j`' option

If your system has multiple CPUs, you can speed up compilation by adding '`-jX`' to the `make` command, where '*X*' is one more than the number of cores you have. For example, a typical Core2Duo machine would use:

```
make -j3
```

If you get errors using the '`-j`' option, and '`make`' succeeds without it, try lowering the *X* value.

Because multiple jobs run in parallel when '`-j`' is used, it can be difficult to determine the source of an error when one occurs. In that case, running '`make`' without the '`-j`' is advised.

3.5.3 Compiling for multiple platforms

If you want to build multiple versions of LilyPond with different configuration settings, you can use the `--enable-config=`*CONF* option of `configure`. You should use `make conf=`*CONF* to generate the output in '`out-`*CONF*'. For example, suppose you want to build with and without profiling, then use the following for the normal build

```
./configure --prefix=$HOME/usr/ --enable-checking
make
```

and for the profiling version, specify a different configuration

```
./configure --prefix=$HOME/usr/ --enable-profiling \
  --enable-config=prof --disable-checking
make conf=prof
```

If you wish to install a copy of the build with profiling, don't forget to use `conf=`*CONF* when issuing `make install`:

```
make conf=prof install
```

See also

Section 3.6.1 [Installing LilyPond from a local build], page 31

3.5.4 Useful `make` variables

If a less verbose build output if desired, the variable `QUIET_BUILD` may be set to `1` on `make` command line, or in '`local.make`' at top of the build tree.

3.6 Post-compilation options

3.6.1 Installing LilyPond from a local build

If you configured `make` to install your local build in a directory where you normally have write permission (such as your home directory), and you have compiled LilyPond by running `make`, you can install the program in your target directory by running:

```
make install
```

If instead, your installation directory is not one that you can normally write to (such as the default '`/usr/local/`', which typically is only writeable by the superuser), you will need to temporarily become the superuser when running `make install`:

```
sudo make install
```

or...

```
su -c 'make install'
```

If you don't have superuser privileges, then you need to configure the installation directory to one that you can write to, and then re-install. See [Configuring target directories], page 30.

3.6.2 Generating documentation

Documentation editor's edit/compile cycle

- Initial documentation build:

```
make [-jX]
make [-jX CPU_COUNT=X] doc  ## can take an hour or more
```

- Edit/compile cycle:

```
## edit source files, then...

make [-jX]                  ## needed if editing outside
                            ##   Documentation/, but useful anyway
                            ##   for finding Texinfo errors.
touch Documentation/*te??   ## bug workaround
make [-jX CPU_COUNT=X] doc  ## usually faster than initial build.
```

- Reset:

```
make doc-clean              ## use only as a last resort.
```

Building documentation

After a successful compile (using `make`), the documentation can be built by issuing:

```
make doc
```

The first time you run `make doc`, the process can easily take an hour or more. After that, `make doc` only makes changes to the pre-built documentation where needed, so it may only take a minute or two to test changes if the documentation is already built.

If `make doc` succeeds, the HTML documentation tree is available in '`out-www/offline-root/`', and can be browsed locally. Various portions of the documentation can be found by looking in '`out/`' and '`out-www`' subdirectories in other places in the source tree, but these are only *portions* of the docs. Please do not complain about anything which is broken in those places; the only complete set of documentation is in '`out-www/offline-root/`' from the top of the source tree.

Compilation of documentation in Info format with images can be done separately by issuing:

```
make info
```

Known issues and warnings

If source files have changed since the last documentation build, output files that need to be rebuilt are normally rebuilt, even if you do not run `make doc-clean` first. However, build dependencies in the documentation are so complex that some newly-edited files may not be rebuilt as they should be; a workaround is to `touch` the top source file for any manual you've edited. For example, if you make changes to a file in '`notation/`', do:

```
touch Documentation/notation.tely
```

The top sources possibly affected by this are:

```
Documentation/extend.texi
Documentation/changes.tely
Documentation/contributor.texi
Documentation/essay.tely
Documentation/extending.tely
Documentation/learning.tely
Documentation/notation.tely
Documentation/snippets.tely
Documentation/usage.tely
Documentation/web.texi
```

You can `touch` all of them at once with:

```
touch Documentation/*te??
```

However, this will rebuild all of the manuals indiscriminately—it is more efficient to `touch` only the affected files.

Saving time with `CPU_COUNT`

The most time consuming task for building the documentation is running LilyPond to build images of music, and there cannot be several simultaneously running `lilypond-book` instances, so the '`-j`' `make` option does not significantly speed up the build process. To help speed it up, the makefile variable '`CPU_COUNT`' may be set in '`local.make`' or on the command line to the number of `.ly` files that LilyPond should process simultaneously, e.g. on a bi-processor or dual core machine:

```
make -j3 CPU_COUNT=3 doc
```

The recommended value of '`CPU_COUNT`' is one plus the number of cores or processors, but it is advisable to set it to a smaller value unless your system has enough RAM to run that many simultaneous LilyPond instances. Also, values for the '`-j`' option that pose problems with '`make`' are less likely to pose problems with '`make doc`' (this applies to both '`-j`' and '`CPU_COUNT`'). For example, with a quad-core processor, it is possible for '`make -j5 CPU_COUNT=5 doc`' to work consistently even if '`make -j5`' rarely succeeds.

AJAX search

To build the documentation with interactive searching, use:

```
make doc AJAX_SEARCH=1
```

This requires PHP, and you must view the docs via a http connection (you cannot view them on your local filesystem).

> **Note:** Due to potential security or load issues, this option is not enabled in the official documentation builds. Enable at your own risk.

Installing documentation

The HTML, PDF and if available Info files can be installed into the standard documentation path by issuing

```
make install-doc
```

This also installs Info documentation with images if the installation prefix is properly set; otherwise, instructions to complete proper installation of Info documentation are printed on standard output.

To install the Info documentation separately, run:

```
make install-info
```

Note that to get the images in Info documentation, `install-doc` target creates symbolic links to HTML and PDF installed documentation tree in '*prefix*`/share/info`', in order to save disk space, whereas `install-info` copies images in '*prefix*`/share/info`' subdirectories.

It is possible to build a documentation tree in '`out-www/online-root/`', with special processing, so it can be used on a website with content negotiation for automatic language selection; this can be achieved by issuing

```
make WEB_TARGETS=online doc
```

and both 'offline' and 'online' targets can be generated by issuing

```
make WEB_TARGETS="offline online" doc
```

Several targets are available to clean the documentation build and help with maintaining documentation; an overview of these targets is available with

```
make help
```

from every directory in the build tree. Most targets for documentation maintenance are available from '`Documentation/`'; for more information, see Section "Documentation work" in *Contributor's Guide*.

The makefile variable `QUIET_BUILD` may be set to `1` for a less verbose build output, just like for building the programs.

Building documentation without compiling

The documentation can be built locally without compiling LilyPond binary, if LilyPond is already installed on your system.

From a fresh Git checkout, do

```
./autogen.sh   # ignore any warning messages
cp GNUmakefile.in GNUmakefile
make -C scripts && make -C python
nice make LILYPOND_EXTERNAL_BINARY=/path/to/bin/lilypond doc
```

Please note that this may break sometimes – for example, if a new feature is added with a test file in input/regression, even the latest development release of LilyPond will fail to build the docs.

You may build the manual without building all the '`input/*`' stuff (i.e. mostly regression tests): change directory, for example to '`Documentation/`', issue `make doc`, which will build documentation in a subdirectory '`out-www`' from the source files in current directory. In this case, if you also want to browse the documentation in its post-processed form, change back to top directory and issue

```
make out=www WWW-post
```

Known issues and warnings

You may also need to create a script for `pngtopnm` and `pnmtopng`. On GNU/Linux, I use this:

```
export LD_LIBRARY_PATH=/usr/lib
exec /usr/bin/pngtopnm "$@"
```

On MacOS X with fink, I use this:

```
export DYLD_LIBRARY_PATH=/sw/lib
exec /sw/bin/pngtopnm "$@"
```

On MacOS X with macports, you should use this:

```
export DYLD_FALLBACK_LIBRARY_PATH=/opt/local/lib
exec /opt/local/bin/pngtopnm "$@"
```

3.6.3 Testing LilyPond binary

LilyPond comes with an extensive suite that exercises the entire program. This suite can be used to test that the binary has been built correctly.

The test suite can be executed with:

```
make test
```

If the test suite completes successfully, the LilyPond binary has been verified.

More information on the regression test suite is found at Section "Regression tests" in *Contributor's Guide*.

3.7 Problems

For help and questions use `lilypond-user@gnu.org`. Send bug reports to `bug-lilypond@gnu.org`.

Bugs that are not fault of LilyPond are documented here.

Bison 1.875

There is a bug in bison-1.875: compilation fails with "parse error before 'goto'" in line 4922 due to a bug in bison. To fix, please recompile bison 1.875 with the following fix

```
$ cd lily; make out/parser.cc
$ vi +4919 out/parser.cc
# append a semicolon to the line containing "__attribute__ ((__unused__))
# save
$ make
```

Compiling on MacOS X

Here are special instructions for compiling under MacOS X. These instructions assume that dependencies are installed using MacPorts. The instructions have been tested using OS X 10.5 (Leopard).

First, install the relevant dependencies using MacPorts.

Next, add the following to your relevant shell initialization files. This is `~/.profile` by default. You should create this file if it does not exist.

```
export PATH=/opt/local/bin:/opt/local/sbin:$PATH
export DYLD_FALLBACK_LIBRARY_PATH=/opt/local/lib:$DYLD_FALLBACK_LIBRARY_PATH
```

Now you must edit the generated `config.make` file. Change

```
FLEXLEXER_FILE = /usr/include/FlexLexer.h
```

to:

```
FLEXLEXER_FILE = /opt/local/include/FlexLexer.h
```

At this point, you should verify that you have the appropriate fonts installed with your ghostscript installation. Check `ls /opt/local/share/ghostscript/fonts` for: 'c0590*' files (.pfb, .pfb and .afm). If you don't have them, run the following commands to grab them from the ghostscript SVN server and install them in the appropriate location:

```
svn export http://svn.ghostscript.com/ghostscript/tags/urw-fonts-1.0.7pre44/
sudo mv urw-fonts-1.0.7pre44/* /opt/local/share/ghostscript/fonts/
rm -rf urw-fonts-1.07pre44
```

Now run the `./configure` script. To avoid complications with automatic font detection, add

```
--with-ncsb-dir=/opt/local/share/ghostscript/fonts
```

Solaris

Solaris7, ./configure

'`./configure`' needs a POSIX compliant shell. On Solaris7, '`/bin/sh`' is not yet POSIX compliant, but '`/bin/ksh`' or bash is. Run configure like

```
CONFIG_SHELL=/bin/ksh ksh -c ./configure
```

or

```
CONFIG_SHELL=/bin/bash bash -c ./configure
```

FreeBSD

To use system fonts, dejaview must be installed. With the default port, the fonts are installed in '`usr/X11R6/lib/X11/fonts/dejavu`'.

Open the file '`$LILYPONDBASE/usr/etc/fonts/local.conf`' and add the following line just after the `<fontconfig>` line. (Adjust as necessary for your hierarchy.)

```
<dir>/usr/X11R6/lib/X11/fonts</dir>
```

International fonts

On Mac OS X, all fonts are installed by default. However, finding all system fonts requires a bit of configuration; see this post on the `lilypond-user` mailing list.

On Linux, international fonts are installed by different means on every distribution. We cannot list the exact commands or packages that are necessary, as each distribution is different, and the exact package names within each distribution changes. Here are some hints, though:

```
Red Hat Fedora

    taipeifonts fonts-xorg-truetype ttfonts-ja fonts-arabic \
         ttfonts-zh_CN fonts-ja fonts-hebrew

Debian GNU/Linux

   apt-get install emacs-intl-fonts xfonts-intl-.* \
        ttf-kochi-gothic ttf-kochi-mincho \
        xfonts-bolkhov-75dpi xfonts-cronyx-100dpi xfonts-cronyx-75dpi
```

Using lilypond python libraries

If you want to use lilypond's python libraries (either running certain build scripts manually, or using them in other programs), set `PYTHONPATH` to '`python/out`' in your build directory, or '`.../usr/lib/lilypond/current/python`' in the installation directory structure.

3.8 Concurrent stable and development versions

It can be useful to have both the stable and the development versions of Lilypond available at once. One way to do this on GNU/Linux is to install the stable version using the precompiled binary, and run the development version from the source tree. After running `make all` from the top directory of the Lilypond source files, there will be a binary called `lilypond` in the `out` directory:

```
<path to>/lilypond/out/bin/lilypond
```

This binary can be run without actually doing the `make install` command. The advantage to this is that you can have all of the latest changes available after pulling from git and running `make all`, without having to uninstall the old version and reinstall the new.

So, to use the stable version, install it as usual and use the normal commands:

```
lilypond foobar.ly
```

To use the development version, create a link to the binary in the source tree by saving the following line in a file somewhere in your `$PATH`:

```
exec <path to>/lilypond/out/bin/lilypond "$@"
```

Save it as `Lilypond` (with a capital L to distinguish it from the stable `lilypond`), and make it executable:

```
chmod +x Lilypond
```

Then you can invoke the development version this way:

```
Lilypond foobar.ly
```

TODO: ADD

- other compilation tricks for developers

3.9 Using a Virtual Machine to Compile LilyPond

TODO: rewrite for lily-git.tcl !!! do before GOP! -gp

Since it is not possible to compile Lilypond on Windows, some developers may find it useful to install a GNU/Linux virtual machine. A disk image with a special remix of **Ubuntu** has been created for this purpose. It has all of the Lilypond build dependencies in place, so that once installed, it is ready to compile both Lilypond and the Documentation. The `lilybuntu` remix is available for download here:

`http://files.lilynet.net/lilybuntu.iso`

We do not necessarily recommend any one virtualization tool, however the `lilybuntu` remix is known to work well on Sun VirtualBox, which is a free download. Consult your virtualization software's documentation for instructions on setting up the software and for general instructions on installing a virtual machine.

Steps to setting up `lilybuntu` in a virtual machine:

1. Download the `lilybuntu` disk image.
2. Install `lilybuntu`. You will use the `.iso` file as the boot disk. It should not be necessary to burn it to a DVD, but consult the documentation for your virtualization software for specific instructions. If possible, use at least the recommended amount of RAM for the virtual machine (384 MB on VirtualBox), and use a dynamically expanding virtual hard drive. A virtual hard drive with 6 GB will be enough to compile LilyPond, but if you intend to build the docs and run the regression tests the virtual hard drive should be at least 10 GB. The Ubuntu installation should be straightforward, although in the partitioning stage do not be afraid to select "use entire disk," since this is only your **virtual disk** and not your machine's actual hard drive.
3. After installation is complete, restart the virtual machine. If you are using **VirtualBox**, you may wish to install the "Guest Additions", which while not essential for compiling `Lilypond` will allow you to use the virtual machine in full screen, Seamless mode (also known as Unity mode on other virtualization platforms) and allow you to share clipboards between the physical and virtual machine. From the `Devices` menu select `Install Guest Additions...`, the `VBOXADDITIONS` CDROM device will appear on the desktop. Open a **terminal** session. (`Applications > Accessories > Terminal`) and `cd` to the top level of the CDROM. Run the `autorun.sh` script as superuser (`sudo ./autorun.sh`), a console window will open while the "Guest Additions" are being installed. Once the script has been finished, reboot your Virtual Machine to complete the installation of the "Guest Additions".
4. Open a **terminal** session. (`Applications > Accessories > Terminal`)
5. Open **Firefox** (there's an icon for it on the panel at the top of the screen) and go to the online Lilypond Contributor's Guide.

6. To retrieve the Lilypond source code from `git`, copy-and-paste each command from the CG "Main source code" section into the terminal. (paste into the terminal with keystroke `CTRL+SHIFT+V`)
7. Prepare to build Lilypond by running the configuration script. Type

   ```
   ./autogen.sh
   ```

   When it is finished you should be presented with the three most common `make` options:

   ```
   Type:
       make all       to build LilyPond
       make install   to install LilyPond
       make help      to see all possible targets

   Edit local.make for local Makefile overrides.
   ```

8. First type `make all` to build Lilypond. This will take a while.
9. When Lilypond is finished building, build the documentation by typing

   ```
   make doc
   ```

   Depending on your system specs it could take from 30-60 minutes to finish.

At this point everything has been compiled. You may install Lilypond using `make install`, or you may wish to set up your system with concurrent stable and development versions as described in the previous section.

3.10 Build system

We currently use make and stepmake, which is complicated and only used by us. Hopefully this will change in the future.

Version-specific texinfo macors

- made with `scripts/build/create-version-itexi.py` and `scripts/build/create-weblinks-itexi.py`
- used extensively in the `WEBSITE_ONLY_BUILD` version of the website (made with website.make, used on lilypond.org)
- not (?) used in the main docs?
- the numbers in VERSION file: MINOR_VERSION should be 1 more than the last release, VERSION_DEVEL should be the last **online** release. Yes, VERSION_DEVEL is less than VERSION.

4 Documentation work

There are currently 11 manuals for LilyPond, not including the translations. Each book is available in HTML, PDF, and info. The documentation is written in a language called `texinfo` – this allows us to generate different output formats from a single set of source files.

To organize multiple authors working on the documentation, we use a Version Control System (VCS) called git, previously discussed in Section 2.2 [Starting with Git], page 6.

4.1 Introduction to documentation work

Our documentation tries to adhere to our Section 4.4 [Documentation policy], page 47. This policy contains a few items which may seem odd. One policy in particular is often questioned by potential contributors: we do not repeat material in the Notation Reference, and instead provide links to the "definitive" presentation of that information. Some people point out, with good reason, that this makes the documentation harder to read. If we repeated certain information in relevant places, readers would be less likely to miss that information.

That reasoning is sound, but we have two counter-arguments. First, the Notation Reference – one of *five* manuals for users to read – is already over 500 pages long. If we repeated material, we could easily exceed 1000 pages! Second, and much more importantly, LilyPond is an evolving project. New features are added, bugs are fixed, and bugs are discovered and documented. If features are discussed in multiple places, the documentation team must find every instance. Since the manual is so large, it is impossible for one person to have the location of every piece of information memorized, so any attempt to update the documentation will invariably omit a few places. This second concern is not at all theoretical; the documentation used to be plagued with inconsistent information.

If the documentation were targeted for a specific version – say, LilyPond 2.10.5 – and we had unlimited resources to spend on documentation, then we could avoid this second problem. But since LilyPond evolves (and that is a very good thing!), and since we have quite limited resources, this policy remains in place.

A few other policies (such as not permitting the use of tweaks in the main portion of NR 1+2) may also seem counter-intuitive, but they also stem from attempting to find the most effective use of limited documentation help.

Before undertaking any large documentation work, contributors are encouraged to contact the Section 11.2 [Meisters], page 106.

4.2 Documentation suggestions

Small additions

For additions to the documentation,

1. Tell us where the addition should be placed. Please include both the section number and title (i.e. "LM 2.13 Printing lyrics").
2. Please write exact changes to the text.
3. A formal patch to the source code is *not* required; we can take care of the technical details. Here is an example of a perfect documentation report:

```
To: lilypond-devel@gnu.org
From: helpful-user@example.net
Subject: doc addition

In LM 2.13 (printing lyrics), above the last line ("More options,
like..."), please add:
```

```
----
To add lyrics to a divided part, use blah blah blah.  For example,

\score {
  \notes {blah <<blah>> }
  \lyrics {blah <<blah>> }
  blah blah blah
}
----

In addition, the second sentence of the first paragraph is
confusing.  Please delete that sentence (it begins "Users
often...") and replace it with this:
----
To align lyrics with something, do this thing.
----

Have a nice day,
Helpful User
```

Larger contributions

To replace large sections of the documentation, the guidelines are stricter. We cannot remove parts of the current documentation unless we are certain that the new version is an improvement.

1. Ask on the lilypond-devel maillist if such a rewrite is necessary; somebody else might already be working on this issue!
2. Split your work into small sections; this makes it much easier to compare the new and old documentation.
3. Please prepare a formal git patch.

Once you have followed these guidelines, please send a message to lilypond-devel with your documentation submissions. Unfortunately there is a strict "no top-posting" check on the mailist; to avoid this, add:

> I'm not top posting.

(you must include the >) to the top of your documentation addition.

We may edit your suggestion for spelling, grammar, or style, and we may not place the material exactly where you suggested, but if you give us some material to work with, we can improve the manual much faster. Thanks for your interest!

4.3 Texinfo introduction and usage policy

4.3.1 Texinfo introduction

The language is called Texinfo; you can see its manual here:

http://www.gnu.org/software/texinfo/manual/texinfo/

However, you don't need to read those docs. The most important thing to notice is that text is text. If you see a mistake in the text, you can fix it. If you want to change the order of something, you can cut-and-paste that stuff into a new location.

> **Note:** Rule of thumb: follow the examples in the existing docs. You can learn most of what you need to know from this; if you want to do anything fancy, discuss it on `lilypond-devel` first.

4.3.2 Documentation files

All manuals live in '`Documentation/`'.

In particular, there are four user manuals, their respective master source files are '`learning.tely`' (LM, Learning Manual), '`notation.tely`' (NR, Notation Reference), '`music-glossary.tely`' (MG, Music Glossary), and '`lilypond-program`' (AU). Each chapter is written in a separate file, ending in '`.itely`' for files containing lilypond code, and '`.itexi`' for files without lilypond code, located in a subdirectory associated to the manual ('`learning/`' for '`learning.tely`', and so on); list the subdirectory of each manual to determine the filename of the specific chapter you wish to modify.

Developer manuals live in '`Documentation/`' too. Currently there is only one: the Contributor's Guide '`contrib-guide.texi`' you are reading.

Snippet files are part of documentation, and the Snippet List (SL) lives in '`Documentation/`' just like the manuals. For information about how to modify the snippet files and SL, see Chapter 6 [LSR work], page 66.

4.3.3 Sectioning commands

Most of the manual operates at the

```
@node Foo
@subsubsection Foo
```

level. Sections are created with

```
@node Foo
@subsection Foo
```

- Please leave two blank lines above a `@node`; this makes it easier to find sections in texinfo.
- Do not use any `@` commands for a `@node`. They may be used for any `@sub...` sections or headings however.

```
not:
@node @code{Foo} Bar
@subsection @code{Foo} Bar

but instead:
@node Foo Bar
@subsection @code{Foo} Bar
```

- If a heading is desired without creating a `@node`, please use the following:

```
@subheading Foo
```

- Sectioning commands (`@node` and `@section`) must not appear inside an `@ignore`. Separate those commands with a space, ie `@n ode`.

Nodes must be included inside a

```
@menu
* foo::
* bar::
@end menu
```

construct. These are easily constructed with automatic tools; see Section 4.6 [Scripts to ease doc work], page 51.

4.3.4 LilyPond formatting

- Use two spaces for indentation in lilypond examples (no tabs).
- All engravers should have double-quotes around them:

  ```
  \consists "Spans_arpeggio_engraver"
  ```

  LilyPond does not strictly require this, but it is a useful convention to follow.
- All context or layout object strings should be prefaced with `#`. Again, LilyPond does not strictly require this, but it is helpful to get users accustomed to this scheme construct. i.e. `\set Staff.instrumentName = #"cello"`
- Try to avoid using `#'` or `#`` within when describing context or layout properties outside of an `@example` or `@lilypond`, unless the description explicitly requires it.

  ie "...setting the `transparent` property leaves the object where it is, but makes it invisible."
- If possible, only write one bar per line.
- If you only have one bar per line, omit bar checks. If you must put more than one bar per line (not recommended), then include bar checks.
- Tweaks should, if possible, also occur on their own line.

  ```
  not:          \override TextScript #'padding = #3 c1^"hi"
  but instead:  \override TextScript #'padding = #3
                c1^"hi"
  ```
- Most LilyPond input should be produced with:

  ```
  @lilypond[verbatim,quote,relative=2]
  ```

  or

  ```
  @lilypond[verbatim,quote,relative=1]
  ```

  If you want to use `\layout{}` or define variables, use

  ```
  @lilypond[verbatim,quote]
  ```

  In rare cases, other options may be used (or omitted), but ask first.
- Inspirational headwords are produced with

  ```
  @lilypondfile[quote,ragged-right,line-width=16\cm,staffsize=16]
  {pitches-headword.ly}
  ```
- LSR snippets are linked with

  ```
  @lilypondfile[verbatim,lilyquote,ragged-right,texidoc,doctitle]
  {filename.ly}
  ```

  excepted in Templates, where 'doctitle' may be omitted.
- Avoid long stretches of input code. Nobody is going to read them in print. Create small examples. However, this does not mean it has be minimal.
- Specify durations for at least the first note of every bar.
- If possible, end with a complete bar.
- Comments should go on their own line, and be placed before the line(s) to which they refer.
- For clarity, always use `{ }` marks even if they are not technically required; ie

  ```
  not:

  \context Voice \repeat unfold 2 \relative c' {
    c2 d
  }

  but instead:
  ```

```
\context Voice {
  \repeat unfold 2 {
    \relative c' {
      c2 d
    }
  }
}
```

- Add a space around `{ }` marks; ie

```
not:          \chordmode{c e g}
but instead:  \chordmode { c e g }
```

- Use `{ }` marks for additional `\markup` format comands; ie

```
not:          c^\markup \tiny\sharp
but instead:  c^\markup { \tiny \sharp }
```

- Remove any space around `< >` marks; ie

```
not:           < c e g > 4
but instead:   <c e g>4
```

- Beam, slur and tie marks should begin immediately after the first note with beam and phrase marks ending immediately after the last.

```
a8(\ ais16[ b cis( d] b) cis4~ b' cis,\)
```

- If you want to work on an example outside of the manual (for easier/faster processing), use this header:

```
\paper {
  indent = 0\mm
  line-width = 160\mm - 2.0 * 0.4\in
  ragged-right = ##t
  force-assignment = #""
  line-width = #(- line-width (* mm  3.000000))
}

\layout {
}
```

  You may not change any of these values. If you are making an example demonstrating special `\paper{}` values, contact the Documentation Editor.

4.3.5 Text formatting

- Lines should be less than 72 characters long. (We personally recommend writing with 66-char lines, but do not bother modifying existing material). Also see the recommendations for fixed-width fonts in the Section 4.3.6 [Syntax survey], page 44.
- Do not use tabs.
- Do not use spaces at the beginning of a line (except in `@example` or `@verbatim` environments), and do not use more than a single space between words. 'makeinfo' copies the input lines verbatim without removing those spaces.
- Use two spaces after a period.
- In examples of syntax, use `@var{`*`musicexpr`*`}` for a music expression.
- Don't use `@rinternals{}` in the main text. If you're tempted to do so, you're probably getting too close to "talking through the code". If you really want to refer to a context, use `@code{}` in the main text and `@rinternals{}` in the `@seealso`.

4.3.6 Syntax survey

Comments

- `@c ...` — single line comment. '`@c NOTE:`' is a comment which should remain in the final version. (gp only command ;)
- `@ignore` — multi-line comment:

```
@ignore
...
@end ignore
```

Cross references

Enter the exact `@node` name of the target reference between the brackets (eg. '`@ref{Syntax survey}`').

- `@ref{...}` — link within current manual.
- `@rchanges{...}` — link to Changes.
- `@rcontrib{...}` — link to Contributor's Guide.
- `@ressay{...}` — link to Engraving Essay.
- `@rextend{...}` — link to Extending LilyPond.
- `@rglos{...}` — link to the Music Glossary.
- `@rinternals{...}` — link to the Internals Reference.
- `@rlearning{...}` — link to Learning Manual.
- `@rlsr{...}` — link to a Snippet section.
- `@rprogram{...}` — link to Application Usage.
- `@ruser{...}` — link to Notation Reference.
- `@rweb{...}` — link to General Informaion.

External links

- `@email{...}` — create a `mailto:` E-mail link.
- `@uref{`*`URL`*`[, `*`link text`*`]}` — link to an external url. Use within an `@example ... @end example`.

```
@example
@uref{URL [, link text ]}
@end example
```

Fixed-width font

- `@code{...}`, `@samp{...}` —

  Use the `@code{...}` command for individual language-specific tokens (keywords, commands, engravers, scheme symbols, etc.). Ideally, a single `@code{...}` block should fit within one line in the PDF output. Use the `@samp{...}` command when you have a short example of user input, unless it constitutes an entire `@item` by itself, in which case `@code{...}` is preferable. Otherwise, both should only be used when part of a larger sentence within a paragraph or `@item`. Never use a `@code{...}` or `@samp{...}` block as a free-standing paragraph; use `@example` instead.

  A single unindented line in the PDF has space for about 79 fixed-width characters (76 if indented). Within an `@item` there is space for about 75 fixed-width characters. Each additional level of `@itemize` or `@enumerate` shortens the line by about 4 columns.

  However, even short blocks of `@code{...}` and `@samp{...}` can run into the margin if the Texinfo line-breaking algorithm gets confused. Additionally, blocks that are longer than

this may in fact print nicely; it all depends where the line breaks end up. If you compile the docs yourself, check the PDF output to make sure the line breaks are satisfactory.

The Texinfo setting `@allowcodebreaks` is set to `false` in the manuals, so lines within `@code{...}` or `@samp{...}` blocks will only break at spaces, not at hyphens or underscores. If the block contains spaces, use `@w{@code{...}}` or `@w{@samp{...}}` to prevent unexpected line breaks.

The Texinfo settings `txicodequoteundirected` and `txicodequotebacktick` are both set in the manuals, so backticks (`` ` ``) and apostrophes (`'`) placed within blocks of `@code`, `@example`, or `@verbatim` are not converted to left- and right-angled quotes (‘ ’) as they normally are within the text, so the apostrophes in ‘`@w{@code{\relative c''}}`’ will display correctly. However, these settings do not affect the PDF output for anything within a `@samp` block (even if it includes a nested `@code` block), so entering ‘`@w{@samp{\relative c''}}`’ wrongly produces ‘`\relative c’’`’ in PDF. Consequently, if you want to use a `@samp{...}` block which contains backticks or apostrophes, you should instead use ‘`@q{@code{...}}`’ (or ‘`@q{@w{@code{...}}}`’ if the block also contains spaces). Note that backslashes within `@q{...}` blocks must be entered as ‘`@bs{}`’, so the example above would be coded as ‘`@q{@w{@code{@bs{}relative c''}}}`’.

- `@command{...}` — Use for command-line commands (eg. ‘`@command{lilypond-book}`’).
- `@example` — Use for examples of program code. Do not add extraneous indentation (ie. don’t start every line with whitespace). Use the following layout (notice the use of blank lines). Omit the `@noindent` if the text following the example starts a new paragraph:

```
...text leading into the example...

@example
...
@end example

@noindent
continuation of the text...
```

  Individual lines within an `@example` block should not exceed 74 characters; otherwise they will run into the margin in the PDF output, and may get clipped. If an `@example` block is part of an `@item`, individual lines in the `@example` block should not exceed 70 columns. Each additional level of `@itemize` or `@enumerate` shortens the line by about 4 columns.

  For long command line examples, if possible, use a trailing backslash to break up a single line, indenting the next line with 2 spaces. If this isn’t feasible, use ‘`@smallexample ... @end smallexample`’ instead, which uses a smaller fontsize. Use `@example` whenever possible, but if needed, `@smallexample` can fit up to 90 characters per line before running into the PDF margin. Each additional level of `@itemize` or `@enumerate` shortens a `@smallexample` line by about 5 columns.

- `@file{...}` — Use for filenames and directories.
- `@option{...}` — Use for options to command-line commands (eg. ‘`@option{--format}`’).
- `@verbatim` — Prints the block exactly as it appears in the source file (including whitespace, etc.). For program code examples, use `@example` instead. `@verbatim` uses the same format as `@example`.

  Individual lines within an `@verbatim` block should not exceed 74 characters; otherwise they will run into the margin in the PDF output, and may get clipped. If an `@verbatim` block is part of an `@item`, individual lines in the `@verbatim` block should not exceed 70 columns. Each additional level of `@itemize` or `@enumerate` shortens the line by about 4 columns.

Indexing

- `@cindex ...` — General index. Please add as many as you can. Don't capitalize the first word.
- `@funindex ...` — is for a \lilycommand.

Lists

- `@enumerate` — Create an ordered list (with numbers). Always put '`@item`' on its own line, and separate consecutive items with a blank line:

```
@enumerate
@item
Foo

@item
Bar
@end enumerate
```

- `@itemize` — Create an unordered list (with bullets). Use the same format as `@enumerate`. Do not use '`@itemize @bullet`'.

Special characters

- `--`, `---` — Create an en dash (–) or an em dash (—) in the text. To print two or three literal hyphens in a row, wrap one of them in a `@w{...}` (eg. '`-@w{-}-`').
- `@@`, `@{`, `@}` — Create an at-sign (@), a left curly bracket ({), or a right curly bracket (}).
- `@bs{}` — Create a backslash within a `@q{...}`, `@qq{...}`, or `@warning{...}` block. This is a custom LilyPond macro, not a builtin `@`-command in Texinfo. Texinfo would also allow '`\\`', but this breaks the PDF output.
- `@tie{}` — Create a *variable-width* non-breaking space in the text (use '`@w{ }`' for a single *fixed-width* non-breaking space). Variables or numbers which consist of a single character (probably followed by a punctuation mark) should be tied properly, either to the previous or the next word. Example: '`The letter@tie{}@q{I} is skipped`'

Miscellany

- `@notation{...}` — refers to pieces of notation, e.g. '`@notation{clef}`'. Also use for specific lyrics ('`the @notation{A - men} is centered`'). Only use once per subsection per term.
- `@q{...}` — Single quotes. Used for 'vague' terms. To get a backslash (\), you must use '`@bs{}`'.
- `@qq{...}` — Double quotes. Used for actual quotes ("he said") or for introducing special input modes. To get a backslash (\), you must use '`@bs{}`'.
- `@var{...}` — Use for variables.
- `@version{}` — Return the current LilyPond version string. Use '`@w{@version{}}`' if it's at the end of a line (to prevent an ugly line break in PDF); use '`@w{"@version{}"}`' if you need it in quotes.
- `@w{...}` — Do not allow any line breaks.
- `@warning{...}` — produces a "Note: " box. Use for important messages. To get a backslash (\), you must use '`@bs{}`'.

4.3.7 Other text concerns

- References must occur at the end of a sentence, for more information see the texinfo manual. Ideally this should also be the final sentence of a paragraph, but this is not required. Any link in a doc section must be duplicated in the `@seealso` section at the bottom.
- Introducing examples must be done with

```
. (ie finish the previous sentence/paragaph)
: (ie `in this example:')
, (ie `may add foo with the blah construct,')
```

  The old "sentence runs directly into the example" method is not allowed any more.
- Abbrevs in caps, e.g., HTML, DVI, MIDI, etc.
- Colon usage
  1. To introduce lists
  2. When beginning a quote: "So, he said,...".

     This usage is rarer. Americans often just use a comma.
  3. When adding a defining example at the end of a sentence.
- Non-ASCII characters which are in utf-8 should be directly used; this is, don't say '`Ba@ss{}tuba`' but '`Baßtuba`'. This ensures that all such characters appear in all output formats.

4.4 Documentation policy

4.4.1 Books

There are four parts to the documentation: the Learning Manual, the Notation Reference, the Program Reference, and the Music Glossary.

- Learning Manual:

  The LM is written in a tutorial style which introduces the most important concepts, structure and syntax of the elements of a LilyPond score in a carefully graded sequence of steps. Explanations of all musical concepts used in the Manual can be found in the Music Glossary, and readers are assumed to have no prior knowledge of LilyPond. The objective is to take readers to a level where the Notation Reference can be understood and employed to both adapt the templates in the Appendix to their needs and to begin to construct their own scores. Commonly used tweaks are introduced and explained. Examples are provided throughout which, while being focussed on the topic being introduced, are long enough to seem real in order to retain the readers' interest. Each example builds on the previous material, and comments are used liberally. Every new aspect is thoroughly explained before it is used.

  Users are encouraged to read the complete Learning Manual from start-to-finish.
- Notation Reference: a (hopefully complete) description of LilyPond input notation. Some material from here may be duplicated in the Learning Manual (for teaching), but consider the NR to be the "definitive" description of each notation element, with the LM being an "extra". The goal is _not_ to provide a step-by-step learning environment – do not avoid using notation that has not be introduced previously in the NR (for example, use \break if appropriate). This section is written in formal technical writing style.

  Avoid duplication. Although users are not expected to read this manual from start to finish, they should be familiar with the material in the Learning Manual (particularly "Fundamental Concepts"), so do not repeat that material in each section of this book. Also watch out for common constructs, like ^ - _ for directions – those are explained in NR 3.

In NR 1, you can write: DYNAMICS may be manually placed above or below the staff, see @ref{Controlling direction and placement}.

Most tweaks should be added to LSR and not placed directly in the .itely file. In some cases, tweaks may be placed in the main text, but ask about this first.

Finally, you should assume that users know what the notation means; explaining musical concepts happens in the Music Glossary.

- Application Usage: information about using the program lilypond with other programs (lilypond-book, operating systems, GUIs, convert-ly, etc). This section is written in formal technical writing style.

  Users are not expected to read this manual from start to finish.

- Music Glossary: information about the music notation itself. Explanations and translations about notation terms go here.

  Users are not expected to read this manual from start to finish.

- Internals Reference: not really a documentation book, since it is automagically generated from the source, but this is its name.

4.4.2 Section organization

- The order of headings inside documentation sections should be:

```
main docs
@predefined
@endpredefined
@snippets
@seealso
@knownissues
```

- You *must* include a @seealso.
  - The order of items inside the @seealso section is

```
Music Glossary:
@rglos{foo},
@rglos{bar}.

Learning Manual:
@rlearning{baz},
@rlearning{foozle}.

Notation Reference:
@ruser{faazle},
@ruser{boo}.

Application Usage:
@rprogram{blah}.

Extending LilyPond:
@rextend{frob}.

Installed Files:
@file{path/to/dir/blahz}.

Snippets: @rlsr{section}.
```

```
Internals Reference:
@rinternals{fazzle},
@rinternals{booar}.
```

- If there are multiple entries, separate them by commas but do not include an 'and'.
- Always end with a period.
- Place each link on a new line as above; this makes it much easier to add or remove links. In the output, they appear on a single line.

  ("Snippets" is REQUIRED; the others are optional)
- Any new concepts or links which require an explanation should go as a full sentence(s) in the main text.
- Don't insert an empty line between @seealso and the first entry! Otherwise there is excessive vertical space in the PDF output.

- To create links, use @ref{} if the link is within the same manual.
- @predefined ... @endpredefined is for commands in 'ly/*-init.ly'
- Do not include any real info in second-level sections (ie 1.1 Pitches). A first-level section may have introductory material, but other than that all material goes into third-level sections (ie 1.1.1 Writing Pitches).

4.4.3 Checking cross-references

Cross-references between different manuals are heavily used in the documentation, but they are not checked during compilation. However, if you compile the documentation, a script called check_texi_refs can help you with checking and fixing these cross-references; for information on usage, cd into a source tree where documentation has been built, cd into Documentation and run:

```
make check-xrefs
make fix-xrefs
```

Note that you have to find yourself the source files to fix cross-references in the generated documentation such as the Internals Reference; e.g. you can grep scm/ and lily/.

Also of interest may be the linkdoc checks on kainhofer.com. Be warned that these docs are not completely rebuilt every day, so it might not accurately reflect the current state of the docs.

http://kainhofer.com/~lilypond/linkdoc/

4.4.4 General writing

- Do not forget to create @cindex entries for new sections of text. Enter commands with @funindex, i.e.

  ```
  @cindex pitches, writing in different octaves
  @funindex \relative
  ```

  do not bother with the @code{} (they are added automatically). These items are added to both the command index and the unified index.

  Both index commands should go in front of the actual material.

  @cindex entries should not be capitalized, ie

  ```
  @cindex time signature
  ```

  is preferred instead of "Time signature", Only use capital letters for musical terms which demand them, like D.S. al Fine.

  For scheme functions, only include the final part, i.e.,

  ```
  @funindex modern-voice-cautionary
       and NOT
  @funindex #(set-accidental-style modern-voice-cautionary)
  ```

- Preferred terms:
  - In general, use the American spellings. The internal lilypond property names use this spelling.
  - List of specific terms:

```
canceled
simultaneous    NOT concurrent
measure: the unit of music
bar line: the symbol delimiting a measure   NOT barline
note head   NOT notehead
chord construct   NOT chord (when referring to <>)
```

4.4.5 Technical writing style

These refer to the NR. The LM uses a more gentle, colloquial style.

- Do not refer to LilyPond in the text. The reader knows what the manual is about. If you do, capitalization is LilyPond.
- If you explicitly refer to 'lilypond' the program (or any other command to be executed), write `@command{lilypond}`.
- Do not explicitly refer to the reader/user. There is no one else besides the reader and the writer.
- Avoid contractions (don't, won't, etc.). Spell the words out completely.
- Avoid abbreviations, except for commonly used abbreviations of foreign language terms such as etc. and i.e.
- Avoid fluff ("Notice that," "as you can see," "Currently,").
- The use of the word 'illegal' is inappropriate in most cases. Say 'invalid' instead.

4.5 Tips for writing docs

In the NR, I highly recommend focusing on one subsection at a time. For each subsection,

- check the mundane formatting. Are the headings (`@predefined`, `@seealso`, etc.) in the right order?
- add any appropriate index entries.
- check the links in the `@seealso` section – links to music glossary, internal references, and other NR sections are the main concern. Check for potential additions.
- move LSR-worthy material into LSR. Add the snippet, delete the material from the .itely file, and add a `@lilypondfile` command.
- check the examples and descriptions. Do they still work? **Do not** assume that the existing text is accurate/complete; some of the manual is highly out of date.
- is the material in the `@knownissues` still accurate?
- can the examples be improved (made more explanatory), or is there any missing info? (feel free to ask specific questions on -user; a couple of people claimed to be interesting in being "consultants" who would help with such questions)

In general, I favor short text explanations with good examples – "an example is worth a thousand words". When I worked on the docs, I spent about half my time just working on those tiny lilypond examples. Making easily-understandable examples is much harder than it looks.

Tweaks

In general, any \set or \override commands should go in the "select snippets" section, which means that they should go in LSR and not the .itely file. For some cases, the command obviously

belongs in the "main text" (i.e. not inside @predefined or @seealso or whatever) – instrument names are a good example of this.

```
\set Staff.instrumentName = #"foo"
```

On the other side of this,

```
\override Score.Hairpin #'after-line-breaking = ##t
```

clearly belongs in LSR.

I'm quite willing to discuss specific cases if you think that a tweaks needs to be in the main text. But items that can go into LSR are easier to maintain, so I'd like to move as much as possible into there.

It would be "nice" if you spent a lot of time crafting nice tweaks for users... but my recommendation is **not** to do this. There's a lot of doc work to do without adding examples of tweaks. Tweak examples can easily be added by normal users by adding them to the LSR.

One place where a documentation writer can profitably spend time writing or upgrading tweaks is creating tweaks to deal with known issues. It would be ideal if every significant known issue had a workaround to avoid the difficulty.

See also

Section 6.2 [Adding and editing snippets], page 66.

4.6 Scripts to ease doc work

Stripping whitespace

To remove extra whitespace from the ends of lines, run

```
scripts/auxiliar/strip-whitespace.py Documentation/FILENAME
```

Sectioning commands

> **Note:** These commands add whitespace.

The emacs `M-x texinfo-all-menus-update` command will regenerate @menu blocks. This can also be run with this command-line script:

```
#!/bin/sh
emacs $1 -batch -f texinfo-all-menus-update -f save-buffer
```

(save the above as something like `texinfo-menus.sh`, make it executable, then run `texinfo-menus.sh foo.itely`)

Updating doc with `convert-ly`

cd into '`Documentation/`' and run

```
find . -name '*.itely' | xargs convert-ly -e
```

This also updates translated documentation.

4.7 Docstrings in scheme

Material in the Internals reference is generated automatically from our source code. Any doc work on Internals therefore requires modifying files in '`scm/*.scm`'. Texinfo is allowed in these docstrings.

Most documentation writers never touch these, though. If you want to work on them, please ask for help.

4.8 Translating the documentation

The mailing list `translations@lilynet.net` is dedicated to LilyPond web site and documentation translation; on this list, you will get support from the Translations Meister and experimented translators, and we regularly discuss translations issues common to all languagues. All people interested in LilyPond translations are invited to subscribe to this list regardless of the amount of their contribution, by sending an email to `translations-request@lilynet.net` with subject `subscribe` and an empty message body. Unless mentioned explicitly or except if a translations coordinator contacts you privately, you should send questions, remarks, patches to this list `translations@lilynet.net`; especially note that the traffic is so high on English-speaking list `lilypond-user@gnu.org` that it may take months before your request or contribution is handled if you send a email to these lists.

4.8.1 Getting started with documentation translation

First, get the sources of branch `lilypond/translation` from the Git repository, see Section 2.2 [Starting with Git], page 6.

Translation requirements

Working on LilyPond documentation translations requires the following pieces of software, in order to make use of dedicated helper tools:

- Python 2.4 or higher,
- GNU Make,
- Gettext,
- Git.

It is not required to build LilyPond and the documentation to translate the documentation. However, if you have enough time and motivation and a suitable system, it can be very useful to build at least the documentation so that you can check the output yourself and more quickly; if you are interested, see Chapter 3 [Compiling], page 27.

Before undertaking any large translation work, contributors are encouraged to contact the Section 11.2 [Meisters], page 106.

Which documentation can be translated

The makefiles and scripts infrastructure currently supports translation of the following documentation:

- the web site, the Learning Manual, the Notation Reference and Application Usage – Texinfo source, PDF and HTML output; Info output might be added if there is enough demand for it;
- the Changes document.

Support for translating the following pieces of documentation should be added soon, by decreasing order of priority:

- automatically generated documentation: markup commands, predefined music functions;
- the Snippets List;
- the Internals Reference.

Starting translation in a new language

At top of the source directory, do

```
./autogen.sh
```

or (if you want to install your self-compiled LilyPond locally)

```
./autogen.sh --prefix=$HOME
```

If you want to compile LilyPond – which is almost required to build the documentation, but is not required to do translation only – fix all dependencies and rerun `./configure` (with the same options as for `autogen.sh`).

Then `cd` into '`Documentation/`' and run

```
make ISOLANG=MY-LANGUAGE new-lang
```

where *MY-LANGUAGE* is the ISO 639 language code.

Finally, add a language definition for your language in '`python/langdefs.py`'.

4.8.2 Documentation translation details

Please follow all the instructions with care to ensure quality work.

All files should be encoded in UTF-8.

Files to be translated

Translation of '`Documentation/foo/bar`' should be '`Documentation/LANG/foo/bar`'. Unmentioned files should not be translated.

Priorities:

- 1. delivery,
- 2. 3. 4. 5. 6. later,
- 7. optional.

Files of priority 1 should be submitted along all files generated by starting a new language in the same commit and thus a unique patch, and the translation of files marked with priority 2 should be committed to Git at the same time and thus sent in a single patch. Files marked with priority 3 or more may be submitted individually. Word counts (excluding LilyPond snippets) are given for each file. For knowing how to commit your work to Git, then make patches of your new translations as well as corrections and updates, see Section 2.3 [Basic Git procedures], page 10.

```
-1- Web site
510   web.texi
4289  web/introduction.itexi
1173  web/download.itexi
1107  macros.itexi
6447  po/lilypond-doc.pot (translate to po/MY_LANGUAGE.po)
0     search-box.ihtml
---   lilypond-texi2html.init (section TRANSLATIONS)
13526 total

-2- Tutorial
1198  web/manuals.itexi
124   learning.tely
2504  learning/tutorial.itely
4191  learning/common-notation.itely
8017  total

-3- Fundamental Concepts, starting of Usage and Community
10838 learning/fundamental.itely -- Fundamental concepts
135   usage.tely
3373  usage/running.itely
1189  usage/updating.itely
```

```
1670  web/community.itexi
17205 total

-4- Rest of Learning manual and Suggestions on writing LilyPond files
15621 learning/tweaks.itely -- Tweaking output
209   learning/templates.itely -- Templates
2694  usage/suggestions.itely -- Suggestions on writing LilyPond files
18524 total

-5- Notation reference
355   notation.tely
91    notation/notation.itely -- Musical notation
3518  notation/pitches.itely
4992  notation/rhythms.itely
1481  notation/expressive.itely
774   notation/repeats.itely
1639  notation/simultaneous.itely
1855  notation/staff.itely
935   notation/editorial.itely
2755  notation/text.itely
81    notation/specialist.itely -- Specialist notation
2805  notation/vocal.itely
1521  notation/chords.itely
702   notation/piano.itely
807   notation/percussion.itely
826   notation/guitar.itely
66    notation/strings.itely
242   notation/bagpipes.itely
4479  notation/ancient.itely
6416  notation/input.itely -- Input syntax
2164  notation/non-music.itely -- Non-musical notation
9258  notation/spacing.itely -- Spacing issues
11815 notation/changing-defaults.itely -- Changing defaults
5187  notation/programming-interface.itely -- Interfaces for programmers
1966  notation/notation-appendices.itely -- Notation manual tables
252   notation/cheatsheet.itely -- Cheat sheet
66982 total

-6- Rest of Application Usage
3439  usage/lilypond-book.itely -- LilyPond-book
1122  usage/converters.itely -- Converting from other formats
4561  total

-7- Appendices whose translation is optional
319   essay/literature.itely
1222  learning/scheme-tutorial.itely (should be revised first)
1541  total
```

In addition, not listed above, Snippets' titles and descriptions should be translated; they are a part of the Notation Reference and therefore their priority is 5.

Translating the Web site and other Texinfo documentation

Every piece of text should be translated in the source file, except Texinfo comments, text in `@lilypond` blocks and a few cases mentioned below.

Node names are translated, but the original node name in English should be kept as the argument of `@translationof` put after the section title; that is, every piece in the original file like

```
@node Foo bar
@section_command Bar baz
```

should be translated as

```
@node translation of Foo bar
@section_command translation of Bar baz
@translationof Foo bar
```

The argument of `@rglos` commands and the first argument of `@rglosnamed` commands must not be translated, as it is the node name of an entry in Music Glossary.

Every time you translate a node name in a cross-reference, i.e. the argument of commands `@ref, @rprogram, @rlearning, @rlsr, @ruser` or the first argument of their `*named` variants, you should make sure the target node is defined in the correct source file; if you do not intend to translate the target node right now, you should at least write the node definition (that is, the `@node @section_commmand @translationof` trio mentioned above) in the expected source file and define all its parent nodes; for each node you have defined this way but have not translated, insert a line that contains `@untranslated`. That is, you should end up for each untranslated node with something like

```
@node translation of Foo bar
@section_command translation of Bar baz
@translationof Foo bar

@untranslated
```

> **Note:** you do not have to translate the node name of a cross-reference to a node that you do not have translated. If you do, you must define an "empty" node like explained just above; this will produce a cross-reference with the translated node name in output, although the target node will still be in English. On the opposite, if all cross-references that refer to an untranslated node use the node name in English, then you do not have to define such an "empty" node, and the cross-reference text will appear in English in the output. The choice between these two strategies implies its particular maintenance requirements and is left to the translators, although the opinion of the Translation meister leans towards not translating these cross-references.

Please think of the fact that it may not make sense translating everything in some Texinfo files, and you may take distance from the original text; for instance, in the translation of the web site section Community, you may take this into account depending on what you know the community in your language is willing to support, which is possible only if you personnally assume this support, or there exists a public forum or mailing list listed in Community for LilyPond in your language:

- Section "Bug reports" in *General Information*: this page should be translated only if you know that every bug report sent on your language's mailing list or forum will be handled by someone who will translate it to English and send it on bug-lilypond or add an issue in the tracker, then translate back the reply from developers.

- Section "Help us" in *General Information*: this page should be translated very freely, and possibly not at all: ask help for contributing to LilyPond for tasks that LilyPond community in your language is able and going to handle.

In any case, please mark in your work the sections which do not result from the direct translation of a piece of English translation, using comments i.e. lines starting with '`@c`'.

Finally, press in Emacs `C-c C-u C-a` to update or generate menus. This process should be made easier in the future, when the helper script `texi-langutils.py` and the makefile target are updated.

Some pieces of text manipulated by build scripts that appear in the output are translated in a '`.po`' file – just like LilyPond output messages – in '`Documentation/po`'. The Gettext domain is named `lilypond-doc`, and unlike `lilypond` domain it is not managed through the Free Translation Project.

Take care of using typographic rules for your language, especially in '`macros.itexi`'.

If you wonder whether a word, phrase or larger piece of text should be translated, whether it is an argument of a Texinfo command or a small piece sandwiched between two Texinfo commands, try to track whether and where it appears in PDF and/or HTML output as visible text. This piece of advice is especially useful for translating '`macros.itexi`'.

Please keep verbatim copies of music snippets (in `@lilypond` blocs). However, some music snippets containing text that shows in the rendered music, and sometimes translating this text really helps the user to understand the documentation; in this case, and only in this case, you may as an exception translate text in the music snippet, and then you must add a line immediately before the `@lilypond` block, starting with

```
@c KEEP LY
```

Otherwise the music snippet would be reset to the same content as the English version at next `make snippet-update` run – see [Updating documentation translation], page 58.

When you encounter

```
@lilypondfile[<number of fragment options>,texidoc]{filename.ly}
```

in the source, open '`Documentation/snippets/`*`filename`*`.ly`', translate the `texidoc` header field it contains, enclose it with `texidoc`*`MY-LANGUAGE`* `= "` and `"`, and write it into '`Documentation/`*`MY-LANGUAGE`*`/texidocs/`*`filename`*`.texidoc`'. Additionnally, you may translate the snippet's title in `doctitle` header field, in case `doctitle` is a fragment option used in `@lilypondfile`; you can do this exactly the same way as `texidoc`. For instance, '`Documentation/`*`MY-LANGUAGE`*`/texidocs/`*`filename`*`.texidoc`' may contain

```
doctitlees = "Spanish title baz"
texidoces = "
Spanish translation blah
"
```

Then, you should get these translated strings into compiled snippets in '`Documentation/snippets`', see 'General guidelines' in Section 6.2 [Adding and editing snippets], page 66.

`@example` blocks need not be verbatim copies, e.g. variable names, file names and comments should be translated.

Finally, please carefully apply every rule exposed in Section 4.3 [Texinfo introduction and usage policy], page 40, and Section 4.4 [Documentation policy], page 47. If one of these rules conflicts with a rule specific to your language, please ask the Translation meister on `translations@lilynet.net` list and/or the Documentation Editors on `lilypond-devel@gnu.org` list.

Adding a Texinfo manual

In order to start translating a new manual whose basename is *FOO*, do

```
cd Documentation/MY-LANGUAGE
cp ../FOO.tely .
mkdir FOO
cp web/GNUmakefile FOO
```

then append *FOO* to variable `SUBDIRS` in Documentation/*MY-LANGUAGE*/GNUmakefile, then translate file *MY-LANGUAGE*/*FOO*.tely and run `skeleton-update`:

```
cd Documentation/
make ISOLANG=MY-LANGUAGE TEXI_LANGUTIL_FLAGS=--head-only skeleton-update
```

Your are now ready to translate the new manual exactly like the web site or the Learning Manual.

4.8.3 Documentation translation maintenance

Several tools have been developed to make translations maintenance easier. These helper scripts make use of the power of Git, the version control system used for LilyPond development.

You should use them whenever you would like to update the translation in your language, which you may do at the frequency that fits your and your cotranslators' respective available times. In the case your translation is up-do-date (which you can discover in the first subsection below), it is enough to check its state every one or two weeks. If you feel overwhelmed by the quantity of documentation to be updated, see [Maintaining without updating translations], page 59.

Check state of translation

First pull from Git – see Section 2.3.2 [Pulling and rebasing], page 10, but DO NOT rebase unless you are sure to master the translation state checking and updating system – then cd into '`Documentation/`' (or at top of the source tree, replace `make` with `make -C Documentation`) and run

```
make ISOLANG=MY_LANGUAGE check-translation
```

This presents a diff of the original files since the most recent revision of the translation. To check a single file, cd into '`Documentation/`' and run

```
make CHECKED_FILES=MY_LANGUAGE/manual/foo.itely check-translation
```

In case this file has been renamed since you last updated the translation, you should specify both old and new file names, e.g. `CHECKED_FILES=MY_LANGUAGE/{manual,user}/foo.itely`.

To see only which files need to be updated, do

```
make ISOLANG=MY_LANGUAGE check-translation | grep 'diff --git'
```

To avoid printing terminal colors control characters, which is often desirable when you redirect output to a file, run

```
make ISOLANG=MY_LANGUAGE NO_COLOR=1 check-translation
```

You can see the diffs generated by the commands above as changes that you should make in your language to the existing translation, in order to make your translation up to date.

> **Note:** do not forget to update the committish in each file you have completely updated, see [Updating translation committishes], page 59.

Global state of the translation is recorded in '`Documentation/translations.itexi`', which is used to generate Translations status page. To update that page, do from '`Documentation/`'

```
make translation-status
```

This will also leave '`out/translations-status.txt`', which contains up-to-dateness percentages for each translated file, and update word counts of documentation files in this Guide.

See also

[Maintaining without updating translations], page 59.

Updating documentation translation

Instead of running `check-translation`, you may want to run `update-translation`, which will run your favorite text editor to update files. First, make sure environment variable `EDITOR` is set to a text editor command, then run from '`Documentation/`'

```
make ISOLANG=MY_LANGUAGE update-translation
```

or to update a single file

```
make CHECKED_FILES=MY_LANGUAGE/manual/foo.itely update-translation
```

For each file to be udpated, `update-translation` will open your text editor with this file and a diff of the file in English; if the diff cannot be generated or is bigger than the file in English itself, the full file in English will be opened instead.

> **Note:** do not forget to update the committish in each file you have completely updated, see [Updating translation committishes], page 59.

Texinfo skeleton files, i.e. '`.itely`' files not yet translated, containing only the first node of the original file in English can be updated automatically: whenever `make check-translation` shows that such files should be updated, run from '`Documentation/`'

```
make ISOLANG=MY_LANGUAGE skeleton-update
```

'`.po`' message catalogs in '`Documentation/po/`' may be updated by issuing from '`Documentation/`' or '`Documentation/po/`'

```
make po-update
```

> **Note:** if you run po-update and somebody else does the same and pushes before you push or send a patch to be applied, there will be a conflict when you pull. Therefore, it is better that only the Translation meister runs this command.

Updating music snippets can quickly become cumbersome, as most snippets should be identical in all languages. Fortunately, there is a script that can do this odd job for you (run from '`Documentation/`'):

```
make ISOLANG=MY_LANGUAGE snippet-update
```

This script overwrites music snippets in '*`MY_LANGUAGE/foo/every.itely`*' with music snippets from '*`foo/every.itely`*'. It ignores skeleton files, and keeps intact music snippets preceded with a line starting with `@c KEEP LY`; it reports an error for each '`.itely`' that has not the same music snippet count in both languages. Always use this script with a lot of care, i.e. run it on a clean Git working tree, and check the changes it made with `git diff` before committing; if you don't do so, some `@lilypond` snippets might be broken or make no sense in their context.

When you have updated texidocs in '`Documentation/`*`MY-LANGUAGE`*`/texidocs`', you can get these changes into compiled snippets in '`Documentation/snippets`', see 'General guidelines' in Section 6.2 [Adding and editing snippets], page 66.

Finally, a command runs the three update processes above for all enabled languages (from '`Documentation/`'):

```
make all-translations-update
```

Use this command with caution, and keep in mind it will not be really useful until translations are stabilized after the end of GDP and GOP.

See also

[Maintaining without updating translations], page 59, Section 6.2 [Adding and editing snippets], page 66.

Updating translation committishes

At the beginning of each translated file except PO files, there is a committish which represents the revision of the sources which you have used to translate this file from the file in English.

When you have pulled and updated a translation, it is very important to update this committish in the files you have completely updated (and only these); to do this, first commit possible changes to any documentation in English which you are sure to have done in your translation as well, then replace in the up-to-date translated files the old committish by the committish of latest commit, which can be obtained by doing

```
git rev-list HEAD |head -1
```

A special case is updating Snippet documentation strings in '`Documentation/MY-LANGUAGE/texidocs`'. For these to be correctly marked as up-to-date, first run `makelsr.py` as explained in Section 6.2 [Adding and editing snippets], page 66, and commit the resulting compiled snippets left in '`Documentation/snippets/`'. Say the SHA1 ID code of this commit is <C>. Now edit again your translated files in '`Documentation/MY-LANGUAGE/texidocs`' adjusting the 40-digit committish that appears in the text to be <C>; finally, commit these updated files. Not doing so would result in changes made both to your updates and original snippets to persistently appear in the check-translation output as if they were out of sync.

This two-phase mechanism avoids the (practically) unsolvable problem of guessing what committish will have our update, and pretending to put this very committish on the files in the same commit.

See also

Chapter 6 [LSR work], page 66.

4.8.4 Translations management policies

These policies show the general intent of how the translations should be managed, they aim at helping translators, developers and coordinators work efficiently.

Maintaining without updating translations

Keeping translations up to date under heavy changes in the documentation in English may be almost impossible, especially as during the former Grand Documentation Project (GDP) or the Grand Organization Project (GOP) when a lot of contributors brings changes. In addition, translators may be — and that is a very good thing — involved in these projects too.

it is possible — and even recommended — to perform some maintenance that keeps translated documentation usable and eases future translation updating. The rationale below the tasks list motivates this plan.

The following tasks are listed in decreasing priority order.

1. Update macros.itexi. For each obsolete macro definition, if it is possible to update macro usage in documentation with an automatic text or regexp substitution, do it and delete the macro definition from macros.itexi; otherwise, mark this macro definition as obsolete with a comment, and keep it in macros.itexi until the documentation translation has been updated and no longer uses this macro.

2. Update '`*.tely`' files completely with `make check-translation` – you may want to redirect ouptput to a file because of overwhelming output, or call check-translation.py on individual files, see [Check state of translation], page 57.
3. In '`.itelys`', match sections and .itely file names with those from English docs, which possibly involves moving nodes contents in block between files, without updating contents itself. In other words, the game is catching where has gone each section. In Learning manual, and in Notation Reference sections which have been revised in GDP, there may be completely new sections: in this case, copy `@node` and `@section`-command from English docs, and add the marker for untranslated status `@untranslated` on a single line. Note that it is not possible to exactly match subsections or subsubsections of documentation in English, when contents has been deeply revised; in this case, keep obsolete (sub)subsections in the translation, marking them with a line `@c obsolete` just before the node.

   Emacs with Texinfo mode makes this step easier:

   - without Emacs AucTeX installed, `C-c C-s` shows structure of current Texinfo file in a new buffer `*Occur*`; to show structure of two files simultaneously, first split Emacs window in 4 tiles (with `C-x 1` and `C-x 2`), press `C-c C-s` to show structure of one file (e.g. the translated file), copy `*Occur*` contents into `*Scratch*`, then press `C-c C-s` for the other file.

     If you happen to have installed AucTeX, you can either call the macro by doing `M-x texinfo-show-structure` or create a key binding in your '`~/.emacs`', by adding the four following lines:

     ```
     (add-hook 'Texinfo-mode-hook
               '(lambda ()
                  (define-key Texinfo-mode-map "\C-cs"
                   'texinfo-show-structure)))
     ```

     and then obtain the structure in the `*Occur*` buffer with `C-c s`.
   - Do not bother updating `@menu`s when all menu entries are in the same file, just do `C-c C-u C-a` ("update all menus") when you have updated all the rest of the file.
   - Moving to next or previous node using incremental search: press `C-s` and type `node` (or `C-s @node` if the text contains the word 'node') then press `C-s` to move to next node or `C-r` to move to previous node. Similar operation can be used to move to the next/previous section. Note that every cursor move exits incremental search, and hitting `C-s` twice starts incremental search with the text entered in previous incremental search.
   - Moving a whole node (or even a sequence of nodes): jump to beginning of the node (quit incremental search by pressing an arrow), press `C-SPACE`, press `C-s node` and repeat `C-s` until you have selected enough text, cut it with `C-w` or `C-x`, jump to the right place (moving between nodes with the previous hint is often useful) and paste with `C-y` or `C-v`.
4. Update sections finished in the English documentation; check sections status at http://lilypondwiki.tuxfamily.org/index.php?title=Documentation_coordination.
5. Update documentation PO. It is recommended not to update strings which come from documentation that is currently deeply revised in English, to avoid doing the work more than once.
6. Fix broken cross-references by running (from '`Documentation/`')

   ```
   make ISOLANG=YOUR-LANGUAGE fix-xrefs
   ```

   This step requires a sucessful documentation build (with `make doc`). Some cross-references are broken because they point to a node that exists in the documentation in English, which has not been added to the translation; in this case, do not fix the cross-reference but keep it

"broken", so that the resulting HTML link will point to an existing page of documentation in English.

Rationale

You may wonder if it would not be better to leave translations as-is until you can really start updating translations. There are several reasons to do these maintenance tasks right now.

- This will have to be done sooner or later anyway, before updating translation of documentation contents, and this can already be done without needing to be redone later, as sections of documentation in English are mostly revised once. However, note that not all documentation sectioning has been revised in one go, so all this maintenance plan has to be repeated whenever a big reorganization is made.
- This just makes translated documentation take advantage of the new organization, which is better than the old one.
- Moving and renaming sections to match sectioning of documentation in English simplify future updating work: it allows updating the translation by side-by-side comparison, without bothering whether cross-reference names already exist in the translation.
- Each maintenance task except 'Updating PO files' can be done by the same person for all languages, which saves overall time spent by translators to achieve this task: the node names and section titles are in English, so you can do. It is important to take advantage of this now, as it will be more complicated (but still possible) to do step 3 in all languages when documentation is compiled with `texi2html` and node names are directly translated in source files.

Managing documentation translation with Git

This policy explains how to manage Git branches and commit translations to Git.

- Translation changes matching master branch are preferably made on `lilypond/translation` branch; they may be pushed directly to `master` only if they do not break compilation of LilyPond and its documentation, and in this case they should be pushed to `lilypond/translation` too. Similarly, changes matching `stable/X.Y` are preferably made on `lilypond/X.Ytranslation`.
- `lilypond/translation` Git branch may be merged into master only if LilyPond (`make all`) and documentation (`make doc`) compile succesfully.
- `master` Git branch may be merged into `lilypond/translation` whenever `make` and `make doc` are succesful (in order to ease documentation compilation by translators), or when significant changes had been made in documentation in English in master branch.
- General maintenance may be done by anybody who knows what he does in documentation in all languages, without informing translators first. General maintenance include simple text substitutions (e.g. automated by sed), compilation fixes, updating Texinfo or lilypond-book commands, updating macros, updating ly code, fixing cross-references, and operations described in [Maintaining without updating translations], page 59.

4.8.5 Technical background

A number of Python scripts handle a part of the documentation translation process. All scripts used to maintain the translations are located in '`scripts/auxiliar/`'.

- '`check_translation.py`' – show diff to update a translation,
- '`texi-langutils.py`' – quickly and dirtily parse Texinfo files to make message catalogs and Texinfo skeleton files,
- '`texi-skeleton-update.py`' – update Texinfo skeleton files,
- '`update-snippets.py`' – synchronize ly snippets with those from English docs,

- '`translations-status.py`' – update translations status pages and word counts in the file you are reading,
- '`tely-gettext.py`' – gettext node names, section titles and references in the sources; WARNING only use this script once for each file, when support for "makeinfo –html" has been dropped.

Other scripts are used in the build process, in '`scripts/build/`':

- '`mass-link.py`' – link or symlink files between English documentation and documentation in other languages.

Python modules used by scripts in '`scripts/auxiliar/`' or '`scripts/build/`' (but not by installed Python scripts) are located in '`python/auxiliar/`':

- '`manuals_definitions.py`' – define manual names and name of cross-reference Texinfo macros,
- '`buildlib.py`' – common functions (read piped output of a shell command, use Git),
- '`postprocess_html.py`' (module imported by '`www_post.py`') – add footer and tweak links in HTML pages.

And finally

- '`python/langdefs.py`' – language definitions module

5 Website work

5.1 Introduction to website work

The website is *not* written directly in HTML; instead, the source is Texinfo, which is then generated into HTML, PDF, and Info formats. The sources are

```
Documentation/web.texi
Documentation/web/*.texi
```

Unless otherwise specified, follow the instructions and policies given in Chapter 4 [Documentation work], page 39. That chapter also contains a quick introduction to Texinfo; consulting an external Texinfo manual should be not necessary.

Exceptions to the documentation policies

- Sectioning: the website only uses chapters and sections; no subsections or subsubsections.
- `@ref{}`s to other manuals (`@ruser`, `@rlearning`, etc): you can't link to any pieces of automatically generated documentation, like the IR or certain NR appendices.

  ...
- For anything not listed here, just follow the same style as the existing texinfo files.

5.2 Uploading and security

The website is generated hourly by user `graham` the host `lilypond.org`. For security reasons, we do not use the makefiles and scripts directly from git; copies of the relevant scripts are examined and copied to `~graham/lilypond/trusted-scripts/`

Initial setup

You should symlink your own '`~/lilypond/`' to '`~graham/lilypond/`'

If this directory does not exist, make it. Git master should go in '`~/lilypond/lilypond-git/`' but make sure you enable:

```
git config core.filemode false
```

If you have created any files in '`~graham/lilypond/`' then please run:

```
chgrp lilypond ~graham/lilypond/ -R
chmod 775 ~graham/lilypond/ -R
```

Normal maintenance

Get latest source code:

```
### update-git.sh
#!/bin/sh
cd $HOME/lilypond/lilypond-git
git fetch origin
git merge origin/master
```

Check for any updates to trusted scripts / files:

```
### check-git.sh
#!/bin/sh
GIT=$HOME/lilypond/lilypond-git
DEST=$HOME/lilypond/trusted-scripts
diff -u $DEST/website.make $GIT/make/website.make
diff -u $DEST/lilypond-texi2html.init $GIT/Documentation/lilypond-texi2html.init
diff -u $DEST/extract_texi_filenames.py $GIT/scripts/build/extract_texi_filenames.py
```

```
diff -u $DEST/create-version-itexi.py $GIT/scripts/build/create-version-itexi.py
diff -u $DEST/create-weblinks-itexi.py $GIT/scripts/build/create-weblinks-itexi.py
diff -u $DEST/mass-link.py $GIT/scripts/build/mass-link.py
diff -u $DEST/website_post.py $GIT/scripts/build/website_post.py
diff -u $DEST/lilypond.org.htaccess $GIT/Documentation/web/server/lilypond.org.htaccess
diff -u $DEST/website-dir.htaccess $GIT/Documentation/web/server/website-dir.htaccess
```

If the changes look ok, make them trusted:

```
### copy-from-git.sh
#!/bin/sh
GIT=$HOME/lilypond/lilypond-git
DEST=$HOME/lilypond/trusted-scripts
cp $GIT/make/website.make $DEST/website.make
cp $GIT/Documentation/lilypond-texi2html.init $DEST/lilypond-texi2html.init
cp $GIT/scripts/build/extract_texi_filenames.py $DEST/extract_texi_filenames.py
cp $GIT/scripts/build/create-version-itexi.py $DEST/create-version-itexi.py
cp $GIT/scripts/build/create-weblinks-itexi.py $DEST/create-weblinks-itexi.py
cp $GIT/scripts/build/mass-link.py $DEST/mass-link.py
cp $GIT/scripts/build/website_post.py $DEST/website_post.py
cp $GIT/Documentation/web/server/lilypond.org.htaccess $DEST/lilypond.org.htaccess
cp $GIT/Documentation/web/server/website-dir.htaccess $DEST/website-dir.htaccess
```

Build the website:

```
### make-website.sh
#!/bin/sh
DEST=$HOME/web/
BUILD=$HOME/lilypond/build-website
mkdir -p $BUILD
cd $BUILD
cp $HOME/lilypond/trusted-scripts/website.make .

make -f website.make WEBSITE_ONLY_BUILD=1 website
rsync -raO $BUILD/out-website/website/ $DEST/website/
cp $BUILD/out-website/pictures $DEST
cp $BUILD/out-website/.htaccess $DEST
```

Cronjob to automate the trusted portions:

```
# website-rebuild.cron
11 * * * * $HOME/lilypond/trusted-scripts/update-git.sh >/dev/null 2>&1
22 * * * * $HOME/lilypond/trusted-scripts/make-website.sh >/dev/null 2>&1
```

To reduce the CPU burden on the shared host (as well as some security concerns), the '`Documentation/pictures/`' and '`Documentation/web/ly-examples/`' directories are **not** compiled. If you modify any files in those directories, a user in the `lilypond` group must upload them to '`~graham/media`' on the host.

Upload latest pictures/ and ly-examples/ (local script):

```
### upload-lily-web-media.sh
#!/bin/sh
BUILD_DIR=$HOME/src/build-lilypond

PICS=$BUILD_DIR/Documentation/pictures/out-www/
EXAMPLES=$BUILD_DIR/Documentation/web/ly-examples/out-www/

cd $BUILD_DIR
```

```
rsync -a $PICS graham@lilypond.org:media/pictures
rsync -a $EXAMPLES graham@lilypond.org:ly-examples
```

Additional information

Some information about the website is stored in '`~graham/lilypond/*.txt`'; this information should not be shared with people without trusted access to the server.

5.3 Translating the website

As it has much more audience, the website should be translated before the documentation; see Section 4.8 [Translating the documentation], page 52.

In addition to the normal documentation translation practices, there are a few additional things to note:

- Build the website with:

  ```
  make website
  ```

  however, please note that this command is not designed for being run multiple times. If you see unexpected output (mainly the page footers getting all messed up), then delete your '`out-website`' directory and run `make website` again.
- Some of the translation infrastructure is defined in python files; you must look at the `### translation data` sections in:

  ```
  scripts/build/create-weblinks-itexi.py
  scripts/build/website_post.py
  ```
- Translations are not included by default in `make website`. To test your translation, edit the `WEB_LANGS` line in '`make/website.make`'. Do not submit a patch to add your language to this file unless `make website` completes with less than 5 warnings.
- Links to manuals are done with macros like `@manualDevelLearningSplit`. To get translated links, you must change that to `@manualDevelLearningSplit-es` (for es/Spanish translations, for example).

6 LSR work

6.1 Introduction to LSR

The LilyPond Snippet Repository (LSR) is a collection of lilypond examples. A subset of these examples are automatically imported into the documentation, making it easy for users to contribute to the docs without learning Git and Texinfo.

6.2 Adding and editing snippets

General guidelines

When you create (or find!) a nice snippet, if it supported by LilyPond version running on LSR, please add it to LSR. Go to LSR and log in – if you haven't already, create an account. Follow the instructions on the website. These instructions also explain how to modify existing snippets.

If you think the snippet is particularly informative and you think it should be included in the documentation, tag it with "docs" and one or more other categories, or ask somebody who has editing permissions to do it on the development list.

Please make sure that the lilypond code follows the guidelines in Section 4.3.4 [LilyPond formatting], page 42.

If a new snippet created for documentation purposes compiles with LilyPond version currently on LSR, it should be added to LSR, and a reference to the snippet should be added to the documentation.

If the new snippet uses new features that are not available in the current LSR version, the snippet should be added to '`Documentation/snippets/new`' and a reference should be added to the manual.

Snippets created or updated in '`Documentation/snippets/new`' should be copied to '`Documentation/snippets`' by invoking at top of the source tree

```
scripts/auxiliar/makelsr.py
```

This also copies translated texidoc fields and snippet titles into snippets in '`Documentation/snippets`'. Note: this, in turn, could make the translated texidoc fields to appear as out of sync when you run `make check-translation`, if the originals changed from the last translation update, even if the translations are also updated; see Section 4.8.3 [Documentation translation maintenance], page 57 for details about updating the docs; in particular, see [Updating translation committishes], page 59 to learn how to mark these translated fields as fully updated.

Be sure that `make doc` runs successfully before submitting a patch, to prevent breaking compilation.

Formatting snippets in '`Documentation/snippets/new`'

When adding a file to this directory, please start the file with

```
\version "2.x.y"
\header {
  lsrtags = "rhythms,expressive-marks"  % use existing LSR tags other than
%   'docs'; see makelsr.py for the list of tags used to sort snippets.
  texidoc = "This code demonstrates ..."  % this will be formated by Texinfo
  doctitle = "Snippet title"  % please put this at the end so that
    the '% begin verbatim' mark is added correctly by makelsr.py.
}
```

and name the file '`snippet-title.ly`'.

6.3 Approving snippets

The main task of LSR editors is approving snippets. To find a list of unapproved snippets, log into LSR and select "No" from the dropdown menu to the right of the word "Approved" at the bottom of the interface, then click "Enable filter".

Check each snippet:

1. Does the snippet make sense and does what the author claims that it does? If you think the snippet is particularly helpful, add the "docs" tag and at least one other tag.
2. If the snippet is tagged with "docs", check to see if it matches our guidelines for Section 4.3.4 [LilyPond formatting], page 42.

   Also, snippets tagged with "docs" should not be explaining (replicating) existing material in the docs. They should not refer to the docs; the docs should refer to them.
3. If the snippet uses scheme, check that everything looks good and there are no security risks.

> **Note:** Somebody could sneak a `#'(system "rm -rf /")` command into our source tree if you do not do this! Take this step **VERY SERIOUSLY**.

6.4 LSR to Git

1. Make sure that `convert-ly` and `lilypond` commands in current PATH are in a bleeding edge version – latest release from master branch, or even better a fresh snapshot from Git master branch.
2. From the top source directory, run:

   ```
   wget http://lsr.dsi.unimi.it/download/lsr-snippets-docs-YYYY-MM-DD.tar.gz
   tar -xzf lsr-snippets-docs-YYYY-MM-DD.tar.gz
   scripts/auxiliar/makelsr.py lsr-snippets-docs-YYYY-MM-DD
   ```

   where *YYYY-MM-DD* is the current date, e.g. 2009-02-28.
3. Follow the instructions printed on the console to manually check for unsafe files.

> **Note:** Somebody could sneak a `#'(system "rm -rf /")` command into our source tree if you do not do this! Take this step **VERY SERIOUSLY**.

4. Do a git add / commit / push.

Note that whenever there is one snippet from '`Documentation/snippets/new`' and the other from LSR with the same file name, the one from '`Documentation/snippets/new`' will be copied by `makelsr.py`.

6.5 Fixing snippets in LilyPond sources

In case some snippet from '`Documentation/snippets`' causes the documentation compilation to fail, the following steps should be followed to fix it reliably.

1. Look up the snippet filename '*foo*`.ly`' in the error output or log, then fix the file '`Documentation/snippets/`*foo*`.ly`' to make the documentation build succesfully.
2. Determine where it comes from by looking at its first line, e.g. run

   ```
   head -1 Documentation/snippets/foo.ly
   ```
3. **In case the snippet comes from LSR**, apply the fix to the snippet in LSR and send a notification email to a LSR editor with CC to the development list – see Section 6.2 [Adding

and editing snippets], page 66. The failure may sometimes not be caused by the snippet in LSR but by the syntax conversion made by `convert-ly`; in this case, try to fix `convert-ly` or report the problem on the development list, then run `makelsr.py` again, see Section 6.4 [LSR to Git], page 67. In some cases, when some features has been introduced or vastly changed so it requires (or takes significant advantage of) important changes in the snippet, it is simpler and recommended to write a new version of the snippet in '`Documentation/snippets/new`', then run `makelsr.py`.

4. **In case the snippet comes from** '`Documentation/snippets/new`', apply in '`Documentation/snippets/new/`*`foo`*`.ly`' the same fix you did in '`Documentation/snippets/`*`foo`*`.ly`'. In case the build failure was caused by a translation string, you may have to fix '`input/texidocs/`*`foo`*`.texidoc`' instead.
5. In any case, commit all changes to Git.

6.6 Updating LSR to a new version

To update LSR, perform the following steps:

1. Download the latest snippet tarball, extract it, and run `convert-ly` on all files using the command-line option `--to=VERSION` to ensure snippets are updated to the correct stable version.
2. Copy relevant snippets (i.e., snippets whose version is equal to or less than the new version of LilyPond) from '`Documentation/snippets/new/`' into the tarball.

   You must not rename any files during this, or the next, stage.
3. Verify that all files compile with the new version of LilyPond, ideally without any warnings or errors. To ease the process, you may use the shell script that appears after this list.

   Due to the workload involved, we *do not* require that you verify that all snippets produce the expected output. If you happen to notice any such snippets and can fix them, great; but as long as all snippets compile, don't delay this step due to some weird output. If a snippet is broken, the hordes of willing web-2.0 volunteers will fix it. It's not our problem.
4. Create a tarball and send it back to Sebastiano.
5. When LSR has been updated, download another snippet tarball, verify that the relevant snippets from '`Documentation/snippets/new/`' were included, then delete those snippets from '`Documentation/snippets/new/`'.

Here is a shell script to run all `.ly` files in a directory and redirect terminal output to text files, which are then searched for the word "failed" to see which snippets do not compile.

```
#!/bin/bash

for LILYFILE in *.ly
do
  STEM=$(basename "$LILYFILE" .ly)
  echo "running $LILYFILE..."
  lilypond --format=png -ddelete-intermediate-files "$LILYFILE" >& "$STEM".txt
done

grep failed *.txt
```

7 Issues

This chapter deals with defects, feature requests, and miscellaneous development tasks.

7.1 Introduction to issues

> **Note:** Unless otherwise specified, all the tasks in this chapter are "simple" tasks: they can be done by a normal user with nothing more than a web browser, email, and lilypond.

"Issues" isn't just a politically-correct term for "bug". We use the same tracker for feature requests and code TODOs, so the term "bug" wouldn't be accurate. Despite the difference between "issue" and "bug", we call our team of contributors who organize issues the *Bug Squad*.

The Bug Squad is mainly composed of non-programmers – their job is to *organize* issues, not solve them. Their duties include removing false bug reports, ensuring that any real bug report contains enough information for developers, and checking that a developer's fix actually resolves the problem.

New volunteers for the Bug Squad should contact the Section 11.2 [Meisters], page 106.

7.2 Bug Squad setup

We highly recommend that you configure your email to use effective sorting; this can reduce your workload *immensely*. The email folders names were chosen specifically to make them work if you sort your folders alphabetically.

1. Skim through every section of this chapter, Chapter 7 [Issues], page 69. Read in detail any sections called "Bug Squad...", or any page linked from Section 7.3 [Bug Squad checklists], page 70.
2. If you do not have one already, create a gmail account and send the email address to the Section 11.2 [Meisters], page 106.
3. Subscribe your gmail account to `bug-lilypond`.
4. Configure your google code account:
   1. Sign in to google code by clicking in the top-right corner of:
      `http://code.google.com/p/lilypond/issues/list`
   2. Go to your "Profile", and select "Settings".
   3. Scroll down to "Issue change notification", and make sure that you have *selected* "If I starred the issue".
5. Configure your email client:
   1. Any email sent with your gmail address in the `To:` or `CC:` fields should go to a `bug-answers` folder.
   2. Any other email either from, or CC'd to,
      `lilypond@googlecode.com`
      should go into a separate `bug-ignore` folder. Alternately, you may automatically delete these emails.
      You will **not read** these emails as part of your Bug Squad duties. If you are curious, go ahead and read them later, but it does **not** count as Bug Squad work.
   3. Any other email sent to (or CC'd to):
      `bug-lilypond`
      should go into a separate `bug-current` folder.

7.3 Bug Squad checklists

When you do Bug Squad work, start at the top of this page and work your way down. Stop when you've done 15 minutes.

Please use the email sorting described in Section 7.2 [Bug Squad setup], page 69. This means that (as Bug Squad members) you will only ever respond to emails sent or CC'd to the `bug-lilypond` mailing list.

Emails to you personally

You are not expected to work on Bug Squad matters outside of your 15 minutes, but sometimes a confused user will send a bug report (or an update to a report) to you personally. If that happens, please forward such emails to the `bug-lilypond` list so that the currently-active Bug Squad member(s) can handle the message.

Daily schedule

```
Sunday: Valentin
Monday: Dmytro
Tuesday: James Bailey
Wednesday: Ralph
Thursday: Phil Holmes
Friday: Urs Liska, Patrick
Saturday: Kieren
```

Emails to `bug-answers`

Some of these emails will be comments on issues that you added to the tracker.

If they are asking for more information, give the additional information.

- If the email says that the issue was classified in some other manner, read the rationale given and take that into account for the next issue you add.
- Otherwise, move them to your `bug-ignore` folder.

Some of these emails will be discussions about Bug Squad work; read those.

Emails to `bug-current`

Dealing with these emails is your main task. Your job is to get rid of these emails in the first method which is applicable:

1. If the email has already been handled by a Bug Squad member (i.e. check to see who else has replied to it), delete it.
2. If the email is a question about how to use LilyPond, reply with this reponse:

   ```
   For questions about how to use LilyPond, please read our
   documentation available from:
     http://lilypond.org/website/manuals.html
   or ask the lilypond-user mailing list.
   ```

3. If a bug report is not in the form of a Tiny example, direct the user to resubmit the report with this response:

   ```
   I'm sorry, but due to our limited resources for handling bugs, we
   can only accept reports in the form of Tiny examples.  Please see
   step 2 in our bug reporting guidelines:
     http://lilypond.org/website/bug-reports.html
   ```

4. If anything is unclear, ask the user for more information.

   How does the graphical output differ from what the user expected? What version of lilypond was used (if not given) and operating system (if this is a suspected cause of the problem)?

In short, if you cannot understand what the problem is, ask the user to explain more. It is the user's responsibility to explain the problem, not your reponsibility to understand it.

5. If the behavior is expected, the user should be told to read the documentation:

   ```
   I believe that this is the expected behaviour -- please read our
   documentation about this topic.  If you think that it really is a
   mistake, please explain in more detail.  If you think that the
   docs are unclear, please suggest an improvement as described by
   \Simple tasks -- Documentation"
    on:
     http://lilypond.org/website/help-us.html
   ```

6. If the issue already exists in the tracker, send an email to that effect:

   ```
   This issue has already been reported; you can follow the
   discussion and be notified about fixes here:
   ```

   (copy+paste the google code issue URL)

7. Accept the report as described in Section 7.5 [Adding issues to the tracker], page 73.

All emails should be CC'd to the `bug-lilypond` list so that other Bug Squad members know that you have processed the email.

> **Note:** There is no option for "ignore the bug report" – if you cannot find a reason to reject the report, you must accept it.

Regular maintenance

After **every release** (both stable and unstable):

- Regression test comparison: if anything has changed suspiciously, ask if it was deliberate. The official comparison is online, at:

  http://lilypond.org/test/

  More information is available from in Section 8.2 [Precompiled regression tests], page 75.

- Issues to verify: try to reproduce the bug with the latest version; if you cannot reproduce the bug, mark the item "Verified" (i.e. "the fix has been verified to work").

  http://code.google.com/p/lilypond/issues/list?can=7

  A few (approximately 10%) of these fixed issues relate to the build system or fundamental architecture changes; there is no way for you to verify these. Leave those issues alone; somebody else will handle them.

7.4 Issue classification

The Bug Squad should classify issues according to the guidelines given by developers. Every issue should have a Status, Type, and Priority; the other fields are optional.

Status (mandatory)

Open issues:

- New: the item was added by a non-member, despite numerous warnings not to do this. Should be reviewed by a member of the Bug Squad.
- Accepted: the Bug Squad added it, or reviewed the item.
- Started: a contributor is working on a fix. Owner should change to be this contributor.

Closed issues:

- Invalid: issue should not have been added in the current state.

- Duplicate: issue already exists in the tracker.
- Fixed: a contributor claims to have fixed the bug. The Bug Squad should check the fix with the next official binary release (not by compiling the source from git). Owner should be set to that contributor.
- Verified: Bug Squad has confirmed that the issue is closed. This means that nobody should ever need look at the report again – if there is any information in the issue that should be kept, open a new issue for that info.

Owner (optional)

Newly-added issues should have *no owner*. When a contributor indicates that he has Started or Fixed an item, he should become the owner.

Type (mandatory)

The issue's Type should be the first relevant item in this list.

- Type-Collision: overlapping notation.
- Type-Defect: a problem in the core program. (the `lilypond` binary, scm files, fonts, etc).
- Type-Documentation: inaccurate, missing, confusing, or desired additional info. Must be fixable by editing a texinfo, ly, or scm file.
- Type-Build: problem or desired features in the build system. This includes the makefiles, stepmake, python scripts, and GUB.
- Type-Scripts: problem or desired feature in the non-build-system scripts. Mostly used for convert-ly, lilypond-book, etc.
- Type-Enhancement: a feature request for the core program. The distinction between enhancement and defect isn't extremely clear; when in doubt, mark it as enhancement.
- Type-Other: anything else.

Priority (mandatory)

Currently, only Critical items will block a stable release.

- Priority-Critical: lilypond segfaults, or a regression occurred within the last two stable versions. (i.e. when developing 2.13, any regression against 2.12 or 2.10 counts)
- Priority-High: highly embarrassing items, and any regression against a version earlier than two stable versions (i.e. when developing 2.13, any regression against 2.8 or earlier). This level is also used for issues which produce no output and fail to give the user a clue about what's wrong.
- Priority-Medium: normal priority.
- Priority-Low: less important than normal.
- Priority-Postponed: no fix planned. Generally used for things like Ancient notation, which nobody wants to touch.

The difference between Priority-Medium and Priority-Low is not well-defined, both in this policy and in practice. The only answer we can give at the moment is "look at existing items in of the same type, and try to guess whether the priority is closer to the Medium items or Low items". We're aware of the ambiguity, and won't complain if somebody picks a 'wrong' value for Medium/Low.

Opsys (optional)

Issues that only affect specific operating systems.

Other items (optional)

Other labels:

- Regression: it used to **deliberately** work in an earlier stable release. If the earlier output was accidental (i.e. we didn't try to stop a collision, but it just so happened that two grobs didn't collide), then breaking it does not count as a regression.
- Patch: a patch to fix an issue is attached.
- Frog: the fix is believed to be suitable for a new contributor (does not require a great deal of knowledge about LilyPond). The issue should also have an estimated time in a comment.
- Maintainability: hinders developent of LilyPond. For example, improvements to the build system, or "helper" python scripts.
- Bounty: somebody is willing to pay for the fix. Only add this tag if somebody has offered an exact figure in US dollars or euros.
- Warning: graphical output is fine, but lilypond prints a false/misleading warning message. Alternately, a warning should be printed (such as a bar line error), but was not. Also applies to warnings when compiling the source code or generating documentation.
- Security: might potentially be used.
- Performance: might potentially be used.

If you particularly want to add an label not in the list, go ahead, but this is not recommended.

7.5 Adding issues to the tracker

> **Note:** This should only be done by the Bug Squad or experienced developers. Normal users should not do this; instead, they should follow the guidelines for Section "Bug reports" in *General Information*.

In order to assign labels to issues, Bug Squad members should log in to their google account before adding an item.

Normal issues

1. Check if the issue falls into any previous category given on the relevant checklists in Section 7.3 [Bug Squad checklists], page 70. If in doubt, add a new issue for a report. We would prefer to have some incorrectly-added issues rather than lose information that should have been added.
2. Add the issue and classify it according to the guidelines in Section 7.4 [Issue classification], page 71. In particular, the item should have `Status`, `Type-`, and `Priority-` labels.

   Include output with the first applicable method:

   - If the issue has a notation example which fits in one system, generate a small '`bug.preview.png`' file with:

     ```
     lilypond -dpreview bug.ly
     ```

   - If the issue has an example which requires more than one system (i.e. a spacing bug), generate a '`bug.png`' file with:

     ```
     lilypond --png bug.ly
     ```

   - If the issue requires multi-page output, then generate a '`bug.pdf`' file with the normal:

     ```
     lilypond --png bug.ly
     ```

3. After adding the issue, please send a response email to the same group(s) that the initial patch was sent to. If the initial email was sent to multiple mailing lists (such as both `user` and `bugs`), then reply to all those mailing lists as well. The email should contain a link to the issue you just added.

Patch reminders

> **Note:** This is not a Bug Squad responsibility; we have a separate person handling this task.

There is a special category of issues: reminders of an existing patch. These should be added if a patch has been sent to a lilypond mailing list (generally `lilypond-devel`, but they sometimes appear on `bug-lilypond` as well) and has had no discussion for at least **3 days**. Do not add issues for patches under active discussion.

Before adding a patch-reminder issue, do a quick check to see if it was pushed without sending any email. This can be checked for searching for relevant terms (from the patch subject or commit message) on the webgit page:

http://git.savannah.gnu.org/gitweb/?p=lilypond.git

After adding the issue, please send a response email to the same group(s) that the initial patch was sent to. If the initial email was sent to multiple mailing lists (such as both `bugs` and `devel`), then reply to all those mailing lists as well. The email should contain a link to the issue you just added.

7.6 Summary of project status

The best overview of our current status is given by the grid view:

http://code.google.com/p/lilypond/issues/list?mode=grid&y=Priority&x=Type&cells=ids

Also of interest might be the issues hindering future development:

http://code.google.com/p/lilypond/issues/list?can=2&q=label:Maintainability&mode=grid&y

Finally, issues tagged with `Frog` indicates a task suitable for a relatively new contributor. The time given is a quick (inaccurate) estimate of the time required for somebody who is familiar with material in this manual, but does not know anything else about LilyPond development.

http://code.google.com/p/lilypond/issues/list?can=2&q=label:Frog&mode=grid&y=Priority&x

7.7 Finding the cause of a regression

> **Note:** This is not a "simple" task; it requires a fair amount of technical knowledge.

Git has special functionality to help tracking down the exact commit which causes a problem. See the git manual page for `git bisect`. This is a job that non-programmers can do, although it requires familiarity with git, ability to compile LilyPond, and generally a fair amount of technical knowledge. An in-depth explanation of this process will not be given here.

Even if you are not familiar with git or are not able to compile LilyPond you can still help to narrow down the cause of a regression simply by downloading the binary releases of different LilyPond versions and testing them for the regression. Knowing which version of LilyPond first exhibited the regression is helpful to a developer as it shortens the `git bisect` procedure described above.

Once a problematic commit is identified, the programmers' job is much easier. In fact, for most regression bugs, the majority of the time is spent simply finding the problematic commit.

More information is in Chapter 8 [Regression tests], page 75.

8 Regression tests

8.1 Introduction to regression tests

LilyPond has a complete suite of regression tests that are used to ensure that changes to the code do not break existing behavior. These regression tests comprise small LilyPond snippets that test the functionality of each part of LilyPond.

Regression tests are added when new functionality is added to LilyPond. They are also added when bugs are identified. The snippet that causes the bug becomes a regression test to verify that the bug has been fixed.

The regression tests are compiled using special `make` targets. There are three primary uses for the regression tests. First, successful completion of the regression tests means that LilyPond has been properly built. Second, the output of the regression tests can be manually checked to ensure that the graphical output matches the description of the intended output. Third, the regression test output from two different versions of LilyPond can be automatically compared to identify any differences. These differences should then be manually checked to ensure that the differences are intended.

Regression tests ("regtests") are available in precompiled form as part of the documentation. Regtests can also be compiled on any machine that has a properly configured LilyPond build system.

8.2 Precompiled regression tests

Regression test output

As part of the release process, the regression tests are run for every LilyPond release. Full regression test output is available for every stable version and the most recent development version.

Regression test output is available in HTML and PDF format. Links to the regression test output are available at the developer's resources page for the version of interest.

The latest stable version of the regtests is found at:

`http://lilypond.org/doc/stable/input/regression/collated-files.html`

The latest development version of the regtests is found at:

`http://lilypond.org/doc/latest/input/regression/collated-files.html`

Regression test comparison

Each time a new version is released, the regtests are compiled and the output is automatically compared with the output of the previous release. The result of these comparisons is archived online:

`http://lilypond.org/test/`

The test comparison shows all of the changes that occured between the current release and the prior release. Each test that has a significant difference in output is displayed, with the old version on the left and the new version on the right. Blurs in the regression tests for the new version show the approximate location of elements in the old version.

Regression tests whose output is the same for both versions are not shown in the test comparison.

Checking these pages is a very important task for the LilyPond project. You are invited to report anything that looks broken, or any case where the output quality is not on par with the previous release, as described in Section "Bug reports" in *General Information*.

Note: The automatic comparison of the regtests checks the LilyPond bounding boxes and the log files. This means that Ghostscript changes and changes in lyrics or text are not found. However, errors and warnings that are printed to the log file but do not change the graphical layout are also identified.

8.3 Compiling regression tests

Developers may wish to see the output of the complete regression test suite for the current version of the source repository between releases. Current source code is available; see Chapter 2 [Working with source code], page 5. Then you will need to build the LilyPond binary; see Section 3.5 [Compiling LilyPond], page 30.

Uninstalling the previous LilyPond version is not necessary, nor is running `make install`, since the tests will automatically be compiled with the LilyPond binary you have just built in your source directory.

From this point, the regtests are compiled with:

```
make test
```

If you have a multi-core machine you may want to use the '`-j`' option and *CPU_COUT* variable, as described in [Saving time with CPU_COUNT], page 33. For a quad-core processor the complete command would be:

```
make -j5 CPU_COUNT=5 test
```

The regtest output will then be available in '`input/regression/out-test`'. '`input/regression/out-test/collated-examples.html`' contains a listing of all the regression tests that were run, but none of the images are included. Individual images are also available in this directory.

The primary use of '`make test`' is to verify that the regression tests all run without error. The regression test page that is part of the documentation is created only when the documentation is built, as described in Section 3.6.2 [Generating documentation], page 32. Note that building the documentation requires more installed components than building the source code, as described in Section 3.2.3 [Requirements for building documentation], page 28.

8.4 Identifying code regressions

Before modified code is committed to master, a regression test comparision must be completed to ensure that the changes have not caused problems with previously working code. The comparison is made automatically upon compiling the regression test suite twice.

Before making changes, a baseline should be established by running:

```
make test-baseline
```

After making the changes, the code should be checked by running:

```
make check
```

After '`make check`' is complete, a regression test comparison will be available at '`out/test-results/index.html`'. For each regression test that differs between the baseline and the changed code, a regression test entry will displayed. Ideally, the only changes would be the changes that you were working on. If regressions are introduced, they must be fixed before committing the code.

Note: The special regression test '`test-output-distance.ly`' will always show up as a regression. This test changes each time it is run, and serves to verify that the regression tests have, in fact, run.

Once '`make test-baseline`' and '`make check`' have been run, the files that differ between '`test-baseline`' and '`check`' can be repeatedly examined by doing:

```
make test-redo
```

This updates the regression list at '`out/test-results/index.html`'. It does *not* redo '`test-output-distance.ly`'.

When all regressions have been resolved, the output list will be empty.

Once all regressions have been resolved, a final check should be completed by running:

```
make test-clean
make check
```

This cleans the results of the previous '`make check`', then does the automatic regression comparison again.

8.5 Memory and coverage tests

In addition to the graphical output of the regression tests, it is possible to test memory usage and to determine how much of the source code has been exercised by the tests.

Memory usage

For tracking memory usage as part of this test, you will need GUILE CVS; especially the following patch: http://www.lilypond.org/vc/old/gub.darcs/patches/guile-1.9-gcstats.patch.

Code coverage

For checking the coverage of the test suite, do the following

```
./scripts/auxiliar/build-coverage.sh
# uncovered files, least covered first
./scripts/auxiliar/coverage.py  --summary out-cov/*.cc
# consecutive uncovered lines, longest first
./scripts/auxiliar/coverage.py  --uncovered out-cov/*.cc
```

8.6 MusicXML tests

LilyPond comes with a complete set of regtests for the MusicXML language. Originally developed to test '`musicxml2ly`', these regression tests can be used to test any MusicXML implementation.

The MusicXML regression tests are found at '`input/regression/musicxml/`'.

The output resulting from running these tests through '`muscxml2ly`' followed by '`lilypond`' is available in the LilyPond documentation:

http://lilypond.org/doc/latest/input/regression/musicxml/collated-files

9 Programming work

9.1 Overview of LilyPond architecture

LilyPond processes the input file into graphical and musical output in a number of stages. This process, along with the types of routines that accomplish the various stages of the process, is described in this section. A more complete description of the LilyPond architecture and internal program execution is found in Erik Sandberg's master's thesis.

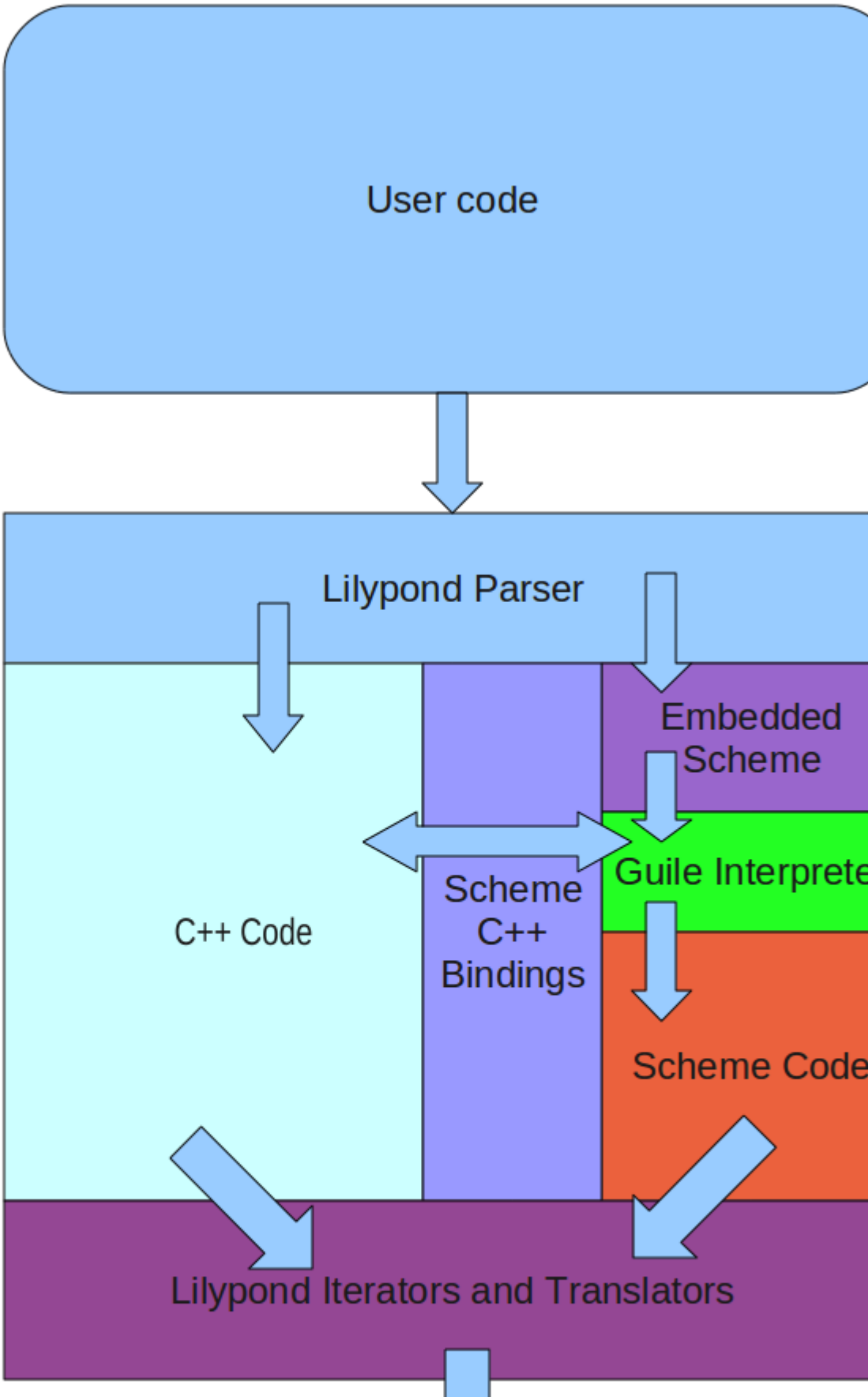
The first stage of LilyPond processing is *parsing*. In the parsing process, music expressions in LilyPond input format are converted to music expressions in Scheme format. In Scheme format, a music expression is a list in tree form, with nodes that indicate the relationships between various music events. The LilyPond parser is written in Bison.

The second stage of LilyPond processing is *iterating*. Iterating assigns each music event to a context, which is the environment in which the music will be finally engraved. The context is responsible for all further processing of the music. It is during the iteration stage that contexts are created as necessary to ensure that every note has a Voice type context (e.g. Voice, TabVoice, DrumVoice, CueVoice, MensuralVoice, VaticanaVoice, GregorianTranscriptionVoice), that the Voice type contexts exist in appropriate Staff type contexts, and that parallel Staff type contexts exist in StaffGroup type contexts. In addition, during the iteration stage each music event is assigned a moment, or a time in the music when the event begins.

Each type of music event has an associated iterator. Iterators are defined in *-iterator.cc. During iteration, an event's iterator is called to deliver that music event to the appropriate context(s).

The final stage of LilyPond processing is *translation*. During translation, music events are prepared for graphical or midi output. The translation step is accomplished by the polymorphic base class Translator through its two derived classes: Engraver (for graphical output) and Performer (for midi output).

Translators are defined in C++ files named *-engraver.cc and *-performer.cc. Much of the work of translating is handled by Scheme functions, which is one of the keys to LilyPond's exceptional flexibility.



9.2 LilyPond programming languages

Programming in LilyPond is done in a variety of programming languages. Each language is used for a specific purpose or purposes. This section describes the languages used and provides links to reference manuals and tutorials for the relevant language.

9.2.1 C++

The core functionality of LilyPond is implemented in C++.

C++ is so ubiquitous that it is difficult to identify either a reference manual or a tutorial. Programmers unfamiliar with C++ will need to spend some time to learn the language before attempting to modify the C++ code.

The C++ code calls Scheme/GUILE through the GUILE interface, which is documented in the GUILE Reference Manual.

9.2.2 Flex

The LilyPond lexer is implemented in Flex, an implementation of the Unix lex lexical analyser generator. Resources for Flex can be found here.

9.2.3 GNU Bison

The LilyPond parser is implemented in Bison, a GNU parser generator. The Bison homepage is found at gnu.org. The manual (which includes both a reference and tutorial) is available in a variety of formats.

9.2.4 GNU Make

GNU Make is used to control the compiling process and to build the documentation and the website. GNU Make documentation is available at the GNU website.

9.2.5 GUILE or Scheme

GUILE is the dialect of Scheme that is used as LilyPond's extension language. Many extensions to LilyPond are written entirely in GUILE. The GUILE Reference Manual is available online.

Structure and Interpretation of Computer Programs, a popular textbook used to teach programming in Scheme is available in its entirety online.

An introduction to Guile/Scheme as used in LilyPond can be found in the Section "Scheme tutorial" in *Extending*.

9.2.6 MetaFont

MetaFont is used to create the music fonts used by LilyPond. A MetaFont tutorial is available at the METAFONT tutorial page.

9.2.7 PostScript

PostScript is used to generate graphical output. A brief PostScript tutorial is available online. The PostScript Lanugage Reference is available online in PDF format.

9.2.8 Python

Python is used for XML2ly and is used for buillding the documentation and the website.

Python documentation is available at python.org.

9.3 Programming without compiling

Much of the development work in LilyPond takes place by changing *.ly or *.scm files. These changes can be made without compiling LilyPond. Such changes are described in this section.

9.3.1 Modifying distribution files

Much of LilyPond is written in Scheme or LilyPond input files. These files are interpreted when the program is run, rather than being compiled when the program is built, and are present in all LilyPond distributions. You will find .ly files in the ly/ directory and the Scheme files in the scm/ directory. Both Scheme files and .ly files can be modified and saved with any text editor. It's probably wise to make a backup copy of your files before you modify them, although you can reinstall if the files become corrupted.

Once you've modified the files, you can test the changes just by running LilyPond on some input file. It's a good idea to create a file that demonstrates the feature you're trying to add. This file will eventually become a regression test and will be part of the LilyPond distribution.

9.3.2 Desired file formatting

Files that are part of the LilyPond distribution have Unix-style line endings (LF), rather than DOS (CR+LF) or MacOS 9 and earlier (CR). Make sure you use the necessary tools to ensure that Unix-style line endings are preserved in the patches you create.

Tab characters should not be included in files for distribution. All indentation should be done with spaces. Most editors have settings to allow the setting of tab stops and ensuring that no tab characters are included in the file.

Scheme files and LilyPond files should be written according to standard style guidelines. Scheme file guidelines can be found at `http://community.schemewiki.org/?scheme-style`. Following these guidelines will make your code easier to read. Both you and others that work on your code will be glad you followed these guidelines.

For LilyPond files, you should follow the guidelines for LilyPond snippets in the documentation. You can find these guidelines at Section 4.3 [Texinfo introduction and usage policy], page 40.

9.4 Finding functions

When making changes or fixing bugs in LilyPond, one of the initial challenges is finding out where in the code tree the functions to be modified live. With nearly 3000 files in the source tree, trial-and-error searching is generally ineffective. This section describes a process for finding interesting code.

9.4.1 Using the ROADMAP

The file ROADMAP is located in the main directory of the lilypond source. ROADMAP lists all of the directories in the LilPond source tree, along with a brief description of the kind of files found in each directory. This can be a very helpful tool for deciding which directories to search when looking for a function.

9.4.2 Using grep to search

Having identified a likely subdirectory to search, the grep utility can be used to search for a function name. The format of the grep command is

```
grep -i functionName subdirectory/*
```

This command will search all the contents of the directory subdirectory/ and display every line in any of the files that contains functionName. The `-i` option makes `grep` ignore case – this can be very useful if you are not yet familiar with our capitalization conventions.

The most likely directories to grep for function names are scm/ for scheme files, ly/ for lilypond input (*.ly) files, and lily/ for C++ files.

9.4.3 Using git grep to search

If you have used git to obtain the source, you have access to a powerful tool to search for functions. The command:

```
git grep functionName
```

will search through all of the files that are present in the git repository looking for functionName. It also presents the results of the search using `less`, so the results are displayed one page at a time.

9.4.4 Searching on the git repository at Savannah

You can also use the equivalent of git grep on the Savannah server.

- Go to http://git.sv.gnu.org/gitweb/?p=lilypond.git
- In the pulldown box that says commit, select grep.
- Type functionName in the search box, and hit enter/return

This will initiate a search of the remote git repository.

9.5 Code style

This section describes style guidelines for LilyPond source code.

9.5.1 Languages

C++ and Python are preferred. Python code should use PEP 8.

9.5.2 Filenames

Definitions of classes that are only accessed via pointers (*) or references (&) shall not be included as include files.

```
filenames

     ".hh"   Include files
          ".cc"      Implementation files
          ".icc"     Inline definition files
          ".tcc"     non inline Template defs

in emacs:

          (setq auto-mode-alist
                (append '(("\\.make$" . makefile-mode)
                     ("\\.cc$" . c++-mode)
                     ("\\.icc$" . c++-mode)
                     ("\\.tcc$" . c++-mode)
                     ("\\.hh$" . c++-mode)
                     ("\\.pod$" . text-mode)
                     )
                   auto-mode-alist))
```

The class Class_name is coded in ‘class-name.*’

9.5.3 Indentation

Standard GNU coding style is used. In emacs:

```
          (add-hook 'c++-mode-hook
               '(lambda() (c-set-style "gnu")
```

```
                 ))
```

If you like using font-lock, you can also add this to your '.emacs':

```
(setq font-lock-maximum-decoration t)
(setq c++-font-lock-keywords-3
      (append
       c++-font-lock-keywords-3
       '(("\\b\\(a-zA-Z_?+_\\)\\b" 1 font-lock-variable-name-face) ("\\b\\(A-Z
       ))
```

Some source files may not currently have proper indenting. If this is the case, it is desirable to fix the improper indenting when the file is modified, with the hope of continually improving the code.

Indenting files with fixcc.py

LilyPond provides a python script that will correct the indentation on a c++ file:

```
scripts/auxiliar/fixcc.py lily/my-test-file.cc
```

Be sure you replace `my-test-file.cc` with the name of the file that you edited.

If you are editing a file that contains an ADD_TRANSLATOR or ADD_INTERFACE macro, the fixcc.py script will move the final parenthesis up one line from where it should be. Please check the end of the file before you run fixcc.py, and then put the final parenthesis and semicolon back on a line by themselves.

Indenting files with emacs in script mode

> **Note:** this is pending some confirmation on -devel. July 2009 -gp

Command-line script to format stuff with emacs:

```
#!/bin/sh
emacs $1 -batch --eval '(indent-region (point-min) (point-max) nil)' -f save-buffer
```

(that's all on one line)

Save it as a shell script, then run on the file(s) you modified.

Indenting with vim

Although emacs indentation is the LilyPond standard, acceptable indentation can usually be accomplished with vim. Some hints for vim are as follows:

A workable .vimrc:

```
set cindent
set smartindent
set autoindent
set expandtab
set softtabstop=2
set shiftwidth=2
filetype plugin indent on
set incsearch
set ignorecase smartcase
set hlsearch
set confirm
set statusline=%F%m%r%h%w\ %{&ff}\ %Y\ [ASCII=\%03.3b]\ [HEX=\%02.2B]\ %04l,%04v\ %p%%\ [LEN
set laststatus=2
set number
```

```
" Remove trailing whitespace on write
autocmd BufWritePre * :%s/\s\+$//e
```

With this .vimrc, files can be reindented automatically by highlihting the lines to be indented in visual mode (use V to enter visual mode) and pressing =.

A scheme.vim file will help improve the indentation. This one was suggested by Patrick McCarty. It should be saved in ~/.vim/after/syntax/scheme.vim.

```
" Additional Guile-specific 'forms'
syn keyword schemeSyntax define-public define* define-safe-public
syn keyword schemeSyntax use-modules define-module
syn keyword schemeSyntax defmacro-public define-macro
syn keyword schemeSyntax define-markup-command
syn keyword schemeSyntax define-markup-list-command
syn keyword schemeSyntax let-keywords* lambda* define*-public
syn keyword schemeSyntax defmacro* defmacro*-public

" All of the above should influence indenting too
set lw+=define-public,define*,define-safe-public,use-modules,define-module
set lw+=defmacro-public,define-macro
set lw+=define-markup-command,define-markup-list-command
set lw+=let-keywords*,lambda*,define*-public,defmacro*,defmacro*-public

" These forms should not influence indenting
set lw-=if
set lw-=set!

" Try to highlight all ly: procedures
syn match schemeFunc "ly:[^) ]\+"
```

9.5.4 Naming Conventions

Naming conventions have been established for LilyPond source code.

Classes and Types

Classes begin with an uppercase letter, and words in class names are separated with _:

```
This_is_a_class
```

Members

Member variable names end with an underscore:

```
Type Class::member_
```

Macros

Macro names should be written in uppercase completely, with words separated by _:

```
THIS_IS_A_MACRO
```

Variables

Variable names should be complete words, rather than abbreviations. For example, it is preferred to use `thickness` rather than `th` or `t`.

Multi-word variable names in C++ should have the words separated by the underscore character ('_'):

```
cxx_multiword_variable
```

Multi-word variable names in Scheme should have the words separated by a hyphen ('-'):

`scheme-multiword-variable`

9.5.5 Broken code

Do not write broken code. This includes hardwired dependencies, hardwired constants, slow algorithms and obvious limitations. If you can not avoid it, mark the place clearly, and add a comment explaining shortcomings of the code.

Ideally, the comment marking the shortcoming would include TODO, so that it is marked for future fixing.

We reject broken-in-advance on principle.

9.5.6 Code comments

Comments may not be needed if descriptive variable names are used in the code and the logic is straightforward. However, if the logic is difficult to follow, and particularly if non-obvious code has been included to resolve a bug, a comment describing the logic and/or the need for the non-obvious code should be included.

There are instances where the current code could be commented better. If significant time is required to understand the code as part of preparing a patch, it would be wise to add comments reflecting your understanding to make future work easier.

9.5.7 Handling errors

As a general rule, you should always try to continue computations, even if there is some kind of error. When the program stops, it is often very hard for a user to pinpoint what part of the input causes an error. Finding the culprit is much easier if there is some viewable output.

So functions and methods do not return errorcodes, they never crash, but report a programming_error and try to carry on.

Error and warning messages need to be localized.

9.5.8 Localization

This document provides some guidelines to help programmers write proper user messages. To help translations, user messages must follow uniform conventions. Follow these rules when coding for LilyPond. Hopefully, this can be replaced by general GNU guidelines in the future. Even better would be to have an English (en_BR, en_AM) guide helping programmers writing consistent messages for all GNU programs.

Non-preferred messages are marked with '+'. By convention, ungrammatical examples are marked with '*'. However, such ungrammatical examples may still be preferred.

- Every message to the user should be localized (and thus be marked for localization). This includes warning and error messages.
- Do not localize/gettextify:
  - 'programming_error ()'s
  - 'programming_warning ()'s
  - debug strings
  - output strings (PostScript, TeX, etc.)
- Messages to be localized must be encapsulated in '_ (STRING)' or '_f (FORMAT, ...)'. E.g.:

  ```
  warning (_ ("need music in a score"));
  error (_f ("cannot open file: `%s'", file_name));
  ```

  In some rare cases you may need to call 'gettext ()' by hand. This happens when you pre-define (a list of) string constants for later use. In that case, you'll probably also need to mark these string constants for translation, using '_i (STRING)'. The '_i' macro is a no-op, it only serves as a marker for 'xgettext'.

```
char const* messages[] = {
  _i ("enable debugging output"),
  _i ("ignore lilypond version"),
  0
};

void
foo (int i)
{
  puts (gettext (messages i));
}
```

See also ‘flower/getopt-long.cc’ and ‘lily/main.cc’.

- Do not use leading or trailing whitespace in messages. If you need whitespace to be printed, prepend or append it to the translated message

```
message ("Calculating line breaks..." + " ");
```

- Error or warning messages displayed with a file name and line number never start with a capital, eg,

```
foo.ly: 12: not a duration: 3
```

Messages containing a final verb, or a gerund (‘-ing’-form) always start with a capital. Other (simpler) messages start with a lowercase letter

```
Processing foo.ly...
`foo': not declared.
Not declaring: `foo'.
```

- Avoid abbreviations or short forms, use ‘cannot’ and ‘do not’ rather than ‘can’t’ or ‘don’t’ To avoid having a number of different messages for the same situation, well will use quoting like this ‘"message: ‘%s’"’ for all strings. Numbers are not quoted:

```
_f ("cannot open file: `%s'", name_str)
_f ("cannot find character number: %d", i)
```

- Think about translation issues. In a lot of cases, it is better to translate a whole message. The english grammar must not be imposed on the translator. So, instead of

```
stem at  + moment.str () +  does not fit in beam
```

have

```
_f ("stem at %s does not fit in beam", moment.str ())
```

- Split up multi-sentence messages, whenever possible. Instead of

```
warning (_f ("out of tune!  Can't find: `%s'", "Key_engraver"));
warning (_f ("cannot find font `%s', loading default", font_name));
```

rather say:

```
warning (_ ("out of tune:"));
warning (_f ("cannot find: `%s', "Key_engraver"));
warning (_f ("cannot find font: `%s', font_name));
warning (_f ("Loading default font"));
```

- If you must have multiple-sentence messages, use full punctuation. Use two spaces after end of sentence punctuation. No punctuation (esp. period) is used at the end of simple messages.

```
_f ("Non-matching braces in text `%s', adding braces", text)
_ ("Debug output disabled.  Compiled with NPRINT.")
_f ("Huh?  Not a Request: `%s'.  Ignoring.", request)
```

- Do not modularize too much; words frequently cannot be translated without context. It is probably safe to treat most occurences of words like stem, beam, crescendo as separately translatable words.
- When translating, it is preferable to put interesting information at the end of the message, rather than embedded in the middle. This especially applies to frequently used messages, even if this would mean sacrificing a bit of eloquency. This holds for original messages too, of course.

```
en: cannot open: `foo.ly'
+   nl: kan `foo.ly' niet openen (1)
kan niet openen: `foo.ly'*   (2)
niet te openen: `foo.ly'*    (3)
```

  The first nl message, although grammatically and stylistically correct, is not friendly for parsing by humans (even if they speak dutch). I guess we would prefer something like (2) or (3).
- Do not run make po/po-update with GNU gettext < 0.10.35

9.6 Debugging LilyPond

The most commonly used tool for debugging LilyPond is the GNU debugger gdb. The gdb tool is used for investigating and debugging core Lilypond code written in C++. Another tool is available for debugging Scheme code using the Guile debugger. This section describes how to use both gdb and the Guile Debugger.

9.6.1 Debugging overview

Using a debugger simplifies troubleshooting in at least two ways.

First, breakpoints can be set to pause execution at any desired point. Then, when execution has paused, debugger commands can be issued to explore the values of various variables or to execute functions.

Second, the debugger can display a stack trace, which shows the sequence in which functions have been called and the arguments passed to the called functions.

9.6.2 Debugging C++ code

The GNU debugger, gdb, is the principal tool for debugging C++ code.

Compiling LilyPond for use with gdb

In order to use gdb with LilyPond, it is necessary to compile LilyPond with debugging information. This is accomplished by running the following commands in the main LilyPond source directory.

```
./configure  --disable-optimising
make
```

This will create a version of LilyPond containing debugging information that will allow the debugger to tie the source code to the compiled code.

You should not do *make install* if you want to use a debugger with LilyPond. The *make install* command will strip debugging information from the LilyPond binary.

Typical gdb usage

Once you have compiled the Lilypond image with the necessary debugging information it will have been written to a location in a subfolder of your current working directory:

```
out/bin/lilypond
```

This is important as you will need to let gdb know where to find the image containing the symbol tables. You can invoke gdb from the command line usinga the following:

```
gdb out/bin/lilypond
```

This loads the LilyPond symbol tables into gdb. Then, to run LilyPond on `test.ly` under the debugger, enter the following:

```
run test.ly
```

at the gdb prompt.

As an alternative to running gdb at the command line you may try a graphical interface to gdb such as ddd:

```
ddd out/bin/lilypond
```

You can also use sets of standard gdb commands stored in a .gdbinit file (see next section).

Typical .gdbinit files

The behavior of gdb can be readily customized through the use of a *.gdbinit* file. A *.gdbinit* file is a file named *.gdbinit* (notice the "." at the beginning of the file name) that is placed in a user's home directory.

The *.gdbinit* file below is from Han-Wen. It sets breakpoints for all errors and defines functions for displaying scheme objects (ps), grobs (pgrob), and parsed music expressions (pmusic).

```
file lily/out/lilypond
b programming_error
b Grob::programming_error

define ps
   print ly_display_scm($arg0)
end
define pgrob
  print ly_display_scm($arg0->self_scm_)
  print ly_display_scm($arg0->mutable_property_alist_)
  print ly_display_scm($arg0->immutable_property_alist_)
  print ly_display_scm($arg0->object_alist_)
end
define pmusic
  print ly_display_scm($arg0->self_scm_)
  print ly_display_scm($arg0->mutable_property_alist_)
  print ly_display_scm($arg0->immutable_property_alist_)
end
```

9.6.3 Debugging Scheme code

Scheme code can be developed using the Guile command line interpreter `top-repl`. You can either investigate interactively using just Guile or you can use the debugging tools available within Guile.

Using Guile interactively with LilyPond

In order to experiment with Scheme programming in the LilyPond environment, it is necessary to have a Guile interpreter that has all the LilyPond modules loaded. This requires the following steps.

First, define a Scheme symbol for the active module in the .ly file:

```
#(module-define! (resolve-module '(guile-user))
                 'lilypond-module (current-module))
```

Now place a Scheme function in the .ly file that gives an interactive Guile prompt:

```
#(top-repl)
```

When the .ly file is compiled, this causes the compilation to be interrupted and an interactive guile prompt to appear. Once the guile prompt appears, the LilyPond active module must be set as the current guile module:

```
guile> (set-current-module lilypond-module)
```

You can demonstrate these commands are operating properly by typing the name of a LilyPond public scheme function to check it has been defined:

```
guile> fret-diagram-verbose-markup
#<procedure fret-diagram-verbose-markup (layout props marking-list)>
```

If the LilyPond module has not been correctly loaded, an error message will be generated:

```
guile> fret-diagram-verbose-markup
ERROR: Unbound variable: fret-diagram-verbose-markup
ABORT: (unbound-variable)
```

Once the module is properly loaded, any valid LilyPond Scheme expression can be entered at the interactive prompt.

After the investigation is complete, the interactive guile interpreter can be exited:

```
guile> (quit)
```

The compilation of the .ly file will then continue.

Using the Guile debugger

To set breakpoints and/or enable tracing in Scheme functions, put

```
\include "guile-debugger.ly"
```

in your input file after any scheme procedures you have defined in that file. This will invoke the Guile command-line after having set up the environment for the debug command-line. When your input file is processed, a guile prompt will be displayed. You may now enter commands to set up breakpoints and enable tracing by the Guile debugger.

Using breakpoints

At the guile prompt, you can set breakpoints with the `set-break!` procedure:

```
guile> (set-break! my-scheme-procedure)
```

Once you have set the desired breakpoints, you exit the guile repl frame by typing:

```
guile> (quit)
```

Then, when one of the scheme routines for which you have set breakpoints is entered, guile will interrupt execution in a debug frame. At this point you will have access to Guile debugging commands. For a listing of these commands, type:

```
debug> help
```

Alternatively you may code the breakpoints in your Lilypond source file using a command such as:

```
#(set-break! my-scheme-procedure)
```

immediately after the `\include` statement. In this case the breakpoint will be set straight after you enter the `(quit)` command at the guile prompt.

Embedding breakpoint commands like this is particularly useful if you want to look at how the Scheme procedures in the *.scm* files supplied with LilyPond work. To do this, edit the file in the relevant directory to add this line near the top:

```
(use-modules (scm guile-debugger))
```

Now you can set a breakpoint after the procedure you are interested in has been declared. For example, if you are working on routines called by *print-book-with* in *lily-library.scm*:

```
(define (print-book-with parser book process-procedure)
  (let* ((paper (ly:parser-lookup parser '$defaultpaper))
 (layout (ly:parser-lookup parser '$defaultlayout))
 (outfile-name (get-outfile-name parser)))
    (process-procedure book paper layout outfile-name)))

(define-public (print-book-with-defaults parser book)
  (print-book-with parser book ly:book-process))

(define-public (print-book-with-defaults-as-systems parser book)
  (print-book-with parser book ly:book-process-to-systems))
```

At this point in the code you could add this to set a breakpoint at print-book-with:

```
(set-break! print-book-with)
```

Tracing procedure calls and evaluator steps

Two forms of trace are available:

```
(set-trace-call! my-scheme-procedure)
```

and

```
(set-trace-subtree! my-scheme-procedure)
```

`set-trace-call!` causes Scheme to log a line to the standard output to show when the procedure is called and when it exits.

`set-trace-subtree!` traces every step the Scheme evaluator performs in evaluating the procedure.

9.7 Tracing object relationships

Understanding the LilyPond source often boils down to figuring out what is happening to the Grobs. Where (and why) are they being created, modified and destroyed? Tracing Lily through a debugger in order to identify these relationships can be time-consuming and tedious.

In order to simplify this process, a facility has been added to display the grobs that are created and the properties that are set and modified. Although it can be complex to get set up, once set up it easily provides detailed information about the life of grobs in the form of a network graph.

Each of the steps necessary to use the graphviz utility is described below.

1. Installing graphviz

   In order to create the graph of the object relationships, it is first necessary to install Graphviz. graphviz is available for a number of different platforms:

   http://www.graphviz.org/Download..php

2. Modifying config.make

   In order for the Graphviz tool to work, config.make must be modified. It is probably a good idea to first save a copy of config.make under a different name. Then, edit config.make by removing every occurence of `-DNDEBUG`.

3. Rebuilding LilyPond

   The executable code of LilyPond must be rebuilt from scratch:

```
make -C lily clean && make -C lily
```

4. Create a graphviz-compatible .ly file

   In order to use the graphviz utility, the .ly file must include '`ly/graphviz-init.ly`', and should then specify the grobs and symbols that should be tracked. An example of this is found in '`input/regression/graphviz.ly`'.

5. Run lilypond with output sent to a log file

   The Graphviz data is sent to stderr by lilypond, so it is necessary to redirect stderr to a logfile:

   ```
   lilypond graphviz.ly 2> graphviz.log
   ```

6. Edit the logfile

   The logfile has standard lilypond output, as well as the Graphviz output data. Delete everything from the beginning of the file up to but not including the first occurence of `digraph`.

7. Process the logfile with `dot`

   The directed graph is created from the log file with the program `dot`:

   ```
   dot -Tpdf graphviz.log > graphviz.pdf
   ```

The pdf file can then be viewed with any pdf viewer.

When compiled without `-DNDEBUG`, lilypond may run slower than normal. The original configuration can be restored by either renaming the saved copy of `config.make` or rerunning `configure`. Then rebuild lilypond with

```
make -C lily clean && make -C lily
```

9.8 Adding or modifying features

When a new feature is to be added to LilyPond, it is necessary to ensure that the feature is properly integrated to maintain its long-term support. This section describes the steps necessary for feature addition and modification.

9.8.1 Write the code

You should probably create a new git branch for writing the code, as that will separate it from the master branch and allow you to continue to work on small projects related to master.

Please be sure to follow the rules for programming style discussed earlier in this chapter.

9.8.2 Write regression tests

In order to demonstrate that the code works properly, you will need to write one or more regression tests. These tests are typically .ly files that are found in input/regression.

Regression tests should be as brief as possible to demonstrate the functionality of the code.

Regression tests should generally cover one issue per test. Several short, single-issue regression tests are preferred to a single, long, multiple-issue regression test.

Use existing regression tests as templates to demonstrate the type of header information that should be included in a regression test.

9.8.3 Write convert-ly rule

If the modification changes the input syntax, a convert-ly rule should be written to automatically update input files from older versions.

convert-ly rules are found in python/convertrules.py

If possible, the convert-ly rule should allow automatic updating of the file. In some cases, this will not be possible, so the rule will simply point out to the user that the feature needs manual correction.

9.8.4 Automatically update auxiliary information

convert-ly should be used to update the documentation, the snippets, and the regression tests. This not only makes the necessary syntax changes, it also tests the convert-ly rules.

The automatic updating is a three step process. First, be sure you are in the top-level source directory. Then, for the documentation, do:

```
find Documentation/ -name '*.itely' | xargs convert-ly -e --from \X.Y.Z"
```

where *X.Y.Z* is the version number of the last released development version.

Next, for the snippets, do:

```
find Documentation/snippets/ -name '*.ly' | xargs convert-ly -e --from \X.Y.Z"
```

Finally, for the regression tests, do:

```
find input/regression/ -name '*.ly' | xargs convert-ly -e --from \X.Y.Z"
```

9.8.5 Manually update auxiliary information

Where the convert-ly rule is not able to automatically update the inline lilypond code in the documentation (i.e. if a NOT_SMART rule is used), the documentation must be manually updated. The inline snippets that require changing must be changed in the English version of the docs and all translated versions. If the inline code is not changed in the translated documentation, the old snippets will show up in the English version of the documentation.

Where the convert-ly rule is not able to automatically update snippets in Documentation/snippets/, those snippets must be manually updated. Those snippets should be copied to Documentation/snippets/new. The comments at the top of the snippet describing its automatic generation should be removed. All translated texidoc strings should be removed. The comment "% begin verbatim" should be removed. The syntax of the snippet should then be manually edited.

Where snippets in Documentation/snippets are made obsolete, the snippet should be copied to Documentation/snippets/new. The comments and texidoc strings should be removed as described above. Then the body of the snippet should be changed to:

```
\markup {
  This snippet is deprecated as of version X.Y.Z and
  will be removed from the documentation.
}
```

where X.Y.Z is the version number for which the convert-ly rule was written.

Update the snippet files by running:

```
scripts/auxiliar/makelsr.py
```

Where the convert-ly rule is not able to automatically update regression tests, the regression tests in input/regression should be manually edited.

Although it is not required, it is helpful if the developer can write relevant material for inclusion in the Notation Reference. If the developer does not feel qualified to write the documentation, a documentation editor will be able to write it from the regression tests. The text that is added to or removed from the documentation should be changed only in the English version.

9.8.6 Edit changes.tely

An entry should be added to Documentation/changes.tely to describe the feature changes to be implemented. This is especially important for changes that change input file syntax.

Hints for changes.tely entries are given at the top of the file.

New entries in changes.tely go at the top of the file.

The changes.tely entry should be written to show how the new change improves LilyPond, if possible.

9.8.7 Verify successful build

When the changes have been made, successful completion must be verified by doing

```
make all
make doc
```

When these commands complete without error, the patch is considered to function successfully.

Developers on Windows who are unable to build LilyPond should get help from a Linux or OSX developer to do the make tests.

9.8.8 Verify regression tests

In order to avoid breaking LilyPond, it is important to verify that the regression tests succeed, and that no unwanted changes are introduced into the output. This process is described in Section 8.4 [Identifying code regressions], page 76.

Typical developer's edit/compile/test cycle

TODO: is `[-jX CPU_COUNT=X]` useful for `test-baseline`, `check`, `clean`, `test-redo`? Neil Puttock says it is useful for everything but `clean`, which is disk-limited. Need to check formally.

- Initial test:

```
make [-jX]
make test-baseline
make [-jX CPU_COUNT=X] check
```

- Edit/compile/test cycle:

```
## edit source files, then...

make clean                      ## only if needed (see below)
make [-jX]                      ## only if needed (see below)
make test-redo                  ## redo files differing from baseline
make [-jX CPU_COUNT=X] check    ## CPU_COUNT here?
```

- Reset:

```
make test-clean
```

If you modify any source files that have to be compiled (such as '`.cc`' or '`.hh`' files in '`flower/`' or '`lily/`'), then you must run `make` before `make test-redo`, so `make` can compile the modified files and relink all the object files. If you only modify files which are interpreted, like those in the '`scm/`' and '`ly/`' directories, then `make` is not needed before `make test-redo`.

TODO: Fix the following paragraph. You can do `rm mf/out/*` instead of make clean, and you can probably do `make -C mf/ clean` as well, but I haven't checked it – cds

Also, if you modify any font definitions in the '`mf/`' directory then you must run `make clean` and `make` before running `make test-redo`. This will recompile everything, whether modified or not, and takes a lot longer.

Running `make check` will leave an HTML page '`out/test-results/index.html`'. This page shows all the important differences that your change introduced, whether in the layout, MIDI, performance or error reporting.

9.8.9 Post patch for comments

For any change other than a minor change, a patch set should be posted on Rietveld for comment. This requires the use of an external package, git-cl, and an email account on Google.

git-cl is installed by:

```
git clone git://neugierig.org/git-cl.git
```

Then, add the git-cl directory to your PATH, or create a symbolic link to the git-cl and upload.py in one of your PATH directories (like usr/bin). git-cl is then configured by entering the command

```
git cl config
```

in the LilyPond git directory and answering the questions that are asked. If you do not understand the question answer with just a newline (CR).

The patch set is posted to Rietveld as follows. Ensure your changes are committed in a separate branch, which should differ from the reference branch to be used by just the changes to be uploaded. If the reference branch is to be origin/master, ensure this is up-to-date. If necessary, use git rebase to rebase the branch containing the changes to the head of origin/master. Finally, check out branch with the changes and enter the command:

```
git cl upload <reference SHA1 ID>
```

where <reference SHA1 ID> is the SHA1 ID of the commit to be used as a reference source for the patch. Generally, this will be the SHA1 ID of origin/master, and in that case the command

```
git cl upload origin/master
```

can be used.

After prompting for your Google email address and password, the patch set will be posted to Rietveld.

You should then announce the patch by sending an email to lilypond-devel, with a subject line starting with PATCH:, asking for comments on the patch.

As revisions are made in response to comments, successive patch sets for the same issue can be uploaded by reissuing the git-cl command with the modified branch checked out.

Sometimes in response to comments on revisions, the best way to work may require creation of a new branch in git. In order to associate the new branch with an existing Reitveld issue, the following command can be used:

```
git cl issue issue-number
```

where `issue-number` is the number of the existing Rietveld issue.

9.8.10 Push patch

Once all the comments have been addressed, the patch can be pushed.

If the author has push privileges, the author will push the patch. Otherwise, a developer with push privileges will push the patch.

9.8.11 Closing the issues

Once the patch has been pushed, all the relevant issues should be closed.

On Rietveld, the author should log in an close the issue either by using the 'Edit Issue' link, or by clicking the circled x icon to the left of the issue name.

If the changes were in response to a feature request on the Google issue tracker for LilyPond, the author should change the status to Fixed and a tag 'fixed_x_y_z' should be added, where

the patch was fixed in version x.y.z. If the author does not have privileges to change the status, an email should be sent to bug-lilypond requesting the BugMeister to change the status.

9.9 Iterator tutorial

TODO – this is a placeholder for a tutorial on iterators

Iterators are routines written in C++ that process music expressions and sent the music events to the appropriate engravers and/or performers.

9.10 Engraver tutorial

Engravers are C++ classes that catch music events and create the appropriate grobs for display on the page. Though the majority of engravers are responsible for the creation of a single grob, in some cases (e.g. `New_fingering_engraver`), several different grobs may be created.

Engravers listen for events and acknowledge grobs. Events are passed to the engraver in time-step order during the iteration phase. Grobs are made available to the engraver when they are created by other engravers during the iteration phase.

9.10.1 Useful methods for information processing

An engraver inherits the following public methods from the Translator base class, which can be used to process listened events and acknowledged grobs:

- `virtual void initialize ()`
- `void start_translation_timestep ()`
- `void process_music ()`
- `void process_acknowledged ()`
- `void stop_translation_timestep ()`
- `virtual void finalize ()`

These methods are listed in order of translation time, with `initialize ()` and `finalize ()` bookending the whole process. `initialize ()` can be used for one-time initialization of context properties before translation starts, whereas `finalize ()` is often used to tie up loose ends at the end of translation: for example, an unterminated spanner might be completed automatically or reported with a warning message.

9.10.2 Translation process

At each timestep in the music, translation proceeds by calling the following methods in turn:

`start_translation_timestep ()` is called before any user information enters the translators, i.e., no property operations (\set, \override, etc.) or events have been processed yet.

`process_music ()` and `process_acknowledged ()` are called after all events in the current time step have been heard, or all grobs in the current time step have been acknowledged. The latter tends to be used exclusively with engravers which only acknowledge grobs, whereas the former is the default method for main processing within engravers.

`stop_translation_timestep ()` is called after all user information has been processed prior to beginning the translation for the next timestep.

9.10.3 Preventing garbage collection for SCM member variables

In certain cases, an engraver might need to ensure private Scheme variables (with type SCM) do not get swept away by Guile's garbage collector: for example, a cache of the previous key signature which must persist between timesteps. The method `virtual derived_mark () const` can be used in such cases:

```
Engraver_name::derived_mark ()
{
  scm_gc_mark (private_scm_member_)
}
```

9.10.4 Listening to music events

External interfaces to the engraver are implemented by protected macros including one or more of the following:

- `DECLARE_TRANSLATOR_LISTENER (event_name)`
- `IMPLEMENT_TRANSLATOR_LISTENER (Engraver_name, event_name)`

where *event_name* is the type of event required to provide the input the engraver needs and *Engraver_name* is the name of the engraver.

Following declaration of a listener, the method is implemented as follows:

```
IMPLEMENT_TRANSLATOR_LISTENER (Engraver_name, event_name)
void
Engraver_name::listen_event_name (Stream event *event)
{
  ...body of listener method...
}
```

9.10.5 Acknowledging grobs

Some engravers also need information from grobs as they are created and as they terminate. The mechanism and methods to obtain this information are set up by the macros:

- `DECLARE_ACKNOWLEDGER (grob_interface)`
- `DECLARE_END_ACKNOWLEDGER (grob_interface)`

where *grob_interface* is an interface supported by the grob(s) which should be acknowledged. For example, the following code would declare acknowledgers for a `NoteHead` grob (via the `note-head-interface`) and any grobs which support the `side-position-interface`:

```
DECLARE_ACKNOWLEDGER (note_head)
DECLARE_ACKNOWLEDGER (side_position)
```

The `DECLARE_END_ACKNOWLEDGER ()` macro sets up a spanner-specific acknowledger which will be called whenever a spanner ends.

Following declaration of an acknowledger, the method is coded as follows:

```
void
Engraver_name::acknowledge_interface_name (Grob_info info)
{
  ...body of acknowledger method...
}
```

9.10.6 Engraver declaration/documentation

An engraver must have a public macro

- `TRANSLATOR_DECLARATIONS (Engraver_name)`

where `Engraver_name` is the name of the engraver. This defines the common variables and methods used by every engraver.

At the end of the engraver file, one or both of the following macros are generally called to document the engraver in the Internals Reference:

- `ADD_ACKNOWLEDGER (Engraver_name, grob_interface)`

- `ADD_TRANSLATOR (Engraver_name, Engraver_doc, Engraver_creates, Engraver_reads, Engraver_writes)`

where `Engraver_name` is the name of the engraver, `grob_interface` is the name of the interface that will be acknowledged, `Engraver_doc` is a docstring for the engraver, `Engraver_creates` is the set of grobs created by the engraver, `Engraver_reads` is the set of properties read by the engraver, and `Engraver_writes` is the set of properties written by the engraver.

The `ADD_ACKNOWLEDGER` and `ADD_TRANSLATOR` macros use a non-standard indentation system. Each interface, grob, read property, and write property is on its own line, and the closing parenthesis and semicolon for the macro all occupy a separate line beneath the final interface or write property. See existing engraver files for more information.

9.11 Callback tutorial

TODO – This is a placeholder for a tutorial on callback functions.

9.12 LilyPond scoping

The Lilypond language has a concept of scoping, ie you can do

```
foo = 1

#(begin
   (display (+ foo 2)))
```

with `\paper`, `\midi` and `\header` being nested scope inside the '`.ly`' file-level scope. `foo = 1` is translated in to a scheme variable definition.

This implemented using modules, with each scope being an anonymous module that imports its enclosing scope's module.

Lilypond's core, loaded from '`.scm`' files, is usually placed in the `lily` module, outside the '`.ly`' level. In the case of

```
lilypond a.ly b.ly
```

we want to reuse the built-in definitions, without changes effected in user-level '`a.ly`' leaking into the processing of '`b.ly`'.

The user-accessible definition commands have to take care to avoid memory leaks that could occur when running multiple files. All information belonging to user-defined commands and markups is stored in a manner that allows it to be garbage-collected when the module is dispersed, either by being stored module-locally, or in weak hash tables.

9.13 LilyPond miscellany

This is a place to dump information that may be of use to developers but doesn't yet have a proper home. Ideally, the length of this section would become zero as items are moved to other homes.

9.13.1 Spacing algorithms

Here is information from an email exchange about spacing algorithms.

On Thu, 2010-02-04 at 15:33 -0500, Boris Shingarov wrote: I am experimenting with some modifications to the line breaking code, and I am stuck trying to understand how some of it works. So far my understanding is that Simple_spacer operates on a vector of Grobs, and it is a well-known Constrained-QP problem (rods = constraints, springs = quadratic function to minimize). What I don't understand is, if the spacer operates at the level of Grobs, which are built at an earlier stage in the pipeline, how are the changes necessitated by differences in line breaking, taken into account? in other words, if I take the last measure of a line and place it on

the next line, it is not just a matter of literally moving that graphic to where the start of the next line is, but I also need to draw a clef, key signature, and possibly other fundamental things – but at that stage in the rendering pipeline, is it not too late??

Joe Neeman answered:

We create lots of extra grobs (eg. a BarNumber at every bar line) but most of them are not drawn. See the break-visibility property in item-interface.

9.13.2 Info from Han-Wen email

In 2004, Douglas Linhardt decided to try starting a document that would explain LilyPond architecture and design principles. The material below is extracted from that email, which can be found at http://thread.gmane.org/gmane.comp.gnu.lilypond.devel/2992. The headings reflect questions from Doug or comments from Han-Wen; the body text are Han-Wen's answers.

Figuring out how things work.

I must admit that when I want to know how a program works, I use grep and emacs and dive into the source code. The comments and the code itself are usually more revealing than technical documents.

What's a grob, and how is one used?

Graphical object - they are created from within engravers, either as Spanners (derived class) -slurs, beams- or Items (also a derived class) -notes, clefs, etc.

There are two other derived classes System (derived from Spanner, contaning a "line of music") and Paper_column (derived from Item, it contains all items that happen at the same moment). They are separate classes because they play a special role in the linebreaking process.

What's a smob, and how is one used?

A C(++) object that is encapsulated so it can be used as a Scheme object. See GUILE info, "19.3 Defining New Types (Smobs)"

@subheading When is each C++ class constructed and used

- Music classes

  In the parser.yy see the macro calls MAKE_MUSIC_BY_NAME().
- Contexts

  Constructed during "interpreting" phase.
- Engravers

  Executive branch of Contexts, plugins that create grobs, usually one engraver per grob type. Created together with context.
- Layout Objects

  = grobs
- Grob Interfaces

  These are not C++ classes per se. The idea of a Grob interface hasn't crystallized well. ATM, an interface is a symbol, with a bunch of grob properties. They are not objects that are created or destroyed.
- Iterators

  Objects that walk through different music classes, and deliver events in a synchronized way, so that notes that play together are processed at the same moment and (as a result) end up on the same horizontal position.

  Created during interpreting phase.

  BTW, the entry point for interpreting is ly:run-translator (ly_run_translator on the C++ side)

Can you get to Context properties from a Music object?

You can create music object with a Scheme function that reads context properties (the \apply-context syntax). However, that function is executed during Interpreting, so you can not really get Context properties from Music objects, since music objects are not directly connected to Contexts. That connection is made by the Music_iterators

Can you get to Music properties from a Context object?

Yes, if you are given the music object within a Context object. Normally, the music objects enter Contexts in synchronized fashion, and the synchronization is done by Music_iterators.

What is the relationship between C++ classes and Scheme objects?

Smobs are C++ objects in Scheme. Scheme objects (lists, functions) are manipulated from C++ as well using the GUILE C function interface (prefix: scm_)

How do Scheme procedures get called from C++ functions?

scm_call_*, where * is an integer from 0 to 4. Also scm_c_eval_string (), scm_eval ()

How do C++ functions get called from Scheme procedures?

Export a C++ function to Scheme with LY_DEFINE.

What is the flow of control in the program?

Good question. Things used to be clear-cut, but we have Scheme and SMOBs now, which means that interactions do not follow a very rigid format anymore. See below for an overview, though.

Does the parser make Scheme procedure calls or C++ function calls?

Both. And the Scheme calls can call C++ and vice versa. It's nested, with the SCM datatype as lubrication between the interactions

(I think the word "lubrication" describes the process better than the traditional word "glue")

How do the front-end and back-end get started?

Front-end: a file is parsed, the rest follows from that. Specifically,

Parsing leads to a Music + Music_output_def object (see parser.yy, definition of toplevel_expression)

A Music + Music_output_def object leads to a Global_context object (see ly_run_translator ())

During interpreting, Global_context + Music leads to a bunch of Contexts. (see Global_translator::run_iterator_on_me ())

After interpreting, Global_context contains a Score_context (which contains staves, lyrics etc.) as a child. Score_context::get_output () spews a Music_output object (either a Paper_score object for notation or Performance object for MIDI).

The Music_output object is the entry point for the backend. (see ly_render_output ())

The main steps of the backend itself are in

- paper-score.cc , Paper_score::process_
- system.cc , System::get_lines()
- The step, where things go from grobs to output, is in System::get_line(): each grob delivers a Stencil (a Device independent output description), which is interpreted by our outputting backends (scm/output-tex.scm and scm/output-ps.scm) to produce TeX and PS.

Interactions between grobs and putting things into .tex and .ps files have gotten a little more complex lately. Jan has implemented page-breaking, so now the backend also involves Paper_book, Paper_lines and other things. This area is still heavily in flux, and perhaps not something you should want to look at.

How do the front-end and back-end communicate?

There is no communication from backend to front-end. From front-end to backend is simply the program flow: music + definitions gives contexts, contexts yield output, after processing, output is written to disk.

Where is the functionality associated with KEYWORDs?

See my-lily-lexer.cc (keywords, there aren't that many) and ly/*.ly (most of the other backslashed \words are identifiers)

What Contexts/Properties/Music/etc. are available when they are processed?

What do you mean exactly with this question?

See ly/engraver-init.ly for contexts, see scm/define-*.scm for other objects.

How do you decide if something is a Music, Context, or Grob property?

Why is part-combine-status a Music property when it seems (IMO) to be related to the Staff context?

The Music_iterators and Context communicate through two channels

Music_iterators can set and read context properties, idem for Engravers and Contexts

Music_iterators can send "synthetic" music events (which aren't in the input) to a context. These are caught by Engravers. This is mostly a one way communication channel.

part-combine-status is part of such a synthetic event, used by Part_combine_iterator to communicate with Part_combine_engraver.

Deciding between context and music properties

I'm adding a property to affect how \autochange works. It seems to me that it should be a context property, but the Scheme autochange procedure has a Music argument. Does this mean I should use a Music property?

\autochange is one of these extra strange beasts: it requires look-ahead to decide when to change staves. This is achieved by running the interpreting step twice (see scm/part-combiner.scm , at the bottom), and storing the result of the first step (where to switch staves) in a Music property. Since you want to influence that where-to-switch list, your must affect the code in make-autochange-music (scm/part-combiner.scm). That code is called directly from the parser and there are no official "parsing properties" yet, so there is no generic way to tune \autochange. We would have to invent something new for this, or add a separate argument,

```
\autochange #around-central-C ..music..
```

where around-central-C is some function that is called from make-autochange-music.

How do I tell about the execution environment?

I get lost figuring out what environment the code I'm looking at is in when it executes. I found both the C++ and Scheme autochange code. Then I was trying to figure out where the code got called from. I finally figured out that the Scheme procedure was called before the C++ iterator code, but it took me a while to figure that out, and I still didn't know who did the calling in

the first place. I only know a little bit about Flex and Bison, so reading those files helped only a little bit.

Han-Wen: GDB can be of help here. Set a breakpoint in C++, and run. When you hit the breakpoint, do a backtrace. You can inspect Scheme objects along the way by doing

```
p ly_display_scm(obj)
```

this will display OBJ through GUILE.

9.13.3 Music functions and GUILE debugging

Ian Hulin was trying to do some debugging in music functions, and came up with the following question

HI all, I'm working on the Guile Debugger Stuff, and would like to try debugging a music function definition such as:

```
conditionalMark = #(define-music-function (parser location) ()
    #{ \tag #'instrumental-part {\mark \default}  #} )
```

It appears conditionalMark does not get set up as an equivalent of a Scheme

```
(define conditionalMark = define-music-function(parser location () ...
```

although something gets defined because Scheme apparently recognizes

```
#(set-break! conditionalMark)
```

later on in the file without signalling any Guile errors.

However the breakpoint trap is never encountered as define-music-function passed things on to ly:make-music-function, which is really C++ code ly_make_music_function, so Guile never finds out about the breakpoint.

Han-Wen answered as follows:

You can see the defintion by doing

```
#(display conditionalMark)
```

noindent inside the .ly file.

The breakpoint failing may have to do with the call sequence. See parser.yy, run_music_function(). The function is called directly from C++, without going through the GUILE evaluator, so I think that is why there is no debugger trap.

10 Release work

10.1 Development phases

There are 2.5 states of development for LilyPond.

- **Stable phase**: Starting from the release of a new major version `2.x.0`, the following patches **MAY NOT** be merged with master:
  - Any change to the input syntax. If a file compiled with a previous `2.x` version, then it must compile in the new version.
  - New features with new syntax *may be committed*, although once committed that syntax cannot change during the remainder of the stable phase.
  - Any change to the build dependencies (including programming libraries, documentation process programs, or python modules used in the buildscripts). If a contributor could compile a previous lilypond `2.x`, then he must be able to compile the new version.
- **Development phase**: Any commits are fine. Readers may be familiar with the term "merge window" from following Linux kernel news.
- **Release prep phase**: TODO: I don't like that name.

  A new git branch `stable/2.x` is created, and a major release is made in two weeks.
  - `stable/2.x branch`: Only translation updates and important bugfixes are allows.
  - `master`: Normal "stable phase" development occurs.

  If we discover the need to change the syntax or build system, we will apply it and re-start the release prep phase.

This marks a radical change from previous practice in LilyPond. However, this setup is not intended to slow development – as a rule of thumb, the next development phase will start within a month of somebody wanting to commit something which is not permitted during the stable phase.

10.2 Minor release checklist

A "minor release" means an update of `y` in `2.x.y`.

Pre-release

1. Switch to the release branch, get changes, prep release announcement:

   ```
   git checkout release/unstable
   git merge origin
   vi Documentation/web/news-front.itexi Documentation/web/news.itexi
   ```

2. Commit, push, switch back to master:

   ```
   git commit -m "Release: update news." Documentation/web/
   git push origin
   ```

3. (optional) Check that lilypond builds from scratch in an out-of-tree build.
4. If you do not have the previous release test-output tarball, download it and put it in `regtests/`
5. Build release on GUB by running:

   ```
   make LILYPOND_BRANCH=release/unstable lilypond
   ```

   or something like:

   ```
   make LILYPOND_BRANCH=stable/2.12 lilypond
   ```

6. Check the regtest comparison in '`uploads/webtest/`' for any unintentional breakage. More info in Section 8.2 [Precompiled regression tests], page 75
7. If any work was done on GUB since the last release, upload binaries to a temporary location, ask for feedback, and wait a day or two in case there's any major problems. Or live dangerously and just add a sentence to the release notes. Or live even more dangerously, and don't tell anybody anything.

Actual release

1. If you're not right user on the webserver, remove the "t" from the rsync command in '`test-lily/rsync-lily-doc.py`' and '`test-lily/rsync-test.py`'

   `graham` owns v2.13; `han-wen` owns v2.12.
2. Upload GUB by running:

   ```
   make lilypond-upload LILYPOND_BRANCH=release/unstable LILYPOND_REPO_URL=git://git.s
   ```

   or something like:

   ```
   make lilypond-upload LILYPOND_BRANCH=stable/2.12 LILYPOND_REPO_URL=git://git.sv.gnu
   ```

Post release

1. Switch back to master and get the updated news:

   ```
   git checkout master
   git merge release/unstable
   ```
2. Update '`VERSION`' in lilypond git and upload changes:

   ```
   vi VERSION
   ```

   - VERSION = what you just did +0.0.1
   - DEVEL_VERSION = what you just did (i.e. is now online)
   - STABLE_VERSION = what's online (probably no change here)

   ```
   git commit -m "Release: bump version." VERSION
   git push origin
   ```
3. (for now) do a `make doc` and manually upload:

   ```
   ### upload-lily-web-media.sh
   #!/bin/sh
   BUILD_DIR=$HOME/src/build-lilypond

   PICS=$BUILD_DIR/Documentation/pictures/out-www/
   EXAMPLES=$BUILD_DIR/Documentation/web/ly-examples/out-www/

   cd $BUILD_DIR
   rsync -a $PICS graham@lilypond.org:media/pictures
   rsync -a $EXAMPLES graham@lilypond.org:media/ly-examples
   ```
4. Wait a few hours for the website to update.
5. Email release notice to `info-lilypond`

10.3 Major release checklist

A "major release" means an update of `x` in `2.x.0`.

- happens when we have 0 Critical issues for two weeks (14 days).

Before release:

* write release notes. note: stringent size requirements for various websites, so be brief.

* write preface section for manual.

* submit pots for translation : send url of tarball to translation@iro.umontreal.ca, mentioning lilypond-VERSION.pot

* Check reg test

* Check all 2ly scripts.

* Run convert-ly on all files, bump parser minimum version.

* update links to distros providing lilypond packages? link in Documentation/web/download.itexi . This has nothing to do with the release, but I'm dumping this here so I'll find it when I reorganize this list later. -gp

* Make FTP directories on lilypond.org

* website: - Make new table in download.html

- add to documentation list

- revise examples tour.html/howto.html

- add to front-page quick links

- change all links to the stable documentation

- make a link from the old unstable to the next stable in lilypond.org's /doc/ dir. Keep all previous unstable->stable doc symlinks.

- doc auto redirects to v2.LATEST-STABLE

- add these two lines to http://www.lilypond.org/robots.txt:

```
Disallow: /doc/v2.PREVIOUS-STABLE/
Disallow: /doc/v2.CURRENT-DEVELOPMENT/
```

- check for emergencies the docs:

```
grep FIXME --exclude "misc/*" --exclude "*GNUmakefile" \
  --exclude "snippets/*" ????*/*
```

- check for altered regtests, and document as necessary. (update tags as appropriate)

```
git diff -u -r release/2.12.0-1 -r release/2.13.13-1 input/regression/
```

News:

comp.music.research comp.os.linux.announce

comp.text.tex rec.music.compose

Mail:

info-lilypond@gnu.org

linux-audio-announce@lists.linuxaudio.org linux-audio-user@lists.linuxaudio.org linux-audio-dev@lists.linuxaudio.org

tex-music@icking-music-archive.org

— non-existant? abcusers@blackmill.net

rosegarden-user@lists.sourceforge.net info-gnu@gnu.org noteedit-user@berlios.de

gmane.comp.audio.fomus.devel gmane.linux.audio.users gmane.linux.audio.announce gmane.comp.audio.rosegarden.devel

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10.4 Release extra notes

Regenerating regression tests

Regenerating regtests (if the lilypond-book naming has changed):

- git checkout release/lilypond-X.Y.Z-A
- take lilypond-book and any related makefile updates from the latest git.
- - configure; make; make test
- tar -cjf lilypond-X.Y.Z-A.test-output.tar.bz2 input/regression/out-test/
- mv lilypond-X.Y.Z-A.test-output.tar.bz2 ../gub/regtests/
- cd ../gub/regtests/
- make lilypond

stable/2.12

If releasing stable/2.12, then:

- apply doc patch: patches/rsync-lily.patch (or something like that)
- change infodir in gub/specs/lilypond-doc.py from "lilypond.info" to "lilypond-web.info"

Updating a release (changing a in x.y.z-a)

Really tentative instructions, almost certainly can be done better.

1. change the VERSION back to release you want. push change. (hopefully you'll have forgotten to update it when you made your last release)
2. make sure that there aren't any lilypond files floating around in target/ (like usr/bin/lilypond).
3. build the specific package(s) you want, i.e.

   ```
   bin/gub mingw::lilypond-installer
   make LILYPOND_BRANCH=stable/2.12 -f lilypond.make doc
   bin/gub --platform=darwin-x86 'git://git.sv.gnu.org/lilypond-doc.git?branch=stable/
   ```

   or

   build everything with the normal "make lilypond", then (maybe) manually delete stuff you don't want to upload.
4. manually upload them. good luck figuring out the rsync command(s). Hints are in test-lily/

   or

   run the normal lilypond-upload command, and (maybe) manually delete stuff you didn't want to upload from the server.

11 Administrative policies

This chapter discusses miscellaneous administrative issues which don't fit anywhere else.

11.1 Meta-policy for this document

The Contributor's Guide as a whole is still a work in progress, but some chapters are much more complete than others. Chapters which are "almost finished" should not have major changes without a discussion on `-devel`; in other chapters, a disorganized "wiki-style dump" of information is encouraged.

Do not change (other than spelling mistakes) without discussion:

- Chapter 1 [Introduction to contributing], page 1
- Chapter 2 [Working with source code], page 5

Please dump info in an appropriate `@`section within these manuals, but discuss any large-scale reorganization:

- Chapter 3 [Compiling], page 27
- Chapter 4 [Documentation work], page 39
- Chapter 7 [Issues], page 69
- Chapter 8 [Regression tests], page 75
- Chapter 9 [Programming work], page 78

Totally disorganized; do whatever the mao you want:

- Chapter 5 [Website work], page 63
- Chapter 6 [LSR work], page 66
- Chapter 10 [Release work], page 102
- Chapter 11 [Administrative policies], page 106

11.2 Meisters

We have four jobs for organizing a team of contributors:

- Bug Meister: trains new Bug Squad volunteers, organizes who works on which part of their job, checks to make sure that everything is running smoothly, and has final say on our policy for Issues.

  Currently: Graham
- Doc Meister: trains new doc editors/writers, organizes who works on which part of the job, checks to make sure that everything is running smoothly, and has final say on our policy for Documentation. Also includes LSR work.

  Currently: Graham
- Translation Meister: trains new translators, updates the translation priority list, and handles merging branches (in both directions).

  Currently: Francisco
- Frog Meister: is responsible for code patches from (relatively) inexperienced contributors. Keeps track of patches, does initial reviewing of those patches, sends them to `-devel` when they've had some initial review on the Frog list, pesters the `-devel` community into actually reviewing said patches, and finally pushes the patches once they're accepted. This person is *not* responsible for training new programmers, because that would be far too much work – he job is "only" to guide completed patches through our process.

  Currently: Carl

11.3 Unsorted policies

Language-specific mailing lists

A translator can ask for an official lilypond-xy mailing list once they've finished all "priority 1" translation items.

Performing yearly copyright update ("grand-replace")

At the start of each year, copyright notices for all source files should be refreshed by running the following command from the top of the source tree:

```
make grand-replace
```

Internally, this invokes the script '`scripts/build/grand-replace.py`', which performs a regular expression substitution for old-year -> new-year wherever it finds a valid copyright notice.

Note that snapshots of third party files such as '`texinfo.tex`' should not be included in the automatic update; '`grand-replace.py`' ignores these files if they are listed in the variable `copied_files`.

Push git access

Git access is given out when a contributor has a significant record of patches being accepted without problems. If existing developers are tired of pushing patches for a contributor, we'll discuss giving them push access. Unsolicited requests from contributors for access will almost always be turned down.

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Version 1.3, 3 November 2008

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