

Debian Packaging Tutorial

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About this tutorial

- ▶ Goal: **tell you what you really need to know about Debian packaging**
 - ▶ Modify existing packages
 - ▶ Create your own packages
 - ▶ Interact with the Debian community
 - ▶ Become a Debian power-user
- ▶ Covers the most important points, but is not complete
 - ▶ You will need to read more documentation
- ▶ Most of the content also applies to Debian derivative distributions
 - ▶ That includes Ubuntu



Outline

- 1 Introduction
- 2 Creating source packages
- 3 Building and testing packages
- 4 Practical session 1: modifying the grep package
- 5 Advanced packaging topics
- 6 Maintaining packages in Debian
- 7 Conclusions
- 8 Additional practical sessions
- 9 Answers to practical sessions



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Debian

- ▶ **GNU/Linux distribution**
- ▶ 1st major distro developed “openly in the spirit of GNU”
- ▶ **Non-commercial**, built collaboratively by over 1,000 volunteers
- ▶ 3 main features:
 - ▶ **Quality** – culture of technical excellence
We release when it's ready
 - ▶ **Freedom** – devs and users bound by the *Social Contract*
Promoting the culture of Free Software since 1993
 - ▶ **Independence** – no (single) company babysitting Debian
And open decision-making process (*do-ocracy* + *democracy*)
- ▶ **Amateur** in the best sense: done for the love of it



Debian packages

- ▶ **.deb** files (binary packages)
- ▶ A very powerful and convenient way to distribute software to users
- ▶ One of the two most common package formats (with RPM)
- ▶ Universal:
 - ▶ 30,000 binary packages in Debian
→ most of the available free software is packaged in Debian!
 - ▶ For 12 ports (architectures), including 2 non-Linux (Hurd; KFreeBSD)
 - ▶ Also used by 120 Debian derivative distributions



The Deb package format

- ▶ .deb file: an ar archive

```
$ ar tv wget_1.12-2.1_i386.deb
rw-r--r-- 0/0      4 Sep  5 15:43 2010 debian-binary
rw-r--r-- 0/0    2403 Sep  5 15:43 2010 control.tar.gz
rw-r--r-- 0/0  751613 Sep  5 15:43 2010 data.tar.gz
```

- ▶ debian-binary: version of the deb file format, "2.0\n"
- ▶ control.tar.gz: metadata about the package
control, md5sums, (pre|post)(rm|inst), triggers, shlibs,...
- ▶ data.tar.gz: data files of the package
- ▶ You could create your .deb files manually
http://tldp.org/HOWTO/html_single/Debian-Binary-Package-Building-HOWTO/
- ▶ But most people don't do it that way

This tutorial: create Debian packages, the Debian way



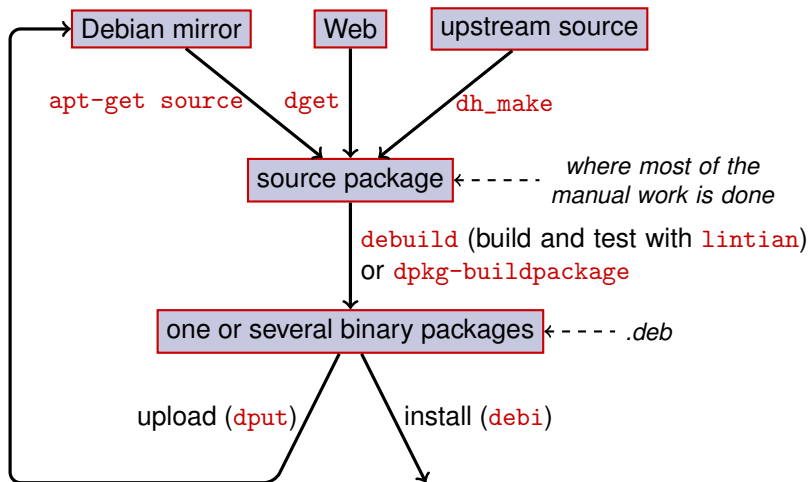
Tools you will need

- ▶ A Debian (or Ubuntu) system (with root access)
- ▶ Some packages:
 - ▶ **build-essential**: has dependencies on the packages that will be assumed to be available on the developer's machine (no need to specify them in the `Build-Depends`: control field of your package)
 - ▶ includes a dependency on **dpkg-dev**, which contains basic Debian-specific tools to create packages
 - ▶ **devscripts**: contains many useful scripts for Debian maintainers

Many other tools will also be mentioned later, such as **debhelper**, **cdb**s, **quilt**, **pbuilder**, **sbuild**, **lintian**, **svn-buildpackage**, **git-buildpackage**, ...
Install them when you need them.



General packaging workflow



Example: rebuilding dash

- 1 Install packages needed to build dash, and devscripts

```
sudo apt-get build-dep dash
```

(requires deb-src lines in /etc/apt/sources.list)

```
sudo apt-get install --no-install-recommends devscripts fakeroot
```
- 2 Create a working directory, and get in it:

```
mkdir /tmp/debian-tutorial ; cd /tmp/debian-tutorial
```
- 3 Grab the dash source package

```
apt-get source dash
```

(This needs you to have deb-src lines in your /etc/apt/sources.list)
- 4 Build the package

```
cd dash-*  
debuild -us -uc (-us -uc disables signing the package with GPG)
```
- 5 Check that it worked
 - ▶ There are some new .deb files in the parent directory
- 6 Look at the debian/ directory
 - ▶ That's where the packaging work is done



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Source package

- ▶ One source package can generate several binary packages
e.g. the `libtar` source generates the `libtar0` and `libtar-dev` binary packages
- ▶ Two kinds of packages: (if unsure, use non-native)
 - ▶ Native packages: normally for Debian specific software (*dpkg*, *apt*)
 - ▶ Non-native packages: software developed outside Debian
- ▶ Main file: `.dsc` (meta-data)
- ▶ Other files depending on the version of the source format
 - ▶ 1.0 or 3.0 (native): `package_version.tar.gz`
 - ▶ 1.0 (non-native):
 - ▶ `pkg_ver.orig.tar.gz`: upstream source
 - ▶ `pkg_debver.diff.gz`: patch to add Debian-specific changes
 - ▶ 3.0 (quilt):
 - ▶ `pkg_ver.orig.tar.gz`: upstream source
 - ▶ `pkg_debver.debian.tar.gz`: tarball with the Debian changes

(See `dpkg-source(1)` for exact details)



Source package example (wget_1.12-2.1.dsc)

```
Format: 3.0 (quilt)
Source: wget
Binary: wget
Architecture: any
Version: 1.12-2.1
Maintainer: Noel Kothé <noel@debian.org>
Homepage: http://www.gnu.org/software/wget/
Standards-Version: 3.8.4
Build-Depends: debhelper (>> 5.0.0), gettext, texinfo,
    libssl-dev (>= 0.9.8), dpatch, info2man
Checksums-Sha1:
    50d4ed2441e67[..]1ee0e94248 2464747 wget_1.12.orig.tar.gz
    d4c1c8bbe431d[..]dd7cef3611 48308 wget_1.12-2.1.debian.tar.gz
Checksums-Sha256:
    7578ed0974e12[..]dcba65b572 2464747 wget_1.12.orig.tar.gz
    1e9b0c4c00eae[..]89c402ad78 48308 wget_1.12-2.1.debian.tar.gz
Files:
    141461b9c04e4[..]9d1f2abf83 2464747 wget_1.12.orig.tar.gz
    e93123c934e3c[..]2f380278c2 48308 wget_1.12-2.1.debian.tar.gz
```

Retrieving an existing source package

- ▶ From the Debian archive:
 - ▶ `apt-get source package`
 - ▶ `apt-get source package=version`
 - ▶ `apt-get source package/release`(You need `deb-src` lines in `sources.list`)
- ▶ From the Internet:
 - ▶ `dget url-to.dsc`
 - ▶ `dget http://snapshot.debian.org/archive/debian-archive/20090802T004153Z/debian/dists/bo/main/source/web/wget_1.4.4-6.dsc`
(`snapshot.d.o` provides all packages from Debian since 2005)
- ▶ From the (declared) version control system:
 - ▶ `debcheckout package`
- ▶ Once downloaded, extract with `dpkg-source -x file.dsc`



Creating a basic source package

- ▶ Download the upstream source
(*upstream source* = the one from the software's original developers)
- ▶ Rename to `<source_package>_<upstream_version>.orig.tar.gz`
(example: `simgrid_3.6.orig.tar.gz`)
- ▶ Untar it
- ▶ Rename the directory to `<source_package>-<upstream_version>`
(example: `simgrid-3.6`)
- ▶ `cd <source_package>-<upstream_version> && dh_make`
(from the **dh-make** package)
- ▶ There are some alternatives to `dh_make` for specific sets of packages:
dh-make-perl, **dh-make-php**, ...
- ▶ `debian/` directory created, with a lot of files in it



Files in debian/

All the packaging work should be made by modifying files in `debian/`

- ▶ Main files:
 - ▶ **control** – meta-data about the package (dependencies, etc.)
 - ▶ **rules** – specifies how to build the package
 - ▶ **copyright** – copyright information for the package
 - ▶ **changelog** – history of the Debian package
- ▶ Other files:
 - ▶ `compat`
 - ▶ `watch`
 - ▶ `dh_install*` targets
 - `*.dirs`, `*.docs`, `*.manpages`, ...
 - ▶ maintainer scripts
 - `*.postinst`, `*.prerm`, ...
 - ▶ `source/format`
 - ▶ `patches/` – if you need to modify the upstream sources
- ▶ Several files use a format based on RFC 822 (mail headers)



debian/changelog

- ▶ Lists the Debian packaging changes
- ▶ Gives the current version of the package

1.2.1.1-5
Upstream Debian
version revision

- ▶ Edited manually or with **dch**
 - ▶ Create a changelog entry for a new release: **dch -i**
- ▶ Special format to automatically close Debian or Ubuntu bugs
Debian: Closes: #595268; Ubuntu: LP: #616929
- ▶ Installed as `/usr/share/doc/package/changelog.Debian.gz`

```
mpich2 (1.2.1.1-5) unstable; urgency=low
```

- * Use `/usr/bin/python` instead of `/usr/bin/python2.5`. Allow to drop dependency on `python2.5`. Closes: #595268
- * Make `/usr/bin/mpdroot` `setuid`. This is the default after the installation of `mpich2` from source, too. LP: #616929
- + Add corresponding `lintian` override.

```
-- Lucas Nussbaum <lucas@debian.org> Wed, 15 Sep 2010 18:13:44 +0200
```

debian/control

- ▶ Package metadata
 - ▶ For the source package itself
 - ▶ For each binary package built from this source
 - ▶ Package name, section, priority, maintainer, uploaders, build-dependencies, dependencies, description, homepage, ...
 - ▶ Documentation: Debian Policy chapter 5
<https://www.debian.org/doc/debian-policy/ch-controlfields>
-

```
Source: wget
Section: web
Priority: important
Maintainer: Noel Kothe <noel@debian.org>
Build-Depends: debhelper (>> 5.0.0), gettext, texinfo,
  libssl-dev (>= 0.9.8), dpatch, info2man
Standards-Version: 3.8.4
Homepage: http://www.gnu.org/software/wget/
```

```
Package: wget
Architecture: any
Depends: ${shlibs:Depends}, ${misc:Depends}
Description: retrieves files from the web
  Wget is a network utility to retrieve files from the Web
```



Architecture: all or any

Two kinds of binary packages:

- ▶ Packages with different contents on each Debian architecture
 - ▶ Example: C program
 - ▶ Architecture: `any` in `debian/control`
 - ▶ Or, if it only works on a subset of architectures:
`Architecture: amd64 i386 ia64 hurd-i386`
 - ▶ `buildd.debian.org`: builds all the other architectures for you on upload
 - ▶ Named `package_version_architecture.deb`
- ▶ Packages with the same content on all architectures
 - ▶ Example: Perl library
 - ▶ Architecture: `all` in `debian/control`
 - ▶ Named `package_version_all.deb`

A source package can generate a mix of Architecture: `any` and
Architecture: `all` binary packages



debian/rules

- ▶ Makefile
- ▶ Interface used to build Debian packages
- ▶ Documented in Debian Policy, chapter 4.8
<https://www.debian.org/doc/debian-policy/ch-source#s-debianrules>
- ▶ Required targets:
 - ▶ build, build-arch, build-indep: should perform all the configuration and compilation
 - ▶ binary, binary-arch, binary-indep: build the binary packages
 - ▶ dpkg-buildpackage will call binary to build all the packages, or binary-arch to build only the Architecture: any packages
 - ▶ clean: clean up the source directory



Packaging helpers – debhelper

- ▶ You could write shell code in `debian/rules` directly
 - ▶ See the `rsync` package for example
- ▶ Better practice (used by most packages): use a *Packaging helper*
- ▶ Most popular one: **debhelper** (used by 98% of packages)
- ▶ Goals:
 - ▶ Factor the common tasks in standard tools used by all packages
 - ▶ Fix some packaging bugs once for all packages

`dh_installdirs`, `dh_installchangelogs`, `dh_installdocs`, `dh_installexamples`, `dh_install`,
`dh_installdebconf`, `dh_installinit`, `dh_link`, `dh_strip`, `dh_compress`, `dh_fixperms`, `dh_perl`,
`dh_makeshlibs`, `dh_installdeb`, `dh_shlibdeps`, `dh_gencontrol`, `dh_md5sums`, `dh_builddeb`, ...

- ▶ Called from `debian/rules`
 - ▶ Configurable using command parameters or files in `debian/`
`package.docs`, `package.examples`, `package.install`, `package.manpages`, ...
- ▶ Third-party helpers for sets of packages: **python-support**, **dh_ocaml**, ...
- ▶ Gotcha: `debian/compat`: Debhelper compatibility version (use "7")



debian/rules using debhelper (1/2)

```
#!/usr/bin/make -f

# Uncomment this to turn on verbose mode.
#export DH_VERBOSE=1

build:
    $(MAKE)
    #docbook-to-man debian/packageName.sgml > packageName.1

clean:
    dh_testdir
    dh_testroot
    rm -f build-stamp configure-stamp
    $(MAKE) clean
    dh_clean

install: build
    dh_testdir
    dh_testroot
    dh_clean -k
    dh_installdirs
    # Add here commands to install the package into debian/packageName
    $(MAKE) DESTDIR=$(CURDIR)/debian/packageName install
```



debian/rules using debhelper (2/2)

```
# Build architecture-independent files here.
```

```
binary-indep: build install
```

```
# Build architecture-dependent files here.
```

```
binary-arch: build install
```

```
dh_testdir
```

```
dh_testroot
```

```
dh_installchangelogs
```

```
dh_installdocs
```

```
dh_installexamples
```

```
dh_install
```

```
dh_installman
```

```
dh_link
```

```
dh_strip
```

```
dh_compress
```

```
dh_fixperms
```

```
dh_installdeb
```

```
dh_shlibdeps
```

```
dh_gencontrol
```

```
dh_md5sums
```

```
dh_builddeb
```

```
binary: binary-indep binary-arch
```

```
.PHONY: build clean binary-indep binary-arch binary install configure
```



CDBS

- ▶ With debhelper, still a lot of redundancy between packages
- ▶ Second-level helpers that factor common functionality
 - ▶ E.g. building with `./configure && make && make install` or CMake
- ▶ CDBS:
 - ▶ Introduced in 2005, based on advanced *GNU make* magic
 - ▶ Documentation: `/usr/share/doc/cdb5/`
 - ▶ Support for Perl, Python, Ruby, GNOME, KDE, Java, Haskell, ...
 - ▶ But some people hate it:
 - ▶ Sometimes difficult to customize package builds:
"twisty maze of makefiles and environment variables"
 - ▶ Slower than plain debhelper (many useless calls to `dh_*`)

```
#!/usr/bin/make -f
include /usr/share/cdb5/1/rules/debhelper.mk
include /usr/share/cdb5/1/class/autotools.mk
```

```
# add an action after the build
build/mypackage::
    /bin/bash debian/scripts/foo.sh
```



Dh (aka Debhelper 7, or dh7)

- ▶ Introduced in 2008 as a *CDBS* killer
- ▶ **dh** command that calls `dh_*`
- ▶ Simple *debian/rules*, listing only overrides
- ▶ Easier to customize than CDBS
- ▶ Doc: manpages (`debhelper(7)`, `dh(1)`) + slides from DebConf9 talk
<http://kitenet.net/~joey/talks/debhelper/debhelper-slides.pdf>

```
#!/usr/bin/make -f
%:
    dh $@

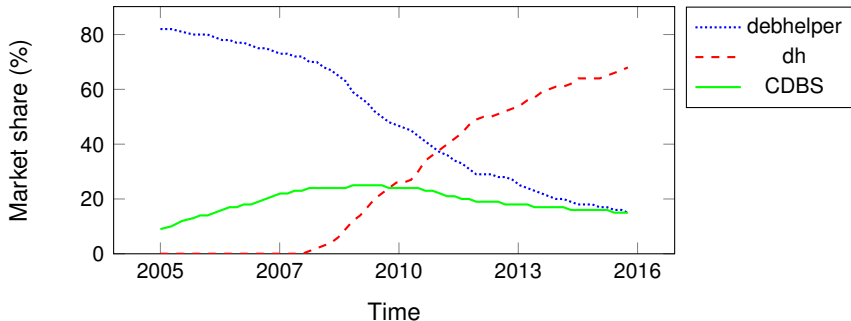
override_dh_auto_configure:
    dh_auto_configure -- --with-kitchen-sink

override_dh_auto_build:
    make world
```



Classic debhelper vs CDBS vs dh

- ▶ Mind shares:
Classic debhelper: 15% CDBS: 15% dh: 68%
- ▶ Which one should I learn?
 - ▶ Probably a bit of all of them
 - ▶ You need to know debhelper to use dh and CDBS
 - ▶ You might have to modify CDBS packages
- ▶ Which one should I use for a new package?
 - ▶ **dh** (only solution with an increasing mind share)



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Building packages

- ▶ `apt-get build-dep mypackage`
Installs the *build-dependencies* (for a package already in Debian)
Or `mk-build-deps -ir` (for a package not uploaded yet)
- ▶ `debuild`: build, test with `lintian`, sign with GPG
- ▶ Also possible to call `dpkg-buildpackage` directly
 - ▶ Usually with `dpkg-buildpackage -us -uc`
- ▶ It is better to build packages in a clean & minimal environment
 - ▶ `pbuilder` – helper to build packages in a *chroot*
Good documentation: <https://wiki.ubuntu.com/PbuilderHowto>
(optimization: `cowbuilder ccache distcc`)
 - ▶ `schroot` and `sbuid`: used on the Debian build daemons
(not as simple as `pbuilder`, but allows LVM snapshots
see: <https://help.ubuntu.com/community/SbuildLVMHowto>)
- ▶ Generates `.deb` files and a `.changes` file
 - ▶ `.changes`: describes what was built; used to upload the package



Installing and testing packages

- ▶ Install the package locally: `debi` (will use `.changes` to know what to install)
- ▶ List the content of the package: `debc` `../mypackage<TAB>.changes`
- ▶ Compare the package with a previous version:
`debdiff` `../mypackage_1_*.changes` `../mypackage_2_*.changes`
or to compare the sources:
`debdiff` `../mypackage_1_*.dsc` `../mypackage_2_*.dsc`
- ▶ Check the package with `lintian` (static analyzer):
`lintian` `../mypackage<TAB>.changes`
`lintian -i`: gives more information about the errors
`lintian -EviIL +pedantic`: shows more problems
- ▶ Upload the package to Debian (`dput`) (needs configuration)
- ▶ Manage a private Debian archive with `reprepro` or `aptly`
Documentation:
<https://wiki.debian.org/HowToSetupADebianRepository>



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Practical session 1: modifying the grep package

- ➊ Go to `http://ftp.debian.org/debian/pool/main/g/grep/` and download version 2.12-2 of the package
 - ▶ If the source package is not unpacked automatically, unpack it with `dpkg-source -x grep_*.dsc`
- ➋ Look at the files in `debian/`.
 - ▶ How many binary packages are generated by this source package?
 - ▶ Which packaging helper does this package use?
- ➌ Build the package
- ➍ We are now going to modify the package. Add a changelog entry and increase the version number.
- ➎ Now disable perl-regexp support (it is a `./configure` option)
- ➏ Rebuild the package
- ➐ Compare the original and the new package with `debdiff`
- ➑ Install the newly built package



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debian/copyright

- ▶ Copyright and license information for the source and the packaging
- ▶ Traditionally written as a text file
- ▶ New machine-readable format:

<https://www.debian.org/doc/packaging-manuals/copyright-format/1.0/>

```
Format: https://www.debian.org/doc/packaging-manuals/copyright-format/1.0/
Upstream-Name: X Solitaire
Source: ftp://ftp.example.com/pub/games
```

```
Files: *
Copyright: Copyright 1998 John Doe <jdoe@example.com>
License: GPL-2+
    This program is free software; you can redistribute it
    [...]
    .
    On Debian systems, the full text of the GNU General Public
    License version 2 can be found in the file
    '/usr/share/common-licenses/GPL-2'.
```

```
Files: debian/*
Copyright: Copyright 1998 Jane Smith <jsmith@example.net>
License:
    [LICENSE TEXT]
```



Modifying the upstream source

Often needed:

- ▶ Fix bugs or add customizations that are specific to Debian
- ▶ Backport fixes from a newer upstream release

Several methods to do it:

- ▶ Modifying the files directly
 - ▶ Simple
 - ▶ But no way to track and document the changes
- ▶ Using patch systems
 - ▶ Eases contributing your changes to upstream
 - ▶ Helps sharing the fixes with derivatives
 - ▶ Gives more exposure to the changes

<http://patch-tracker.debian.org/> (down currently)



Patch systems

- ▶ Principle: changes are stored as patches in `debian/patches/`
- ▶ Applied and unapplied during build
- ▶ Past: several implementations – *simple-patchsys* (*cdb*s), *dpatch*, ***quilt***
 - ▶ Each supports two `debian/rules` targets:
 - ▶ `debian/rules patch`: apply all patches
 - ▶ `debian/rules unpatch`: de-apply all patches
 - ▶ More documentation: <https://wiki.debian.org/debian/patches>
- ▶ **New source package format with built-in patch system: 3.0 (quilt)**
 - ▶ Recommended solution
 - ▶ You need to learn *quilt*
<http://pkg-perl.alioth.debian.org/howto/quilt.html>
 - ▶ Patch-system-agnostic tool in `devscripts`: `edit-patch`



Documentation of patches

- ▶ Standard headers at the beginning of the patch
- ▶ Documented in DEP-3 - Patch Tagging Guidelines
<http://dep.debian.net/deps/dep3/>

```
Description: Fix widget frobnication speeds
 Frobnicating widgets too quickly tended to cause explosions.
Forwarded: http://lists.example.com/2010/03/1234.html
Author: John Doe <johndoe-guest@users.alioth.debian.org>
Applied-Upstream: 1.2, http://bazaar.foo.com/frobnicator/revision/123
Last-Update: 2010-03-29

--- a/src/widgets.c
+++ b/src/widgets.c
@@ -101,9 +101,6 @@ struct {
```



Doing things during installation and removal

- ▶ Decompressing the package is sometimes not enough
- ▶ Create/remove system users, start/stop services, manage *alternatives*
- ▶ Done in *maintainer scripts*
preinst, postinst, prerm, postrm
 - ▶ Snippets for common actions can be generated by debhelper
- ▶ Documentation:
 - ▶ Debian Policy Manual, chapter 6
<https://www.debian.org/doc/debian-policy/ch-maintainerscripts>
 - ▶ Debian Developer's Reference, chapter 6.4
<https://www.debian.org/doc/developers-reference/best-pkging-practices.html>
 - ▶ <https://people.debian.org/~srivasta/MaintainerScripts.html>
- ▶ Prompting the user
 - ▶ Must be done with **debconf**
 - ▶ Documentation: debconf-devel(7) (debconf-doc package)



Monitoring upstream versions

- ▶ Specify where to look in `debian/watch` (see `uscan(1)`)

```
version=3
```

```
http://tmrc.mit.edu/mirror/twisted/Twisted/(\d\.\d)/ \
Twisted-([\d\.]*)\.tar\.bz2
```

- ▶ There are automated trackers of new upstream versions, that notify the maintainer on various dashboards including <https://tracker.debian.org/> and <https://udd.debian.org/dmd/>
- ▶ `uscan`: run a manual check
- ▶ `uupdate`: try to update your package to the latest upstream version



Packaging with a Version Control System

- ▶ Several tools to help manage branches and tags for your packaging work:
svn-buildpackage, git-buildpackage
- ▶ Example: git-buildpackage
 - ▶ upstream branch to track upstream with upstream/version tags
 - ▶ master branch tracks the Debian package
 - ▶ debian/version tags for each upload
 - ▶ pristine-tar branch to be able to rebuild the upstream tarball

Doc: <http://honk.sigxcpu.org/projects/git-buildpackage/manual-html/gbp.html>

- ▶ Vcs-* fields in debian/control to locate the repository
 - ▶ <https://wiki.debian.org/Alioth/Git>
 - ▶ <https://wiki.debian.org/Alioth/Svn>

Vcs-Browser: <http://anonscm.debian.org/gitweb/?p=collab-maint/devscripts.git>

Vcs-Git: <git://anonscm.debian.org/collab-maint/devscripts.git>

Vcs-Browser: <http://svn.debian.org/viewsvn/pkg-perl/trunk/libwww-perl/>

Vcs-Svn: <svn://svn.debian.org/pkg-perl/trunk/libwww-perl>

- ▶ VCS-agnostic interface: debcheckout, debcommit, debrelease
 - ▶ debcheckout grep → checks out the source package from Git



Backporting packages

- ▶ Goal: use a newer version of a package on an older system
e.g. use *mutt* from Debian *unstable* on Debian *stable*
- ▶ General idea:
 - ▶ Take the source package from Debian unstable
 - ▶ Modify it so that it builds and works fine on Debian stable
 - ▶ Sometimes trivial (no changes needed)
 - ▶ Sometimes difficult
 - ▶ Sometimes impossible (many unavailable dependencies)
- ▶ Some backports are provided and supported by the Debian project
<http://backports.debian.org/>



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Several ways to contribute to Debian

► **Worst** way to contribute:

- ❶ Package your own application
- ❷ Get it into Debian
- ❸ Disappear

► **Better** ways to contribute:

- Get involved in packaging teams
 - Many teams that focus on set of packages, and need help
 - List available at <https://wiki.debian.org/Teams>
 - An excellent way to learn from more experienced contributors
- Adopt existing unmaintained packages (*orphaned packages*)
- Bring new software to Debian
 - Only if it's interesting/useful enough, please
 - Are there alternatives already packaged in Debian?



Adopting orphaned packages

- ▶ Many unmaintained packages in Debian
- ▶ Full list + process: <https://www.debian.org/devel/wnpp/>
- ▶ Installed on your machine: `wnpp-alert`
Or better: `how-can-i-help`
- ▶ Different states:
 - ▶ **Orphaned**: the package is unmaintained
Feel free to adopt it
 - ▶ **RFA: Request For Adopter**
Maintainer looking for adopter, but continues work in the meantime
Feel free to adopt it. A mail to the current maintainer is polite
 - ▶ **ITA: Intent To Adopt**
Someone intends to adopt the package
You could propose your help!
 - ▶ **RFH: Request For Help**
The maintainer is looking for help
- ▶ Some unmaintained packages not detected → not orphaned yet
- ▶ When in doubt, ask `debian-qa@lists.debian.org`



Adopting a package: example

```
From: You <you@yourdomain>  
To: 640454@bugs.debian.org, control@bugs.debian.org  
Cc: Francois Marier <francois@debian.org>  
Subject: ITA: verbiste -- French conjugator
```

```
retitle 640454 ITA: verbiste -- French conjugator  
owner 640454 !  
thanks
```

Hi,

I am using verbiste and I am willing to take care of the package.

Cheers,

You

- ▶ Polite to contact the previous maintainer (especially if the package was RFAed, not orphaned)
- ▶ Very good idea to contact the upstream project



Getting your package in Debian

- ▶ You do not need any official status to get your package into Debian
 - ➊ Submit an **ITP** bug (Intend To Package) using `reportbug wnpp`
 - ➋ Prepare a source package
 - ➌ Find a Debian Developer that will sponsor your package
- ▶ Official status (when you are an experienced package maintainer):
 - ▶ **Debian Maintainer (DM):**
Permission to upload your own packages
See <https://wiki.debian.org/DebianMaintainer>
 - ▶ **Debian Developer (DD):**
Debian project member; can vote and upload any package



Things to check before asking for sponsorship

- ▶ Debian puts **a lot of focus on quality**
- ▶ Generally, **sponsors are hard to find and busy**
 - ▶ Make sure your package is ready before asking for sponsorship
- ▶ Things to check:
 - ▶ Avoid missing build-dependencies: make sure that your package build fine in a clean *sid chroot*
 - ▶ Using `pbuilder` is recommended
 - ▶ Run `lintian -EviIL +pedantic` on your package
 - ▶ Errors must be fixed, all other problems should be fixed
 - ▶ Do extensive testing of your package, of course
- ▶ In doubt, ask for help



Where to find help?

Help you will need:

- ▶ Advice and answers to your questions, code reviews
- ▶ Sponsorship for your uploads, once your package is ready

You can get help from:

- ▶ **Other members of a packaging team**
 - ▶ List of teams: <https://wiki.debian.org/Teams>
- ▶ The **Debian Mentors group** (if your package does not fit in a team)
 - ▶ <https://wiki.debian.org/DebianMentorsFaq>
 - ▶ Mailing list: debian-mentors@lists.debian.org
(also a good way to learn by accident)
 - ▶ IRC: #debian-mentors on irc.debian.org
 - ▶ <http://mentors.debian.net/>
 - ▶ Documentation: <http://mentors.debian.net/intro-maintainers>
- ▶ **Localized mailing lists** (get help in your language)
 - ▶ debian-devel-{french,italian,portuguese,spanish}@lists.d.o
 - ▶ Full list: <https://lists.debian.org/devel.html>
 - ▶ Or users lists: <https://lists.debian.org/users.html>



More documentation

- ▶ Debian Developers' Corner
<https://www.debian.org/devel/>
Links to many resources about Debian development
- ▶ Debian New Maintainers' Guide
<https://www.debian.org/doc/maint-guide/>
An introduction to Debian packaging, but could use an update
- ▶ Debian Developer's Reference
<https://www.debian.org/doc/developers-reference/>
Mostly about Debian procedures, but also some best packaging practices (part 6)
- ▶ Debian Policy
<https://www.debian.org/doc/debian-policy/>
 - ▶ All the requirements that every package must satisfy
 - ▶ Specific policies for Perl, Java, Python, ...
- ▶ Ubuntu Packaging Guide
<http://developer.ubuntu.com/resources/tools/packaging/>



Debian dashboards for maintainers

- ▶ **Source package centric:**

<https://tracker.debian.org/dpkg>

- ▶ **Maintainer/team centric:** Developer's Packages Overview (DDPO)

<https://qa.debian.org/developer.php?login=pkg-ruby-extras-maintainers@lists.alioth.debian.org>

- ▶ **TODO-list oriented:** Debian Maintainer Dashboard (DMD)

<https://udd.debian.org/dmd/>



Using the Debian Bug Tracking System (BTS)

- ▶ A quite unique way to manage bugs
 - ▶ Web interface to view bugs
 - ▶ Email interface to make changes to bugs
- ▶ Adding information to bugs:
 - ▶ Write to `123456@bugs.debian.org` (does not include the submitter, you need to add `123456-submitter@bugs.debian.org`)
- ▶ Changing bug status:
 - ▶ Send commands to `control@bugs.debian.org`
 - ▶ Command-line interface: `bts` command in `devscripts`
 - ▶ Documentation: <https://www.debian.org/Bugs/server-control>
- ▶ Reporting bugs: use `reportbug`
 - ▶ Normally used with a local mail server: install `ssmtp` or `nullmailer`
 - ▶ Or use `reportbug --template`, then send (manually) to `submit@bugs.debian.org`



Using the BTS: examples

- ▶ Sending an email to the bug and the submitter:
`https://bugs.debian.org/cgi-bin/bugreport.cgi?bug=680822#10`
- ▶ Tagging and changing the severity:
`https://bugs.debian.org/cgi-bin/bugreport.cgi?bug=680227#10`
- ▶ Reassigning, changing the severity, retitling ...:
`https://bugs.debian.org/cgi-bin/bugreport.cgi?bug=680822#93`
 - ▶ notfound, found, notfixed, fixed are for **version-tracking**
See `https://wiki.debian.org/HowtoUseBTS#Version_tracking`
- ▶ Using usertags: `https://bugs.debian.org/cgi-bin/bugreport.cgi?msg=42;bug=642267`
See `https://wiki.debian.org/bugs.debian.org/usertags`
- ▶ BTS Documentation:
 - ▶ `https://www.debian.org/Bugs/`
 - ▶ `https://wiki.debian.org/HowtoUseBTS`



More interested in Ubuntu?

- ▶ Ubuntu mainly manages the divergence with Debian
- ▶ No real focus on specific packages
Instead, collaboration with Debian teams
- ▶ Usually recommend uploading new packages to Debian first
<https://wiki.ubuntu.com/UbuntuDevelopment/NewPackages>
- ▶ Possibly a better plan:
 - ▶ Get involved in a Debian team and act as a bridge with Ubuntu
 - ▶ Help reduce divergence, triage bugs in Launchpad
 - ▶ Many Debian tools can help:
 - ▶ Ubuntu column on the Developer's packages overview
 - ▶ Ubuntu box on the Package Tracking System
 - ▶ Receive launchpad bugmail via the PTS



Outline

- 1 Introduction
- 2 Creating source packages
- 3 Building and testing packages
- 4 Practical session 1: modifying the grep package
- 5 Advanced packaging topics
- 6 Maintaining packages in Debian
- 7 Conclusions**
- 8 Additional practical sessions
- 9 Answers to practical sessions



Conclusions

- ▶ You now have a full overview of Debian packaging
- ▶ But you will need to read more documentation
- ▶ Best practices have evolved over the years
 - ▶ If not sure, use the **dh** packaging helper, and the **3.0 (quilt)** format
- ▶ Things that were not covered in this tutorial:
 - ▶ UCF – manage user changes to configuration files when upgrading
 - ▶ dpkg triggers – group similar maintainer scripts actions together
 - ▶ Debian development organization:
 - ▶ Suites: stable, testing, unstable, experimental, security, *-updates, backports, . . .
 - ▶ Debian Blends – subsets of Debian targeting specific groups

Feedback: **packaging-tutorial@packages.debian.org**



Legal stuff

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- ▶ The terms of the Creative Commons Attribution-ShareAlike 3.0 Unported License.
<http://creativecommons.org/licenses/by-sa/3.0/>



Contribute to this tutorial

► Contribute:

- `apt-get source packaging-tutorial`
- `debcheckout packaging-tutorial`
- `git clone`
`git://git.debian.org/collab-maint/packaging-tutorial.git`
- `http://git.debian.org/?p=collab-maint/packaging-tutorial.git`
- Open bugs: `bugs.debian.org/src:packaging-tutorial`

► Provide feedback:

- `mailto:packaging-tutorial@packages.debian.org`
 - What should be added to this tutorial?
 - What should be improved?
- `reportbug packaging-tutorial`



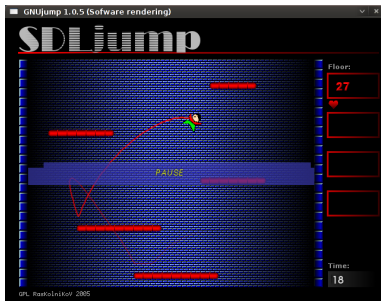
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Practical session 2: packaging GNUjump

- 1 Download GNUjump 1.0.8 from
<http://ftp.gnu.org/gnu/gnujump/gnujump-1.0.8.tar.gz>
- 2 Create a Debian package for it
 - ▶ Install build-dependencies so that you can build the package
 - ▶ Fix bugs
 - ▶ Get a basic working package
 - ▶ Finish filling `debian/control` and other files
- 3 Enjoy



Practical session 2: packaging GNUjump (tips)

- ▶ To get a basic working package, use `dh_make`
- ▶ To start with, creating a *1.0* source package is easier than *3.0* (*quilt*) (change that in `debian/source/format`)
- ▶ To search for missing build-dependencies, find a missing file, and use `apt-file` to find the missing package
- ▶ If you encounter that error:

```
/usr/bin/ld: SDL_rotozoom.o: undefined reference to symbol 'ceil@@GLIBC_2.2.5'  
//lib/x86_64-linux-gnu/libm.so.6: error adding symbols: DSO missing from command line  
collect2: error: ld returned 1 exit status  
Makefile:376: recipe for target 'gnujump' failed
```

You need to add `-lm` to the linker command line:

Edit `src/Makefile.am` and replace

```
gnujump_LDFLAGS = $(all_libraries)
```

by

```
gnujump_LDFLAGS = -Wl,--as-needed  
gnujump_LDADD = $(all_libraries) -lm
```

Then run `autoreconf -i`



Practical session 3: packaging a Java library

❶ Take a quick look at some documentation about Java packaging:

- ▶ <https://wiki.debian.org/Java>
- ▶ <https://wiki.debian.org/Java/Packaging>
- ▶ <https://www.debian.org/doc/packaging-manuals/java-policy/>
- ▶ <http://pkg-java.alioth.debian.org/docs/tutorial.html>
- ▶ Paper and slides from a Debconf10 talk about javahelper:
<http://pkg-java.alioth.debian.org/docs/debconf10-javahelper-paper.pdf>
<http://pkg-java.alioth.debian.org/docs/debconf10-javahelper-slides.pdf>

❷ Download IRCLib from <http://moepii.sourceforge.net/>

❸ Package it



Practical session 4: packaging a Ruby gem

- 1 Take a quick look at some documentation about Ruby packaging:
 - ▶ <https://wiki.debian.org/Ruby>
 - ▶ <https://wiki.debian.org/Teams/Ruby>
 - ▶ <https://wiki.debian.org/Teams/Ruby/Packaging>
 - ▶ `gem2deb(1)`, `dh_ruby(1)` (in the `gem2deb` package)
- 2 Create a basic Debian source package from the `peach` gem:
`gem2deb peach`
- 3 Improve it so that it becomes a proper Debian package



Practical session 5: packaging a Perl module

- 1 Take a quick look at some documentation about Perl packaging:
 - ▶ <http://pkg-perl.alioth.debian.org/>
 - ▶ <https://wiki.debian.org/Teams/DebianPerlGroup>
 - ▶ `dh-make-perl(1)`, `dpt(1)` (in the `pkg-perl-tools` package)
- 2 Create a basic Debian source package from the Acme CPAN distribution:
`dh-make-perl --cpan Acme`
- 3 Improve it so that it becomes a proper Debian package



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Answers to practical sessions



Practical session 1: modifying the grep package

- ➊ Go to `http://ftp.debian.org/debian/pool/main/g/grep/` and download version 2.12-2 of the package
- ➋ Look at the files in `debian/`.
 - ▶ How many binary packages are generated by this source package?
 - ▶ Which packaging helper does this package use?
- ➌ Build the package
- ➍ We are now going to modify the package. Add a changelog entry and increase the version number.
- ➎ Now disable perl-regexp support (it is a `./configure` option)
- ➏ Rebuild the package
- ➐ Compare the original and the new package with `debdiff`
- ➑ Install the newly built package



Fetching the source

- ❶ Go to <http://ftp.debian.org/debian/pool/main/g/grep/> and download version 2.12-2 of the package
 - ▶ Use `dget` to download the `.dsc` file:
`dget http://cdn.debian.net/debian/pool/main/g/grep/grep_2.12-2.dsc`
 - ▶ If you have `deb-src` for a Debian release that has `grep` version 2.12-2 (find out on <https://tracker.debian.org/grep>), you can use: `apt-get source grep=2.12-2`
or `apt-get source grep/release` (e.g. `grep/stable`
or, if you feel lucky: `apt-get source grep`
 - ▶ The `grep` source package is composed of three files:
 - ▶ `grep_2.12-2.dsc`
 - ▶ `grep_2.12-2.debian.tar.bz2`
 - ▶ `grep_2.12.orig.tar.bz2`

This is typical of the "3.0 (quilt)" format.

- ▶ If needed, uncompress the source with
`dpkg-source -x grep_2.12-2.dsc`



Looking around and building the package

2 Look at the files in `debian/`.

- ▶ How many binary packages are generated by this source package?
- ▶ Which packaging helper does this package use?
- ▶ According to `debian/control`, this package only generates one binary package, named `grep`.
- ▶ According to `debian/rules`, this package is typical of *classic* debhelper packaging, without using *CDBS* or *dh*. One can see the various calls to `dh_*` commands in `debian/rules`.

3 Build the package

- ▶ Use `apt-get build-dep grep` to fetch the build-dependencies
- ▶ Then `debuild` or `dpkg-buildpackage -us -uc` (Takes about 1 min)



Editing the changelog

- 4 We are now going to modify the package. Add a changelog entry and increase the version number.
- ▶ `debian/changelog` is a text file. You could edit it and add a new entry manually.
- ▶ Or you can use `dch -i`, which will add an entry and open the editor
- ▶ The name and email can be defined using the `DEBFULLNAME` and `DEBEMAIL` environment variables
- ▶ After that, rebuild the package: a new version of the package is built
- ▶ Package versioning is detailed in section 5.6.12 of the Debian policy <https://www.debian.org/doc/debian-policy/ch-controlfields>



Disabling Perl regexp support and rebuilding

- 5 Now disable perl-regexp support (it is a `./configure` option)
- 6 Rebuild the package
 - ▶ Check with `./configure --help`: the option to disable Perl regexp is `--disable-perl-regexp`
 - ▶ Edit `debian/rules` and find the `./configure` line
 - ▶ Add `--disable-perl-regexp`
 - ▶ Rebuild with `debuild` or `dpkg-buildpackage -us -uc`



Comparing and testing the packages

- 7 Compare the original and the new package with debdiff
 - 8 Install the newly built package
- ▶ Compare the binary packages: `debdiff ../changes`
 - ▶ Compare the source packages: `debdiff ../dsc`
 - ▶ Install the newly built package: `debi`
Or `dpkg -i ../grep_<TAB>`
 - ▶ `grep -P foo` no longer works!

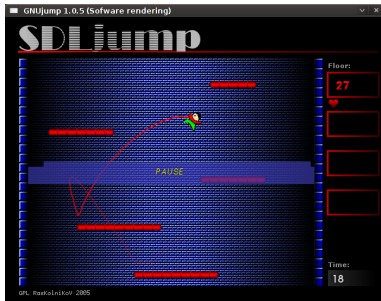
Reinstall the previous version of the package:

- ▶ `apt-get install --reinstall grep=2.6.3-3 (= previous version)`



Practical session 2: packaging GNUjump

- 1 Download GNUjump 1.0.8 from
<http://ftp.gnu.org/gnu/gnujump/gnujump-1.0.8.tar.gz>
- 2 Create a Debian package for it
 - ▶ Install build-dependencies so that you can build the package
 - ▶ Get a basic working package
 - ▶ Finish filling `debian/control` and other files
- 3 Enjoy



Step by step...

- ▶ `wget http://ftp.gnu.org/gnu/gnujump/gnujump-1.0.8.tar.gz`
- ▶ `mv gnujump-1.0.8.tar.gz gnujump_1.0.8.orig.tar.gz`
- ▶ `tar xf gnujump_1.0.8.orig.tar.gz`
- ▶ `cd gnujump-1.0.8/`
- ▶ `dh_make -f ../gnujump-1.0.8.tar.gz`
 - ▶ Type of package: single binary (for now)

```
gnujump-1.0.8$ ls debian/
changelog          gnujump.default.ex  preinst.ex
compat            gnujump.doc-base.EX prerm.ex
control           init.d.ex           README.Debian
copyright         manpage.1.ex       README.source
docs             manpage.sgml.ex    rules
emacsen-install.ex manpage.xml.ex      source
emacsen-remove.ex  menu.ex            watch.ex
emacsen-startup.ex postinst.ex
gnujump.cron.d.ex  postrm.ex
```



Step by step... (2)

- ▶ Look at `debian/changelog`, `debian/rules`, `debian/control` (auto-filled by **dh_make**)
- ▶ In `debian/control`:
Build-Depends: `debhelper (>= 7.0.50)`, `autotools-dev`
Lists the *build-dependencies* = packages needed to build the package
- ▶ Try to build the package as-is with `debuild` (thanks to **dh** magic)
 - ▶ And add build-dependencies, until it builds
 - ▶ Hint: use `apt-cache search` and `apt-file` to find the packages
 - ▶ Example:

```
checking for sdl-config... no
checking for SDL - version >= 1.2.0... no
[...]
configure: error: *** SDL version 1.2.0 not found!
```

→ Add **libsdl1.2-dev** to Build-Depends and install it.

- ▶ Better: use **pbuilder** to build in a clean environment



Step by step... (3)

- ▶ Required build-dependencies are `libsdl1.2-dev`, `libsdl-image1.2-dev`, `libsdl-mixer1.2-dev`
- ▶ Then, you will probably run into another error:

```
/usr/bin/ld: SDL_rotozoom.o: undefined reference to symbol 'ceil@@GLIBC_2.2.5'  
//lib/x86_64-linux-gnu/libm.so.6: error adding symbols: DSO missing from command line  
collect2: error: ld returned 1 exit status  
Makefile:376: recipe for target 'gnujump' failed
```

- ▶ This problem is caused by bitrot: `gnujump` has not been adjusted following linker changes.
- ▶ If you are using source format version **1.0**, you can directly change upstream sources.
 - ▶ Edit `src/Makefile.am` and replace

```
gnujump_LDFLAGS = $(all_libraries)
```

by

```
gnujump_LDFLAGS = -Wl,--as-needed  
gnujump_LDADD = $(all_libraries) -lm
```

- ▶ Then run `autoreconf -i`



Step by step... (4)

- ▶ If you are using source format version **3.0 (quilt)**, use quilt to prepare a patch. (see <https://wiki.debian.org/UsingQuilt>)

- ▶ `export QUILT_PATCHES=debian/patches`
- ▶ `mkdir debian/patches`
`quilt new linker-fixes.patch`
`quilt add src/Makefile.am`

- ▶ Edit `src/Makefile.am` and replace

```
gnujump_LDFLAGS = $(all_libraries)
```

by

```
gnujump_LDFLAGS = -Wl,--as-needed  
gnujump_LDADD = $(all_libraries) -lm
```

- ▶ `quilt refresh`
- ▶ Since `src/Makefile.am` was changed, `autoreconf` must be called during the build. To do that automatically with `dh`, change the `dh` call in `debian/rules` from: `dh $ --with autotools-dev`
to: `dh $ --with autotools-dev --with autoreconf`



Step by step... (5)

- ▶ The package should now build fine.
- ▶ Use `debnc` to list the content of the generated package, and `debi` to install it and test it.
- ▶ Test the package with `lintian`
 - ▶ While not a strict requirement, it is recommended that packages uploaded to Debian are *lintian-clean*
 - ▶ More problems can be listed using `lintian -EviIL +pedantic`
 - ▶ Some hints:
 - ▶ Remove the files that you don't need in `debian/`
 - ▶ Fill in `debian/control`
 - ▶ Install the executable to `/usr/games` by overriding `dh_auto_configure`
 - ▶ Use *hardening* compiler flags to increase security. See <https://wiki.debian.org/Hardening>



Step by step... (6)

- ▶ Compare your package with the one already packaged in Debian:
 - ▶ It splits the data files to a second package, that is the same across all architectures (→ saves space in the Debian archive)
 - ▶ It installs a .desktop file (for the GNOME/KDE menus) and also integrates into the Debian menu
 - ▶ It fixes a few minor problems using patches



Practical session 3: packaging a Java library

❶ Take a quick look at some documentation about Java packaging:

- ▶ <https://wiki.debian.org/Java>
- ▶ <https://wiki.debian.org/Java/Packaging>
- ▶ <https://www.debian.org/doc/packaging-manuals/java-policy/>
- ▶ <http://pkg-java.alioth.debian.org/docs/tutorial.html>
- ▶ Paper and slides from a Debconf10 talk about javahelper:
<http://pkg-java.alioth.debian.org/docs/debconf10-javahelper-paper.pdf>
<http://pkg-java.alioth.debian.org/docs/debconf10-javahelper-slides.pdf>

❷ Download IRCLib from <http://moepii.sourceforge.net/>

❸ Package it



Step by step...

- ▶ `apt-get install javahelper`
- ▶ Create a basic source package: `jh_makepkg`
 - ▶ Library
 - ▶ None
 - ▶ Default Free compiler/runtime
- ▶ Look at and fix `debian/*`
- ▶ `dpkg-buildpackage -us -uc` OR `debuild`
- ▶ `lintian`, `debc`, etc.
- ▶ Compare your result with the `libirc-lib-java` source package



Practical session 4: packaging a Ruby gem

- 1 Take a quick look at some documentation about Ruby packaging:
 - ▶ <https://wiki.debian.org/Ruby>
 - ▶ <https://wiki.debian.org/Teams/Ruby>
 - ▶ <https://wiki.debian.org/Teams/Ruby/Packaging>
 - ▶ `gem2deb(1)`, `dh_ruby(1)` (in the `gem2deb` package)
- 2 Create a basic Debian source package from the `peach` gem:
`gem2deb peach`
- 3 Improve it so that it becomes a proper Debian package



Step by step...

`gem2deb peach:`

- ▶ Downloads the gem from `rubygems.org`
- ▶ Creates a suitable `.orig.tar.gz` archive, and untar it
- ▶ Initializes a Debian source package based on the gem's metadata
 - ▶ Named `ruby-gemname`
- ▶ Tries to build the Debian binary package (this might fail)

`dh_ruby` (included in *gem2deb*) does the Ruby-specific tasks:

- ▶ Build C extensions for each Ruby version
- ▶ Copy files to their destination directory
- ▶ Update shebangs in executable scripts
- ▶ Run tests defined in `debian/ruby-tests.rb`, `debian/ruby-tests.rake`, or `debian/ruby-test-files.yaml`, as well as various other checks



Step by step... (2)

Improve the generated package:

- ▶ Run `debclean` to clean the source tree. Look at `debian/`.
- ▶ `changelog` and `compat` should be correct
- ▶ Edit `debian/control`: improve `Description`
- ▶ Write a proper `copyright` file based on the upstream files
- ▶ Build the package
- ▶ Compare your package with the `ruby-peach` package in the Debian archive



Practical session 5: packaging a Perl module

- 1 Take a quick look at some documentation about Perl packaging:
 - ▶ <http://pkg-perl.alioth.debian.org/>
 - ▶ <https://wiki.debian.org/Teams/DebianPerlGroup>
 - ▶ `dh-make-perl(1)`, `dpt(1)` (in the `pkg-perl-tools` package)
- 2 Create a basic Debian source package from the Acme CPAN distribution:
`dh-make-perl --cpan Acme`
- 3 Improve it so that it becomes a proper Debian package



Step by step...

`dh-make-perl --cpan Acme:`

- ▶ Downloads the tarball from the CPAN
- ▶ Creates a suitable `.orig.tar.gz` archive, and untars it
- ▶ Initializes a Debian source package based on the distribution's metadata
 - ▶ Named `libdistname-perl`



Step by step... (2)

Improve the generated package:

- ▶ `debian/changelog`, `debian/compat`, `debian/libacme-perl.docs`, and `debian/watch` should be correct
- ▶ Edit `debian/control`: improve `Description`, and remove boilerplate at the bottom
- ▶ Edit `debian/copyright`: remove boilerplate paragraph at the top, add years of copyright to the `Files: *` stanza

