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

> 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**, **c dbs**, **quilt**, **p builder**, **s build**, **linti an**, **svn-buildpackage**, **git-buildpackage**, ... Install them when you need them.
General packaging workflow

Debian mirror → Web → upstream source

- apt-get source
- dget
- dh_make

source package

where most of the manual work is done

- debuild (build and test with lintian)
- or dpkg-buildpackage

one or several binary packages

- upload (dput)
- install (debi)

.deb
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 Kothe <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[...]:ace0e94248 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
  \textit{(upstream source = the one from the software’s original developers)}
- Rename to $<\text{source\_package}>_<\text{upstream\_version}>.\text{orig.tar.gz}$
  (example: simgrid\_3.6\_orig.tar.gz)
- Untar it
- Rename the directory to $<\text{source\_package}>-<\text{upstream\_version}>$
  (example: simgrid-3.6)
- \texttt{cd $<\text{source\_package}>-<\text{upstream\_version}>$ && dh\_make}$
  (from the \texttt{dh\_make} package)
- There are some alternatives to \texttt{dh\_make} for specific sets of packages:
  \texttt{dh\_make\_perl}, \texttt{dh\_make\_php}, \ldots
- \texttt{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)
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

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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-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/cdbs/
- 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_*)

```bash
#!/usr/bin/make -f
include /usr/share/cdbs/1/rules/debhelper.mk
include /usr/share/cdbs/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

```bash
#!/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)
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 `sbuild`: 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 -Evil +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

   ▶ If the source package is not unpacked automatically, unpack it with dpkg-source -x grep_*.dsc

2. Look at the files in debian/.
   ▶ How many binary packages are generated by this source package?
   ▶ Which packaging helper does this package use?

3. Build the package

4. We are now going to modify the package. Add a changelog entry and increase the version number.

5. Now disable perl-regexp support (it is a ./configure option)

6. Rebuild the package

7. Compare the original and the new package with debdiff

8. Install the newly built package
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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

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* (c dbs), *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*
    https://perl-team.pages.debian.net/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/

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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>
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
    
  
  - Debian Developer’s Reference, chapter 6.4
    
  
    [https://people.debian.org/~srivasta/MaintainerScripts.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


- **Vcs-* fields** in `debian/control` to locate the repository
  - [https://wiki.debian.org/Salsa](https://wiki.debian.org/Salsa)

Vcs-Browser: [https://salsa.debian.org/debian/devscripts](https://salsa.debian.org/debian/devscripts)
Vcs-Git: [https://salsa.debian.org/debian/devscripts.git](https://salsa.debian.org/debian/devscripts.git)

Vcs-Browser: [https://salsa.debian.org/perl-team/modules/packages/libwww-perl](https://salsa.debian.org/perl-team/modules/packages/libwww-perl)
Vcs-Git: [https://salsa.debian.org/perl-team/modules/packages/libwww-perl.git](https://salsa.debian.org/perl-team/modules/packages/libwww-perl.git)

- **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 \texttt{mutt} from Debian \textit{unstable} on Debian \textit{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
  \url{http://backports.debian.org/}
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Debian archive and suites

Based on graph by Antoine Beaupré. https://salsa.debian.org/debian/package-cycle
Suites for development

- New versions of packages are uploaded to **unstable** (**sid**)
- Packages migrate from **unstable** to **testing** based on several criterias (e.g. has been in unstable for 10 days, and no regressions)
- New packages can also be uploaded to:
  - **experimental** (for more *experimental* packages, such as when the new version is not ready to replace the one currently in unstable)
  - **testing-proposed-updates**, to update the version in **testing** without going through **unstable** (this is rarely used)
Freezing and releasing

- At some point during the release cycle, the release team decides to freeze testing: automatic migrations from unstable to testing are stopped, and replaced by manual review.

- When the release team considers testing to be ready for release:
  - The testing suite becomes the new stable suite
  - Similarly, the old stable becomes oldstable
  - Unsupported releases are moved to archive.debian.org

- See https://release.debian.org/
Stable release suites and management

- Several suites are used to provide stable release packages:
  - **stable**: the main suite
  - **security** updates suite provided on security.debian.org, used by the security team. Updates are announced on the debian-security-announce mailing list
  - **stable-updates**: updates that are not security related, but that should urgently be installed (without waiting for the next point release): antivirus databases, timezone-related packages, etc. Announced on the debian-stable-announce mailing list
  - **backports**: new upstream versions, based on the version in testing
  - The **stable** suite is updated every few months by *stable point releases* (that include only bug fixes)
    - Packages targeting the next stable point release are uploaded to **stable-proposed-updates** and reviewed by the release team
  - The **oldstable** release has the same set of suites
Several ways to contribute to Debian

▶ Worst way to contribute:
   ① Package your own application
   ② Get it into Debian
   ③ 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
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

1. Submit an ITP bug (Intent To Package) using reportbug wnpp
2. Prepare a source package
3. 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](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

- Guide for Debian Maintainers
  https://www.debian.org/doc/manuals/debmake-doc/

- 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
- 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
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

Feedback: packaging-tutorial@packages.debian.org
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Contribute to this tutorial

- Contribute:
  - `apt-get source packaging-tutorial`
  - `debcheckout packaging-tutorial`
  - `git clone https://salsa.debian.org/debian/packaging-tutorial.git`
  - `https://salsa.debian.org/debian/packaging-tutorial`
  - 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`
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
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
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

1. Take a quick look at some documentation about Java packaging:
   - https://wiki.debian.org/Java
   - https://wiki.debian.org/Java/Packaging
   - /usr/share/doc/javahelper/tutorial.txt.gz

2. Download IRClib from http://moepii.sourceforge.net/

3. 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:
   - https://perl-team.pages.debian.net
   - 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
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
Answers to practical sessions
Practical session 1: modifying the grep 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?

3. Build the package

4. We are now going to modify the package. Add a changelog entry and increase the version number.

5. Now disable perl-regexp support (it is a ./configure option)

6. Rebuild the package

7. Compare the original and the new package with debdiff

8. Install the newly built package
Fetching the source


   - 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)
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.
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
    ```
If you are using source format version **3.0 (quilt)**, use quilt to prepare a patch. (see [https://wiki.debian.org/UsingQuilt](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
  ```
The package should now build fine.

Use `debinc` 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 -EviiIL +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

1. Take a quick look at some documentation about Java packaging:
   - https://wiki.debian.org/Java
   - https://wiki.debian.org/Java/Packaging
   - /usr/share/doc/javahelper/tutorial.txt.gz

2. Download IRClib from http://moepii.sourceforge.net/

3. 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 `libirclib-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:
   - https://perl-team.pages.debian.net
   - 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
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