

# **Release Notes for Debian 12 (bookworm), ARMv7 (EABI hard-float ABI)**

The Debian Documentation Project (<https://www.debian.org/doc/>)

April 22, 2024

---

## Release Notes for Debian 12 (bookworm), ARMv7 (EABI hard-float ABI)

This document is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License, version 2, as published by the Free Software Foundation.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA.

The license text can also be found at <https://www.gnu.org/licenses/gpl-2.0.html> and `/usr/share/common-licenses/GPL-2` on Debian systems.

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Reporting bugs on this document . . . . .	1
1.2	Contributing upgrade reports . . . . .	1
1.3	Sources for this document . . . . .	2
<b>2</b>	<b>What's new in Debian 12</b>	<b>3</b>
2.1	Supported architectures . . . . .	3
2.2	Archive areas . . . . .	3
2.3	What's new in the distribution? . . . . .	4
2.3.1	Desktops and well known packages . . . . .	4
2.3.2	More translated man pages . . . . .	5
2.3.3	News from Debian Med Blend . . . . .	5
2.3.4	News from Debian Astro Blend . . . . .	5
<b>3</b>	<b>Installation System</b>	<b>7</b>
3.1	What's new in the installation system? . . . . .	7
3.2	Container and Virtual Machine images . . . . .	7
<b>4</b>	<b>Upgrades from Debian 11 (bullseye)</b>	<b>9</b>
4.1	Preparing for the upgrade . . . . .	9
4.1.1	Back up any data or configuration information . . . . .	9
4.1.2	Inform users in advance . . . . .	9
4.1.3	Prepare for downtime on services . . . . .	9
4.1.4	Prepare for recovery . . . . .	10
4.1.4.1	Debug shell during boot using initrd . . . . .	10
4.1.4.2	Debug shell during boot using systemd . . . . .	10
4.1.5	Prepare a safe environment for the upgrade . . . . .	11
4.2	Start from "pure" Debian . . . . .	11
4.2.1	Upgrade to Debian 11 (bullseye) . . . . .	11
4.2.2	Upgrade to latest point release . . . . .	11
4.2.3	Debian Backports . . . . .	12
4.2.4	Prepare the package database . . . . .	12
4.2.5	Remove obsolete packages . . . . .	12
4.2.6	Remove non-Debian packages . . . . .	12
4.2.7	Clean up leftover configuration files . . . . .	12
4.2.8	The non-free and non-free-firmware components . . . . .	13
4.2.9	The proposed-updates section . . . . .	13
4.2.10	Unofficial sources . . . . .	13
4.2.11	Disabling APT pinning . . . . .	13
4.2.12	Check gpgv is installed . . . . .	13
4.2.13	Check package status . . . . .	13
4.3	Preparing APT source-list files . . . . .	14
4.3.1	Adding APT Internet sources . . . . .	14
4.3.2	Adding APT sources for a local mirror . . . . .	15
4.3.3	Adding APT sources from optical media . . . . .	15
4.4	Upgrading packages . . . . .	15
4.4.1	Recording the session . . . . .	16
4.4.2	Updating the package list . . . . .	16
4.4.3	Make sure you have sufficient space for the upgrade . . . . .	17
4.4.4	Stop monitoring systems . . . . .	18
4.4.5	Minimal system upgrade . . . . .	19
4.4.6	Upgrading the system . . . . .	19
4.5	Possible issues during upgrade . . . . .	19
4.5.1	Full-upgrade fails with "Could not perform immediate configuration" . . . . .	19

4.5.2	Expected removals . . . . .	19
4.5.3	Conflicts or Pre-Depends loops . . . . .	20
4.5.4	File conflicts . . . . .	20
4.5.5	Configuration changes . . . . .	20
4.5.6	Change of session to console . . . . .	20
4.6	Upgrading your kernel and related packages . . . . .	21
4.6.1	Installing a kernel metapackage . . . . .	21
4.7	Preparing for the next release . . . . .	21
4.7.1	Purging removed packages . . . . .	21
4.8	Obsolete packages . . . . .	22
4.8.1	Transitional dummy packages . . . . .	22
<b>5</b>	<b>Issues to be aware of for bookworm</b> . . . . .	<b>23</b>
5.1	Upgrade specific items for bookworm . . . . .	23
5.1.1	Non-free firmware moved to its own component in the archive . . . . .	23
5.1.2	Changes to packages that set the system clock . . . . .	23
5.1.3	Puppet configuration management system upgraded to 7 . . . . .	23
5.1.4	youtube-dl replaced with yt-dlp . . . . .	24
5.1.5	Fcix versions no longer co-installable . . . . .	24
5.1.6	MariaDB package names no longer include version numbers . . . . .	24
5.1.7	Changes to system logging . . . . .	25
5.1.8	rsyslog changes affecting log analyzers such as logcheck . . . . .	25
5.1.9	rsyslog creates fewer log files . . . . .	25
5.1.10	slapd upgrade may require manual intervention . . . . .	26
5.1.11	GRUB no longer runs os-prober by default . . . . .	26
5.1.12	GNOME has reduced accessibility support for screen readers . . . . .	26
5.1.13	Changes to polkit configuration . . . . .	27
5.1.14	A “merged-/usr” is now required . . . . .	27
5.1.15	Unsupported upgrades from buster fail on libcrypt1 . . . . .	28
5.1.16	Things to do post upgrade before rebooting . . . . .	28
5.2	Items not limited to the upgrade process . . . . .	28
5.2.1	Limitations in security support . . . . .	28
5.2.1.1	Security status of web browsers and their rendering engines . . . . .	28
5.2.1.2	Go- and Rust-based packages . . . . .	29
5.2.2	Python Interpreters marked externally-managed . . . . .	29
5.2.3	Limited hardware-accelerated video encoding/decoding support in VLC . . . . .	29
5.2.4	systemd-resolved has been split into a separate package . . . . .	29
5.2.5	systemd-boot has been split into a separate package . . . . .	29
5.2.6	systemd-journal-remote no longer uses GnuTLS . . . . .	30
5.2.7	Extensive changes in adduser for bookworm . . . . .	30
5.2.8	Predictable naming for Xen network interfaces . . . . .	30
5.2.9	Change in dash handling of circumflex . . . . .	30
5.2.10	netcat-openbsd supports abstract sockets . . . . .	30
5.3	Obsolescence and deprecation . . . . .	30
5.3.1	Noteworthy obsolete packages . . . . .	30
5.3.2	Deprecated components for bookworm . . . . .	31
5.4	Known severe bugs . . . . .	31
<b>6</b>	<b>More information on Debian</b> . . . . .	<b>35</b>
6.1	Further reading . . . . .	35
6.2	Getting help . . . . .	35
6.2.1	Mailing lists . . . . .	35
6.2.2	Internet Relay Chat . . . . .	35
6.3	Reporting bugs . . . . .	35
6.4	Contributing to Debian . . . . .	36
<b>7</b>	<b>Glossary</b> . . . . .	<b>37</b>

<b>A</b>	<b>Managing your bullseye system before the upgrade</b>	<b>39</b>
A.1	Upgrading your bullseye system . . . . .	39
A.2	Checking your APT source-list files . . . . .	39
A.3	Performing the upgrade to latest bullseye release . . . . .	40
A.4	Removing obsolete configuration files . . . . .	40
<b>B</b>	<b>Contributors to the Release Notes</b>	<b>41</b>
	<b>Index</b>	<b>43</b>



# Chapter 1

## Introduction

This document informs users of the Debian distribution about major changes in version 12 (codenamed bookworm).

The release notes provide information on how to upgrade safely from release 11 (codenamed bullseye) to the current release and inform users of known potential issues they could encounter in that process.

You can get the most recent version of this document from <https://www.debian.org/releases/bookworm/releasenotes>.

### CAUTION



Note that it is impossible to list every known issue and that therefore a selection has been made based on a combination of the expected prevalence and impact of issues.

Please note that we only support and document upgrading from the previous release of Debian (in this case, the upgrade from bullseye). If you need to upgrade from older releases, we suggest you read previous editions of the release notes and upgrade to bullseye first.

### 1.1 Reporting bugs on this document

We have attempted to test all the different upgrade steps described in this document and to anticipate all the possible issues our users might encounter.

Nevertheless, if you think you have found a bug (incorrect information or information that is missing) in this documentation, please file a bug in the [bug tracking system](https://bugs.debian.org/) (<https://bugs.debian.org/>) against the `release-notes` package. You might first want to review the [existing bug reports](https://bugs.debian.org/release-notes) (<https://bugs.debian.org/release-notes>) in case the issue you've found has already been reported. Feel free to add additional information to existing bug reports if you can contribute content for this document.

We appreciate, and encourage, reports providing patches to the document's sources. You will find more information describing how to obtain the sources of this document in Section [1.3](#).

### 1.2 Contributing upgrade reports

We welcome any information from users related to upgrades from bullseye to bookworm. If you are willing to share information please file a bug in the [bug tracking system](https://bugs.debian.org/) (<https://bugs.debian.org/>) against the `upgrade-reports` package with your results. We request that you compress any attachments that are included (using `gzip`).

Please include the following information when submitting your upgrade report:

- The status of your package database before and after the upgrade: `dpkg`'s status database available at `/var/lib/dpkg/status` and `apt`'s package state information, available at `/var/lib/`

`apt/extended_states`. You should have made a backup before the upgrade as described at Section 4.1.1, but you can also find backups of `/var/lib/dpkg/status` in `/var/backups`.

- Session logs created using **script**, as described in Section 4.4.1.
- Your **apt** logs, available at `/var/log/apt/term.log`, or your **aptitude** logs, available at `/var/log/aptitude`.

#### NOTE



You should take some time to review and remove any sensitive and/or confidential information from the logs before including them in a bug report as the information will be published in a public database.

## 1.3 Sources for this document

The source of this document is in DocBook XML format. The HTML version is generated using `docbook-xsl` and `xsltproc`. The PDF version is generated using `dblatex` or `xmlroff`. Sources for the Release Notes are available in the Git repository of the *Debian Documentation Project*. You can use the **web interface** (<https://salsa.debian.org/ddp-team/release-notes/>) to access its files individually through the web and see their changes. For more information on how to access Git please consult the **Debian Documentation Project VCS information pages** (<https://www.debian.org/doc/vcs>).



# Chapter 2

## What's new in Debian 12

The [Wiki](https://wiki.debian.org/NewInBookworm) (<https://wiki.debian.org/NewInBookworm>) has more information about this topic.

### 2.1 Supported architectures

The following are the officially supported architectures for Debian 12:

- 32-bit PC (`i386`) and 64-bit PC (`amd64`)
- 64-bit ARM (`arm64`)
- ARM EABI (`armel`)
- ARMv7 (EABI hard-float ABI, `armhf`)
- little-endian MIPS (`mipsel`)
- 64-bit little-endian MIPS (`mips64el`)
- 64-bit little-endian PowerPC (`ppc64el`)
- IBM System z (`s390x`)

You can read more about port status, and port-specific information for your architecture at the [Debian port web pages](https://www.debian.org/ports/) (<https://www.debian.org/ports/>).

### 2.2 Archive areas

The following archive areas, mentioned in the Social Contract and in the Debian Policy, have been around for a long time:

- `main`: the Debian distribution;
- `contrib`: supplemental packages intended to work with the Debian distribution, but which require software outside of the distribution to either build or function;
- `non-free`: supplemental packages intended to work with the Debian distribution that do not comply with the DFSG or have other problems that make their distribution problematic.

Following the [2022 General Resolution about non-free firmware](https://www.debian.org/vote/2022/vote_003) ([https://www.debian.org/vote/2022/vote\\_003](https://www.debian.org/vote/2022/vote_003)), the 5th point of the Social Contract was extended with the following sentence:

The Debian official media may include firmware that is otherwise not part of the Debian system to enable use of Debian with hardware that requires such firmware.

While it's not mentioned explicitly in either the Social Contract or Debian Policy yet, a new archive area was introduced, making it possible to separate non-free firmware from the other non-free packages:

- non-free-firmware

Most non-free firmware packages have been moved from `non-free` to `non-free-firmware` in preparation for the Debian 12 release. This clean separation makes it possible to build official installation images with packages from `main` and from `non-free-firmware`, without `contrib` or `non-free`. In turn, these installation images make it possible to install systems with only `main` and `non-free-firmware`, without `contrib` or `non-free`.

See Section 4.2.8 for upgrades from bullseye.

## 2.3 What's new in the distribution?

This new release of Debian again comes with a lot more software than its predecessor bullseye; the distribution includes over 11089 new packages, for a total of over 64419 packages. Most of the software in the distribution has been updated: over 43254 software packages (this is 67% of all packages in bullseye). Also, a significant number of packages (over 6296, 10% of the packages in bullseye) have for various reasons been removed from the distribution. You will not see any updates for these packages and they will be marked as "obsolete" in package management front-ends; see Section 4.8.

### 2.3.1 Desktops and well known packages

Debian again ships with several desktop applications and environments. Among others it now includes the desktop environments GNOME 43, KDE Plasma 5.27, LXDE 11, LXQt 1.2.0, MATE 1.26, and Xfce 4.18.

Productivity applications have also been upgraded, including the office suites:

- LibreOffice is upgraded to version 7.4;
- GNUMcash is upgraded to 4.13;

Among many others, this release also includes the following software updates:

Package	Version in 11 (bullseye)	Version in 12 (bookworm)
Apache	2.4.54	2.4.57
Bash	5.1	5.2.15
BIND DNS Server	9.16	9.18
Cryptsetup	2.3	2.6
Emacs	27.1	28.2
Exim default e-mail server	4.94	4.96
GNU Compiler Collection as default compiler	10.2	12.2
GIMP	2.10.22	2.10.34
GnuPG	2.2.27	2.2.40
Inkscape	1.0.2	1.2.2
the GNU C library	2.31	2.36
Linux kernel image	5.10 series	6.1 series
LLVM/Clang toolchain	9.0.1 and 11.0.1 (default) and 13.0.1	13.0.1 and 14.0 (default) and 15.0.6
MariaDB	10.5	10.11
Nginx	1.18	1.22
OpenJDK	11	17
OpenLDAP	2.4.57	2.5.13
OpenSSH	8.4p1	9.2p1
OpenSSL	1.1.1n	3.0.8
Perl	5.32	5.36
PHP	7.4	8.2
Postfix MTA	3.5	3.7
PostgreSQL	13	15
Python 3	3.9.2	3.11.2
Rustc	1.48	1.63

Package	Version in 11 (bullseye)	Version in 12 (bookworm)
Samba	4.13	4.17
Systemd	247	252
Vim	8.2	9.0

### 2.3.2 More translated man pages

Thanks to our translators, more documentation in **man**-page format is available in more languages than ever. For example, many man pages are now available in Czech, Danish, Greek, Finnish, Indonesian, Macedonian, Norwegian (Bokmål), Russian, Serbian, Swedish, Ukrainian and Vietnamese, and all `systemd` man pages are now available in German.

To ensure the `man` command shows the documentation in your language (where possible), install the right `manpages-lang` package and make sure your locale is correctly configured by using

```
dpkg-reconfigure locales
```

.

### 2.3.3 News from Debian Med Blend

As in every release new packages have been added in the fields of medicine and life sciences. The new package `shiny-server` might be worth a particular mention, since it simplifies scientific web applications using R. We also kept up the effort to provide Continuous Integration support for the packages maintained by the Debian Med team.

The Debian Med team is always interested in feedback from users, especially in the form of requests for packaging of not-yet-packaged free software, or for backports from new packages or higher versions in testing.

To install packages maintained by the Debian Med team, install the metapackages named `med-*`, which are at version 3.8.x for Debian bookworm. Feel free to visit the [Debian Med tasks pages](https://blends.debian.org/med/tasks) (<https://blends.debian.org/med/tasks>) to see the full range of biological and medical software available in Debian.

### 2.3.4 News from Debian Astro Blend

Debian bookworm comes with version 4.0 of the Debian Astro Pure Blend, which continues to represent a great one-stop solution for professional astronomers, enthusiasts and everyone who is interested in astronomy. Almost all packages in Debian Astro were updated to new versions, but there are also several new software packages.

For radio astronomers, the open source correlator `openvubi` is now included. The new packages `astap` and `planetary-system-stacker` are useful for image stacking and astrometry resolution. A large number of new drivers and libraries supporting the INDI protocol were packaged and are now shipped with Debian.

The new Astropy affiliated packages `python3-extinction`, `python3-sncosmo`, `python3-specreduce`, and `python3-synphot` are included, as well as packages created around `python3-yt` and `python3-sunpy`. Python support for the ASDF file format is much extended, while the Java ecosystem is extended with libraries handling the ECSV and TFCAT file formats, primarily for use with `topcat`.

Check [the Astro Blend page](https://blends.debian.org/astro) (<https://blends.debian.org/astro>) for a complete list and further information.



# Chapter 3

## Installation System

The Debian Installer is the official installation system for Debian. It offers a variety of installation methods. The methods that are available to install your system depend on its architecture.

Images of the installer for bookworm can be found together with the Installation Guide on the [Debian website](https://www.debian.org/releases/bookworm/debian-installer/) (<https://www.debian.org/releases/bookworm/debian-installer/>).

The Installation Guide is also included on the first media of the official Debian DVD (CD/blu-ray) sets, at:

```
/doc/install/manual/language/index.html
```

You may also want to check the [errata](https://www.debian.org/releases/bookworm/debian-installer/index#errata) (<https://www.debian.org/releases/bookworm/debian-installer/index#errata>) for `debian-installer` for a list of known issues.

### 3.1 What's new in the installation system?

There has been a lot of development on the Debian Installer since its previous official release with Debian 11, resulting in improved hardware support and some exciting new features or improvements.

If you are interested in an overview of the changes since bullseye, please check the release announcements for the bookworm beta and RC releases available from the Debian Installer's [news history](https://www.debian.org/devel/debian-installer/News/) (<https://www.debian.org/devel/debian-installer/News/>).

### 3.2 Container and Virtual Machine images

Multi-architecture Debian bookworm container images are available on [Docker Hub](https://hub.docker.com/_/debian) ([https://hub.docker.com/\\_/debian](https://hub.docker.com/_/debian)). In addition to the standard images, a “slim” variant is available that reduces disk usage.

Virtual machine images for the Hashicorp Vagrant VM manager are published to [Vagrant Cloud](https://app.vagrantup.com/debian) (<https://app.vagrantup.com/debian>).



## Chapter 4

# Upgrades from Debian 11 (bullseye)

### 4.1 Preparing for the upgrade

We suggest that before upgrading you also read the information in Chapter 5. That chapter covers potential issues which are not directly related to the upgrade process but could still be important to know about before you begin.

#### 4.1.1 Back up any data or configuration information

Before upgrading your system, it is strongly recommended that you make a full backup, or at least back up any data or configuration information you can't afford to lose. The upgrade tools and process are quite reliable, but a hardware failure in the middle of an upgrade could result in a severely damaged system.

The main things you'll want to back up are the contents of `/etc`, `/var/lib/dpkg`, `/var/lib/apt/extended_states` and the output of:

```
$ dpkg --get-selections '*' # (the quotes are important)
```

If you use **aptitude** to manage packages on your system, you will also want to back up `/var/lib/aptitude/pkgstates`.

The upgrade process itself does not modify anything in the `/home` directory. However, some applications (e.g. parts of the Mozilla suite, and the GNOME and KDE desktop environments) are known to overwrite existing user settings with new defaults when a new version of the application is first started by a user. As a precaution, you may want to make a backup of the hidden files and directories (“dot-files”) in users' home directories. This backup may help to restore or recreate the old settings. You may also want to inform users about this.

Any package installation operation must be run with superuser privileges, so either log in as `root` or use **su** or **sudo** to gain the necessary access rights.

The upgrade has a few preconditions; you should check them before actually executing the upgrade.

#### 4.1.2 Inform users in advance

It's wise to inform all users in advance of any upgrades you're planning, although users accessing your system via an **ssh** connection should notice little during the upgrade, and should be able to continue working.

If you wish to take extra precautions, back up or unmount the `/home` partition before upgrading.

You will have to do a kernel upgrade when upgrading to bookworm, so a reboot will be necessary. Typically, this will be done after the upgrade is finished.

#### 4.1.3 Prepare for downtime on services

There might be services that are offered by the system which are associated with packages that will be included in the upgrade. If this is the case, please note that, during the upgrade, these services will be stopped while their associated packages are being replaced and configured. During this time, these services will not be available.

The precise downtime for these services will vary depending on the number of packages being upgraded in the system, and it also includes the time the system administrator spends answering any configuration questions from package upgrades. Notice that if the upgrade process is left unattended and the system requests input during the upgrade there is a high possibility of services being unavailable<sup>1</sup> for a significant period of time.

If the system being upgraded provides critical services for your users or the network<sup>2</sup>, you can reduce the downtime if you do a minimal system upgrade, as described in Section 4.4.5, followed by a kernel upgrade and reboot, and then upgrade the packages associated with your critical services. Upgrade these packages prior to doing the full upgrade described in Section 4.4.6. This way you can ensure that these critical services are running and available through the full upgrade process, and their downtime is reduced.

#### 4.1.4 Prepare for recovery

Although Debian tries to ensure that your system stays bootable at all times, there is always a chance that you may experience problems rebooting your system after the upgrade. Known potential issues are documented in this and the next chapters of these Release Notes.

For this reason it makes sense to ensure that you will be able to recover if your system should fail to reboot or, for remotely managed systems, fail to bring up networking.

If you are upgrading remotely via an `ssh` link it is recommended that you take the necessary precautions to be able to access the server through a remote serial terminal. There is a chance that, after upgrading the kernel and rebooting, you will have to fix the system configuration through a local console. Also, if the system is rebooted accidentally in the middle of an upgrade there is a chance you will need to recover using a local console.

For emergency recovery we generally recommend using the *rescue mode* of the bookworm Debian Installer. The advantage of using the installer is that you can choose between its many methods to find one that best suits your situation. For more information, please consult the section “Recovering a Broken System” in chapter 8 of the [Installation Guide](https://www.debian.org/releases/bookworm/installmanual) (<https://www.debian.org/releases/bookworm/installmanual>) and the [Debian Installer FAQ](https://wiki.debian.org/DebianInstaller/FAQ) (<https://wiki.debian.org/DebianInstaller/FAQ>).

If that fails, you will need an alternative way to boot your system so you can access and repair it. One option is to use a special rescue or [live install](https://www.debian.org/CD/live/) (<https://www.debian.org/CD/live/>) image. After booting from that, you should be able to mount your root file system and `chroot` into it to investigate and fix the problem.

##### 4.1.4.1 Debug shell during boot using `initrd`

The `initramfs-tools` package includes a debug shell<sup>3</sup> in the `initrds` it generates. If for example the `initrd` is unable to mount your root file system, you will be dropped into this debug shell which has basic commands available to help trace the problem and possibly fix it.

Basic things to check are: presence of correct device files in `/dev`; what modules are loaded (`cat /proc/modules`); output of `dmesg` for errors loading drivers. The output of `dmesg` will also show what device files have been assigned to which disks; you should check that against the output of `echo $ROOT` to make sure that the root file system is on the expected device.

If you do manage to fix the problem, typing `exit` will quit the debug shell and continue the boot process at the point it failed. Of course you will also need to fix the underlying problem and regenerate the `initrd` so the next boot won't fail again.

##### 4.1.4.2 Debug shell during boot using `systemd`

If the boot fails under `systemd`, it is possible to obtain a debug root shell by changing the kernel command line. If the basic boot succeeds, but some services fail to start, it may be useful to add `systemd.unit=rescue.target` to the kernel parameters.

---

<sup>1</sup>If the `debconf` priority is set to a very high level you might prevent configuration prompts, but services that rely on default answers that are not applicable to your system will fail to start.

<sup>2</sup>For example: DNS or DHCP services, especially when there is no redundancy or failover. In the DHCP case end-users might be disconnected from the network if the lease time is lower than the time it takes for the upgrade process to complete.

<sup>3</sup>This feature can be disabled by adding the parameter `panic=0` to your boot parameters.



Otherwise, the kernel parameter `systemd.unit=emergency.target` will provide you with a root shell at the earliest possible point. However, this is done before mounting the root file system with read-write permissions. You will have to do that manually with:

```
# mount -o remount,rw /
```

Another approach is to enable the systemd “early debug shell” via the `debug-shell.service`. On the next boot this service opens a root login shell on `tty9` very early in the boot process. It can be enabled with the kernel boot parameter `systemd.debug-shell=1`, or made persistent with **systemctl enable debug-shell** (in which case it should be disabled again when debugging is completed).

More information on debugging a broken boot under systemd can be found in the [Freedesktop.org Diagnosing Boot Problems](https://freedesktop.org/Diagnosing-Boot-Problems) (<https://freedesktop.org/wiki/Software/systemd/Debugging/>) article.

### 4.1.5 Prepare a safe environment for the upgrade

#### IMPORTANT



If you are using some VPN services (such as `tinc`) consider that they might not be available throughout the upgrade process. Please see Section [4.1.3](#).

In order to gain extra safety margin when upgrading remotely, we suggest that you run upgrade processes in the virtual console provided by the `screen` program, which enables safe reconnection and ensures the upgrade process is not interrupted even if the remote connection process temporarily fails.

## 4.2 Start from “pure” Debian

The upgrade process described in this chapter has been designed for “pure” Debian stable systems. APT controls what is installed on your system. If your APT configuration mentions additional sources besides `bullseye`, or if you have installed packages from other releases or from third parties, then to ensure a reliable upgrade process you may wish to begin by removing these complicating factors.

The main configuration file that APT uses to decide what sources it should download packages from is `/etc/apt/sources.list`, but it can also use files in the `/etc/apt/sources.list.d/` directory - for details see [sources.list\(5\)](https://manpages.debian.org//bookworm/apt/sources.list.5.html) (<https://manpages.debian.org//bookworm/apt/sources.list.5.html>). If your system is using multiple source-list files then you will need to ensure they stay consistent.

### 4.2.1 Upgrade to Debian 11 (bullseye)

Only upgrades from Debian 11 (bullseye) are supported. Display your Debian version with:

```
$ cat /etc/debian_version
```

Please follow the instructions in the [Release Notes for Debian 11](https://www.debian.org/releases/bullseye/releasenotes) (<https://www.debian.org/releases/bullseye/releasenotes>) to upgrade to Debian 11 first if needed.

### 4.2.2 Upgrade to latest point release

This procedure assumes your system has been updated to the latest point release of bullseye. If you have not done this or are unsure, follow the instructions in Section [A.1](#).

### 4.2.3 Debian Backports

**Debian Backports** (<https://backports.debian.org/>) allows users of Debian stable to run more up-to-date versions of packages (with some tradeoffs in testing and security support). The Debian Backports Team maintains a subset of packages from the next Debian release, adjusted and recompiled for usage on the current Debian stable release.

Packages from `bullseye-backports` have version numbers lower than the version in `bookworm`, so they should upgrade normally to `bookworm` in the same way as “pure” `bullseye` packages during the distribution upgrade. While there are no known potential issues, the upgrade paths from backports are less tested, and correspondingly incur more risk.

#### CAUTION



While regular Debian Backports are supported, there is no clean upgrade path from `sloppy` (<https://backports.debian.org/Instructions/#index4h2>) backports (which use APT source-list entries referencing `bullseye-backports-sloppy`).

As with Section 4.2.10, users are advised to remove `bullseye-backports` entries from their APT source-list files before the upgrade. After it is completed, they may consider adding `bookworm-backports` (<https://backports.debian.org/Instructions/>).

For more information, consult the [Backports Wiki page](https://wiki.debian.org/Backports) (<https://wiki.debian.org/Backports>).

### 4.2.4 Prepare the package database

You should make sure the package database is ready before proceeding with the upgrade. If you are a user of another package manager like `aptitude` or `synaptic`, review any pending actions. A package scheduled for installation or removal might interfere with the upgrade procedure. Note that correcting this is only possible if your APT source-list files still point to `bullseye` and not to `stable` or `bookworm`; see Section A.2.

### 4.2.5 Remove obsolete packages

It is a good idea to **remove obsolete packages** from your system before upgrading. They may introduce complications during the upgrade process, and can present security risks as they are no longer maintained.

### 4.2.6 Remove non-Debian packages

Below there are two methods for finding installed packages that did not come from Debian, using either `apt` or `apt-forktracer`. Please note that neither of them are 100% accurate (e.g. the `apt` example will list packages that were once provided by Debian but no longer are, such as old kernel packages).

```
$ apt list '?narrow(?installed, ?not(?origin(Debian)))'
$ apt-forktracer | sort
```

### 4.2.7 Clean up leftover configuration files

A previous upgrade may have left unused copies of configuration files; **old versions** of configuration files, versions supplied by the package maintainers, etc. Removing leftover files from previous upgrades can avoid confusion. Find such leftover files with:

```
# find /etc -name '*.dpkg-*' -o -name '*.ucf-*' -o -name '*.merge-error'
```

### 4.2.8 The non-free and non-free-firmware components

If you have non-free firmware installed it is recommended to add `non-free-firmware` to your APT `sources-list`. For details see Section 2.2 and Section 5.1.1.

### 4.2.9 The proposed-updates section

If you have listed the `proposed-updates` section in your APT source-list files, you should remove it before attempting to upgrade your system. This is a precaution to reduce the likelihood of conflicts.

### 4.2.10 Unofficial sources

If you have any non-Debian packages on your system, you should be aware that these may be removed during the upgrade because of conflicting dependencies. If these packages were installed by adding an extra package archive in your APT source-list files, you should check if that archive also offers packages compiled for bookworm and change the source item accordingly at the same time as your source items for Debian packages.

Some users may have *unofficial* backported “newer” versions of packages that *are* in Debian installed on their bullseye system. Such packages are most likely to cause problems during an upgrade as they may result in file conflicts<sup>4</sup>. Section 4.5 has some information on how to deal with file conflicts if they should occur.

### 4.2.11 Disabling APT pinning

If you have configured APT to install certain packages from a distribution other than stable (e.g. from testing), you may have to change your APT pinning configuration (stored in `/etc/apt/preferences` and `/etc/apt/preferences.d/`) to allow the upgrade of packages to the versions in the new stable release. Further information on APT pinning can be found in [apt\\_preferences\(5\)](https://manpages.debian.org//bookworm/apt/apt_preferences.5.en.html) ([https://manpages.debian.org//bookworm/apt/apt\\_preferences.5.en.html](https://manpages.debian.org//bookworm/apt/apt_preferences.5.en.html)).

### 4.2.12 Check gpgv is installed

APT needs `gpgv` version 2 or greater to verify the keys used to sign releases of bookworm. Since `gpgv1` technically satisfies the dependency but is useful only in specialized circumstances, users may wish to ensure the correct version is installed with:

```
# apt install gpgv
```

### 4.2.13 Check package status

Regardless of the method used for upgrading, it is recommended that you check the status of all packages first, and verify that all packages are in an upgradable state. The following command will show any packages which have a status of Half-Installed or Failed-Config, and those with any error status.

```
$ dpkg --audit
```

You could also inspect the state of all packages on your system using `aptitude` or with commands such as

```
$ dpkg -l | pager
```

or

```
# dpkg --get-selections '*' > ~/curr-pkgs.txt
```

Alternatively you can also use `apt`.

```
# apt list --installed > ~/curr-pkgs.txt
```

---

<sup>4</sup>Debian’s package management system normally does not allow a package to remove or replace a file owned by another package unless it has been defined to replace that package.

It is desirable to remove any holds before upgrading. If any package that is essential for the upgrade is on hold, the upgrade will fail.

```
$ apt-mark showhold
```

If you changed and recompiled a package locally, and didn't rename it or put an epoch in the version, you must put it on hold to prevent it from being upgraded.

The “hold” package state for **apt** can be changed using:

```
# apt-mark hold package_name
```

Replace `hold` with `unhold` to unset the “hold” state.

If there is anything you need to fix, it is best to make sure your APT source-list files still refer to bullseye as explained in Section A.2.

## 4.3 Preparing APT source-list files

Before starting the upgrade you must reconfigure APT source-list files (`/etc/apt/sources.list` and files under `/etc/apt/sources.list.d/`) to add sources for `bookworm` and typically to remove sources for `bullseye`.

APT will consider all packages that can be found via any configured archive, and install the package with the highest version number, giving priority to the first entry in the files. Thus, if you have multiple mirror locations, list first the ones on local hard disks, then CD-ROMs, and then remote mirrors.

A release can often be referred to both by its codename (e.g. `bullseye`, `bookworm`) and by its status name (i.e. `oldstable`, `stable`, `testing`, `unstable`). Referring to a release by its codename has the advantage that you will never be surprised by a new release and for this reason is the approach taken here. It does of course mean that you will have to watch out for release announcements yourself. If you use the status name instead, you will just see loads of updates for packages available as soon as a release has happened.

Debian provides two announcement mailing lists to help you stay up to date on relevant information related to Debian releases:

- By [subscribing to the Debian announcement mailing list](https://lists.debian.org/debian-announce/) (<https://lists.debian.org/debian-announce/>), you will receive a notification every time Debian makes a new release. Such as when `bookworm` changes from e.g. `testing` to `stable`.
- By [subscribing to the Debian security announcement mailing list](https://lists.debian.org/debian-security-announce/) (<https://lists.debian.org/debian-security-announce/>), you will receive a notification every time Debian publishes a security announcement.

### 4.3.1 Adding APT Internet sources

On new installations the default is for APT to be set up to use the Debian APT CDN service, which should ensure that packages are automatically downloaded from a server near you in network terms. As this is a relatively new service, older installations may have configuration that still points to one of the main Debian Internet servers or one of the mirrors. If you haven't done so yet, it is recommended to switch over to the use of the CDN service in your APT configuration.

To make use of the CDN service, add a line like this to your APT source configuration (assuming you are using `main` and `contrib`):

```
deb https://deb.debian.org/debian bookworm main contrib
```

After adding your new sources, disable the previously existing “deb” lines by placing a hash sign (`#`) in front of them.

However, if you get better results using a specific mirror that is close to you in network terms, this option is still available.

Debian mirror addresses can be found at <https://www.debian.org/distrib/ftplist> (look at the “list of Debian mirrors” section).

For example, suppose your closest Debian mirror is <http://mirrors.kernel.org>. If you inspect that mirror with a web browser, you will notice that the main directories are organized like this:

```
http://mirrors.kernel.org/debian/dists/bookworm/main/binary-armhf/...
http://mirrors.kernel.org/debian/dists/bookworm/contrib/binary-armhf/...
```

To configure APT to use a given mirror, add a line like this (again, assuming you are using `main` and `contrib`):

```
deb http://mirrors.kernel.org/debian bookworm main contrib
```

Note that the “`dists`” is added implicitly, and the arguments after the release name are used to expand the path into multiple directories.

Again, after adding your new sources, disable the previously existing archive entries.

### 4.3.2 Adding APT sources for a local mirror

Instead of using remote package mirrors, you may wish to modify the APT source-list files to use a mirror on a local disk (possibly mounted over NFS).

For example, your package mirror may be under `/var/local/debian/`, and have main directories like this:

```
/var/local/debian/dists/bookworm/main/binary-armhf/...
/var/local/debian/dists/bookworm/contrib/binary-armhf/...
```

To use this with `apt`, add this line to your `sources.list` file:

```
deb file:/var/local/debian bookworm main contrib
```

Note that the “`dists`” is added implicitly, and the arguments after the release name are used to expand the path into multiple directories.

After adding your new sources, disable the previously existing archive entries in the APT source-list files by placing a hash sign (`#`) in front of them.

### 4.3.3 Adding APT sources from optical media

If you want to use *only* DVDs (or CDs or Blu-ray Discs), comment out the existing entries in all the APT source-list files by placing a hash sign (`#`) in front of them.

Make sure there is a line in `/etc/fstab` that enables mounting your CD-ROM drive at the `/media/cdrom` mount point. For example, if `/dev/sr0` is your CD-ROM drive, `/etc/fstab` should contain a line like:

```
/dev/sr0 /media/cdrom auto noauto,ro 0 0
```

Note that there must be *no spaces* between the words `noauto,ro` in the fourth field.

To verify it works, insert a CD and try running

```
# mount /media/cdrom # this will mount the CD to the mount point
# ls -alF /media/cdrom # this should show the CD's root directory
# umount /media/cdrom # this will unmount the CD
```

Next, run:

```
# apt-cdrom add
```

for each Debian Binary CD-ROM you have, to add the data about each CD to APT’s database.

## 4.4 Upgrading packages

The recommended way to upgrade from previous Debian releases is to use the package management tool `apt`.

## NOTE



**apt** is meant for interactive use, and should not be used in scripts. In scripts one should use **apt-get**, which has a stable output better suitable for parsing.

Don't forget to mount all needed partitions (notably the root and `/usr` partitions) read-write, with a command like:

```
# mount -o remount,rw /mountpoint
```

Next you should double-check that the APT source entries (in `/etc/apt/sources.list` and files under `/etc/apt/sources.list.d/`) refer either to “bookworm” or to “stable”. There should not be any sources entries pointing to bullseye.

## NOTE



Source lines for a CD-ROM might sometimes refer to “unstable”; although this may be confusing, you should *not* change it.

### 4.4.1 Recording the session

It is strongly recommended that you use the `/usr/bin/script` program to record a transcript of the upgrade session. Then if a problem occurs, you will have a log of what happened, and if needed, can provide exact information in a bug report. To start the recording, type:

```
# script -t 2>~/upgrade-bookwormstep.time -a ~/upgrade-bookwormstep.script
```

or similar. If you have to rerun the typescript (e.g. if you have to reboot the system) use different `step` values to indicate which step of the upgrade you are logging. Do not put the typescript file in a temporary directory such as `/tmp` or `/var/tmp` (files in those directories may be deleted during the upgrade or during any restart).

The typescript will also allow you to review information that has scrolled off-screen. If you are at the system's console, just switch to VT2 (using `Alt + F2`) and, after logging in, use `less -R ~/root/upgrade-bookworm.script` to view the file.

After you have completed the upgrade, you can stop **script** by typing `exit` at the prompt.

**apt** will also log the changed package states in `/var/log/apt/history.log` and the terminal output in `/var/log/apt/term.log`. **dpkg** will, in addition, log all package state changes in `/var/log/dpkg.log`. If you use **aptitude**, it will also log state changes in `/var/log/aptitude`.

If you have used the `-t` switch for **script** you can use the **scriptreplay** program to replay the whole session:

```
# scriptreplay ~/upgrade-bookwormstep.time ~/upgrade-bookwormstep.script
```

### 4.4.2 Updating the package list

First the list of available packages for the new release needs to be fetched. This is done by executing:

```
# apt update
```

## NOTE



Users of `apt-secure` may find issues when using `aptitude` or `apt-get`. For `apt-get`, you can use `apt-get update --allow-releaseinfo-change`.

### 4.4.3 Make sure you have sufficient space for the upgrade

You have to make sure before upgrading your system that you will have sufficient hard disk space when you start the full system upgrade described in Section 4.4.6. First, any package needed for installation that is fetched from the network is stored in `/var/cache/apt/archives` (and the `partial/` subdirectory, during download), so you must make sure you have enough space on the file system partition that holds `/var/` to temporarily download the packages that will be installed in your system. After the download, you will probably need more space in other file system partitions in order to both install upgraded packages (which might contain bigger binaries or more data) and new packages that will be pulled in for the upgrade. If your system does not have sufficient space you might end up with an incomplete upgrade that is difficult to recover from.

`apt` can show you detailed information about the disk space needed for the installation. Before executing the upgrade, you can see this estimate by running:

```
# apt -o APT::Get::Trivial-Only=true full-upgrade
[ ... ]
XXX upgraded, XXX newly installed, XXX to remove and XXX not upgraded.
Need to get xx.xMB of archives.
After this operation, AAAMB of additional disk space will be used.
```

## NOTE



Running this command at the beginning of the upgrade process may give an error, for the reasons described in the next sections. In that case you will need to wait until you've done the minimal system upgrade as in Section 4.4.5 before running this command to estimate the disk space.

If you do not have enough space for the upgrade, `apt` will warn you with a message like this:

```
E: You don't have enough free space in /var/cache/apt/archives/.
```

In this situation, make sure you free up space beforehand. You can:

- Remove packages that have been previously downloaded for installation (at `/var/cache/apt/archives`). Cleaning up the package cache by running `apt clean` will remove all previously downloaded package files.
- Remove forgotten packages. If you have used `aptitude` or `apt` to manually install packages in `bullseye` it will have kept track of those packages you manually installed, and will be able to mark as redundant those packages pulled in by dependencies alone which are no longer needed due to a package being removed. They will not mark for removal packages that you manually installed. To remove automatically installed packages that are no longer used, run:

```
# apt autoremove
```

You can also use `deborphan`, `debfooster`, or `cruft` to find redundant packages. Do not blindly remove the packages these tools present, especially if you are using aggressive non-default options that are prone to false positives. It is highly recommended that you manually review the packages suggested for removal (i.e. their contents, sizes, and descriptions) before you remove them.

- Remove packages that take up too much space and are not currently needed (you can always reinstall them after the upgrade). If you have `popularity-contest` installed, you can use **popcon-largest-unused** to list the packages you do not use that occupy the most space. You can find the packages that just take up the most disk space with **dpigs** (available in the `debian-goodies` package) or with **wajig** (running `wajig size`). They can also be found with `aptitude`. Start **aptitude** in full-terminal mode, select Views → New Flat Package List, press **l** and enter `~i`, then press **S** and enter `~installsize`. This will give you a handy list to work with.
- Remove translations and localization files from the system if they are not needed. You can install the `localepurge` package and configure it so that only a few selected locales are kept in the system. This will reduce the disk space consumed at `/usr/share/locale`.
- Temporarily move to another system, or permanently remove, system logs residing under `/var/log/`.
- Use a temporary `/var/cache/apt/archives`: You can use a temporary cache directory from another filesystem (USB storage device, temporary hard disk, filesystem already in use, ...).

**NOTE**

Do not use an NFS mount as the network connection could be interrupted during the upgrade.

For example, if you have a USB drive mounted on `/media/usbkey`:

1. remove the packages that have been previously downloaded for installation:

```
# apt clean
```

2. copy the directory `/var/cache/apt/archives` to the USB drive:

```
# cp -ax /var/cache/apt/archives /media/usbkey/
```

3. mount the temporary cache directory on the current one:

```
# mount --bind /media/usbkey/archives /var/cache/apt/archives
```

4. after the upgrade, restore the original `/var/cache/apt/archives` directory:

```
# umount /var/cache/apt/archives
```

5. remove the remaining `/media/usbkey/archives`.

You can create the temporary cache directory on whatever filesystem is mounted on your system.

- Do a minimal upgrade of the system (see Section 4.4.5) or partial upgrades of the system followed by a full upgrade. This will make it possible to upgrade the system partially, and allow you to clean the package cache before the full upgrade.

Note that in order to safely remove packages, it is advisable to switch your APT source-list files back to bullseye as described in Section A.2.

#### 4.4.4 Stop monitoring systems

As `apt` may need to temporarily stop services running on your computer, it's probably a good idea to stop monitoring services that can restart other terminated services during the upgrade. In Debian, `monit` is an example of such a service.



### 4.4.5 Minimal system upgrade

In some cases, doing the full upgrade (as described below) directly might remove large numbers of packages that you will want to keep. We therefore recommend a two-part upgrade process: first a minimal upgrade to overcome these conflicts, then a full upgrade as described in Section 4.4.6.

To do this, first run:

```
# apt upgrade --without-new-pkgs
```

This has the effect of upgrading those packages which can be upgraded without requiring any other packages to be removed or installed.

The minimal system upgrade can also be useful when the system is tight on space and a full upgrade cannot be run due to space constraints.

If the `apt-listchanges` package is installed, it will (in its default configuration) show important information about upgraded packages in a pager after downloading the packages. Press **q** after reading to exit the pager and continue the upgrade.

### 4.4.6 Upgrading the system

Once you have taken the previous steps, you are now ready to continue with the main part of the upgrade. Execute:

```
# apt full-upgrade
```

This will perform a complete upgrade of the system, installing the newest available versions of all packages, and resolving all possible dependency changes between packages in different releases. If necessary, it will install some new packages (usually new library versions, or renamed packages), and remove any conflicting obsoleted packages.

When upgrading from a set of CDs/DVDs/BDs, you will probably be asked to insert specific discs at several points during the upgrade. You might have to insert the same disc multiple times; this is due to inter-related packages that have been spread out over the discs.

New versions of currently installed packages that cannot be upgraded without changing the install status of another package will be left at their current version (displayed as “held back”). This can be resolved by either using **aptitude** to choose these packages for installation or by trying `apt install package`.

## 4.5 Possible issues during upgrade

The following sections describe known issues that might appear during an upgrade to bookworm.

### 4.5.1 Full-upgrade fails with “Could not perform immediate configuration”

In some cases the `apt full-upgrade` step can fail after downloading packages with:

```
E: Could not perform immediate configuration on 'package'. Please see man 5 apt. ←  
conf under APT::Immediate-Configure for details.
```

If that happens, running `apt full-upgrade -o APT::Immediate-Configure=0` instead should allow the upgrade to proceed.

Another possible workaround for this problem is to temporarily add both bullseye and bookworm sources to your APT source-list files and run `apt update`.

### 4.5.2 Expected removals

The upgrade process to bookworm might ask for the removal of packages on the system. The precise list of packages will vary depending on the set of packages that you have installed. These release notes give general advice on these removals, but if in doubt, it is recommended that you examine the package removals proposed by each method before proceeding. For more information about packages obsoleted in bookworm, see Section 4.8.

### 4.5.3 Conflicts or Pre-Depends loops

Sometimes it's necessary to enable the `APT::Force-LoopBreak` option in APT to be able to temporarily remove an essential package due to a Conflicts/Pre-Depends loop. `apt` will alert you of this and abort the upgrade. You can work around this by specifying the option `-o APT::Force-LoopBreak=1` on the `apt` command line.

It is possible that a system's dependency structure can be so corrupt as to require manual intervention. Usually this means using `apt` or

```
# dpkg --remove package_name
```

to eliminate some of the offending packages, or

```
# apt -f install
# dpkg --configure --pending
```

In extreme cases you might have to force re-installation with a command like

```
# dpkg --install /path/to/package_name.deb
```

### 4.5.4 File conflicts

File conflicts should not occur if you upgrade from a “pure” bullseye system, but can occur if you have unofficial backports installed. A file conflict will result in an error like:

```
Unpacking <package-foo> (from <package-foo-file>) ...
dpkg: error processing <package-foo> (--install):
trying to overwrite `<some-file-name>',
which is also in package <package-bar>
dpkg-deb: subprocess paste killed by signal (Broken pipe)
Errors were encountered while processing:
<package-foo>
```

You can try to solve a file conflict by forcibly removing the package mentioned on the *last* line of the error message:

```
# dpkg -r --force-depends package_name
```

After fixing things up, you should be able to resume the upgrade by repeating the previously described `apt` commands.

### 4.5.5 Configuration changes

During the upgrade, you will be asked questions regarding the configuration or re-configuration of several packages. When you are asked if any file in the `/etc/init.d` directory, or the `/etc/manpath.config` file should be replaced by the package maintainer's version, it's usually necessary to answer “yes” to ensure system consistency. You can always revert to the old versions, since they will be saved with a `.dpkg-old` extension.

If you're not sure what to do, write down the name of the package or file and sort things out at a later time. You can search in the typescript file to review the information that was on the screen during the upgrade.

### 4.5.6 Change of session to console

If you are running the upgrade using the system's local console you might find that at some points during the upgrade the console is shifted over to a different view and you lose visibility of the upgrade process. For example, this may happen in systems with a graphical interface when the display manager is restarted.

To recover the console where the upgrade was running you will have to use `Ctrl+Alt+F1` (if in the graphical startup screen) or `Alt+F1` (if in the local text-mode console) to switch back to the virtual terminal 1. Replace `F1` with the function key with the same number as the virtual terminal the upgrade was running in. You can also use `Alt+Left Arrow` or `Alt+Right Arrow` to switch between the different text-mode terminals.

## 4.6 Upgrading your kernel and related packages

This section explains how to upgrade your kernel and identifies potential issues related to this upgrade. You can either install one of the `linux-image-*` packages provided by Debian, or compile a customized kernel from source.

Note that a lot of information in this section is based on the assumption that you will be using one of the modular Debian kernels, together with `initramfs-tools` and `udev`. If you choose to use a custom kernel that does not require an `initrd` or if you use a different `initrd` generator, some of the information may not be relevant for you.

### 4.6.1 Installing a kernel metapackage

When you full-upgrade from bullseye to bookworm, it is strongly recommended that you install a `linux-image-*` metapackage, if you have not done so before. These metapackages will automatically pull in a newer version of the kernel during upgrades. You can verify whether you have one installed by running:

```
$ dpkg -l 'linux-image*' | grep ^ii | grep -i meta
```

If you do not see any output, then you will either need to install a new `linux-image` package by hand or install a `linux-image` metapackage. To see a list of available `linux-image` metapackages, run:

```
$ apt-cache search linux-image- | grep -i meta | grep -v transition
```

If you are unsure about which package to select, run `uname -r` and look for a package with a similar name. For example, if you see “4.9.0-8-amd64”, it is recommended that you install `linux-image-amd64`. You may also use `apt` to see a long description of each package in order to help choose the best one available. For example:

```
$ apt show linux-image-amd64
```

You should then use `apt install` to install it. Once this new kernel is installed you should reboot at the next available opportunity to get the benefits provided by the new kernel version. However, please have a look at Section 5.1.16 before performing the first reboot after the upgrade.

For the more adventurous there is an easy way to compile your own custom kernel on Debian. Install the kernel sources, provided in the `linux-source` package. You can make use of the `deb-pkg` target available in the sources’ makefile for building a binary package. More information can be found in the [Debian Linux Kernel Handbook](https://kernel-team.pages.debian.net/kernel-handbook/) (<https://kernel-team.pages.debian.net/kernel-handbook/>), which can also be found as the `debian-kernel-handbook` package.

If possible, it is to your advantage to upgrade the kernel package separately from the main `full-upgrade` to reduce the chances of a temporarily non-bootable system. Note that this should only be done after the minimal upgrade process described in Section 4.4.5.

## 4.7 Preparing for the next release

After the upgrade there are several things you can do to prepare for the next release.

- Remove newly redundant or obsolete packages as described in Section 4.4.3 and Section 4.8. You should review which configuration files they use and consider purging the packages to remove their configuration files. See also Section 4.7.1.

### 4.7.1 Purging removed packages

It is generally advisable to purge removed packages. This is especially true if these have been removed in an earlier release upgrade (e.g. from the upgrade to bullseye) or they were provided by third-party vendors. In particular, old `init.d` scripts have been known to cause issues.

**CAUTION**

Purging a package will generally also purge its log files, so you might want to back them up first.

The following command displays a list of all removed packages that may have configuration files left on the system (if any):

```
$ apt list '~c'
```

The packages can be removed by using **apt purge**. Assuming you want to purge all of them in one go, you can use the following command:

```
# apt purge '~c'
```

## 4.8 Obsolete packages

Introducing lots of new packages, bookworm also retires and omits quite a few old packages that were in bullseye. It provides no upgrade path for these obsolete packages. While nothing prevents you from continuing to use an obsolete package where desired, the Debian project will usually discontinue security support for it a year after bookworm’s release<sup>5</sup>, and will not normally provide other support in the meantime. Replacing them with available alternatives, if any, is recommended.

There are many reasons why packages might have been removed from the distribution: they are no longer maintained upstream; there is no longer a Debian Developer interested in maintaining the packages; the functionality they provide has been superseded by different software (or a new version); or they are no longer considered suitable for bookworm due to bugs in them. In the latter case, packages might still be present in the “unstable” distribution.

“Obsolete and Locally Created Packages” can be listed and purged from the commandline with:

```
$ apt list '~o'
# apt purge '~o'
```

The **Debian Bug Tracking System** (<https://bugs.debian.org/>) often provides additional information on why the package was removed. You should review both the archived bug reports for the package itself and the archived bug reports for the **ftp.debian.org pseudo-package** (<https://bugs.debian.org/cgi-bin/pkgreport.cgi?pkg=ftp.debian.org&archive=yes>).

For a list of obsolete packages for Bookworm, please refer to Section **5.3.1**.

### 4.8.1 Transitional dummy packages

Some packages from bullseye may have been replaced in bookworm by transitional dummy packages, which are empty placeholders designed to simplify upgrades. If for instance an application that was formerly a single package has been split into several, a transitional package may be provided with the same name as the old package and with appropriate dependencies to cause the new ones to be installed. After this has happened the redundant dummy package can be safely removed.

The package descriptions for transitional dummy packages usually indicate their purpose. However, they are not uniform; in particular, some “dummy” packages are designed to be kept installed, in order to pull in a full software suite, or track the current latest version of some program. You might also find **deborphan** with the `--guess-*` options (e.g. `--guess-dummy`) useful to detect transitional dummy packages on your system.

<sup>5</sup>Or for as long as there is not another release in that time frame. Typically only two stable releases are supported at any given time.

# Chapter 5

## Issues to be aware of for bookworm

Sometimes, changes introduced in a new release have side-effects we cannot reasonably avoid, or they expose bugs somewhere else. This section documents issues we are aware of. Please also read the errata, the relevant packages' documentation, bug reports, and other information mentioned in Section 6.1.

### 5.1 Upgrade specific items for bookworm

This section covers items related to the upgrade from bullseye to bookworm.

#### 5.1.1 Non-free firmware moved to its own component in the archive

As described in Section 2.2, non-free firmware packages are now served from a dedicated archive component, called `non-free-firmware`. To ensure installed non-free firmware packages receive proper upgrades, changes to the APT configuration are required. Assuming the `non-free` component was only added to the APT sources-list to install firmware, the updated APT source-list entry could look like:

```
deb https://deb.debian.org/debian bookworm main non-free-firmware
```

If you were pointed to this chapter by `apt` you can prevent it from continuously notifying you about this change by creating an `apt.conf(5)` (<https://manpages.debian.org//bookworm/apt/apt.conf.5.html>) file named `/etc/apt/apt.conf.d/no-bookworm-firmware.conf` with the following content:

```
APT::Get::Update::SourceListWarnings::NonFreeFirmware "false";
```

#### 5.1.2 Changes to packages that set the system clock

The `ntp` package, which used to be the default way to set the system clock from a Network Time Protocol (NTP) server, has been replaced by `ntpsec`.

Most users will not need to take any specific action to transition from `ntp` to `ntpsec`.

In bookworm there are also several other packages that provide a similar service. The Debian default is now `systemd-timesyncd`, which may be adequate for users who only need an `ntp` client to set their clock. bookworm also includes `chrony` and `openntpd` which support more advanced features, such as operating your own NTP server.

#### 5.1.3 Puppet configuration management system upgraded to 7

Puppet has been upgraded from 5 to 7, skipping the Puppet 6 series altogether. This introduces major changes to the Puppet ecosystem.

The classic Ruby-based Puppet Master 5.5.x application has been deprecated upstream and is no longer available in Debian. It is replaced by Puppet Server 7.x, provided by the `puppetserver` package. The package is automatically installed as a dependency of the transitional `puppet-master` package.

In some cases, Puppet Server is a drop-in replacement for Puppet Master, but you should review the configuration files available under `/etc/puppet/puppetserver` to ensure the new defaults are suitable for your deployment. In particular the legacy format for the `auth.conf` file is deprecated,



### 5.1.7 Changes to system logging

The `rsyslog` package is no longer needed on most systems and you may be able to remove it.

Many programs produce log messages to inform the user of what they are doing. These messages can be managed by `systemd`'s “journal” or by a “syslog daemon” such as `rsyslog`.

In bullseye, `rsyslog` was installed by default and the `systemd` journal was configured to forward log messages to `rsyslog`, which writes messages into various text files such as `/var/log/syslog`.

From bookworm, `rsyslog` is no longer installed by default. If you do not want to continue using `rsyslog`, after the upgrade you can mark it as automatically installed with

```
apt-mark auto rsyslog
```

and then an

```
apt autoremove
```

will remove it, if possible. If you have upgraded from older Debian releases, and not accepted the default configuration settings, the journal may not have been configured to save messages to persistent storage: instructions for enabling this are in [journal.d.conf\(5\)](https://manpages.debian.org/bookworm/systemd/journald.conf.5.html) (<https://manpages.debian.org/bookworm/systemd/journald.conf.5.html>).

If you decide to switch away from `rsyslog` you can use the `journalctl` command to read log messages, which are stored in a binary format under `/var/log/journal`. For example,

```
journalctl -e
```

shows the most recent log messages in the journal and

```
journalctl -ef
```

shows new messages as they are written (similar to running

```
tail -f /var/log/syslog
```

).

### 5.1.8 rsyslog changes affecting log analyzers such as logcheck

`rsyslog` now defaults to “high precision timestamps” which may affect other programs that analyze the system logs. There is further information about how to customize this setting in [rsyslog.conf\(5\)](https://manpages.debian.org/bookworm/rsyslog/rsyslog.conf.5.html) (<https://manpages.debian.org/bookworm/rsyslog/rsyslog.conf.5.html>).

The change in timestamps may require locally-created `logcheck` rules to be updated. `logcheck` checks messages in the system log (produced by `systemd-journald` or `rsyslog`) against a customizable database of regular expressions known as rules. Rules that match the time the message was produced will need to be updated to match the new `rsyslog` format. The default rules, which are provided by the `logcheck-database` package, have been updated, but other rules, including those created locally, may require updating to recognize the new format. See [/usr/share/doc/logcheck-database/NEWS.Debian.gz](https://salsa.debian.org/debian/logcheck/-/blob/debian/1.4.0/debian/logcheck-database.NEWS) (<https://salsa.debian.org/debian/logcheck/-/blob/debian/1.4.0/debian/logcheck-database.NEWS>) for a script to help update local `logcheck` rules.

### 5.1.9 rsyslog creates fewer log files

`rsyslog` has changed which log files it creates, and some files in `/var/log` can be deleted.

If you are continuing to use `rsyslog` (see Section 5.1.7), some log files in `/var/log` will no longer be created by default. The messages that were written to these files are also in `/var/log/syslog` but are no longer created by default. Everything that used to be written to these files will still be available in `/var/log/syslog`.

The files that are no longer created are:

- `/var/log/mail.{info,warn,err}`

These files contained messages from the local mail transport agent (MTA), split up by priority.

As `/var/log/mail.log` contains all mail related messages, these files (and their rotated counterparts) can be deleted safely. If you were using those files to monitor anomalies, a suitable alternative might be something like `logcheck`.

- `/var/log/lpr.log`

This file contained log messages relating to printing. The default print system in debian is `cups` which does not use this file, so unless you installed a different printing system this file (and its rotated counterparts) can be deleted.

- `/var/log/{messages, debug, daemon.log}`

These files (and their rotated counterparts) can be deleted. Everything that used to be written to these files will still be in `/var/log/syslog`.

### 5.1.10 slapd upgrade may require manual intervention

OpenLDAP 2.5 is a major new release and includes several incompatible changes as described in [the upstream release announcement](https://git.openldap.org/openldap/openldap/-/raw/OPENLDAP_REL_ENG_2_5/ANNOUNCEMENT) ([https://git.openldap.org/openldap/openldap/-/raw/OPENLDAP\\_REL\\_ENG\\_2\\_5/ANNOUNCEMENT](https://git.openldap.org/openldap/openldap/-/raw/OPENLDAP_REL_ENG_2_5/ANNOUNCEMENT)). Depending on the configuration, the `slapd` service might remain stopped after the upgrade, until necessary configuration updates are completed.

The following are some of the known incompatible changes:

- The [slapd-bdb\(5\)](https://manpages.debian.org//bullseye/slapd/slapd-bdb.5.html) (<https://manpages.debian.org//bullseye/slapd/slapd-bdb.5.html>) and [slapd-hdb\(5\)](https://manpages.debian.org//bullseye/slapd/slapd-hdb.5.html) (<https://manpages.debian.org//bullseye/slapd/slapd-hdb.5.html>) database backends have been removed. If you are using one of these backends under bullseye, it is strongly recommended to migrate to the [slapd-mdb\(5\)](https://manpages.debian.org//bookworm/slapd/slapd-mdb.5.html) (<https://manpages.debian.org//bookworm/slapd/slapd-mdb.5.html>) backend *before* upgrading to bookworm.
- The [slapd-shell\(5\)](https://manpages.debian.org//bullseye/slapd/slapd-shell.5.html) (<https://manpages.debian.org//bullseye/slapd/slapd-shell.5.html>) database backend has been removed.
- The [slapo-ppolicy\(5\)](https://manpages.debian.org//bookworm/slapd/slapo-ppolicy.5.html) (<https://manpages.debian.org//bookworm/slapd/slapo-ppolicy.5.html>) overlay now includes its schema compiled into the module. The old external schema, if present, conflicts with the new built-in one.
- The [pw-argon2](https://manpages.debian.org//bullseye/slapd-contrib/slapd-pw-argon2.5.html) (<https://manpages.debian.org//bullseye/slapd-contrib/slapd-pw-argon2.5.html>) contrib password module has been renamed to [argon2](https://manpages.debian.org//bookworm/slapd/slappw-argon2.5.html) (<https://manpages.debian.org//bookworm/slapd/slappw-argon2.5.html>).

Instructions for completing the upgrade and resuming the `slapd` service can be found in [doc/slapd/README.Debian.gz](https://sources.debian.org/src/openldap/bookworm/debian/slapd.README.Debian/) (<https://sources.debian.org/src/openldap/bookworm/debian/slapd.README.Debian/>). You should also consult [the upstream upgrade notes](https://openldap.org/doc/admin25/appendix-upgrading.html) (<https://openldap.org/doc/admin25/appendix-upgrading.html>).

### 5.1.11 GRUB no longer runs os-prober by default

For a long time, `grub` has used the `os-prober` package to detect other operating systems installed on a computer so that it can add them to the boot menu. Unfortunately, that can be problematic in certain cases (e.g. where guest virtual machines are running), so this has now been disabled by default in the latest upstream release.

If you are using GRUB to boot your system and want to continue to have other operating systems listed on the boot menu, you can change this. Either edit the file `/etc/default/grub`, ensure you have the setting `GRUB_DISABLE_OS_PROBER=false` and re-run `update-grub`, or run

```
dpkg-reconfigure <GRUB_PACKAGE>
```

to change this and other GRUB settings in a more user-friendly way.

### 5.1.12 GNOME has reduced accessibility support for screen readers

Many GNOME apps have switched from the GTK3 graphics toolkit to GTK4. Sadly, this has made many apps much less usable with screen readers such as `orca`.

If you depend on a screen reader you should consider switching to a different desktop such as [Mate](https://mate-desktop.org) (<https://mate-desktop.org>), which has better accessibility support. You can do this by installing the `mate-desktop-environment` package. Information about how to use Orca under Mate is available at [here](https://wiki.debian.org/Accessibility/Orca#MATE) (<https://wiki.debian.org/Accessibility/Orca#MATE>).



### 5.1.13 Changes to polkit configuration

For consistency with upstream and other distributions, the `polkit` (formerly `PolicyKit`) service, which allows unprivileged programs to access privileged system services, has changed the syntax and location for local policy rules. You should now write local rules for customizing the security policy in **JavaScript** (<https://wikipedia.org/wiki/JavaScript>), and place them at `/etc/polkit-1/rules.d/*.rules`. Example rules using the new format can be found in `/usr/share/doc/polkitd/examples/`, and **polkit(8)** ([https://manpages.debian.org//unstable/polkitd/polkit.8.html#AUTHORIZATION\\_RULES](https://manpages.debian.org//unstable/polkitd/polkit.8.html#AUTHORIZATION_RULES)) has further information.

Previously, rules could be written in `pkla` format, and placed in subdirectories of `/etc/polkit-1/localauthority` or `/var/lib/polkit-1/localauthority`. However, `.pkla` files should now be considered deprecated, and will only continue to work if the `polkitd-pkla` package is installed. This package will usually be installed automatically when you upgrade to bookworm, but it is likely not to be included in future Debian releases, so any local policy overrides will need to be migrated to the JavaScript format.

### 5.1.14 A “merged-/usr” is now required

Debian has adopted a filesystem layout, referred to as “merged-/usr”, which no longer includes the legacy directories `/bin`, `/sbin`, `/lib`, or optional variants such as `/lib64`. In the new layout, the legacy directories are replaced with symlinks to the corresponding locations `/usr/bin`, `/usr/sbin`, `/usr/lib`, and `/usr/lib64`. This means that, for example, both `/bin/bash` and `/usr/bin/bash` will launch **bash**.

For systems installed as `buster` or `bullseye` there will be no change, as the new filesystem layout was already the default in these releases. However, the older layout is no longer supported, and systems using it will be converted to the new layout when they are upgraded to bookworm.

The conversion to the new layout should have no impact on most users. All files are automatically moved to their new locations even if they were installed locally or come from packages not provided by Debian, and hardcoded paths such as `/bin/sh` continue to work. There are, however, some potential issues:

- ```
dpkg --search
```

will give wrong answers for files moved to the new locations:

```
dpkg --search /usr/bin/bash
```

will not identify that **bash** came from a package. (But

```
dpkg --search /bin/bash
```

still works as expected.)
- Local software not provided by Debian may not support the new layout and may, for example, rely on `/usr/bin/name` and `/bin/name` being two different files. This is not supported on merged systems (including new installations since `buster`), so any such software must be fixed or removed before the upgrade.
- Systems that rely on a “base layer” that is not directly writable (such as **WSL1** (<https://wiki.debian.org//https://wiki.debian.org/InstallingDebianOn/Microsoft/Windows/SubsystemForLinux>) images or container systems using multi-layer **overlayfs** (<https://en.wikipedia.org/wiki/OverlayFS>) filesystems) cannot be safely converted and should either be replaced (e.g., by installing a new WSL1 image from the store) or have each individual layer upgraded (e.g., by upgrading the base Debian layer of the `overlayfs` independently) rather than dist-upgraded.

For further information, see **The Case for the /usr merge** (<https://www.freedesktop.org/wiki/Software/systemd/TheCaseForTheUsrMerge/>) and **the Debian Technical Committee resolution** (<https://bugs.debian.org/994388#110>).

### 5.1.15 Unsupported upgrades from buster fail on libcrypt1

Debian officially supports upgrades only from one stable release to the next, e.g. from bullseye to bookworm. Upgrades from buster to bookworm are not supported, and will fail due to [Bug #993755](https://bugs.debian.org/993755) (<https://bugs.debian.org/993755>) with the following error:

```
Setting up libc6:armhf (2.36-9) ...
/usr/bin/perl: error while loading shared libraries: libcrypt.so.1: cannot open ←
  shared object file: No such file or directory
dpkg: error processing package libc6:armhf (--configure):
installed libc6:armhf package post-installation script subprocess returned error ←
  exit status 127
```

It is however possible to manually recover from this particular situation by forcibly installing the new `libcrypt1`:

```
# cd $(mktemp -d)
# apt download libcrypt1
# dpkg-deb -x libcrypt1_*.deb .
# cp -ra lib/* /lib/
# apt --fix-broken install
```

### 5.1.16 Things to do post upgrade before rebooting

When `apt full-upgrade` has finished, the “formal” upgrade is complete. For the upgrade to bookworm, there are no special actions needed before performing a reboot.

## 5.2 Items not limited to the upgrade process

### 5.2.1 Limitations in security support

There are some packages where Debian cannot promise to provide minimal backports for security issues. These are covered in the following subsections.

#### NOTE



The package `debian-security-support` helps to track the security support status of installed packages.

#### 5.2.1.1 Security status of web browsers and their rendering engines

Debian 12 includes several browser engines which are affected by a steady stream of security vulnerabilities. The high rate of vulnerabilities and partial lack of upstream support in the form of long term branches make it very difficult to support these browsers and engines with backported security fixes. Additionally, library interdependencies make it extremely difficult to update to newer upstream releases. Applications using the `webkit2gtk` source package (e.g. `epiphany`) are covered by security support, but applications using `qtwebkit` (source package `qtwebkit-opensource-src`) are not.

For general web browser use we recommend Firefox or Chromium. They will be kept up-to-date by rebuilding the current ESR releases for stable. The same strategy will be applied for Thunderbird.

Once a release becomes `oldstable`, officially supported browsers may not continue to receive updates for the standard period of coverage. For example, Chromium will only receive 6 months of security support in `oldstable` rather than the typical 12 months.

### 5.2.1.2 Go- and Rust-based packages

The Debian infrastructure currently has problems with rebuilding packages of types that systematically use static linking. With the growth of the Go and Rust ecosystems it means that these packages will be covered by limited security support until the infrastructure is improved to deal with them maintainably.

In most cases if updates are warranted for Go or Rust development libraries, they will only be released via regular point releases.

## 5.2.2 Python Interpreters marked externally-managed

The Debian provided python3 interpreter packages (python3.11 and pypy3) are now marked as being externally-managed, following [PEP-668](https://peps.python.org/pep-0668/) (<https://peps.python.org/pep-0668/>). The version of python3-pip provided in Debian follows this, and will refuse to manually install packages on Debian's python interpreters, unless the `--break-system-packages` option is specified.

If you need to install a Python application (or version) that isn't packaged in Debian, we recommend that you install it with **pipx** (in the `pipx` Debian package). **pipx** will set up an environment isolated from other applications and system Python modules, and install the application and its dependencies into that.

If you need to install a Python library module (or version) that isn't packaged in Debian, we recommend installing it into a virtualenv, where possible. You can create virtualenvs with the `venv` Python stdlib module (in the `python3-venv` Debian package) or the **virtualenv** Python 3rd-party tool (in the `virtualenv` Debian package). For example, instead of running `pip install --user foo`, run: `mkdir -p ~/.venvs && python3 -m venv ~/.venvs/foo && ~/.venvs/foo/bin/python -m pip install foo` to install it in a dedicated virtualenv.

See `/usr/share/doc/python3.11/README.venv` for more details.

## 5.2.3 Limited hardware-accelerated video encoding/decoding support in VLC

The VLC video player supports hardware-accelerated video decoding and encoding via VA-API and VDPAU. However, VLC's support for VA-API is tightly related to the version of FFmpeg. Because FFmpeg was upgraded to the 5.x branch, VLC's VA-API support has been disabled. Users of GPUs with native VA-API support (e.g., Intel and AMD GPUs) may experience high CPU usage during video playback and encoding.

Users of GPUs offering native VDPAU support (e.g., NVIDIA with non-free drivers) are not affected by this issue.

Support for VA-API and VDPAU can be checked with **vainfo** and **vdpauintfo** (each provided in a Debian package of the same name).

## 5.2.4 systemd-resolved has been split into a separate package

The new `systemd-resolved` package will not be installed automatically on upgrades. If you were using the **systemd-resolved** system service, please install the new package manually after the upgrade, and note that until it has been installed, DNS resolution might no longer work since the service will not be present on the system. Installing this package will automatically give `systemd-resolved` control of `/etc/resolv.conf`. For more information about `systemd-resolved`, consult the official [documentation](https://www.freedesktop.org/software/systemd/man/systemd-resolved.service.html) (<https://www.freedesktop.org/software/systemd/man/systemd-resolved.service.html>). Note that `systemd-resolved` was not, and still is not, the default DNS resolver in Debian. If you have not configured your machine to use `systemd-resolved` as the DNS resolver, no action is required.

## 5.2.5 systemd-boot has been split into a separate package

The new `systemd-boot` package will not be installed automatically on upgrades. If you were using **systemd-boot**, please install this new package manually, and note that until you do so, the older version of `systemd-boot` will be used as the bootloader. Installing this package will automatically configure `systemd-boot` as the machine's bootloader. The default boot loader in Debian is still GRUB. If you have not configured the machine to use `systemd-boot` as the bootloader, no action is required.

### 5.2.6 systemd-journal-remote no longer uses GnuTLS

The optional [systemd-journal-gatewayd](https://www.freedesktop.org/software/systemd/man/systemd-journal-remote.service.html#--trust=) (<https://www.freedesktop.org/software/systemd/man/systemd-journal-remote.service.html#--trust=>) and [systemd-journal-remote](https://www.freedesktop.org/software/systemd/man/systemd-journal-gatewayd.service.html#--trust=) (<https://www.freedesktop.org/software/systemd/man/systemd-journal-gatewayd.service.html#--trust=>) services are now built without GnuTLS support, which means the `--trust` option is no longer provided by either program, and an error will be raised if it is specified.

### 5.2.7 Extensive changes in adduser for bookworm

There have been several changes in `adduser`. The most prominent change is that `--disabled-password` and `--disabled-login` are now functionally identical. For further details, please read the `/usr/share/doc/adduser/NEWS.Debian.gz`.

### 5.2.8 Predictable naming for Xen network interfaces

The predictable naming logic in `systemd` for network interfaces has been extended to generate stable names from Xen netfront device information. This means that instead of the former system of names assigned by the kernel, interfaces now have stable names of the form `enX#`. Please adapt your system before rebooting after the upgrade. Some more information can be found on the [NetworkInterfaceNames wiki page](https://wiki.debian.org/NetworkInterfaceNames#bookworm-xen) (<https://wiki.debian.org/NetworkInterfaceNames#bookworm-xen>).

### 5.2.9 Change in dash handling of circumflex

`dash`, which by default provides the system shell `/bin/sh` in Debian, has switched to treating the circumflex (`^`) as a literal character, as was always the intended POSIX-compliant behavior. This means that in bookworm `[^0-9]` no longer means “not 0 to 9” but “0 to 9 and `^`”.

### 5.2.10 netcat-openbsd supports abstract sockets

The `netcat` utility for reading and writing data across network connections supports [abstract sockets](https://manpages.debian.org//bookworm/manpages/unix.7.html#Abstract_sockets) ([https://manpages.debian.org//bookworm/manpages/unix.7.html#Abstract\\_sockets](https://manpages.debian.org//bookworm/manpages/unix.7.html#Abstract_sockets)), and uses them by default in some circumstances.

By default, `netcat` is provided by `netcat-traditional`. However, if `netcat` is provided by the `netcat-openbsd` package and you are using an `AF_UNIX` socket, then this new default applies. In this case the `-U` option to `nc` will now interpret an argument starting with an `@` as requesting an abstract socket rather than as a filename beginning with an `@` in the current directory. This can have security implications because filesystem permissions can no longer be used to control access to an abstract socket. You can continue to use a filename starting with an `@` by prefixing the name with `./` or by specifying an absolute path.

## 5.3 Obsolescence and deprecation

### 5.3.1 Noteworthy obsolete packages

The following is a list of known and noteworthy obsolete packages (see Section 4.8 for a description).

The list of obsolete packages includes:

- The `libnss-ldap` package has been removed from bookworm. Its functionalities are now covered by `libnss-ldapd` and `libnss-sss`.
- The `libpam-ldap` package has been removed from bookworm. Its replacement is `libpam-ldapd`.
- The `fdflush` package has been removed from bookworm. In its stead, please use `blockdev --flushbufs` from `util-linux`.
- The `libgdal-perl` package has been removed from bookworm, because the Perl binding for GDAL is no longer supported upstream. If you need Perl support for GDAL, you can migrate to the FFI interface provided by the `Geo::GDAL::FFI` package, available on CPAN. You will have to build your own binaries as documented on the [BookwormGdalPerl Wiki page](https://wiki.debian.org/BookwormGdalPerl) (<https://wiki.debian.org/BookwormGdalPerl>).

### 5.3.2 Deprecated components for bookworm

With the next release of Debian 13 (codenamed trixie) some features will be deprecated. Users will need to migrate to other alternatives to prevent trouble when updating to Debian 13.

This includes the following features:

- Development of the NSS service `gw_name` stopped in 2015. The associated package `libnss-gw-name` may be removed in future Debian releases. The upstream developer suggests using `libnss-myhostname` instead.
- `dmraid` has not seen upstream activity since end 2010 and has been on life support in Debian. `bookworm` will be the last release to ship it, so please plan accordingly if you're using `dmraid`.
- `request-tracker4` has been superseded by `request-tracker5` in this release, and will be removed in future releases. We recommend that you plan to migrate from `request-tracker4` to `request-tracker5` during the lifetime of this release.
- The `isc-dhcp` suite has been **deprecated** (<https://www.isc.org/blogs/isc-dhcp-eol/>) by the **ISC** (<https://www.isc.org/>). The **Debian Wiki** (<https://wiki.debian.org/>) has a list of alternative implementations, see **DHCP Client** ([https://wiki.debian.org/DHCP\\_Client](https://wiki.debian.org/DHCP_Client)) and **DHCP Server** ([https://wiki.debian.org/DHCP\\_Server](https://wiki.debian.org/DHCP_Server)) pages for the latest. If you are using `NetworkManager` or `systemd-networkd`, you can safely remove the `isc-dhcp-client` package as they both ship their own implementation. If you are using the `ifupdown` package, you can experiment with `udhcp` as a replacement. The ISC recommends the `Kea` package as a replacement for DHCP servers.

The security team will support the `isc-dhcp` package during the `bookworm` lifetime, but the package will likely be unsupported in the next stable release, see [bug #1035972 \(isc-dhcp EOL'ed\)](https://bugs.debian.org/1035972) (<https://bugs.debian.org/1035972>) for more details.

## 5.4 Known severe bugs

Although Debian releases when it's ready, that unfortunately doesn't mean there are no known bugs. As part of the release process all the bugs of severity serious or higher are actively tracked by the Release Team, so an [overview of those bugs](https://bugs.debian.org/cgi-bin/pkgreport.cgi?users=release.debian.org@packages.debian.org;tag=bookworm-can-defer) (<https://bugs.debian.org/cgi-bin/pkgreport.cgi?users=release.debian.org@packages.debian.org;tag=bookworm-can-defer>) that were tagged to be ignored in the last part of releasing `bookworm` can be found in the [Debian Bug Tracking System](https://bugs.debian.org/) (<https://bugs.debian.org/>). The following bugs were affecting `bookworm` at the time of the release and worth mentioning in this document:

| Bug number                                                                                                                              | Package (source or binary)         | Description                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------------------------------------------------------|
| <a href="https://bugs.debian.org/1032240">1032240</a> ( <a href="https://bugs.debian.org/1032240">https://bugs.debian.org/1032240</a> ) | <code>akonadi-backend-mysql</code> | akonadi server fails to start since it cannot connect to mysql database            |
| <a href="https://bugs.debian.org/918984">918984</a> ( <a href="https://bugs.debian.org/918984">https://bugs.debian.org/918984</a> )     | <code>src:fuse3</code>             | provide upgrade path fuse -> fuse3 for bookworm                                    |
| <a href="https://bugs.debian.org/1016903">1016903</a> ( <a href="https://bugs.debian.org/1016903">https://bugs.debian.org/1016903</a> ) | <code>g++-12</code>                | tree-vectorize: Wrong code at O2 level (-fno-tree-vectorize is working)            |
| <a href="https://bugs.debian.org/1020284">1020284</a> ( <a href="https://bugs.debian.org/1020284">https://bugs.debian.org/1020284</a> ) | <code>git-daemon-run</code>        | fails to purge: deluser -f: Unknown option: f                                      |
| <a href="https://bugs.debian.org/919296">919296</a> ( <a href="https://bugs.debian.org/919296">https://bugs.debian.org/919296</a> )     | <code>git-daemon-run</code>        | fails with 'warning: git-daemon: unable to open supervise/ok: file does not exist' |
| <a href="https://bugs.debian.org/1034752">1034752</a> ( <a href="https://bugs.debian.org/1034752">https://bugs.debian.org/1034752</a> ) | <code>src:gluegen2</code>          | embeds non-free headers                                                            |

| Bug number                                                                              | Package (source or binary) | Description                                                                                                                                        |
|-----------------------------------------------------------------------------------------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <a href="https://bugs.debian.org/1036256">1036256</a> (https://bugs.debian.org/1036256) | src:golang-github-pin-tftp | FTBFS in testing: dh_auto_test: error: cd _build && go test -vet=off -v -p 8 github.com/pin/tftp github.com/pin/tftp/netascii returned exit code 1 |
| <a href="https://bugs.debian.org/1036575">1036575</a> (https://bugs.debian.org/1036575) | groonga-bin                | missing Depends: libjs-jquery-flot, libjs-jquery-ui                                                                                                |
| <a href="https://bugs.debian.org/1036041">1036041</a> (https://bugs.debian.org/1036041) | src:grub2                  | upgrade-reports: Dell XPS 9550 fails to boot after bulls-eye to bookworm upgrade - grub/bios interaction bug?                                      |
| <a href="https://bugs.debian.org/558422">558422</a> (https://bugs.debian.org/558422)    | grub-pc                    | upgrade hangs                                                                                                                                      |
| <a href="https://bugs.debian.org/913916">913916</a> (https://bugs.debian.org/913916)    | grub-efi-amd64             | UEFI boot option removed after update to grub2 2.02~beta3-5+deb9u1                                                                                 |
| <a href="https://bugs.debian.org/924151">924151</a> (https://bugs.debian.org/924151)    | grub2-common               | wrong grub.cfg for efi boot and fully encrypted disk                                                                                               |
| <a href="https://bugs.debian.org/925134">925134</a> (https://bugs.debian.org/925134)    | grub-efi-amd64             | grub-efi-amd64-signed: doesn't mount cryptodisk                                                                                                    |
| <a href="https://bugs.debian.org/945001">945001</a> (https://bugs.debian.org/945001)    | grub-efi-amd64             | GRUB-EFI messes up boot variables                                                                                                                  |
| <a href="https://bugs.debian.org/965026">965026</a> (https://bugs.debian.org/965026)    | grub-emu                   | grub-emu hangs linux console when run as root                                                                                                      |
| <a href="https://bugs.debian.org/984760">984760</a> (https://bugs.debian.org/984760)    | grub-efi-amd64             | upgrade works, boot fails (error: symbol `grub_is_lockdown` not found)                                                                             |
| <a href="https://bugs.debian.org/1036263">1036263</a> (https://bugs.debian.org/1036263) | src:guestfs-tools          | FTBFS in testing: make[6]: *** [Makefile:1716: test-suite.log] Error 1                                                                             |
| <a href="https://bugs.debian.org/916596">916596</a> (https://bugs.debian.org/916596)    | iptables                   | iptables.postinst failure on link creation                                                                                                         |
| <a href="https://bugs.debian.org/919058">919058</a> (https://bugs.debian.org/919058)    | itstool                    | its-tools: crashes when freeing xmlDoc                                                                                                             |
| <a href="https://bugs.debian.org/1028416">1028416</a> (https://bugs.debian.org/1028416) | kexec-tools                | systemctl kexec doesn't shutdown system properly and corrupts mounted filesystems                                                                  |
| <a href="https://bugs.debian.org/935182">935182</a> (https://bugs.debian.org/935182)    | libreoffice-core           | Concurrent file open on the same host results file deletion                                                                                        |
| <a href="https://bugs.debian.org/1036755">1036755</a> (https://bugs.debian.org/1036755) | src:linux                  | 6.1.26 <= x < 6.1.30 breaks applications using mmap(MAP_32BIT) [affects ganeti]                                                                    |
| <a href="https://bugs.debian.org/1036580">1036580</a> (https://bugs.debian.org/1036580) | src:llvm-defaults          | please add some Breaks for smoother upgrades from bulls-eye                                                                                        |
| <a href="https://bugs.debian.org/1036359">1036359</a> (https://bugs.debian.org/1036359) | elpa-markdown-toc          | crashes with (wrong-type-argument consp nil)                                                                                                       |
| <a href="https://bugs.debian.org/1032647">1032647</a> (https://bugs.debian.org/1032647) | nvidia-driver              | Intermittent black screen after updating to 525.89.02-1                                                                                            |
| <a href="https://bugs.debian.org/1029342">1029342</a> (https://bugs.debian.org/1029342) | openjdk-17-jre-headless    | jexec: can't locate java: No such file or directory                                                                                                |
| <a href="https://bugs.debian.org/1035798">1035798</a> (https://bugs.debian.org/1035798) | libphp8.2-embed            | does not ship SONAME link /usr/lib/libphp.so -> libphp8.2.so                                                                                       |

| Bug number                                                                                                                              | Package (source or binary) | Description                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------|----------------------------------------------------------------------------------|
| <a href="https://bugs.debian.org/1034993">1034993</a> ( <a href="https://bugs.debian.org/1034993">https://bugs.debian.org/1034993</a> ) | software-properties-qt     | missing Breaks+Replaces for software-properties-kde when upgrading from bullseye |
| <a href="https://bugs.debian.org/1036388">1036388</a> ( <a href="https://bugs.debian.org/1036388">https://bugs.debian.org/1036388</a> ) | sylpheed                   | account reset when mail is checked                                               |
| <a href="https://bugs.debian.org/1036424">1036424</a> ( <a href="https://bugs.debian.org/1036424">https://bugs.debian.org/1036424</a> ) | sylpheed                   | replying to an email you sent doesn't set account accordingly                    |
| <a href="https://bugs.debian.org/994274">994274</a> ( <a href="https://bugs.debian.org/994274">https://bugs.debian.org/994274</a> )     | src:syslinux               | FTBFS with gnu-efi 3.0.13                                                        |
| <a href="https://bugs.debian.org/1031152">1031152</a> ( <a href="https://bugs.debian.org/1031152">https://bugs.debian.org/1031152</a> ) | system-config-printer      | unlock button in system-config-printer provides no elevated permissions dialog   |
| <a href="https://bugs.debian.org/975490">975490</a> ( <a href="https://bugs.debian.org/975490">https://bugs.debian.org/975490</a> )     | u-boot-sunxi               | A64-Olinuxino-eMMC boot stuck at "Starting kernel ..."                           |
| <a href="https://bugs.debian.org/1034995">1034995</a> ( <a href="https://bugs.debian.org/1034995">https://bugs.debian.org/1034995</a> ) | python-is-python3          | missing Breaks+Replaces for python-dev-is-python2 when upgrading from bullseye   |
| <a href="https://bugs.debian.org/1036881">1036881</a> ( <a href="https://bugs.debian.org/1036881">https://bugs.debian.org/1036881</a> ) | whitedune                  | segfaults                                                                        |
| <a href="https://bugs.debian.org/1036601">1036601</a> ( <a href="https://bugs.debian.org/1036601">https://bugs.debian.org/1036601</a> ) | xenstore-utils             | missing Depends: xen-utils-common                                                |
| <a href="https://bugs.debian.org/1036578">1036578</a> ( <a href="https://bugs.debian.org/1036578">https://bugs.debian.org/1036578</a> ) | python3-yade               | does not ship a python module                                                    |





## Chapter 6

# More information on Debian

### 6.1 Further reading

Beyond these release notes and the [installation guide](https://www.debian.org/releases/bookworm/installmanual) (<https://www.debian.org/releases/bookworm/installmanual>), further documentation on Debian is available from the Debian Documentation Project (DDP), whose goal is to create high-quality documentation for Debian users and developers, such as the Debian Reference, Debian New Maintainers Guide, the Debian FAQ, and many more. For full details of the existing resources see the [Debian Documentation website](https://www.debian.org/doc/) (<https://www.debian.org/doc/>) and the [Debian Wiki](https://wiki.debian.org/) (<https://wiki.debian.org/>).

Documentation for individual packages is installed into `/usr/share/doc/package`. This may include copyright information, Debian specific details, and any upstream documentation.

### 6.2 Getting help

There are many sources of help, advice, and support for Debian users, though these should only be considered after researching the issue in available documentation. This section provides a short introduction to these sources which may be helpful for new Debian users.

#### 6.2.1 Mailing lists

The mailing lists of most interest to Debian users are the `debian-user` list (English) and other `debian-user-language` lists (for other languages). For information on these lists and details of how to subscribe see <https://lists.debian.org/>. Please check the archives for answers to your question prior to posting and also adhere to standard list etiquette.

#### 6.2.2 Internet Relay Chat

Debian has an IRC channel dedicated to support and aid for Debian users, located on the OFTC IRC network. To access the channel, point your favorite IRC client at `irc.debian.org` and join `#debian`.

Please follow the channel guidelines, respecting other users fully. The guidelines are available at the [Debian Wiki](https://wiki.debian.org/DebianIRC) (<https://wiki.debian.org/DebianIRC>).

For more information on OFTC please visit the [website](http://www.oftc.net/) (<http://www.oftc.net/>).

### 6.3 Reporting bugs

We strive to make Debian a high-quality operating system; however that does not mean that the packages we provide are totally free of bugs. Consistent with Debian's "open development" philosophy and as a service to our users, we provide all the information on reported bugs at our own Bug Tracking System (BTS). The BTS can be browsed at <https://bugs.debian.org/>.

If you find a bug in the distribution or in packaged software that is part of it, please report it so that it can be properly fixed for future releases. Reporting bugs requires a valid e-mail address. We ask for this so that we can trace bugs and developers can get in contact with submitters should additional information be needed.

You can submit a bug report using the program **reportbug** or manually using e-mail. You can find out more about the Bug Tracking System and how to use it by reading the reference documentation (available at `/usr/share/doc/debian` if you have `doc-debian` installed) or online at the **Bug Tracking System** (<https://bugs.debian.org/>).

## 6.4 Contributing to Debian

You do not need to be an expert to contribute to Debian. By assisting users with problems on the various user support **lists** (<https://lists.debian.org/>) you are contributing to the community. Identifying (and also solving) problems related to the development of the distribution by participating on the development **lists** (<https://lists.debian.org/>) is also extremely helpful. To maintain Debian's high-quality distribution, **submit bugs** (<https://bugs.debian.org/>) and help developers track them down and fix them. The tool `how-can-i-help` helps you to find suitable reported bugs to work on. If you have a way with words then you may want to contribute more actively by helping to write **documentation** (<https://www.debian.org/doc/vcs>) or **translate** (<https://www.debian.org/international/>) existing documentation into your own language.

If you can dedicate more time, you could manage a piece of the Free Software collection within Debian. Especially helpful is if people adopt or maintain items that people have requested for inclusion within Debian. The **Work Needing and Prospective Packages database** (<https://www.debian.org/devel/wnpp/>) details this information. If you have an interest in specific groups then you may find enjoyment in contributing to some of Debian's **subprojects** (<https://www.debian.org/devel/#projects>) which include ports to particular architectures and **Debian Pure Blends** (<https://wiki.debian.org/DebianPureBlends>) for specific user groups, among many others.

In any case, if you are working in the free software community in any way, as a user, programmer, writer, or translator you are already helping the free software effort. Contributing is rewarding and fun, and as well as allowing you to meet new people it gives you that warm fuzzy feeling inside.

# Chapter 7

## Glossary

**ACPI**

Advanced Configuration and Power Interface

**ALSA**

Advanced Linux Sound Architecture

**BD**

Blu-ray Disc

**CD**

Compact Disc

**CD-ROM**

Compact Disc Read Only Memory

**DHCP**

Dynamic Host Configuration Protocol

**DLBD**

Dual Layer Blu-ray Disc

**DNS**

Domain Name System

**DVD**

Digital Versatile Disc

**GIMP**

GNU Image Manipulation Program

**GNU**

GNU's Not Unix

**GPG**

GNU Privacy Guard

**LDAP**

Lightweight Directory Access Protocol

**LSB**

Linux Standard Base

**LVM**

Logical Volume Manager

**MTA**

Mail Transport Agent

**NBD**

Network Block Device

**NFS**

Network File System

**NIC**

Network Interface Card

**NIS**

Network Information Service

**PHP**

PHP: Hypertext Preprocessor

**RAID**

Redundant Array of Independent Disks

**SATA**

Serial Advanced Technology Attachment

**SSL**

Secure Sockets Layer

**TLS**

Transport Layer Security

**UEFI**

Unified Extensible Firmware Interface

**USB**

Universal Serial Bus

**UUID**

Universally Unique Identifier

**WPA**

Wi-Fi Protected Access

## Appendix A

# Managing your bullseye system before the upgrade

This appendix contains information on how to make sure you can install or upgrade bullseye packages before you upgrade to bookworm.

### A.1 Upgrading your bullseye system

Basically this is no different from any other upgrade of bullseye you've been doing. The only difference is that you first need to make sure your package list still contains references to bullseye as explained in Section A.2.

If you upgrade your system using a Debian mirror, it will automatically be upgraded to the latest bullseye point release.

### A.2 Checking your APT source-list files

If any of the lines in your APT source-list files (see [sources.list\(5\)](https://manpages.debian.org//bookworm/apt/sources.list.5.html) (<https://manpages.debian.org//bookworm/apt/sources.list.5.html>)) contain references to “stable”, this is effectively pointing to bookworm already. This might not be what you want if you are not yet ready for the upgrade. If you have already run **apt update**, you can still get back without problems by following the procedure below.

If you have also already installed packages from bookworm, there probably is not much point in installing packages from bullseye anymore. In that case you will have to decide for yourself whether you want to continue or not. It is possible to downgrade packages, but that is not covered here.

As root, open the relevant APT source-list file (such as `/etc/apt/sources.list`) with your favorite editor, and check all lines beginning with `deb http:`, `deb https:`, `deb tor+http:`, `deb tor+https:`, `URIs: http:`, `URIs: https:`, `URIs: tor+http:` or `URIs: tor+https:` for a reference to “stable”. If you find any, change `stable` to `bullseye`.

If you have any lines starting with `deb file:` or `URIs: file:`, you will have to check for yourself if the location they refer to contains a bullseye or bookworm archive.

#### IMPORTANT



Do not change any lines that begin with `deb cdrom:` or `URIs: cdrom:`. Doing so would invalidate the line and you would have to run **apt-cdrom** again. Do not be alarmed if a `cdrom:` source line refers to “unstable”. Although confusing, this is normal.

If you've made any changes, save the file and execute

```
# apt update
```

to refresh the package list.

### A.3 Performing the upgrade to latest bullseye release

To upgrade all packages to the state of the latest point release for bullseye, do

```
# apt full-upgrade
```

### A.4 Removing obsolete configuration files

Before upgrading your system to bookworm, it is recommended to remove old configuration files (such as `*.dpkg-{new,old}` files under `/etc`) from the system.

## Appendix B

# Contributors to the Release Notes

Many people helped with the release notes, including, but not limited to

Adam D. Barratt, Adam Di Carlo, Andreas Barth, Andrei Popescu, Anne Bezemer, Bob Hilliard, Charles Plessy, Christian Perrier, Christoph Berg, Daniel Baumann, David Prévot, Eddy Petrișor, Emmanuel Kasper, Esko Arajärvi, Frans Pop, Giovanni Rapagnani, Gordon Farquharson, Hideki Yamane, Holger Wansing, Javier Fernández-Sanguino Peña, Jens Seidel, Jonas Meurer, Jonathan Nieder, Joost van Baal-Ilić, Josip Rodin, Julien Cristau, Justin B Rye, LaMont Jones, Luk Claes, Martin Michlmayr, Michael Biebl, Moritz Mühlenhoff, Niels Thykier, Noah Meyerhans, Noritada Kobayashi, Osamu Aoki, Paul Gevers, Peter Green, Rob Bradford, Samuel Thibault, Simon Bienlein, Simon Paillard, Stefan Fritsch, Steve Langasek, Steve McIntyre, Tobias Scherer, victory, Vincent McIntyre, and W. Martin Borgert.

This document has been translated into many languages. Many thanks to the translators!





# Index

## A

Apache, 4

## B

Bash, 4

BIND, 4

## C

Cryptsetup, 4

## D

DocBook XML, 2

## E

Exim, 4

## G

GCC, 4

GIMP, 4

GNOME, 4

GNUCash, 4

GnuPG, 4

## I

Inkscape, 4

## K

KDE, 4

## L

LibreOffice, 4

LXDE, 4

LXQt, 4

## M

MariaDB, 4

MATE, 4

## N

Nginx, 4

## O

OpenJDK, 4

OpenSSH, 4

OpenSSL, 4

## P

packages

adduser, 30

akonadi-backend-mysql, 31

apt, 1, 2, 15

apt-listchanges, 19

aptitude, 12, 18

astap, 5

chrony, 23

cups, 26

dblatex, 2

debian-goodies, 18

debian-kernel-handbook, 21

debian-security-support, 28

dmraid, 31

doc-debian, 36

docbook-xsl, 2

dpkg, 1

elpa-markdown-toc, 32

fcitx, 24

fcitx5, 24

fdflush, 30

g++-12, 31

ganeti, 32

git-daemon-run, 31

gpgv1, 13

groonga-bin, 32

grub, 26

grub-efi-amd64, 32

grub-emu, 32

grub-pc, 32

grub2-common, 32

how-can-i-help, 36

ifupdown, 31

initramfs-tools, 10, 21

iptables, 32

isc-dhcp, 31

isc-dhcp-client, 31

itstool, 32

Kea, 31

kexec-tools, 32

libcrypt1, 28

libgdal-perl, 30

libnss-gw-name, 31

libnss-ldap, 30

libnss-ldapd, 30

libnss-myhostname, 31

libnss-sss, 30

libpam-ldap, 30

libpam-ldapd, 30

libphp8.2-embed, 32

libreoffice-core, 32

linux-image-\*, 21

linux-image-amd64, 21

linux-source, 21

localepurge, 18

logcheck, 25

logcheck-database, 25

manpages-lang, 5

mariadb-client, 24

mariadb-client-10.5, 24

mariadb-server, 24

mariadb-server-10.5, 24

mate-desktop-environment, 26

monit, 18

netcat-openbsd, 30

netcat-traditional, 30

NetworkManager, 31

ntp, 23

ntpsec, 23  
nvidia-driver, 32  
openjdk-17-jre-headless, 32  
openntpd, 23  
openvli, 5  
orca, 26  
pipx, 29  
planetary-system-stacker, 5  
polkitd-pkla, 27  
popularity-contest, 18  
puppet, 24  
puppet-agent, 24  
puppet-master, 23  
puppetdb, 24  
puppetserver, 23  
pypy3, 29  
python-is-python3, 33  
python3-extinction, 5  
python3-pip, 29  
python3-sncosmo, 5  
python3-specreduce, 5  
python3-sunpy, 5  
python3-synphot, 5  
python3-venv, 29  
python3-yade, 33  
python3-yt, 5  
python3.11, 29  
release-notes, 1  
request-tracker4, 31  
request-tracker5, 31  
rsyslog, 25  
shiny-server, 5  
software-properties-qt, 33  
src:fuse3, 31  
src:gluegen2, 31  
src:golang-github-pin-tftp, 32  
src:grub2, 32  
src:guestfs-tools, 32  
src:linux, 32  
src:llvm-defaults, 32  
src:syslinux, 33  
sylvheed, 33  
synaptic, 12  
system-config-printer, 33  
systemd, 5, 30  
systemd-boot, 29  
systemd-networkd, 31  
systemd-resolved, 29  
systemd-timesyncd, 23  
tinc, 11  
topcat, 5  
u-boot-sunxi, 33  
udev, 21  
udhcpc, 31  
upgrade-reports, 1  
util-linux, 30  
virtualenv, 29  
whitedune, 33  
xenstore-utils, 33  
xmlroff, 2  
xsltproc, 2  
youtube-dl, 24  
yt-dlp, 24  
Perl, 4  
PHP, 4  
Postfix, 4  
PostgreSQL, 4  
**S**  
Systemd, 5  
**X**  
Xfce, 4