

Linux & Docker Basics

Lecture 15

Dr. Colin Rundel



Duke VCM

Welcome to Virtual Computing Manager!

Virtual Computing Manager is a service providing the Duke community with easy access to virtual software packages, and semester-long virtual machine (VM) reservations. Access specialized software without installing it on your own computer, host your own server for development projects and coursework, or customize your own environment to use for the semester.

My Reservations

No reserved resources for the current semester



Virtual Machines (aka VMs)

Your Duke VM is like having a second computer that lives in OIT. You can log into and use your VM from your own machine.

- Run Windows or Linux
- Install zero, one or multiple apps for free

Reserve a VM



Virtual Software (aka Containers)

A Container lets you use a desktop software application in your browser without installing it on your machine or your VM.

- Simple to use
- Launch an app in a click!
- Use anywhere you can run a browser

Reserve a Container

Not sure what you need? Check out the [Help](#) page or contact vm-manager-help@duke.edu for assistance

vcm.duke.edu


Virtual Computing Manager x +

vcm.duke.edu/apps/index


Duke UNIVERSITY | **Virtual Computing Manager** Welcome, Colin Rundel [Logout](#)

[Home](#) [Request a VM](#) [Reserve a Container](#) [Help](#)


Most Popular



[Windows 11](#)
Windows 11



[Ubuntu Server 22.04](#)
Ubuntu Server 22.04 (Jammy Jellyfish)



[Ubuntu Server 24.04](#)
Ubuntu Server 24.04 (Noble Numbat)

Everything

[All](#) [My Courses](#) [Linux](#) [Windows](#)

[AlmaLinux 9](#)

AlmaLinux OS is an open source, community-owned and governed, forever-free enterprise Linux distribution, focused on long-term stability, providing a robust production-grade platform. AlmaLinux OS is binary-compatible with RHEL, and is owned and controlled by the non-profit AlmaLinux OS Foundation, managed by a community-elected board of directors.

Virtual Computing Manager

vcm.duke.edu/reservations/49702

Duke UNIVERSITY | Virtual Computing Manager

Welcome, Colin Rundel [Logout](#)

Home Request a VM Reserve a Container Help

My VMs

- vcm-52470.vm.duke.edu
- vcm-52472.vm.duke.edu
- vcm-52510.vm.duke.edu

vcm-52470.vm.duke.edu

[Power on](#)
[Power off](#)
[Create an alias](#)
[Transfer ownership](#)
[Delete this reservation](#)

Automatic power downs?

THIS VM DOES NOT POWER DOWN AUTOMATICALLY

You have opted out of the automatic power down for this VM. Your VM will run continuously and produce a larger carbon footprint than if you opt for scheduled power downs. If you do not need this VM to be powered at all times, please check the **Automatic power down**

General Information

Hostname	vcm-52470.vm.duke.edu
Operating System:	ubuntu-24
App:	Ubuntu Server 24.04
Base memory:	4.0 GB
Processors:	2
Total disk size:	50 GB
VM Status:	complete

Users

User:	cr173
Admin user:	vcm
Admin password:	[REDACTED]

Getting Started

Connecting

```
> rundel@tbBook [~]$ ssh cr173@vcm-52470.vm.duke.edu
```

```
The authenticity of host 'vcm-52470.vm.duke.edu (67.159.69.176)' can't be established.
```

```
ED25519 key fingerprint is SHA256:fSZfURPpnL4M+0bWv6S3jMYtalAeKZWSLH6DR+sx0e0.
```

```
This key is not known by any other names.
```

```
Are you sure you want to continue connecting (yes/no/[fingerprint])?
```

```
Warning: Permanently added 'vcm-52470.vm.duke.edu' (ED25519) to the list of known hosts.
```

```
cr173@vcm-52470.vm.duke.edu's password:
```

```
Welcome to Ubuntu 24.04.4 LTS (GNU/Linux 6.8.0-100-generic x86_64)
```

- * Documentation: <https://help.ubuntu.com>
- * Management: <https://landscape.canonical.com>
- * Support: <https://ubuntu.com/pro>

```
System information as of Tue Feb 24 09:50:33 PM EST 2026
```

```
System load: 0.0          Processes: 150
Usage of /home: 2.1% of 17.93GB  Users logged in: 0
Memory usage: 28%          IPv4 address for eth0: 67.159.65.108
Swap usage: 16%
```

- * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s just raised the bar for easy, resilient and secure K8s cluster deployment.

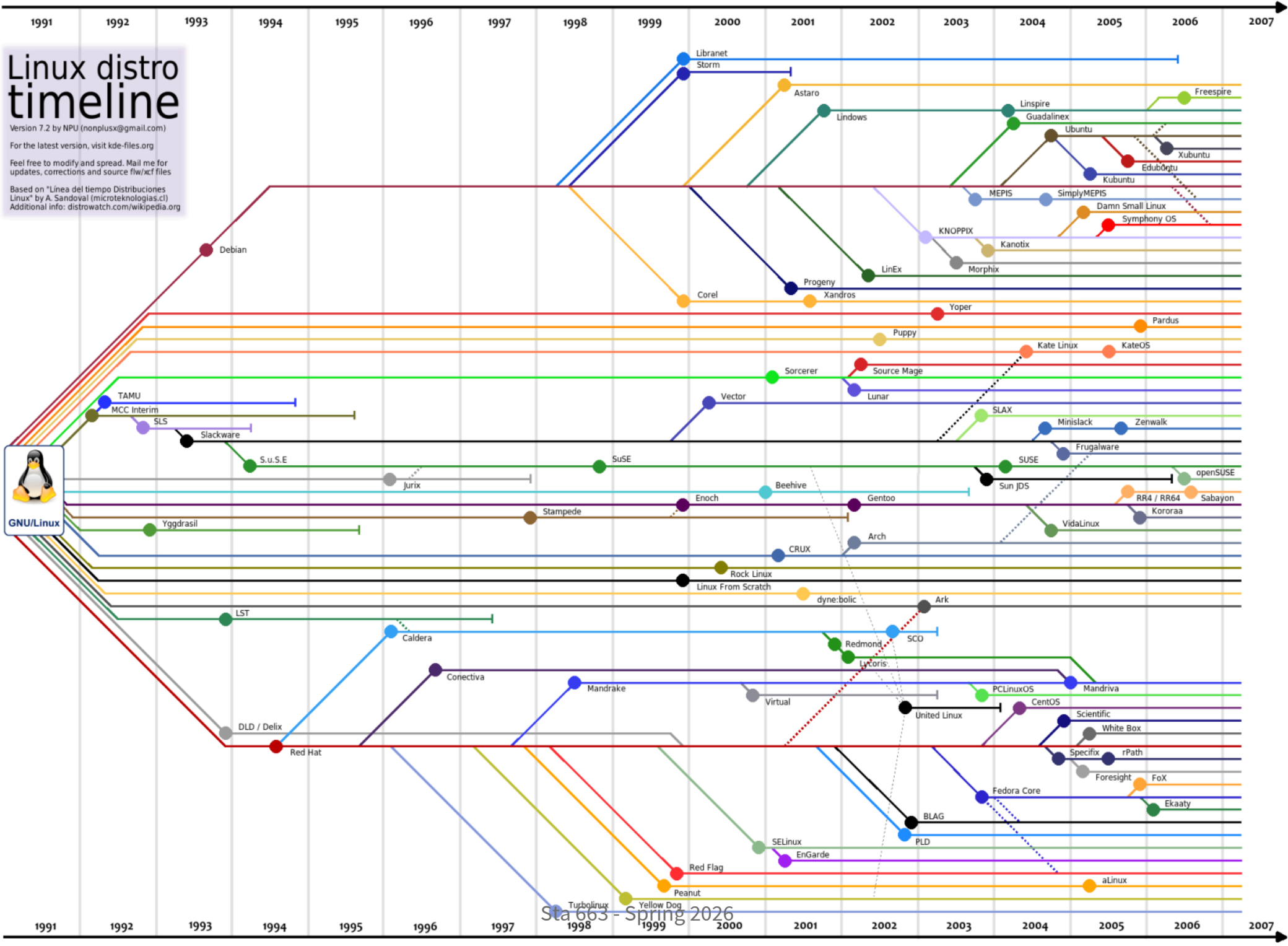
<https://ubuntu.com/engage/secure-kubernetes-at-the-edge>

```
Expanded Security Maintenance for Applications is now enabled.
```

0 updates can be applied immediately.

Linux distro timeline

Version 7.2 by NPU (nonplusx@gmail.com)
 For the latest version, visit kde-files.org
 Feel free to modify and spread. Mail me for updates, corrections and source fw/xcf files
 Based on "Línea del tiempo Distribuciones Linux" by A. Sandoval (microtecnologias.cl)
 Additional info: distrowatch.com/wikipedia.org



Sta 663 - Spring 2026

Determining Distribution

Ubuntu / Debian

Fedora / RHEL

```
> cr173@vcm-52470:~$ cat /etc/os-release
```

```
PRETTY_NAME="Ubuntu 24.04.2 LTS"  
NAME="Ubuntu"  
VERSION_ID="24.04"  
VERSION="24.04.2 LTS (Noble Numbat)"  
VERSION_CODENAME=noble  
ID=ubuntu  
ID_LIKE=debian  
HOME_URL="https://www.ubuntu.com/"  
SUPPORT_URL="https://help.ubuntu.com/"  
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"  
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms-and-policies/privacy-policy"  
UBUNTU_CODENAME=noble  
LOGO=ubuntu-logo
```

System Details

Filesystem Hierarchy Standard

See Wikipedia's [article](#)

Some common folders:

- `/bin/` & `/usr/bin/` - executables
- `/etc/` - configuration files
- `/lib*` & `/usr/lib*` - Static and shared libraries
- `/usr/include/` - header files
- `/home/` - user home directories
- `/var/` - logs
- `/tmp/` - temporary files

Primary Secondary

```
> tree -d -L 1 /
```

```
/
├── bin -> usr/bin
├── bin.usr-is-merged
├── boot
├── cdrom
├── dev
├── etc
├── home
├── lib -> usr/lib
├── lib64 -> usr/lib64
├── lib.usr-is-merged
├── media
├── mnt
├── opt
├── proc
├── root
├── run
├── sbin -> usr/sbin
├── sbin.usr-is-merged
├── snap
├── srv
├── sys
├── tmp
├── usr
└── var
```

Basic Filesystem Navigation

Command	Description
<code>pwd</code>	Print working directory
<code>ls</code>	List directory contents (<code>-l</code> long, <code>-a</code> include hidden)
<code>cd <dir></code>	Change directory
<code>cd ..</code>	Move up one level
<code>cd ~</code>	Go to home directory
<code>mkdir <dir></code>	Create a directory
<code>rm <file></code>	Remove a file (<code>-r</code> for directories, <code>-f</code> force)
<code>cp <src> <dst></code>	Copy file or directory (<code>-r</code> for directories)
<code>mv <src> <dst></code>	Move or rename file/directory
<code>cat <file></code>	Print file contents
<code>less <file></code>	Page through file contents

Useful shortcuts: `.` = current directory, `..` = parent, `~` = home

Installing packages with **apt** (Ubuntu, Debian, etc.)

Update the package list

```
> apt update
```

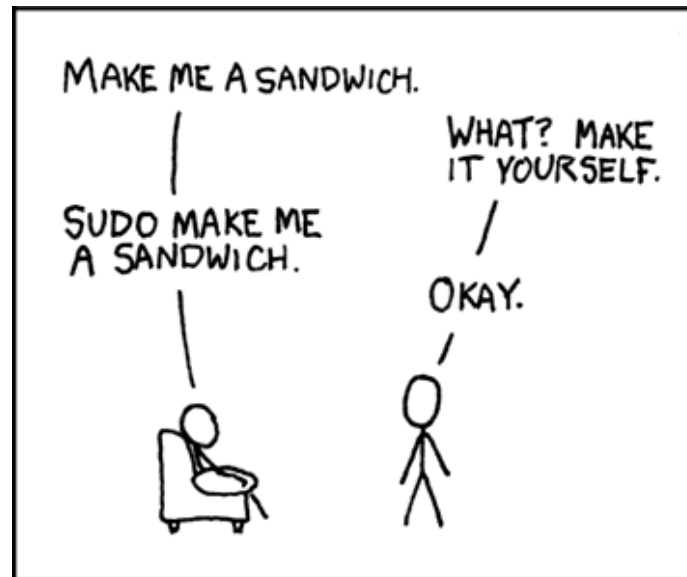
```
Reading package lists... Done
```

```
E: Could not open lock file /var/lib/apt/lists/lock - open (13: Permission denied)
```

```
E: Unable to lock directory /var/lib/apt/lists/
```

```
W: Problem unlinking the file /var/cache/apt/pkgcache.bin - RemoveCaches (13: Permission denied)
```

```
W: Problem unlinking the file /var/cache/apt/srcpkgcache.bin - RemoveCaches (13: Permission denied)
```



XKCD 149 - Sandwich

Update the package list

```
> sudo apt update
```

```
[sudo] password for cr173:  
Hit:1 http://archive.linux.duke.edu/ubuntu focal InRelease  
Get:2 http://archive.linux.duke.edu/ubuntu focal-updates InRelease [114 kB]  
Hit:3 https://falcon-dl.oit.duke.edu/ubuntu focal InRelease  
Get:4 http://archive.linux.duke.edu/ubuntu focal-backports InRelease [108 kB]  
Get:5 http://archive.linux.duke.edu/ubuntu focal-security InRelease [114 kB]  
Get:6 http://archive.linux.duke.edu/ubuntu focal-updates/main amd64 Packages [1,711 kB]  
Get:7 http://archive.linux.duke.edu/ubuntu focal-updates/main i386 Packages [628 kB]  
Get:8 http://archive.linux.duke.edu/ubuntu focal-updates/main Translation-en [320 kB]  
Get:9 http://archive.linux.duke.edu/ubuntu focal-updates/restricted amd64 Packages [917 kB]  
Get:10 http://archive.linux.duke.edu/ubuntu focal-updates/restricted Translation-en [131 kB]  
Get:11 http://archive.linux.duke.edu/ubuntu focal-updates/universe amd64 Packages [916 kB]  
Get:12 http://archive.linux.duke.edu/ubuntu focal-updates/universe i386 Packages [676 kB]  
Get:13 http://archive.linux.duke.edu/ubuntu focal-updates/universe Translation-en [204 kB]  
Get:14 http://archive.linux.duke.edu/ubuntu focal-updates/universe amd64 c-n-f Metadata [20.4 kB]  
Get:15 http://archive.linux.duke.edu/ubuntu focal-security/main i386 Packages [416 kB]  
Get:16 http://archive.linux.duke.edu/ubuntu focal-security/main amd64 Packages [1,383 kB]  
Get:17 http://archive.linux.duke.edu/ubuntu focal-security/main Translation-en [239 kB]  
Get:18 http://archive.linux.duke.edu/ubuntu focal-security/restricted amd64 Packages [859 kB]  
Get:19 http://archive.linux.duke.edu/ubuntu focal-security/restricted Translation-en [122 kB]  
Get:20 http://archive.linux.duke.edu/ubuntu focal-security/universe i386 Packages [547 kB]  
Get:21 http://archive.linux.duke.edu/ubuntu focal-security/universe amd64 Packages [696 kB]  
Get:22 http://archive.linux.duke.edu/ubuntu focal-security/universe Translation-en [122 kB]
```

Installing R

```
> sudo apt install r-base
```

```
[sudo] password for cr173:
```

```
Reading package lists... Done
```

```
Building dependency tree
```

```
Reading state information... Done
```

```
The following additional packages will be installed:
```

```
build-essential bzip2-doc cpp cpp-9 dpkg-dev fakeroot fontconfig fontconfig-config fonts-dejavu-core g++  
libalgorithm-diff-perl libalgorithm-diff-xs-perl libalgorithm-merge-perl libasan5 libatomic1 libauthen-sa  
libdata-dump-perl libdatrie1 libdpkg-perl libdrm-amdgpu1 libdrm-intel1 libdrm-nouveau2 libdrm-radeon1 lib  
libfile-desktopentry-perl libfile-fcntllock-perl libfile-listing-perl libfile-mimeinfo-perl libfont-afm-p  
libgfortran5 libgl1 libgl1-mesa-dri libglapi-mesa libglvnd0 libglx-mesa0 libglx0 libgomp1 libgraphite2-3  
libhtml-parser-perl libhtml-tagset-perl libhtml-tree-perl libhttp-cookies-perl libhttp-daemon-perl libhtt  
libicu-dev libio-html-perl libio-socket-ssl-perl libio-stringy-perl libipc-system-simple-perl libisl22 li  
libjpeg8-dev liblapack-dev liblapack3 libllvm12 liblsan0 liblwp-mediatypes-perl liblwp-protocol-https-per  
libncurses5-dev libnet-dbus-perl libnet-http-perl libnet-smtp-ssl-perl libnet-ssleay-perl libpango-1.0-0  
libpciaccess0 libpcre16-3 libpcre2-16-0 libpcre2-32-0 libpcre2-dev libpcre2-posix2 libpcre3-dev libpcre32  
libreadline-dev libsensors-config libsensors5 libsm6 libstdc++-9-dev libtcl8.6 libthai-data libthai0 libt  
libtsan0 libubsan1 liburi-perl libvulkan1 libwayland-client0 libwebp6 libwww-perl libwww-robotrules-perl  
libxcb-glx0 libxcb-present0 libxcb-randr0 libxcb-render0 libxcb-shape0 libxcb-shm0 libxcb-sync1 libxcb-xf  
libxinerama1 libxkbfile1 libxml-parser-perl libxml-twig-perl libxml-xpathengine-perl libxmu6 libxpm4 libx  
libxxf86dga1 libxxf86vm1 make mesa-vulkan-drivers perl-openssl-defaults pkg-config r-base-core r-base-dev  
r-cran-foreign r-cran-kernsmooth r-cran-lattice r-cran-mass r-cran-matrix r-cran-mgcv r-cran-nlme r-cran-  
r-recommended unzip x11-common x11-utils x11-xserver-utils xdg-utils zip zlib1g-dev
```

```
Suggested packages:
```

```
cpp-doc gcc-9-locales debian-keyring g++-multilib g++-9-multilib gcc-9-doc gcc-multilib autoconf automake  
gfortran-doc gfortran-9-multilib gfortran-9-doc libcoarrays-dev libdigest-hmac-perl libgssapi-perl liblap  
readline-doc lm-sensors libstdc++-9-doc tcl8.6 tk8.6 libauthen-ntlm-perl libunicode-map8-perl libunicode-
```

Removing R

```
> sudo apt remove r-base
```

Reading package lists... Done

Building dependency tree

Reading state information... Done

The following packages were automatically installed and are no longer required:

```
fontconfig fontconfig-config fonts-dejavu-core gfortran gfortran-9 icu-devtools libblas-dev libk
libdrm-nouveau2 libdrm-radeon1 libfile-basedir-perl libfile-desktopentry-perl libfile-mimeinfo-p
libgl1-mesa-dri libglapi-mesa libglvnd0 libglx-mesa0 libglx0 libgraphite2-3 libharfbuzz0b libice
libjpeg-turbo8 libjpeg-turbo8-dev libjpeg8 libjpeg8-dev liblapack-dev liblapack3 libllvm12 libl
libpangocairo-1.0-0 libpangoft2-1.0-0 libpaper-utils libpaper1 libpciaccess0 libpcre16-3 libpcre
libpcrecpp0v5 libpixman-1-0 libpng-dev libpng-tools libreadline-dev libsensors-config libsensors
libvulkan1 libwayland-client0 libwebp6 libx11-protocol-perl libx11-xcb1 libxaw7 libxcb-dri2-0 l
libxcb-shape0 libxcb-shm0 libxcb-sync1 libxcb-xfixes0 libxcomposite1 libxcursor1 libxfixes3 libx
libxml-xpathengine-perl libxmu6 libxpm4 libxrandr2 libxrender1 libxshmfence1 libxss1 libxt6 libx
r-base-dev r-base-html r-cran-boot r-cran-class r-cran-cluster r-cran-codetools r-cran-foreign r
r-cran-nlme r-cran-nnet r-cran-rpart r-cran-spatial r-cran-survival r-doc-html r-recommended un
```

Use 'sudo apt autoremove' to remove them.

The following packages will be REMOVED:

```
r-base
```

0 upgraded, 0 newly installed, 1 to remove and 1 not upgraded.

After this operation, 62.5 kB disk space will be freed.

and all of its dependencies

```
> sudo apt autoremove
```

```
Reading package lists... Done
```

```
Building dependency tree
```

```
Reading state information... Done
```

```
The following packages will be REMOVED:
```

```
fontconfig fontconfig-config fonts-dejavu-core gfortran gfortran-9 icu-devtools libblas-dev libk  
libdrm-nouveau2 libdrm-radeon1 libfile-basedir-perl libfile-desktopentry-perl libfile-mimeinfo-p  
libgl1-mesa-dri libglapi-mesa libglvnd0 libglx-mesa0 libglx0 libgraphite2-3 libharfbuzz0b libice  
libjpeg-turbo8 libjpeg-turbo8-dev libjpeg8 libjpeg8-dev liblapack-dev liblapack3 libllvm12 libl  
libpangocairo-1.0-0 libpangoft2-1.0-0 libpaper-utils libpaper1 libpciaccess0 libpcre16-3 libpcre  
libpcrecpp0v5 libpixmap-1-0 libpng-dev libpng-tools libreadline-dev libsensors-config libsensors  
libvulkan1 libwayland-client0 libwebp6 libx11-protocol-perl libx11-xcb1 libxaw7 libxcb-dri2-0 l  
libxcb-shape0 libxcb-shm0 libxcb-sync1 libxcb-xfixes0 libxcomposite1 libxcursor1 libxfixes3 lib  
libxml-xpathengine-perl libxmu6 libxpm4 libxrandr2 libxrender1 libxshmfence1 libxss1 libxt6 libx  
r-base-dev r-base-html r-cran-boot r-cran-class r-cran-cluster r-cran-codetools r-cran-foreign r  
r-cran-nlme r-cran-nnet r-cran-rpart r-cran-spatial r-cran-survival r-doc-html r-recommended un  
0 upgraded, 0 newly installed, 140 to remove and 1 not upgraded.
```

```
After this operation, 749 MB disk space will be freed.
```

```
Do you want to continue? [Y/n]
```

Updating & Upgrading

```
> sudo apt update
```

```
Hit:1 http://archive.linux.duke.edu/ubuntu focal InRelease
Hit:2 http://archive.linux.duke.edu/ubuntu focal-updates InRelease
Hit:3 http://archive.linux.duke.edu/ubuntu focal-backports InRelease
Hit:4 http://archive.linux.duke.edu/ubuntu focal-security InRelease
Hit:5 https://falcon-dl.oit.duke.edu/ubuntu focal InRelease
Reading package lists... Done
Building dependency tree
Reading state information... Done
1 package can be upgraded. Run 'apt list --upgradable' to see it.
```

```
> sudo apt upgrade
```

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following packages will be upgraded:
  libfribidi0
1 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
1 standard security update
Need to get 24.2 kB of archives.
After this operation, 0 B of additional disk space will be used.
Do you want to continue? [Y/n]
```

Aside - Conflicts

```
> ...
> update-initramfs: deferring update (trigger activated)
> amd64-microcode: microcode will be updated at next boot
> Setting up intel-microcode (3.20180807a.0ubuntu0.18.04.1) ...
> update-initramfs: deferring update (trigger activated)
> intel-microcode: microcode will be updated at next boot
> Setting up kmod (24-1ubuntu3.1) ...
>
> *Configuration file '/etc/modprobe.d/blacklist.conf'
> * ==> Modified (by you or by a script) since installation.
> * ==> Package distributor has shipped an updated version.
> *   What would you like to do about it? Your options are:
> *   Y or I   : install the package maintainer's version
> *   N or O   : keep your currently-installed version
> *   D       : show the differences between the versions
> *   Z       : start a shell to examine the situation
> * The default action is to keep your current version.
> **** blacklist.conf (Y/I/N/O/D/Z) [default=N] ?
> Setting up initramfs-tools-core (0.130ubuntu3.6) ...
> Setting up linux-headers-4.15.0-43-generic (4.15.0-43.46) ...
> Setting up initramfs-tools (0.130ubuntu3.6) ...
>
```

Package Details

```
> apt show r-base
```

```
Package: r-base
Version: 4.3.3-2build2
Priority: optional
Section: universe/math
Origin: Ubuntu
Maintainer: Ubuntu Developers <ubuntu-devel-discuss@lists.ubuntu.com>
Original-Maintainer: Dirk Eddelbuettel <edd@debian.org>
Bugs: https://bugs.launchpad.net/ubuntu/+filebug
Installed-Size: 33.8 kB
Depends: r-base-core (>= 4.3.3-2build2), r-recommended (= 4.3.3-2build2)
Recommends: r-base-html, r-doc-html
Suggests: elpa-ess, r-doc-info | r-doc-pdf
Homepage: http://www.r-project.org/
Download-Size: 9,304 B
APT-Sources: http://archive.linux.duke.edu/ubuntu noble/universe amd64 Packages
Description: GNU R statistical computation and graphics system
 R is a system for statistical computation and graphics. It consists
 of a language plus a run-time environment with graphics, a debugger,
 access to certain system functions, and the ability to run programs
 stored in script files.
...
```

Package Contents

To list the files installed by a package,

```
> dpkg -L r-base
```

```
/.  
/usr  
/usr/share  
/usr/share/doc  
/usr/share/doc/r-base  
/usr/share/doc/r-base/README.Debian  
/usr/share/doc/r-base/copyright  
/usr/share/doc/r-base/changelog.Debian.gz
```

or if you want to find which package created a file,

```
> dpkg -S /usr/bin/R
```

```
r-base-core: /usr/bin/R
```

Package Manager Comparison

	Ubuntu / Debian	RHEL / Fedora	Requires root
Install	<code>apt install</code>	<code>dnf install</code>	Yes
Install Local	<code>dpkg -i pkg.deb</code>	<code>dnf install pkg.rpm</code>	Yes
Remove	<code>apt remove</code>	<code>dnf remove</code>	Yes
Update	<code>apt update</code>	<code>dnf check-update</code>	Yes
Upgrade	<code>apt upgrade</code> <code>apt full-upgrade</code>	<code>dnf upgrade</code>	Yes
Clean Deps.	<code>apt autoremove</code>	<code>dnf autoremove</code>	Yes
Reinstall	<code>apt install --reinstall</code>	<code>dnf reinstall</code>	Yes
Details.	<code>apt show</code>	<code>dnf info</code>	No
Dependencies	<code>apt show</code>	<code>dnf repoquery --requires</code>	No
Pkg -> Files	<code>dpkg -L</code>	<code>rpm -ql</code> or <code>dnf repoquery -l</code>	No
Files -> Pkg	<code>dpkg -S</code>	<code>rpm -qf</code>	No

A bit about libraries

System libraries

These are shared common components that are used by a variety of software on a Linux system. For the most part they are a collection of compiled code (typically C / C++) that are stored in a single file.

- Allows for code reuse
- Allows for multiple (concurrent) versions
- Avoids reinventing and/or duplicating the wheel
- Installed in `/lib`, `/usr/lib`, `/usr/local/lib`, etc.
- Two flavors: static (`.a`) and dynamic / shared (`.so`)

libcurl

```
> ls -la /usr/lib/x86_64-linux-gnu/libcurl*
```

```
-rw-r--r-- 1 root root 1057632 Oct 29 08:10 /usr/lib/x86_64-linux-gnu/libcurl.a
lrwxrwxrwx 1 root root      19 Oct 29 08:10 /usr/lib/x86_64-linux-gnu/libcurl-gnutls.so.3 -> libcurl-gnutls
lrwxrwxrwx 1 root root      23 Oct 29 08:10 /usr/lib/x86_64-linux-gnu/libcurl-gnutls.so.4 -> libcurl-gnutls
-rw-r--r-- 1 root root  510408 Oct 29 08:10 /usr/lib/x86_64-linux-gnu/libcurl-gnutls.so.4.5.0
-rw-r--r-- 1 root root    951 Oct 29 08:10 /usr/lib/x86_64-linux-gnu/libcurl.la
lrwxrwxrwx 1 root root      16 Oct 29 08:10 /usr/lib/x86_64-linux-gnu/libcurl.so -> libcurl.so.4.5.0
lrwxrwxrwx 1 root root      16 Oct 29 08:10 /usr/lib/x86_64-linux-gnu/libcurl.so.4 -> libcurl.so.4.5.0
-rw-r--r-- 1 root root  518600 Oct 29 08:10 /usr/lib/x86_64-linux-gnu/libcurl.so.4.5.0
```

Getting what you want

The following is a basic heuristic of library package naming schemes for the two primary distro families; there are exceptions and edge cases.

These are the names that would then be used with something like `apt install` or `dnf install` respectively.

	Debian	Redhat
Dynamic library (.so)	<code>lib{name}</code>	<code>{name}</code>
Headers	<code>lib{name}-dev</code>	<code>{name}-devel</code>
Static library (.a)	<code>lib{name}-dev</code>	<code>{name}-static</code>
Documentation	<code>lib{name}-doc</code>	<code>{name}-devel</code>

Troubleshooting dynamic libraries

```
> ldd /usr/lib/x86_64-linux-gnu/libcurl.so
```

```
linux-vdso.so.1 (0x00007ffd98176000)
libnghttp2.so.14 => /usr/lib/x86_64-linux-gnu/libnghttp2.so.14 (0x00007f1e3dc60000)
libidn2.so.0 => /usr/lib/x86_64-linux-gnu/libidn2.so.0 (0x00007f1e3da43000)
librtmp.so.1 => /usr/lib/x86_64-linux-gnu/librtmp.so.1 (0x00007f1e3d827000)
libpsl.so.5 => /usr/lib/x86_64-linux-gnu/libpsl.so.5 (0x00007f1e3d619000)
libssl.so.1.1 => /usr/lib/x86_64-linux-gnu/libssl.so.1.1 (0x00007f1e3d3af000)
libcrypto.so.1.1 => /usr/lib/x86_64-linux-gnu/libcrypto.so.1.1 (0x00007f1e3cf37000)
libgssapi_krb5.so.2 => /usr/lib/x86_64-linux-gnu/libgssapi_krb5.so.2 (0x00007f1e3ccec000)
libldap_r-2.4.so.2 => /usr/lib/x86_64-linux-gnu/libldap_r-2.4.so.2 (0x00007f1e3ca9a000)
liblber-2.4.so.2 => /usr/lib/x86_64-linux-gnu/liblber-2.4.so.2 (0x00007f1e3c88c000)
libz.so.1 => /lib/x86_64-linux-gnu/libz.so.1 (0x00007f1e3c66f000)
libpthread.so.0 => /lib/x86_64-linux-gnu/libpthread.so.0 (0x00007f1e3c450000)
libc.so.6 => /lib/x86_64-linux-gnu/libc.so.6 (0x00007f1e3c05f000)
libunistring.so.2 => /usr/lib/x86_64-linux-gnu/libunistring.so.2 (0x00007f1e3bce1000)
libgnutls.so.30 => /usr/lib/x86_64-linux-gnu/libgnutls.so.30 (0x00007f1e3b97c000)
libhogweed.so.4 => /usr/lib/x86_64-linux-gnu/libhogweed.so.4 (0x00007f1e3b748000)
libnettle.so.6 => /usr/lib/x86_64-linux-gnu/libnettle.so.6 (0x00007f1e3b512000)
libgmp.so.10 => /usr/lib/x86_64-linux-gnu/libgmp.so.10 (0x00007f1e3b291000)
libdl.so.2 => /lib/x86_64-linux-gnu/libdl.so.2 (0x00007f1e3b08d000)
libkrb5.so.3 => /usr/lib/x86_64-linux-gnu/libkrb5.so.3 (0x00007f1e3adb7000)
libk5crypto.so.3 => /usr/lib/x86_64-linux-gnu/libk5crypto.so.3 (0x00007f1e3ab85000)
libcom_err.so.2 => /lib/x86_64-linux-gnu/libcom_err.so.2 (0x00007f1e3a981000)
libkrb5support.so.0 => /usr/lib/x86_64-linux-gnu/libkrb5support.so.0 (0x00007f1e3a776000)
libresolv.so.2 => /lib/x86_64-linux-gnu/libresolv.so.2 (0x00007f1e3a55b000)
libsasl2.so.2 => /usr/lib/x86_64-linux-gnu/libsasl2.so.2 (0x00007f1e3a340000)
```

Python management

```
> pip install torch
```

Command 'pip' not found, but can be installed with:

```
apt install python3-pip  
Please ask your administrator.
```

```
> sudo apt install python3-pip
```

```
[sudo] password for cr173:
```

```
Reading package lists... Done
```

```
Building dependency tree... Done
```

```
Reading state information... Done
```

```
The following additional packages will be installed:
```

```
build-essential bzip2 cpp cpp-13 cpp-13-x86-64-linux-gnu cpp-x86-64-linux-gnu dpkg-dev fakeroot  
gcc-13-x86-64-linux-gnu gcc-x86-64-linux-gnu javascript-common libalgorithm-diff-perl libalgorit  
libexpat1-dev libfakeroot libfile-fcntllock-perl libgcc-13-dev libgomp1 libhwasan0 libisl23 lib:  
libpython3.12-dev libquadmath0 libstdc++-13-dev libtsan2 libubsan1 lto-disabled-list make pythor
```

```
Suggested packages:
```

```
bzip2-doc cpp-doc gcc-13-locales cpp-13-doc debian-keyring g++-multilib g++-13-multilib gcc-13-c  
gdb-x86-64-linux-gnu apache2 | lighttpd | httpd bzip2 libstdc++-13-doc make-doc
```

```
The following NEW packages will be installed:
```

```
build-essential bzip2 cpp cpp-13 cpp-13-x86-64-linux-gnu cpp-x86-64-linux-gnu dpkg-dev fakeroot  
gcc-13-x86-64-linux-gnu gcc-x86-64-linux-gnu javascript-common libalgorithm-diff-perl libalgorit  
libexpat1-dev libfakeroot libfile-fcntllock-perl libgcc-13-dev libgomp1 libhwasan0 libisl23 lib:  
libpython3.12-dev libquadmath0 libstdc++-13-dev libtsan2 libubsan1 lto-disabled-list make pythor
```

```
0 upgraded, 51 newly installed, 0 to remove and 0 not upgraded.
```

```
Need to get 72.6 MB of archives.
```

Package manager vs pip

```
> sudo apt install python3-numpy
```

```
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libblas3 libgfortran5 liblapack3
Suggested packages:
  gfortran python3-pytest
The following NEW packages will be installed:
  libblas3 libgfortran5 liblapack3 python3-numpy
0 upgraded, 4 newly installed, 0 to remove and 0 not upgraded.
Need to get 8,238 kB of archives.
After this operation, 35.2 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

```
> python3
```

```
Python 3.12.3 (main, Jan 22 2026, 20:57:42) [GCC 13.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> import numpy as np
>>> np.__version__
'1.26.4'
```

pip install & PEP 668

pip uv

```
> sudo pip install numpy --upgrade
```

```
sudo pip install numpy --upgrade  
error: externally-managed-environment
```

× This environment is externally managed

↳ To install Python packages system-wide, try apt install python3-xyz, where xyz is the package you are trying to install.

If you wish to install a non-Debian-packaged Python package, create a virtual environment using `python3 -m venv path/to/venv`. Then use `path/to/venv/bin/python` and `path/to/venv/bin/pip`. Make sure you have `python3-full` installed.

If you wish to install a non-Debian packaged Python application, it may be easiest to use `pipx install xyz`, which will manage a virtual environment for you. Make sure you have `pipx` installed.

See `/usr/share/doc/python3.12/README.venv` for more information.

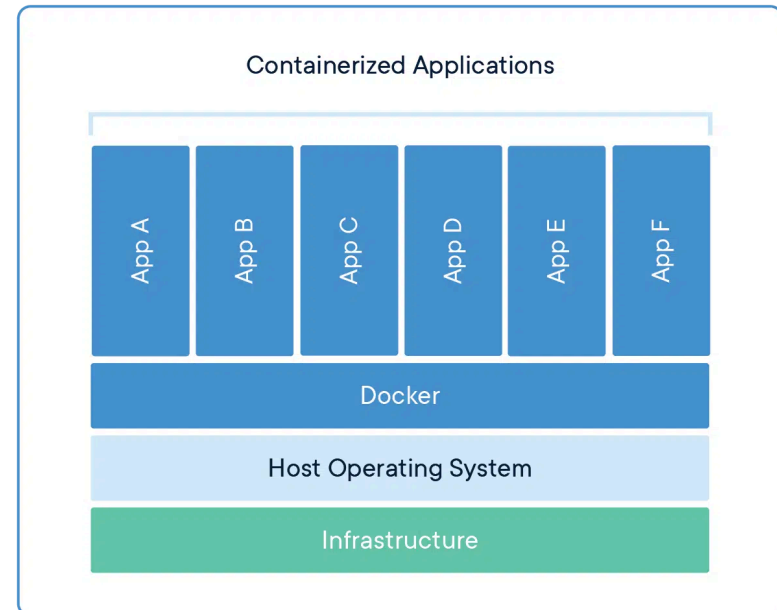
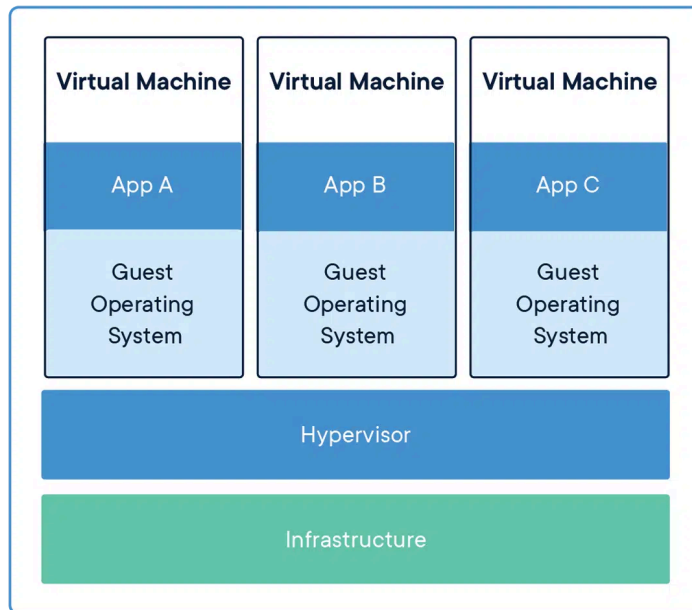
note: If you believe this is a mistake, please contact your Python installation or OS distributor
hint: See PEP 668 for the detailed specification.

Docker

Docker

Docker can package an application and its dependencies in a virtual container that can run on any Linux, Windows, or macOS computer. This enables the application to run in a variety of locations, such as on-premises, in the public or private cloud. When running on Linux, Docker uses the resource isolation features of the Linux kernel (such as cgroups and kernel namespaces) and a union-capable file system to allow containers to run within a single Linux instance, avoiding the overhead of starting and maintaining virtual machines.

From Wikipedia



Installation - Ubuntu / Debian

See official Docker install [docs](#) - below is the yolo method.

```
> curl -fsSL https://get.docker.com -o get-docker.sh
> sudo sh get-docker.sh
```

```
# Executing docker install script, commit: f381ee68b32e515bb4dc034b339266aff1fbc460
+ sh -c apt-get -qq update >/dev/null
+ sh -c DEBIAN_FRONTEND=noninteractive apt-get -y -qq install ca-certificates curl >/dev/null
+ sh -c install -m 0755 -d /etc/apt/keyrings
+ sh -c curl -fsSL "https://download.docker.com/linux/ubuntu/gpg" -o /etc/apt/keyrings/docker.asc
+ sh -c chmod a+r /etc/apt/keyrings/docker.asc
+ sh -c echo "deb [arch=amd64 signed-by=/etc/apt/keyrings/docker.asc] https://download.docker.com/linux/ubuntu
+ sh -c apt-get -qq update >/dev/null
+ sh -c DEBIAN_FRONTEND=noninteractive apt-get -y -qq install docker-ce docker-ce-cli containerd.io docker-
Scanning processes...
Scanning linux images...
Using systemd to manage Docker service
+ sh -c systemctl enable --now docker.service
```

...

INFO: Docker daemon enabled and started

```
+ sh -c docker version
Client: Docker Engine - Community
Version:      29.2.1
API version:  1.53
Go version:   go1.25.6
Git commit:   a5c7197
Built:        Mon Feb  2 17:17:26 2026   Sta 663 - Spring 2026
```

Troubleshooting - daemon

```
> sudo docker run hello-world
```

docker: Cannot connect to the Docker daemon at unix:///var/run/docker.sock. Is the docker daemon running?
See 'docker run --help'.

This occurs when the docker daemon (service) is not running. This can be fixed by enabling and starting the docker service / daemon:

```
> sudo systemctl enable docker
```

Synchronizing state of docker.service with SysV service script with /usr/lib/systemd/systemd-sysv-install
Executing: /usr/lib/systemd/systemd-sysv-install enable docker

```
> sudo systemctl start docker
```

Success

```
> sudo docker run hello-world
```

```
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
1b930d010525: Pull complete
Digest: sha256:2557e3c07ed1e38f26e389462d03ed943586f744621577a99efb77324b0fe535
Status: Downloaded newer image for hello-world:latest
```

Hello from Docker!

This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:

1. The Docker client contacted the Docker daemon.
2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
(amd64)
3. The Docker daemon created a new container from that image which runs the executable that produces the output you are currently reading.
4. The Docker daemon streamed that output to the Docker client, which sent it to your terminal.

To try something more ambitious, you can run an Ubuntu container with:

```
$ docker run -it ubuntu bash
```

Share images, automate workflows, and more with a free Docker ID:

```
https://hub.docker.com/
```

Troubleshooting - permissions

```
> docker run hello-world
```

permission denied while trying to connect to the docker API at unix:///var/run/docker.sock

You must either be root or be a member of the `docker` group to use most Docker commands. Currently, your VM may or may not have a docker group and your account is likely not a member. If you get tired of typing `sudo` + your password there is an easy fix,

```
> sudo groupadd docker
> sudo usermod -aG docker $USER
> groups
```

cr173 docker

If `docker` is not listed by `groups` - log out and log back in

Success

```
> docker run hello-world
```

Hello from Docker!

This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:

1. The Docker client contacted the Docker daemon.
2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
(amd64)
3. The Docker daemon created a new container from that image which runs the executable that produces the output you are currently reading.
4. The Docker daemon streamed that output to the Docker client, which sent it to your terminal.

To try something more ambitious, you can run an Ubuntu container with:

```
$ docker run -it ubuntu bash
```

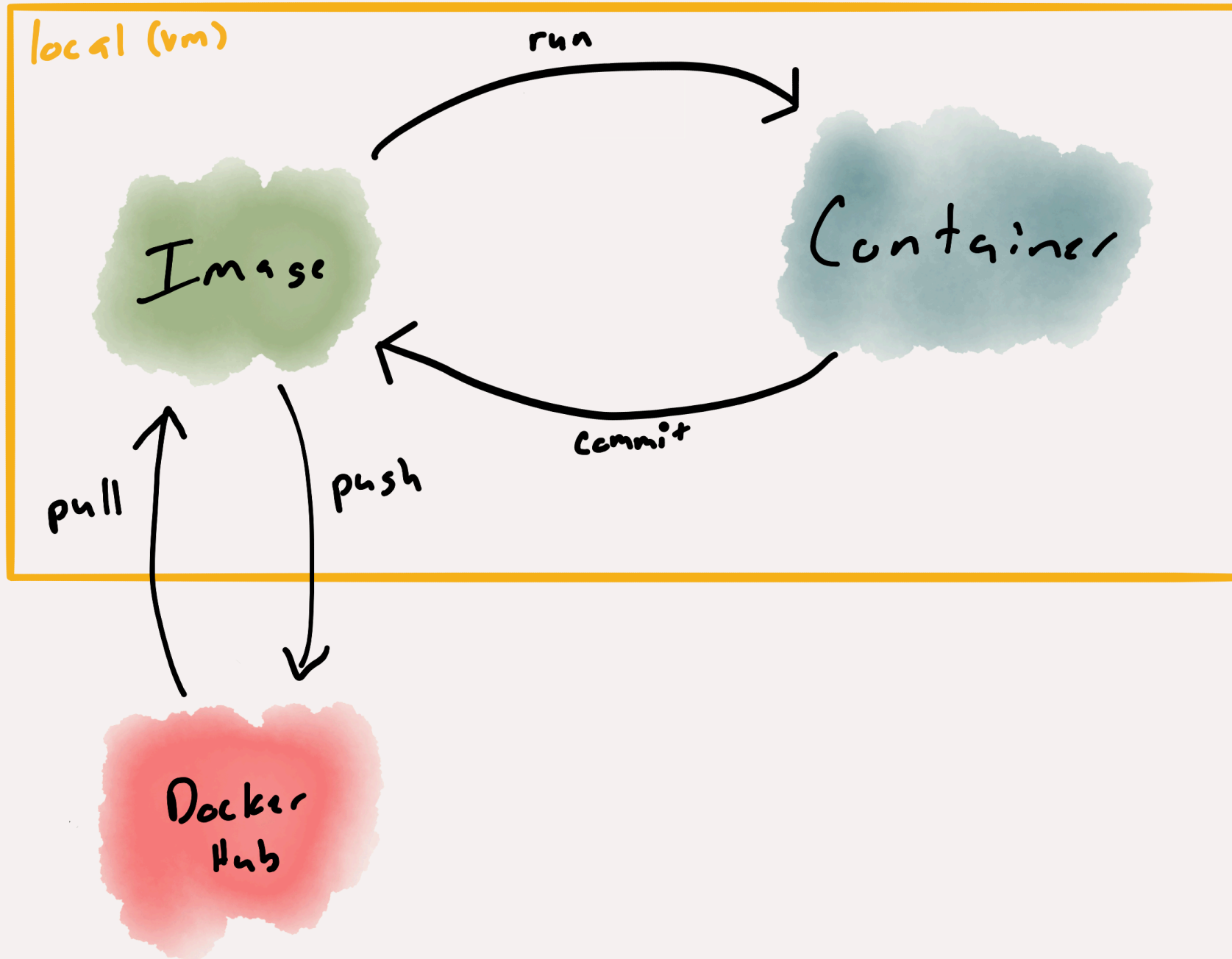
Share images, automate workflows, and more with a free Docker ID:

<https://hub.docker.com/>

For more examples and ideas, visit:

<https://docs.docker.com/get-started/>

Getting Started



Getting images

```
> docker pull ubuntu
```

```
Using default tag: latest
latest: Pulling from library/ubuntu
5a7813e071bf: Pull complete
Digest: sha256:72297848456d5d37d1262630108ab308d3e9ec7ed1c3286a32fe09856619a782
Status: Downloaded newer image for ubuntu:latest
docker.io/library/ubuntu:latest
```

```
> docker images
```


IMAGE	ID	DISK USAGE	CONTENT SIZE	EXTRA
hello-world:latest	ef54e839ef54	21.8kB	9.52kB	
ubuntu:latest	d1e2e92c075e	117MB	31.7MB	

ubuntu - Official Image | Docker x +

hub.docker.com/_/ubuntu

dockerhub Search Docker Hub

Explore / Official Images / ubuntu



ubuntu Docker Official Image · ↓ 1B+ · ☆ 10K+

Ubuntu is a Debian-based Linux operating system based on free software.

OPERATING SYSTEMS

```
docker pull ubuntu
```

Copy

Overview Tags

Quick reference

- Maintained by: [Canonical](#)
- Where to get help: [the Docker Community Slack](#), [Server Fault](#), [Unix & Linux](#), or [Stack Overflow](#)

Supported tags and respective Dockerfile links

- `20.04` `focal-20241011` `focal`
- `22.04` `jammy-20250126` `jammy`
- `24.04` `noble-20250127` `noble` `latest`
- `24.10` `oracular-20241120` `oracular` `rolling`

Recent tags

noble-20250127 noble latest jammy-20250126
jammy 24.04 22.04 plucky-20241213 plucky devel

About Official Images

Docker Official Images are a curated set of Docker open source and drop-in solution repositories.

Why Official Images?

These images have clear documentation, promote best practices, and are designed for the most common use cases.

Tags (versions)

```
> docker pull ubuntu:25.10
```

```
25.10: Pulling from library/ubuntu  
16c195d4c5e9: Pull complete  
458996317100: Download complete  
Digest: sha256:4a9232cc47bf99defcc8860ef6222c99773330367fcec21ba2edb0b810a31e  
Status: Downloaded newer image for ubuntu:25.10  
docker.io/library/ubuntu:25.10
```

```
> docker pull ubuntu:24.04
```

```
24.04: Pulling from library/ubuntu  
Digest: sha256:72297848456d5d37d1262630108ab308d3e9ec7ed1c3286a32fe09856619a782  
Status: Downloaded newer image for ubuntu:24.04  
docker.io/library/ubuntu:24.04
```

```
> docker images
```

IMAGE	ID	DISK USAGE	CONTENT SIZE	EXTRA
hello-world:latest	ef54e839ef54	21.8kB	9.52kB	
ubuntu:24.04	d1e2e92c075e	117MB	31.7MB	
ubuntu:25.10	4a9232cc47bf	134MB	36.6MB	
ubuntu:latest	d1e2e92c075e	117MB	31.7MB	

Other sources

DockerHub is not the only source of images - there are many other possible hosts and all you need to provide is a URL along with the image name.

```
> docker pull ghcr.io/dukestatsci/r_gh_actions:latest
```

```
latest: Pulling from dukestatsci/r_gh_actions
4f4fb700ef54: Pull complete
20043066d3d5: Pull complete
a7f34fb66e20: Pull complete
4eca9b252235: Pull complete
def0e092fa23: Pull complete
685ec124a2b4: Pull complete
19147305769e: Pull complete
600a4a837ad4: Pull complete
644298603b9d: Pull complete
d43d99a2c25f: Pull complete
2adec7c973e0: Pull complete
c0de31d8db54: Pull complete
b66843124b28: Pull complete
147156882b74: Pull complete
83797ba50aaf: Pull complete
7a7094a09d9b: Download complete
Digest: sha256:0c15f386b4e0a0fe8ac18e4a513db49294a0f05558f92741beb4604f22109298
Status: Downloaded newer image for ghcr.io/dukestatsci/r_gh_actions:latest
ghcr.io/dukestatsci/r_gh_actions:latest
```

```
> docker images
```

IMAGE	ID	DISK USAGE	CONTENT SIZE	EXTRA
ghcr.io/dukestatsci/r_gh_actions:latest	0c15f386b4e0	3.5GB	888MB	
hello-world:latest	ef54e839ef54	21.8kB	9.52kB	
ubuntu:24.04	d1e2e92c075e	117MB	31.7MB	
ubuntu:25.10	4a9232cc47bf	134MB	36.6MB	
ubuntu:latest	d1e2e92c075e	117MB	31.7MB	

Running a container

```
> docker run --rm ubuntu cat /etc/os-release
```

```
PRETTY_NAME="Ubuntu 24.04.1 LTS"  
NAME="Ubuntu"  
VERSION_ID="24.04"  
VERSION="24.04.1 LTS (Noble Numbat)"  
VERSION_CODENAME=noble  
ID=ubuntu  
ID_LIKE=debian  
HOME_URL="https://www.ubuntu.com/"  
SUPPORT_URL="https://help.ubuntu.com/"  
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"  
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms  
UBUNTU_CODENAME=noble  
LOGO=ubuntu-logo
```

```
> docker run --rm ubuntu:25.10 cat /etc/os-release
```

```
PRETTY_NAME="Ubuntu 25.10"  
NAME="Ubuntu"  
VERSION_ID="25.10"  
VERSION="25.10 (Questing Quokka)"  
VERSION_CODENAME=questing  
ID=ubuntu  
ID_LIKE=debian  
HOME_URL="https://www.ubuntu.com/"  
SUPPORT_URL="https://help.ubuntu.com/"  
BUG_REPORT_URL="https://bugs.launchpad.net/ubuntu/"  
PRIVACY_POLICY_URL="https://www.ubuntu.com/legal/terms  
UBUNTU_CODENAME=questing  
LOGO=ubuntu-logo
```

```
> docker run --rm fedora:latest cat /etc/os-release
```

```
Unable to find image 'fedora:latest' locally
latest: Pulling from library/fedora
0c5a86865c5d: Pull complete
Digest: sha256:3ec60eb34fa1a095c0c34dd37cead9fd38afb62612d43892fcf1d3425c32bc1e
Status: Downloaded newer image for fedora:latest
NAME="Fedora Linux"
VERSION="41 (Container Image)"
RELEASE_TYPE=stable
ID=fedora
VERSION_ID=41
VERSION_CODENAME=""
PLATFORM_ID="platform:f41"
PRETTY_NAME="Fedora Linux 41 (Container Image)"
ANSI_COLOR="0;38;2;60;110;180"
LOGO=fedora-logo-icon
CPE_NAME="cpe:/o:fedoraproject:fedora:41"
DEFAULT_HOSTNAME="fedora"
HOME_URL="https://fedoraproject.org/"
DOCUMENTATION_URL="https://docs.fedoraproject.org/en-US/fedora/f41/system-administrators-guide/"
SUPPORT_URL="https://ask.fedoraproject.org/"
BUG_REPORT_URL="https://bugzilla.redhat.com/"
REDHAT_BUGZILLA_PRODUCT="Fedora"
REDHAT_BUGZILLA_PRODUCT_VERSION=41
REDHAT_SUPPORT_PRODUCT="Fedora"
REDHAT_SUPPORT_PRODUCT_VERSION=41
```

docker run common options

```
docker run [OPTIONS] IMAGE[:TAG|@DIGEST] [COMMAND] [ARG...]
```

Option	Description
<code>--name</code>	Give your container a name
<code>--rm</code>	Automatically remove the container when it exits
<code>-i -t</code>	Allow for interaction with container (STDIN & tty specifically)
<code>-p host:cont</code>	Publish a container's port
<code>-v host:cont</code>	Share filesystems
<code>-e "VAR=VAL"</code>	Define environmental variables

Other useful commands

command	Description
<code>docker pull NAME[:TAG]</code>	Pull docker image (usually from DockerHub)
<code>docker images</code>	List docker images
<code>docker rmi IMAGE</code>	Remove an image
<code>docker container ls [--all]</code>	List (all) docker containers
<code>docker rm CONTAINER</code>	Remove a container
<code>docker stop CONTAINER</code>	Stop a running container
<code>docker start CONTAINER</code>	Start a stopped container
<code>docker attach CONTAINER</code>	Attach to a running container
<code>docker exec CONTAINER CMD</code>	Runs a new command in a running container
<code>docker commit CONTAINER REPO[:TAG]</code>	Create an image from a container
<code>docker rename CONTAINER NAME</code>	Rename a container

rocker



The rocker project provides a collection of containers suited for different needs. find a base image to extend or images with popular software and optimized libraries pre-installed. Get the latest version or a reproducibly fixed environment.

2.1 The versioned stack

image	base image	description
rocker/r-ver	ubuntu	Install R from source and set RSPM as default CRAN mirror
rocker/rstudio	rocker/r-ver	Adds RStudio Server
rocker/tidyverse	rocker/rstudio	Adds tidyverse packages & devtools
rocker/verse	rocker/tidyverse	Adds tex & publishing-related package
rocker/geospatial	rocker/verse	Adds geospatial packages
rocker/binder	rocker/geospatial	Adds requirements to run repositories on mybinder.org
rocker/shiny	rocker/r-ver	Adds shiny server
rocker/shiny-verse	rocker/shiny	Adds tidyverse packages
rocker/cuda	rocker/r-ver	Adds CUDA support to rocker/r-ver
rocker/ml	rocker/cuda	Adds CUDA support to rocker/tidyverse
rocker/ml-verse	rocker/ml	Adds CUDA support to rocker/geospatial

2.2 The base stack

image	base image	description
r-base rocker/r-base	debian:testing	Install current R from unstable repos
rocker/r-devel	r-base	R-devel added side-by-side onto r-base (using alias <code>RD</code>)
rocker/drd	r-base	Lighter rocker/r-devel
rocker/drp	r-base	R-patched added side-by-side onto r-base (using alias <code>RP</code>)
rocker/r-devel-san	r-base	as rocker/r-devel , but built with compiler sanitizers
rocker/r-devel-ubsan-clang	r-base	Sanitizers, clang c compiler (instead of gcc)

Recker
Versioned

geospatial

verse

+ sf, etc.

tidyverse

+ latex

rstudio

+ dplyr, tidyr, etc

r-ver

+ server




tass
3.5.2
3.5.1
3.5
3
...

python - Official Image | Docker x +

hub.docker.com/_/python

dockerhub Search Docker Hub

Explore / Official Images / python



python Docker Official Image · ↓ 1B+ · ☆ 10K+

Python is an interpreted, interactive, object-oriented, open-source programming language.

LANGUAGES & FRAMEWORKS

```
docker pull python
```

Copy

Overview Tags

Quick reference

- **Maintained by:**
[the Docker Community](#) ☆
- **Where to get help:**
[the Docker Community Slack](#) ↗, [Server Fault](#) ↗, [Unix & Linux](#) ↗, or [Stack Overflow](#) ↗

Recent tags

3.9.21-bookworm 3.9.21 3.9-bookworm 3.9

3.14.0a6-bullseye 3.14.0a6-bookworm 3.14.0a6

3.14-rc-bullseye 3.14-rc-bookworm 3.14-rc

Docker + Python

```
> docker pull python:latest
```

```
latest: Pulling from library/python
7cd785773db4: Pull complete
091eb8249475: Pull complete
255774e0027b: Pull complete
353e14e5cc47: Pull complete
70847531e23d: Pull complete
af0b544b1a82: Pull complete
379f06e37dbb: Pull complete
Digest: sha256:8c55c44b9e81d537f8404d0000b7331863d134db87c1385dd0ec7fefff656495
Status: Downloaded newer image for python:latest
docker.io/library/python:latest
```

```
> docker run --rm python:latest python -V
```

Python 3.14.3

```
> docker run --rm python:latest pip install numpy
```

Collecting numpy

```
  Downloading numpy-2.2.4-cp313-cp313-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (62
  Downloading numpy-2.2.4-cp313-cp313-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (16.1 MB)
  ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 16.1/16.1 MB 77.0 MB/s eta 0:00:00
```

Installing collected packages: numpy

Successfully installed numpy-2.2.4

WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour

```
> docker run --rm python:latest cat /etc/os-release
```

```
PRETTY_NAME="Debian GNU/Linux 13 (trixie)"  
NAME="Debian GNU/Linux"  
VERSION_ID="13"  
VERSION="13 (trixie)"  
VERSION_CODENAME=trixie  
DEBIAN_VERSION_FULL=13.3  
ID=debian  
HOME_URL="https://www.debian.org/"  
SUPPORT_URL="https://www.debian.org/support"  
BUG_REPORT_URL="https://bugs.debian.org/"
```

Interactive usage

For interactive use we use the `-it` (or `-i -t`) flags,

```
> docker run -it --rm python:latest
```

```
Python 3.14.3 (main, Mar 18 2025, 03:30:45) [GCC 12.2.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

```
> docker run -it --rm python:latest bash
```

```
root@0200ab573e93:/#
```

```
> docker ps
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
--------------	-------	---------	---------	--------	-------	-------

```
> docker ps --all
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS
fa52839a6bb0	python:latest	"bash"	4 seconds ago	Exited (0) 2 seconds ago	
41de571bce2d	python:latest	"python3"	12 seconds ago	Exited (0) 10 seconds ago	

Building a container interactively

```
> docker run -it --name python-uv python:latest bash
```

```
root@b08cd30d4148:/# pip install uv
```

```
Collecting uv
```

```
  Downloading uv-0.10.6-py3-none-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (11 kB)
```

```
Downloading uv-0.10.6-py3-none-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (23.2 MB)
```

```
----- 23.2/23.2 MB 159.3 MB/s 0:00:00
```

```
Installing collected packages: uv
```

```
Successfully installed uv-0.10.6
```

```
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour
```

```
[notice] A new release of pip is available: 25.3 -> 26.0.1
```

```
[notice] To update, run: pip install --upgrade pip
```

```
root@b08cd30d4148:/# uv self version
```

```
uv 0.10.6
```

Container -> Image

```
> docker ps --all
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS
b08cd30d4148	python:latest	"bash"	About a minute ago	Exited (0) 4 seconds ago	

```
> docker commit python-uv python-uv:latest
```

```
sha256:7cc45fe8b0b7796015f3d796d2740403a52d75d9e157da7a2f792c72b0335980
```

```
> docker images
```

IMAGE	ID	DISK USAGE	CONTENT SIZE	EXTRA
fedora:latest	781b7642e8bf	261MB	70.7MB	
ghcr.io/dukestatsci/r_gh_actions:latest	0c15f386b4e0	3.5GB	888MB	
hello-world:latest	ef54e839ef54	21.8kB	9.52kB	
python-uv:latest	7cc45fe8b0b7	1.74GB	465MB	
python:latest	61346539f7b2	1.61GB	432MB	U
ubuntu:24.04	d1e2e92c075e	117MB	31.7MB	
ubuntu:25.10	4a9232cc47bf	134MB	36.6MB	
ubuntu:latest	d1e2e92c075e	117MB	31.7MB	

Using the image

```
> docker run --rm -it python-uv:latest
```

```
root@7ea404da10d1:/# mkdir proj
root@7ea404da10d1:/# cd proj/
root@7ea404da10d1:/proj# uv init --bare
Initialized project `proj`
root@7ea404da10d1:/proj# uv add numpy scipy matplotlib
Using CPython 3.14.3 interpreter at: /usr/local/bin/python3
Creating virtual environment at: .venv
Resolved 13 packages in 336ms
Prepared 12 packages in 1.56s
Installed 12 packages in 1.44s
+ contourpy==1.3.3
+ cycler==0.12.1
+ fonttools==4.61.1
+ kiwisolver==1.4.9
+ matplotlib==3.10.8
+ numpy==2.4.2
+ packaging==26.0
+ pillow==12.1.1
+ pyparsing==3.3.2
+ python-dateutil==2.9.0.post0
+ scipy==1.17.1
+ six==1.17.0
root@7ea404da10d1:/proj# uv run python
```