



useR! (Salzburg)
11 July 2024

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Desert Island Docker

R Edition



Which
three
Docker
images?

1. Nonsense!

2. Utter nonsense!!

1. R

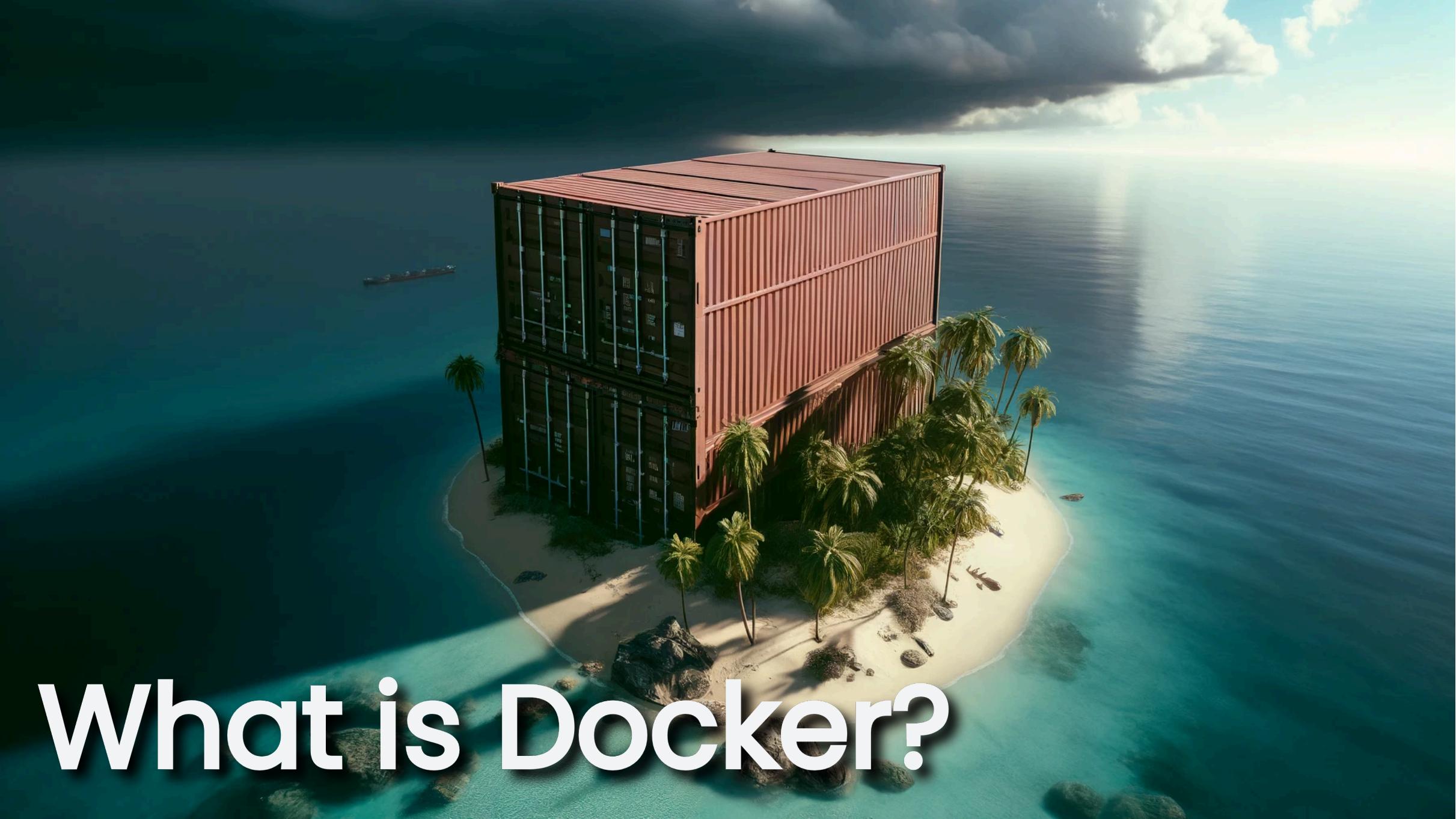
2. Shiny

3. Jupyter



WARNING!

No advanced content.



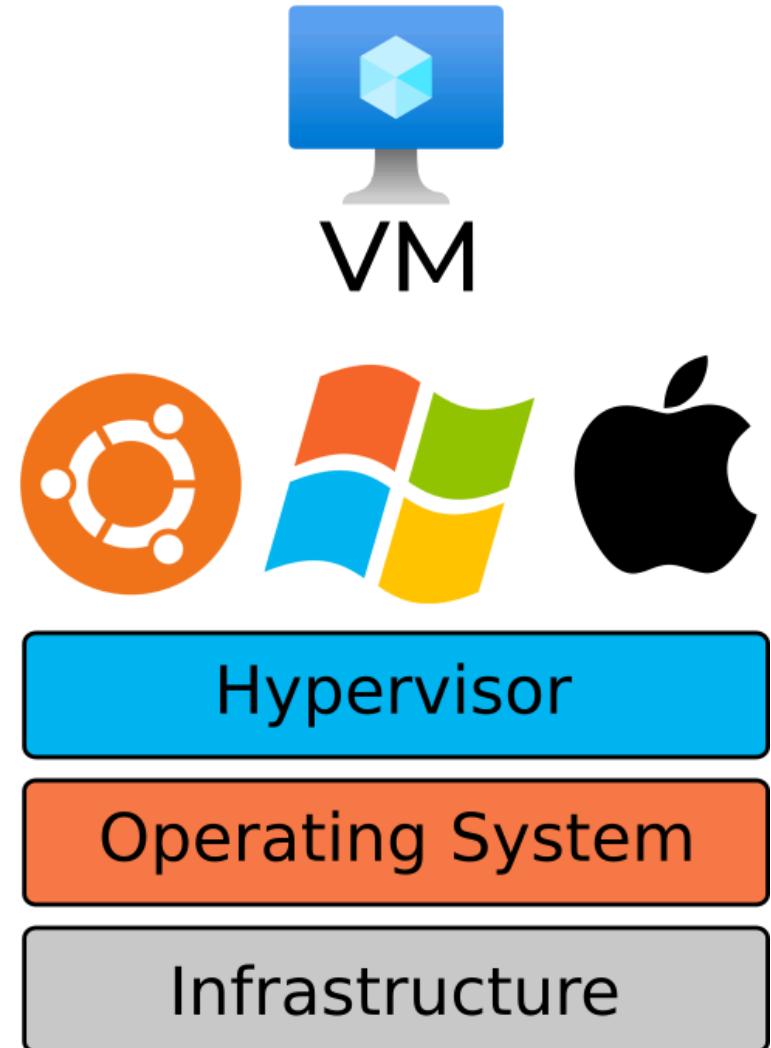
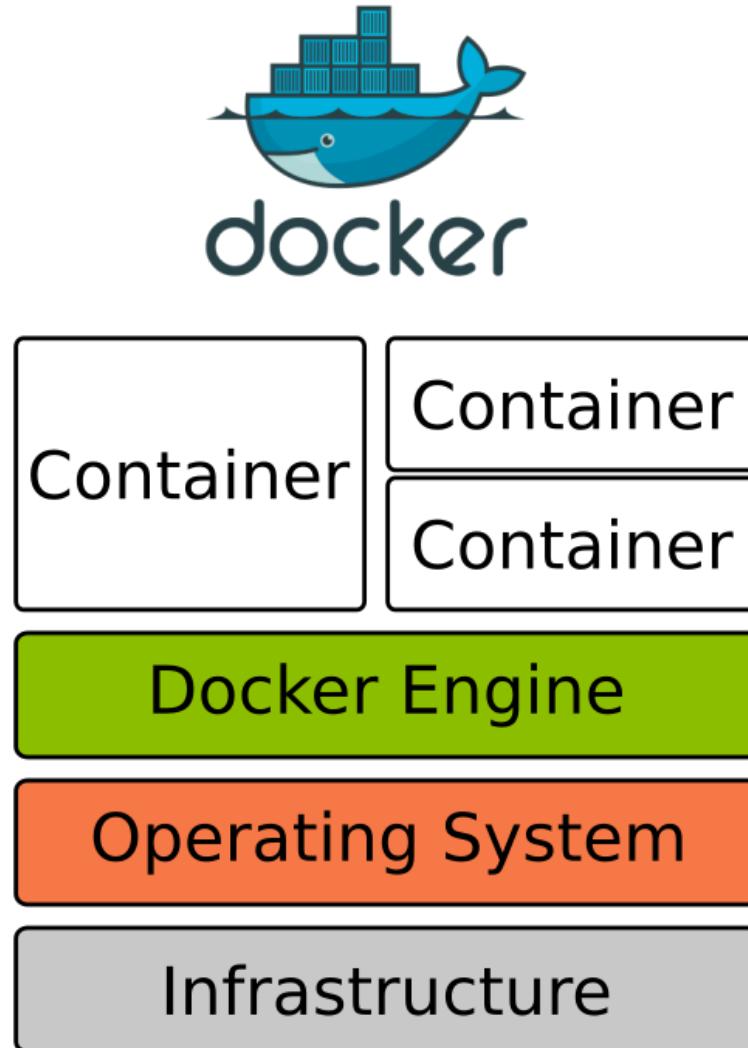
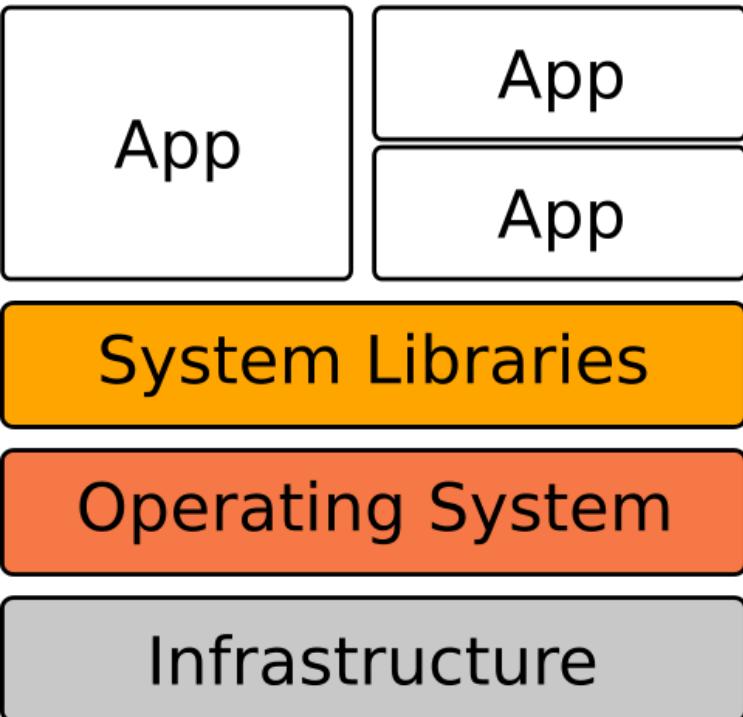
What is Docker?

It's *like* a Virtual Machine.

* For example, you can use it to run Linux processes on a Windows machine.

But also totally different.

* Nonsense! You're explaining one technology by referring to another (equally obscure) technology.



1

A large shipping container, specifically a red one, sits atop a small, sandy island. The island is densely populated with palm trees and some low-lying greenery. The container appears to be resting on a thin layer of sand or perhaps a small artificial foundation. The surrounding water is a vibrant turquoise color, and the sky above is filled with dramatic, dark clouds, suggesting an approaching storm. In the distance, another smaller vessel is visible on the horizon.

Food & Water: R

image

Can have a selection of images.



Image can create multiple containers.

container

A container comes from an image.

Where does an **image** come from?



rocker/tidyverse

Sponsored OSS

☆189

Pulls 10M+

By [rocker](#) • Updated 1 day ago

Version-stable build of R, rstudio, and R packages

IMAGE

<https://hub.docker.com/r/rocker/tidyverse>

More than 10 million downloads. 😎 Around 200 000 downloads per week.

The rocker organisation publishes a number of images including:

- rocker/r-ver – Specific R version ●
- rocker/rstudio – Adds RStudio ★
- rocker/tidyverse – Adds {tidyverse} and {devtools}
- rocker/verse – Adds TeX and publishing packages ★
- rocker/geospatial – Adds geospatial packages
- rocker/shiny – Adds Shiny server ●
- rocker/shiny-verse
- rocker/binder – Adds requirements to run on <https://mybinder.org/>
- rocker/cuda – Adds CUDA support
- rocker/
- rocker/

* ● – included in this talk; ★ – very handy indeed!

pull → run

```
Terminal
$ docker pull rocker/r-ver
Using default tag: latest
latest: Pulling from rocker/r-ver
a8b1c5f80c2d: Pull complete
52afab1e5214: Pull complete
ea6d94e8c960: Pull complete
c23c887d4e2c: Pull complete
a66ed71411fd: Pull complete
9304df79333a: Pull complete
a6de95df1c8a: Pull complete
Digest: sha256:77679d3f7b4d774d87be238641dc426190e6a7d06a636714fa011f92fdd42b11
Status: Downloaded newer image for rocker/r-ver:latest
docker.io/rocker/r-ver:latest
$
```

A screenshot of a terminal window titled "Terminal". The window has a dark theme with white text. At the top, there are standard window controls (minimize, maximize, close) and a search bar. The main area of the terminal shows the output of the command `$ docker run rocker/r-ver`. The output is the standard R startup message, which includes:

- R version 4.4.0 (2024-04-24) -- "Puppy Cup"
- Copyright (C) 2024 The R Foundation for Statistical Computing
- Platform: x86_64-pc-linux-gnu
- R is free software and comes with ABSOLUTELY NO WARRANTY.
- You are welcome to redistribute it under certain conditions.
- Type 'license()' or 'licence()' for distribution details.
- Natural language support but running in an English locale
- R is a collaborative project with many contributors.
- Type 'contributors()' for more information and 'citation()' on how to cite R or R packages in publications.
- Type 'demo()' for some demos, 'help()' for on-line help, or 'help.start()' for an HTML browser interface to help.
- Type 'q()' to quit R.

At the bottom of the terminal window, there is a prompt line starting with a greater than sign (`>`) and a dollar sign (`$`), followed by a small black rectangular input field.

* Er, that's rather underwhelming. So what?

```
$ docker run -it rocker/r-ver:latest

R version 4.4.0 (2024-04-24) -- "Puppy Cup"
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'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> print("Hello, World!")
[1] "Hello, World!"
> █
```

What's the :latest for?

It's a **tag**.

TAG	OS/ARCH	Compressed Size ⓘ
4.4.0		<code>docker pull rocker/tidyverse:4.4.0</code> <button>Copy</button>
Last pushed a day ago by cboettig		
Digest		
4c95ec812c89	linux/amd64	847.46 MB

TAG	OS/ARCH	Compressed Size ⓘ
4.3.0		<code>docker pull rocker/tidyverse:4.3.0</code> <button>Copy</button>
Last pushed 20 days ago by cboettig		
Digest		
af55e8e949a3	linux/amd64	739.48 MB

TAG	OS/ARCH	Compressed Size ⓘ
4.3.1		<code>docker pull rocker/tidyverse:4.3.1</code> <button>Copy</button>
Last pushed 20 days ago by cboettig		
Digest		
9971a134959e	linux/amd64	776.98 MB

Use the right tag!

```
Terminal
$ docker run -it rocker/r-ver:latest

R version 4.4.0 (2024-04-24) -- "Puppy Cup"
Copyright (C) 2024 The R Foundation for Statistical Computing
Platform: x86_64-pc-linux-gnu

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Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> df <- data.frame(name = c("Alice", "Bob"), age = c(25, 30))
> levels(df$name)
NULL
> █
```

```
Terminal
$ docker run -it rocker/r-ver:3.1.2

R version 3.1.2 (2014-10-31) -- "Pumpkin Helmet"
Copyright (C) 2014 The R Foundation for Statistical Computing
Platform: x86_64-unknown-linux-gnu (64-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> df <- data.frame(name = c("Alice", "Bob"), age = c(25, 30))
> levels(df$name)
[1] "Alice" "Bob"
> █
```

2

Shelter: Shiny





rocker/shiny

Sponsored OSS

☆179

Pulls 1M+

By [rocker](#) • Updated 7 days ago

IMAGE

TAG

[4.4](#)

Last pushed 7 days ago by [cboettig](#)

Digest

[c1bb3650405d](#)

OS/ARCH

linux/amd64

Compressed Size ⓘ

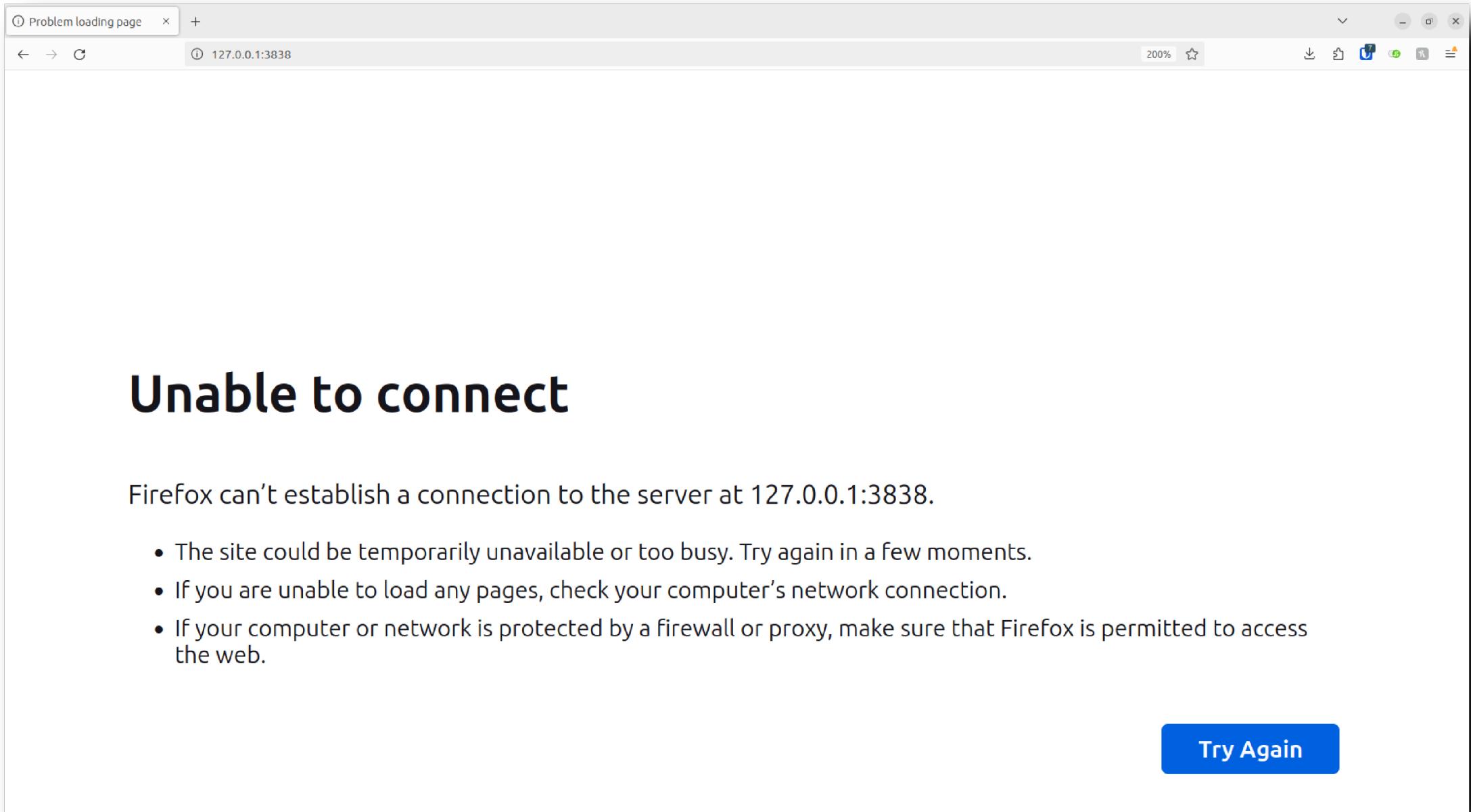
`docker pull rocker/shiny:4.4`

[Copy](#)

514.66 MB

```
Terminal
$ docker run rocker/shiny
[s6-init] making user provided files available at /var/run/s6/etc...exited 0.
[s6-init] ensuring user provided files have correct perms...exited 0.
[fix-attrs.d] applying ownership & permissions fixes...
[fix-attrs.d] done.
[cont-init.d] executing container initialization scripts...
[cont-init.d] 01_set_env: executing...
skipping /var/run/s6/container_environment/HOME
[cont-init.d] 01_set_env: exited 0.
[cont-init.d] done.
[services.d] starting services
[services.d] done.

*** warning - no files are being watched ***
[2024-05-20T13:40:13.461] [INFO] shiny-server - Shiny Server v1.5.23.1020 (Node.js v18.18.2)
[2024-05-20T13:40:13.462] [INFO] shiny-server - Using config file "/etc/shiny-server/shiny-server.conf"
[2024-05-20T13:40:13.476] [WARN] shiny-server - Running as root unnecessarily is a security risk!
You could be running more securely as non-root.
[2024-05-20T13:40:13.478] [INFO] shiny-server - Starting listener on http://[::]:3838
```



THAT'S A BUMMER

MAN



A container is a sealed environment!

* You could say that everything is "contained". Nothing comes in. Nothing goes out.

But you can    holes in it.

- v – mount a (disk) volume
- p – publish a (network) port

```
docker run rocker/shiny
```

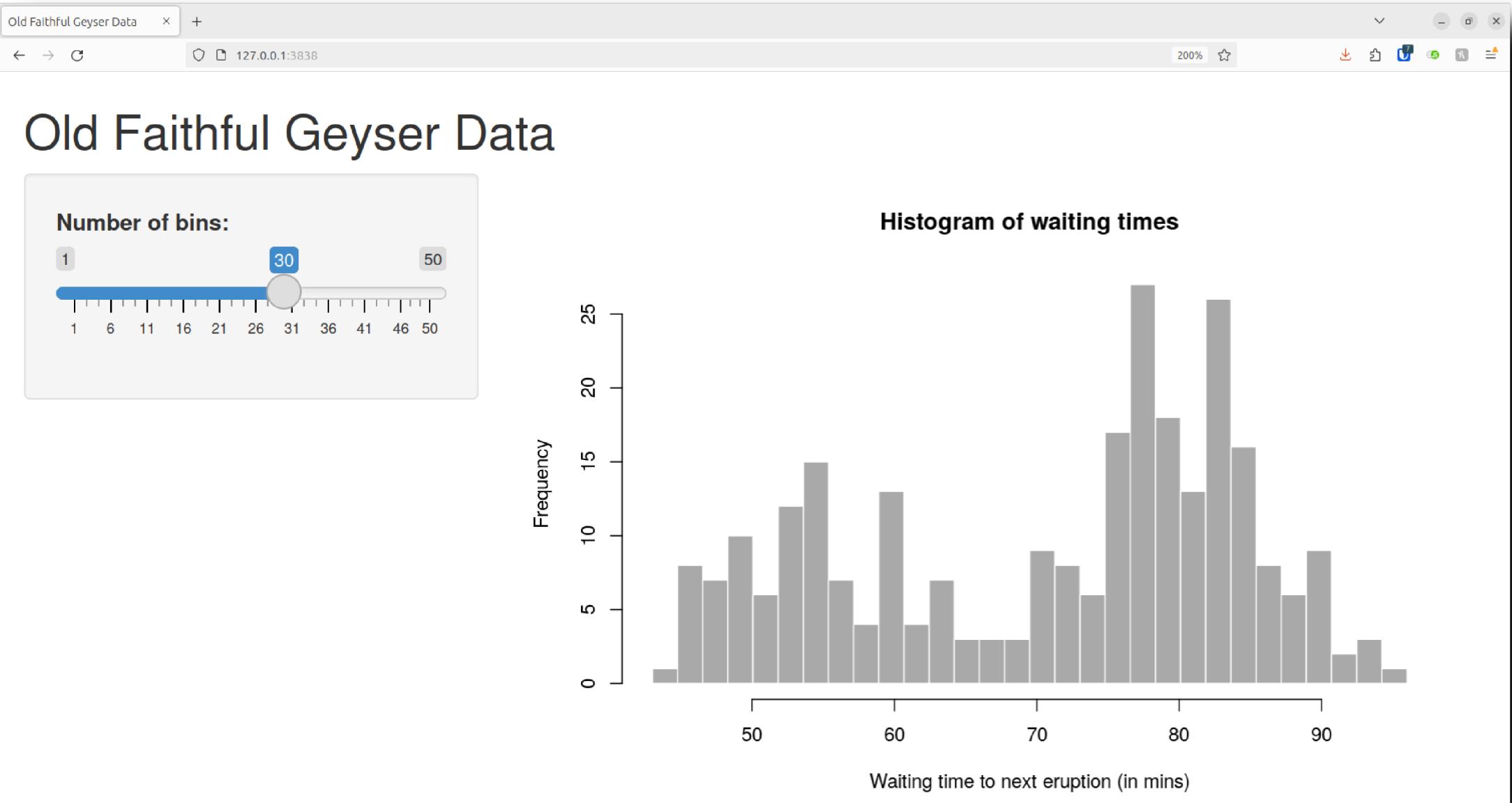
But that's **inaccessible!** 😞

Share the app directory (so you can access files).

```
docker run \  
  -v $(pwd)/shiny-faithful/:/srv/shiny-server/ \  
  rocker/shiny
```

Make it accessible via port 3838 (so you can access the app with your browser).

```
docker run \  
  -v $(pwd)/shiny-faithful/:/srv/shiny-server/ \  
  -p 3838:3838 \  
  rocker/shiny
```



Make
this
much more
useful!



* Roll your own Docker image by creating a Dockerfile.

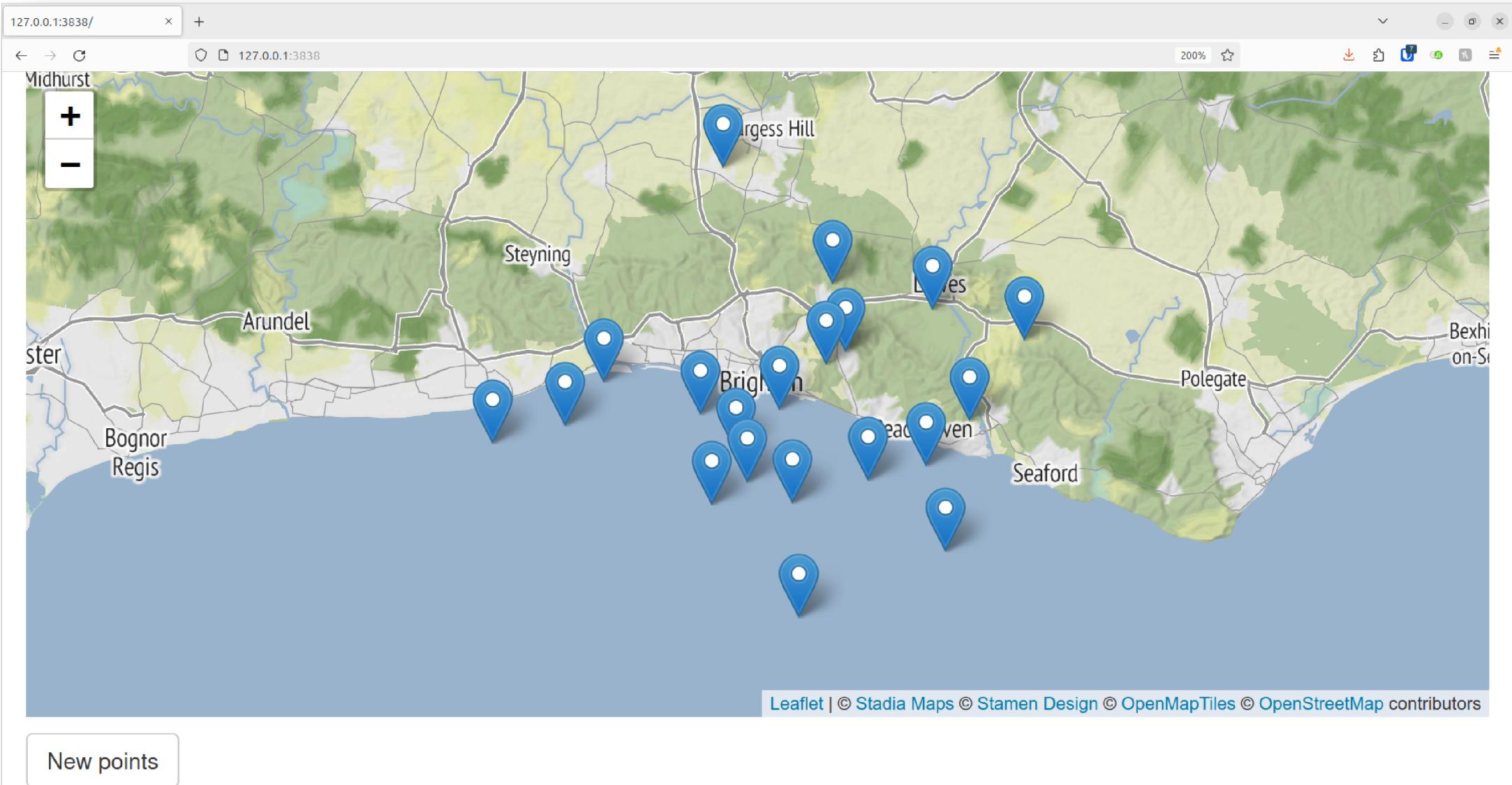
Create a Dockerfile:

```
FROM rocker/shiny  
  
RUN R -e "install.packages('leaflet')"  
  
COPY app.R /srv/shiny-server/
```

Then build and run:

```
docker build -t shiny-leaflet .  
docker run -p 3838:3838 shiny-leaflet
```

 No need for `-v` because the application is baked into the image.



3

Build a Raft: Jupyter





jupyter/r-notebook



Sponsored OSS



59

Pulls 1M+

By [Jupyter Project](#) • Updated 7 months ago

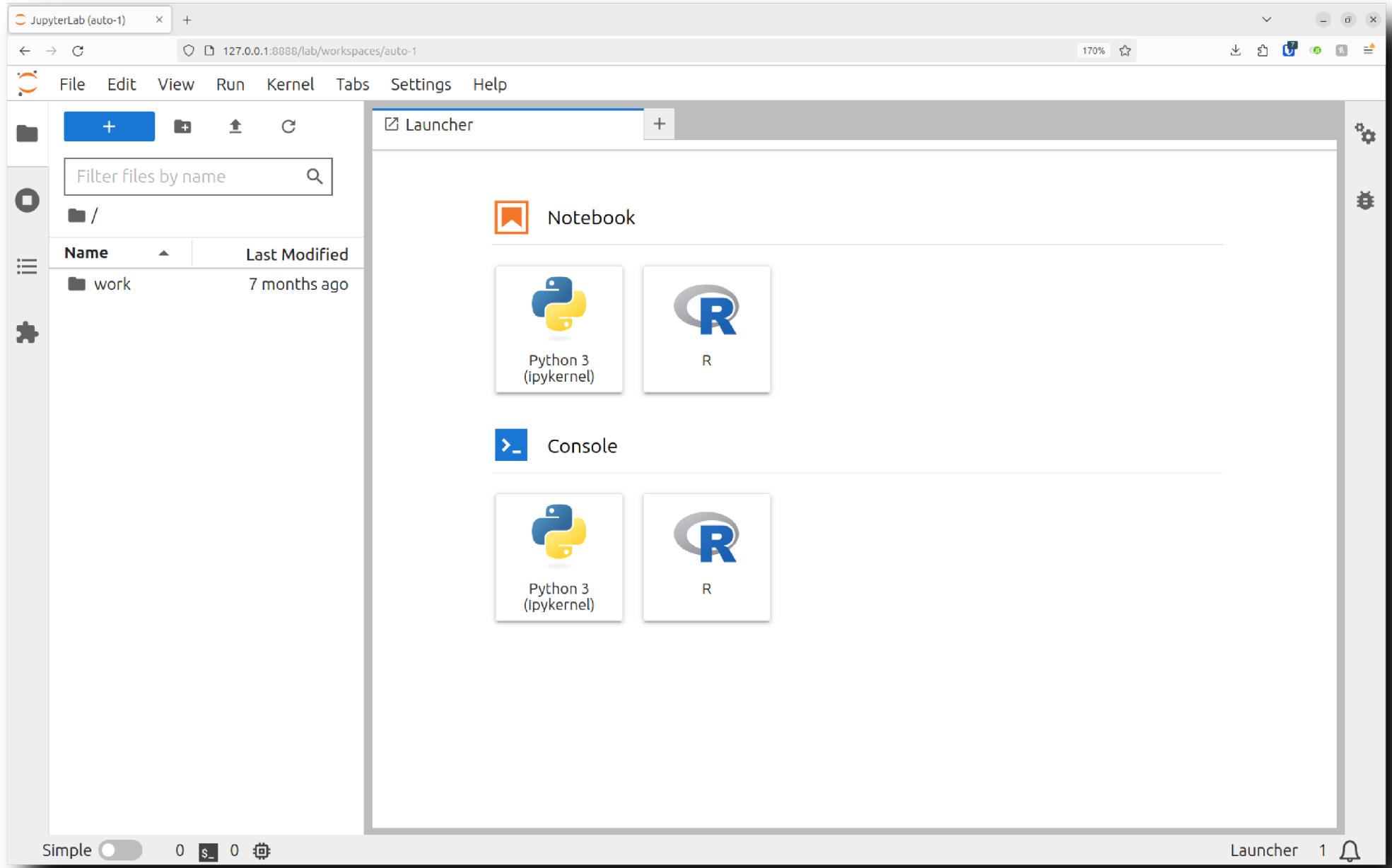
R Jupyter Notebook Stack from <https://github.com/jupyter/docker-stacks>

IMAGE

ARTIFACT

```
docker run \
-p 8888:8888 \
-v $(pwd):/home/jovyan \
jupyter/r-notebook
```

- The `-p` option makes it accessible via port 8888.
- The `-v` option shares the content of a directory on the host.



Let's make this more interesting by...

... installing {rJava}.



True story.

Create a Dockerfile:

```
FROM jupyter/r-notebook:r-4.3.1

USER root

RUN apt update -y && \
    apt install -y default-jdk

ENV JAVA_HOME=/usr/lib/jvm/java-11-openjdk-amd64
ENV LD_LIBRARY_PATH=${JAVA_HOME}/lib/server:${LD_LIBRARY_PATH}

RUN R CMD javareconf

# Install {rJava} because it's a dependency of {mailR}.
#
RUN R -e 'install.packages("rJava", repos="cran.r-project.org")' && \
    R -e 'install.packages("mailR", repos="cran.r-project.org")'

COPY send-email.ipynb /home/jovyan
```

The screenshot shows a Jupyter Notebook interface with a single open notebook titled "send-email.ipynb".

The left sidebar displays a file tree with a folder named "work" containing a file named "send-email.ipynb" (last modified 3 minutes ago).

The main workspace contains the following R code:

```
[1]: library(mailR)
[2]: msg <- send.mail(
  from = "sender@gmail.com",
  to = c("Recipient <recipient@gmail.com>"),
  subject = "Test email from Jupyter in Docker",
  body = "I'm sending email from a Docker container using Jupyter and R!",
  smtp = list(host.name = "mail.smtpbucket.com", port = 8025),
  authenticate = FALSE,
  send = TRUE
)
```

The status bar at the bottom indicates "Simple" mode, 0 cells run, and "R | Idle". The bottom right corner shows the status "Mode: Command" and "Ln 1, Col 1 send-email.ipynb 1".

[Search Results](#) > Test email from Jupyter in Docker

Message Details

Subject	Test email from Jupyter in Docker
Sender	sender@gmail.com
Recipients	recipient@gmail.com
Timestamp	2024-05-22 15:09:09

REST API call for this e-mail: GET <https://api.smtpbucket.com/emails/ff8081818f57b1cf018fa0a26a9f5c71>

Message Body

```
Date: Wed, 22 May 2024 15:09:09 +0100 (BST)
From: sender@gmail.com
To: Recipient <recipient@gmail.com>
Message-ID: <333362446.1.1716386949739@methane>
Subject: Test email from Jupyter in Docker
MIME-Version: 1.0
Content-Type: text/plain; charset=ISO-8859-1
Content-Transfer-Encoding: 7bit
```

I'm sending email from a Docker container using Jupyter and R!

But if you want to send email from R, then check out `{emayili}`.



<https://datawookie.github.io/emayili/>

Links

[View on CRAN](#)

[Browse source code](#)

[Report a bug](#)

License

[GPL-3](#)

Citation

[Citing emayili](#)

Developers

[Andrew B. Collier](#)

Author, maintainer, copyright holder

[More about authors...](#)

Dev status

CRAN 0.8.0

coverage 100%

lifecycle stable

1. R

2. Shiny

3. Jupyter

Don't wait to be marooned...

 Use these images now! 

Slides at <https://bit.ly/2024-salzburg-desert-island-docker>.

* Add a mechanical keyboard and gaming mouse and I might never leave.



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