

The tools of reproducible research

The reproducibility crisis – Social Psychology under investigation (early 2010s)

PLOS ONE

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

Behavioral Priming: It's All in the Mind, but Whose Mind?

Stéphane Doyen , Olivier Klein, Cora-Lise Pichon, Axel Cleeremans

Publis

...He found that the volunteers moved more slowly only when they were tested by experimenters *who expected them to move slowly*... Let that sink in: the only way Doyen could repeat Bargh's results was to deliberately tell the experimenters to expect those results.

OPEN ACCESS

REPLICATION

Investigating Variation in Replicability

A “Many Labs” Replication Project

 [CORRECTIONS FOR THIS ARTICLE](#) 

Richard A. Klein, Kate A. Ratliff, Michelangelo Vianello, Reginald B. Adams Jr., Štěpán Bahník, Michael J. Bernstein, Konrad Bocian, Mark J. Brandt, Beach Brooks, Claudia Chloe Brumbaugh... [SEE MORE](#) 

Published Online: January 01, 2014 • <https://doi.org/10.1371/journal.pone.000178>

The reproducibility crisis – Medicine airing the lack of utility in published research (early 2010s)

Published: 28 March 2012

Drug development

Raise standards for preclinical cancer research

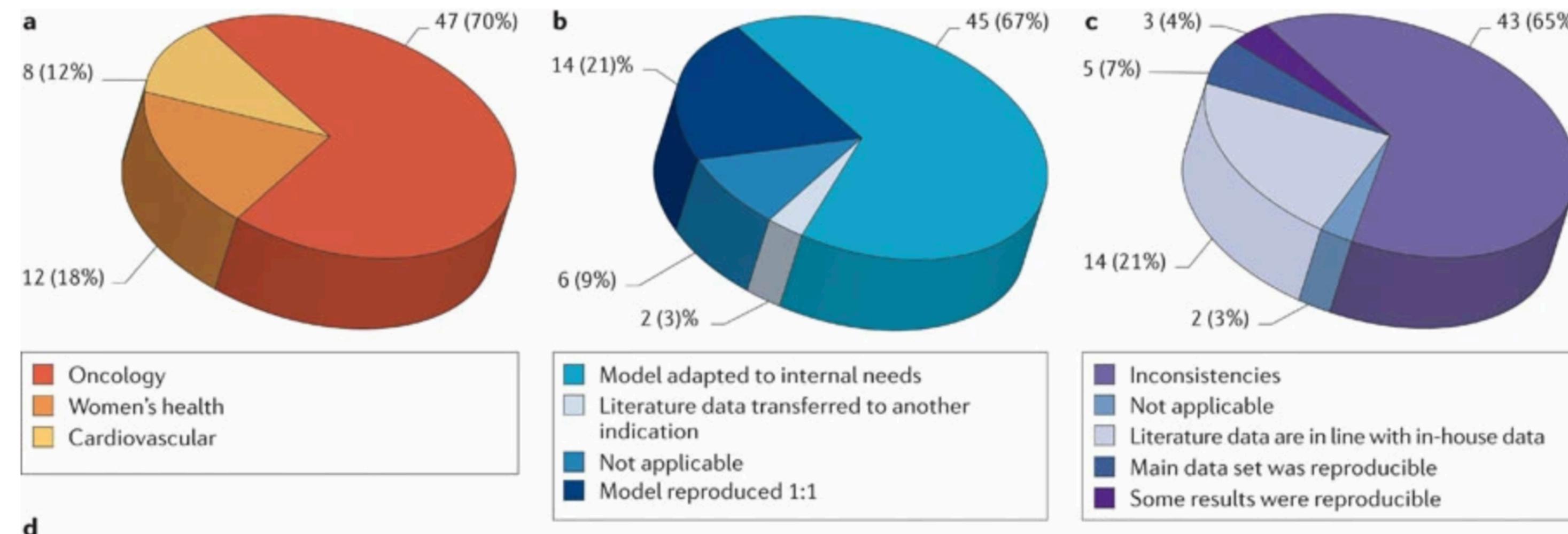
C. Glenn Begley & Lee M. Ellis 

Nature 483, 531–533 (2012) | [Cite this article](#)

244k Accesses | 1916 Citations | 2309 Altmetric | [Metrics](#)

Figure 1: Analysis of the reproducibility of published data in 67 in-house projects.

From: [Believe it or not: how much can we rely on published data on potential drug targets?](#)



But the reproducibility crisis extends to all (social) science research even if it's coming later

Evaluating replicability of laboratory experiments in economics

[COLIN F. CAMERER](#), [ANNA DREBER](#), [ESKIL FORSELL](#), [TECK-HUA HO](#), [...], AND [HANG WU](#)

+13 authors

[Authors Info & Affiliations](#)

SCIENCE • 3 Mar 2016 • Vol 351, Issue 6280 • pp. 1433-1436 • DOI: 10.1126/science.aaf0918

4,280 , 566



[CHECK ACCESS](#)

Another social science looks at itself

Experimental economists have joined the reproducibility discussion by replicating selected published experiments from two top-tier journals in economics. Camerer *et al.* found that two-thirds of the 18 studies examined yielded replicable estimates of effect size and direction. This proportion is somewhat lower than unaffiliated experts were willing to bet in an associated prediction market, but roughly in line with expectations from sample sizes and P values.

Science, this issue p. [1433](#)



And those who broadly look for malfeasance exist



Thinking about evidence, and vice versa

[HOME](#) [TABLE OF CONTENTS](#) [FEEDBACK POLICY](#) [SEMINAR](#) [ABOUT](#)

[114] Exhibits 3, 4, and 5

Posted on September 16, 2023 by Uri, Joe, & Leif

We recently presented evidence of data tampering in four retracted papers co-authored by Harvard Business School professor Francesca Gino. She is now suing the three of us (and Harvard University). Gino's lawsuit (.htm), like many lawsuits, contains a number of Exhibits that present information relevant to the case. For example, the lawsuit contains some Exhibits...

[Read more](#)

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SOCIAL MEDIA

Why does the reproducibility crisis exist?

So many reasons

Fraud and misconduct
“Publish or Perish”

EDUCATION

Stanford president resigns after fallout from falsified data in his research

Updated July 20, 2023 · 6:36 PM ET ⓘ

By [Ayana Archie](#)



People walk on the Stanford University campus beneath Hoover Tower in Stanford, Calif., on March 14, 2019. Stanford President Marc Tessier-Lavigne said on Wednesday he would resign, citing an independent review that cleared him of research misconduct but found flaws in other papers authored by his lab.

Ben Margot/AP

Why does the reproducibility crisis exist?

So many reasons

Fraud and misconduct
“Publish or Perish”

Bias in publishing
“System Function”

‘Behind Closed Drawers’: The File Drawer Effect

by Sarah Hill



In psychology, “the file drawer effect,” coined in 1979 by Robert Rosenthal, refers to the fact that in science many results remain unpublished, especially negative ones. Publication bias is more widespread than scientists might like to think.

Why does the reproducibility crisis exist?

So many reasons

Fraud and misconduct
“Publish or Perish”

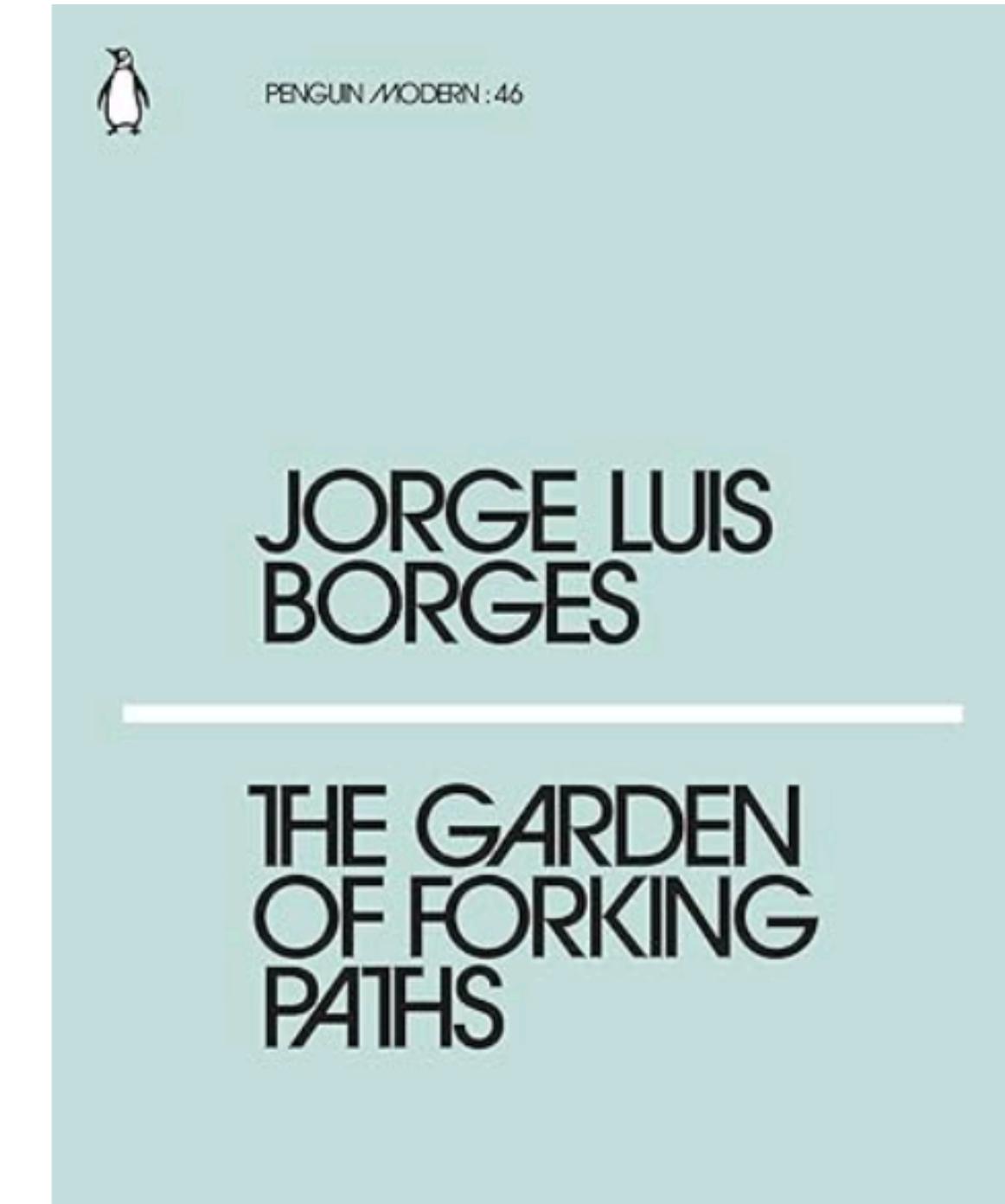
Bias in publishing
“System Function”

Methodological Errors
“Oopsie doopsies”

Common methodological mistakes

Jesper N. Wulff^a, Gwendolin B. Sajons^b, Ganna Pogrebna^{c d e}, Sirio Lonati^f,
Nicolas Bastardoz^g, George C. Banks^h  , John Antonakisⁱ

Show more ▾



Important

The issue with reproducibility ****is not**** just because of bad actors or intentional decisions

Science ****is**** and always has been a work in progress
Being wrong, but doing the work right is not a fault

Being wrong because the work is wrong is a fault when
you don't make it easy for others to inspect your work

Relatedly – What will and won't be covering

Discussing methodology is an entire, separate class

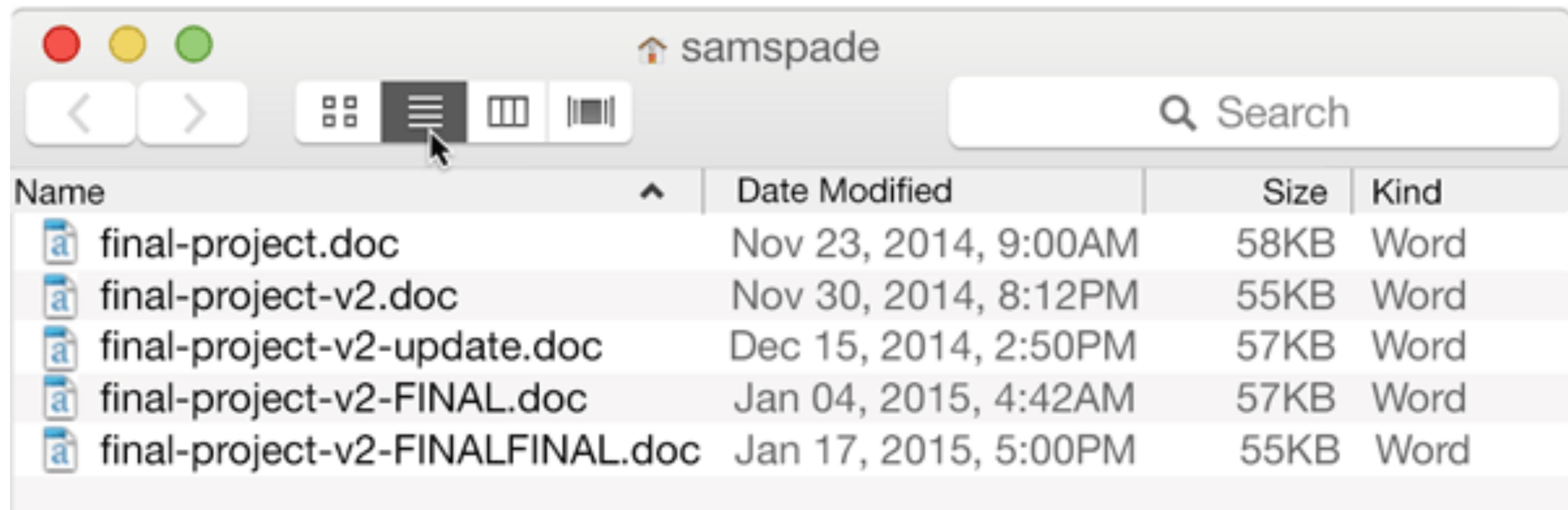
Tools are what we will focus on – how do we enable others to use our research

Major Tools

Version Control for our code

Installation requirements

Version Control – it's really for you



admit it. this is all of us.

Git(hub) won the version control wars



The screenshot shows the GitHub homepage with a dark background featuring a landscape of Mars and a futuristic satellite. At the top, there's a navigation bar with links for Product, Solutions, Open Source, and Pricing, along with a search bar and sign-in options. A purple curved line highlights a call-to-action button for "GitHub Universe". The main headline reads "Let's build from here" with the subtitle "The AI-powered developer platform to build, scale, and deliver secure software."

Product Solutions Open Source Pricing

Search or jump to... / Sign in Sign up

GitHub Universe: Dive in to AI, security, and DevEx >
Get your tickets now to join us on Nov. 8-9.

Let's build from here

The AI-powered developer platform to build, scale, and deliver secure software.

Git tracks the history of files and lets you revisit them

The screenshot shows a GitHub repository page for 'adamrpah / CSSMA'. The top navigation bar includes links for Code, Issues, Pull requests, Actions, Projects, Wiki, Security, Insights, and Settings. Below the navigation is a search bar and a user profile icon. The main content area is titled 'Activity' and displays a list of recent commits. The commits are grouped by category: 'updated fundamentals notebooks for the first three course weeks', 'majors files', 'additional homeworks', 'file changes and fixes', 'working docker and class environments', and 'finished rebasing'. Each commit is shown with the author's name ('adamrpah'), the branch ('master'), the commit hash, and the time since the push. The interface uses a dark theme with light-colored text and icons.

Code Issues Pull requests Actions Projects Wiki Security Insights Settings

CSSMA Public

Pin Watch 12 Fork 8 Star 25

Activity

All branches All activity All users All time Showing most recent first

updated fundamentals notebooks for the first three course weeks

adamrpah pushed 1 commit to master · ef56b4f...5b6c6fb · 2 days ago

majors files

adamrpah pushed 3 commits to master · b4ce0da...ef56b4f · 2 days ago

additional homeworks

adamrpah pushed 4 commits to master · 792cb3c...b4ce0da · 4 days ago

file changes and fixes

adamrpah pushed 1 commit to master · 2355e3a...792cb3c · 27 days ago

working docker and class environments

adamrpah pushed 2 commits to master · c06c3da...2355e3a · 27 days ago

finished rebasing

adamrpah pushed 5 commits to master · 2f90219...c06c3da · 28 days ago

By yourself git is extremely simple

create a repository

The screenshot shows the GitHub interface for creating a new repository. At the top, there's a navigation bar with icons for dashboard, search, and user profile. The main title is "Create a new repository". Below it, a sub-instruction says "A repository contains all project files, including the revision history. Already have a project repository elsewhere? [Import a repository](#)". A note indicates "Required fields are marked with an asterisk (*)".

The form starts with "Repository template" set to "No template". There's a placeholder text: "Start your repository with a template repository's contents.".

Owner is set to "adamlrpah" and Repository name is "scaling-winner". A note suggests "Great repository names are short and memorable. Need inspiration? How about [scaling-winner](#) ?".

Description (optional) is left empty.

For visibility, "Public" is selected (indicated by a blue radio button), with the description "Anyone on the internet can see this repository. You choose who can commit.". An alternative, "Private", is also shown with the description "You choose who can see and commit to this repository.".

Under "Initialize this repository with:", there's an unchecked checkbox for "Add a README file". A note explains: "This is where you can write a long description for your project. [Learn more about READMEs](#)."

"Add .gitignore" is selected, with ".gitignore template: None". A note says: "Choose which files not to track from a list of templates. [Learn more about ignoring files](#)."

"Choose a license" is set to "None". A note states: "A license tells others what they can and can't do with your code. [Learn more about licenses](#)."

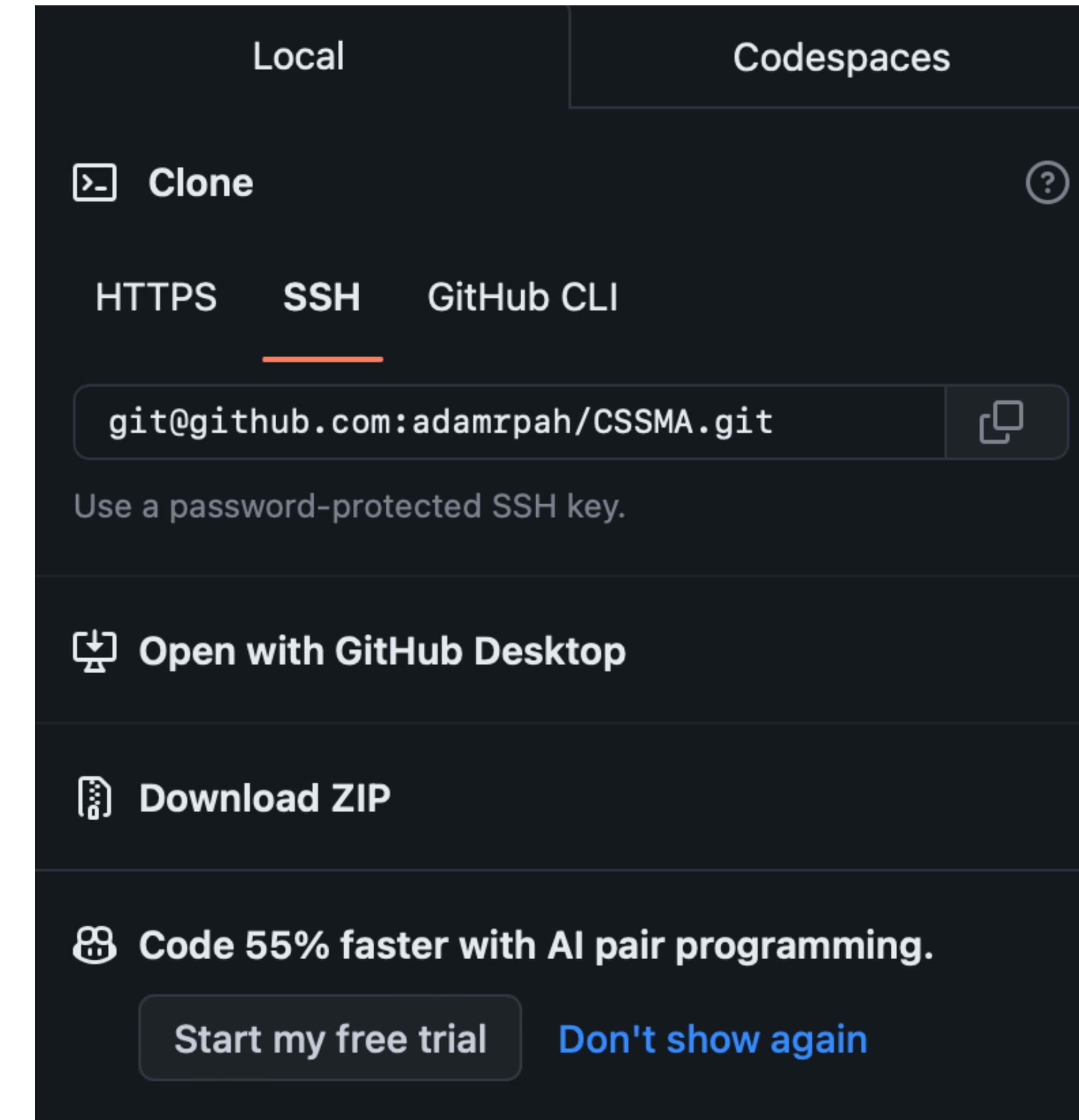
A informational note at the bottom says: "You are creating a public repository in your personal account."

At the bottom right is a green "Create repository" button.

By yourself git is extremely simple

create a repository

clone the repository
to your computer



By yourself git is extremely simple

create a repository

clone the repository
to your computer

add your files

```
[(cssma) adampah@delilah fundamentals % l
total 488
-rw-----@ 1 adampah staff    46K Oct 27 16:35 Data-Types.ipynb
-rw-----@ 1 adampah staff    24K Oct 30 10:59 Dictionaries.ipynb
-rw-----@ 1 adampah staff    21K Oct  4 15:39 File-IO.ipynb
-rw-----@ 1 adampah staff    18K Oct 30 10:54 Flow-Control.ipynb
-rw-----@ 1 adampah staff    15K Oct  4 15:39 Handling_Errors.ipynb
-rw-----@ 1 adampah staff    33K Oct 27 16:35 Lists-Tuples-and-Sets.ipynb
-rw-----@ 1 adampah staff    50K Oct 30 11:23 Structured-Data-Analysis-Pt1.ipynb
-rw-----@ 1 adampah staff    19K Oct 30 11:29 Structured-Data-Analysis-Pt2.ipynb
[(cssma) adampah@delilah fundamentals % git add *
```

By yourself git is extremely simple

create a repository

clone the repository
to your computer

add your files

commit the changes
(the message is for you!)

```
[cssma) adampah@delilah fundamentals % git commit -m 'updated fundamentals notebooks for the first three course weeks'
[master 5b6c6fb] updated fundamentals notebooks for the first three course weeks
 10 files changed, 8259 insertions(+), 6 deletions(-)
  create mode 100644 data/student_gpa_data.csv
  create mode 100644 lessons/fundamentals/Data-Types.ipynb
  create mode 100644 lessons/fundamentals/Dictionaries.ipynb
  create mode 100644 lessons/fundamentals/File-IO.ipynb
  create mode 100644 lessons/fundamentals/Flow-Control.ipynb
  create mode 100644 lessons/fundamentals/Handling_Errors.ipynb
  create mode 100644 lessons/fundamentals/Lists-Tuples-and-Sets.ipynb
  create mode 100644 lessons/fundamentals/Structured-Data-Analysis-Pt1.ipynb
  create mode 100644 lessons/fundamentals/Structured-Data-Analysis-Pt2.ipynb
```

By yourself git is extremely simple

create a repository

clone the repository
to your computer

add your files

commit the changes
(the message is for you!)

```
[(cssma) adampah@delilah fundamentals % git push
Enumerating objects: 19, done.
Counting objects: 100% (19/19), done.
Delta compression using up to 8 threads
Compressing objects: 100% (15/15), done.
Writing objects: 100% (15/15), 57.72 KiB | 7.21 MiB/s, done.
Total 15 (delta 3), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (3/3), completed with 3 local objects.
To github.com:adamrpah/CSSMA.git
  ef56b4f..5b6c6fb  master -> master
(cssma) adampah@delilah fundamentals %
```

push the files to GitHub
now they're available!

Compiled languages (Fortran, C, C++, Java)

myfirstprogram.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

Management Start here X myfirstprogram.cpp X

Projects Files FSymbols Workspace

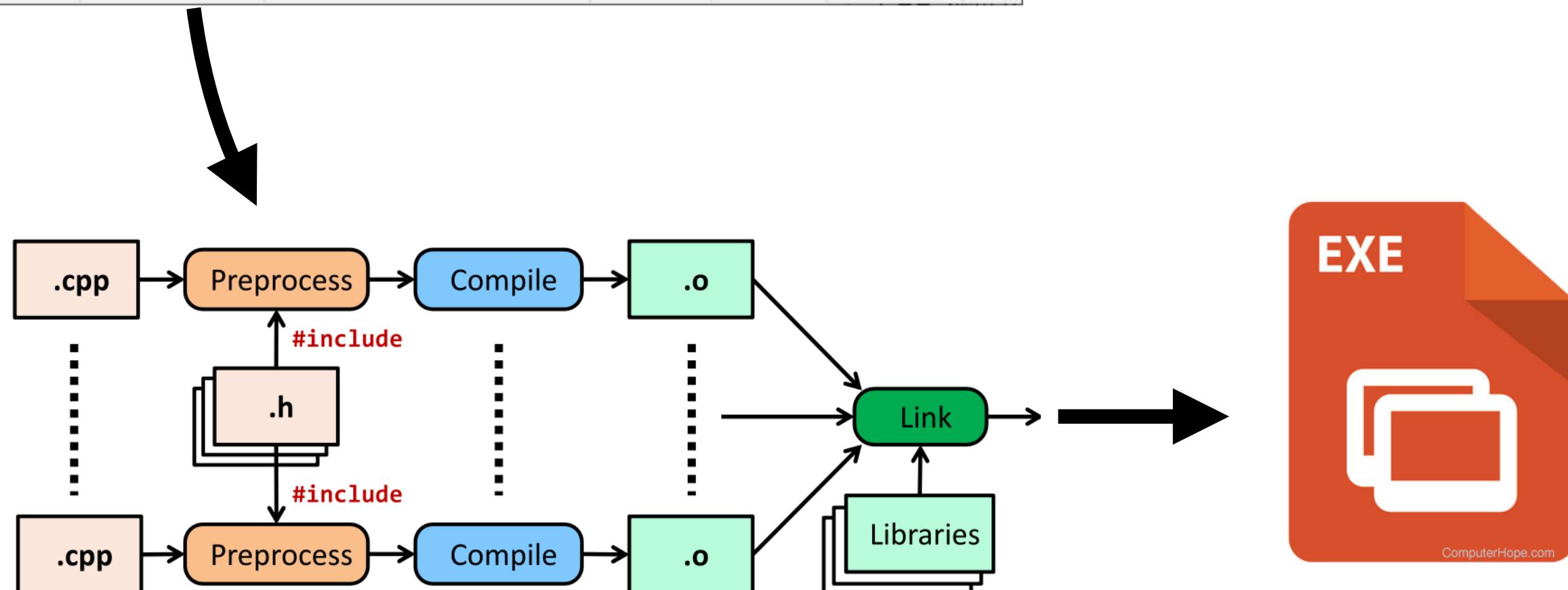
Highlighted Occurrences

```
1 #include <iostream>
2 using namespace std;
3
4 int main() {
5     cout << "Hello World!";
6     return 0;
7 }
```

C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write d.

Command Prompt - python

```
C:\Users\Anonymous>python
Python 3.7.3 (v3.7.3:ef4ec6ed12, Mar 25 2019, 21:26:53) [MSC v.1916 32 bit
(Intel)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> name = "Aakash"
>>> print("My name is " + name)
My name is Aakash
>>>
```



compiling

Run executable



Executable bytecode
for Operating System

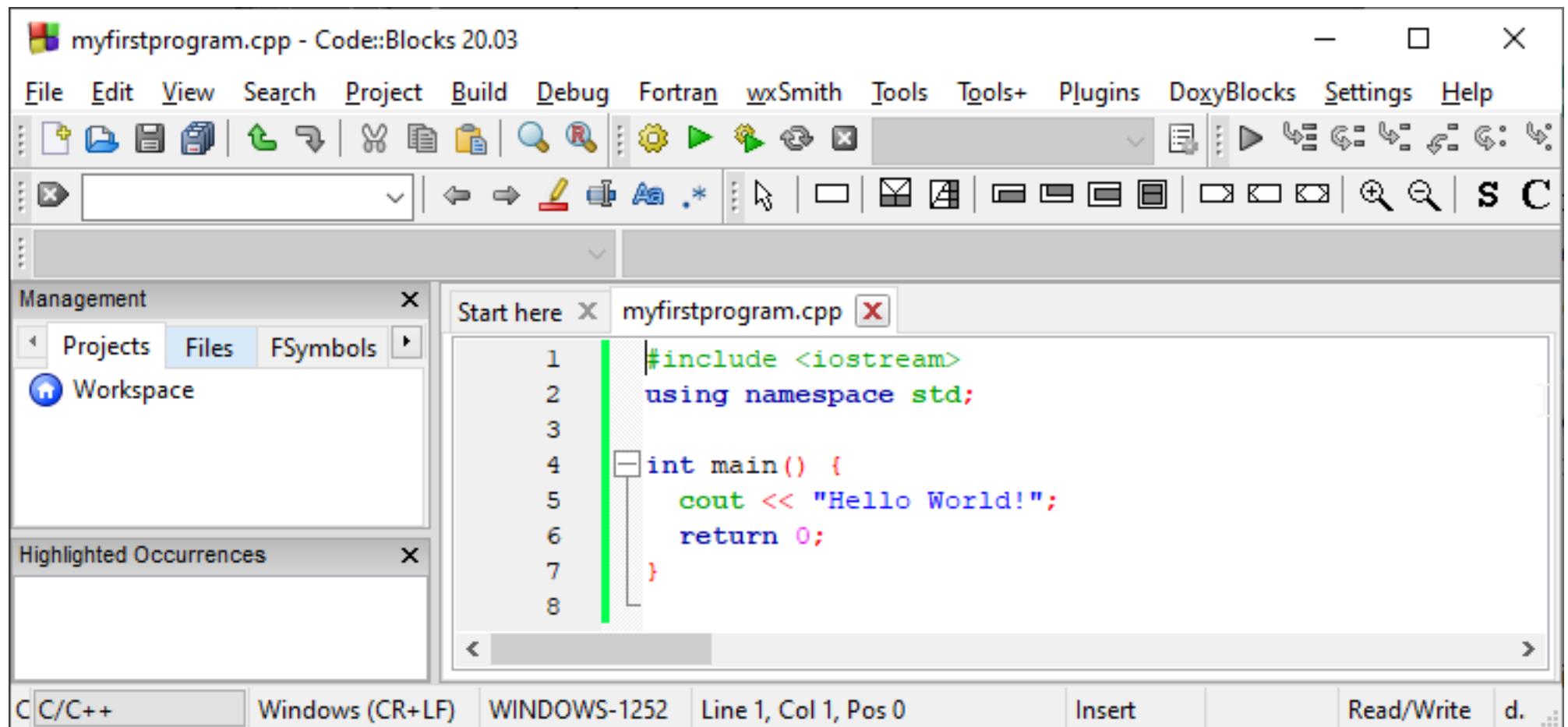
You all will make a github repository and use it
for your final project

Software Environment (how this is related to PDF processing)

Let's talk about differences in programming languages

compiled vs. interpreted

Interpreted languages (Python, R, Stata)



myfirstprogram.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

Management Start here myfirstprogram.cpp

```
1 #include <iostream>
2 using namespace std;
3
4 int main() {
5     cout << "Hello World!";
6     return 0;
7 }
```

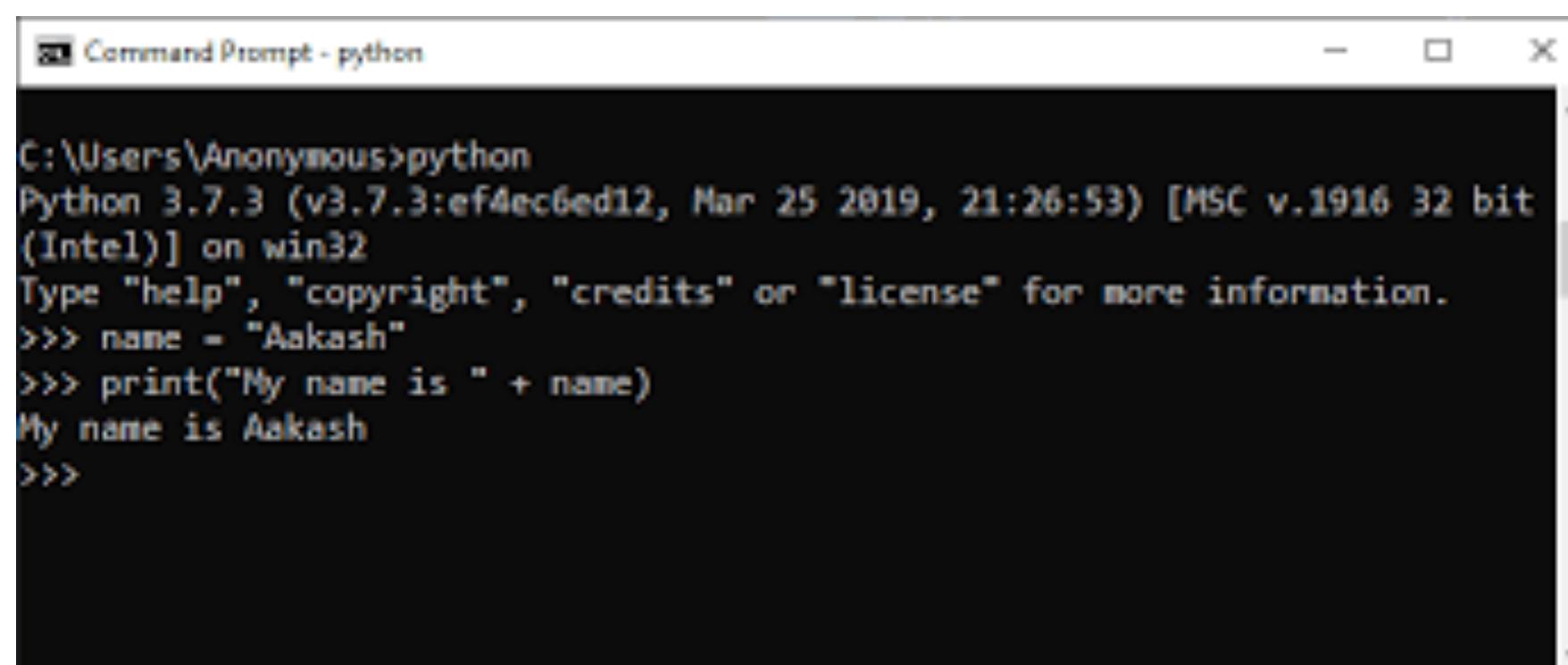
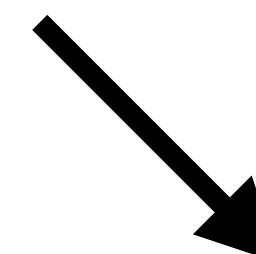
C/C++ Windows (CR+LF) WINDOWS-1252 Line 1, Col 1, Pos 0 Insert Read/Write d...

A screenshot of the Code::Blocks IDE. The main window shows a C++ file named 'myfirstprogram.cpp' with the following code:

```
#include <iostream>
using namespace std;

int main() {
    cout << "Hello World!";
    return 0;
}
```

The code editor has syntax highlighting for C++. The IDE interface includes a toolbar, a menu bar, and several tool windows on the left side.



Command Prompt - python

```
C:\Users\Anonymous>python
Python 3.7.3 (v3.7.3:ef4ec6ed12, Mar 25 2019, 21:26:53) [MSC v.1916 32 bit
(Intel)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> name = "Aakash"
>>> print("My name is " + name)
My name is Aakash
>>>
```

A screenshot of a Windows Command Prompt window titled 'Command Prompt - python'. It shows the Python interpreter running a script. The output of the script, 'My name is Aakash', is displayed in white text on a black background.

Code runs

Pros and cons

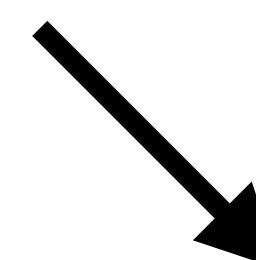
Compiled languages are much faster because of the optimization during compilation

Interpreted languages are much easier to learn and use

The reality of interpreted languages

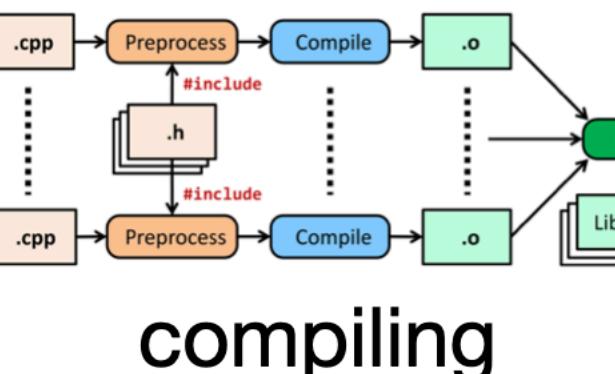
```
#include <iostream>
using namespace std;

int main() {
    cout << "Hello World!";
    return 0;
}
```



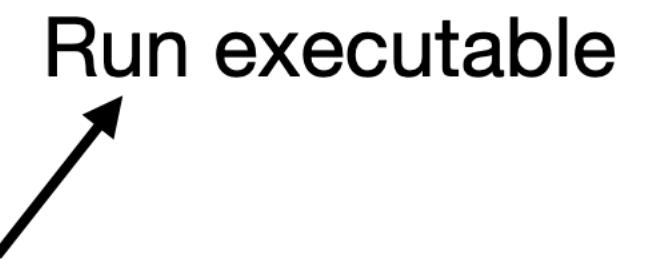
```
C:\Users\Anonymous>python
Python 3.7.3 (v3.7.3:ef4ec6ed12, Mar 25 2019, 21:26:53) [MSC v.1916 32 bit
(Intel)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> name = "Aakash"
>>> print("My name is " + name)
My name is Aakash
>>>
```

Code runs



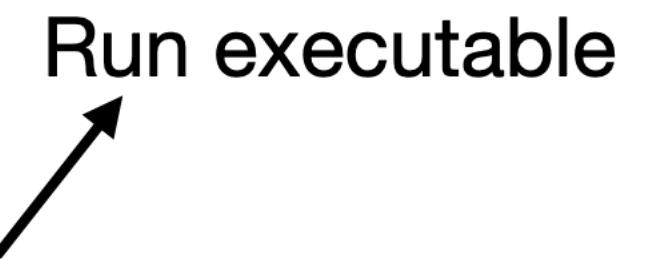
compiling

```
C:\Users\Anonymous>python
Python 3.7.3 (v3.7.3:ef4ec6ed12, Mar 25 2019, 21:26:53) [MSC v.1916 32 bit
(Intel)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> name = "Aakash"
>>> print("My name is " + name)
My name is Aakash
>>>
```



Executable bytecode
for Operating System

it sits on top of a
mountain of
compiled code

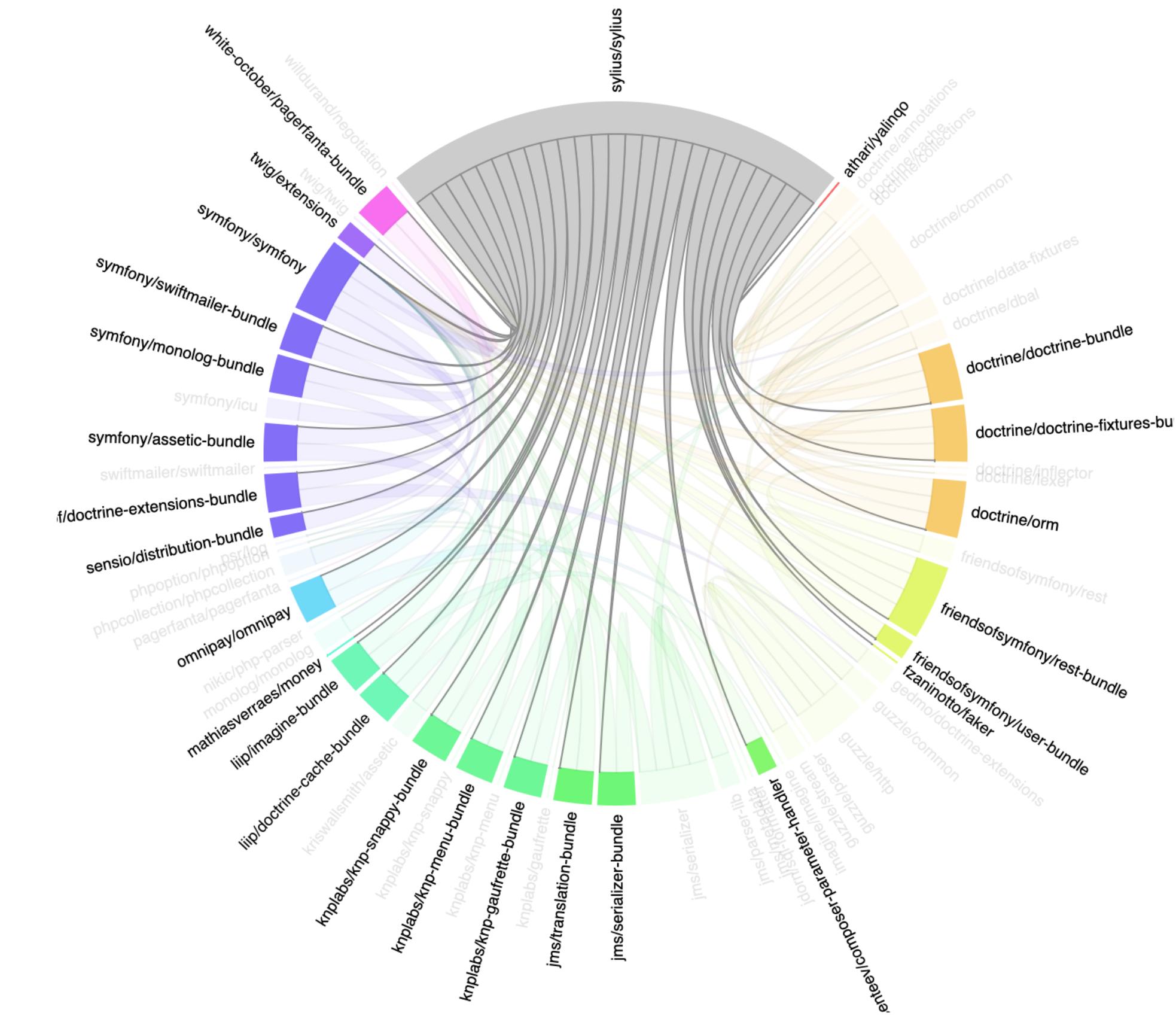


Run executable

Complicated/complex tasks rely on standard compiled libraries



Fortran Standard Library



Package managers exist and solve the bulk of this problem

Conda



Package, dependency and environment management for any language—Python, R, Ruby, Lua, Scala, Java, JavaScript, C/ C++, Fortran, and more.

Definitive advance for the field

1. To create an environment:

```
conda create --name myenv
```



Replace `myenv` with the environment name.

2. When conda asks you to proceed, type `y`:

```
proceed ([y]/n)?
```

This creates the `myenv` environment in `/envs/`. No packages will be installed in this environment.

3. To create an environment with a specific version of Python:

```
conda create -n myenv python=3.9
```

4. To create an environment with a specific package:

```
conda create -n myenv scipy
```

OR:

```
conda create -n myenv python  
conda install -n myenv scipy
```

5. To create an environment with a specific version of a package:

```
conda create -n myenv scipy=0.17.3
```

But we still run into a wall in terms of OS libraries

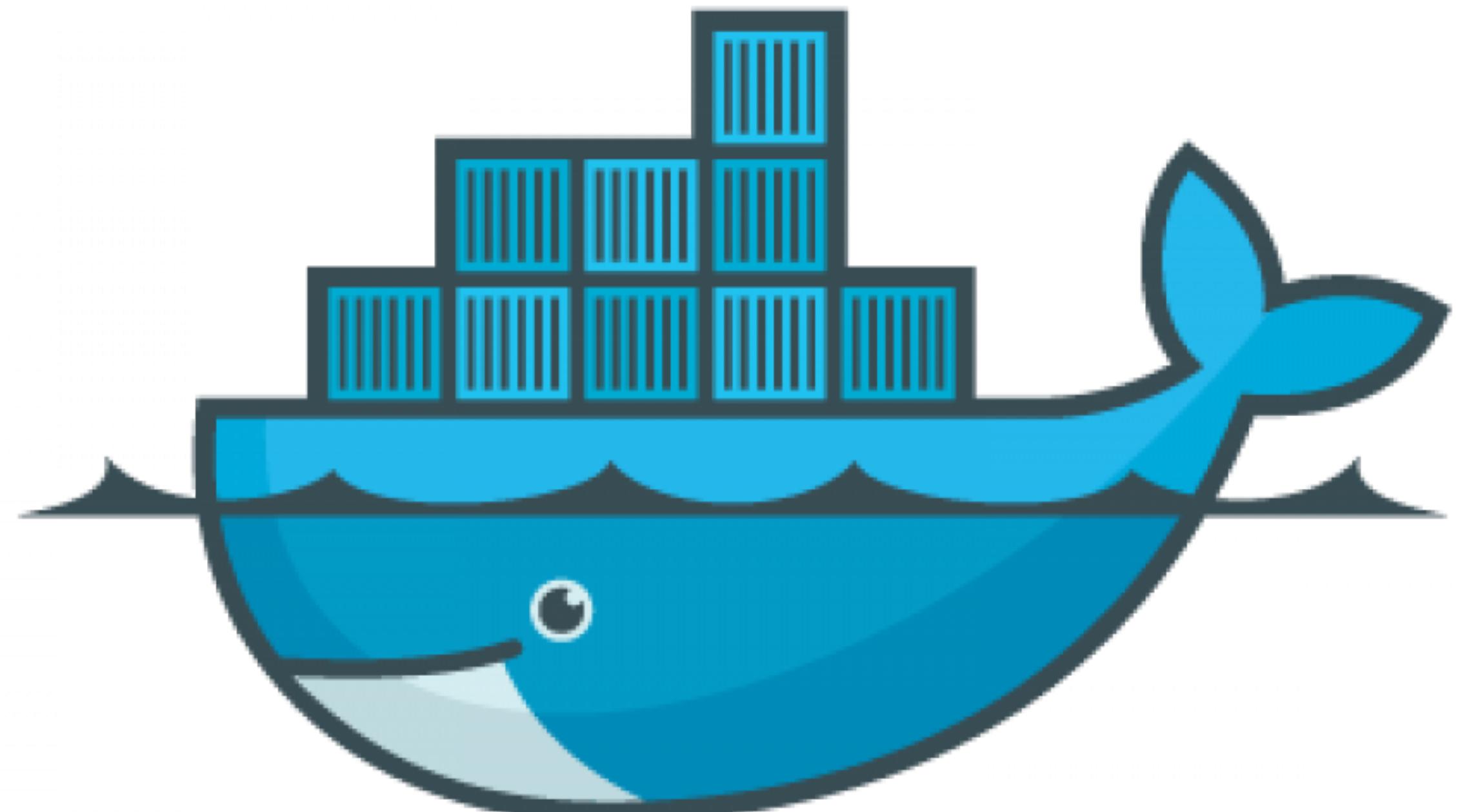


Advanced Packaging Tool – APT

The `apt` command is a powerful command-line tool, which works with Ubuntu's Advanced Packaging Tool (APT). The commands contained within `apt` provide the means for installing new software packages, upgrading existing software packages, updating the package list index, and even upgrading the entire Ubuntu system.

Some examples of popular uses for the `apt` utility include:

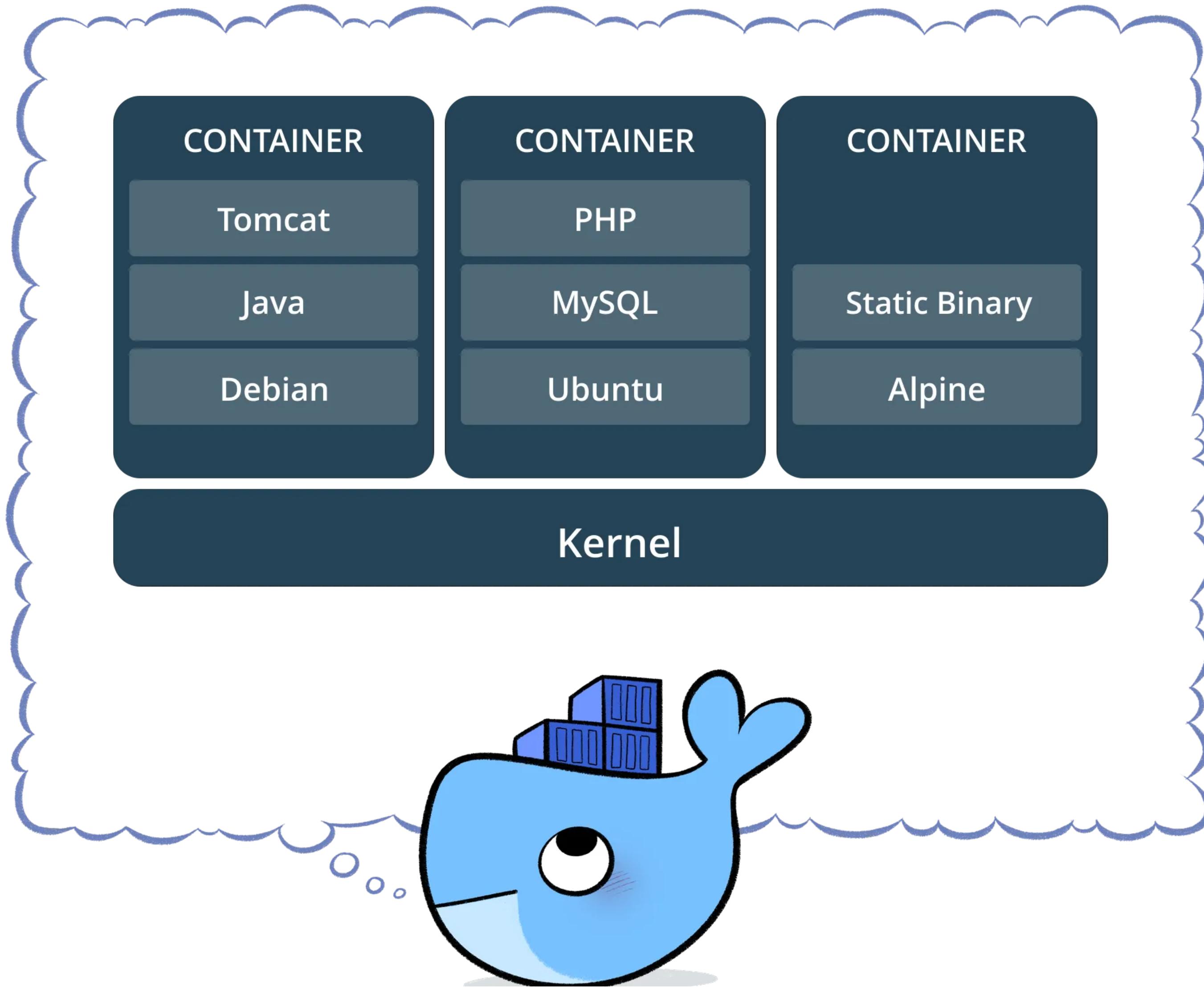
Containerization and OS virtualization



docker



The gist of docker



Relatively lightweight
software to run an entire
computing environment

You don't have to build a docker image from scratch

The screenshot shows the Docker Hub search interface with the query 'python pytorch'. The results page displays 1 - 25 of 10,000 results. On the left, there are filters for Products (Images, Extensions, Plugins), Trusted Content (Docker Official Image, Verified Publisher, Sponsored OSS), Operating Systems (Linux, Windows), Architectures (ARM, ARM 64, IBM POWER, IBM Z, PowerPC 64 LE, x86, x86-64), and a dropdown for Best Match.

- python** Docker Official Image · 1B+ · 9.1K · Updated 14 hours ago · Python is an interpreted, interactive, object-oriented, open-source programming language. · Linux, Windows, ARM 64, 386, PowerPC 64 LE, IBM Z, mips64le, x86-64, ARM · Pulls: 8,625,673 Last week · Learn more
- pypy** Docker Official Image · 10M+ · 380 · Updated 17 hours ago · PyPy is a fast, compliant alternative implementation of the Python language. · Linux, Windows, ARM 64, 386, IBM Z, PowerPC 64 LE, ARM, x86-64 · Pulls: 25,809 Last week · Learn more
- hylang** Docker Official Image · 10M+ · 58 · Updated 19 hours ago · Hy is a Lisp dialect that translates expressions into Python's abstract syntax tree. · Windows, Linux, mips64le, x86-64, ARM, ARM 64, 386, PowerPC 64 LE, IBM Z · Pulls: 2,879 Last week · Learn more
- bitnami/pytorch** Verified Publisher · 500K+ · 66 · By VMware · Updated 7 days ago · Bitnami PyTorch Docker Image · Linux, x86-64, arm64 · Pulls: 525 Last week · Learn more
- circleci/python** Verified Publisher · 100M+ · 85 · By CircleCI · Updated 2 years ago · Python is an interpreted, interactive, object-oriented, open-source programming language. · Linux, x86-64 · Learn more
- graphcore/pytorch** Verified Publisher · 100K+ · 3 · By Graphcore · Updated 4 months ago · The Poplar® SDK components required to run Pytorch on IPUs. Designed for production. · Linux, x86-64 · Pulls: 184 Last week · Learn more

dockerhub is a repository of pre-built containers that you can download and use

creating custom docker containers is not extremely difficult either

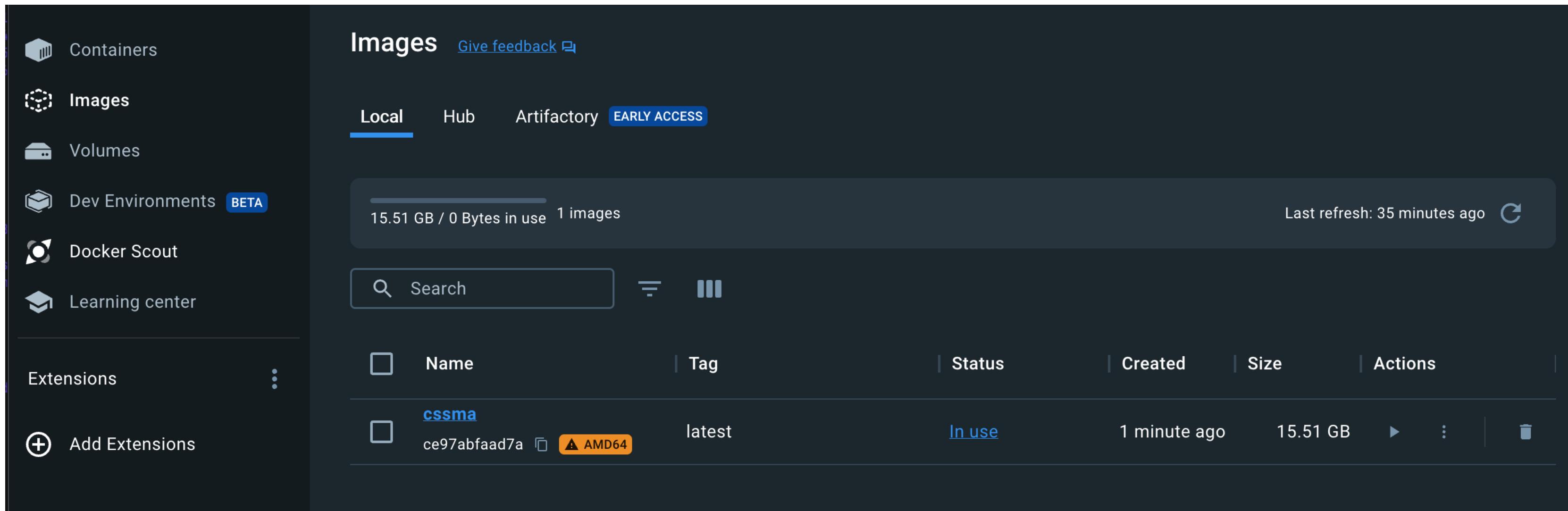
The screenshot shows the Docker Hub interface for the repository 'tiagopeixoto/graph-tool'. At the top, there's a blue header bar with the Docker Hub logo, a search bar, and navigation links for 'Explore', 'Pricing', 'Sign In', and 'Sign up'. Below the header, the repository path 'Explore / tiagopeixoto/graph-tool' is shown. The main card for the repository includes the name 'tiagopeixoto/graph-tool' with a star icon, the creator 'By [tiagopeixoto](#)', the last update '2 months ago', and a description 'Arch GNU/Linux image with graph-tool installed.' There's also a 'Image' button. To the right, it shows 'Pulls 100K'. Below this card, there are two tabs: 'Overview' (which is selected) and 'Tags'. The 'Overview' section contains a text box with instructions: 'This is a fully working installation of graph-tool with Python 3 on Arch GNU/Linux. For more information visit: <https://graph-tool.skewed.de>. Problems with the image should be reported at: <https://graph-tool.skewed.de/issues>'. To the right of this text box is a 'Docker Pull Command' box containing the command 'docker pull tiagopeixoto/graph-tool' with a copy icon.

Dockerfile – the instructions on what software to install for an operating system

```
1 FROM tiagopeixoto/graph-tool
2 USER root
3 RUN pacman -S wget firefox python-pip --noconfirm
4 #Gecko driver install
5 RUN wget https://github.com/mozilla/geckodriver/releases/download/v0.33.0/geckodriver-v0.33.0-linux64.tar.gz
6 RUN tar -xvf geckodriver-v0.33.0-linux64.tar.gz -C /usr/local/bin/
7 #Python package and data installs
8 RUN pip install jupyter networkx gensim soupsieve beautifulsoup4 nltk seaborn statsmodels spacy booknlp selenium --break-system-packages
9 RUN wget https://github.com/explosion/spacy-models/releases/download/en_core_web_sm-3.6.0/en_core_web_sm-3.6.0.tar.gz
10 RUN tar -xf en_core_web_sm-3.6.0.tar.gz
11 RUN rm en_core_web_sm-3.6.0.tar.gz
12 USER user
13 RUN python -c 'import nltk; nltk.download("all")'
```

Once you have docker file instructions you need to ‘build’ the container

```
docker-compose -f docker-compose.yml -p cssma build
```

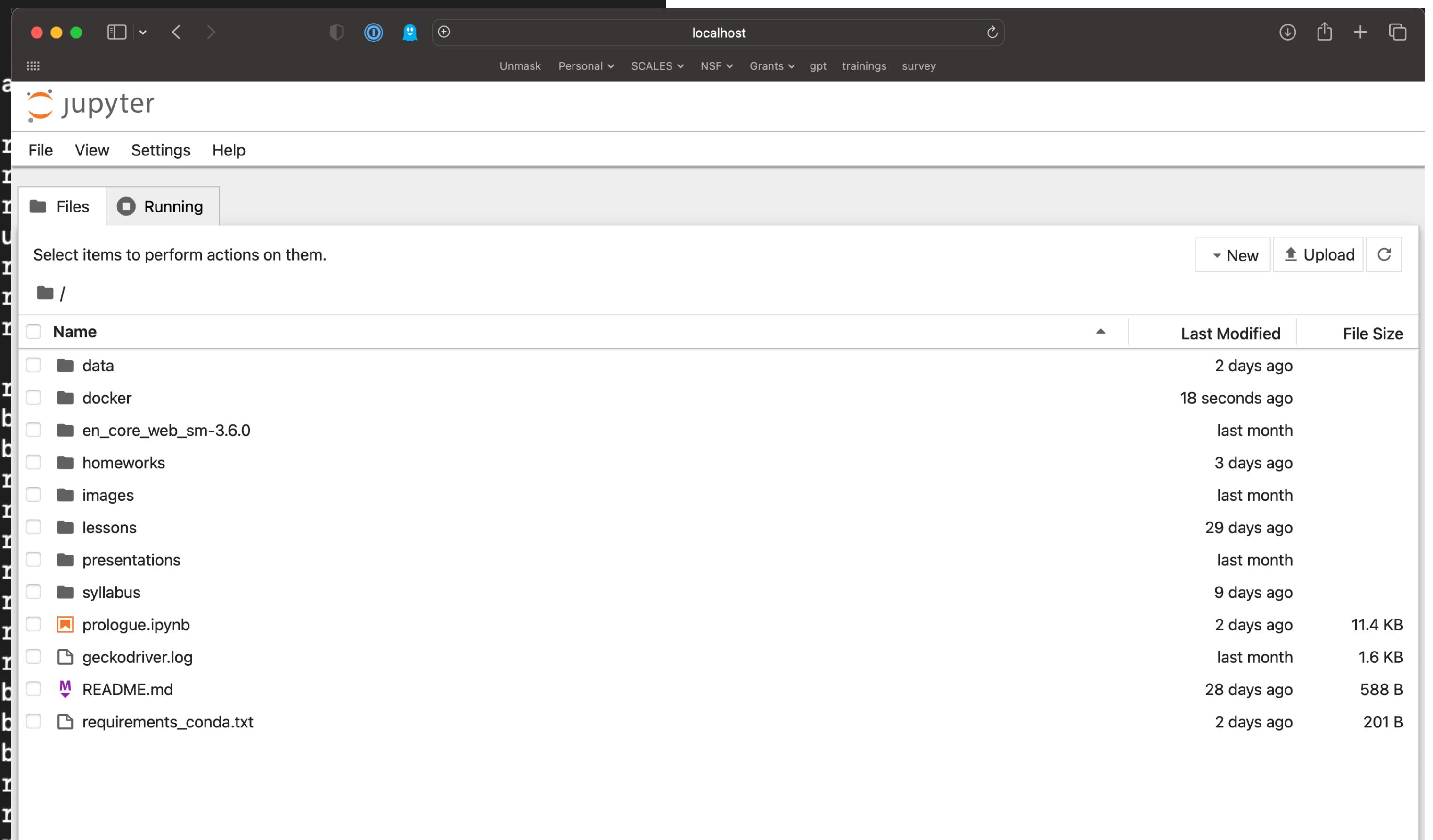


A compose file makes it easy to specify how a container should be run

```
1  version: "3"
2  services:
3    graphtool:
4      image: cssma
5      build:
6        context: .
7      working_dir: /home/user
8      volumes:
9        - /Users/adampah/Dropbox/Teaching/CSSMA/KPHD_CSS:/home/user
10     env_file: cssma.env
11     ports:
12       - 8888:8888
13       - 6006:6006
14       - 8889:8889
15       - 4444:4444
16       - 7900:7900
17     networks:
18       - graphtool
19     user: user
20     command: jupyter notebook --ip 0.0.0.0 --NotebookApp.token=' ' --NotebookApp.password=' ' --no-browser
21
22   networks:
23     graphtool:
24       driver: bridge
```

And to run the container

```
[(cssma) adampah@SPS-203-MacAdam docker % docker-compose up
WARN[0000] The "DISPLAY" variable is not set. Defaulting to a blank string.
[+] Running 3/0
  ✓ Network docker_graphtool
  ✓ Container docker-graphtool-1
  ! graphtool The requested image's platform (linux/amd64) does not match the host (linux/arm/v7). If you expect to run this image on the host, you may need to add 'platform: linux/amd64' to your Dockerfile or use --platform=linux/amd64 when running the command.
Attaching to docker-graphtool-1
docker-graphtool-1  | [I 2023-11-02 19:13:09.685 ServerApp] Serving notebooks from local directory:
docker-graphtool-1 | [I 2023-11-02 19:13:09.714 ServerApp] Jupyter Server 2.7.2 is running at:
docker-graphtool-1 | [W 2023-11-02 19:13:09.714 ServerApp] ion name will be deprecated in future releases of Ju
ion name will be deprecated in future releases of Ju
docker-graphtool-1 | [I 2023-11-02 19:13:09.715 ServerApp] [I 2023-11-02 19:13:09.821 ServerApp]
docker-graphtool-1 | [I 2023-11-02 19:13:09.821 ServerApp] [W 2023-11-02 19:13:09.821 ServerApp]
ction name will be deprecated in future releases of Ju
ction name will be deprecated in future releases of Ju
docker-graphtool-1 | [I 2023-11-02 19:13:09.822 ServerApp] [W 2023-11-02 19:13:09.827 LabApp]
docker-graphtool-1 | [W 2023-11-02 19:13:09.827 LabApp] [W 2023-11-02 19:13:09.827 LabApp]
docker-graphtool-1 | [W 2023-11-02 19:13:09.835 ServerApp] [I 2023-11-02 19:13:09.835 ServerApp]
docker-graphtool-1 | [I 2023-11-02 19:13:09.835 ServerApp] [I 2023-11-02 19:13:09.845 ServerApp]
docker-graphtool-1 | [I 2023-11-02 19:13:10.412 ServerApp] [W 2023-11-02 19:13:10.479 ServerApp]
docker-graphtool-1 | [W 2023-11-02 19:13:10.479 ServerApp] [I 2023-11-02 19:13:10.480 ServerApp]
docker-graphtool-1 | [I 2023-11-02 19:13:10.480 ServerApp] [I 2023-11-02 19:13:10.486 ServerApp]
docker-graphtool-1 | [I 2023-11-02 19:13:10.486 ServerApp] [I 2023-11-02 19:13:10.491 LabApp]
docker-graphtool-1 | [I 2023-11-02 19:13:10.491 LabApp] [I 2023-11-02 19:13:10.491 LabApp]
docker-graphtool-1 | [I 2023-11-02 19:13:10.492 LabApp] [I 2023-11-02 19:13:10.499 ServerApp]
docker-graphtool-1 | [I 2023-11-02 19:13:10.505 ServerApp] [I 2023-11-02 19:13:10.507 ServerApp] Serving notebooks from local directory:
docker-graphtool-1 | [I 2023-11-02 19:13:10.507 ServerApp] Jupyter Server 2.7.2 is running at:
docker-graphtool-1 | [I 2023-11-02 19:13:10.507 ServerApp] http://f4a033068ac6:8888/tree
docker_graphtool_1 | [I 2023-11-02 19:13:10.507 ServerApp] http://127.0.0.1:8888/tree
```



We will use the Docker container for the rest of the course

Final thoughts

The ability for the community to engage with and build on our work is fundamental to our responsibility as researchers

Distributing data is no longer sufficient to fully support the community and our responsibility

Using tools that enable reproducible research dramatically improves our own lives too