Intro: Files, BASH and Git

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GeoZentrum Nordbayern

Why?

and GitHub

Paleontological data in the 21st century

We have gone a long way…

Collectors only

-1960s

Pioneers

1960-1990/2000

The Paleobiology Database
revealing the history of life

NEOTOMADB.ORG

Neptune
SANDBOX Berlin

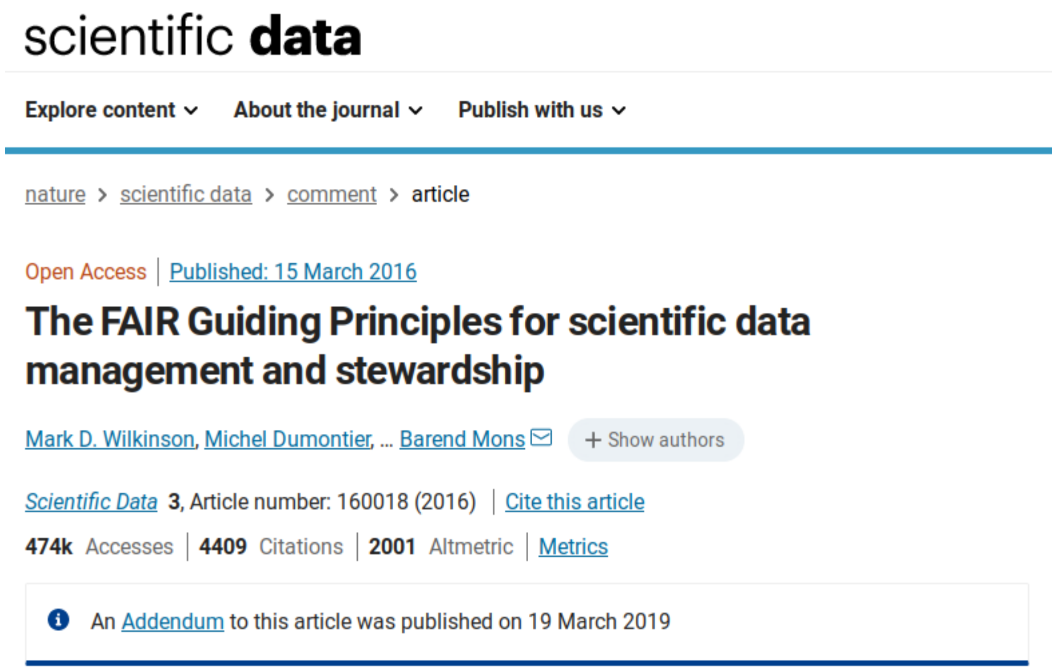
Community of
database-based research

Being FAIR

A standard way to publish data and dat-based research.

- **F**indable
- **A**ccessible
- **I**nteroperable
- **R**eproducible

www.go-fair.org



scientific **data**

Explore content ⌄ About the journal ⌄ Publish with us ⌄

nature › scientific data › comment › article

Open Access | Published: 15 March 2016

The FAIR Guiding Principles for scientific data management and stewardship

Mark D. Wilkinson, Michel Dumontier, … Barend Mons + Show authors

Scientific Data 3, Article number: 160018 (2016) | Cite this article

474k Accesses | **4409** Citations | **2001** Altmetric | Metrics

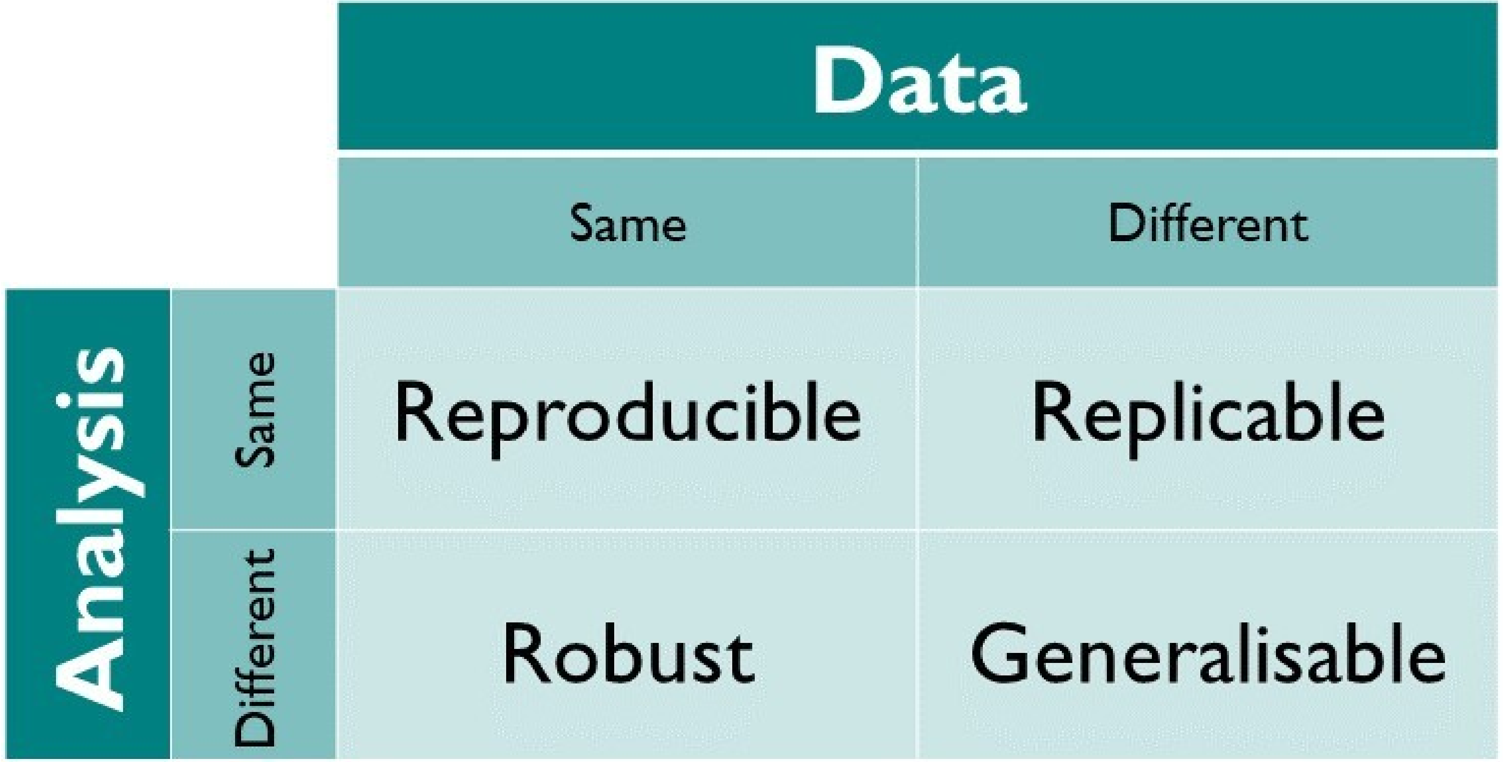
An Addendum to this article was published on 19 March 2019

Reproducibility

The foundation of the scientific experiment

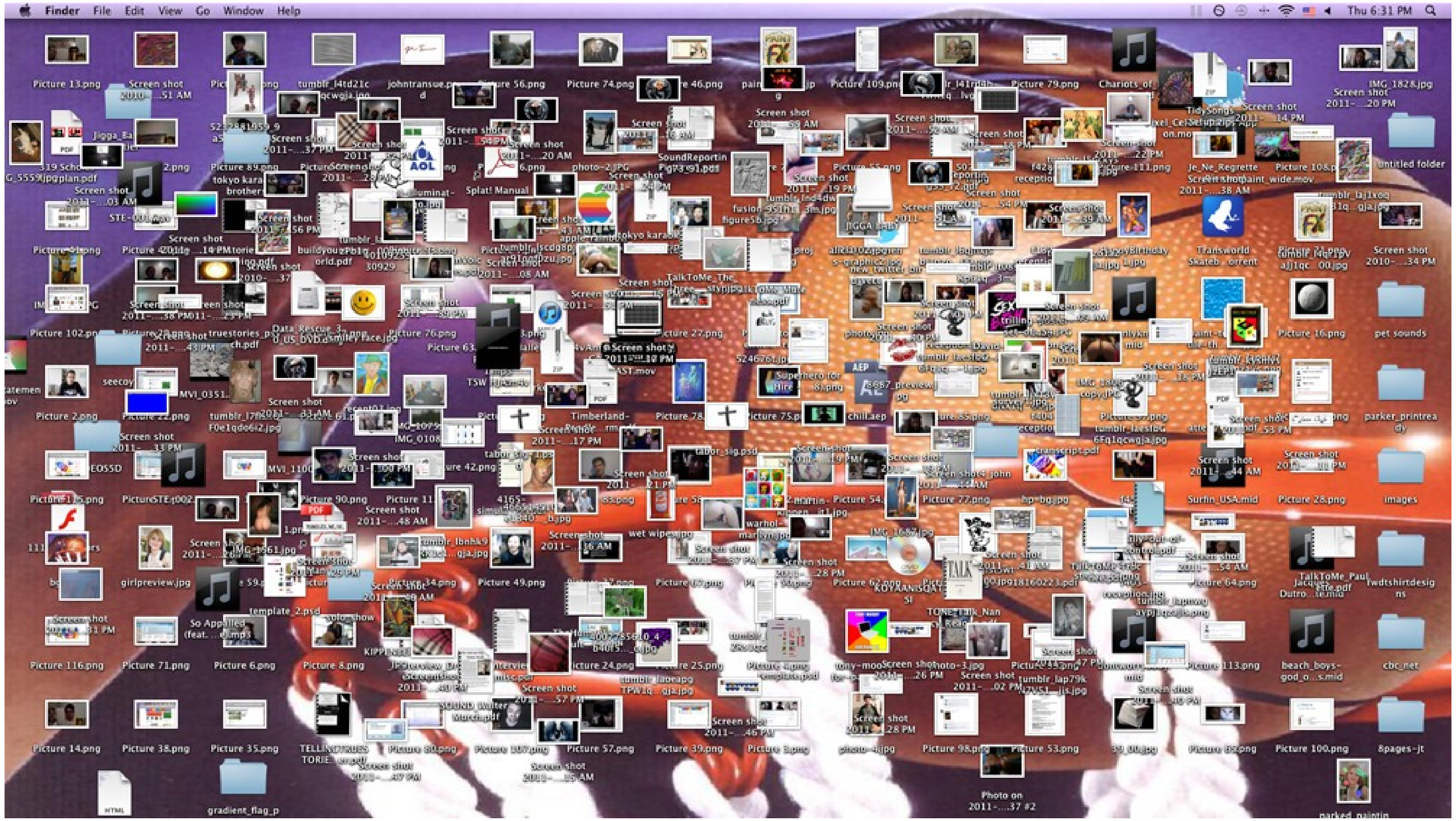
- Can you reproduce the exact results that you acquired 5 years ago?
- If you cannot reproduce what you have done, how can other people?

Source: The Turing Way: https://the-turing-way.netlify.app/



		Data	
		Same	Different
Analysis	Same	Reproducible	Replicable
	Different	Robust	Generalisable

Avoid this at all costs…



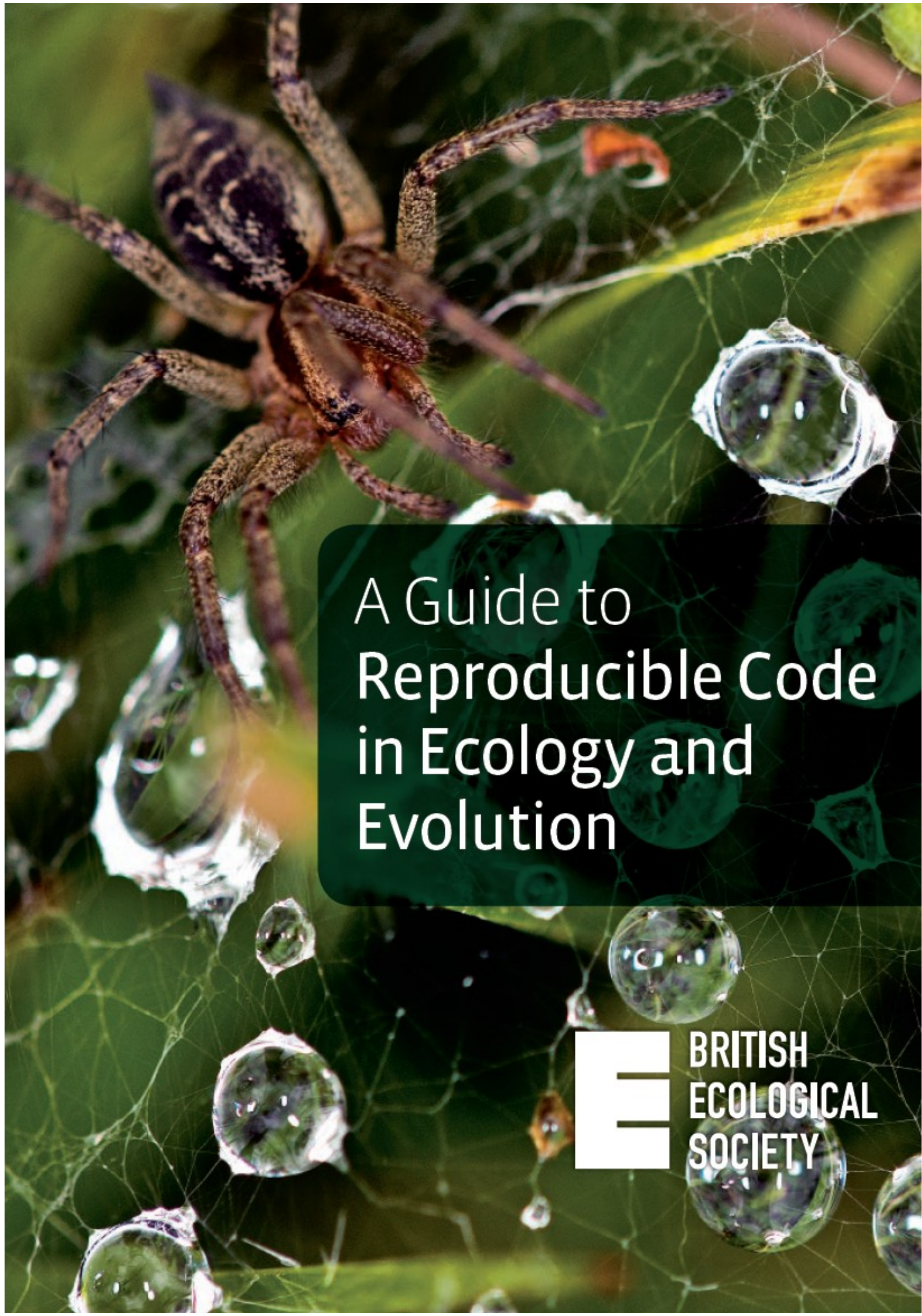
Do not keep things on your desktop!

Overall file management

Suggestions

- Keep all your stuff together (separate partition!)
- Logical hierarchy
- Make it portable (Windows!)
- Regularly spend time on organizing and cleaning files
- Naming and grouping: self-explanatory – make it for somebody else (you!)
- Try to avoid spaces in paths
- Cloud backups!

Reproducibility is your main goal!

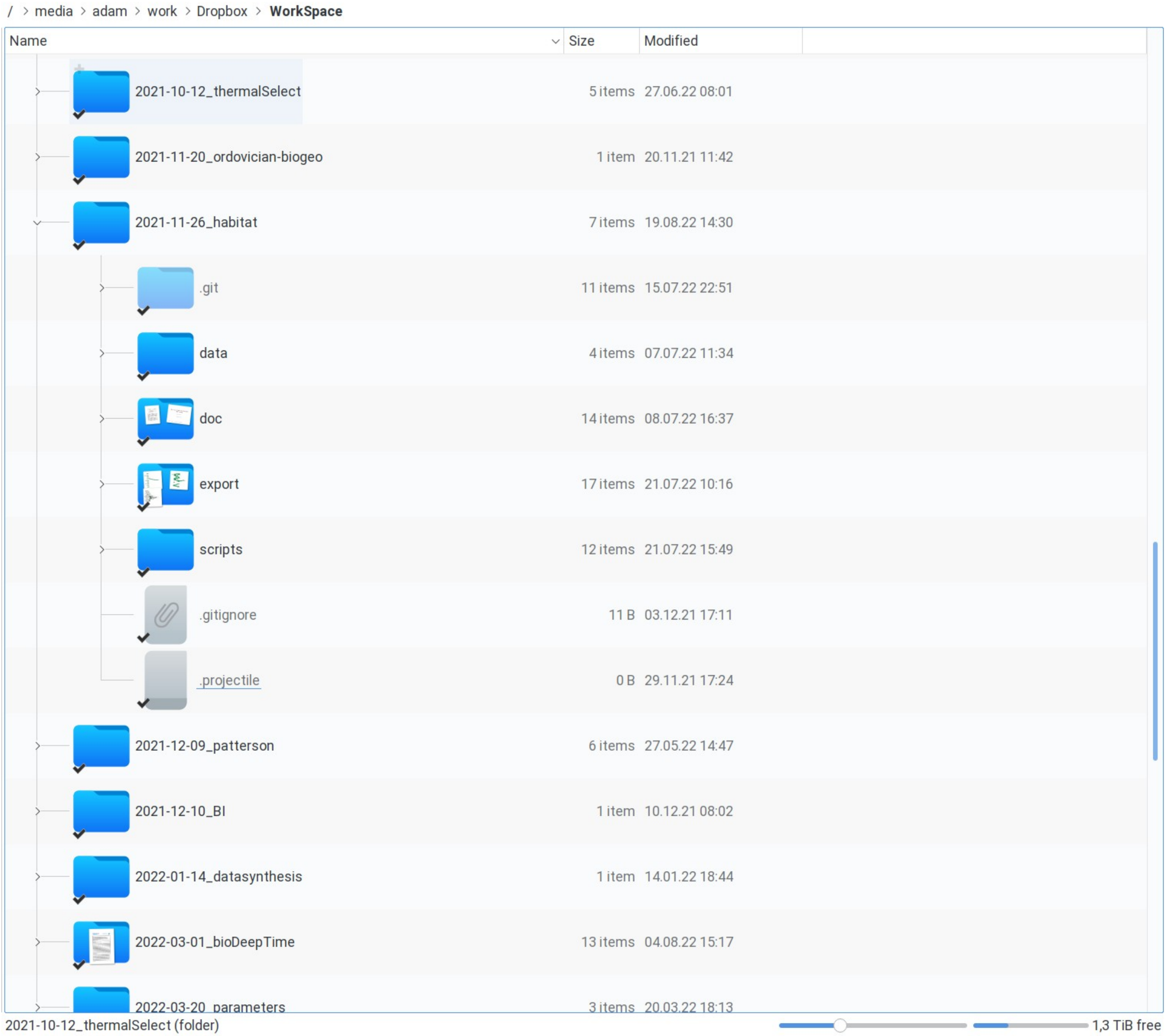


Suggestions

Keep all your projects separate!

Use the same project structure:

- Input Data (data)
- Computer code (code/scripts)
- Written documents (doc)
- Calculation output (export/output)



/ › media › adam › work › Dropbox › **WorkSpace**

Name	Size	Modified
2021-10-12_thermalSelect	5 items	27.06.22 08:01
2021-11-20_ordovician-biogeo	1 item	20.11.21 11:42
2021-11-26_habitat	7 items	19.08.22 14:30
.git	11 items	15.07.22 22:51
data	4 items	07.07.22 11:34
doc	14 items	08.07.22 16:37
export	17 items	21.07.22 10:16
scripts	12 items	21.07.22 15:49
.gitignore	11 B	03.12.21 17:11
.projectile	0 B	29.11.21 17:24
2021-12-09_patterson	6 items	27.05.22 14:47
2021-12-10_BI	1 item	10.12.21 08:02
2022-01-14_datasynthesis	1 item	14.01.22 18:44
2022-03-01_bioDeepTime	13 items	04.08.22 15:17
2022-03-20_parameters	3 items	20.03.22 18:13

2021-10-12_thermalSelect (folder)

1,3 TiB free

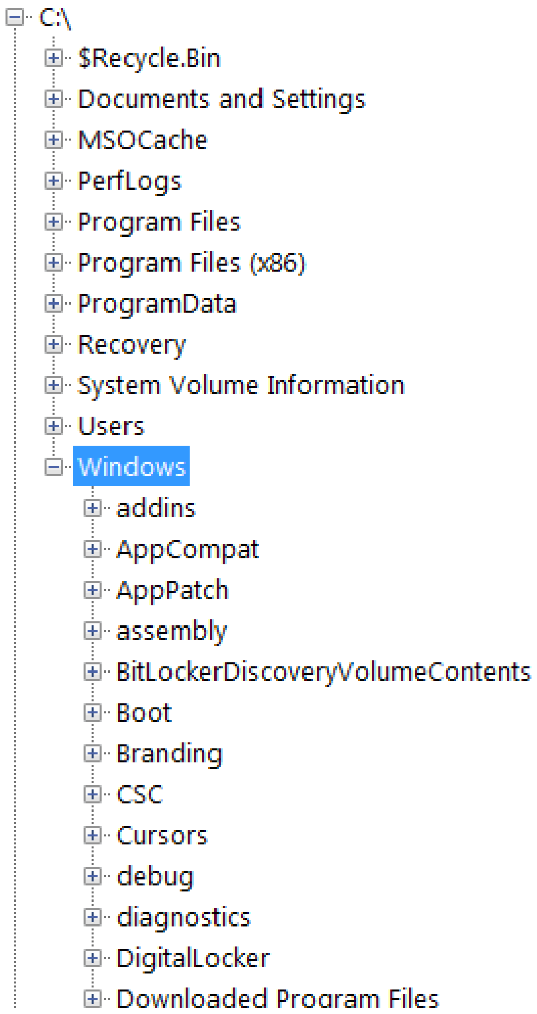
About files…

The Windows file system

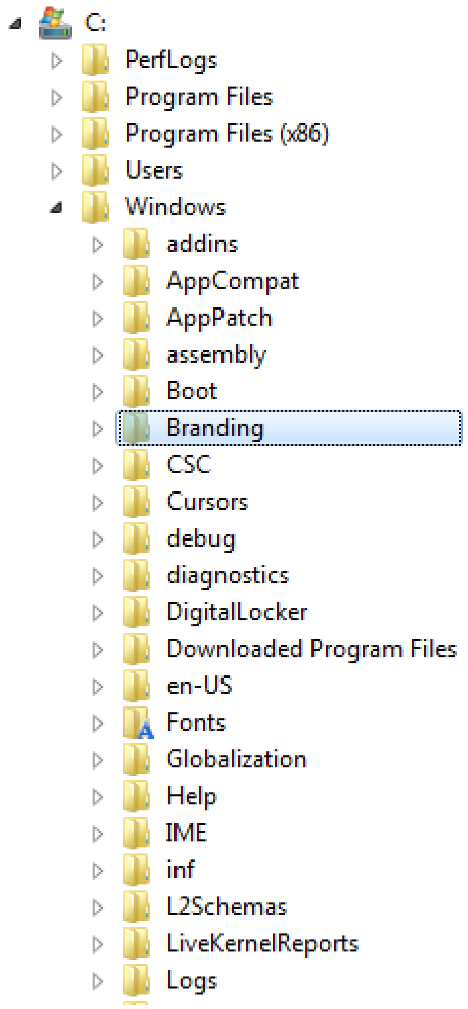
- Files are data items on storage devices
- Paths use the characteristic backslash \ character to depict nestedness
- Directories are called “Folders”
- File format: filename.ext
- Total path to “Branding”:

```
C:\Windows\Branding
```

- Case insensitive!



- C:\
  - $Recycle.Bin
  - Documents and Settings
  - MSOCache
  - PerfLogs
  - Program Files
  - Program Files (x86)
  - ProgramData
  - Recovery
  - System Volume Information
  - Users
  - Windows
    - addins
    - AppCompat
    - AppPatch
    - assembly
    - BitLockerDiscoveryVolumeContents
    - Boot
    - Branding
    - CSC
    - Cursors
    - debug
    - diagnostics
    - DigitalLocker
    - Downloaded Program Files



- C:
  - PerfLogs
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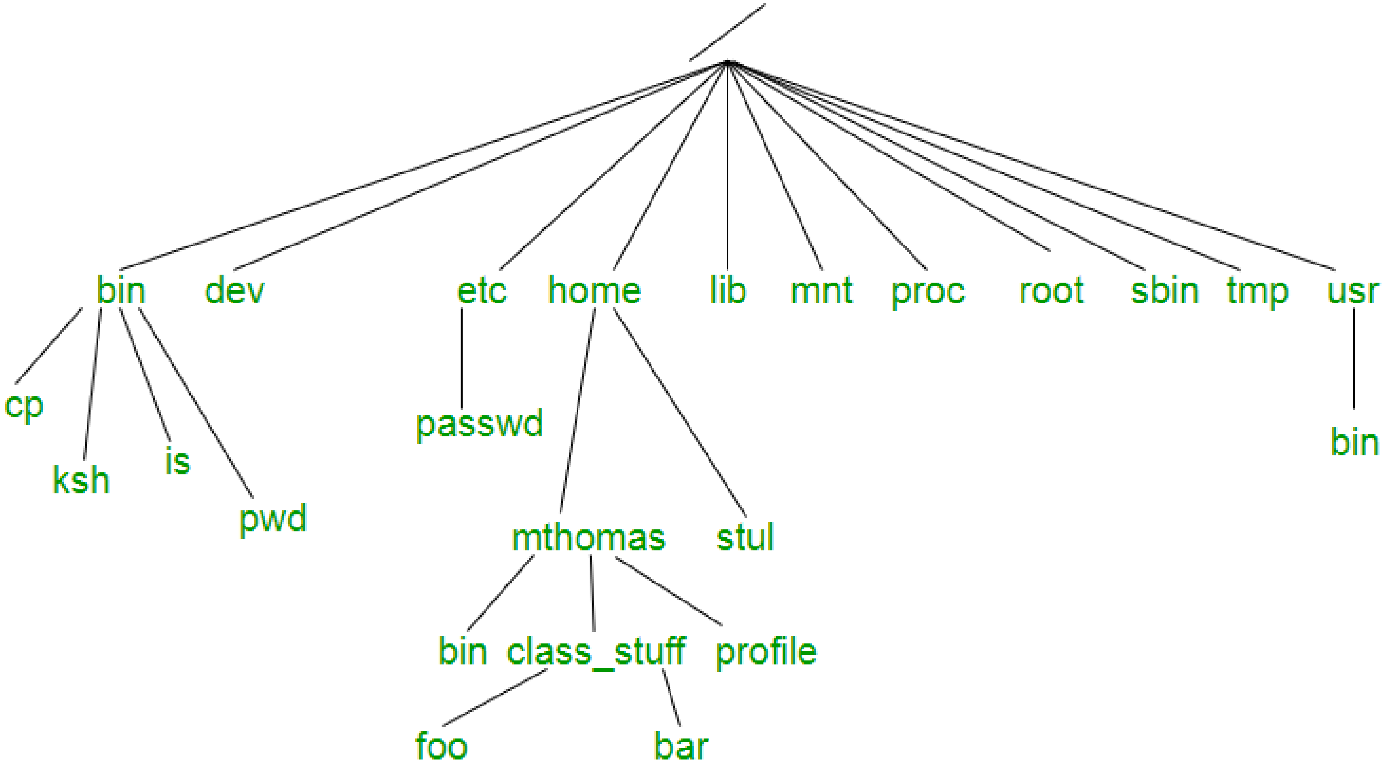
    - diagnostics
    - DigitalLocker
    - Downloaded Program Files
    - en-US
    - Fonts
    - Globalization
    - Help
    - IME
    - inf
    - L2Schemas
    - LiveKernelReports
    - Logs

The UNIX file system

- Shared for UNIX and UNIX-like systems (GNU/Linux, macOS, Android)
- Concept: everything in the computer is represented by a file
- Nestedness coded with forward slash : /
- File format can be anything
- Complete path to “bar”

```
/home/mthomas/class_stuff/bar
```

- Case sensitive!



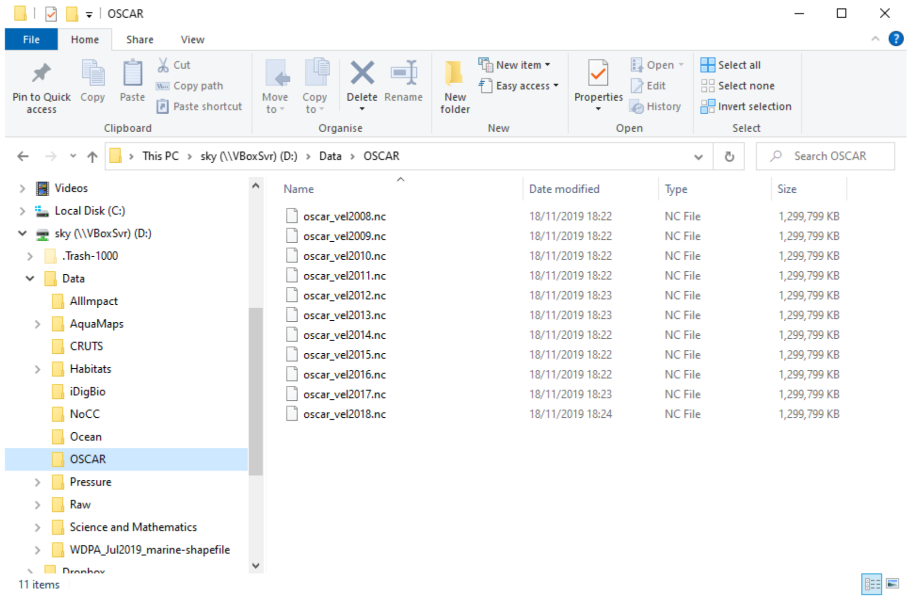
Two main options:

Graphical User Interface (GUI)

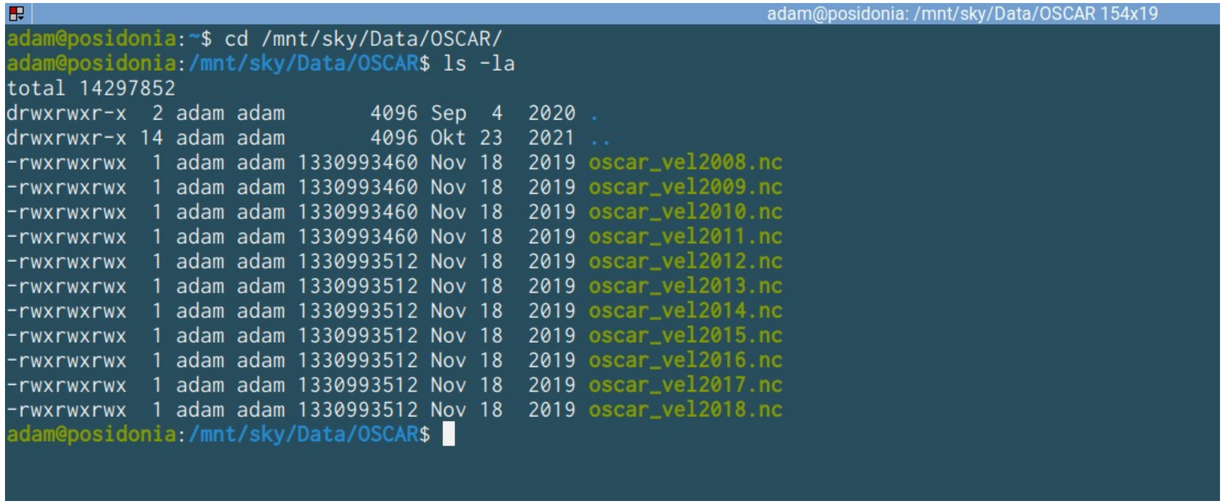
- Super simple + mouse
- Visually appealing
- “Novice-friendly”

Command Line Interpreter (CLI)

- Steeper learning curve
- Automation
- Keyboard-only “Expert-friendly”



Name	Date modified	Type	Size
oscar_vel2008.nc	18/11/2019 18:22	NC File	1,299,799 KB
oscar_vel2009.nc	18/11/2019 18:22	NC File	1,299,799 KB
oscar_vel2010.nc	18/11/2019 18:22	NC File	1,299,799 KB
oscar_vel2011.nc	18/11/2019 18:22	NC File	1,299,799 KB
oscar_vel2012.nc	18/11/2019 18:23	NC File	1,299,799 KB
oscar_vel2013.nc	18/11/2019 18:23	NC File	1,299,799 KB
oscar_vel2014.nc	18/11/2019 18:22	NC File	1,299,799 KB
oscar_vel2015.nc	18/11/2019 18:22	NC File	1,299,799 KB
oscar_vel2016.nc	18/11/2019 18:22	NC File	1,299,799 KB
oscar_vel2017.nc	18/11/2019 18:23	NC File	1,299,799 KB
oscar_vel2018.nc	18/11/2019 18:24	NC File	1,299,799 KB

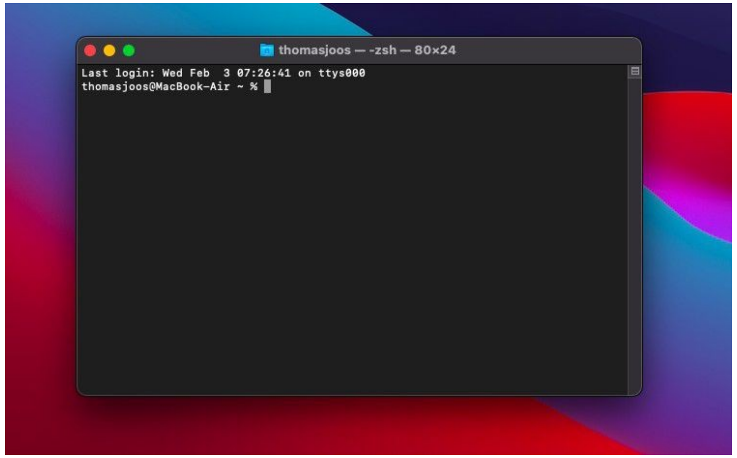


```
adam@posidonia:~$ cd /mnt/sky/Data/OSCAR/
adam@posidonia:/mnt/sky/Data/OSCAR$ ls -la
total 14297852
drwxrwxr-x  2 adam adam       4096 Sep  4  2020 .
drwxrwxr-x 14 adam adam       4096 Okt 23  2021 ..
-rwxrwxrwx  1 adam adam 1330993460 Nov 18  2019 oscar_vel2008.nc
-rwxrwxrwx  1 adam adam 1330993460 Nov 18  2019 oscar_vel2009.nc
-rwxrwxrwx  1 adam adam 1330993460 Nov 18  2019 oscar_vel2010.nc
-rwxrwxrwx  1 adam adam 1330993460 Nov 18  2019 oscar_vel2011.nc
-rwxrwxrwx  1 adam adam 1330993512 Nov 18  2019 oscar_vel2012.nc
-rwxrwxrwx  1 adam adam 1330993512 Nov 18  2019 oscar_vel2013.nc
-rwxrwxrwx  1 adam adam 1330993512 Nov 18  2019 oscar_vel2014.nc
-rwxrwxrwx  1 adam adam 1330993512 Nov 18  2019 oscar_vel2015.nc
-rwxrwxrwx  1 adam adam 1330993512 Nov 18  2019 oscar_vel2016.nc
-rwxrwxrwx  1 adam adam 1330993512 Nov 18  2019 oscar_vel2017.nc
-rwxrwxrwx  1 adam adam 1330993512 Nov 18  2019 oscar_vel2018.nc
adam@posidonia:/mnt/sky/Data/OSCAR$ 
```

Terminal emulators

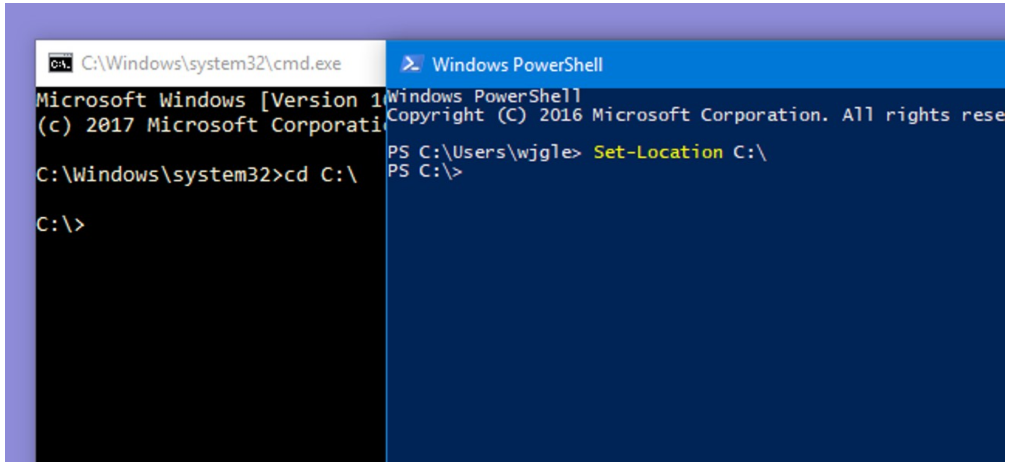
- Every OS has one
- Graphical applications that run a program called the “shell”: an interpreter program that translates instructions
- Console applications can be run with the shell
  - Automation
  - Program building
  - Scientific calculations
- Shells are programmable

Mac (zsh or bash)



```
Last login: Wed Feb  3 07:26:41 on ttys000
thomasjoos@MacBook-Air ~ % 
```

Windows (cmd and powershell)



```
Microsoft Windows [Version 1
(c) 2017 Microsoft Corporati

C:\Windows\system32>cd C:\

C:\>
```

```
Windows PowerShell
Copyright (C) 2016 Microsoft Corporation. All rights rese

PS C:\Users\wjgle> Set-Location C:\
PS C:\>
```

The BASH shell

- Ubiquitous
- Most frequently used on servers and clusters
- UNIX-native: most programming systems use UNIX-like paths – even on Windows!
- Mac: have it, z shell (zsh) is almost the same
- Windows: a simplified version is available with git (git bash)

https://git-scm.com

Installing git for Windows

and GitHub

BASH essentials

Most important functions and browsing directories

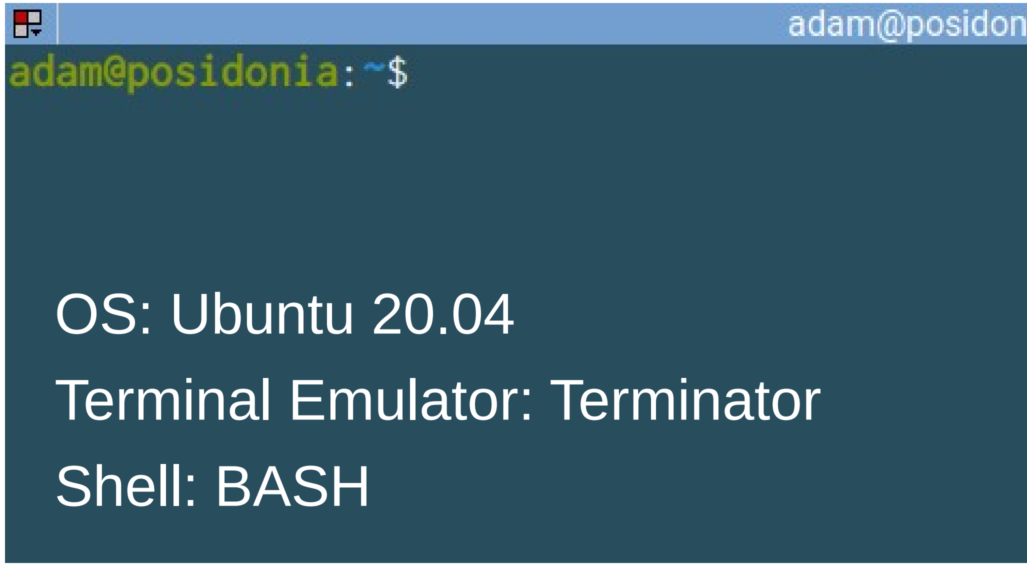
The prompt

- User input expected (typing)
- Looks different on all, but there are conventions:

`user@host`

~: is shorthand for user home

$: means normal user mode

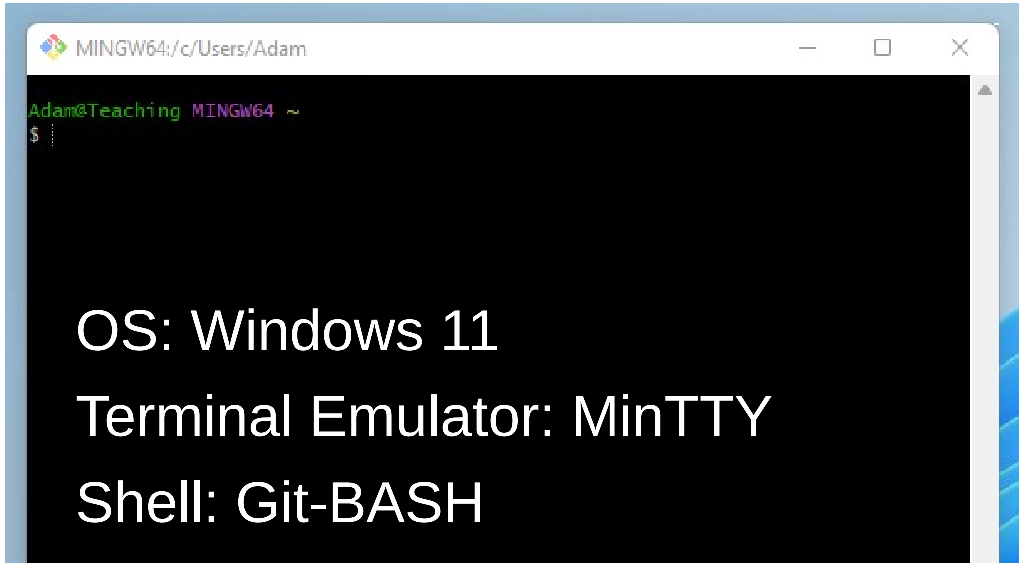


```
adam@posidonia:~$
```

OS: Ubuntu 20.04

Terminal Emulator: Terminator

Shell: BASH



```
Adam@Teaching MINGW64 ~
$
```

OS: Windows 11

Terminal Emulator: MinTTY

Shell: Git-BASH

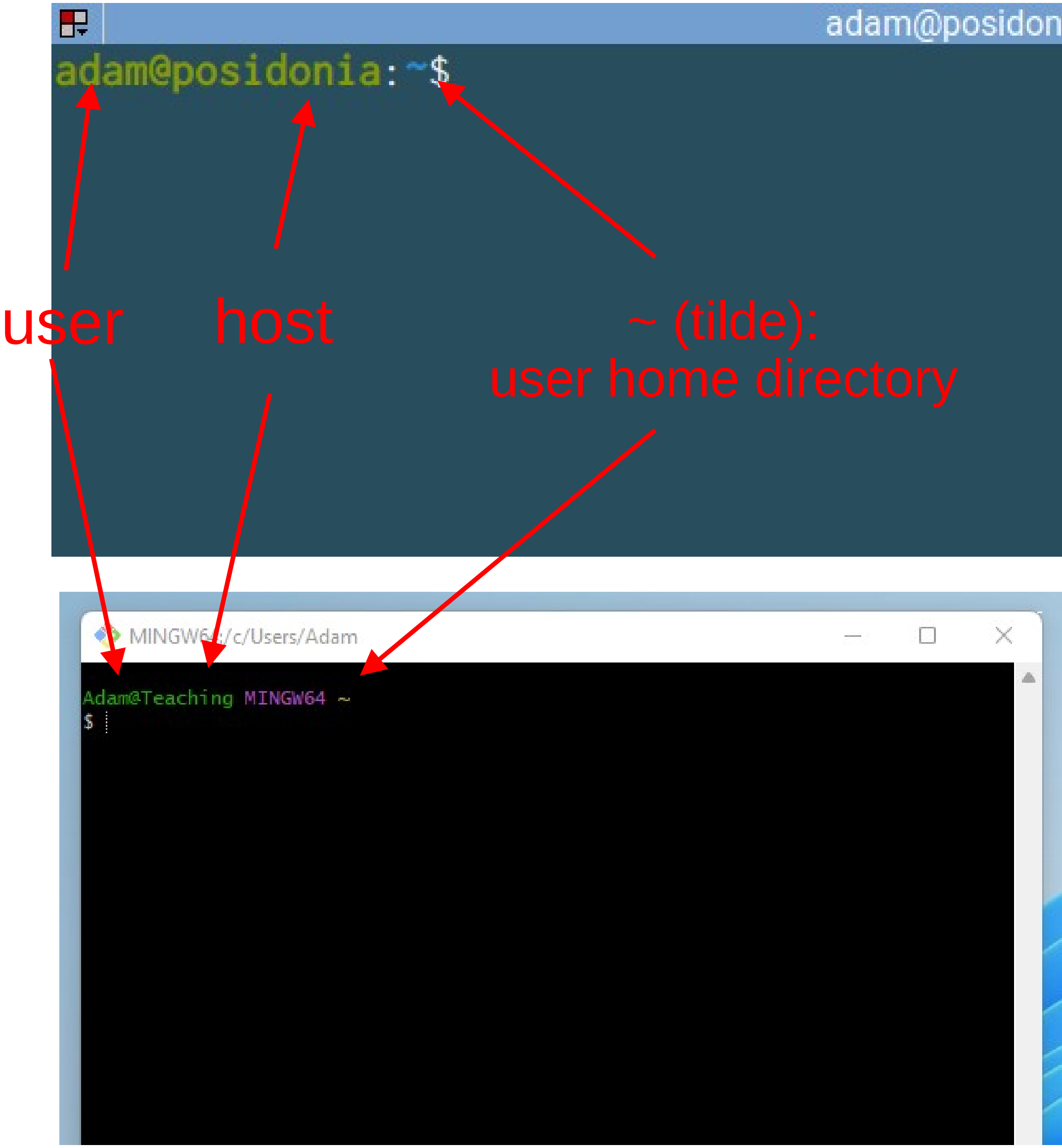
The prompt

- User input expected (typing)
- Looks different on all, but there are conventions:

`user@host`

~: is shorthand for user home

$: means normal user mode



```
adam@posidonia:~$
```

user

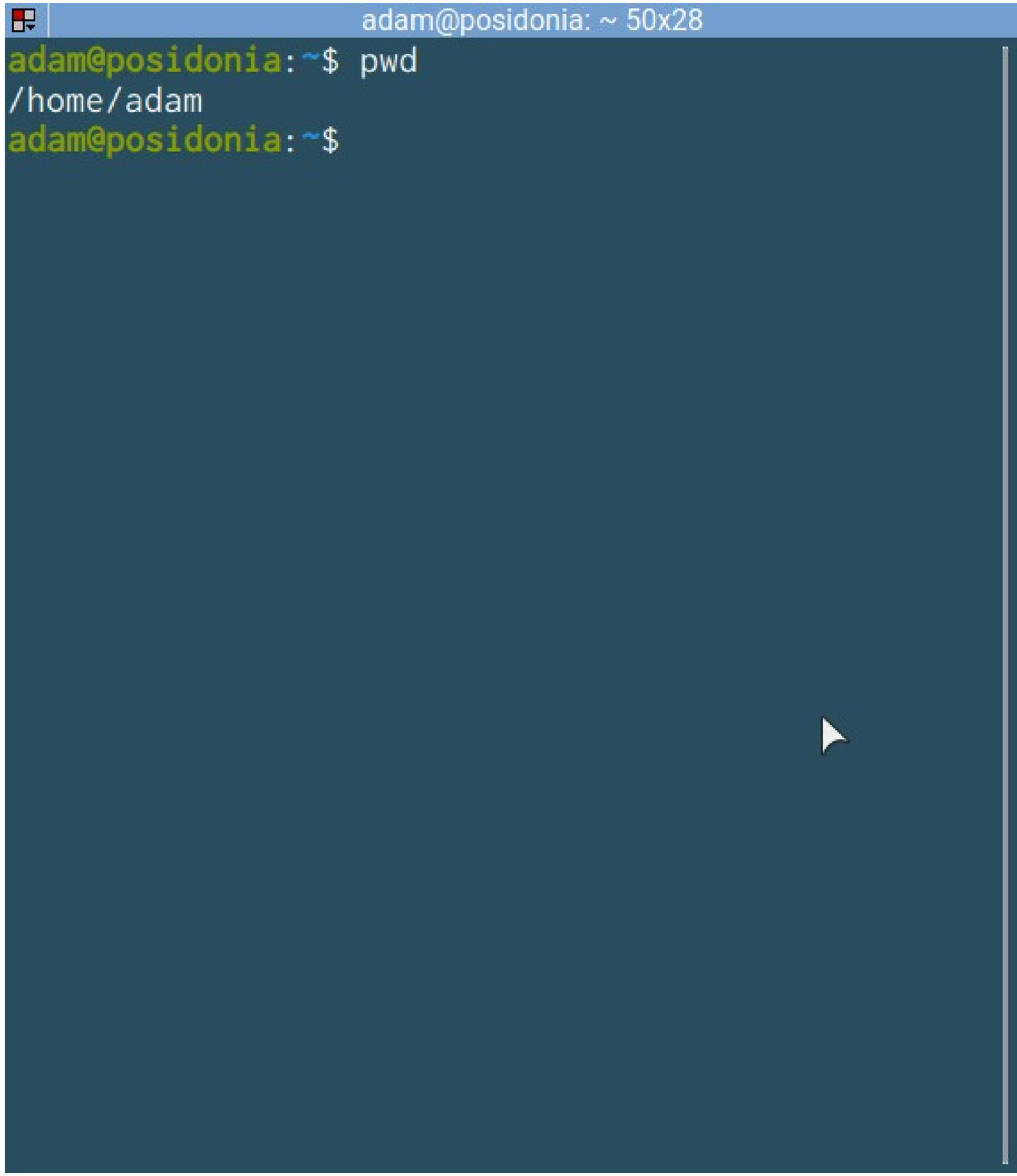
host

~ (tilde):
user home directory

```
Adam@Teaching MINGW64 ~
$
```

pwd

Return path to current directory



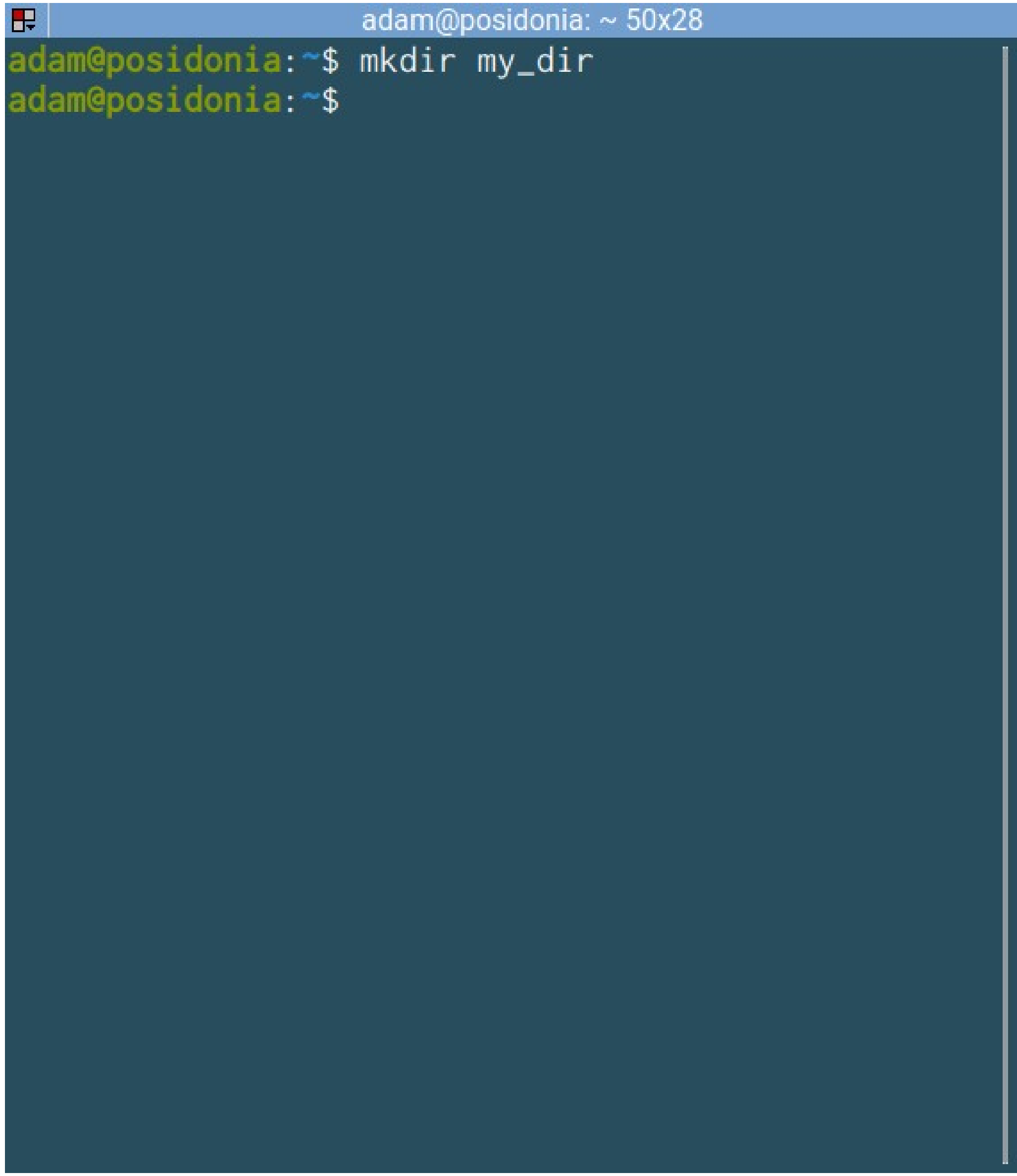
```
adam@posidonia:~$ pwd
/home/adam
adam@posidonia:~$
```

`mkdir␣<name>`

space

Create a directory

- No output to the console: no error occurred (directory was created)

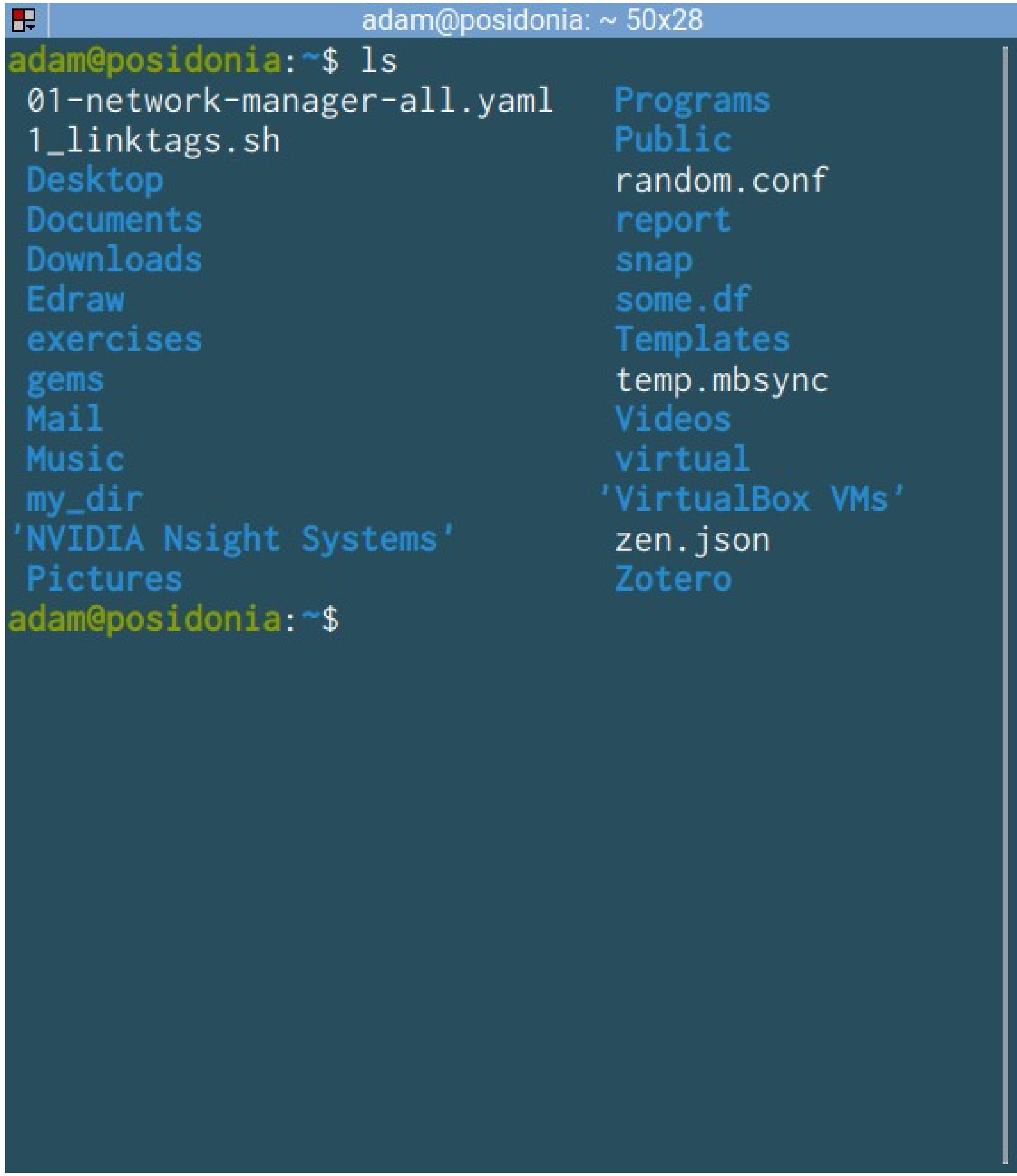


```
adam@posidonia:~$ mkdir my_dir
adam@posidonia:~$
```

ls

List directory contents

- Returns a list of entries (both normal files and directories) – can be colored
- Note the quotes around entries with spaces in them!

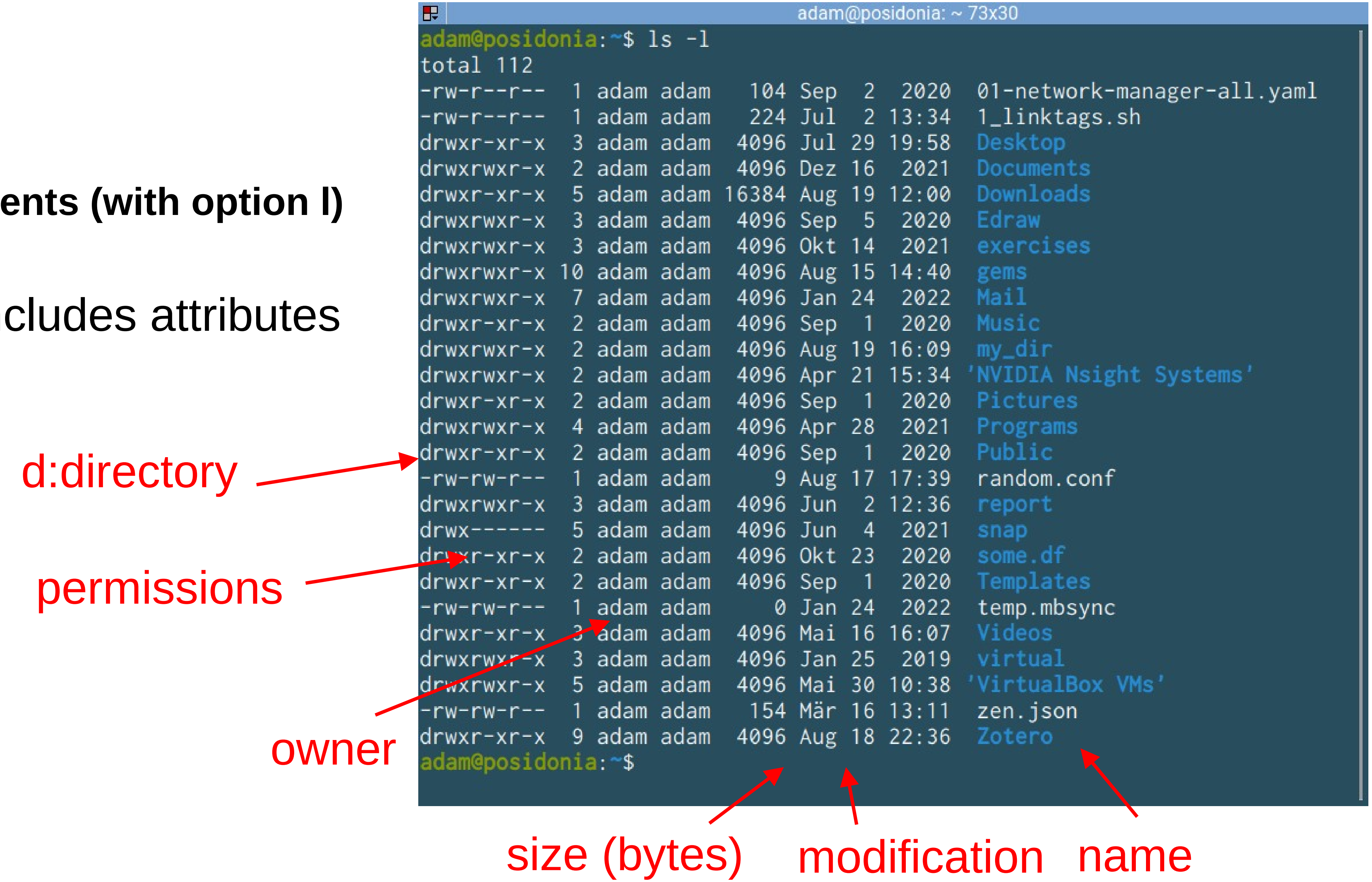


```
adam@posidonia:~$ ls
 01-network-manager-all.yaml   Programs
 1_linktags.sh                 Public
 Desktop                       random.conf
 Documents                     report
 Downloads                     snap
 Edraw                         some.df
 exercises                     Templates
 gems                          temp.mbsync
 Mail                          Videos
 Music                         virtual
 my_dir                       'VirtualBox VMs'
'NVIDIA Nsight Systems'        zen.json
 Pictures                      Zotero
adam@posidonia:~$
```

ls␣-l

List directory contents (with option l)

- Long output, includes attributes



adam@posidonia: ~ 73x30

```
adam@posidonia:~$ ls -l
total 112
-rw-r--r--  1 adam adam   104 Sep  2  2020  01-network-manager-all.yaml
-rw-r--r--  1 adam adam   224 Jul  2 13:34  1_linktags.sh
drwxr-xr-x  3 adam adam  4096 Jul 29 19:58  Desktop
drwxrwxr-x  2 adam adam  4096 Dez 16  2021  Documents
drwxr-xr-x  5 adam adam 16384 Aug 19 12:00  Downloads
drwxrwxr-x  3 adam adam  4096 Sep  5  2020  Edraw
drwxrwxr-x  3 adam adam  4096 Okt 14  2021  exercises
drwxrwxr-x 10 adam adam  4096 Aug 15 14:40  gems
drwxrwxr-x  7 adam adam  4096 Jan 24  2022  Mail
drwxr-xr-x  2 adam adam  4096 Sep  1  2020  Music
drwxrwxr-x  2 adam adam  4096 Aug 19 16:09  my_dir
drwxrwxr-x  2 adam adam  4096 Apr 21 15:34 'NVIDIA Nsight Systems'
drwxr-xr-x  2 adam adam  4096 Sep  1  2020  Pictures
drwxrwxr-x  4 adam adam  4096 Apr 28  2021  Programs
drwxr-xr-x  2 adam adam  4096 Sep  1  2020  Public
-rw-rw-r--  1 adam adam     9 Aug 17 17:39  random.conf
drwxrwxr-x  3 adam adam  4096 Jun  2 12:36  report
drwx------  5 adam adam  4096 Jun  4  2021  snap
drwxr-xr-x  2 adam adam  4096 Okt 23  2020  some.df
drwxr-xr-x  2 adam adam  4096 Sep  1  2020  Templates
-rw-rw-r--  1 adam adam     0 Jan 24  2022  temp.mbsync
drwxr-xr-x  3 adam adam  4096 Mai 16 16:07  Videos
drwxrwxr-x  3 adam adam  4096 Jan 25  2019  virtual
drwxrwxr-x  5 adam adam  4096 Mai 30 10:38 'VirtualBox VMs'
-rw-rw-r--  1 adam adam   154 Mär 16 13:11  zen.json
drwxr-xr-x  9 adam adam  4096 Aug 18 22:36  Zotero
adam@posidonia:~$
```

d:directory

permissions

owner

size (bytes)

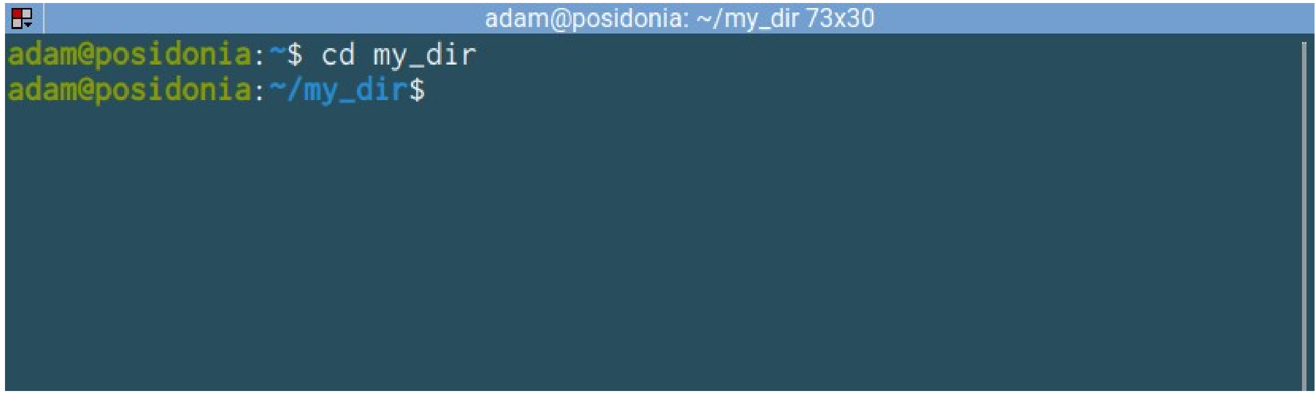
modification

name

cd␣<path_to_directory>

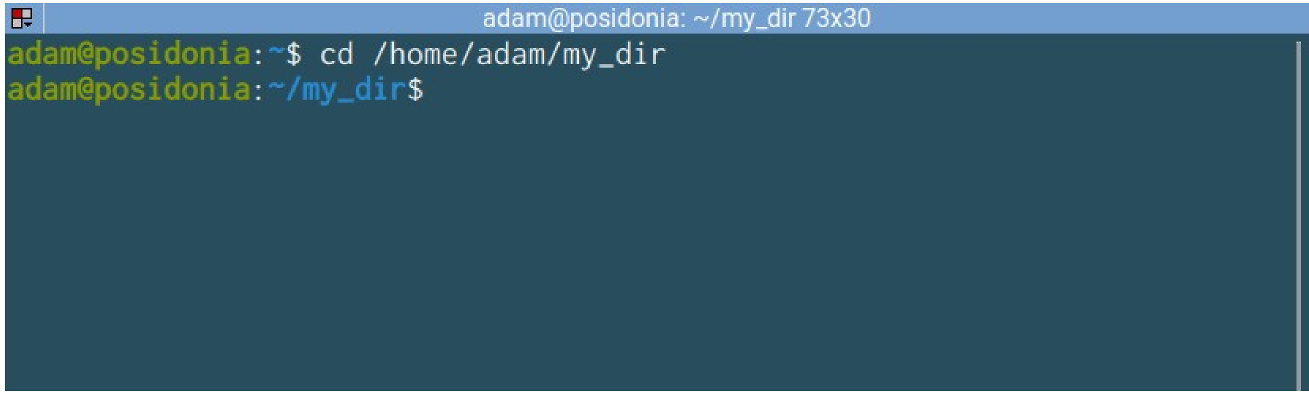
Go to a directory

- Can be relative or absolute!



adam@posidonia: ~/my_dir 73x30

```
adam@posidonia:~$ cd my_dir
adam@posidonia:~/my_dir$
```



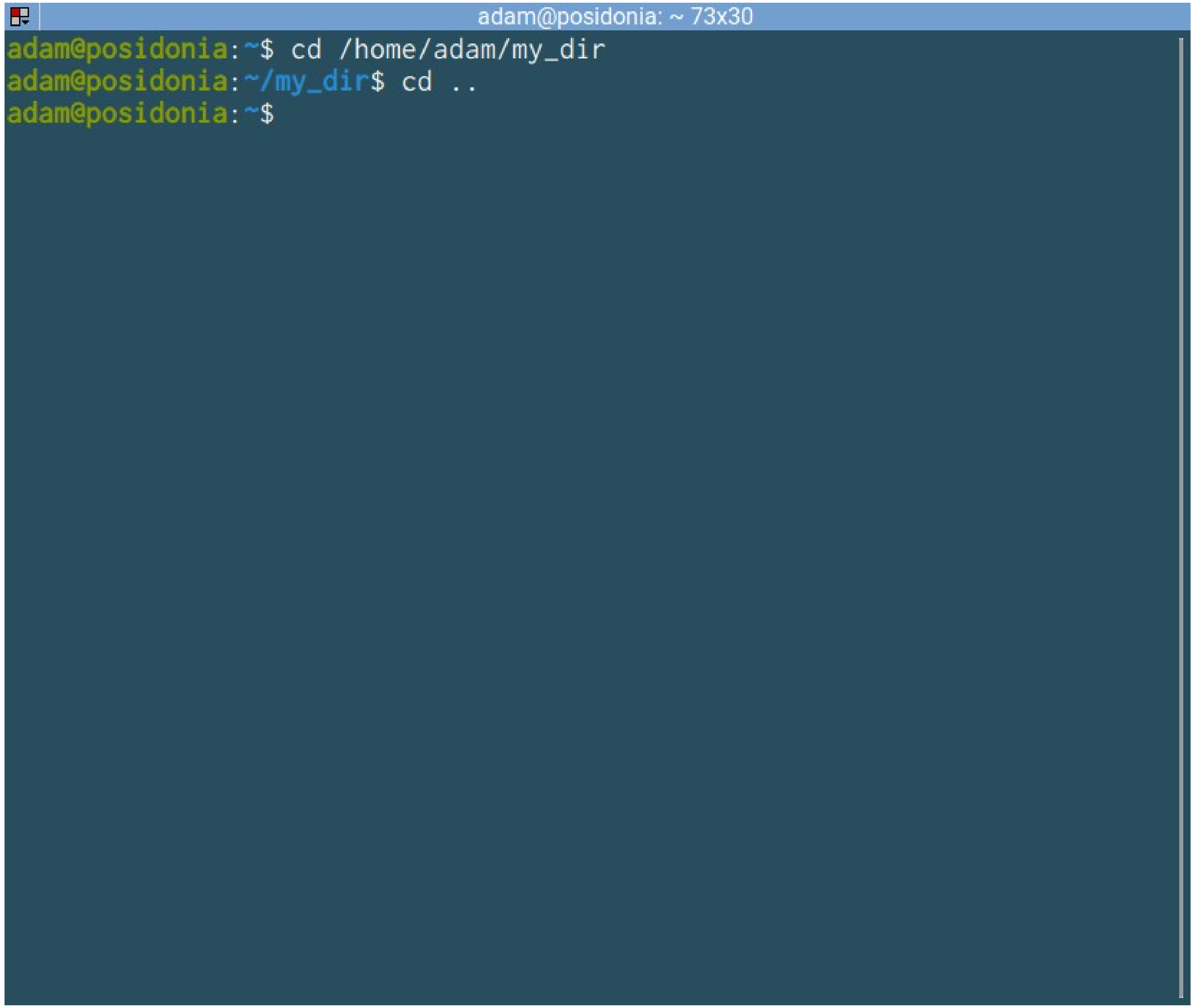
adam@posidonia: ~/my_dir 73x30

```
adam@posidonia:~$ cd /home/adam/my_dir
adam@posidonia:~/my_dir$
```

cd␣..

Go to parent directory

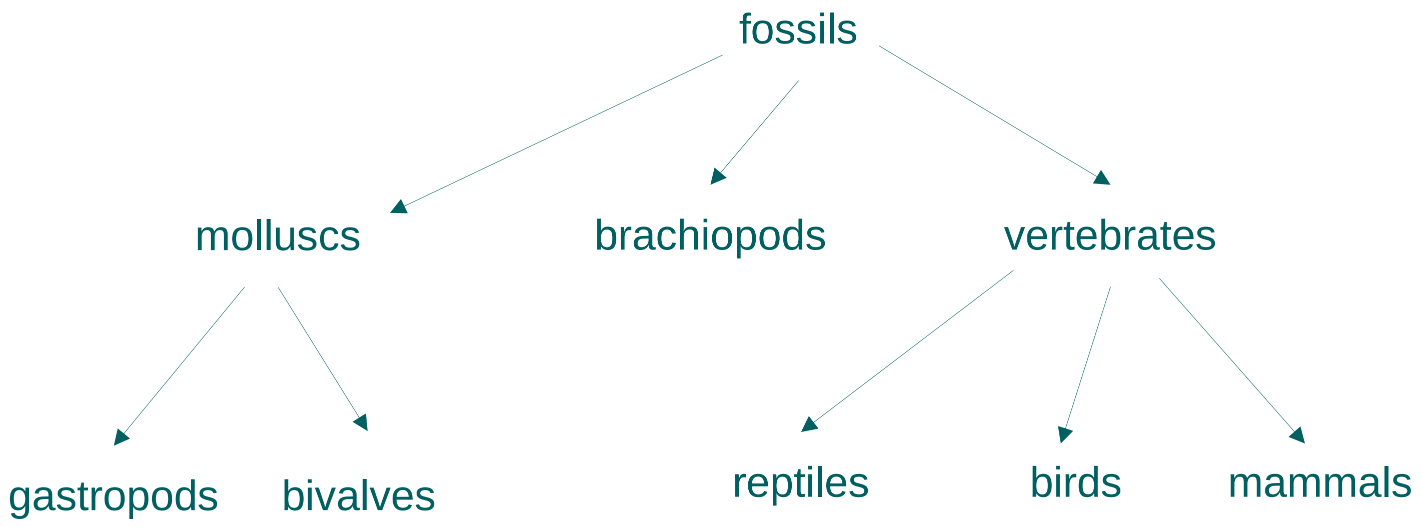
- .. (dot dot) is a placeholder for the parent of the current directory (one up in the hierarchy)



```
adam@posidonia:~$ cd /home/adam/my_dir
adam@posidonia:~/my_dir$ cd ..
adam@posidonia:~$
```

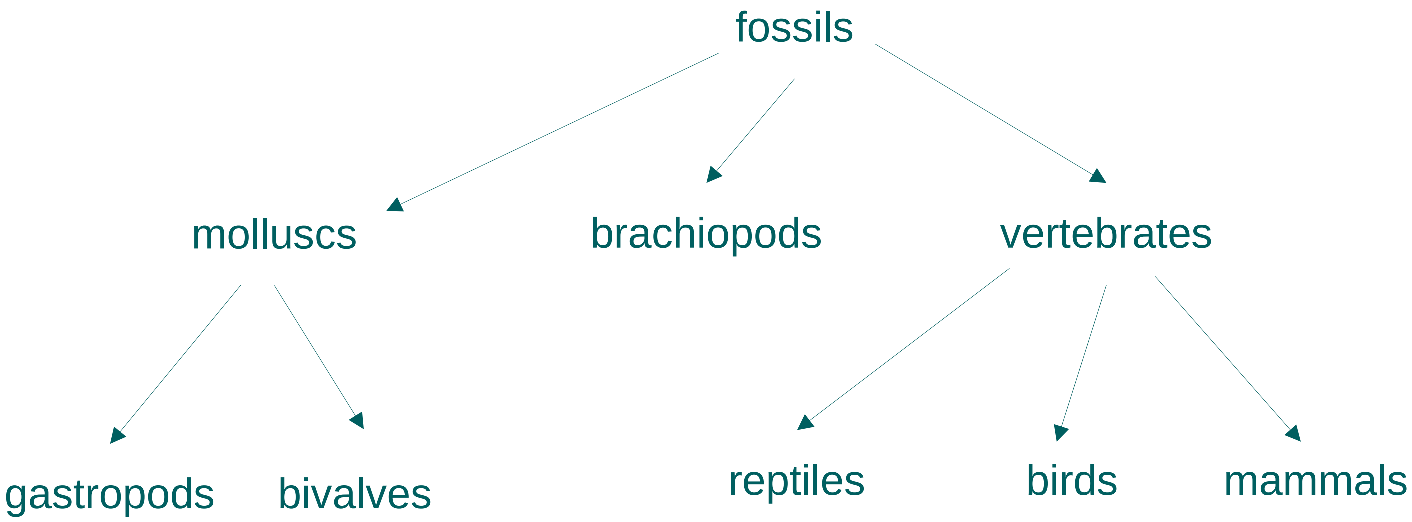
Exercise (5 minutes)

- Create this directory structure using the combinations of the previous commands!



Exercise (5 minutes)

- Create this directory structure using the combinations of the previous commands!



fossils

molluscs

brachiopods

vertebrates

gastropods

bivalves

reptiles

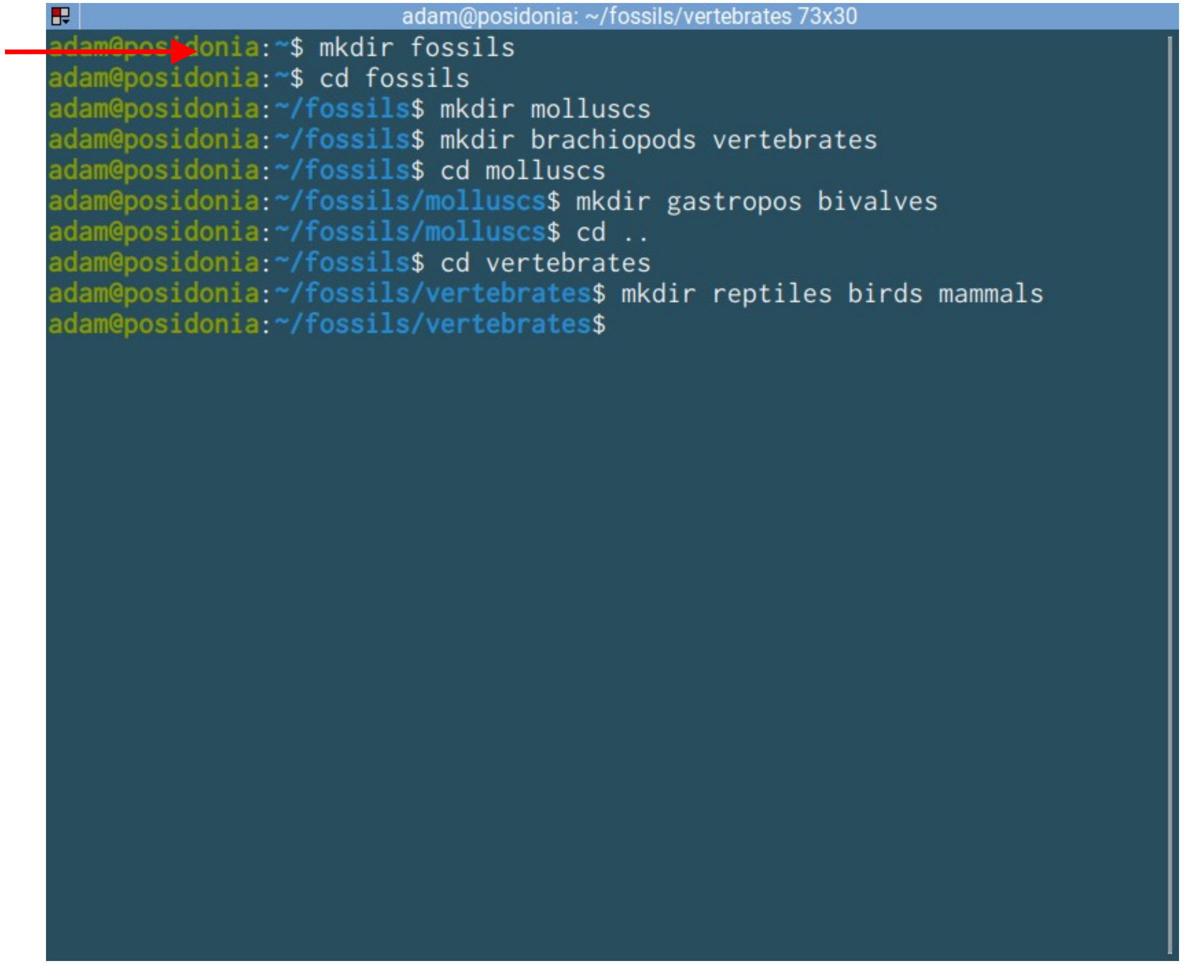
birds

mammals

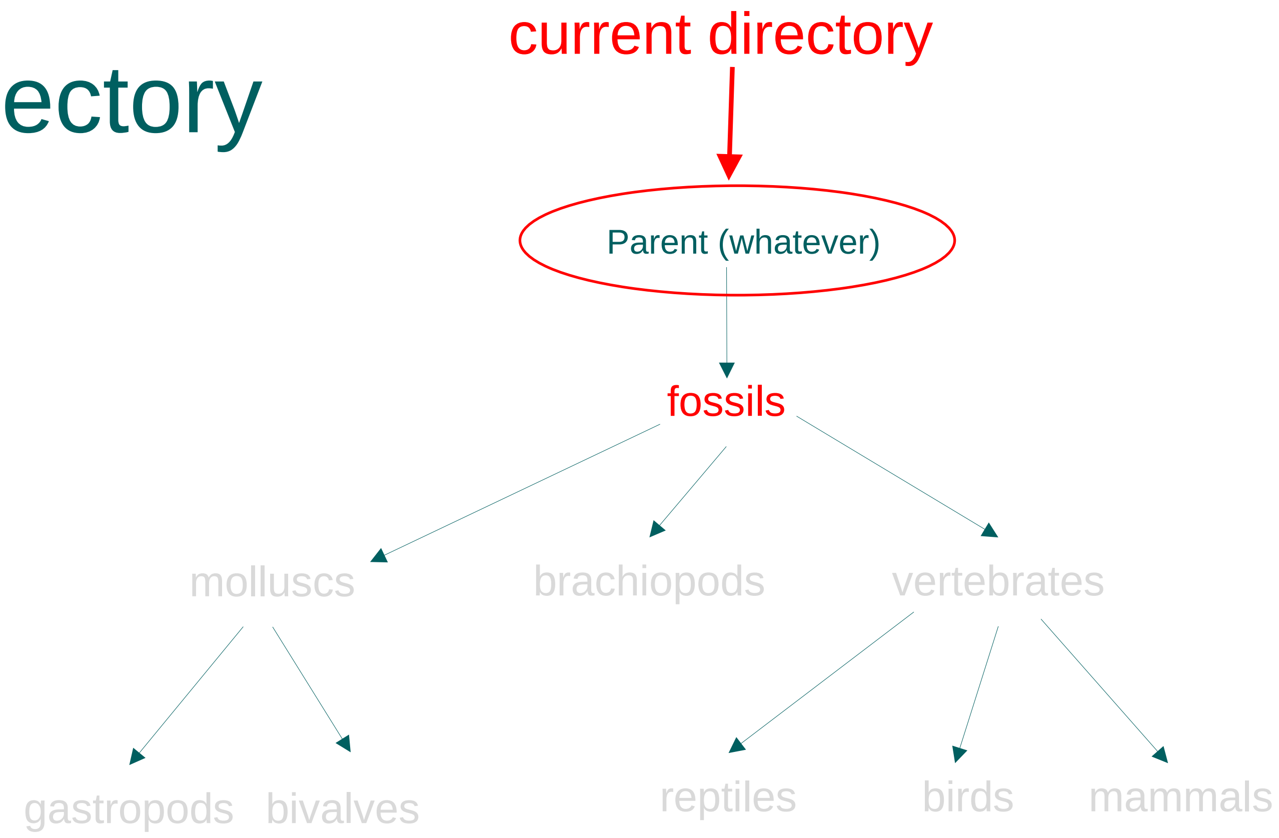
Hints

- use `<TAB>` completion (try `<TAB> <TAB>` to see multiple solutions)
- use `<UP>` and `<DOWN>` to search command history for already given commands

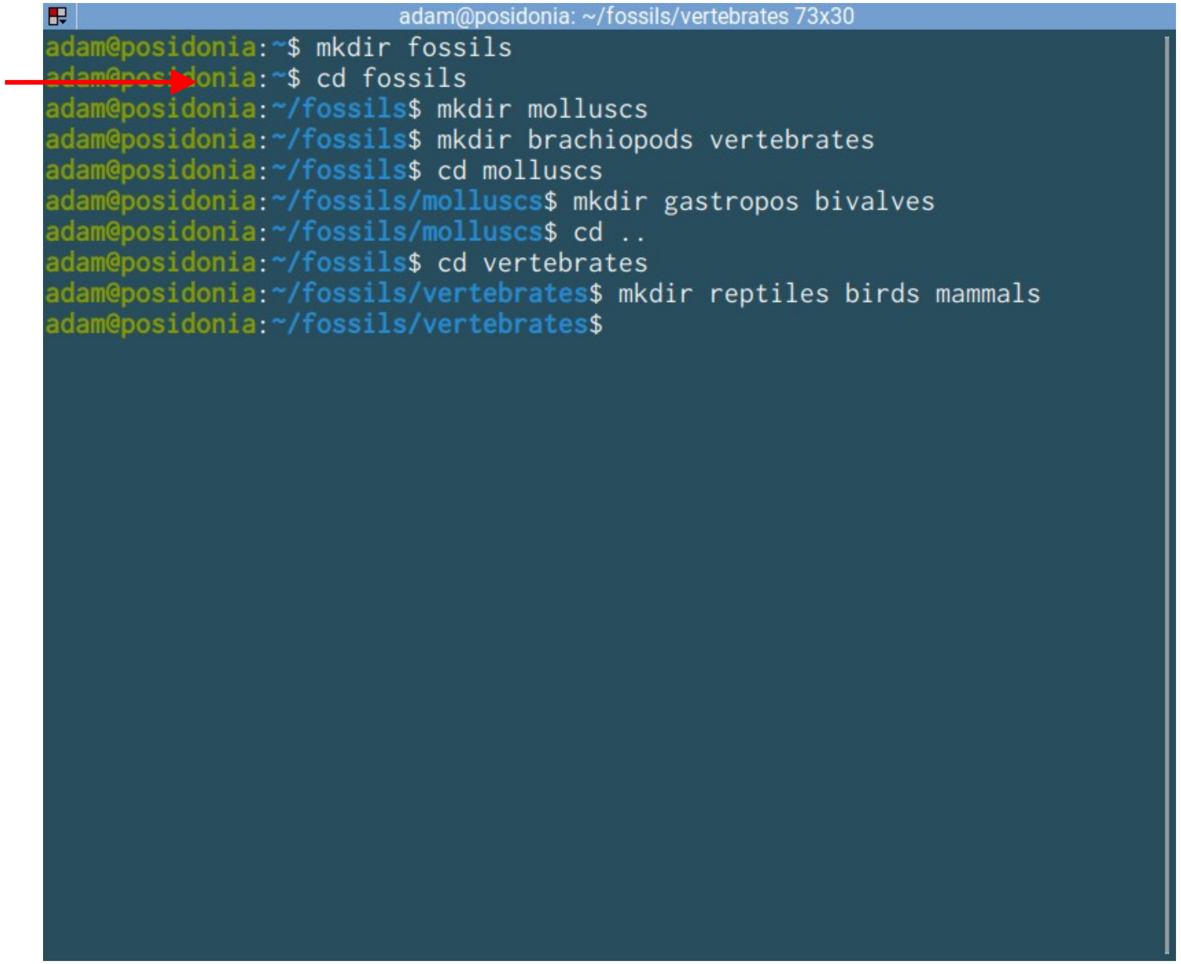
Solution 1 – changing directory



```
adam@posidonia:~$ mkdir fossils
adam@posidonia:~$ cd fossils
adam@posidonia:~/fossils$ mkdir molluscs
adam@posidonia:~/fossils$ mkdir brachiopods vertebrates
adam@posidonia:~/fossils$ cd molluscs
adam@posidonia:~/fossils/molluscs$ mkdir gastropos bivalves
adam@posidonia:~/fossils/molluscs$ cd ..
adam@posidonia:~/fossils$ cd vertebrates
adam@posidonia:~/fossils/vertebrates$ mkdir reptiles birds mammals
adam@posidonia:~/fossils/vertebrates$
```

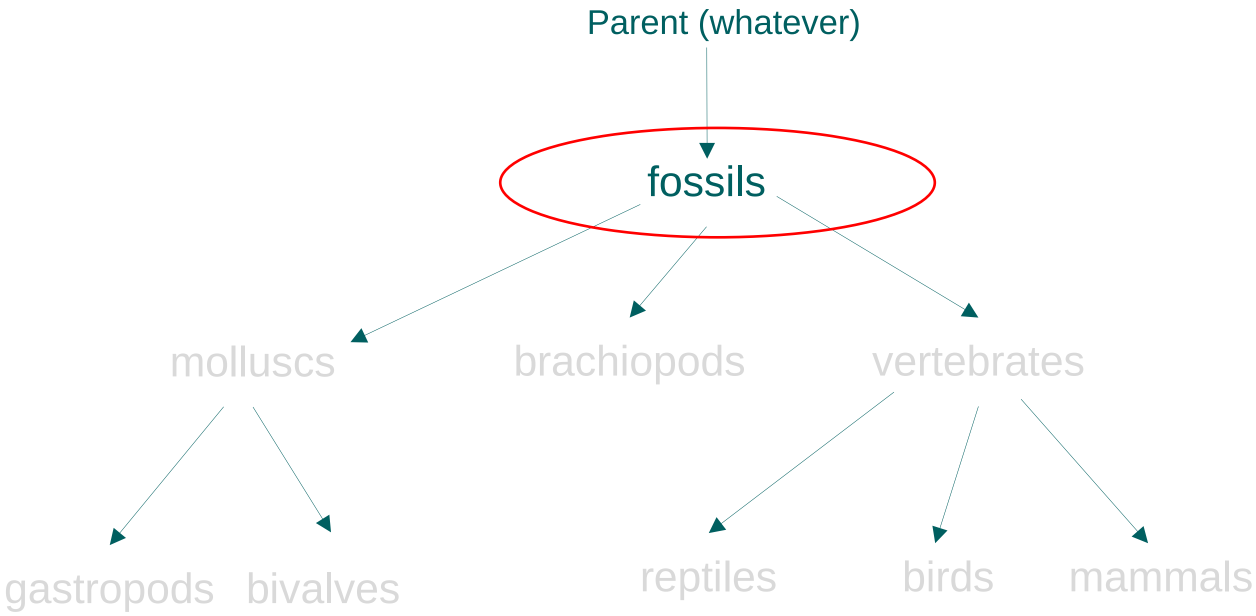


Solution 1 – changing directory



adam@posidonia: ~/fossils/vertebrates 73x30

```
adam@posidonia:~$ mkdir fossils
adam@posidonia:~$ cd fossils
adam@posidonia:~/fossils$ mkdir molluscs
adam@posidonia:~/fossils$ mkdir brachiopods vertebrates
adam@posidonia:~/fossils$ cd molluscs
adam@posidonia:~/fossils/molluscs$ mkdir gastropos bivalves
adam@posidonia:~/fossils/molluscs$ cd ..
adam@posidonia:~/fossils$ cd vertebrates
adam@posidonia:~/fossils/vertebrates$ mkdir reptiles birds mammals
adam@posidonia:~/fossils/vertebrates$
```



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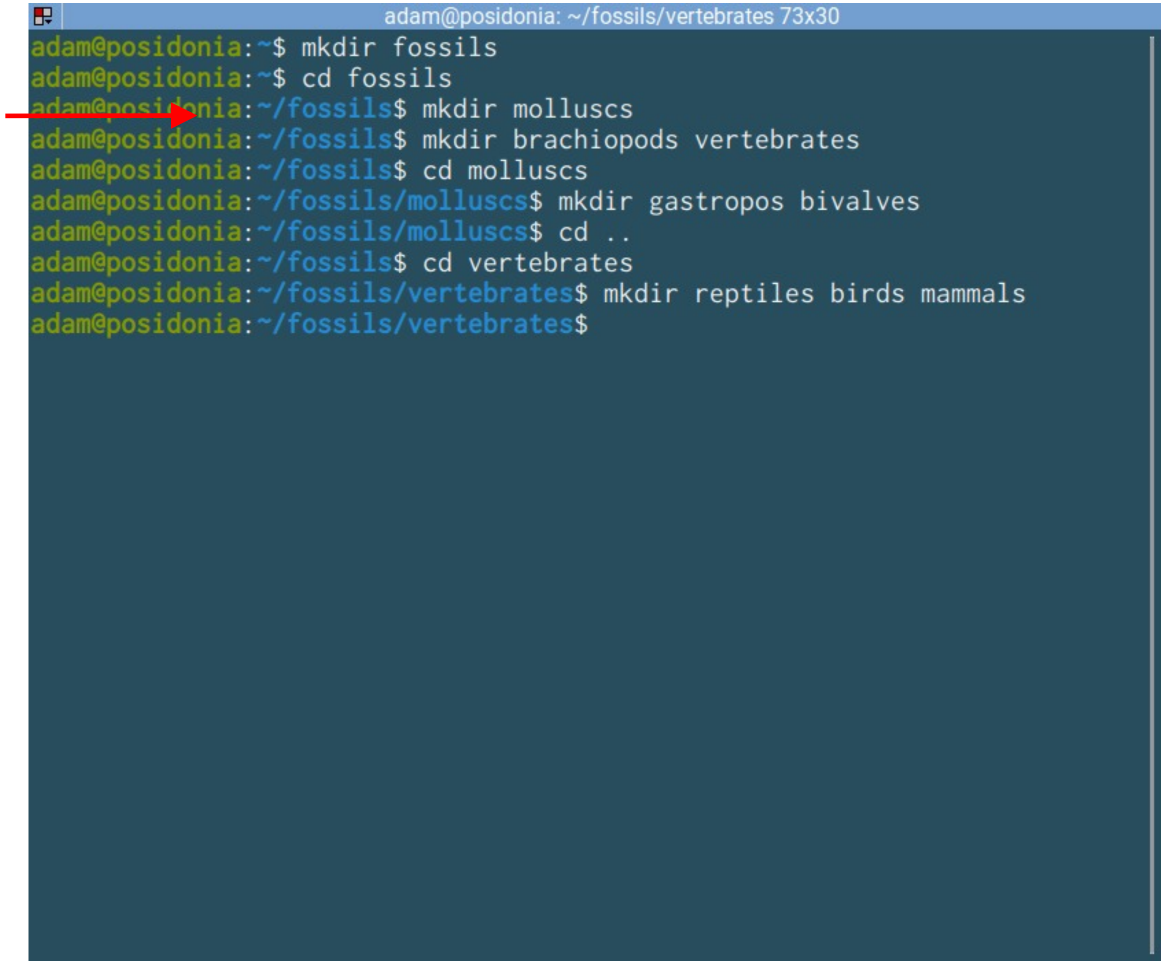

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adam@posidonia:~$ mkdir fossils
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adam@posidonia:~/fossils/molluscs$ mkdir gastropos bivalves
adam@posidonia:~/fossils/molluscs$ cd ..
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adam@posidonia:~/fossils/vertebrates$ mkdir reptiles birds mammals
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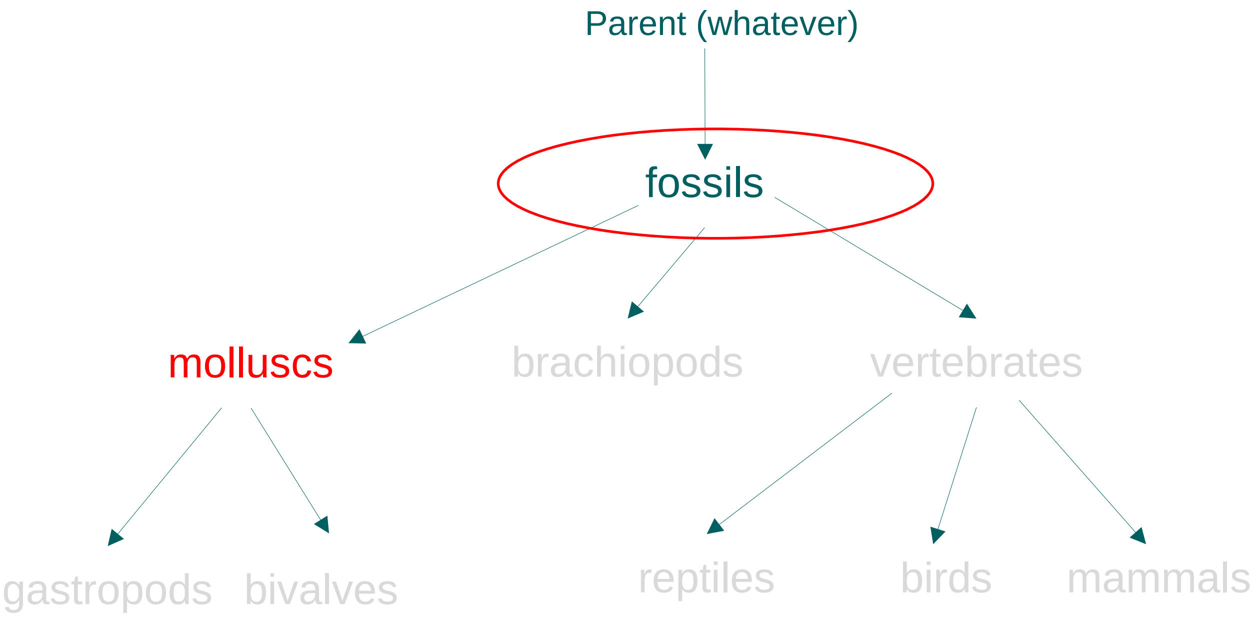
```



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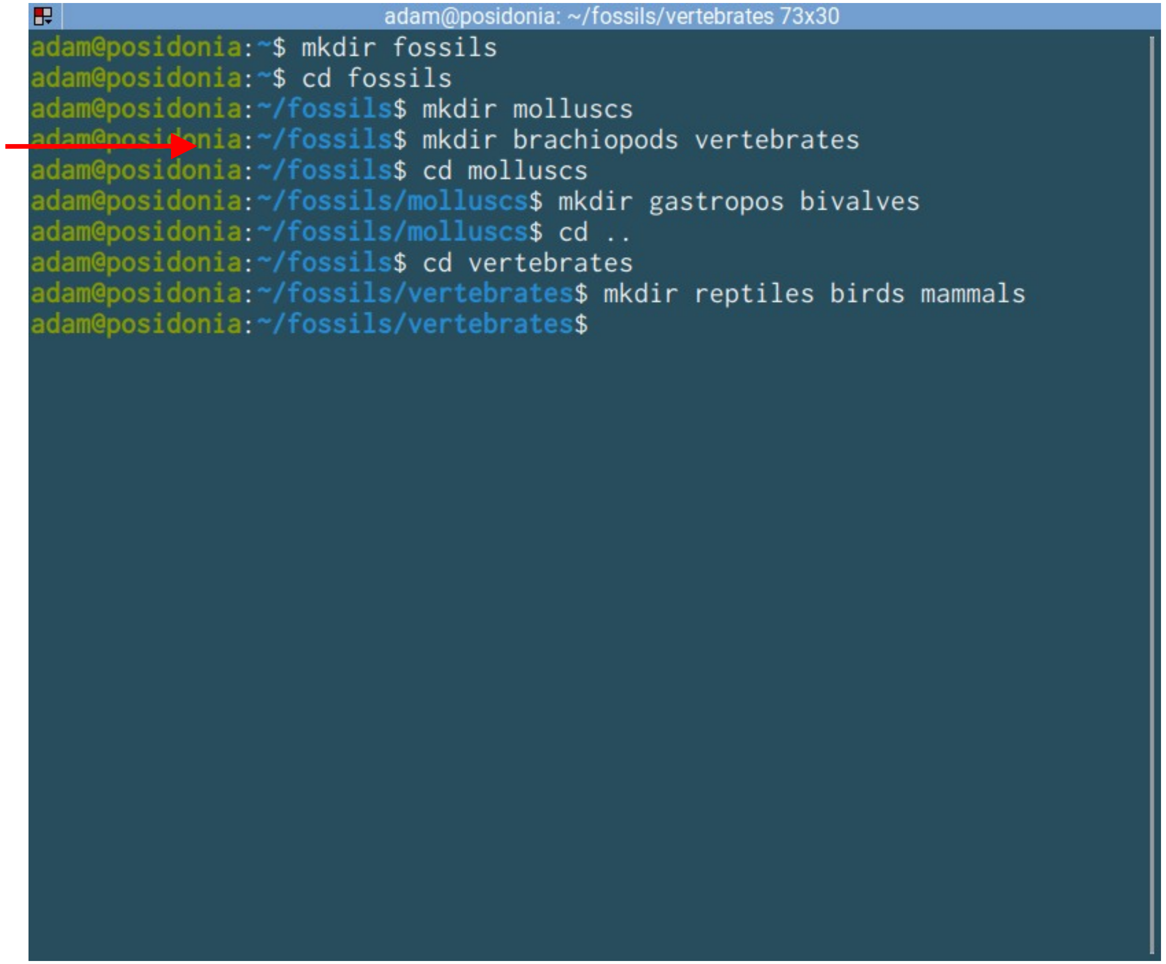

```
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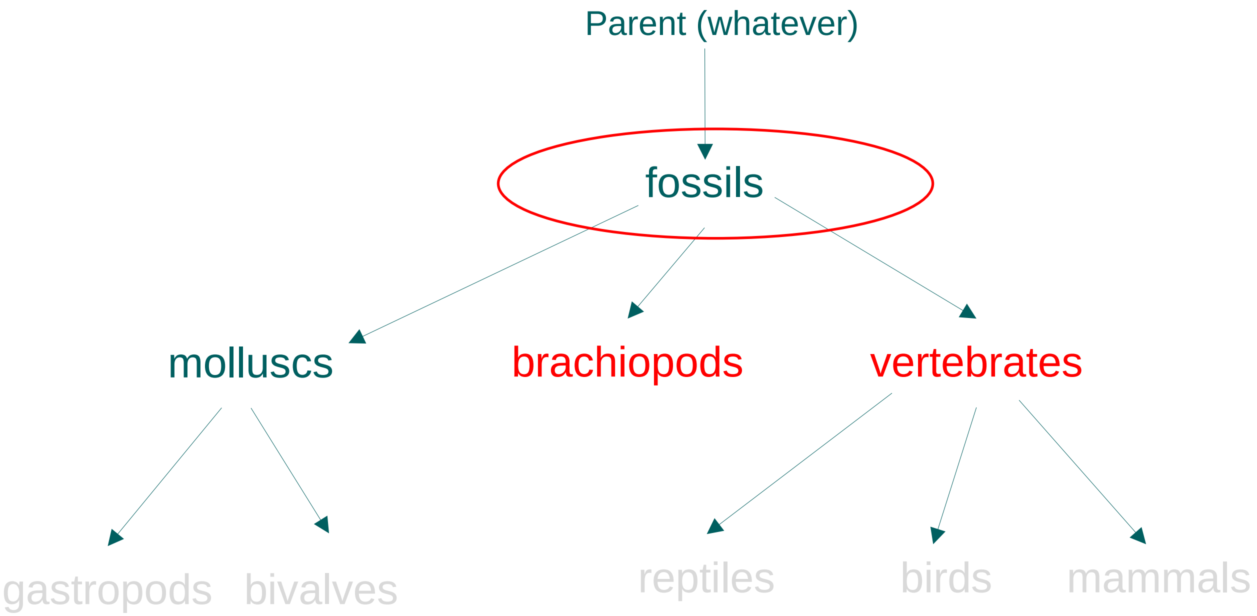
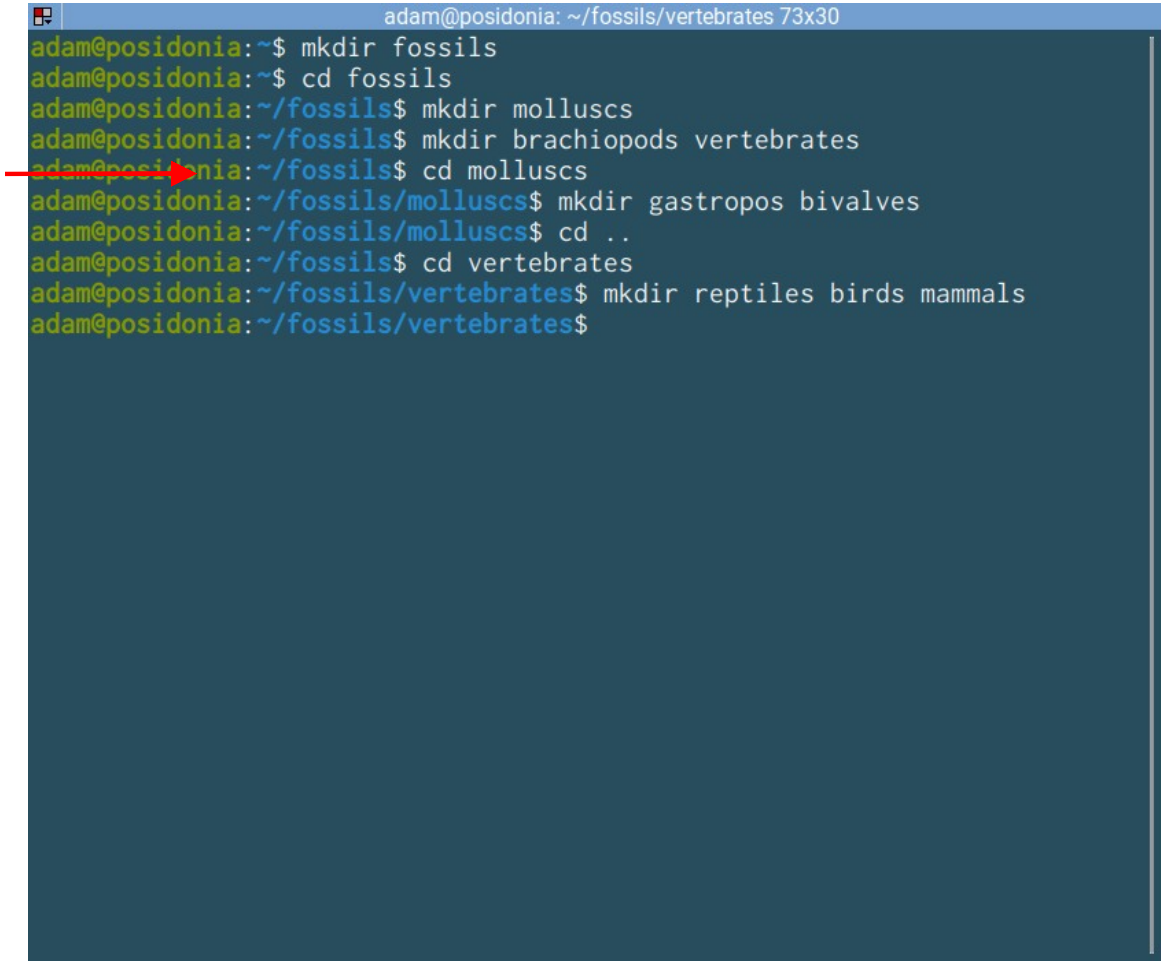
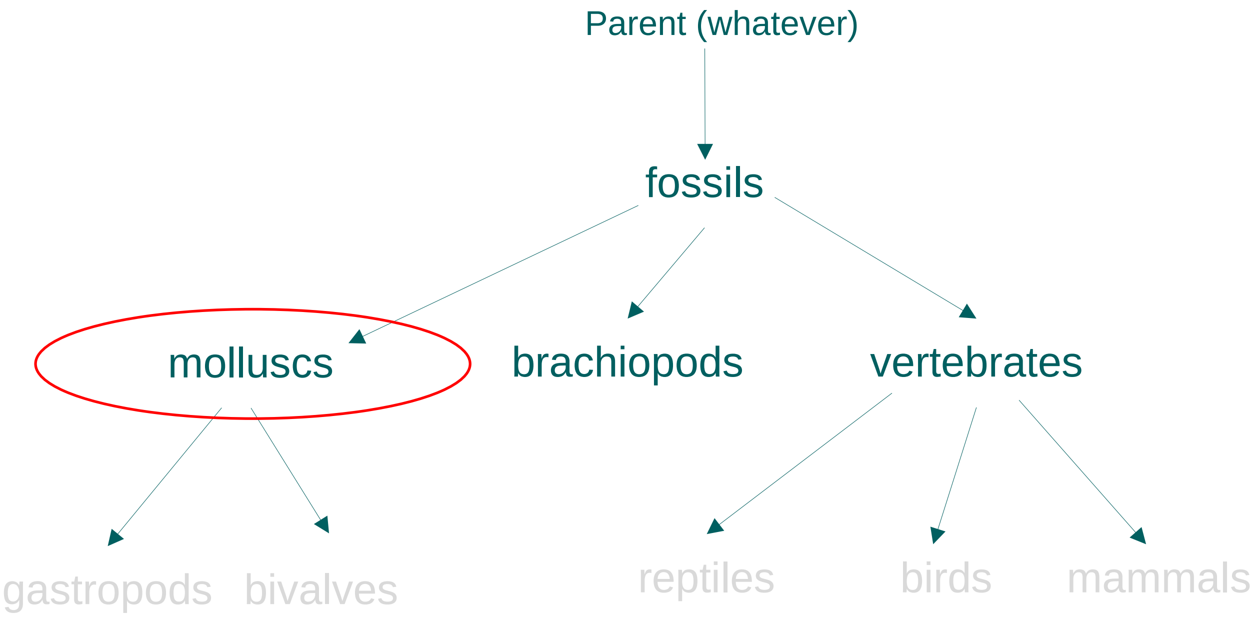
adam@posidonia:~$ cd fossils
adam@posidonia:~/fossils$ mkdir molluscs
adam@posidonia:~/fossils$ mkdir brachiopods vertebrates
adam@posidonia:~/fossils$ cd molluscs
adam@posidonia:~/fossils/molluscs$ mkdir gastropos bivalves
adam@posidonia:~/fossils/molluscs$ cd ..
adam@posidonia:~/fossils$ cd vertebrates
adam@posidonia:~/fossils/vertebrates$ mkdir reptiles birds mammals
adam@posidonia:~/fossils/vertebrates$
```



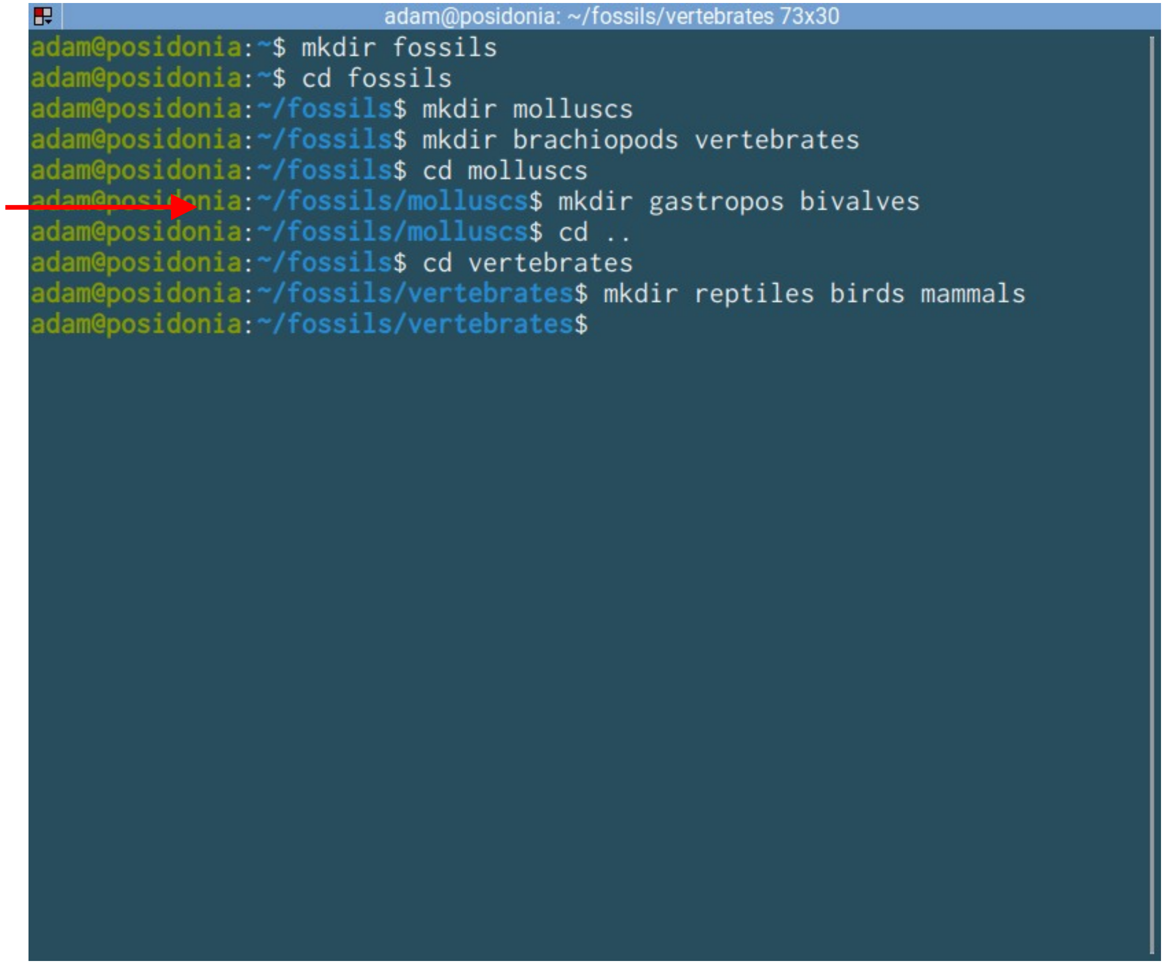
Solution 1 – changing directory



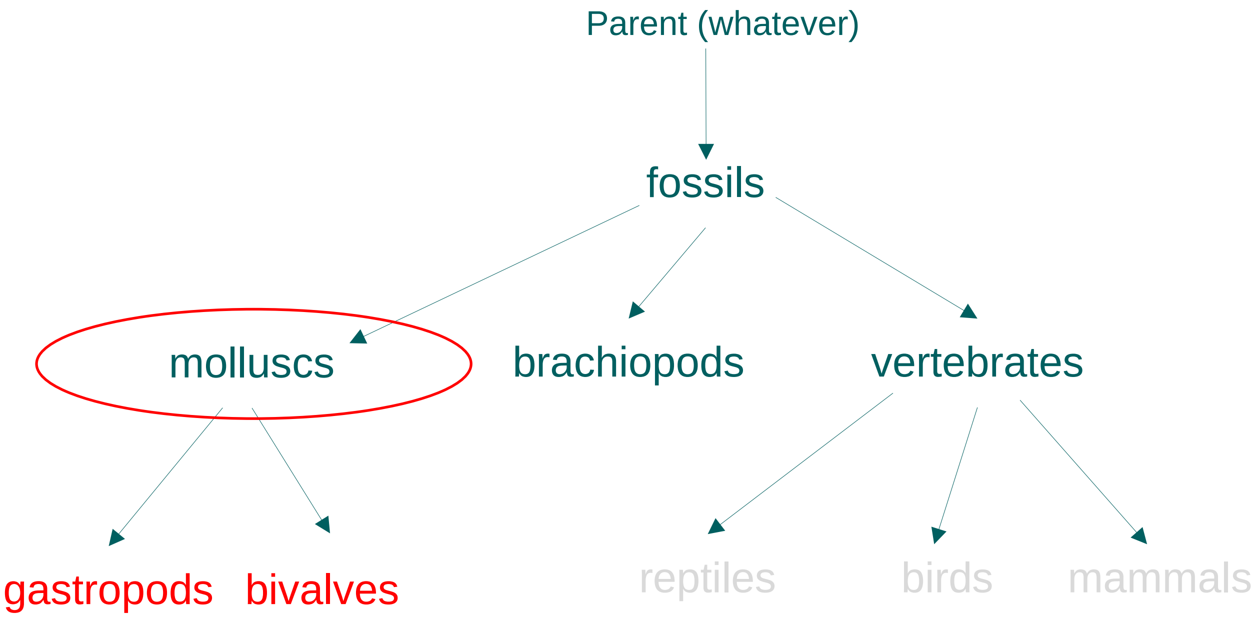
```
adam@posidonia:~$ mkdir fossils
adam@posidonia:~$ cd fossils
adam@posidonia:~/fossils$ mkdir molluscs
adam@posidonia:~/fossils$ mkdir brachiopods vertebrates
adam@posidonia:~/fossils$ cd molluscs
adam@posidonia:~/fossils/molluscs$ mkdir gastropos bivalves
adam@posidonia:~/fossils/molluscs$ cd ..
adam@posidonia:~/fossils$ cd vertebrates
adam@posidonia:~/fossils/vertebrates$ mkdir reptiles birds mammals
adam@posidonia:~/fossils/vertebrates$
```



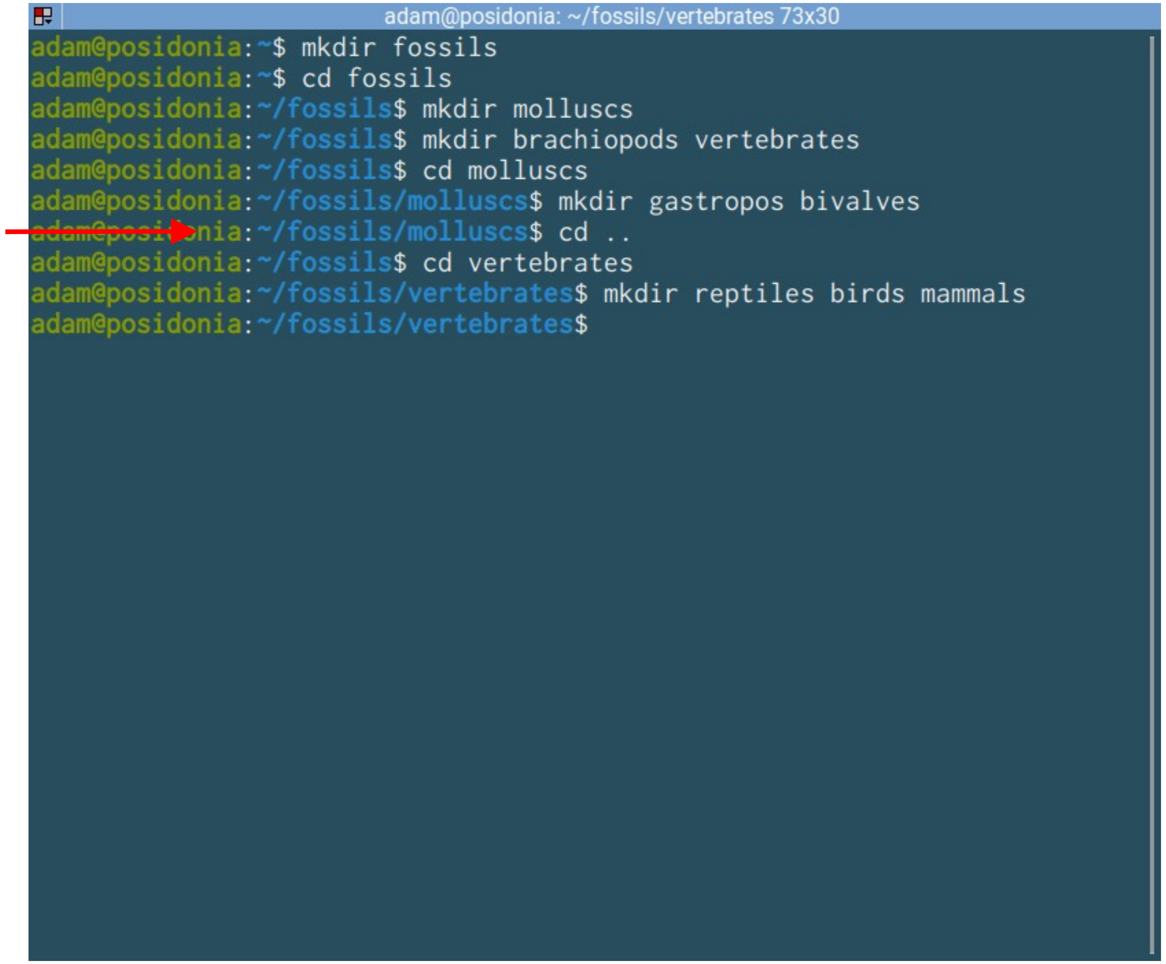
Solution 1 – changing directory



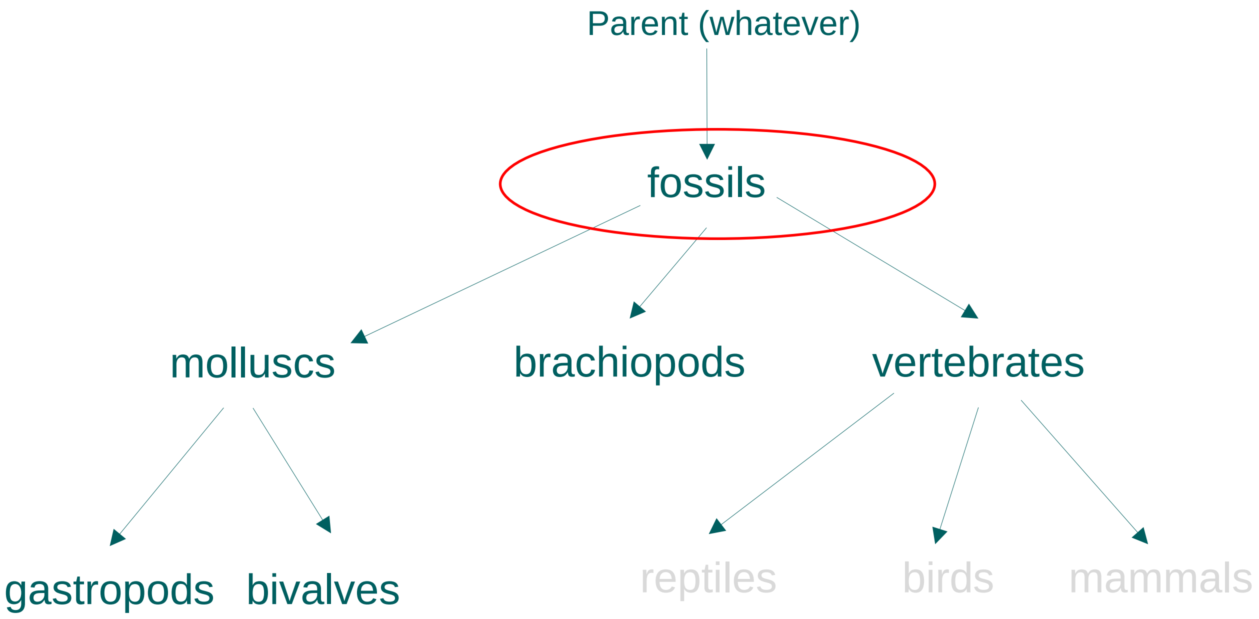
```
adam@posidonia:~$ mkdir fossils
adam@posidonia:~$ cd fossils
adam@posidonia:~/fossils$ mkdir molluscs
adam@posidonia:~/fossils$ mkdir brachiopods vertebrates
adam@posidonia:~/fossils$ cd molluscs
adam@posidonia:~/fossils/molluscs$ mkdir gastropos bivalves
adam@posidonia:~/fossils/molluscs$ cd ..
adam@posidonia:~/fossils$ cd vertebrates
adam@posidonia:~/fossils/vertebrates$ mkdir reptiles birds mammals
adam@posidonia:~/fossils/vertebrates$
```



Solution 1 – changing directory



```
adam@posidonia:~$ mkdir fossils
adam@posidonia:~$ cd fossils
adam@posidonia:~/fossils$ mkdir molluscs
adam@posidonia:~/fossils$ mkdir brachiopods vertebrates
adam@posidonia:~/fossils$ cd molluscs
adam@posidonia:~/fossils/molluscs$ mkdir gastropos bivalves
adam@posidonia:~/fossils/molluscs$ cd ..
adam@posidonia:~/fossils$ cd vertebrates
adam@posidonia:~/fossils/vertebrates$ mkdir reptiles birds mammals
adam@posidonia:~/fossils/vertebrates$
```



Parent (whatever)

fossils

molluscs

brachiopods

vertebrates

gastropods

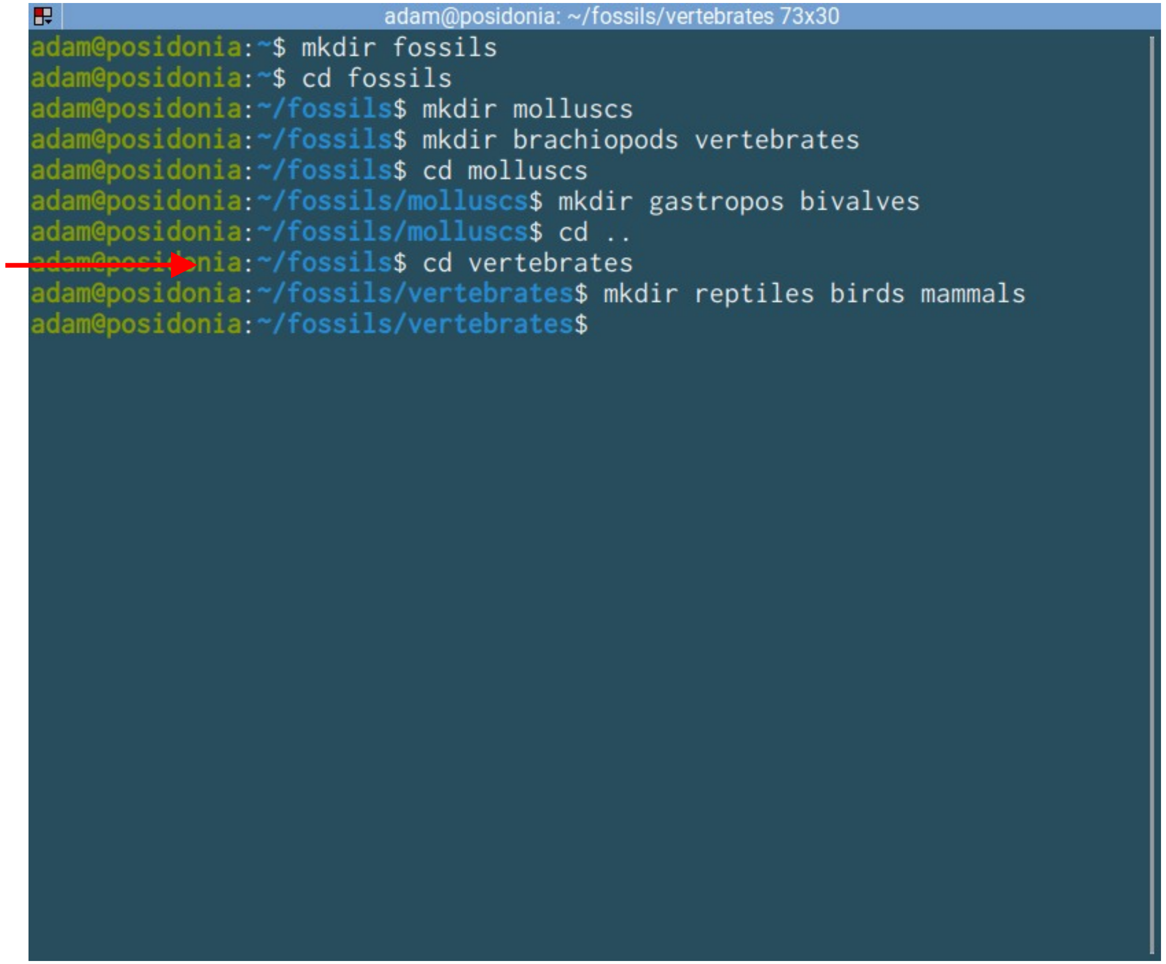
bivalves

reptiles

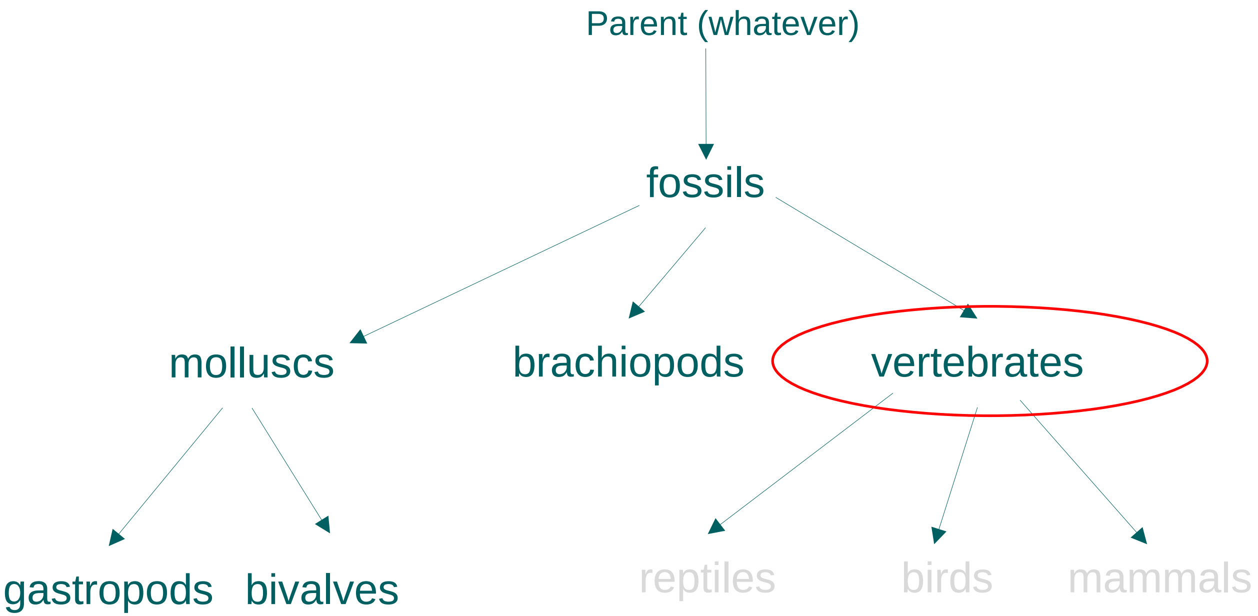
birds

mammals

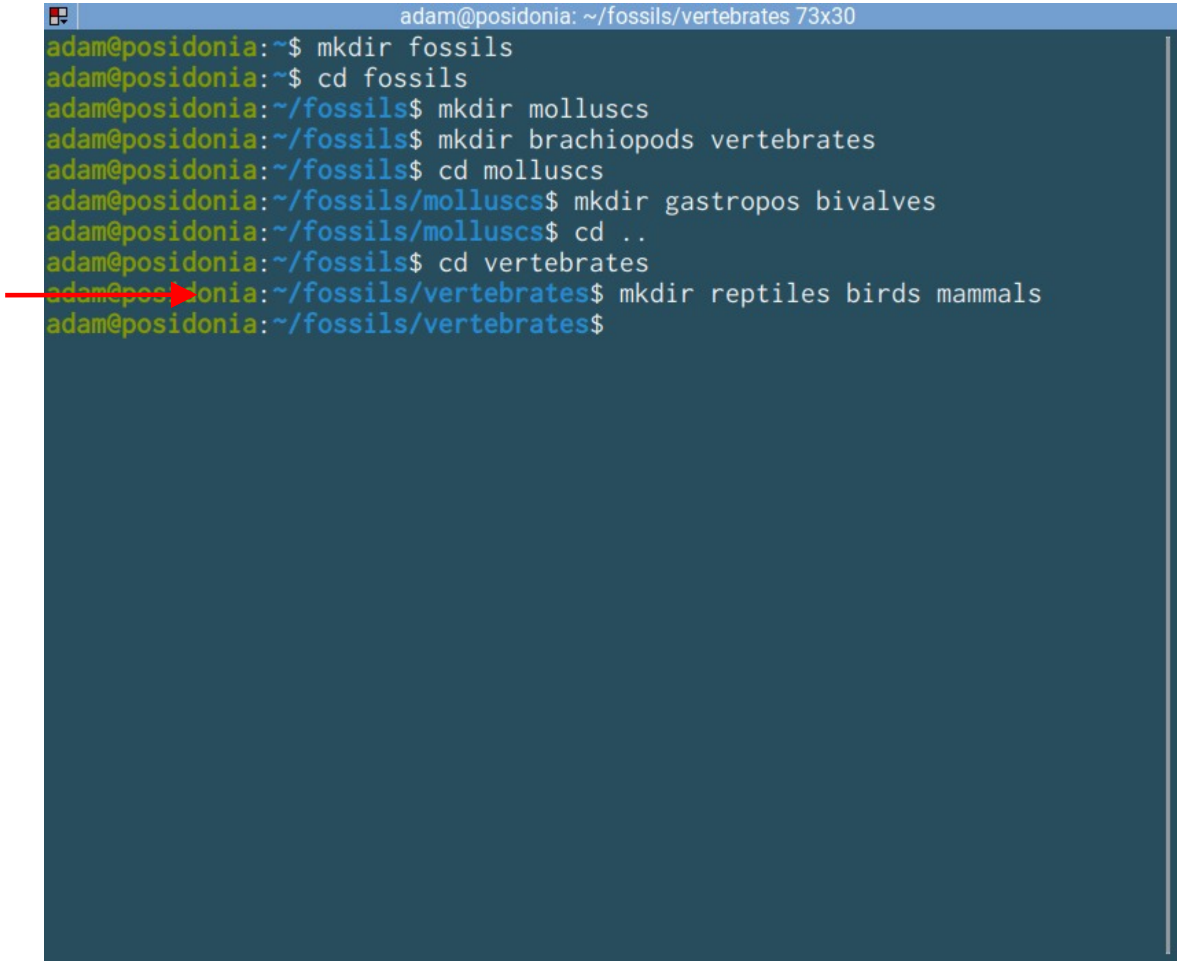
Solution 1 – changing directory



```
adam@posidonia:~$ mkdir fossils
adam@posidonia:~$ cd fossils
adam@posidonia:~/fossils$ mkdir molluscs
adam@posidonia:~/fossils$ mkdir brachiopods vertebrates
adam@posidonia:~/fossils$ cd molluscs
adam@posidonia:~/fossils/molluscs$ mkdir gastropos bivalves
adam@posidonia:~/fossils/molluscs$ cd ..
adam@posidonia:~/fossils$ cd vertebrates
adam@posidonia:~/fossils/vertebrates$ mkdir reptiles birds mammals
adam@posidonia:~/fossils/vertebrates$
```

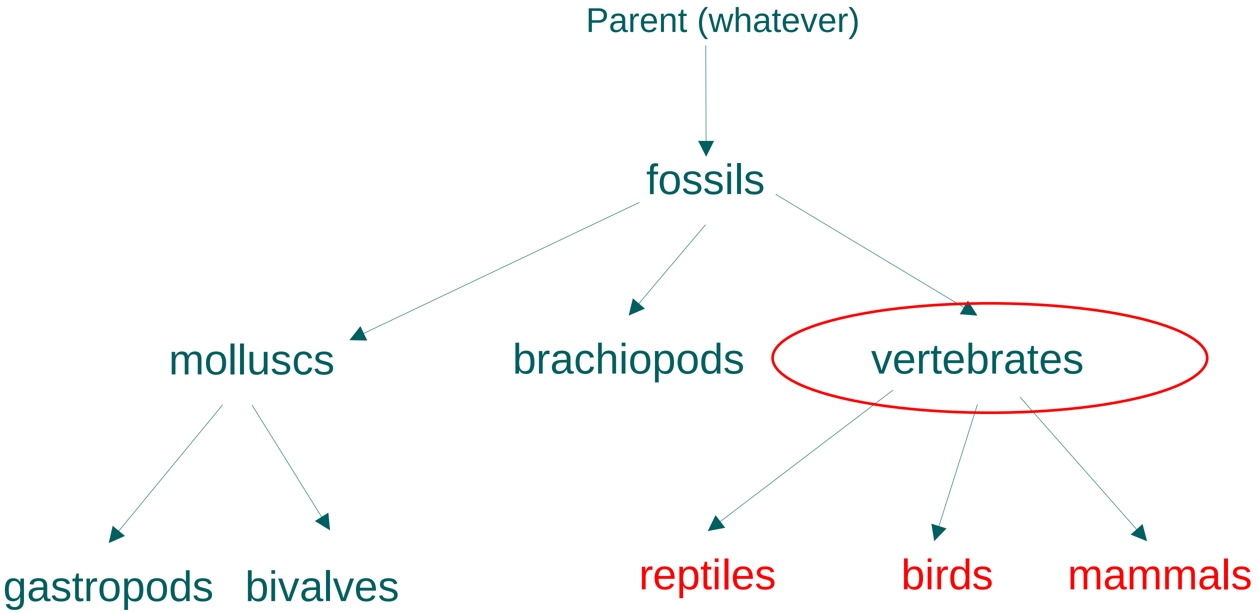


Solution 1 – changing directory



adam@posidonia: ~/fossils/vertebrates 73x30

```
adam@posidonia:~$ mkdir fossils
adam@posidonia:~$ cd fossils
adam@posidonia:~/fossils$ mkdir molluscs
adam@posidonia:~/fossils$ mkdir brachiopods vertebrates
adam@posidonia:~/fossils$ cd molluscs
adam@posidonia:~/fossils/molluscs$ mkdir gastropos bivalves
adam@posidonia:~/fossils/molluscs$ cd ..
adam@posidonia:~/fossils$ cd vertebrates
adam@posidonia:~/fossils/vertebrates$ mkdir reptiles birds mammals
adam@posidonia:~/fossils/vertebrates$
```



Parent (whatever)

fossils

molluscs

brachiopods

vertebrates

gastropods

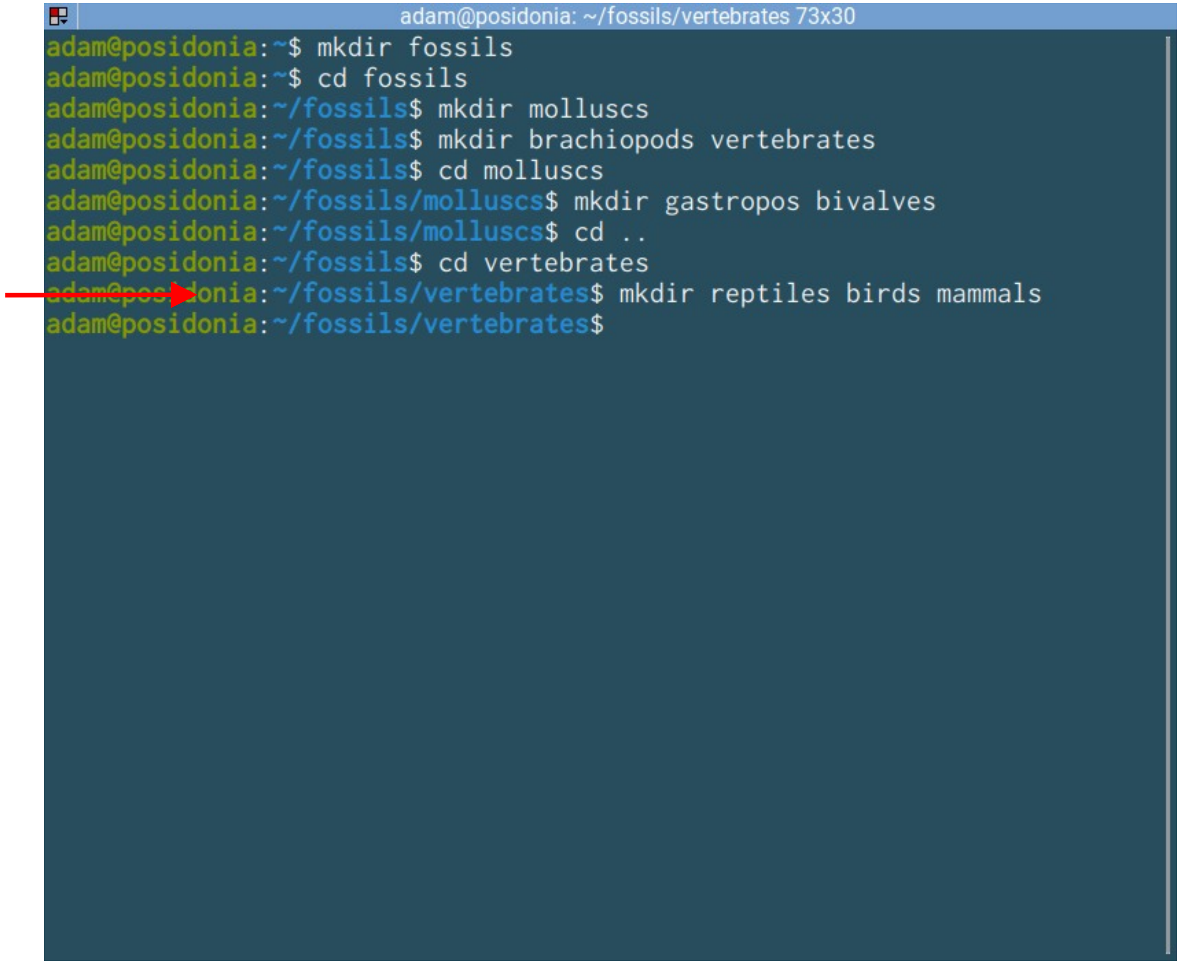
bivalves

reptiles

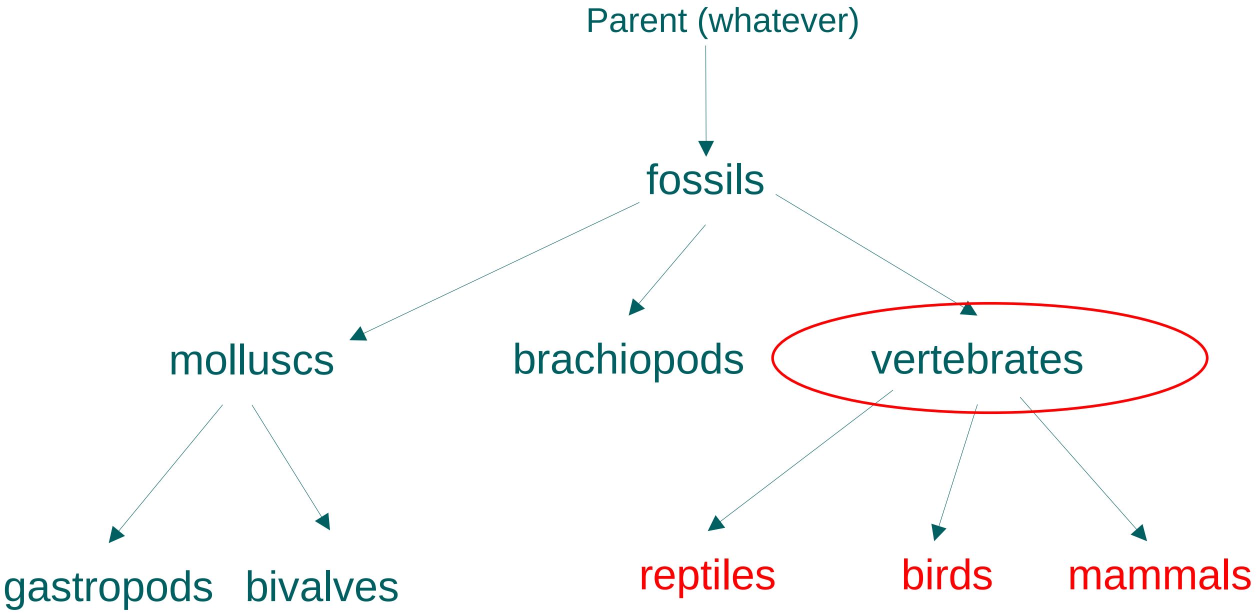
birds

mammals

Solution 1 – changing directory



```
adam@posidonia:~$ mkdir fossils
adam@posidonia:~$ cd fossils
adam@posidonia:~/fossils$ mkdir molluscs
adam@posidonia:~/fossils$ mkdir brachiopods vertebrates
adam@posidonia:~/fossils$ cd molluscs
adam@posidonia:~/fossils/molluscs$ mkdir gastropos bivalves
adam@posidonia:~/fossils/molluscs$ cd ..
adam@posidonia:~/fossils$ cd vertebrates
adam@posidonia:~/fossils/vertebrates$ mkdir reptiles birds mammals
adam@posidonia:~/fossils/vertebrates$
```

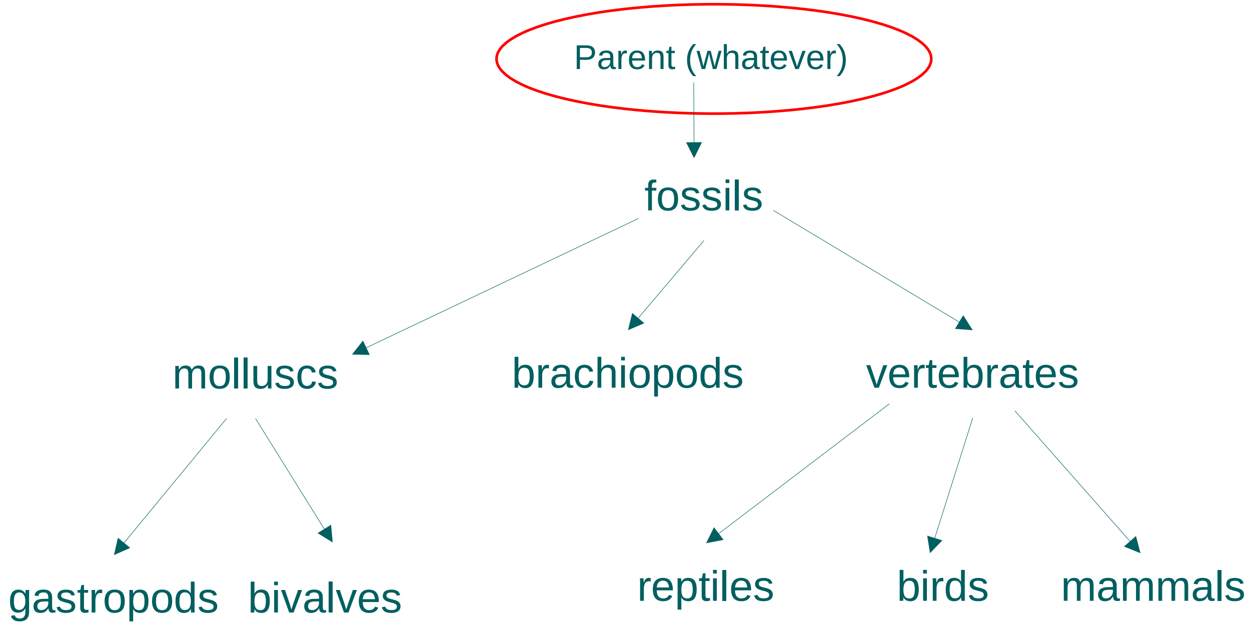


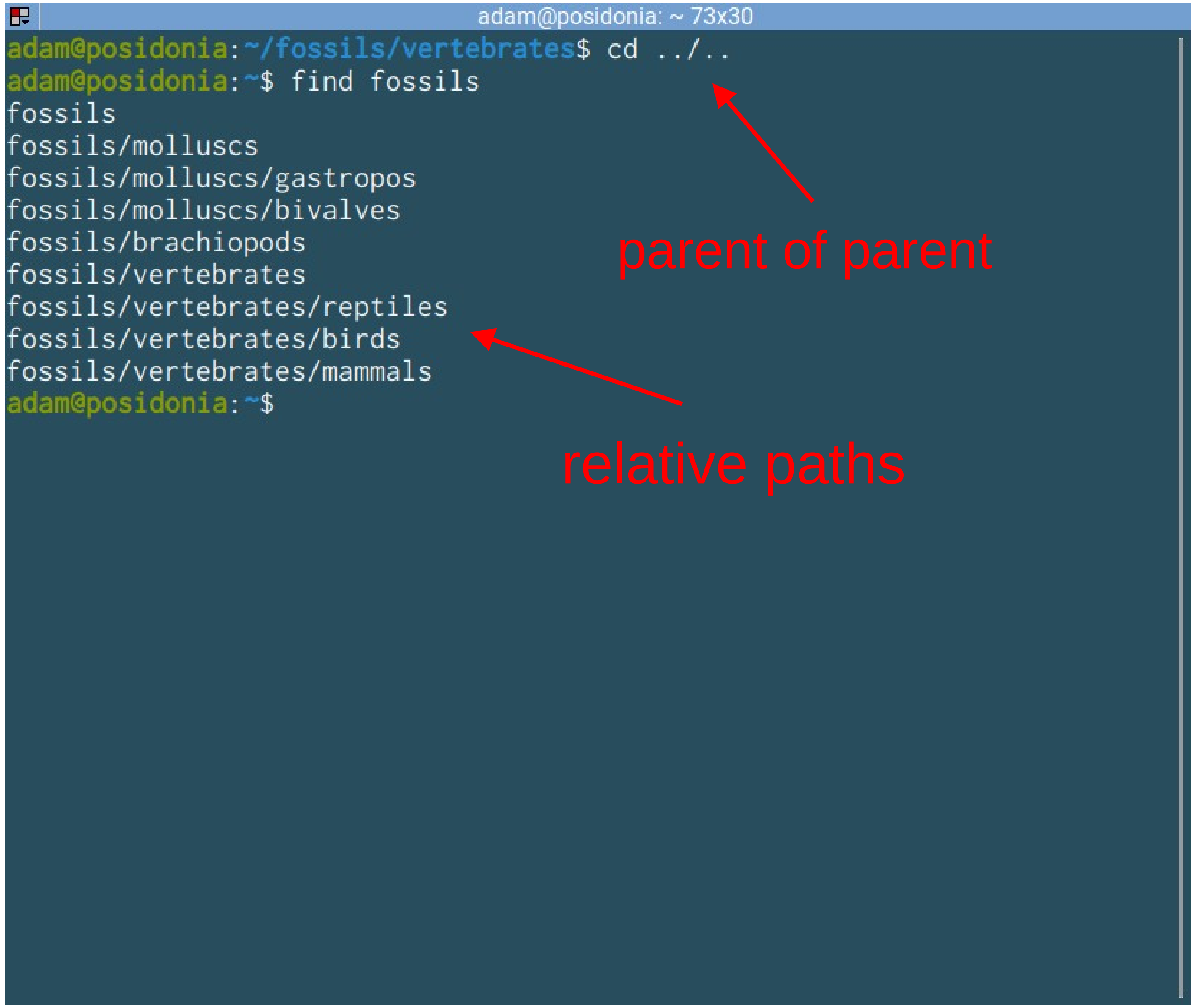
How to check?

find␣<path to directory>

Recursive listing

- 1. Go back to the parent
- 2. Use find there!





```
adam@posidonia:~/fossils/vertebrates$ cd ../..
adam@posidonia:~$ find fossils
fossils
fossils/molluscs
fossils/molluscs/gastropos
fossils/molluscs/bivalves
fossils/brachiopods
fossils/vertebrates
fossils/vertebrates/reptiles
fossils/vertebrates/birds
fossils/vertebrates/mammals
adam@posidonia:~$
```

parent of parent

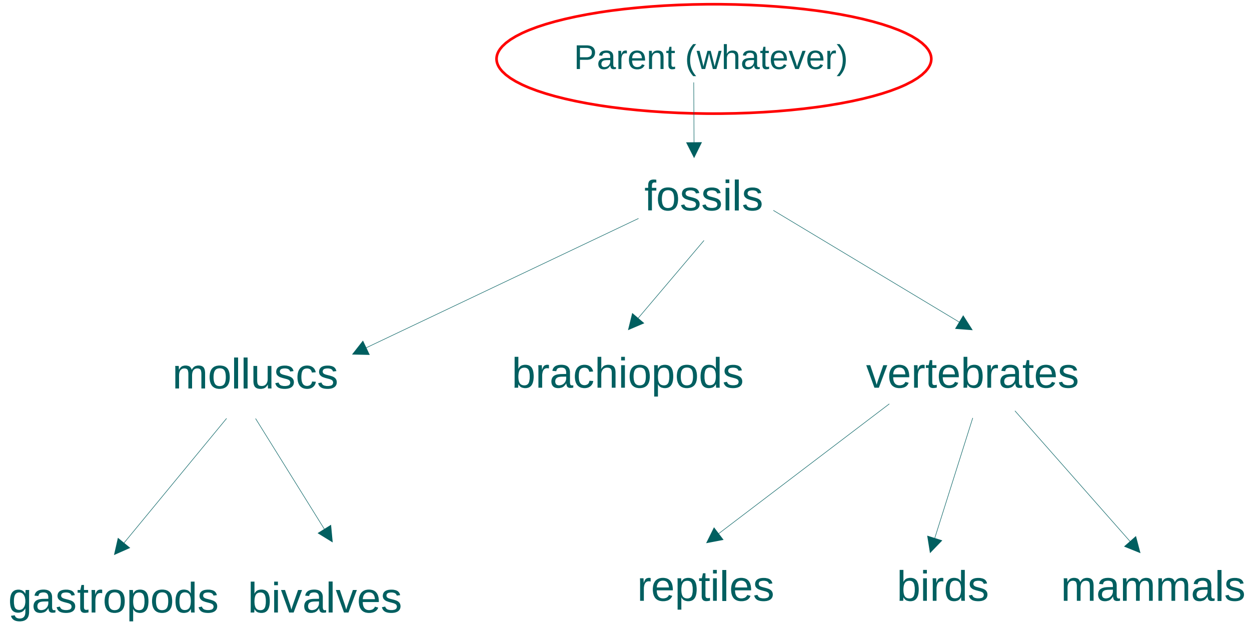
relative paths

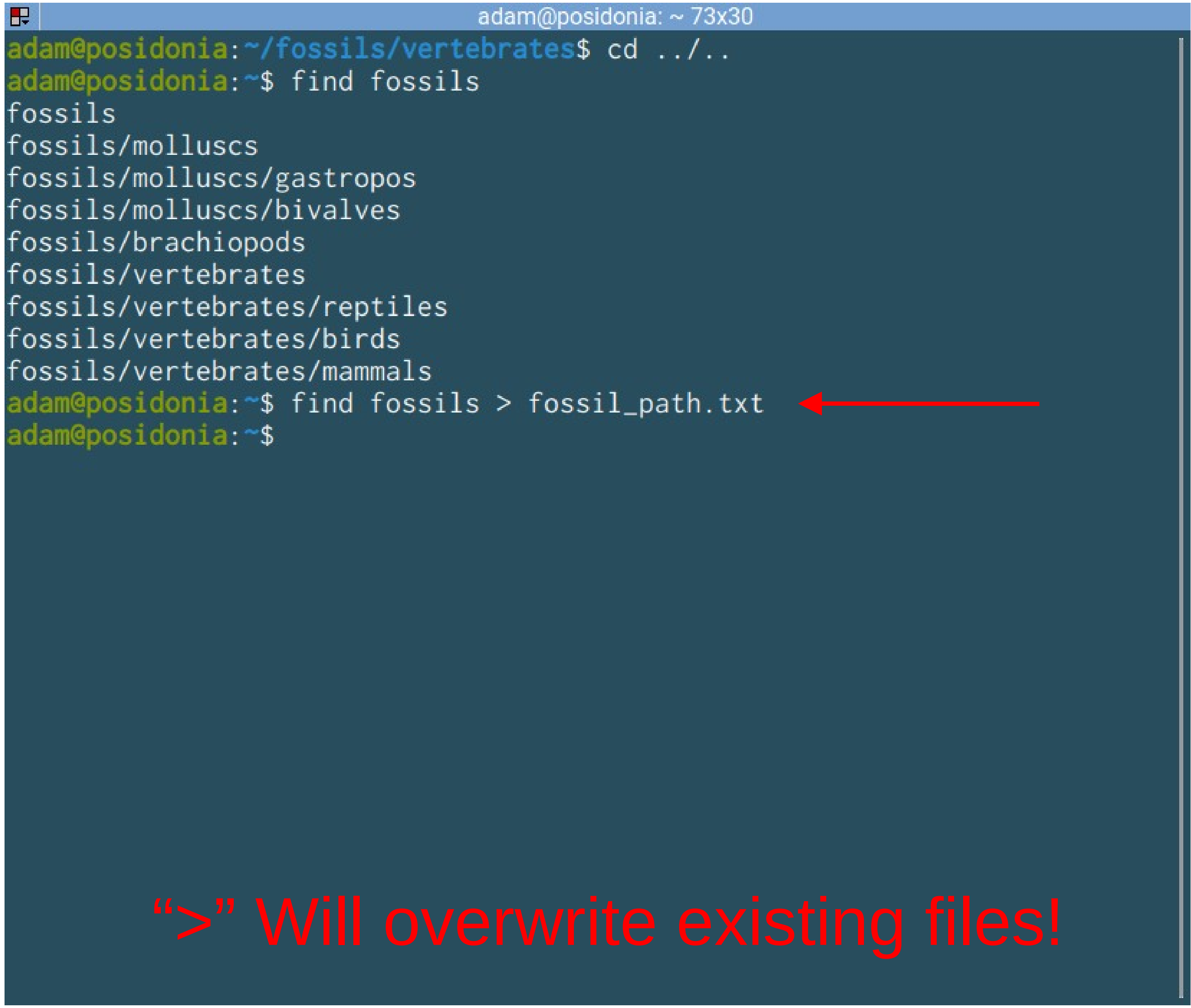
Angled bracket or ***chevron***

find␣<path>␣>␣<path_to file>

Output redirection

- Whatever was output to the console is now in a new file!





```
adam@posidonia:~/fossils/vertebrates$ cd ../..
adam@posidonia:~$ find fossils
fossils
fossils/molluscs
fossils/molluscs/gastropos
fossils/molluscs/bivalves
fossils/brachiopods
fossils/vertebrates
fossils/vertebrates/reptiles
fossils/vertebrates/birds
fossils/vertebrates/mammals
adam@posidonia:~$ find fossils > fossil_path.txt
adam@posidonia:~$
```

“>” Will overwrite existing files!

Suggested nomenclature

( ): **Parenthesis** (open and close)

[ ]: **Bracket** (open and close)

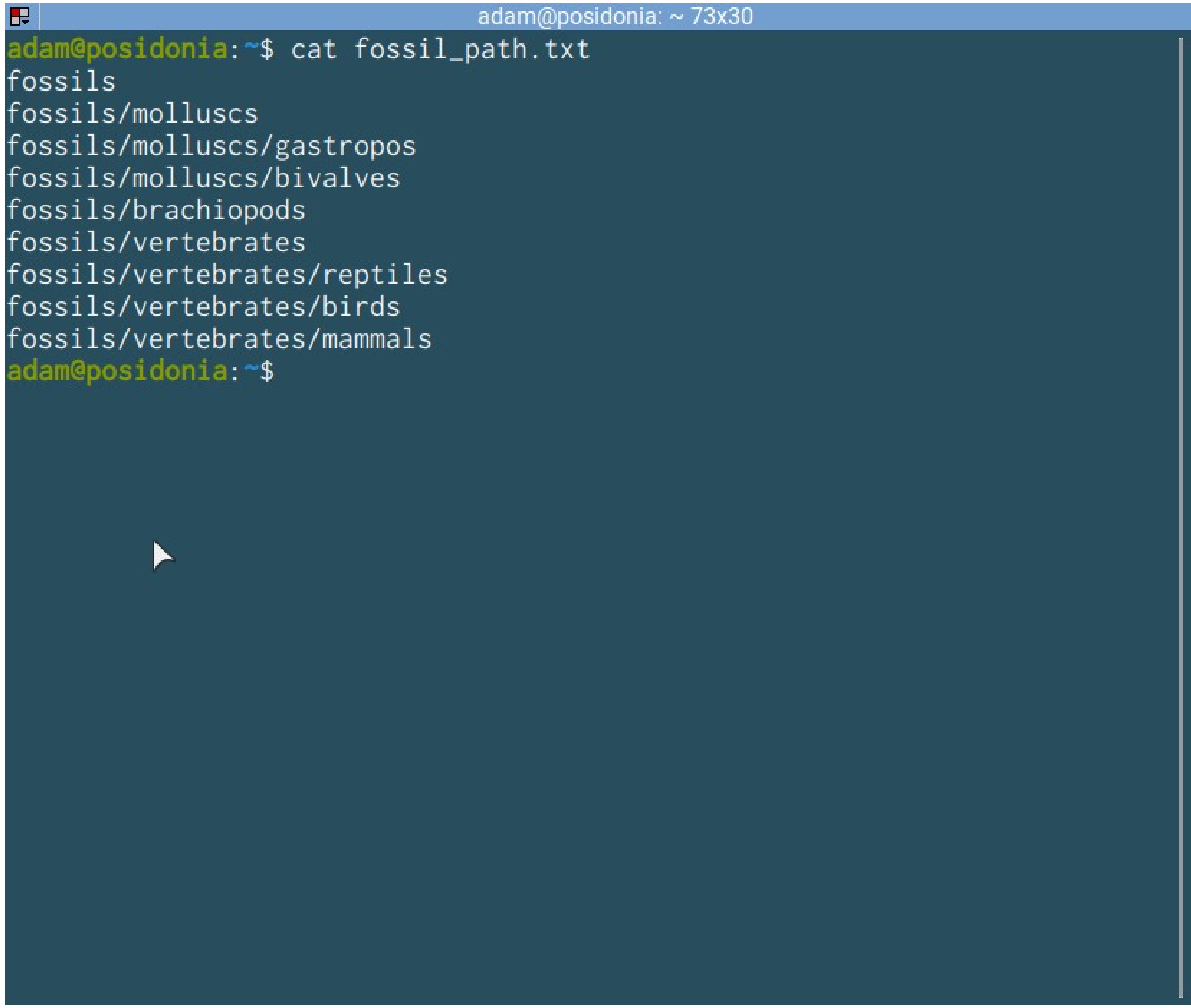
{ }: **Brace** (open and close)

< >: **Chevrons** (left and right)

cat␣<path to file>

Display contents of file

- Exactly as it was output to the console

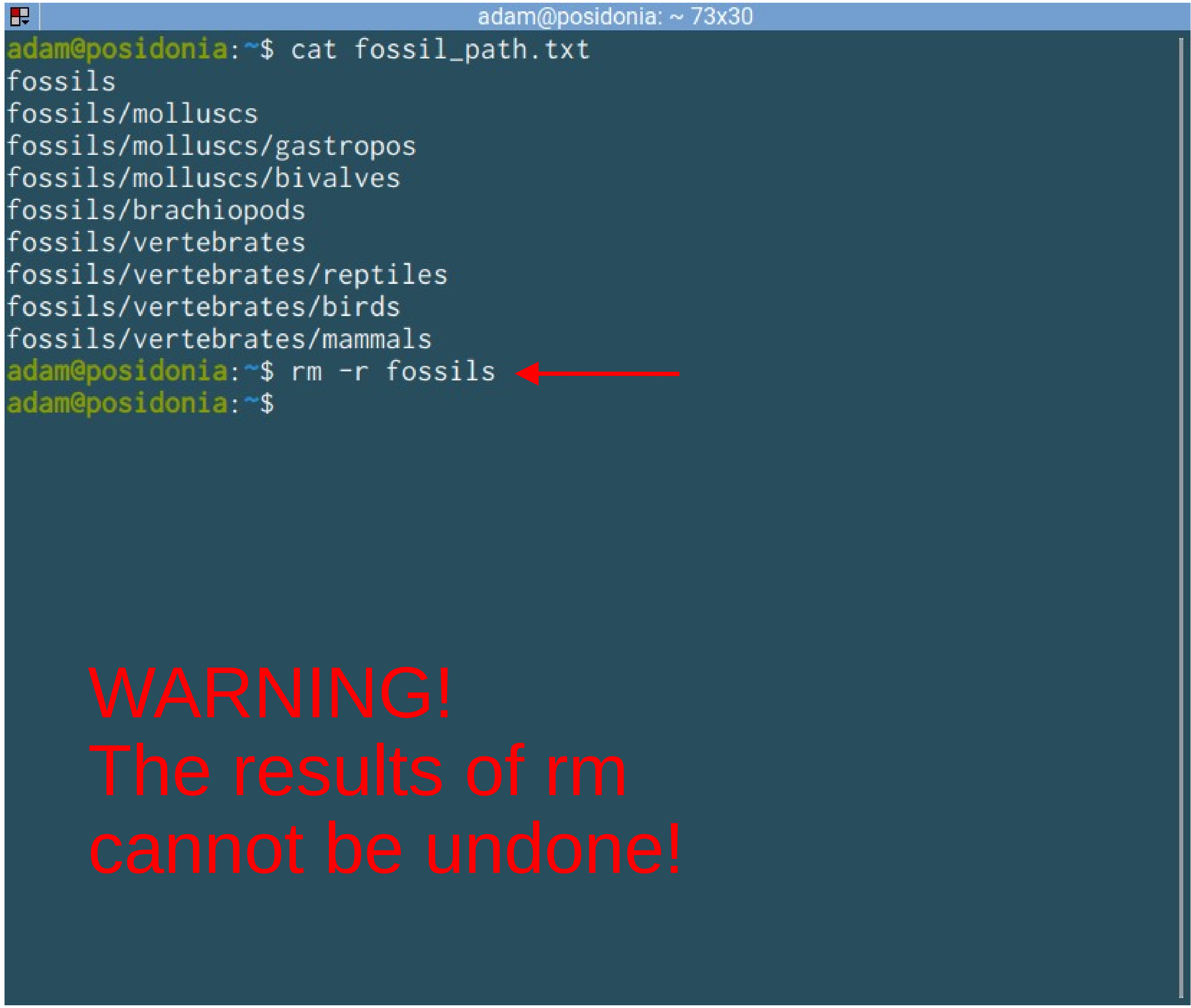


```
adam@posidonia:~$ cat fossil_path.txt
fossils
fossils/molluscs
fossils/molluscs/gastropos
fossils/molluscs/bivalves
fossils/brachiopods
fossils/vertebrates
fossils/vertebrates/reptiles
fossils/vertebrates/birds
fossils/vertebrates/mammals
adam@posidonia:~$
```

rm␣-r␣<path to dir>

Recursive deletion (-r)

- Deletes the content of the directory and the directory itself
- rmdir doesn’t work!
- No output = success?!



```
adam@posidonia:~$ cat fossil_path.txt
fossils
fossils/molluscs
fossils/molluscs/gastropos
fossils/molluscs/bivalves
fossils/brachiopods
fossils/vertebrates
fossils/vertebrates/reptiles
fossils/vertebrates/birds
fossils/vertebrates/mammals
adam@posidonia:~$ rm -r fossils
adam@posidonia:~$
```

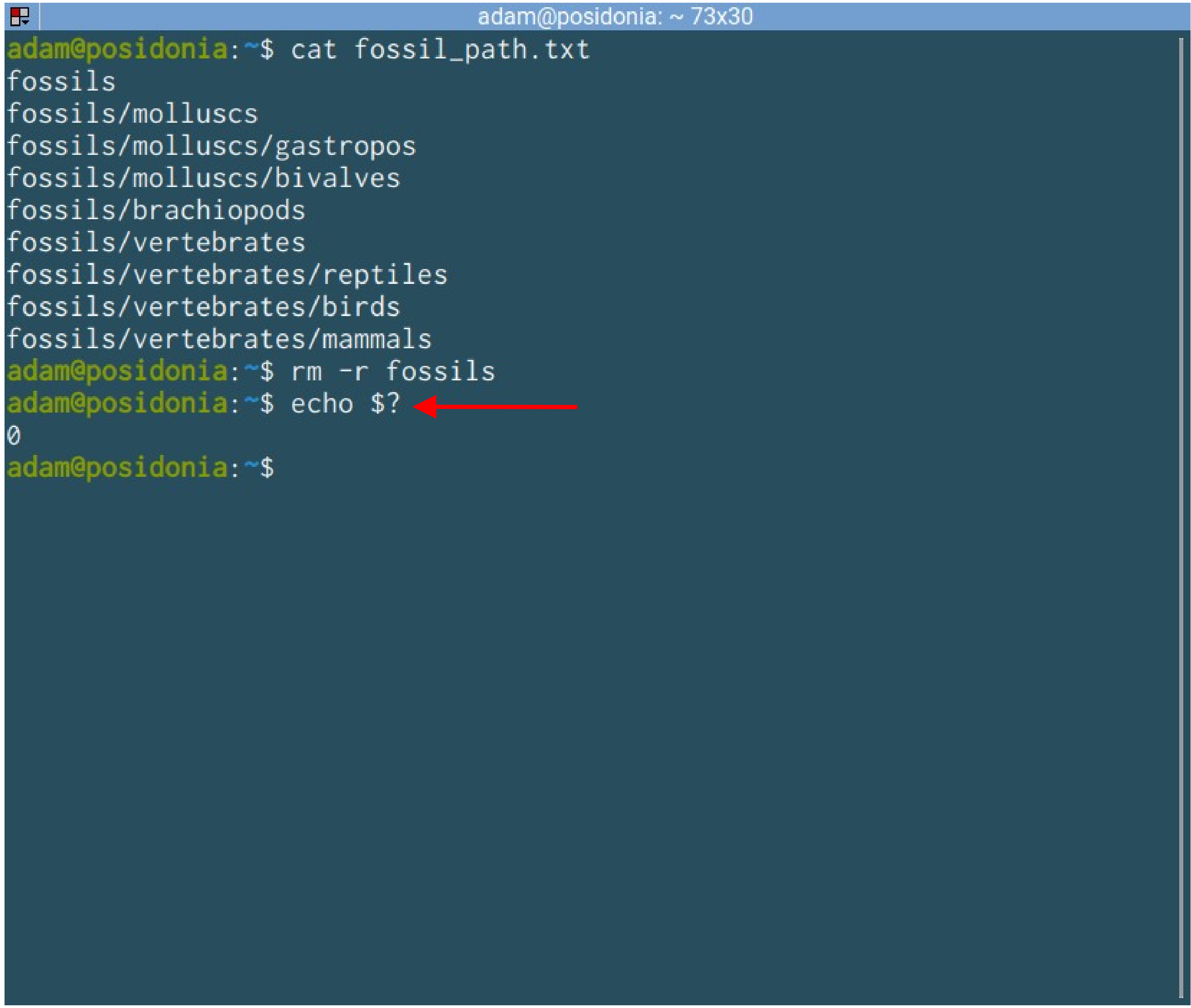
WARNING!
The results of rm cannot be undone!

echo␣<text>

Print something

- Used to print things to the console (standard output)
- $? Is a special symbol: the exit code of the last command:
  - 0: Success
  - Other: Failure

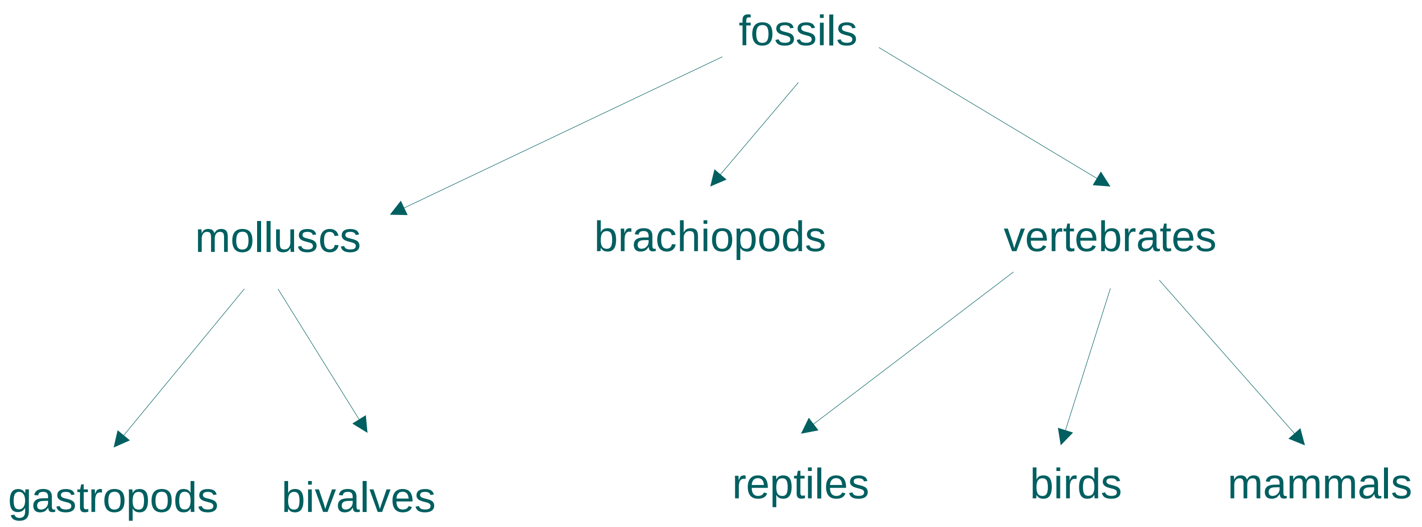
https://www.redhat.com/sysadmin/exit-codes-demystified



```
adam@posidonia:~$ cat fossil_path.txt
fossils
fossils/molluscs
fossils/molluscs/gastropos
fossils/molluscs/bivalves
fossils/brachiopods
fossils/vertebrates
fossils/vertebrates/reptiles
fossils/vertebrates/birds
fossils/vertebrates/mammals
adam@posidonia:~$ rm -r fossils
adam@posidonia:~$ echo $?
0
adam@posidonia:~$
```

Recreate the structure!

- Did you type things into the console?!



Hint 1. Use a general-purpose text editor!

Novice-friendly:

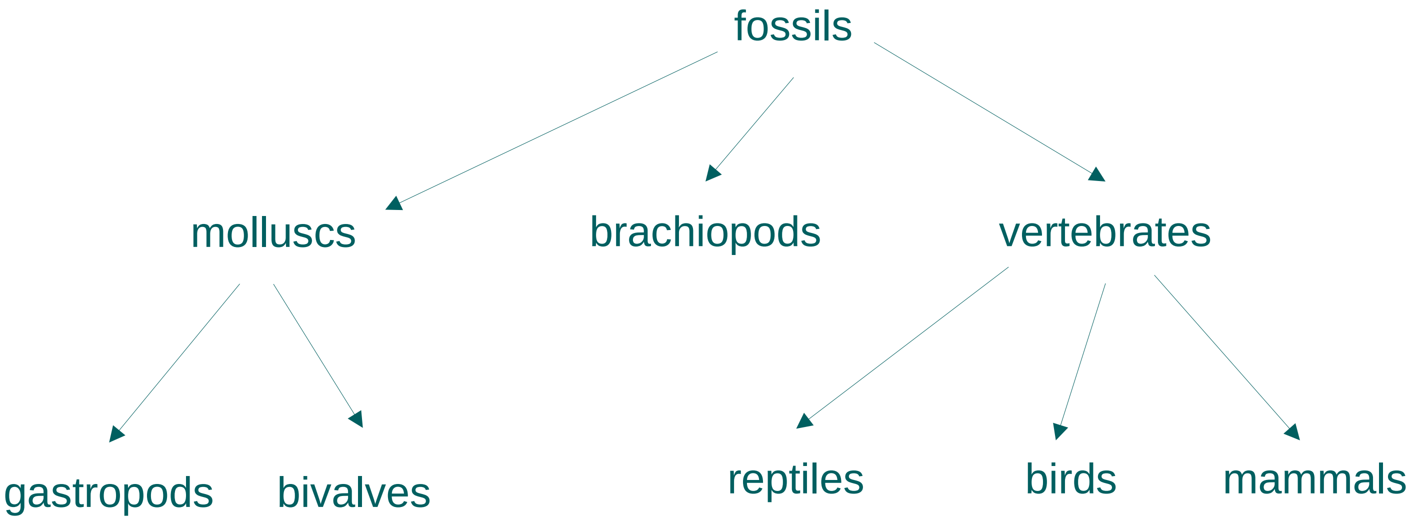
- Sublime Text
- **VS Code**
- Atom

Expert-friendly:

- Vim
- Emacs

Solution 2

- Using the same reference directory


fossils

molluscs

brachiopods

vertebrates

gastropods

bivalves

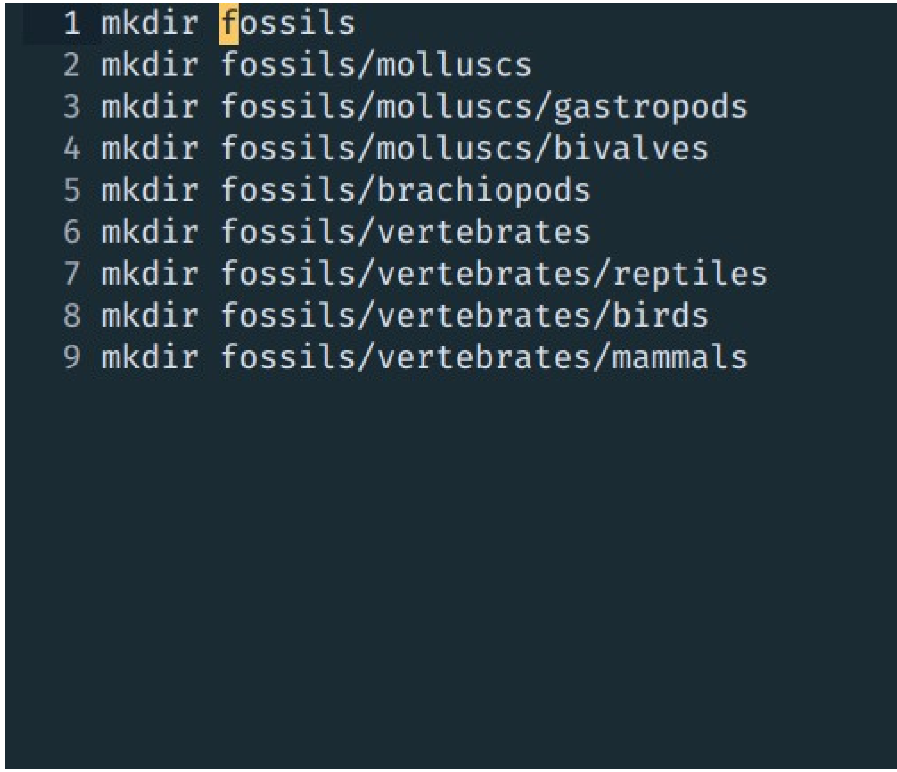
reptiles

birds

mammals

Hint 2. we can use the contents of fossil_path.txt

Add mkdir in front of every line, then copy and paste into the console!

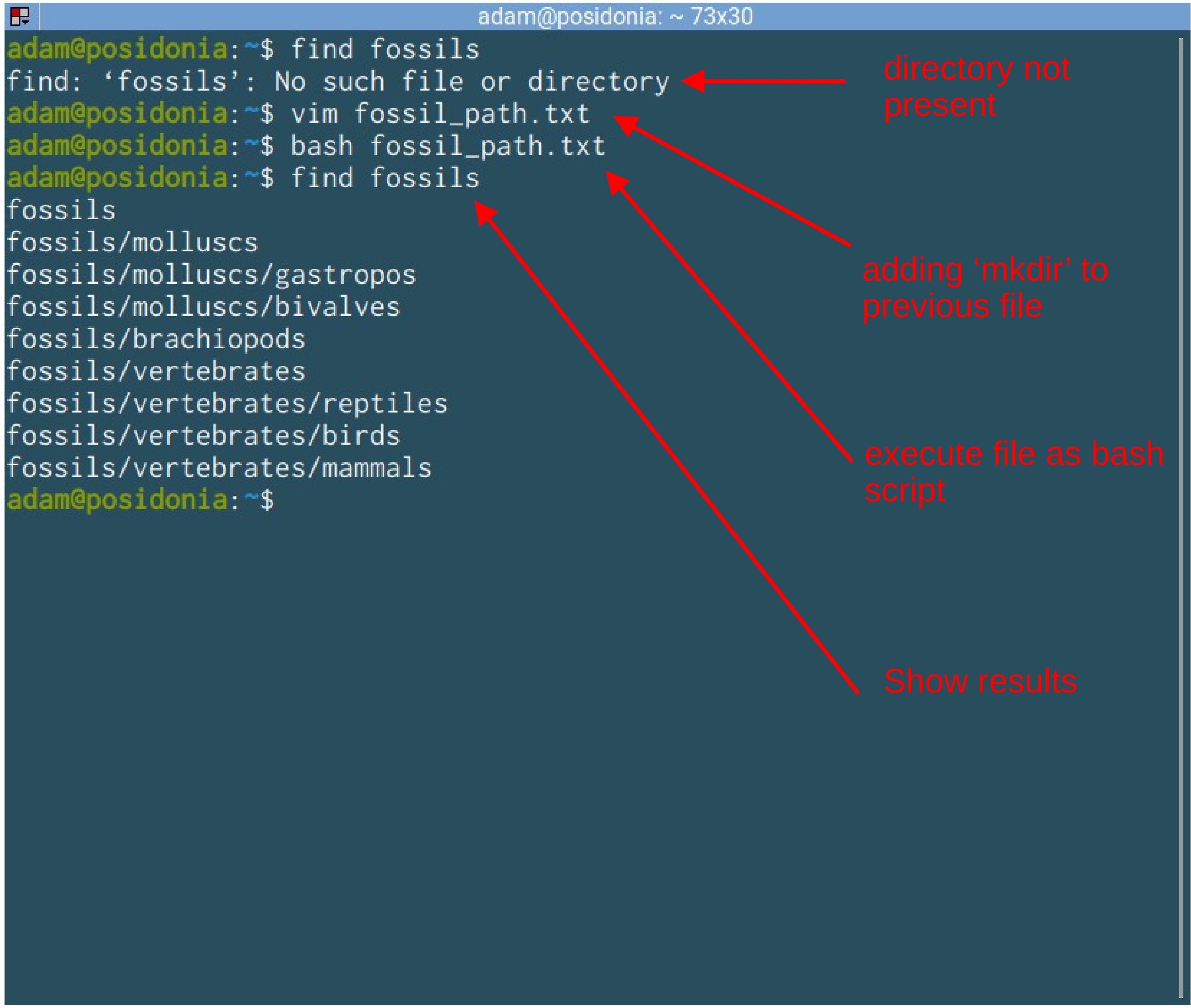

```
mkdir fossils
mkdir fossils/molluscs
mkdir fossils/molluscs/gastropods
mkdir fossils/molluscs/bivalves
mkdir fossils/brachiopods
mkdir fossils/vertebrates
mkdir fossils/vertebrates/reptiles
mkdir fossils/vertebrates/birds
mkdir fossils/vertebrates/mammals
```

bash␣<path>

Executing shell scripts

- The text we created is actually a shell script
- The “bash” console application program can be used to execute it.

https://www.redhat.com/sysadmin/exit-codes-demystified



```
adam@posidonia:~$ find fossils
find: ‘fossils’: No such file or directory
adam@posidonia:~$ vim fossil_path.txt
adam@posidonia:~$ bash fossil_path.txt
adam@posidonia:~$ find fossils
fossils
fossils/molluscs
fossils/molluscs/gastropos
fossils/molluscs/bivalves
fossils/brachiopods
fossils/vertebrates
fossils/vertebrates/reptiles
fossils/vertebrates/birds
fossils/vertebrates/mammals
adam@posidonia:~$
```

directory not present

adding ‘mkdir’ to previous file

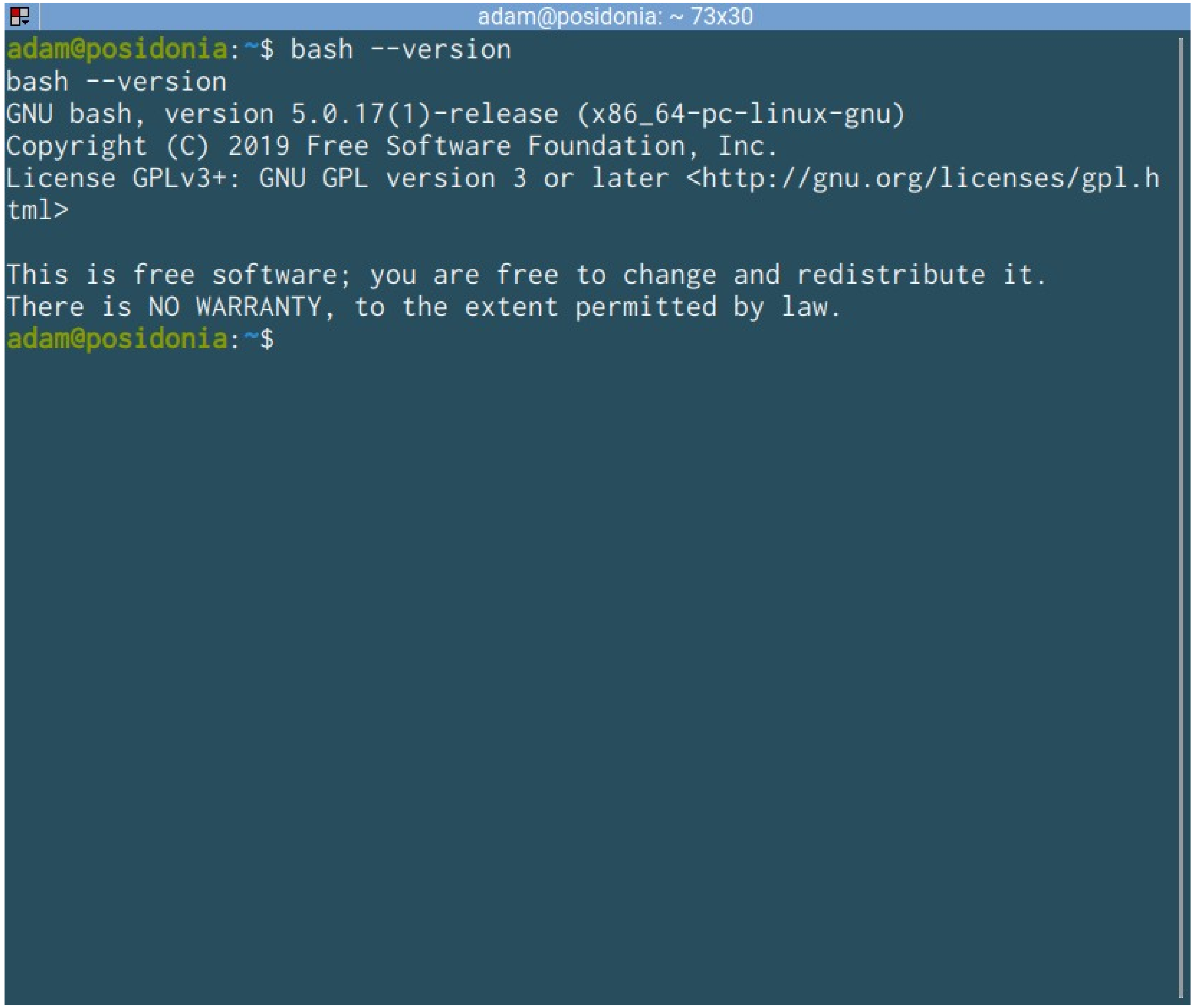
execute file as bash script

Show results

bash␣--version

Running console applications

- `--version`: ask for program version
- `--help`: display help for program



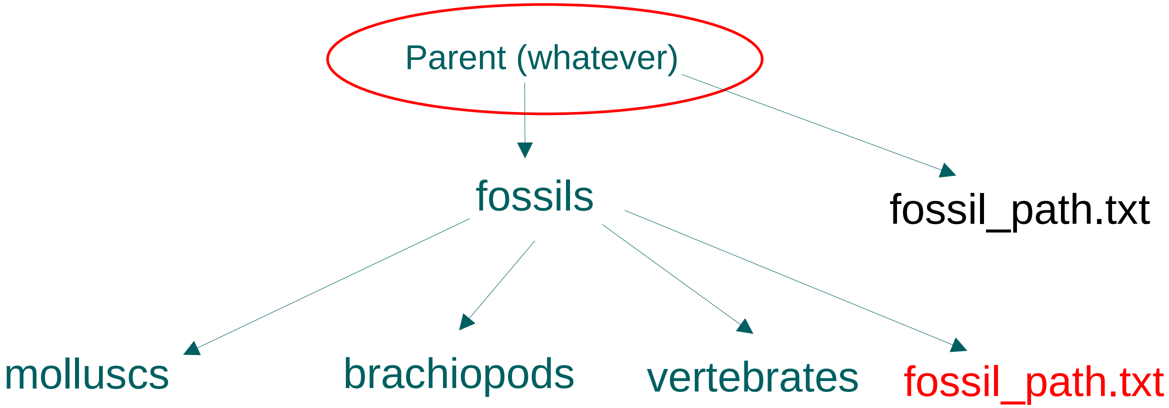
```
adam@posidonia:~$ bash --version
bash --version
GNU bash, version 5.0.17(1)-release (x86_64-pc-linux-gnu)
Copyright (C) 2019 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.h
tml>

This is free software; you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
adam@posidonia:~$
```

cp␣<what>␣<where>

Copying a file or directory

- Target directory or file
- If directory, the file will be put into it



Parent (whatever)

fossils

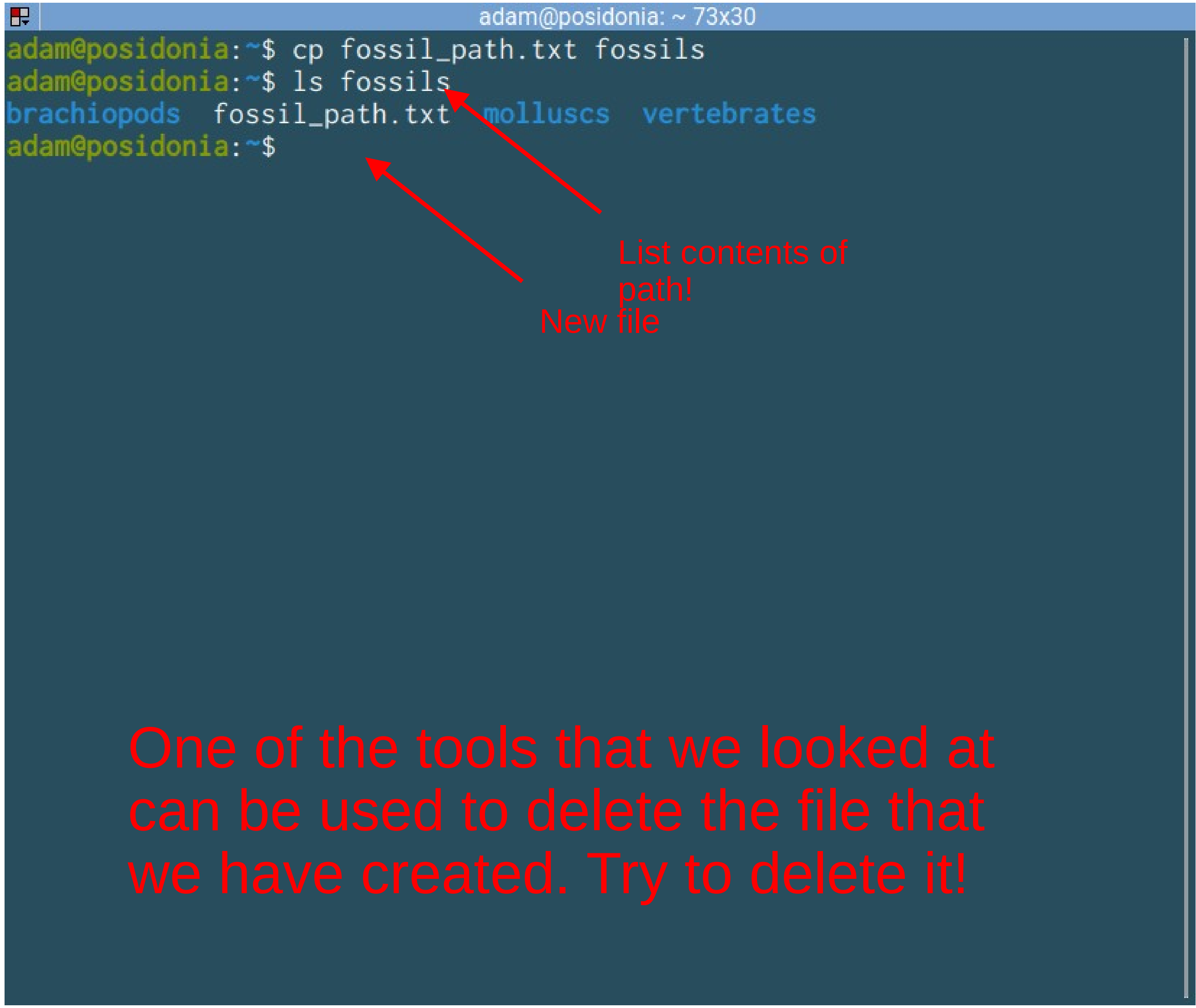
fossil_path.txt

molluscs

brachiopods

vertebrates

fossil_path.txt



```
adam@posidonia:~$ cp fossil_path.txt fossils
adam@posidonia:~$ ls fossils
brachiopods  fossil_path.txt  molluscs  vertebrates
adam@posidonia:~$
```

List contents of path!

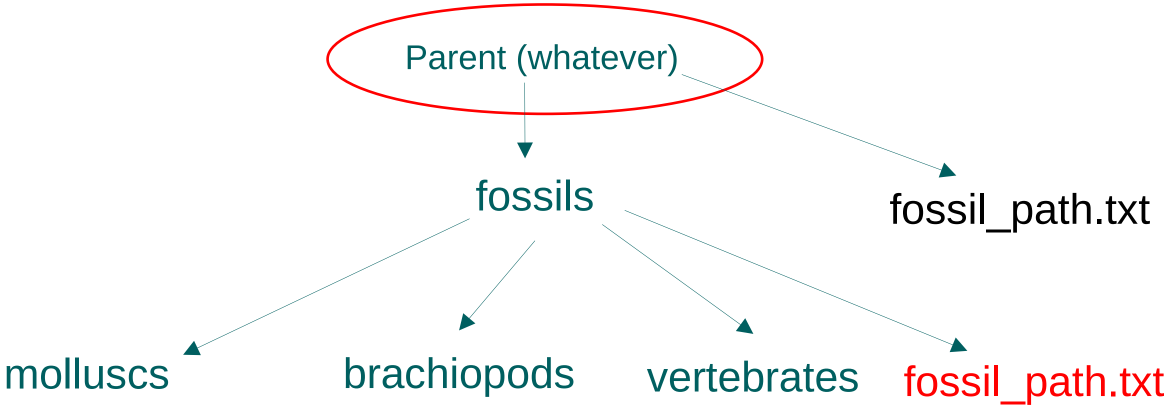
New file

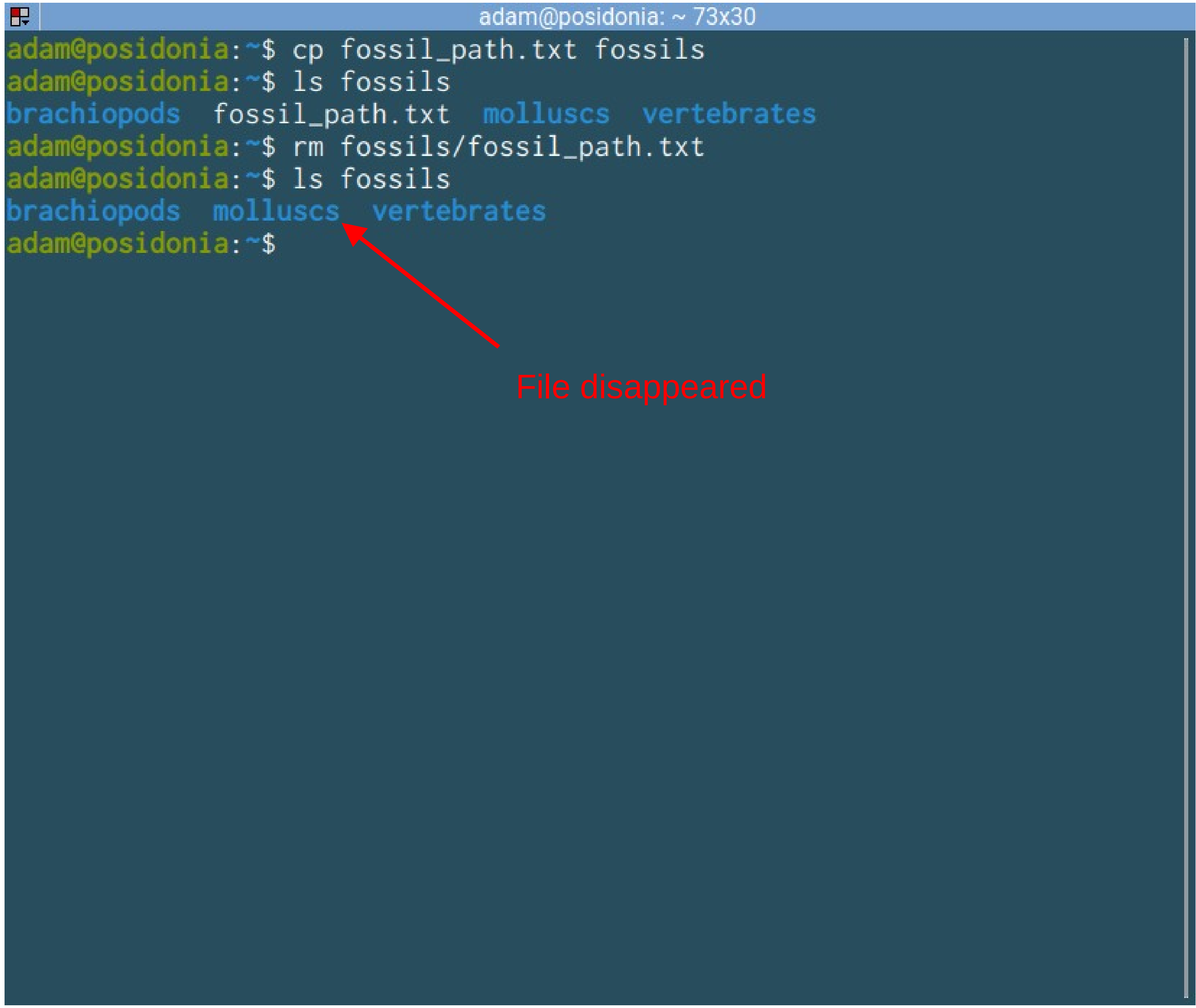
One of the tools that we looked at can be used to delete the file that we have created. Try to delete it!

rm␣<path_file>

Without –r removes a single file

- As with cp, multiple files can be passed to this
  (separated by spaces)

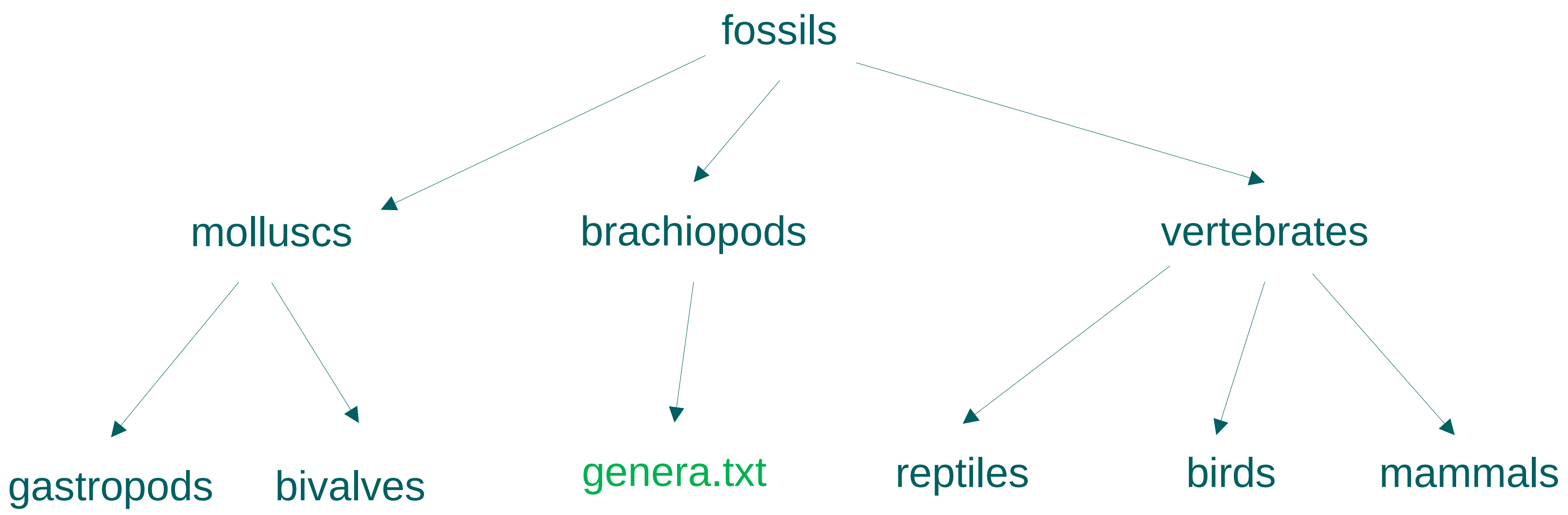




```
adam@posidonia:~$ cp fossil_path.txt fossils
adam@posidonia:~$ ls fossils
brachiopods  fossil_path.txt  molluscs  vertebrates
adam@posidonia:~$ rm fossils/fossil_path.txt
adam@posidonia:~$ ls fossils
brachiopods  molluscs  vertebrates
adam@posidonia:~$
```

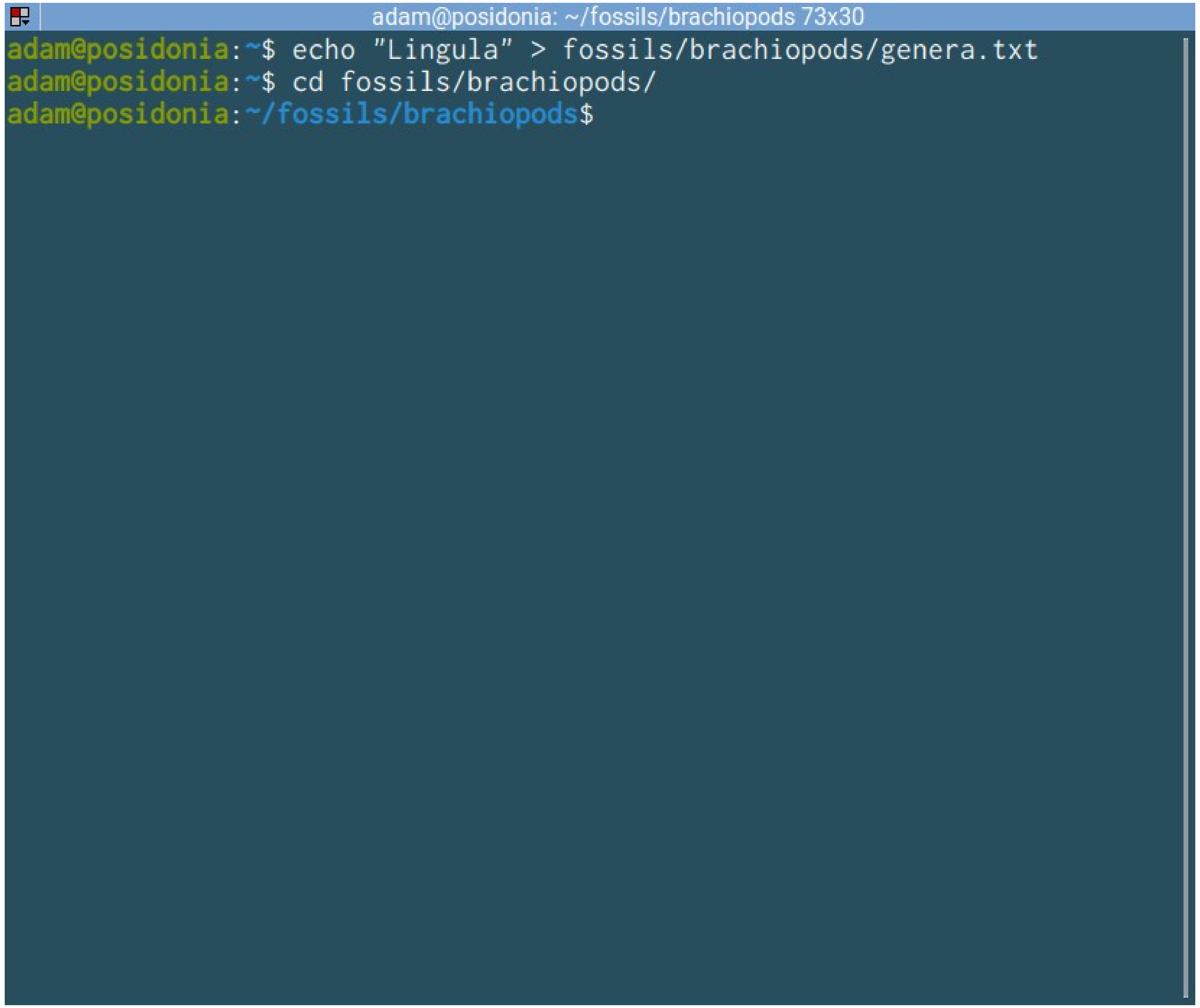
Demo!

1. Use an `echo` statement to write the genus name “*Lingula*” into `fossils/brachiopods/genera.txt`!
2. Then change directory to `brachiopods`.



echo␣“Lingula”␣>␣fossils/brachiopods/genera.txt

- You can use the double chevron >> to append to an existing file

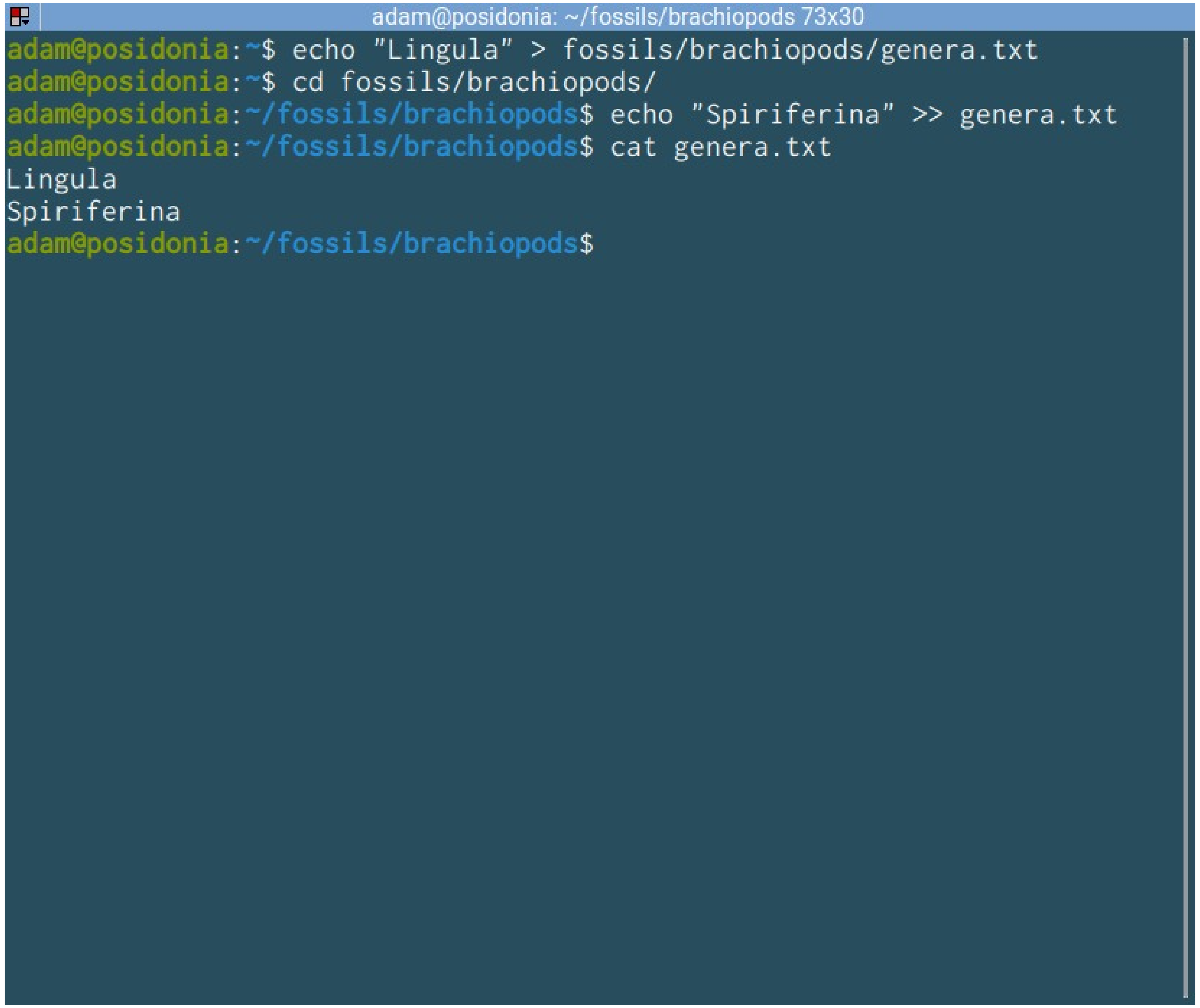


```
adam@posidonia:~$ echo "Lingula" > fossils/brachiopods/genera.txt
adam@posidonia:~$ cd fossils/brachiopods/
adam@posidonia:~/fossils/brachiopods$
```

echo␣“Spiriferina”␣>>␣genera.txt

Appending to files

- You can use the double chevron >> to append to an existing file
- Added to new line!



```
adam@posidonia:~$ echo "Lingula” > fossils/brachiopods/genera.txt
adam@posidonia:~$ cd fossils/brachiopods/
adam@posidonia:~/fossils/brachiopods$ echo "Spiriferina” >> genera.txt
adam@posidonia:~/fossils/brachiopods$ cat genera.txt
Lingula
Spiriferina
adam@posidonia:~/fossils/brachiopods$
```

Special characters

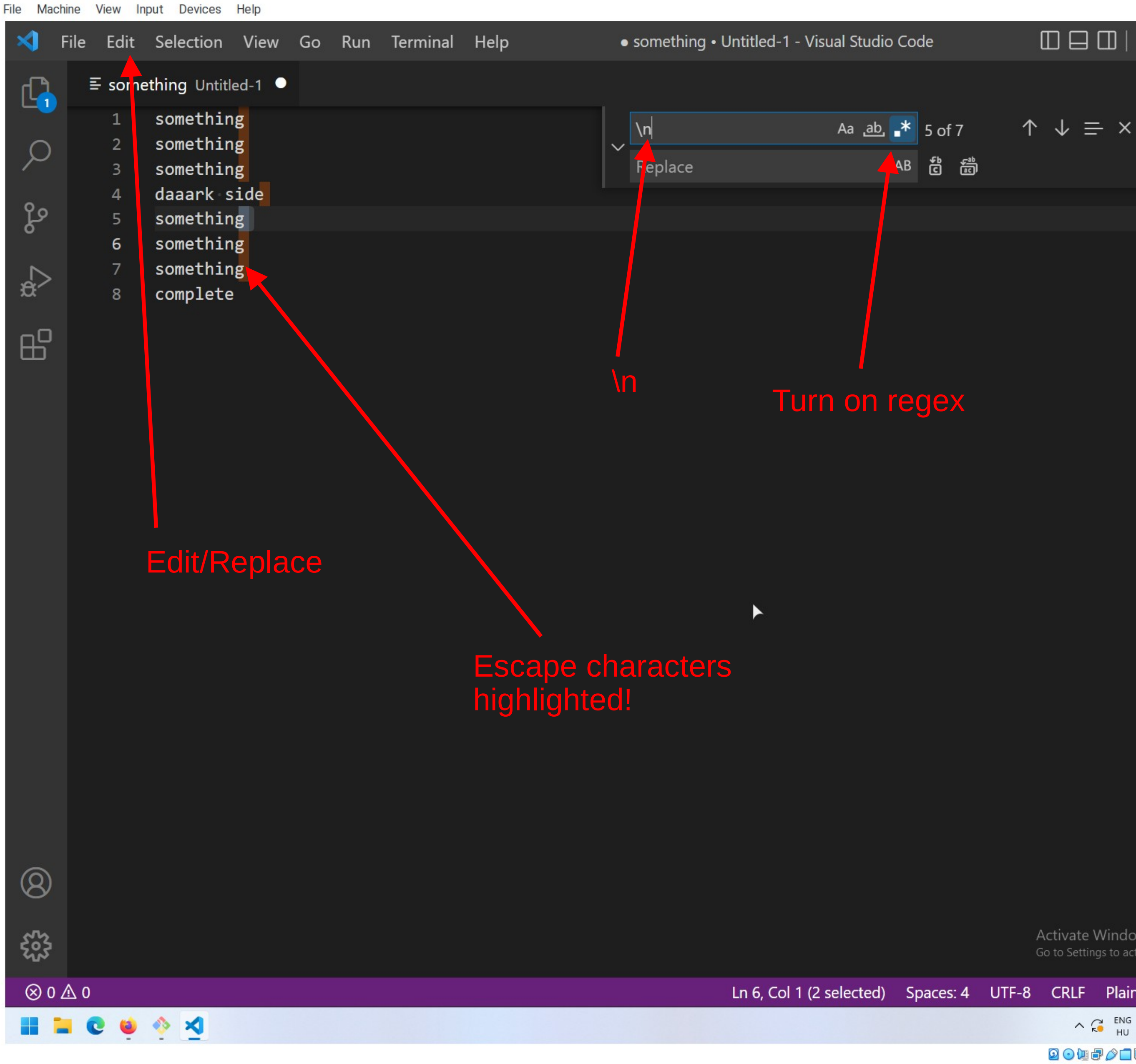
We use so called “escape characters” to denote special symbols, that sometimes have other meanings.

\n: newline escape

\t : tab escape

\” : double quote escape

\’ : single quote escape

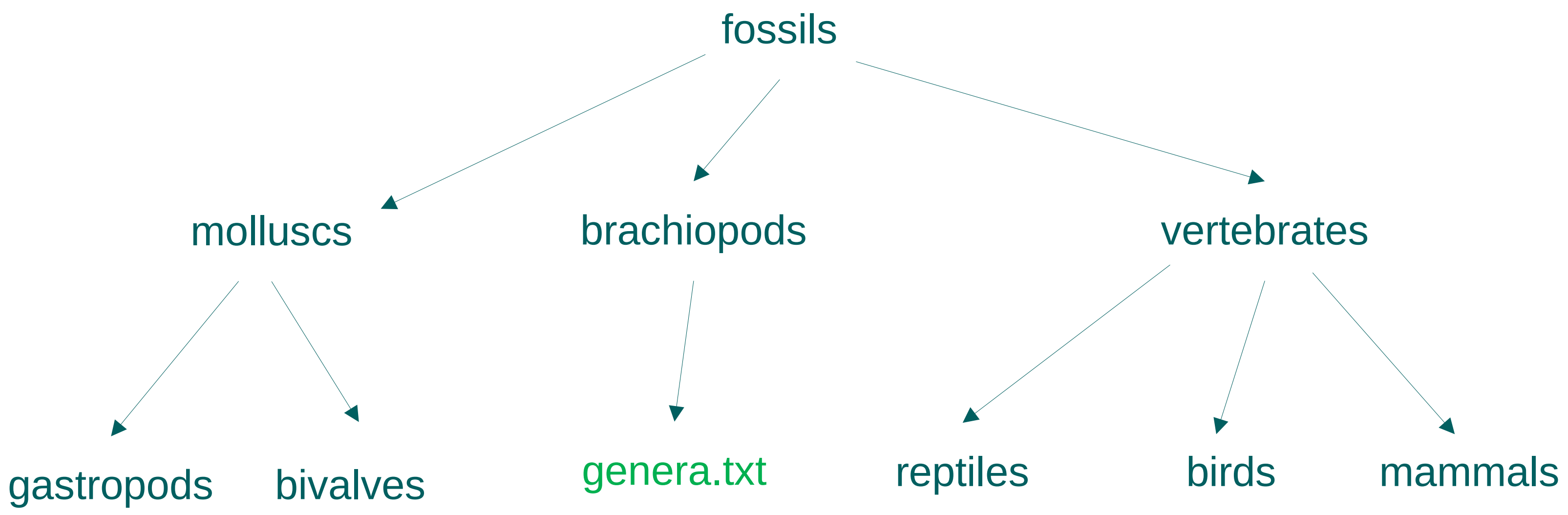


File Machine View Input Devices Help
File Edit Selection View Go Run Terminal Help
● something • Untitled-1 - Visual Studio Code
something Untitled-1
\n
Aa ab .*
5 of 7
Replace
AB
Ln 6, Col 1 (2 selected) Spaces: 4 UTF-8 CRLF Plain
Activate Windo
Go to Settings to act
ENG
HU
Edit/Replace
\n
Turn on regex
Escape characters highlighted!

```
something
something
something
daaark side
something
something
something
complete
```

Demo!

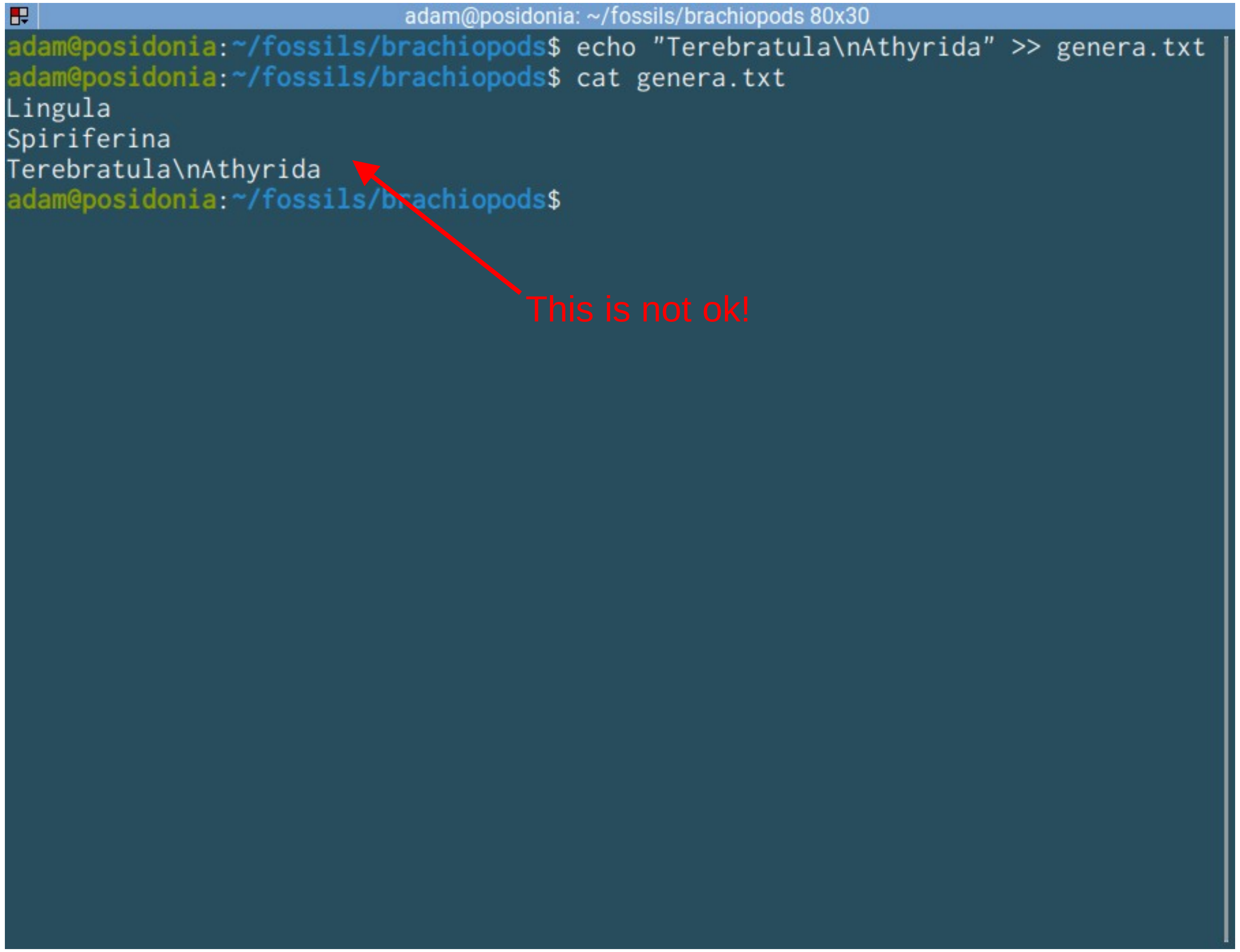
1. Use an echo statement to write the genus name “*Terebratula*” and “*Athyris*” into `fossils/brachiopods/genera.txt`, **`use a newline escape between them!`**
2. Then change directory to `brachiopods`.



echo␣”Terebratula\nAthyrida”␣>>␣genera.txt

Appending to files

- It doesn’t seem to work!
- Echo needs to know to replace the combination `\n` with the newline character!



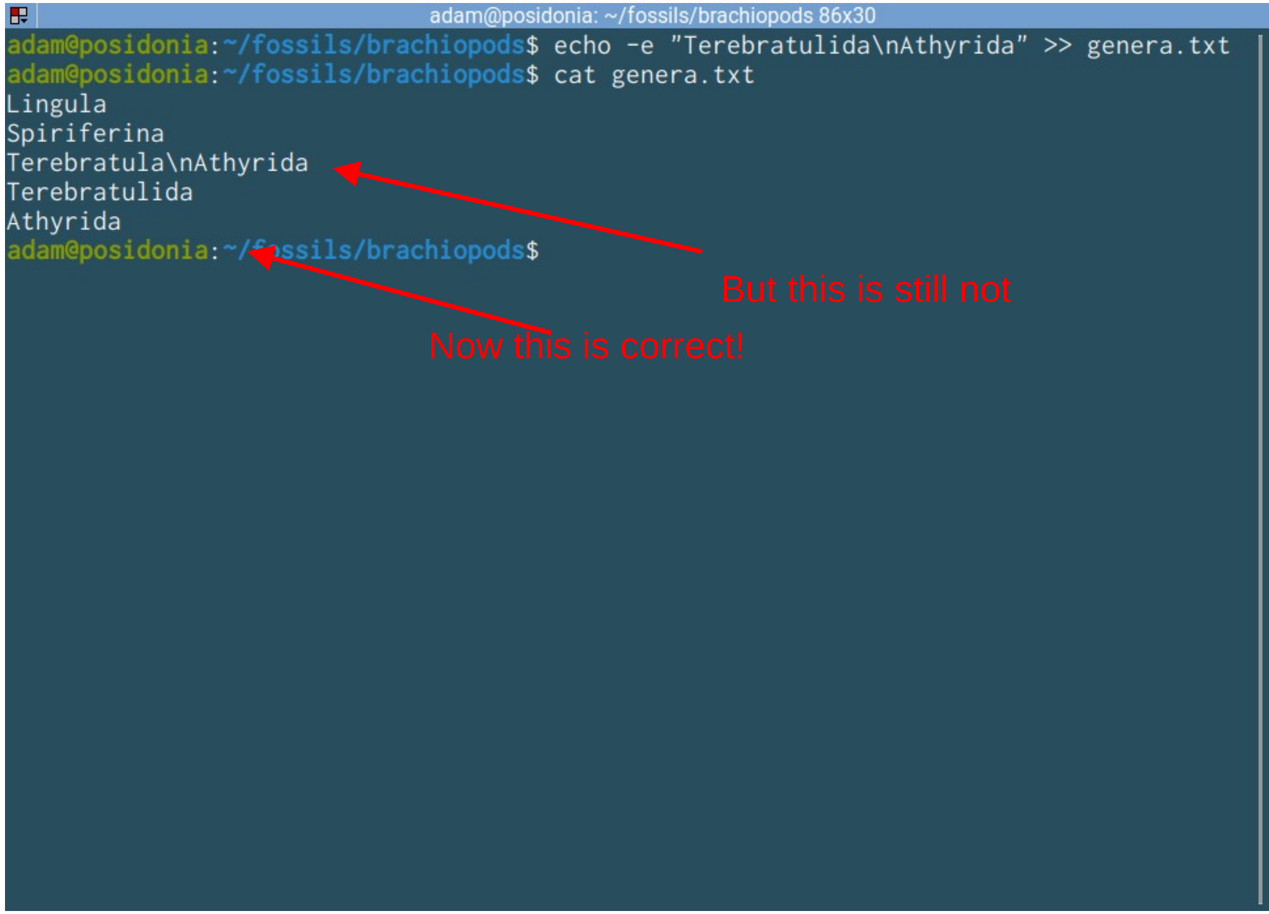
```
adam@posidonia:~/fossils/brachiopods$ echo "Terebratula\nAthyrida" >> genera.txt
adam@posidonia:~/fossils/brachiopods$ cat genera.txt
Lingula
Spiriferina
Terebratula\nAthyrida
adam@posidonia:~/fossils/brachiopods$
```

This is not ok!

echo␣-e␣“Terebratula\nAthyrida”␣>>␣genera.txt

Appending to files

- Use the –e option!
- Our file is messed up. Options:
  - 1. Redo our file
  - 2. Use an editor to correct
- Delete the bad line!
- Better, next time: go back in time.



```
adam@posidonia:~/fossils/brachiopods$ echo -e "Terebratulida\nAthyrida" >> genera.txt
adam@posidonia:~/fossils/brachiopods$ cat genera.txt
Lingula
Spiriferina
Terebratula\nAthyrida
Terebratulida
Athyrida
adam@posidonia:~/fossils/brachiopods$
```

But this is still not

Now this is correct!

Basic version control with Git

and GitHub

Why version control?

**Projects evolve in a non-linear way,
especially programming projects.**

- Multiple people work on them, sometimes at the same time
- Recording the history of project development
- Working with many files
- Sharing code is necessary, we also need to know who changes what

Difference between Git and GitHub?

git

- Locally running application
- Operates with files in a local directory (repository)
- Works without a remotes!

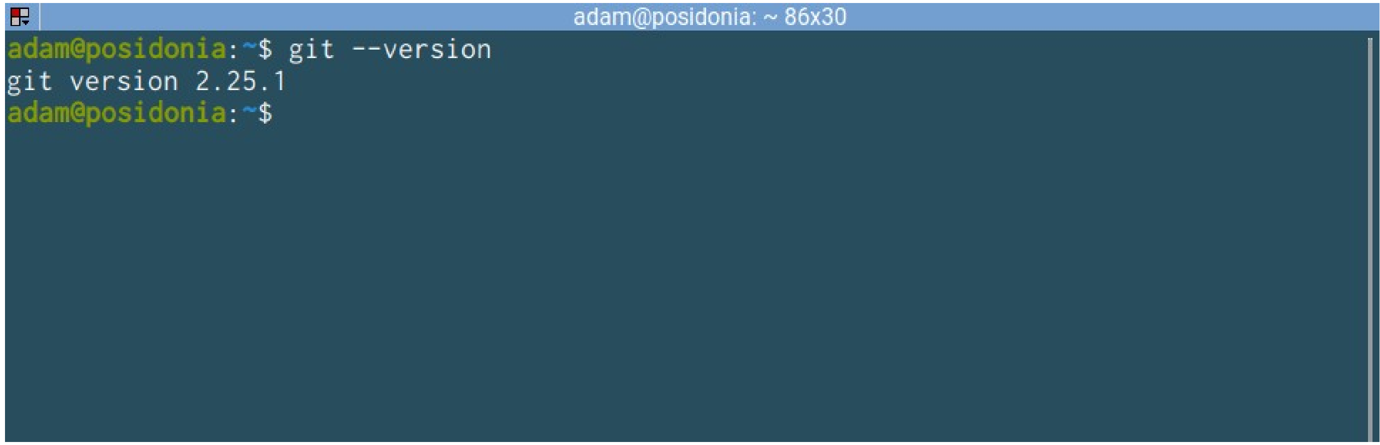
GitHub and GitLab

- Remote servers with copies of the repository

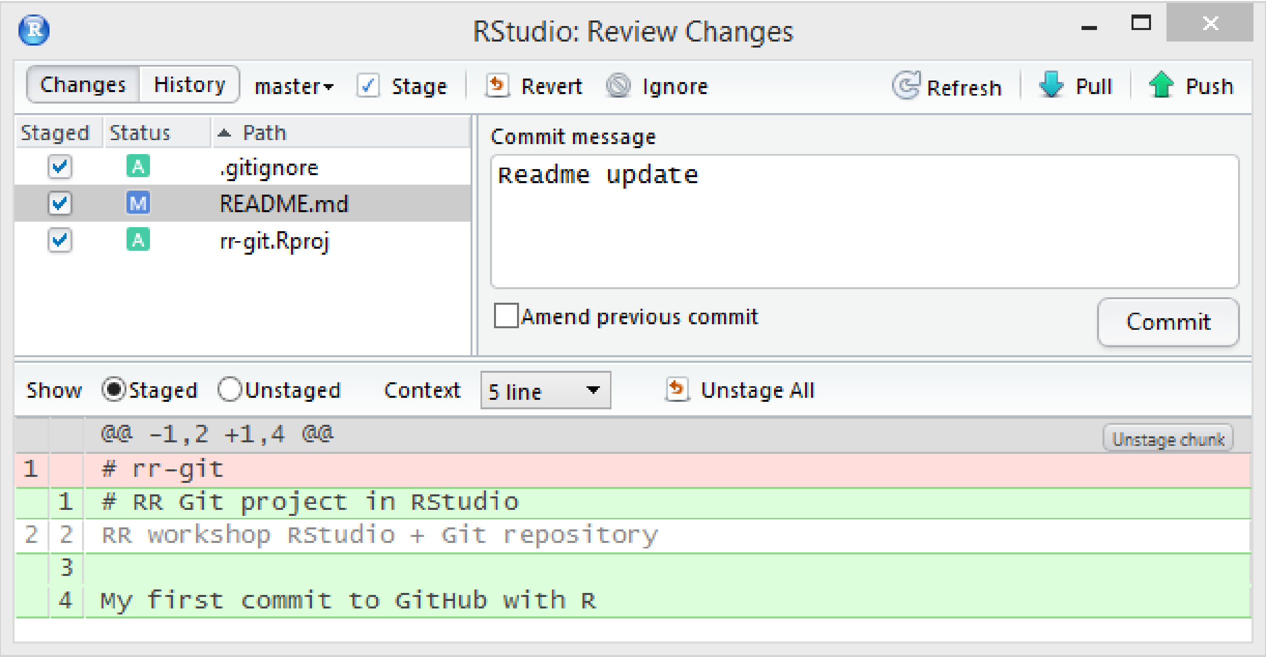
Interfaces to git

Git is a command line (console application)

- The complete features are only available via the command line!
- Simplified graphical interfaces written for novices, embedded in IDEs
- These actually just translate the actions to the command line application -> Experiment!



```
adam@posidonia:~$ git --version
git version 2.25.1
adam@posidonia:~$
```



Staged	Status	Path
☑	A	.gitignore
☑	M	README.md
☑	A	rr-git.Rproj

Commit message

Readme update

□ Amend previous commit

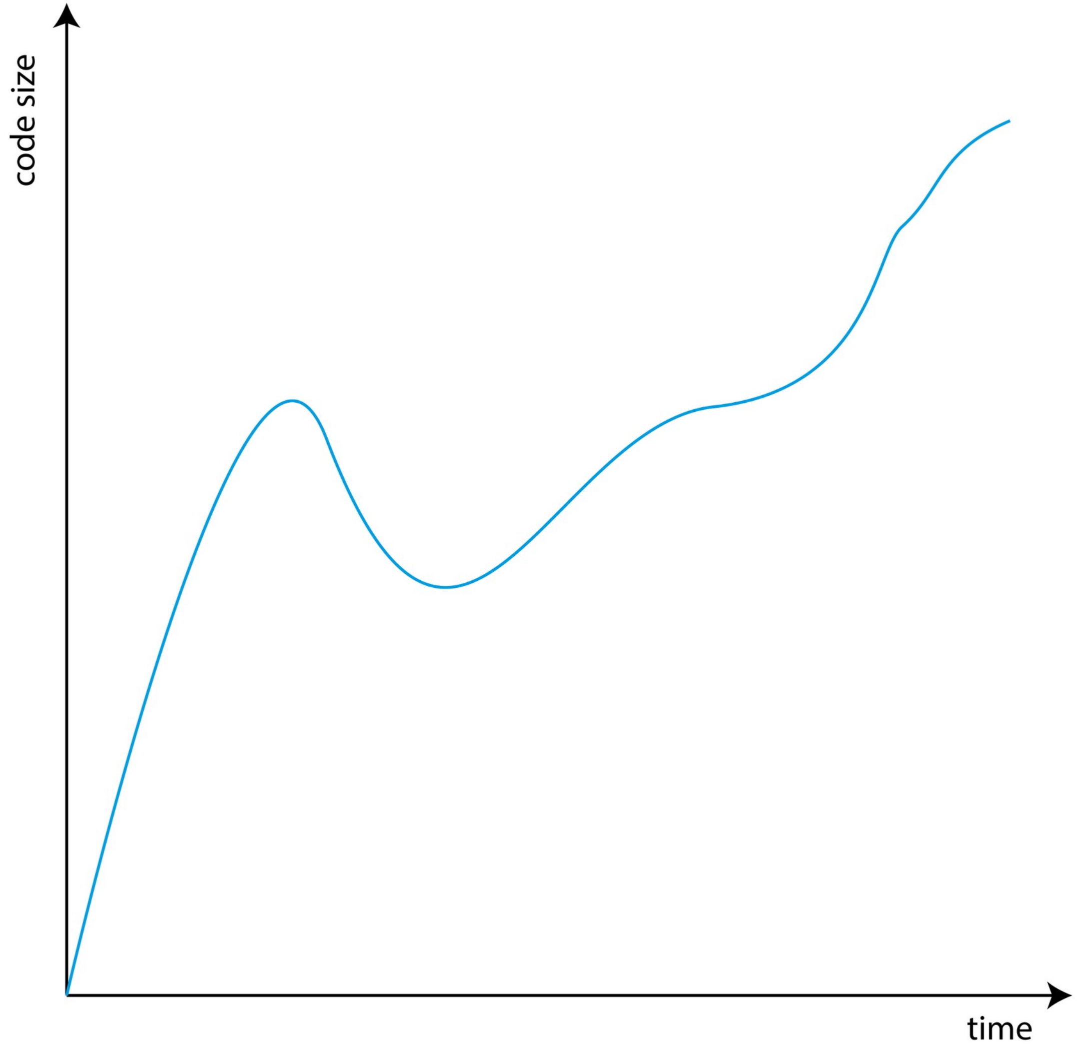
Show ● Staged ○ Unstaged Context 5 line

```
@@ -1,2 +1,4 @@
1     # rr-git
   1  # RR Git project in RStudio
2  2  RR workshop RStudio + Git repository
   3
   4  My first commit to GitHub with R
```

The basic use of git

Record snapshots of how a project develops.

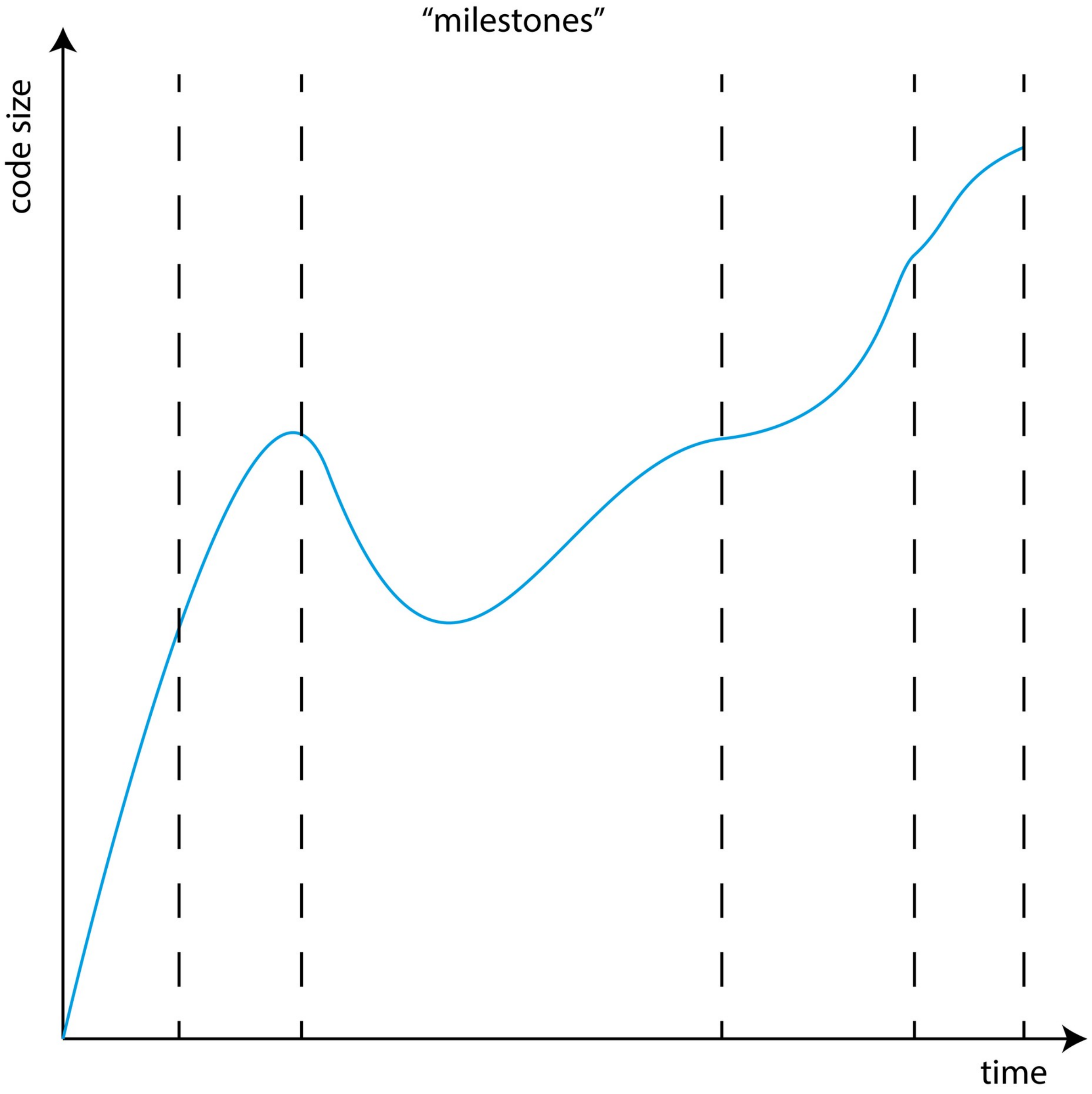
- Code develops in a non-linear, but continuous way, with lots of small changes:
  - Contents of files change
  - New files are added to the repository
  - Old files are delete from the respository



The basic use of git

Record snapshots of how a project develops.

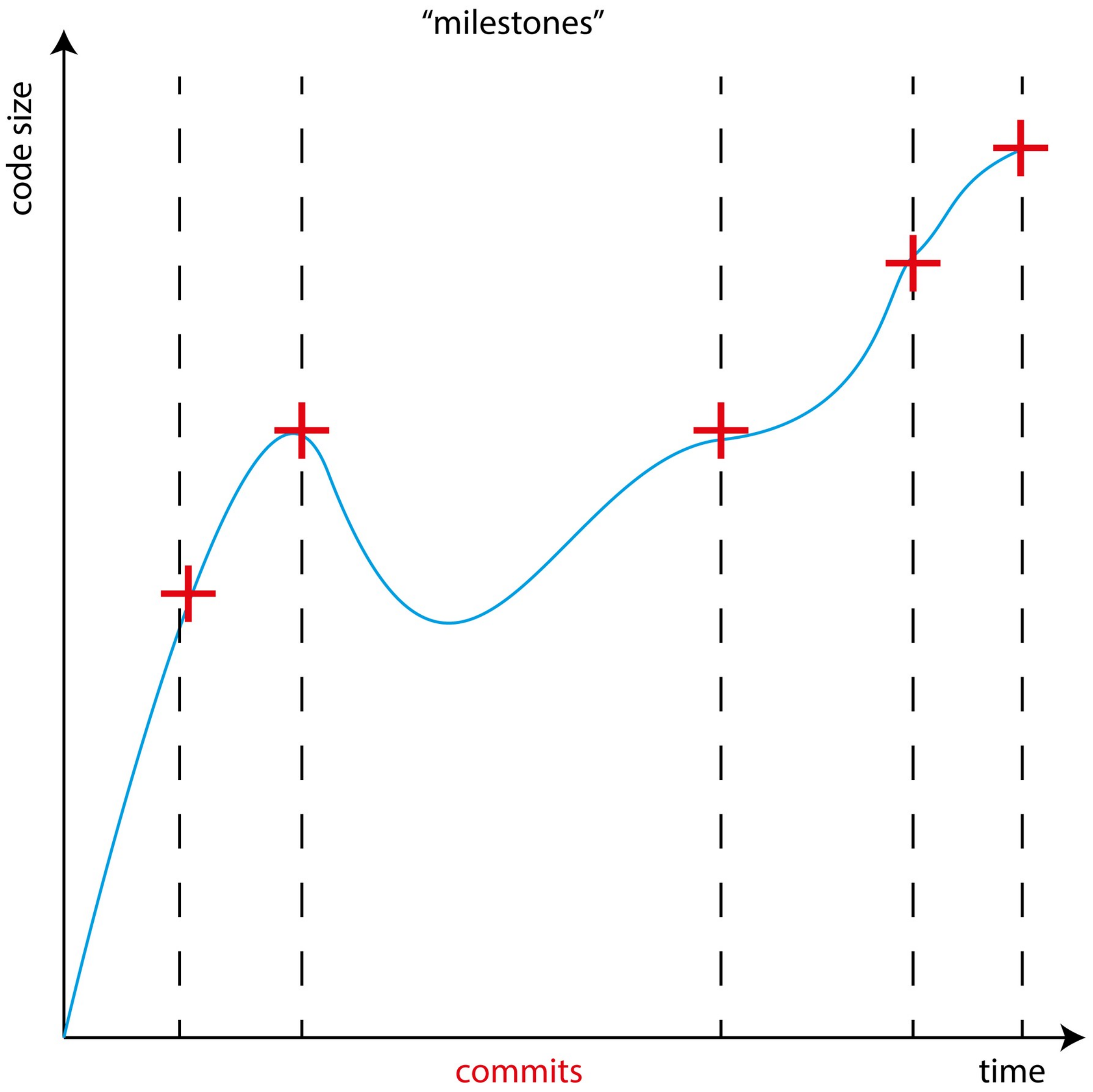
- Specific states of the code represent milestones:
  - Something works completely
  - Everything is cleaned up
  - Ready for further development
- In between these are transient states, when you are working on something but that is not yet done.



The basic use of git

Record snapshots of how a project develops.

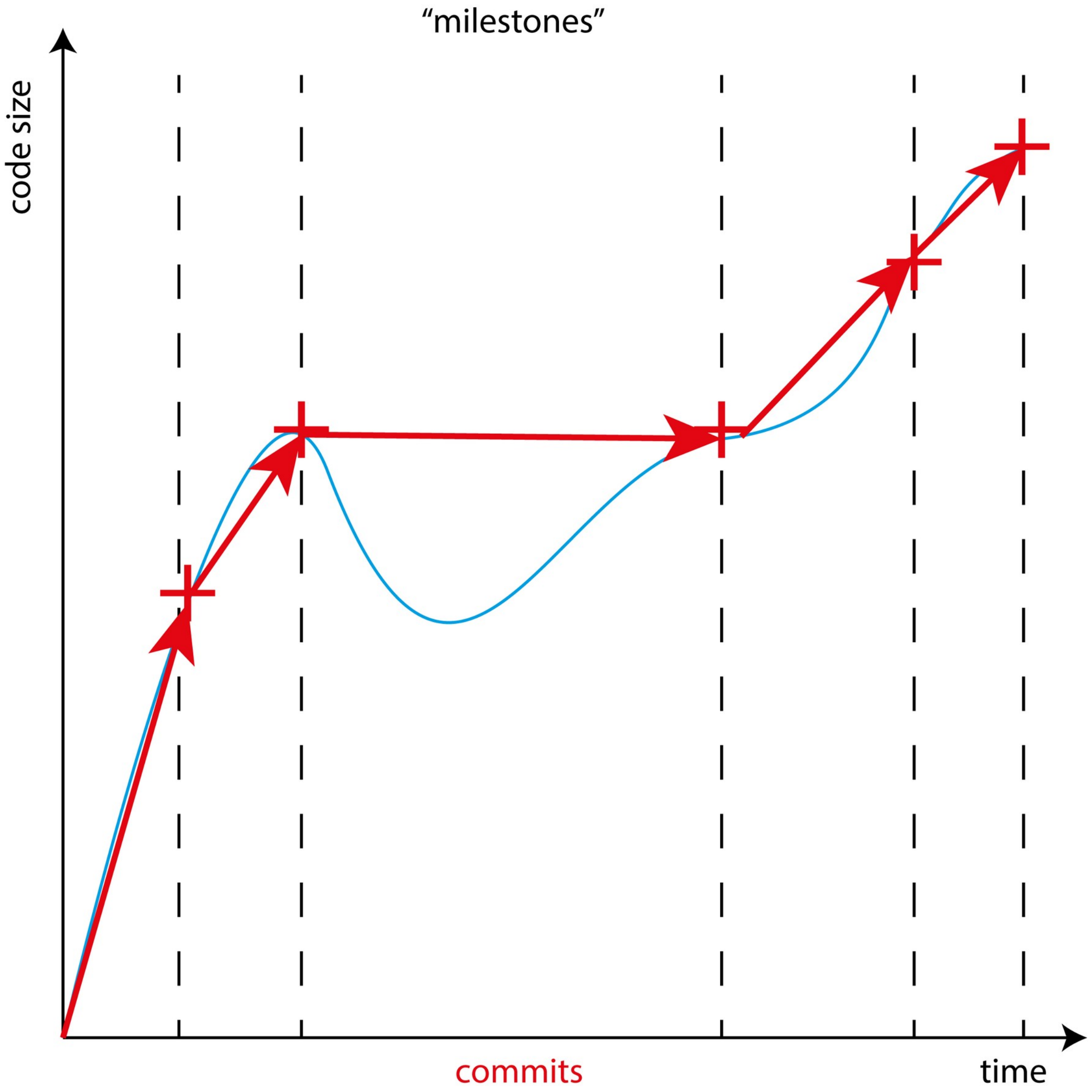
- These milesones can be saved and accessed at any time.
- These states are called as ‘commits’ in git’s terminology



The basic use of git

Record snapshots of how a project develop

- Only the committed stages are recorded, the rest of the history is discarded
- The git repository is recorded as changes from one commit to the next



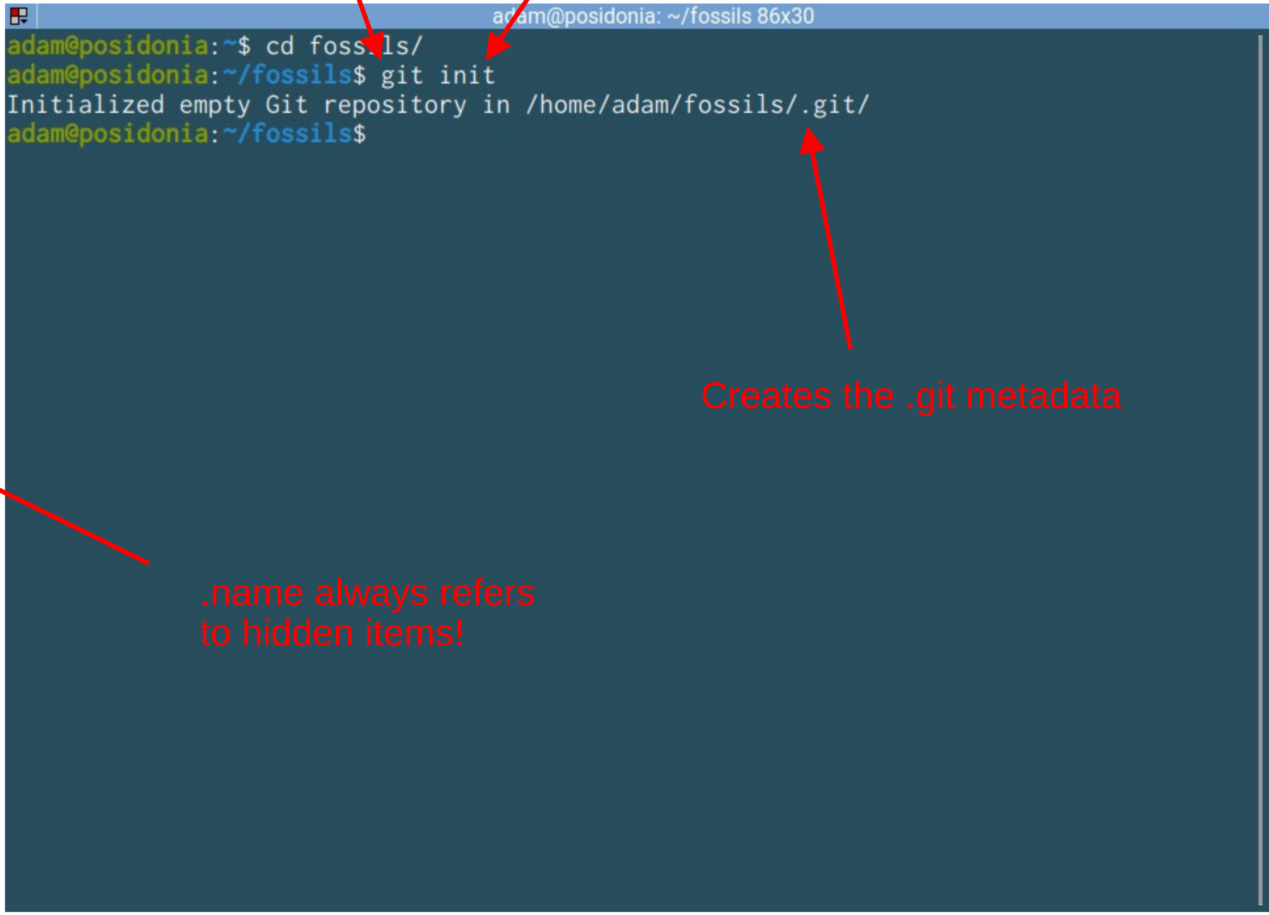
git␣init

Create a new git repository in current directory.

- A git repository is a directory with git metadata in it.
- The git metadata are in the `.git` directory

Name of application

Command for the application



```
adam@posidonia:~$ cd fossils/
adam@posidonia:~/fossils$ git init
Initialized empty Git repository in /home/adam/fossils/.git/
adam@posidonia:~/fossils$
```

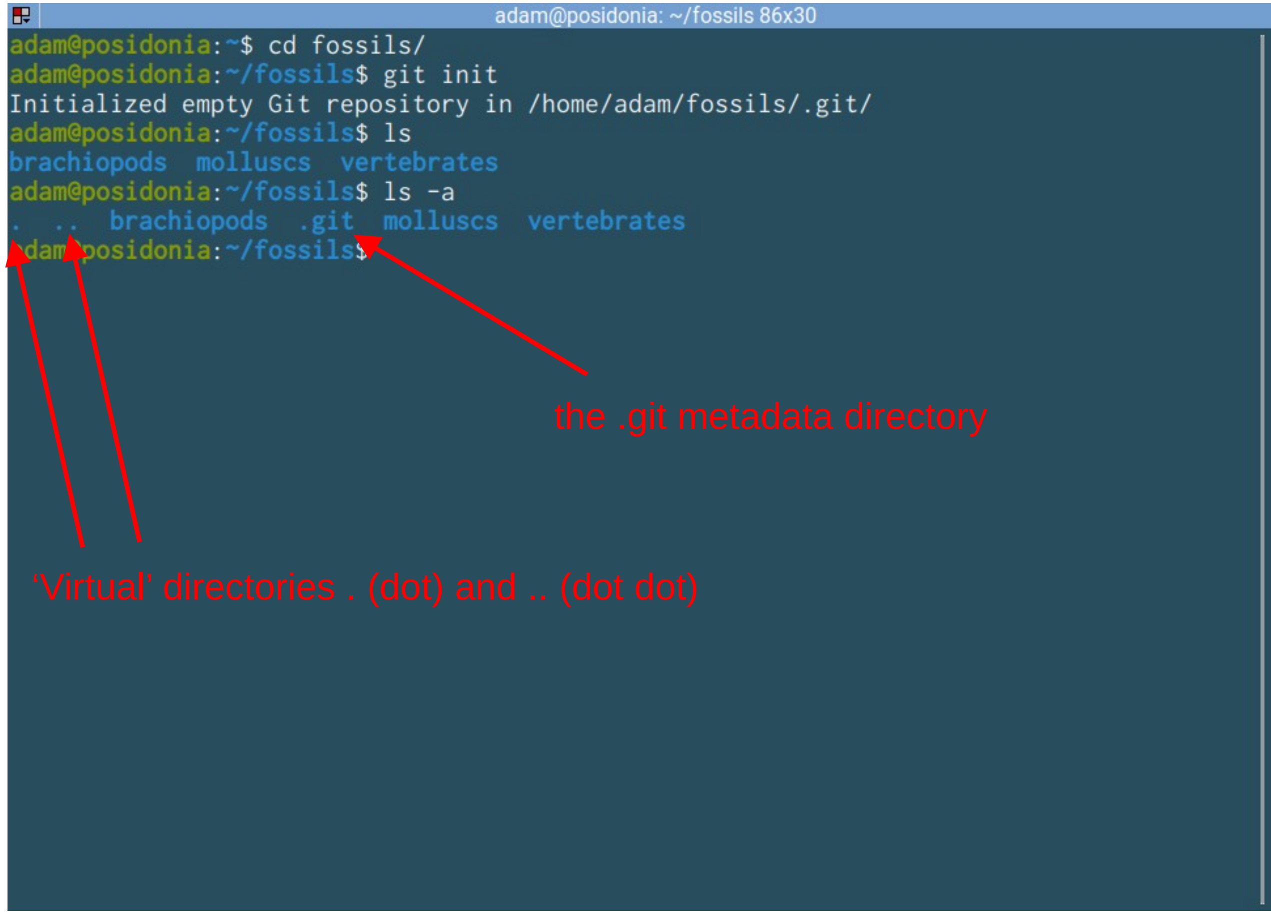
Creates the .git metadata

.name always refers
to hidden items!

`ls␣-a`

List all files and directories in directory, including hidden items!

- The double dot (`..`) represents a way to refer to the previous directory, as we have seen earlier
- The single dot (`.`) represents a way to refer to the current directory.
- Note: `cd brachiopods` and `cd ./brachiopods` are the same!



```
adam@posidonia:~$ cd fossils/
adam@posidonia:~/fossils$ git init
Initialized empty Git repository in /home/adam/fossils/.git/
adam@posidonia:~/fossils$ ls
brachiopods  molluscs  vertebrates
adam@posidonia:~/fossils$ ls -a
.  ..  brachiopods  .git  molluscs  vertebrates
adam@posidonia:~/fossils$
```

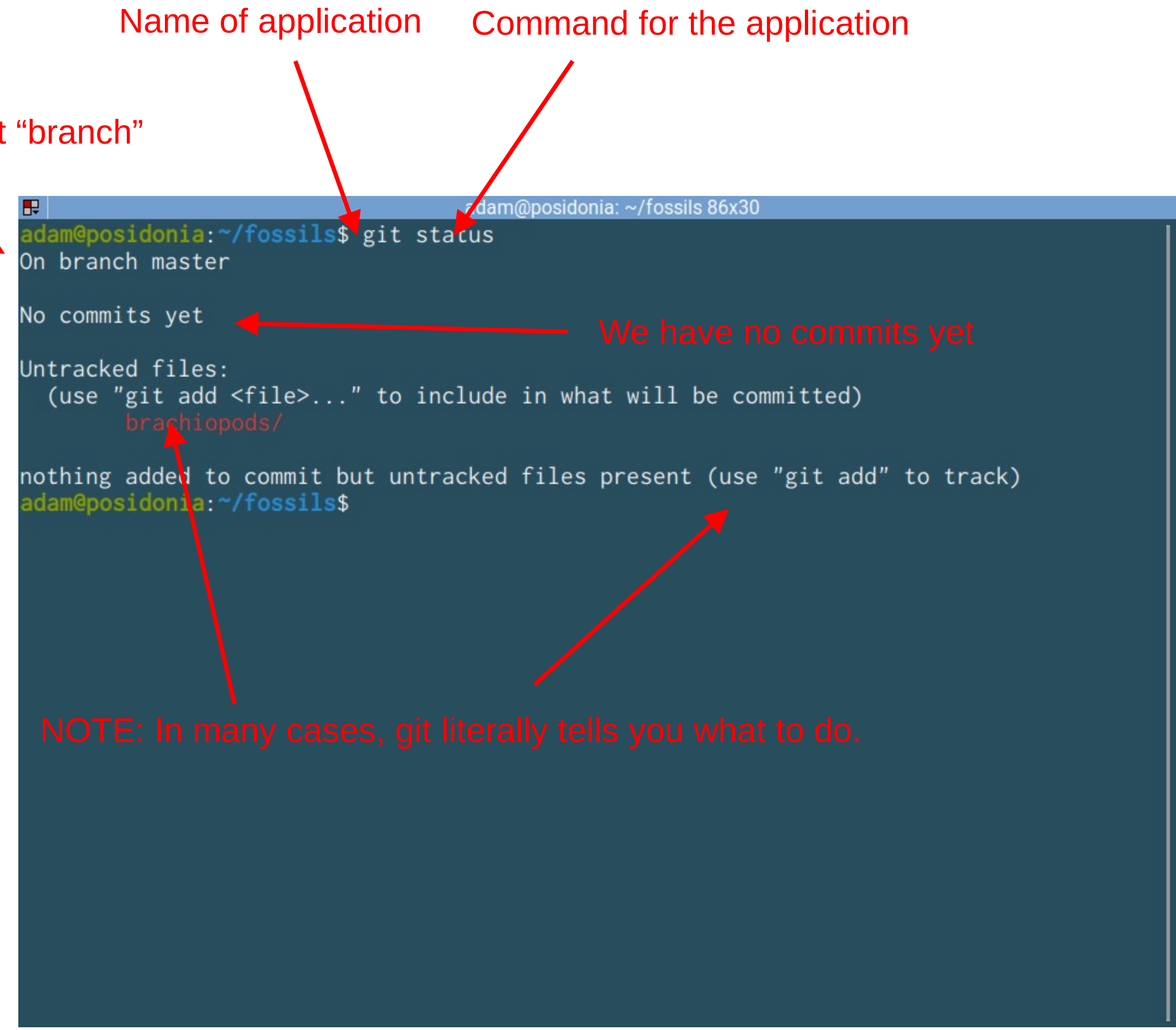
the .git metadata directory

'Virtual' directories . (dot) and .. (dot dot)

git␣status

Show the status of the current respository

- A series of commits is called a ‘branch’. Simple repos use only one. There is always a current one
- Git has detected that there are things in the repo that are not registered.
- **Git can only detect files. Empty directories are not recorded!**



```
adam@posidonia:~/fossils$ git status
On branch master

No commits yet

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        brachiopods/

nothing added to commit but untracked files present (use "git add" to track)
adam@posidonia:~/fossils$
```

Name of application

Command for the application

Name of the current “branch”

We have no commits yet

NOTE: In many cases, git literally tells you what to do.

Staging

The preparation of a commit

- Commits are permanent, or are difficult to remove once done, so we have tools to make sure that they are ok
- Changes first have to be staged, before commiting. This allows us to include only specific changes in the commit, and to make sure that we are doing things ok.

Staging and commit (Airport)

Initial boarding pass control vs. boarding

- If you go through security you are staged to fly. You are expected to be on the plane, but you can still leave.
- If you board the plane and the cabin doors are closed, you are committed to a flight.

Getting staged

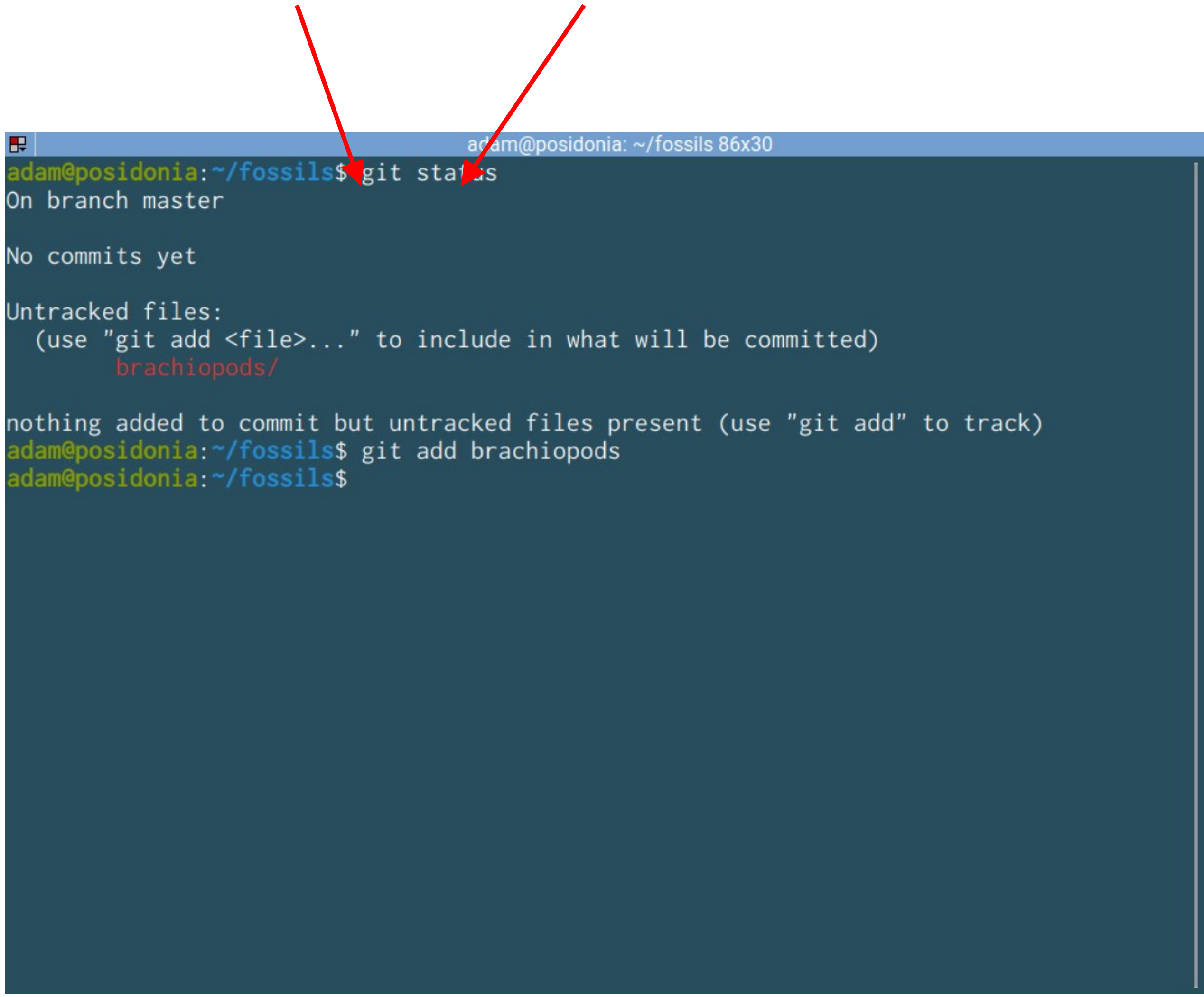
In the staged area, waiting to be commited

The commit

git␣add␣<path>

Stage the target file or directory.

- Frequently this is an entire directory, including `.` (dot)
- If successful does not return anything, has to be checked with git status



Name of application

Command for the application

```
adam@posidonia: ~/fossils 86x30
adam@posidonia:~/fossils$ git status
On branch master

No commits yet

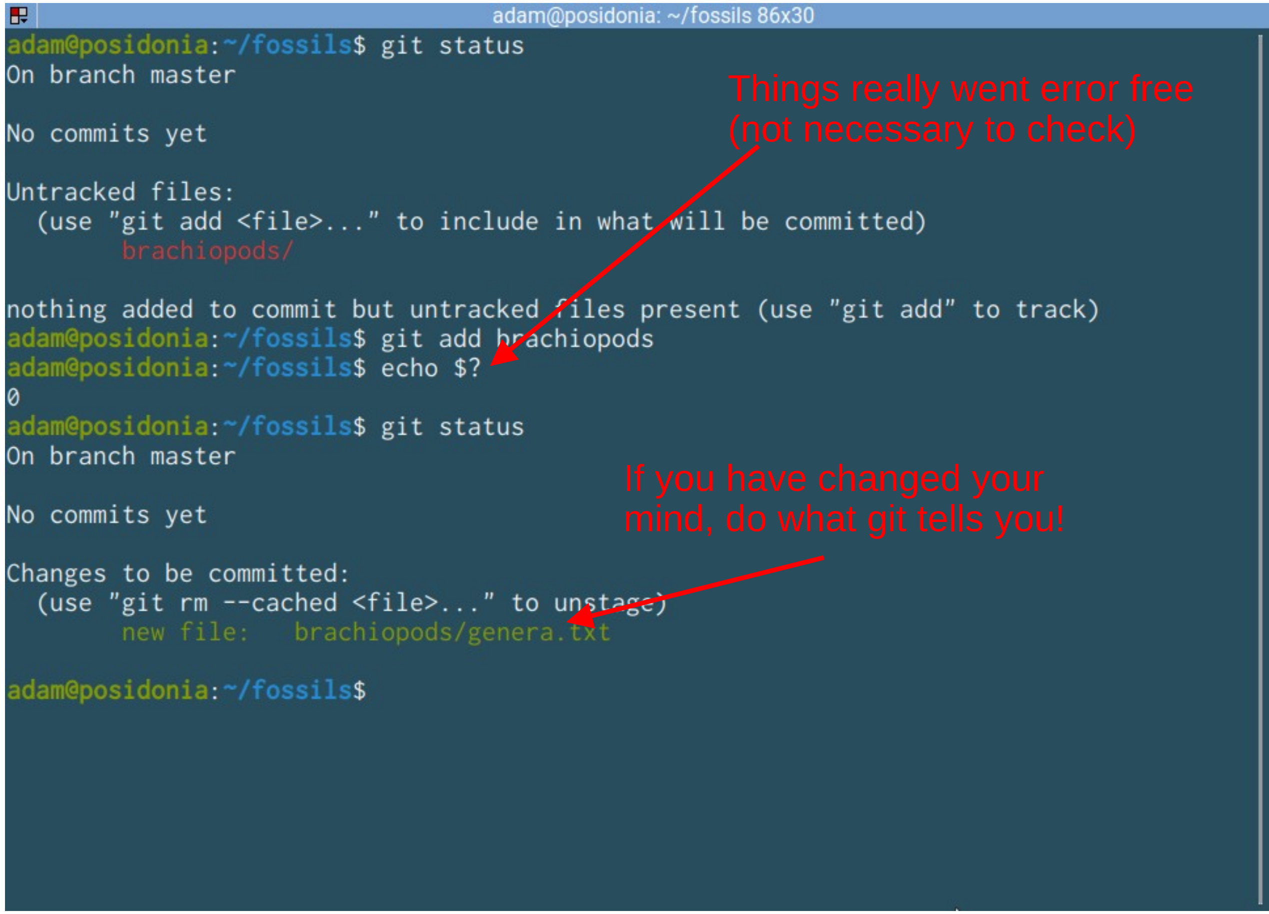
Untracked files:
  (use "git add <file>..." to include in what will be committed)
        brachiopods/

nothing added to commit but untracked files present (use "git add" to track)
adam@posidonia:~/fossils$ git add brachiopods
adam@posidonia:~/fossils$
```

git␣status (again)

Show status of repo

- There is just one file here which git finds.
- The file is now stages to be commited.



adam@posidonia: ~/fossils 86x30

```
adam@posidonia:~/fossils$ git status
On branch master

No commits yet

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        brachiopods/

nothing added to commit but untracked files present (use "git add" to track)
adam@posidonia:~/fossils$ git add brachiopods
adam@posidonia:~/fossils$ echo $?
0
adam@posidonia:~/fossils$ git status
On branch master

No commits yet

Changes to be committed:
  (use "git rm --cached <file>..." to unstage)
        new file:   brachiopods/genera.txt

adam@posidonia:~/fossils$
```

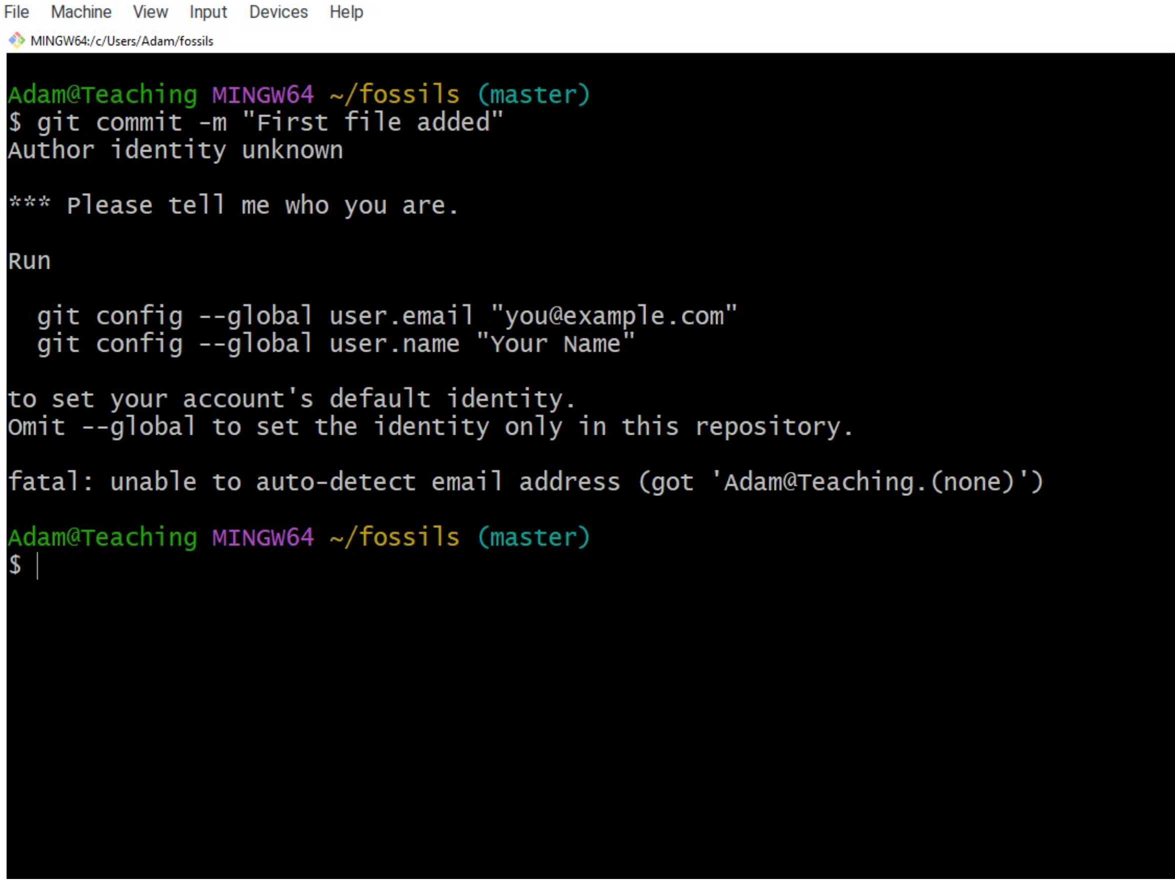
Things really went error free (not necessary to check)

If you have changed your mind, do what git tells you!

git␣commit␣-m␣<message>

First use not permitted without credentials!

- You need to provide a user name and an email address with the git config command



```
Adam@Teaching MINGW64 ~/fossils (master)
$ git commit -m "First file added"
Author identity unknown

*** Please tell me who you are.

Run

  git config --global user.email "you@example.com"
  git config --global user.name "Your Name"

to set your account's default identity.
Omit --global to set the identity only in this repository.

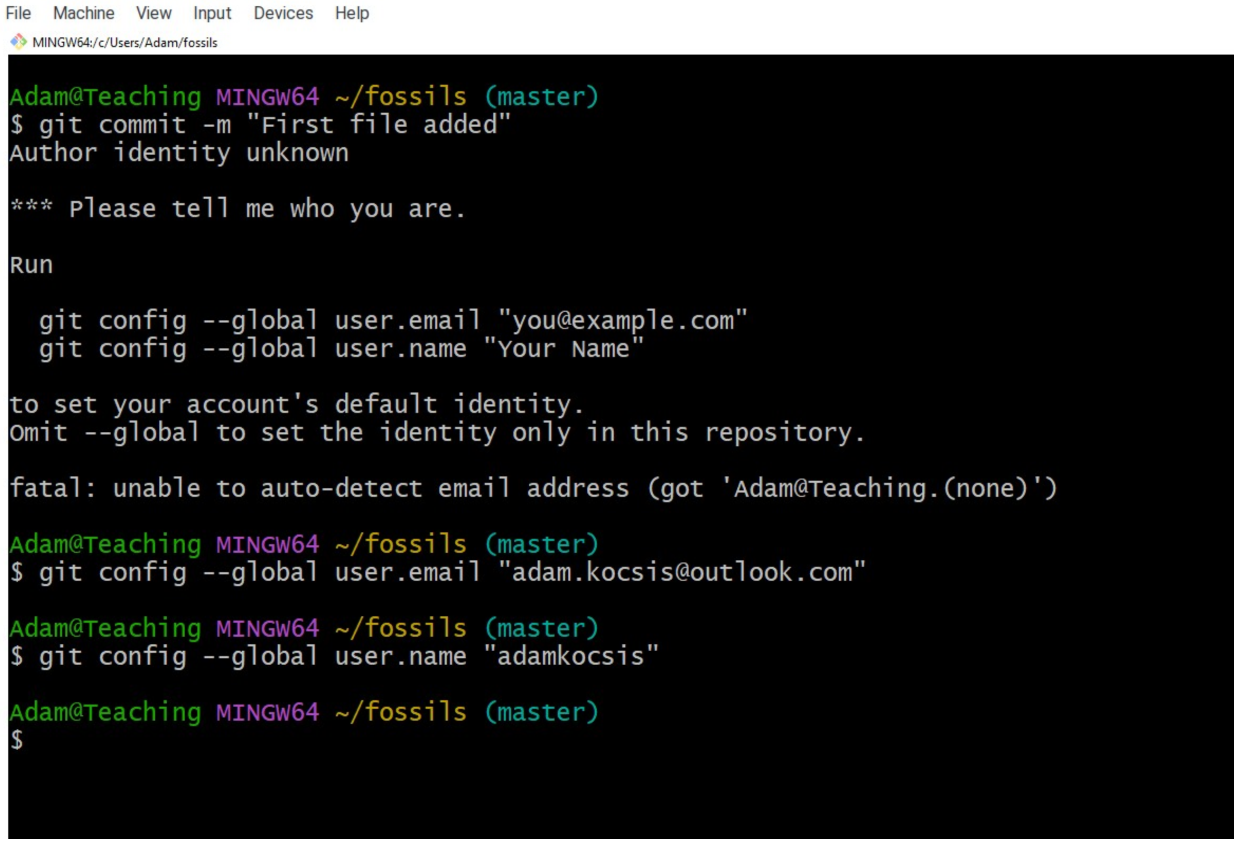
fatal: unable to auto-detect email address (got 'Adam@Teaching.(none)')

Adam@Teaching MINGW64 ~/fossils (master)
$ 
```

git␣config␣--global␣<what>␣<value>

Configuring git

- user.name and user.email
- --global sets this for all your local git repositories
- Now you are ready to commit



```
Adam@Teaching MINGW64 ~/fossils (master)
$ git commit -m "First file added"
Author identity unknown

*** Please tell me who you are.

Run

  git config --global user.email "you@example.com"
  git config --global user.name "Your Name"

to set your account's default identity.
Omit --global to set the identity only in this repository.

fatal: unable to auto-detect email address (got 'Adam@Teaching.(none)')

Adam@Teaching MINGW64 ~/fossils (master)
$ git config --global user.email "adam.kocsis@outlook.com"

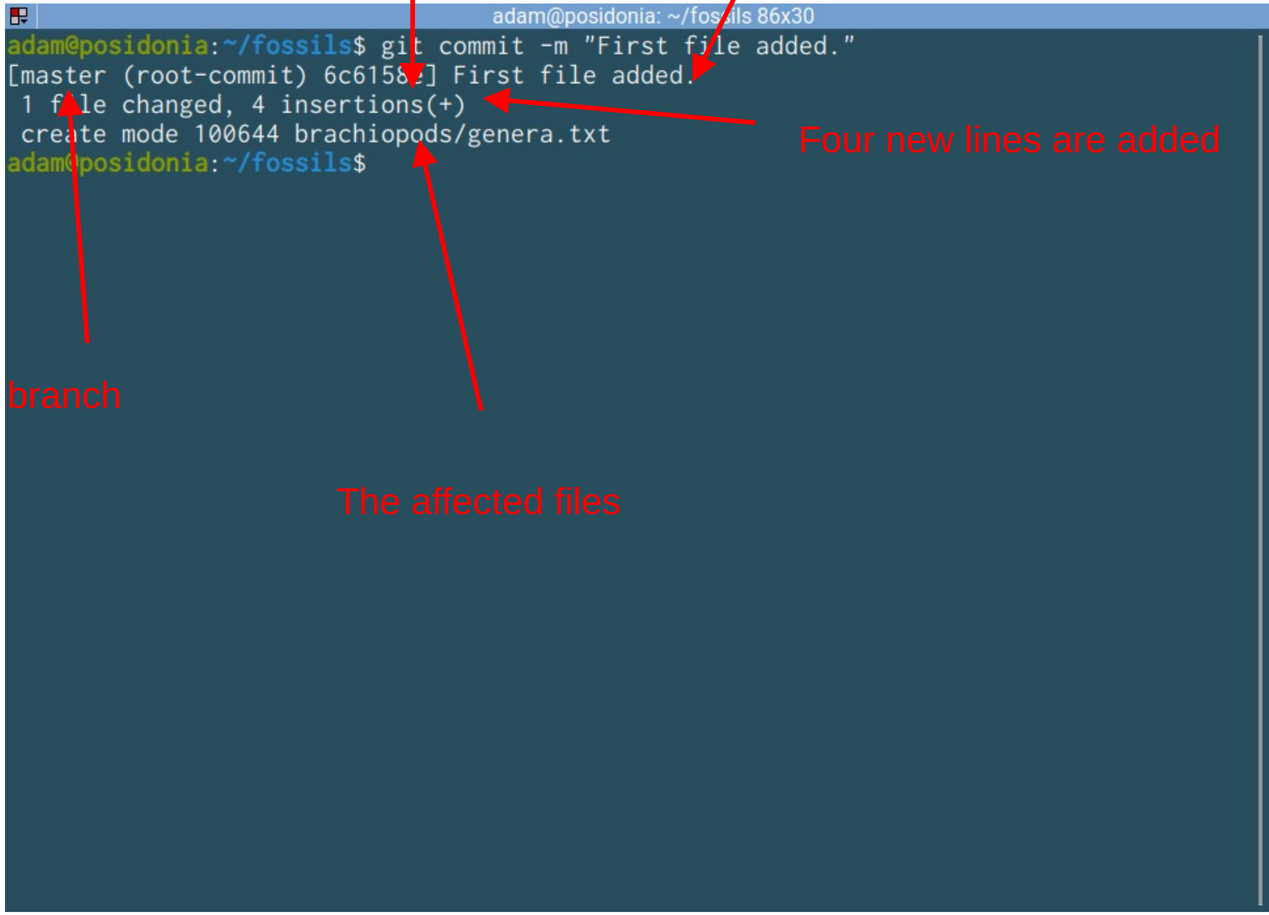
Adam@Teaching MINGW64 ~/fossils (master)
$ git config --global user.name "adamkocsis"

Adam@Teaching MINGW64 ~/fossils (master)
$
```

git␣commit␣-m␣<message>

Now create a new commit

- Provide a message in **quotes**! This is the human readable description of what changed.
- Every commit gets a unique ‘hash’, a random set of characters that are used to identify unambiguously identify the commit

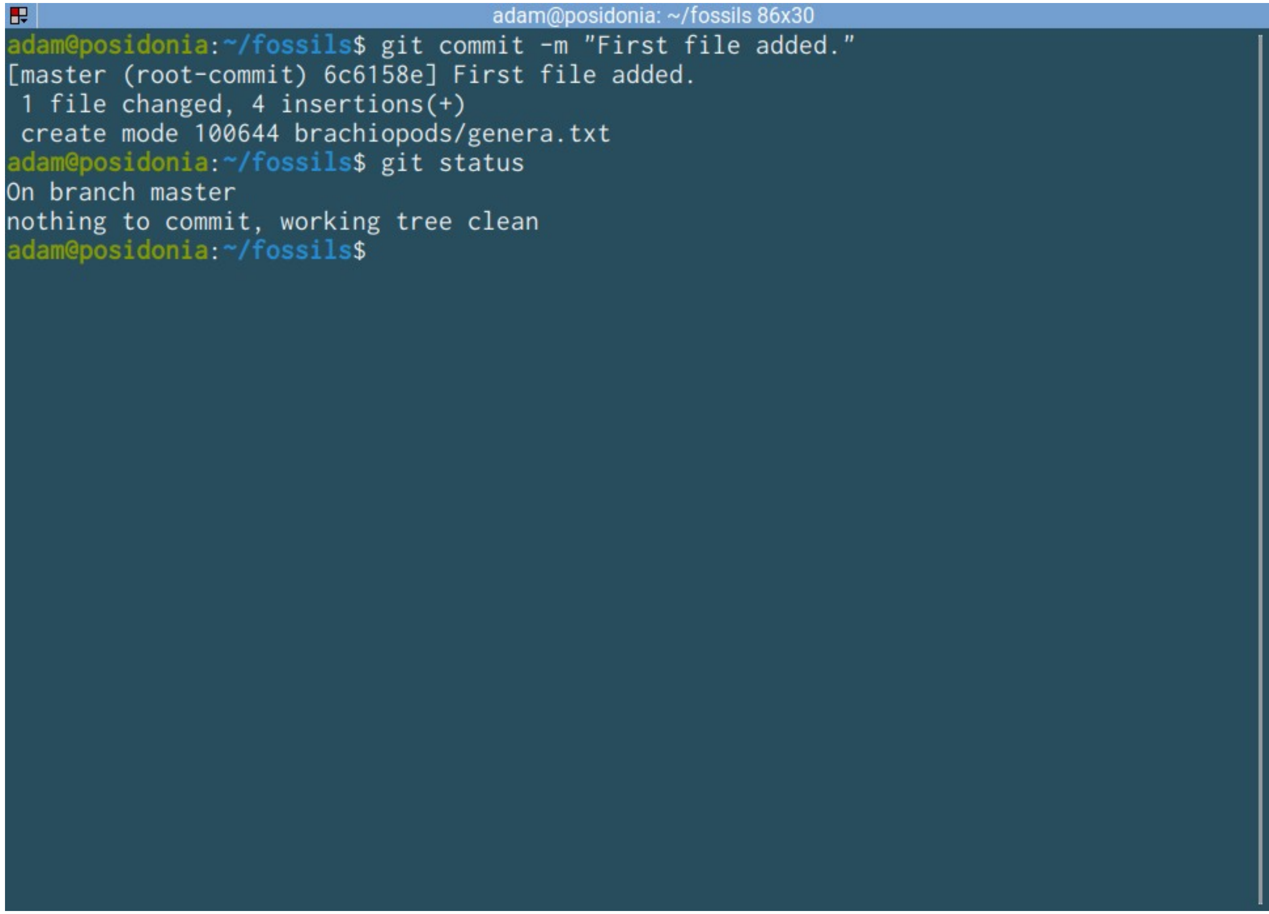


```
adam@posidonia:~/fossils$ git commit -m "First file added."
[master (root-commit) 6c6158e] First file added.
 1 file changed, 4 insertions(+)
 create mode 100644 brachiopods/genera.txt
adam@posidonia:~/fossils$
```

git␣status (yet again)

Nothing to be done.

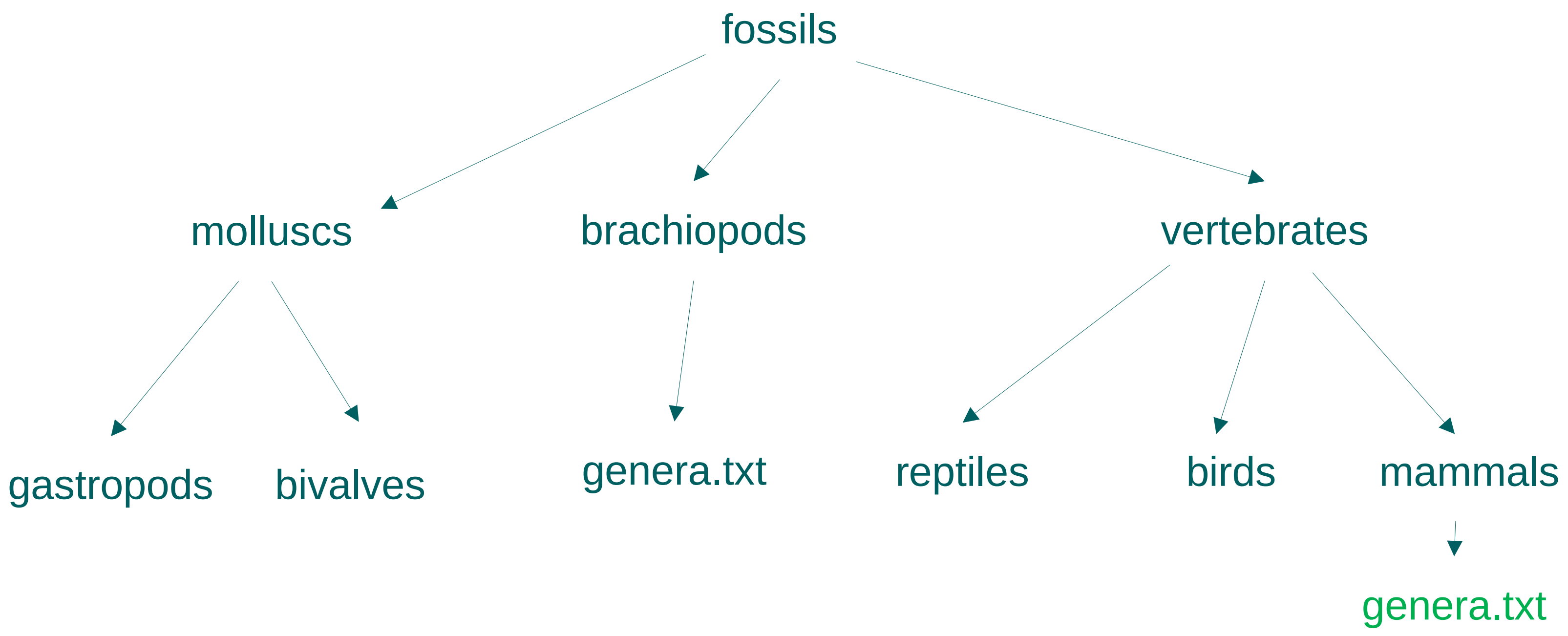
- Create two new files



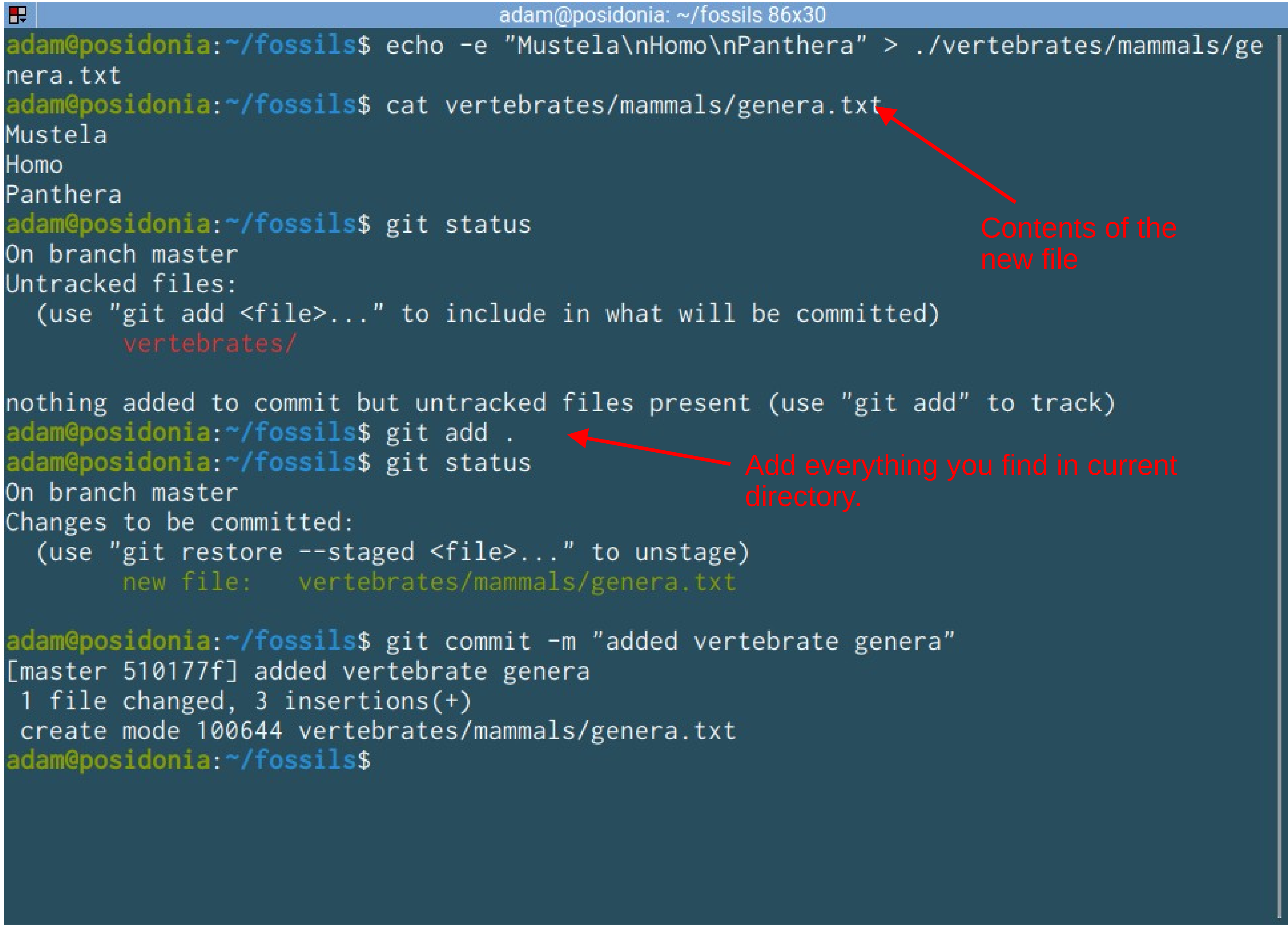
```
adam@posidonia:~/fossils$ git commit -m "First file added."
[master (root-commit) 6c6158e] First file added.
 1 file changed, 4 insertions(+)
 create mode 100644 brachiopods/genera.txt
adam@posidonia:~/fossils$ git status
On branch master
nothing to commit, working tree clean
adam@posidonia:~/fossils$
```

Demo!

1. Create a new file `genera.txt` in the `mammals` directory, and put the names of 3 mammalian genera in it!
2. Stage and commit the changes!



My solution



```
adam@posidonia:~/fossils$ echo -e "Mustela\nHomo\nPanthera" > ./vertebrates/mammals/ge
nera.txt
adam@posidonia:~/fossils$ cat vertebrates/mammals/genera.txt
Mustela
Homo
Panthera
adam@posidonia:~/fossils$ git status
On branch master
Untracked files:
  (use "git add <file>..." to include in what will be committed)
        vertebrates/

nothing added to commit but untracked files present (use "git add" to track)
adam@posidonia:~/fossils$ git add .
adam@posidonia:~/fossils$ git status
On branch master
Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
        new file:   vertebrates/mammals/genera.txt

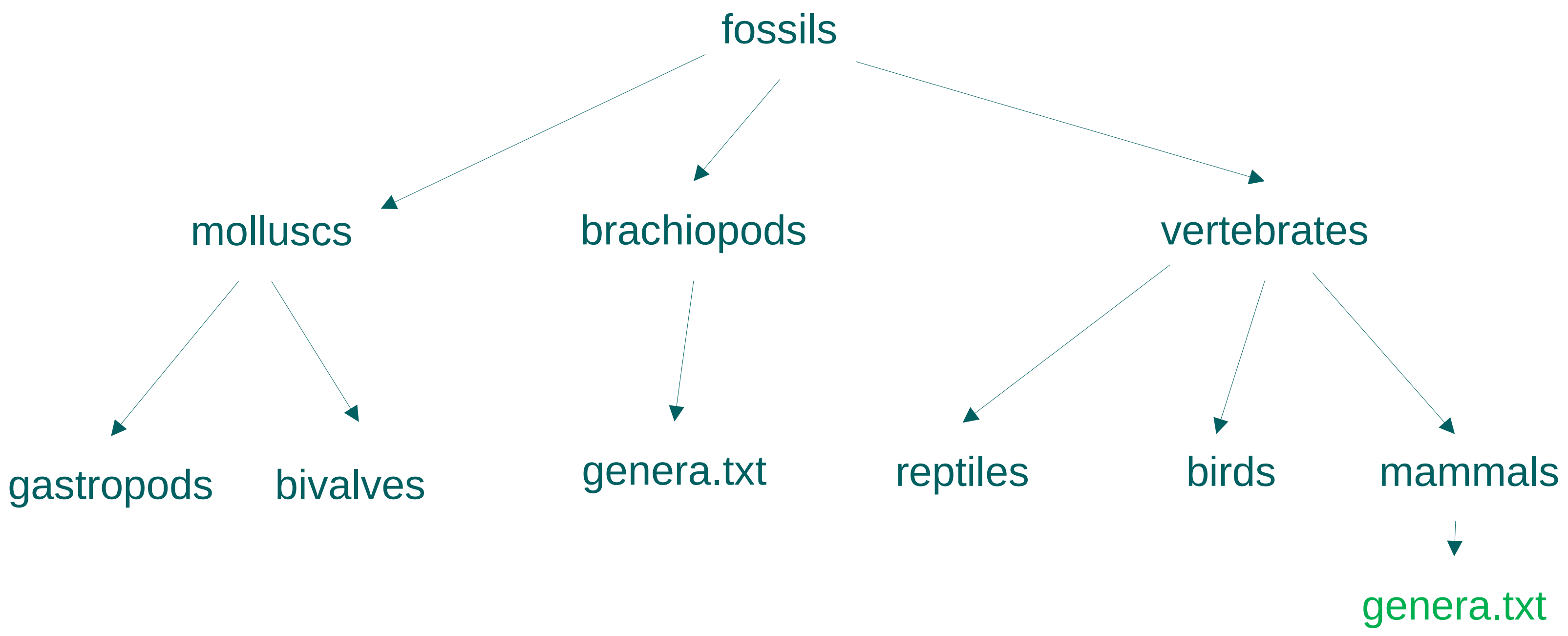
adam@posidonia:~/fossils$ git commit -m "added vertebrate genera"
[master 510177f] added vertebrate genera
 1 file changed, 3 insertions(+)
 create mode 100644 vertebrates/mammals/genera.txt
adam@posidonia:~/fossils$
```

Contents of the new file

Add everything you find in current directory.

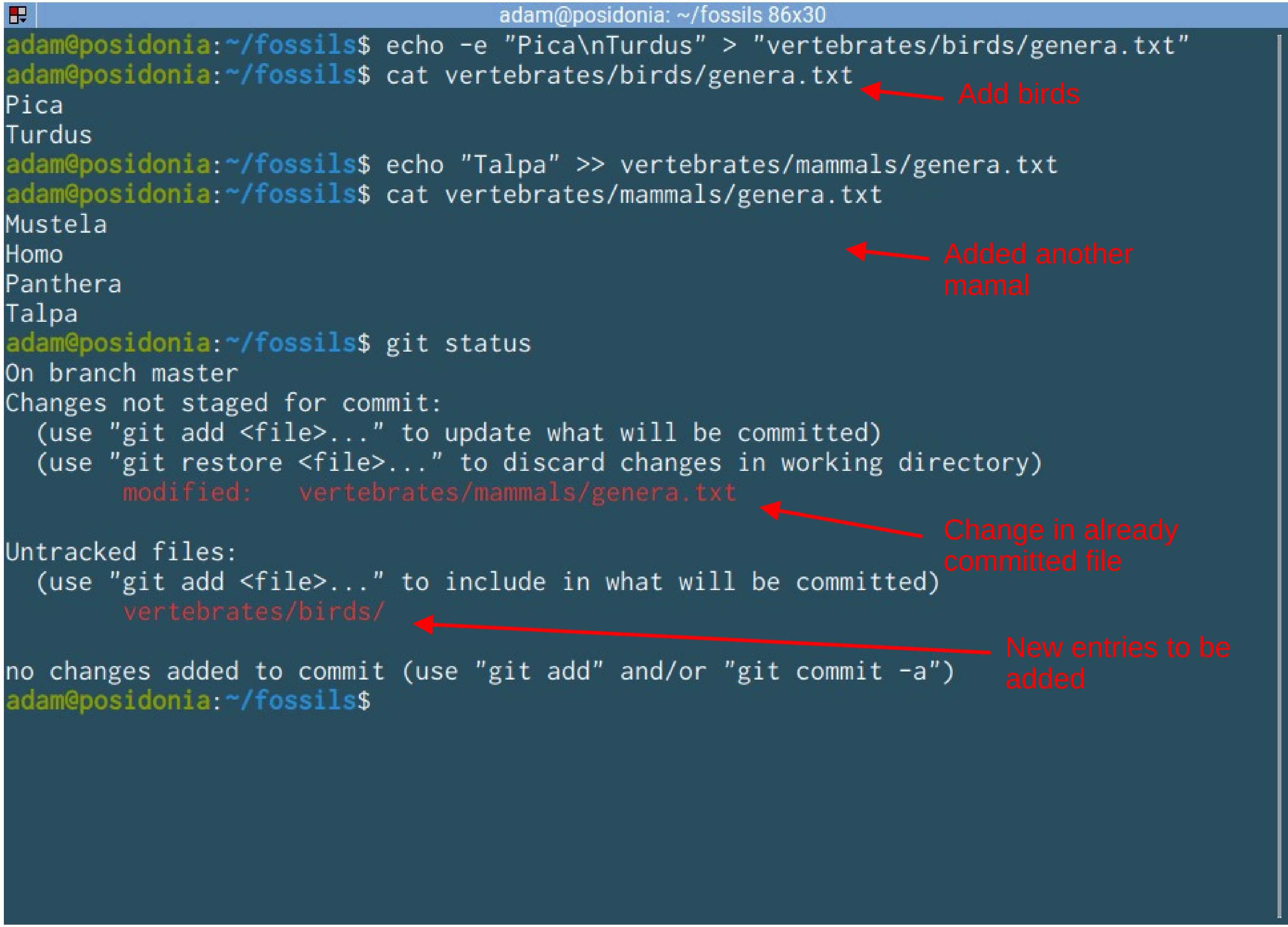
Demo!

1. Create a new file `genera.txt` in the `birds` directory, and put the names of 2 bird genera in it!
2. Add another genus to the mammals.
3. Try to commit only the birds!



My solution

1. **Make the changes.**



```
adam@posidonia:~/fossils$ echo -e "Pica\nTurdus" > "vertebrates/birds/genera.txt"
adam@posidonia:~/fossils$ cat vertebrates/birds/genera.txt
Pica
Turdus
adam@posidonia:~/fossils$ echo "Talpa" >> vertebrates/mammals/genera.txt
adam@posidonia:~/fossils$ cat vertebrates/mammals/genera.txt
Mustela
Homo
Panthera
Talpa
adam@posidonia:~/fossils$ git status
On branch master
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   vertebrates/mammals/genera.txt

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        vertebrates/birds/

no changes added to commit (use "git add" and/or "git commit -a")
adam@posidonia:~/fossils$
```

Add birds

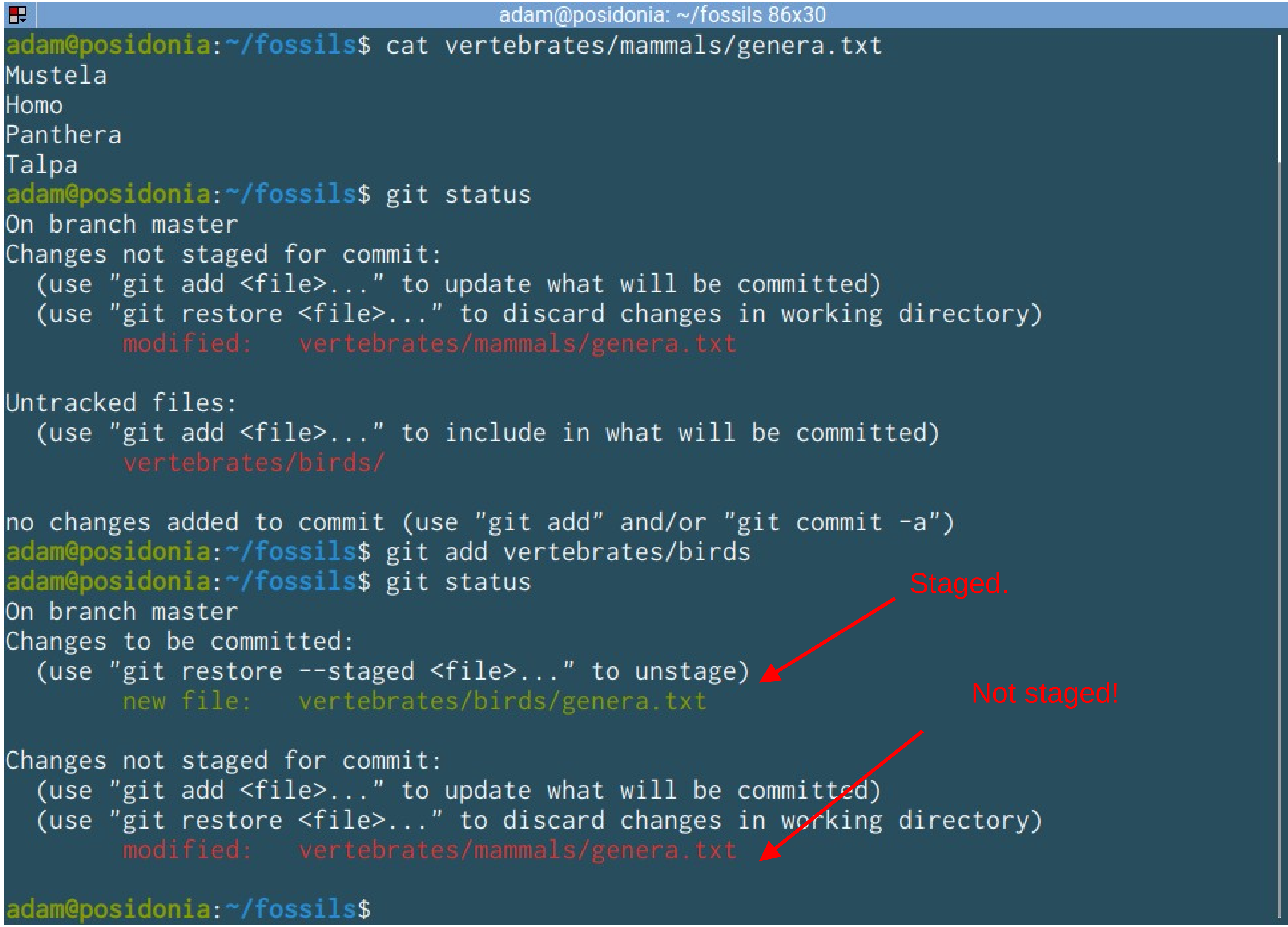
Added another mamal

Change in already committed file

New entries to be added

My solution

2. Stage only the birds.



adam@posidonia: ~/fossils 86x30

```
adam@posidonia:~/fossils$ cat vertebrates/mammals/genera.txt
Mustela
Homo
Panthera
Talpa
adam@posidonia:~/fossils$ git status
On branch master
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   vertebrates/mammals/genera.txt

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        vertebrates/birds/

no changes added to commit (use "git add" and/or "git commit -a")
adam@posidonia:~/fossils$ git add vertebrates/birds
adam@posidonia:~/fossils$ git status
On branch master
Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
        new file:   vertebrates/birds/genera.txt

Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   vertebrates/mammals/genera.txt

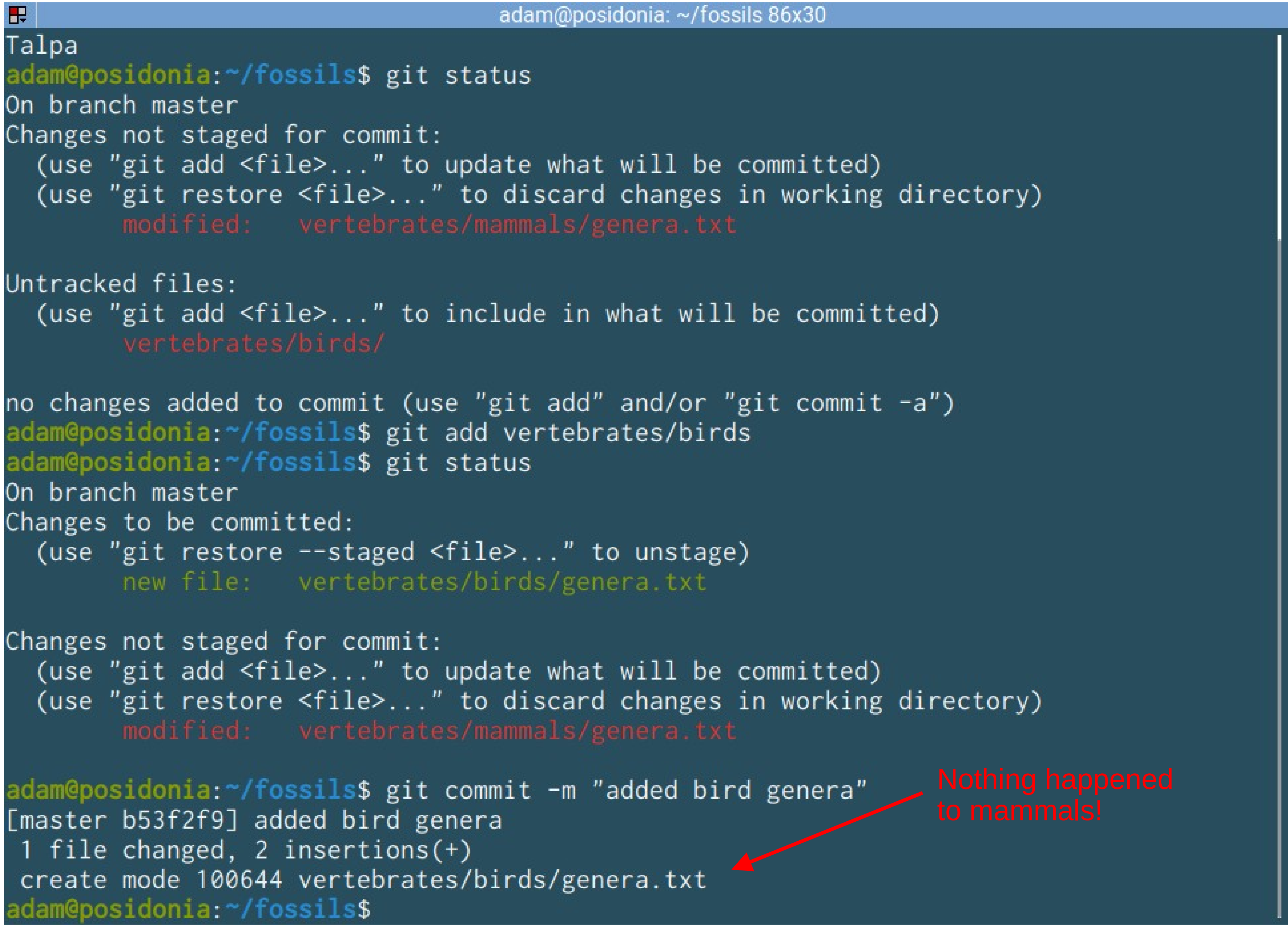
adam@posidonia:~/fossils$
```

Staged.

Not staged!

My solution

3. Stage only the birds.



```
Talpa
adam@posidonia:~/fossils$ git status
On branch master
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   vertebrates/mammals/genera.txt

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        vertebrates/birds/

no changes added to commit (use "git add" and/or "git commit -a")
adam@posidonia:~/fossils$ git add vertebrates/birds
adam@posidonia:~/fossils$ git status
On branch master
Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
        new file:   vertebrates/birds/genera.txt

Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   vertebrates/mammals/genera.txt

adam@posidonia:~/fossils$ git commit -m "added bird genera"
[master b53f2f9] added bird genera
 1 file changed, 2 insertions(+)
 create mode 100644 vertebrates/birds/genera.txt
adam@posidonia:~/fossils$
```

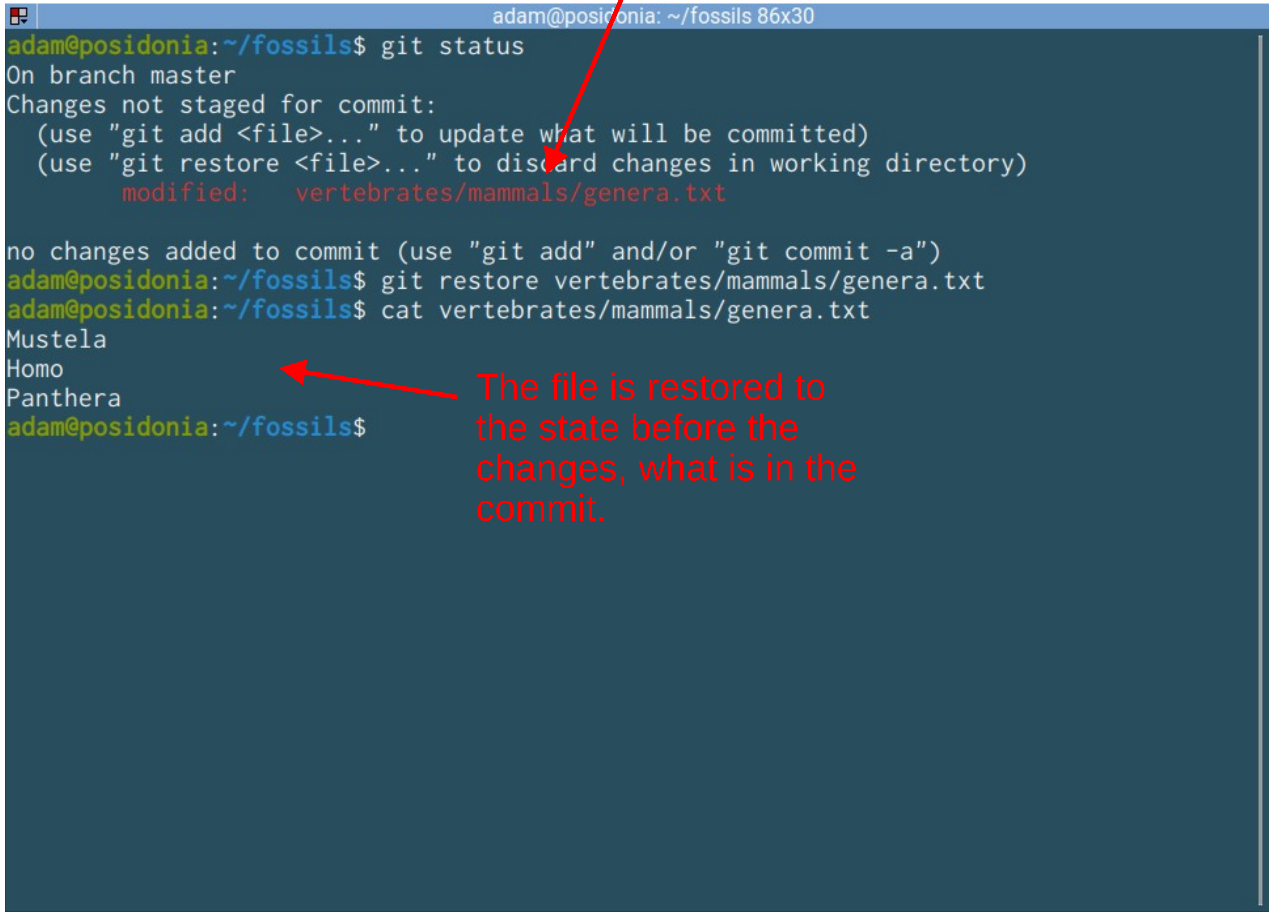
Nothing happened to mammals!

git␣restore␣<path>

Discarding changes from previous commit

- We can commit the new mammal or discard it.
- You can correct unintended changes with this.
- What about even older changes?

Again, git literally tells you your options



```
adam@posidonia:~/fossils$ git status
On branch master
Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   vertebrates/mammals/genera.txt

no changes added to commit (use "git add" and/or "git commit -a")
adam@posidonia:~/fossils$ git restore vertebrates/mammals/genera.txt
adam@posidonia:~/fossils$ cat vertebrates/mammals/genera.txt
Mustela
Homo
Panthera
adam@posidonia:~/fossils$
```

The file is restored to the state before the changes, what is in the commit.

GitHub

and GitHub

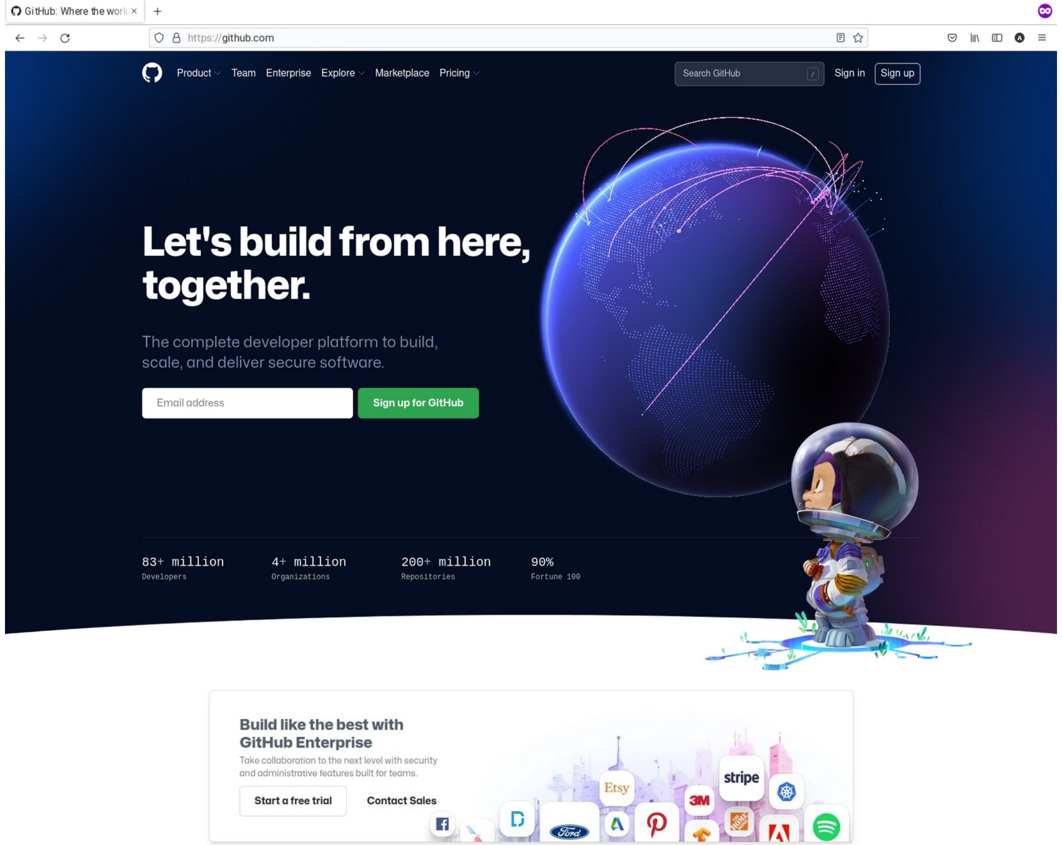
GitHub

Where the world builds software (2008-)

- Open source software development platform, places to store and share git repositories
- Currently owned by Microsoft
- Applications, packages, plugins, webpages and many more!
- Free and private repositories.

GitHub

Sign up if you haven’t yet!



Let's build from here, together.

The complete developer platform to build, scale, and deliver secure software.

83+ million Developers

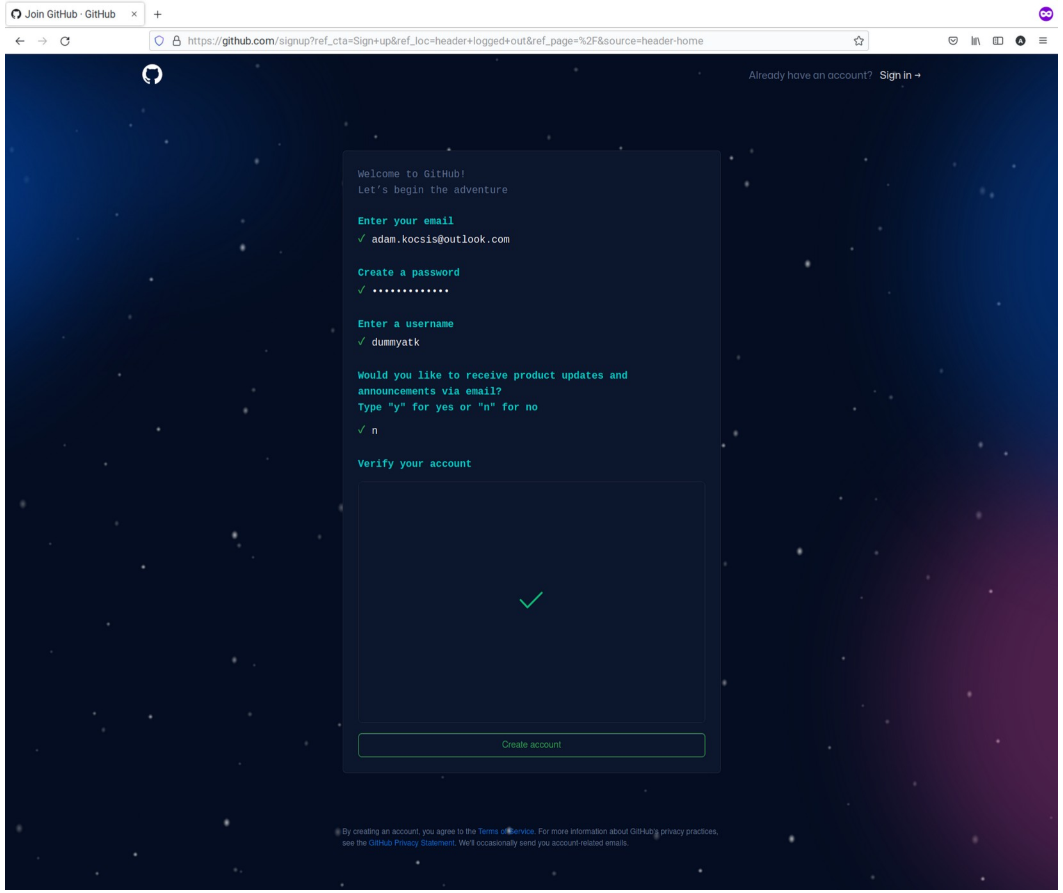
4+ million Organizations

200+ million Repositories

90% Fortune 100

Build like the best with GitHub Enterprise

Take collaboration to the next level with security and administrative features built for teams.


Join GitHub · GitHub
https://github.com/signup?ref_cta=Sign+up&ref_loc=header+logged+out&ref_page=%2F&source=header-home
Already have an account? Sign in →
Create account

```
Welcome to GitHub!
Let’s begin the adventure

Enter your email
✓ adam.kocsis@outlook.com

Create a password
✓ •••••••••••••

Enter a username
✓ dummyatk

Would you like to receive product updates and
announcements via email?
Type "y" for yes or "n" for no
✓ n

Verify your account
```

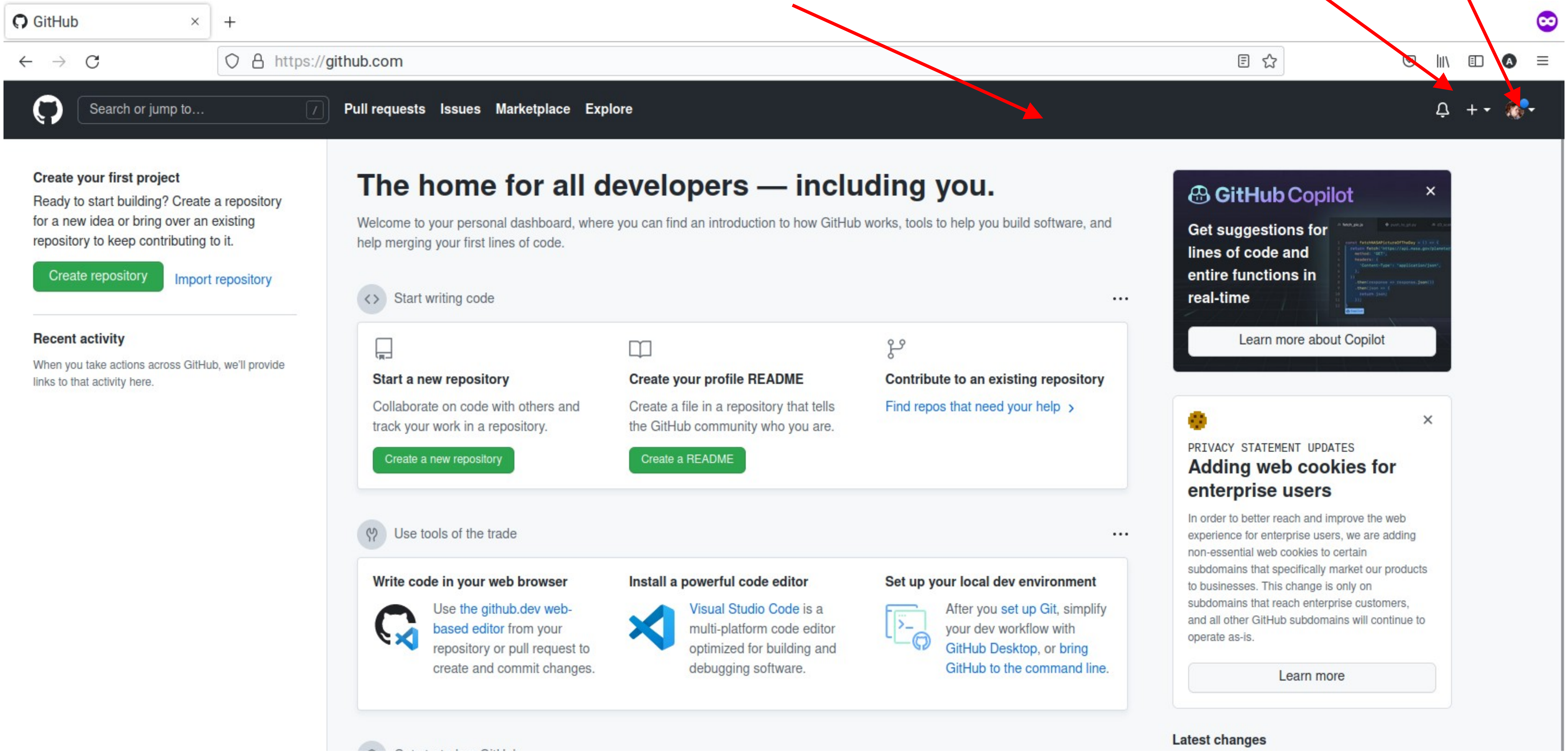
By creating an account, you agree to the Terms of Service. For more information about GitHub's privacy practices, see the GitHub Privacy Statement. We'll occasionally send you account-related emails.

GitHub - Dashboard

Notifications

Notifications

Settings



Create your first project

Ready to start building? Create a repository for a new idea or bring over an existing repository to keep contributing to it.

Create repository | Import repository

Recent activity

When you take actions across GitHub, we'll provide links to that activity here.

The home for all developers — including you.

Welcome to your personal dashboard, where you can find an introduction to how GitHub works, tools to help you build software, and help merging your first lines of code.

Start writing code

Start a new repository

Collaborate on code with others and track your work in a repository.

Create a new repository

Create your profile README

Create a file in a repository that tells the GitHub community who you are.

Create a README

Contribute to an existing repository

Find repos that need your help ›

Use tools of the trade

Write code in your web browser

Use the github.dev web-based editor from your repository or pull request to create and commit changes.

Install a powerful code editor

Visual Studio Code is a multi-platform code editor optimized for building and debugging software.

Set up your local dev environment

After you set up Git, simplify your dev workflow with GitHub Desktop, or bring GitHub to the command line.

GitHub Copilot

Get suggestions for lines of code and entire functions in real-time

Learn more about Copilot

PRIVACY STATEMENT UPDATES

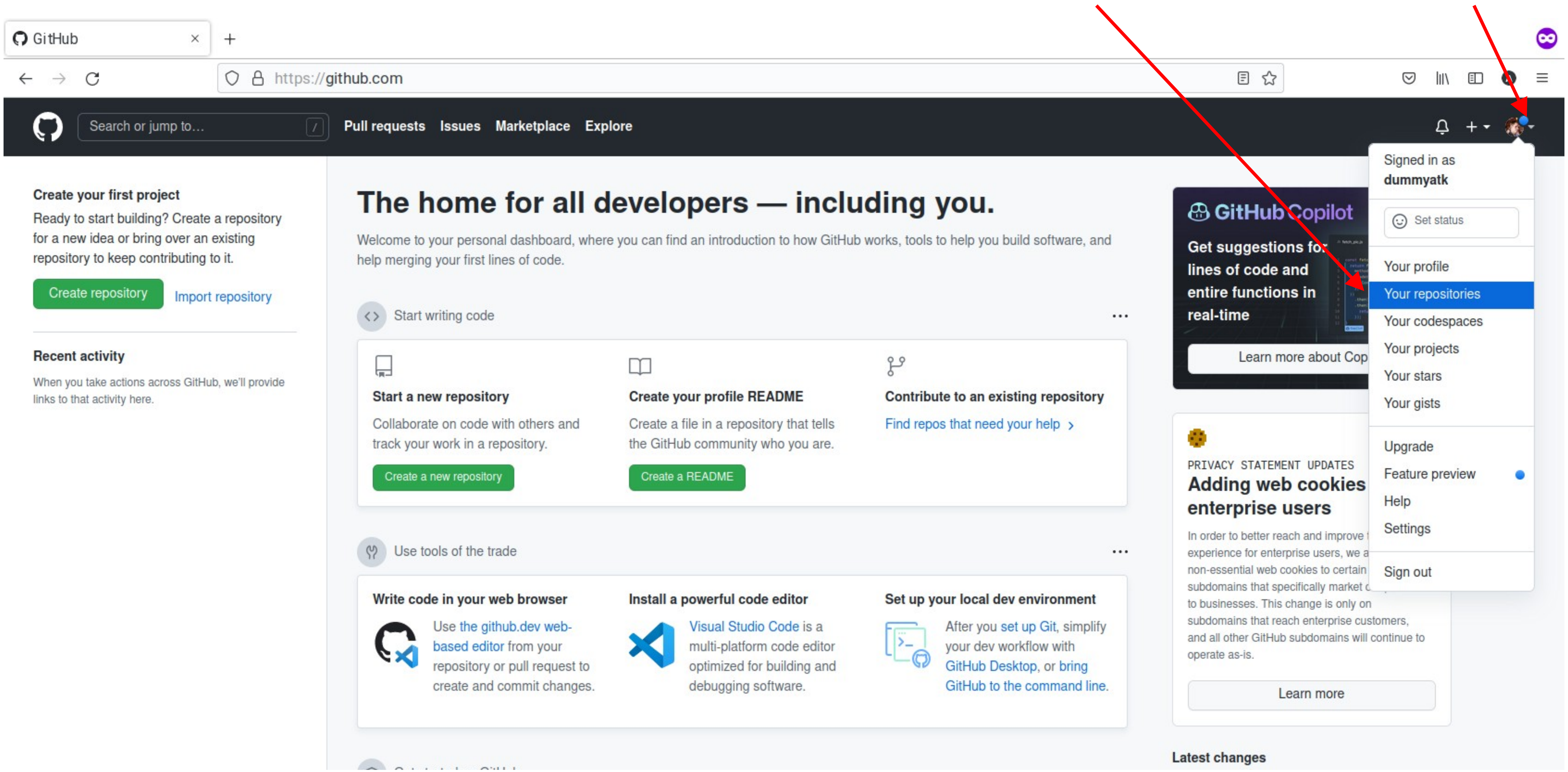
Adding web cookies for enterprise users

In order to better reach and improve the web experience for enterprise users, we are adding non-essential web cookies to certain subdomains that specifically market our products to businesses. This change is only on subdomains that reach enterprise customers, and all other GitHub subdomains will continue to operate as-is.

Learn more

Latest changes

GitHub - Dashboard



Access you repos

Settings

GitHub

https://github.com

Search or jump to…

Pull requests Issues Marketplace Explore

Signed in as
dummyatk

Set status

Your profile

Your repositories

Your codespaces

Your projects

Your stars

Your gists

Upgrade

Feature preview

Help

Settings

Sign out

Create your first project

Ready to start building? Create a repository for a new idea or bring over an existing repository to keep contributing to it.

Create repository Import repository

Recent activity

When you take actions across GitHub, we'll provide links to that activity here.

The home for all developers — including you.

Welcome to your personal dashboard, where you can find an introduction to how GitHub works, tools to help you build software, and help merging your first lines of code.

Start writing code

Start a new repository

Collaborate on code with others and track your work in a repository.

Create a new repository

Create your profile README

Create a file in a repository that tells the GitHub community who you are.

Create a README

Contribute to an existing repository

Find repos that need your help ›

Use tools of the trade

Write code in your web browser

Use the github.dev web-based editor from your repository or pull request to create and commit changes.

Install a powerful code editor

Visual Studio Code is a multi-platform code editor optimized for building and debugging software.

Set up your local dev environment

After you set up Git, simplify your dev workflow with GitHub Desktop, or bring GitHub to the command line.

GitHub Copilot

Get suggestions for lines of code and entire functions in real-time

Learn more about Cop

PRIVACY STATEMENT UPDATES

Adding web cookies enterprise users

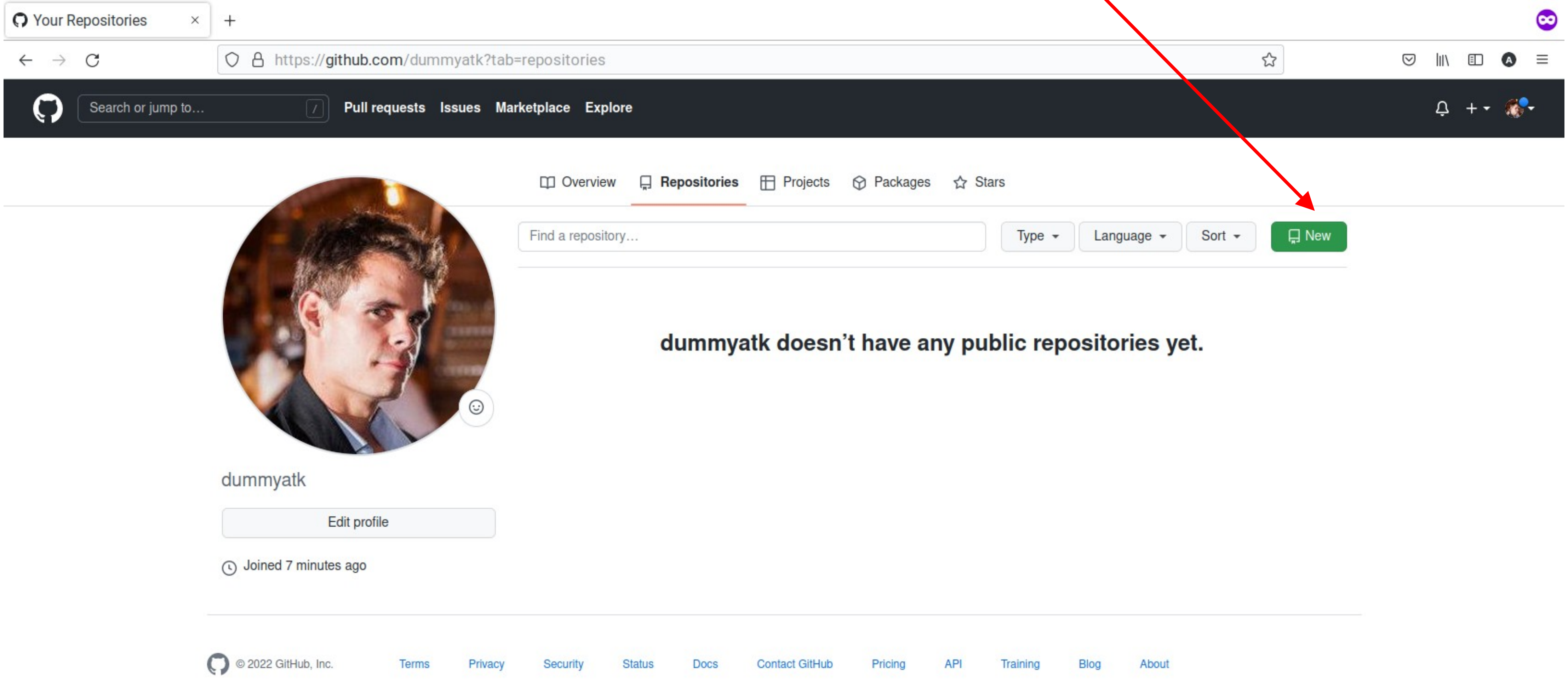
In order to better reach and improve experience for enterprise users, we a non-essential web cookies to certain subdomains that specifically market to businesses. This change is only on subdomains that reach enterprise customers, and all other GitHub subdomains will continue to operate as-is.

Learn more

Latest changes

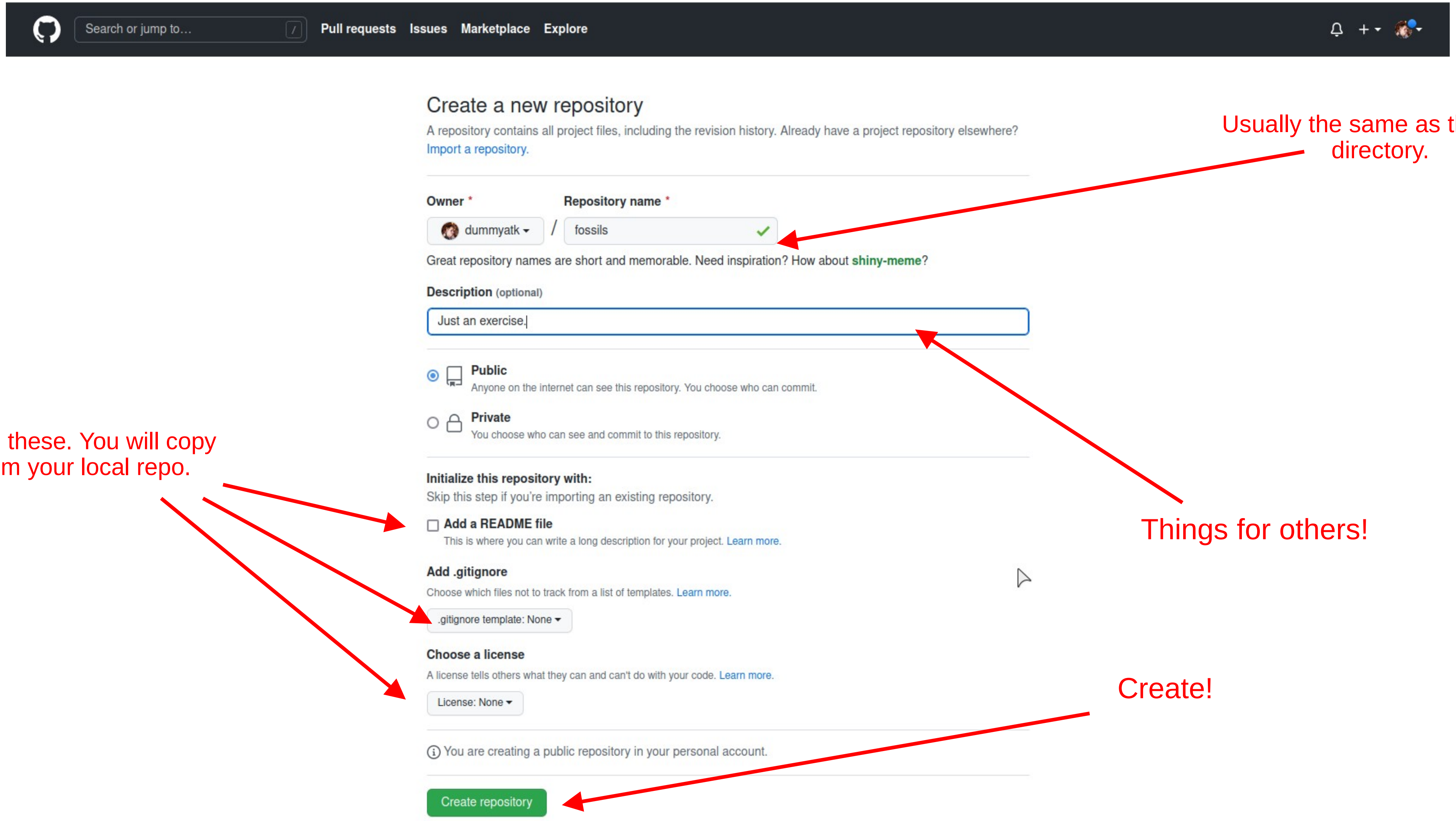
GitHub – Creating a new repo

Make a new repo



dummyatk doesn’t have any public repositories yet.

GitHub – Creating a new repo



Create a new repository

A repository contains all project files, including the revision history. Already have a project repository elsewhere? Import a repository.

Owner * dummyatk / **Repository name** * fossils ✓

Great repository names are short and memorable. Need inspiration? How about **shiny-meme**?

Description (optional)

Just an exercise.

● **Public**
Anyone on the internet can see this repository. You choose who can commit.

○ **Private**
You choose who can see and commit to this repository.

Initialize this repository with:
Skip this step if you're importing an existing repository.

□ **Add a README file**
This is where you can write a long description for your project. Learn more.

Add .gitignore
Choose which files not to track from a list of templates. Learn more.

.gitignore template: None

Choose a license
A license tells others what they can and can't do with your code. Learn more.

License: None

ⓘ You are creating a public repository in your personal account.

Create repository

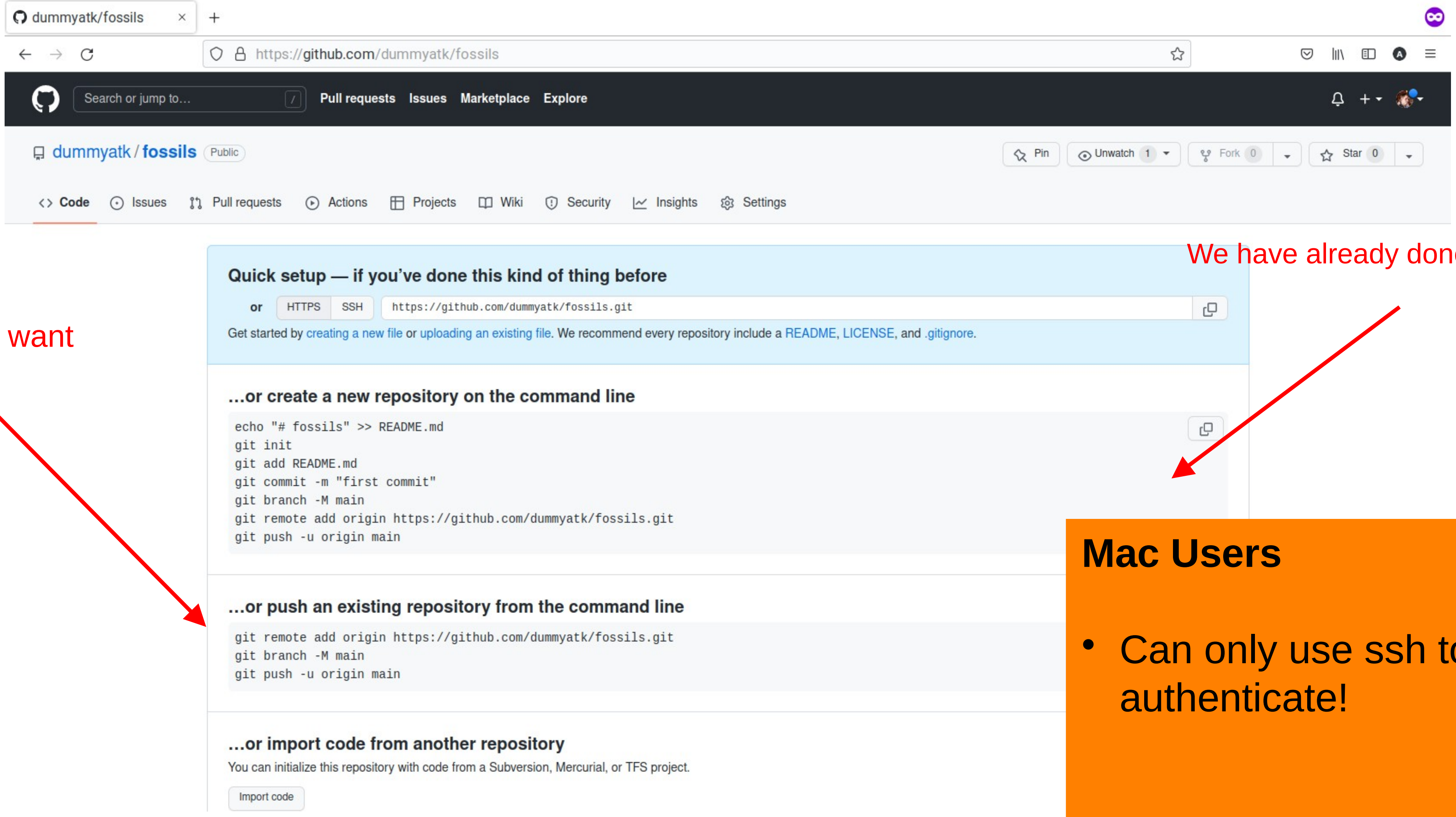
Usually the same as the local directory.

Things for others!

Do not change these. You will copy files over from your local repo.

Create!

GitHub – The fresh empty repo



Quick setup — if you've done this kind of thing before

or HTTPS SSH `https://github.com/dummyatk/fossils.git`

Get started by creating a new file or uploading an existing file. We recommend every repository include a README, LICENSE, and .gitignore.

...or create a new repository on the command line

```
echo "# fossils" >> README.md
git init
git add README.md
git commit -m "first commit"
git branch -M main
git remote add origin https://github.com/dummyatk/fossils.git
git push -u origin main
```

...or push an existing repository from the command line

```
git remote add origin https://github.com/dummyatk/fossils.git
git branch -M main
git push -u origin main
```

...or import code from another repository

You can initialize this repository with code from a Subversion, Mercurial, or TFS project.

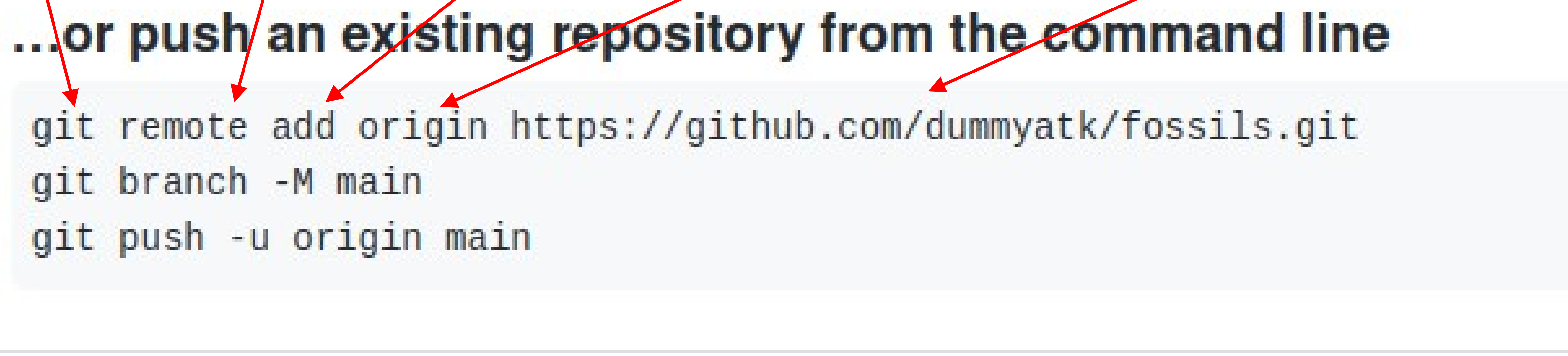
This is what you want

We have already done this mostly

Mac Users

- Can only use ssh to authenticate!

GitHub – Add new remote



...or push an existing repository from the command line

```
git remote add origin https://github.com/dummyatk/fossils.git
git branch -M main
git push -u origin main
```

Application name

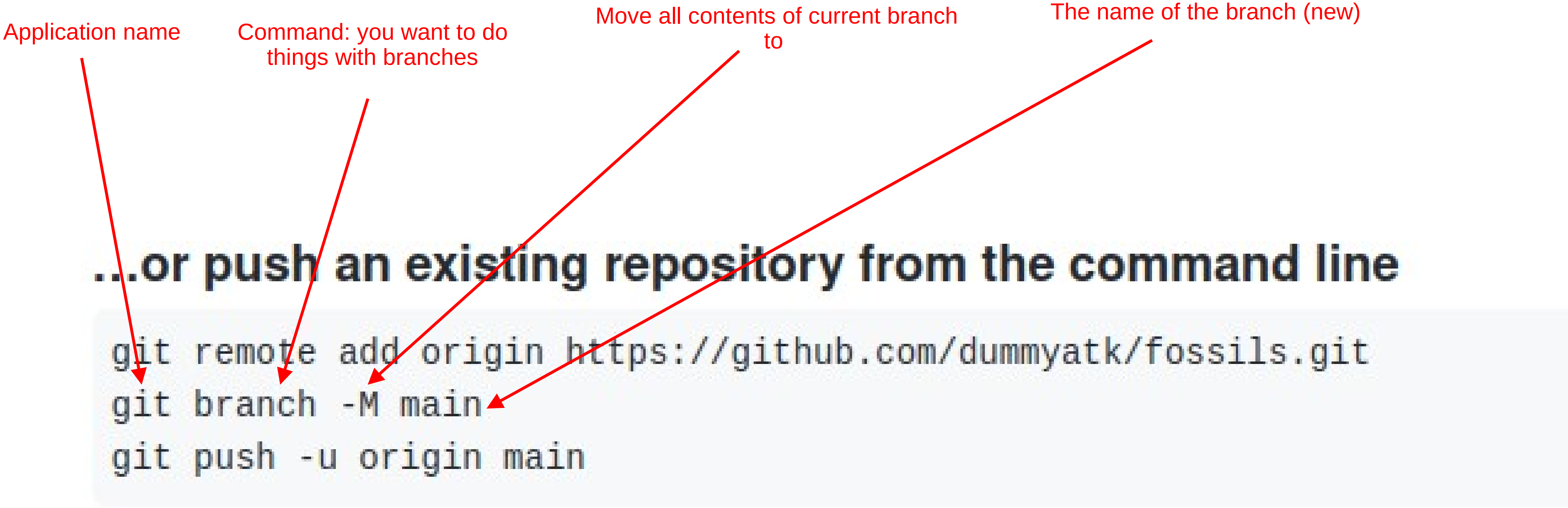
Command: you want to make changes of how your local repository is connected to remotes

You are registering a new remote

The name of the new remote. You can refer to it from now on using this name!

The URL of the remote. This is used to identify the remote on the web.

GitHub – Rename current branch to main



Application name

Command: you want to do things with branches

Move all contents of current branch to

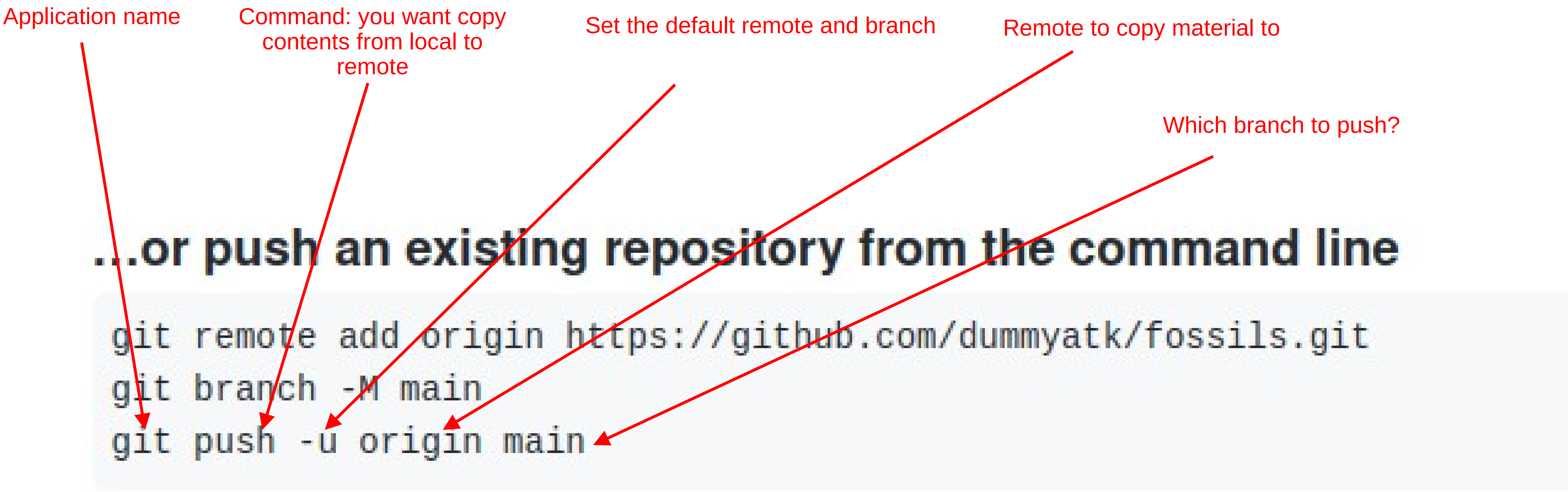
The name of the branch (new)

…or push an existing repository from the command line

```
git remote add origin https://github.com/dummyatk/fossils.git
git branch -M main
git push -u origin main
```

For political reasons, GitHub does not allow the use of the name master, hence this extra step.

GitHub – Pushing contents of branch to remote



…or push an existing repository from the command line

```
git remote add origin https://github.com/dummyatk/fossils.git
git branch -M main
git push -u origin main
```

Application name

Command: you want copy contents from local to remote

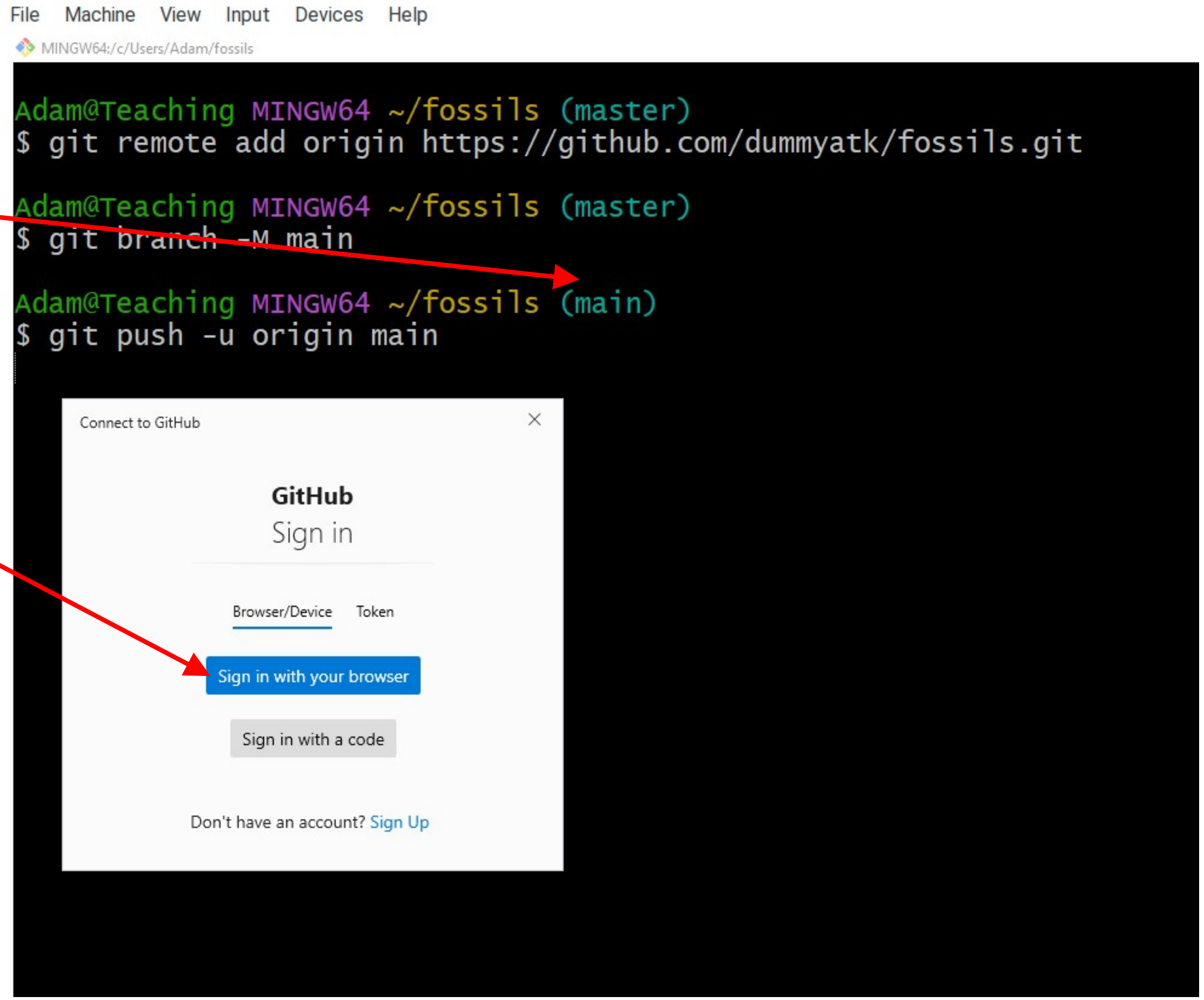
Set the default remote and branch

Remote to copy material to

Which branch to push?

GitHub will ask for your credentials

GitHub – Executing this and signing in on windows



File Machine View Input Devices Help
MINGW64:/c/Users/Adam/fossils

```
Adam@Teaching MINGW64 ~/fossils (master)
$ git remote add origin https://github.com/dummyatk/fossils.git

Adam@Teaching MINGW64 ~/fossils (master)
$ git branch -M main

Adam@Teaching MINGW64 ~/fossils (main)
$ git push -u origin main
```

Connect to GitHub

GitHub

Sign in

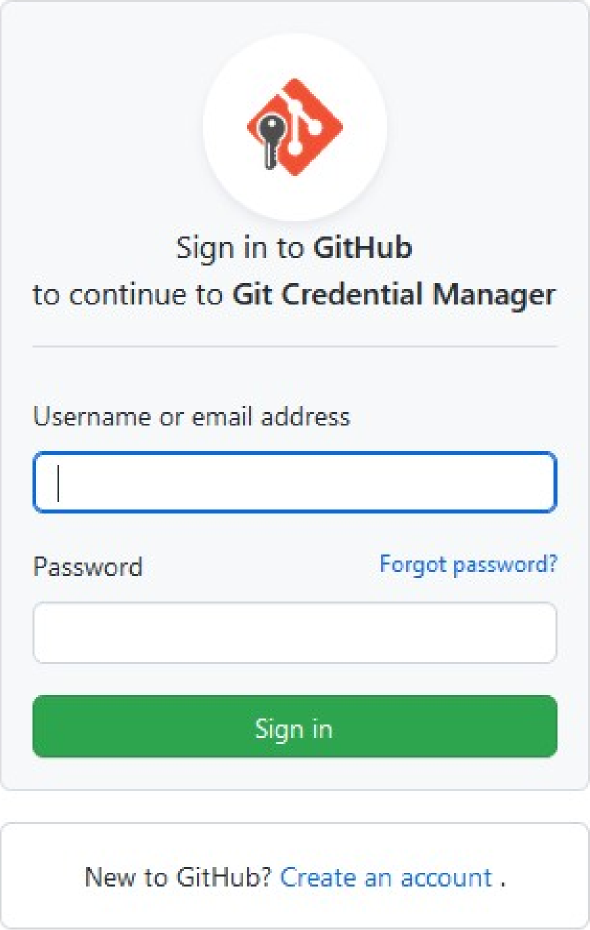
Browser/Device
Token
Sign in with your browser
Sign in with a code

Don't have an account? Sign Up

Note branch name change

Most interactive sign in option available on Windows

GitHub – Executing this and signing in on windows



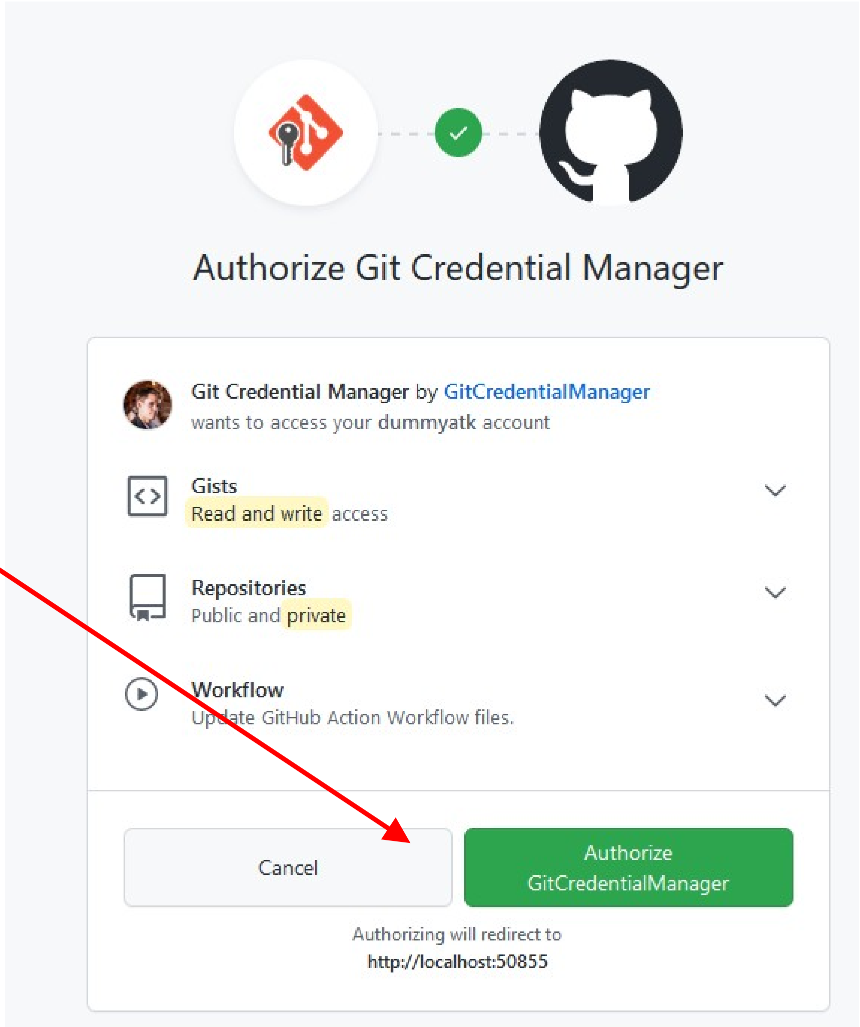
Sign in to **GitHub**
to continue to **Git Credential Manager**

Username or email address

Password

New to GitHub? Create an account .

This is what you want



Authorize Git Credential Manager

Git Credential Manager by GitCredentialManager
wants to access your **dummyatk** account

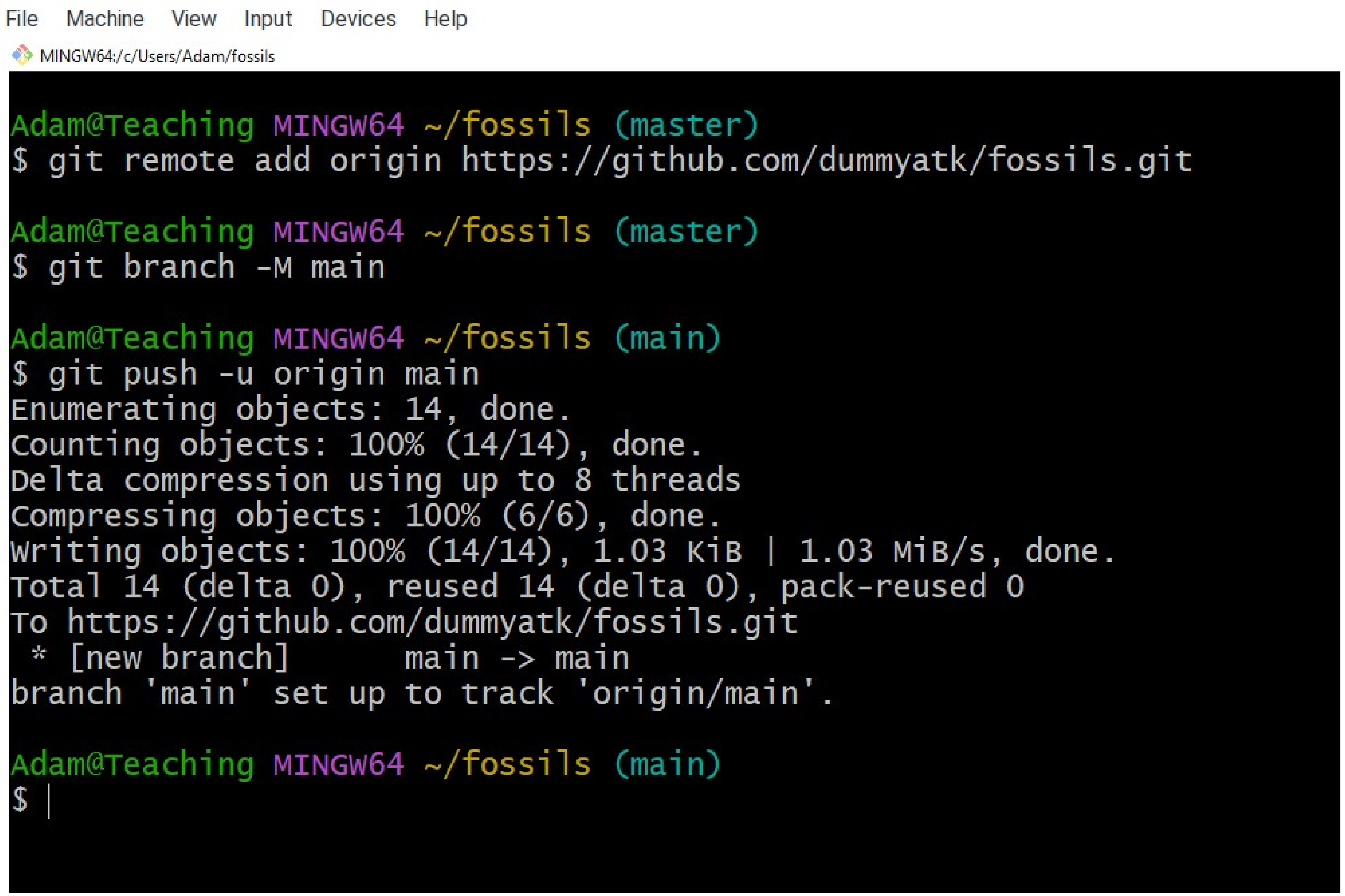
Gists
Read and write access

Repositories
Public and private

Workflow
Update GitHub Action Workflow files.

Authorizing will redirect to
http://localhost:50855

GitHub – Successful push



File Machine View Input Devices Help
MINGW64:/c/Users/Adam/fossils

```
Adam@Teaching MINGW64 ~/fossils (master)
$ git remote add origin https://github.com/dummyatk/fossils.git

Adam@Teaching MINGW64 ~/fossils (master)
$ git branch -M main

Adam@Teaching MINGW64 ~/fossils (main)
$ git push -u origin main
Enumerating objects: 14, done.
Counting objects: 100% (14/14), done.
Delta compression using up to 8 threads
Compressing objects: 100% (6/6), done.
Writing objects: 100% (14/14), 1.03 KiB | 1.03 MiB/s, done.
Total 14 (delta 0), reused 14 (delta 0), pack-reused 0
To https://github.com/dummyatk/fossils.git
 * [new branch]      main -> main
branch 'main' set up to track 'origin/main'.

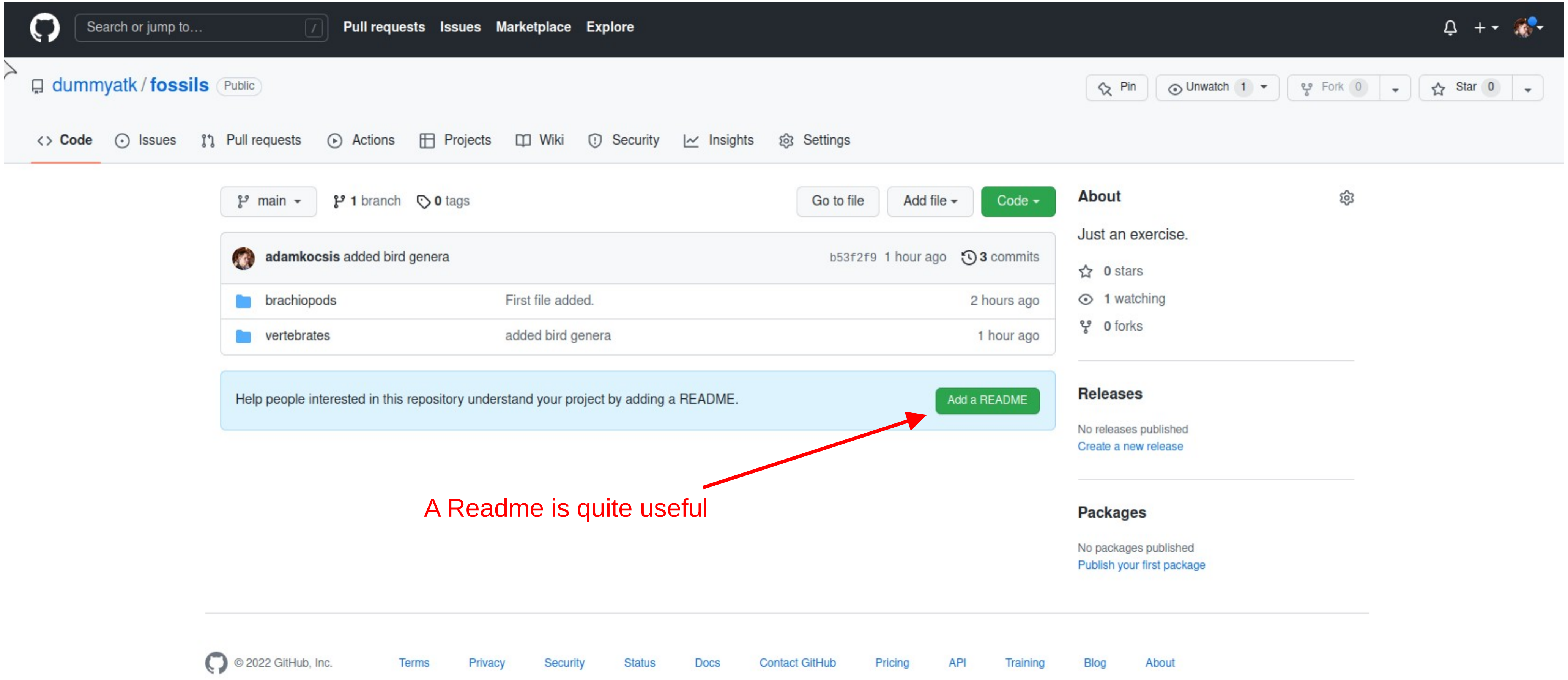
Adam@Teaching MINGW64 ~/fossils (main)
$ 
```

Transfer stats

New branch main is created on remote

And is now in sync with local

GitHub – Successful push



adamkocsis added bird genera b53f2f9 1 hour ago 3 commits

brachiopods	First file added.	2 hours ago
vertebrates	added bird genera	1 hour ago

Help people interested in this repository understand your project by adding a README.

About

Just an exercise.

0 stars

1 watching

0 forks

Releases

No releases published

Create a new release

Packages

No packages published

Publish your first package

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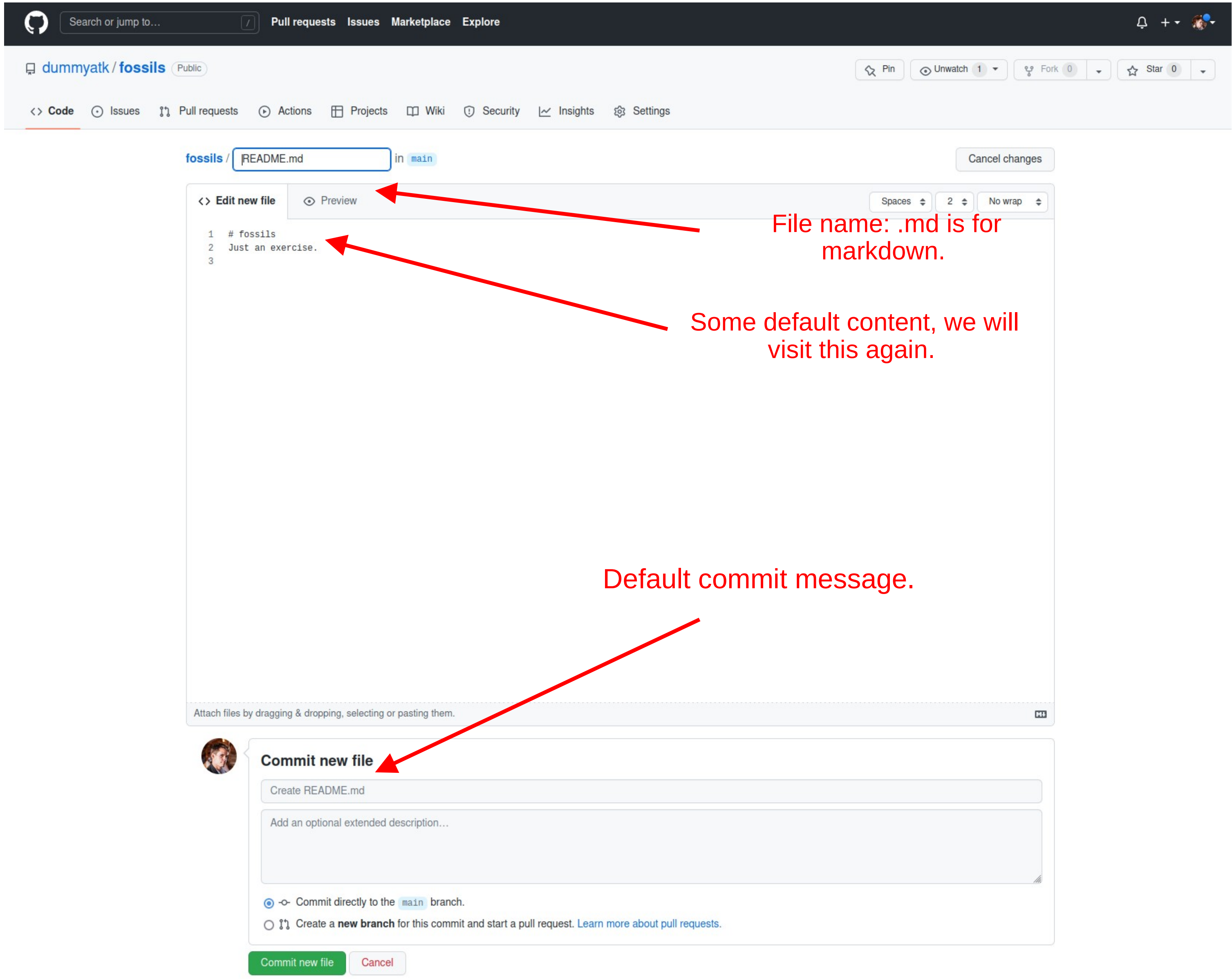
A Readme is quite useful

Writing a Readme

- Default format is **markdown (later)**
- You can work on files using GitHub's interface
- Save the defaults, by clicking on the green button
- Note that you are technically creating a new commit!



fossils / README.md in main

```
# fossils
Just an exercise.

```

Commit new file

Create README.md

Add an optional extended description...

● Commit directly to the main branch.

○ Create a **new branch** for this commit and start a pull request. Learn more about pull requests.

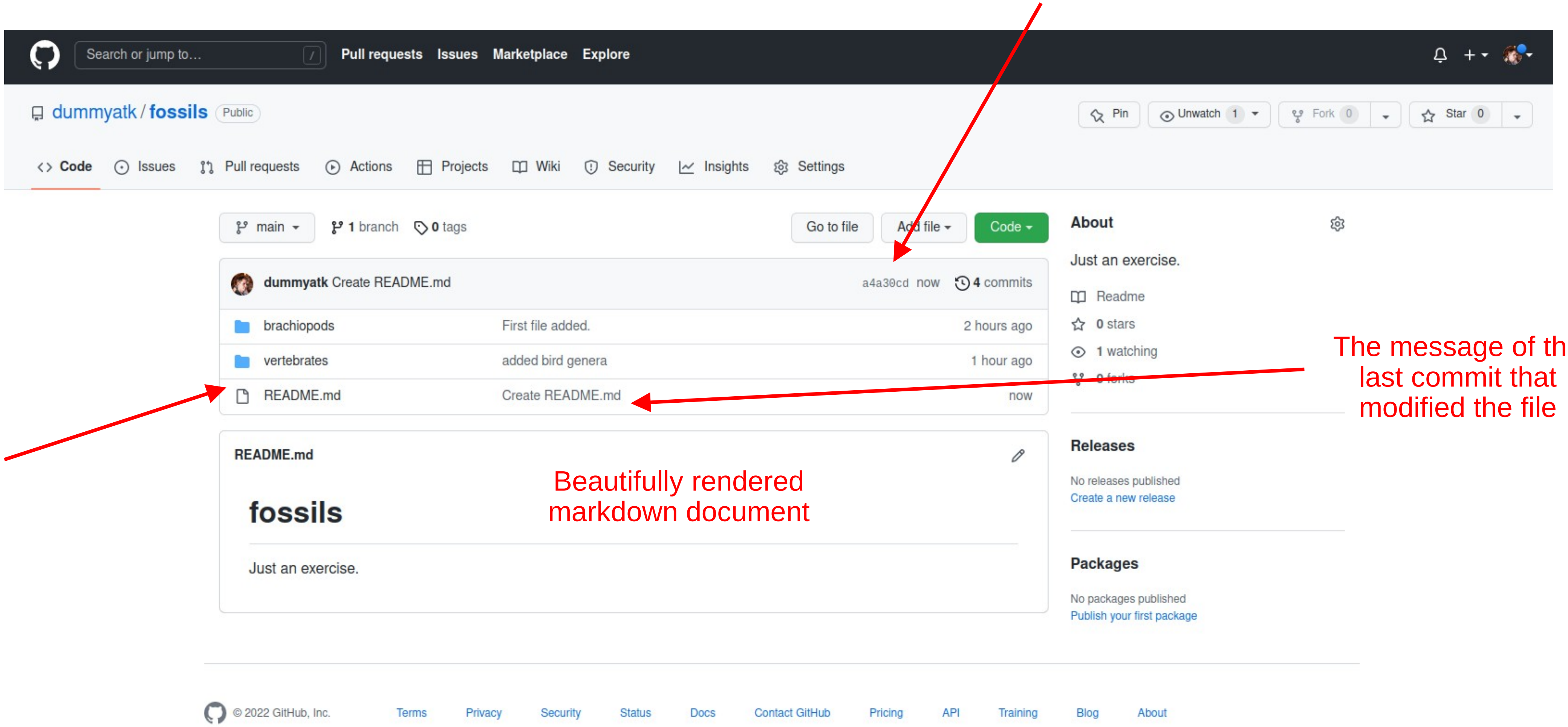
File name: .md is for markdown.

Some default content, we will visit this again.

Default commit message.

GitHub – Changing the remote

The very last commit's hash



dummyatk Create README.md a4a30cd now 4 commits

brachiopods	First file added.	2 hours ago
vertebrates	added bird genera	1 hour ago
README.md	Create README.md	now

README.md

fossils

Just an exercise.

The message of the last commit that modified the file

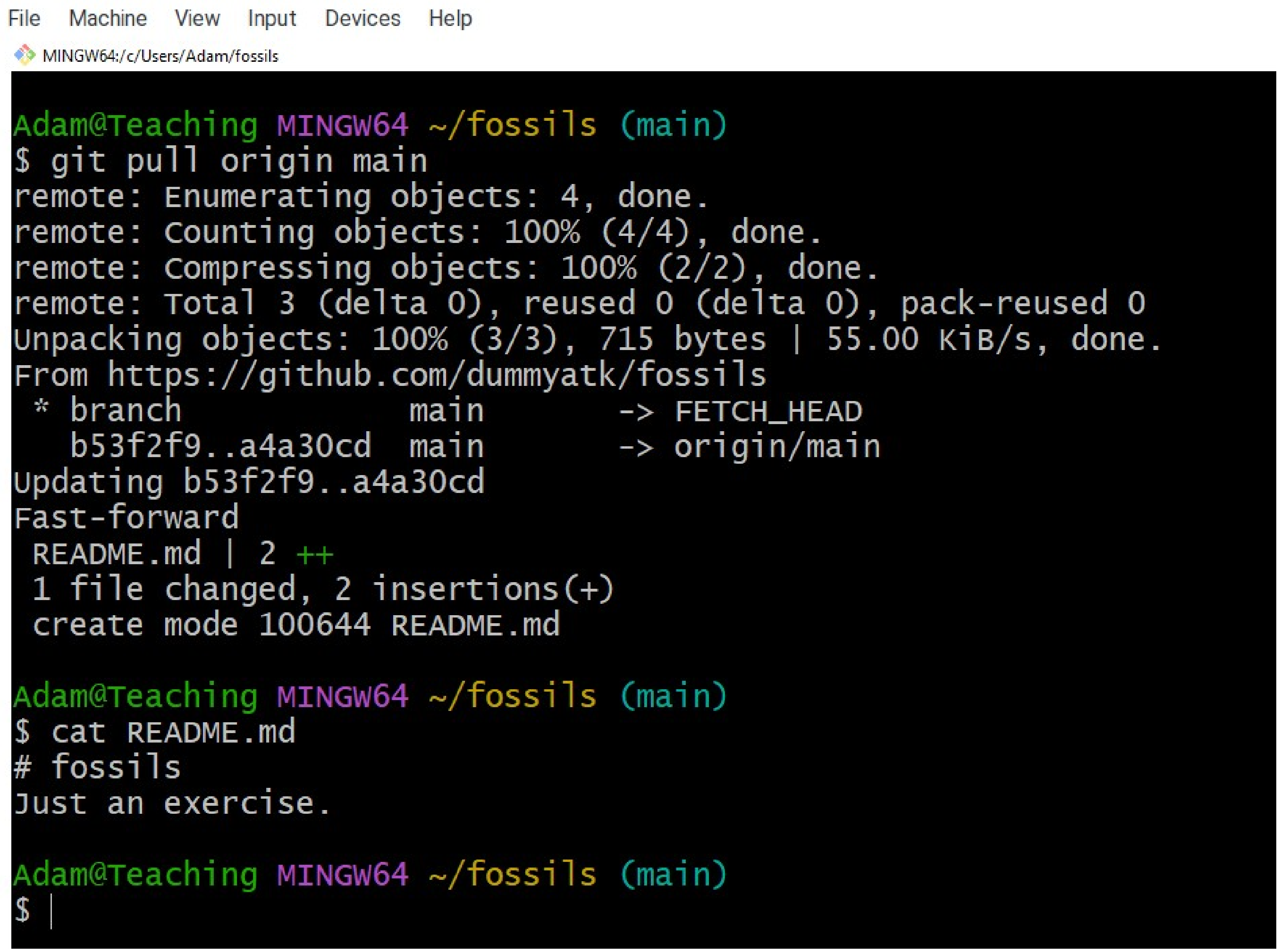
Readme file now added!

Beautifully rendered markdown document

git␣pull␣<remote>␣<branch>

Pull changes from remote

- Just because you changed something on the remote server does not make things magically appear locally
- You have to pull the contents of the remote to have the new file that you just created!


File Machine View Input Devices Help
MINGW64:/c/Users/Adam/fossils

```
Adam@Teaching MINGW64 ~/fossils (main)
$ git pull origin main
remote: Enumerating objects: 4, done.
remote: Counting objects: 100% (4/4), done.
remote: Compressing objects: 100% (2/2), done.
remote: Total 3 (delta 0), reused 0 (delta 0), pack-reused 0
Unpacking objects: 100% (3/3), 715 bytes | 55.00 KiB/s, done.
From https://github.com/dummyatk/fossils
 * branch            main       -> FETCH_HEAD
   b53f2f9..a4a30cd  main       -> origin/main
Updating b53f2f9..a4a30cd
Fast-forward
 README.md | 2 ++
 1 file changed, 2 insertions(+)
 create mode 100644 README.md

Adam@Teaching MINGW64 ~/fossils (main)
$ cat README.md
# fossils
Just an exercise.

Adam@Teaching MINGW64 ~/fossils (main)
$ 
```