Part 1.1:
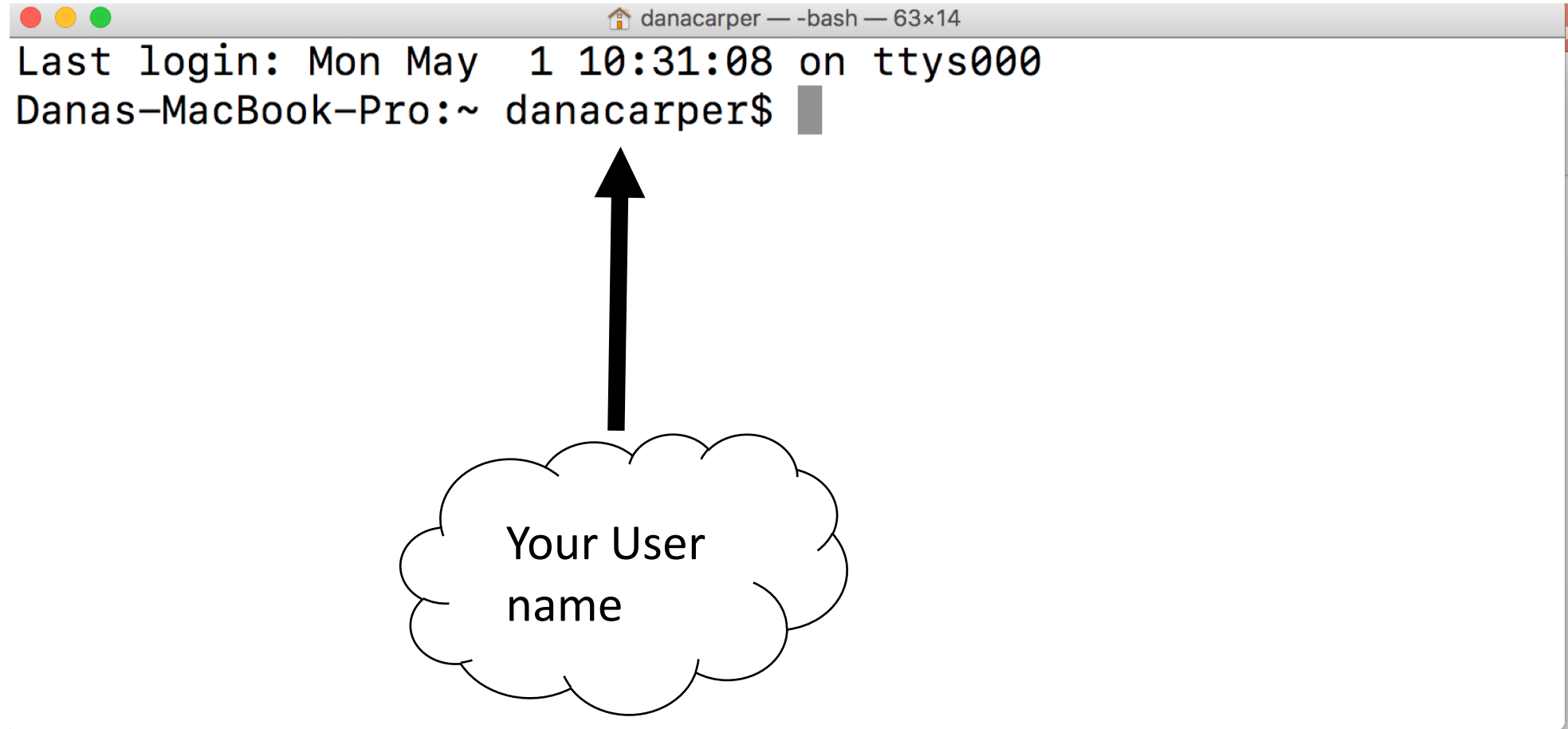# Introduction to directory structures and command line

Dana L Carper and Travis J Lawrence

Quantitative and Systems Biology

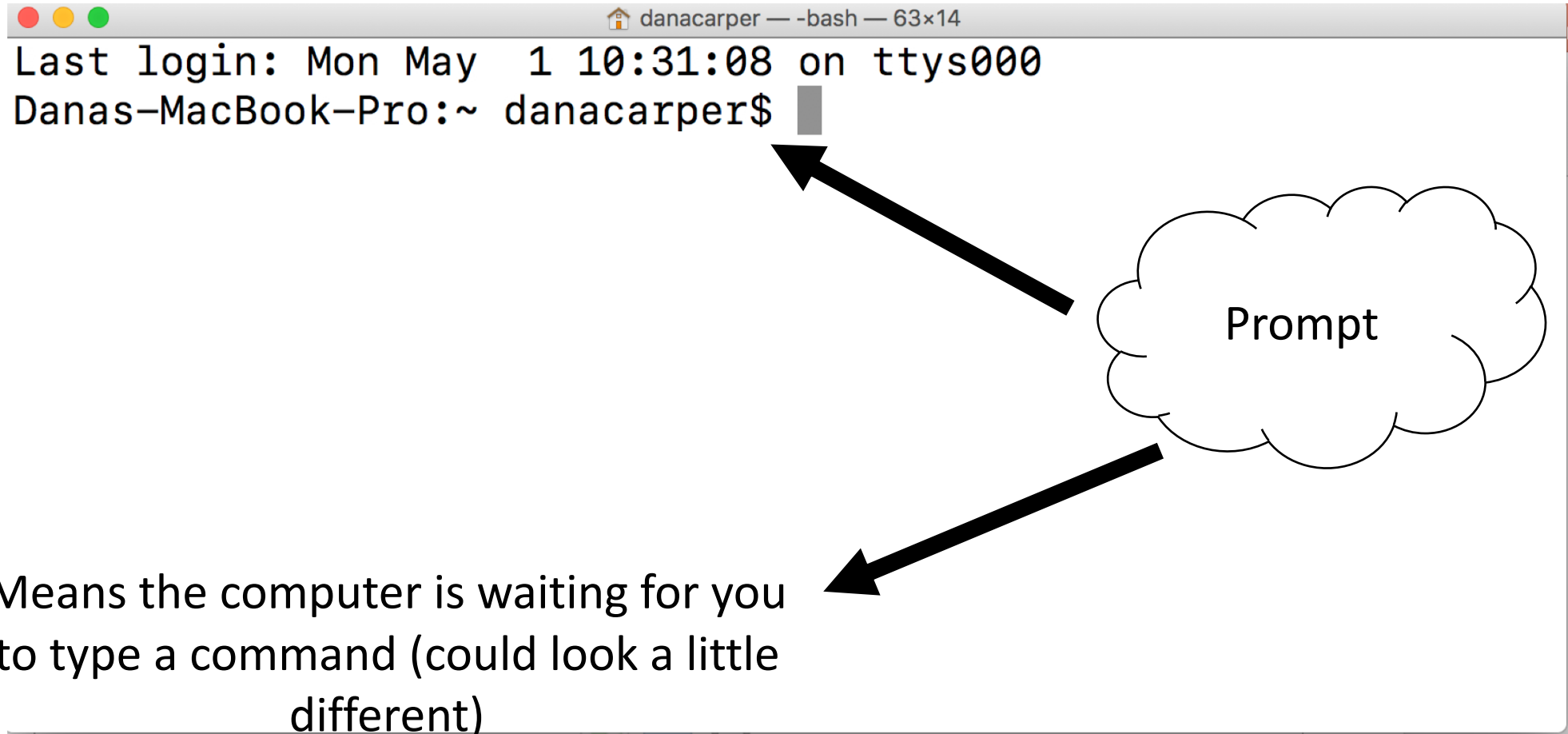University of California, Merced

Where to find a terminal?

- A Terminal is a device that allows you to talk to the computer

- It can usually be found within the utilities folder in mac

- In ubuntu, under applications or search for terminal

Opening Terminal

```
● ● ●              🏠 danacarper — -bash — 63×14
Last login: Mon May   1 10:31:08 on ttys000
Danas-MacBook-Pro:~ danacarper$ ▮
```

Your User
name

Opening Terminal

Last login: Mon May 1 10:31:08 on ttys000
Danas-MacBook-Pro:~ danacarper$

Prompt

Means the computer is waiting for you to type a command (could look a little different)

Computer Terminology

Directory **=**

Folder

How do we determine which directory we are in?

```
● ● ●              🏠 danacarper — -bash — 63×14
Last login: Mon May  1 10:31:08 on ttys000
Danas-MacBook-Pro:~ danacarper$ pwd
```
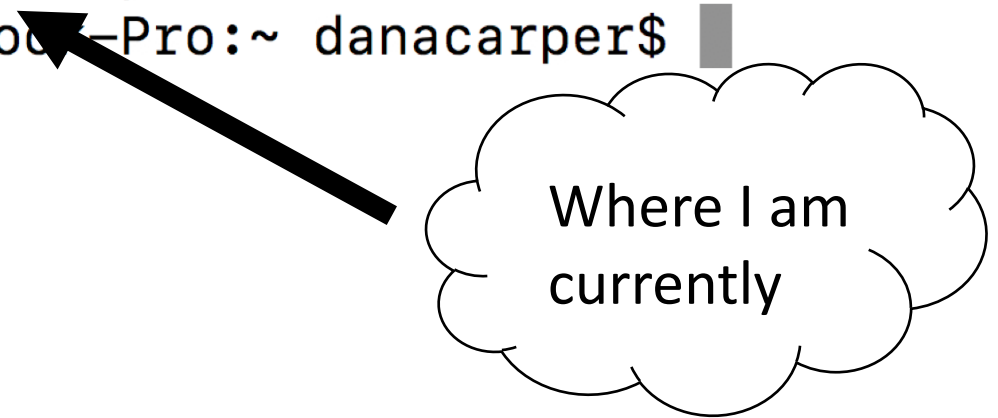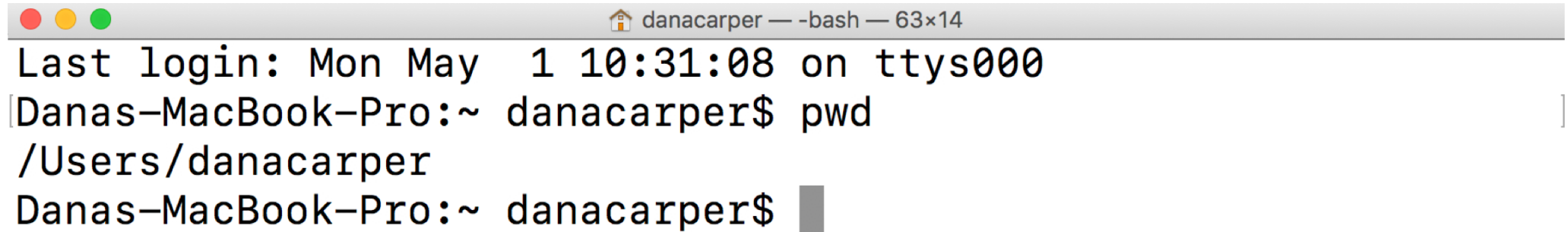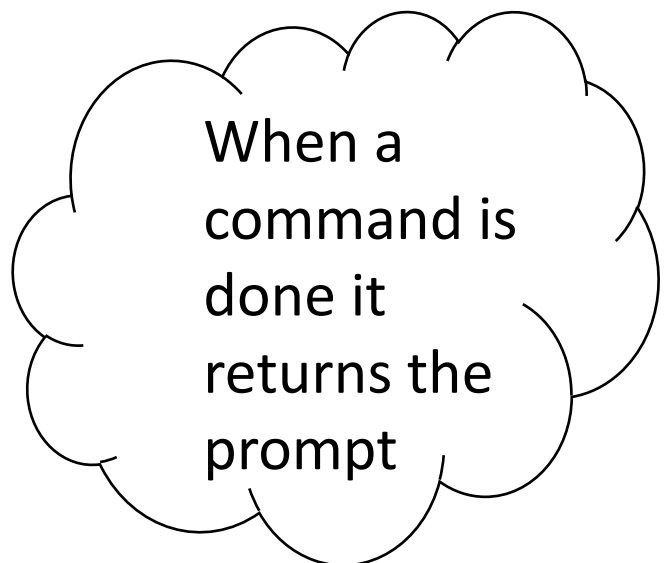
Print working directory

Print out which directory (folder) I am in currently

How do we determine which directory we are in?

How do we determine which directory we are in?

When a command is done it returns the prompt

A file system is set up like a hierarchy

users/

danacarper/ ➡️
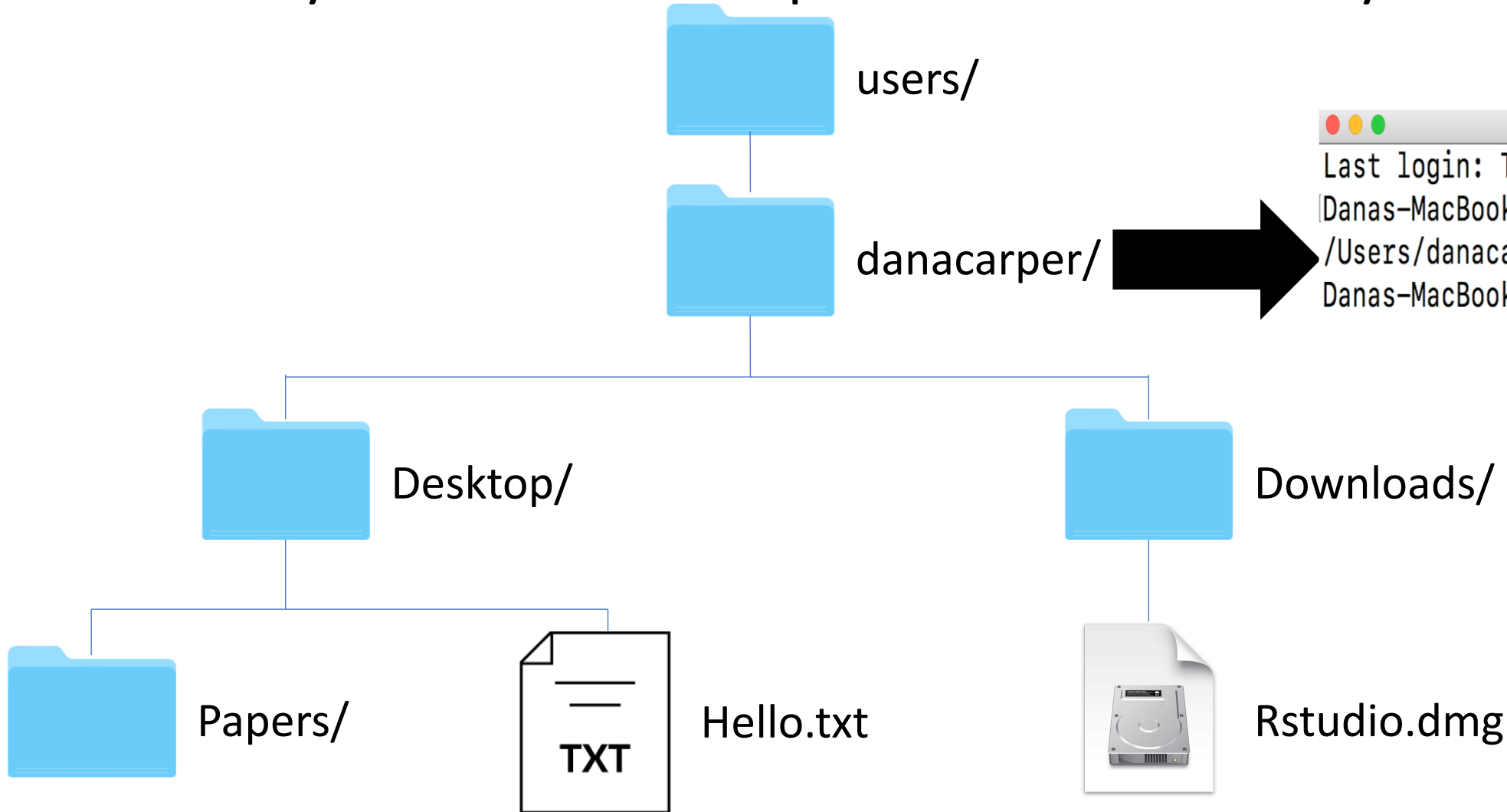
```
● ● ●                                    🏠 danacar
Last login: Tue Jun  6 13:14:22 on tt
Danas-MacBook-Pro:~ danacarper$ pwd
/Users/danacarper
Danas-MacBook-Pro:~ danacarper$ ▮
```
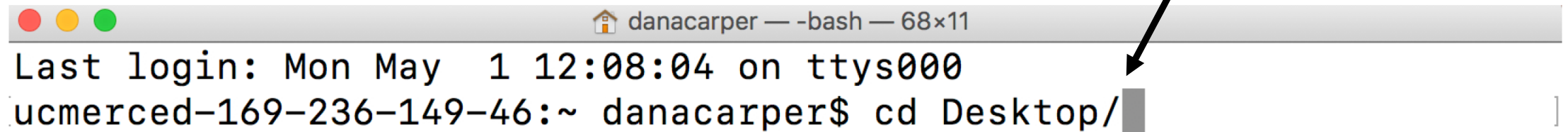
Desktop/

Downloads/

Papers/

Hello.txt

Rstudio.dmg

Moving to a different directory

danacarper — -bash — 68×11

```
Last login: Mon May  1 12:08:04 on ttys000
ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
```

Change directory
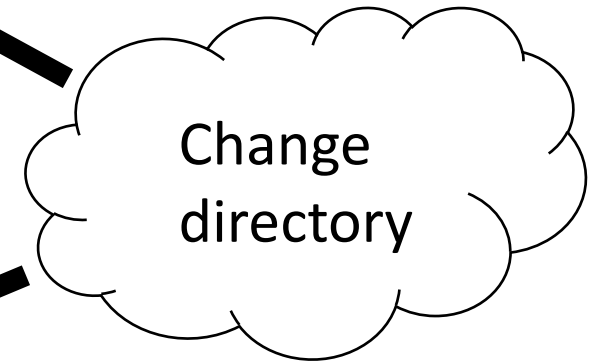
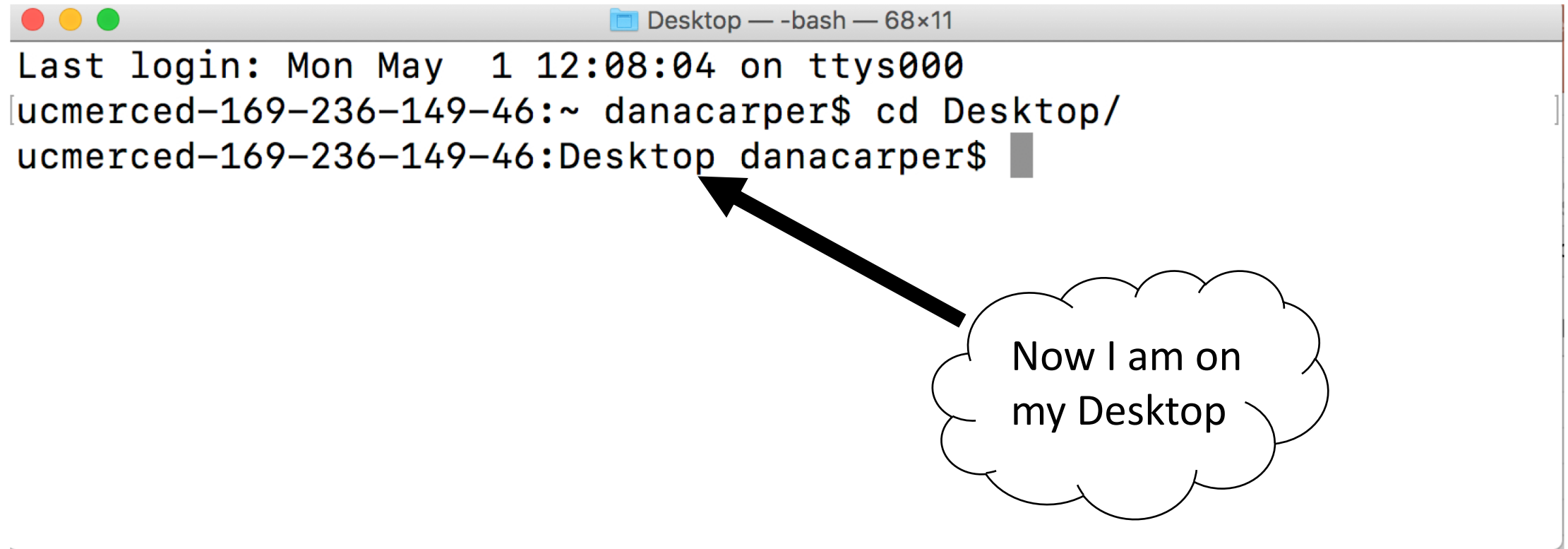This is the same and double clicking on a folder

Moving to a different directory

A slash indicates it is a folder

```
Last login: Mon May  1 12:08:04 on ttys000
ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
```

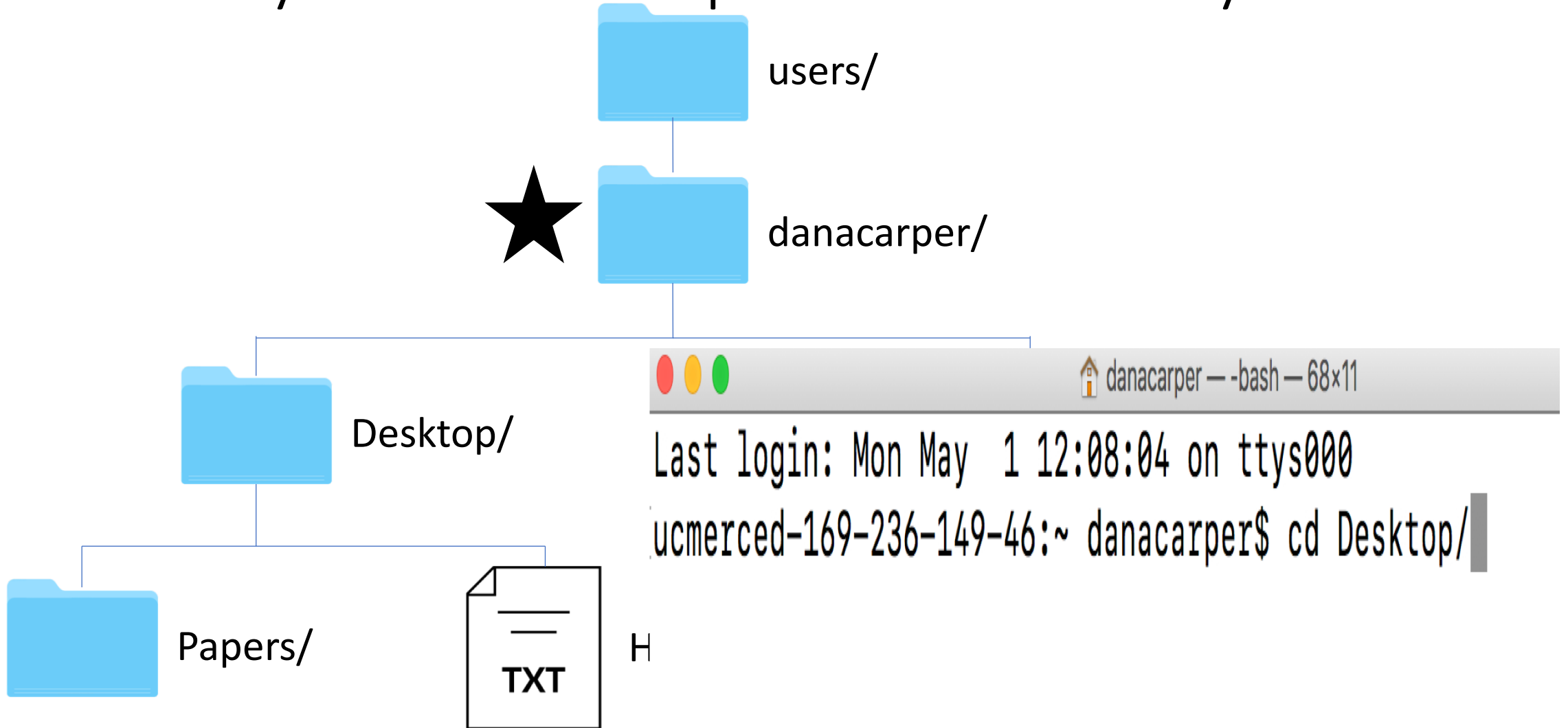Which folder I want to go to

Moving to a different directory

A file system is set up like a hierarchy

users/

★ danacarper/

Desktop/

Papers/

TXT H

```
● ● ●                    🏠 danacarper — -bash — 68×11

Last login: Mon May  1 12:08:04 on ttys000
ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
```

How do I know what is in a directory?

Desktop — -bash — 68×11

Last login: Mon May 1 12:08:04 on ttys000
ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
ucmerced-169-236-149-46:Desktop danacarper$ ls

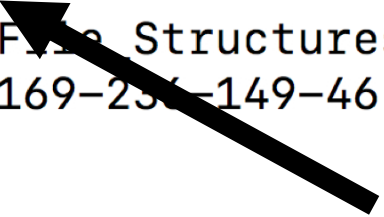means list what is in this folder

How do I know what is in a directory?


```
Last login: Mon May  1 12:22:30 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
[ucmerced-169-236-149-46:Desktop danacarper$ ls
Carper_manuscript_2017          Order_List.xlsx
Genetics_S17                    Overall_Semester_Goals_S17.docx
Hello.txt                       Papers
Intro_to_File_Structures.pptx   Seedling_adult
ucmerced-169-236-149-46:Desktop danacarper$ ▊
```
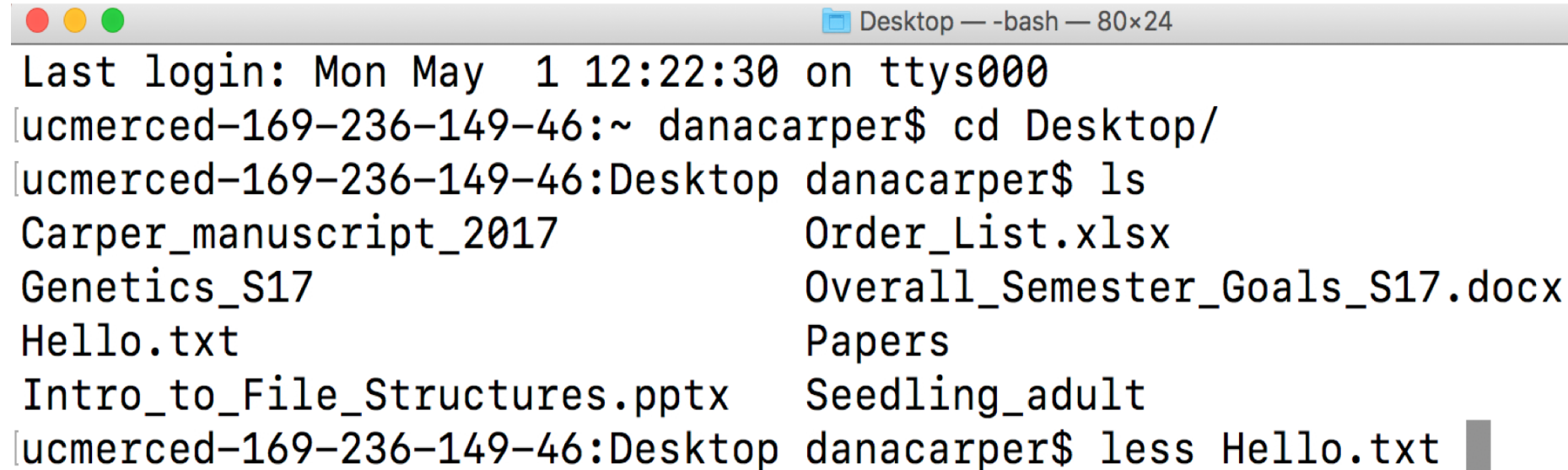
Everything in this folder

How do I look at a file?

How do I look at a file?

```
Last login: Mon May  1 12:22:30 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
[ucmerced-169-236-149-46:Desktop danacarper$ ls
Carper_manuscript_2017          Order_List.xlsx
Genetics_S17                    Overall_Semester_Goals_S17.docx
Hello.txt                       Papers
Intro_to_File_Structures.pptx   Seedling_adult
[ucmerced-169-236-149-46:Desktop danacarper$ less Hello.txt
```
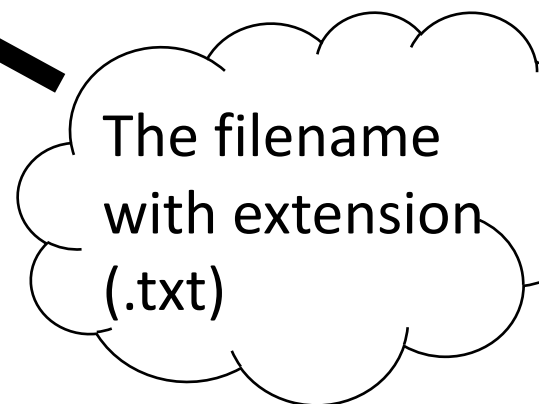
Means view

How do I look at a file?


```
Last login: Mon May  1 12:22:30 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
[ucmerced-169-236-149-46:Desktop danacarper$ ls
Carper_manuscript_2017          Order_List.xlsx
Genetics_S17                    Overall_Semester_Goals_S17.docx
Hello.txt                       Papers
Intro_to_File_Structures.pptx   Seedling_adult
[ucmerced-169-236-149-46:Desktop danacarper$ less Hello.txt
```

The filename with extension (.txt)

How do I look at a file?

Desktop — less Hello.txt — 80×24

```
Hello
Hello.txt (END)
```

Contents of file
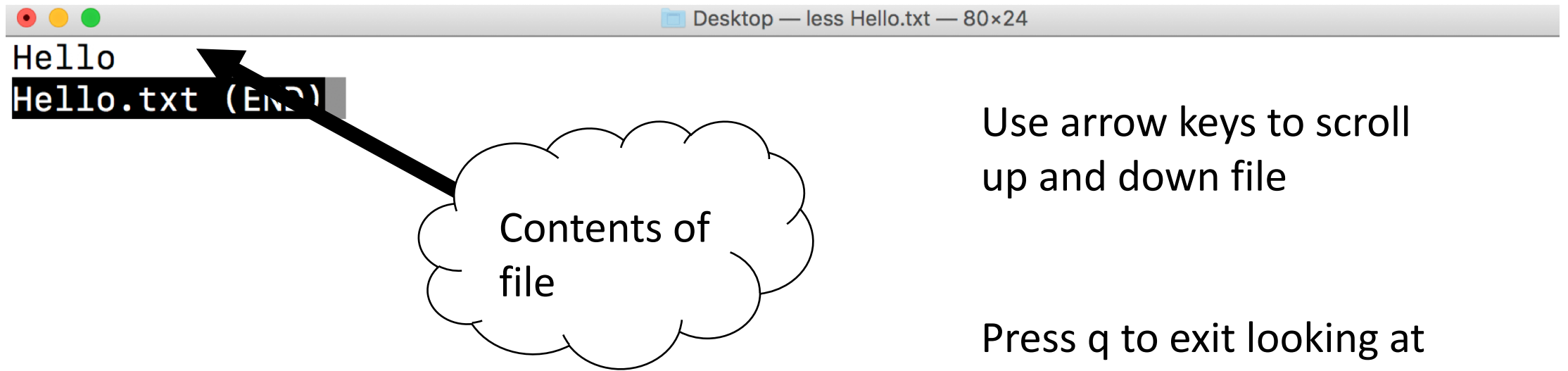
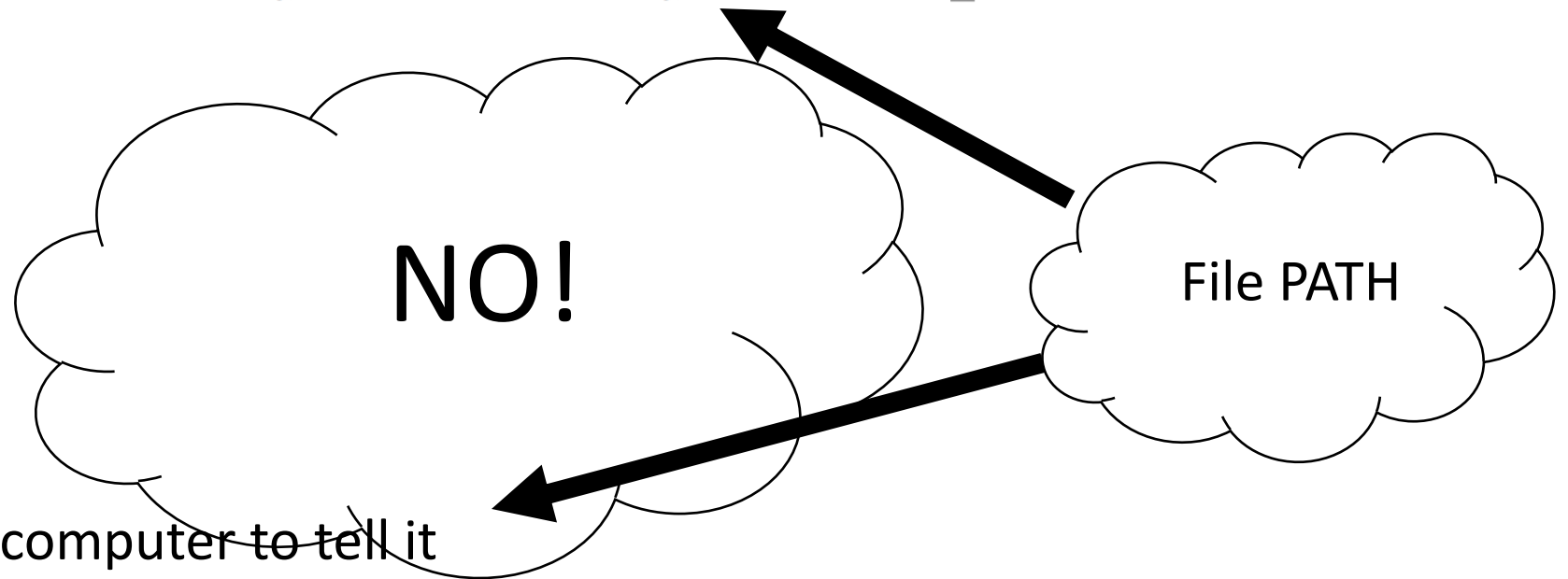Use arrow keys to scroll up and down file

Press q to exit looking at the file (q =quit)

Do I have to be in the same folder as the file to look at it?
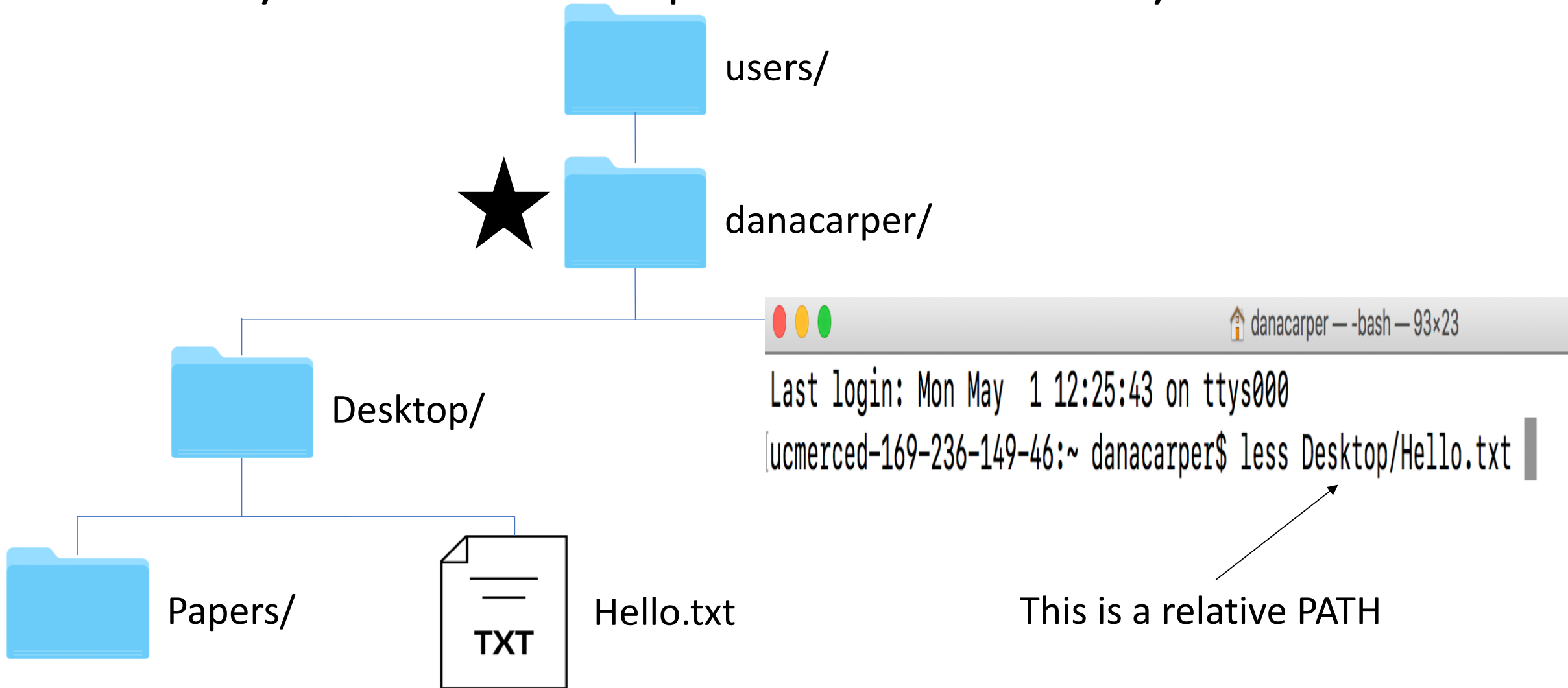
```
danacarper — -bash — 93×23
Last login: Mon May  1 12:25:43 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ less Desktop/Hello.txt
```
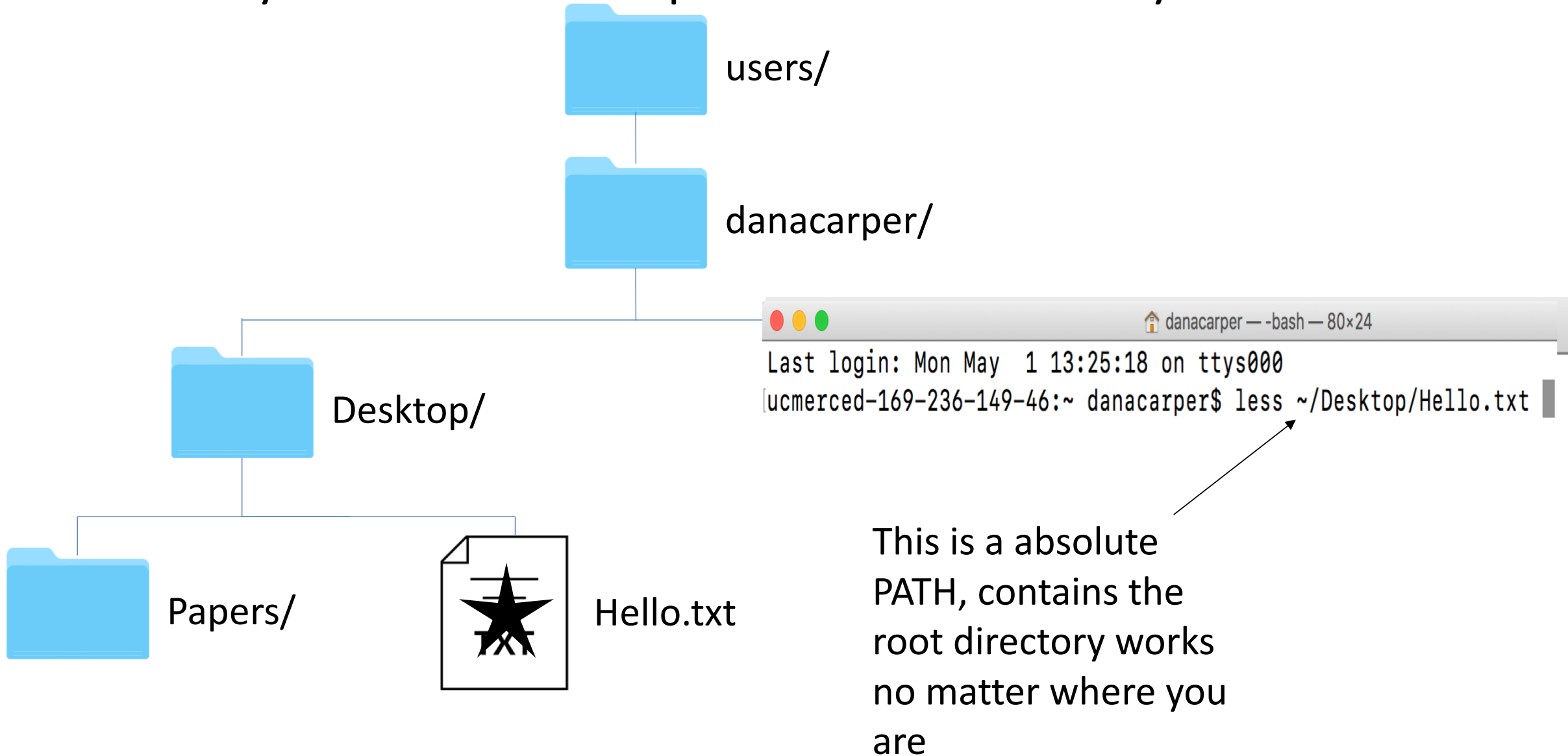
NO!
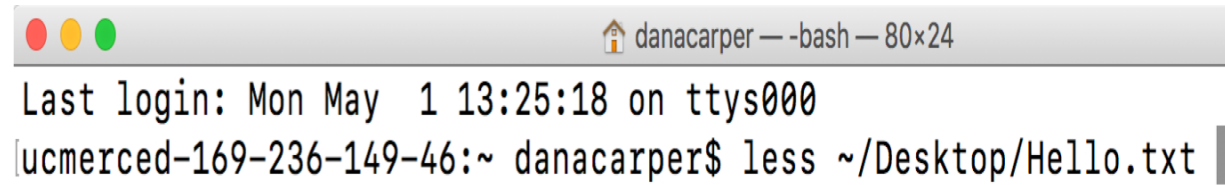
File PATH

Directions for the computer to tell it where the file is

A file system is set up like a hierarchy
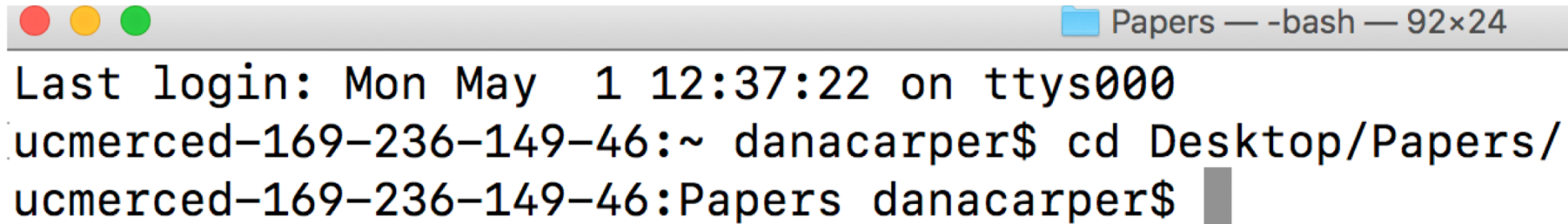
users/

danacarper/

Desktop/

Papers/

Hello.txt

```
danacarper — -bash — 93×23

Last login: Mon May  1 12:25:43 on ttys000
ucmerced-169-236-149-46:~ danacarper$ less Desktop/Hello.txt
```

This is a relative PATH

A file system is set up like a hierarchy

users/

danacarper/

Desktop/

```
                              danacarper — -bash — 80×24
Last login: Mon May  1 13:25:18 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ less ~/Desktop/Hello.txt
```

Papers/

Hello.txt

This is a absolute PATH, contains the root directory works no matter where you are

Absolute PATH

```
● ● ●                    🏠 danacarper — -bash — 80×24
Last login: Mon May  1 13:25:18 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ less ~/Desktop/Hello.txt
```

~ ≡ HOME
(/users/danacarper/)

Giving the PATH works for other commands too!
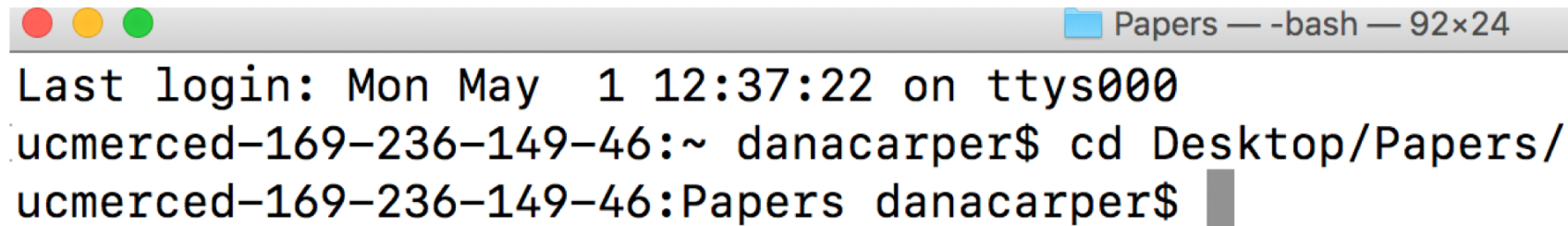
A file system is set up like a hierarchy

users/

danacarper/

Desktop/

```
Papers — -bash — 92×24
Last login: Mon May  1 12:37:22 on ttys000
ucmerced-169-236-149-46:~ danacarper$ cd Desktop/Papers/
ucmerced-169-236-149-46:Papers danacarper$ ▉
```
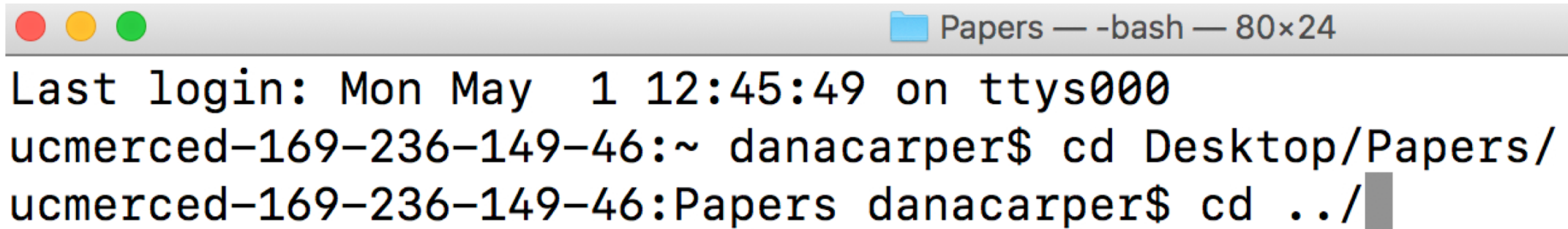
Papers/

Hello.txt

Rstudio.dmg
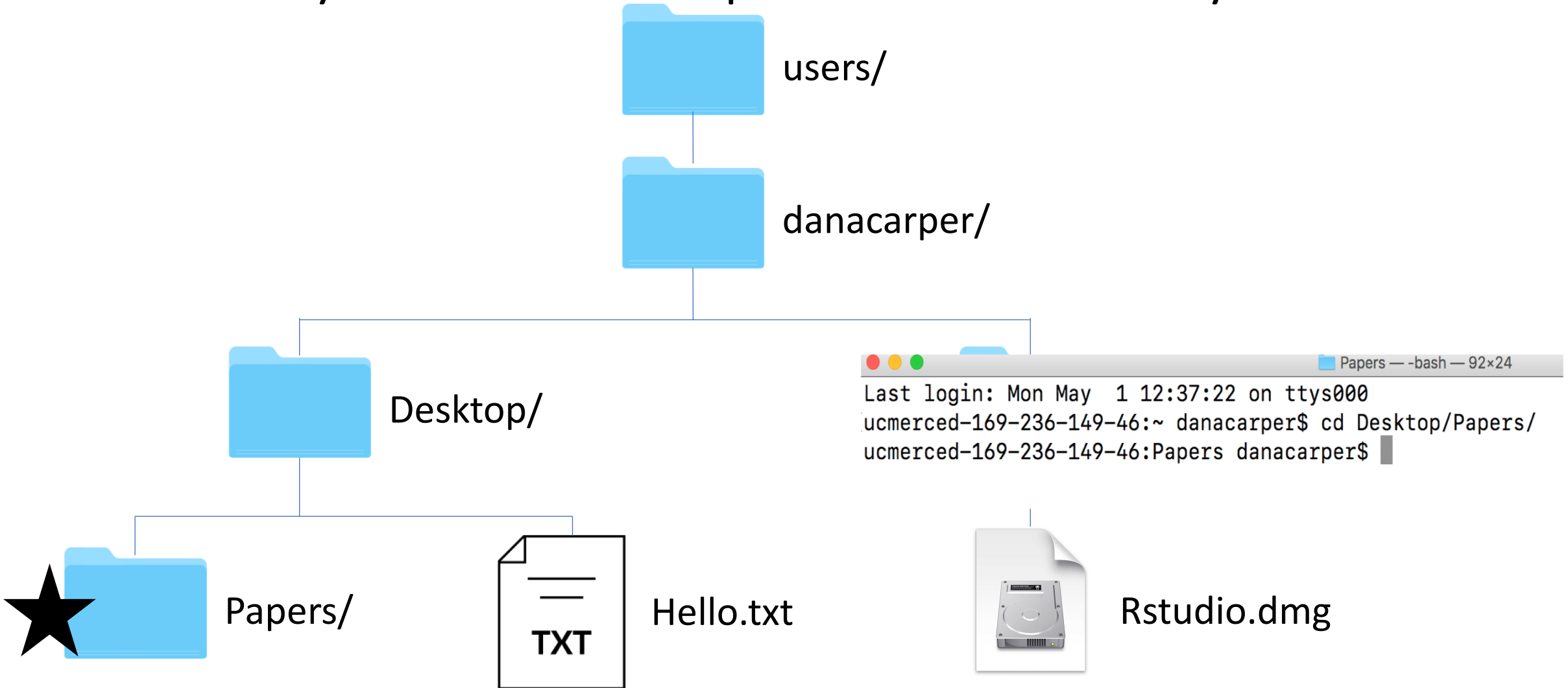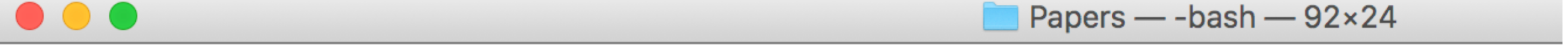
Oops I went too far I meant to be on the desktop, How do I go back?

```
Last login: Mon May  1 12:37:22 on ttys000
ucmerced-169-236-149-46:~ danacarper$ cd Desktop/Papers/
ucmerced-169-236-149-46:Papers danacarper$ ▉
```
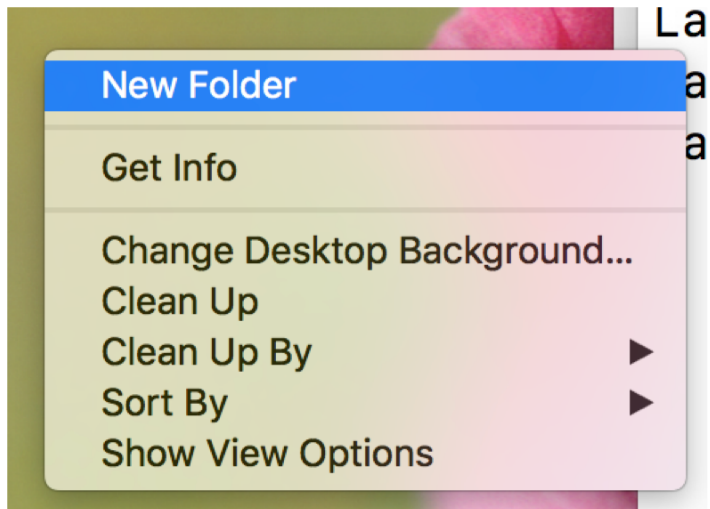
Multiple ways to go back


```
Last login: Mon May  1 12:37:22 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/Papers/
[ucmerced-169-236-149-46:Papers danacarper$ cd ~/Desktop/
```

Papers — -bash — 92×24

Means Home
(/users/danacarper/)

Multiple ways to go back

```
Papers — -bash — 80×24

Last login: Mon May  1 12:45:49 on ttys000
ucmerced-169-236-149-46:~ danacarper$ cd Desktop/Papers/
ucmerced-169-236-149-46:Papers danacarper$ cd ../
```

Means go back one folder

Now that we have navigated directories

How do we create a new directory?
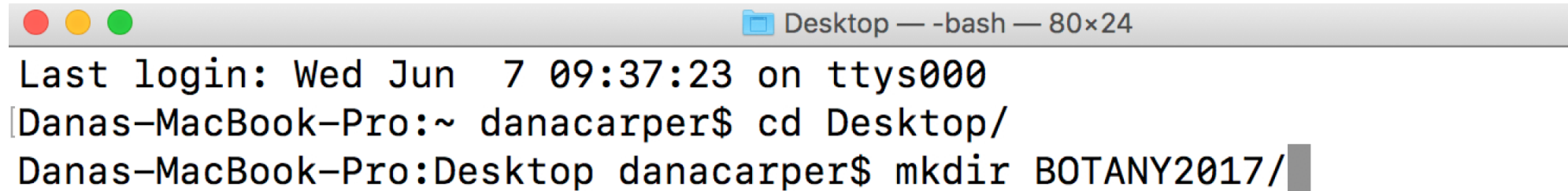
Desktop — -bash — 80×24

```
Last login: Wed Jun  7 09:37:23 on ttys000
[Danas-MacBook-Pro:~ danacarper$ cd Desktop/
Danas-MacBook-Pro:Desktop danacarper$ mkdir BOTANY2017/
```
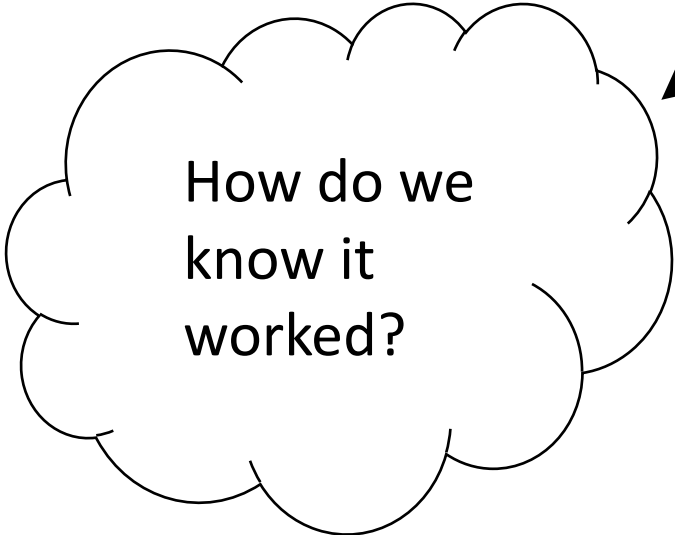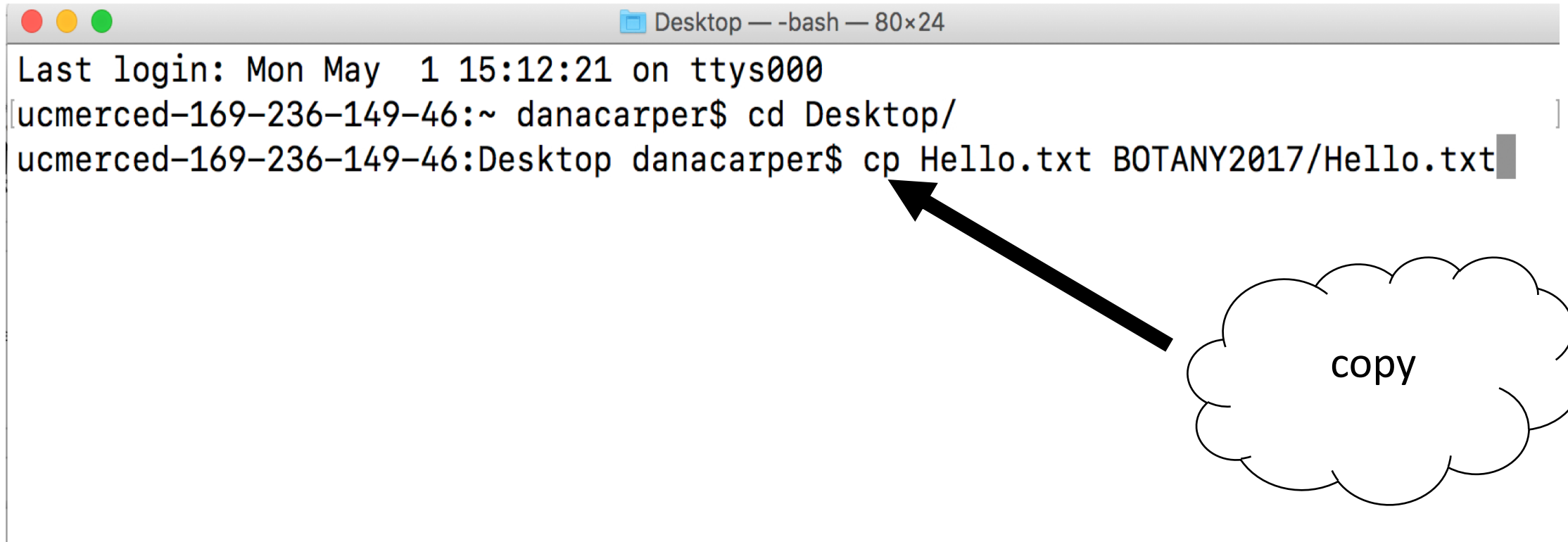
Make new folder

The same a right clicking to make a new folder

New Folder

Get Info

Change Desktop Background...
Clean Up
Clean Up By   ▶
Sort By   ▶
Show View Options

How do we create a new directory?

```
Last login: Wed Jun  7 09:37:23 on ttys000
[Danas-MacBook-Pro:~ danacarper$ cd Desktop/
Danas-MacBook-Pro:Desktop danacarper$ mkdir BOTANY2017/
```
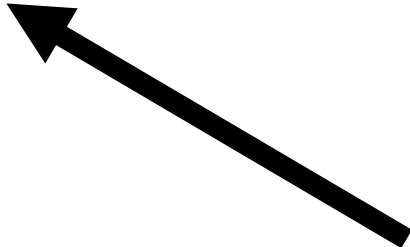
Name of folder

How do we create a new directory?

How do we create a new directory?

How do we copy a file to that new folder?

How do we copy a file to that new folder?

File you
want to copy

How do we copy a file to that new folder?

```
Last login: Mon May  1 15:12:21 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
ucmerced-169-236-149-46:Desktop danacarper$ cp Hello.txt BOTANY2017/Hello.txt
```

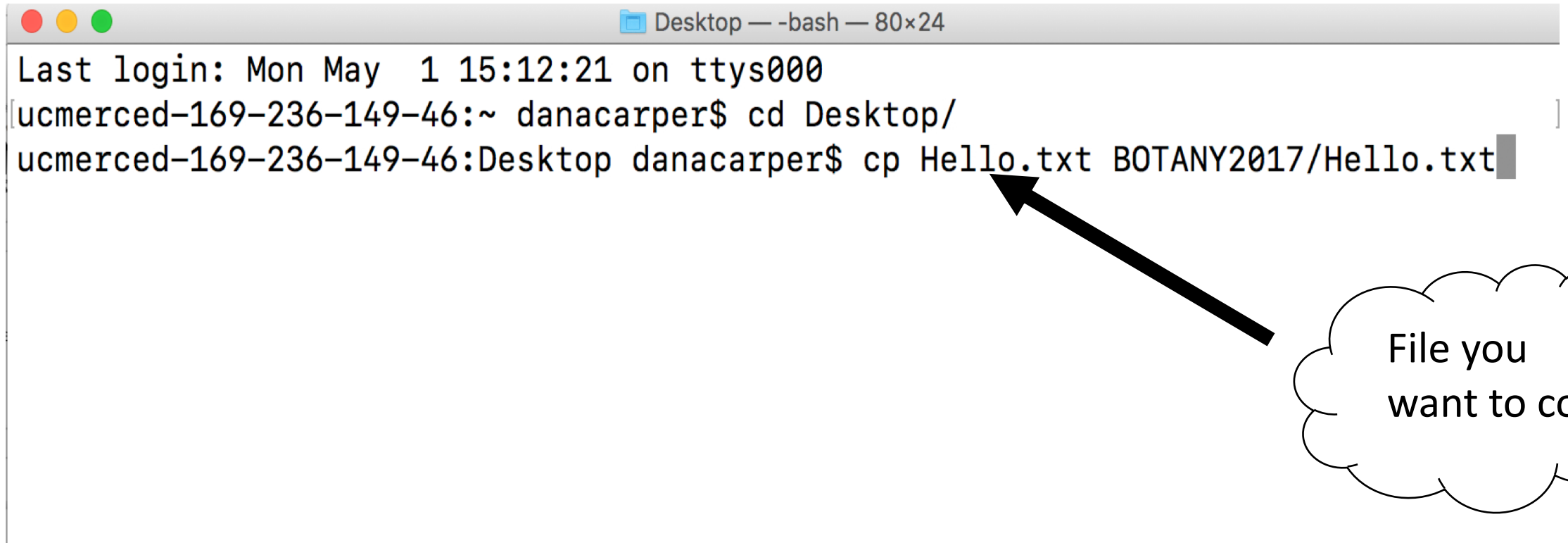Location where you want the file absolute or relative path

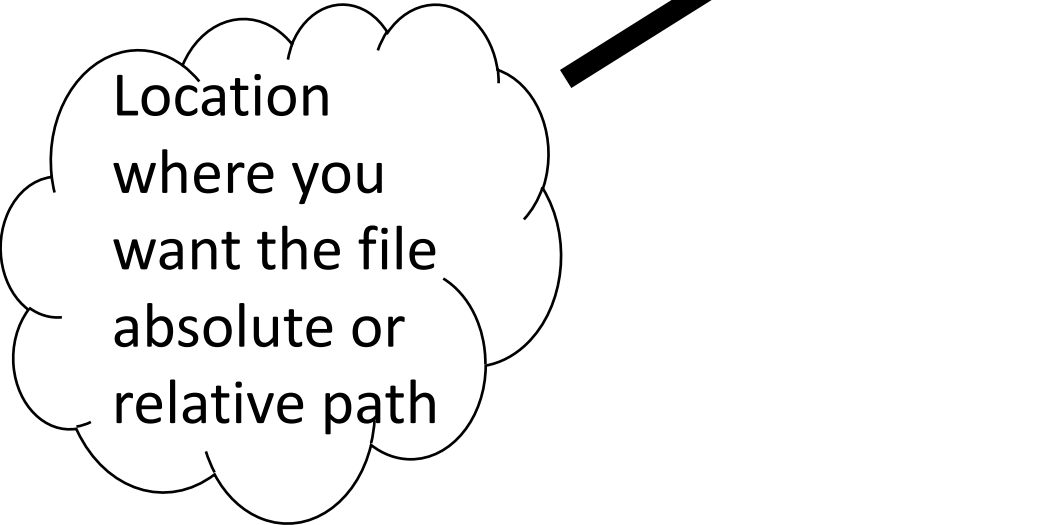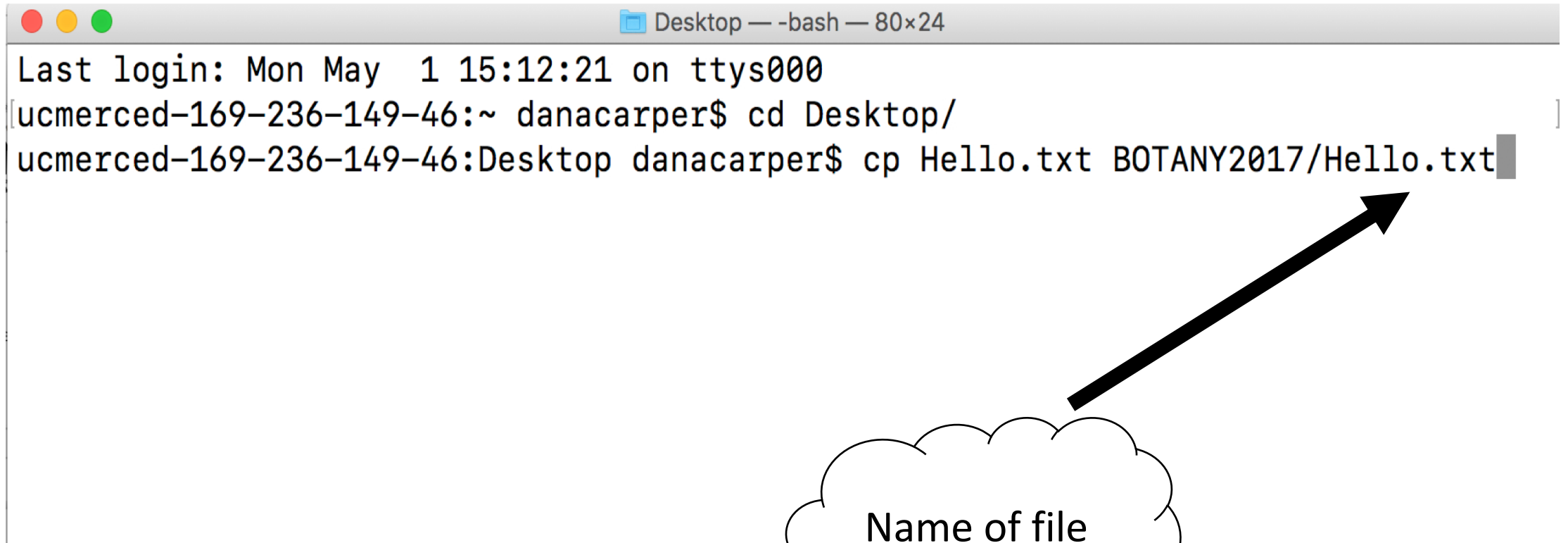# How do we copy a file to that new folder?

Desktop — -bash — 80×24

```
Last login: Mon May  1 15:12:21 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
ucmerced-169-236-149-46:Desktop danacarper$ cp Hello.txt BOTANY2017/Hello.txt
```

Name of file

What if we want to delete a file?

Desktop — -bash — 80×24

```
Last login: Mon May  1 15:13:12 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
[ucmerced-169-236-149-46:Desktop danacarper$ rm BOTANY2017/Hello.txt
```
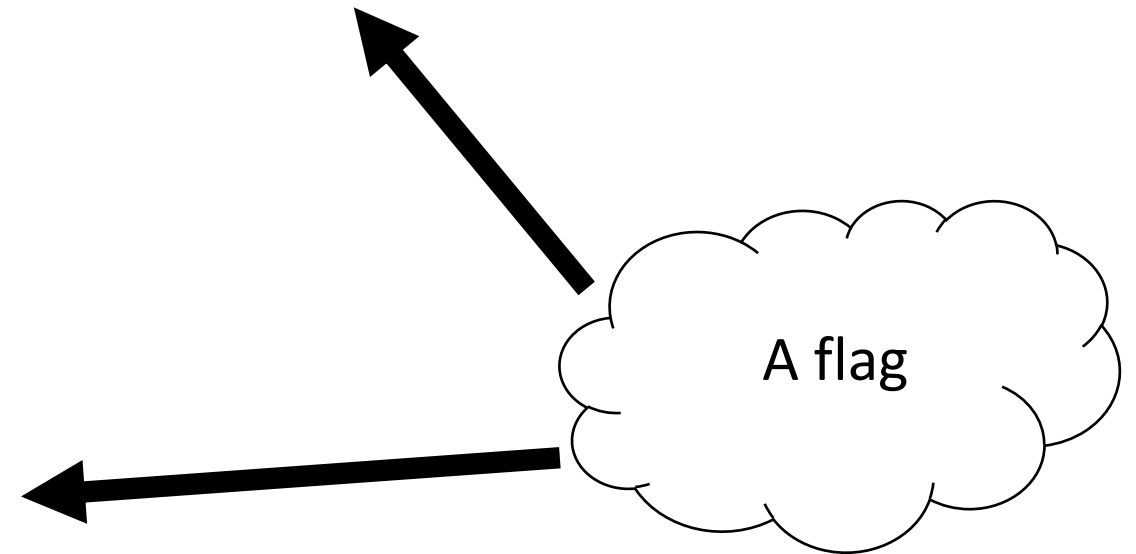
Remove or delete

THIS CAN NOT BE UNDONE!!!!!

What if we want to delete a file and a folder?

```
Last login: Mon May  1 15:22:15 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
[ucmerced-169-236-149-46:Desktop danacarper$ rm -R BOTANY2017/
```

A flag

This is an option for a command

What if we want to delete a file and a folder?

```
Desktop — -bash — 80×24

Last login: Mon May  1 15:22:15 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
[ucmerced-169-236-149-46:Desktop danacarper$ rm -R BOTANY2017/
```
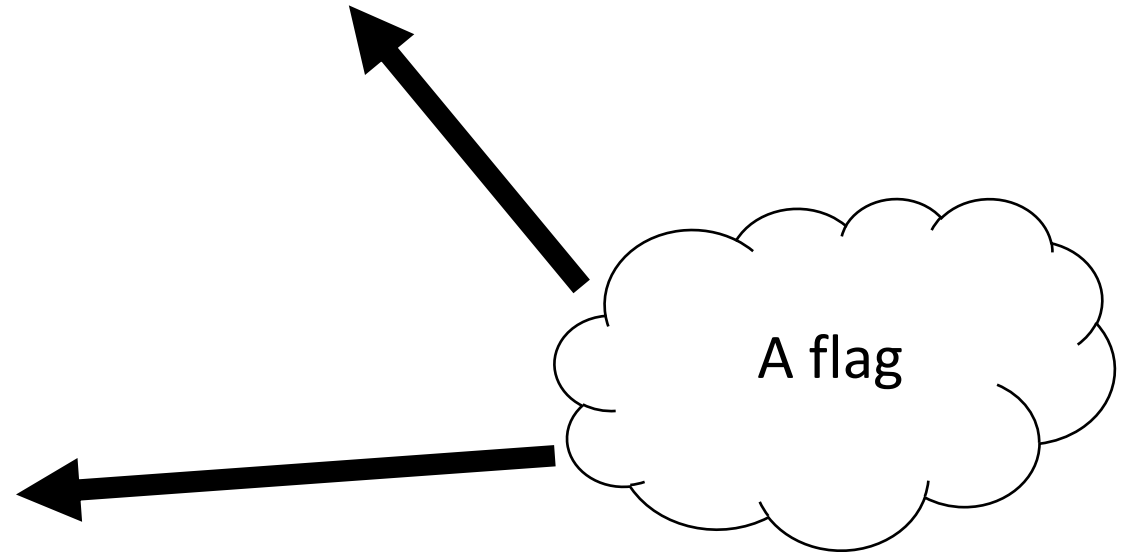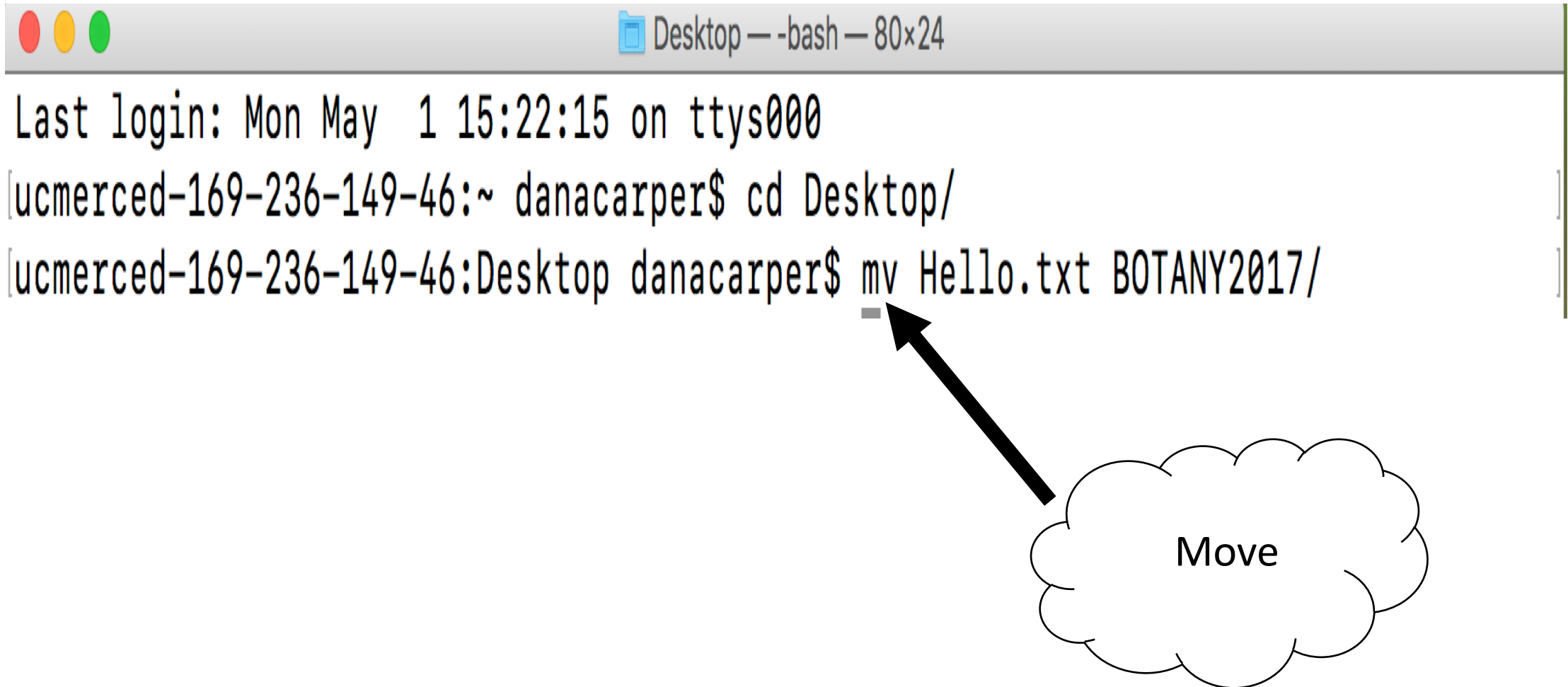
A flag

means remove all files and folder
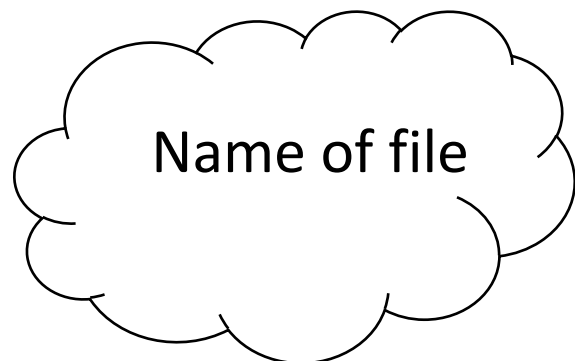
What if we want to move a file instead of copying it?


```
Last login: Mon May  1 15:22:15 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
[ucmerced-169-236-149-46:Desktop danacarper$ mv Hello.txt BOTANY2017/
```

Move

What if we want to move a file instead of copying it?

Last login: Mon May 1 15:22:15 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
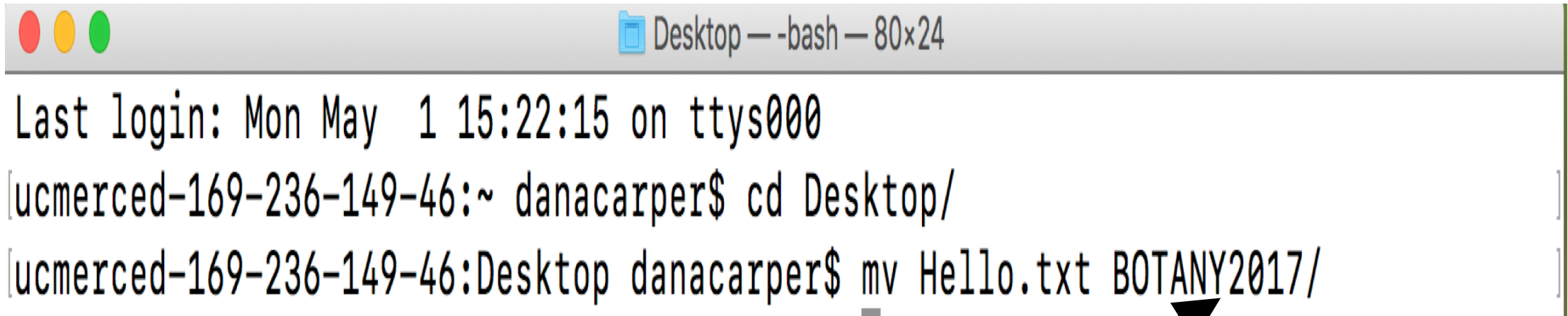[ucmerced-169-236-149-46:Desktop danacarper$ mv Hello.txt BOTANY2017/

Name of file

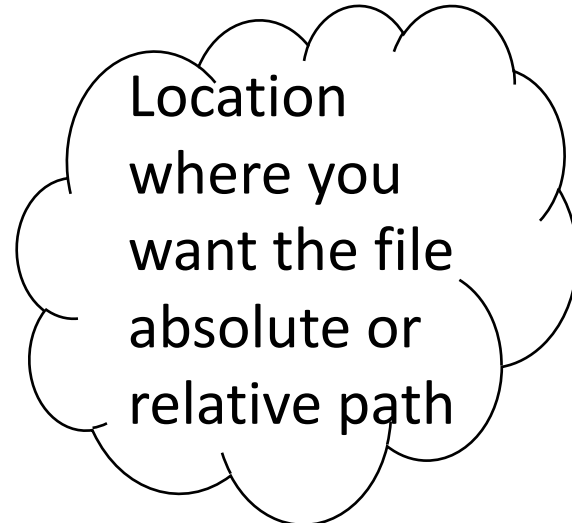# What if we want to move a file instead of copying it?

```
Desktop — -bash — 80×24

Last login: Mon May  1 15:22:15 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
[ucmerced-169-236-149-46:Desktop danacarper$ mv Hello.txt BOTANY2017/
```

Location where you want the file absolute or relative path

Why do these things on command line?

- Don't always have a interface that has a mouse
  - such as a cluster or server

- Working with a bunch of files
  - will show you how to move many files coming up in the next sections

UNIX Ideas: PATH

How does the computer know commands?

- Computers need to know where to look for commands or new functions

- If you add a new function or command:
  - To be able to use it no matter what folder you are in it has to be in your $PATH
  - A $PATH is a list of folders the computer checks for a command or function

- Example $PATH:
  - /usr/local/bin:/usr/local:/usr/bin
  - What does this mean?
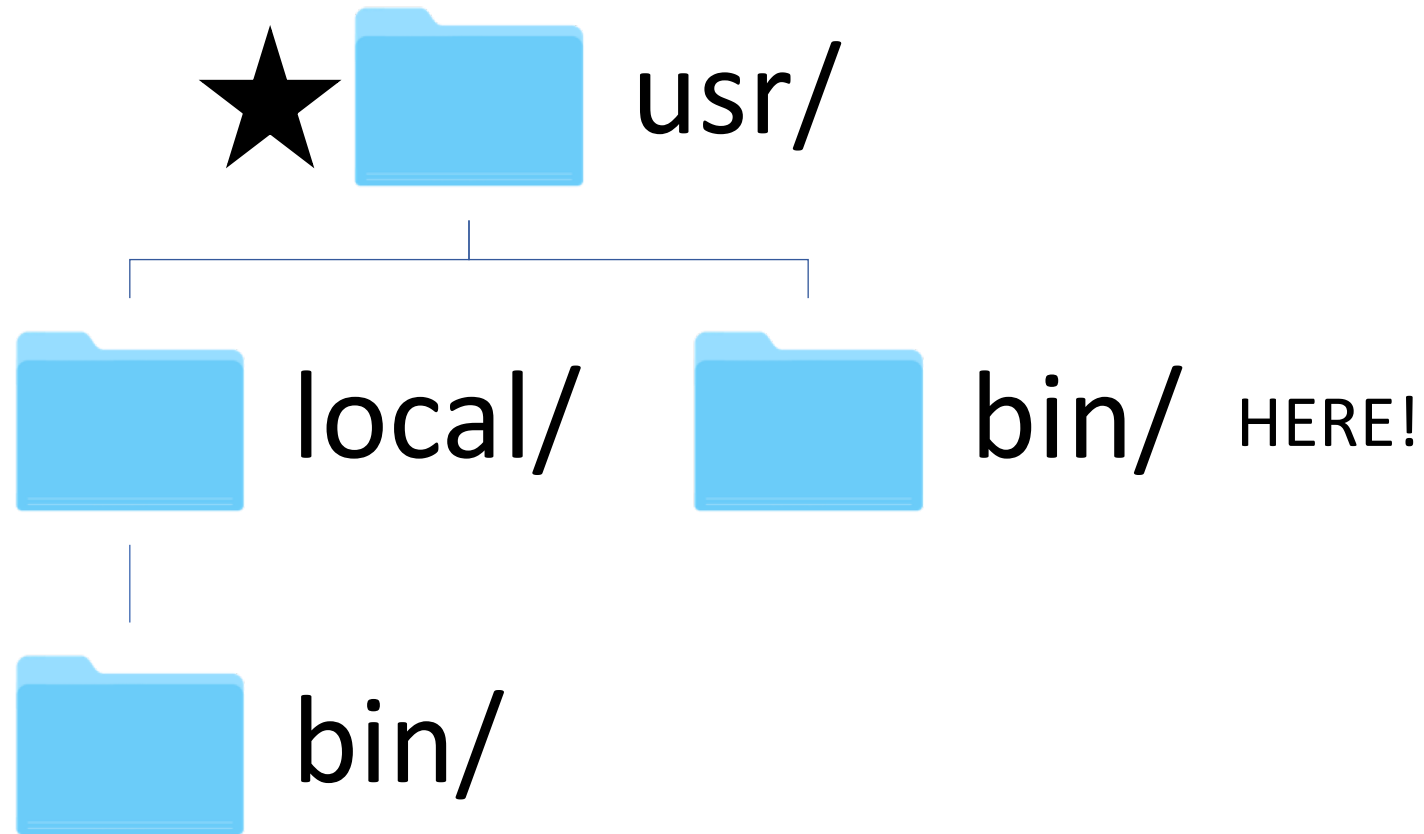
Example $PATH:
/usr/local/bin:/usr/local:/usr/bin
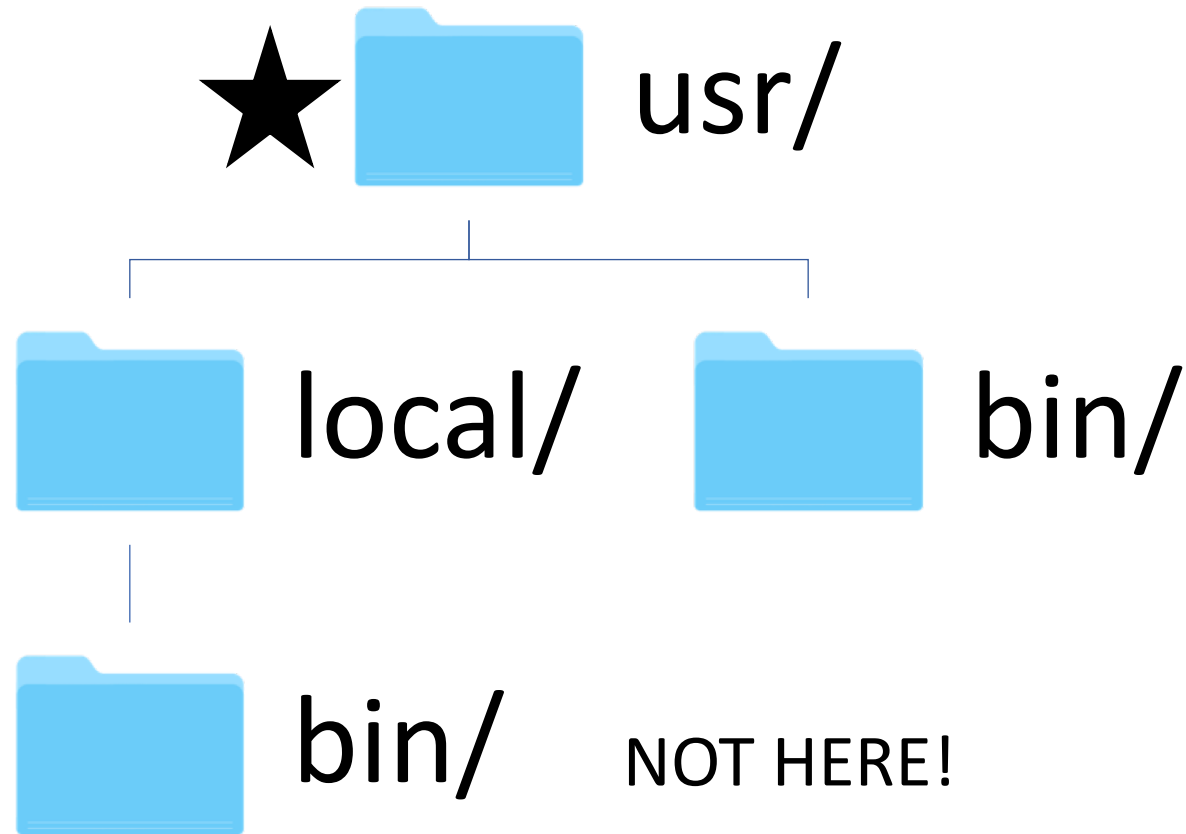
Example $PATH:
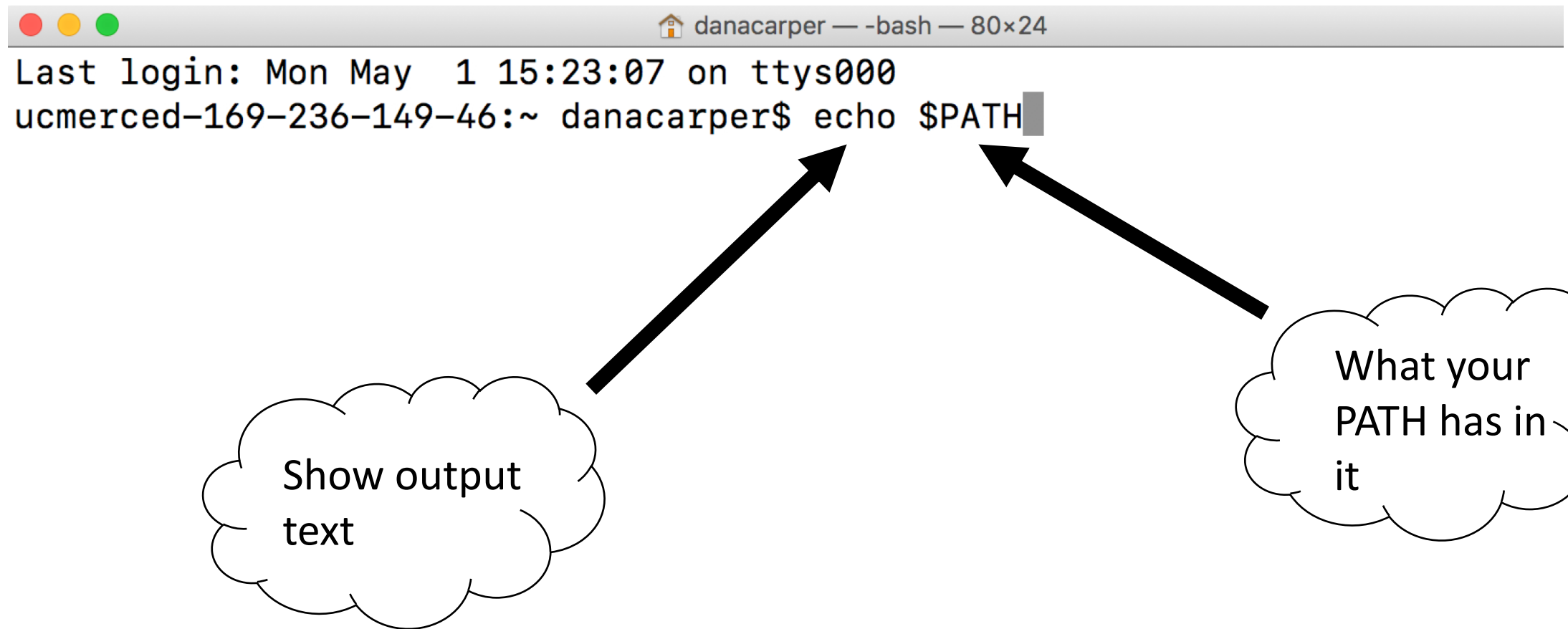# /usr/local/bin:/usr/local:/usr/bin
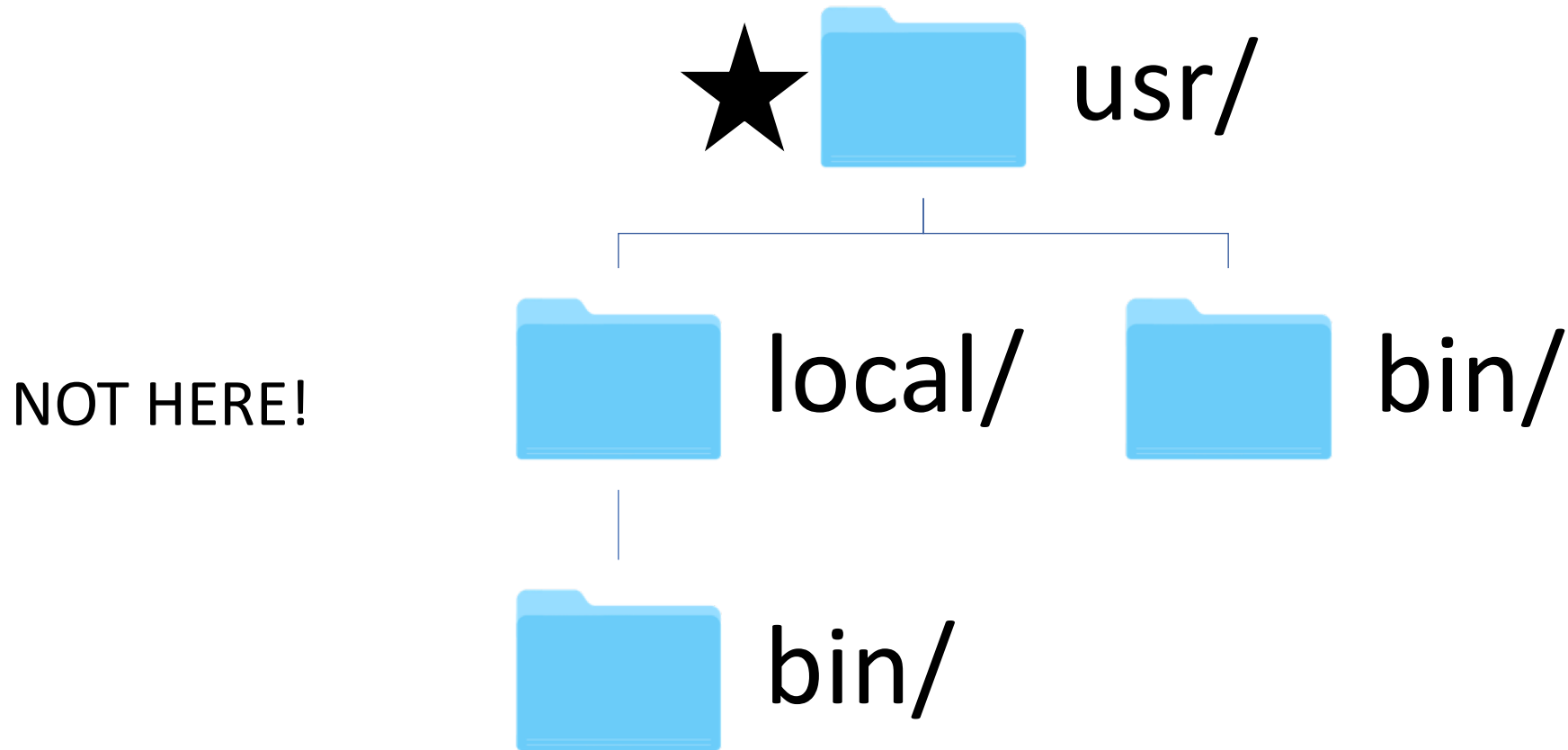
Example $PATH:
/usr/local/bin:/usr/local:/usr/bin

Why do we need to know about our $PATH?

- When we install new programs they need to be in our path for them to work
  - so it is important to know what folders are in our path so we can put new programs in them
  - or so we can add new folders to our path
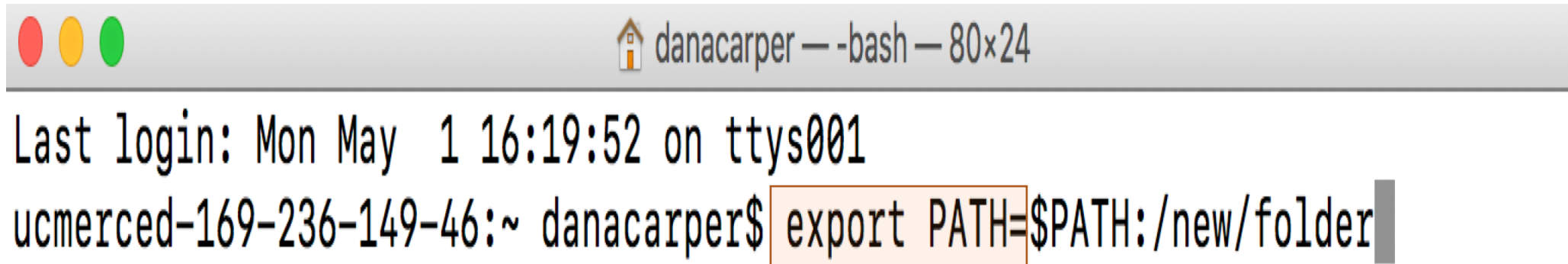
Displaying your PATH

```
Last login: Mon May  1 15:23:07 on ttys000
ucmerced-169-236-149-46:~ danacarper$ echo $PATH
```

danacarper — -bash — 80×24

Show output text

What your PATH has in it

Displaying your PATH

```
Last login: Mon May  1 15:23:07 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ echo $PATH
/Users/danacarper/perl5/perlbrew/bin:/Users/danacarper/perl5/perlbrew/perls/perl
-5.22.0/bin:/usr/local/bin:/usr/bin:/bin:/usr/sbin:/sbin:/opt/X11/bin:/Users/dan
acarper/Bin
ucmerced-169-236-149-46:~ danacarper$ █
```

Output is a list of folders that it will search for commands, separated by :

Displaying your PATH

I have a new folder I want in my path

Last login: Mon May 1 16:19:52 on ttys001
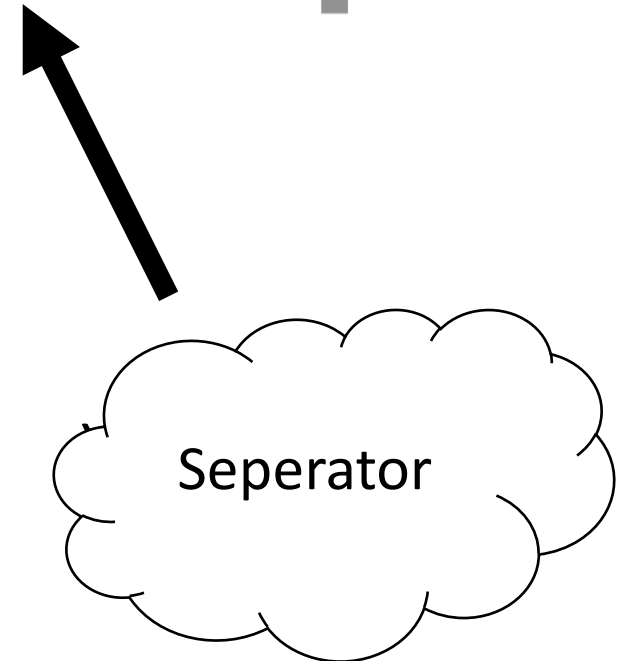ucmerced-169-236-149-46:~ danacarper$ export PATH=$PATH:/new/folder

Add to your current PATH

I have a new folder I want in my path

Last login: Mon May 1 16:19:52 on ttys001
ucmerced-169-236-149-46:~ danacarper$ export PATH=$PATH:/new/folder
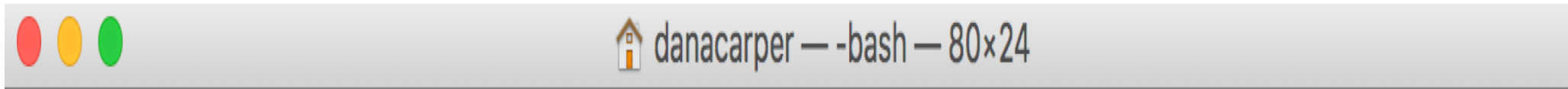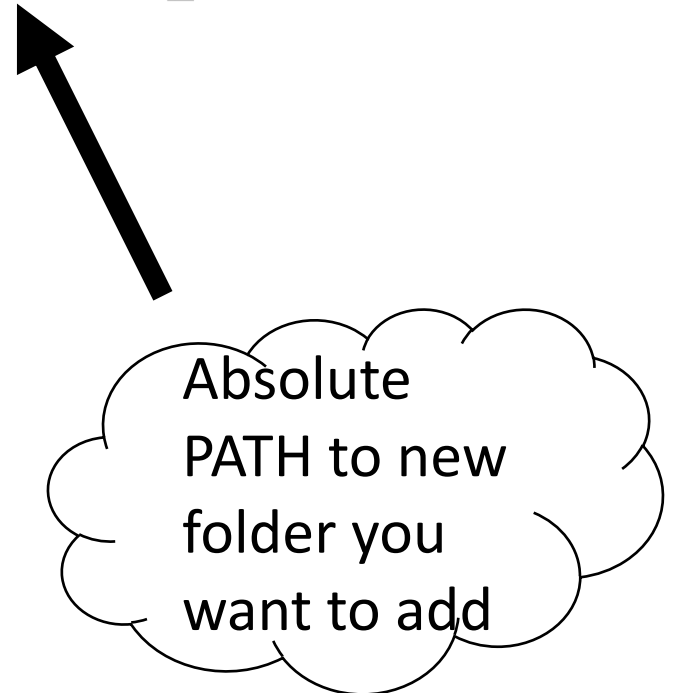
Your current PATH
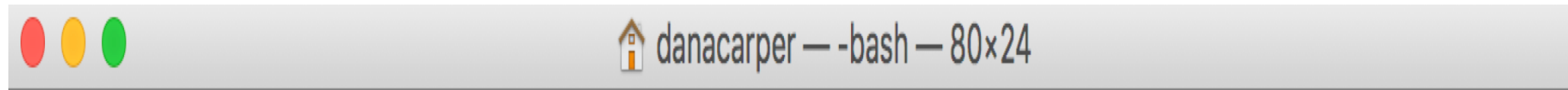
I have a new folder I want in my path

```
Last login: Mon May  1 16:19:52 on ttys001
ucmerced-169-236-149-46:~ danacarper$ export PATH=$PATH:/new/folder
```
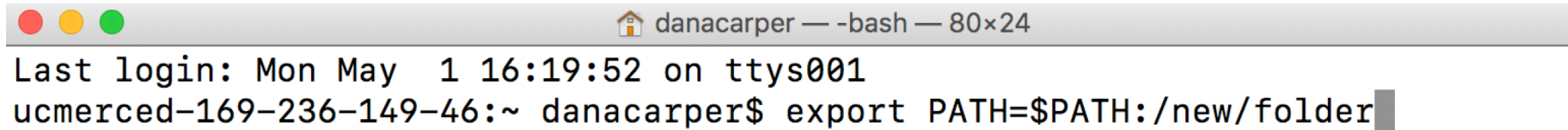
Seperator

I have a new folder I want in my path

Last login: Mon May 1 16:19:52 on ttys001
ucmerced-169-236-149-46:~ danacarper$ export PATH=$PATH:/new/folder

Absolute PATH to new folder you want to add

Export $PATH is not permanent

```
                        🏠 danacarper — -bash — 80×24
Last login: Mon May  1 16:19:52 on ttys001
ucmerced-169-236-149-46:~ danacarper$ export PATH=$PATH:/new/folder
```

This is only saved until you exit the terminal, when you re-open the terminal the new folder wont be a part of your PATH
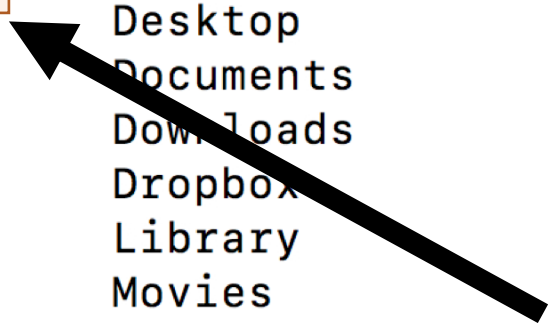
How to permanently change your PATH

- Need to change .bash_profile

- A file containing your PATH

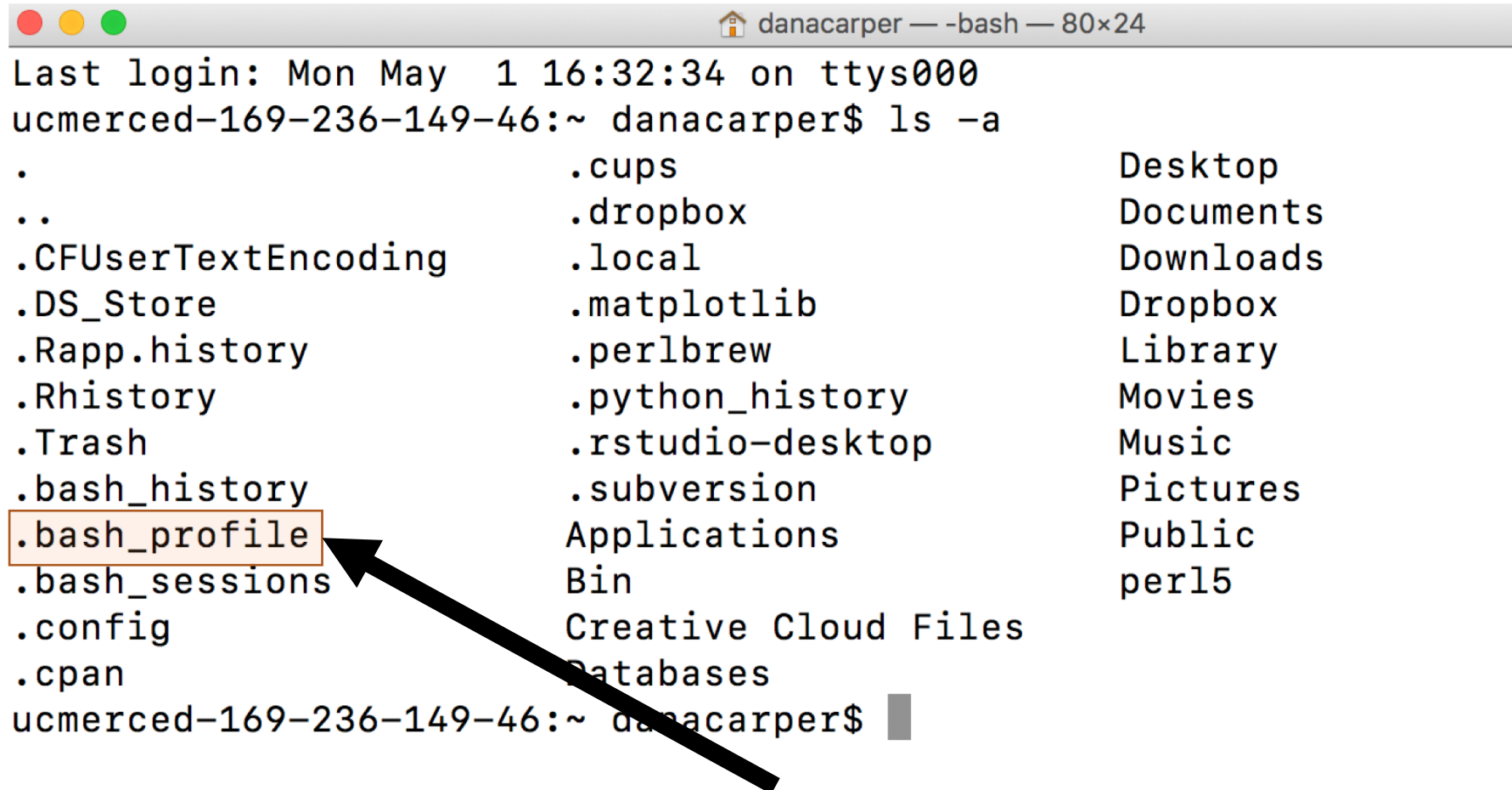- Where is it? I have never seen a file named this!

Showing hidden files
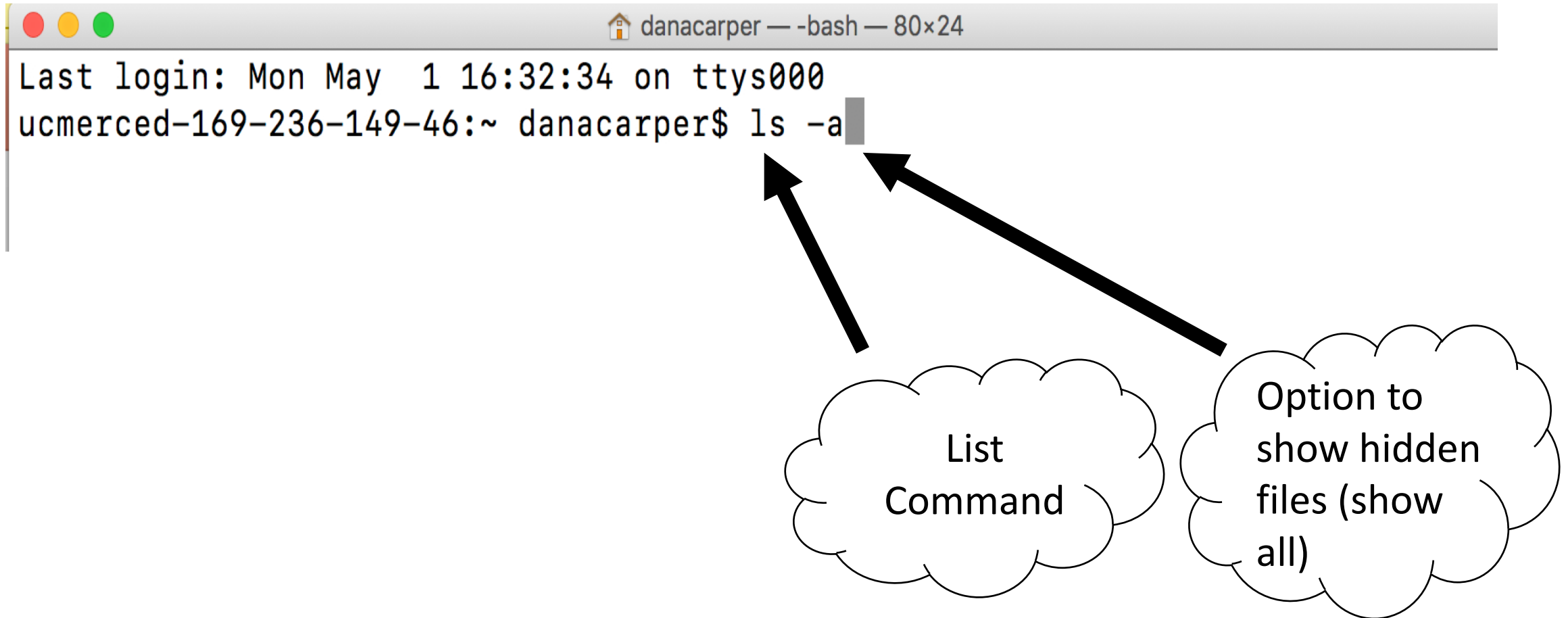

```
Last login: Mon May  1 16:32:34 on ttys000
ucmerced-169-236-149-46:~ danacarper$ ls -a
```

List Command

Option to show hidden files (show all)

Showing hidden files

Showing hidden files

Modifying .bash_profile

- Open in a text editor
  - Nano
  - Vim
  - Add export PATH=$PATH:/new/folder
- Or enter this in the terminal:
  - echo 'export PATH=$PATH:/usr/local/bin' >>~/.bash_profile

Add /usr/local/bin

make sure to have >> to not erase original