

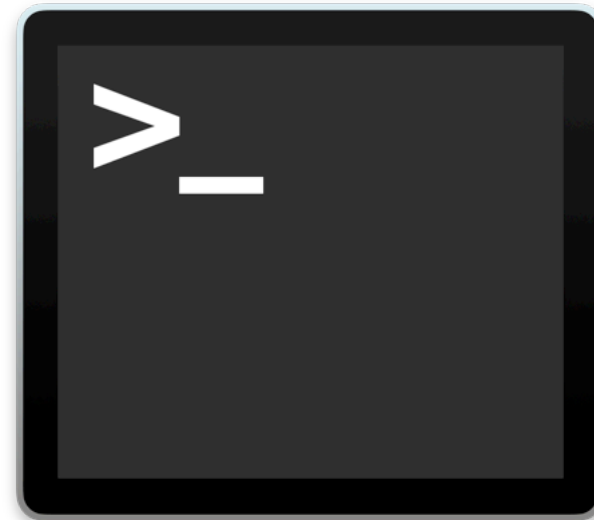
Part 1_1: Introduction to directory structures and command line



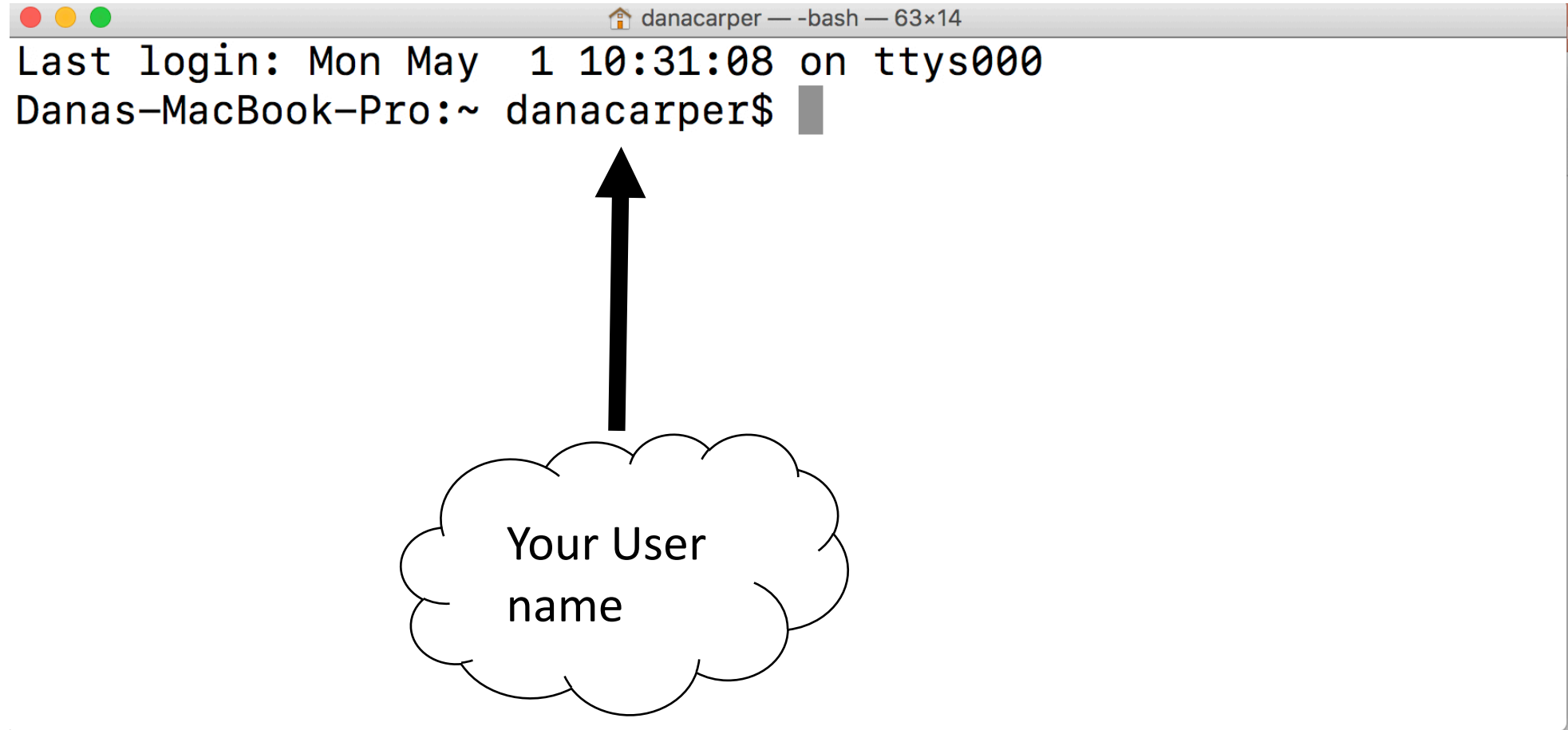
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Quantitative and Systems Biology
University of California, Merced

Where to find a terminal?

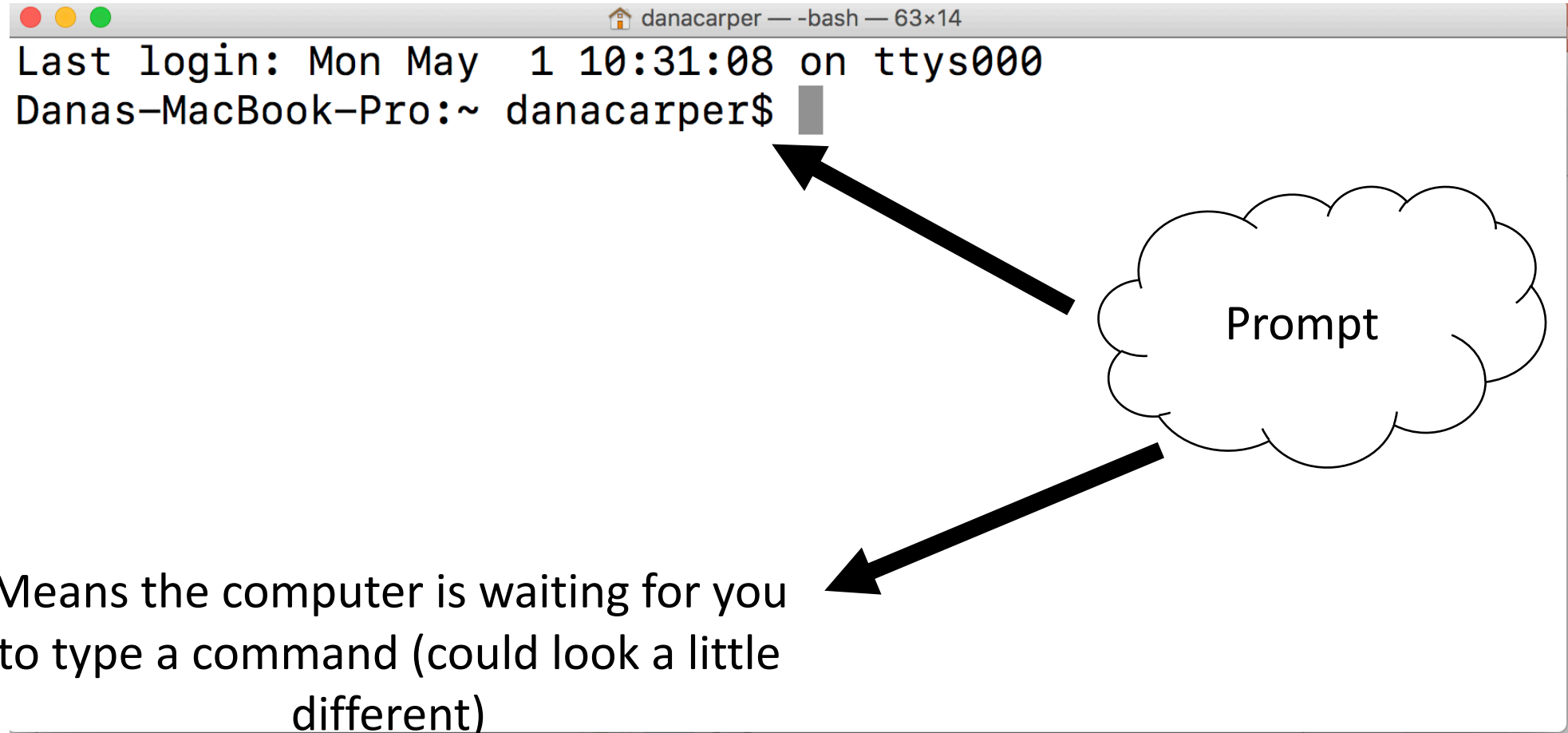
- A Terminal is a device that allows you to talk to the computer
- It can usually be found within the utilities folder in mac
- In ubuntu, under applications or search for terminal



Opening Terminal



Opening Terminal



Computer Terminology

Directory



Folder

How do we determine which directory we are in?

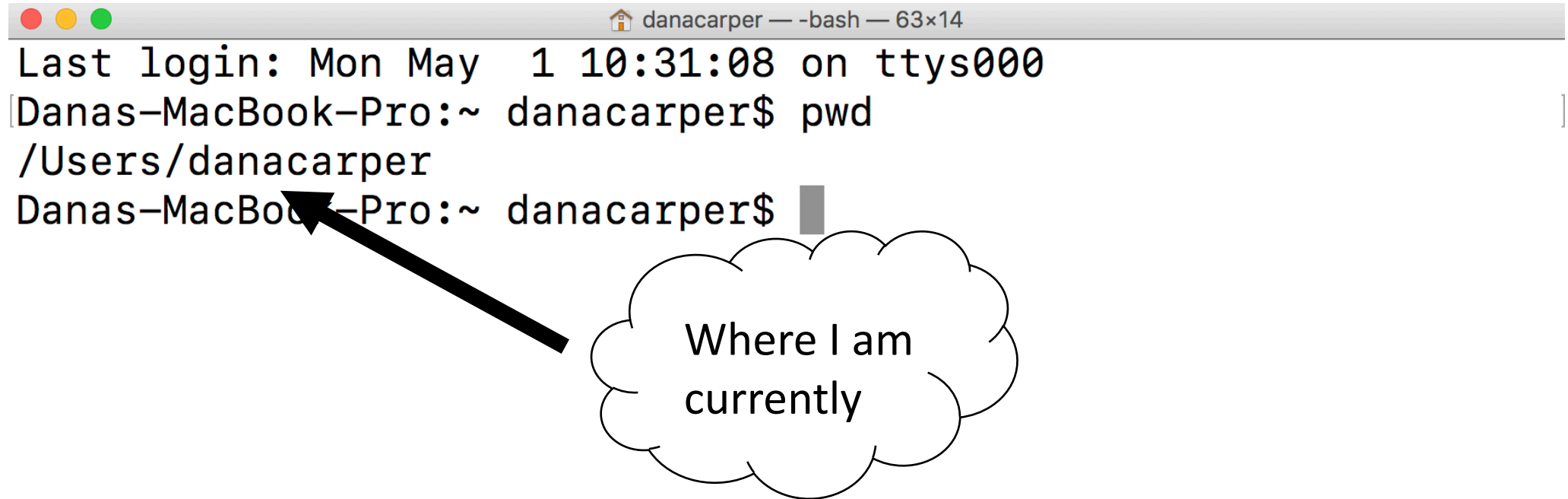
```
danacarper — -bash — 63x14
Last login: Mon May  1 10:31:08 on ttys000
Danas-MacBook-Pro:~ danacarper$ pwd
```



Print
working
directory

Print out which directory (folder) I am in
currently

How do we determine which directory we are in?

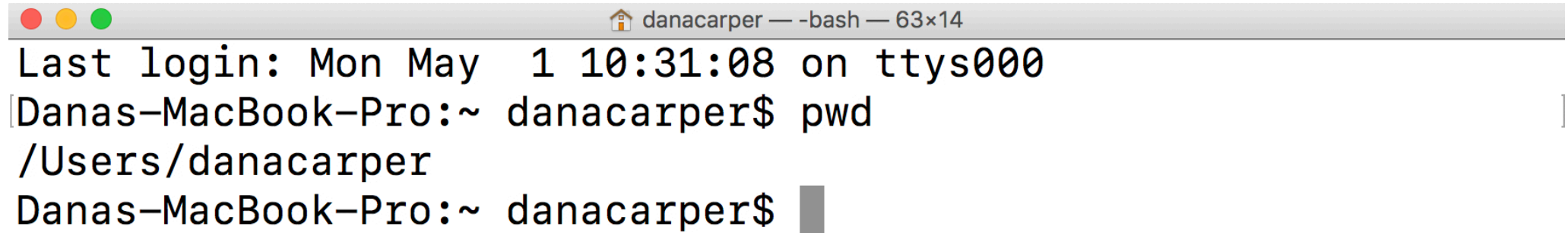


```
danacarper — -bash — 63x14
Last login: Mon May  1 10:31:08 on ttys000
Danas-MacBook-Pro:~ danacarper$ pwd
/Users/danacarper
Danas-MacBook-Pro:~ danacarper$
```

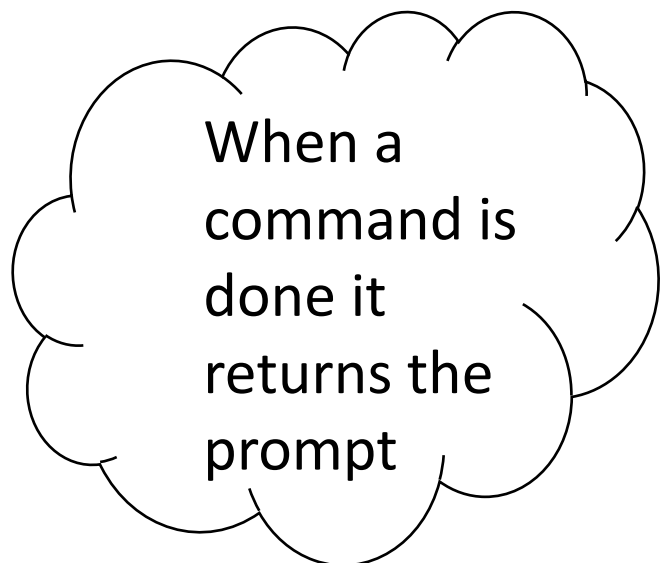
Where I am currently

The image shows a macOS terminal window with a title bar containing three colored window control buttons (red, yellow, green) and a title text 'danacarper — -bash — 63x14'. The terminal output shows a successful login on May 1st at 10:31:08, followed by the execution of the 'pwd' command which returns the current directory as '/Users/danacarper'. A thick black arrow points from a cloud-shaped callout bubble containing the text 'Where I am currently' to the tilde '~' symbol in the prompt 'Danas-MacBook-Pro:~ danacarper\$'.

How do we determine which directory we are in?

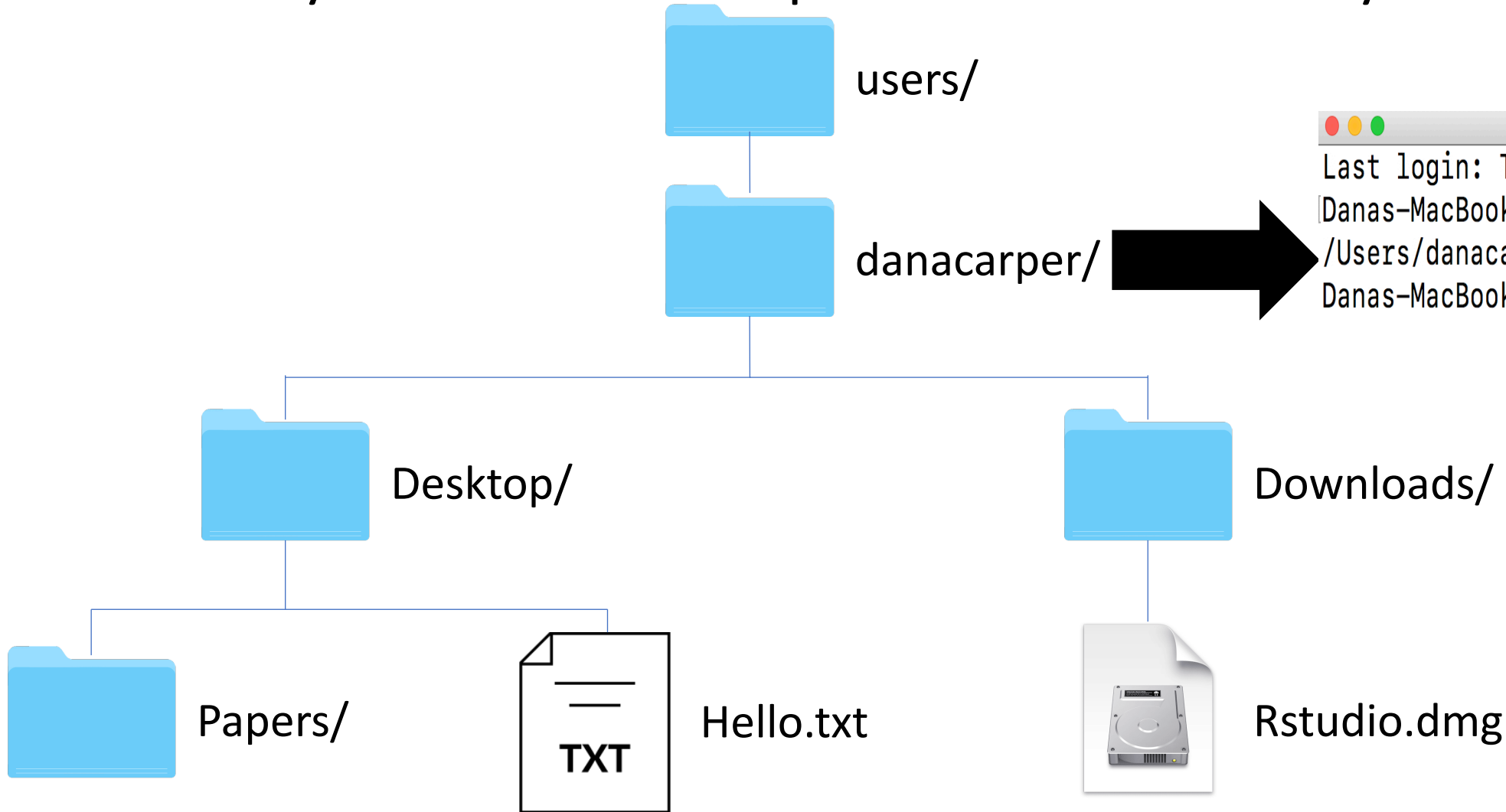


```
danacarper — -bash — 63x14
Last login: Mon May  1 10:31:08 on ttys000
Danas-MacBook-Pro:~ danacarper$ pwd
/Users/danacarper
Danas-MacBook-Pro:~ danacarper$
```



When a
command is
done it
returns the
prompt

A file system is set up like a hierarchy

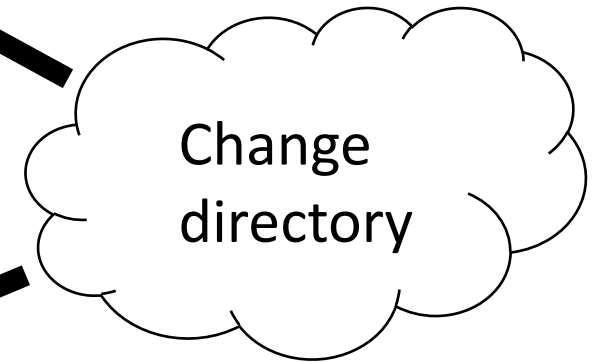


```
danacarper$ pwd
/Users/danacarper
danacarper$
```

A terminal window showing the output of the `pwd` command. The prompt is `Danas-MacBook-Pro:~ danacarper$`. The output is `/Users/danacarper`. The prompt then changes to `Danas-MacBook-Pro:~ danacarper$`.

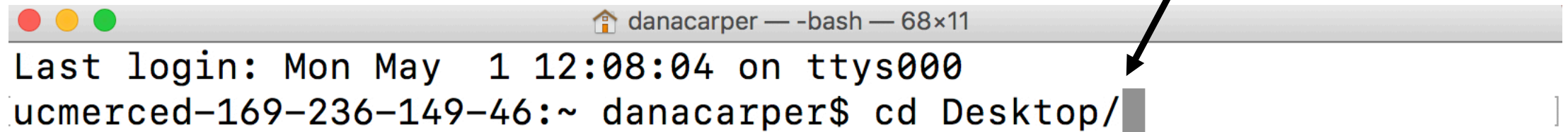
Moving to a different directory

```
danacarper — -bash — 68x11
Last login: Mon May  1 12:08:04 on ttys000
ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
```



This is the same as double clicking on a folder

Moving to a different directory



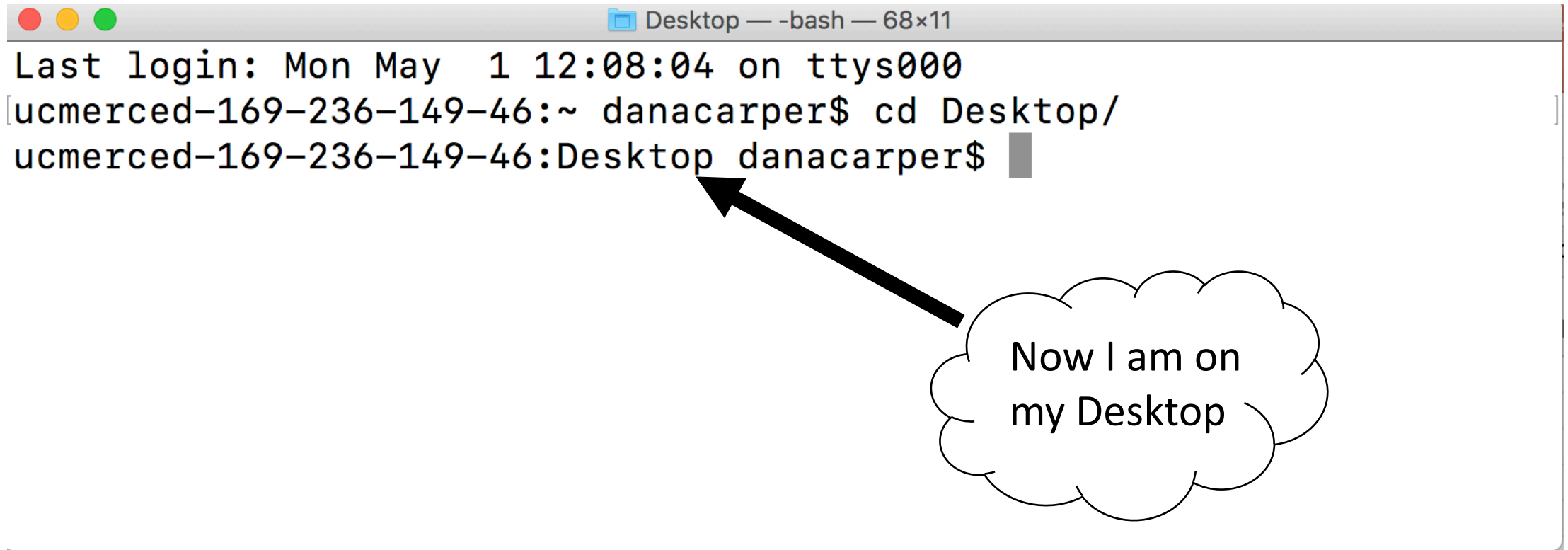
A terminal window with a title bar showing 'danacarper — -bash — 68x11'. The terminal text includes a login message and a command to change directories. A cloud callout points to the slash in the command.

```
danacarper — -bash — 68x11
Last login: Mon May  1 12:08:04 on ttys000
ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
```

A slash
indicates it
is a folder

Which folder
I want to go
to

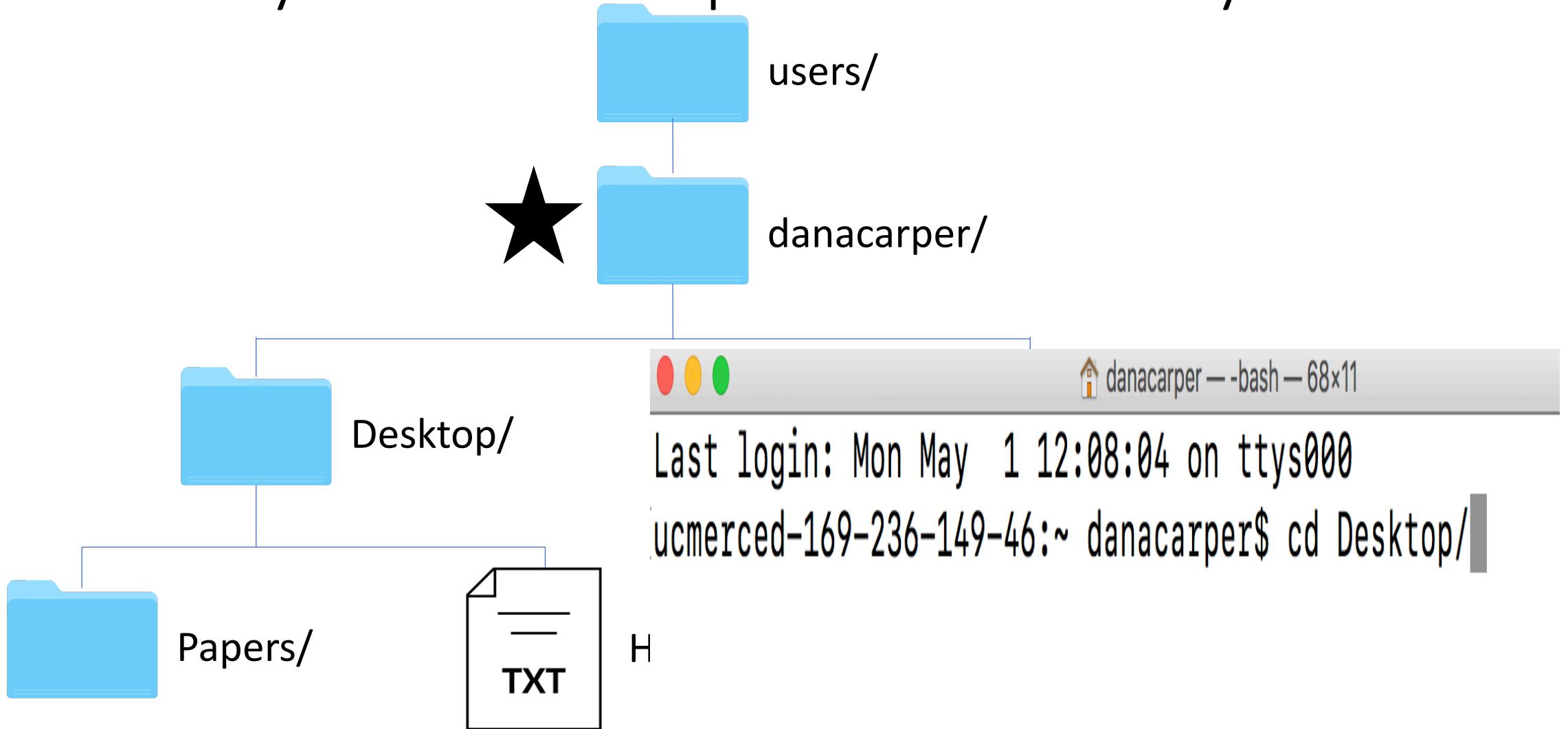
Moving to a different directory

A terminal window titled "Desktop — -bash — 68x11" with standard macOS window controls (red, yellow, green buttons). The terminal output shows a login message, a directory change command, and the resulting prompt. A speech bubble with an arrow points to the new prompt.

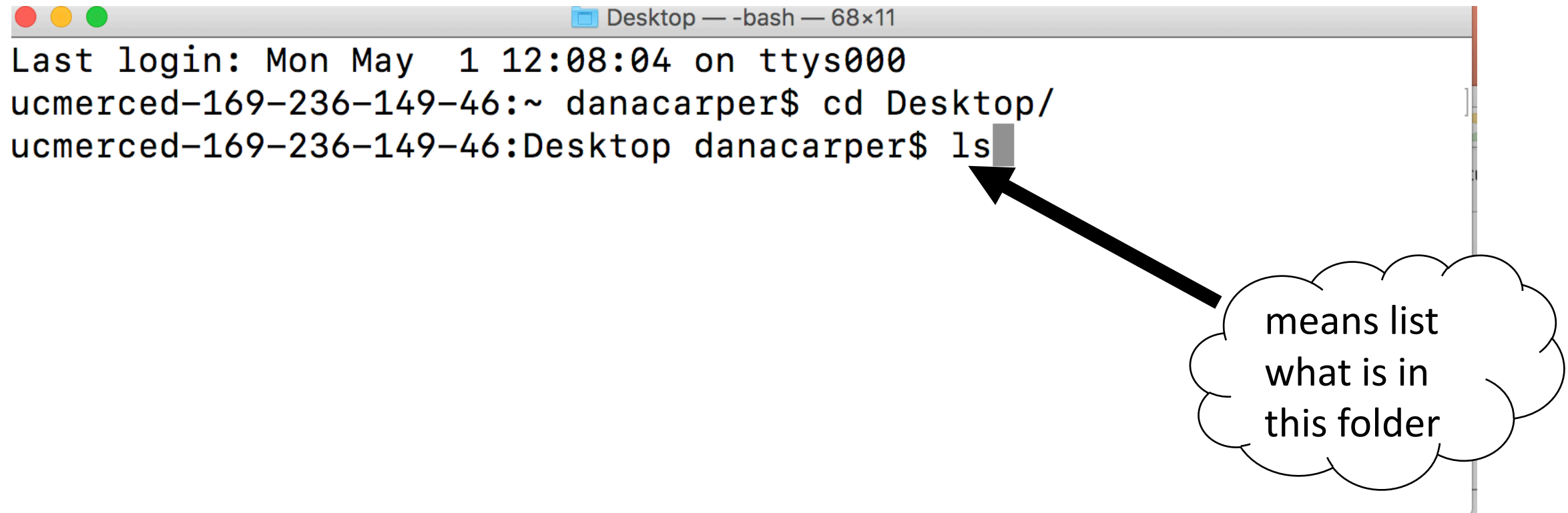
```
Last login: Mon May  1 12:08:04 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
ucmerced-169-236-149-46:Desktop danacarper$
```

Now I am on my Desktop

A file system is set up like a hierarchy



How do I know what is in a directory?



A terminal window titled "Desktop — -bash — 68x11" is shown. The window contains the following text:

```
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
```

An arrow points from a thought bubble to the `ls` command in the terminal.

means list
what is in
this folder

How do I know what is in a directory?

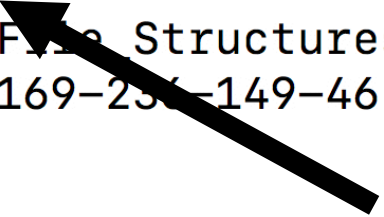
```
Desktop — -bash — 80x24
Last login: Mon May  1 12:22:30 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
[ucmerced-169-236-149-46:Desktop danacarper$ ls
Carper_manuscript_2017      Order_List.xlsx
Genetics_S17               Overall_Semester_Goals_S17.docx
Hello.txt                  Papers
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?

```
Desktop — -bash — 80x24
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_Fish_Structures.pptx  Seedling_adult
ucmerced-169-236-149-46:Desktop danacarper$
```



I want to
look at this
file

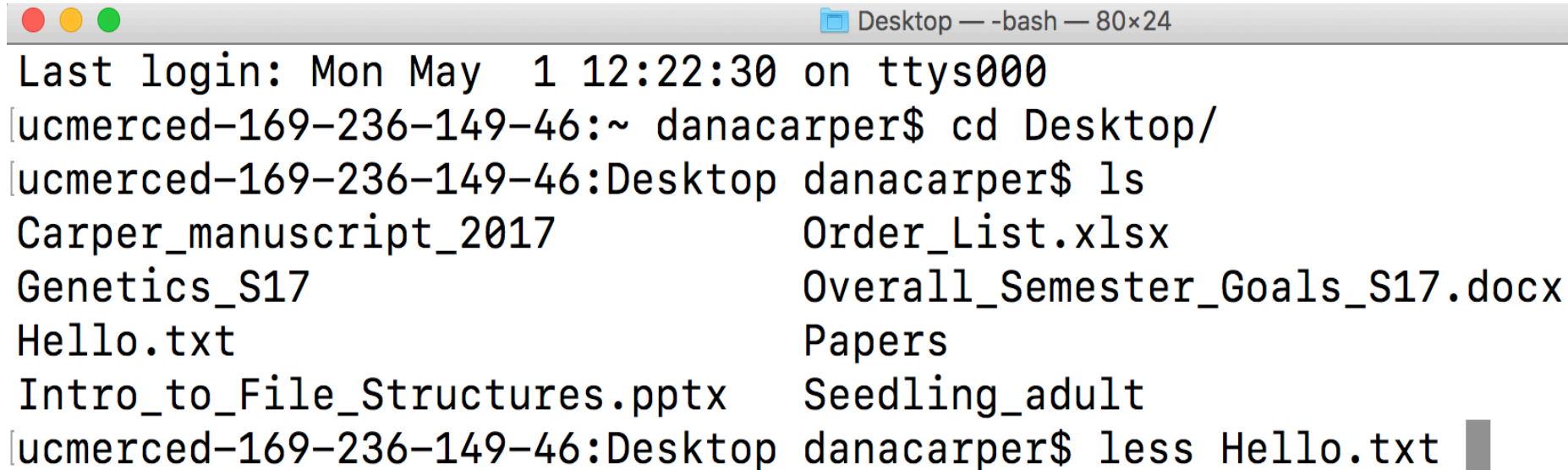
How do I look at a file?

```
Desktop — -bash — 80x24
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 █
```

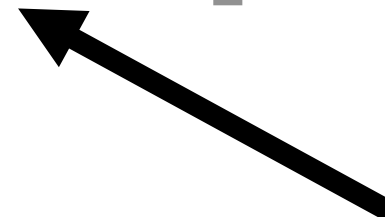


Means view

How do I look at a file?

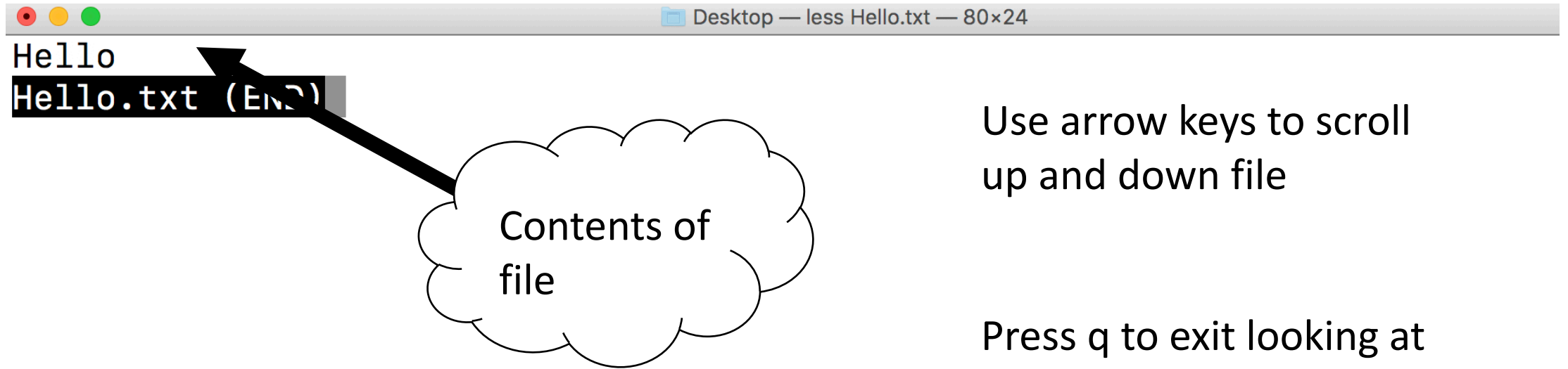


```
Desktop — -bash — 80x24
Last login: Mon May  1 12:22:30 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
[ucmerced-169-236-149-46:Desktop danacarper$ ls
Carper_manuscript_2017      Order_List.xlsx
Genetics_S17               Overall_Semester_Goals_S17.docx
Hello.txt                  Papers
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?



Use arrow keys to scroll
up and down file

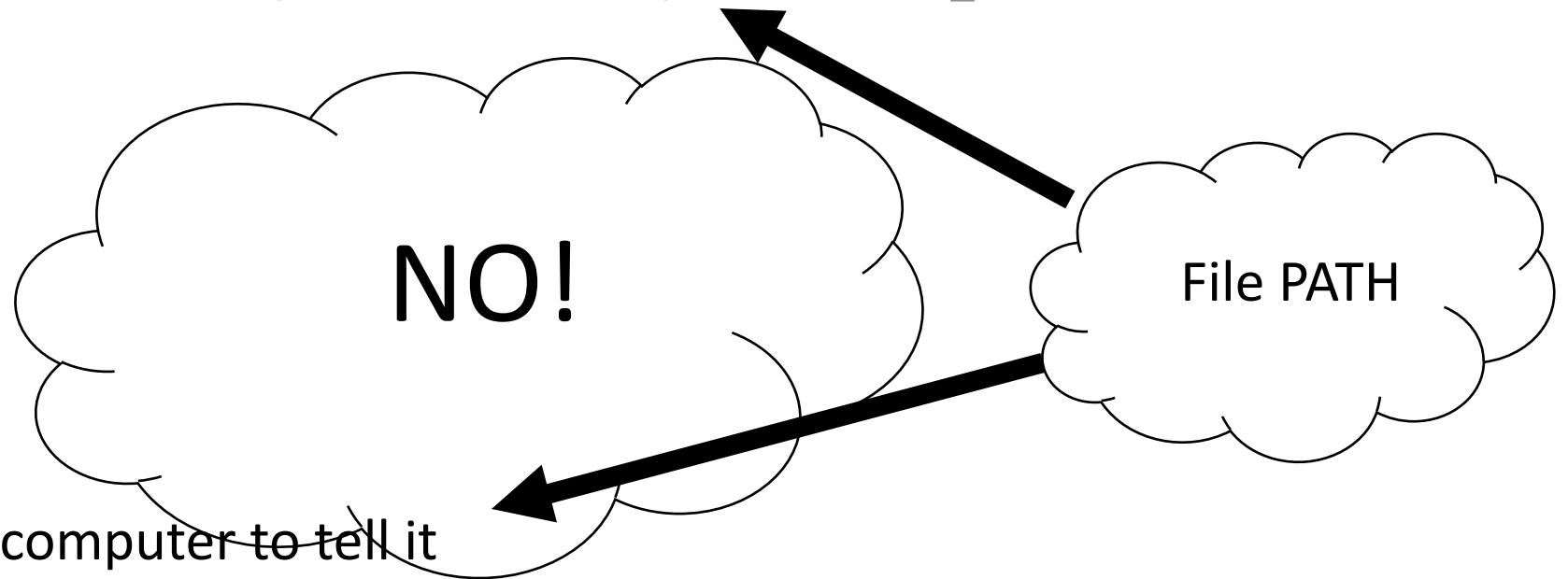
Press q to exit looking at
the file (q =quit)

Do I have to be in the same folder as the file to look at it?

danacarper — -bash — 93x23

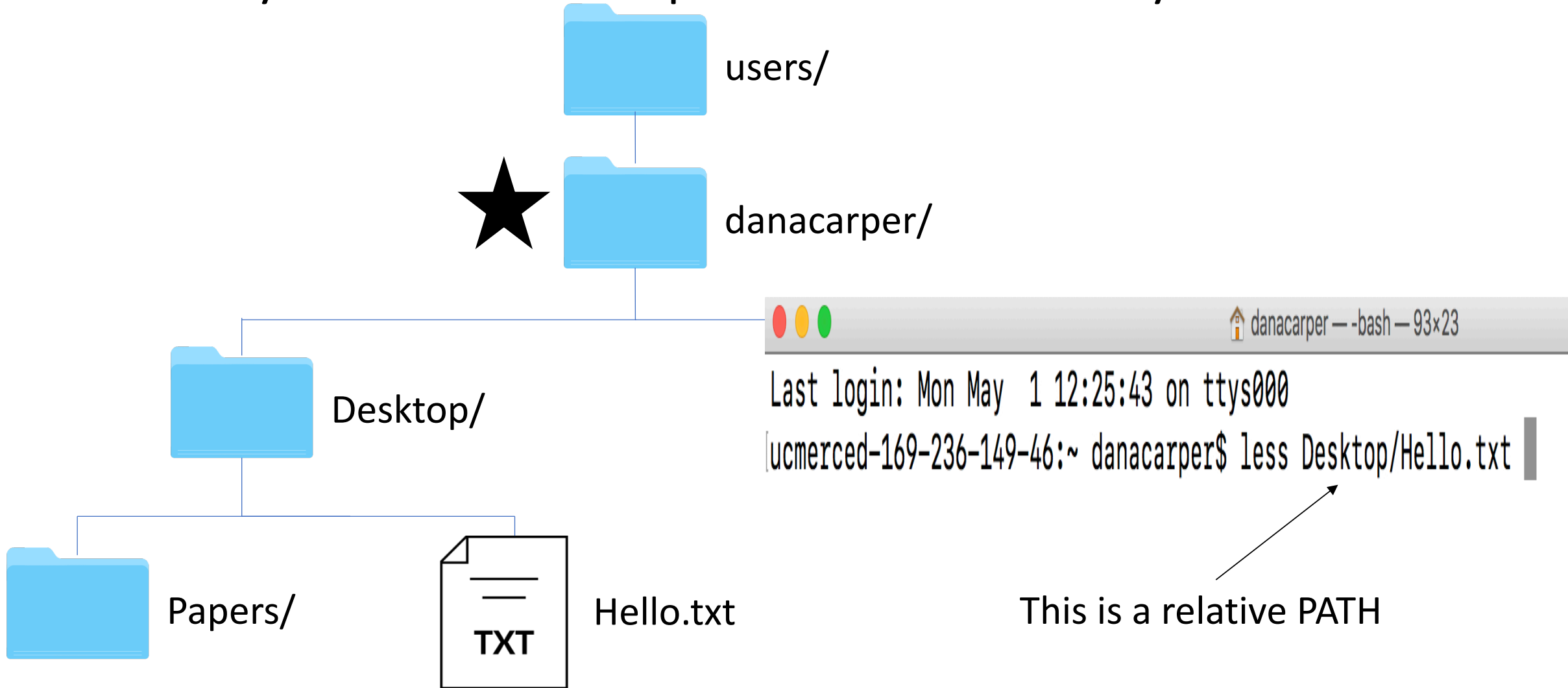
Last login: Mon May 1 12:25:43 on ttys000

ucmerced-169-236-149-46:~ danacarper\$ less Desktop/Hello.txt

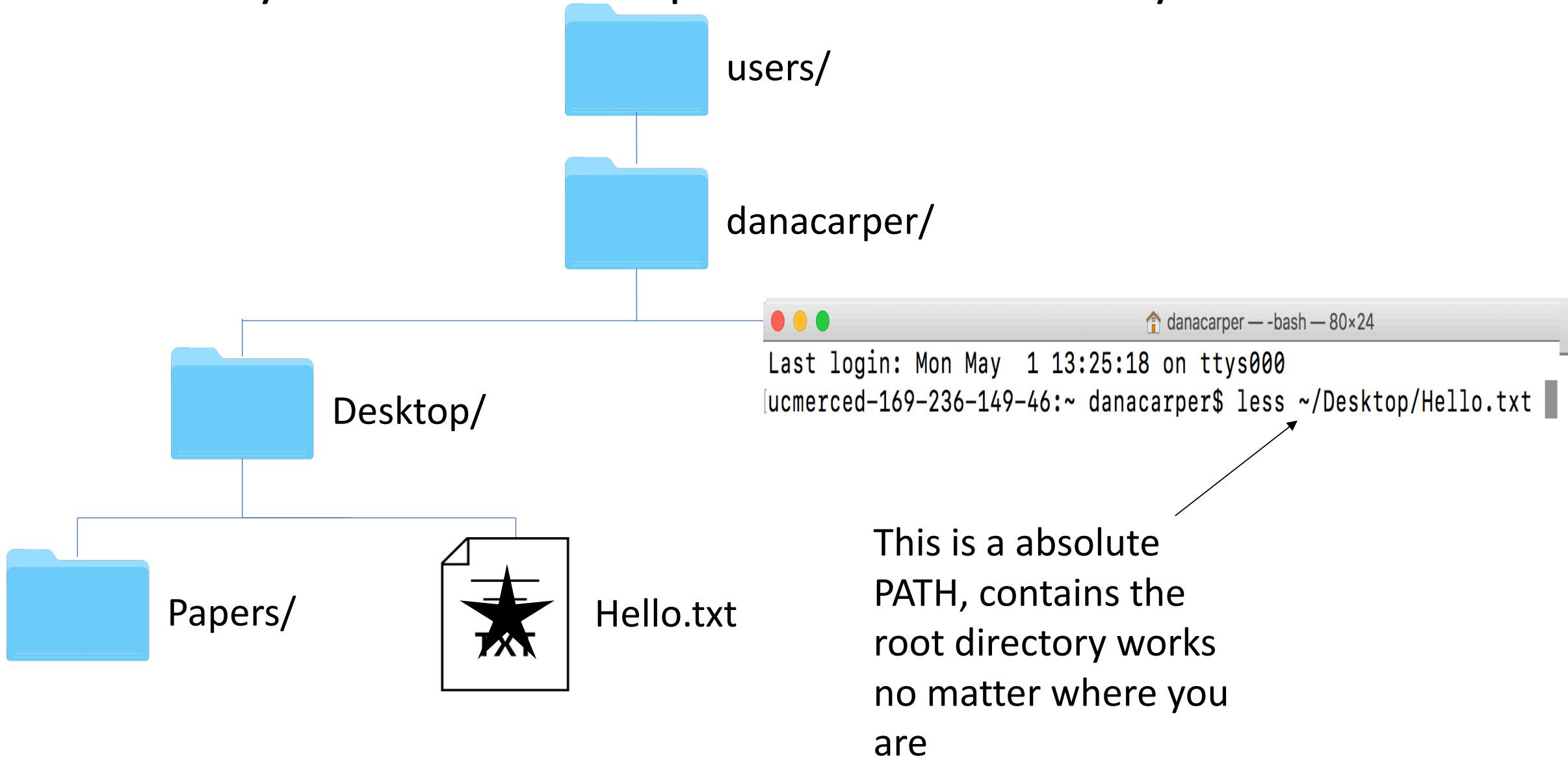


Directions for the computer to tell it
where the file is

A file system is set up like a hierarchy



A file system is set up like a hierarchy

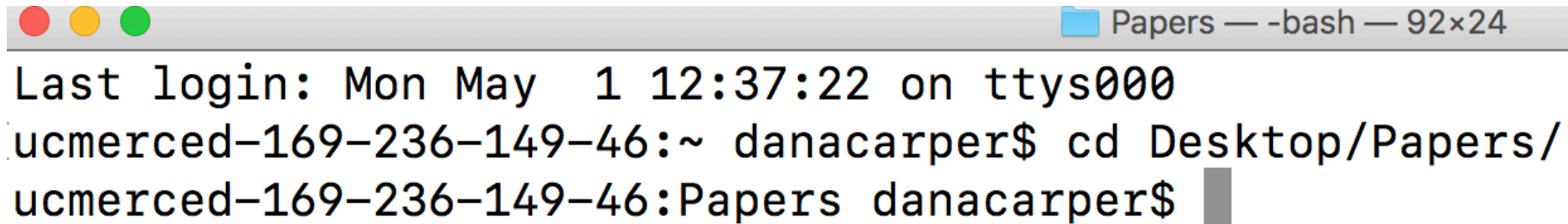


Absolute PATH

```
danacarper — -bash — 80x24
Last login: Mon May  1 13:25:18 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ less ~/Desktop/Hello.txt
```

~ = HOME
(/users/danacarper/)

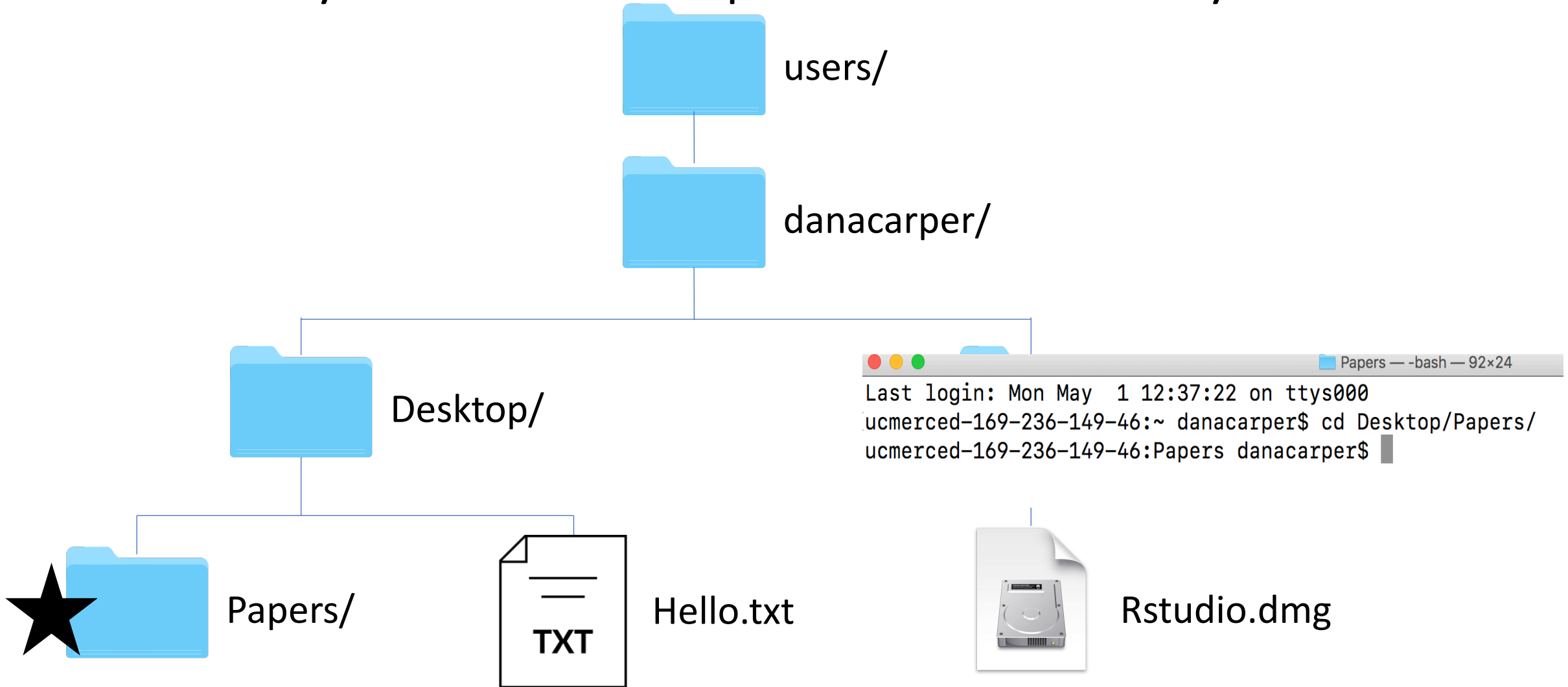
Giving the PATH works for other commands too!



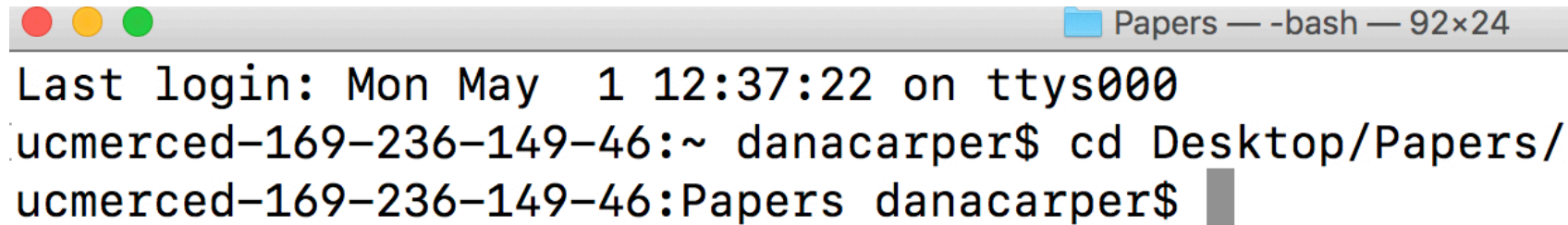
A terminal window titled "Papers — -bash — 92x24" with standard macOS window controls (red, yellow, green buttons). The terminal output shows a login message and a directory change command. A black arrow points to the word "Papers" in the second line of the terminal output.

```
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$
```


A file system is set up like a hierarchy



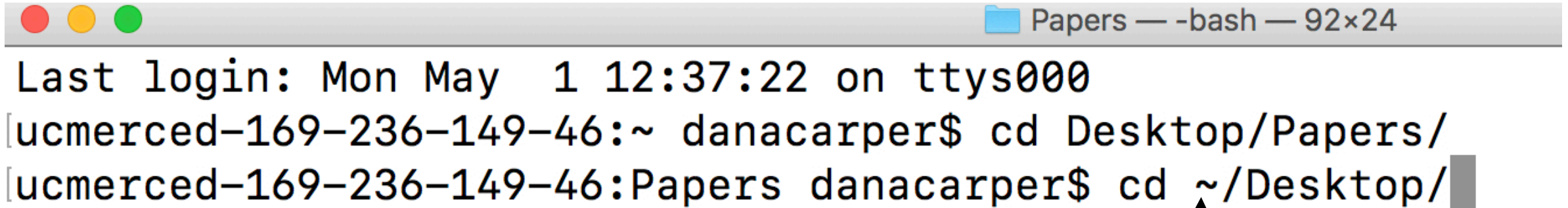
Oops I went too far I meant to be on the desktop, How do I go back?



A terminal window with a title bar containing three colored circles (red, yellow, green) on the left and the text 'Papers — -bash — 92x24' on the right. The terminal content shows a login message and a directory change command.

```
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

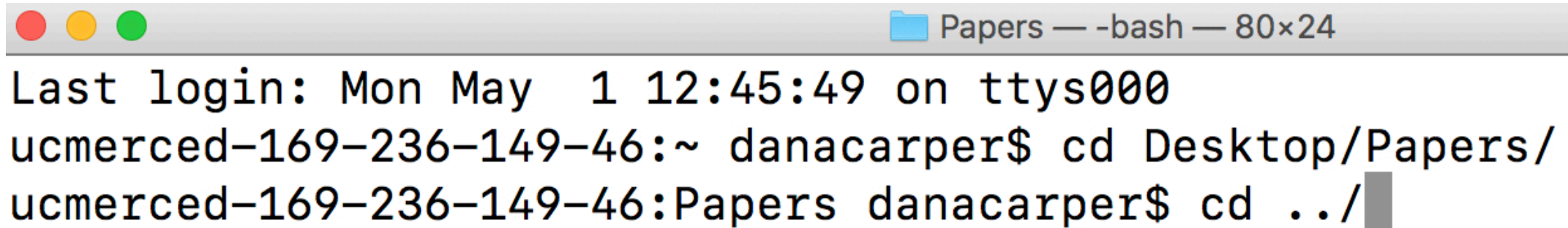
A screenshot of a macOS terminal window. The title bar at the top shows three colored window control buttons (red, yellow, green) on the left and a folder icon followed by the text 'Papers — -bash — 92x24' on the right. The terminal content shows a login message and two command-line prompts. The first prompt is '[ucmerced-169-236-149-46:~ danacarper\$ cd Desktop/Papers/' and the second is '[ucmerced-169-236-149-46:Papers danacarper\$ cd ~/Desktop/'. A thick black arrow points from the text 'Means Home (/users/danacarper/)' below to the tilde symbol (~) in the second command line.

```

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/
```

Means Home
(/users/danacarper/)

Multiple ways to go back



A terminal window titled "Papers — -bash — 80x24" with three colored window control buttons (red, yellow, green) on the left. The terminal text shows a login message, a directory change to Desktop/Papers/, and another change to the parent directory using the relative path ...

```
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 ../
```



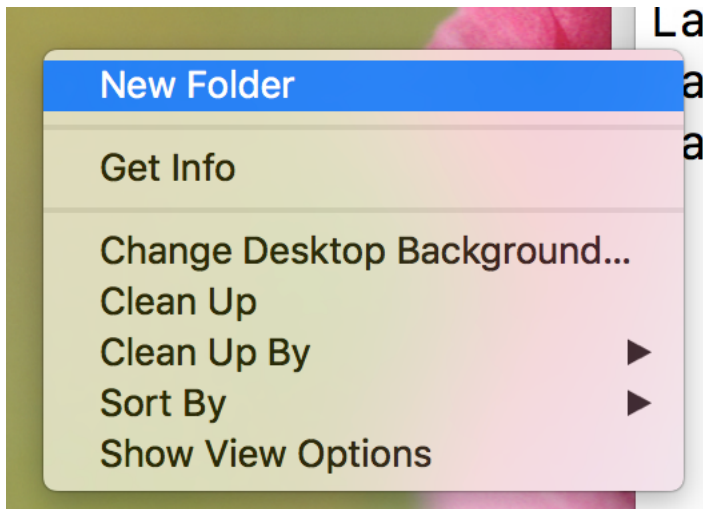
Means go back
one folder

Now that we have navigated
directories

How do we create a new directory?

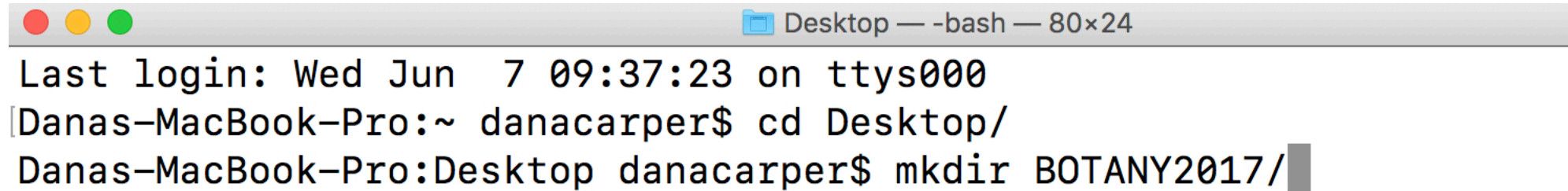
```
Desktop — -bash — 80x24
Last login: Wed Jun  7 09:37:23 on ttys000
Danas-MacBook-Pro:~ danacarper$ cd Desktop/
Danas-MacBook-Pro:Desktop danacarper$ mkdir BOTANY2017/
```

The same a
right clicking
to make a
new folder

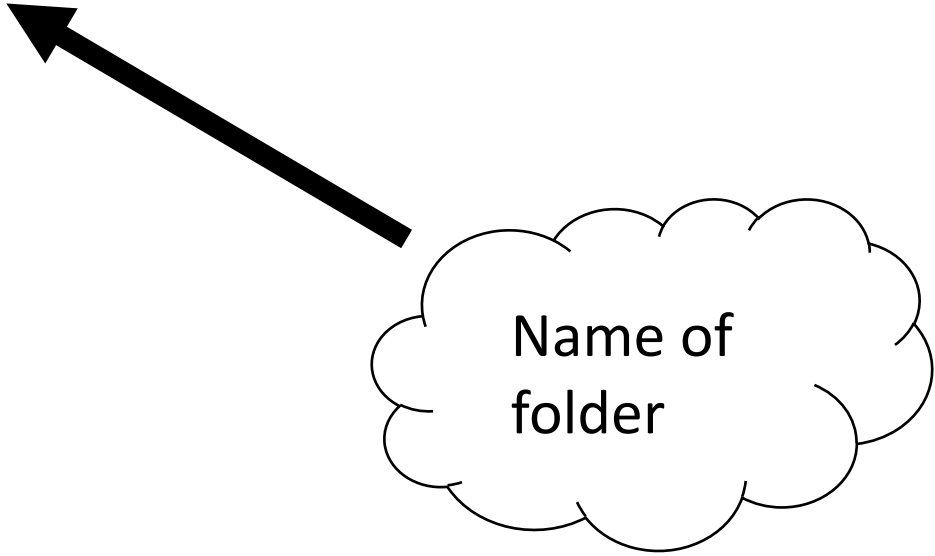


Make new
folder

How do we create a new directory?

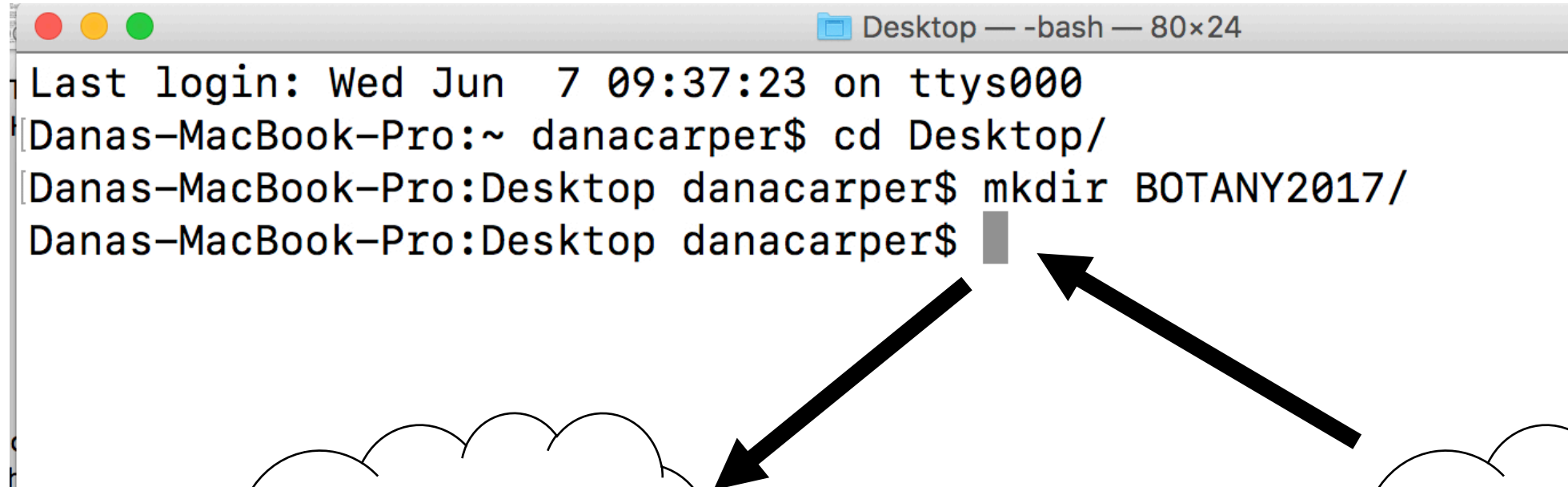
A screenshot of a macOS terminal window. The title bar shows three colored window control buttons (red, yellow, green) on the left and a folder icon followed by the text 'Desktop — -bash — 80x24' on the right. The terminal content shows a login message, a directory change command, and a directory creation command.

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

A diagram consisting of a cloud-like shape with a black arrow pointing from it to the text 'BOTANY2017/' in the terminal window above.

Name of
folder

How do we create a new directory?

A terminal window titled "Desktop — -bash — 80x24" with three colored window control buttons (red, yellow, green) in the top-left corner. The terminal text shows a user logging in, changing to the Desktop directory, and running the 'mkdir' command to create a directory named 'BOTANY2017'. The prompt returns after the command is executed.

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

How do we
know it
worked?

After we run a
command we
just get the
prompt back

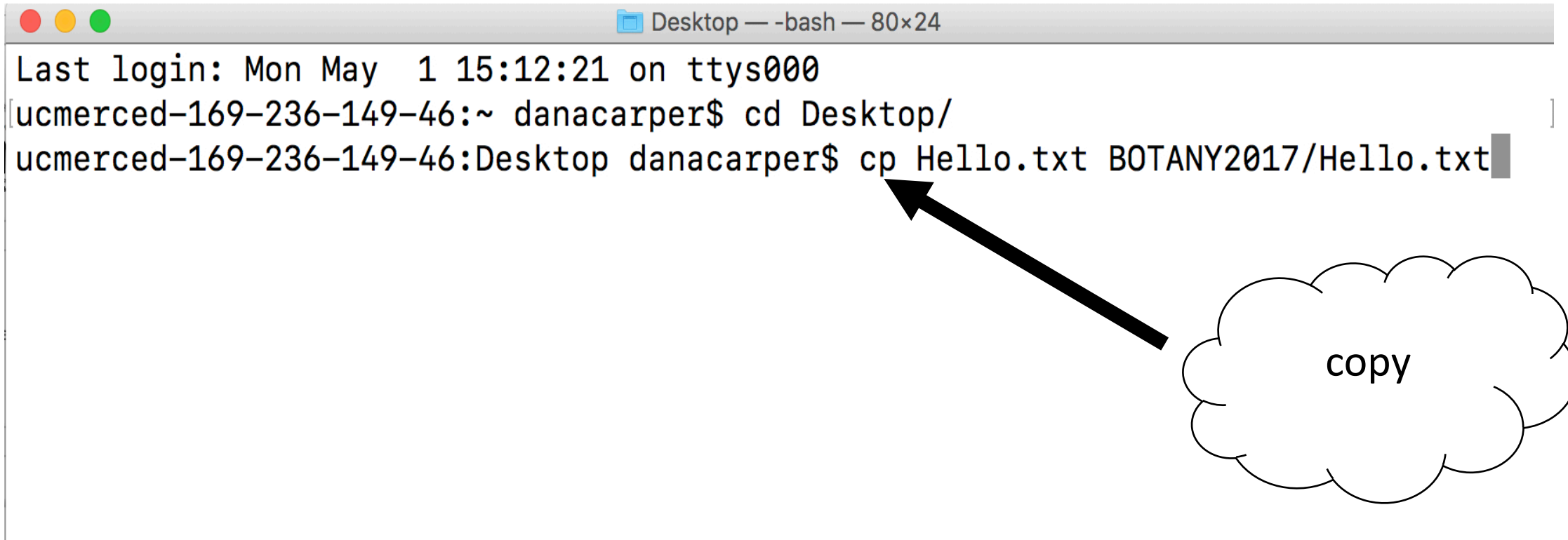
How do we create a new directory?

```
Desktop — -bash — 80x24
Last login: Wed Jun  7 09:37:23 on ttys000
Danas-MacBook-Pro:~ danacarper$ cd Desktop/
Danas-MacBook-Pro:Desktop danacarper$ mkdir BOTANY2017/
Danas-MacBook-Pro:Desktop danacarper$ ls
Arabidopsis_thaliana.TAIR10.35.gff3
BOTANY2017
BOTANY_2017_carper.pptx
Carper_manuscript_2017
Hello.txt
Order_List.xlsx
Overall_Semester_Goals_S17.doc
Papers
Plantae.csv
Screen Shot 2017-06-07 at 9
Screen Shot 2017-06-07 at 9
Screen Shot 2017-06-07 at 9
Seedling_adult
hisat2
Danas-MacBook-Pro:Desktop danacarper$
```

There is our
new folder

Check using ls
command

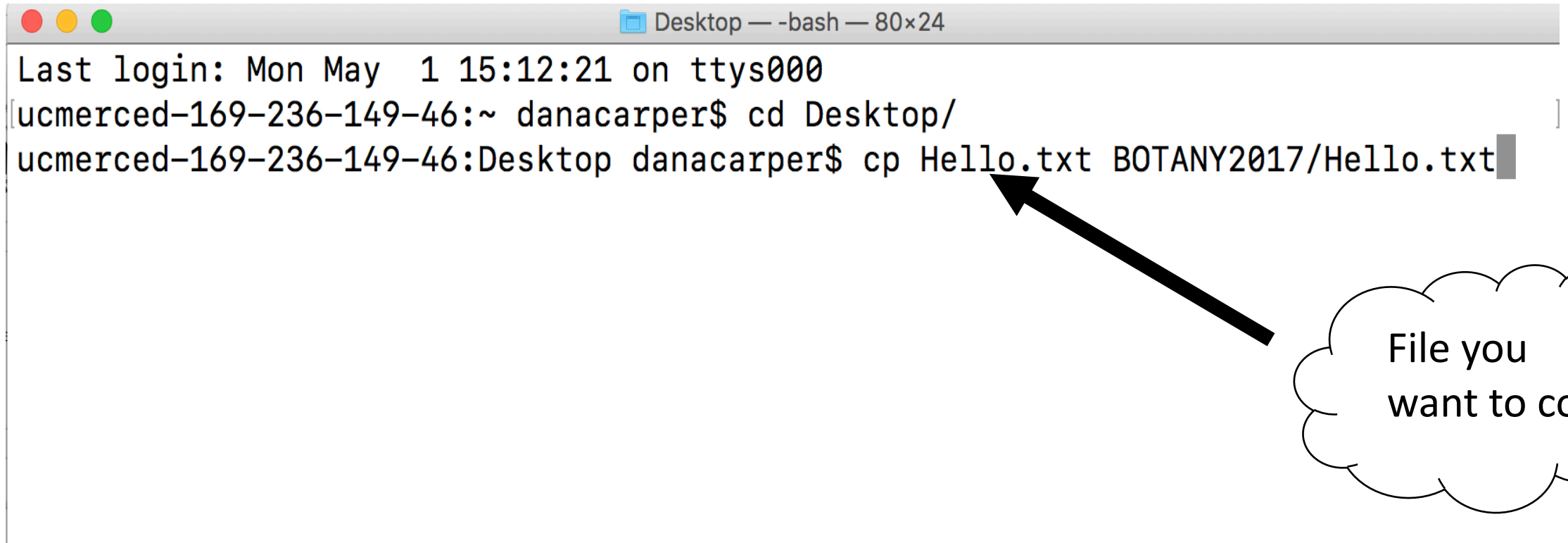
How do we copy a file to that new folder?



```
Desktop — -bash — 80x24
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
```

A diagram illustrating the copy action. A cloud shape contains the word "copy". A thick black arrow points from the cloud to the command `cp Hello.txt BOTANY2017/Hello.txt` in the terminal window.

How do we copy a file to that new folder?

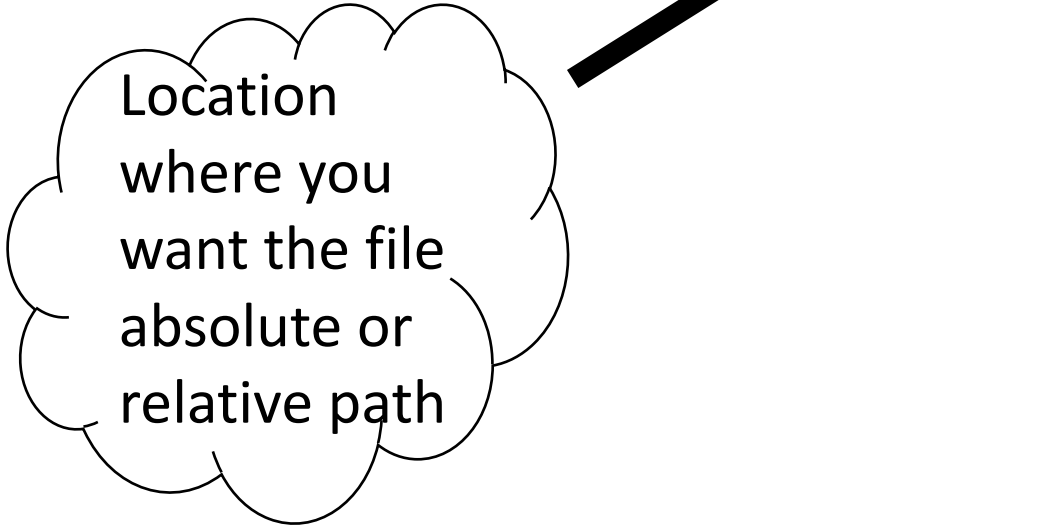


```
Desktop — -bash — 80x24
Last login: Mon May  1 15:12:21 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
ucmerced-169-236-149-46:Desktop danacarper$ cp Hello.txt BOTANY2017/Hello.txt
```

A diagram consisting of a black arrow pointing from a cloud-shaped callout to the text 'Hello.txt' in the terminal command. The callout cloud contains the text 'File you want to copy'.

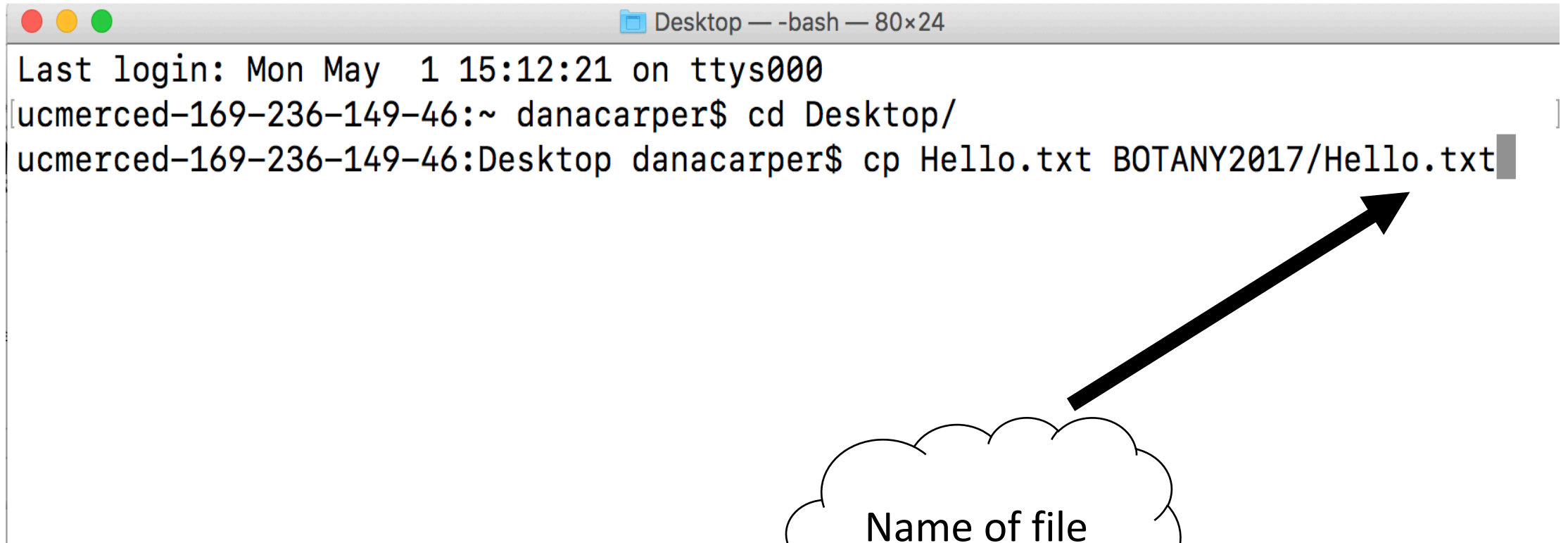
How do we copy a file to that new folder?

```
Desktop — -bash — 80x24
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 — 80x24
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
```

The diagram shows a cloud containing the text "Name of file". A thick black arrow points from this cloud to the file name "Hello.txt" in the terminal command above.

What if we want to delete a file?

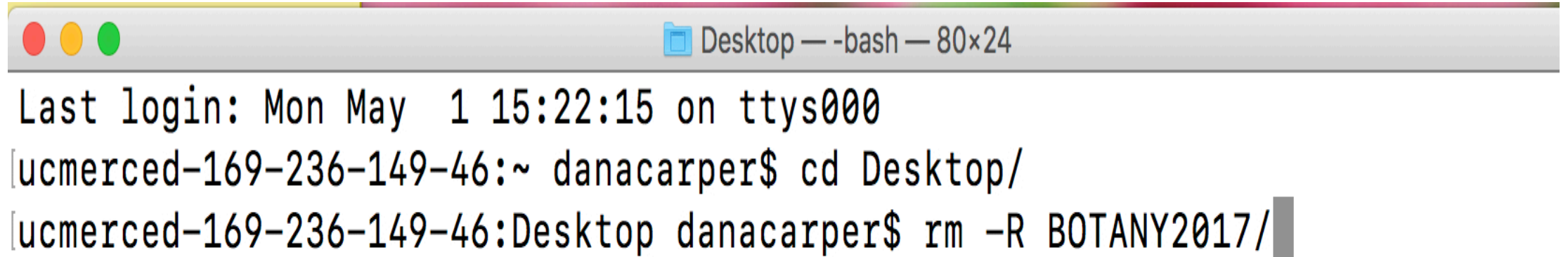
```
Desktop — -bash — 80x24
Last login: Mon May  1 15:13:12 on ttys000
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/
[ucmerced-169-236-149-46:Desktop danacarper$ rm BOTANY2017/Hello.txt
```

THIS CAN NOT BE UNDONE!!!!



Remove or
delete

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



```
Desktop — -bash — 80x24  
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/
```

This is an option for a command



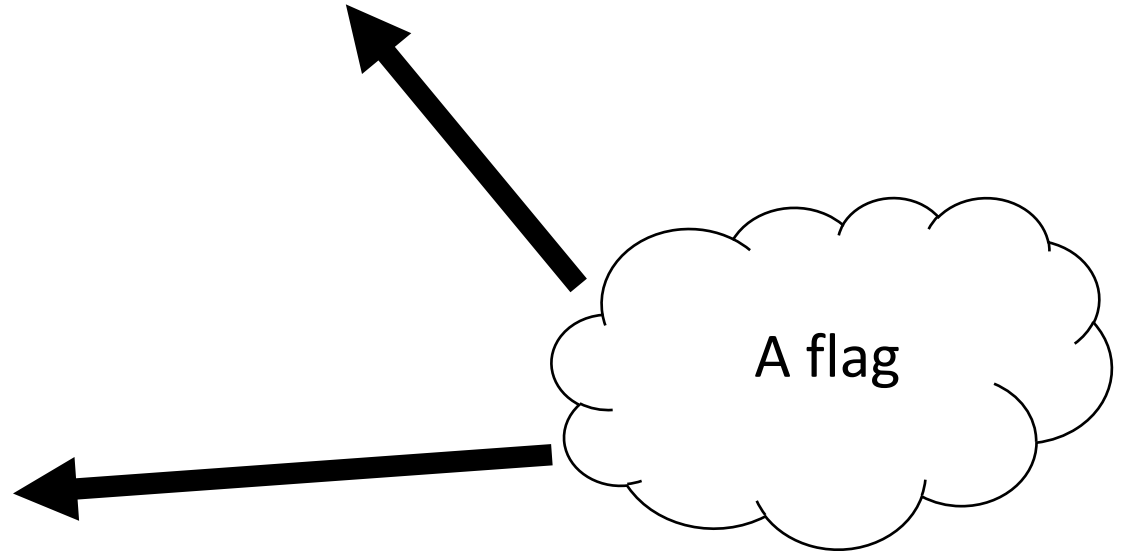
A flag

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

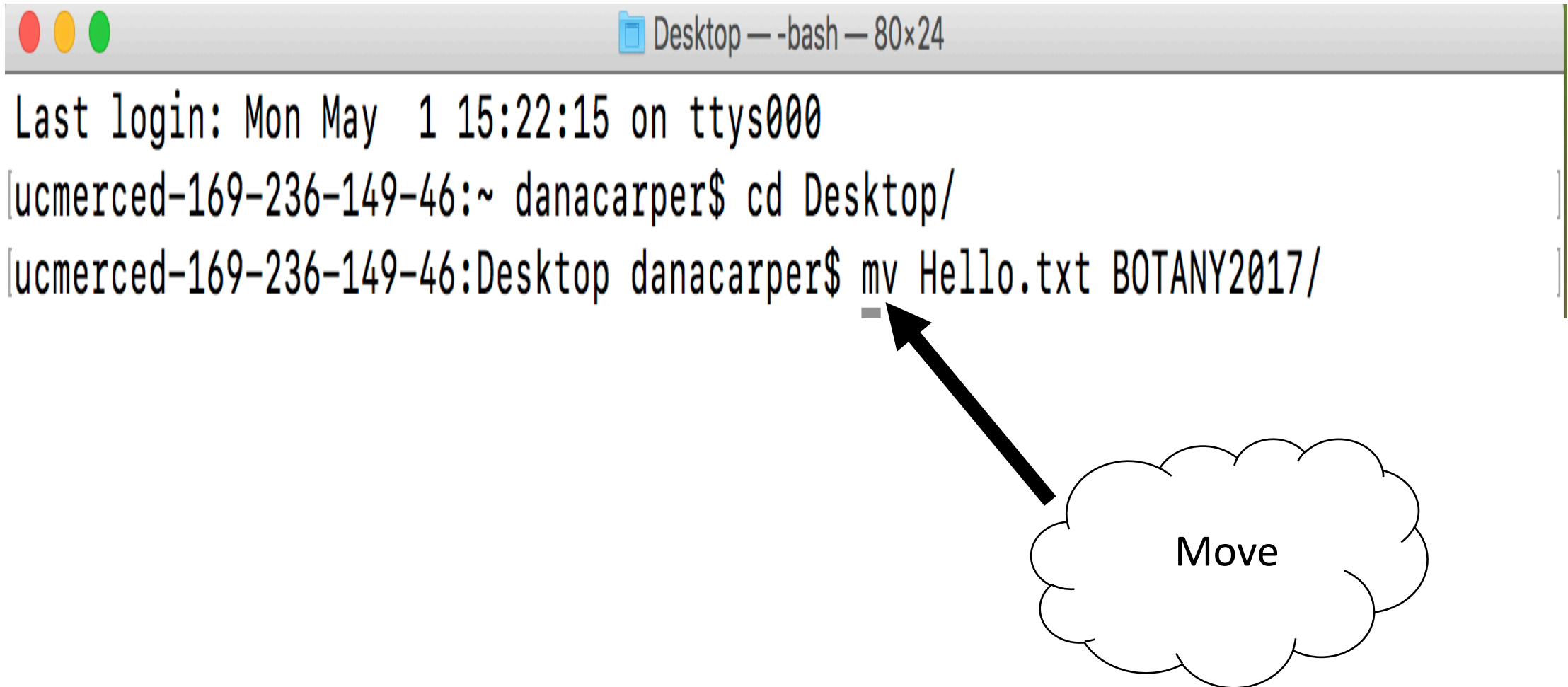
```
Desktop — -bash — 80x24  
Last login: Mon May  1 15:22:15 on ttys000  
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/  
[ucmerced-169-236-149-46:Desktop danacarper$ rm -R BOTANY2017/
```

means remove all files and folder

A flag



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



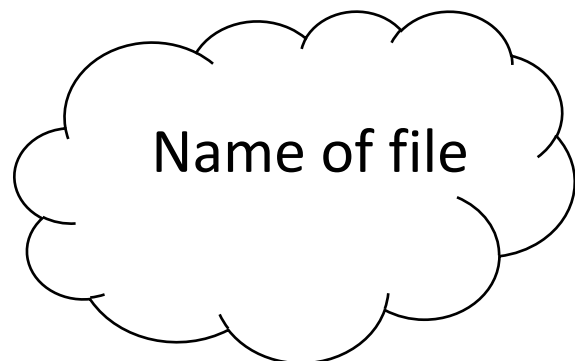
A terminal window with a title bar that reads "Desktop — -bash — 80x24". The window contains the following text:

```
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/
```

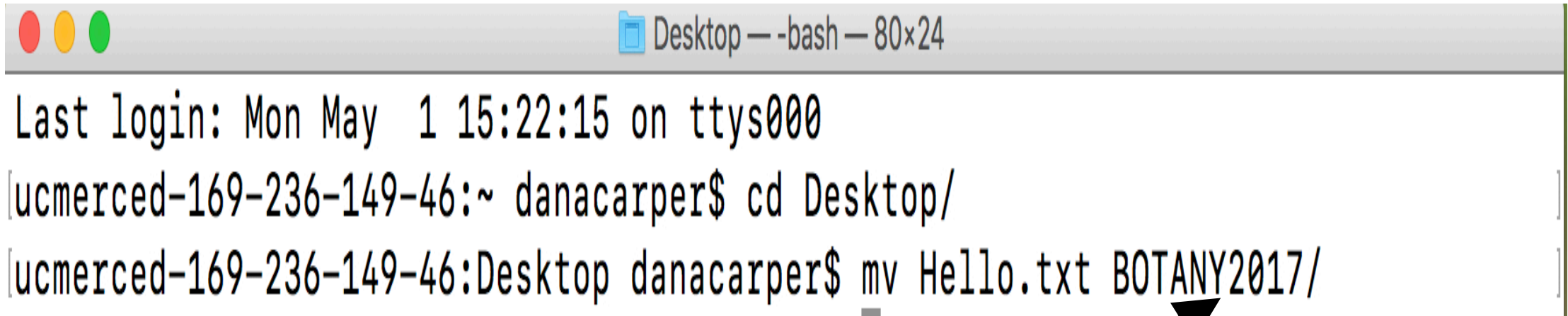
An arrow points from a cloud labeled "Move" to the `mv` command in the terminal.

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

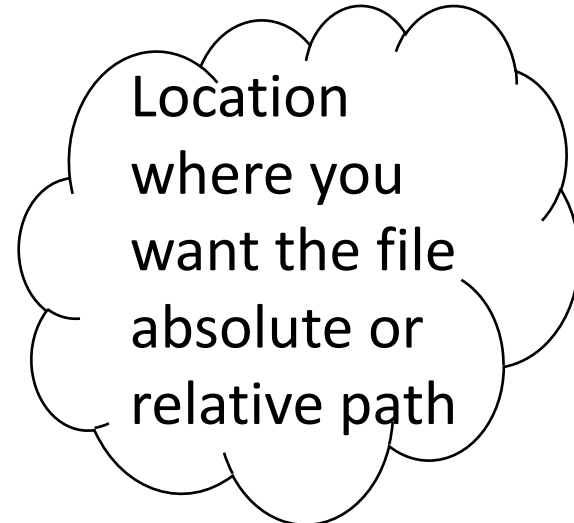
```
Desktop — -bash — 80x24  
Last login: Mon May  1 15:22:15 on ttys000  
[ucmerced-169-236-149-46:~ danacarper$ cd Desktop/  
[ucmerced-169-236-149-46:Desktop danacarper$ mv Hello.txt BOTANY2017/
```



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

A terminal window with a title bar that says "Desktop — -bash — 80x24". The window contains three lines of text: "Last login: Mon May 1 15:22:15 on ttys000", "[ucmerced-169-236-149-46:~ danacarper\$ cd Desktop/", and "[ucmerced-169-236-149-46:Desktop danacarper\$ mv Hello.txt BOTANY2017/". The cursor is at the end of the third line.

```
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/
```



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

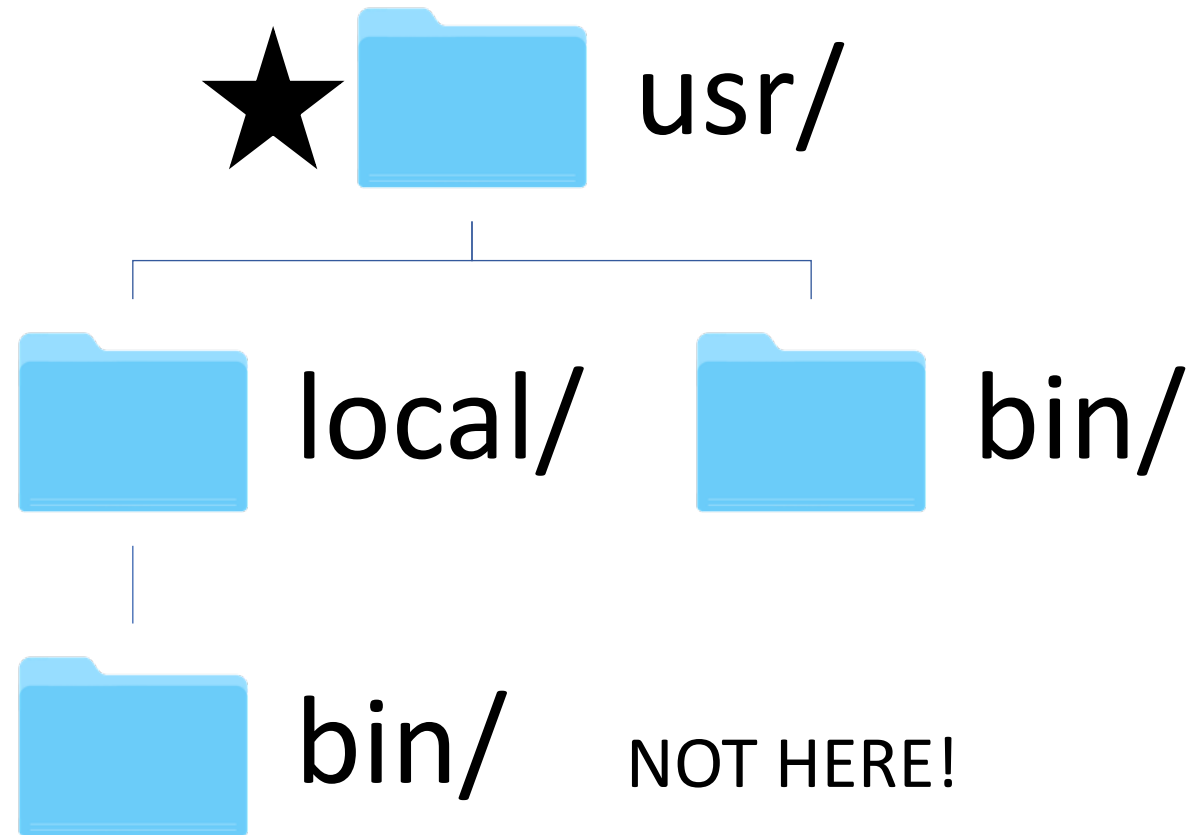
UNIX Ideas: PATH

How does the computer know commands?

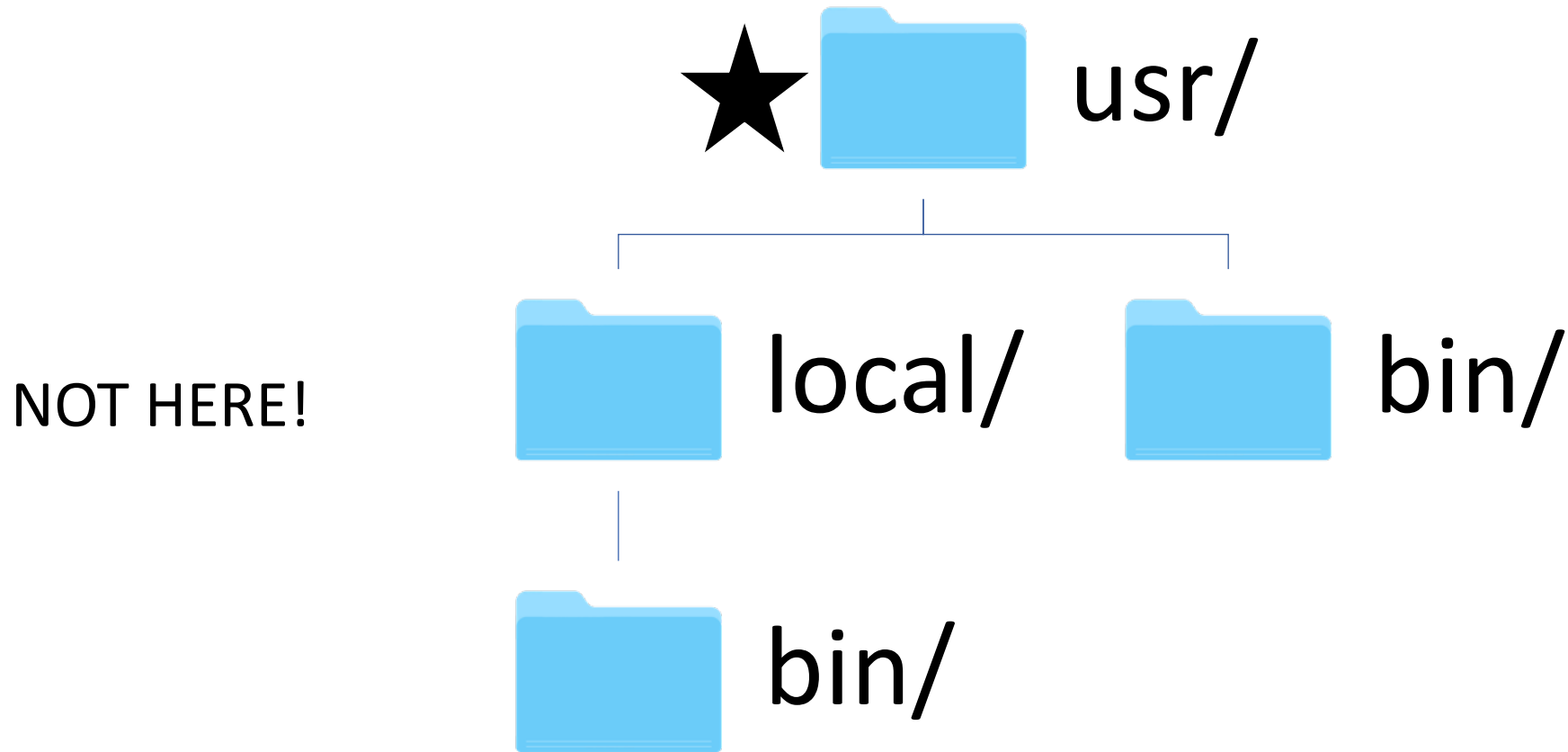
- Computers need to know where to look for commands or new functions
- If you add a new function or command:
 - To be able to use it no matter what folder you are in it has to be in your \$PATH
 - A \$PATH is a list of folders the computer checks for a command or function
- Example \$PATH:
 - /usr/local/bin:/usr/local:/usr/bin
 - What does this mean?

Example \$PATH:

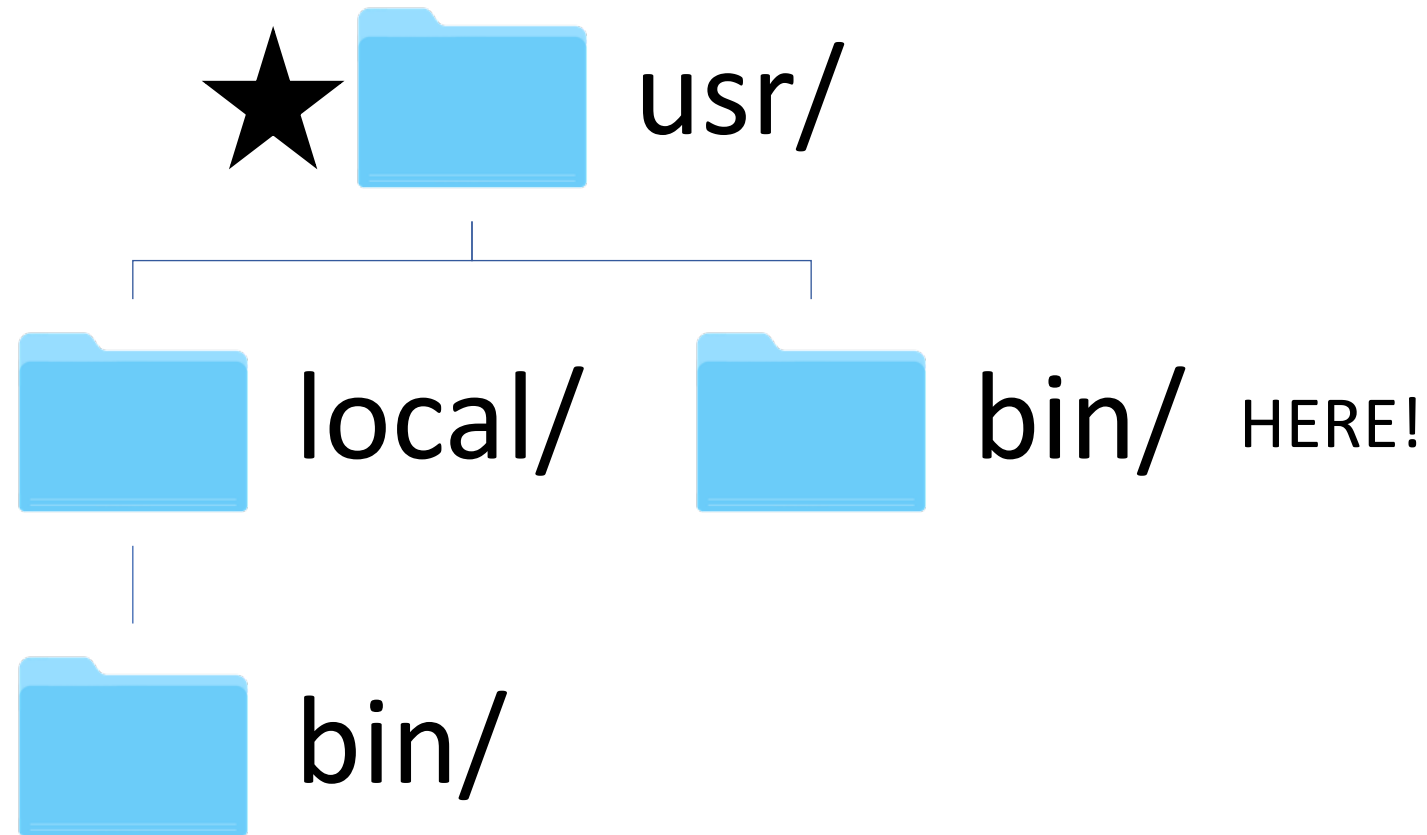
/usr/local/bin:/usr/local:/usr/bin



Example \$PATH:
/usr/local/bin:/usr/local:/usr/bin



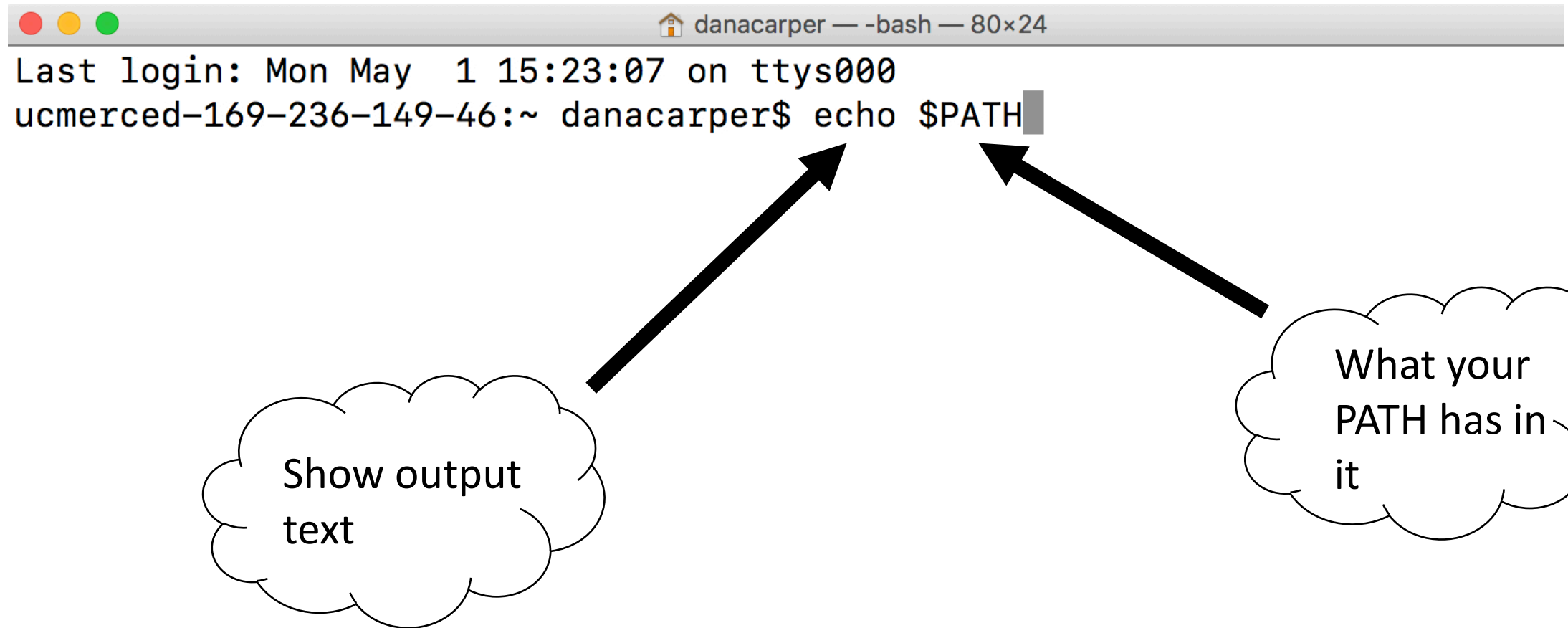
Example \$PATH:
/usr/local/bin:/usr/local:/usr/bin



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



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 :

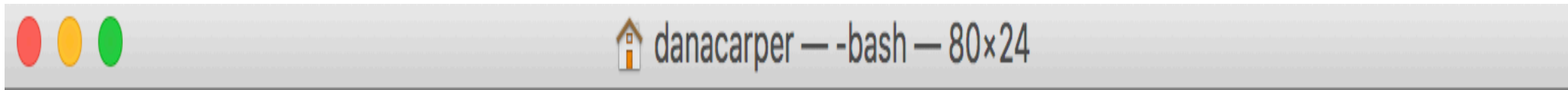
Displaying your PATH

```
danacarper — -bash — 80x24
Last login: Mon May  1 15:23:07 on ttys000
ucmerced-169-236-149-46:~ danacarper$ echo $PATH
/Users/danacarper/perl5/perlbrew/bin:/Users/danacarper/perl5/perlbrew/perls/perl
-5.22.0/bin:/usr/local/bin:/usr/bin:/bin:/usr/sbin:/sbin:/opt/X11/bin:/Users/dan
acarper/Bin
ucmerced-169-236-149-46:~ danacarper$
```



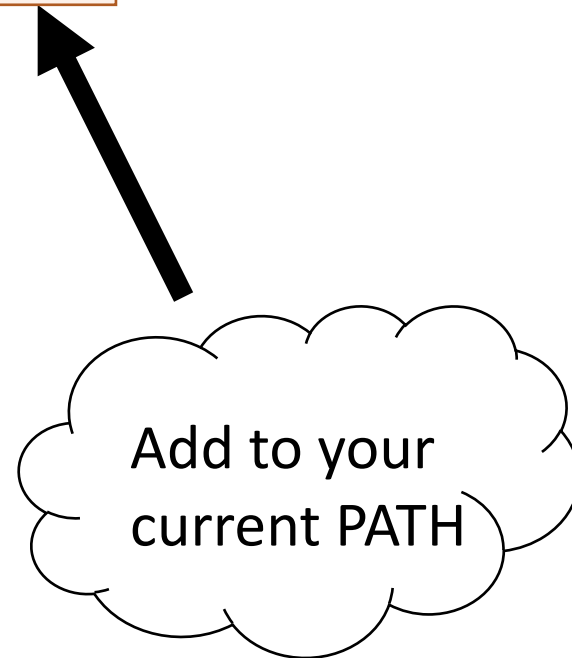
A folder it is
searching

I have a new folder I want in my path

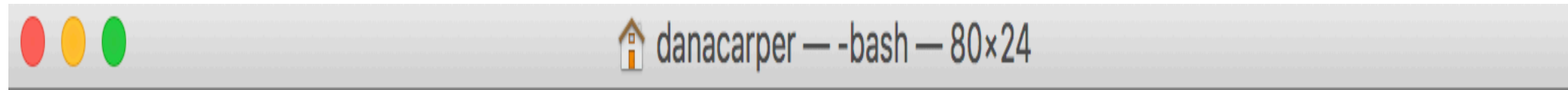


Last login: Mon May 1 16:19:52 on ttys001

ucmerced-169-236-149-46:~ danacarper\$ `export PATH=$PATH:/new/folder`

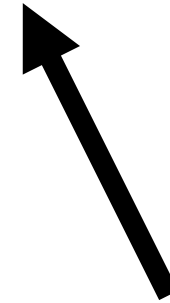


I have a new folder I want in my path

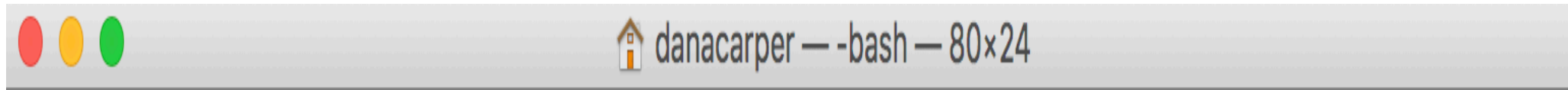


Last login: Mon May 1 16:19:52 on ttys001

ucmerced-169-236-149-46:~ danacarper\$ export PATH=\$PATH:/new/folder

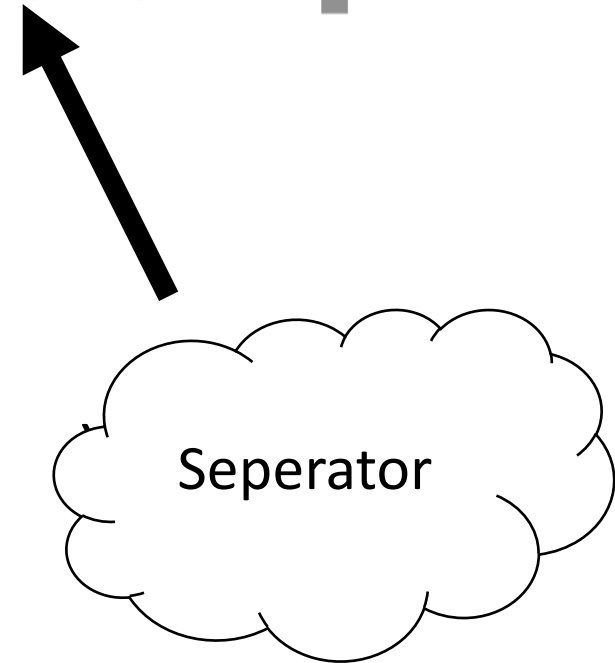


I have a new folder I want in my path

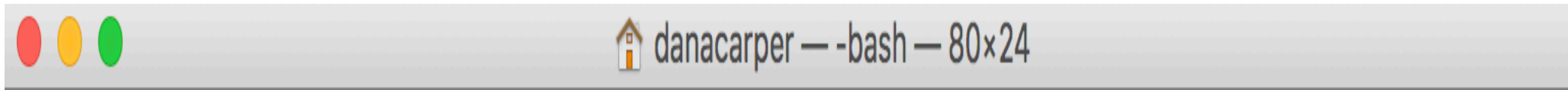


Last login: Mon May 1 16:19:52 on ttys001

ucmerced-169-236-149-46:~ danacarper\$ export PATH=\$PATH:/new/folder

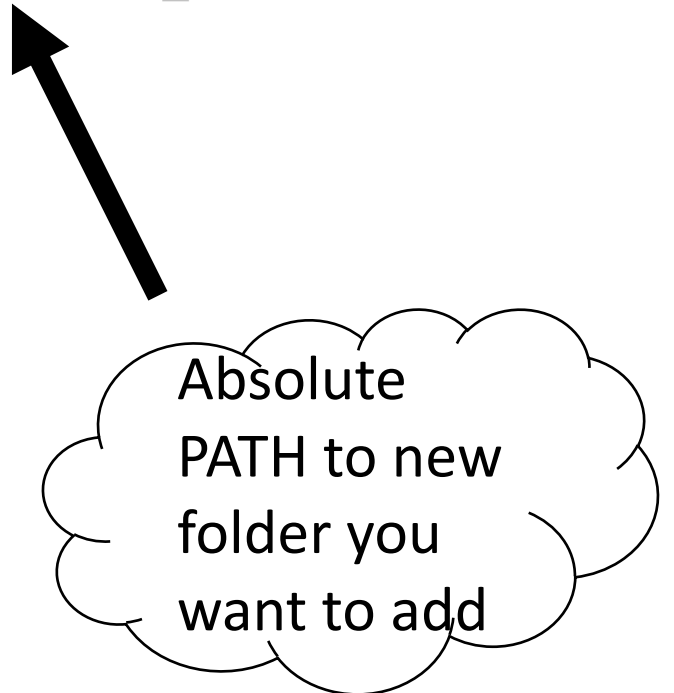


I have a new folder I want in my path

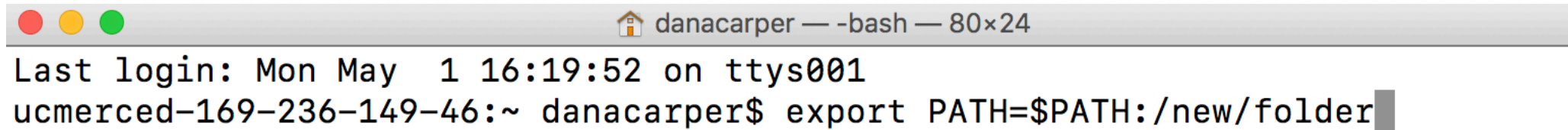


Last login: Mon May 1 16:19:52 on ttys001

```
ucmerced-169-236-149-46:~ danacarper$ export PATH=$PATH:/new/folder
```



Export \$PATH is not permanent

A screenshot of a macOS terminal window. The title bar at the top shows three colored window control buttons (red, yellow, green) on the left, and a home icon followed by the text 'danacarper — -bash — 80x24' on the right. The terminal content shows the last login message: 'Last login: Mon May 1 16:19:52 on ttys001'. Below that, the prompt 'ucmerced-169-236-149-46:~ danacarper\$' is followed by the command 'export PATH=\$PATH:/new/folder' which has been entered and is followed by a black cursor block.

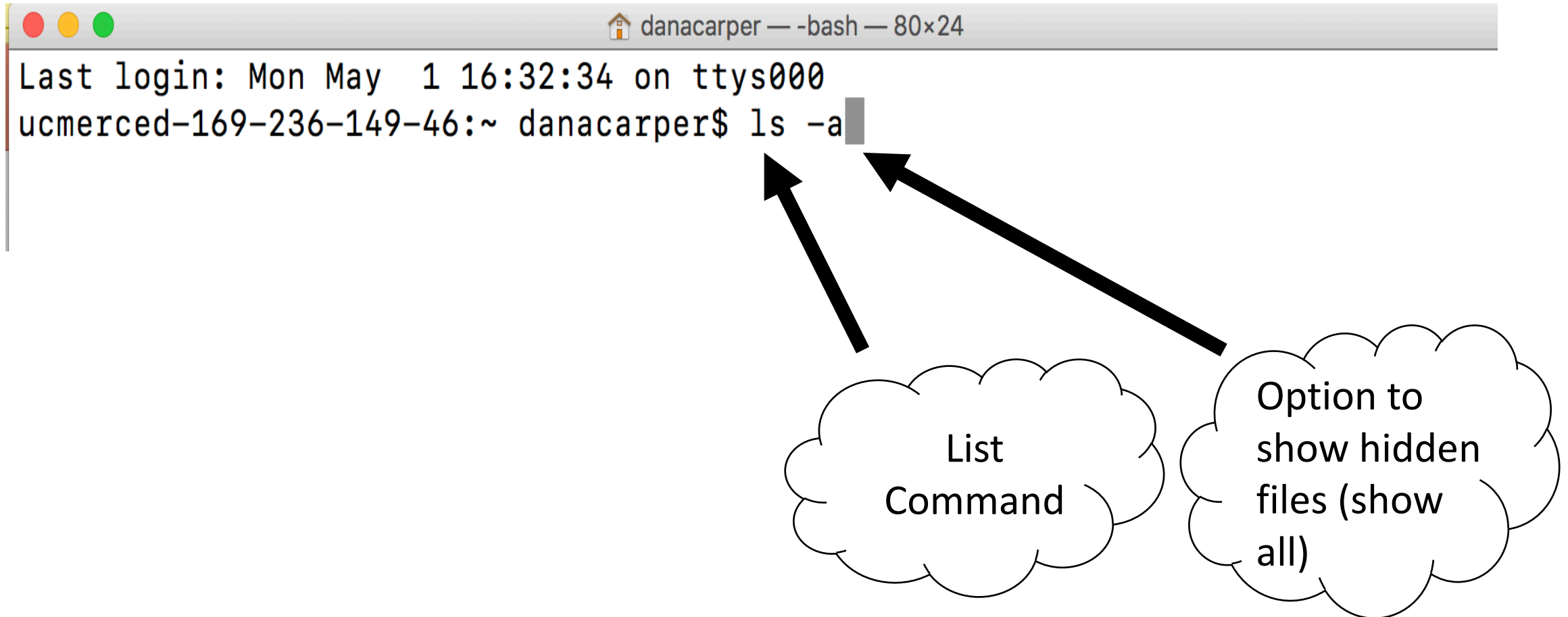
```
Last login: Mon May 1 16:19:52 on ttys001
ucmerced-169-236-149-46:~ danacarper$ export PATH=$PATH:/new/folder
```

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

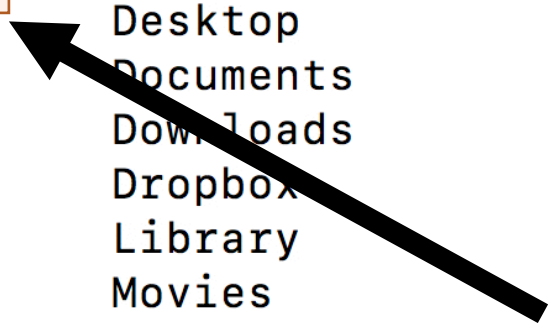
- Need to change `.bash_profile`
- A file containing your PATH
- Where is it? I have never seen a file named this!

Showing hidden files



Showing hidden files

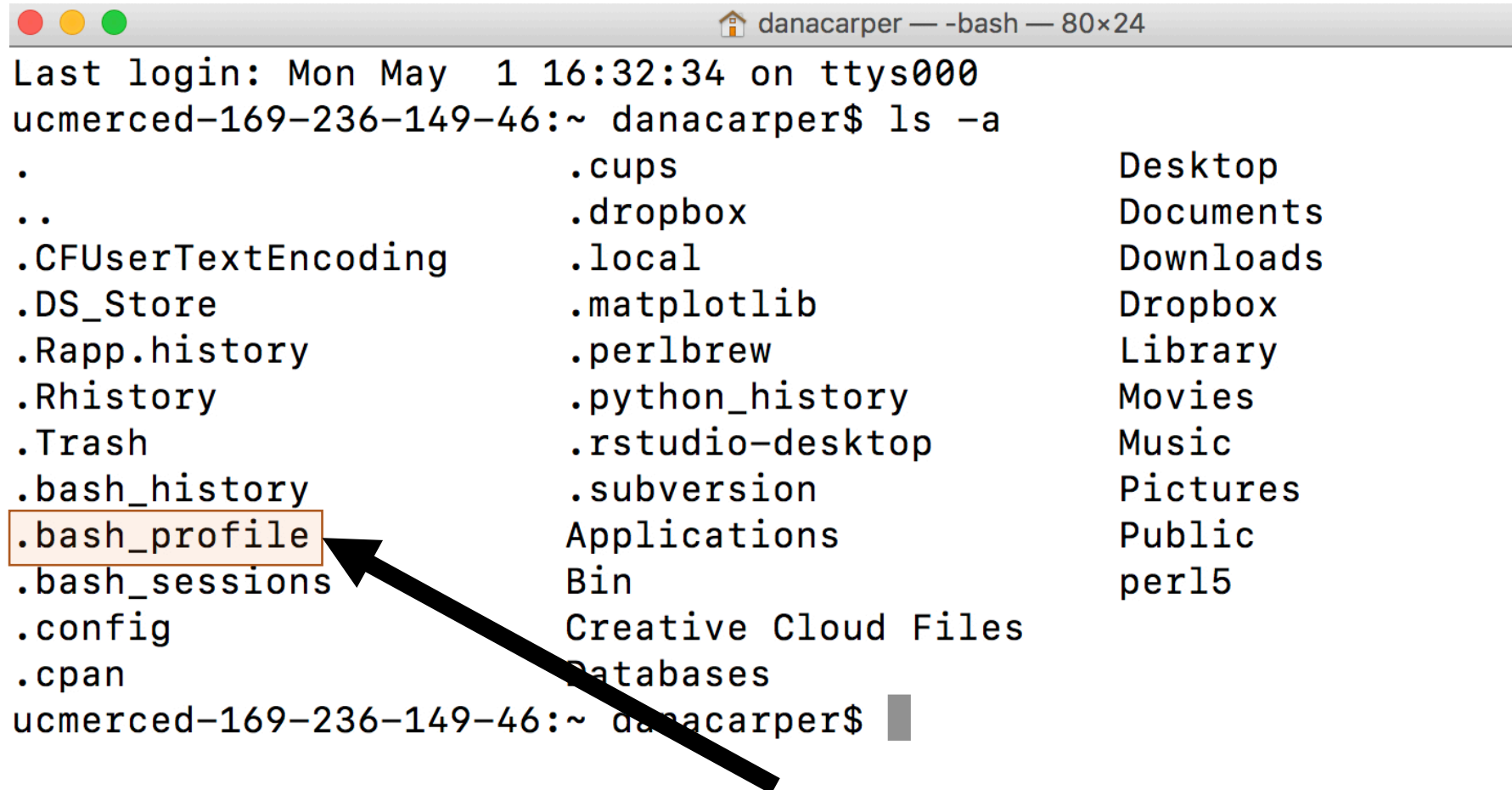
```
danacarper — -bash — 80x24
Last login: Mon May  1 16:32:34 on ttys000
ucmerced-169-236-149-46:~ danacarper$ ls -a
.          .cups
..         .dropbox
.CFUserTextEncoding .local
.DS_Store  .matplotlib
.Rapp.history .perlbrew
.Rhistory  .python_history
.Trash     .rstudio-desktop
.bash_history .subversion
.bash_profile Applications
.bash_sessions Bin
.config     Creative Cloud Files
.cpan       Databases
ucmerced-169-236-149-46:~ danacarper$
```



Desktop
Documents
Downloads
Dropbox
Library
Movies
Music
Pictures
Public
perl5

Showing hidden files

```
danacarper — -bash — 80x24
Last login: Mon May  1 16:32:34 on ttys000
ucmerced-169-236-149-46:~ danacarper$ ls -a
.          .cups          Desktop
..         .dropbox       Documents
.CFUserTextEncoding .local        Downloads
.DS_Store  .matplotlib   Dropbox
.Rapp.history .perlbrew     Library
.Rhistory  .python_history Movies
.Trash     .rstudio-desktop Music
.bash_history .subversion   Pictures
.bash_profile Applications   Public
.bash_sessions Bin           perl5
.config     Creative Cloud Files
.cpan       Databases
ucmerced-169-236-149-46:~ danacarper$
```



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`

