Lab 0 Objectives

- Intro to Labs
- Intro to Operating Systems
- Start Lab 0
  - UNIX/Linux intro
  - Use emacs (Text Editor)
  - Register for Interactive Textbook
  - Canvas (Forum for “Broader Issues”)

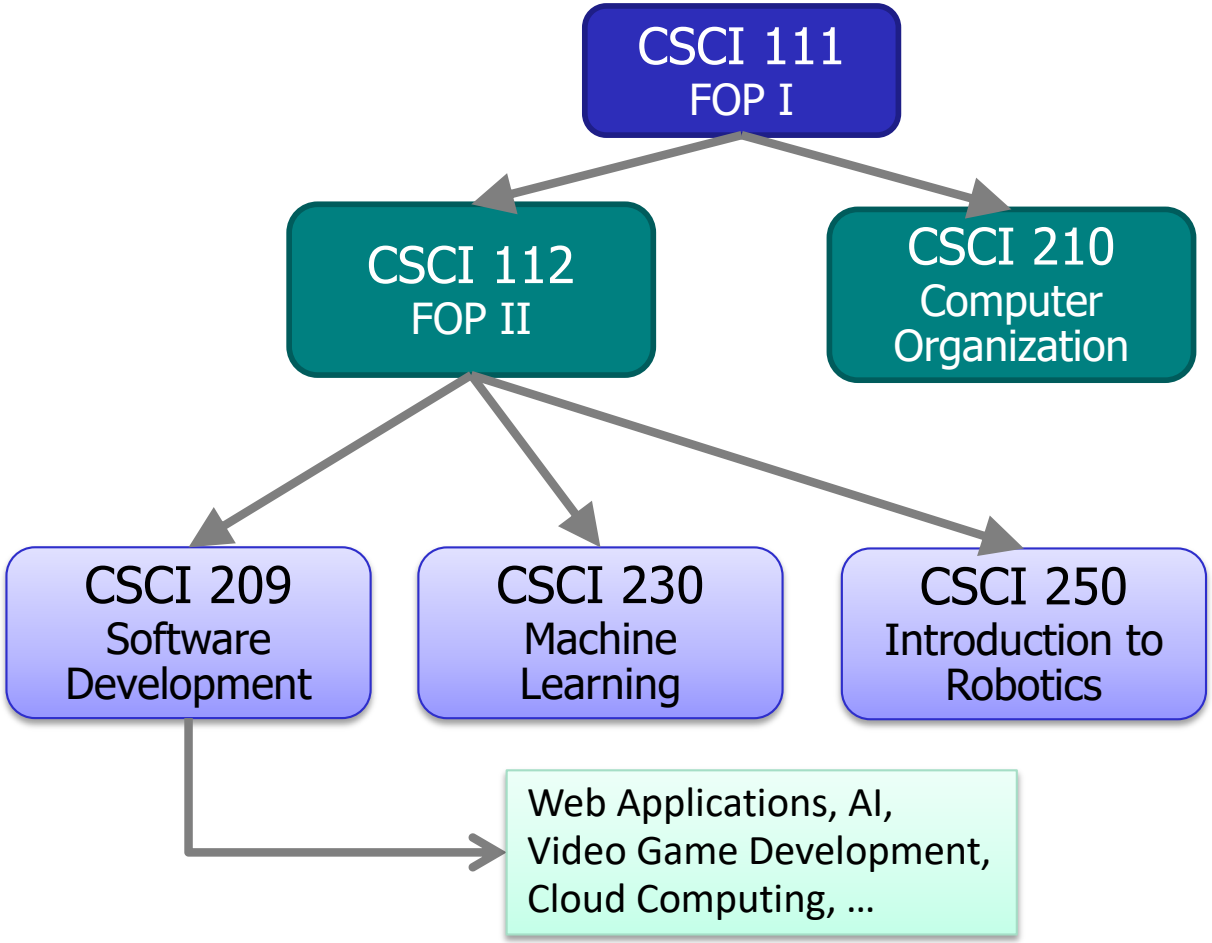
Intro to Labs

- Student Assistants
  - Tim Johns ‘26
  - Ignas Volčokas ’25
- Tech Support Tom Marcais
  - Linux/CS account issues
  - tmarcais@wlu.edu

What to Expect from this Class

- First programming course
- Lots to learn!
  - Introductions to a lot of new ideas
- Different way of thinking
  - Similar yet different from math
  - May get stuck but ask for help!
- Writing some basic programs
  - Foundations for more complex, sophisticated code
- Great power, great responsibility

Where You Can Go From Here



Class Details

- Course web page
  - https://cs.wlu.edu/~sprenkles/cs111
  - Check schedule frequently for updates
- Monday, Wednesday, Friday classes
  - Slides posted after class, in PDF format
  - Don't copy down slides verbatim
    - A lot isn't on the slides
    - Use PDF slides later to review
- Tuesday labs
  - "Pre-lab" assignments in the textbook, due *before lab on Tuesday*
  - Programming projects due at the *beginning of class on Friday*

Classtime

- Classes are in-person
- Classes will be recorded on Zoom and posted in Yuja on Canvas
- If you're not feeling well, you can attend the class on Zoom **BUT** that should not be a frequent occurrence

Class Details

- 3 Exams
  - 2 Exams (see schedule online for dates)
  - Final Exam
- Discussion of broader issues in CS
  - Articles about computer science's effect on everything
    - Get big picture of CS
  - Write up on Canvas, due Thursdays by 11:59 p.m.
  - Discussion Friday
  - Opportunities for extra credit for finding, reading, summarizing additional articles

Instructor Responsibilities

- Keep your interest in CS
- Prompt, constructive feedback on assignments
- Office hours: Zoom and in-person
  - Wednesdays: 2-4 p.m.
  - Thursdays: 10:30-11:30 a.m., 1:00-2:30 p.m.
  - Email for appointments at other times
- Goal: respond within 24 hours to emailed questions

Student Responsibilities

- Outside of class:
  - Review entire syllabus online
  - Check W&L email and course web page frequently for updates
- During class
  - Attend and participate in class and lecture
    - Mandatory attendance
    - Be respectful to other students
  - Arrive promptly to lecture/lab
  - Bring your notes and handouts
  - Turn off cell phone

Be patient, flexible, and learn from mistakes

Intro to Labs

- Typically: ~2 hours to get started on labs
  - ~1st hour is review (which is meant to help you get started on lab too)
  - Help from me and the student assistants
  - Today is not a typical lab!
- Often, will need to finish lab after lab period
  - Lab assignments are the majority of your homework
- Use this lab (P405), preferably, or P413
  - Or, work remotely *on these machines!*

What Today Is and Is Not

- Not ready for programming
- Set up for the rest of semester
- Develop skills
  - Communicating with computer
    - When we talk to computer, we need to be ***precise***
  - **Identifying problems** and **solving those problems**
- Start to learn Linux

Basic Computer Architecture

Solve problems

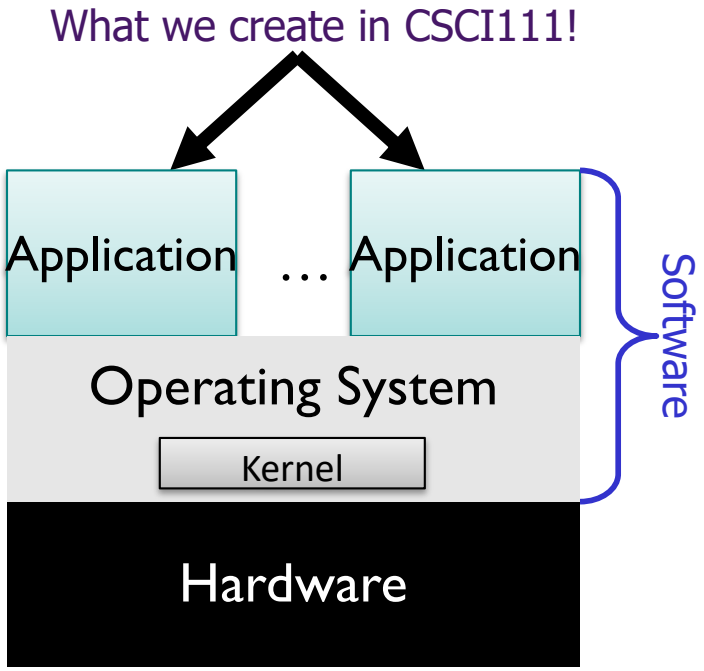
MSOffice Applications (Excel, Word), Solitaire, Firefox, Internet Explorer

Manages hardware resources

Windows, OSX/11, UNIX, Android, Linux

The machine, made up of CPU, memory, hard drive, keyboard, etc.

Dell, Apple, HP, IBM, Toshiba, …



Parmly 405 Machines

- Run Linux, distribution: Ubuntu
- Parmly 413 is the “advanced lab” down the hall
  - Can use those machines when this lab is in use
- Use your W&L username and password to login
  - But, the **files** you have access to on the Linux machines are ***not*** the same as the files you have access to on other W&L lab machines

Operating Systems

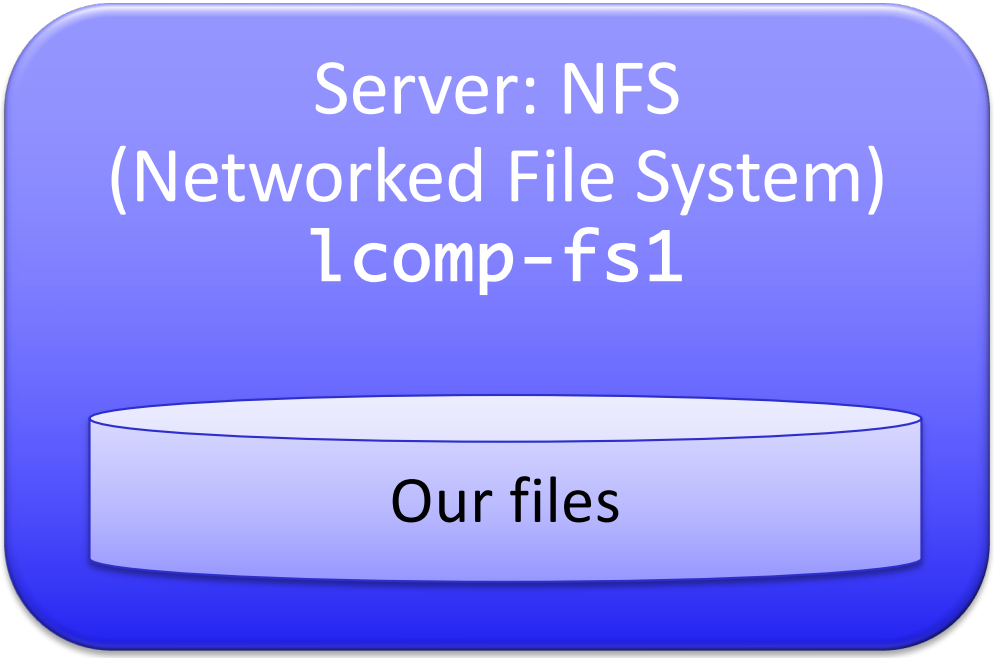
- Manage hardware resources
- Three popular desktop operating system variations:

macOS	Windows 11	UNIX

- Learn Linux (a UNIX variation) in this class

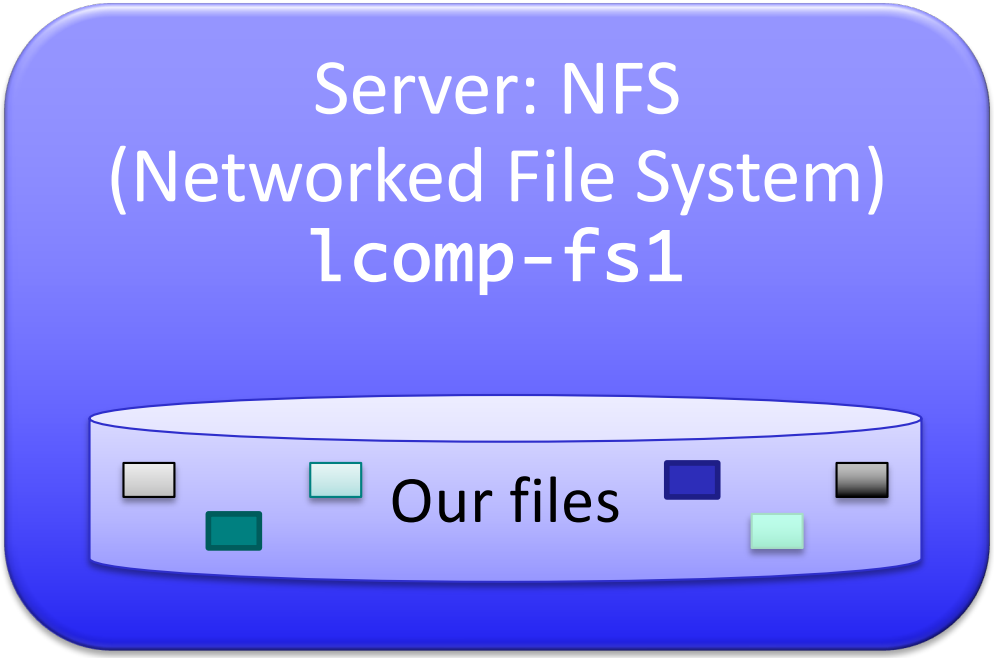
Macs are built on UNIX → can use UNIX commands
Windows has Power Shell.

CS Lab Architecture: File Server



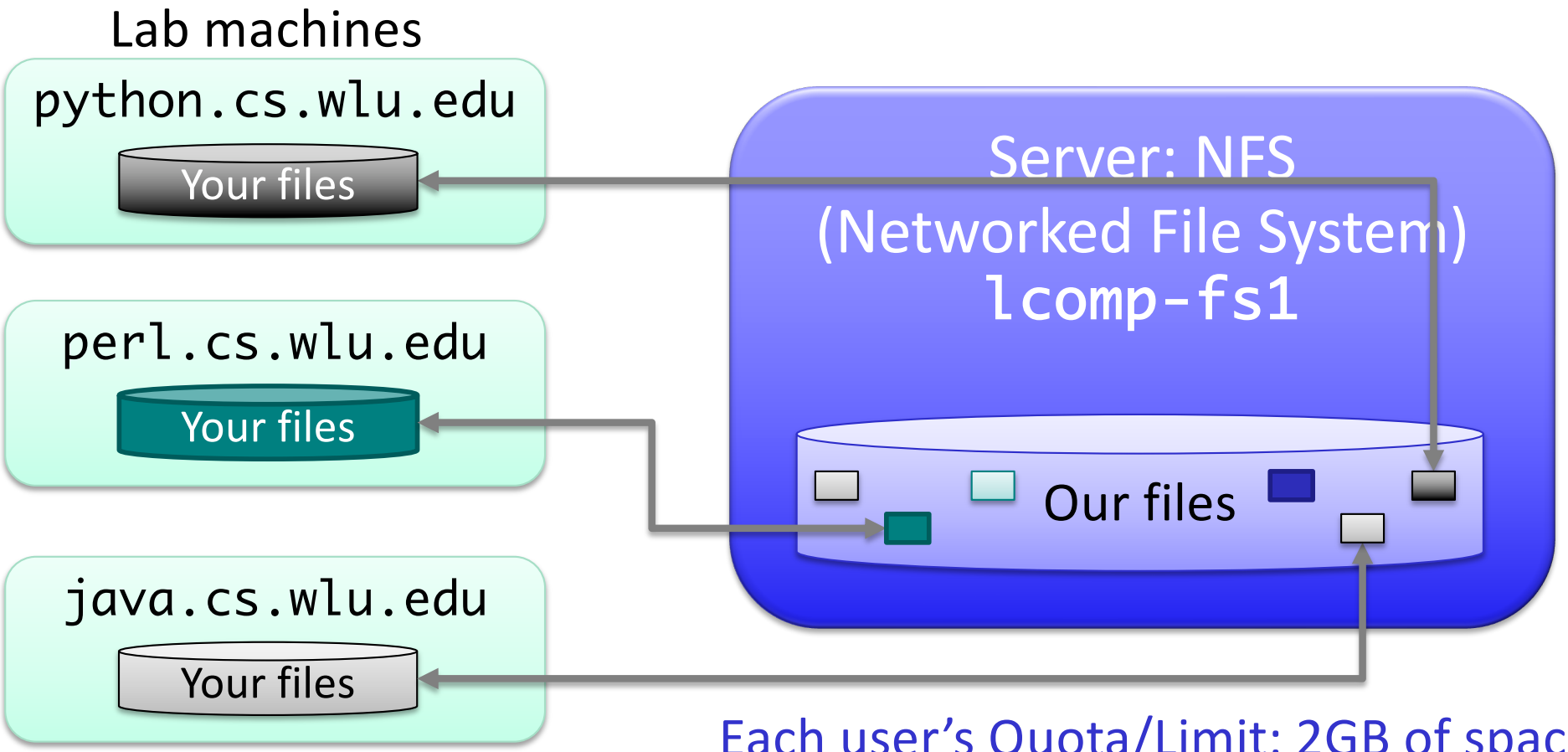
- Stores files for the Computer Science department
  - Individuals' files, shared files for courses, …

CS Lab Architecture: File Server



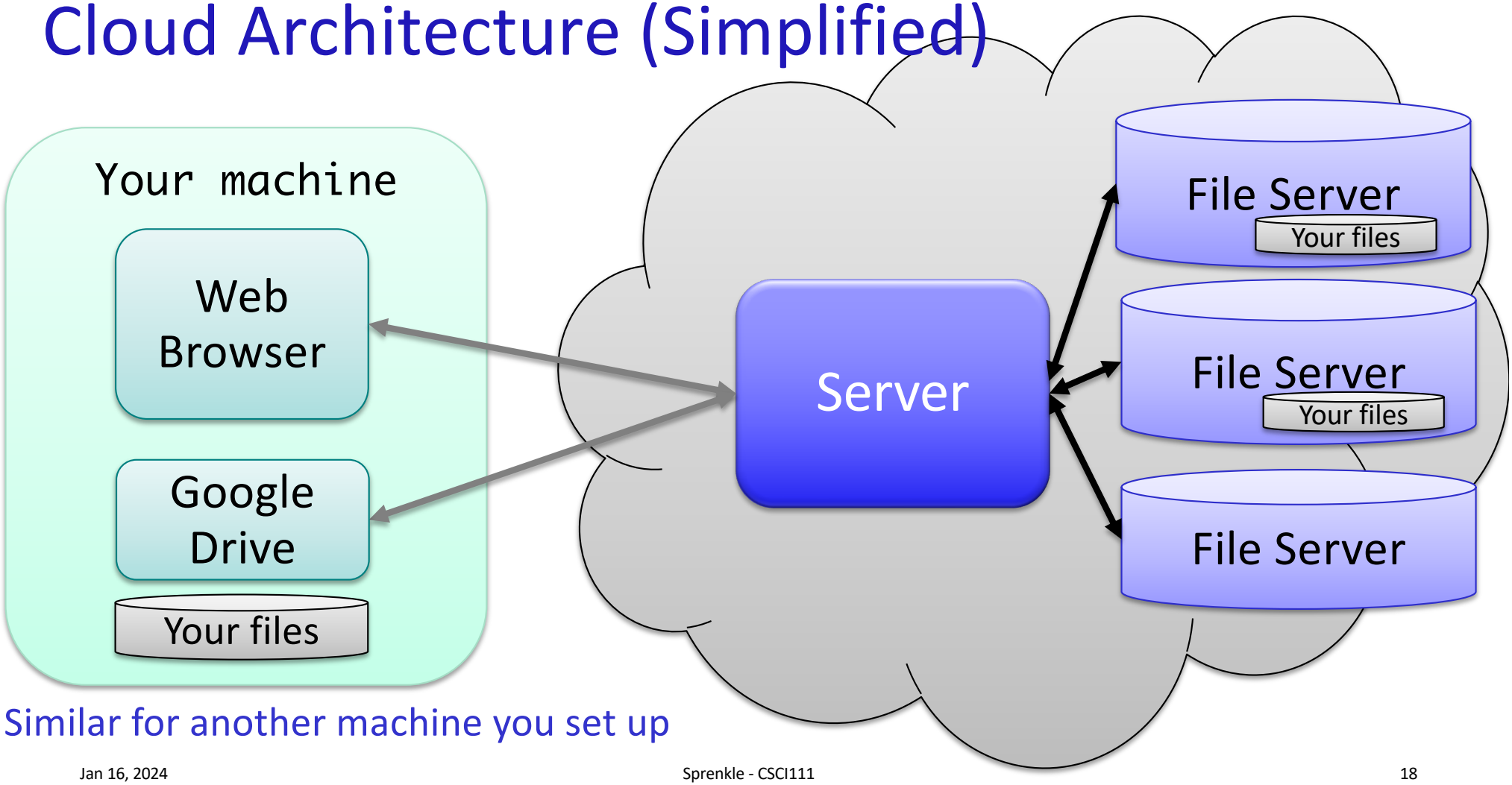
- Stores files for the Computer Science department
  - Individuals' files, shared files

CS Lab Architecture



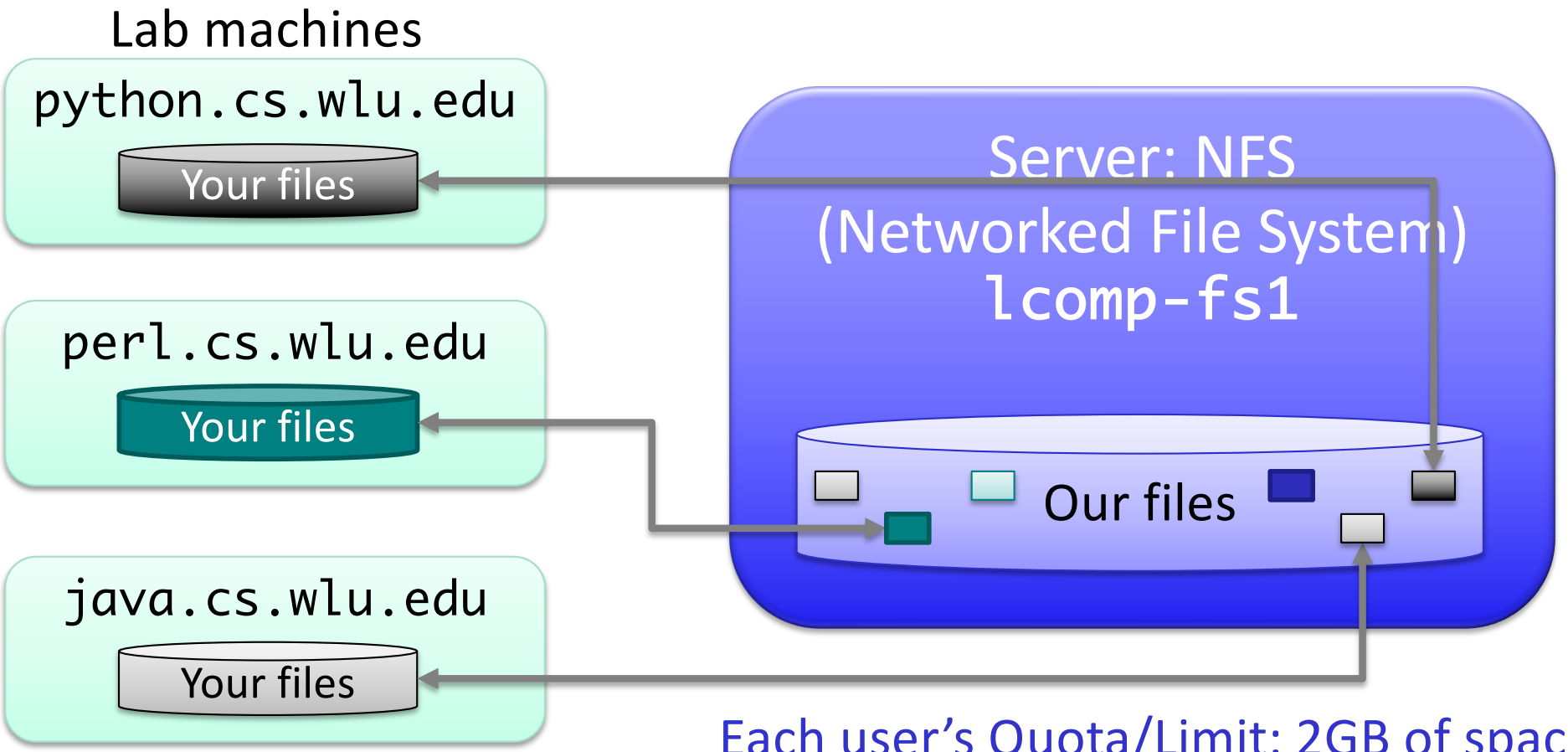
Each user's Quota/Limit: 2GB of space

Cloud Architecture (Simplified)



Similar for another machine you set up

Recap: CS Lab Architecture



Each user's Quota/Limit: 2GB of space

Getting Started

- You'll need a web browser

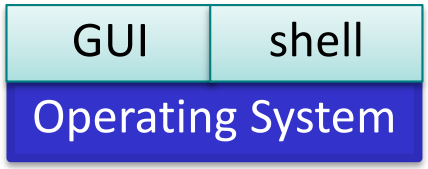
How can you launch a web browser?

- Navigate to the course web site
- When you're done and leave lab, you should log out **BUT** not shutdown the machine

How do you log out?

Intro to UNIX

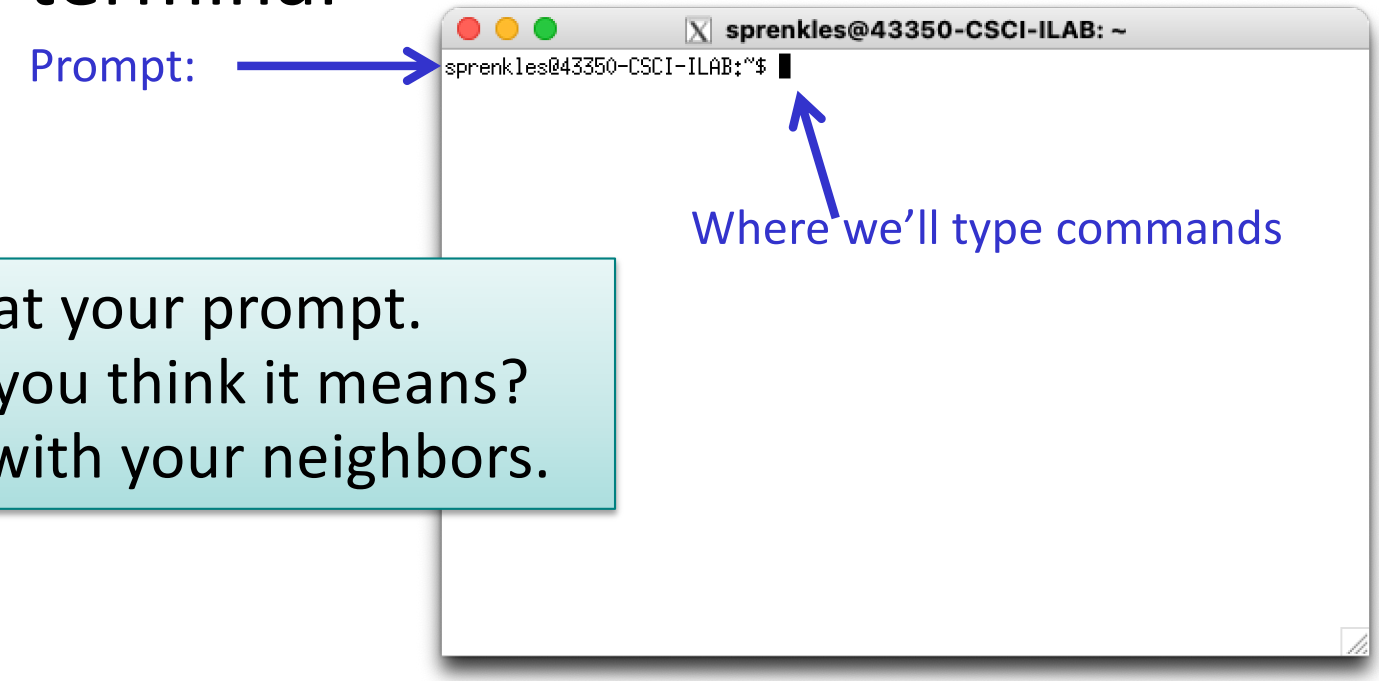
- Execute operations by typing commands in shell ***or*** using GUIs (Graphical User Interfaces)
- We will use both GUIs and command-line tools



- Pros and cons of command-line tools
  - Faster to use keyboard than mouse
  - Easier to repeat and automate
  - Larger learning curve, more error-prone, and can be intimidating

Terminal

- Command-line interface to operating system
- Open a terminal



Look at your prompt.
What do you think it means?
Compare with your neighbors.

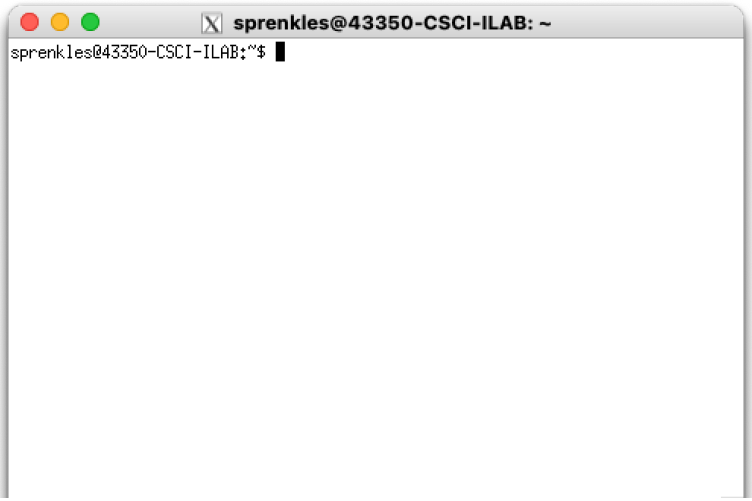
Terminal

- Command-line interface to operating system
- Open a terminal

  Prompt: [username@machinename:directoryIAmIn]$

UNIX Shortcuts: ~

- ~ represents ***your*** home directory
  - **Not** *the* home directory
  - Always with respect to the user
- When you open a new terminal, you're in *your* home directory



GUI to Get Help

- At the prompt, type the command
  - `labhelp`
- Press enter

- Example of process of using the command-line interface: type commands, press enter

Challenge: UNIX is a Bad Coach

- Doesn't tell you when you've done something right
- Only tells you when you've done something wrong

```
sprenkle@spartacus Desktop$ mv lab00.pptx.pdf lab00.pdf
sprenkle@spartacus Desktop$
```

Renames file from `lab00.pptx.pdf` to `lab00.pdf`

Since you didn't get an error message, it did something!
(May not be what you wanted/expected.)

Intro to UNIX: Essential Commands

- Manipulating Files

Command	What it does
`ls`	**l**i**s**t the files, directories in a directory
`mkdir dname`	**m**a**k**e a **dir**ectory with the name *dname*
`cp src dest`	**c**o**p**y a *src* to a *dest* *src* can be a file, set of files, or a directory *dest can be a file or a directory*
`rm file`	re**m**ove (delete) a file/directory

- Navigating Directories

`pwd`	**p**rint **w**orking **d**irectory
`cd name`	**c**hange to **d**irectory name

Command-Line Practice

- In the terminal, execute the following commands:
  - `pwd`
  - `ls`
  - `ls Documents`

Home Directories

- When you entered the command pwd, the response was the path to your home directory:
  - /home/**username**@ad.wlu.edu, where *username* is your username
    - I will often shorthand this to just `/home/username`

Useful Trick: Up Arrow

- Hit the up arrow. What happened?

- Hit the up arrow again? What happened?

What is the Unix command to do the following?

In your pods, determine these commands

1. Find out what directory you're in
2. View the contents of the directory
3. Create a directory called cs111
4. View the contents of your directory (again)
5. Go into the cs111 directory
6. Find out what directory you're in
7. View the contents of cs111 directory

What is the Unix command to do the following?

Now, execute those commands!

1. Find out what directory you're in
   - `pwd`

   You should be in your home directory
2. View the contents of the directory
   - `ls`

   What files are in your home directory?
3. Create a directory called cs111
   - `mkdir cs111`
4. View the contents of your directory again

   What files are in your home directory now?
   - `ls`
5. Go into the cs111 directory
   - `cd cs111`
6. Find out what directory you're in
   - `pwd`

   You should be in /home/username@ad.wlu.edu/cs111
7. View the contents of cs111 directory
   - `ls`

Process for Determining a Command?

- Reflect on your process for determining a command
  - Having a process makes a task a little less daunting to repeat

Process for Determining Command

1. Figure out what you're trying to do → what command does that?
2. What additional information does that command need?

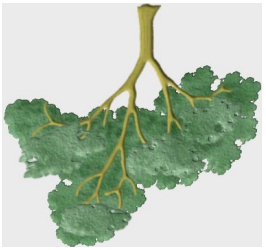
Intro to UNIX: File Structure

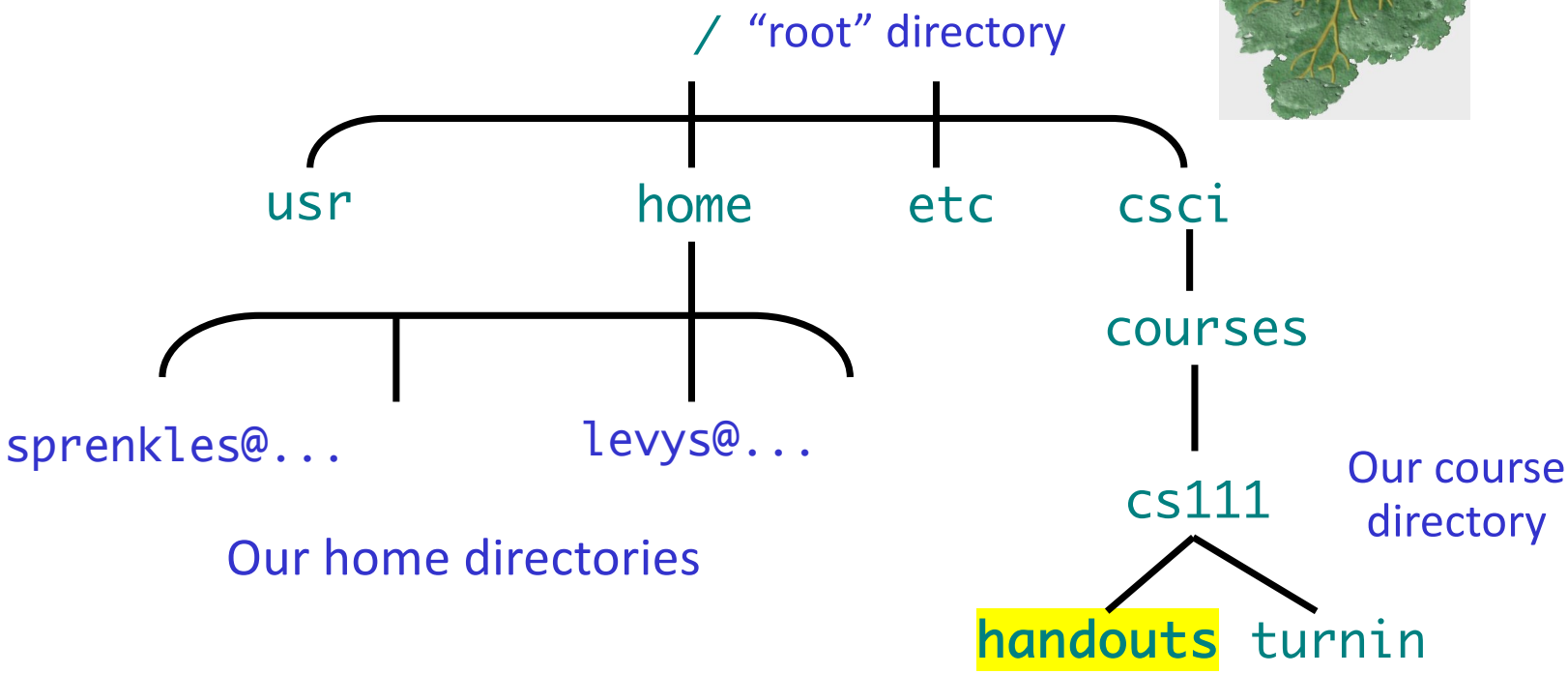
- Organize our files
- Hierarchy of *directories* or “folders”

- Similar to what you have on your computer

(Partial) Linux File Structure

Paths through tree

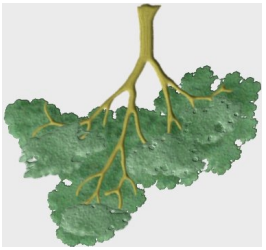


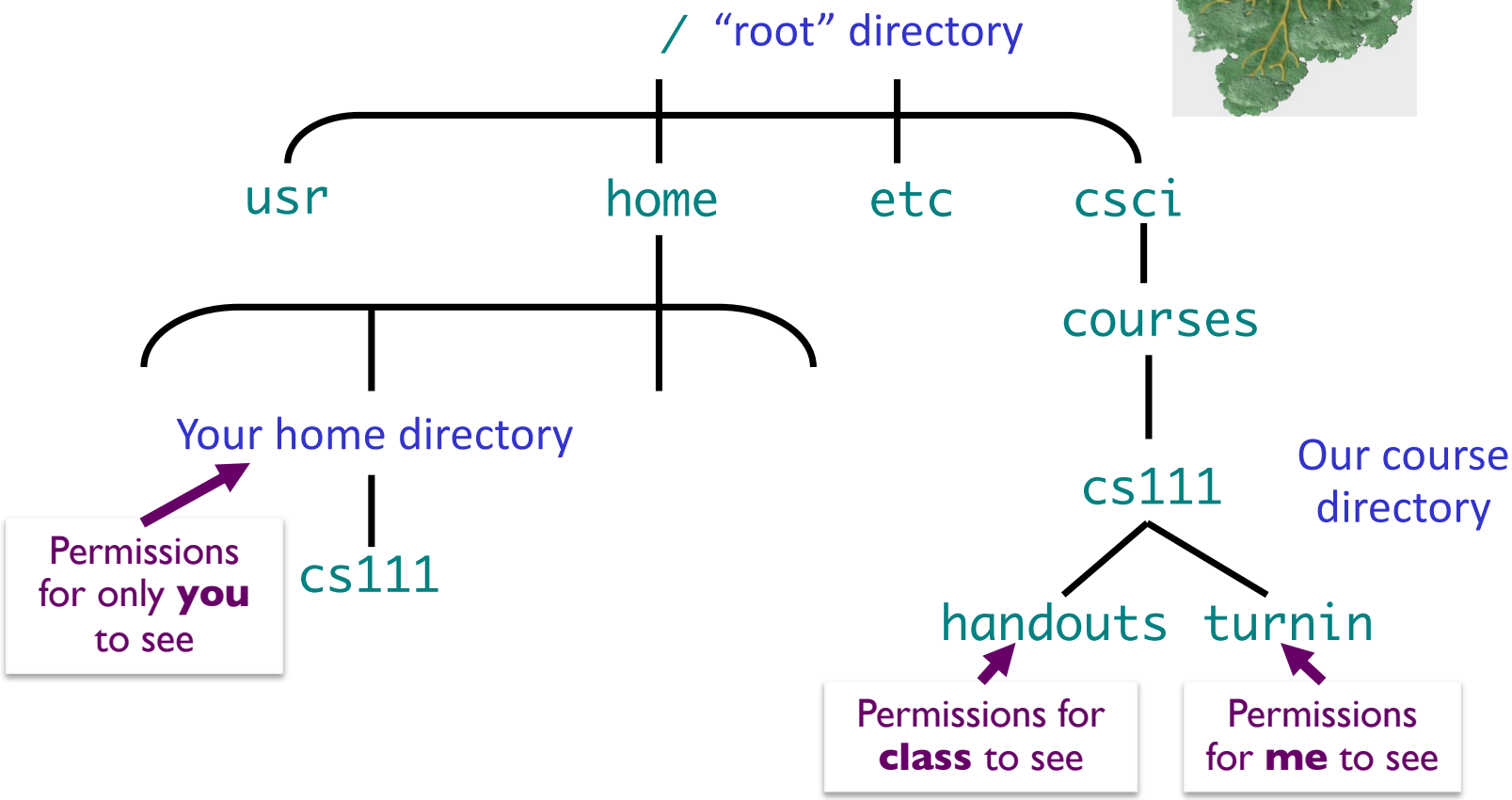


Path to `handouts`: `/csci/courses/cs111/handouts`

(Partial) Linux File Structure

Paths through tree





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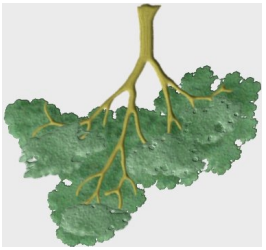
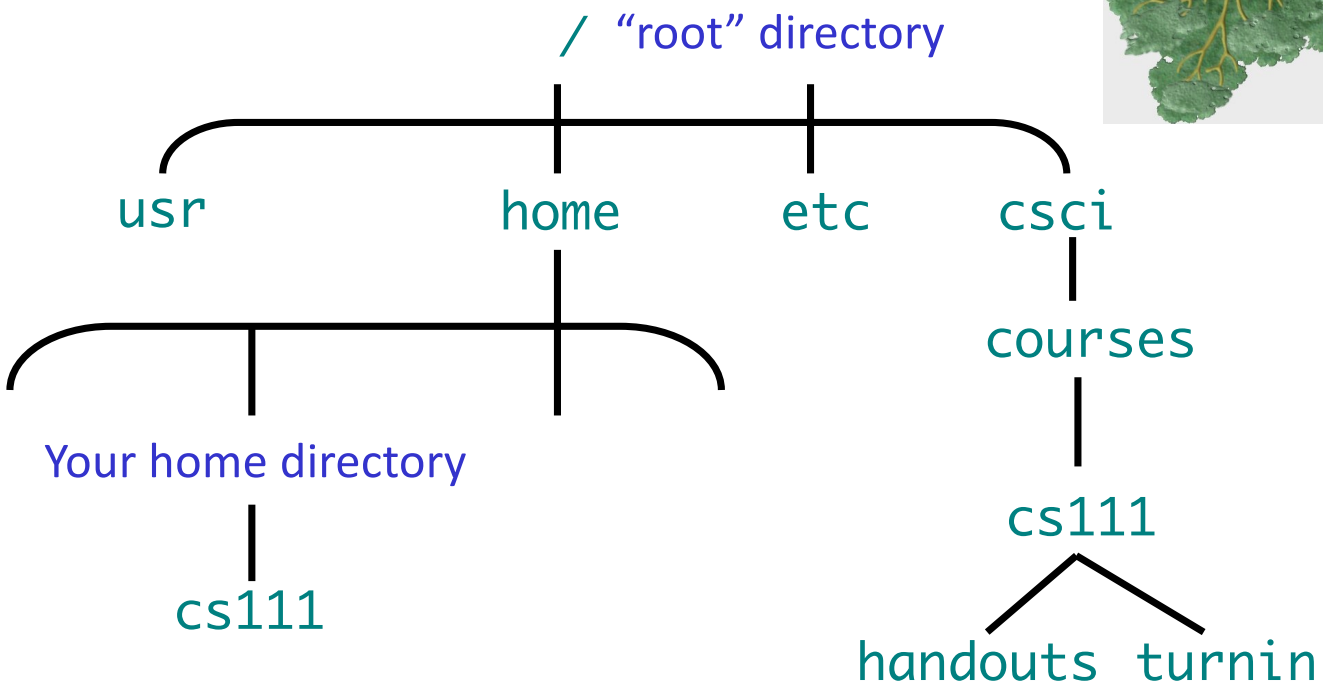
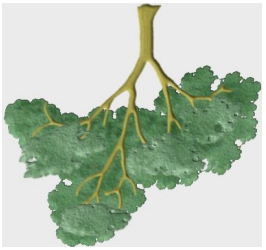


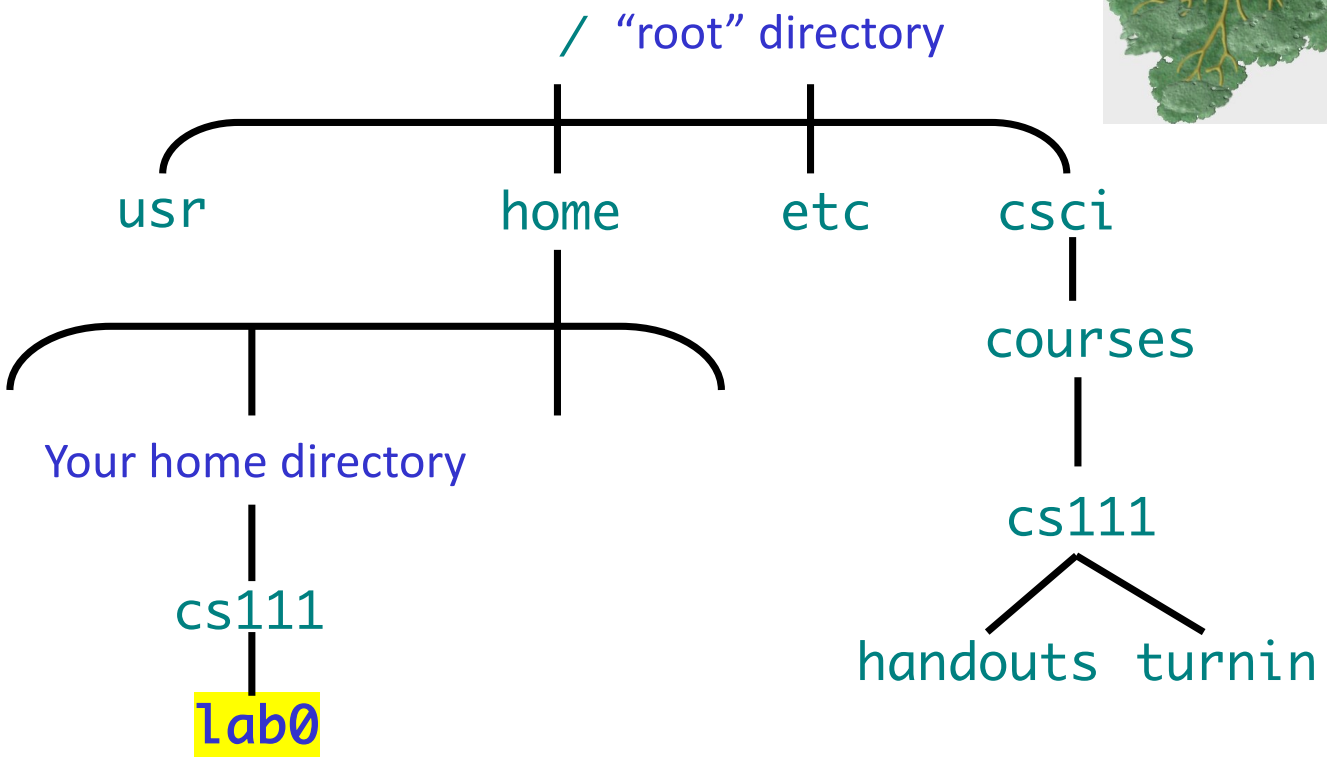


Consider if you are in your cs111 directory and you run `mkdir lab0`, how does the file structure change?

(Partial) Linux File Structure

Paths through tree





You now have this directory!

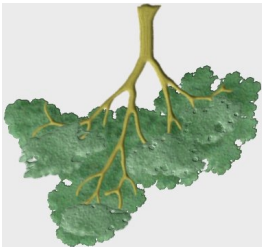
Do this in the terminal!

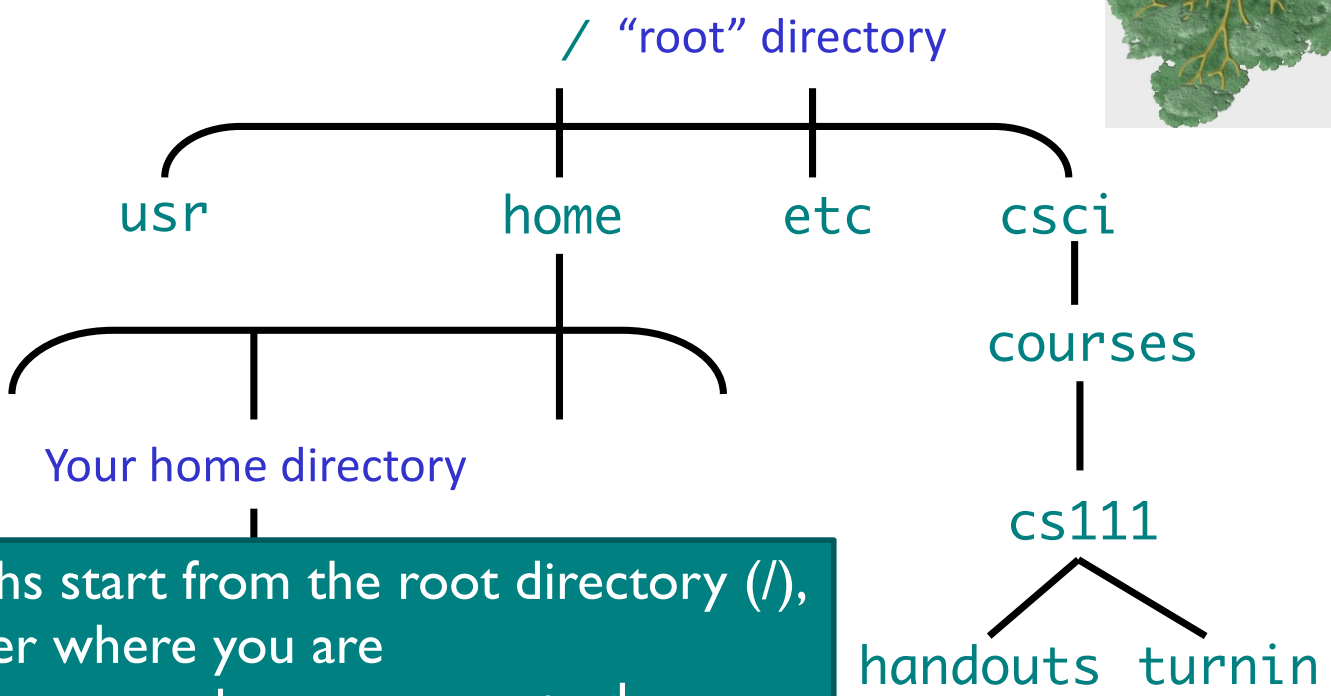
Paths

- ***Paths*** specify locations of files, directories
  - Used in a variety of commands
- Two types of paths: ***absolute*** and ***relative***

Absolute vs Relative Paths

Paths through tree





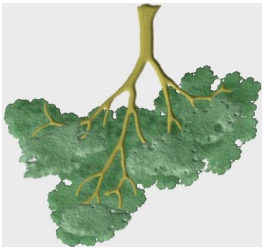
Absolute paths start from the root directory (/), work no matter where you are

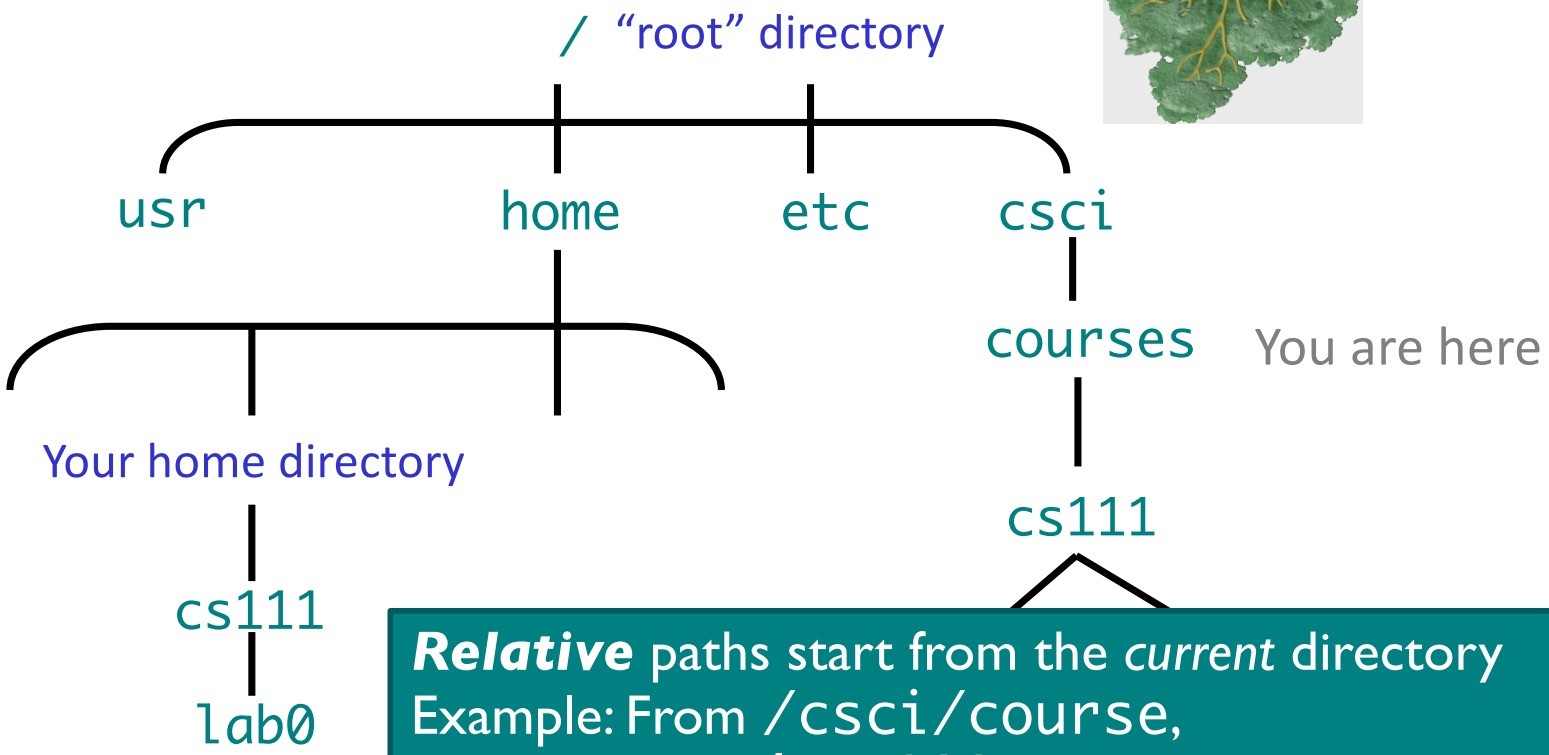
→ What you see when you type `pwd`

What is the absolute path to the cs111 directory?

Absolute vs Relative Paths

Paths through tree





Relative paths start from the *current* directory
Example: From `/csci/course`,
you can type **`cd cs111`** rather than
`cd /csci/courses/cs111`

Absolute vs Relative Paths

Absolute

- Always start at the root: /
- Absolute is kinda like always giving directions from Elrod Commons, where Elrod is our root
  - Benefit: directions always work!
- Made up example to get to Parmly 405
  - /Leyburn/ScienceCenter/Parmly/405

/ = Elrod Commons

Relative

- Start from current directory
- Relative is giving direction from where you are
  - **But**, only work if you're in that location
- Made up example to get to Parmly 405, where you're in the Science Center
  - Parmly/405
  - This path won't work if you're in the CGL

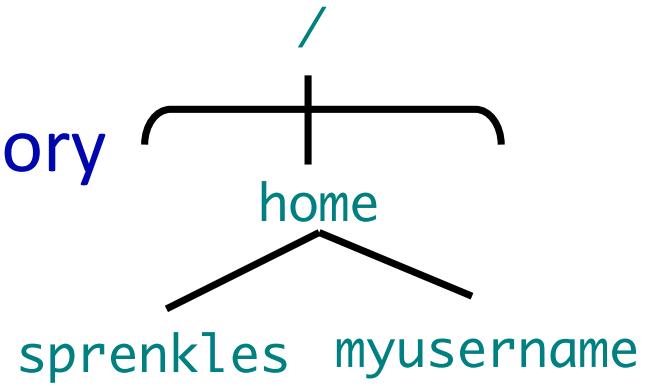
Takeaway: Either can be used to specify a path. With experience, you'll know which to use when.

Intro to UNIX: Shortcuts

Shortcut	Meaning
.	Current Directory
..	Parent Directory

- Often used with **`cp`**, **`mv`**, **`cd`** commands

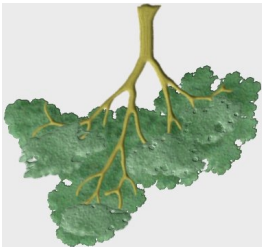
- **`cd`** or **`cd ~`**
  - Change to *your* HOME directory

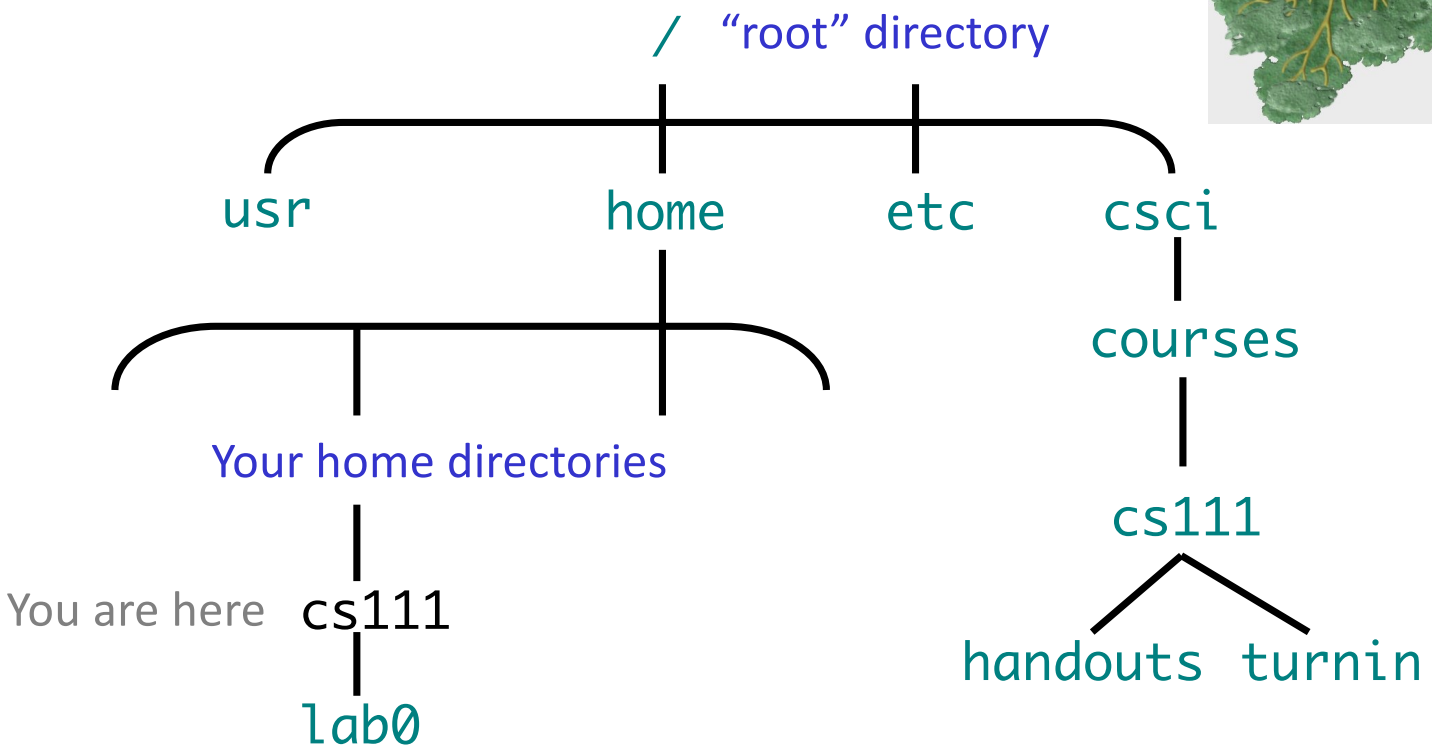


Example: `/home` is the ***parent directory*** of `/home/sprenkles@ad.wlu.edu`

Absolute vs Relative Paths

Paths through tree



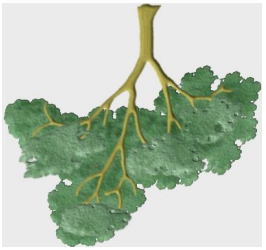


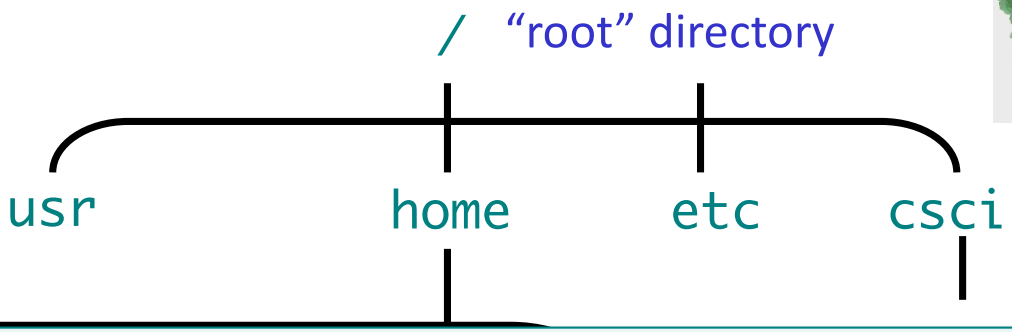
Given that you're in *your* cs111 directory, how would you get to *lab0*? To your *home* directory? To the *handouts* directory?

- Provide 1) the *absolute* path and 2) the *relative* path

Absolute vs Relative Paths

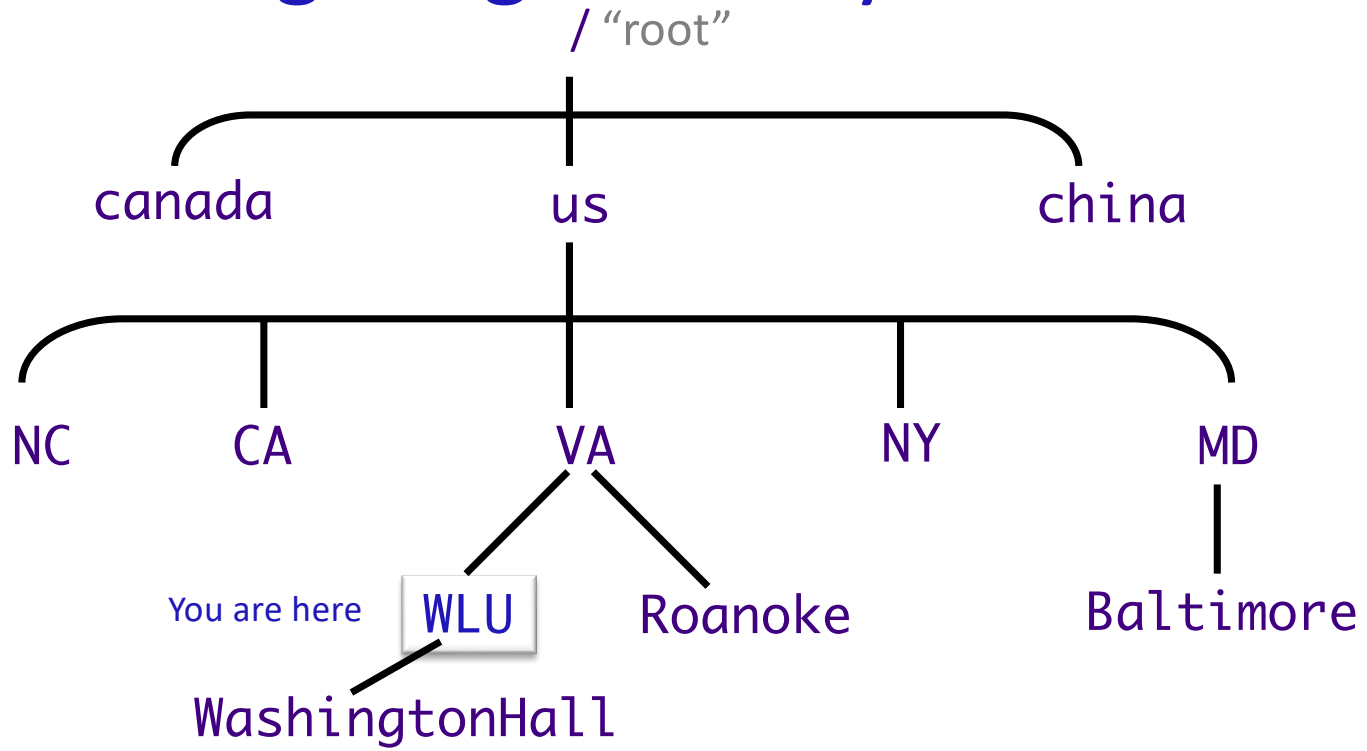
Paths through tree





- To lab0
  - cd /home/username/cs111/lab0
  - cd lab0
- To home
  - cd /home/username@ad.wlu.edu
  - cd ..
  - cd
  - cd ~
- To handouts
  - cd /csci/courses/cs111/handouts
  - cd ../../../csci/courses/cs111/handouts

Practice: Navigating A File System



Given that you're at **WLU**, how would you get to Washington Hall? To Roanoke? To Baltimore?

- Use either absolute or relative path, whichever is easier

Practice, with Tab Completion

This is an absolute path

- Goal: go to the directory `/csci/courses/2023_24_winter-csci_111_01`
  - You can use ***tab completion*** to help you complete commands
  - After typing the appropriate command, start to type `/cs` and then press tab.
    - What happens?
  - Now that you're in the `/csci` directory, press tab twice
    - What do you see?
  - Use tab completion to help you complete the rest of the path

- To make navigation easier, I have linked the name `cs111` to that long name (`2023_24_winter-csci_111_01`) so we don't need to use the long name

Practice, with Tab Completion

This is an absolute path

- Current directory
  `/csci/courses/2023_24_winter-csci_111_01`
- What are the contents of this directory?
- How can you get to the directory `/csci/courses`?
- How can you get back to *your* home directory? (3 ways)

Opening a Text Editor

- Text editor: an application to write/edit text files
  - Text files: program source code, HTML code
  - Like NotePad++ or TextEdit
- To run one text editor:
  - `emacs &`
  - & means "run in the background" so you can keep using the terminal

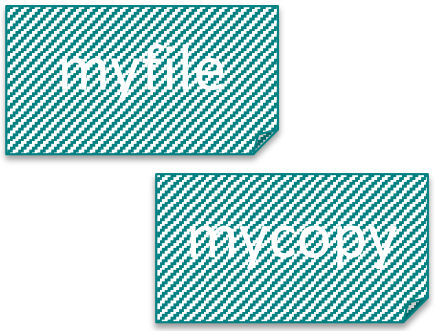
emacs: A text editor

Check: are you are in your home directory?
Now, go into your `cs111` directory.

- `emacs &`
  - Command to run
- Create a new file (under File → Visit New File), add some text to it
  - e.g., "this is my file"
- Save the file in *your* `cs111` directory, naming it `test.txt`
- Exit emacs from the menu
- What are the contents of the directory now?

More on the `cp` command

- `cp src dest`
  - `src`: what you want to copy
  - `dest`: to where you want to copy
    - If `dest` is a directory, copies `src` into that directory
    - If `dest` is not a directory, makes a copy of `src` and names it `dest`
- Example: `cp myfile mycopy`



More on the `cp` command

- `cp src dest`
  - `src`: what you want to copy
  - `dest`: to where you want to copy
    - If `dest` is a directory, copies `src` into that directory
    - If `dest` is not a directory, makes a copy of `src` and names it `dest`
- Practice in the terminal:
  - If needed, go to the location of test.txt
  - Copy the file you just created to make a backup of it, e.g., named `test.txt.bkup`
  - Check that the command worked. (How?)
  - Copy the original (test.txt) to your lab0 directory
  - Check that the command worked.

First, discuss the steps

Using the Wildcard: *

- Go into `/csci/courses/cs111/handouts/lab0`
  - What are the contents of this directory?
- Try executing
  - `ls *.py`
  - `ls example.*`

What does the * do?

Wildcard: *

- Match 0 or more characters in filenames
- Used to operate on more than one file

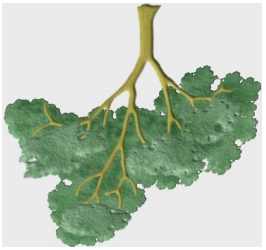
- Follow up question: What does * on its own do?

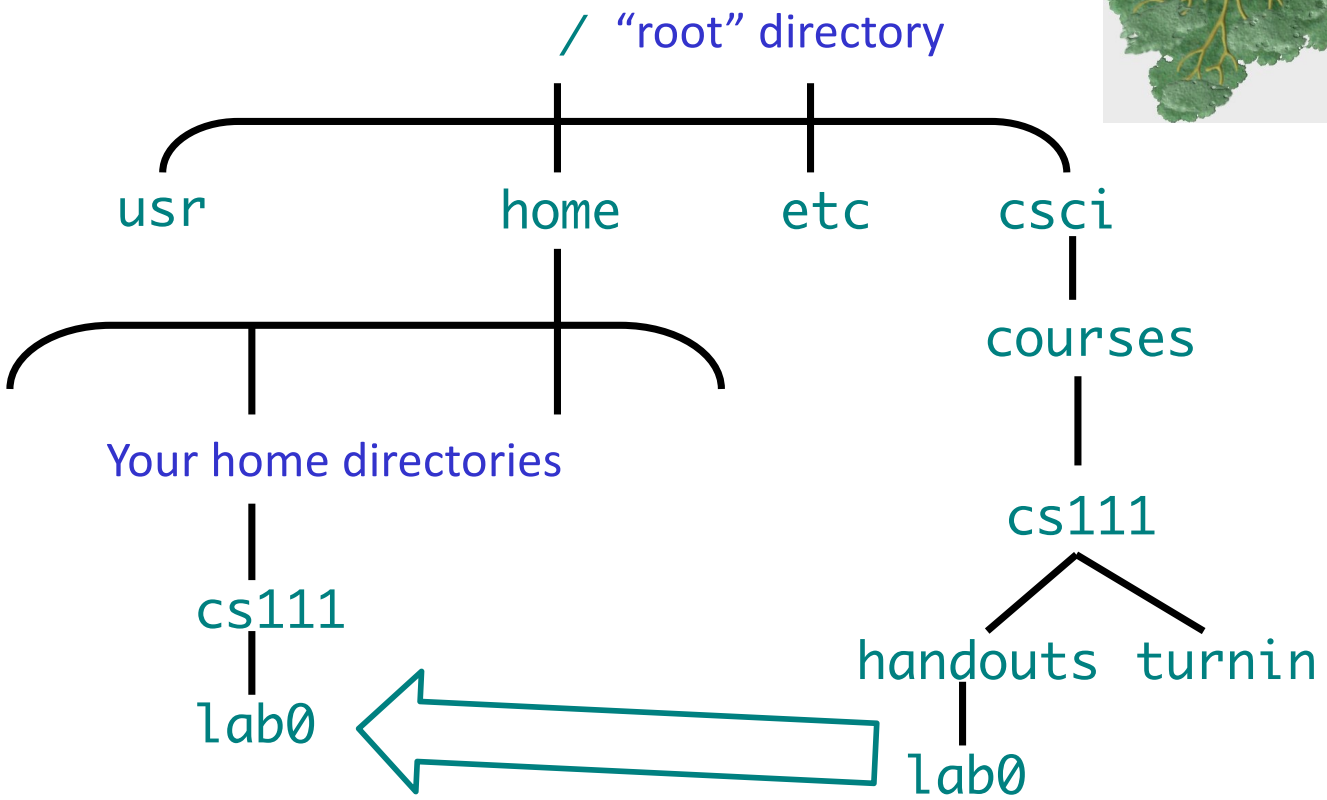
Reset!

- Go to your home directory!
- Now go into your cs111/lab0 directory

New Copy Task

Paths through tree





Task: Copy all the files from the course's lab0 to my lab0 directory

Breaking Down the Task

- What do we want to do?
- What command should we use?
- What does that command require?

Breaking Down the Task

- What do we want to do? Copy!
- What command should we use? cp
- What does cp require? A source and destination
  - What is the source?
  - What is the destination?
  - How should we specify those directories?
    - Keep in mind: Where are we?

Breaking Down Task

- What do we want to do? Copy!
- What command should we use? cp
- What does cp require? A source and destination
  - What is the source? The files in the course's handouts/lab0 directory
  - What is the destination? My cs111/lab0 directory
- How should we specify those directories?
  - Keep in mind: Where are you? I am in my cs111/lab0 directory
- Bring it all together:

```
cp /csci/courses/cs111/handouts/lab0/* .
```

Linux Quiz

- True or False: I should shut down the machine when I am done using it.
- True or False: My CS account is the same as my W&L account.
- True or False: I can give my password to my friend who needs to access my account.

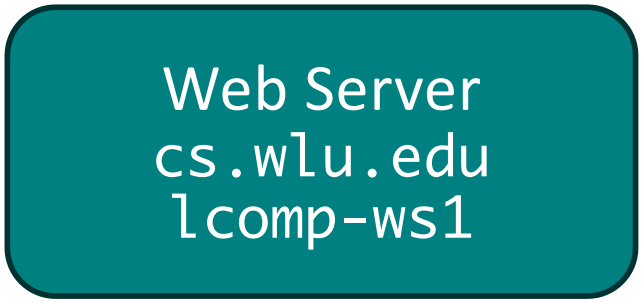
ssh: secure shell

- Allows us to remotely log into a lab machine!
- After “ssh’d” in, use terminal just like if we were directly on the lab machine

Creating a Web Page

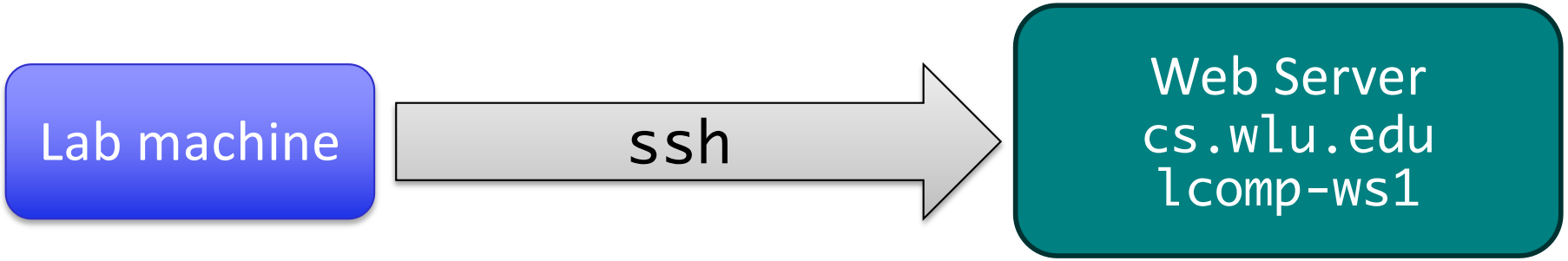
- Practical application of UNIX command skills
  - Practice commands you learned today
- Learning from following examples and adapting
- Learn what's "behind the curtain" of web pages

CS Department's Web Server



- Holds files that we want to expose to the world through the web
- Separate file system from the CS file system
- Requires special permissions to be able to access
  - YOU have that special permission!

ssh: secure shell



- Allows you to remotely log into the web server
  - Create web pages
- After "ssh'd" in, use terminal like if we were directly on the web server

Whew!

- You hung in there!
- You learned a lot! (I hope!)
- You didn't back down!
- But…. We're not done yet

Lab 0 Checklist

- ✓ Linux
- Go to Browser, Lab 0 Page
  - Web page
  - Canvas discussion forum
  - Interactive textbook
  - Canvas: introductory survey
  - Remote access to the lab machines

Due Friday before class