```
$ cat welcome.c
#include <stdio.h>

int main(int argc, char *argv[])
{
   printf("Welcome to COS 217\n");
   printf("Introduction to Programming Systems\n\n");

   printf("%s %d\n", ”Spring", 2026);
   return 0;
}

$ cat Makefile
CC=gcc217
welcome: welcome.o

$ make
gcc217 -c -o welcome.o welcome.c
gcc217 welcome.o -o welcome

$ ./welcome
Welcome to COS 217
Introduction to Programming Systems

Spring 2026
```

# Agenda

Course overview

- Introductions
- Course goals
- Resources
- Grading
- Policies

Our computing environment

- Key software / terminology
- Navigating the filesystem
- Demo (time permitting)

# Introductions

## Course Faculty

- Christopher Moretti — cmoretti@cs.princeton.edu
- Xiaoyan Li — xiaoyan@cs.princeton.edu

## Graduate Preceptors

- Viola Chen — yc1709@princeton.edu
- Lana Glisic ‘24 — lglisic@princeton.edu
- Polly Ren — pollyren@princeton.edu
- David Shustin ‘24 — dshustin@princeton.edu
- Nicholas Yap — zy4586@princeton.edu

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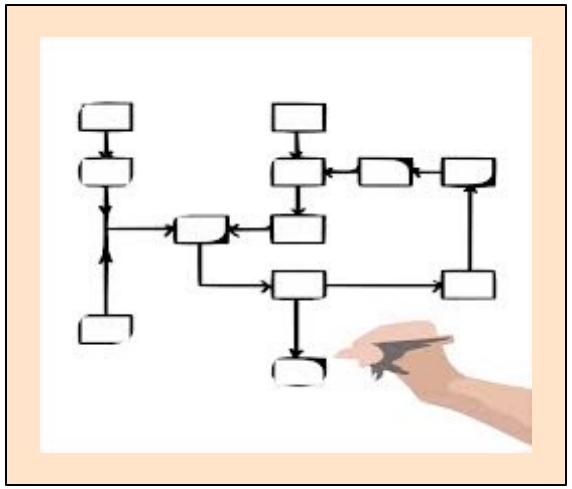
# Goal 1: Programming in the Large



Learn how to compose
large(r) computer programs

Topics

- Modularity/abstraction, information hiding, resource management, error handling, testing, debugging, performance improvement
- Tools: ssh, bash, shell utilities, git, gcc, make, gdb, gprof, valgrind, splint

# Along the Way: Learn Linux

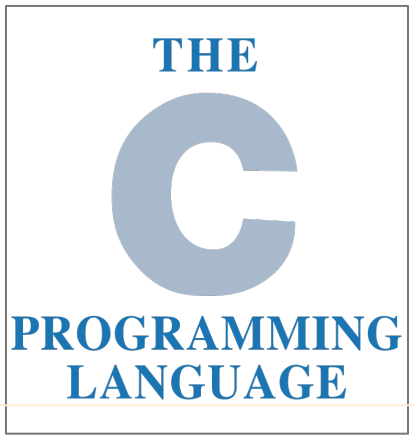
**Question:** Why use the Linux operating system?

**Answer 1:** Linux is the industry standard for servers, embedded devices, education, and research

**Answer 2:** Linux (with GNU tools) is good for programming (which helps explain answer 1)


# Goal 2: Lower-level Languages

```
int main(void) {
   while ((iChar = getchar()) != EOF) {
      lCharCount++;
      if (isspace(iChar)) {
         if (iInWord) {
            lWordCount++;
            iInWord = FALSE;
         }
      }
```



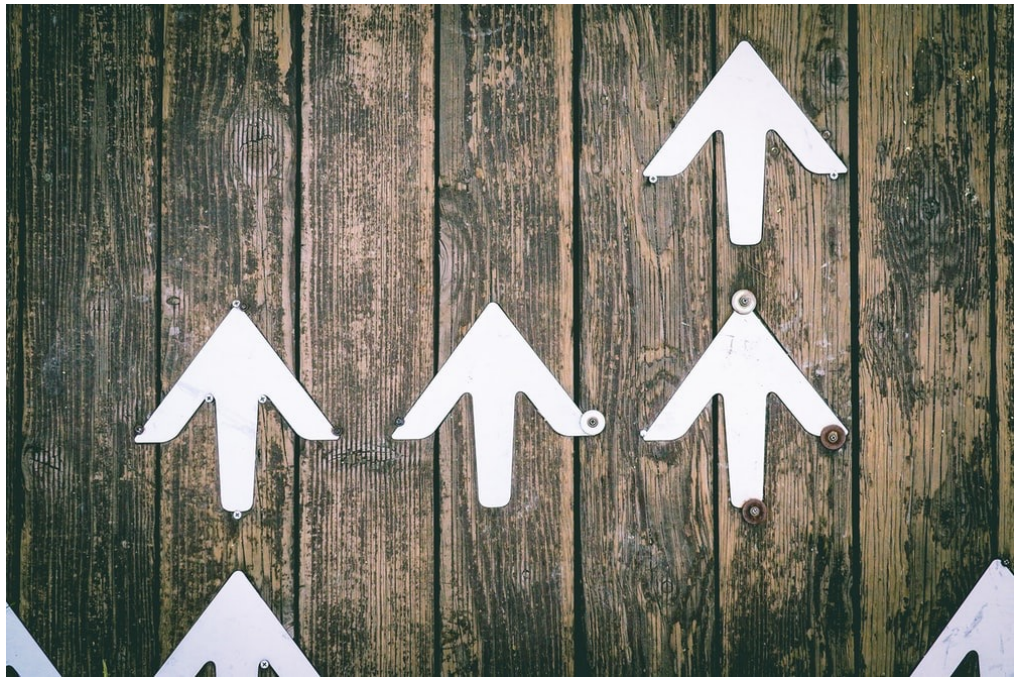

```
main:
.LFB0:
.cfi_startproc
stp x29, x30, [sp, -16]!
.cfi_def_cfa_offset 16
.cfi_offset 29, -16
.cfi_offset 30, -8
add x29, sp, 0
.cfi_def_cfa_register 29
b .L2
```

```
RELOCATION RECORDS FOR [.eh_frame]:
OFFSET           TYPE                VALUE
000000000000001c R_AARCH64_PREL32    .text

Contents of section .text:
 0000 fd7bbfa9 fd030091 39000014
00000090  .{......9.......
```

# Goals: Summary

Help you to gain …



Jungwoo Hong

***Programming Maturity***

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# Lectures

Describe material at a mix of levels

- Some conceptual (high) overview
- Some digging into details

Slides on course website

Videos from some previous offerings are available on YouTube

… but be careful, you are responsible for any differences

Etiquette

- Ask questions as they come up!
- Use electronic devices *primarily* for taking notes or annotating slides
- Limit your SnapTokInstaRedSkyFacr, please -- for yourself and your neighbors

# iClicker

Occasional questions in class, graded on participation not correctness.

- Using an app on your phone or the web client
- Setup is "iClicker Cloud", integrated with our course's Canvas.
- Register, select Princeton University, and find course "COS 217 – Spring 2026"

# iClicker Question

Q: Can you answer this iClicker question today?

A. Yes

B. No, but I've been practicing my mental electrotelekinesis and the response is being registered anyway

C. I'm not here, but someone texted me to iClick or is iClicking for me (don't do this – it's an academic violation!)

# Precepts

Describe material at the “practical” (low) level

- Support your work on assignments
- Hard-copy handouts distributed in precept
- Handouts also available via course website

Etiquette

- Attend your precept: attendance will be taken
- Use TigerHub to move to another precept if timing is a problem
- Must miss your precept once or twice? ⇒ inform preceptors & attend another

**Precepts begin today!**

# Websites

https://www.cs.princeton.edu/~cos217

(Course website)

- Home page, schedule page, assignment page, policies page


https://princeton.instructure.com/courses/20690

(Canvas)

- Links to Ed, Library reserves and other readings, NameCoach

# Ed

https://edstem.org/us/courses/94503

- Also available as a Canvas link from the course website
- Q&A – post here instead of emailing staff when possible


Etiquette

- Study provided material before posting question
  - Lecture slides, precept handouts, required readings
- Read / search all (recent) Ed threads before posting question
- Don’t reveal your code or design decisions in a public post!
  - See course policies
  - Click “private” if in doubt – we can make it public after-the-fact

# codePost

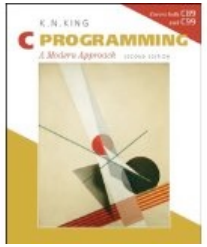

We will use `codePost.io` to annotate your assignment submissions with feedback and grades.

More information on this when we get ready to return Assignment 1.

# Books

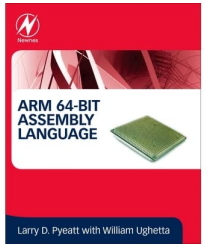
*C Programming: A Modern Approach (Second Edition)* (required)

- King
- C programming language and standard libraries



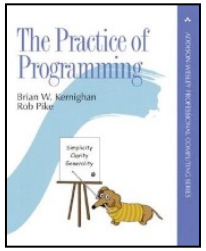

*ARM 64-bit Assembly Language* (required / online)

- Pyeatt with Ughetta




*The Practice of Programming* (online)

- Kernighan and Pike
- "Programming in the large"



# Help!

## Office Hours, Concept Hours, and Study Hall

- 3+ hours per day 6 days per week; schedule is on the course website
- Office hours: offer help on assignments, as well as lecture and precept material
- “Concept” office hours after lecture: focus on course material, not debugging
- McGraw Study Hall: like Concept hours, but with peers

## Intro COS Lab Hours

- Intro Lab TAs are your peers who have already completed this course.
- Available 4+ hours per day, every single day in CS 105:
  https://introlab.cs.princeton.edu/
- These sessions are specific to **debugging** your assignments.
  Go to (regular or concept) office hours or study hall
  for **conceptual** help with course materials.

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# Grading

| Course Component | Percentage of Grade |
|---|---|
| Assignments Submissions * | 25 |
| Assignment Quizzes ** | 20 |
| Midterm Exam *** | 20 |
| Final Exam *** | 30 |
| Participation **** | 5 |

* Late assignments 10% off per day; first 4 late days waived.

** During lecture the day after the assignment submission is due.

*** During midterms week and final exam period, respectively – dates on website.

**** Did your involvement benefit the course?

- Lecture/precept attendance and precept/Ed participation

# Programming Assignments

Regular (every 1.5-2.5 weeks) assignments

0. Introductory survey
1. "De-comment" program
2. String module
3. Symbol table module
4. Debugging directory and file trees *
5. Assembly language programming *
6. Buffer overrun attack *

*(partnered assignment)


**Assignments 0 and 1 are available now: start early!!**

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# Policies

Learning is a collaborative activity!

- Discussions with others that help you understand concepts from class are encouraged

But programming assignments are graded!

- Everything that gets submitted for a grade must be your own work
- Don't look at code from someone else, the web, GitHub, etc. – see the course "Policies" web page
- Don't reveal your code or design decisions to anyone except course staff – see the course "Policies" web page
- AI chatbots or assistants are allowed, but tread carefully to avoid stunting your own learning. Embrace the struggle.

@jdent

Violations of course policies

- Typical course-level penalty is 0
- Typical University-level penalty is probation or suspension

Questions?

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# **ssh**! While I **bash** this shell…

A quick COS217 ⟷ English dictionary so that we're on the same page

# What's an Operating System?

## Narrow definition:

A piece of software that controls the interaction between programs and hardware (CPU, memory, storage, peripherals).

Also called a "kernel".

### Modern Kernel Examples

- Unix lineage: Linux, XNU
- VMS lineage: Windows NT

## Looser definition:

The kernel plus a variety of libraries and tools built upon it, that provide a specific experience to users (e.g., GUI).

### Modern OS Examples

- Linux kernel: Linux/GNU, Android
- XNU kernel: macOS, iOS
- Windows NT kernel: Windows

# What's a Command Line?

## Graphical User Interface (GUI):

Graphical "point and click" or "swipe and tap" paradigm for interacting with programs.

Programs usually designed to respond to "events", and display output via "widgets".

Often more user-friendly.

## Command Line Interface (CLI):

Text-based paradigm for interacting with programs.

Programs usually designed to accept typed (text-based) input and produce text-based output.

Easier to code, more flexible, easier to execute remotely, and easier to automate/script!

# What's a Terminal and a Shell?

## Terminal Emulator:

GUI program that relays typed input to a CLI program and displays its output on the screen.


## Shell:

CLI or GUI program for managing files and running other programs.

### GUI examples:

Mac finder / dock,
Windows file mgr / start menu

### CLI example: `bash`

# What's `ssh`?

`ssh:`

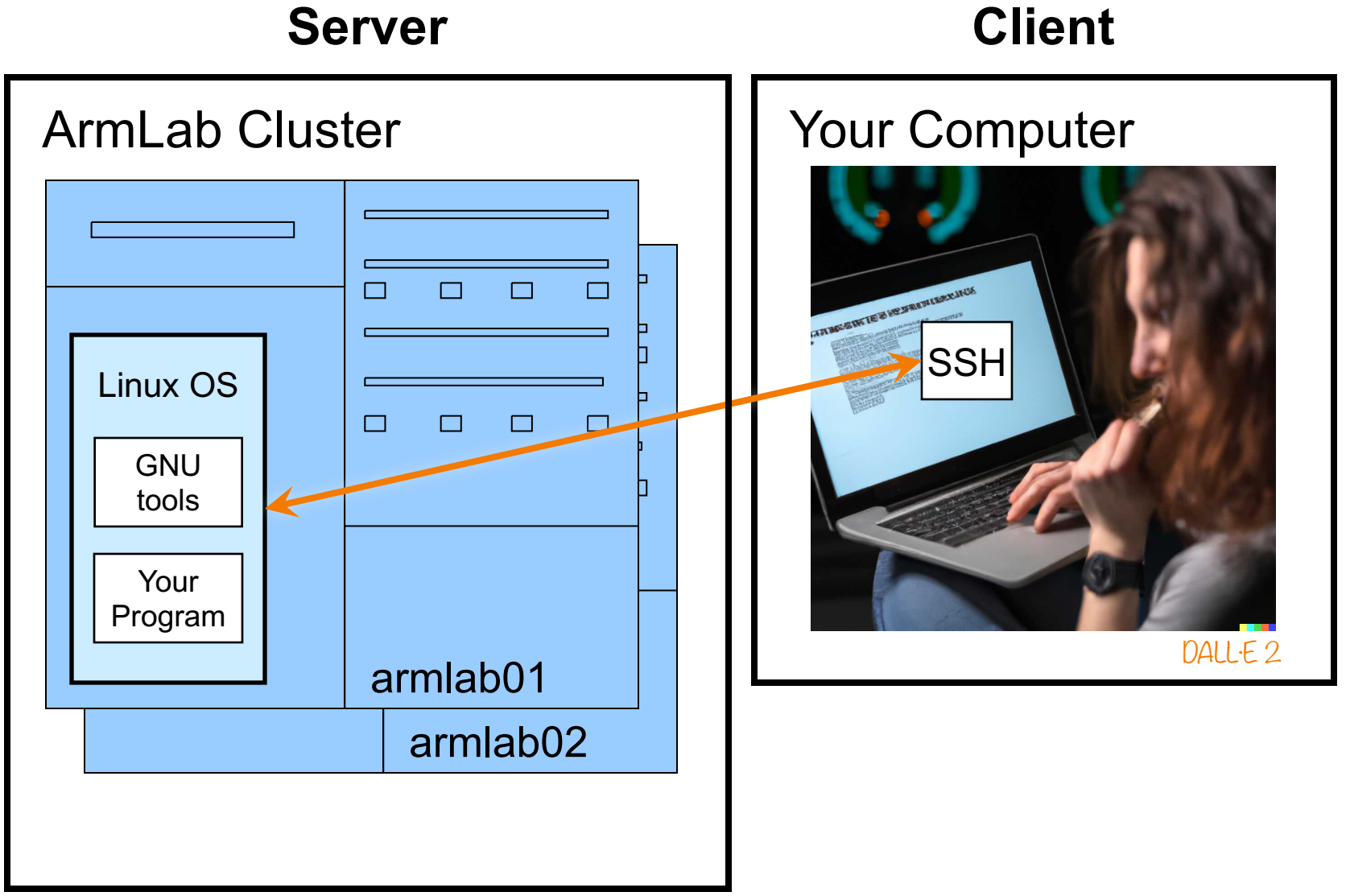
Stands for "secure shell"
(but it's not a shell!)

CLI program that connects to `sshd` on another computer and relays text back/forth securely.

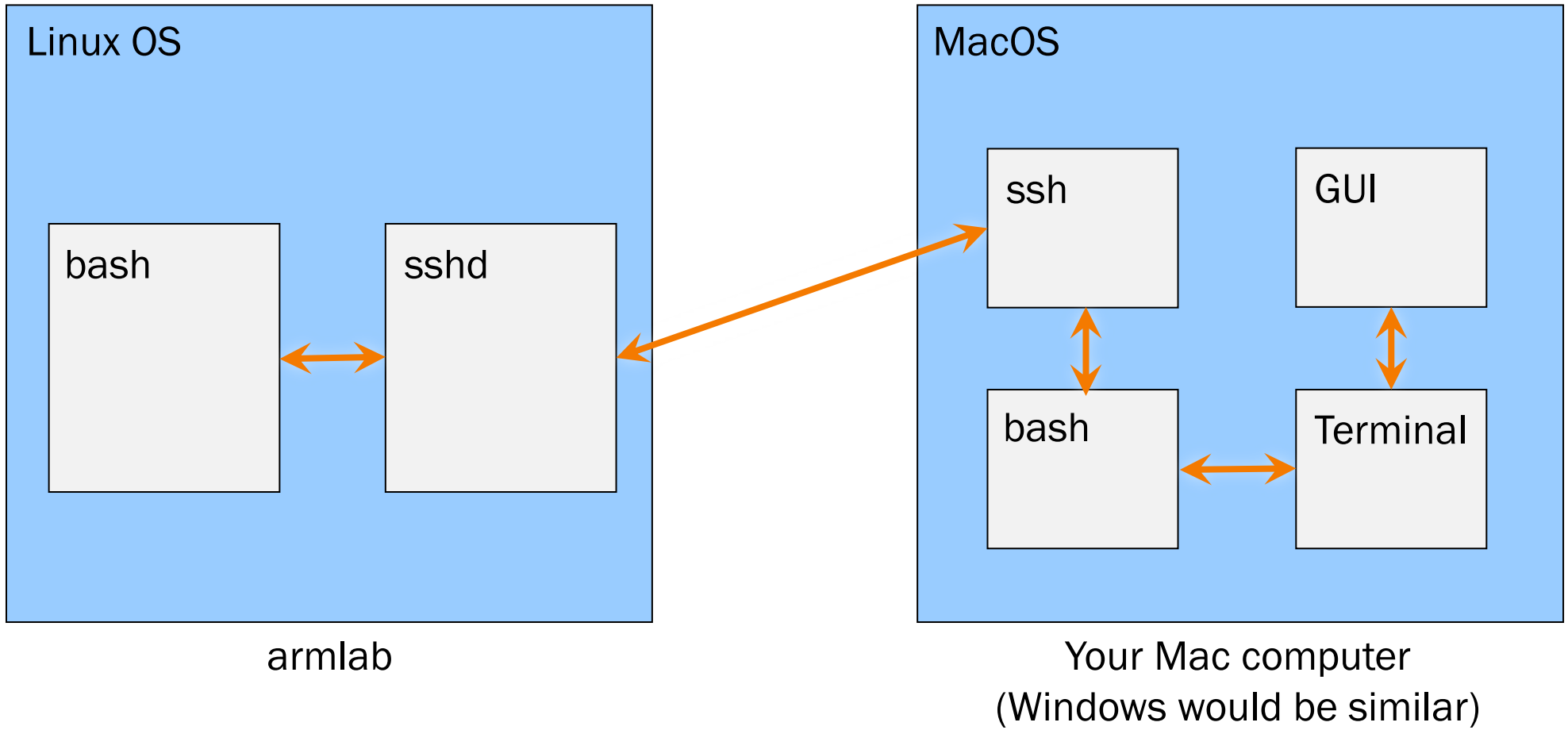
`sshd:`

Program that runs continuously on a server, accepts network connections from ssh clients, and relays text back/forth to a local shell (e.g., `bash`).

# Programming Environment – The Illusion



# Programming Environment – The Reality



# What's a Text Editor?

Text Editor:

Allows editing *plain text*:
just a sequence of characters.
Examples: TextEdit, Notepad,
Sublime Text, emacs, vi

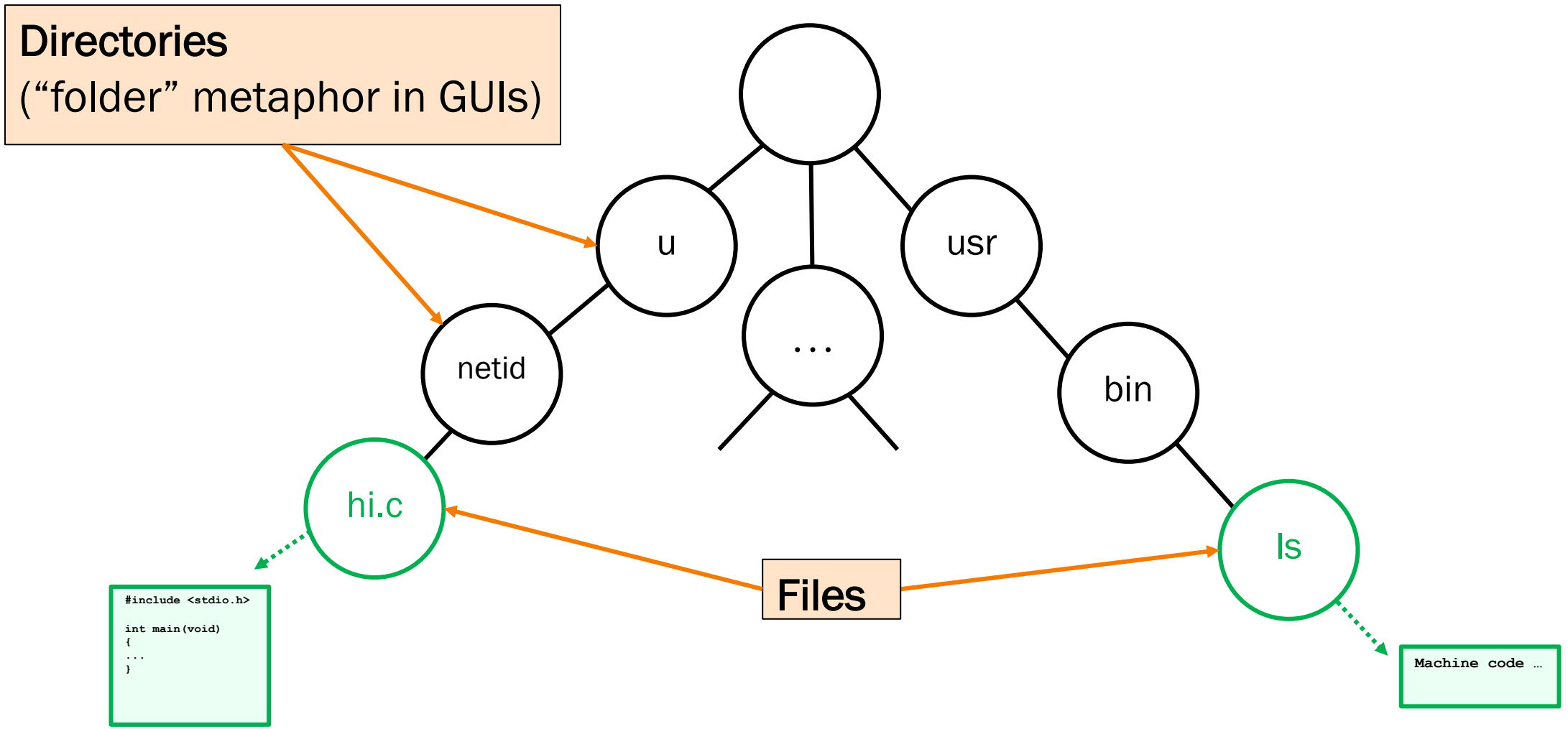
Word Processor:

Allows editing text with formatting
(various fonts, paragraphs, etc.)
Does *not* output plain-text.
Examples: Word, Pages

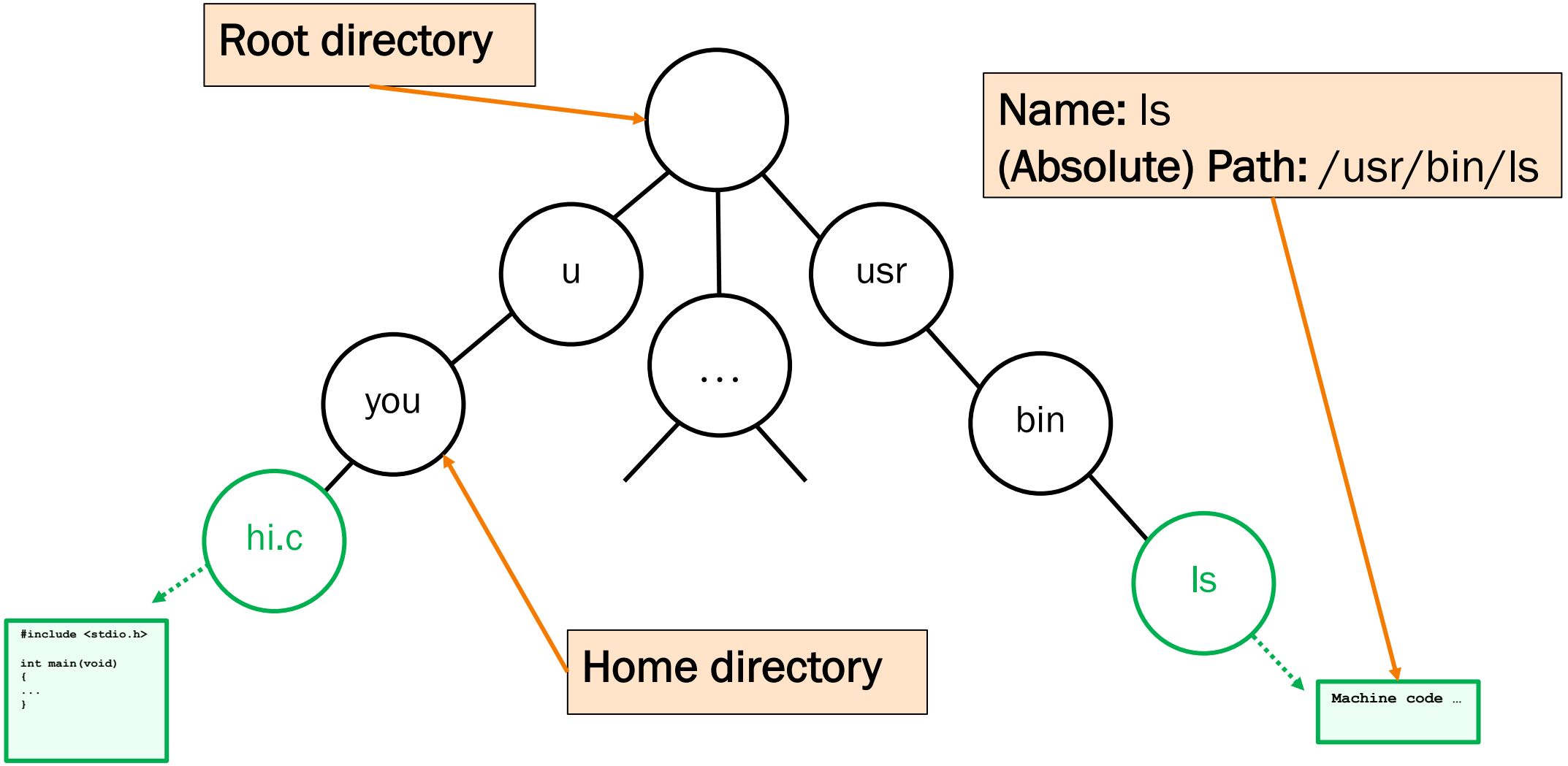
Integrated Development Environment (IDE):

Text editor optimized for code – usually integrates syntax coloring, compiling, searching for errors, sometimes suggesting variable names or code snippets.
Examples: IntelliJ, VS Code, {emacs, vi} *with the appropriate configuration*

# Filesystems



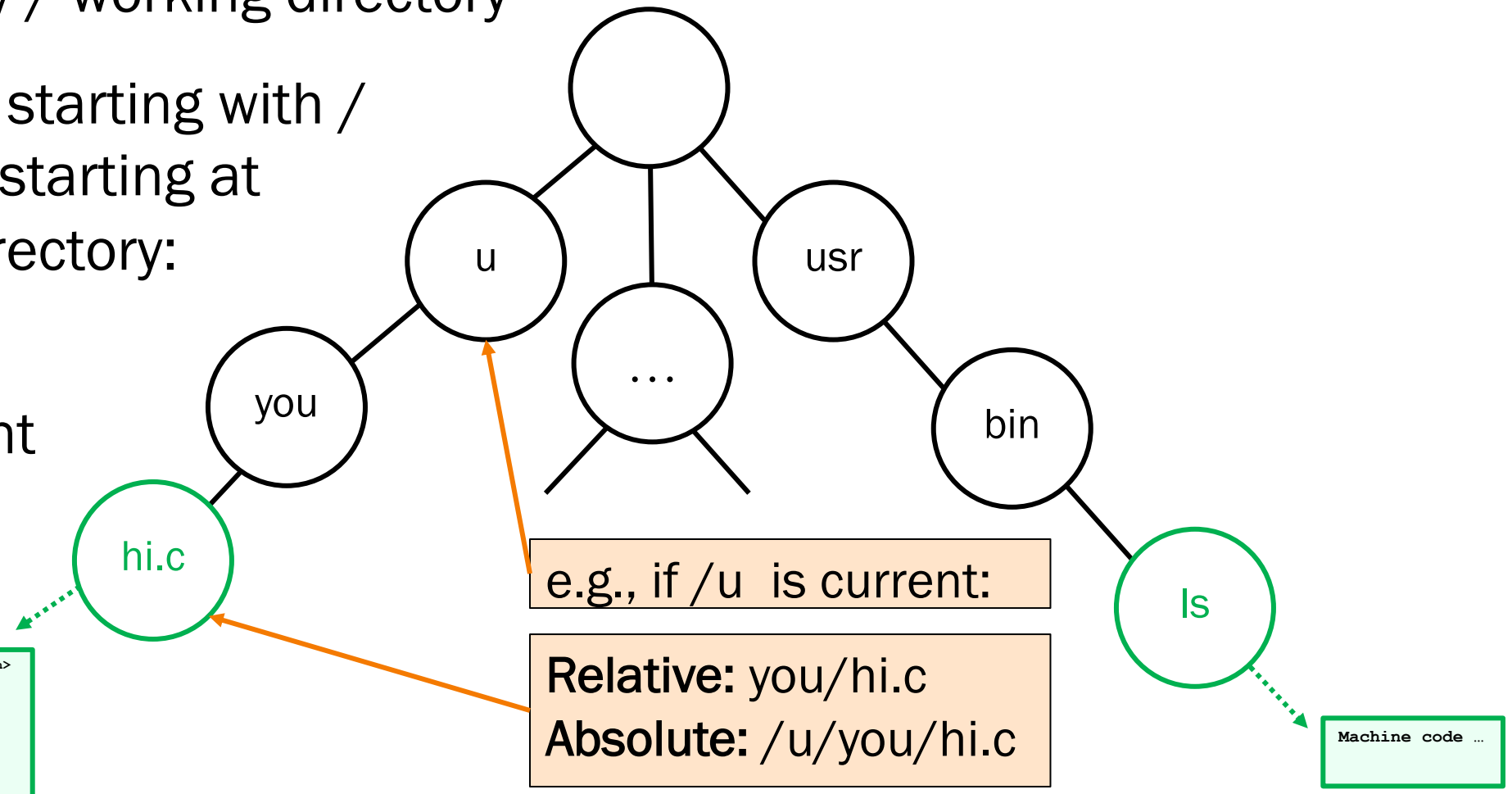
# Filesystems



# Filesystems

Current directory / working directory

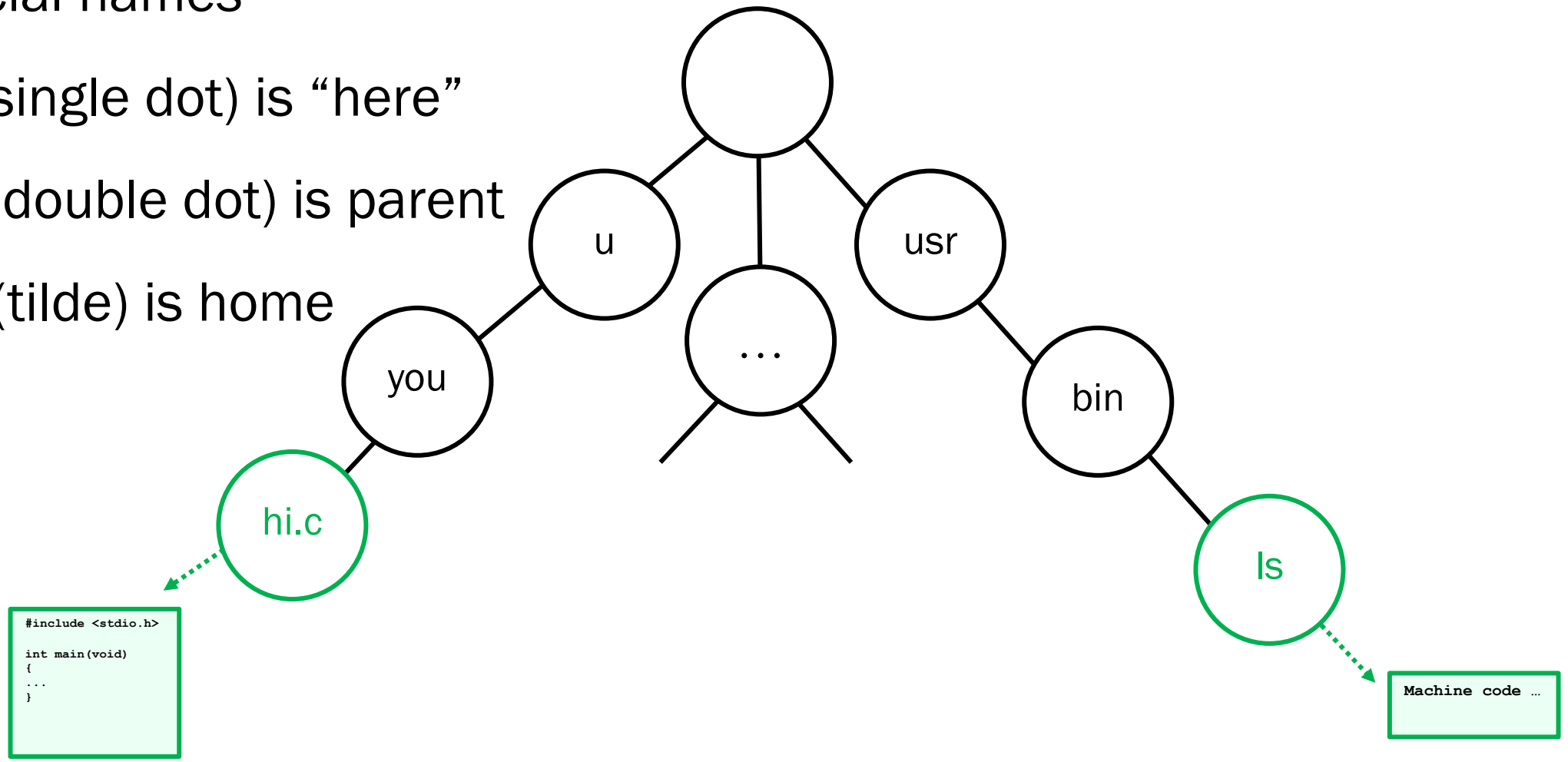
- Any name *not* starting with / is interpreted starting at the current directory: *relative* path
- Change current directory with *cd* command



# Filesystems

Special names

- . (single dot) is “here”
- .. (double dot) is parent
- ~ (tilde) is home



# Next steps …

- Check out website and policies **soon**
  https://www.cs.princeton.edu/~cos217
- Precepts start today/tomorrow!
- For more on Linux/Shell – optional (but strongly encouraged) lecture videos from Fall 2020:
  - "Getting Started with bash" walkthrough
  - Advanced bash walkthrough