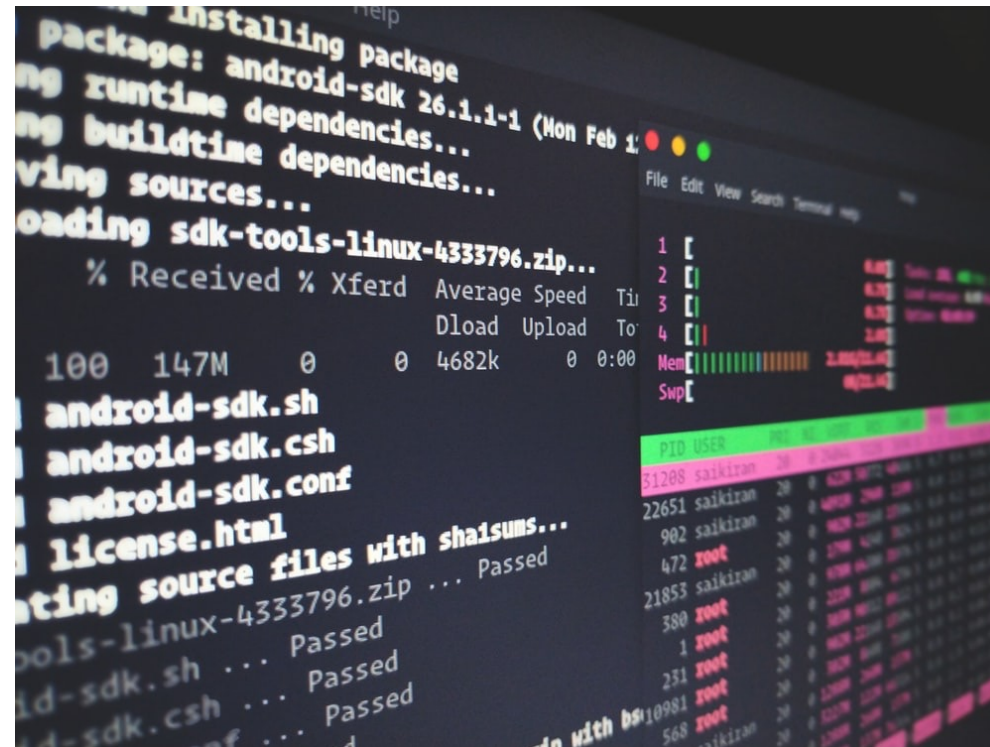# COS 217: Introduction to Programming Systems

Intro to Linux and the Shell

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ssh! While I bash this shell...

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

avcj.com

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, and *easier to execute remotely*.

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.
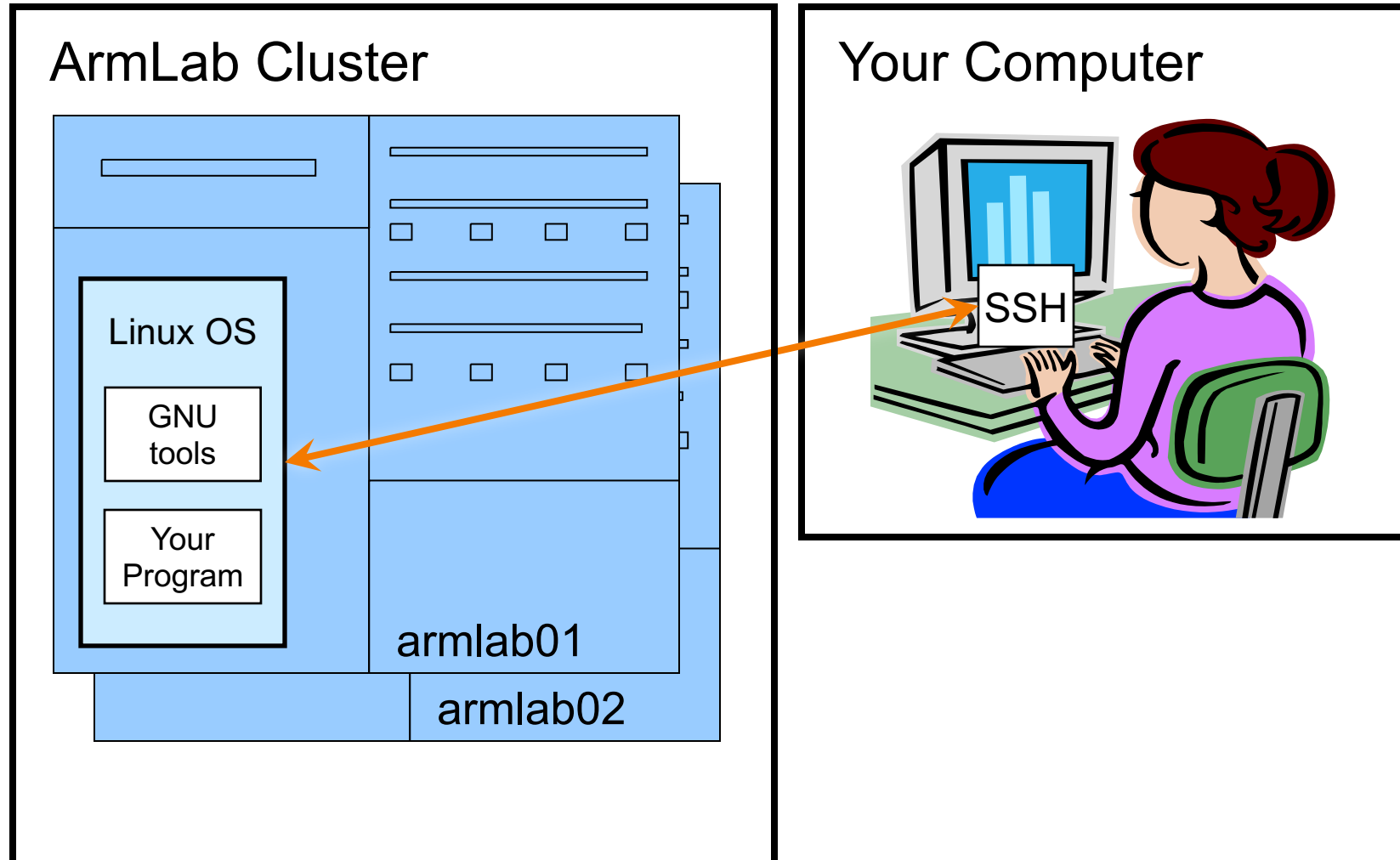
`sshd:`

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`).
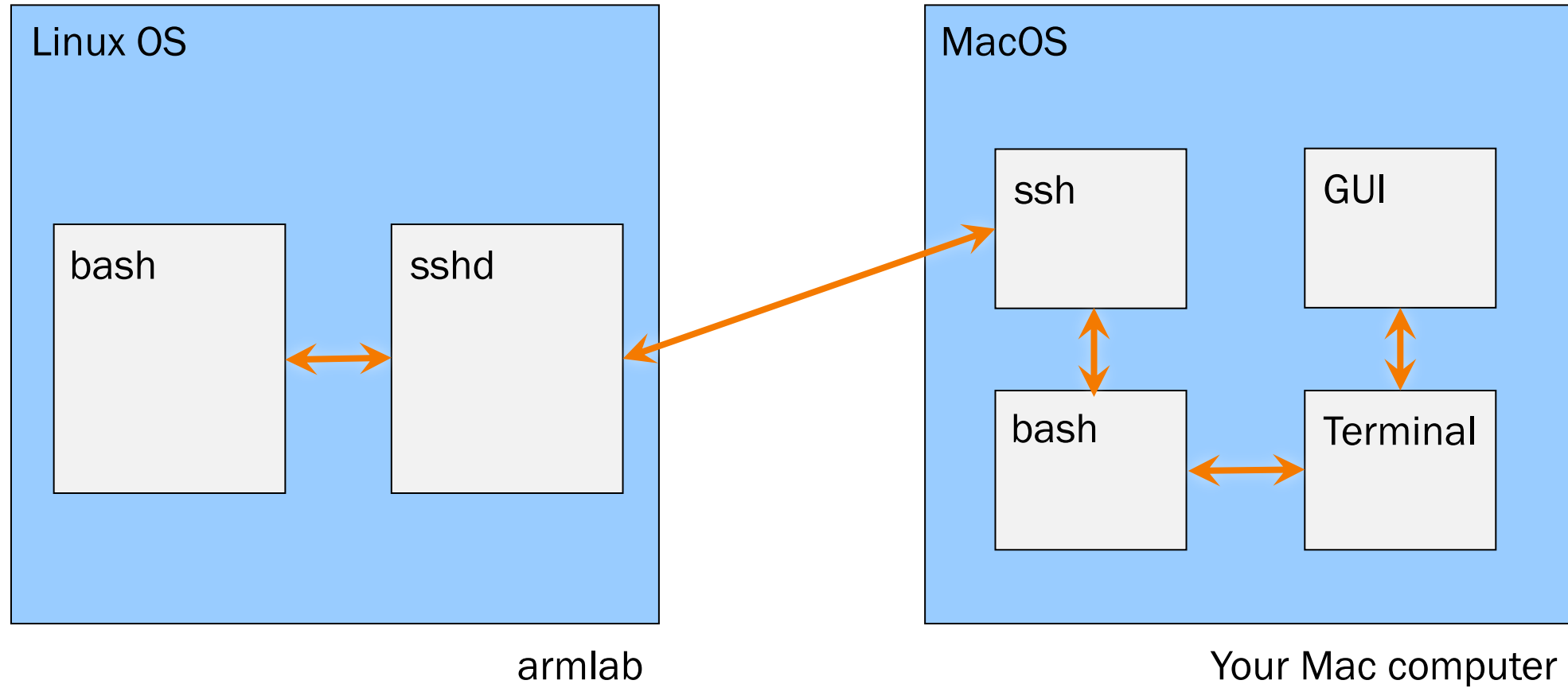
Programming Environment – The Illusion
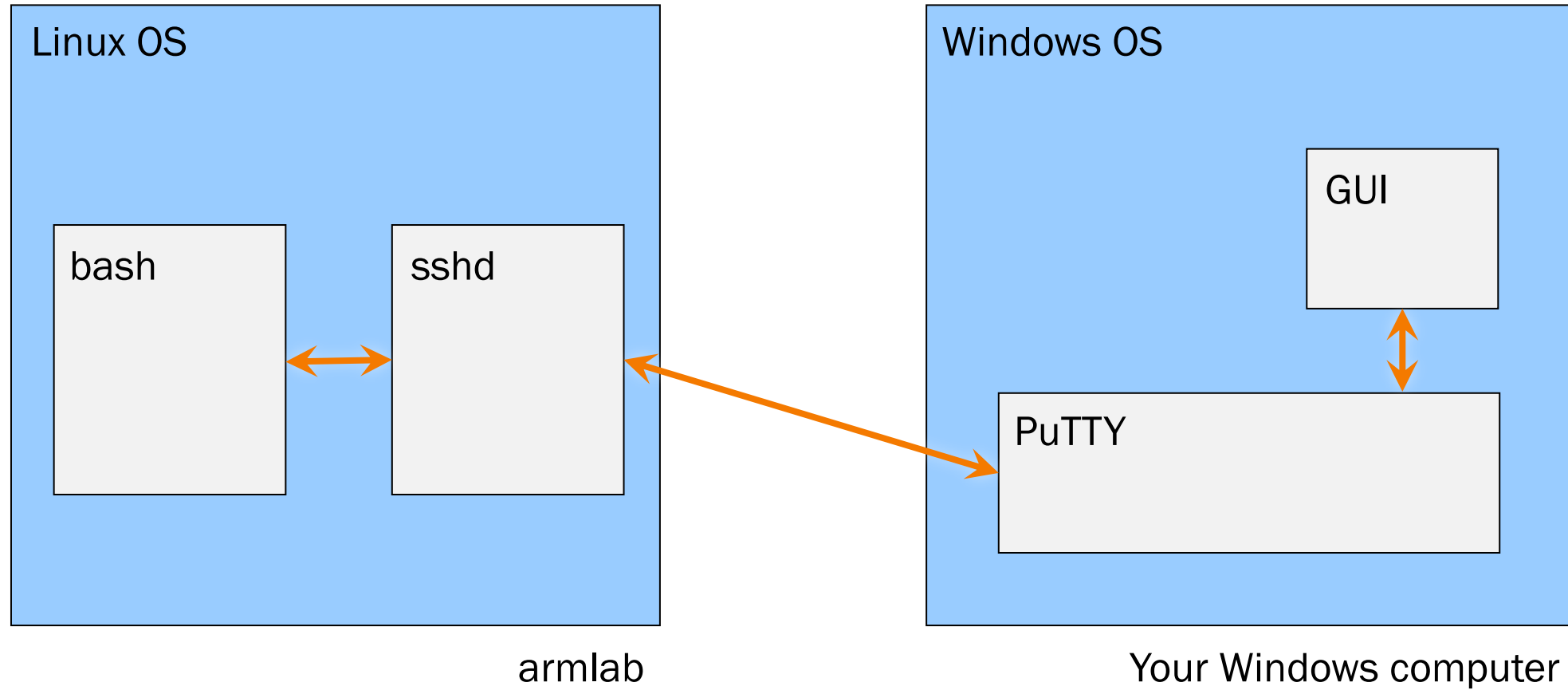
Server

Client

ArmLab Cluster

Your Computer

Linux OS

GNU tools

Your Program

SSH

armlab01

armlab02

Linux OS

bash

sshd

armlab

MacOS

ssh

GUI

bash

Terminal

Your Mac computer

8

Linux OS

bash ↔ sshd

armlab

Windows OS

GUI

PuTTY

Your Windows computer

9

What's a Text Editor?

Text Editor:

Allows editing *plain text*:
just a sequence of characters.

Examples: TextEdit, Notepad, emacs

Word Processor:

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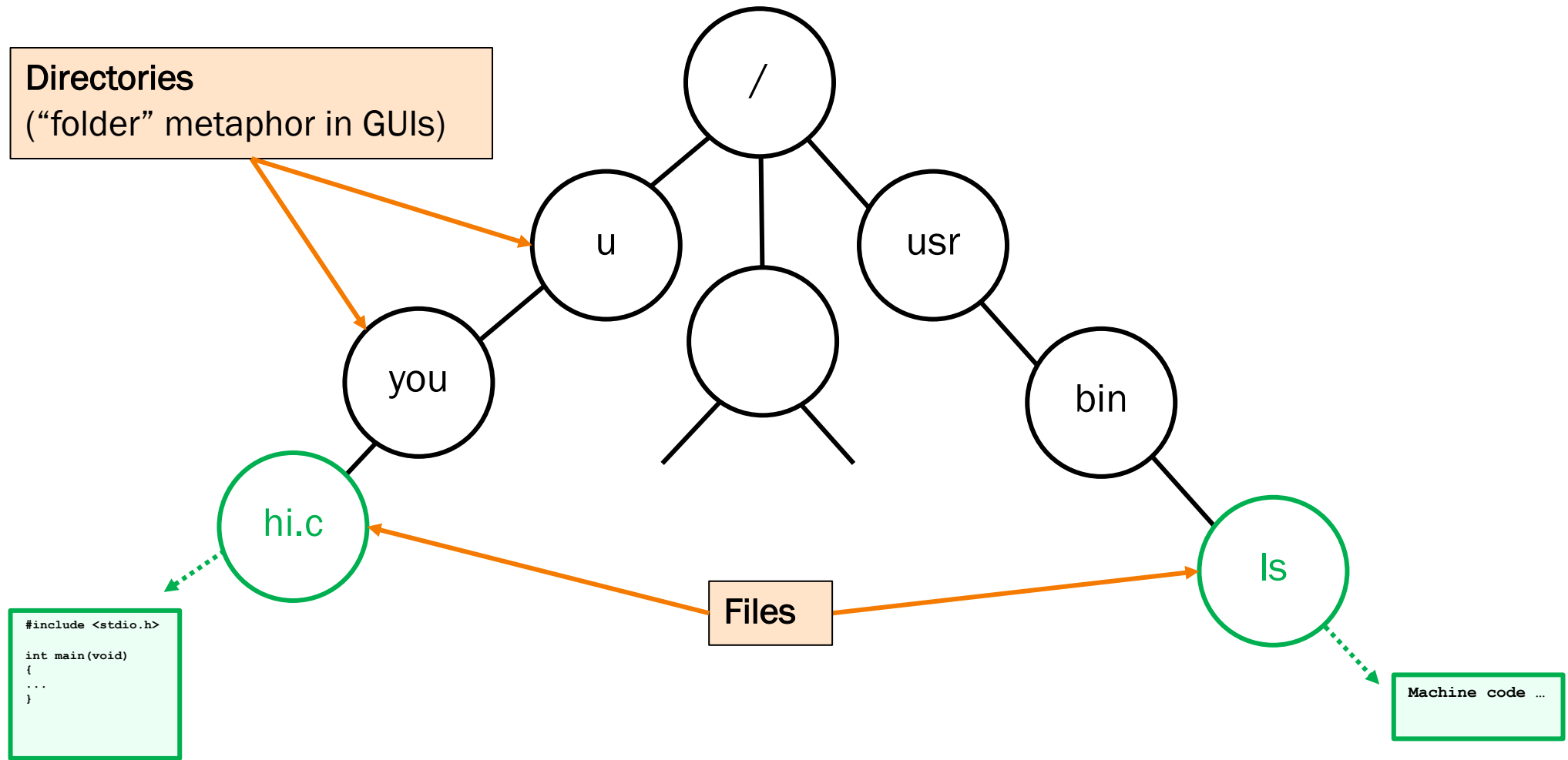Does *not* output plain-text.

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.
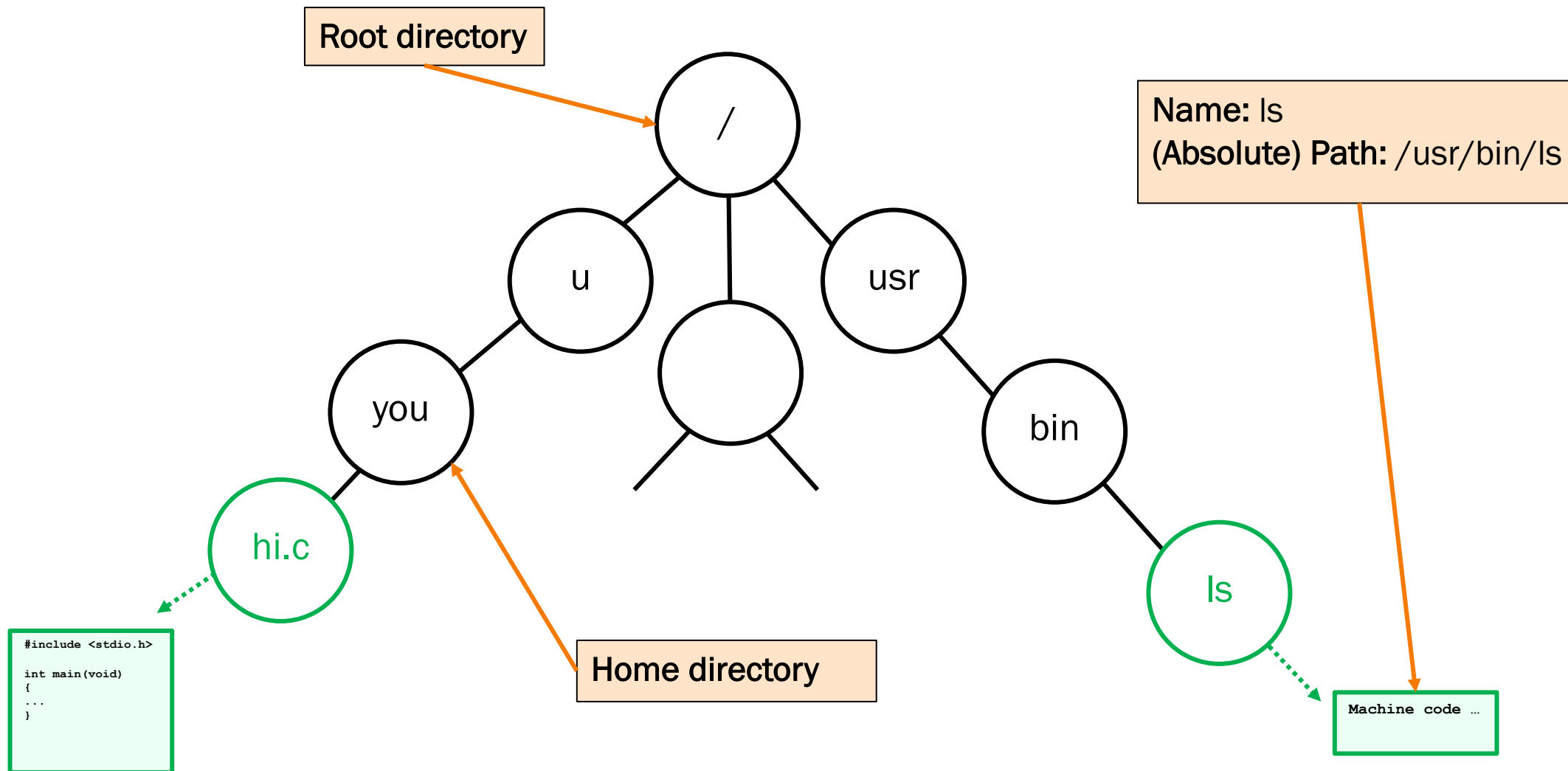
Examples: IntelliJ, Visual Studio, emacs *with the appropriate configuration*

Filesystems

Directories
("folder" metaphor in GUIs)

/

u

usr

you

bin

hi.c

ls

Files

```
#include <stdio.h>

int main(void)
{
...
}
```

```
Machine code …
```

Filesystems

Root directory

Name: ls
(Absolute) Path: /usr/bin/ls

/

u

usr

you

bin

hi.c

ls

Home directory

```
#include <stdio.h>

int main(void)
{
...
}
```
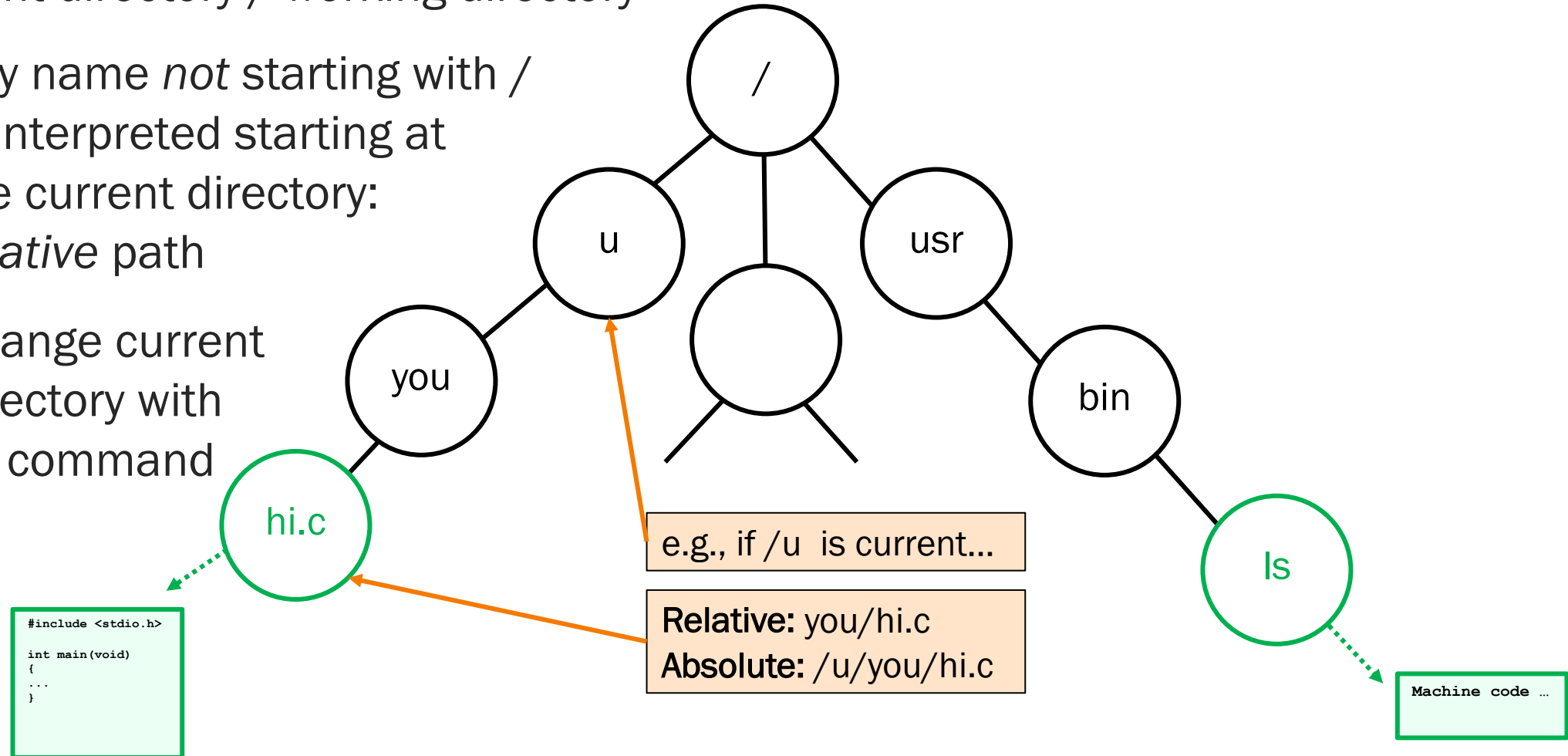
```
Machine code ...
```

Filesystems

Current directory / working directory

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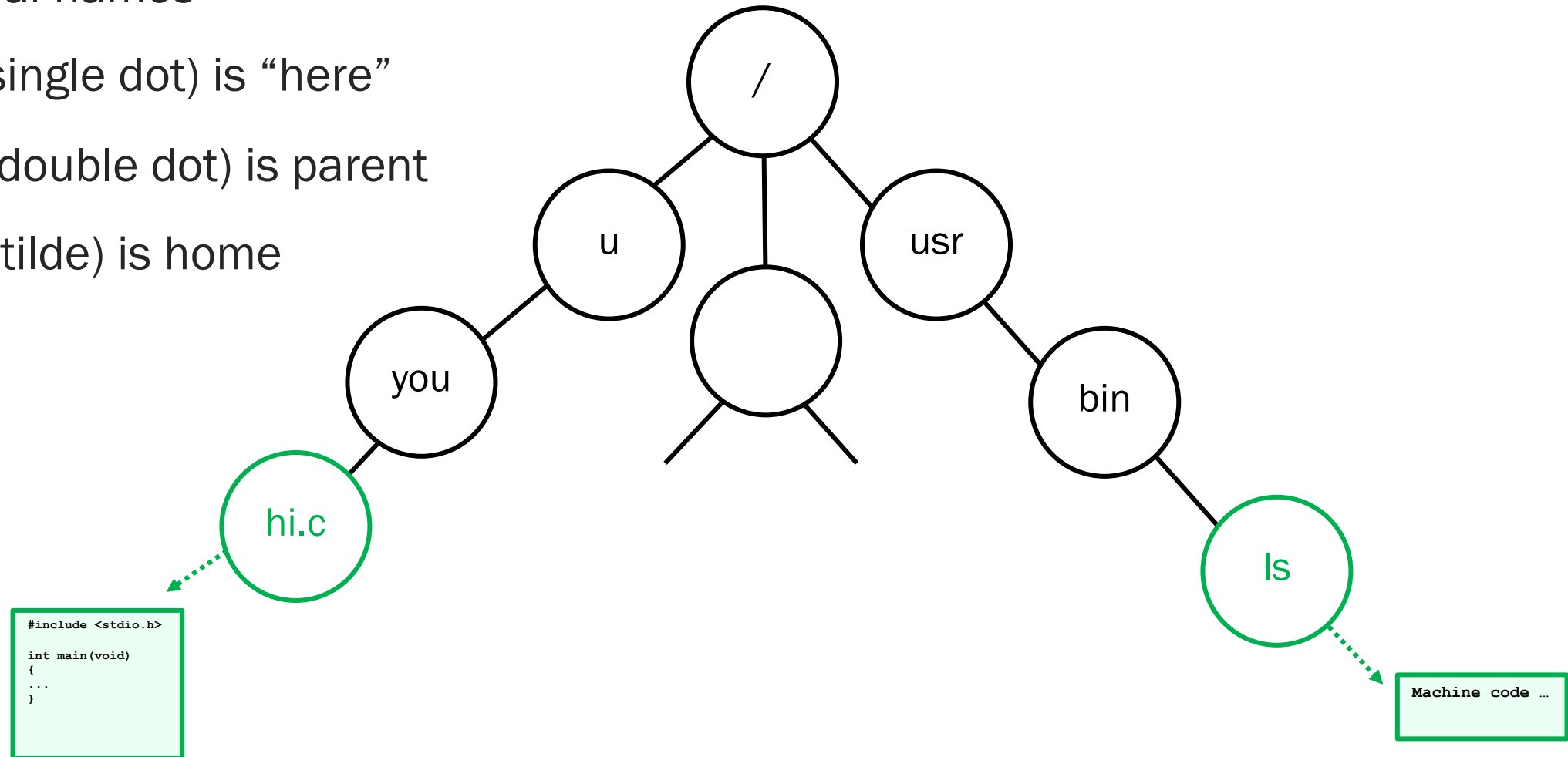
- Change current directory with *cd* command

/

u   usr

you   bin

hi.c   ls

```
#include <stdio.h>

int main(void)
{
...
}
```

Machine code …

e.g., if /u is current...

Relative: you/hi.c
Absolute: /u/you/hi.c

Filesystems

Special names

- . (single dot) is "here"

- .. (double dot) is parent

- ~ (tilde) is home


```
#include <stdio.h>

int main(void)
{
...
}
```

```
Machine code …
```

AND NOW THE DEMO...