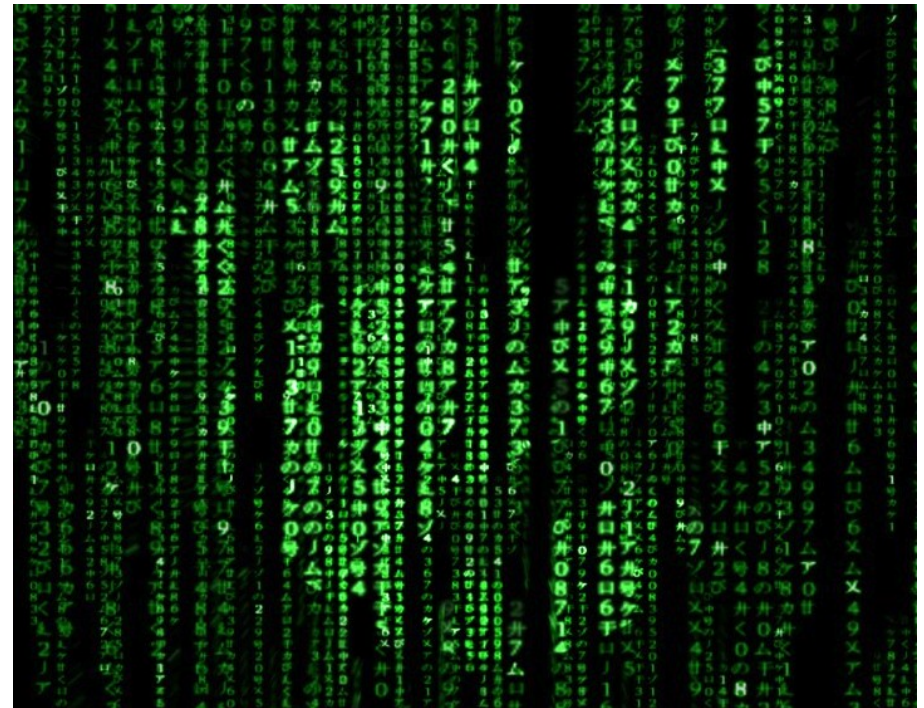


CS 261 Spring 2024

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Command Line Introduction

Linux and the command line

- **Linux** is a popular **operating system** in computer science
 - We'll study **operating systems** in more detail later this semester
 - For now, think of it as the low-level software that manages the hardware
- You interact with your operating system through an **interface**
 - In **Windows** and **macOS**, the primary interface is **graphical**
 - In **Linux**, the primary interface is **textual**

Graphical interfaces



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Textual interface



Why use the command line?

- More speed
 - Typing is often quicker than clicking
 - Easy to create shortcuts for common tasks
- More power
 - Write custom software / scripts
 - Chain together programs (e.g., w/ **pipes**)
- More flexibility
 - Command-line arguments to customize behavior
 - Work remotely even if your connection is slow

Computer conversations

- **Shell** programs facilitate a command/response conversation with a computer system
 - Example: `sh`, `bash`, `zsh`, `PowerShell`
- **Terminal** programs provide a visual interface
 - Examples: `Terminal`, `iTerm2`, `gnome-terminal`
- **SSH clients** provide remote access
 - Examples: `ssh`, `PuTTY`, `MobaXterm`
- **Text editors** allow you to edit files
 - Examples: `nano`, `emacs`, `vim`

Context is important

- In a shell, the conversation context is the **working directory**
 - This is your current location in the file system (also called ‘.’)
 - Use ‘pwd’ to see the full path
 - Use ‘ls’ to list the files in the working directory
 - Other useful commands:

<code>cd <dir></code>	"change directory" to the given directory name
<code>cd ..</code>	change to the parent of the current directory
<code>cd</code>	change to your home directory
<code>less <file></code>	view a long file one screen at a time
<code>cp <src> <dest></code>	copy a file from "src" to "dest"
<code>mv <src> <dest></code>	move/rename a file from "src" to "dest"
<code>rm <file></code>	remove a file
<code>mkdir <dir></code>	create a new directory
<code>rmdir <dir></code>	remove a directory (it must be empty first!)
<code>man <command></code>	read help text about the given command
<code>tar -xvf <file></code>	extract a "tarball" (similar to a zip file)
<code>nano <file></code>	open a file in the Nano text editor

Command-line text editing

- Recommended: learn [emacs](#) or [vim](#)
 - Run “emacs” and press Ctrl-’h’ followed by ‘t’
 - Run “vimtutor”
- Alternative: just use [nano](#)
 - Run “nano <filename>” to open or create a file
 - Useful key combinations:
 - Ctrl-O Save (“Write Out”)
 - Ctrl-X Exit
 - Ctrl-W Search
 - Ctrl-K Cut line
 - Ctrl-U Paste (“uncut”) line
 - Ctrl-C See current line number
 - Ctrl-_ Go to a specific line number

JMU CS student server

- “stu” is a server running Linux that is available to all JMU CS students
 - Fully-qualified name: `stu.cs.jmu.edu`
 - Pre-configured for CS 261
 - Use for all project distribution and submission
 - You should already have an account
 - Username is your eID
 - Password is the same as your eID password
 - For technical support, email `cs-sysadmin@jmu.edu`
 - **(also CC me!)**

Accessing stu

- Windows
 - Run PowerShell (or download PuTTY or MobaXterm)
- macOS
 - Run Terminal (or download iTerm2)
- Debian-based Linux (e.g., Ubuntu, Mint)
 - Run `gnome-terminal`
- Run this command:
 - `ssh lam2mo@stu.cs.jmu.edu` *(use your eID!)*

More info here: wiki.cs.jmu.edu/student/stu/basics

Working on CS 261 projects

- **New for 2022:** support for Visual Studio Code
 - Install VS Code on your local computer
 - <https://code.visualstudio.com>
 - Install Remote SSH extension
 - Set up password-less SSH access to stu
 - Connect to stu in VS Code
 - Submit on stu via the command line
 - Video tutorials:
 - <https://youtu.be/-RBHz-Ep6Y0>
 - <https://youtu.be/WQTwtnrk8hc>



“Hello, World” in C

```
#include <stdio.h>

int main()
{
    printf("Hello, world!\n");
    return 0;
}
```

hello.c

Compiling C programs

(use “-c” flag to run only this portion of the sequence)

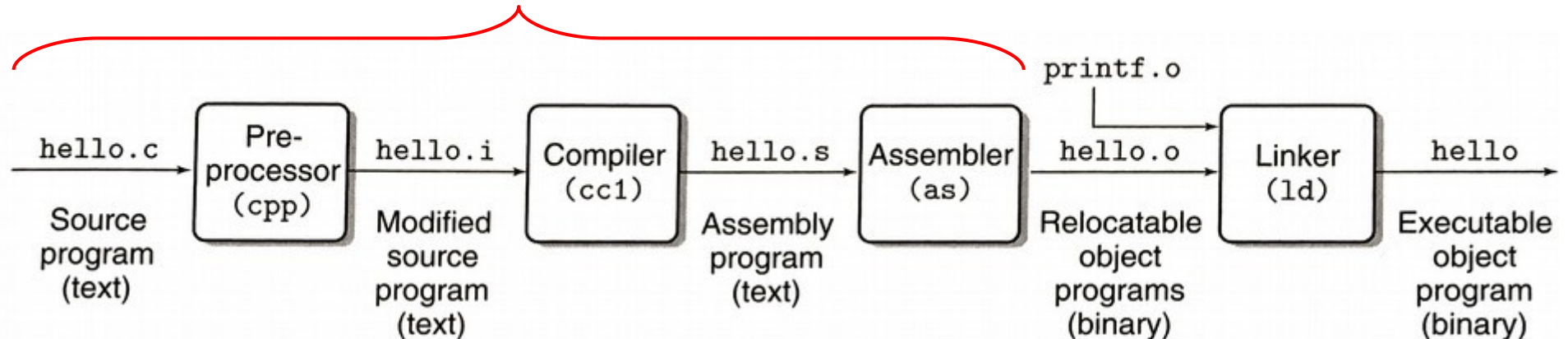


Figure 1.3 The compilation system.

```
linux> gcc -o hello hello.c
```

Here, the gcc compiler driver reads the source file `hello.c` and translates it into an executable object file `hello`. The translation is performed in the sequence of four phases shown in Figure 1.3. The programs that perform the four phases (*preprocessor*, *compiler*, *assembler*, and *linker*) are known collectively as the *compilation system*.

To run the program (after compiling): `./hello`

(“./” means “execute something in the current working directory”)

Using a build system

- The compilation process is usually streamlined using a **build system** (we'll use **Make**)
 - Provide a text file (must be called “Makefile”) that contains individual commands to compile and link the project
 - Run the entire build with one command: “make”
- Example Makefile:

The diagram shows a Makefile entry with three annotations. A blue arrow labeled 'target' points to 'hello:'. A blue arrow labeled 'dependency' points to 'hello.c'. A blue arrow labeled 'build command' points to the command 'gcc -o hello hello.c'.

```
target      dependency
  ↓         ↓
hello: hello.c
        gcc -o hello hello.c
        ↑
    build command
```

Getting started

- Complete today's command line and compilation lab
- Read or skim the project guide and P0 description
 - Project guide: w3.cs.jmu.edu/lam2mo/cs261/project_guide.html
 - P0 description: w3.cs.jmu.edu/lam2mo/cs261/p0-intro.html
- Watch and follow along with the P0 setup video
 - Link: <https://youtu.be/NrdZYWmkn04>
- Take the project guide quiz (due Friday)
 - Re-read the project guide and P0 description as needed
- Watch and follow along with the VS Code setup videos
 - <https://youtu.be/-RBHz-Ep6Y0>
 - <https://youtu.be/WQTwtnrk8hc>
- Begin work on P0 (intro to C)
 - **Don't panic!** There's no need to finish it immediately
 - Work on it incrementally over the next couple of weeks as you learn more about C