Introduction to Linux and Ubuntu

Unit 7

Learning Objectives

- Understand the basics of Linux, including the nature, architecture, and differences/ similarities with Windows
  - Linux overview
  - Common Linux terms and definitions
  - Linux system architecture
  - Differences and similarities with Windows
- Utilize the Linux command line environment at an introductory level
  - The “sudo” command

What is Linux

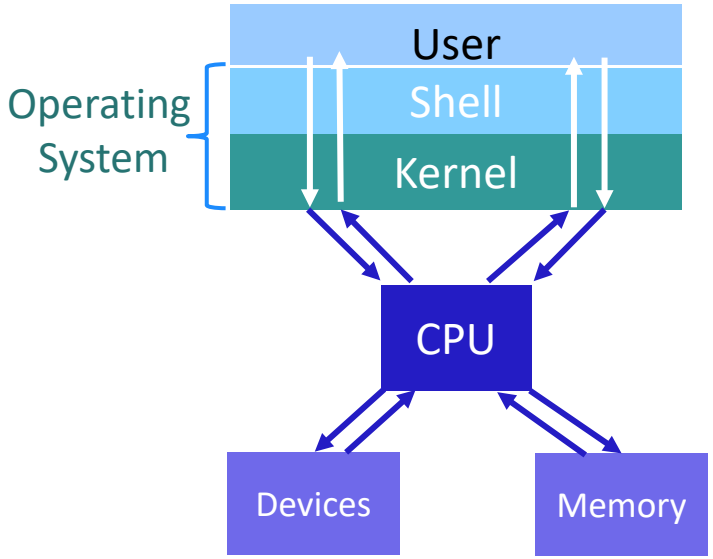
Section 1

A Family of Operating Systems

- Linux refers to a family of operating systems modeled off of Unix
- Can perform many of the same functions as Windows or OS X
- Built in a collaborative, open-source environment
  - Anyone may use, modify, or distribute the Linux kernel
  - Anyone can develop software to run on the Linux kernel
  - Many programmers collaborate to develop or improve Linux programs
  - Many Linux operating systems and add-on programs are free

Linux Kernel

- A kernel is the core component of an OS
  - Windows operating systems have kernels, but since they are not open-source or packaged separately for programmers to build off, they are less-often discussed
- Manages system resources (Memory, Processes, Input and Output Devices)
- When a user does something in the shell (the OS's user interface and applications), the kernel translates the command and prioritizes it against other requests for resources, so that it can be understood and executed by the CPU



Different Linux Operating Systems

- There are many different **flavors** (OSes) built off the Linux kernel
  - **Ubuntu:** Most popular flavor. It is free and is the most user-friendly.
  - **Mint:** A popular variation of Linux.
  - **Red Hat:** Designed by a company that develops specialized flavors for government and big business.
  - **Fedora:** An open-source, free version of Red Hat. Used frequently as a test bed for Red Hat programs.
- These **flavors** are similar at the basic level but can have very different interfaces and specialized commands.

Source: http://www.ubuntu.com/

Source: http://www.linuxmint.com/

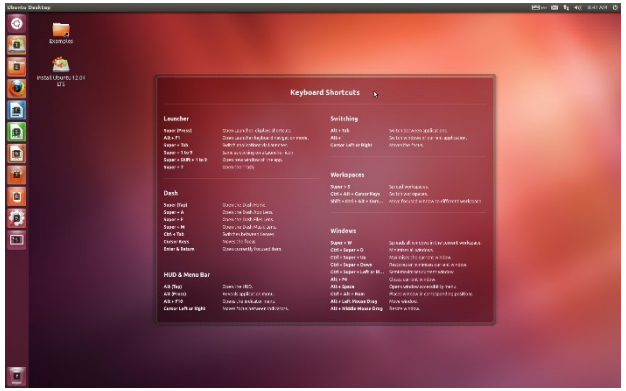
Source: http://www.redhat.com/

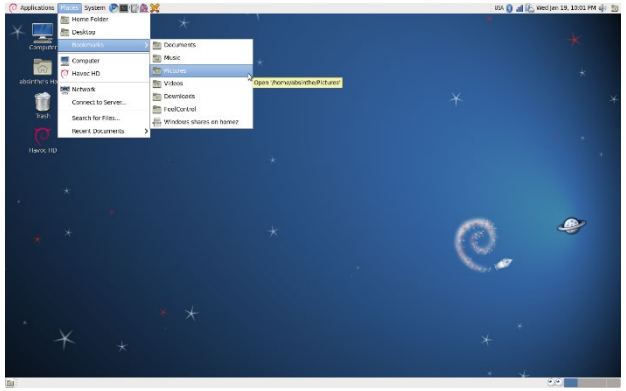
Source: https://fedoraproject.org/

Differences between Linux flavors

Ubuntu with Unity Environment

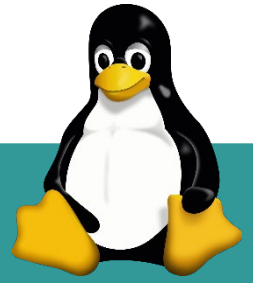
- Different default desktop environments
  - Ubuntu uses Unity
  - Debian uses GNOME
- Different purposes and target audiences
  - Ubuntu and Debian are for general audiences
  - Kali is used for security, auditing, and forensics
- Different file systems and architecture support (32-bit or 64-bit)
  - Ubuntu and Debian have the same file system and have both 32-bit and 64-bit versions
- Different package management and installation
  - Ubuntu and Debian both use the APT package management tools
  - Fedora and Red Hat use *yum*





Debian with GNOME Environment

Differences between Linux and Windows

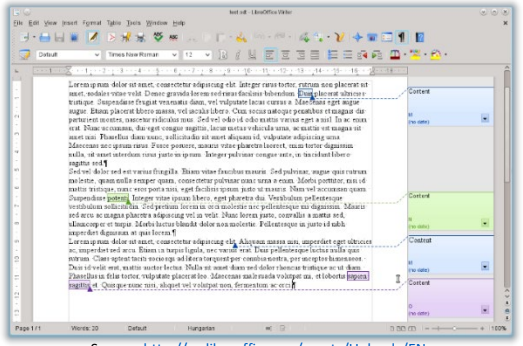


LINUX	WINDOWS
Open source and free	Windows OS and applications are paid
Commonly used by developers for easy distribution	More popular and therefore programs are more profitable
Comes with many different desktop environments	Comes with the default GUI that offers slight modifications
Command Line Interface (CLI) used commonly as an alternative to the GUI	Command line that can be accessed in the GUI
Less prone to Malware	More prone to Malware
Fewer compatible hardware	More compatible hardware

Similarities to Windows

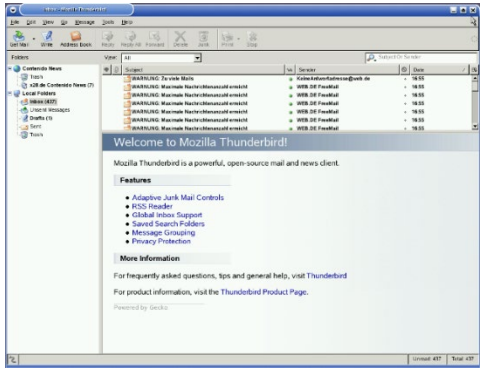
- Can be servers and workstations
  - Linux servers and workstations are more similar than Windows ones. Linux servers come pre-installed with server applications
- Can complete similar tasks
  - There are Linux programs that function like to Microsoft Office (LibreOffice), Outlook (Thunderbird), etc.
- Are stable and have significant support
- Subject to very similar vulnerabilities
  - Linux systems are targeted less frequently by malware, but still have many of the same vulnerabilities and patches (firewalls, password policy, etc.)

LibreOffice



Source: http://es.libreoffice.org/assets/Uploads/EN-Project_images/4.0NewFeatures/Writer/Comment-text-range.png?r=45758

Mozilla Thunderbird



Source: http://commons.wikimedia.org/wiki/File:Mozilla_thunderbird_empty_screenshot.png

Ubuntu Terminology and Concepts

Section 2

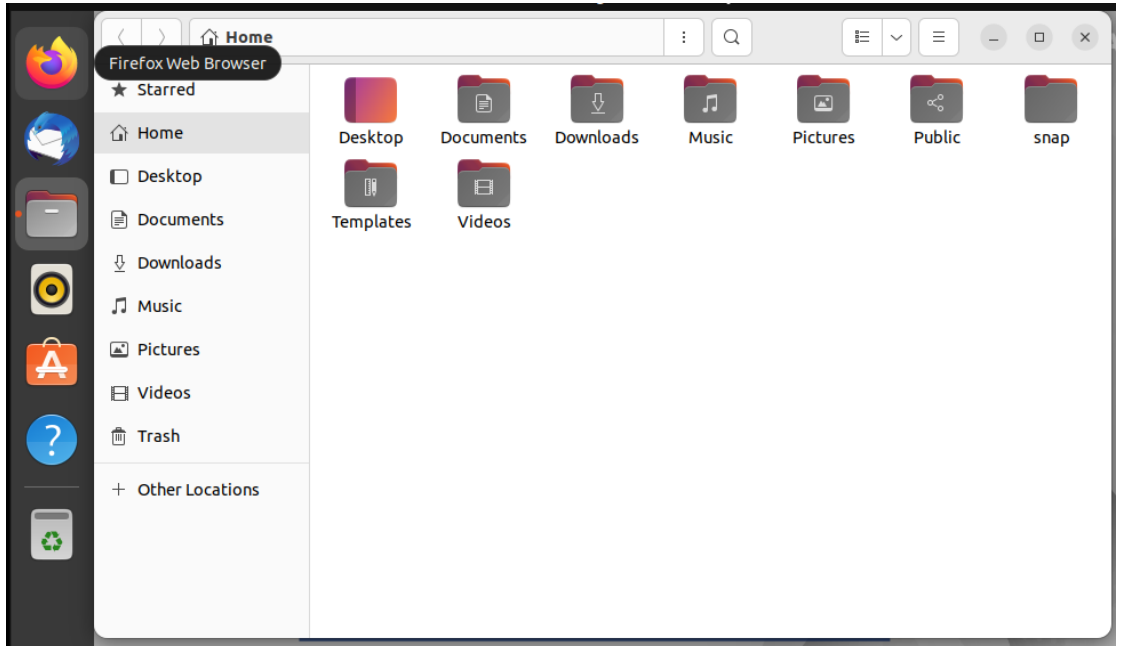
The Root Account

- Account types: **User** and **Root**
- **Root –** The Linux Administrator account
  - Like the built-in Administrator in Windows, Linux comes with a built-in root account
  - A system can have multiple root accounts
  - Users can switch whether their actions are carried out as a user or root
  - When someone enacts root permissions, they can access all of the files and run all commands on a system, as well as set policies for other users
- Root actions require a password in both GUI and command line
- **Authentication vs. Authorization**
  - Root users are authorized to do many different tasks, but they must first authenticate their identity by entering their password

Source: http://eswalls.com/wp-content/uploads/2014/01/i-am-root.png

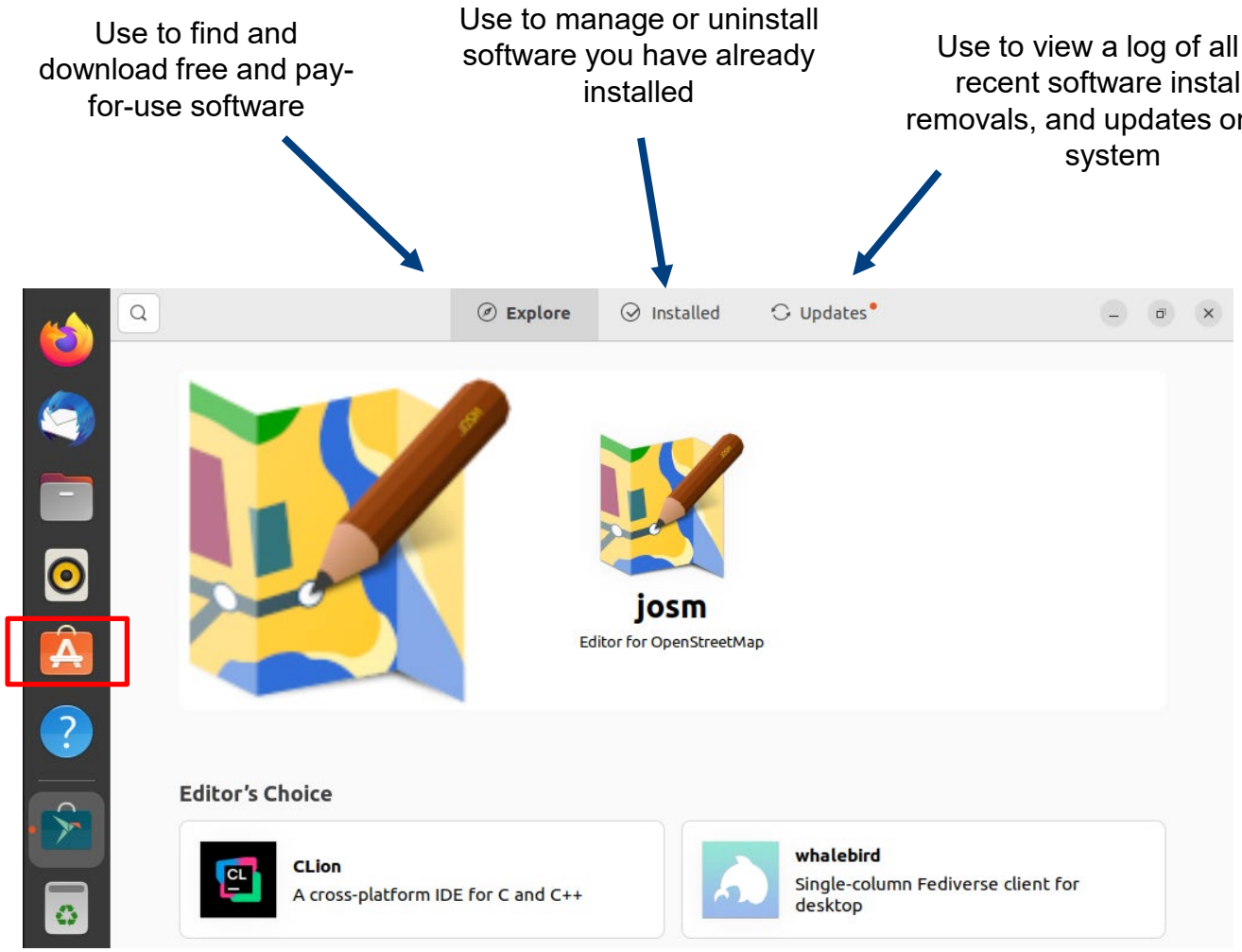
Ubuntu File System

- Different from the Windows file system
  - Does not specify on which drive a folder is stored and uses forward slashes (/) to identify root directories
- Example:
  - Windows: C:\Documents\hello.txt
  - Linux: /home/CyberPatriot/hello.txt
- Important folders:
  - /home: stores each user's documents, media files, etc. Users can only access their own folders, unless they have enacted root permissions.
  - /boot: contains startup files and kernel files. Should not be modified unless you are an expert user.
  - /etc: contains configuration files with settings for various parts of the system.
- The file system can be accessed by clicking the file cabinet on your Ubuntu menu bar



Adding and Removing Software

- Linux software is bundled into packages
- Packages are managed by package managers
  - In Ubuntu, the package manager is called “Ubuntu Software Center.”
  - It looks and functions a lot like Mac’s App Store
  - Many programs are free
- To access Ubuntu Software Center, click the shopping bag on your Ubuntu menu bar
- Users must enact root permissions to install, uninstall, or modify software

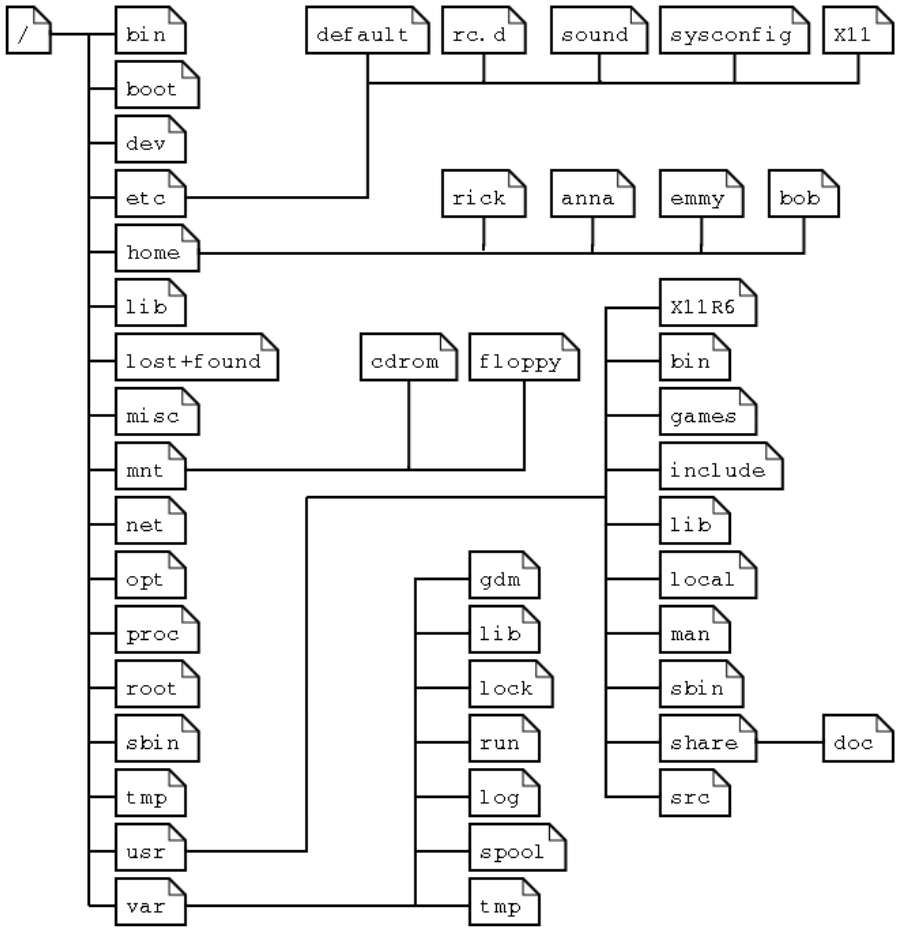


Introduction to Ubuntu Command Line

Section 3

Linux Filesystem

- Linux files are stored in directories, which are the same as folders in windows
- Linux filesystem tree
  - Base or trunk of the tree is the *root directory* (/)
  - Branches of the tree are *directories*
  - Leaves of the tree are *files*
- Linux commands, files, and directory names are case sensitive



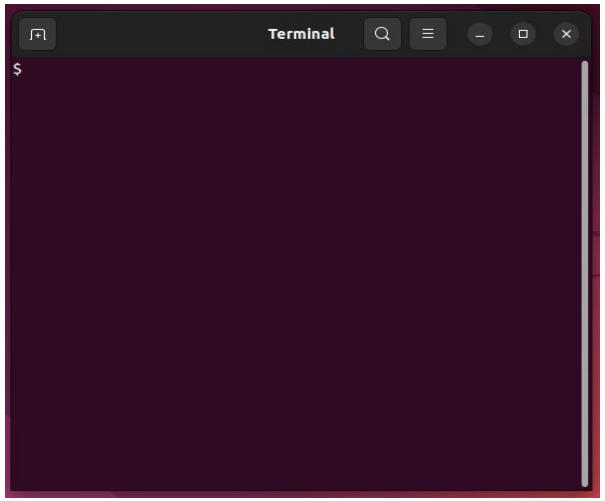
Command Line Pros and Cons

Pros

- Provides the user more control
  - Unlike the GUI, which pre-programs certain tasks, command line allows you to send more detailed and customized commands
- Only option for some tasks in Ubuntu
- Saves clicking time because it just requires a keyboard
- Uses less of the computer's processing power than the GUI (no animations or graphical processing)
- Can be made easier with scripting
  - Scripts are sequenced lists of commands that allow users to send multiple commands at once
  - Can be used for routine tasks like backing up files, monitoring a system, and quickly gathering information about memory and processes

Cons

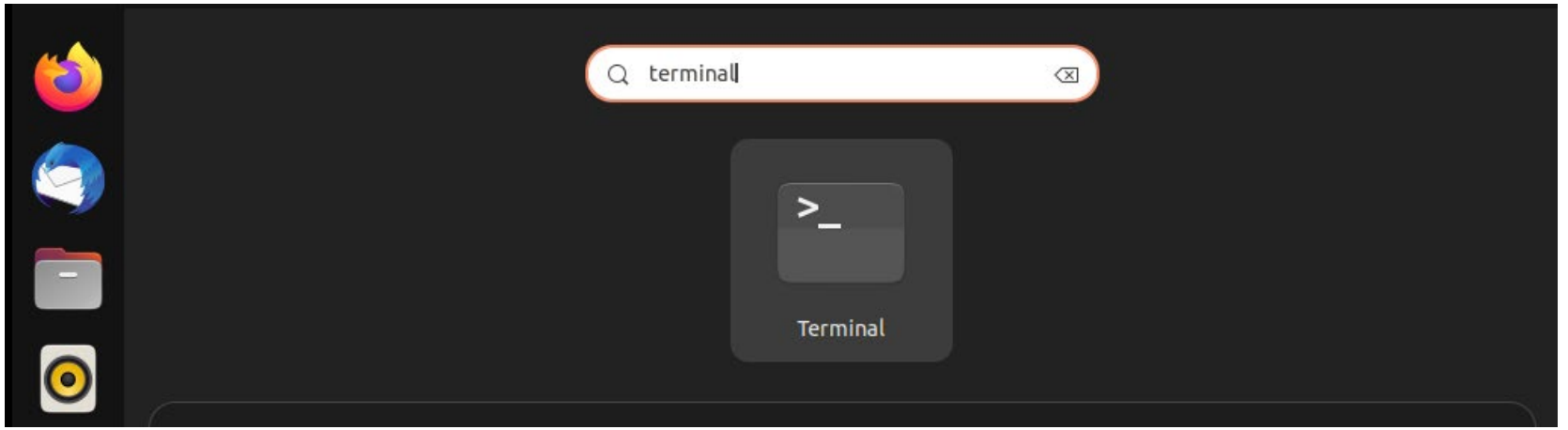
- Not as user-friendly as GUI
  - Requires memorizing commands or using a reference
- Harder to multitask
  - Having multiple command line windows open at once can be confusing, since they look nearly identical



Accessing The Command Line

- Terminal is the tool used to access the Ubuntu Command Line
- Click the Show Applications button 
- Type terminal
- Press Enter or click the icon labeled Terminal

  OR
- Press Ctrl-Alt-T



Using Terminal

- When typing commands in Terminal, it is very important to pay attention to capitalization and spaces
- Hitting Enter will execute your command and hitting Ctrl+D will close any commands you have running or exit the Terminal
- There are numerous Ubuntu command databases and command line tutorials online. Here are a few sites:
  - https://help.ubuntu.com/community/UsingTheTerminal
  - http://ryanstutorials.net/linuxtutorial/
  - http://manpages.ubuntu.com/
  - http://ubuntu-manual.org/

Command Syntax

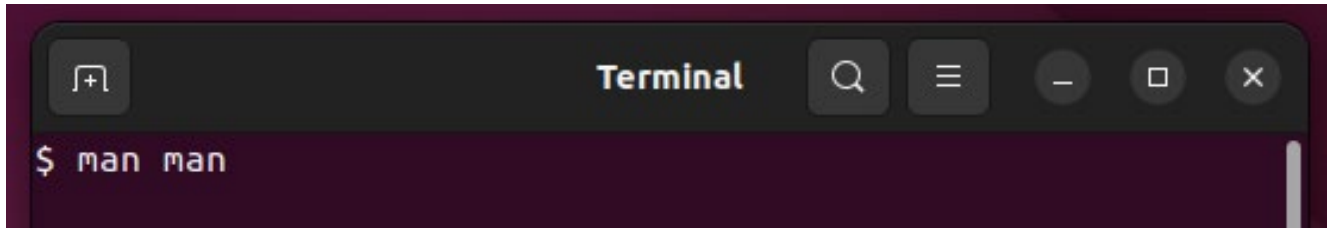
- Command: tells the computer what you want it to do
  - All other components of the syntax depend on what the command is
  - The “cat” command creates, displays, or copies files
- Option: customizes the output of the command
  - “-n“ told the computer to add a number to each line of text in the file you created
  - The effect an option has varies by command
  - Not required for all commands
- Operator: directs the output of the command
  - Not required for all commands
- File Name/Location: Tells the OS to which file you want the command and options to happen
- Like English sentences, Command Syntax can get very complex

Basic Navigation Commands

- pwd
  - “Present Working Directory”
  - Prints out your current working directory
- ls [FILE]…
  - “List Segments”
  - Optional file/directory paths as an argument
- cd [dir]
  - “Change Directory”
  - Optional directory path as an argument
- Absolute paths
  - Starts from the *root directory* (/)
  - cd /home/cyberpatriot/Music
- Relative paths
  - Start from the *current directory* (.)
  - cd ./Music or just cd Music
  - One dot (.) indicates the *current directory*
  - Two dots (..) indicates the *parent directory*

Command Manuals and Usage

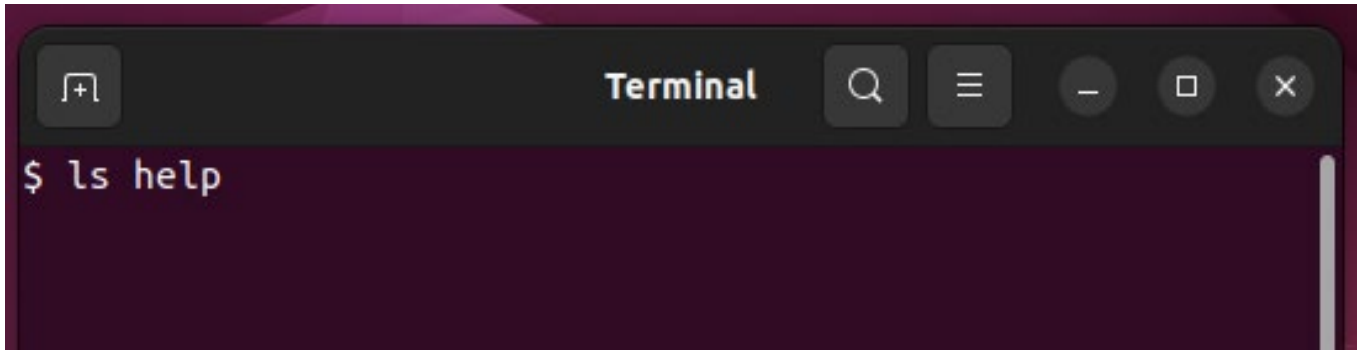
- man [section] page
  - "Manual"
  - Displays the manual for a command
- Type man man and press Enter
  - Displays the manual for the command "man"
  - Use the arrow keys or PgUp/PgDn to scroll up and down



- Type q
  - Exits man

Command Manuals and Usage

- Many commands have a --help or –h option
- Type ls --help and press Enter
  – Displays help for the command ls



File Contents and Output Redirection

- cat [FILE]...
  - "Concatenate"
  - Concatenate files and prints to standard output
  - Commonly used to print the contents of a single file
- file [FILE]...
  - determines the type of a file
- echo [STRING]...
  - displays a line of text in the command line
- [command] > [FILE]
  - The standard output of any command can be redirected to a file with a "greater than" symbol
  - This will create a new file or overwrite an existing file

Sample Command

Note: If the Linux Operating System does not have a CyberPatriot Directory, use another directory

1. In Terminal, type

   cat –n > /home/cyberpatriot/Documents/hello2.txt

   **Make sure to capitalize Documents and to put the spaces before –n, >, and /home

```
cyberpatriot@ubuntu:~$ cat > /home/cyberpatriot/Documents/hello2.txt
```

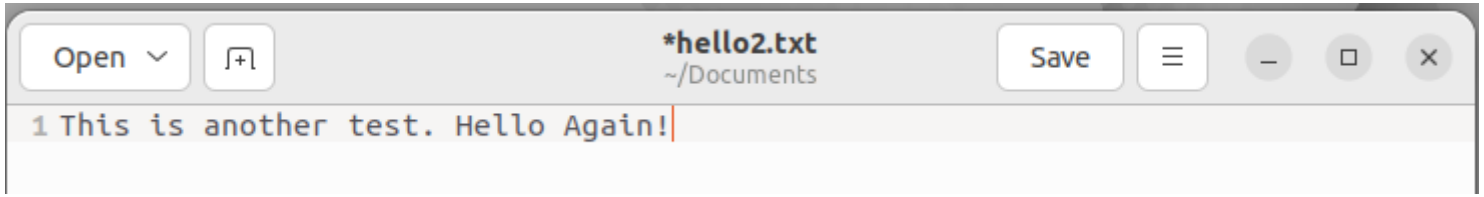
2. Hit Enter to execute the command
3. Type This is another test. Hello Again!

```
cyberpatriot@ubuntu:~$ cat > /home/cyberpatriot/Documents/hello2.txt
This is another test. Hello Again!
```

4. Hit Enter to execute the command
5. Type Ctrl+D to close your commands

Sample Command (cont.)

1. Close Terminal and open the Home Folder by clicking the orange folder on the Ubuntu menu bar
2. Navigate to the Documents folder
3. Double-click the hello2.txt file



- The commands you just entered created this text document
  - It includes the file name you selected, the text typed, and a “1” at the beginning of the line of text. The next few slides will examine why.

The sudo Command

- Allows an authorized user (one with root permissions) to temporarily elevate their privileges using their own password instead of having to know the password belonging to the built-in root account
- This command must be used to perform administrative tasks (e.g. adding a user account)
  - Example: To add “archimedes“ as a user on your system, type adduser archimedes and hit Enter
  - You will get the error message below because you have not authenticated yourself
  - Note: user names must be lower case

```
acyberpatriot@ubuntu:~$ adduser archimedes
adduser: Only root may add a user or group to the system.
cyberpatriot@ubuntu:~$
```

The sudo Command (cont.)

- Now try adding “archimedes” as a user by entering the sudo command first:
  - Type sudo adduser archimedes
  - Hit Enter
  - When prompted, type in your password and hit Enter
    - Note: Your password will not be visible when you type. This is an Ubuntu security feature.
    - Remember, the sudo command will only work if you are using an account with root permissions
  - When prompted, type a password and any other details you wish to add to the user account
  - Hit Enter

The sudo su Command

- The sudo su command is a variation of the sudo command
  - It tells the command line that you want to run all of the subsequent commands in your current session as root, so that you do not have to enter the sudo command and your password each time
- Try adding “riemann“ as a user on your system using the sudo su command:
  - Exit the Terminal and then restart it
  - Type sudo su
  - Hit Enter
  - When prompted, type in your password
  - Type adduser riemann
  - Hit Enter
  - Type a password and any other details you want to add to the user’s account
  - Hit Enter

Confirm Creation of User Accounts

- To check that accounts for “archimedes” and “riemann” were created when you entered your commands, click the gear icon on your Ubuntu menu bar and search "users" in settings.
- Select "Users Add or remove users and change your password".