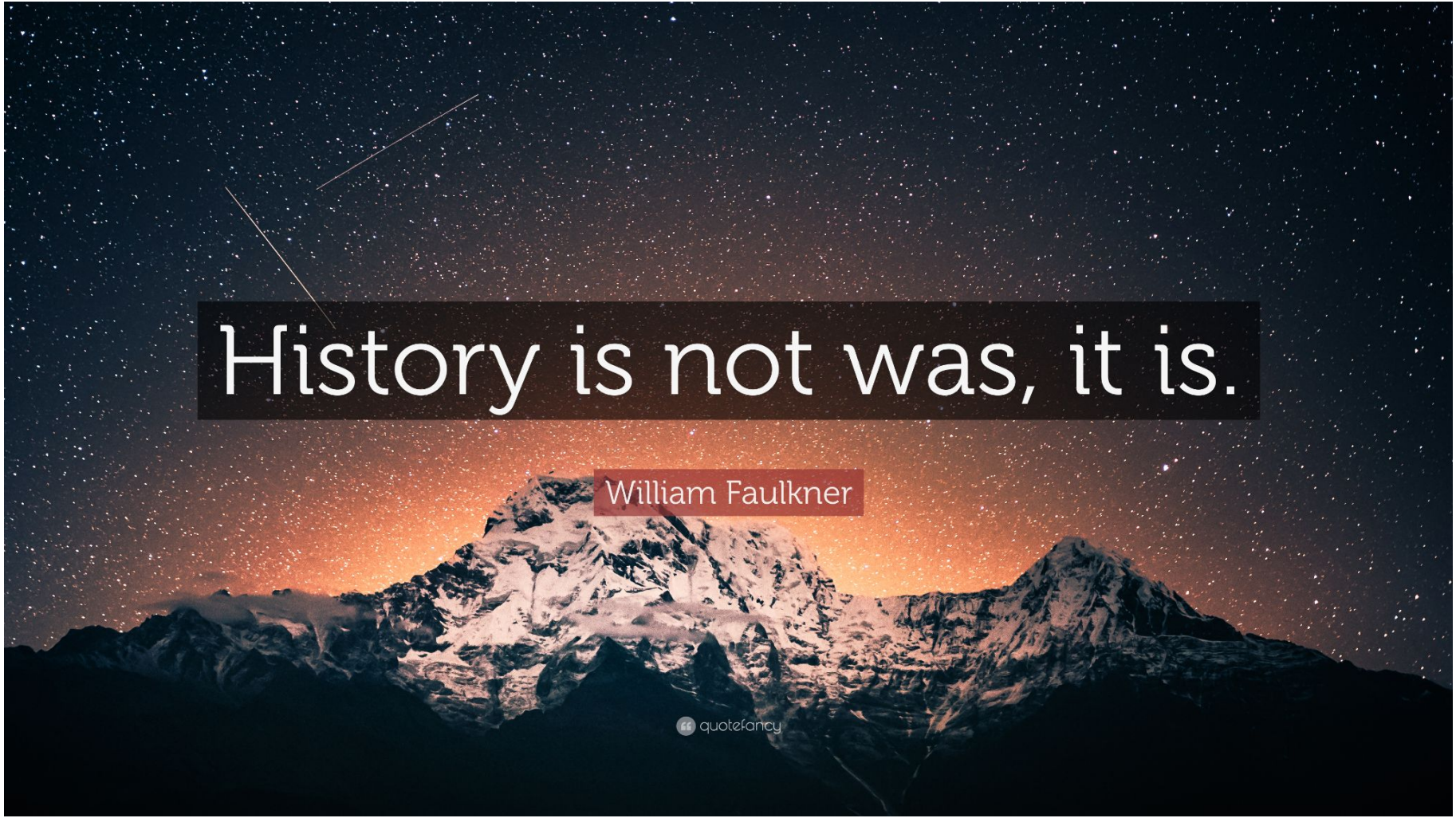
Unix Command Line

Kameswari Chebrolu

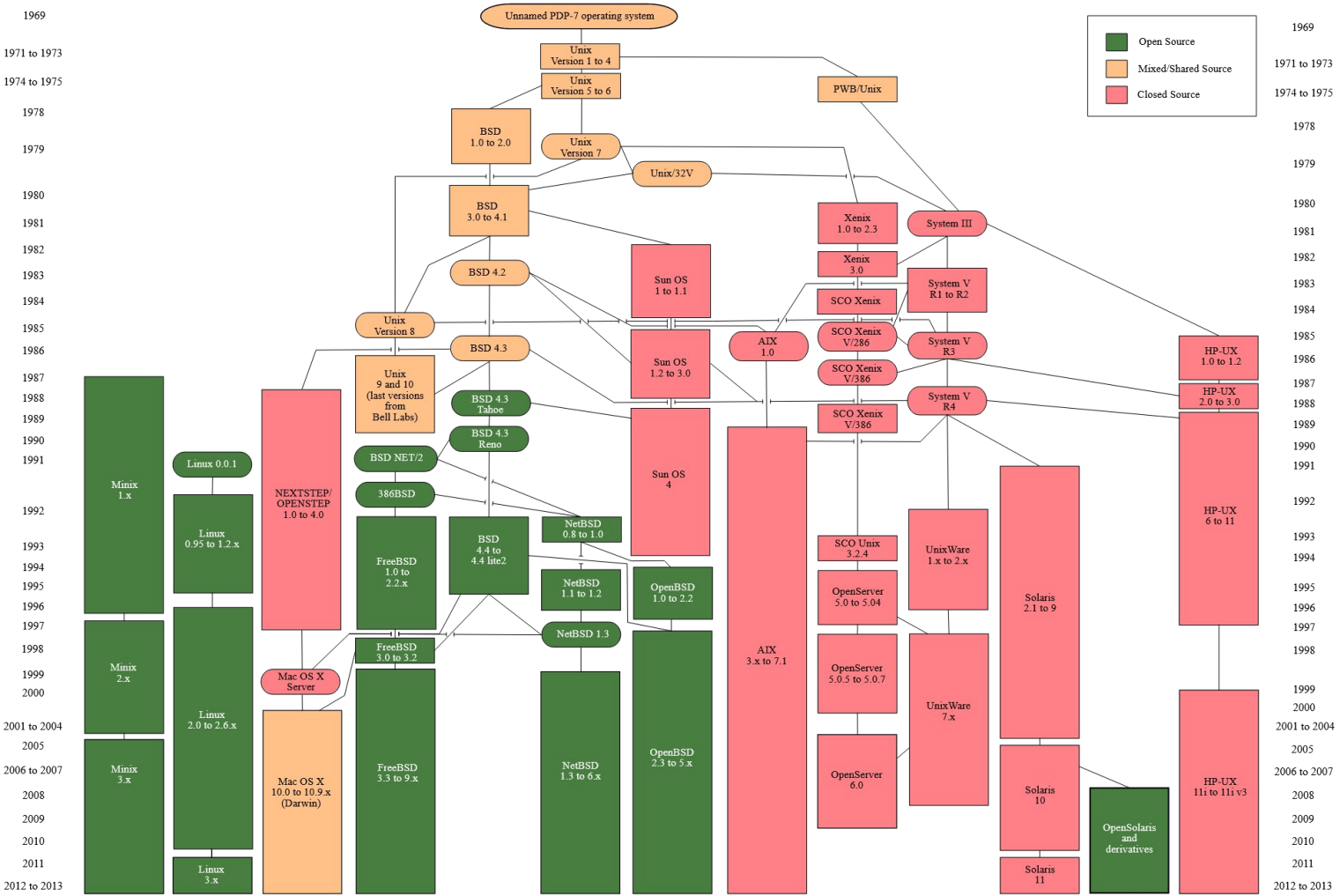
Outline

- Unix history, why Unix?
- Command line vs GUI
- What is a Shell?
- Linux File System
- Various commands (basic)


History is not was, it is.
William Faulkner
quotefancy

Unix/Linux OS

- Unix: Proprietary OS created in late 1960s at AT&T Bell Labs
- Linux: a clone of Unix, free and open source; written from scratch by Linus Torvalds in 1991
- Distributions of Linux: Linux OS packaged with lot of additional free software
  - Fedora, Ubuntu, CentOS, SuSe etc
  - Differ wrt to desktop environment, package installation, display server etc
- Other Unix clones: FreeBSD and Mac OS X (its kernel Darwin, is based on BSD
- A user on one Unix system can move to another easily wrt to command-line



https://sosheskaz.github.io/technology/2017/05/12/Adventures-In-Bsd.html

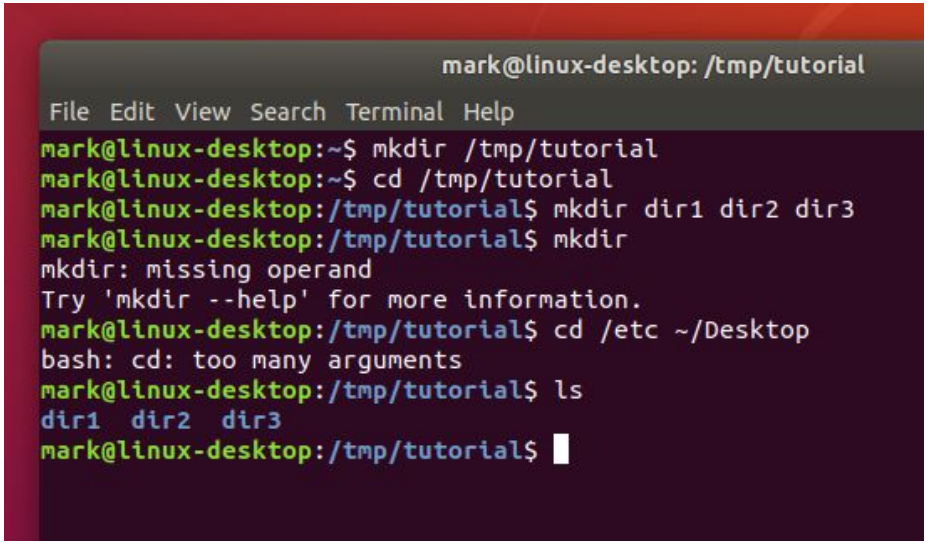
Why *nix?

- “Since we are programmers, we naturally designed the system to make it easy to write, test, and run programs” – Unix Creators, Dennis M. Ritchie and Ken Thompson
  - Very server and programmer-friendly OS
  - Linux (FREE) is for developers!
  - Easy to do scripting
  - Lot of scientific libraries and programs are written for *nix

- Open source (some versions) and exposes you to an ecosystem of open-source software
  - Helps bridge the concepts you learn with how they're applied in practice.
    - Interested in OS? Dig into details of open source linux and interaction with device drivers
    - Interested in Compilers? Clone gcc source
    - Interested in distributed systems? Clone Hadoop and run a cluster on your laptop
    - Interested in cloud computing? Containers origins in linux

Command Line vs GUI

Windows GUI: use pre-programmed interface ⇒ set of possible actions pre-decided



Command-line Shell: a prog. (scripting) language ⇒ use pre-written programs **AND** compose new scripts!

Power of the Shell

1. Rename a set of files
2. Number of lines in all C files in a directory
3. Top five files with maximum number of lines

A brief history

- Alias: shell, terminal, console, prompt etc
- Unix: OS for mainframe computers
  - Users connecting remotely via individual terminals (keyboard and screen)
  - No local programs, send text and receive text
  - Terminals based on text since text is light on resources
  - Commands kept very terse to reduce the number of keystrokes needed

- Need to support all kinds of file management tasks (create files, list files, rename, move to folders etc)
  - Each task required its own program (or command)
  - Master program to coordinate execution of all these programs → shell
- Original Unix shell called sh (Bourne shell)
  - Extended with better features and syntax is BASH (Bourne Again SHell)
  - Other shells also: zsh (mac OS), csh, fish etc

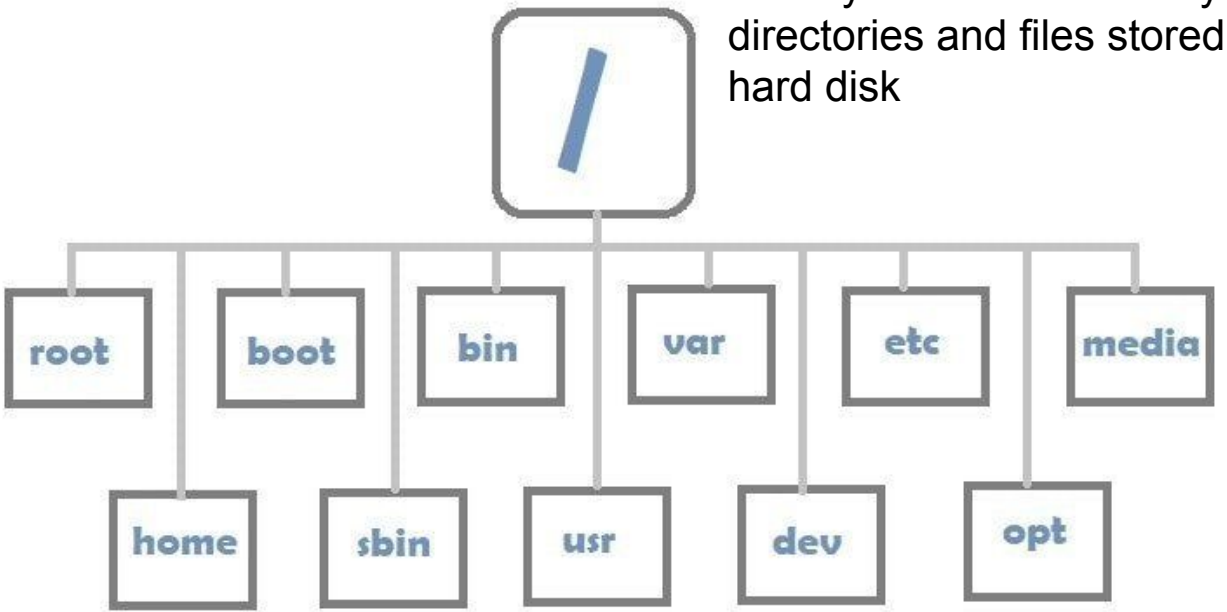
Basic Instructions

- Open shell: Click on “Activities” top left of the screen ⟶ type shell in the search box (or) use Ctrl-Alt-T
- Type a command in the same line as where $ (prompt) appears (command line ;-)
- Commands sometimes have number of arguments (command-line arguments)
  - tar -zcvf lab1.tgz lab1/

- The shell does not execute commands until the “Enter key” is pressed
- Any output the shell produces will usually be printed directly in the terminal
  - Another prompt is shown once finished
- Commands are case sensitive (ls vs LS)

Linux Filesystem

A filesystem is a hierarchy of directories and files stored on hard disk

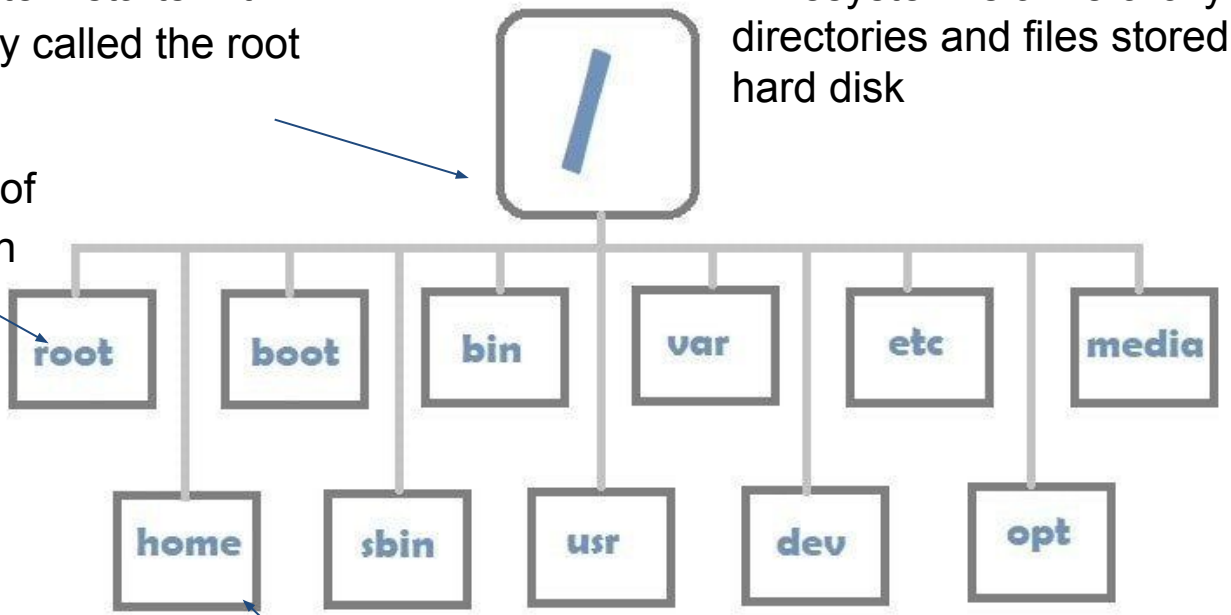


Linux Filesystem

The file system starts with the directory called the root directory

A filesystem is a hierarchy of directories and files stored on hard disk

Home directory of superuser/admin



User's personal directories

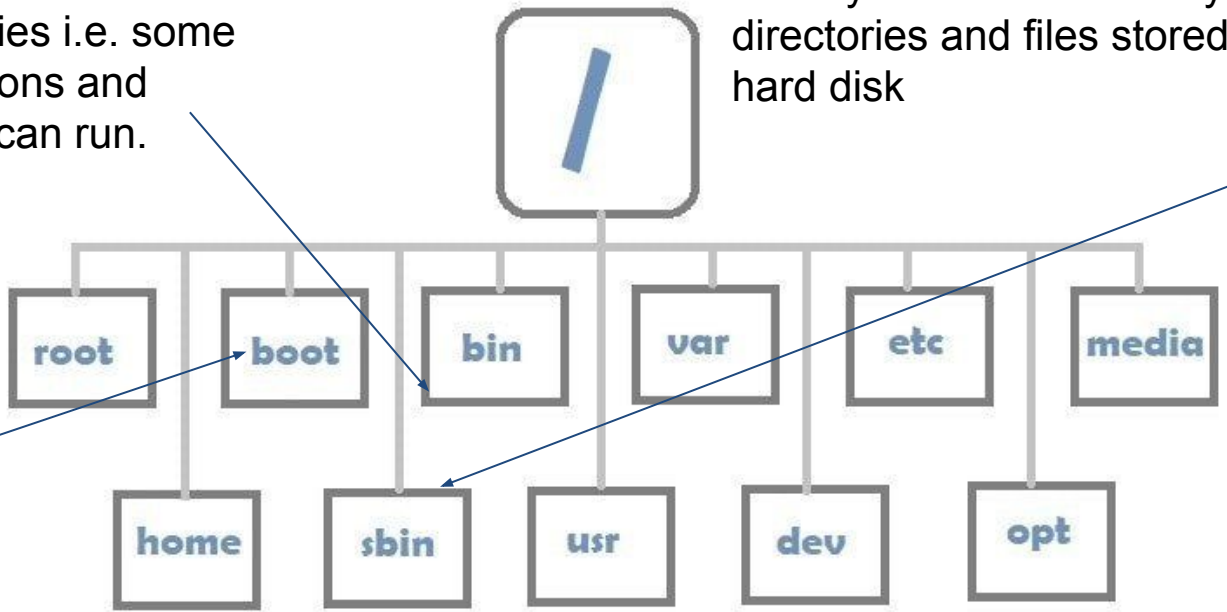
Linux Filesystem

A filesystem is a hierarchy of directories and files stored on hard disk

Contains *bin*aries i.e. some of the applications and programs you can run.

sbin is similar to /bin, but contains applications for superuser

Contains files required for starting your system



Navigate file system: pwd and cd

- Shell has a notion of a default location
  - For the root user, home is at /root
  - Regular users, it is /home/username (e.g. /home/kc)
- Pwd (present working directory) command tells your current working directory

- You can change the working directory using “cd” command
  - Relative and absolute paths
  - Absolute paths:
    - “/” at the start of your path means “starting from the root directory”
    - (”~”) at the start of your path means “starting from my home directory”
  - “Tab” for autofilling
    - Applies to all commands, not just cd!

- ls: display contents of the current directory
  - Syntax: ls [OPTIONS] [FILES]
  - ls -l (print files in a long listing format)
    - Short cut ll
  - ls -a (display all files including the hidden files)
  - Every directory has at least two entries: “.” and “..” (called dot and dotdot)
    - dot directory is a shortcut for the current directory
    - dotdot is a shortcut to the parent directory
  - Checkout options: -X, -S, -t, -R
- Lets explore through examples

Create folders/files: mkdir, echo, cat

- mkdir (make directory): create a directory
  - Syntax: mkdir [OPTION] [DIRECTORY]
    - Takes one or more directory names as its arguments.
  - “-p” option: creates the directory only if it doesn’t exist.
- echo: create and populate files via redirection (>)
  - Displays text on the screen
  - Handy when writing scripts

- Cat (concatenation): display the contents of a text file to screen
  - Why named cat then? can combine outputs also
  - “-n” option to display contents of a file with line numbers
  - “-s” option to omit repeated empty output lines:
  - Big file: use “less” command
    - Can use Up Arrow, Down Arrow, Page Up, Page Down, Home and End keys to move through your file
- Lets explore some examples

Manipulating files/folders: mv, cp, rm, rmdir

- mv: move files or folders
  - Syntax: mv [OPTIONS] SOURCE DESTINATION
    - SOURCE can be one, or more files or directories, and DESTINATION can be a single file or directory
    - When multiple files or directories are given as a SOURCE, the DESTINATION must be a directory
      - In this case, the SOURCE files are moved to the target directory.
    - If you specify a single file as SOURCE, and the DESTINATION target is an existing directory, then the file is moved to the specified directory.
    - If you specify a single file as SOURCE, and a single file as DESTINATION target then you're renaming the file .
    - When the SOURCE is a directory and DESTINATION doesn't exist, SOURCE will be renamed to DESTINATION. Otherwise if DESTINATION exist, it be moved inside the DESTINATION directory.
  - Use wildcards for ease of moving
  - Checkout options: -i, -n, -f

- cp: copy files or folders
  - Very similar to mv, except it copies files instead of moving
  - Checkput options: -R, -i, -p
- rm: remove files
  - “-i” option: prompt before removing
  - “-r” recursively remove and also directories via -r
- rmdir: remove folder (but folder has to be empty)
  - rm -d is same as this

- **Caution:** rm doesn't move files to a folder called "trash" or similar
  - Deletes them totally, utterly and irrevocably
  - Be extra careful when using wildcards!!!
  - Use -i (interactive) option to rm, which will prompt you for confirmation
    - Y to delete it, N to keep it, and Ctrl-C to stop the operation
- Lets see some examples!

Miscellaneous

- man: manual for commands
  - E.g. man ls
- clear: helps clear the screen to reduce clutter
- head/tail: print n lines from head or tail
  - head file; head -n 2 file
  - Checkout: -n and -c option
- which: identify the location of a given executable(s)

(Simple) Editors

- Vi
- Nano
- gedit

(write some text, delete some text, save, more editing, save and exit, reopen)

References

- https://ubuntu.com/tutorials/command-line-for-beginners#1-overview
- https://www.linuxfordevices.com/tutorials/linux/nano-editor-in-linux
- https://www.linuxfordevices.com/tutorials/linux/vim-tutorial

Misc.

- File System:

https://www.linuxfoundation.org/blog/blog/classic-sysadmin-the-linux-filesystem-explained

- Figure of Unix variants: https://sosheskaz.github.io/technology/2017/05/12/Adventures-In-Bsd.html