Lecture Two

- **Agenda for today, August 29, 2018**
  - Questions?
  - Monday = Holiday
  - Moodle
  - A Glimpse of Our Path
  - Setting up your VM
  - Let’s Look at Linux

Path

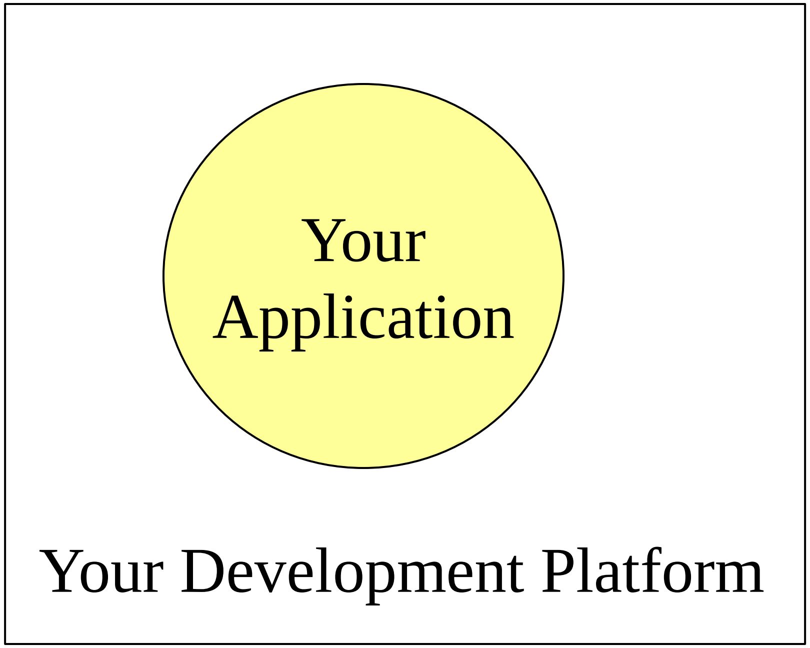
- **Objectives:**
  - Work with a team of people
  - Develop a working software application
  - Built with components
    - A **platform** for development
      - O/S –Windows, Linux, IOS, Android
      - A framework – like NodeJS Express
        - https://techterms.com/definition/framework
      - Programming Language(s)
      - Database – PostgreSQL, MySQL, Mongo, Firebase, etc.
      - Repostiory – github
      - Web Services?

Path

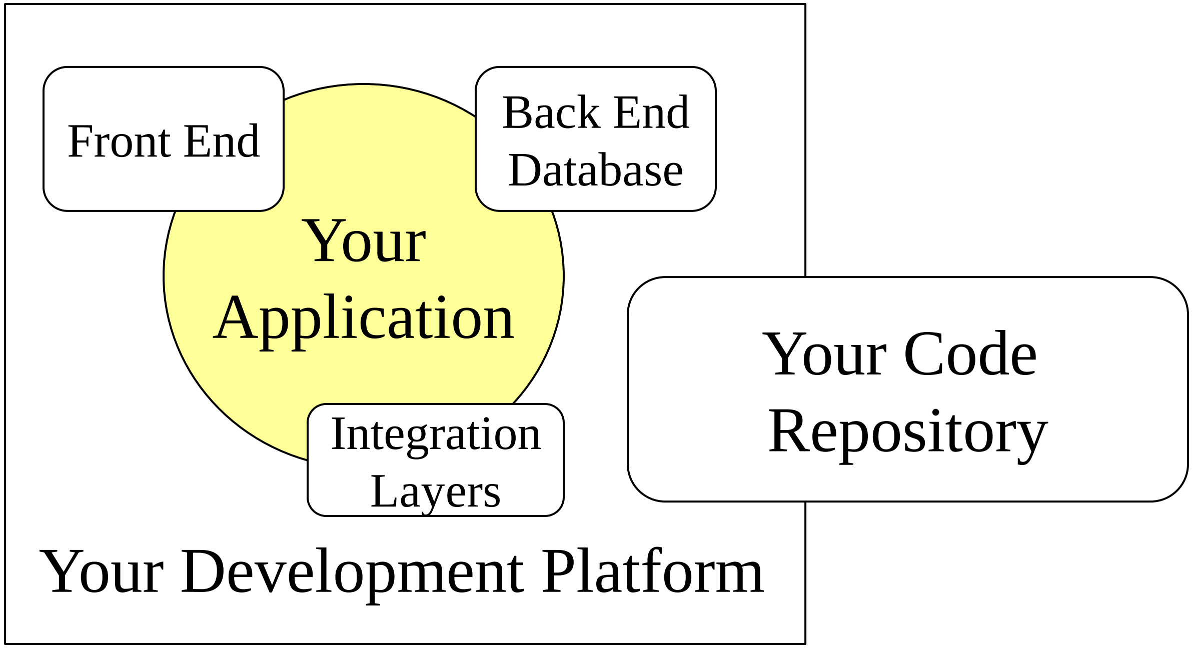
- A platform for deployment
  - Web Site, Mobile App, Embedded System
  - Hosted where?   Local, cloud

- Layers
  - User Interface
  - Back End Database
  - Integration Layer

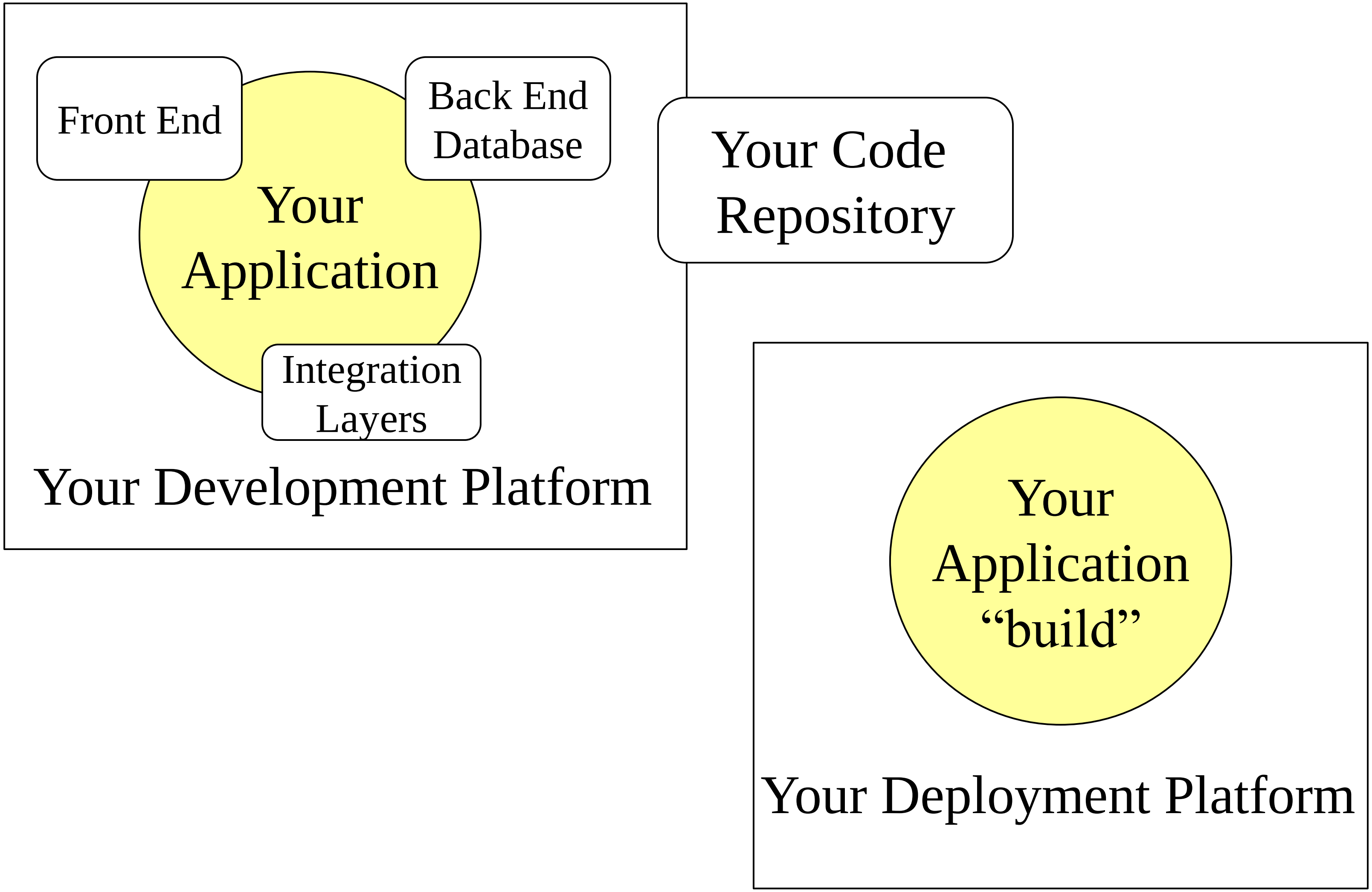
Path



Path


Front End
Back End Database
Your Application
Integration Layers
Your Code Repository
Your Development Platform

Path



Front End

Back End
Database

Your
Application

Integration
Layers

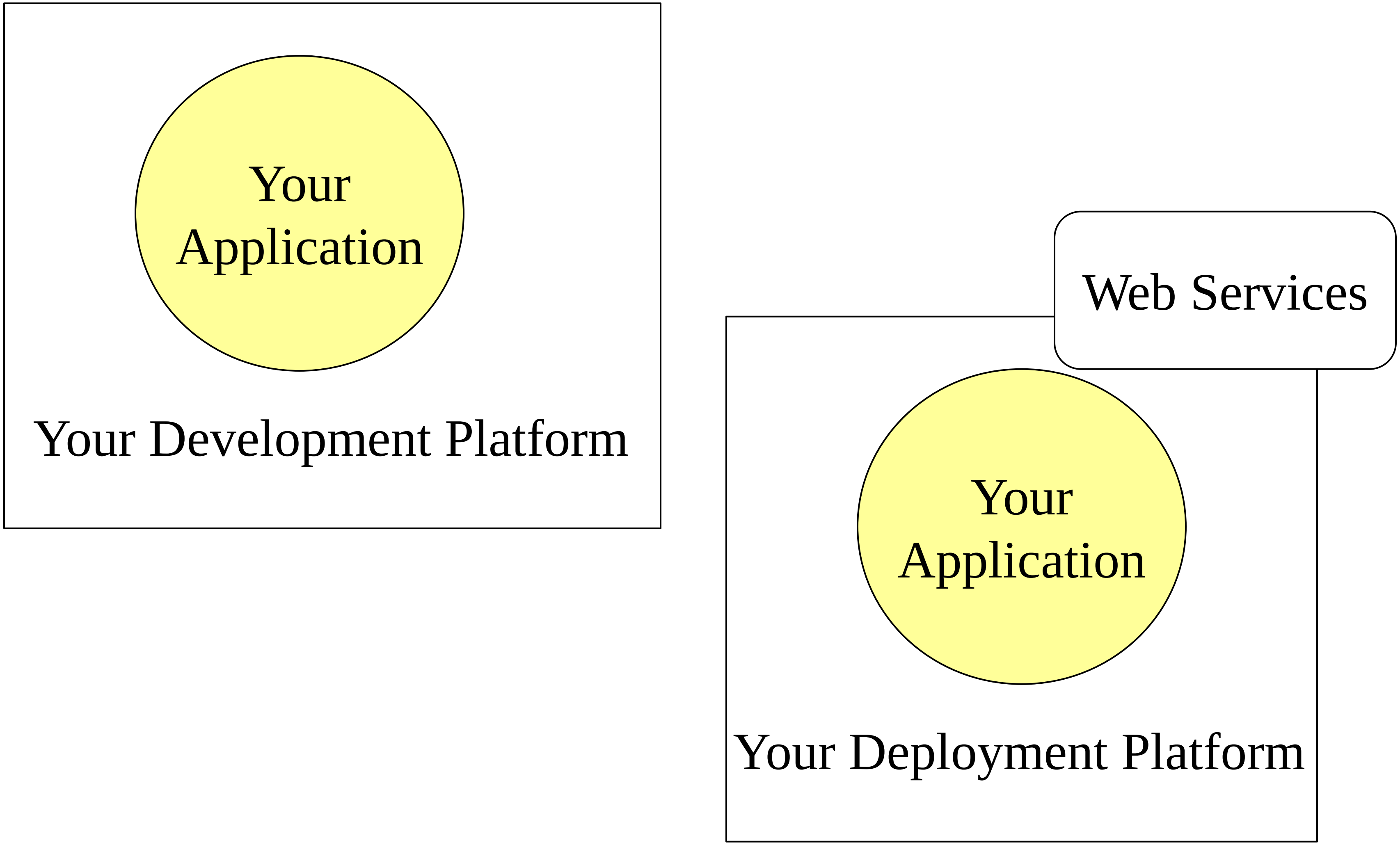
Your Development Platform

Your Code
Repository

Your
Application
“build”

Your Deployment Platform

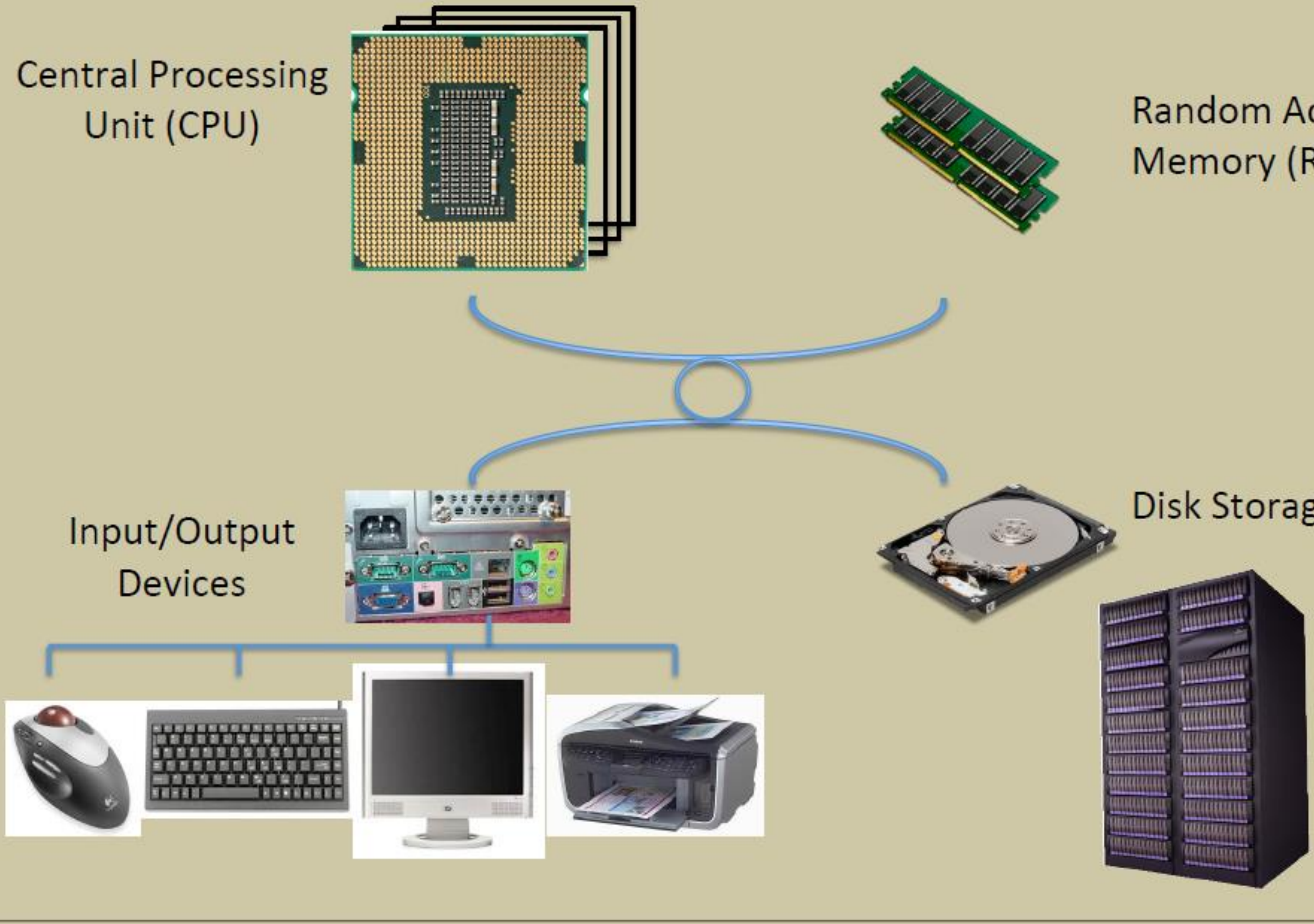
Path


Your Application
Your Development Platform
Web Services
Your Application
Your Deployment Platform

VM

- **Much of your development work will be done on your own PC under Linux**
- **What is a VM?**
  - – A virtual computer running on your PC
    - Runs under your PC’s OS
    - Shares memory, CPU, disk, ports
- **Setting up your VM**
  - – https://foundation.cs.colorado.edu/vm/

Computer Architecture



Central Processing Unit (CPU)

Random Access Memory (RAM)

Input/Output Devices

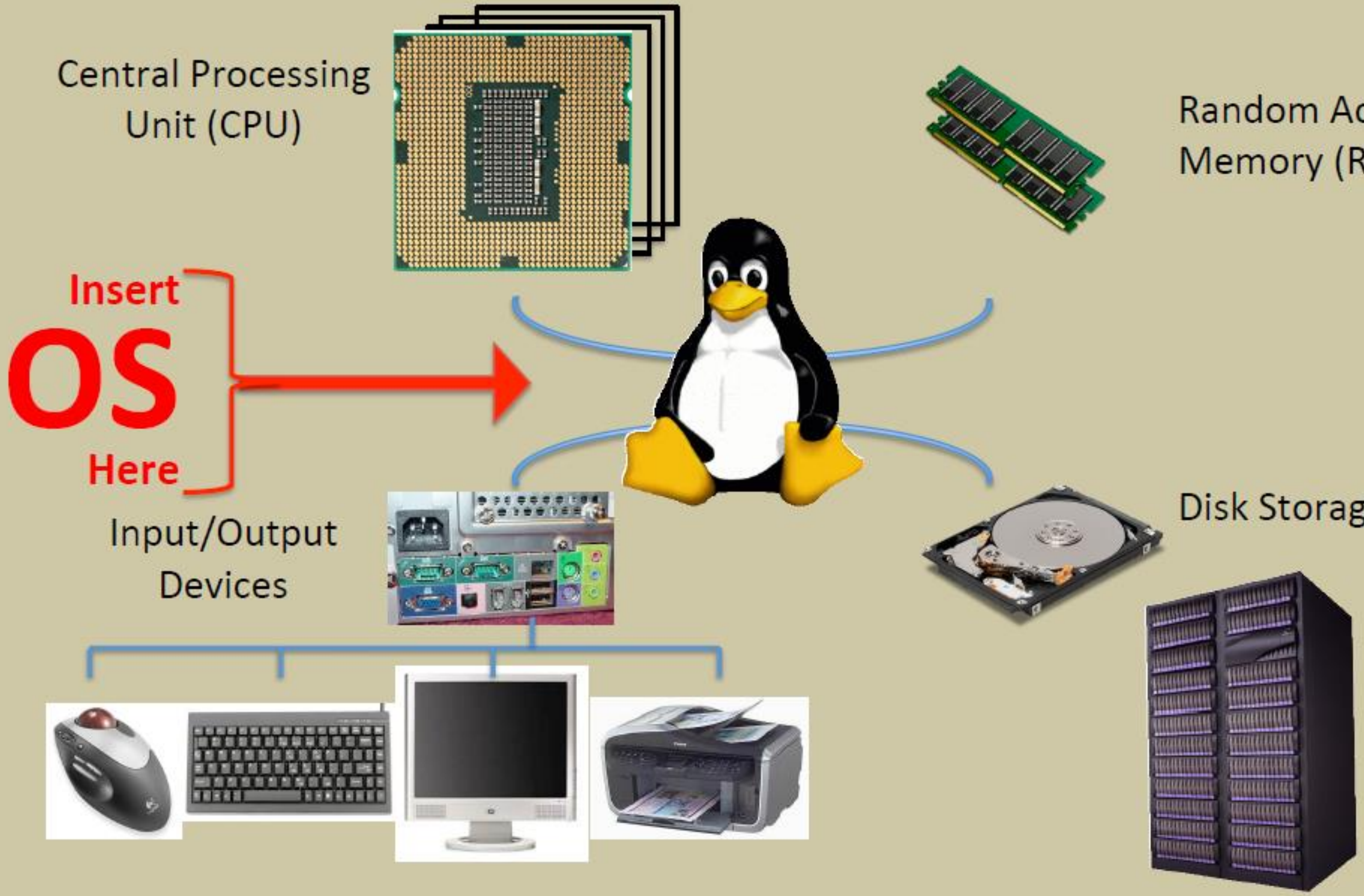
Disk Storage

What is an Operating System?

- Hardware components are only able to control themselves (CPU, RAM, DISK)
- Components do not know how to interact with each other.
- How do we get components to operate together?

Add an Operating System

Computer Architecture



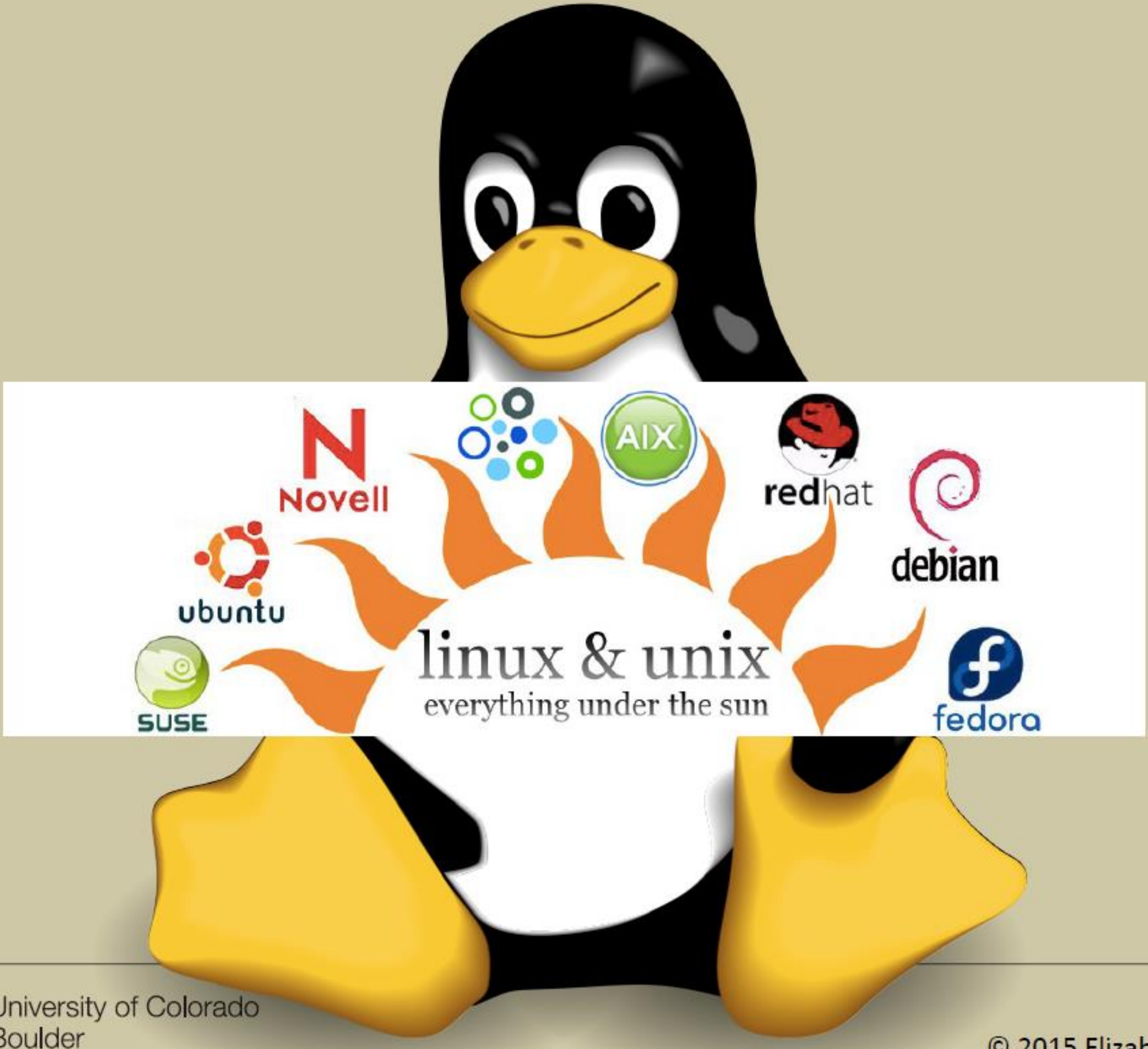
Central Processing Unit (CPU)

Random Access Memory (RAM)

Insert OS Here

Input/Output Devices

Disk Storage


Novell
ubuntu
SUSE
AIX
redhat
debian
fedora
linux & unix
everything under the sun

Linux

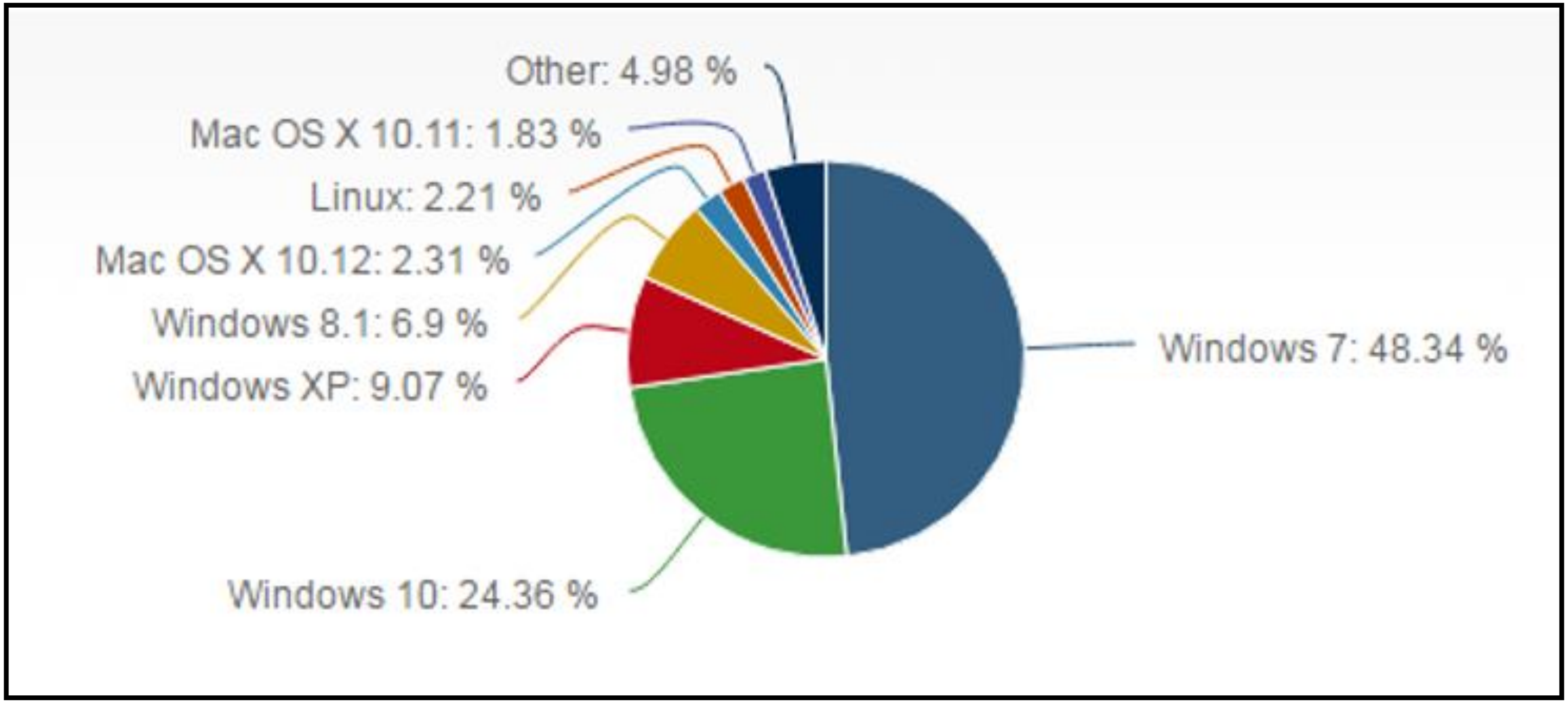
- **Who is Linus Torvalds?**

Is it Unix or is it Linux?

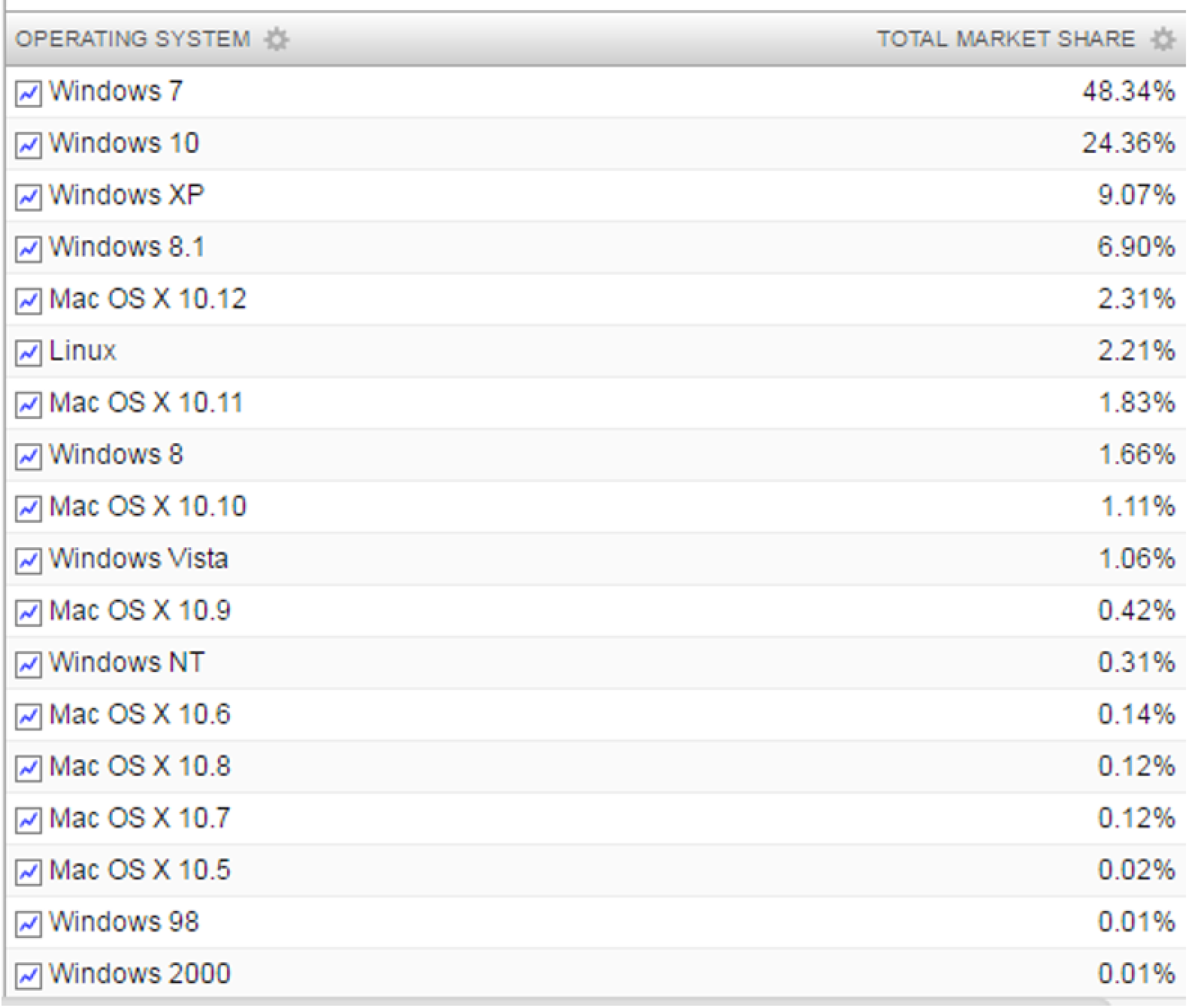
- Unix is a trademarked word
- The operating system originally designed in the late 60's was reborn again as open source
- Linux contains many of the original features and quirks of the Unix operating system

UNIX®

OS Market Share

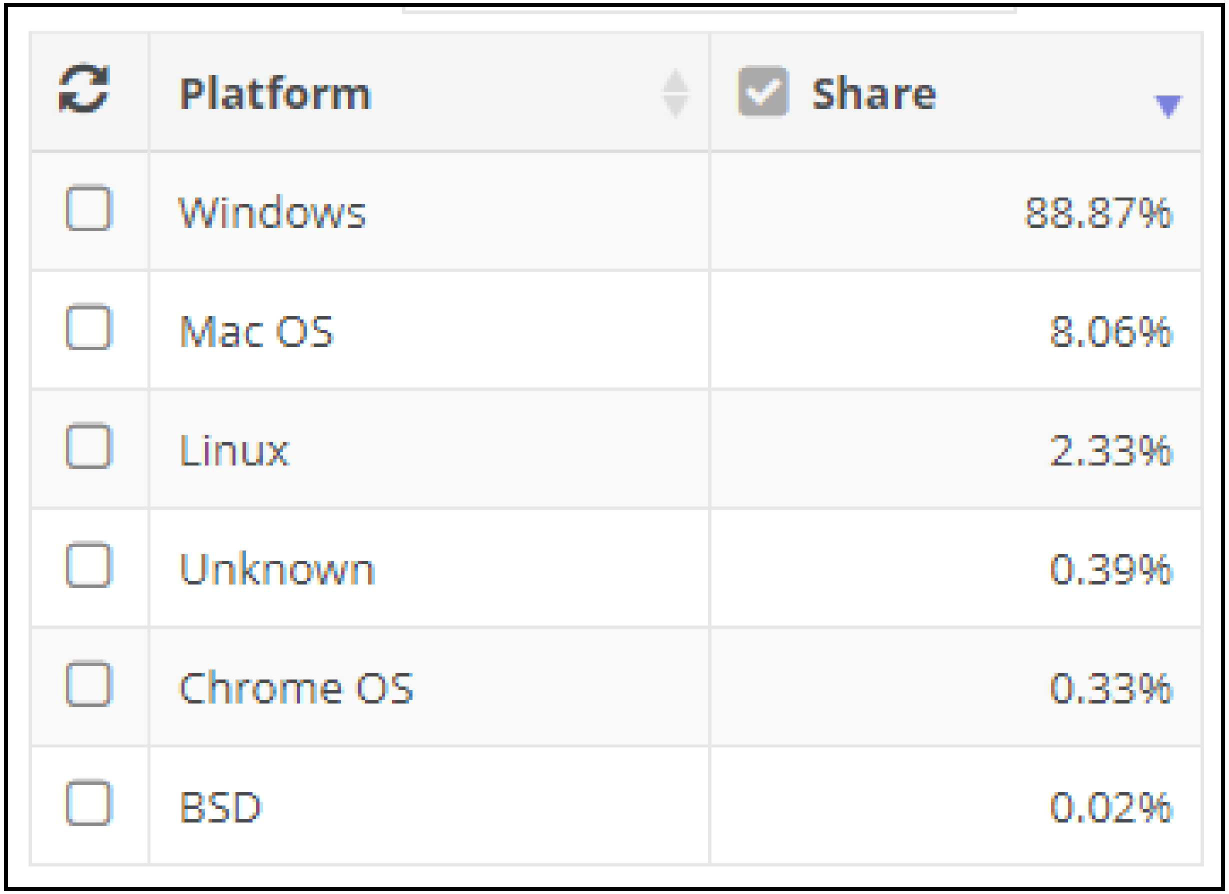


https://www.netmarketshare.com/operating-system-market-share.aspx



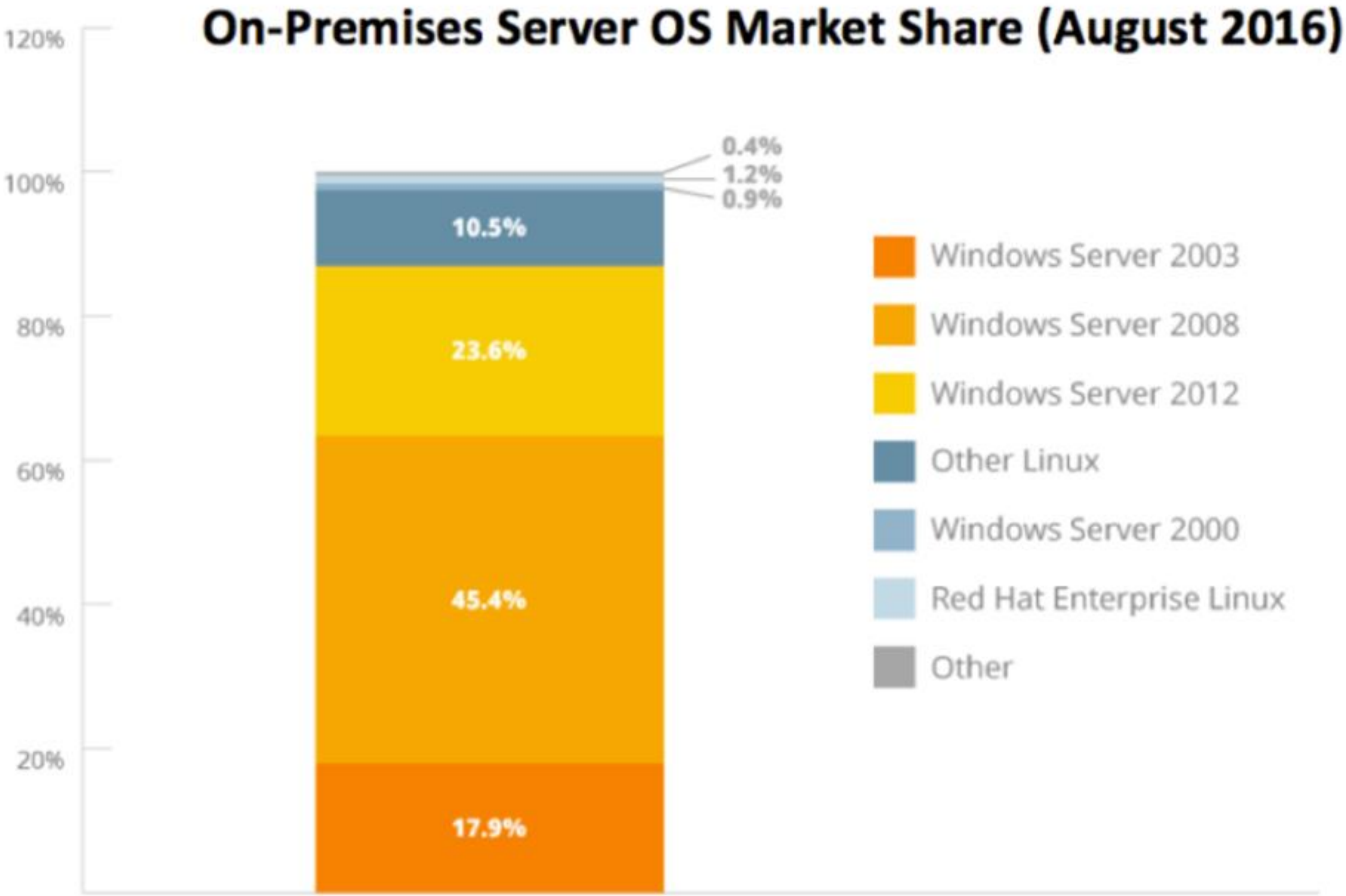
OPERATING SYSTEM	TOTAL MARKET SHARE
Windows 7	48.34%
Windows 10	24.36%
Windows XP	9.07%
Windows 8.1	6.90%
Mac OS X 10.12	2.31%
Linux	2.21%
Mac OS X 10.11	1.83%
Windows 8	1.66%
Mac OS X 10.10	1.11%
Windows Vista	1.06%
Mac OS X 10.9	0.42%
Windows NT	0.31%
Mac OS X 10.6	0.14%
Mac OS X 10.8	0.12%
Mac OS X 10.7	0.12%
Mac OS X 10.5	0.02%
Windows 98	0.01%
Windows 2000	0.01%

https://www.netmarketshare.com/operating-system-market-share.aspx



	Platform	☑ Share
□	Windows	88.87%
□	Mac OS	8.06%
□	Linux	2.33%
□	Unknown	0.39%
□	Chrome OS	0.33%
□	BSD	0.02%

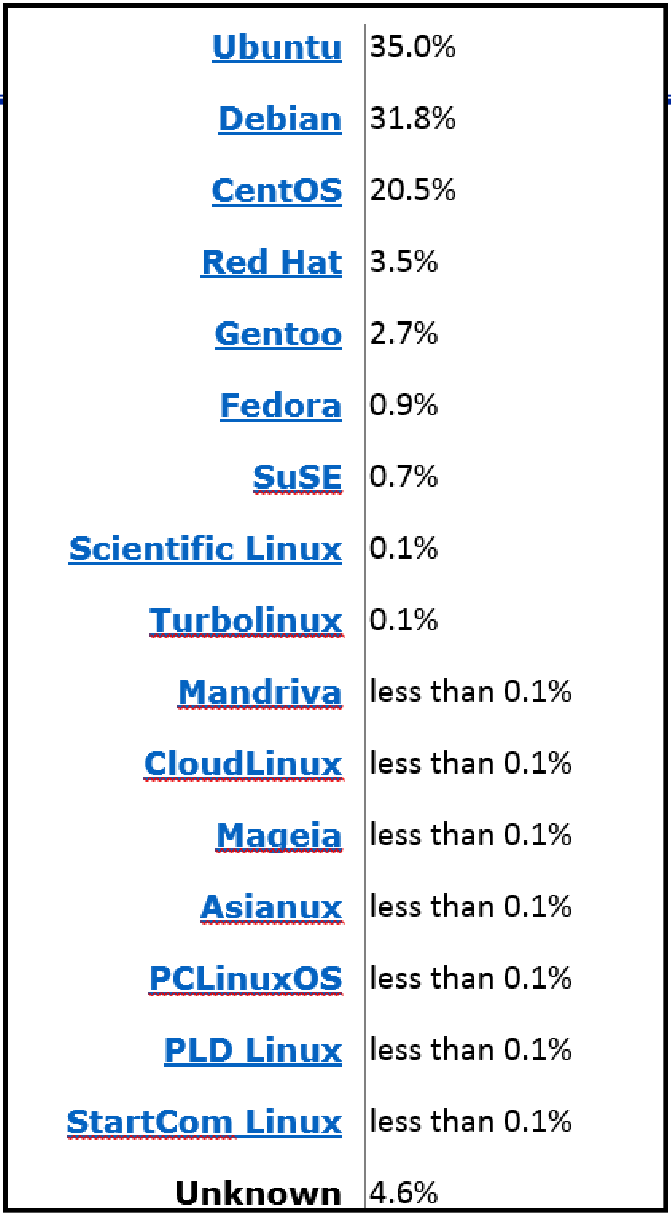
https://www.netmarketshare.com/operating-system-market-share.aspx



On-Premises Server OS Market Share (August 2016)

https://community.spiceworks.com/.../articles/2462-server-virtualization-and-os-trends

*Linux Flavor Market Share**

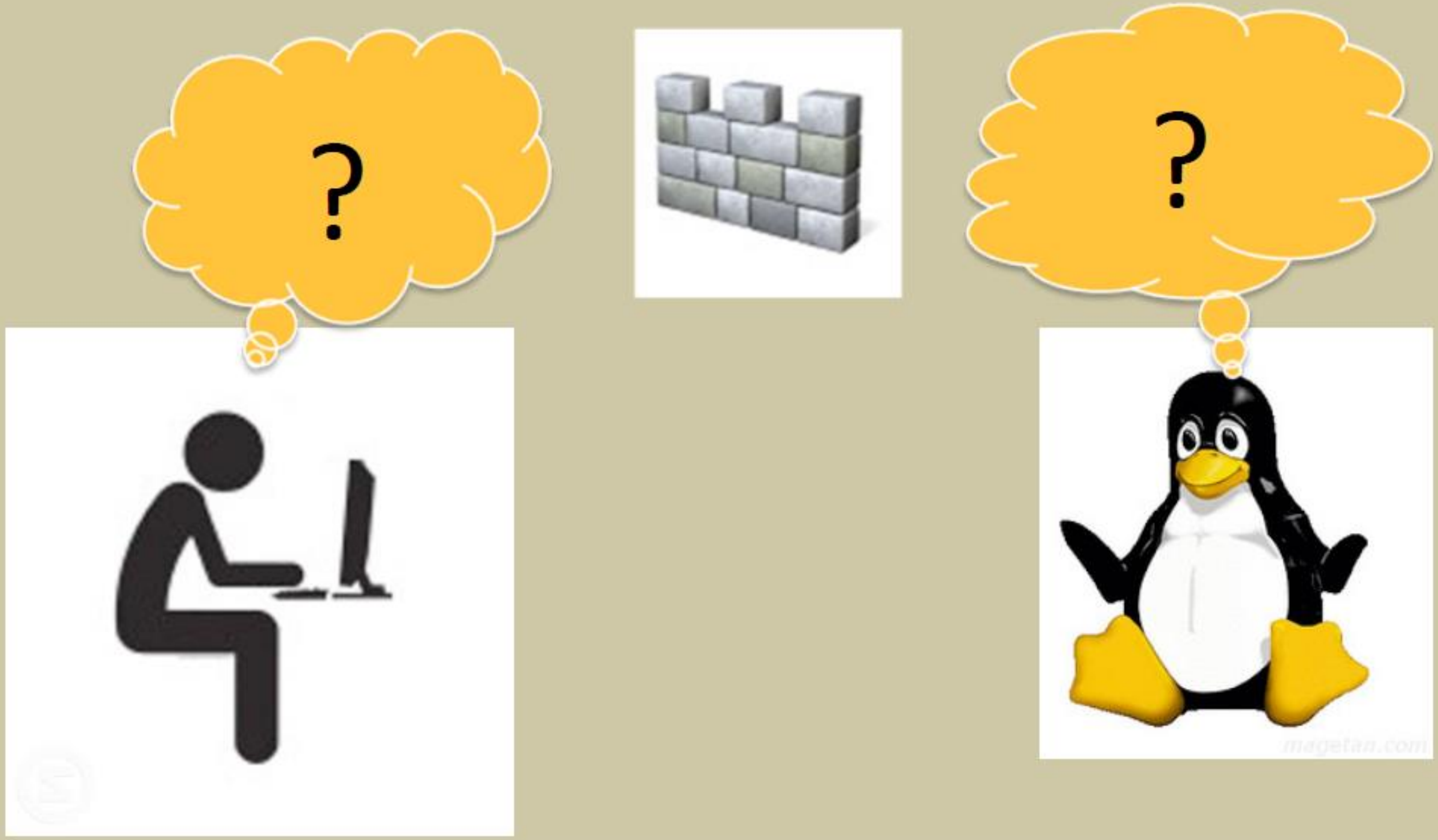


Ubuntu	35.0%
Debian	31.8%
CentOS	20.5%
Red Hat	3.5%
Gentoo	2.7%
Fedora	0.9%
SuSE	0.7%
Scientific Linux	0.1%
Turbolinux	0.1%
Mandriva	less than 0.1%
CloudLinux	less than 0.1%
Mageia	less than 0.1%
Asianux	less than 0.1%
PCLinuxOS	less than 0.1%
PLD Linux	less than 0.1%
StartCom Linux	less than 0.1%
Unknown	4.6%

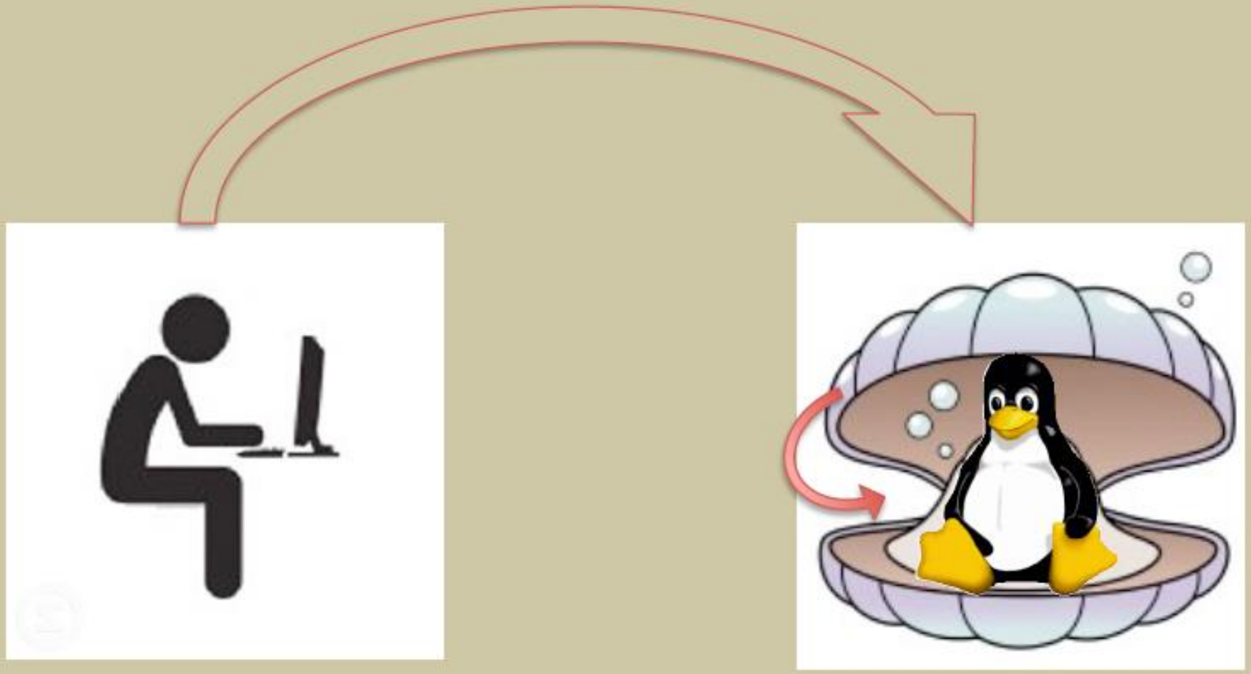
* On web servers

https://w3techs.com/technologies/details/os-linux/all

How can a user communicate with the Operating System?

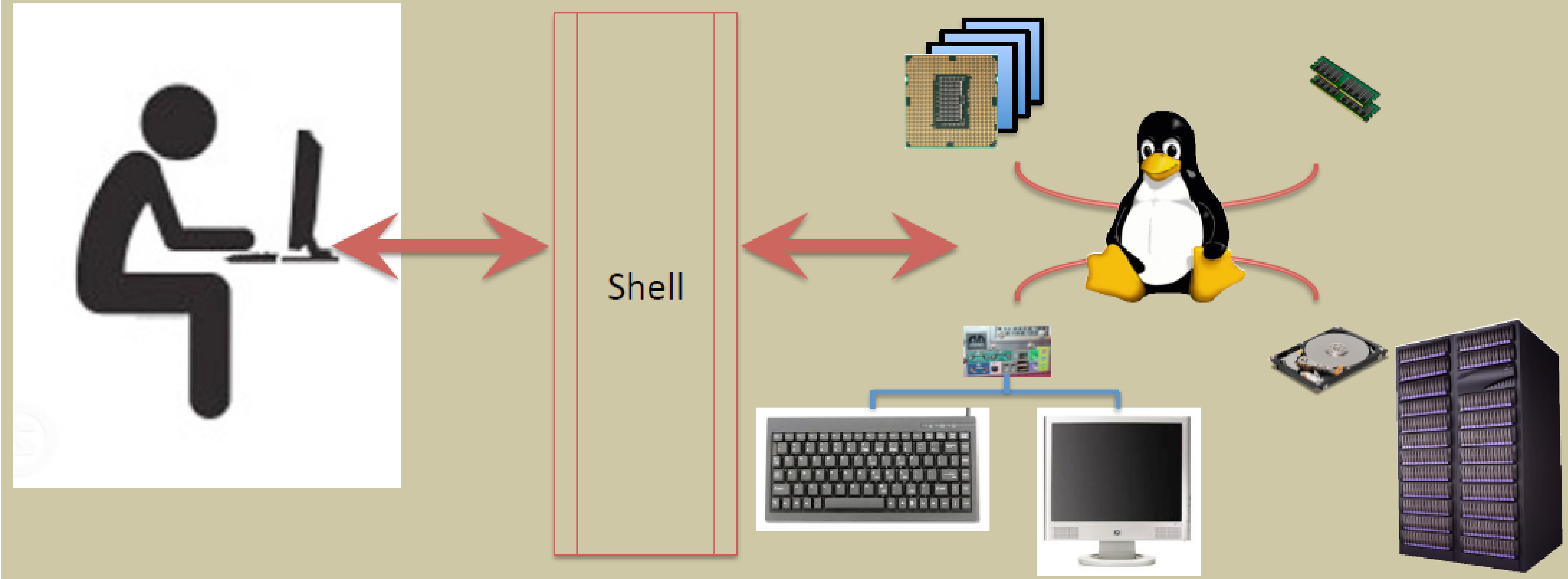


How can a user communicate with the Operating System?



- User talks to the shell
- The shell interprets the commands and talks to the operating system

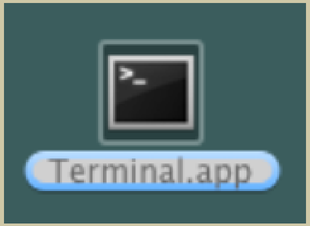
We can communicate with the Operating System by using the Shell

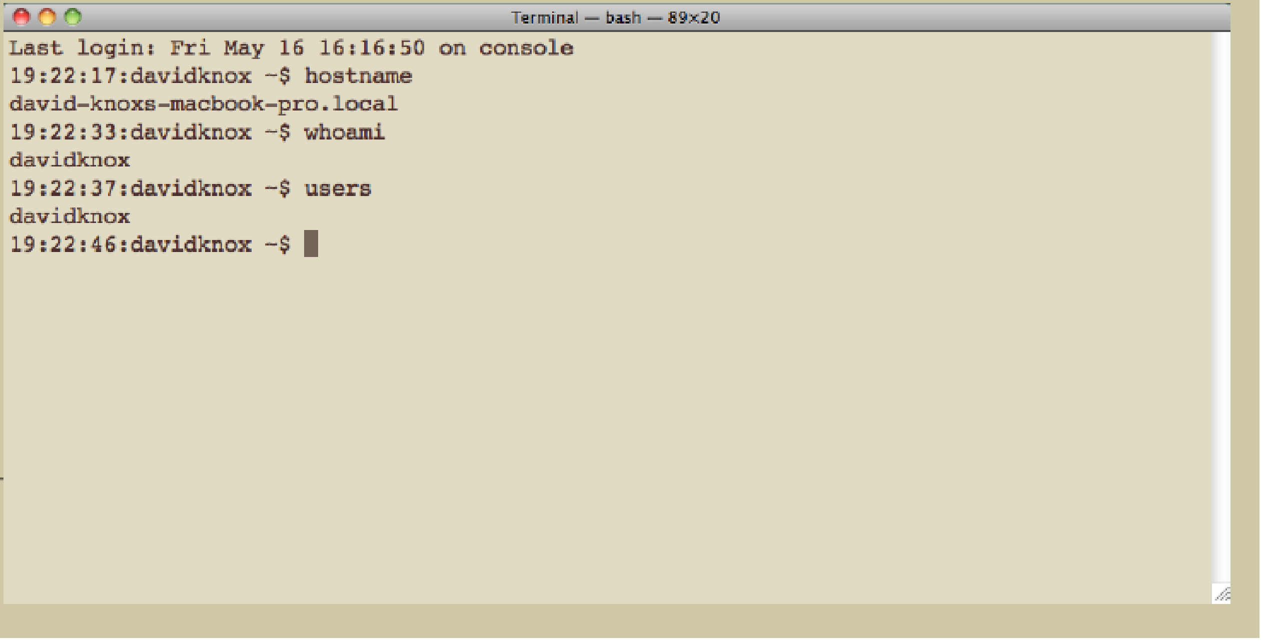


Shell

Using the Terminal Window

- When you select the terminal icon from your desktop, you create an interface with a Shell
- Every keystroke is sent to the shell, every character sent back is displayed in the window



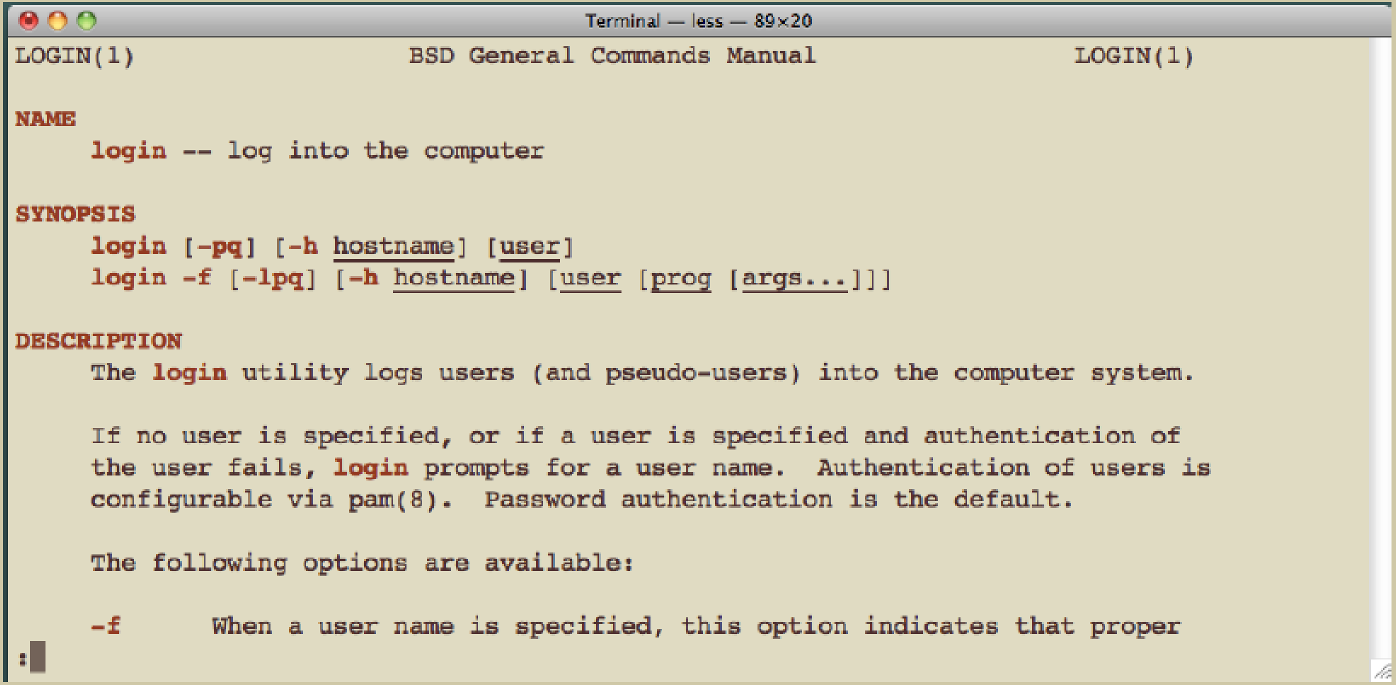


```
Last login: Fri May 16 16:16:50 on console
19:22:17:davidknox ~$ hostname
david-knoxs-macbook-pro.local
19:22:33:davidknox ~$ whoami
davidknox
19:22:37:davidknox ~$ users
davidknox
19:22:46:davidknox ~$ 
```

Getting help with Commands

- Most programs will understand the “--help” option and print information about the programs usage
- The shell can also lookup the usage by using the “man” command. To get help on connecting to a server,

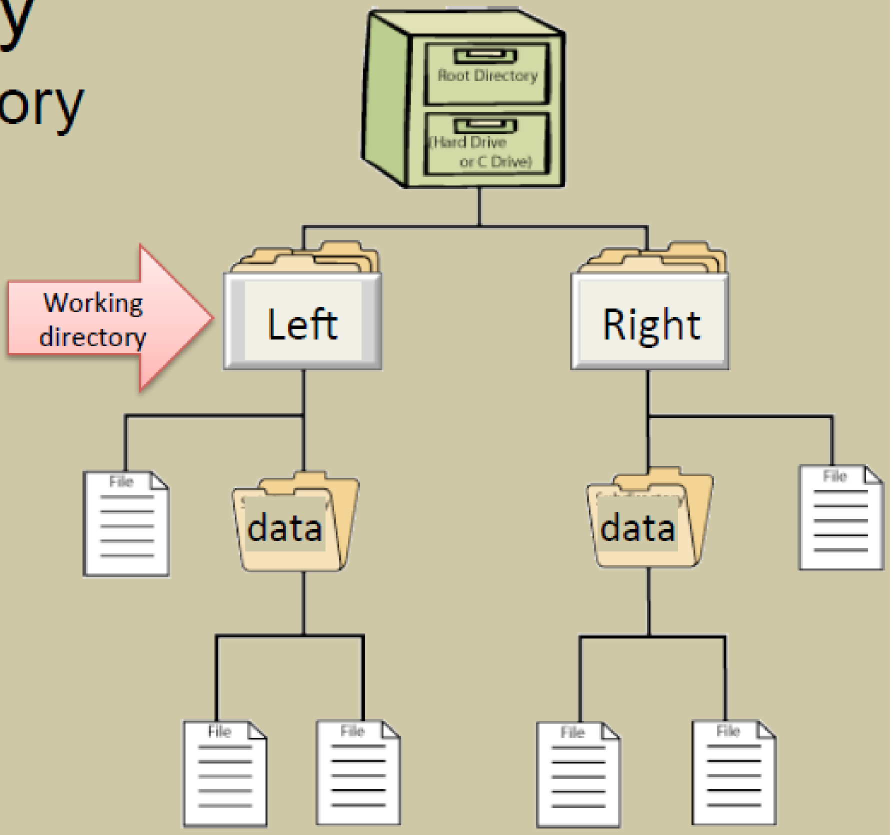
  Type: **man login**



```
LOGIN(1)                  BSD General Commands Manual                  LOGIN(1)

NAME
     login -- log into the computer

SYNOPSIS
     login [-pq] [-h hostname] [user]
     login -f [-lpq] [-h hostname] [user [prog [args...]]]

DESCRIPTION
     The login utility logs users (and pseudo-users) into the computer system.

     If no user is specified, or if a user is specified and authentication of
     the user fails, login prompts for a user name.  Authentication of users is
     configurable via pam(8).  Password authentication is the default.

     The following options are available:

     -f      When a user name is specified, this option indicates that proper
:
```

Navigating the File System

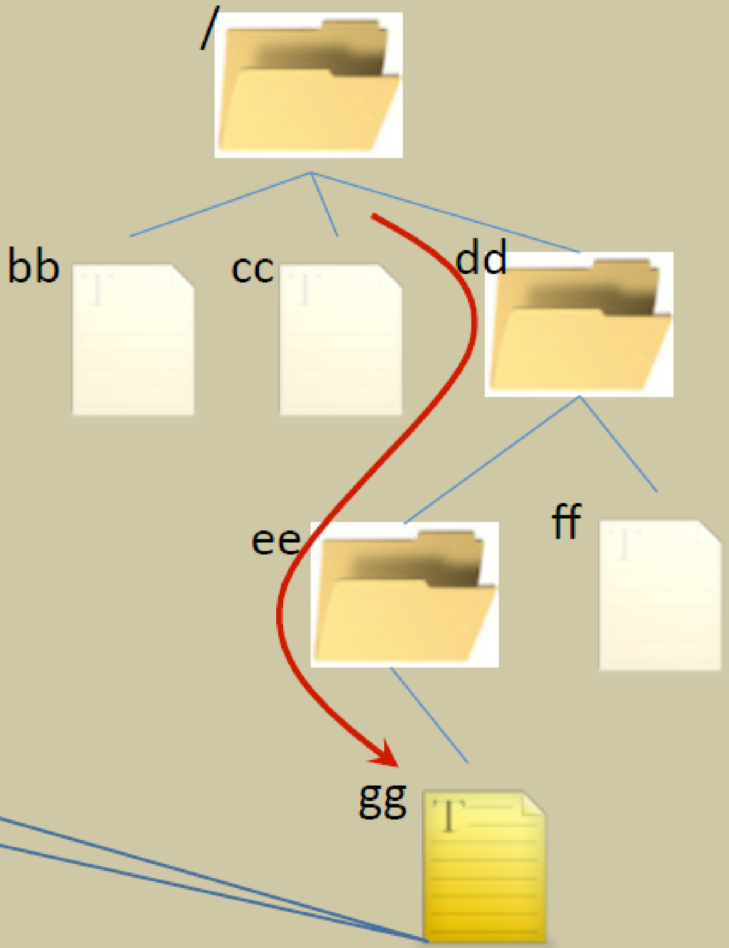
- Current working directory
  - pwd – print working directory
  - cd – change directory
  - Relative path vs full path
- File System commands:
  - ls – list directory contents
  - cp – copy files
  - rm – remove files
  - mv – move files
  - mkdir – make directory
  - rmdir – remove directory



```
cd  /Right
cd  data
```

Referring to files: Absolute Paths

- *Absolute path*
  - list the directories on the path from the root ("/")
  - separated by "/"



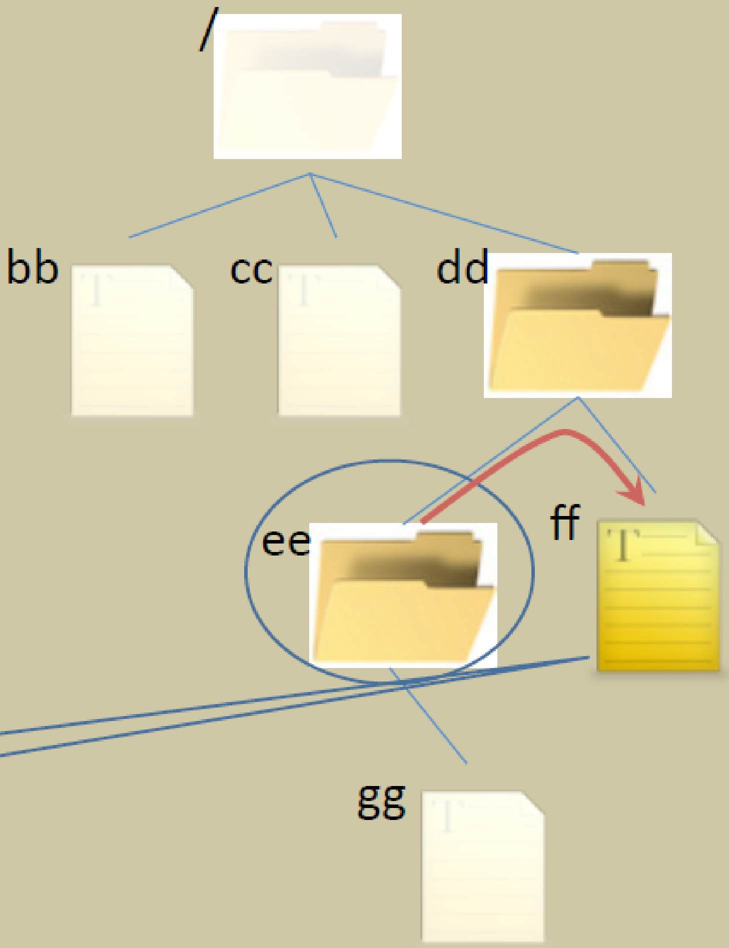
What is the absolute path of gg?

Referring to files: Relative Paths

- *Current directory*
- *Relative path*

..

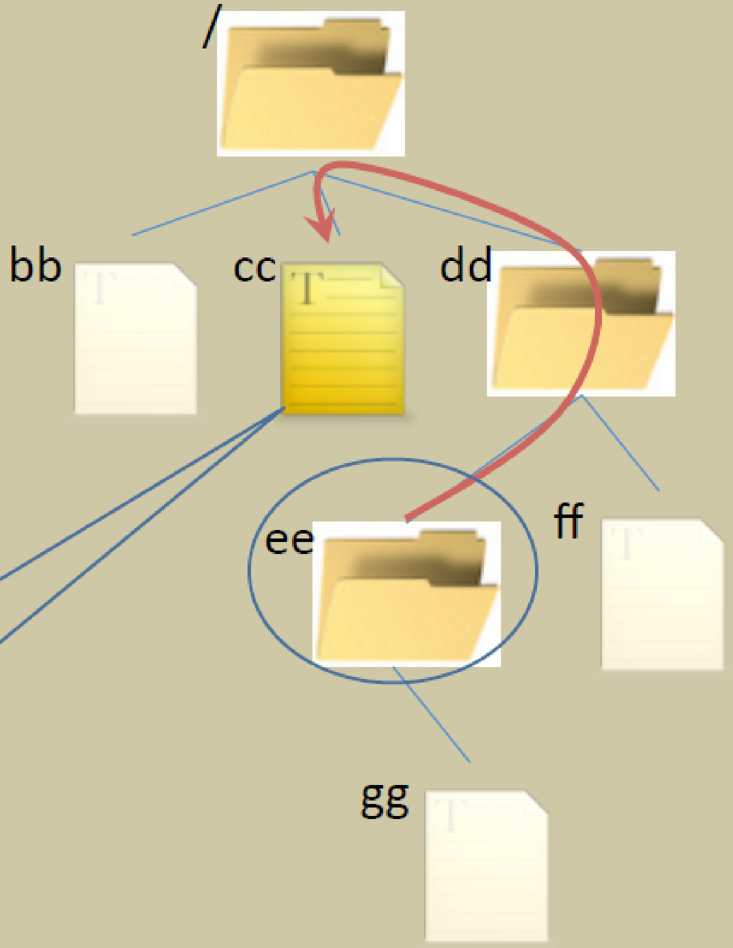
.



If you are in the ee directory, what is the relative path to ff?

University of Colorado Boulder

Referring to files: Relative Paths



What is the relative path from ee to cc?

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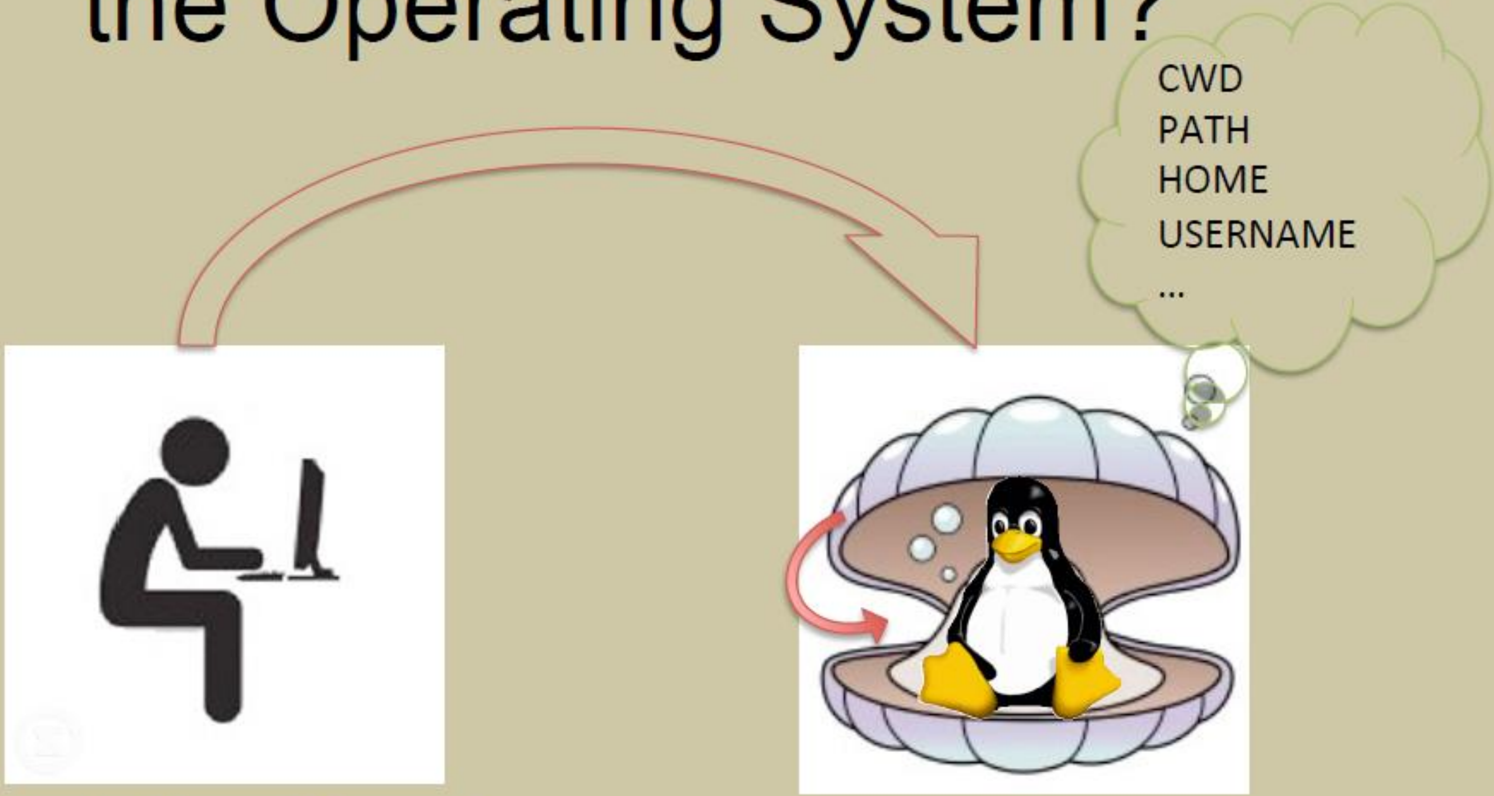
Commands for Processing Files

- cat – copy the contents to the screen
- more (less) – display file contents in user friendly manner
- head – copy the first lines of a file to the screen
- tail – copy the last lines of a file to the screen
- wc – count the number of lines, words, characters in a file
- grep - globally search a regular expression and print

Commands for checking the System Status

- who – list of current users
- whoami – what is my user name
- top – list the processes using the most resources
- ps – process status
- uptime – how long has the system been running
- date – current date and time

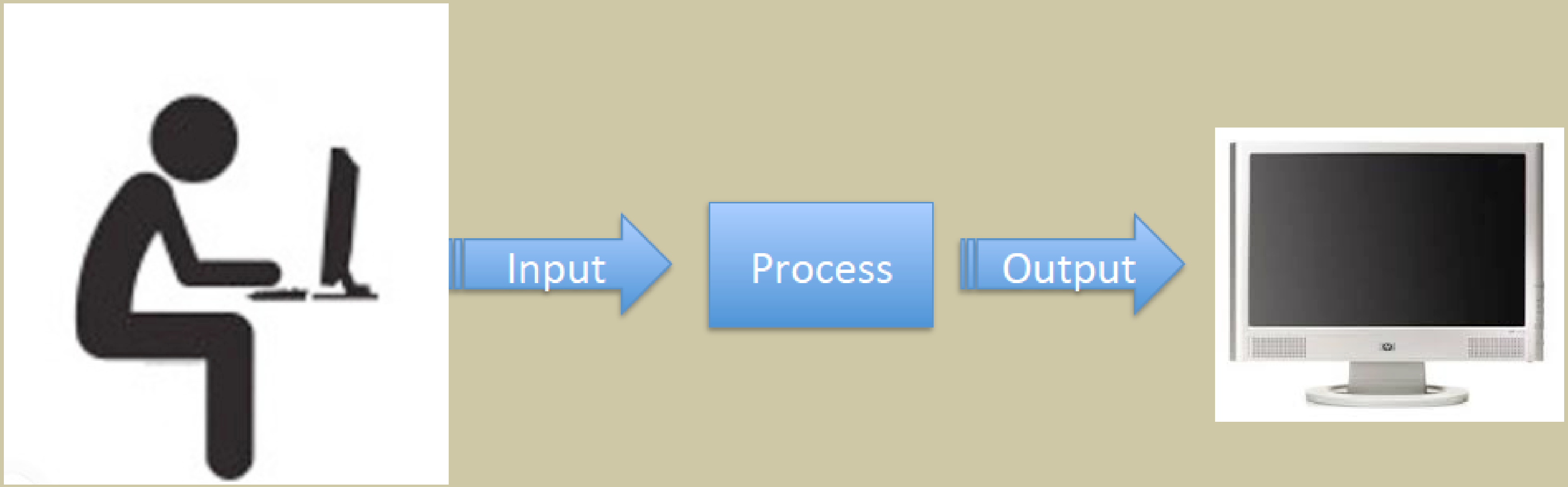
How can a user communicate with the Operating System?



CWD
PATH
HOME
USERNAME
…

- Shell maintains information
  - PATH : used for finding programs/scripts to be executed
  - HOME : full path to users home directory
  - …

Input and Output for a Process



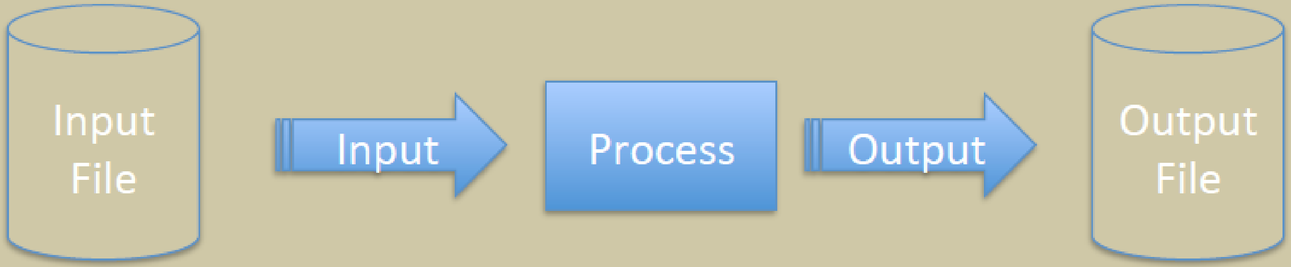
Input

Process

Output

- Most programs can accept input from the keyboard
- Most programs produce output
- Normally the output is given to the shell to be displayed on the screen

Redirecting Input and Output



- We can tell the shell to pass the characters from a file to a process as input
- We can ask the shell to place the output into a file instead of displaying it on the screen

Useful Commands in Piping

- wc - word, line, character, and byte count
- grep - output lines matching a pattern
- sort - sort lines of text files
- uniq - filter out repeated lines in a file
- cut - cut out selected portions of each line of a file
- tee – sends the data to both to a file and *stdout*

File completion

From command line,

- Type part of name of a command or filename, press <tab> and will auto-complete the name for you.

- Arrow keys to go back through history of commands you typed in.

Some other useful commands

- **wc**

```
wc file
wc –l file
wc –w file
```

- **grep** *pattern [file]*

```
grep public *java
grep include controller.cpp
grep TODO src/*
ls | grep –i main
```

diff

Compare two files

- `diff file1 file2`
- `sdiff file1 file2`

sort

- sort data.txt

- sort –n data.txt *(on numerical data file)*
  Why is the –n parameter necessary?

- Sort by column
  sort –k2 data.txt
  sort –k2,3 data.txt

- sort –u data.txt

find

- Find a file in a directory tree.
  (period means to start in the current directory)
- `find . -name filename -print`

- **Stop Here 8/29**

Let’s Play

- Pwd
- Ls
- Ls –l
- Cd (home)
- Cd (down)
- Mkdir
- Rmdir
- Rm
- Touch
- Cp (from) (to)
- Mv (from) (to)
- Echo “this” >> target
- Cat
- Vim
- Grep “pattern” in-target

Let’s Play

- **Modes in vim**
  - Command
  - Insert “i”
  - Last Line

Let’s Play

- **vim *filename* to edit a file, Vim starts out in command mode.**
- **To enter the *insert* mode, type i (for "insert")**
  - To get out of insert mode, hit the Escape key.
- **Once you press Escape, you're in command mode again.**
- **press : and Vim will switch to *last-line* mode. Enter a command like :w to write the file or :q to exit the editor. To quit without saving, :q!**

Let's Play

- h moves the cursor one character to the left.
- j moves the cursor down one line.
- k moves the cursor up one line.
- l moves the cursor one character to the right.
- 0 moves the cursor to the beginning of the line.
- $ moves the cursor to the end of the line.
- w move forward one word.
- b move backward one word.
- G move to the end of the file.
- gg move to the beginning of the file.
- dd deletes a record
- x deletes a character