$ linux 101

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$ what are we learning today?

- An introduction to Linux
- Linux filesystem
- The terminal
- Basic Linux commands
- Some tips and tricks
- User and group management
- File and owner permissions
- Networking commands
- Services and processes commands
- Some Linux security tips along the way!

$ a brief **introduction** to answer
all your burning questions

$ ***what*** is Linux?

- Open-source operating system
- Different distributions include…
  - Ubuntu
  - CentOS
  - Arch Linux
  - Debian
  - Fedora
  - Linux Mint
  - Red Hat Enterprise Linux
  - Slackware Linux
  - And many more!

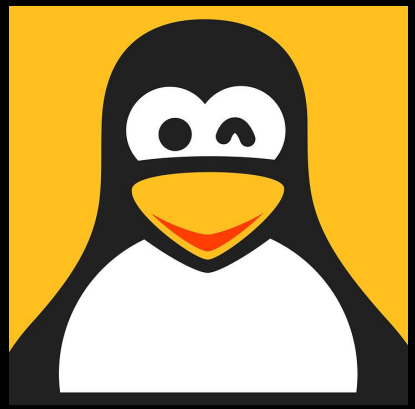
$ ***where*** is Linux used?

- Software Development
- Embedded Systems
- Supercomputing
- LAMP stack and web development
- And much more!

- Used in both business settings and schools

$ ***when*** did Linux start?

- **1991:** Linus Torvalds develops Linux as a personal project in Finland
- **1992:** Linux gets released online for free
- **1996:** Linux Mascot is created



His name is...

Torvalds **Uni**X aka **TUX**!

$ ***when*** did Linux start?

- **2002:** Red Hat Enterprise Linux released
- **2005:** Linus Torvalds created Git to maintain Linux kernel
- **2009:** Google announced Chrome OS based on Linux kernel
- **2013:** Valve released SteamOS based on Debian (Linux distro)





$ ***why*** use Linux?

PROS

- FREE!
- Open source community
- Highly secure

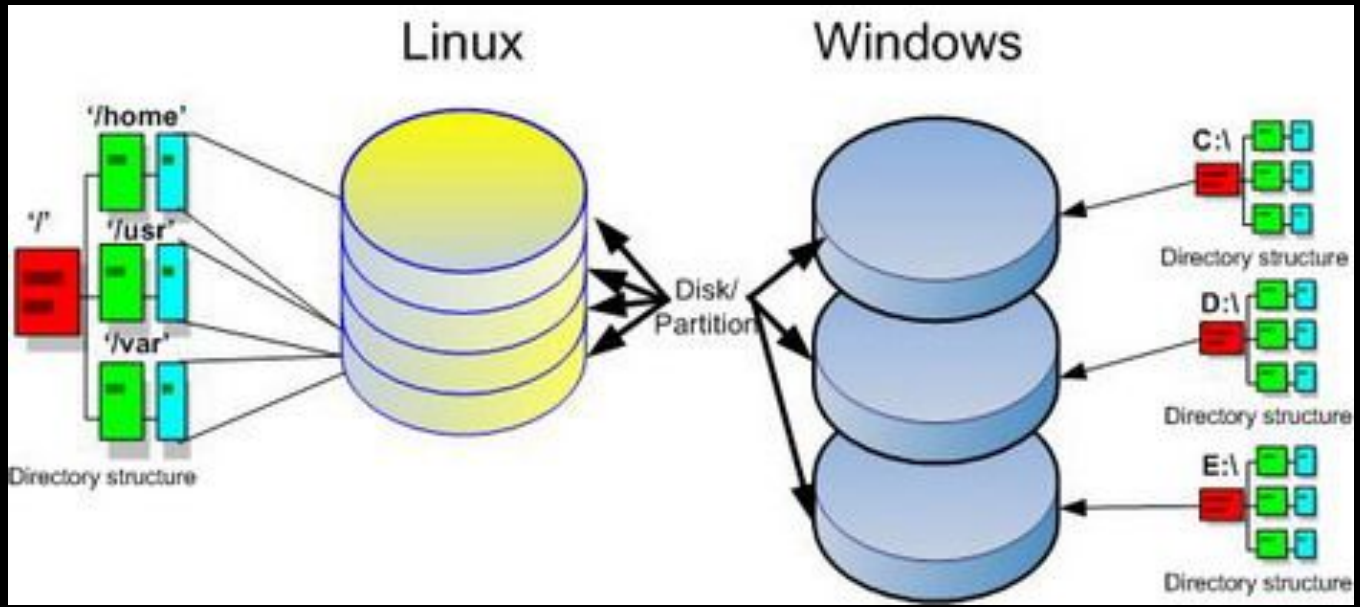
CONS

- Confusing for beginners / not UI friendly
- Games :-(

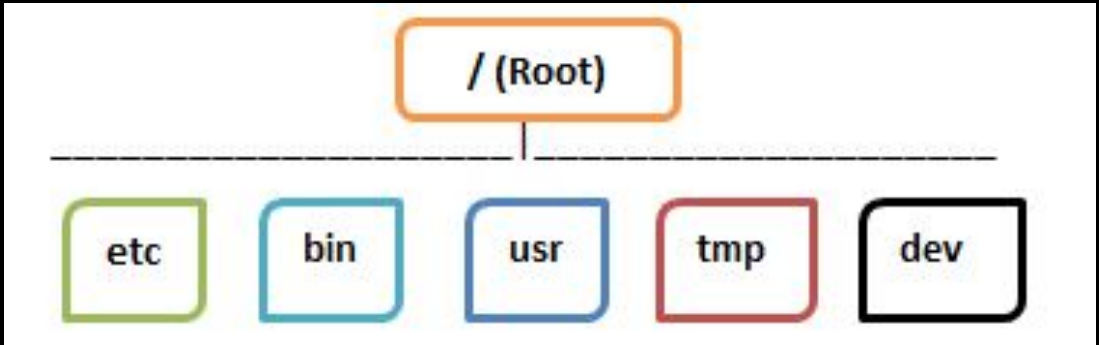
$ ***how*** do I Linux?

$ understanding the **filesystem**

$ filesystem comparison

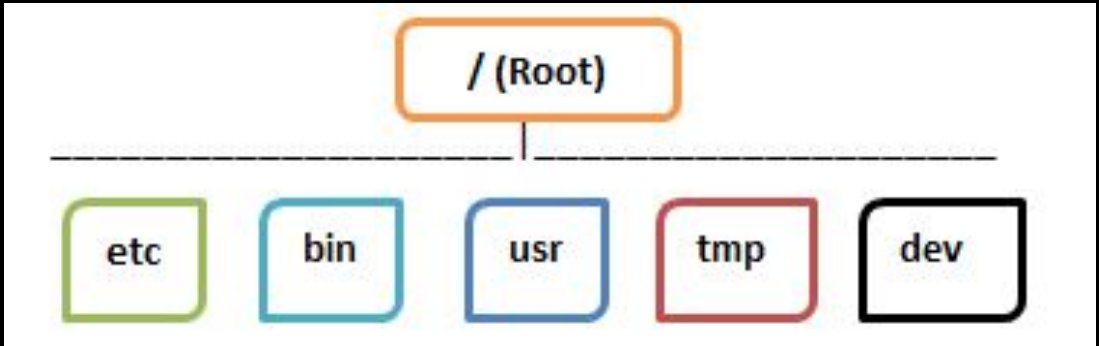


$ an overview of the filesystem



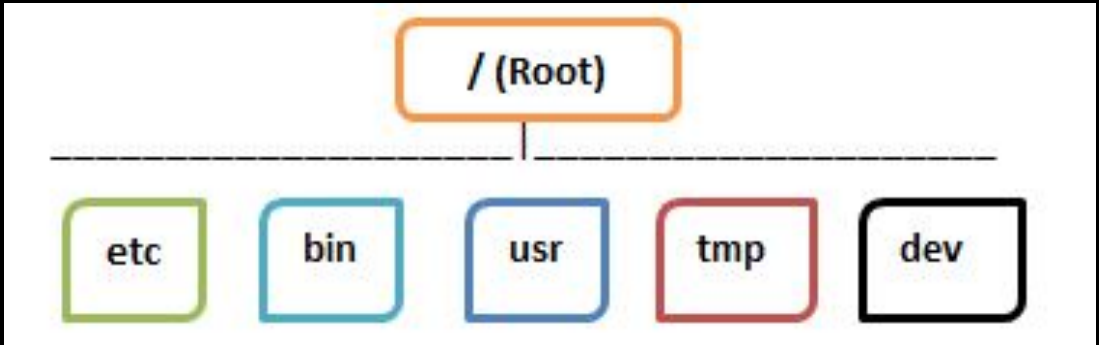
- **/ (root)** - root directory of the entire system hierarchy
- **/etc** - host-specific system-wide configuration files

$ an overview of the filesystem



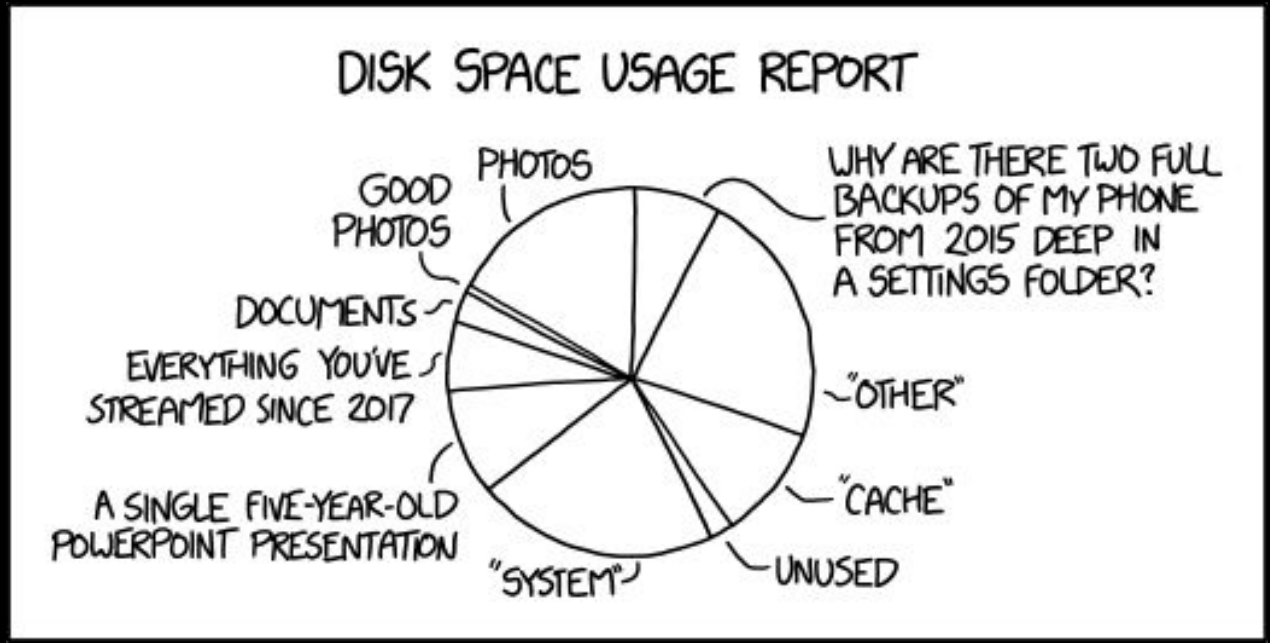
- **/bin** - essential user command binaries
- **/usr** - user utilities and applications

$ an overview of the filesystem



- **/tmp** - temporary files
- **/dev** - essential device files attached to the system

$ **Security Tip:** Follow partitions and use backups

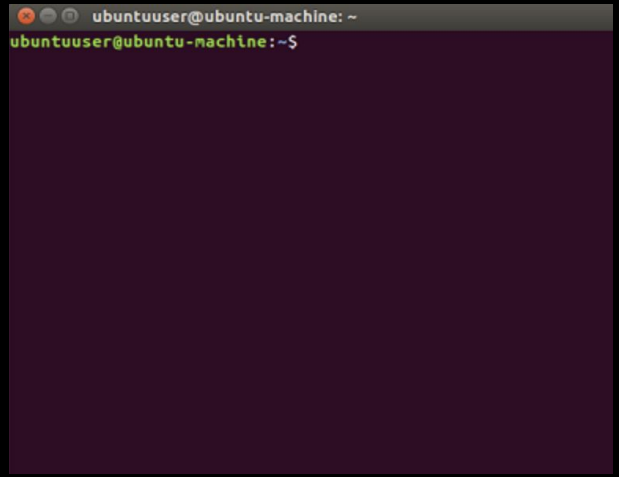


$ navigating your way through the **terminal**

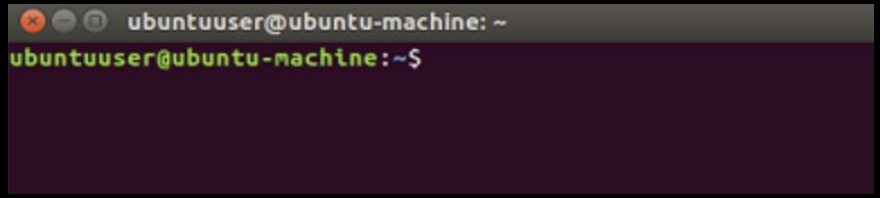
$ the what now?

- An interface where you can type and execute text-based commands

- Can be used to make your life easier!
  - Not always given the UI (ie remote connecting)
  - Powerful commands that can execute tasks faster and more efficiently



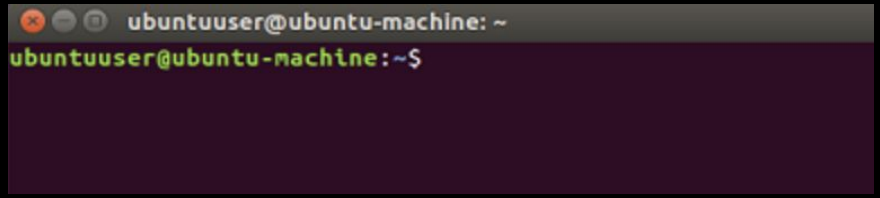
$ some basics about the terminal



- ubuntuuser = username
- ubuntu-machine = hostname
- ~ = current working directory
- $ (No) = superuser

Wait...superuser?

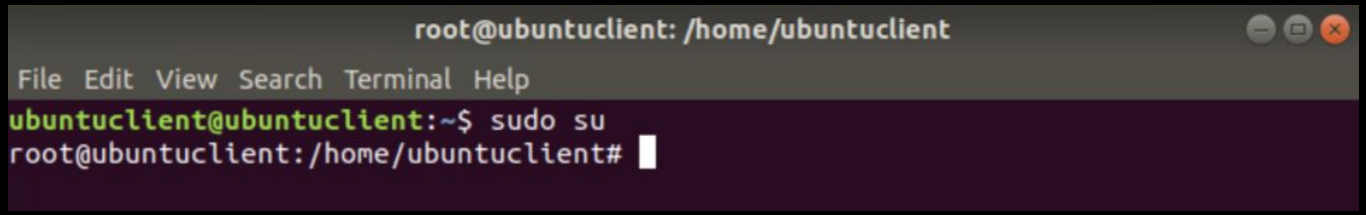
$ some basics about the terminal



- ubuntuuser = username
- ubuntu-machine = hostname
- ~ = current working directory
- $ (No) = superuser

Change to superuser with **sudo su**

$ some basics about the terminal



- root = username
- ubuntuclient = hostname
- /home/ubuntuclient = current working directory
- # (Yes) = superuser

$ ~~Security~~ Tip: Don't always run as root

I AM ROOT.

OK.

I AM ROOT.

OK.

rm -rf /

NO!!

$ learning the **basics**

$ about commands

- Commands are your way of communicating with your computer

- Three components to a command…
  - Utility (required)
  - Flag
  - Argument

$ pwd

- **pwd** = “Print working directory”
- It tells you where you are

```
$ pwd
/home/ubuntuclient
```

$ ls

- **ls** = “List”
- It lists out what’s in your folder

- Use flags to list more things...
  - **-a** : hidden files (starting with “.”)
  - **-l** : long format (with permissions)
- Can combine flags (ie -la)
- Can also list parent directory (ls ..), root directory (ls /) and user’s home directory (ls ~)

$ cd

- **cd** = “change directory”
- It lets you move from one folder to another

- Can change to the parent directory, root directory, and user’s home directory
  - Anyone remember how?

$ cd

- **cd** = “change directory”
- It lets you move from one folder to another

- Can change to the parent directory, root directory, and user’s home directory
  - Anyone remember how?
  - Using cd .. cd / and cd ~

$ echo and cat

- **echo** lets you display text in the terminal

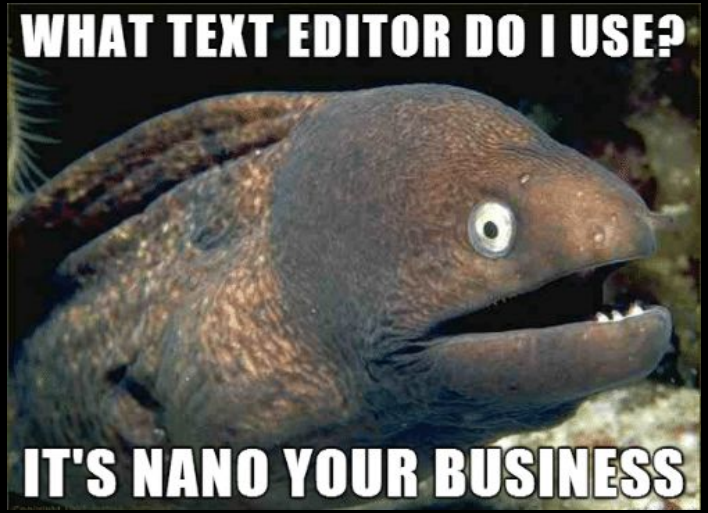
```
$ echo hello world
hello world
```

- **cat** = “concatenate”
- It lets you display text from files

```
$ cat example.txt
This is an example file.
```

$ vi, gedit, emacs, nano, etc

- Text editors to edit files
- All programmers have different preferences
  - vi is pretty powerful, but nano or gedit recommended for beginners
  - Some OS's might not have your prefered text editor, so good to learn others



$ touch

- **touch** lets you create, change and modify timestamps of files

- Can create multiple files
- Can use flags for additional specifications

$ mkdir

- **mkdir** = “make directory”
- It lets you create folders

$ rm, cp, and mv

- **rm** = "remove"
- It removes a file (use **rm -r** or **rmdir** to remove directories)

- **cp** = "copy"
- It copies the contents from one file to another

- **mv** = "move"
- It moves the contents from one file to another

$ grep and find

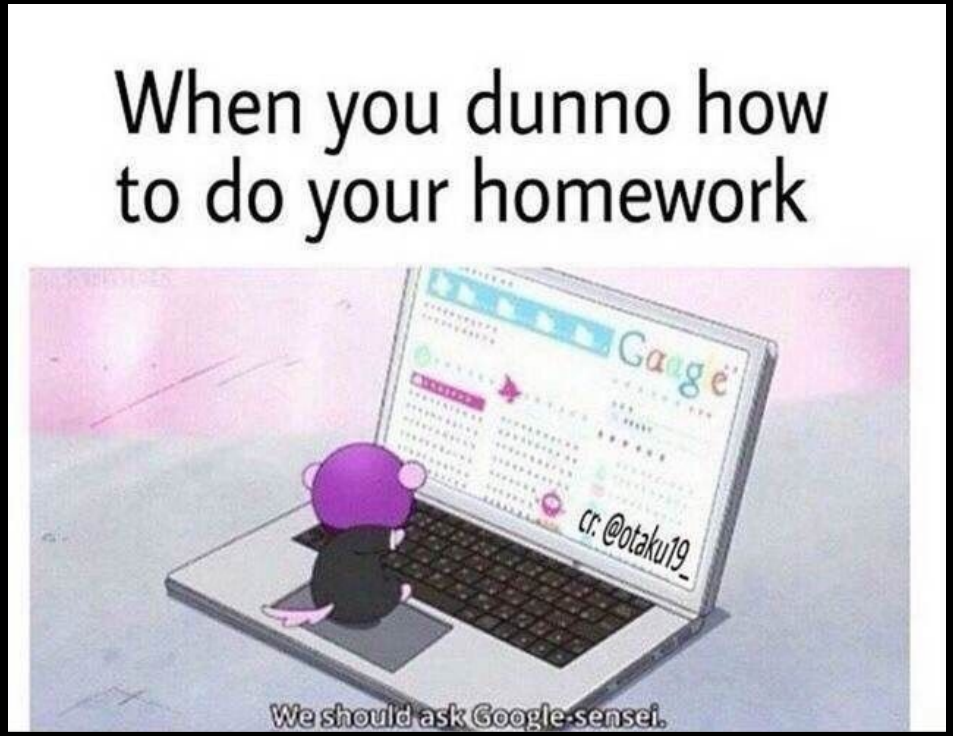
- **grep** lets you search for patterns in a file

```
$ grep helloworld complicatedfile.txt
```

- **find** lets you search for files and directories

```
$ find *.conf
```

$ ~~**Security**~~ **Tip:** Use man, tldr, or google!



$ learning **tips** and **tricks**

$ some general tips

- Use the **up** and **down** keys to run previous commands
- Use **TAB** for autocompletion

- **!!** - run the previous command
- **!$** - gives you access to previous command arguments
- Use **CTRL X**, **CTRL C** or **q** for exiting

$ clear and history

- **clear** lets you clear up the terminal
- You can also use **CTRL L**

- **history** lists out the commands you've previously used
- Clear history with **-c**
- You can use **CTRL R** for an interactive history search

$ redirection and pipes

- Redirect a command to a file or vice versa

```
$ echo some text > file
$ cat < file
```

- Pipes effectively chain commands together

```
$ cat file | less
```

$ **user** and **group** management

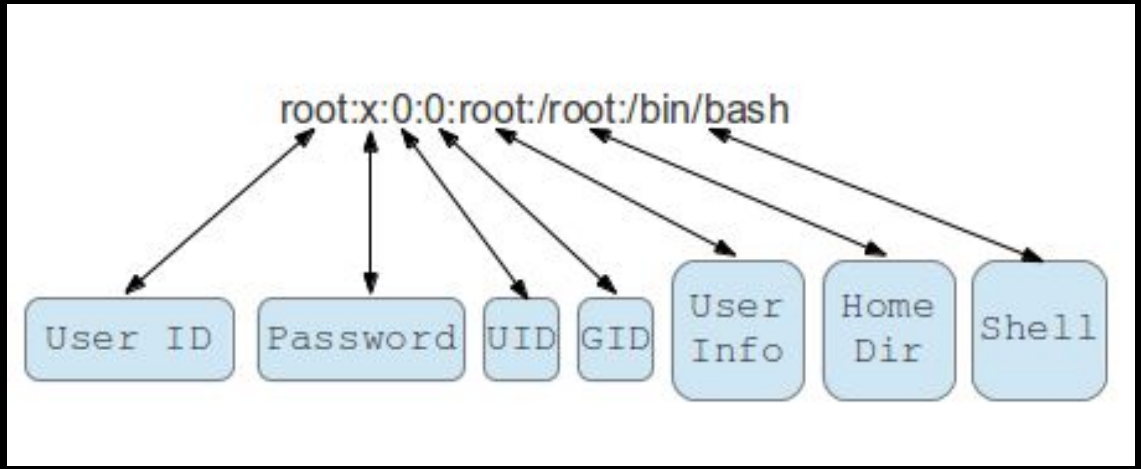
$ what info does a user have?

- Username
- UID (user ID)
- Default group
- Comments
- Shell
- Home directory location

And where exactly is all this stuff stored?

$ /etc/passwd

- User info is stored in passwd file wherein the format is…



- What's up with that x though?

$ /etc/shadow

- Encrypted passwords formally stored in **/etc/passwd**
- Now stored in **/etc/shadow** which is only readable by root

- Increase security as to reduce brute-force attacks

$ useradd and adduser

- **useradd** takes the form…

```
$ useradd -c "<comment>" -m (create homdir) -s <shell> -g <primary group> -G <other groups> <username>
```

  - Need to create password with **passwd <username>**

- **adduser** is interactive
  - Handles creating the home directory, shell, password, etc

$ userdel and deluser

- **userdel** and **deluser** delete the user…

  $ userdel <username>

  $ deluser <username>

- -r flag can be used to remove the user's home directory

$ what info does a group have?

- Group name
- Password (usually unused)
- GID (Group ID)
- List of accounts which belong to the group

- All groups found in **/etc/group**

$ groupadd, groupdel and usermod

- **groupadd** and **groupdel** add/delete groups

```
$ groupadd <group name>
$ groupdel <group name>
```

- usermod lets you add users to a group

```
$ usermod -g <primary> -G <alt1>, <altN>

$ usermod -aG <newgrp1>, <newgrp2>,
<newgrpN>
```

$ id, groups, and passwd

- **id** and **groups** check the id and group the user belongs to

```
$ id <user>
$ groups <user>
```

- **passwd** changes the user's password

```
$ passwd <user>
```

- Note: root always has UID and GUI of 0

$ **Security Tip:** Implement password policy!

$ sudo and su

- sudo <command> - run command as root
- su <username> - changes your user id to become superuser

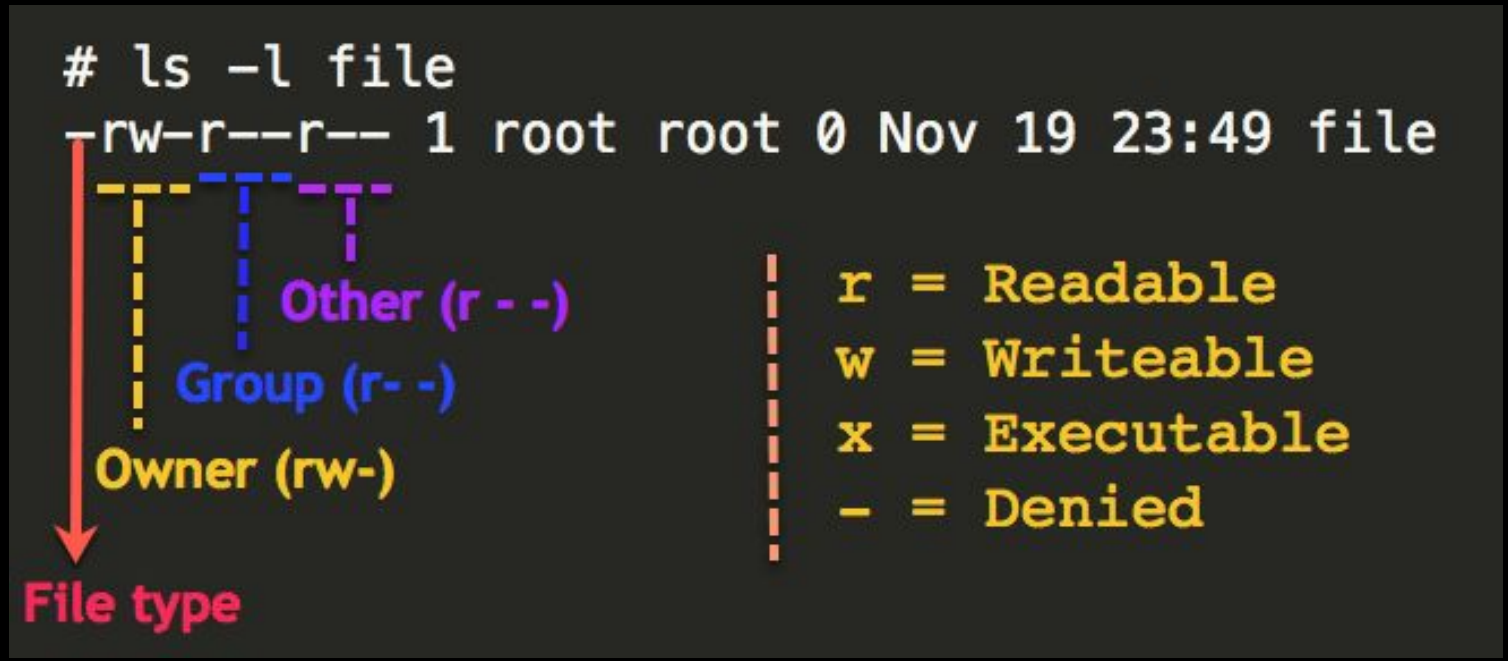
- Access to sudo is defined in the **/etc/sudoers** file

$ sudo and su

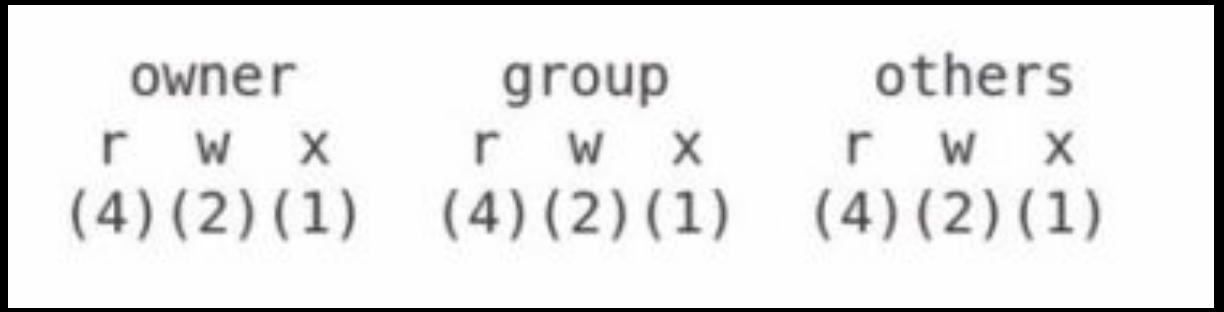
- Fun fact!

$ file and owner **permissions**

$ file permissions



$ file permissions



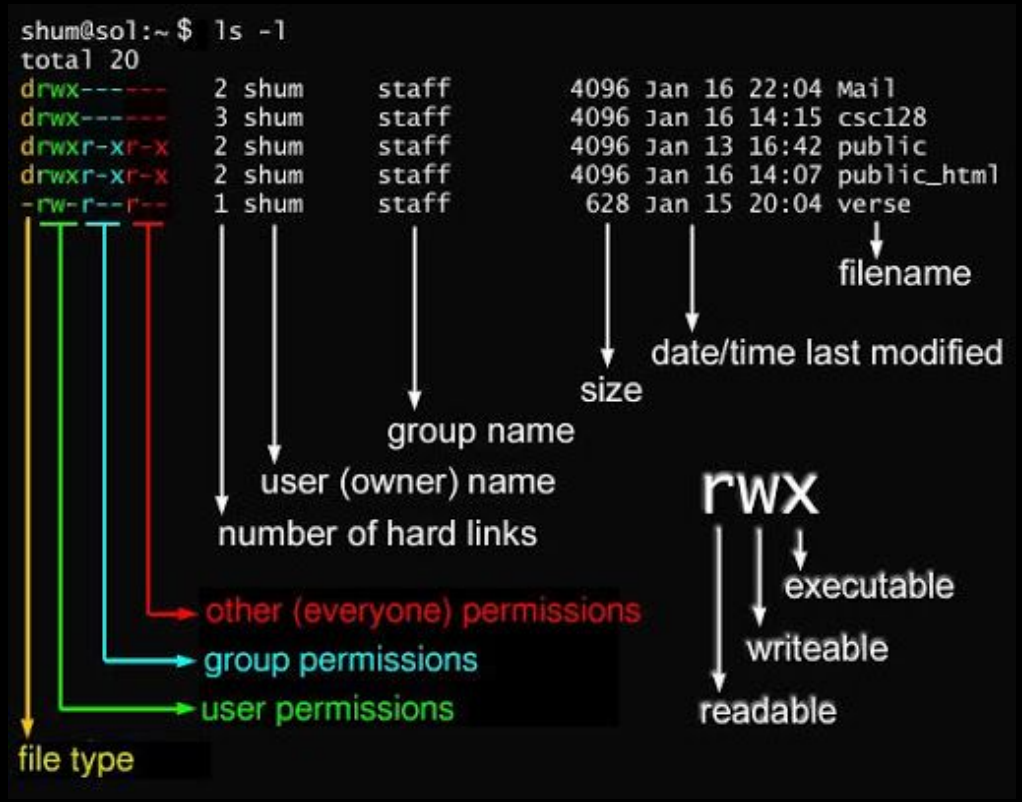
$ chmod

- chmod lets you change file permissions

- **4** = **R**ead
- **2** = **W**rite
- **1** = E**X**ecute

```
$ chmod <permission> <filename>
```

$ owner permissions



$ chown and chgrp

- **chown** lets you change the user who owns the file

  ```
  $ chown <user> <path_to_file>
  ```

- **chgrp** lets you change the group who owns the file
-

  ```
  $ chgrp <group> <path_to_file>
  ```

$ **networking** commands

$ ip addr and ifconfig

- **ip addr** and **ifconfig** let you display the network specifications

```
$ ip addr
$ ip a
$ ip r

$ ifconfig
```

$ ping

- **ping** lets you send an ICMP echo request packet to network hosts to check connectivity

```
$ ping <IP address>
```

$ nslookup and dig

- **nslookup** and **dig** let you query DNS nameservers

```
$ nslookup <domain name>

$ dig <domain name>
```

$ netstat and netcat

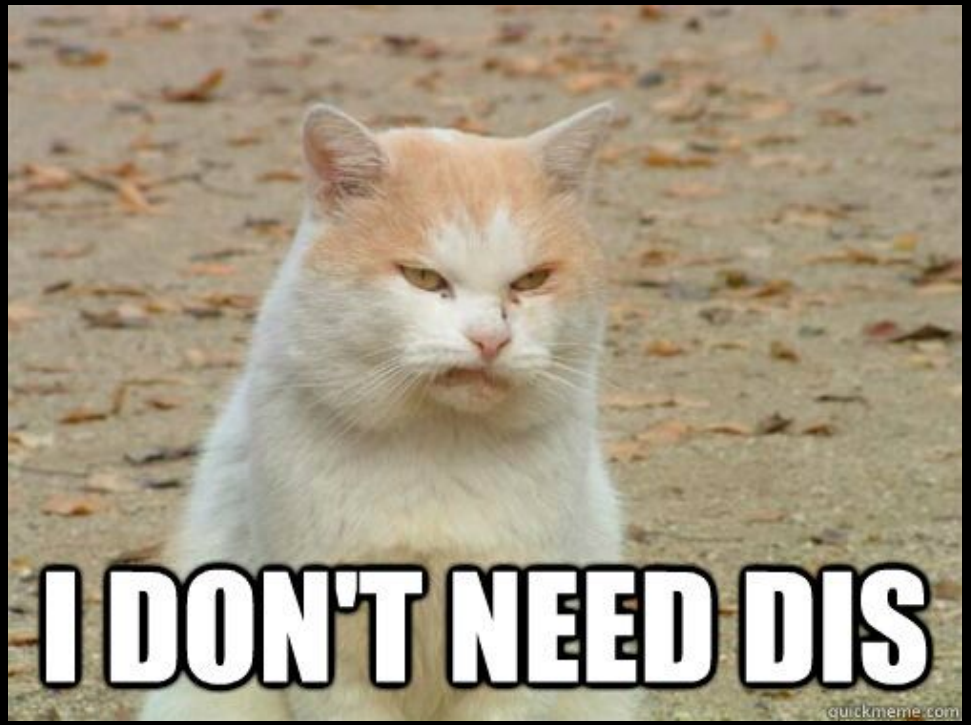
- **netstat** lets you see which applications are listening to current traffic

- **netcat** lets you connect connectivity to a TCP or UDP port
  - **-v** : verbose
  - **-z** : Scan without sending data

```
$ netstat

$ nc -vz <domain> <port>
```

$ **Security Tip:** Only open ports that you need!



$ nmap and traceroute

- **nmap** = “network mapper”
- It lets you scan a host to see what ports the host is listening to

```
$ nmap <IP address>
```

- **traceroute** lets you trace the path of the network
  - Useful for determining latency and network issues

```
$ traceroute <IP address>
```

$ ssh

- **ssh** = “secure shell”
- It lets you remote connect securely to another machine (replaced by Telnet)

```
$ ssh username@hostname
```

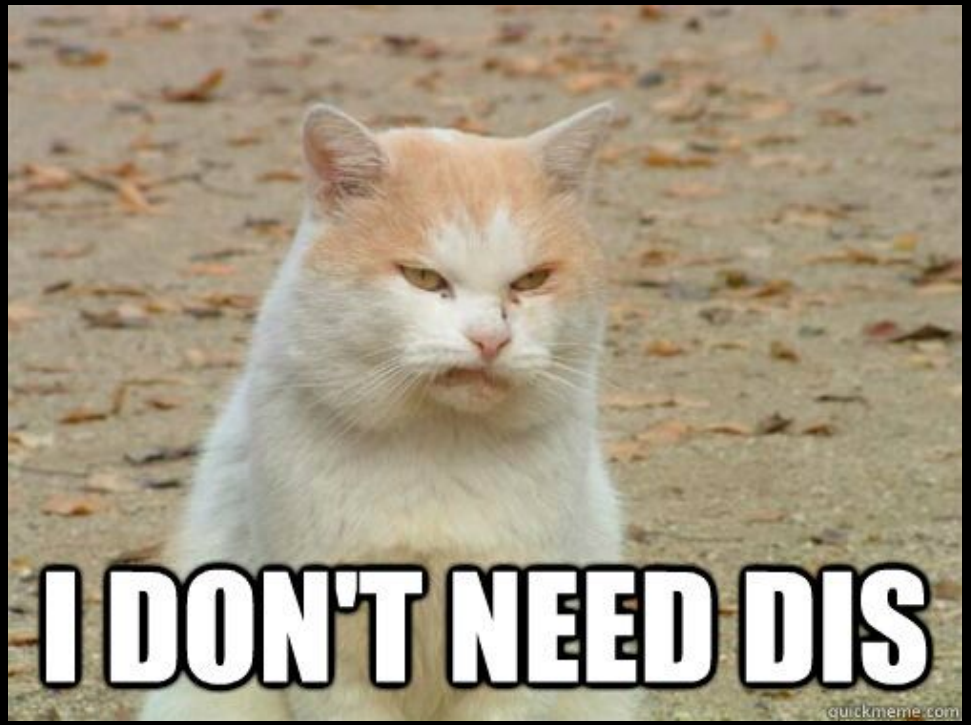
$ **services** and **processes** commands

$ apt

- **apt** lets you install package managers

```
$ apt-get update
$ apt-get install <package>
$ apt upgrade <package>
```

$ **Security Tip:** Only install what you need!



$ ps

- **ps** = "process status"
- It lets you see info about current processes
  - **a** : Shows processes for all users
  - **u** : Displays the process' user/owner
  - **x** : Shows processes not attached to a terminal

```
$ ps aux
$ ps aux | grep <search> | less
```

$ top and htop

- **top** and **htop** let you see info about current processes interactively
  - htop needs to be installed first

```
$ top
$ htop
```

$ service and systemctl

- Two main ways to control a service…
- System V uses service (older)

```
$ service <name> <start | stop | restart
| reload | status>
```

- Systemd uses systemctl (newer)

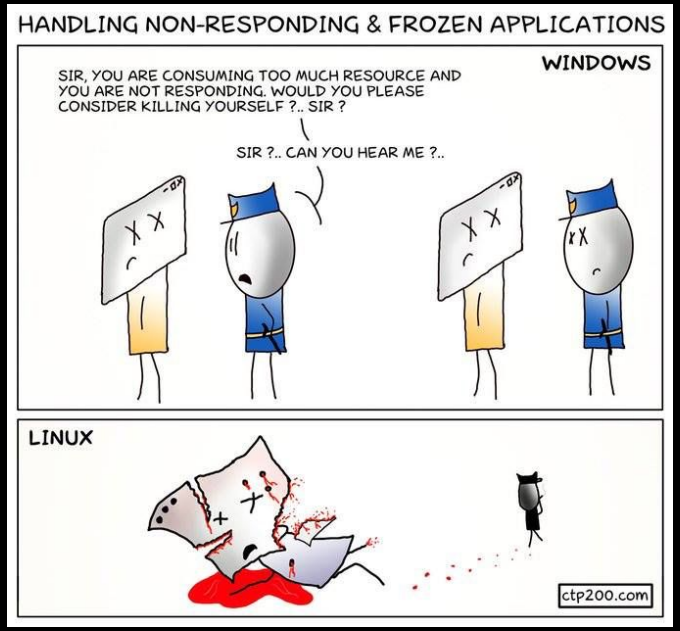
```
$ systemctl <name> <start | stop |
restart | reload | status>
```

$ kill

- **kill** lets you stop running a process

```
$ kill <process id>
$ kill %<job id>

$ kill -9 <process id>
```



$ any **questions**?