



THE FUNDAMENTALS OF LINUX OPERATIONS

BY: DIALLO WILLIAMS

OBJECTIVES:

- Introduction
- Linux Filesystem Hierarchy
- Linux Shell Scripts
- User and Group Management
- Network Configuration
- Career / Softskills
- Conclusion

Freedom. Choices. Beautiful.



INTRODUCTION

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- LINUX IS AN OPERATING SYSTEM (OS) USED TO RUN A VARIETY OF APPLICATIONS ON A VARIETY OF DIFFERENT HARDWARE COMPONENTS.
- LINUX BEGAN IN 1991 AS A PERSONAL PROJECT BY FINNISH STUDENT LINUS TORVALDS: TO CREATE A NEW FREE OPERATING SYSTEM KERNEL.
- LINUX IS AN **OPEN SOURCE SOFTWARE (OSS)** THAT IS FREELY DEVELOPED AND CONTINUOUSLY IMPROVED BY A LARGE COMMUNITY OF SOFTWARE DEVELOPERS.

```
@ubuntu:~$ cd ~
@ubuntu:~$ pwd
~/lowill
@ubuntu:~$ mkdir NovDecSession
@ubuntu:~$ cd NovDecSession
@ubuntu:~/NovDecSession$ mkdir Course1
@ubuntu:~/NovDecSession$ mkdir Course2
@ubuntu:~/NovDecSession$ mkdir Course3
@ubuntu:~/NovDecSession$ ls
Course1 Course2 Course3
@ubuntu:~/NovDecSession$ cd Cpourse1
Cpourse1: No such file or directory
@ubuntu:~/NovDecSession$ cd Course1
@ubuntu:~/NovDecSession/Course1$ touch file1 file2 file3
@ubuntu:~/NovDecSession/Course1$ ls
file1 file2 file3
@ubuntu:~/NovDecSession/Course1$
```

```
file1
-rw-rw-r-- 1 diallowill diallowill 0 Nov  8 07:44 file1
-rw-rw-r-- 1 diallowill diallowill 0 Nov  8 07:44 file2
-rw-rw-r-- 1 diallowill diallowill 0 Nov  8 07:44 file3
diallowill@ubuntu:~/NovDecSession/Course1$ ls -l ~/NovDecSession/Course1
total 0
-rw-rw-r-- 1 diallowill diallowill 0 Nov  8 07:44 file1
-rw-rw-r-- 1 diallowill diallowill 0 Nov  8 07:44 file2
-rw-rw-r-- 1 diallowill diallowill 0 Nov  8 07:44 file3
diallowill@ubuntu:~/NovDecSession/Course1$ ls -l~/NovDecSession/Course1
ls: invalid option -- '~'
Try 'ls --help' for more information.
diallowill@ubuntu:~/NovDecSession/Course1$ tree -d -L 2
.
├── Course1
├── Course2
└── Course3
0 directories
diallowill@ubuntu:~/NovDecSession/Course1$ ls -l ~/NovDecSession/Course1
total 0
```

CREATE DIRECTORIES AND FILES

COPY AND REMOVE DIRECTORIES AND FILES

```
diallowill@ubuntu:~/Desktop$ cd ~
diallowill@ubuntu:~$ pwd
/home/diallowill
diallowill@ubuntu:~$ cp -r NovDecSession JanFebSession
diallowill@ubuntu:~$ tree NovDecSession JanFebSession
NovDecSession
├── Course1
│   ├── file1
│   ├── file2
│   └── file3
├── Course2
└── Course3
JanFebSession
├── Course1
│   ├── file1
│   ├── file2
│   └── file3
├── Course2
└── Course3

6 directories, 6 files
diallowill@ubuntu:~$ rmdir JanFebSession/Course3
diallowill@ubuntu:~$ ls JanFebSession
Course1 Course2
diallowill@ubuntu:~$ rm JanFebSession/Course1/file3
diallowill@ubuntu:~$ tree NovDecSession JanFebSession
NovDecSession
├── Course1
│   ├── file1
│   ├── file2
│   └── file3
├── Course2
└── Course3
JanFebSession
├── Course1
│   ├── file1
│   └── file2
├── Course2
└── Course3

5 directories, 5 files
diallowill@ubuntu:~$
```

```
├── Course1
│   ├── file1
│   ├── file2
│   └── file3
├── Course2
└── Course3
```

6 directories, 6 files

```
diallowill@ubuntu:~$ rmdir JanFebSession/Course3
```

```
diallowill@ubuntu:~$ ls JanFebSession
```

```
Course1 Course2
```

```
diallowill@ubuntu:~$ rm JanFebSession/Course1/file3
```

```
diallowill@ubuntu:~$ tree NovDecSession JanFebSession
```

```
NovDecSession
```

```
├── Course1
│   ├── file1
│   ├── file2
│   └── file3
├── Course2
└── Course3
```

```
JanFebSession
```

```
├── Course1
│   ├── file1
│   └── file2
├── Course2
└── Course3
```

5 directories, 5 files

```
diallowill@ubuntu:~$
```

LOCATE DIRECTORIES AND FILES

```
diallowill@ubuntu:~/Desktop$ cd ~
diallowill@ubuntu:~$ pwd
/home/diallowill
diallowill@ubuntu:~$ find ~ -iname course* type d
find: paths must precede expression: `type'
diallowill@ubuntu:~$ find ~ -iname course* -type d
/home/diallowill/NovDecSession/Course3
/home/diallowill/NovDecSession/Course2
/home/diallowill/NovDecSession/Course1
/home/diallowill/JanFebSession/Course2
/home/diallowill/JanFebSession/Course1
diallowill@ubuntu:~$ find ~ -iname file1
/home/diallowill/NovDecSession/Course1/file1
/home/diallowill/JanFebSession/Course1/file1
diallowill@ubuntu:~$ find ~ -iname file*
/home/diallowill/NovDecSession/Course1/file3
/home/diallowill/NovDecSession/Course1/file2
/home/diallowill/NovDecSession/Course1/file1
/home/diallowill/JanFebSession/Course1/file2
/home/diallowill/JanFebSession/Course1/file1
diallowill@ubuntu:~$ find ~ -iname file[1,2,3]
/home/diallowill/NovDecSession/Course1/file3
/home/diallowill/NovDecSession/Course1/file2
/home/diallowill/NovDecSession/Course1/file1
```

```
diallowill@ubuntu:~$ sudo updatedb
in/find: '/run/user/1000/doc': Permission denied
in/find: '/run/user/1000/gvfs': Permission denied
diallowill@ubuntu:~$ locate -S
Database /var/cache/locate/locatedb is in the GNU LOCATE02 format.
Database was last modified at 2020:11:08 09:15:48.756684529 -0800
Database size: 3786246 bytes
Database filenames: 312581
Database file names have a cumulative length of 20127081 bytes.
Database file names,
- 75 contain whitespace,
- 0 contain newline characters,
- and 4 contain characters with the high bit set.
Database compression ratio 81.19% (higher is better)
```

```
home/diallowill/NovDecSession/Course1/file1
home/diallowill/JanFebSession/Course1/file2
home/diallowill/JanFebSession/Course1/file1
diallowill@ubuntu:~$ find ~ -iname file[1,2,3]
/home/diallowill/NovDecSession/Course1/file3
/home/diallowill/NovDecSession/Course1/file2
/home/diallowill/NovDecSession/Course1/file1
/home/diallowill/JanFebSession/Course1/file2
/home/diallowill/JanFebSession/Course1/file1
diallowill@ubuntu:~$ sudo apt install locate
Password for diallowill:
Get package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
locate
1 newly installed, 0 to remove and 238 not upgraded.
85.3 kB of archives.
After this operation, 265 kB of additional disk space will be used.
Get:1 /us.archive.ubuntu.com/ubuntu focal/universe amd64/locate 0.26-3 [85.3 kB]
debconf: delaying package configuration, since apt-utils is not installed.
Fetched 85.3 kB in 0s (223 kB/s)
debconf: previously unselected package locate;
Setting up locate (0.26-3) ...
```

```
diallowill@ubuntu:~$ sudo updatedb
```

CHANGE SCRIPT FILE PERMISSION

```
diallowill@ubuntu:~$ cd ~
diallowill@ubuntu:~$ pwd
/home/diallowill
diallowill@ubuntu:~$ nano todolist
diallowill@ubuntu:~$ ls -l todolist
-rw-rw-r-- 1 diallowill diallowill 185 Nov 15 10:39 todolist
diallowill@ubuntu:~$ bash todolist
Enter Today's to-do-list (Press ENTER to complete):
1-family 2-work 3-school
You entered: 1-family 2-work 3-school
diallowill@ubuntu:~$ ls
Desktop  Downloads  Music  NovDecSession  Public  Templates  todolis
Documents  JanFebSession  MyToDoList  Pictures  snap  todo  Videos
diallowill@ubuntu:~$ cat MyToDoList
Sun 15 Nov 2020 10:42:18 AM PST
Today's to-do-list -- 1-family 2-work 3-school

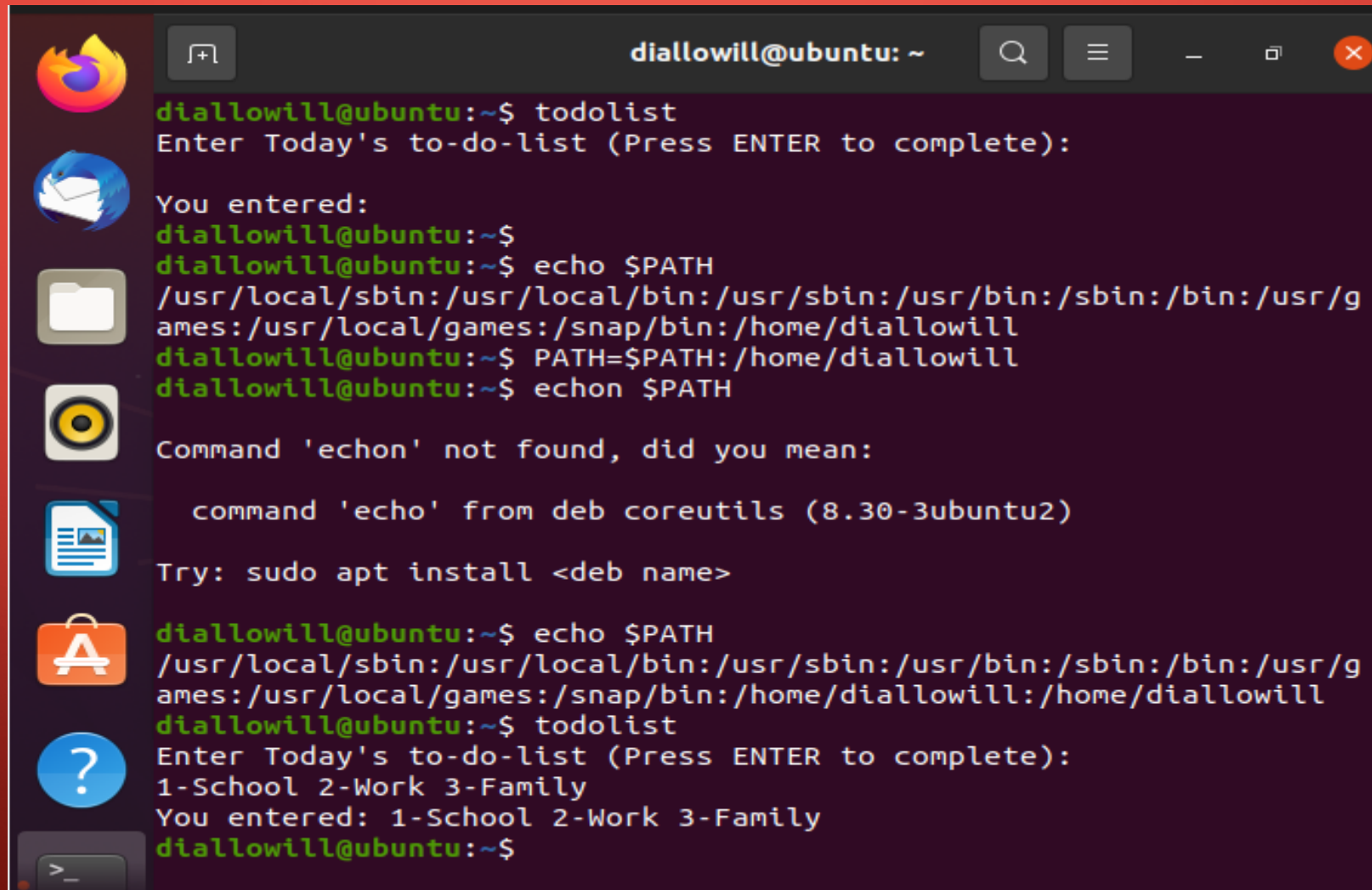
diallowill@ubuntu:~$ cd ~
diallowill@ubuntu:~$ pwd
/home/diallowill
diallowill@ubuntu:~$ nano todolist
diallowill@ubuntu:~$ chmod 755 todolist
diallowill@ubuntu:~$ ls -l todolist
-rwxr-xr-x 1 diallowill diallowill 197 Nov 15 10:50 todolist
diallowill@ubuntu:~$ ./todolist
bash: ./todolist: pathbash: bad interpreter: No such file or directory
diallowill@ubuntu:~$ nano todolist
diallowill@ubuntu:~$ chmod 755 todolist
diallowill@ubuntu:~$ ls -l todolist
```

CHANGE SCRIPT FILE PERMISSION CONTINUED..

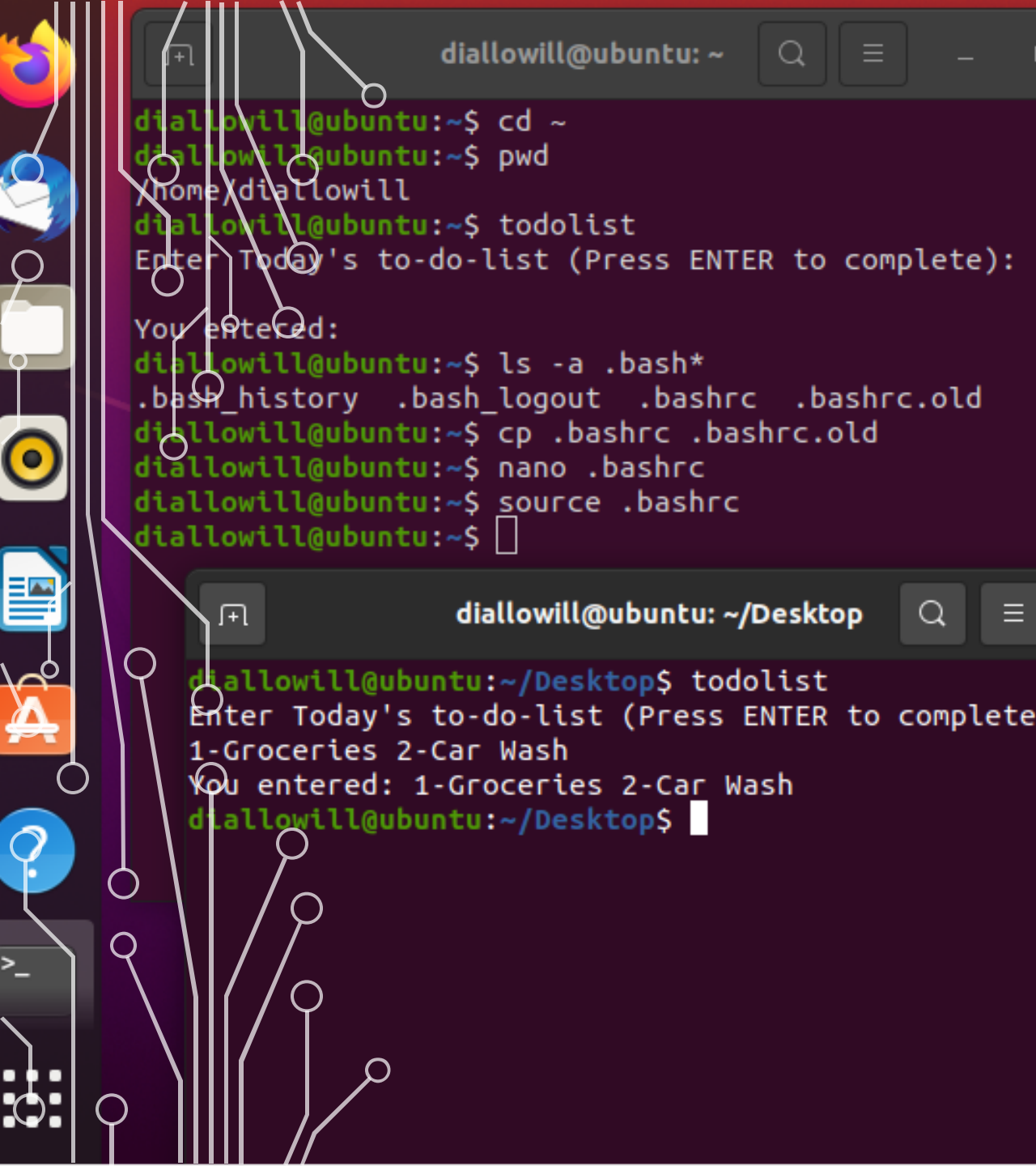
```
diallowill@ubuntu:~$ bash todolist
Enter Today's to-do-list (Press ENTER to complete):
1-family 2-work 3-school
You entered: 1-family 2-work 3-school
diallowill@ubuntu:~$ ls
Desktop      Downloads      Music          NovDecSession  Public  Templates  todolist
Documents    JanFebSession MyToDoList    Pictures        snap    todo       Videos
diallowill@ubuntu:~$ cat MyToDoList
Sun 15 Nov 2020 10:42:18 AM PST
Today's to-do-list -- 1-family 2-work 3-school

diallowill@ubuntu:~$ cd ~
diallowill@ubuntu:~$ pwd
/home/diallowill
diallowill@ubuntu:~$ nano todolist
diallowill@ubuntu:~$ chmod 755 todolist
diallowill@ubuntu:~$ ls -l todolist
-rwxr-xr-x 1 diallowill diallowill 197 Nov 15 10:50 todolist
diallowill@ubuntu:~$ ./todolist
bash: ./todolist: pathbash: bad interpreter: No such file or directory
diallowill@ubuntu:~$ nano todolist
diallowill@ubuntu:~$ chmod 755 todolist
diallowill@ubuntu:~$ ls -l todolist
-rwxr-xr-x 1 diallowill diallowill 198 Nov 15 11:06 todolist
diallowill@ubuntu:~$ ./todolist
Enter Today's to-do-list (Press ENTER to complete):
1-Work 2-Family 3-School
You entered: 1-Work 2-Family 3-School
diallowill@ubuntu:~$
```


SET PATH VARIABLE



```
diallowill@ubuntu: ~  
diallowill@ubuntu:~$ todolist  
Enter Today's to-do-list (Press ENTER to complete):  
  
You entered:  
diallowill@ubuntu:~$  
diallowill@ubuntu:~$ echo $PATH  
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/g  
ames:/usr/local/games:/snap/bin:/home/diallowill  
diallowill@ubuntu:~$ PATH=$PATH:/home/diallowill  
diallowill@ubuntu:~$ echon $PATH  
  
Command 'echon' not found, did you mean:  
  
  command 'echo' from deb coreutils (8.30-3ubuntu2)  
  
Try: sudo apt install <deb name>  
  
diallowill@ubuntu:~$ echo $PATH  
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/g  
ames:/usr/local/games:/snap/bin:/home/diallowill:/home/diallowill  
diallowill@ubuntu:~$ todolist  
Enter Today's to-do-list (Press ENTER to complete):  
1-School 2-Work 3-Family  
You entered: 1-School 2-Work 3-Family  
diallowill@ubuntu:~$
```



MAKE PATH VARIABLE PERMANENT

ADD USERS AND GROUPS USING THE COMMAND LINE INTERFACE (C.L.I.)

- 1. What does the `-m` option in the `useradd` command do?
- Answer here: The `-m` option creates a home folder

- 2. What does the `-3` option in the `tail` command do?
- Answer here: the `-3` option in the `tail` command is Three lines

- 3. Which line of the `/etc/group` file lists members of the “students” group? Copy it here.
- Answer here: Line 3 `sudo tail -3 /etc/group`
- `systemd-coredump:x:999:`
- `mary:x:1001:`
- `students:x:1002:diallowill,mary`

TEST USER & GROUP SETTINGS

```
mary@ubuntu: ~/Desktop
mary@ubuntu:~/Desktop$ nano .bashrc
mary@ubuntu:~/Desktop$ source .bashrc
mary@ubuntu:~/Desktop$ todolist
Enter Today's to-do-list (Press ENTER to complete):
1-School 2-School 3-School
You entered: 1-School 2-School 3-School
mary@ubuntu:~/Desktop$ cat MyToDoList
Mon 16 Nov 2020 02:26:01 PM PST
Today's to-do-list -- 1-School 2-School 3-School

mary@ubuntu:~/Desktop$
```

```
john@ubuntu:~/Desktop$ nano .bashrc
john@ubuntu:~/Desktop$ source .bashrc
john@ubuntu:~/Desktop$ todolist
Enter Today's to-do-list (Press ENTER to complete):
1-Family 2-Family 3-Family
You entered: 1-Family 2-Family 3-Family
john@ubuntu:~/Desktop$ cat MyToDoList
Mon 16 Nov 2020 03:08:09 PM PST
Today's to-do-list -- 1-Family 2-Family 3-Family

john@ubuntu:~/Desktop$
```

ADD USERS IN GUI



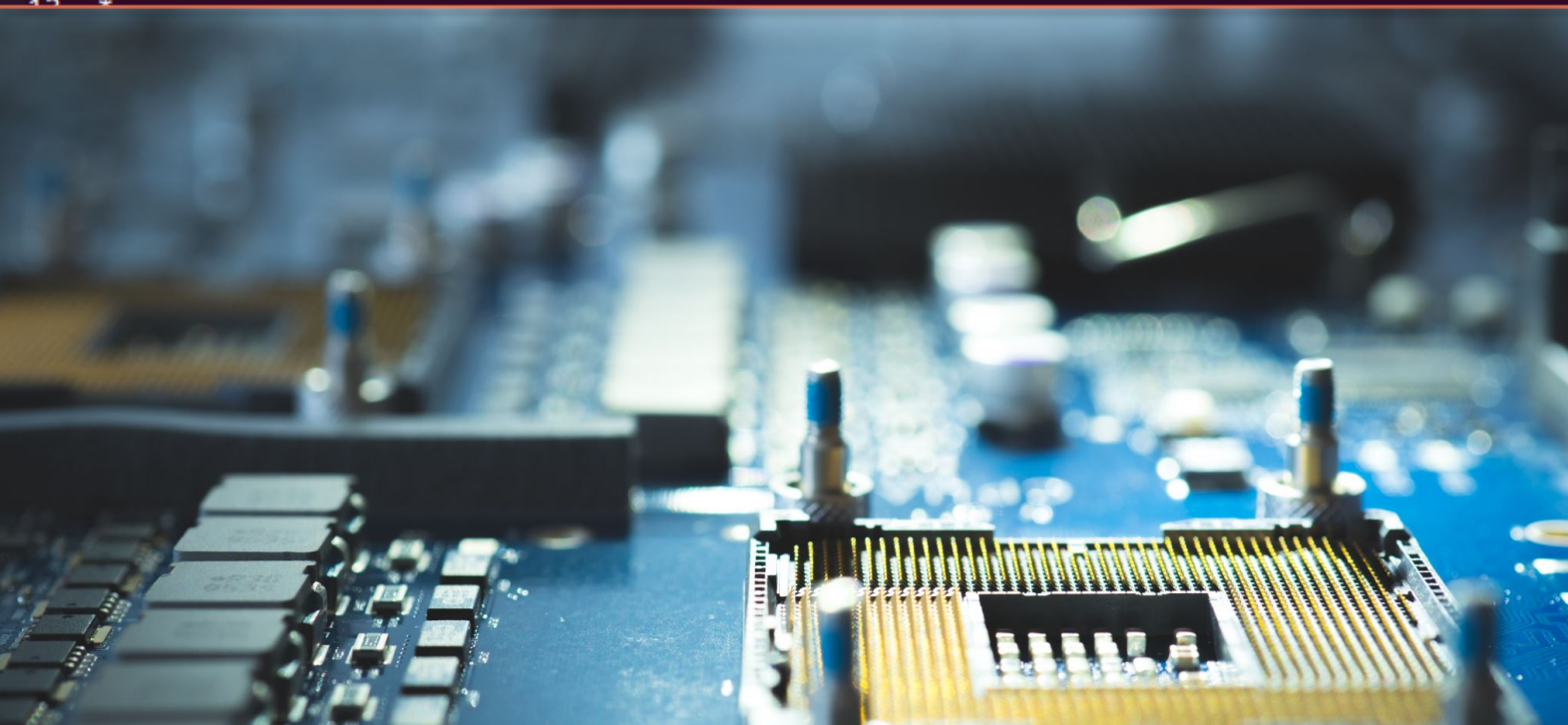
REMOVE USERS & GROUPS

```
diallowill@ubuntu: ~  
diallowill@ubuntu:~$ cd ~  
diallowill@ubuntu:~$ pwd  
/home/diallowill  
diallowill@ubuntu:~$ ls -l todolist  
-rwxr-xr-x 1 diallowill diallowill 198 Nov 15 11:06 todolist  
diallowill@ubuntu:~$ sudo chgrp students todolist  
[sudo] password for diallowill:  
diallowill@ubuntu:~$ ls -l todolist  
-rwxr-xr-x 1 diallowill students 198 Nov 15 11:06 todolist  
diallowill@ubuntu:~$ sudo chmod 750 todolist  
diallowill@ubuntu:~$ ls -l todolist  
-rwxr-x--- 1 diallowill students 198 Nov 15 11:06 todolist  
diallowill@ubuntu:~$
```

```
mary@ubuntu: ~/Desktop  
mary@ubuntu:~/Desktop$ nano .bashrc  
mary@ubuntu:~/Desktop$ source .bashrc  
mary@ubuntu:~/Desktop$ todolist  
Enter Today's to-do-list (Press ENTER to complete):  
1-School 2-School 3-School  
You entered: 1-School 2-School 3-School  
mary@ubuntu:~/Desktop$ cat MyToDoList  
Thu 17 Dec 2020 01:14:33 PM PST  
Today's to-do-list -- 1-School 2-School 3-School  
mary@ubuntu:~/Desktop$
```

```
diallowill@ubuntu: ~
update-alternatives: using /usr/bin/traceproto.db to provide
/usr/bin/traceproto (traceproto) in auto mode
update-alternatives: using /usr/sbin/tcptraceroute.db to provide
/usr/sbin/tcptraceroute (tcptraceroute) in auto mode
Processing triggers for man-db (2.9.1-1) ...
diallowill@ubuntu:~$ traceroute -n -q 1 www.devry.edu
traceroute to www.devry.edu (104.123.65.184), 30 hops max, 60 byte packets
 1  192.168.30.2  3.727 ms
 2  *
 3  *
 4  *
 5  *
 6  *
 7  *
 8  *
 9  *
10  *
11  *
12  *
```

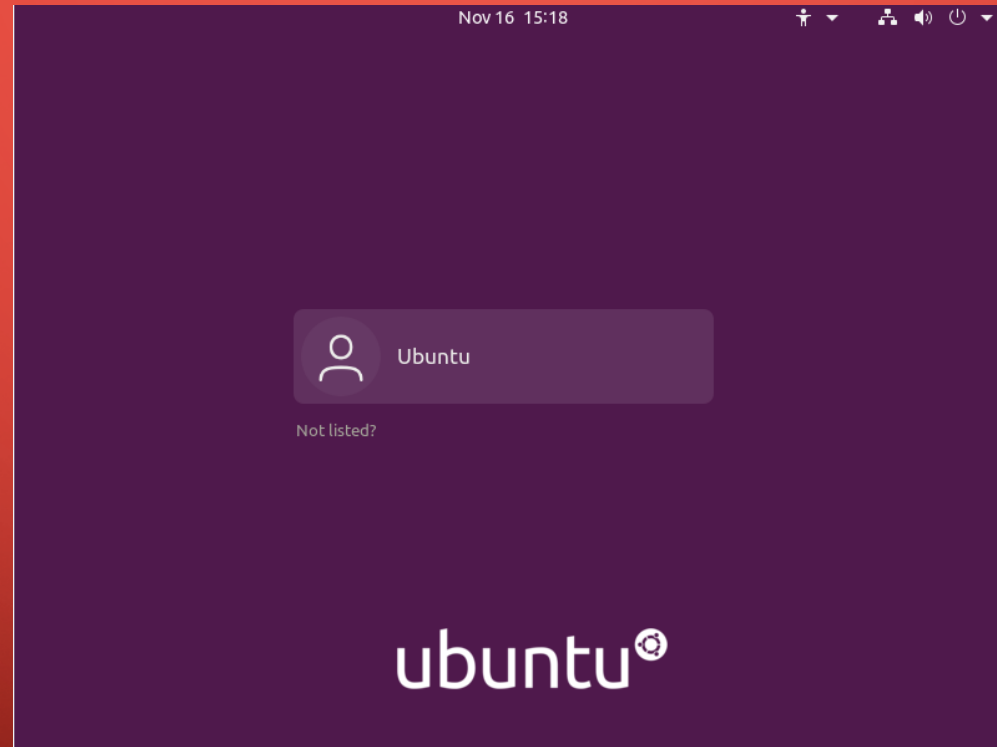
USE NETWORK UTILITIES



```
diallowill@ubuntu: ~
 8  *
 9  *
10  *
11  *
12  *
13  *
14  *
15  *
16  *
17  *
18  *
19  *
20  *
21  *
22  *
23  *
24  *
25  *
26  *
27  *
28  *
29  *
30  *
diallowill@ubuntu:~$ nslookup www.devry.edu.8.8.8.8
Server:      127.0.0.53
Address:     127.0.0.53#53

** server can't find www.devry.edu.8.8.8.8: NXDOMAIN
diallowill@ubuntu:~$
```

REMOVE USERS AND GROUPS CONTINUED...



DISCOVER HOST IP CONFIGURATIONS

```
root@ubuntu: /var/lib/NetworkManager
cat: dhcilent: No such file or directory
# This is private data. Do not parse.
ADDRESS=192.168.30.129
root@ubuntu:/var/lib/NetworkManager# cat /run/systemd/resolve/resolv.conf
# This file is managed by man:systemd-resolved(8). Do not edit.
#
# This is a dynamic resolv.conf file for connecting local clients directly to
# all known uplink DNS servers. This file lists all configured search domains
#
# Third party programs must not access this file directly, but only through t
# symlink at /etc/resolv.conf. To manage man:resolv.conf(5) in a different wa
# replace this symlink by a static file or a different symlink.
#
# See man:systemd-resolved.service(8) for details about the supported modes o
# operation for /etc/resolv.conf.

nameserver 192.168.30.2
search localdomain
root@ubuntu:/var/lib/NetworkManager# ping -c 4 192.168.30.2
PING 192.168.30.2 (192.168.30.2) 56(84) bytes of data:
64 bytes from 192.168.30.2: icmp_seq=1 ttl=128 time=0.910 ms
64 bytes from 192.168.30.2: icmp_seq=2 ttl=128 time=0.198 ms
64 bytes from 192.168.30.2: icmp_seq=3 ttl=128 time=0.344 ms
64 bytes from 192.168.30.2: icmp_seq=4 ttl=128 time=0.133 ms

--- 192.168.30.2 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3041ms
rtt min/avg/max/mdev = 0.133/0.396/0.910/0.306 ms
root@ubuntu:/var/lib/NetworkManager#
```

1. What is the IP address of your Ubuntu machine?

Answer here:

192.168.30.129

2. What is the IP address of its default gateway?

Answer here:192.168.30.2

3. What is the IP address of its DHCP server?

Answer here:

4. What is the IP address of its DNS server?

Answer here192.168.30.2:

MANAGE NETWORK INTERFACES

1. Which DHCP message is shown in the output of the **sudo dhclient -v -r ens33** command?

Answer here DHCPRELEASE of 192.168.30.130 on ens33 to 192.168.30.254 port 67 (xid=0x11bfeaf9)
:

2. Which four DHCP messages are shown in the output of the **sudo dhclient -v ens33** command?

Answer here:DHCPDISCOVER on ens33 to 255.255.255.255 port 67 interval 3 (xid=0xdd97b25d)

DHCPOFFER of 192.168.30.130 from 192.168.30.254

DHCPREQUEST for 192.168.30.130 on ens33 to 255.255.255.255 port 67 (xid=0x5db297dd)

DHCPACK of 192.168.30.130 from 192.168.30.254 (xid=0xdd97b25d)

cmp: EOF on /tmp/tmp.pAvntsud0u which is empty

bound to 192.168.30.130 -- renewal in 748 seconds.

DHCPDISCOVER on ens33 to 255.255.255.255 port 67 interval 6 (xid=0x55b9480e)

DHCPOFFER of 192.168.30.130 from 192.168.30.254

DHCPREQUEST for 192.168.30.130 on ens33 to 255.255.255.255 port 67 (xid=0xe48b955)

DHCPACK of 192.168.30.130 from 192.168.30.254 (xid=0x55b9480e)

MONITOR LINUX PROCESSES

- 1. What is the default action of the **15 SIGTERM** kill signal?
- Answer here: Closes the application.

- 2. In the System Monitor window, click on **% CPU** to sort the processes by CPU load. Which process shows the highest percentage of CPU usage?
- Answer here:Gnome Shell/ Gnome-system-Monitor

MONITOR USER ACTIVITIES

- Issue the **sudo accton on** command to turn on GNC accounting. Enter **lastcomm apt** to check if the apt command was executed before. Remember to turn off GNC accounting (**sudo accton off**) after answering the questions.
- 1. What flag value is displayed in the output?
- Answer here: S for the Suoer user, pts0 for the terminal name and the number of seconds each process ran.
- 2. Why is the name of the user who ran the processes shown as root, not your username?
- Answer here: Root ,by default, has access to all commands and files on a Linux



CAREER/SOFTSKILLS

- Communication - Having strong communication skills is the most important soft skill you can have.
- Teamwork - knowing how to be a team player is a key skillset
- Problem Solver – A person who is quick on their feet and can work well under pressure and are adaptable.
- Ability to follow instructions
- Strong Drive to Learn

CONCLUSION



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