



# Introduction to Linux

CEIS106  
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# Introduction



- Created by Linus Torvalds, Linux was not made for profit, but as a solution to a problem, and for creating useful tools that others could share for free
- Linux is an Open Source Software (OSS), this means developers can view, modify, and redistribute each others source code allowing for more improvements and bug fixes
- For companies Linux is a top choice as the software is free, and easily maintained by a community of developers or even the company itself



# Linux Filesystem Hierarchy



- Navigating the Linux filesystem
- Creating, moving, copying, removing and locating files and directories



# Navigating the filesystem

1. What is the `pwd` command an acronym for? What about the `cd` command?

`pwd`-print working directory

`cd`-change directory

2. Explain the differences between a relative path and an absolute/full path in Linux.

An absolute path is the path that you take to get from the root to your target file. The absolute path for the Course Project file would be

`/home/student/Documents/Course Project.txt`

A relative path is a path that is relative to your current directory. So, let's say you are in the student directory, and you want to open the `Course Project.txt`. Your relative path would be `Documents/Course Project.txt`.

(Varshni, D)



# Creating directories and files

```
student@student: ~/JanFebSession/Course1
student@student:~/JanFebSession$ cd Course1
student@student:~/JanFebSession/Course1$ touch file1 file2 file3
student@student:~/JanFebSession/Course1$ tree -d -L 2 ~
/home/student
├── Desktop
├── Documents
├── Downloads
├── JanFebSession
│   ├── Course1
│   ├── Course2
│   └── Course3
├── Music
├── Pictures
├── Public
├── Templates
└── Videos

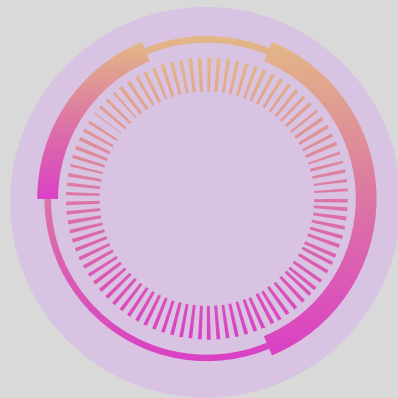
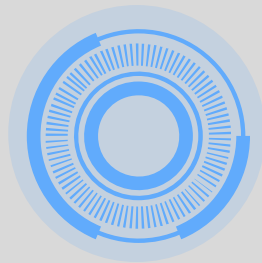
12 directories
student@student:~/JanFebSession/Course1$ ls -l ~/JanFebSession/Course1
total 0
-rw-rw-r-- 1 student student 0 Jun 17 20:44 file1
-rw-rw-r-- 1 student student 0 Jun 17 20:44 file2
-rw-rw-r-- 1 student student 0 Jun 17 20:44 file3
student@student:~/JanFebSession/Course1$
```

# Copy and remove directories and files

```
student@student: ~  
├── file2  
├── file3  
├── Course2  
└── Course3  
  
6 directories, 6 files  
student@student:~$ rmdir MarAprSession/Course3  
student@student:~$ rm MarAprSession/Course1/file3  
student@student:~$ tree JanFebSession MarAprSession  
JanFebSession  
├── Course1  
│   ├── file1  
│   ├── file2  
│   └── file3  
├── Course2  
├── Course3  
MarAprSession  
├── Course1  
│   ├── file1  
│   └── file2  
└── Course2  
  
5 directories, 5 files  
student@student:~$
```

# Locate directories and files

```
student@student: ~  
/home/student/MarAprSession/Course1/file1  
student@student:~$ locate -S  
Database /var/lib/mlocate/mlocate.db:  
    32,307 directories  
   417,452 files  
  29,167,645 bytes in file names  
  10,328,892 bytes used to store database  
student@student:~$ sudo updatedb  
[sudo] password for student:  
student@student:~$ locate -i course  
/home/student/JanFebSession/Course1  
/home/student/JanFebSession/Course2  
/home/student/JanFebSession/Course3  
/home/student/JanFebSession/Course1/file1  
/home/student/JanFebSession/Course1/file2  
/home/student/JanFebSession/Course1/file3  
/home/student/MarAprSession/Course1  
/home/student/MarAprSession/Course2  
/home/student/MarAprSession/Course1/file1  
/home/student/MarAprSession/Course1/file2  
student@student:~$ locate -r /file1$  
/home/student/JanFebSession/Course1/file1  
/home/student/MarAprSession/Course1/file1  
student@student:~$
```



# Linux Shell Scripts



- Creating a shell script
- Changing file permissions
- Setting the PATH variable and making it permanent





# Creating a shell script

1. What are the file permissions of the script?

`-rw-rw-r--`

2. What's the name of the user-defined variable in the script?

`text`

3. Which redirection meta-character is used in the script? What does it do?

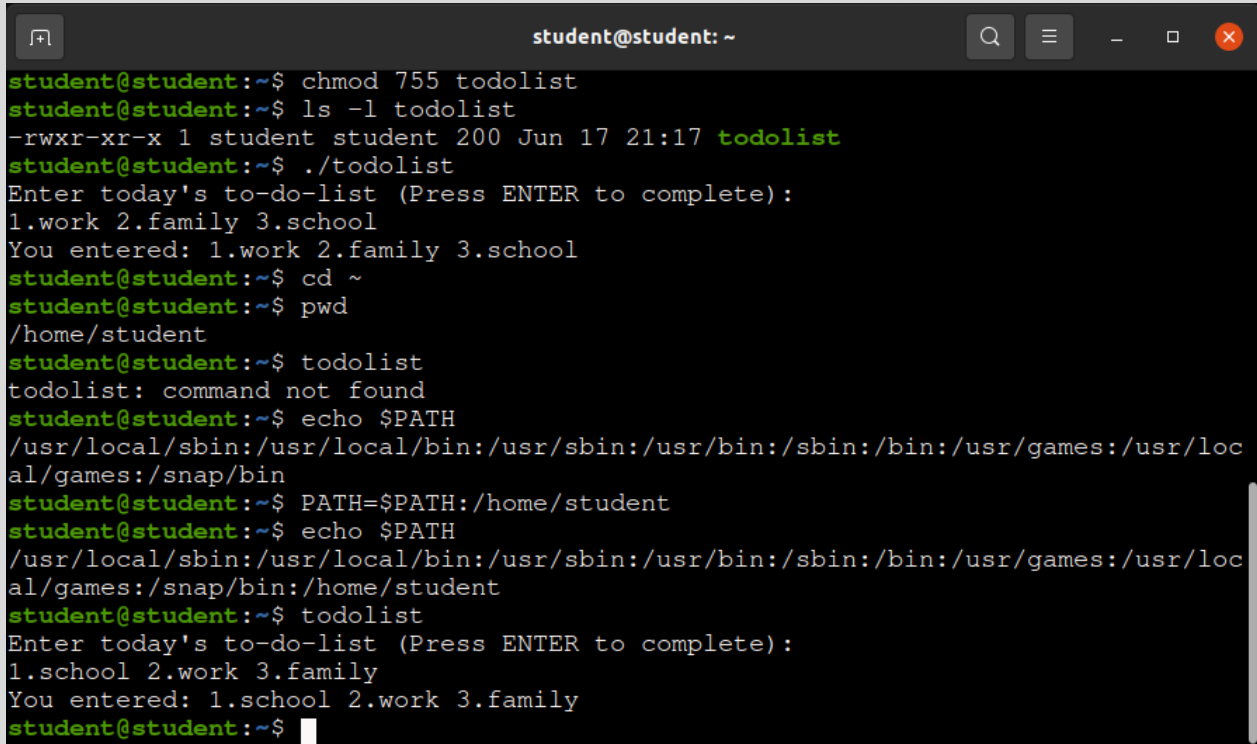
`>>`-append data of an existing file and `$`-used to access the value stored in a variable



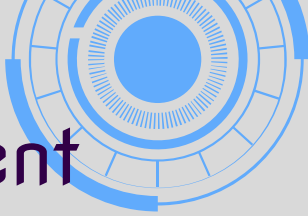
# Change the script permissions

```
student@student: ~  
You entered: 1.family 2.work 3.school  
student@student:~$ bash todolist  
Enter today's to-do-list (Press ENTER to complete):  
1.school 2.family 3.work  
You entered: 1.school 2.family 3.work  
student@student:~$ cat MyToDoLists  
Fri 17 Jun 2022 09:09:28 PM CDT  
Today's to-do-list -- 1.family 2.work 3.school  
  
Fri 17 Jun 2022 09:09:45 PM CDT  
Today's to-do-list -- 1.school 2.family 3.work  
  
student@student:~$ cd ~  
student@student:~$ pwd  
/home/student  
student@student:~$ nano todolist  
student@student:~$ chmod 755 todolist  
student@student:~$ ls -l todolist  
-rwxr-xr-x 1 student student 200 Jun 17 21:10 todolist  
student@student:~$ ./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  
student@student:~$
```

# Set the PATH variable



```
student@student: ~  
student@student:~$ chmod 755 todolist  
student@student:~$ ls -l todolist  
-rwxr-xr-x 1 student student 200 Jun 17 21:17 todolist  
student@student:~$ ./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  
student@student:~$ cd ~  
student@student:~$ pwd  
/home/student  
student@student:~$ todolist  
todolist: command not found  
student@student:~$ echo $PATH  
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin  
student@student:~$ PATH=$PATH:/home/student  
student@student:~$ echo $PATH  
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:/home/student  
student@student:~$ 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  
student@student:~$
```



# Making the PATH variable permanent

```
student@student: ~  
student@student:~$ chmod 755 todolist  
student@student:~$ ls -l todolist  
-rwxr-xr-x 1 student student 200 Jun 17 21:17 todolist  
student@student:~$ ./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  
student@student:~$ cd ~  
student@student:~$ pwd  
/home/student  
student@student:~$ todolist  
todolist: command not found  
student@student:~$ echo $PATH  
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin  
student@student:~$ PATH=$PATH:/home/student  
student@student:~$ echo $PATH  
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:/home/student  
student@student:~$ 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  
student@student:~$  
  
student@student:~/Desktop$ cd ~  
student@student:~$ pwd  
/home/student  
student@student:~$ todolist  
todolist: command not found  
student@student:~$ ls -a .bash*  
.bash_history .bash_logout .bashrc  
student@student:~$ cp .bashrc .bashrc.old  
student@student:~$ nano .bashrc  
student@student:~$ source .bashrc  
student@student:~$ todolist  
Enter today's to-do-list (Press ENTER to complete):
```



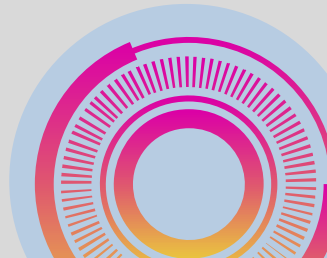
# User and Group Management

- Add users and groups in CLI
- Test user and group settings
- Using the graphical interface to add users
- Removing users and groups

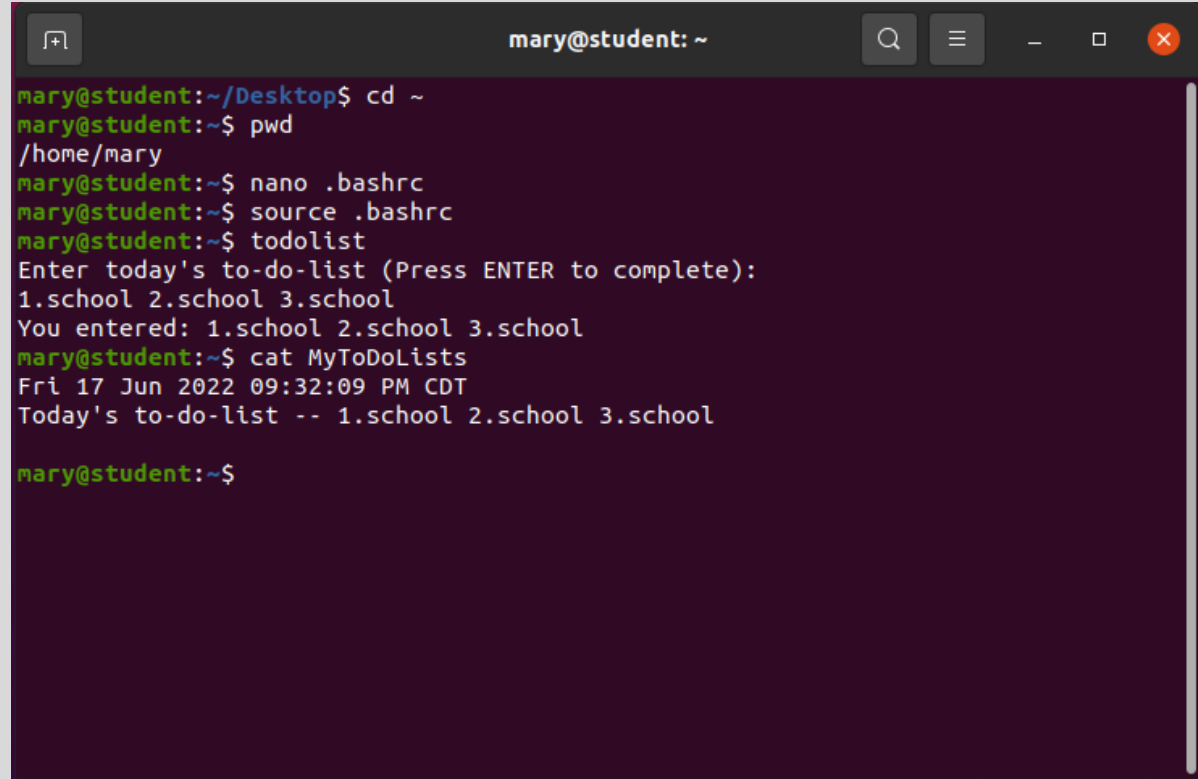
# Add users and groups in CLI

1. What does the `-m` option in the `useradd` command do?  
Creates a home directory for new user.
2. What does the `-3` option in the `tail` command do?  
Allows you to read the last 3 lines from a specific text file.
3. Which line of the `/etc/group` file lists members of the "students" group?

```
students:x:1002:student,mary
```



# Test user and group settings

A terminal window titled 'mary@student: ~' with standard window controls. The terminal shows a series of commands and their outputs: 'cd ~' changes the directory to the home directory; 'pwd' shows '/home/mary'; 'nano .bashrc' opens the bashrc file in nano; 'source .bashrc' sources the file; 'todolist' prompts for a to-do list, which is entered as '1.school 2.school 3.school'; 'cat MyToDoLists' shows the contents of the file, which include the date and the entered to-do list.

```
mary@student:~/Desktop$ cd ~
mary@student:~$ pwd
/home/mary
mary@student:~$ nano .bashrc
mary@student:~$ source .bashrc
mary@student:~$ 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@student:~$ cat MyToDoLists
Fri 17 Jun 2022 09:32:09 PM CDT
Today's to-do-list -- 1.school 2.school 3.school
mary@student:~$
```

# Add users in the GUI



```
john@student: ~  
john@student:~/Desktop$ cd ~  
john@student:~$ pwd  
/home/john  
john@student:~$ nano .bashrc  
john@student:~$ source .bashrc  
john@student:~$ 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@student:~$ cat MyToDoLists  
Fri 17 Jun 2022 09:41:31 PM CDT  
Today's to-do-list -- 1.family 2.family 3.family  
john@student:~$
```



# Remove users and groups

 student

 mary

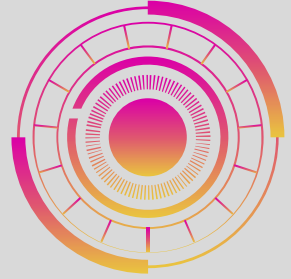
 John

Not listed?

 student

Not listed?

# Network Configuration



- Discover host IP configurations
- Manage network interfaces
- User network utilities



# Discover host IP configurations

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

192.168.4.112

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

192.168.4.1

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

192.168.4.1

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

127.0.0.53

```
student@student: /var/lib/dhcp
#
# Third party programs must not access this file directly, but only through the
# symlink at /etc/resolv.conf. To manage man:resolv.conf(5) in a different way,
# replace this symlink by a static file or a different symlink.
#
# See man:systemd-resolved.service(8) for details about the supported modes of
# operation for /etc/resolv.conf.

nameserver 71.10.216.1
nameserver 71.10.216.2
nameserver 2607:f428:ffff:ffff::1
# Too many DNS servers configured, the following entries may be ignored.
nameserver 2607:f428:ffff:ffff::2
student@student:/var/lib/dhcp$ ping -c 4 192.168.4.1
PING 192.168.4.1 (192.168.4.1) 56(84) bytes of data.
64 bytes from 192.168.4.1: icmp_seq=1 ttl=64 time=2.55 ms
64 bytes from 192.168.4.1: icmp_seq=2 ttl=64 time=3.41 ms
64 bytes from 192.168.4.1: icmp_seq=3 ttl=64 time=0.713 ms
64 bytes from 192.168.4.1: icmp_seq=4 ttl=64 time=0.708 ms

--- 192.168.4.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3016ms
rtt min/avg/max/mdev = 0.708/1.844/3.405/1.173 ms
student@student:/var/lib/dhcp$
```

# Manage network interfaces

1. Which DHCP message is shown in the output of the `sudo dhclient -v -r enp0s3` command?

DHCPRELEASE of 192.168.4.96 on enp0s3 to 192.168.4.1 port 67 (xid=0x3efc4bb1)

2. Which four DHCP messages are shown in the output of the `sudo dhclient -v enp0s3` command?

DHCPDISCOVER on enp0s3 to 255.255.255.255 port 67 interval 3 (xid=0x9343037c)

Ip DHCPOFFER of 192.168.4.96 from 192.168.4.1

DHCPREQUEST for 192.168.4.96 on enp0s3 to 255.255.255.255 port 67 (xid=0x7c034393)

DHCPACK of 192.168.4.96 from 192.168.4.1 (xid=0x9343037c)

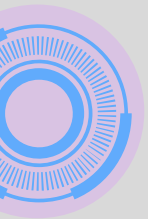


# Use network utilities

```
student@student: ~  
RX errors 0 dropped 39 overruns 0 frame 0  
TX packets 334 bytes 46486 (46.4 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
student@student:~$ sudo ifconfig enp0s3 up  
student@student:~$ ifconfig enp0s3  
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
inet 192.168.4.112 netmask 255.255.252.0 broadcast 192.168.7.255  
inet6 fde1:6b9b:7b90:1:f958:fb2a:a4a8:f9e8 prefixlen 64 scopeid 0x0<gl  
obal>  
inet6 fe80::cec3:ccc0:b5e2:9627 prefixlen 64 scopeid 0x20<link>  
inet6 2600:6c40:5d00:58d:9ee9:d5:1e95:1a08 prefixlen 64 scopeid 0x0<gl  
obal>  
inet6 fde1:6b9b:7b90:1:5bd3:a275:68cb:ac2a prefixlen 64 scopeid 0x0<gl  
obal>  
inet6 2600:6c40:5d00:58d:46cf:d4c8:fdfe:1bcc prefixlen 64 scopeid 0x0<  
global>  
ether 08:00:27:ee:df:4a txqueuelen 1000 (Ethernet)  
RX packets 1044 bytes 204820 (204.8 KB)  
RX errors 0 dropped 40 overruns 0 frame 0  
TX packets 429 bytes 60534 (60.5 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
student@student:~$
```

# System Performance Monitoring

- Monitor processes, activities and network bandwidth usage



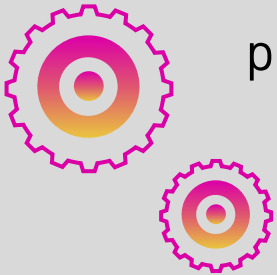
# Monitor Linux processes

1. What is the default action of the 15 SIGTERM kill signal?

Kill or end selected process.

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?

gnome-shell



# Monitor user activities



Issue the *sudo accton* on command to turn on GNC accounting. Run the *sudo updatedb* command. Enter *lastcomm updatedb* to check if the *updatedb* command was executed before. Remember to turn off GNC accounting(*sudo accton off*) after answering the questions.

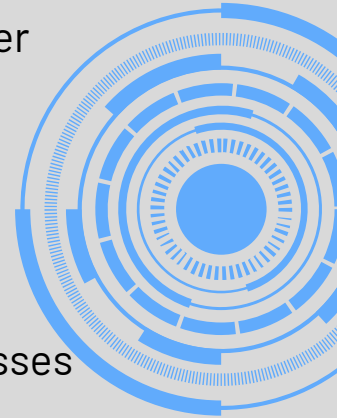


1. What flag value is displayed in the output?

S-executed by superuser(root)

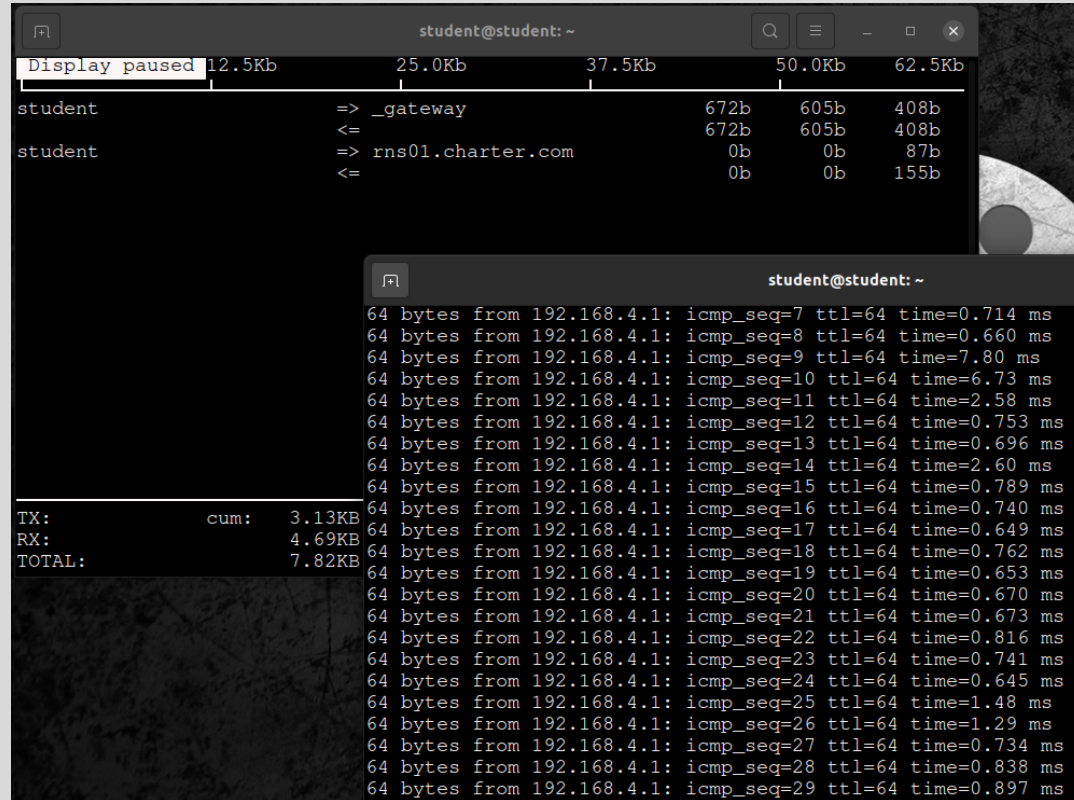
2. Why is the name of the user who ran the processes shown as root, not student?

We put *sudo* in front of the command, which executes the command by root



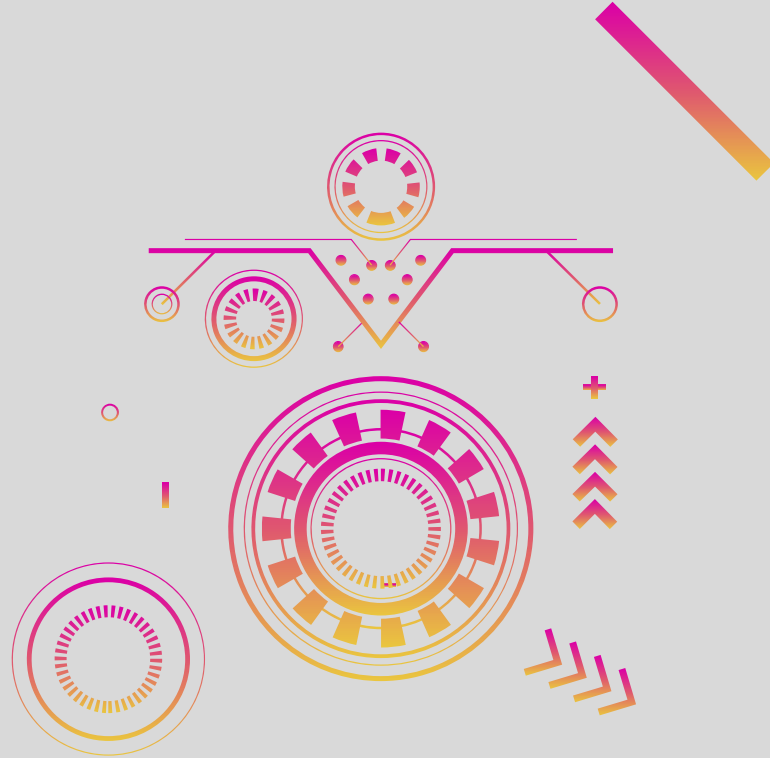


# Monitor network bandwidth usage



# Challenges

- It was difficult to remember additional attributes of a command, I used the man command quite a lot
- Knowing when to switch from user to administrator
- Assigning permissions and understanding the alphabetical command versus the numerical command



# Skills



- Creating, copying, moving, and removing files and directories
- Adding, removing, and assigning permissions to users and groups
- Configuring networks

# Conclusion



- The experience gained from installing and configuring my own virtual box and Linux system gives me the ability to apply that knowledge to other operating systems
- Using commands in the terminal instead of the GUI is such a great learning opportunity, I feel more capable learning how things are working step by step



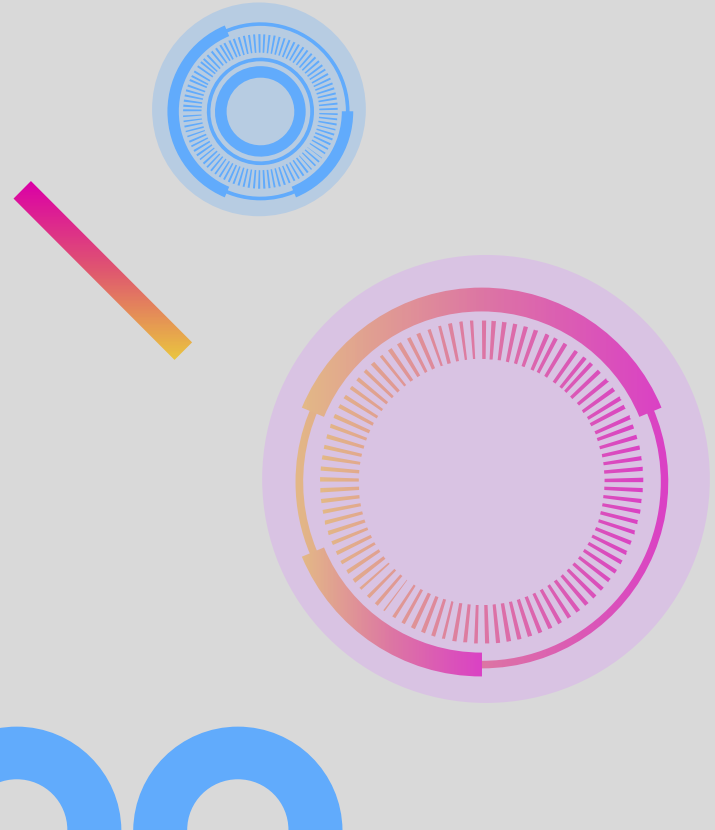
# List of references



Varshni,D, Retrieved on 05/13/2022,  
<https://www.geeksforgeeks.org/absolute-relative-pathnames-unix/>

CEIS106 recorded/live lessons

Linux+ and LPIC-1 Guide to Linux  
Certification,5<sup>th</sup> Ed., Jason Eckert(2020)



# Thanks!

Do you have any questions?

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