

The background is a light gray gradient with several realistic water droplets of various sizes scattered across it. A faint, large circular pattern, possibly a watermark or a decorative element, is visible in the upper right quadrant.

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CEIS 106

Final Project

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Introduction

- CIS and Networking Professionals use Linux
- Linux servers are very popular in corporations
 - Web servers
 - Database servers
 - Email servers
 - File servers
- 64% of world's servers run some variant of Unix or Linux
- Linux / Unix used on 77%+ of web servers



WHAT ARE IOT DEVICES?

INTERNET OF THINGS

Devices With Sensors That Connect To The Network

LINUX IS USED ON 71.8% OF IOT DEVICES

EXAMPLES OF IOT DEVICES

Ring Doorbells And Cameras

Samsung Smart Refrigerators

Networking Hardware

Medical Devices (e.g., Pacemakers)

Smart Locks

Starship Autonomous Food Delivery Robots

Kuri Mobile Robots

Tesla Cars





Module 2

Linux Filesystem Hierarchy

Navigate the Linux filesystem tree

1. WHAT IS THE *PWD* COMMAND AN ACRONYM FOR? WHAT ABOUT THE *CD* COMMAND?

Answer:

- Print Working Directory
- Change Directory

2. EXPLAIN THE DIFFERENCES BETWEEN A RELATIVE PATH AND AN ABSOLUTE/FULL PATH IN LINUX

Answer:

- Absolute Pathname is the root directory to a certain file or directory.
- Relative Pathname is a current directory to a certain file or directory and can be used in place of an absolute pathname to reduce typing.

REFERENCES:

- Absolute Pathname: /JanFebSessions/Course1/File1
- Relative Pathname: Course1/File1

Create Directories And Files

```
inal ▾ May 16 14:10
student@student-VirtualBox: ~/JanFebSession/Course1
student@student-VirtualBox:~/JanFebSession/Course1$ touch file1 file2 file3
student@student-VirtualBox:~/JanFebSession/Course1$ tree -d -L 2 ~
/home/student
├── Desktop
├── Documents
├── Downloads
├── JanFebSession
│   ├── Course1
│   ├── Course2
│   └── Course3
├── Music
├── Pictures
├── Public
├── snap
│   └── snap-store
├── Templates
└── Videos

14 directories
student@student-VirtualBox:~/JanFebSession/Course1$ ls -l ~/JanFebSession/Cours
e1
ls: command not found
student@student-VirtualBox:~/JanFebSession/Course1$ ls -l ~/JanFebSession/Cours
e1
total 0
-rw-rw-r-- 1 student student 0 May 16 14:05 file1
-rw-rw-r-- 1 student student 0 May 16 14:05 file2
-rw-rw-r-- 1 student student 0 May 16 14:05 file3
student@student-VirtualBox:~/JanFebSession/Course1$
```


Copy And Remove Directories And Files

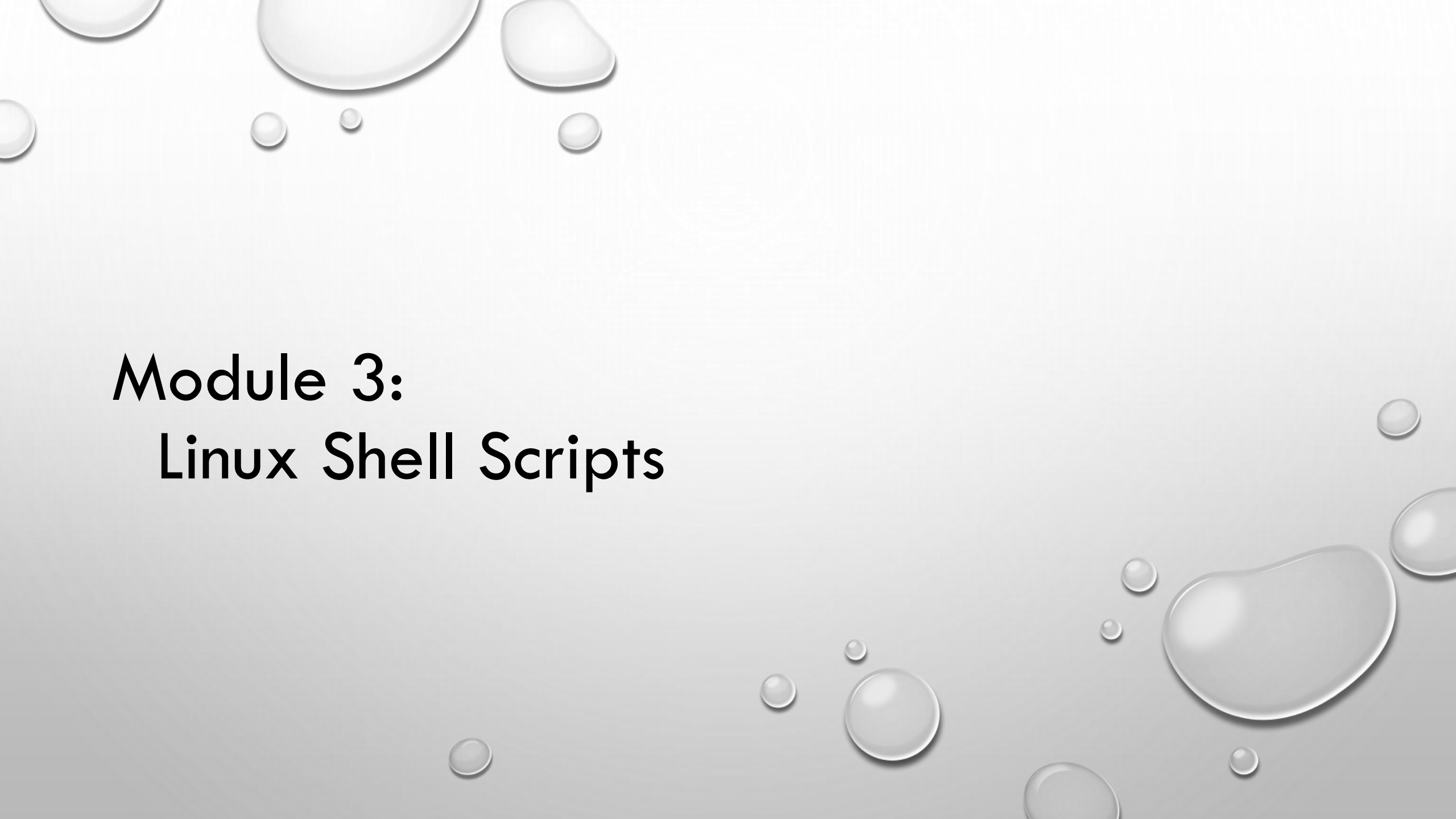
```
inal ▾ May 16 14:19
student@student-VirtualBox: ~
├── file3
├── Course2
└── Course3

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

5 directories, 5 files
student@student-VirtualBox:~$
```


Locate Directories And Files

```
terminal ▾ May 16 14:30
student@student-VirtualBox: ~
student@student-VirtualBox:~$ locate -S
Database /var/lib/mlocate/mlocate.db:
    25,521 directories
    309,835 files
    20,468,380 bytes in file names
    7,525,268 bytes used to store database
student@student-VirtualBox:~$ sudo updatedb
[sudo] password for student:
student@student-VirtualBox:~$ 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-VirtualBox:~$ locate -r /file1$
/home/student/JanFebSession/Course1/file1
/home/student/MarAprSession/Course1/file1
student@student-VirtualBox:~$
```


The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. The text is positioned in the lower-left quadrant of the slide.

Module 3:

Linux Shell Scripts

Create A Shell Script

1. What Are The File Permissions Of The Script?

Answer:

rw- For The Owner – Read And Write Only (No Execute)

rw- For The Group – Read And Write Only (No Execute)

r-- For Anyone Else – Read Only (No Write Or Execute)

2. What's The Name Of The User-defined Variable In The Script?

Answer:

Text

3. Which Redirection Meta-character Is Used In The Script? What Does It Do?

Answer:

>> -- Redirects Output To The File And Appends To The File

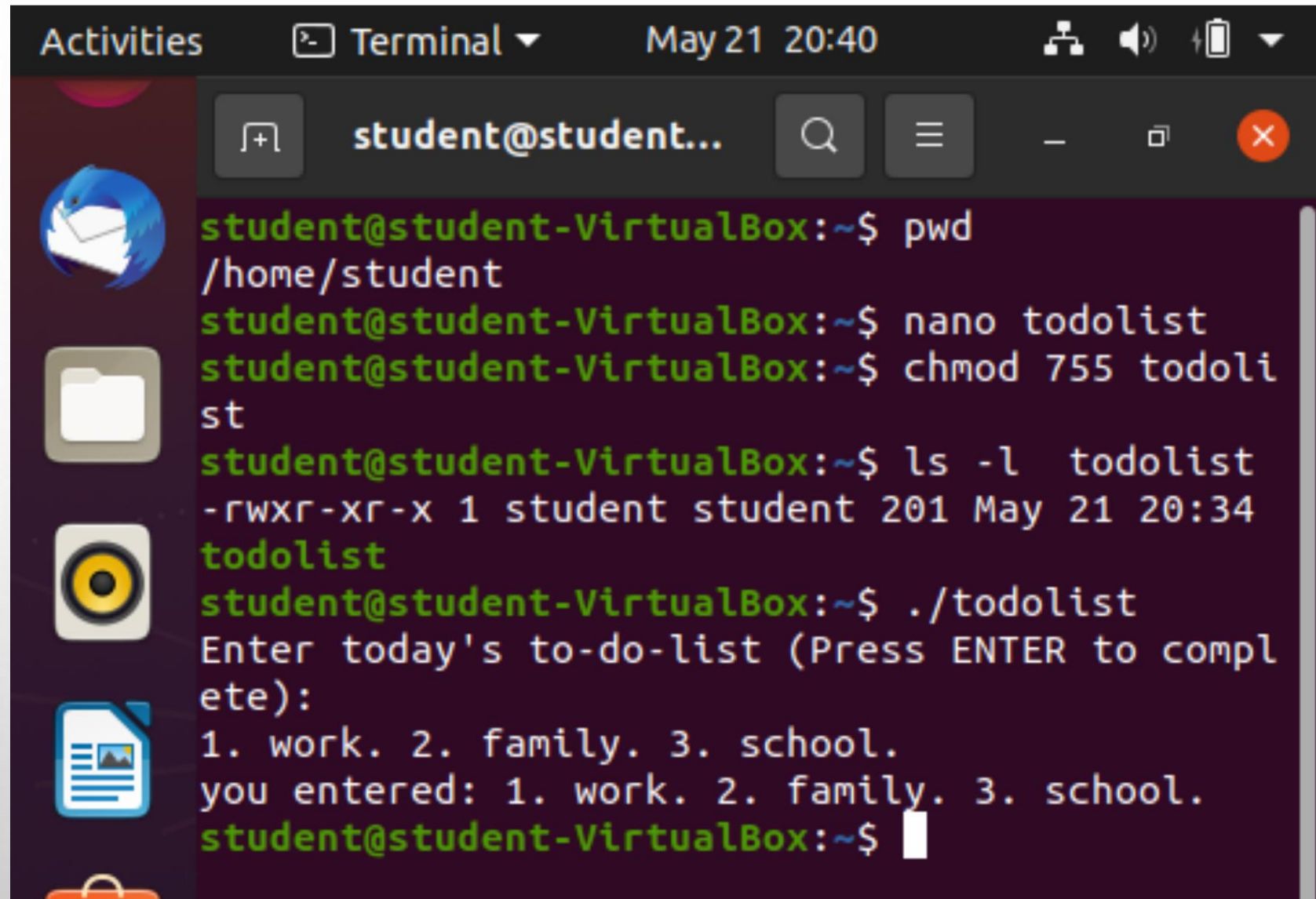
(Single Arrow, > -- Will Overwrite The File)

References:

Live Lecture

Recorded Lecture

Change Script File Permissions



The image shows a terminal window titled "Terminal" with a date and time of "May 21 20:40". The window title bar also includes "Activities", "Terminal", and "student@student...". The terminal content shows the following commands and output:

```
student@student-VirtualBox:~$ pwd
/home/student
student@student-VirtualBox:~$ nano todolist
student@student-VirtualBox:~$ chmod 755 todolist
student@student-VirtualBox:~$ ls -l todolist
-rwxr-xr-x 1 student student 201 May 21 20:34
todolist
student@student-VirtualBox:~$ ./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-VirtualBox:~$
```

The terminal window has a dark background and a light-colored text. The output of the `ls -l` command shows the file `todolist` with permissions `-rwxr-xr-x`, owner `student`, group `student`, size `201`, and date `May 21 20:34`. The output of the `./todolist` command shows the prompt "Enter today's to-do-list (Press ENTER to complete):" and the user's input "1. work. 2. family. 3. school." followed by the confirmation "you entered: 1. work. 2. family. 3. school."

Set The PATH Variable

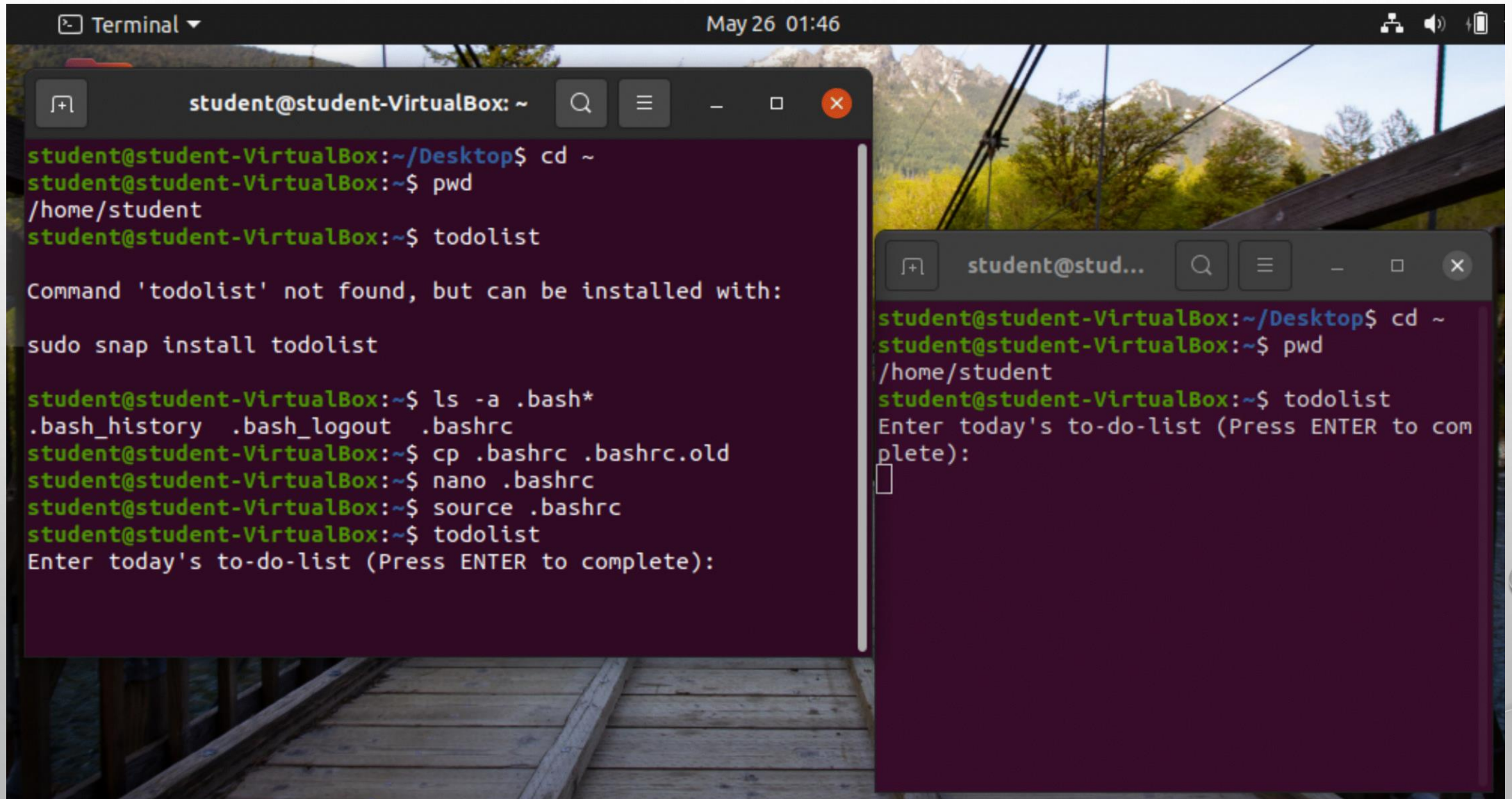
```
student@student-VirtualBox: ~
student@student-VirtualBox:~$ cd ~
student@student-VirtualBox:~$ pwd
/home/student
student@student-VirtualBox:~$ todolist

Command 'todolist' not found, but can be installed with:

sudo snap install todolist

student@student-VirtualBox:~$ echo $PATH
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
student@student-VirtualBox:~$ PATH=$PATH:/home/student
student@student-VirtualBox:~$ echo $PATH
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin:/home/student
student@student-VirtualBox:~$ 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-VirtualBox:~$
```


Make The PATH Variable Permanent



The image shows a terminal window titled "Terminal" with a date and time of "May 26 01:46". The terminal is running on a system named "student@student-VirtualBox". The user is in the directory "~/Desktop". The terminal output shows the following commands and their results:

```
student@student-VirtualBox:~/Desktop$ cd ~
student@student-VirtualBox:~$ pwd
/home/student
student@student-VirtualBox:~$ todolist

Command 'todolist' not found, but can be installed with:

sudo snap install todolist

student@student-VirtualBox:~$ ls -a .bash*
.bash_history .bash_logout .bashrc
student@student-VirtualBox:~$ cp .bashrc .bashrc.old
student@student-VirtualBox:~$ nano .bashrc
student@student-VirtualBox:~$ source .bashrc
student@student-VirtualBox:~$ todolist
Enter today's to-do-list (Press ENTER to complete):
```

The terminal window is split into two panes. The left pane shows the initial steps: navigating to the home directory, checking the current directory, attempting to run 'todolist' (which fails), installing it via 'sudo snap install todolist', listing the contents of the '.bashrc' file, creating a backup, and editing the file with 'nano'. The right pane shows the user running 'source .bashrc' and then 'todolist' again, which now prompts for a to-do list.

The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. The text is centered on the left side of the slide.

Module 4:

Linux Administrative Tasks

Add Users And Groups In CLI

1. What Does The `-M` Option In The `Useradd` Command Do?

Answer:

Create A Home Directory For The User

2. What does the `-3` option in the `tail` command do?

Answer:

Show the last three lines

3. Which line of the `/etc/group` file lists members of the “students” group?

Answer:

```
students:x:1002:  
mary:x:1001:
```

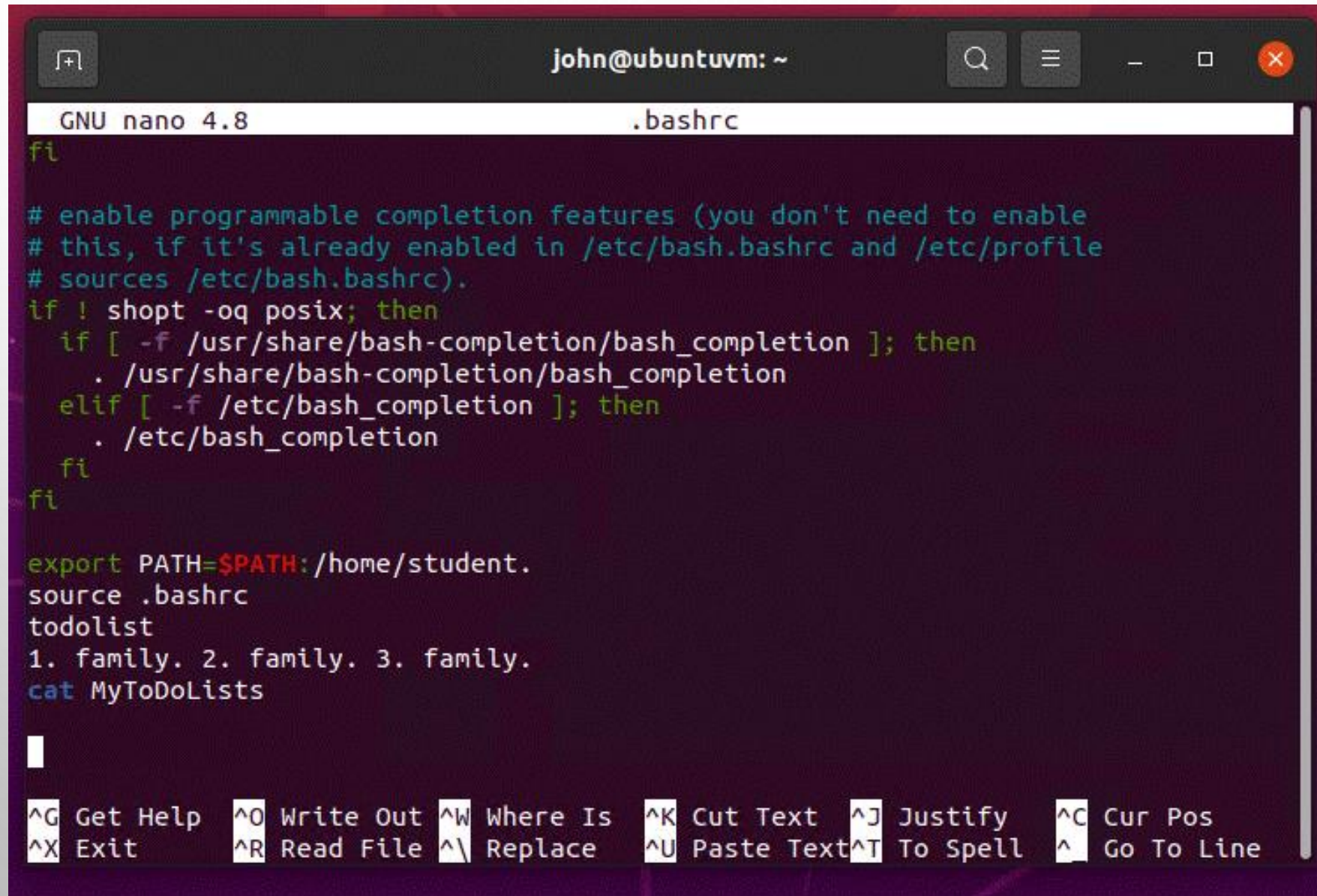
References:

Recorded Project Help

Test User And Group Settings

```
student@ubuntuvvm: ~  
You entered: cd ~  
student@ubuntuvvm:~$ pwd  
/home/student  
student@ubuntuvvm:~$ sudo useradd -m -s /bin/bash mary  
[sudo] password for student:  
student@ubuntuvvm:~$ sudo passwd mary  
New password:  
Retype new password:  
passwd: password updated successfully  
student@ubuntuvvm:~$ sudo groupadd students  
student@ubuntuvvm:~$ sudo usermod -a -G students student  
student@ubuntuvvm:~$ sudo usermod -a -G students mary  
student@ubuntuvvm:~$ sudo tail -3 /etc/shadow  
student:$6$LDaCr2JKJ18zg046$YZDHXxu1DoY4M6N/SAkBJPL0XbX51Q0EoUV1jrXyb4MHLxzgmqn2i0rCUKbRfhPRyeL0EbKd5bscTud7  
MW5ju/:18691:0:99999:7:::  
systemd-coredump:!!:18691:::::  
mary:$6$gC3v0tiwo4gzluLF$.ADiyx21vLmuJYga38QTz7W7apcGxs7wGFVGNFLDxB8oGjh7mJsq6lzgkqKfi74dCbSYu9xGfEUrYr8w6Tk  
u/0:19142:0:99999:7:::  
student@ubuntuvvm:~$ sudo tail -3 /etc/group  
mlocate:x:133:  
mary:x:1001:  
students:x:1002:student,mary  
student@ubuntuvvm:~$
```


Add Users In GUI



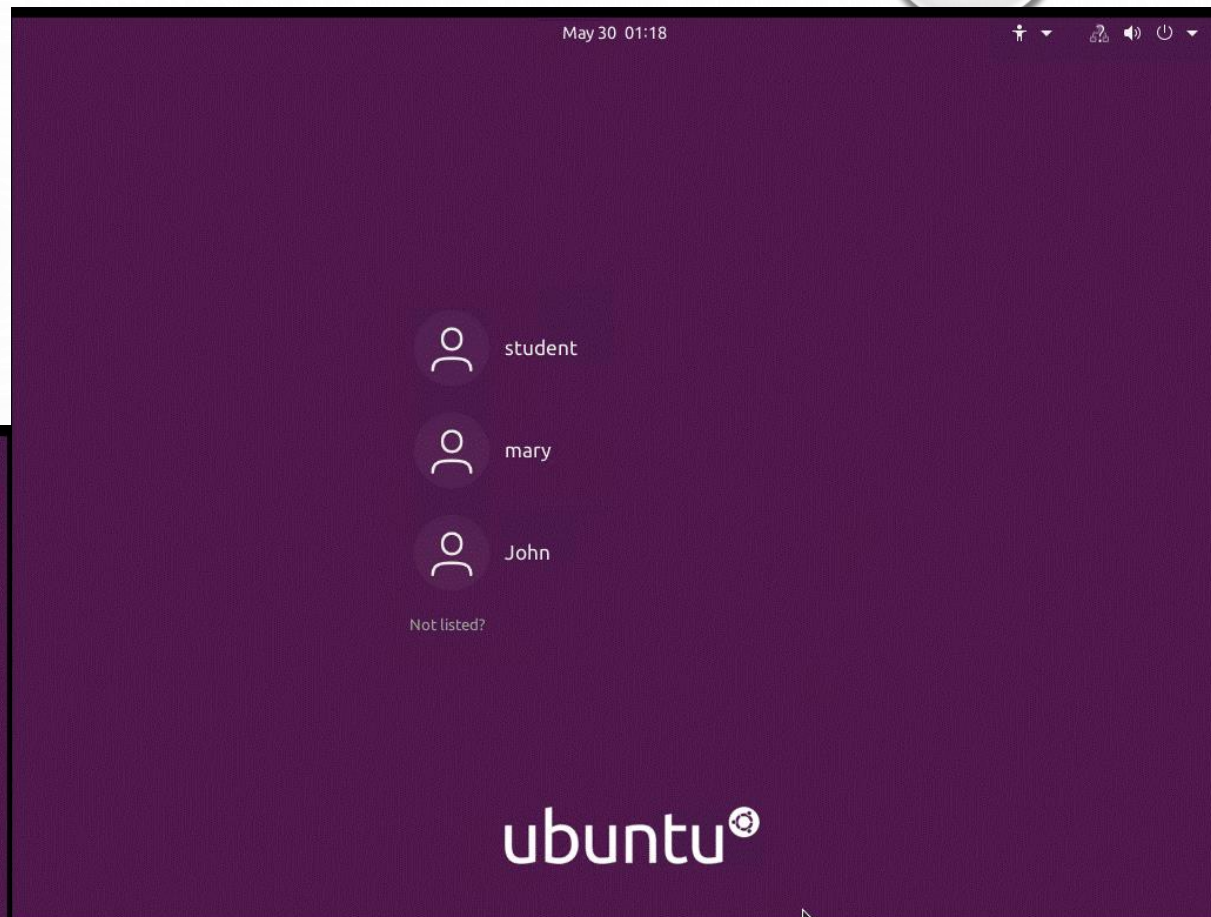
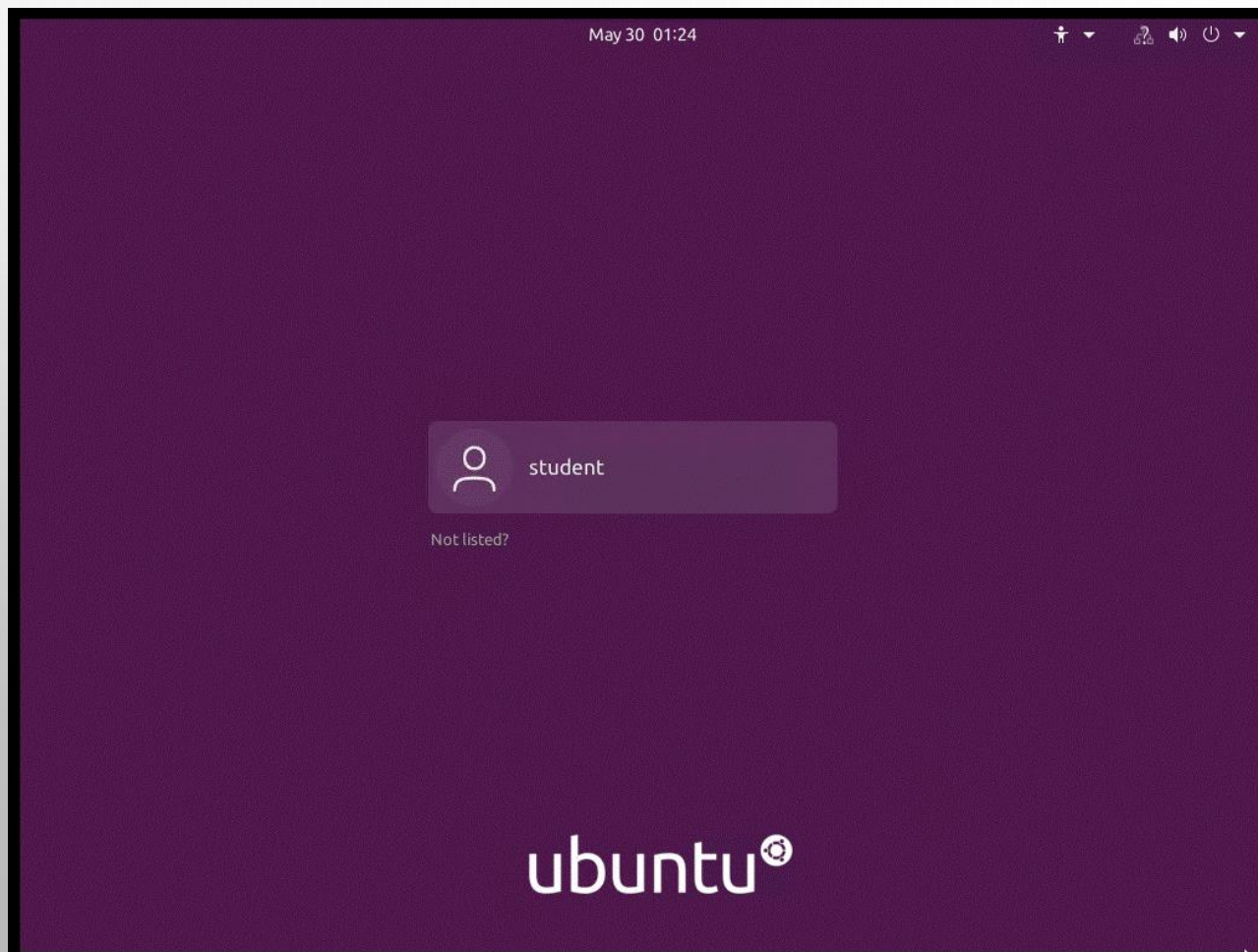
```
john@ubuntuvvm: ~
GNU nano 4.8 .bashrc
fi

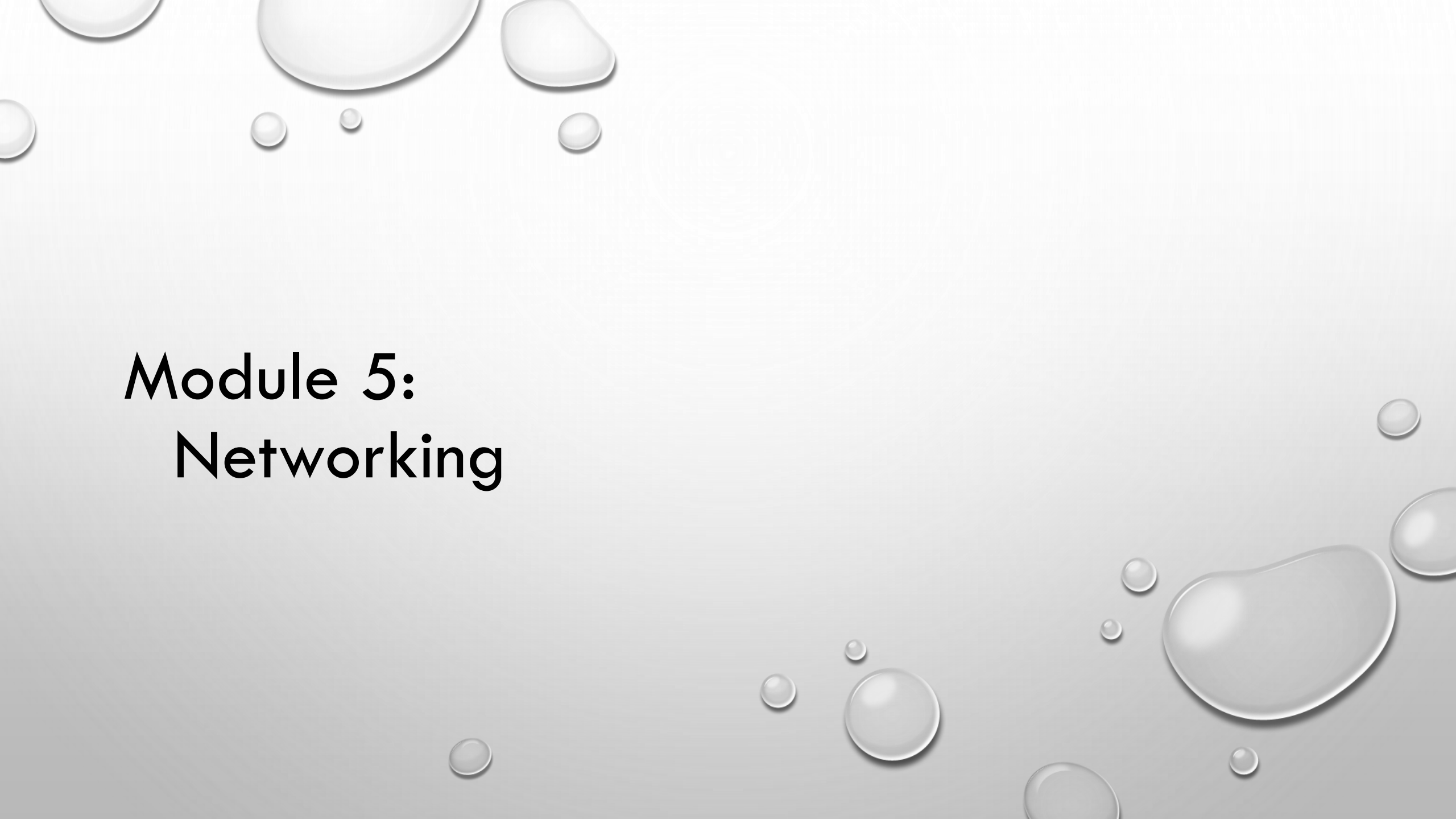
# enable programmable completion features (you don't need to enable
# this, if it's already enabled in /etc/bash.bashrc and /etc/profile
# sources /etc/bash.bashrc).
if ! shopt -oq posix; then
  if [ -f /usr/share/bash-completion/bash_completion ]; then
    . /usr/share/bash-completion/bash_completion
  elif [ -f /etc/bash_completion ]; then
    . /etc/bash_completion
  fi
fi

export PATH=$PATH:/home/student.
source .bashrc
todolist
1. family. 2. family. 3. family.
cat MyToDoLists

^G Get Help  ^O Write Out  ^W Where Is  ^K Cut Text  ^J Justify   ^C Cur Pos
^X Exit      ^R Read File  ^\ Replace   ^U Paste Text ^T To Spell  ^ Go To Line
```

Remove Users And Groups



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Module 5: Networking

Discover Host IP Configurations

1. What Is The IP Address Of Your Ubuntu Machine?

Answer:

192.168.1.104

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

Answer:

192.168.1.1

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

Answer:

192.168.1.1

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

Answer:

192.168.1.1

```
student@ubuntuvvm: /var/lib/dhcp
#
# 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 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 192.168.1.1
search devry.edu
student@ubuntuvvm:/var/lib/dhcp$ ping -c 4 192.168.1.1
PING 192.168.1.1 (192.168.1.1) 56(84) bytes of data:
64 bytes from 192.168.1.1: icmp_seq=1 ttl=64 time=1.50 ms
64 bytes from 192.168.1.1: icmp_seq=2 ttl=64 time=0.662 ms
64 bytes from 192.168.1.1: icmp_seq=3 ttl=64 time=0.485 ms
64 bytes from 192.168.1.1: icmp_seq=4 ttl=64 time=0.719 ms

--- 192.168.1.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3030ms
rtt min/avg/max/mdev = 0.485/0.842/1.503/0.391 ms
student@ubuntuvvm:/var/lib/dhcp$
```


Manage Network Interfaces

1. Which DHCP Message Is Shown In The Output Of The **SUDO DHCPCLIENT -V -R ETH0** Command?

Answer:

DHCPRELEASE

2. Which Four DHCP Messages Are Shown In The Output Of The **SUDO DHCPCLIENT -V ETH0** Command?

Answer:

DHCPDISCOVER, DHCPOFFER, DCHPREQUEST, DHCPACK

References:

Project Recording

Use Network Utilities

```
student@ubuntuvms: ~  
TX packets 11347 bytes 893903 (893.9 KB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
student@ubuntuvms:~$ sudo ifconfig eth0 down  
student@ubuntuvms:~$ ifconfig eth0  
eth0: flags=4098<BROADCAST,MULTICAST> mtu 1500  
ether 00:15:5d:00:04:01 txqueuelen 1000 (Ethernet)  
RX packets 19998 bytes 1299855 (1.2 MB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 22529 bytes 1798540 (1.7 MB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
student@ubuntuvms:~$ sudo ifconfig eth0 up  
student@ubuntuvms:~$ ifconfig eth0  
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500  
inet 192.168.1.104 netmask 255.255.255.0 broadcast 192.168.1.255  
inet6 fe80::dc70:6737:b80c:95a6 prefixlen 64 scopeid 0x20<link>  
ether 00:15:5d:00:04:01 txqueuelen 1000 (Ethernet)  
RX packets 20064 bytes 1304558 (1.3 MB)  
RX errors 0 dropped 0 overruns 0 frame 0  
TX packets 22634 bytes 1808514 (1.8 MB)  
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0  
  
student@ubuntuvms:~$
```



Module 6:
Security, Troubleshooting, Performance

Monitor Linux Processes

1. What Is The Default Action Of The *15 SIGTERM* Kill Signal?

Answer:

Killed/ended 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?

Answer:

gnome-shell and Firefox were both 24%

References:

[Live Project Guidance](#)

Monitor User Activities

- Issue **Sudo Accton On** Command To Turn On GNC Accounting
- Run **Sudo Updatedb** Command
- Enter **Lastcomm Updatedb** To Check If *Updatedb* Command Was Executed Before
- Turn Off GNC Accounting (**Sudo Accton Off**)

1. What Flag Value Is Displayed In The Output?

Answer:

S - ROOT

2. Why Is The Name Of The User Who Ran The Processes Shown As Root, Not Student?

Answer:

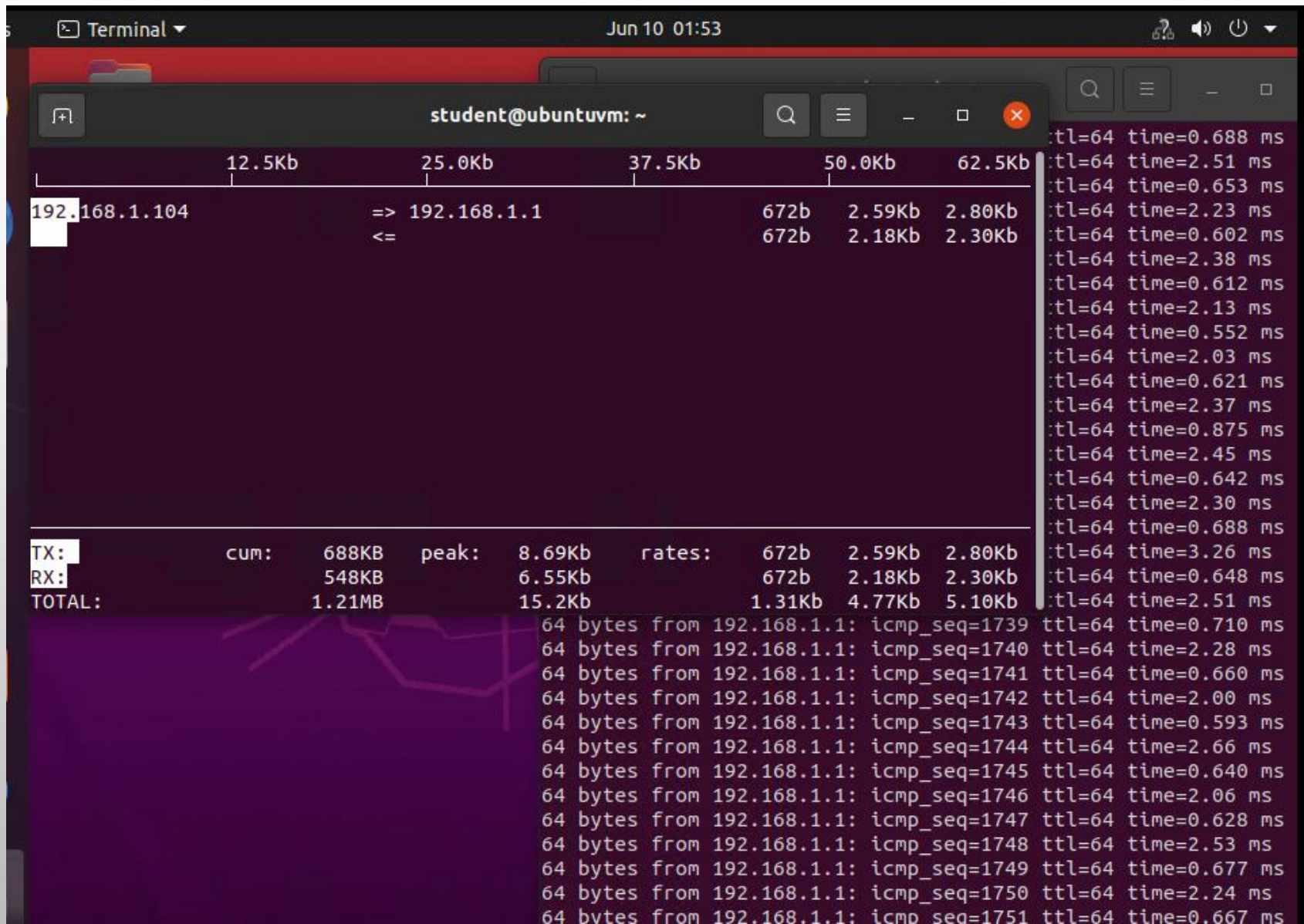
We Used Sudo To Execute As A Superuser Which Changed The Status From Student To Root

References:

Live Lecture

Recorded Project Guidance

Monitor Network Bandwidth Usage



The background features a light gray gradient with several realistic water droplets of various sizes scattered across the surface. A faint, circular, textured pattern is visible in the upper-middle section of the image.

Challenges

Challenges

1. We were introduced to virtual machines to install and run Ubuntu either on our desktop or in a class lab. Setting up and installing wasn't difficult, but since we were using the terminal and the command line instead of a graphical interface, it took some time to get used to remembering and working with the commands for Ubuntu (otherwise you get an error message or no response)
2. There are a lot of commands to learn and I keep forgetting them and have to keep looking them up. I know from past experience, only practice will make them second nature.

The background features a light gray gradient with several realistic water droplets of various sizes scattered across the surface. A faint, large circular pattern, resembling a fingerprint or a stylized logo, is centered in the upper half of the image.

Career Skills

Career Skills

1. Attention to Details: If you aren't detail oriented when you start working with the command line in Linux, you will learn to be. Using the wrong punctuation or the wrong case when writing a command will create an error or no result at all and you will have to be patient while you find the problem.
2. Investigative Skills: Searching for the reason your program isn't working will teach you to patiently examine your code.
3. Patience: It's hard to be patient with myself when I know how capable I am of learning new skills and subjects. Learning Linux will take a lot of practice before I'm as comfortable using it as I am with other computer products.

Conclusion

The background of the slide is a light gray gradient. It features several realistic water droplets of various sizes scattered across the surface. In the center, there is a faint, circular, textured pattern that resembles a fingerprint or a similar concentric design.

Why Learn Linux?

- Linux servers are very popular in corporations
 - Web servers
 - Database servers
 - Email servers
 - File servers
- 64% of world's servers run some variant of Unix or Linux
- Linux / Unix used on 77%+ of web servers
- Linux is used on 71.8% of IOT Devices

Lessons Learned

- ✓ Navigate the Linux filesystem tree
- ✓ Create Directories and files
- ✓ Copy and remove directories and files
- ✓ Locate Directories and Files
- ✓ Create a Shell Script
- ✓ Change Script File Permissions
- ✓ Set the PATH Variable
- ✓ Make the PATH Variable Permanent
- ✓ Add Users and Groups in CLI
- ✓ Test User and Group Settings
- ✓ Add Users in GUI
- ✓ Remove Users and Groups
- ✓ Discover Host IP Configurations
- ✓ Manage Network Interfaces
- ✓ Use Network Utilities
- ✓ Monitor Linux Processes
- ✓ Monitor User Activities
- ✓ Monitor Network Bandwidth Usage

The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. The word "Challenges" is centered in a large, bold, black font.

Challenges

- Learning and remembering how to write commands
- Using the command line instead of using a graphical interface

The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. The title 'Career Skills' is centered in the upper half of the slide.

Career Skills

- Attention to Details
- Investigative Skills
- Patience with Self