

Abstract

Utilizing the Linux bash shell to create, remove and manage users, groups, and directories as well as using commands to write into files. Learning how file and directory permissions are used and changed for groups and users.

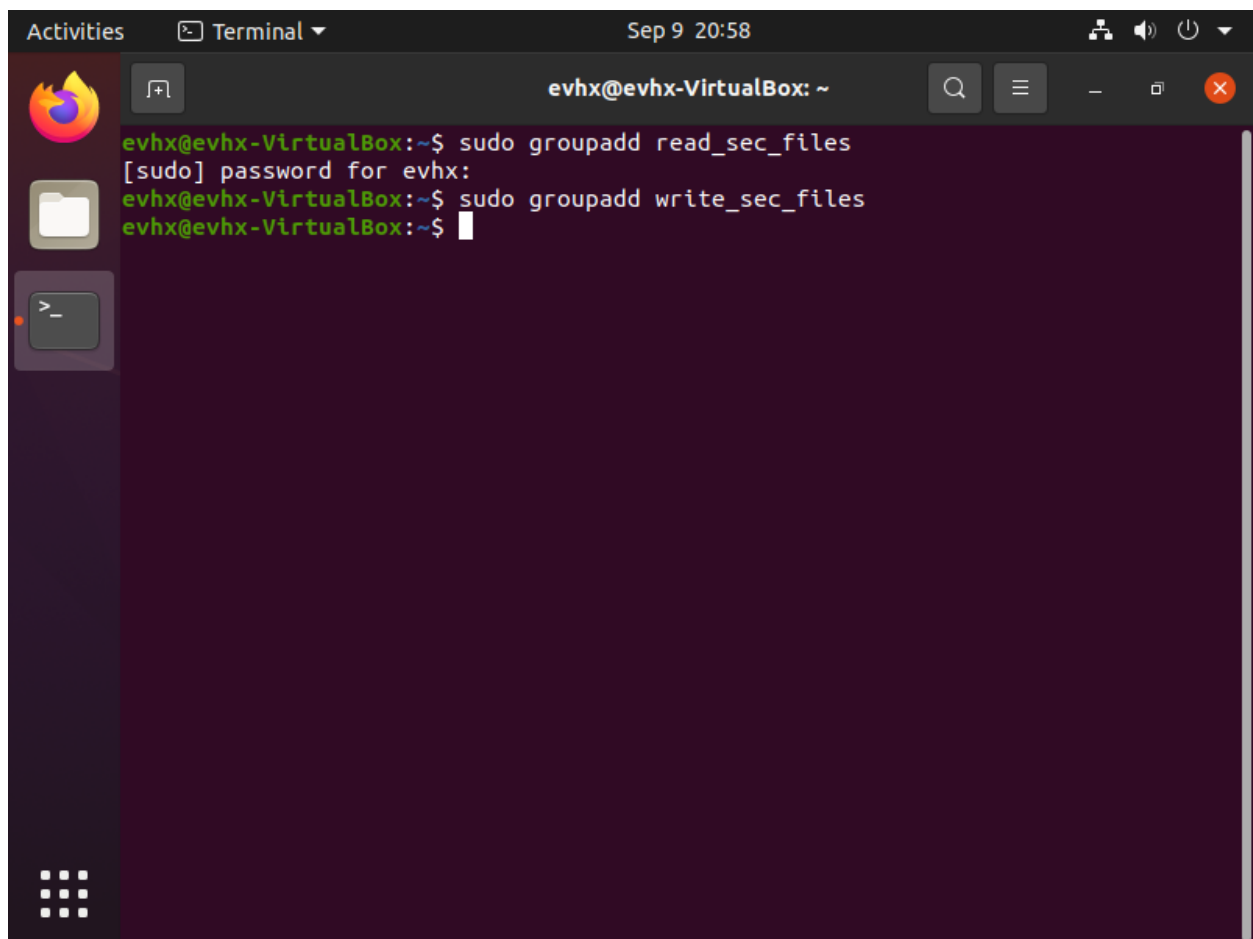
Introduction

The Linux command line in the bash shell will be used to create users, groups, and directories. Users will be placed into groups with specific permissions given. A directory named CS497, and a file called the myFile.txt will be created and managed with the bash shell. Permissions will be checked using the command 'ls -la'. The 'cat' command will be used to create and write into the myFile.txt. Commands such as 'date', 'uname -a', 'whoami', and 'ip address' will be redirected into the myFile.txt using the '>' operator. Permissions to different groups will be changed, and information retrieval commands will be used on the myFile.txt.

Summary of Results

On the Linux terminal two groups will be created using the command:
sudo groupadd [groupName]

sudo (for root privileges)
groupadd (create a group)

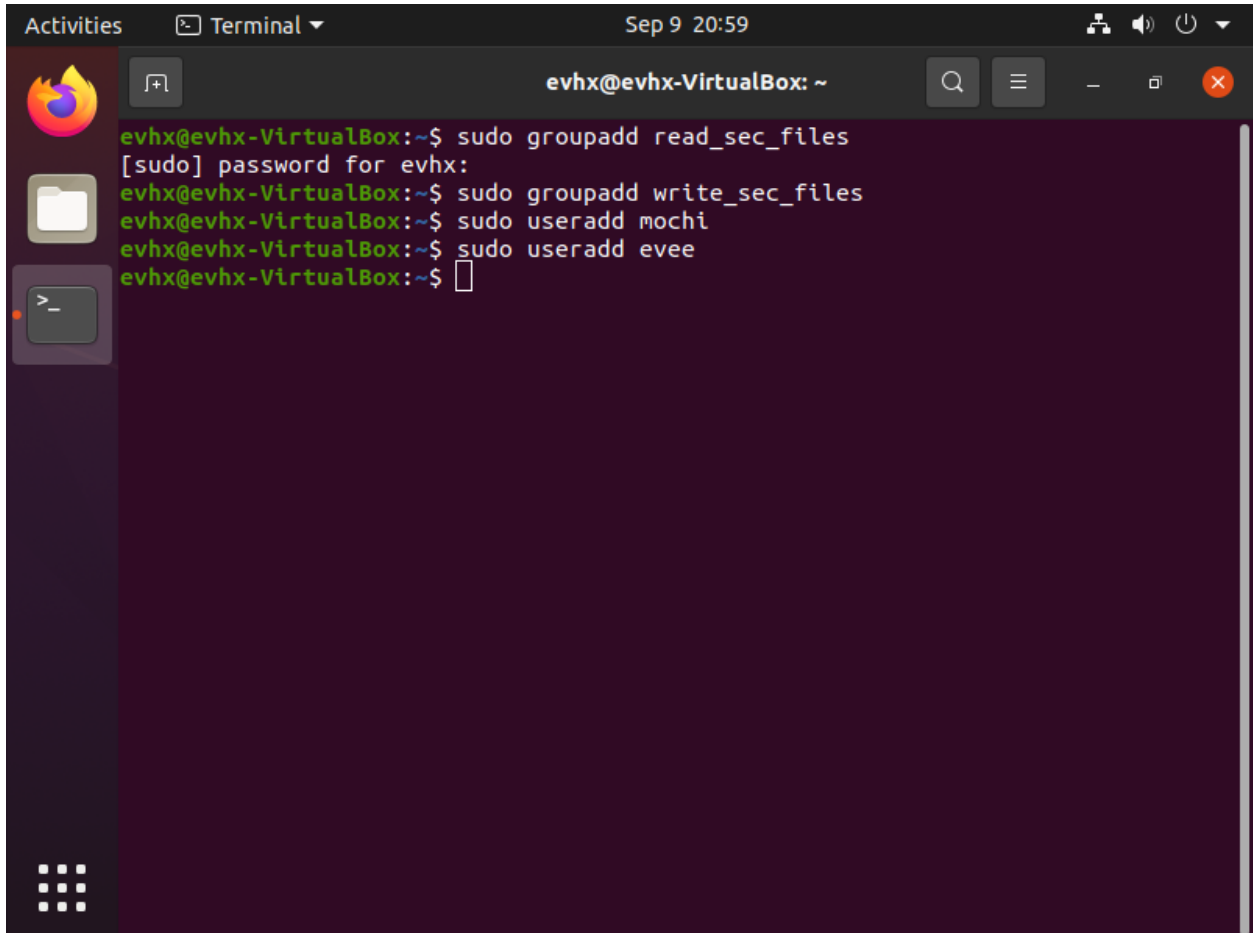
A screenshot of a Linux terminal window. The window title is "evhx@evhx-VirtualBox: ~". The terminal shows the following commands and output:

```
evhx@evhx-VirtualBox:~$ sudo groupadd read_sec_files
[sudo] password for evhx:
evhx@evhx-VirtualBox:~$ sudo groupadd write_sec_files
evhx@evhx-VirtualBox:~$
```

The terminal has a dark purple background with green text. On the left side of the terminal window, there is a vertical sidebar with icons for "Activities", "Terminal", and a file manager. The "Terminal" icon is currently selected. The top of the window shows the system clock as "Sep 9 20:58" and various system icons on the right.

Two users will be created using the command:
sudo useradd [username]

sudo (for root privileges)
useradd (create a group)



The screenshot shows a terminal window titled "evhx@evhx-VirtualBox: ~" with a dark background and green text. The terminal displays the following commands and their outputs:

```
evhx@evhx-VirtualBox:~$ sudo groupadd read_sec_files
[sudo] password for evhx:
evhx@evhx-VirtualBox:~$ sudo groupadd write_sec_files
evhx@evhx-VirtualBox:~$ sudo useradd mochi
evhx@evhx-VirtualBox:~$ sudo useradd evee
evhx@evhx-VirtualBox:~$
```

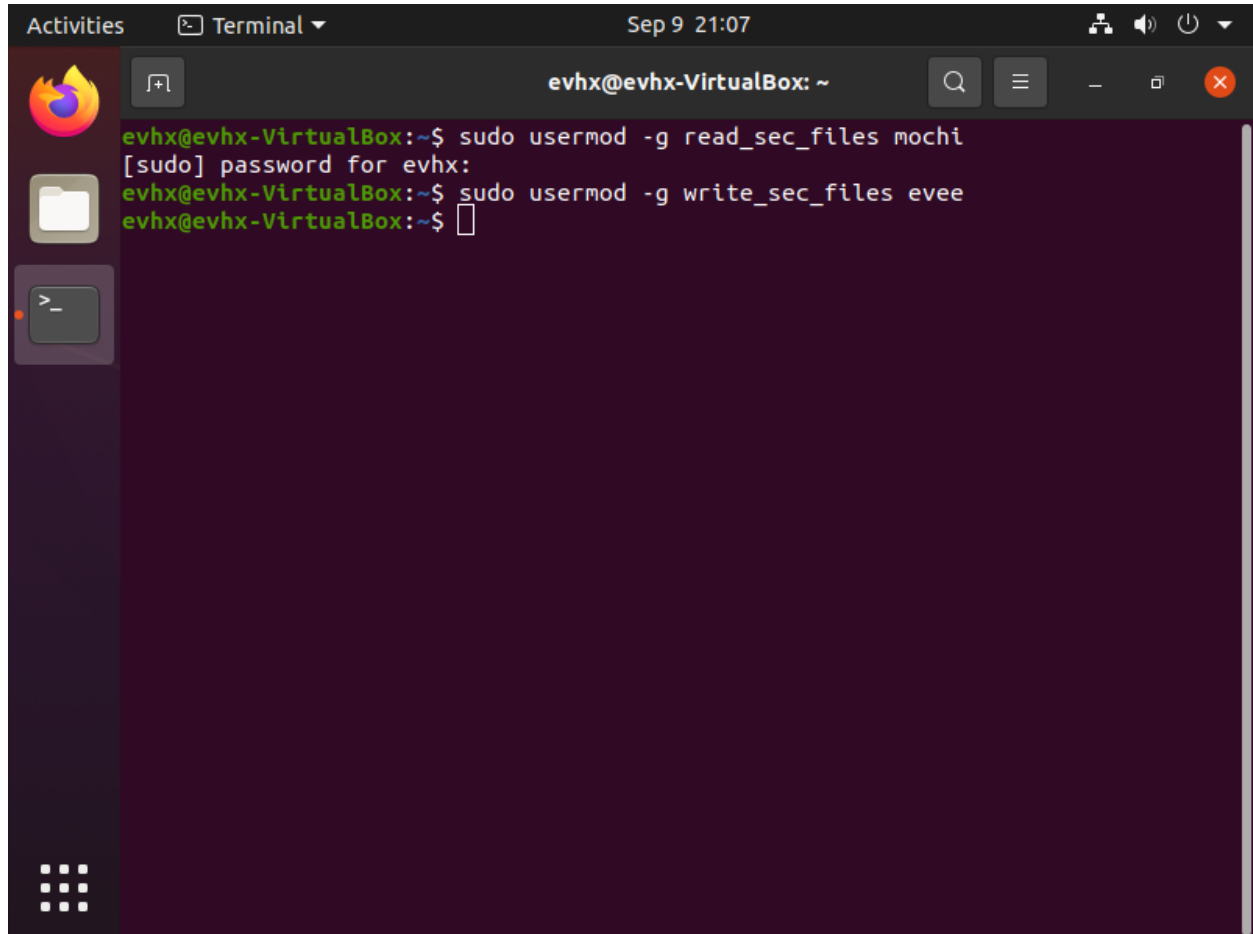
The terminal window is part of a desktop environment with a sidebar on the left containing icons for Firefox, a file manager, and a terminal. The top of the window shows the "Activities" menu, the "Terminal" application name, the date and time "Sep 9 20:59", and system status icons.

To add the users into a specified group, use the command:

`sudo usermod -g [groupname] [username]`

`usermod` (make changes to an existing user)

`-g` (change the primary group for a user)

A screenshot of a Linux terminal window. The window title bar shows 'Activities', 'Terminal', and the date 'Sep 9 21:07'. The terminal prompt is 'evhx@evhx-VirtualBox: ~'. The user has entered the command 'sudo usermod -g read_sec_files mochi', followed by the password prompt '[sudo] password for evhx:'. The user has then entered 'sudo usermod -g write_sec_files evee', followed by another password prompt. The terminal shows the prompt 'evhx@evhx-VirtualBox:~\$' again. The terminal window has a dark background and a light-colored text. The window is titled 'evhx@evhx-VirtualBox: ~'. The terminal shows the following commands and output:

```
evhx@evhx-VirtualBox:~$ sudo usermod -g read_sec_files mochi
[sudo] password for evhx:
evhx@evhx-VirtualBox:~$ sudo usermod -g write_sec_files evee
evhx@evhx-VirtualBox:~$
```

Change the directory location to /var/tmp with the command:

`cd /var/tmp`

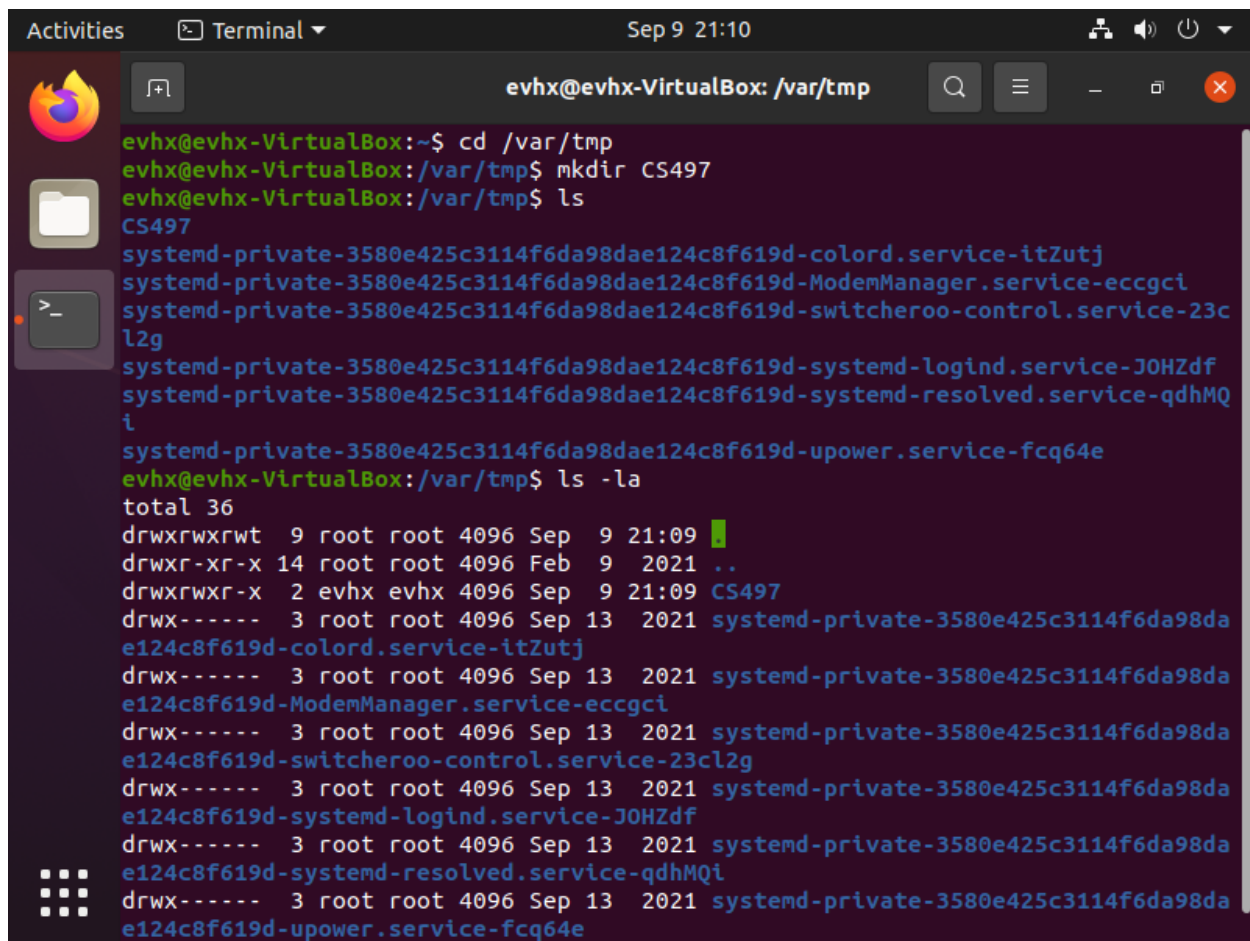
Create a directory with the command:

`mkdir [directory name]`

Check the permissions to the directory using the command:

`ls -la`

<code>cd</code>	(change the directory)
<code>mkdir</code>	(make a directory)
<code>ls</code>	(list files)
<code>ls -la</code>	(detailed info on every file)



The screenshot shows a terminal window titled "evhx@evhx-VirtualBox: /var/tmp". The user has executed the following commands:

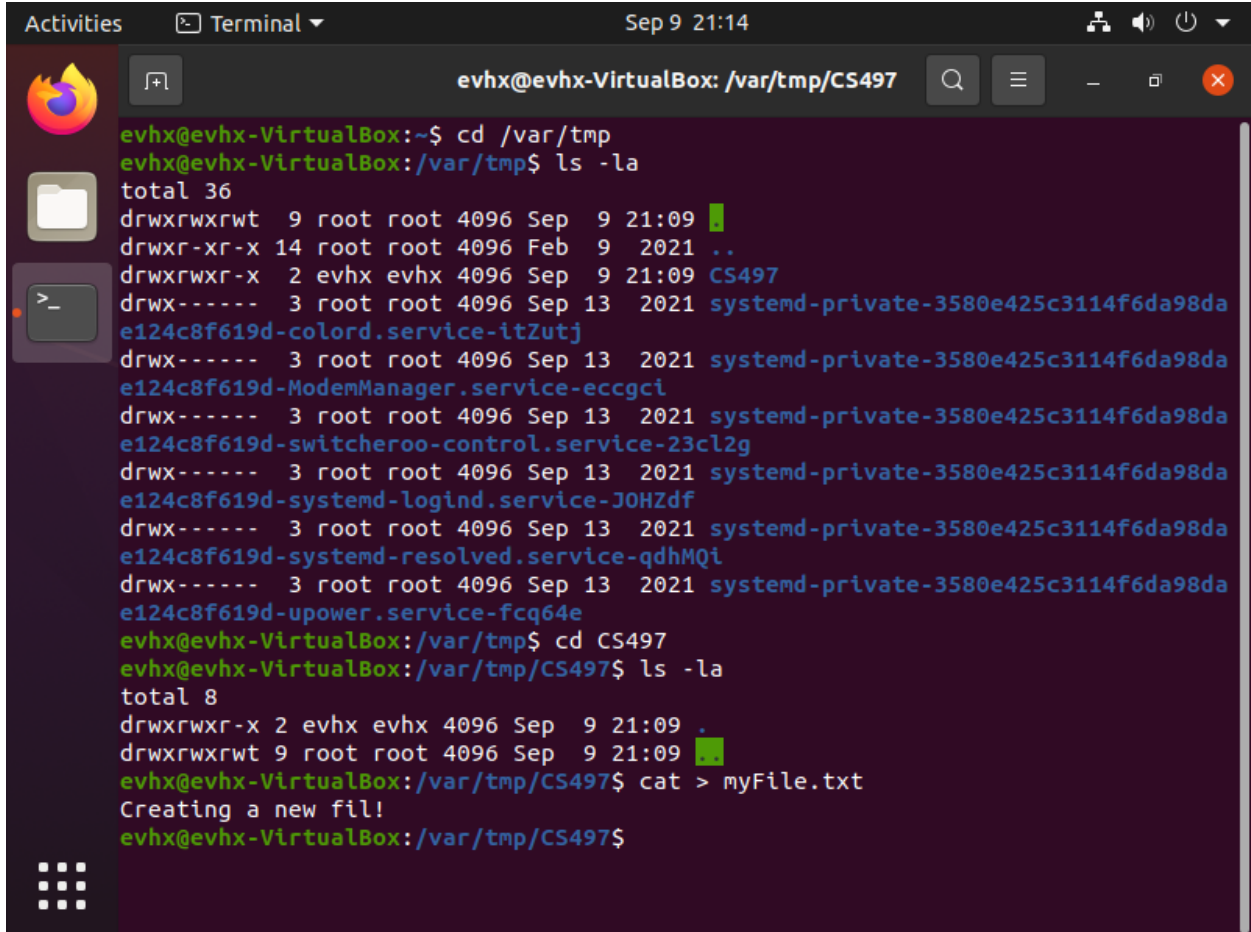
```
evhx@evhx-VirtualBox:~$ cd /var/tmp
evhx@evhx-VirtualBox:/var/tmp$ mkdir CS497
evhx@evhx-VirtualBox:/var/tmp$ ls
CS497
systemd-private-3580e425c3114f6da98dae124c8f619d-colord.service-itZutj
systemd-private-3580e425c3114f6da98dae124c8f619d-ModemManager.service-eccgci
systemd-private-3580e425c3114f6da98dae124c8f619d-switcheroo-control.service-23cl2g
systemd-private-3580e425c3114f6da98dae124c8f619d-systemd-logind.service-J0HZdf
systemd-private-3580e425c3114f6da98dae124c8f619d-systemd-resolved.service-qdhMQi
systemd-private-3580e425c3114f6da98dae124c8f619d-upower.service-fcq64e
evhx@evhx-VirtualBox:/var/tmp$ ls -la
total 36
drwxrwxrwt  9 root root 4096 Sep  9 21:09 .
drwxr-xr-x 14 root root 4096 Feb  9 2021 ..
drwxrwxr-x  2 evhx evhx 4096 Sep  9 21:09 CS497
drwx-----  3 root root 4096 Sep 13 2021 systemd-private-3580e425c3114f6da98dae124c8f619d-colord.service-itZutj
drwx-----  3 root root 4096 Sep 13 2021 systemd-private-3580e425c3114f6da98dae124c8f619d-ModemManager.service-eccgci
drwx-----  3 root root 4096 Sep 13 2021 systemd-private-3580e425c3114f6da98dae124c8f619d-switcheroo-control.service-23cl2g
drwx-----  3 root root 4096 Sep 13 2021 systemd-private-3580e425c3114f6da98dae124c8f619d-systemd-logind.service-J0HZdf
drwx-----  3 root root 4096 Sep 13 2021 systemd-private-3580e425c3114f6da98dae124c8f619d-systemd-resolved.service-qdhMQi
drwx-----  3 root root 4096 Sep 13 2021 systemd-private-3580e425c3114f6da98dae124c8f619d-upower.service-fcq64e
```

Within this new directory, a text file will be created, named myFile.txt using the command:

cat > [filename]

cat (print content of a file)

cat < (write to a file)



The screenshot shows a terminal window titled "evhx@evhx-VirtualBox: /var/tmp/CS497". The user is in the directory /var/tmp and has run the command `ls -la`, which lists the contents of the directory. The output shows several files and directories, including `systemd-private-3580e425c3114f6da98da` and `systemd-private-3580e425c3114f6da98da`. The user then runs `cd CS497` to move into the subdirectory. The output of `ls -la` in the subdirectory shows a file named `myFile.txt`. Finally, the user runs `cat > myFile.txt` to create a new file.

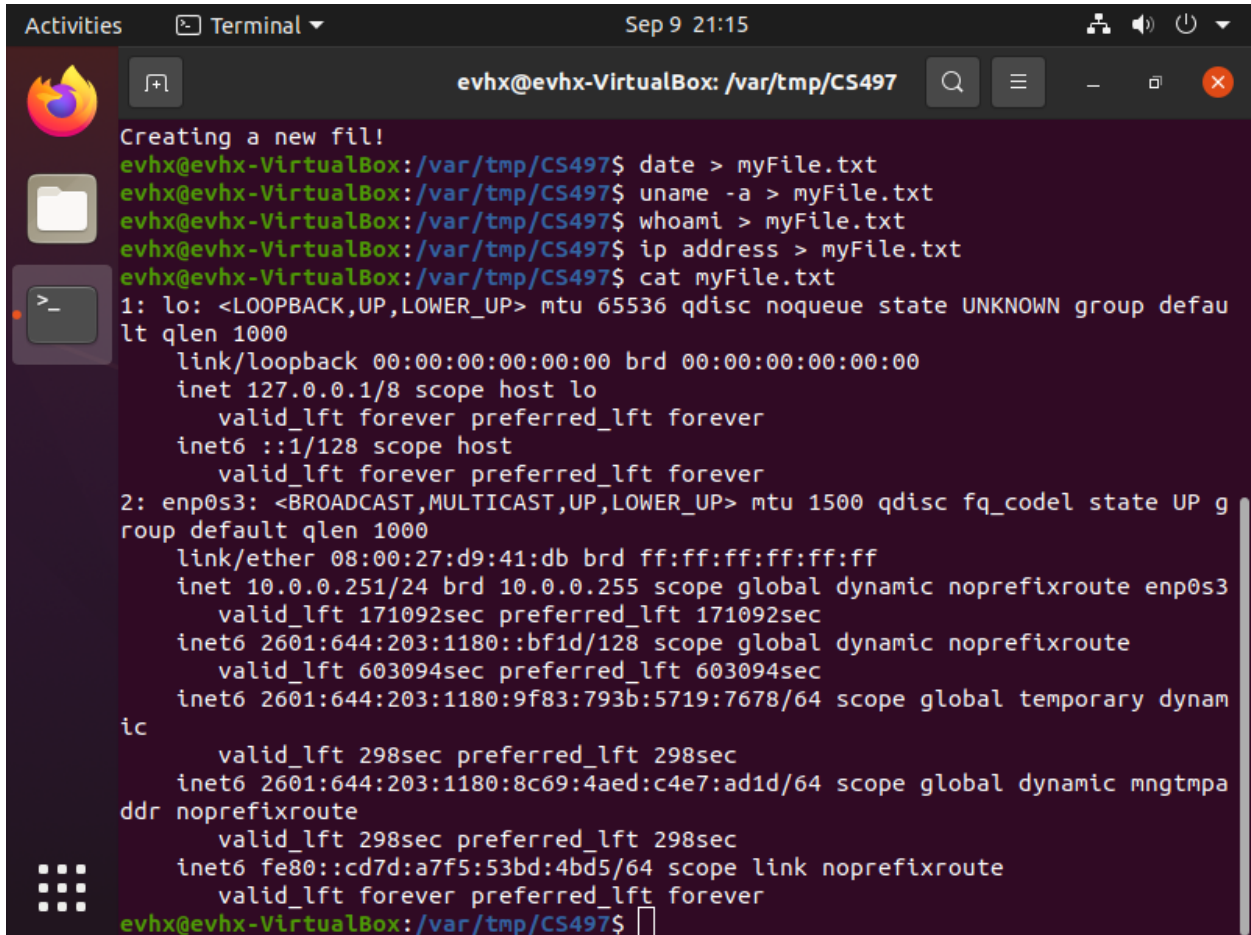
```
evhx@evhx-VirtualBox:~$ cd /var/tmp
evhx@evhx-VirtualBox:/var/tmp$ ls -la
total 36
drwxrwxrwt  9 root root 4096 Sep  9 21:09 .
drwxr-xr-x 14 root root 4096 Feb  9 2021 ..
drwxrwxr-x  2 evhx evhx 4096 Sep  9 21:09 CS497
drwx----- 3 root root 4096 Sep 13 2021 systemd-private-3580e425c3114f6da98da
e124c8f619d-colord.service-itZutj
drwx----- 3 root root 4096 Sep 13 2021 systemd-private-3580e425c3114f6da98da
e124c8f619d-ModemManager.service-eccgci
drwx----- 3 root root 4096 Sep 13 2021 systemd-private-3580e425c3114f6da98da
e124c8f619d-switcheroo-control.service-23cl2g
drwx----- 3 root root 4096 Sep 13 2021 systemd-private-3580e425c3114f6da98da
e124c8f619d-systemd-logind.service-J0HZdf
drwx----- 3 root root 4096 Sep 13 2021 systemd-private-3580e425c3114f6da98da
e124c8f619d-systemd-resolved.service-qdhMQi
drwx----- 3 root root 4096 Sep 13 2021 systemd-private-3580e425c3114f6da98da
e124c8f619d-upower.service-fcq64e
evhx@evhx-VirtualBox:/var/tmp$ cd CS497
evhx@evhx-VirtualBox:/var/tmp/CS497$ ls -la
total 8
drwxrwxr-x 2 evhx evhx 4096 Sep  9 21:09 .
drwxrwxrwt 9 root root 4096 Sep  9 21:09 ..
evhx@evhx-VirtualBox:/var/tmp/CS497$ cat > myFile.txt
Creating a new fil!
evhx@evhx-VirtualBox:/var/tmp/CS497$
```

The following commands will be used in order to redirect the output into the new text file:

date > [filename]	(retrieves the date)
uname -a > [filename]	(retrieves the kernel version)
whoami > [filename]	(retrieves username)
ip address > [filename]	(retrieves the ip address)

To show the contents of the file, use the command:

cat [filename]



The screenshot shows a terminal window titled "evhx@evhx-VirtualBox: /var/tmp/CS497". The terminal output is as follows:

```
Creating a new file!
evhx@evhx-VirtualBox:/var/tmp/CS497$ date > myFile.txt
evhx@evhx-VirtualBox:/var/tmp/CS497$ uname -a > myFile.txt
evhx@evhx-VirtualBox:/var/tmp/CS497$ whoami > myFile.txt
evhx@evhx-VirtualBox:/var/tmp/CS497$ ip address > myFile.txt
evhx@evhx-VirtualBox:/var/tmp/CS497$ cat myFile.txt
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 08:00:27:d9:41:db brd ff:ff:ff:ff:ff:ff
    inet 10.0.0.251/24 brd 10.0.0.255 scope global dynamic noprefixroute enp0s3
        valid_lft 171092sec preferred_lft 171092sec
    inet6 2601:644:203:1180::bf1d/128 scope global dynamic noprefixroute
        valid_lft 603094sec preferred_lft 603094sec
    inet6 2601:644:203:1180:9f83:793b:5719:7678/64 scope global temporary dynamic
    valid_lft 298sec preferred_lft 298sec
    inet6 2601:644:203:1180:8c69:4aed:c4e7:ad1d/64 scope global dynamic mngtmpa
    ddr noprefixroute
        valid_lft 298sec preferred_lft 298sec
    inet6 fe80::cd7d:a7f5:53bd:4bd5/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
evhx@evhx-VirtualBox:/var/tmp/CS497$
```

Change the directory by using the command:

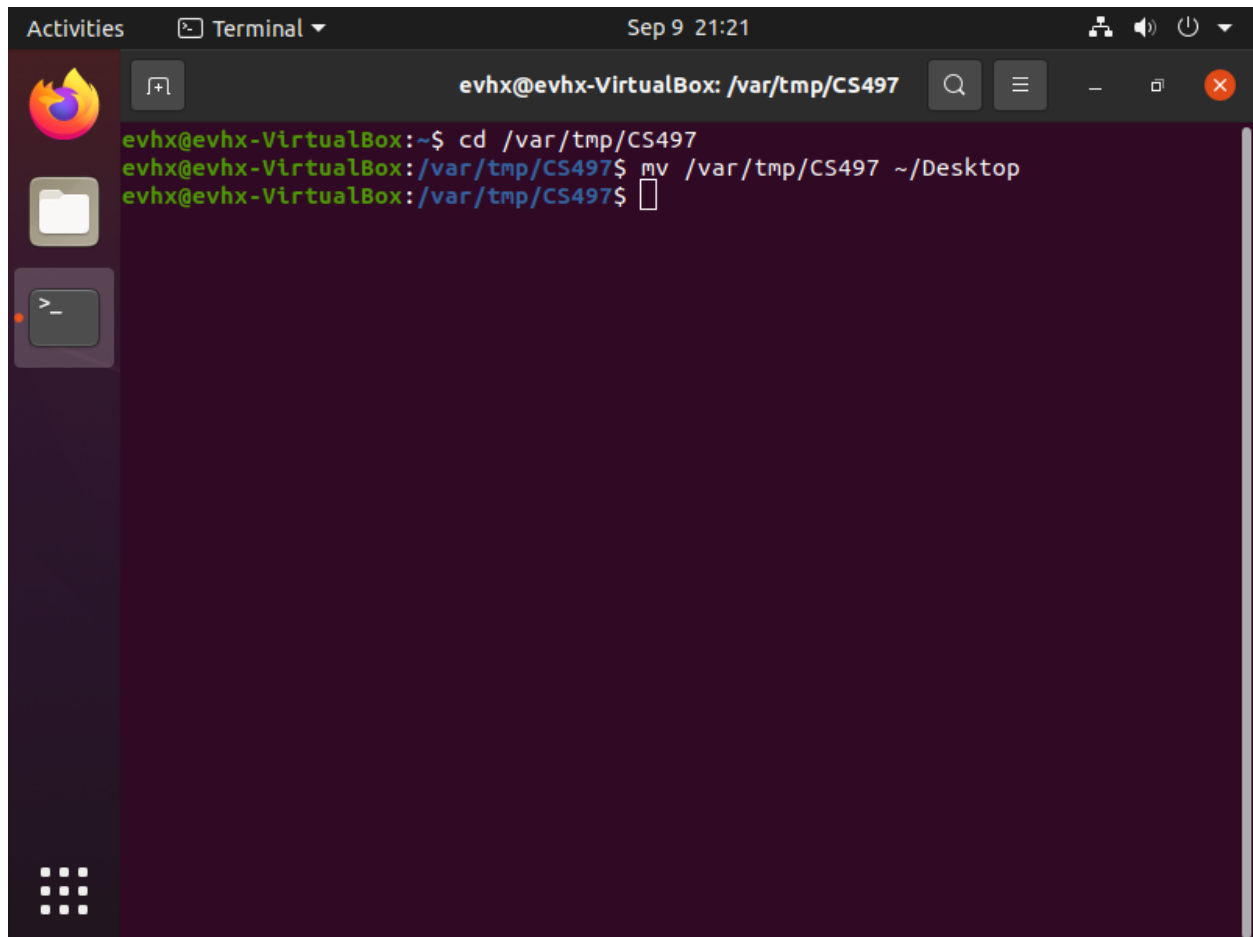
`cd [directory location]`

Move the directory to another location using the command:

`mv [directory] [new directory location]`

`cd` (change directory)

`mv` (move)

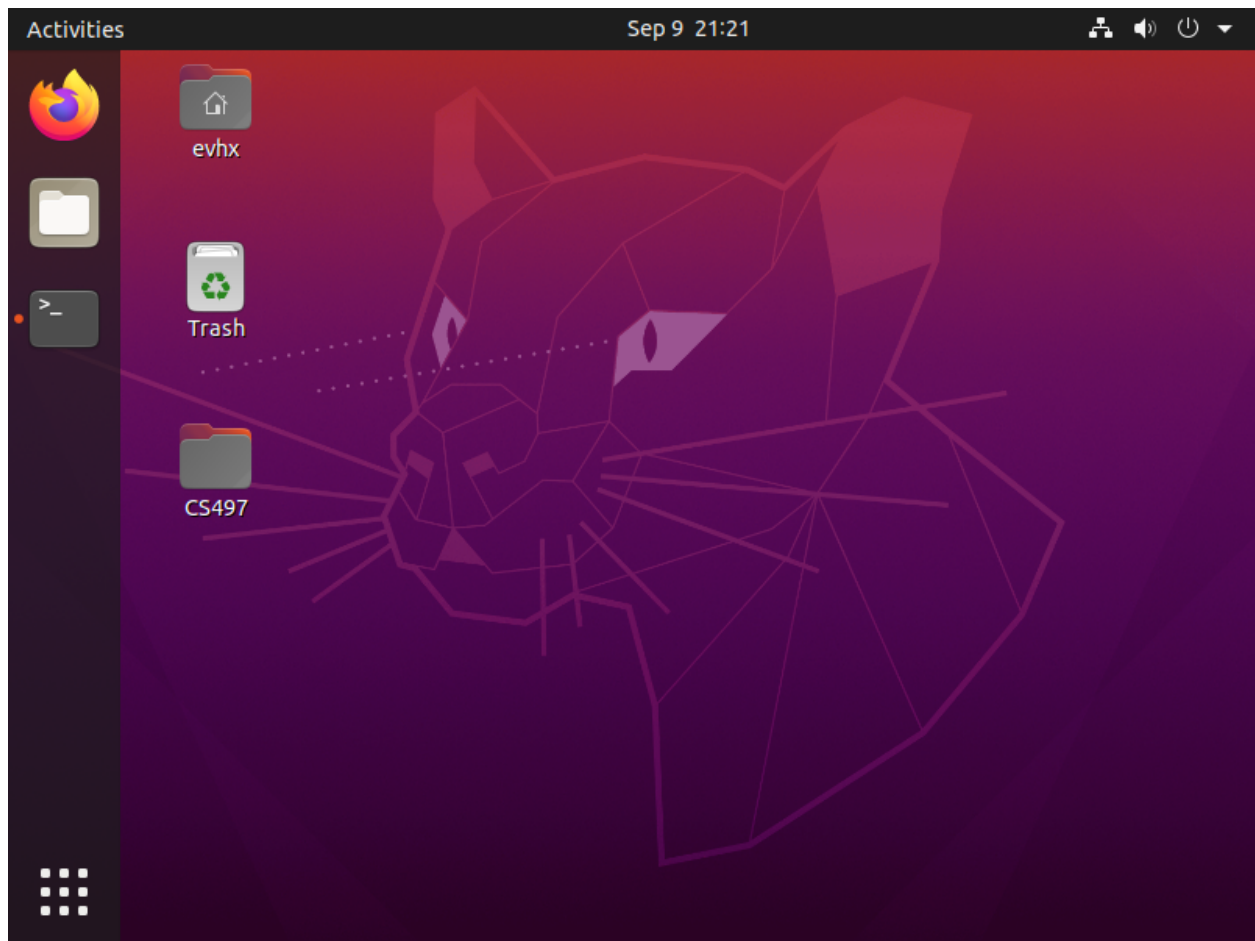


The screenshot shows a terminal window titled "evhx@evhx-VirtualBox: /var/tmp/CS497". The terminal output is as follows:

```
evhx@evhx-VirtualBox:~$ cd /var/tmp/CS497
evhx@evhx-VirtualBox:/var/tmp/CS497$ mv /var/tmp/CS497 ~/Desktop
evhx@evhx-VirtualBox:/var/tmp/CS497$
```

The terminal window has a dark background with a light-colored cursor. The top bar shows the date and time "Sep 9 21:21". The left sidebar contains icons for "Activities", "Terminal", and a file manager. The bottom left corner has a grid of application icons.

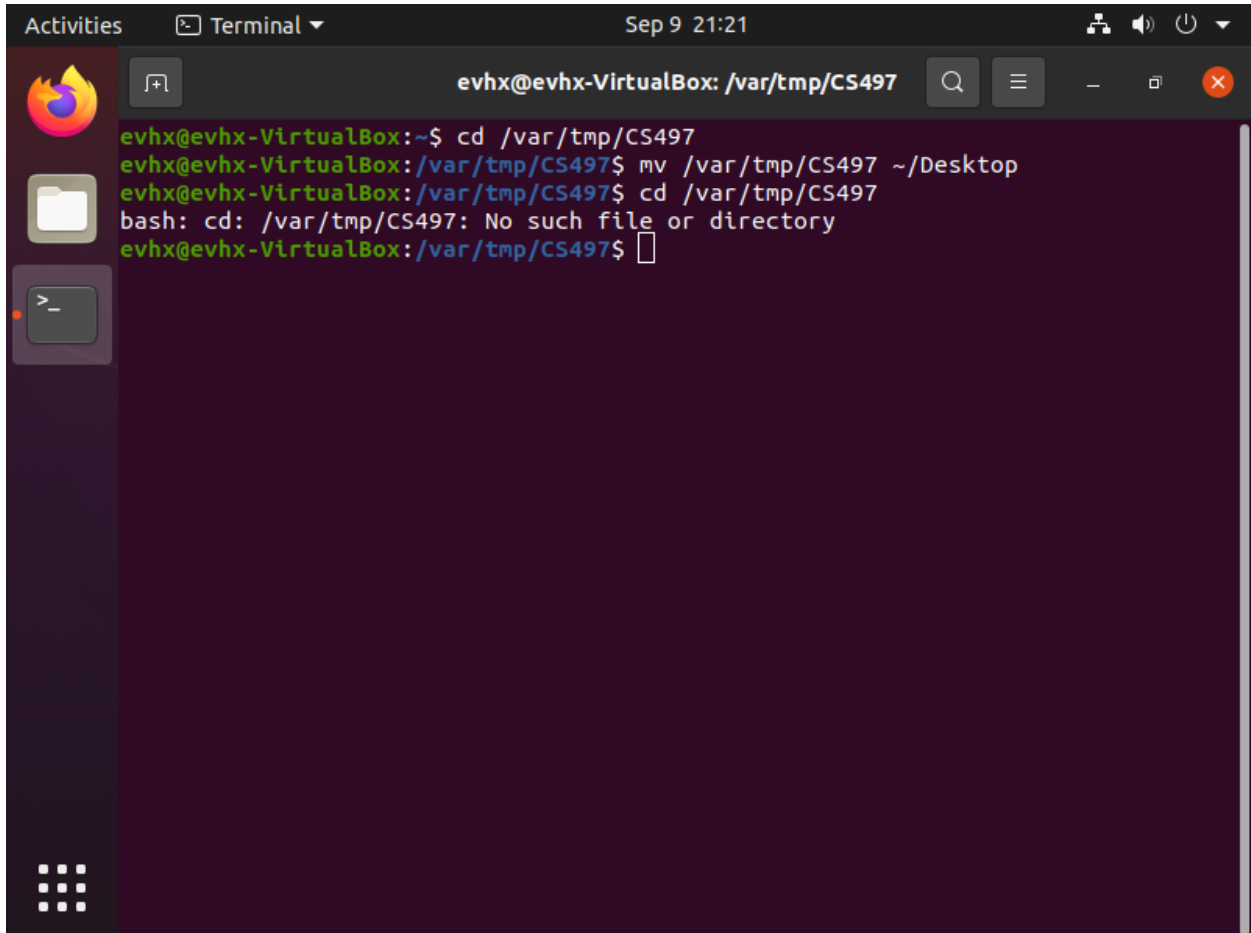
The moved directory (named CS497) is now at its new location.



To confirm that the directory does not exist in its previous location, an attempt to access the directory will be done with the command:

`cd [directory location]`

The directory does no longer exist.

A screenshot of a Linux terminal window titled "evhx@evhx-VirtualBox: /var/tmp/CS497". The terminal shows a sequence of commands: first, `cd /var/tmp/CS497`; then, `mv /var/tmp/CS497 ~/Desktop`; and finally, `cd /var/tmp/CS497`. The last command results in an error message: `bash: cd: /var/tmp/CS497: No such file or directory`. The terminal window has a dark theme and includes standard window controls and a sidebar with icons for Activities, Terminal, and a file manager.

```
evhx@evhx-VirtualBox:~$ cd /var/tmp/CS497
evhx@evhx-VirtualBox:/var/tmp/CS497$ mv /var/tmp/CS497 ~/Desktop
evhx@evhx-VirtualBox:/var/tmp/CS497$ cd /var/tmp/CS497
bash: cd: /var/tmp/CS497: No such file or directory
evhx@evhx-VirtualBox:/var/tmp/CS497$
```

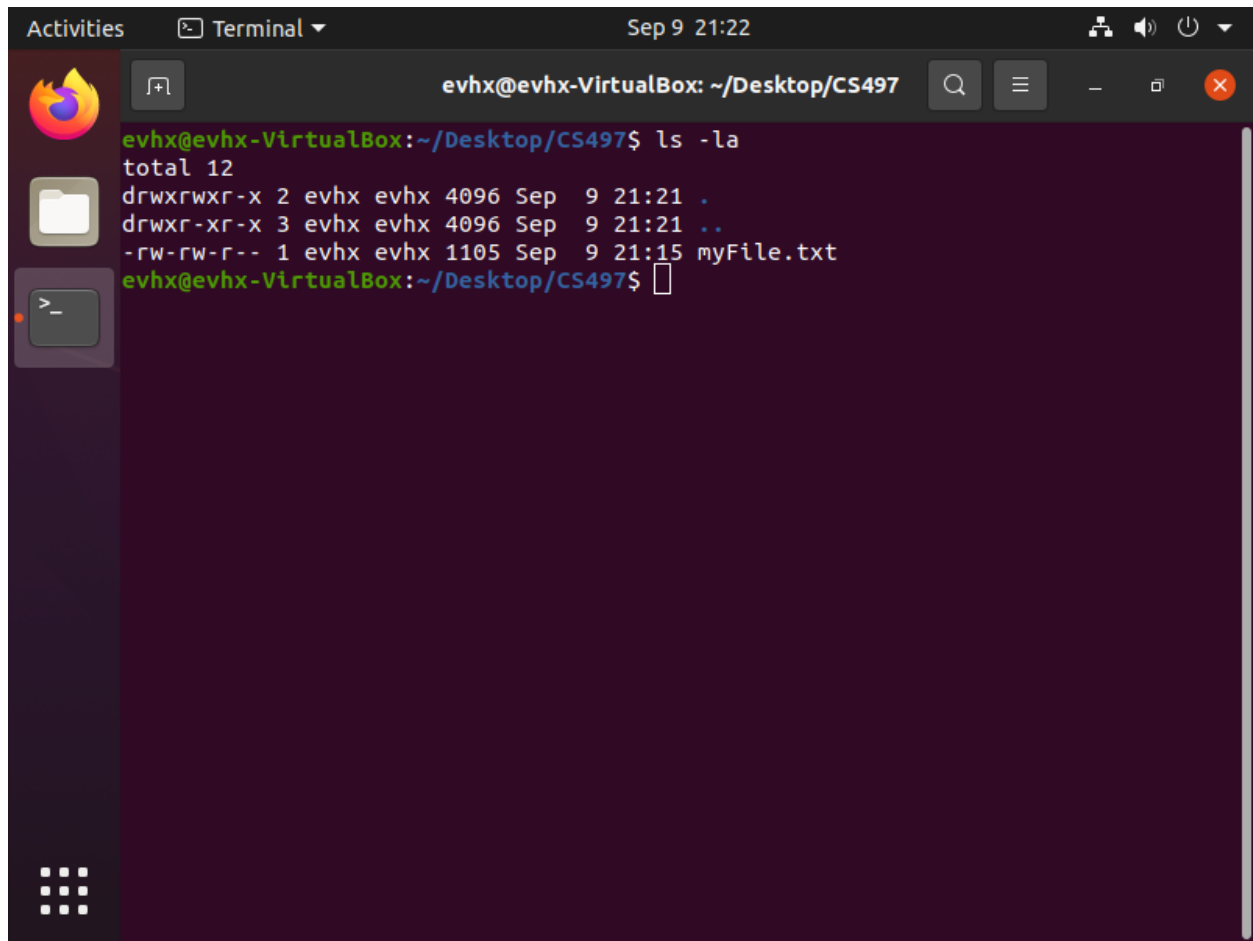
The permissions for the 'CS497' directory and the myFile.txt file, now located on the desktop will be checked with the command:

`ls -la`

To read the permissions, one must know:

d	(directory permission)
- (when at the start)	(file permission)
r	(read permission)
w	(write permission)
x	(execute permission)
-	(no permission)

[directory/file][rwx for user][rwx for group][rwx for others]



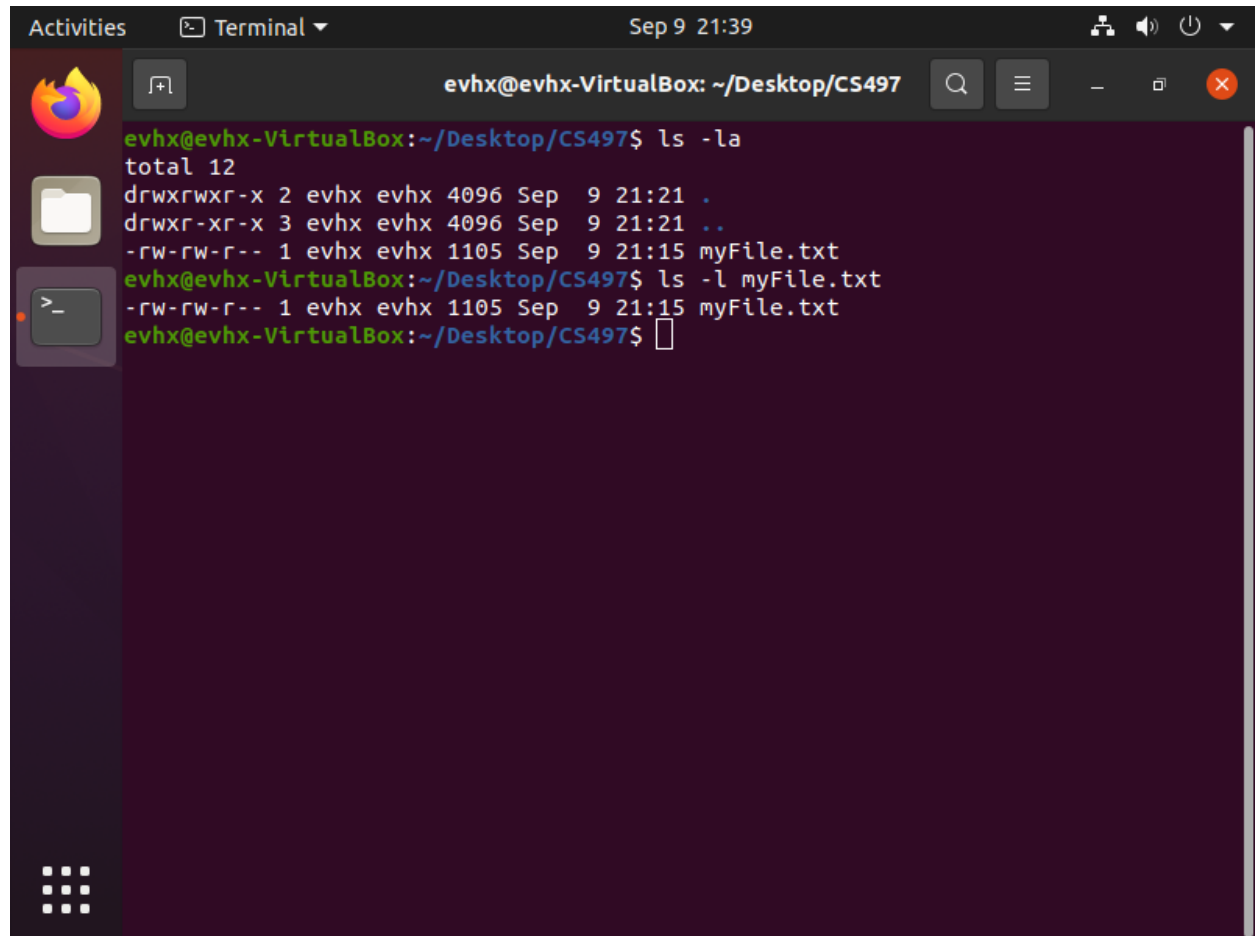
The screenshot shows a terminal window titled "evhx@evhx-VirtualBox: ~/Desktop/CS497". The terminal output of the command `ls -la` is as follows:

```
evhx@evhx-VirtualBox:~/Desktop/CS497$ ls -la
total 12
drwxrwxr-x 2 evhx evhx 4096 Sep  9 21:21 .
drwxr-xr-x 3 evhx evhx 4096 Sep  9 21:21 ..
-rw-rw-r-- 1 evhx evhx 1105 Sep  9 21:15 myFile.txt
evhx@evhx-VirtualBox:~/Desktop/CS497$
```

The terminal window includes a sidebar on the left with icons for Activities, Terminal, and a file manager. The top bar shows the date and time as "Sep 9 21:22".

The command to specifically look at a file's permissions is:

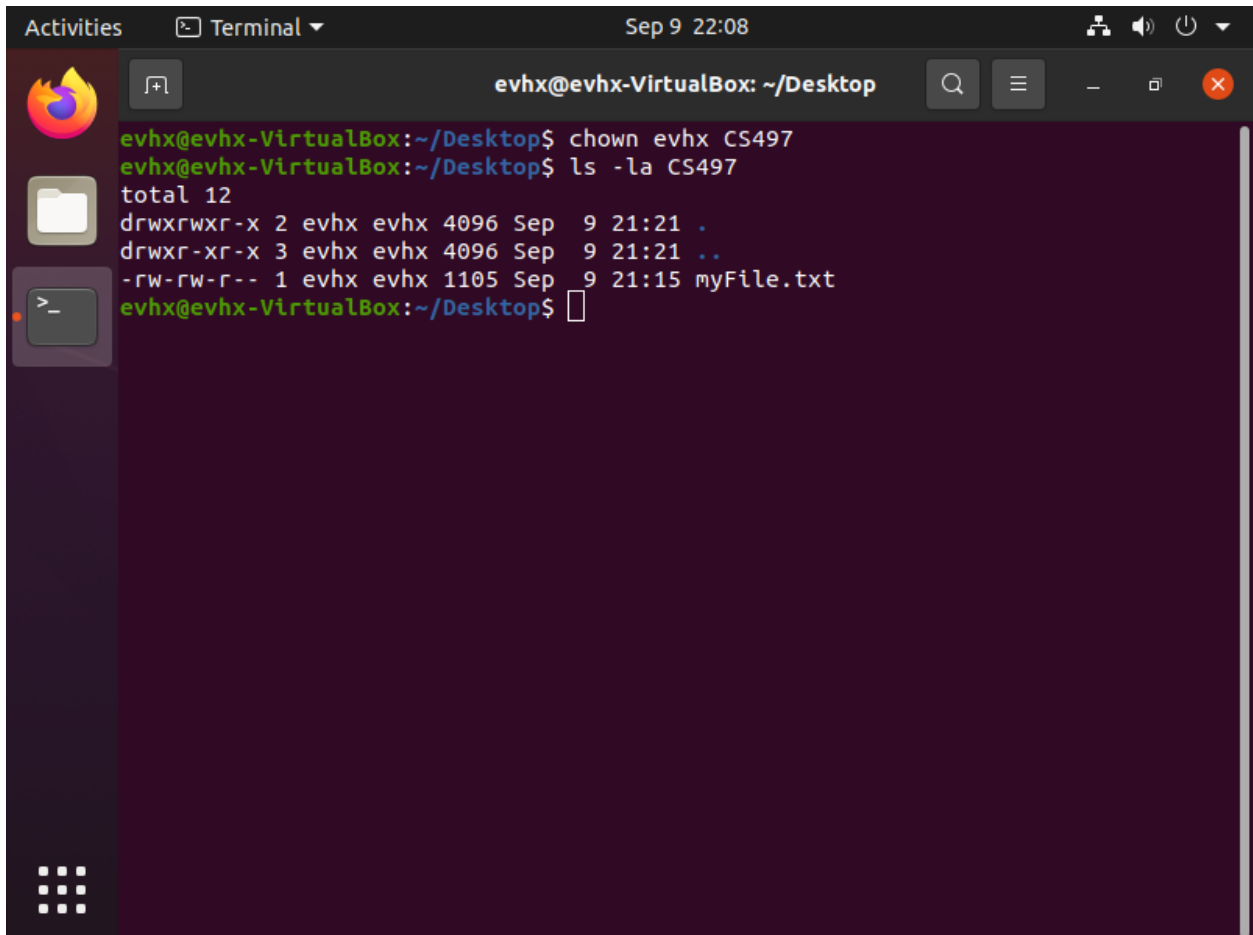
`ls -l [filename]`

A screenshot of a Linux terminal window. The window title bar shows 'Activities', 'Terminal', and the date 'Sep 9 21:39'. The terminal prompt is 'evhx@evhx-VirtualBox: ~/Desktop/CS497'. The user has entered the command 'ls -la', which outputs the following: 'total 12', 'drwxrwxr-x 2 evhx evhx 4096 Sep 9 21:21 .', 'drwxr-xr-x 3 evhx evhx 4096 Sep 9 21:21 ..', and '-rw-rw-r-- 1 evhx evhx 1105 Sep 9 21:15 myFile.txt'. The user then enters 'ls -l myFile.txt', which outputs '-rw-rw-r-- 1 evhx evhx 1105 Sep 9 21:15 myFile.txt'. The terminal window has a dark background and a sidebar on the left with icons for Activities, Files, and a terminal icon. The bottom left corner shows a grid of application icons.

```
evhx@evhx-VirtualBox: ~/Desktop/CS497$ ls -la
total 12
drwxrwxr-x 2 evhx evhx 4096 Sep  9 21:21 .
drwxr-xr-x 3 evhx evhx 4096 Sep  9 21:21 ..
-rw-rw-r-- 1 evhx evhx 1105 Sep  9 21:15 myFile.txt
evhx@evhx-VirtualBox:~/Desktop/CS497$ ls -l myFile.txt
-rw-rw-r-- 1 evhx evhx 1105 Sep  9 21:15 myFile.txt
evhx@evhx-VirtualBox:~/Desktop/CS497$
```

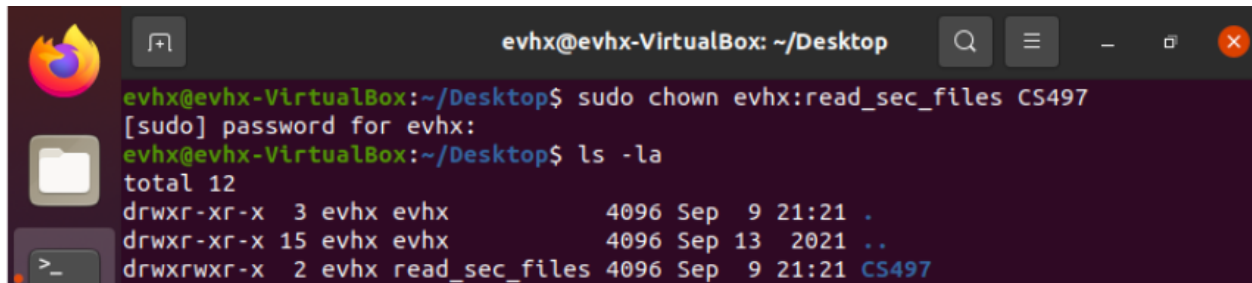
To make the user account into the owner of a directory, use the command:
`chown [useraccount] [directory]`

`chown` (change owner)

A screenshot of a Linux terminal window titled "evhx@evhx-VirtualBox: ~/Desktop". The window shows the execution of the `chown` command to change the ownership of a directory named `CS497` to the user `evhx`. The command `chown evhx CS497` is entered and executed. Following this, the command `ls -la CS497` is entered and executed, displaying the directory listing for `CS497`. The output shows a total size of 12, with three entries: a directory `.` with permissions `drwxrwxr-x`, a directory `..` with permissions `drwxr-xr-x`, and a file `myFile.txt` with permissions `-rw-rw-r--`. All entries are owned by `evhx` and have a group of `evhx`. The terminal window includes a sidebar with icons for Firefox, a file manager, and a terminal, and a top bar with system status icons and the date/time "Sep 9 22:08".

```
evhx@evhx-VirtualBox:~/Desktop$ chown evhx CS497
evhx@evhx-VirtualBox:~/Desktop$ ls -la CS497
total 12
drwxrwxr-x 2 evhx evhx 4096 Sep  9 21:21 .
drwxr-xr-x 3 evhx evhx 4096 Sep  9 21:21 ..
-rw-rw-r-- 1 evhx evhx 1105 Sep  9 21:15 myFile.txt
evhx@evhx-VirtualBox:~/Desktop$
```

A way to have certain groups have specific permissions to directories and files, change the ownership to the group, then change the permissions allowed for the group with the command:
`sudo chown [original owner]:[new owner] [directory/file]`

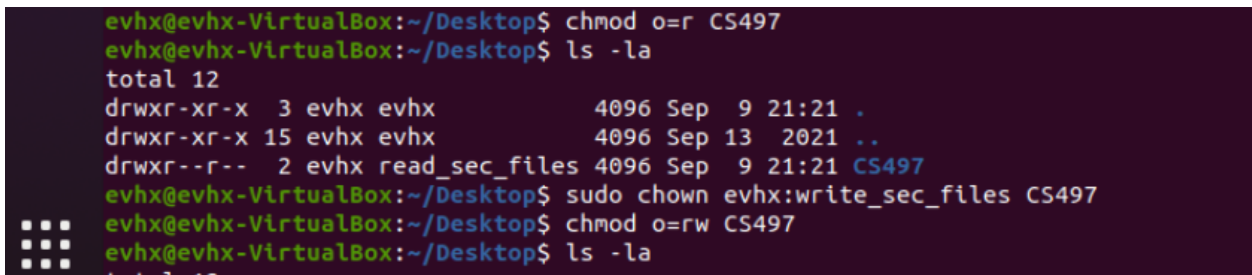
A terminal window titled 'evhx@evhx-VirtualBox: ~/Desktop'. The user enters the command 'sudo chown evhx:read_sec_files CS497'. The system prompts for a password, which is entered. Then, the user enters 'ls -la'. The output shows the permissions for the current directory, its parent, and the file 'CS497'. The file 'CS497' is now owned by 'evhx' and has permissions 'drwxrwxr-x' for the group 'read_sec_files'.

```
evhx@evhx-VirtualBox:~/Desktop$ sudo chown evhx:read_sec_files CS497
[sudo] password for evhx:
evhx@evhx-VirtualBox:~/Desktop$ ls -la
total 12
drwxr-xr-x  3 evhx evhx          4096 Sep  9 21:21 .
drwxr-xr-x 15 evhx evhx          4096 Sep 13 2021 ..
drwxrwxr-x  2 evhx read_sec_files 4096 Sep  9 21:21 CS497
```

To change the owner permissions to read-only, use the command:
`chmod o=r [directory name]`

To change the owner permissions to read and write, use the command:
`chmod o=rw [directory name]`

`chmod` (change the access permissions)

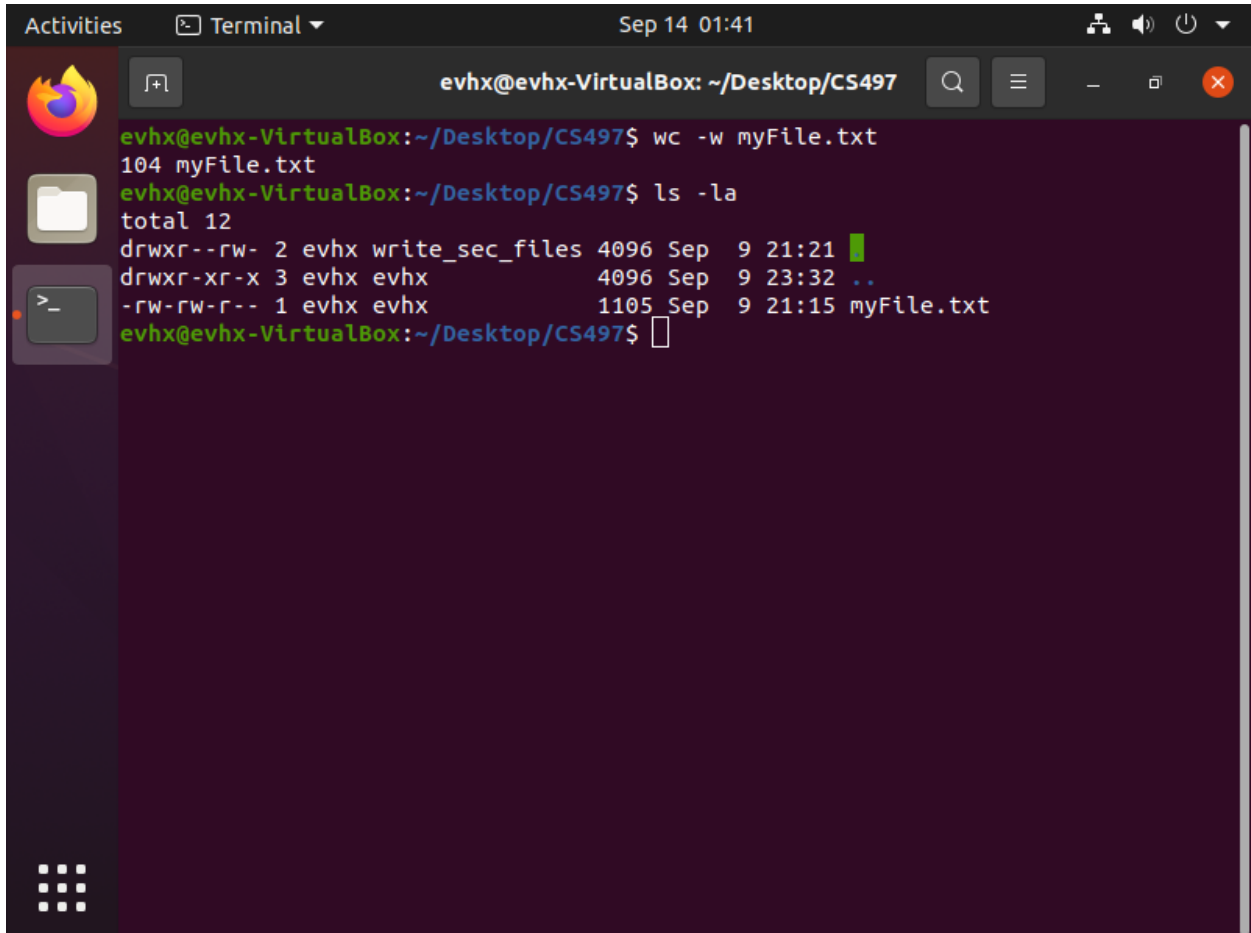
A terminal window titled 'evhx@evhx-VirtualBox: ~/Desktop'. The user enters 'chmod o=r CS497'. Then, they enter 'ls -la'. The output shows the file 'CS497' with permissions 'drwxr--r--'. Next, the user enters 'sudo chown evhx:write_sec_files CS497'. Then, they enter 'chmod o=rw CS497'. Finally, they enter 'ls -la'. The output shows the file 'CS497' with permissions 'drwxr--r--' and ownership 'evhx:write_sec_files'.

```
evhx@evhx-VirtualBox:~/Desktop$ chmod o=r CS497
evhx@evhx-VirtualBox:~/Desktop$ ls -la
total 12
drwxr-xr-x  3 evhx evhx          4096 Sep  9 21:21 .
drwxr-xr-x 15 evhx evhx          4096 Sep 13 2021 ..
drwxr--r--  2 evhx read_sec_files 4096 Sep  9 21:21 CS497
evhx@evhx-VirtualBox:~/Desktop$ sudo chown evhx:write_sec_files CS497
evhx@evhx-VirtualBox:~/Desktop$ chmod o=rw CS497
evhx@evhx-VirtualBox:~/Desktop$ ls -la
total 12
drwxr--r--  2 evhx write_sec_files 4096 Sep  9 21:21 CS497
```

To display the word count of a file, use the command:

`wc -w [file name]`

`wc` (word count)



The screenshot shows a terminal window titled "evhx@evhx-VirtualBox: ~/Desktop/CS497". The terminal output is as follows:

```
evhx@evhx-VirtualBox:~/Desktop/CS497$ wc -w myFile.txt
104 myFile.txt
evhx@evhx-VirtualBox:~/Desktop/CS497$ ls -la
total 12
drwxr--rw- 2 evhx write_sec_files 4096 Sep  9 21:21 
drwxr-xr-x 3 evhx evhx            4096 Sep  9 23:32 ..
-rw-rw-r-- 1 evhx evhx            1105 Sep  9 21:15 myFile.txt
evhx@evhx-VirtualBox:~/Desktop/CS497$
```

Conclusion

The bash shell in Linux can be used to create, remove, and manage user groups, and directories, along with writing into files, and creating specific permissions for users, groups and others.

To access the man page for the 'chmod', use the command:

```
man chmod
```

To change the permissions for a file to be readable and writable for the owner, but only readable to the group and others, use the command:

```
chmod 644 [filename]
```

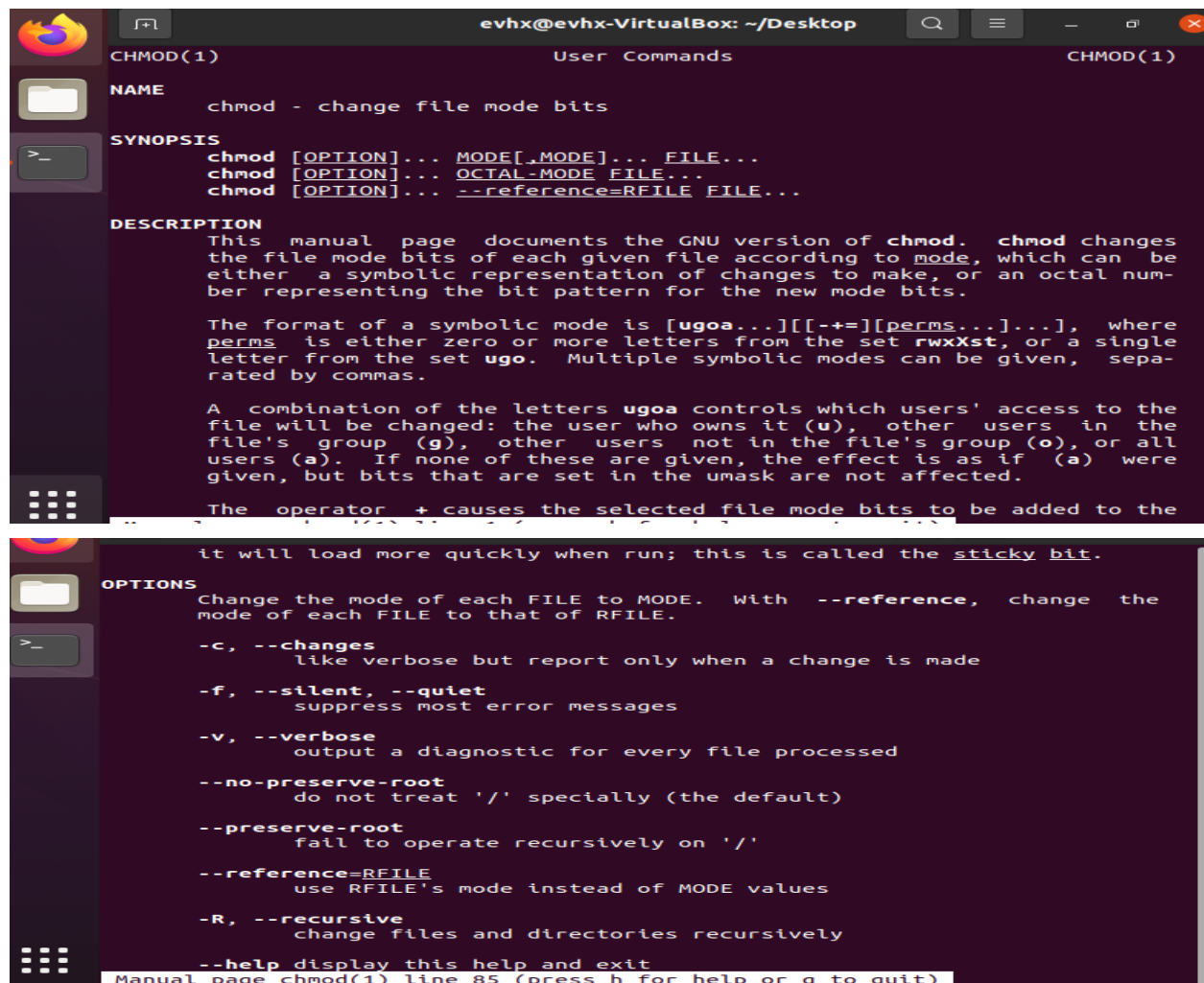
Permissions 644 represent '-rw-r--r--', by following the values:

read = 4

write = 2

execute = 1

Other numbers would represent different permissions, such as 666 would be -rw-rwrw-. To make a file only readable by a user, the permissions would be '-r-----' which is chmod 400. To make files executable, the x's are needed for the permissions such as '-rwxrwxrwx' for example, which gives full permissions, thus being chmod 777. Access permissions can only be changed by the root user and the owner of the file.



```
evhx@evhx-VirtualBox: ~/Desktop
CHMOD(1)                                User Commands                                CHMOD(1)

NAME
    chmod - change file mode bits

SYNOPSIS
    chmod [OPTION]... MODE[,MODE]... FILE...
    chmod [OPTION]... OCTAL-MODE FILE...
    chmod [OPTION]... --reference=RFILE FILE...

DESCRIPTION
    This manual page documents the GNU version of chmod. chmod changes
    the file mode bits of each given file according to mode, which can be
    either a symbolic representation of changes to make, or an octal num-
    ber representing the bit pattern for the new mode bits.

    The format of a symbolic mode is [ugoa...][[-+=][perms...]]..., where
    perms is either zero or more letters from the set rwXst, or a single
    letter from the set ugo. Multiple symbolic modes can be given, sepa-
    rated by commas.

    A combination of the letters ugoa controls which users' access to the
    file will be changed: the user who owns it (u), other users in the
    file's group (g), other users not in the file's group (o), or all
    users (a). If none of these are given, the effect is as if (a) were
    given, but bits that are set in the umask are not affected.

    The operator + causes the selected file mode bits to be added to the
    it will load more quickly when run; this is called the sticky bit.

OPTIONS
    Change the mode of each FILE to MODE. With --reference, change the
    mode of each FILE to that of RFILE.

    -c, --changes
        like verbose but report only when a change is made

    -f, --silent, --quiet
        suppress most error messages

    -v, --verbose
        output a diagnostic for every file processed

    --no-preserve-root
        do not treat '/' specially (the default)

    --preserve-root
        fail to operate recursively on '/'

    --reference=RFILE
        use RFILE's mode instead of MODE values

    -R, --recursive
        change files and directories recursively

    --help display this help and exit
    Manual page chmod(1) line 85 (press h for help or q to quit)
```