

Experiment 3: Linux File Manipulation and System Manipulation I

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Aim:

- To practice Linux file manipulation commands like `touch`, `cp`, `mv`, `rm`, `cat`, `less`, `head`, `tail`.
- To explore file permissions and ownership with `ls -l`, `chmod`, `chown`, and `chgrp`.
- To search and filter files using `find` and `grep`.
- To understand archiving and compression with `tar`, `gzip`, and `gunzip`.
- To create and manage links (`ln`) for both hard and symbolic links.

Requirements

- A Linux machine with bash shell (Ubuntu/Fedora/other).
- User privileges to create, modify, and delete files and directories.
- Access to system utilities like `tar`, `gzip`, `grep`, and `find`.

Theory

Linux file management involves creating, copying, moving, removing, and viewing files. File permissions and ownership ensure secure access control. Searching and filtering tools like `grep` and `find` help locate information efficiently. Archiving with `tar` and compression with `gzip` reduce storage usage and simplify file transfer. Links (`ln`) allow multiple references to the same file data (hard links) or path references (symbolic links).

Procedure & Observations

Exercise 1: Creating and Managing Files

Task Statement:

Create files and manage timestamps using `touch`.

Command(s):

```
touch newfile.txt
touch file1.txt file2.txt file3.txt
touch -t 202401151430 dated_file.txt
```

Output:

```
PS C:\Users\drago\OneDrive\Desktop> wsl
tanishq@tanishq:/mnt/c/Users/drago/OneDrive/Desktop$ touch newfile.txt
tanishq@tanishq:/mnt/c/Users/drago/OneDrive/Desktop$ touch file1.txt file2.txt file3.txt
tanishq@tanishq:/mnt/c/Users/drago/OneDrive/Desktop$ touch -t 202401151430 dated_file.txt
tanishq@tanishq:/mnt/c/Users/drago/OneDrive/Desktop$ ls
'Buckshot Roulette.url'  'Grand Theft Auto V Enhanced.url'  'Visual Studio Code.lnk'  dated_file.txt  file2.txt
'Cyberpunk 2077.url'    'Mafia The Old Country.url'         'WWE 2K24.url'           desktop.ini     file3.txt
'Discord.lnk'           'MinGW Installer.lnk'              'Wondershare Filmora 14.lnk'  file1.txt      newfile.txt
'Rockstar Games Launcher.lnk'  'TEKKEN 7.url'
```

Exercise 2: Copying, Moving, and Deleting Files

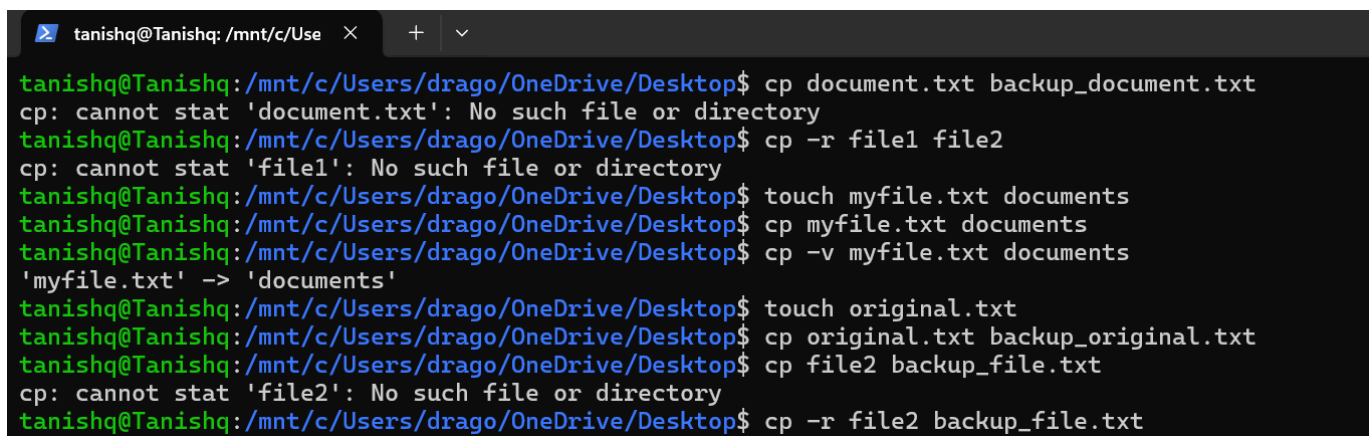
Task Statement:

Use `cp`, `mv`, and `rm` to copy, rename, move, and delete files and directories.

Command(s):

```
cp document.txt backup_document.txt
mv oldname.txt newname.txt
rm unwanted_file.txt
rm -r old_directory/
```

Output:

A terminal window with a dark background and light-colored text. The window title is 'tanishq@Tanishq: /mnt/c/Use'. The terminal shows a series of commands and their outputs. The first command is 'cp document.txt backup_document.txt', which results in an error: 'cp: cannot stat 'document.txt': No such file or directory'. The second command is 'cp -r file1 file2', which also results in an error: 'cp: cannot stat 'file1': No such file or directory'. The third command is 'touch myfile.txt documents', which succeeds. The fourth command is 'cp myfile.txt documents', which succeeds. The fifth command is 'cp -v myfile.txt documents', which succeeds and shows the file being copied. The sixth command is 'touch original.txt', which succeeds. The seventh command is 'cp original.txt backup_original.txt', which succeeds. The eighth command is 'cp file2 backup_file.txt', which results in an error: 'cp: cannot stat 'file2': No such file or directory'. The ninth command is 'cp -r file2 backup_file.txt', which also results in an error: 'cp: cannot stat 'file2': No such file or directory'.

Exercise 3: Viewing File Contents

Task Statement:

Display file contents using `cat`, `less`, `head`, and `tail`.

Command(s):

```
cat filename.txt
less /var/log/syslog
head -n 5 filename.txt
tail -n 20 filename.txt
tail -f /var/log/syslog
```

Output:

```
tanishq@Tanishq: /mnt/c/Use x + v
tanishq@Tanishq:/mnt/c/Users/drago/OneDrive/Desktop$ rm myfile.txt
tanishq@Tanishq:/mnt/c/Users/drago/OneDrive/Desktop$ ls
'Buckshot Roulette.url'  'Discord.lnk'  'MinGW Installer.lnk'  'Visual Studio Code.lnk'  dated_file.txt  file2.txt
'Grand Theft Auto V Enhanced.url'  'Rockstar Games Launcher.lnk'  'WWE 2K24.url'  desktop.ini  file3.txt
'Mafia The Old Country.url'  'TEKKEN 7.url'  backup_original.txt  documents  newfile.txt
file1.txt  original.txt
```

Exercise 4: File Permissions and Ownership

Task Statement:

Explore file permissions and ownership with `ls -l`, `chmod`, `chown`, and `chgrp`.

Command(s):

```
ls -l
chmod 755 script.sh
chmod u+x script.sh
sudo chown newuser:newgroup file.txt
chgrp developers project.txt
```

Output:

```
friday@friday-VirtualBox: ~/Desktop/Om
friday@friday-VirtualBox:~/Desktop/Om$ mv file3 dir1
friday@friday-VirtualBox:~/Desktop/Om$ ls dir1
file3
friday@friday-VirtualBox:~/Desktop/Om$ mkdir file4
friday@friday-VirtualBox:~/Desktop/Om$ mkdir dir2
friday@friday-VirtualBox:~/Desktop/Om$ mv file2 file4 dir2
friday@friday-VirtualBox:~/Desktop/Om$ ls dir2
file2 file4
friday@friday-VirtualBox:~/Desktop/Om$ touch fil.txt
friday@friday-VirtualBox:~/Desktop/Om$ mv file1 touch.txt
friday@friday-VirtualBox:~/Desktop/Om$ ls
2 backup_file.txt backup_original.txt dated_file.txt dir1 dir2 documents file file1.txt file2.txt file3.txt fil.txt newfile.txt original.txt touch.txt
friday@friday-VirtualBox:~/Desktop/Om$ mv dir1 dir_1
friday@friday-VirtualBox:~/Desktop/Om$ ls
2 backup_file.txt backup_original.txt dated_file.txt dir_1 dir2 documents file file1.txt file2.txt file3.txt fil.txt newfile.txt original.txt touch.txt
friday@friday-VirtualBox:~/Desktop/Om$
```

Exercise 5: File Searching with `find`

Task Statement:

Search files by name, type, size, and permissions using `find`.

Command(s):

```
find /home -name "*.txt"
find /home -type f -size +100M
```

```
find /etc -name "*conf*"
find /tmp -type f -empty -delete
```

Output:



Exercise 6: Pattern Searching with **grep**

Task Statement:

Search for patterns in files using **grep**.

Command(s):

```
grep "error" /var/log/syslog
grep -i "Error" logfile.txt
grep -r "function" ~/code/
grep -n "TODO" *.txt
```

Output:

```
PS C:\Users\drago\OneDrive\Desktop> wsl
tanishq@tanishq:/mnt/c/Users/drago/OneDrive/Desktop$ touch logfile.txt
tanishq@tanishq:/mnt/c/Users/drago/OneDrive/Desktop$ grep "error" /var/log/syslog
2025-10-29T07:31:14.435951+00:00 Tanishq systemd[1]: apport-autoreport.path - Process error reports when automatic reporting is enabled (file watch) was skipped because of an unmet condition check (ConditionPathExists=/var/lib/apport/autoreport).
2025-10-29T07:31:14.436004+00:00 Tanishq systemd[1]: apport-autoreport.timer - Process error reports when automatic reporting is enabled (timer based) was skipped because of an unmet condition check (ConditionPathExists=/var/lib/apport/autoreport).
2025-10-29T09:08:25.063881+00:00 Tanishq systemd[1]: apport-autoreport.path - Process error reports when automatic reporting is enabled (file watch) was skipped because of an unmet condition check (ConditionPathExists=/var/lib/apport/autoreport).
2025-10-29T09:08:25.063885+00:00 Tanishq systemd[1]: apport-autoreport.timer - Process error reports when automatic reporting is enabled (timer based) was skipped because of an unmet condition check (ConditionPathExists=/var/lib/apport/autoreport).
2025-10-29T11:01:16.838157+00:00 Tanishq systemd[1]: apport-autoreport.path - Process error reports when automatic reporting is enabled (file watch) was skipped because of an unmet condition check (ConditionPathExists=/var/lib/apport/autoreport).
2025-10-29T11:01:16.838169+00:00 Tanishq systemd[1]: apport-autoreport.timer - Process error reports when automatic reporting is enabled (timer based) was skipped because of an unmet condition check (ConditionPathExists=/var/lib/apport/autoreport).
2025-10-29T11:35:41.611185+00:00 Tanishq systemd[1]: apport-autoreport.path - Process error reports when automatic reporting is enabled (file watch) was skipped because of an unmet condition check (ConditionPathExists=/var/lib/apport/autoreport).
2025-10-29T11:35:41.611188+00:00 Tanishq systemd[1]: apport-autoreport.timer - Process error reports when automatic reporting is enabled (timer based) was skipped because of an unmet condition check (ConditionPathExists=/var/lib/apport/autoreport).
2025-10-29T12:55:03.175495+00:00 Tanishq systemd[1]: apport-autoreport.path - Process error reports when automatic reporting is enabled (file watch) was skipped because of an unmet condition check (ConditionPathExists=/var/lib/apport/autoreport).
2025-10-29T12:55:03.175497+00:00 Tanishq systemd[1]: apport-autoreport.timer - Process error reports when automatic reporting is enabled (timer based) was skipped because of an unmet condition check (ConditionPathExists=/var/lib/apport/autoreport).
2025-10-29T12:59:23.495040+00:00 Tanishq systemd[1]: apport-autoreport.path - Process error reports when automatic reporting is enabled (file watch) was skipped because of an unmet condition check (ConditionPathExists=/var/lib/apport/autoreport).
2025-10-29T12:59:23.495041+00:00 Tanishq systemd[1]: apport-autoreport.timer - Process error reports when automatic reporting is enabled (timer based) was skipped because of an unmet condition check (ConditionPathExists=/var/lib/apport/autoreport).
tanishq@tanishq:/mnt/c/Users/drago/OneDrive/Desktop$
```

Exercise 7: Archiving and Compression

Task Statement:

Create and extract archives using **tar**, compress and decompress with **gzip/gunzip**.

Command(s):

```
tar -czf backup.tar.gz /home/user/documents
tar -xzf backup.tar.gz -C /restore/
gzip largefile.txt
gunzip largefile.txt.gz
```

Output:

```

friday@friday-VirtualBox:~/Desktop/0m$ ln file1.txt hardlink_file1
friday@friday-VirtualBox:~/Desktop/0m$ ls -li
total 28
1445807 drwxrwxr-x 2 friday friday 4096 Sep 26 14:41 2
1445410 -rw-rw-r-- 1 friday friday 461 Oct 2 21:24 archive.tar.gz
1445785 drwxrwxr-x 2 friday friday 4096 Sep 26 14:46 backup_file.txt
1445809 -rw-rw-r-- 1 friday friday 0 Sep 26 14:45 backup_original.txt
1445803 -rw-rw-r-- 1 friday friday 0 Jan 15 2024 dated_file.txt
1445795 drwxrwxr-x 3 friday friday 4096 Sep 26 14:48 dir_1
1445819 drwxrwxr-x 4 friday friday 4096 Sep 26 14:49 dir2
1445811 -rw-rw-r-- 1 friday friday 0 Sep 26 14:44 documents
1445806 drwxrwxr-x 2 friday friday 4096 Sep 26 14:41 file
1445595 -rw-rw-r-- 2 friday friday 0 Sep 26 14:35 file1.txt
1445801 -rw-rw-r-- 1 friday friday 0 Sep 26 14:35 file2.txt
1445802 -rw-rw-r-- 1 friday friday 0 Sep 26 14:35 file3.txt
1445812 -rw-rw-r-- 1 friday friday 0 Sep 26 14:50 fil.txt
1445595 -rw-rw-r-- 2 friday friday 0 Sep 26 14:35 hardlink_file1
1445818 -rw-rw-r-- 1 friday friday 0 Oct 2 21:22 logfile.txt
1445767 -rw-rw-r-- 1 friday friday 0 Sep 26 14:35 newfile.txt
1445813 -rw-rw-r-- 1 friday friday 0 Sep 26 14:44 original.txt
1445792 drwxrwxr-x 2 friday friday 4096 Sep 26 14:41 touch.txt
friday@friday-VirtualBox:~/Desktop/0m$ ls -s file1.txt symlink_file1
ls: cannot access 'symlink_file1': No such file or directory
0 file1.txt
friday@friday-VirtualBox:~/Desktop/0m$ mkdir symlink_file1
friday@friday-VirtualBox:~/Desktop/0m$ ls -s file1.txt symlink_file1
0 file1.txt

symlink_file1:
total 0
friday@friday-VirtualBox:~/Desktop/0m$ ls
2 archive.tar.gz backup_file.txt backup_original.txt dated_file.txt dir_1 dir2 documents file file1.txt file2.txt file3.txt fil.txt hardlink_file1 logfile.txt newfile.txt original.txt symlink_file1 touch.txt
friday@friday-VirtualBox:~/Desktop/0m$

```

Exercise 8: Creating Links

Task Statement:

Create and test hard and symbolic links using `ln`.

Command(s):

```

echo "Hello" > original.txt
ln original.txt hardlink.txt
ln -s original.txt symlink.txt
ls -li original.txt hardlink.txt symlink.txt

```

Output:

```

tanishq@Tanishq: /mnt/c/Use  X  +  v
tanishq@Tanishq:/mnt/c/Users/drago/OneDrive/Desktop$ ln file1.txt hardlink_file1
tanishq@Tanishq:/mnt/c/Users/drago/OneDrive/Desktop$ ls -li
total 20
4503599627478877 -rwxrwxrwx 1 tanishq tanishq 223 May 20 13:38 'Buckshot Roulette.url'
36873221949186718 drwxrwxrwx 1 tanishq tanishq 4096 Oct 29 08:21 'C H W'
7318349394632873 drwxrwxrwx 1 tanishq tanishq 4096 Oct 4 10:57 'C PROGRAM'
2814749767509211 drwxrwxrwx 1 tanishq tanishq 4096 Sep 26 13:34 'C++'
3377699720586040 drwxrwxrwx 1 tanishq tanishq 4096 Sep 21 19:10 'DSA C++'
1125899906863934 -rwxrwxrwx 1 tanishq tanishq 2260 Jun 30 14:42 'Discord.lnk'
32088147345119547 -rwxrwxrwx 1 tanishq tanishq 223 Oct 10 16:06 'Grand Theft Auto V Enhanced.url'
9007199254799607 -rwxrwxrwx 1 tanishq tanishq 223 Aug 15 03:27 'Mafia The Old Country.url'
2251799814000688 -rwxrwxrwx 1 tanishq tanishq 896 Sep 1 07:54 'MinGW Installer.lnk'
7036874417869988 drwxrwxrwx 1 tanishq tanishq 4096 Oct 27 13:51 'Python'
1970324837152374 -rwxrwxrwx 1 tanishq tanishq 1930 Apr 9 2025 'Rockstar Games Launcher.lnk'
5629499534276784 -rwxrwxrwx 1 tanishq tanishq 222 Oct 15 15:51 'TEKKEN 7.url'
3940649674299801 -rwxrwxrwx 1 tanishq tanishq 1417 Sep 1 09:06 'Visual Studio Code.lnk'
4785074604179898 -rwxrwxrwx 1 tanishq tanishq 223 Jul 31 12:13 'WWE 2K24.url'
2533274790667815 -rwxrwxrwx 1 tanishq tanishq 1475 Jul 2 09:17 'Wondershare Filmora 14.lnk'
32932572275287282 -rwxrwxrwx 1 tanishq tanishq 0 Oct 29 11:42 'backup_original.txt'
5066549580921651 -rwxrwxrwx 1 tanishq tanishq 0 Jan 15 2024 'dated_file.txt'
1407374883561381 -rwxrwxrwx 1 tanishq tanishq 282 Oct 28 07:07 'desktop.ini'
13229323905520309 -rwxrwxrwx 1 tanishq tanishq 0 Oct 29 11:41 'documents'
11821949021911620 -rwxrwxrwx 2 tanishq tanishq 0 Oct 29 11:36 'file1.txt'
7318349394541388 -rwxrwxrwx 1 tanishq tanishq 0 Oct 29 11:36 'file2.txt'
15481123719179015 -rwxrwxrwx 1 tanishq tanishq 0 Oct 29 11:36 'file3.txt'
11821949021911620 -rwxrwxrwx 2 tanishq tanishq 0 Oct 29 11:36 'hardlink_file1'
5629499534442157 -rwxrwxrwx 1 tanishq tanishq 0 Oct 29 12:59 'logfile.txt'
13510798882174417 -rwxrwxrwx 1 tanishq tanishq 0 Oct 29 11:35 'newfile.txt'
11821949021976809 -rwxrwxrwx 1 tanishq tanishq 0 Oct 29 11:41 'original.txt'
tanishq@Tanishq:/mnt/c/Users/drago/OneDrive/Desktop$

```

Result

- Successfully created, copied, moved, and deleted files.
- Practiced viewing file contents and monitoring logs.
- Explored file permissions and ownership management.
- Used `find` and `grep` to locate and filter data.
- Created archives and compressed files.
- Demonstrated both hard and symbolic links.

Challenges Faced & Learning Outcomes

- Challenge 1: Accidentally deleted files with `rm` without `-i`. Learned to use `rm -i` for safety.
- Challenge 2: Remembering numeric vs symbolic permissions in `chmod`. Fixed through repeated practice.

Learning:

- Gained practical skills with file manipulation and permission commands.
- Learned how to efficiently search files and patterns in Linux.
- Understood how to archive and compress files for better storage management.
- Understood differences between hard and symbolic links.

Conclusion

This experiment provided hands-on experience with core Linux file management, permissions, searching, archiving, and linking. These are foundational skills for effective Linux system administration and daily usage.