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"Lab Report - 1"

[Code No: COMP 307]
Subject: Operating Systems

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Introduction

1. What is Linux?

Linux is an operating system that is open-source and which is used to power computers and servers among numerous other smart devices. It is also reputed to be quick, safe and extremely steady over other operating systems. Linux enables the users to see, edit and distribute the code of the programs without restriction. Programmers, ethical hackers as well as system administrators are known to use it. Android and web servers are among the most popular systems using Linux. It is particularly appreciated when learning how to work with command lines and system administration.

2. The Linux Hierarchical File System

Linux File system hierarchy is based on the Filesystem Hierarchy Standard (FHS) that is used to organize directories and files in Linux and other Unix based operating systems. In Linux, all things begin with the root directory which is denoted by the / followed by all the other files and folders. Notable directories used are **/bin** that has critical user commands, **/etc** that contains user configuration files, **/home** that holds user personal folder, **/var** that contains user variable data, such as logs, **/usr** containing the programs installed by users and **/tmp** that hold temporary files. The device files are found in the **/dev** directory, and the information about the system and processes is found in the **/proc**. This well-organized hierarchy enables consistency, security and effective management of systems within Linux systems.

3. Importance of Linux commands in Operating Systems

Linux commands are a vital tool when working with the operating system. The importance are listed below :

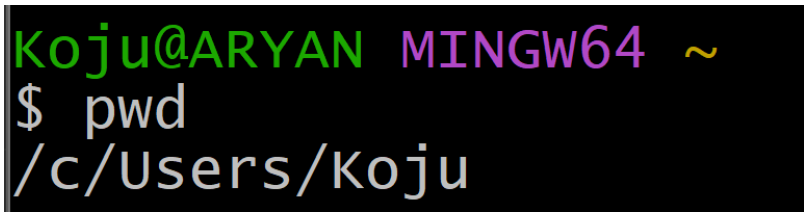
- Linux commands provide powerful control over the operating system through the terminal.
- They are used to manage files, directories, processes, users, and network operations efficiently.
- Basic tasks like creating files and folders can be done using simple commands.
- Advanced system administration tasks such as software installation require Linux commands.
- Monitoring tools help observe system performance and running processes in real time.

- Linux commands support automation through shell scripting.
- They are widely used in servers, cloud computing, and embedded systems.

Commands

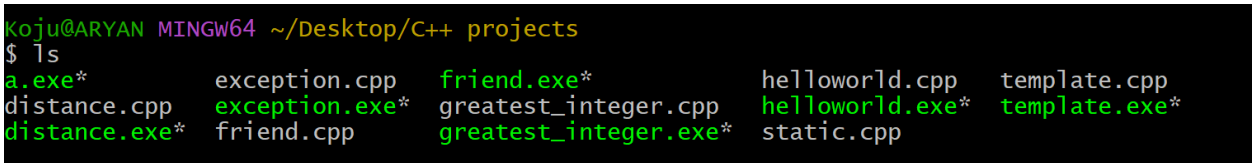
1. **pwd (Print Working Directory)**

   Displays the absolute path of the current working directory. It helps users identify their exact location within the Linux file system.



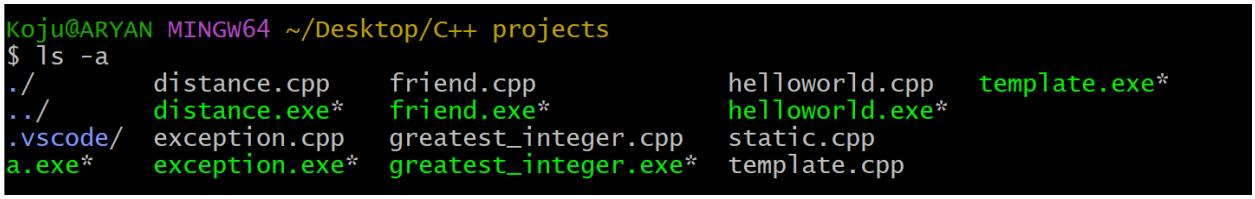
2. **ls (List)**

   Lists all files and directories present in the current directory. It is commonly used to explore folder contents.



3. **ls -a**

   Displays all files including hidden files that start with a dot (`.`). Hidden files usually store system or configuration data.



4. **ls -l**

   Shows detailed information such as file permissions, ownership, file size, and last modified date in long format.

```
Koju@ARYAN MINGW64 ~
$ ls -l
total 378221
drwxr-xr-x 1 Koju 197609         0 Feb  3  2025  AppData/
lrwxrwxrwx 1 Koju 197609        29 Feb  3  2025 'Application Data
' -> /c/Users/Koju/AppData/Roaming/
drwxr-xr-x 1 Koju 197609         0 Feb  3  2025  Contacts/
lrwxrwxrwx 1 Koju 197609        57 Feb  3  2025  Cookies -> /c/Us
ers/Koju/AppData/Local/Microsoft/Windows/INetCookies/
drwxr-xr-x 1 Koju 197609         0 Dec  1 11:54  Desktop/
drwxr-xr-x 1 Koju 197609         0 Dec  1 09:53  Documents/
drwxr-xr-x 1 Koju 197609         0 Dec  7 22:04  Downloads/
drwxr-xr-x 1 Koju 197609         0 Nov 14  2024  Dropbox/
drwxr-xr-x 1 Koju 197609         0 Feb  3  2025  Favorites/
drwxr-xr-x 1 Koju 197609         0 Feb  3  2025  Links/
lrwxrwxrwx 1 Koju 197609        27 Feb  3  2025 'Local Settings'
-> /c/Users/Koju/AppData/Local/
drwxr-xr-x 1 Koju 197609         0 Feb  3  2025  Music/
lrwxrwxrwx 1 Koju 197609        23 Feb  3  2025 'My Documents' ->
 /c/Users/Koju/Documents/
-rw-r--r-- 1 Koju 197609  19398656 Dec  4 23:38  NTUSER.DAT
-rw-r--r-- 1 Koju 197609     65536 Feb  3  2025  NTUSER.DAT{2ad83
8bc-efea-11ee-a54d-000d3a94eaa1}.TM.blf
-rw-r--r-- 1 Koju 197609    524288 Feb  3  2025  NTUSER.DAT{2ad83
8bc-efea-11ee-a54d-000d3a94eaa1}.TMContainer00000000000000000001.
regtrans-ms
-rw-r--r-- 1 Koju 197609    524288 Feb  3  2025  NTUSER.DAT{2ad83
8bc-efea-11ee-a54d-000d3a94eaa1}.TMContainer00000000000000000002.
regtrans-ms
lrwxrwxrwx 1 Koju 197609        65 Feb  3  2025  NetHood -> '/c/U
sers/Koju/AppData/Roaming/Microsoft/Windows/Network Shortcuts'/
drwxr-xr-x 1 Koju 197609         0 Dec  7 12:26  OneDrive/
drwxr-xr-x 1 Koju 197609         0 Dec  1 10:58  Pictures/
lrwxrwxrwx 1 Koju 197609        65 Feb  3  2025  PrintHood -> '/c
/Users/Koju/AppData/Roaming/Microsoft/Windows/Printer Shortcuts'/
drwxr-xr-x 1 Koju 197609         0 Nov  5  2024  PycharmProjects/
lrwxrwxrwx 1 Koju 197609        54 Feb  3  2025  Recent -> /c/Use
rs/Koju/AppData/Roaming/Microsoft/Windows/Recent/
drwxr-xr-x 1 Koju 197609         0 Feb  3  2025 'Saved Games'/
drwxr-xr-x 1 Koju 197609         0 Feb  3  2025  Searches/
lrwxrwxrwx 1 Koju 197609        54 Feb  3  2025  SendTo -> /c/Use
rs/Koju/AppData/Roaming/Microsoft/Windows/SendTo/
lrwxrwxrwx 1 Koju 197609        58 Feb  3  2025 'Start Menu' -> '
/c/Users/Koju/AppData/Roaming/Microsoft/Windows/Start Menu'/
lrwxrwxrwx 1 Koju 197609        57 Feb  3  2025  Templates -> /c/
Users/Koju/AppData/Roaming/Microsoft/Windows/Templates/
drwxr-xr-x 1 Koju 197609         0 Mar 19  2025  Videos/
-rwxr-xr-x 1 Koju 197609  12172440 Jan  6  2025  edb_pgagent_pg17
.exe*
-rw-r--r-- 1 Koju 197609   3145728 Feb  3  2025  ntuser.dat.LOG1
-rw-r--r-- 1 Koju 197609   1966080 Feb  3  2025  ntuser.dat.LOG2
-rw-r--r-- 1 Koju 197609        20 Feb  3  2025  ntuser.ini
-rwxr-xr-x 1 Koju 197609 349392592 Jan  6  2025  postgresql_17.ex
e*
drwxr-xr-x 1 Koju 197609         0 Nov 13  2024  project/
```

5. **cd (Change Directory)**
   Used to navigate between directories in the Linux file system. It allows movement to parent, root, or any specific folder.

```
Koju@ARYAN MINGW64 ~
$ cd Desktop/Lexora/

Koju@ARYAN MINGW64 ~/Desktop/Lexora
$
```

6. **mkdir (Make Directory)**
   Creates one or more new directories at the specified location. It is commonly used for organizing files.

```
Koju@ARYAN MINGW64 ~/Desktop/Learning
$ mkdir Comp_307

Koju@ARYAN MINGW64 ~/Desktop/Learning
$ cd Comp_307/

Koju@ARYAN MINGW64 ~/Desktop/Learning/Comp_307
$
```

7. **rmdir (Remove Directory)**
   Deletes empty directories only. It cannot remove directories that contain files or subfolders.

```
Koju@ARYAN MINGW64 ~/Desktop/Learning
$ rmdir Comp_307/

Koju@ARYAN MINGW64 ~/Desktop/Learning
$ ls
hello.js  input.csv  main.py    martrix.exe*  output1.json
hi.js     koju.cpp   martrix.c  output.json   vertex.c

Koju@ARYAN MINGW64 ~/Desktop/Learning
$
```

8. **rm (Remove)**
   Deletes files permanently from the system. Once removed, the file cannot be recovered easily.

```
Koju@ARYAN MINGW64 ~/Desktop/Learning
$ ls
demo.txt  hi.js      koju.cpp  martrix.c     output.json   vertex.c
hello.js  input.csv  main.py   martrix.exe*  output1.json

Koju@ARYAN MINGW64 ~/Desktop/Learning
$ rm demo.txt

Koju@ARYAN MINGW64 ~/Desktop/Learning
$ ls
hello.js  input.csv  main.py    martrix.exe*  output1.json
hi.js     koju.cpp   martrix.c  output.json   vertex.c
```

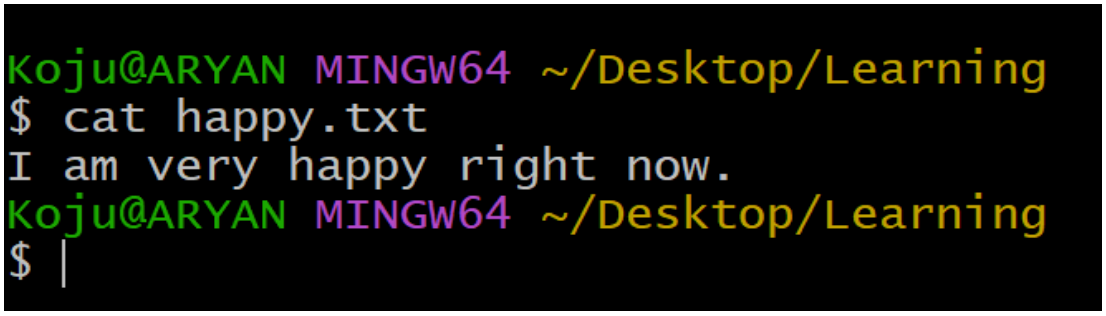
9. **rm -r (Recursive Remove)**
   Deletes a directory along with all its files and subdirectories. This command must be used carefully.

```
Koju@ARYAN MINGW64 ~/Desktop/Learning/Comp_307
$ ls
'Screenshot 2025-12-07 223852.png'  'Screenshot 2025-12-07 224259.png'
'Screenshot 2025-12-07 224123.png'  'Screenshot 2025-12-07 224326.png'

Koju@ARYAN MINGW64 ~/Desktop/Learning/Comp_307
$ cd ..

Koju@ARYAN MINGW64 ~/Desktop/Learning
$ rm -r Comp_307/

Koju@ARYAN MINGW64 ~/Desktop/Learning
$ ls
hello.js  input.csv  main.py    martrix.exe*  output1.json
hi.js     koju.cpp   martrix.c  output.json   vertex.c
```

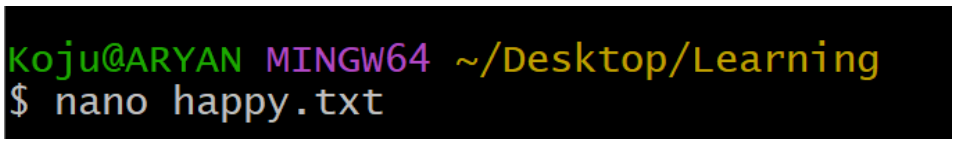
10. **touch**
    Creates a new empty file or updates the timestamp of an existing file. It is widely used to quickly generate files.

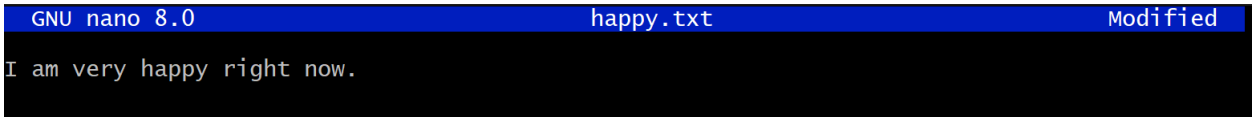
```
Koju@ARYAN MINGW64 ~/Desktop/Learning
$ touch happy.txt

Koju@ARYAN MINGW64 ~/Desktop/Learning
$ ls
happy.txt  hi.js      koju.cpp  martrix.c     output.json   vertex.c
hello.js   input.csv  main.py   martrix.exe*  output1.json
```

11. **cat (Concatenate)**
    Displays the content of a file on the terminal. It can also be used to combine multiple files.

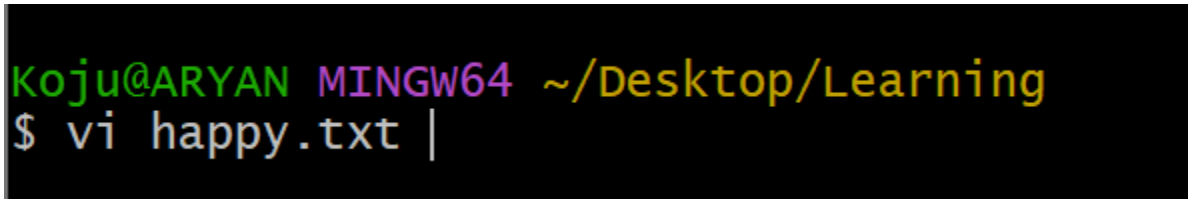


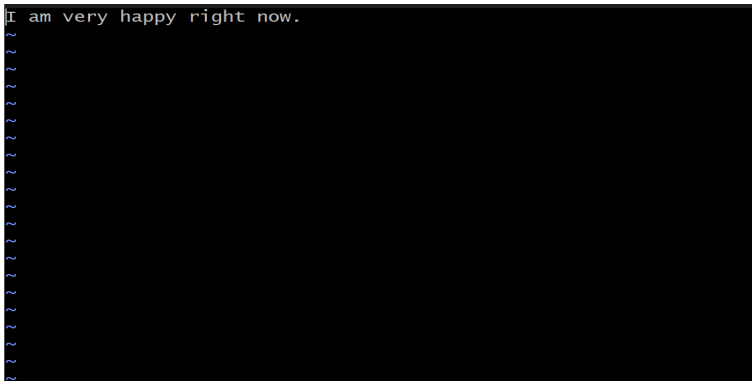
12. **nano**
    The nano command launches the GNU nano text editor, a user-friendly, command-line based editor in Unix/Linux systems.





13. **vi**
    The vi command launches the Vi text editor, one of the original and most powerful screen-oriented text editors available in Unix, Linux, and macOS environments.





14. **cp (Copy)**
    Copies files or directories from one location to another. It is useful for creating backups or duplicating data.

```
Koju@ARYAN MINGW64 ~/Desktop/Learning
$ cp happy.txt sad.txt

Koju@ARYAN MINGW64 ~/Desktop/Learning
$ ls
happy.txt  hi.js      koju.cpp  martrix.c     output.json   sad.txt
hello.js   input.csv  main.py   martrix.exe*  output1.json  vertex.c
```

15. **mv (Move)**
    Moves files and directories from one location to another. It is also used to rename files.

```
Koju@ARYAN MINGW64 ~/Desktop/Learning
$ ls
Comp_307/  hello.js  input.csv  main.py    martrix.exe*  output1.json  vertex.c
happy.txt  hi.js     koju.cpp   martrix.c  output.json   sad.txt

Koju@ARYAN MINGW64 ~/Desktop/Learning
$ mv happy.txt Comp_307/

Koju@ARYAN MINGW64 ~/Desktop/Learning
$ LS
Comp_307  hi.js      koju.cpp  martrix.c    output.json   sad.txt
hello.js  input.csv  main.py   martrix.exe  output1.json  vertex.c
```

16. **locate**
    Finds files quickly by searching a pre-built indexed database. It is faster than the find command.

```
Koju@ARYAN MINGW64 ~/Desktop/Learning
$ find . -type f -name "*.txt"
./Comp_307/happy.txt
./sad.txt
```

17. **echo**
    Displays messages or variable values on the terminal. It is also used to insert text into files using redirection.

```
Koju@ARYAN MINGW64 ~/Desktop/Learning
$ echo "Hello Beautiful Lady"
Hello Beautiful Lady
```

18. **uname -a**
    Displays complete system information including kernel name, version, machine type, and operating system.

```
Koju@ARYAN MINGW64 ~/Desktop/Learning
$ uname -a
MINGW64_NT-10.0-26100 ARYAN 3.4.10-87d57229.x86_64 2024-02-14 20:17 UTC x86_64 Msys
```

19. **df -h (Disk Free)**
    Shows details of disk space usage in a human-readable format such as GB and MB.

```
Koju@ARYAN MINGW64 ~/Desktop/Learning
$ df
Filesystem           1K-blocks      Used Available Use% Mounted on
C:/Program Files/Git 998872060 186260588 812611472  19% /

Koju@ARYAN MINGW64 ~/Desktop/Learning
$ df -h
Filesystem            Size  Used Avail Use% Mounted on
C:/Program Files/Git  953G  178G  775G  19% /
```

20. **ps**
    Displays all active processes running under the current user. It helps monitor user-level system activities.

```
Koju@ARYAN MINGW64 ~/Desktop/Learning
$ ps
      PID    PPID    PGID     WINPID   TTY         UID    STIME COMMAND
     1351    1350    1351      19968  pty0      197609 22:59:49 /usr/bin/bash
     1350       1    1350      28648  ?         197609 22:59:49 /usr/bin/mintty
     1442    1351    1442       9680  pty0      197609 23:06:37 /usr/bin/ps
```

21. **chmod (Change Mode)**
    Used to change access permissions of files and directories. It controls who can read, write, or execute a file.

```
Koju@ARYAN MINGW64 ~/Desktop/Learning
$ chmod 755 sad.txt

Koju@ARYAN MINGW64 ~/Desktop/Learning
$ ls -l sad.txt
-rw-r--r-- 1 Koju 197609 26 Dec  7 23:01 sad.txt
```