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Part 1: Linux Environment Orientation

1.1 Understanding the Linux Environment

- ♦ Concepts to Cover:

- What is Linux? Brief history and distributions
- Linux vs Windows: Key differences
- Understanding the shell (bash)
- WSL2 as a Linux environment

- ♦ **Hands-on Activity:**

```
# Students open WSL2 terminal and explore
whoami          # Check current user
pwd             # Print working directory
uname -a        # System information
```

1.2 Getting Help in Linux

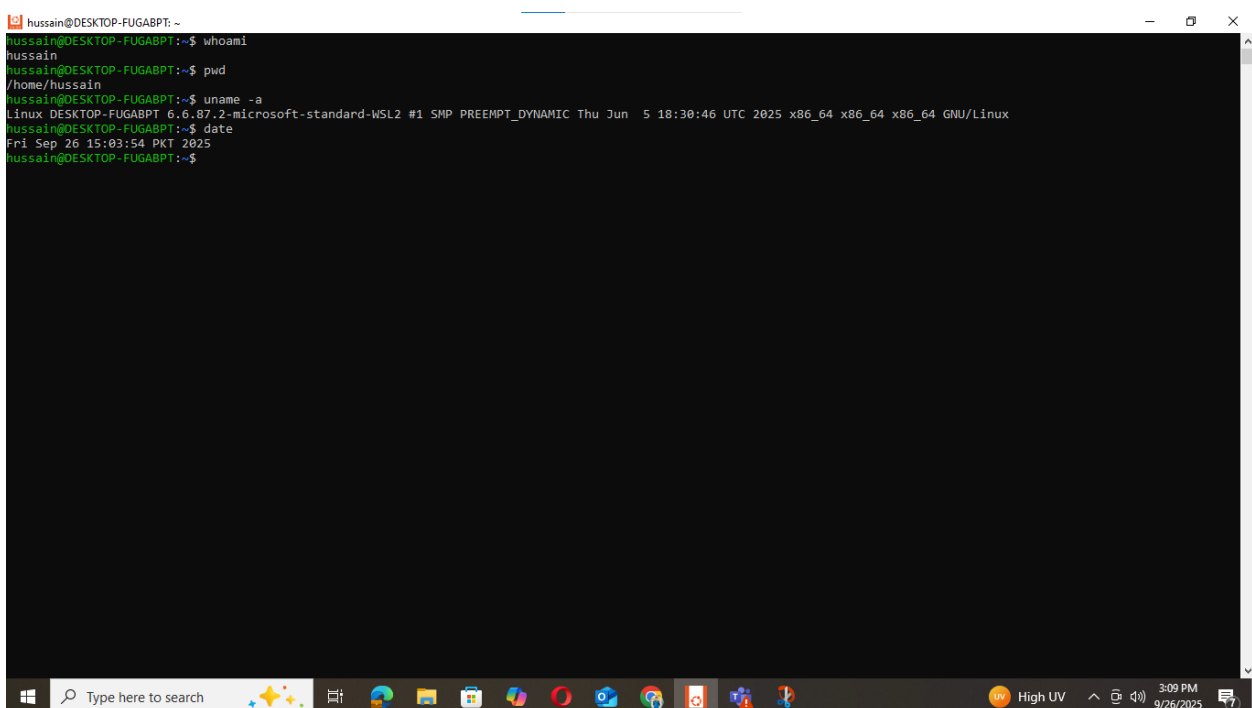
- ♦ **Commands to demonstrate:**

```
man ls          # Manual pages
ls --help       # Built-in help
which ls        # Location of commands
```

Remarks

Copies the file hello.txt to backup.txt.

Used for creating a backup of a file.



The screenshot shows a Windows terminal window titled "hussain@DESKTOP-FUGABPT: ~". The terminal displays the following commands and their outputs:

```
hussain@DESKTOP-FUGABPT:~$ whoami
hussain
hussain@DESKTOP-FUGABPT:~$ pwd
/home/hussain
hussain@DESKTOP-FUGABPT:~$ uname -a
Linux DESKTOP-FUGABPT 6.6.87.2-microsoft-standard-WSL2 #1 SMP PREEMPT_DYNAMIC Thu Jun  5 18:30:46 UTC 2025 x86_64 x86_64 x86_64 GNU/Linux
hussain@DESKTOP-FUGABPT:~$ date
Fri Sep 26 15:03:54 PKT 2025
hussain@DESKTOP-FUGABPT:~$
```

The terminal window is running on a Windows desktop. The taskbar at the bottom shows the Start button, a search bar, and several application icons. The system tray on the right indicates "High UV", network status, and the time "3:09 PM 9/26/2025".

```
hussain@DESKTOP-FUGABPT: ~
LS(1) User Commands LS(1)
NAME
ls - list directory contents
SYNOPSIS
ls [OPTION]... [FILE]...
DESCRIPTION
List information about the FILES (the current directory by default). Sort entries alphabetically if none of -cftuvSUX nor --sort is specified.
Mandatory arguments to long options are mandatory for short options too.
-a, --all
do not ignore entries starting with .
-A, --almost-all
do not list implied . and ..
--author
with -l, print the author of each file
-b, --escape
print C-style escapes for nongraphic characters
--block-size=SIZE
with -l, scale sizes by SIZE when printing them; e.g., '--block-size=M'; see SIZE format below
-B, --ignore-backups
do not list implied entries ending with ~
-c
with -lt: sort by, and show, ctime (time of last change of file status information); with -l: show ctime and sort by name; otherwise: sort by ctime, newest first
-C
list entries by columns
--color[=WHEN]
color the output WHEN; more info below
-d, --directory
list directories themselves, not their contents
-D, --dired
Manual page ls(1) line 1 (press h for help or q to quit)
```

```
hussain@DESKTOP-FUGABPT: ~$ man ls
hussain@DESKTOP-FUGABPT: ~$ ls --help
Usage: ls [OPTION]... [FILE]...
List information about the FILES (the current directory by default).
Sort entries alphabetically if none of -cftuvSUX nor --sort is specified.
Mandatory arguments to long options are mandatory for short options too.
-a, --all
do not ignore entries starting with .
-A, --almost-all
do not list implied . and ..
--author
with -l, print the author of each file
-b, --escape
print C-style escapes for nongraphic characters
--block-size=SIZE
with -l, scale sizes by SIZE when printing them;
e.g., '--block-size=M'; see SIZE format below
-B, --ignore-backups
do not list implied entries ending with ~
-c
with -lt: sort by, and show, ctime (time of last
change of file status information);
with -l: show ctime and sort by name;
otherwise: sort by ctime, newest first
-C
list entries by columns
--color[=WHEN]
color the output WHEN; more info below
-d, --directory
list directories themselves, not their contents
-D, --dired
generate output designed for Emacs' dired mode
-f
list all entries in directory order
-F, --classify[=WHEN]
append indicator (one of */=>@|) to entries WHEN
likewise, except do not append '*'
--file-type
across -x, commas -m, horizontal -x, long -l,
single-column -1, verbose -l, vertical -C
--full-time
like -l --time-style=full-iso
like -l, but do not list owner
-g
--group-directories-first
group directories before files;
can be augmented with a --sort option, but any
use of --sort=none (-U) disables grouping
-G, --no-group
in a long listing, don't print group names
-h, --human-readable
with -l and -s, print sizes like 1K 234M 2G etc.
--si
likewise, but use powers of 1000 not 1024
-H, --dereference-command-line
follow symbolic links listed on the command line
--dereference-command-line-symlink-to-dir
follow each command line symbolic link
```

```
hussain@DESKTOP-FUGABPT: ~  
hussain@DESKTOP-FUGABPT:~$ which ls  
/usr/bin/ls  
hussain@DESKTOP-FUGABPT:~$ type ls  
ls is aliased to `ls --color=auto`  
hussain@DESKTOP-FUGABPT:~$
```

Part 2: File System Navigation

2.1 Understanding Linux Directory Structure

- ◆ Concepts to Cover:

- Root directory (/)
- Important directories: /home, /usr, /etc, /var, /tmp

- Absolute vs relative paths
- Hidden files and directories

♦ **Demonstration:**

```
ls /           # Root directory contents
ls -la        # Long listing with hidden files
cd /home      # Change directory
cd ~          # Home directory shortcut
```

2.2 Basic Navigation Commands (15 minutes)

♦ **Commands to practice:**

```
pwd           # Present working directory
ls            # List directory contents
ls -l         # Long format
ls -la        # Include hidden files
ls -lh        # Human readable sizes
cd            # Change directory
cd ..         # Parent directory #
```

Remarks

Copies the whole directory mylab2 into mylab2_backup.

The -r option allows copying folders with their contents.

```
hussain@DESKTOP-FUGABPT:~$ ls /
bin  boot  etc  init  lib  usr-is-merged  lost+found  mnt  proc  run  sbin  usr-is-merged  srv  var
bin  usr-is-merged  dev  home  lib  lib64  media  opt  root  sbin  snap

hussain@DESKTOP-FUGABPT:~$ ls -la
total 56
drwxr-xr-x 7 hussain hussain 4096 Sep 26 15:18 .
drwxr-xr-x 3 root    root    4096 Sep 18 15:50 ..
-rw-r--r-- 1 hussain hussain 1992 Sep 26 14:28 .bash_history
-rw-r--r-- 1 hussain hussain 220  Sep 18 15:50 .bash_logout
-rw-r--r-- 1 hussain hussain 3771 Sep 18 15:50 .bashrc
drwxr-xr-x 3 hussain hussain 4096 Sep 18 16:23 .cache
drwxr-xr-x 8 hussain hussain 4096 Sep 19 15:28 .git
-rw-r--r-- 1 hussain hussain 66   Sep 19 15:28 .gitconfig
-rw-r--r-- 1 hussain hussain 20   Sep 26 15:18 .lesshst
-rw-rw-r-- 1 hussain hussain 0    Sep 26 09:09 .motd.shown
-rw-r--r-- 1 hussain hussain 807   Sep 18 15:50 .profile
drwxr-xr-x 2 hussain hussain 4096 Sep 26 09:33 .ssh
-rw-r--r-- 1 hussain hussain 0    Sep 18 16:01 .sudo_as_admin_successful
drwxr-xr-x 5 hussain hussain 4096 Sep 18 16:23 .vscode-server
-rw-r--r-- 1 hussain hussain 183   Sep 18 16:47 .wget-hsts
drwxr-xr-x 3 hussain hussain 4096 Sep 26 12:20 assignment
hussain@DESKTOP-FUGABPT:~$ cd /home
hussain@DESKTOP-FUGABPT:/home$ cd ~
hussain@DESKTOP-FUGABPT:~$
```

2.2

```
hussain@DESKTOP-FUGABPT:/$ pwd
/home/hussain
hussain@DESKTOP-FUGABPT:~$ ls
assignment
hussain@DESKTOP-FUGABPT:~$ ls -l
total 4
drwxr-xr-x 3 hussain hussain 4096 Sep 26 12:20 assignment
hussain@DESKTOP-FUGABPT:~$ ls -la
total 56
drwxr-xr-x 7 hussain hussain 4096 Sep 26 15:18 .
drwxr-xr-x 3 root root 4096 Sep 18 15:50 ..
-rw-r--r-- 1 hussain hussain 1992 Sep 26 14:28 .bash_history
-rw-r--r-- 1 hussain hussain 220 Sep 18 15:50 .bash_logout
-rw-r--r-- 1 hussain hussain 3771 Sep 18 15:50 .bashrc
drwx----- 3 hussain hussain 4096 Sep 18 16:23 .cache
drwxr-xr-x 8 hussain hussain 4096 Sep 19 15:28 .git
-rw-r--r-- 1 hussain hussain 66 Sep 19 15:20 .gitconfig
-rw-r--r-- 1 hussain hussain 20 Sep 26 15:18 .lesshst
-rw-rw-r-- 1 hussain hussain 0 Sep 26 00:00 .motd.shown
-rw-r--r-- 1 hussain hussain 807 Sep 18 15:50 .profile
drwx----- 2 hussain hussain 4096 Sep 26 09:33 .ssh
-rw-r--r-- 1 hussain hussain 0 Sep 18 16:01 .sudo_as_admin_successful
drwxr-xr-x 5 hussain hussain 4096 Sep 18 16:23 .vscode-server
-rw-r--r-- 1 hussain hussain 183 Sep 18 16:47 .wget-hsts
drwxr-xr-x 3 hussain hussain 4096 Sep 26 12:20 assignment
hussain@DESKTOP-FUGABPT:~$ ls -lh
total 4.0K
drwxr-xr-x 3 hussain hussain 4.0K Sep 26 12:20 assignment
hussain@DESKTOP-FUGABPT:~$ cd ..
hussain@DESKTOP-FUGABPT:~$ cd ..
hussain@DESKTOP-FUGABPT:/home$ cs ~
Command 'cs' not found, but can be installed with:
sudo apt install csound
hussain@DESKTOP-FUGABPT:/home$ cd ~
hussain@DESKTOP-FUGABPT:~$ cd /
hussain@DESKTOP-FUGABPT:/$
```

Part 3: File and Directory Operations

**3.1 Creating and Managing Files/Directories

- ◆ **Commands to demonstrate:**

```
mkdir mylab2 # Create directory
mkdir -p test/sub/dir # Create nested directories
touch file1.txt # Create empty file

# Text editors introduction
nano hello.txt # Simple text editor
# OR
```

- ◆ **File viewing commands:**

```
cat hello.txt # Display file contents
less hello.txt # Page through file
head hello.txt
```

```
tail hello.txt          # Last 10 lines
wc hello.txt            # Word count
```

3.2 Copying, Moving, and Deleting

- Commands to practice:

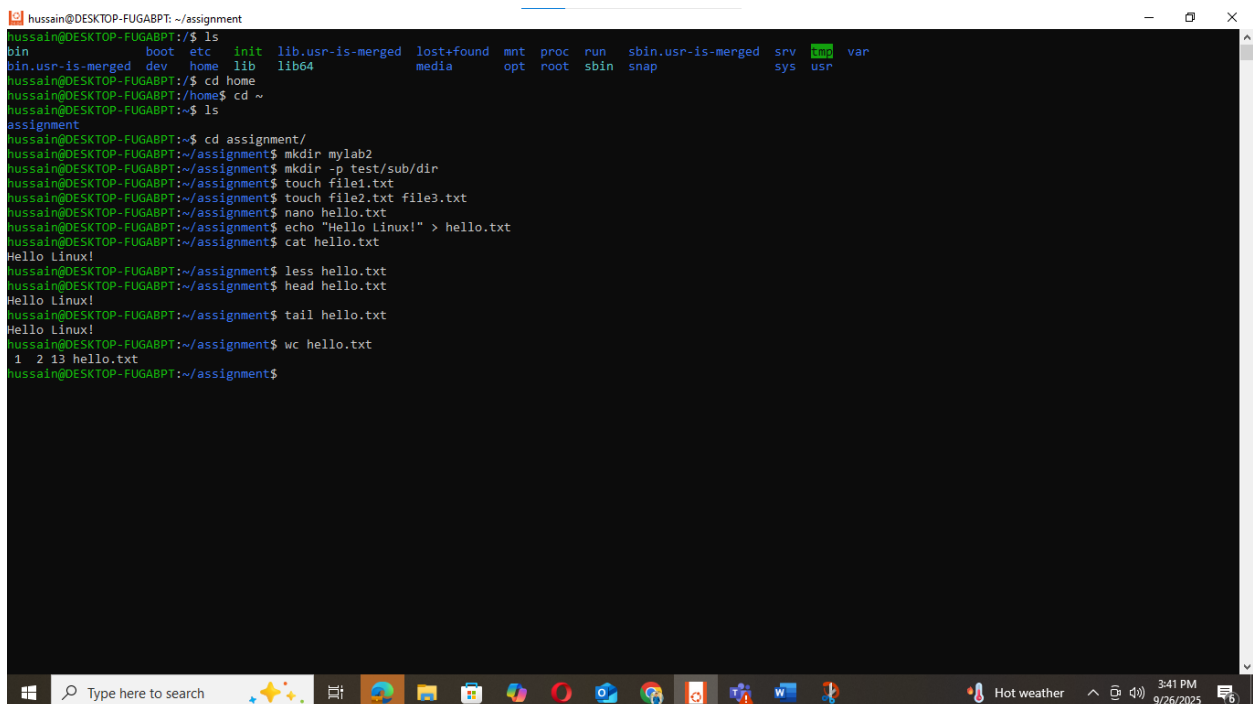
```
cp hello.txt backup.txt    # Copy file
cp -r mylab2 mylab2_backup # Copy directory recursively
mv backup.txt renamed.txt  # Move/rename file
rm renamed.txt             # Remove file
rm -r mylab2_backup        # Remove directory
```

Hands-on Exercise: Students create a directory structure, add files, and practice file operations.

Remarks

Renames backup.txt to renamed.txt.

mv can also move files between directories.



```
hussain@DESKTOP-FUGABPT: ~/assignment
hussain@DESKTOP-FUGABPT:/$ ls
bin      boot  etc  init  lib.usr-is-merged  lost+found  mnt  proc  run  sbin.usr-is-merged  srv  tmp  var
bin.usr-is-merged  dev  home  lib  lib64
hussain@DESKTOP-FUGABPT:/$ cd home
hussain@DESKTOP-FUGABPT:~/home$ cd ~
hussain@DESKTOP-FUGABPT:~$ ls
assignment
hussain@DESKTOP-FUGABPT:~$ cd assignment/
hussain@DESKTOP-FUGABPT:~/assignment$ mkdir mylab2
hussain@DESKTOP-FUGABPT:~/assignment$ mkdir -p test/sub/dir
hussain@DESKTOP-FUGABPT:~/assignment$ touch file1.txt
hussain@DESKTOP-FUGABPT:~/assignment$ touch file2.txt file3.txt
hussain@DESKTOP-FUGABPT:~/assignment$ nano hello.txt
hussain@DESKTOP-FUGABPT:~/assignment$ echo "Hello Linux!" > hello.txt
hussain@DESKTOP-FUGABPT:~/assignment$ cat hello.txt
Hello Linux!
hussain@DESKTOP-FUGABPT:~/assignment$ less hello.txt
Hello Linux!
hussain@DESKTOP-FUGABPT:~/assignment$ head hello.txt
Hello Linux!
hussain@DESKTOP-FUGABPT:~/assignment$ tail hello.txt
Hello Linux!
hussain@DESKTOP-FUGABPT:~/assignment$ wc hello.txt
 1  2 13 hello.txt
hussain@DESKTOP-FUGABPT:~/assignment$
```

3.2

```
hussain@DESKTOP-FUGABPT: ~/assignment
hussain@DESKTOP-FUGABPT:~/assignment$ cp hello.txt backup.txt
hussain@DESKTOP-FUGABPT:~/assignment$ cp -r mylab2 mylab2_backup
hussain@DESKTOP-FUGABPT:~/assignment$ mv backup.txt renamed.txt
hussain@DESKTOP-FUGABPT:~/assignment$ rm renamed.txt
hussain@DESKTOP-FUGABPT:~/assignment$ rm -r mylab2_backup
hussain@DESKTOP-FUGABPT:~/assignment$ rmdir empty_directory
rmdir: failed to remove 'empty_directory': No such file or directory
hussain@DESKTOP-FUGABPT:~/assignment$ rmdir empty_directory_
```

Part 4: File Permissions and Ownership

4.1 Understanding File Permissions

- ◆ **Concepts to Cover:**
 - Permission types: read (r), write (w), execute (x)
 - Permission groups: user (u), group (g), others (o)
 - Numeric notation: 755, 644, etc.

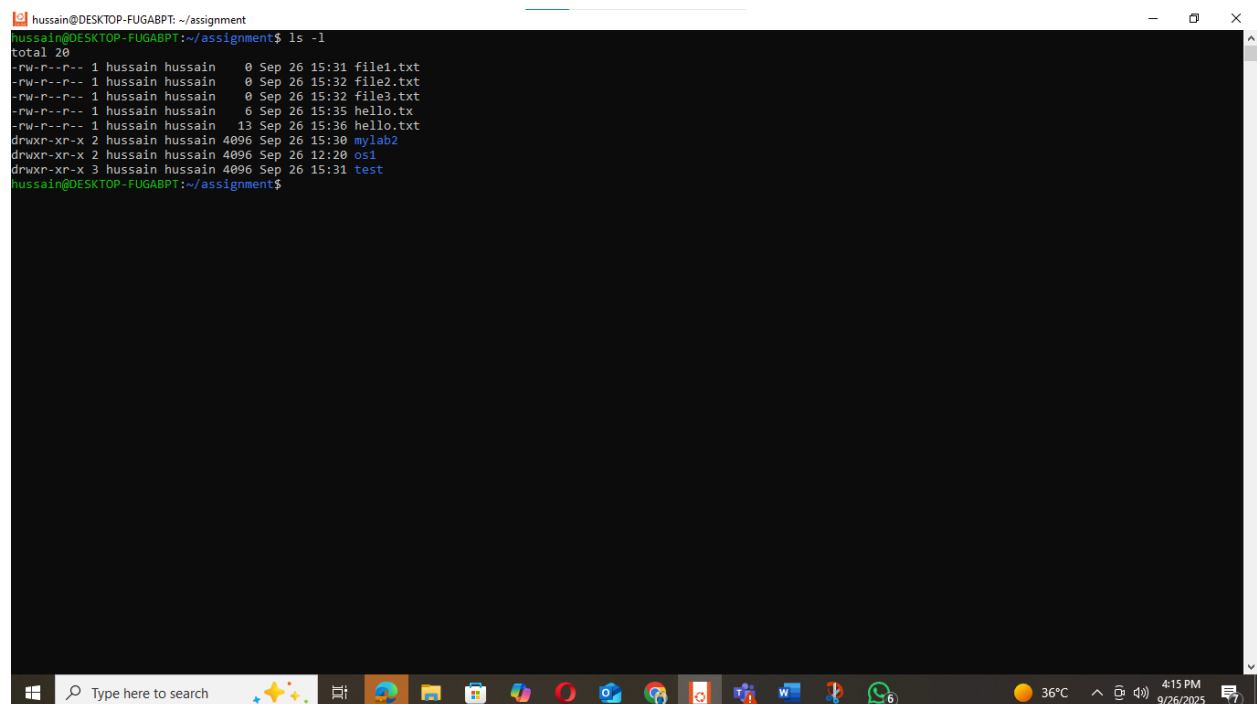
Commands to demonstrate:

```
ls -l          # View permissions
chmod 755 file.txt  # Change permissions (numeric)
chmod u+x file.txt  # Add execute permission for user
chown user:group file.txt  # Change ownership (if applicable)
```

Remarks

Deletes the file renamed.txt.

Removes it permanently from the system



```
hussain@DESKTOP-FUGABPT: ~/assignment
hussain@DESKTOP-FUGABPT:~/assignment$ ls -l
total 20
-rw-r--r-- 1 hussain hussain  0 Sep 26 15:31 file1.txt
-rw-r--r-- 1 hussain hussain  0 Sep 26 15:32 file2.txt
-rw-r--r-- 1 hussain hussain  0 Sep 26 15:32 file3.txt
-rw-r--r-- 1 hussain hussain  6 Sep 26 15:35 hello.tx
-rw-r--r-- 1 hussain hussain 13 Sep 26 15:36 hello.txt
drwxr-xr-x 2 hussain hussain 4096 Sep 26 15:30 mylab2
drwxr-xr-x 2 hussain hussain 4096 Sep 26 12:20 os1
drwxr-xr-x 3 hussain hussain 4096 Sep 26 15:31 test
hussain@DESKTOP-FUGABPT:~/assignment$
```

The screenshot shows a Windows terminal window with a dark background. The command prompt is 'hussain@DESKTOP-FUGABPT: ~/assignment'. The user has entered 'ls -l', and the output shows a directory listing with permissions, owner, group, size, date, and filename. The files listed are file1.txt, file2.txt, file3.txt, hello.tx, hello.txt, mylab2, os1, and test. The terminal window has a standard Windows taskbar at the bottom with various application icons and system tray information showing 36°C and 4:15 PM on 9/26/2025.