DEVOPS PRACTICAL REPORT

Linux and Window:

Windows Operating System:

Windows is a commercial operating system developed by Microsoft. It is widely used for personal computers and enterprise environments.

Features of Windows:

- Graphical User Interface (GUI) based
- Easy to use
- Licensed software (paid)
- Mostly used for desktop applications
- Uses PowerShell and Command Prompt for command-line operations

Linux Operating System

Linux is an open-source operating system. It is widely used in servers, cloud platforms, and DevOps environments.

Features of Linux:

- Open-source (free to use)
- Highly secure
- Lightweight and stable
- Mostly command-line based
- Used in servers and cloud systems
- Multiple distributions (Ubuntu, CentOS, RedHat, etc.)

Difference Between Linux and Windows:

Feature	Windows	Linux
License	Paid	Free & Open-source
Usage	Desktop-focused	Server-focused
Security	Moderate	High
Customization	Limited	Highly customizable
Command Line	PowerShell / CMD	Terminal (Bash)
DevOps Usage	Limited	Highly preferred

Virtual Machine (VM)

What is a Virtual Machine?

A Virtual Machine (VM) is a software-based computer that runs inside another computer. It allows us to run multiple operating systems on a single physical system.

For example:
We can run Ubuntu (Linux) inside a Windows system using VMware.

Why Virtual Machine is Used in DevOps?

- To test applications in different environments
- To simulate server environments
- To isolate systems
- To practice Linux without removing Windows

Important VM Concepts

1. Hypervisor

A hypervisor is software that creates and manages virtual machines.
Example:

- VMware
- VirtualBox
- Hyper-V

2. Guest OS

The operating system installed inside the virtual machine.
Example: Ubuntu inside VMware.

3. Host OS

The main operating system installed on the physical computer.
Example: Windows 10.

4. Networking Modes in VM

1. NAT (Network Address Translation)
    - VM shares internet connection from host
    - Safe and commonly used
2. Bridged Network
    - VM acts like a separate computer in same network
    - Gets its own IP address

What is WSL?

Definition

- WSL (Windows Subsystem for Linux) allows users to run Linux directly inside Windows without installing a virtual machine.
- It enables Linux commands and tools to run on Windows.

Features of WSL

- No need for full VM
- Lightweight
- Direct integration with Windows
- Faster than traditional VM

Difference Between WSL and Virtual Machine

Feature	WSL	Virtual Machine
Full OS	Partial Linux Kernel	Full Operating System
Performance	Faster	Slightly slower
Resource Usage	Low	High
Isolation	Less	More
Setup	Simple	Requires installation

VMware Installation and Setup:

1. Introduction

VMware Workstation Pro is a virtualization software used to create and manage virtual machines on Windows and Linux systems. After Broadcom's acquisition of VMware, VMware Workstation Pro (for Windows/Linux) and VMware Fusion (for macOS) are available as free software downloads.

This section explains the complete procedure to download, configure, and install VMware Workstation Pro 25H2 on a Windows system.

2. Creating a Broadcom Account

To download VMware Workstation Pro, a Broadcom account is required.

Steps:

1. Open a web browser.

2. Search for “VMware Workstation”.
3. Open the official VMware website.
4. Click on “Download Now”.
5. You will be redirected to the Broadcom website.
6. If you already have an account, sign in.
7. If not, click “Register” and complete the registration process:

    - Enter email address.
    - Complete CAPTCHA verification.
    - Verify email using the code received.
    - Enter name and country.
    - Create a password.
    - Accept terms and conditions.

8. After registration, log in to access the Broadcom dashboard.

3. Downloading VMware Workstation Pro 25H2

After logging into Broadcom:

1. Go to “My Downloads”.
2. Click “Free software downloads available here”.
3. Locate VMware Workstation Pro.
    - If not visible, use the search bar and type “Workstation Pro”.
4. Select “Workstation Pro 25H2” (latest version).
5. Choose your operating system (Windows or Linux).
6. Click the version number.
7. Open the Terms and Conditions link.
8. Accept the agreement by checking the box.
9. Click “Download”.
10. Complete the verification form:
    - Full name
    - Email address
    - Physical address
    - Country
    - Postal code
11. Submit the form.
12. Click the active download button.
13. The installer file will begin downloading.

4. Disabling Conflicting Windows Features (Important)

VMware requires direct access to hardware virtualization. Some Windows features interfere with VMware and must be disabled.

Steps:

1. Open Control Panel.
2. Select “Turn Windows features on or off”.

3. Uncheck the following options if enabled:
    - Hyper-V
    - Virtual Machine Platform
    - Windows Hypervisor Platform
    - Windows Sandbox
    - Windows Subsystem for Linux (WSL)
4. Click “OK”.
5. Restart the system when prompted.

5. Disabling Memory Integrity

Memory Integrity (Core Isolation) may block VMware virtualization.

Steps:

1. Open “Windows Security”.
2. Go to “Device Security”.
3. Click “Core Isolation Details”.
4. Turn off “Memory Integrity” if enabled.
5. Restart the system.

6. Enabling Virtualization in BIOS/UEFI

VMware requires hardware virtualization to run 64-bit operating systems.

To Check in Windows:

1. Open Task Manager.
2. Go to “Performance” tab.
3. Select CPU.
4. Check the “Virtualization” status.
    - If it shows “Enabled” → No action needed.
    - If “Disabled” → Enable in BIOS.

To Enable in BIOS:

1. Restart the system.
2. Enter BIOS/UEFI setup (usually by pressing F2, F10, DEL, or ESC during boot).
3. Locate virtualization settings:
    - Intel: Intel VT-x or Intel Virtualization Technology.
    - AMD: AMD-V or Secure Virtual Machine (SVM).
4. Enable the option.
5. Save and exit BIOS.

7. Installing VMware Workstation Pro 25H2

After completing the above configurations:

1. Open the downloaded installer file.
2. Double-click to start setup.
3. Confirm that Hyper-V is not detected.
4. Click “Next” through installation steps.
5. Accept license agreement.
6. Choose installation location.
7. Click “Install”.
8. After installation completes, click “Finish”.

8. Post-Installation

1. Open VMware Workstation Pro from Start Menu.
2. The software is now ready to create new virtual machines.
3. Ubuntu or any other operating system ISO can now be installed.

Ubuntu Server 22.04.5 Installation in VMware

1. Creating a New Virtual Machine

1. Open **VMware Workstation Pro**.
2. Click **Create a New Virtual Machine**.
3. Select **Typical (Recommended)** → Click *Next*.
4. Choose **Installer disc image file (ISO)** and browse the Ubuntu 22.04.5 Server ISO file.
5. Select Guest OS:
    - Type: **Linux**
    - Version: **Ubuntu 64-bit**
6. Enter a VM name (e.g., *Ubuntu-Server-22.04*) and choose location.
7. Set disk size (recommended: **40–60 GB**) and select **Store virtual disk as a single file**.
8. Click **Customize Hardware** (optional):
    - Memory: 4 GB or more
    - Processors: 2 cores
9. Click **Finish** to create the virtual machine.

2. Starting Ubuntu Installation

1. Power on the VM.
2. Select **Install Ubuntu Server** from the menu.
3. Choose language (e.g., English).
4. Select keyboard layout.
5. Choose installation type and continue.

3. Network and Basic Configuration

1. Accept default network settings (DHCP).
2. Leave proxy blank (if not required).
3. Accept default mirror address and continue.

4. Disk Partitioning

1. Select **Use an entire disk**.
2. Ensure the selected disk is the VMware virtual disk.
3. Review partition details.
4. Confirm to write changes (affects only the virtual disk).

5. User and Server Setup

1. Enter:
    - Your name
    - Server name (hostname)
    - Username
    - Password
2. Select **Install OpenSSH server** (recommended for remote access).
3. Skip additional server packages unless required.

6. Installation and Reboot

1. Wait for installation to complete.
2. Select **Reboot Now**.
3. The system will restart and boot from the virtual disk.

7. First Login and Update

1. Log in using the created username and password.
2. Update the system:

```
sudo apt update
sudo apt upgrade
```

Linux Commands With Explanation

Linux commands are executed in the terminal to manage files, directories, users, and system processes. Below is a structured list of important commands.

1. **File and Directory Management**

Command	Explanation	Example
pwd	Show current working directory	pwd → /home/user
ls	List files and directories	ls or ls -l (detailed view)
ls -a	Show all files including hidden	ls -a
ls -lh	List with human-readable sizes	ls -lh
cd	Change directory	cd Documents
mkdir	Create a directory	mkdir Projects
rmdir	Remove an empty directory	rmdir OldFolder
rm	Remove a file	rm file.txt
rm -r	Remove a directory and all contents recursively	rm -r OldFolder
rm -rf	Force remove a directory and contents without prompts	rm -rf /tmp/test
touch	Create an empty file	touch file.txt
cp	Copy files or directories	cp file.txt backup.txt
cp -r	Copy directories recursively	cp -r folder1 folder2
mv	Move or rename files/directories	mv file.txt Documents/

2. **Viewing and Editing Files**

Command	Explanation	Example
cat	Display entire file content	cat file.txt
less	View file page by page	less file.txt
head	Show first lines of a file	head -5 file.txt
tail	Show last lines of a file	tail -5 file.txt
nano	Open file in terminal text editor	nano file.txt

Command	Explanation	Example
vim	Advanced terminal editor	vim file.txt

3. Searching and Filtering

12	Explanation	Example
grep	Search text inside files	grep "error" file.txt
find	Find files/directories	find /home -name "*.txt"
locate	Quickly find files (uses database)	locate file.txt
wc	Count lines, words, characters	wc file.txt
sort	Sort file lines	sort file.txt
uniq	Remove duplicate lines	uniq file.txt

4. Wildcards and Pattern Matching

Symbol	Explanation	Example
*	**Matches any number of characters**	**ls *.txt → all .txt files**
?	**Matches a single character**	**ls file?.txt → file1.txt, file2.txt**
[ ]	**Matches any one character inside brackets**	**ls file[12].txt → file1.txt and file2.txt**

5. Permissions and Ownership

Command	Explanation	Example
chmod	Change file permissions	chmod 755 file.sh
chown	Change file owner	sudo chown user file.txt
chgrp	Change file group	sudo chgrp group file.txt
ls -l	View permissions and ownership	ls -l file.txt

Permissions:

- r → read
- w → write
- x → execute

Roles:

- Owner/User
- Group
- Others

6. System Information

Command	Explanation	Example
uname -a	Show OS and kernel info	uname -a
df -h	Disk usage	df -h
free -h	Memory usage	free -h
top	Show running processes	top
uptime	Show system uptime	uptime
whoami	Show current user	whoami

7. Networking

Command	Explanation	Example
ip a	Show IP address and interfaces	ip a
ifconfig	Show network interfaces (older)	ifconfig
ping	Test connectivity	ping google.com
netstat -tuln	Show listening ports	netstat -tuln

8. Package Management (Ubuntu/Debian)

Command	Explanation	Example
sudo apt update	Update package list	sudo apt update

Command	Explanation	Example
sudo apt upgrade	Upgrade installed packages	sudo apt upgrade
sudo apt install	Install a package	sudo apt install nginx
sudo apt remove	Remove a package	sudo apt remove nginx
sudo apt autoremove	Remove unnecessary packages	sudo apt autoremove

9. Process Management

Command	Explanation	Example
ps aux	Show running processes	ps aux
kill PID	Terminate a process by PID	kill 1234
killall	Terminate process by name	killall firefox
jobs	Show background jobs	jobs
fg / bg	Move jobs to foreground/background	fg %1

10. Shutdown and Reboot

Command	Explanation	Example
shutdown -h now	Turn off immediately	sudo shutdown -h now
reboot	Restart system	sudo reboot
logout	Log out current user	logout

1. vi Editor

- `vi` is a **basic terminal text editor** available on almost all Linux distributions.
- You can use it to create or edit files.

Basic Commands:

Command	Explanation
vi file.txt	Open or create file file.txt
i	Enter **insert mode** to write text
Esc	Exit insert mode
:w	Save changes
:q	Quit editor
:wq	Save and quit
:q!	Quit without saving

2. LTS – Long Term Support

- **LTS** stands for **Long Term Support**.
- In Linux (Ubuntu, for example), LTS versions are supported **for a longer period** (typically 5 years).
- Includes **security updates, bug fixes, and stability improvements**.
- Recommended for servers and production environments because they are **stable and reliable**.

Example:

- Ubuntu **22.04.5 LTS** → supported until **2027**.
- Ubuntu 24.04 → next LTS in future.

rm -rf Command in Linux

1. What is rm?

- `rm` stands for **remove**.
- It is used to delete **files** or **directories** from Linux.

2. Options / Flags

Flag	Meaning
-r	**Recursive** – deletes directories and all their contents, including subdirectories
-f	**Force** – deletes without asking for confirmation
-d	Delete **empty directories only** (optional, not commonly used with -rf)

Commonly used: `rm -rf directory_name`
(`-rdf` is sometimes written but `-rf` is sufficient; the order of flags doesn't matter)

Wildcards in ls Command

- `*` → Matches **any number of characters**.
  - Example: `ls *.txt` → lists all `.txt` files.
- `?` → Matches **exactly one character**.
  - Example: `ls file?.txt` → matches `file1.txt`, `file2.txt`, but not `file10.txt`.
- `[ ]` → Matches **any one character inside brackets**.
  - Example: `ls file[12].txt` → matches `file1.txt` and `file2.txt`.
- `ls *.??` → Lists files with **any name** and **exactly two-character extension**.
  - Matches: `file.sh`, `data.py`
  - Does not match: `file.txt` or `a.c`

1. sudo apt update && sudo apt upgrade

- **Purpose:** Keep your Ubuntu system **up-to-date**.
- **`sudo apt update`** → Updates the list of available software packages and their versions.
- **`sudo apt upgrade`** → Installs the latest versions of installed packages.
- **`sudo`** → Runs the command as **superuser (administrator)**.

Example:

```
sudo apt update
sudo apt upgrade -y
```

- The `-y` automatically confirms all upgrades.

IPv4 – Address Allocation

- **IPv4** is a 32-bit address system for identifying devices on a network, written as four numbers (0–255) separated by dots, e.g., `192.168.1.10`.
- **How it is assigned:**
  1. **Static IP (Manual):** Admin assigns a fixed address to a device.
     - Example: Printer or server often uses static IP.
  2. **Dynamic IP (Automatic):** A DHCP server automatically gives an available IP to a device when it connects.
     - Example: Your laptop or phone usually gets a dynamic IP from your Wi-Fi router.
- **Purpose:** Ensures every device has a unique address to send and receive data.