
Activities
Apr 19 21:49
Linux Red Hat EL9 VM
Full
Course
LONG VIDEO • 48 MIN
From Zero To Hero!



The Direct Path to

Red Hat Enterprise Linux 9

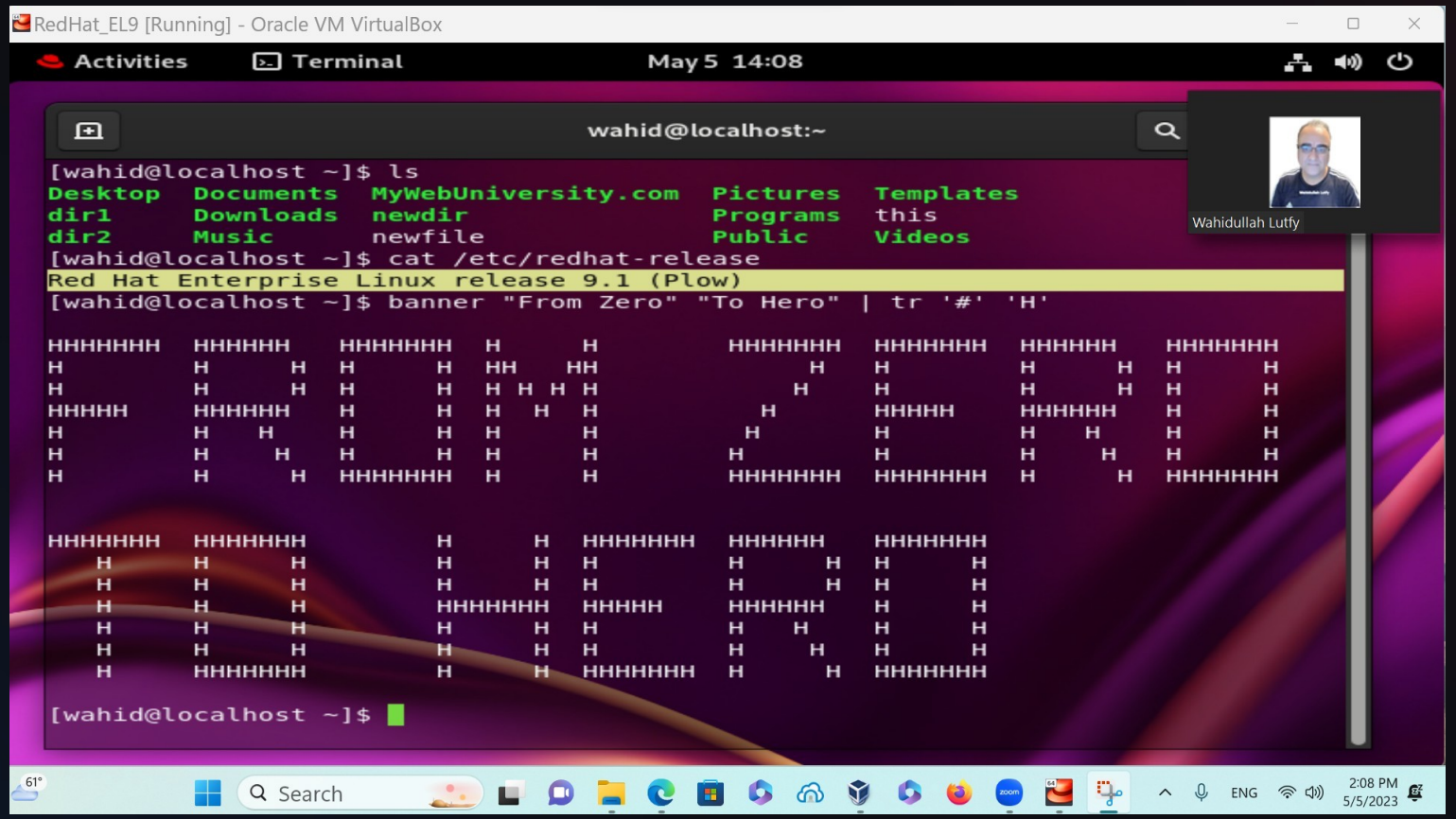
(Zero to Hero)

Learning Never Stops. Every Drop, A River

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WELCOME

From Zero to Hero



Real Red Hat system

Everything in this course runs on a real RHEL 9 virtual machine.

Learn by doing

Type each command yourself. Mistakes are part of learning.

YOUR INSTRUCTOR

About Me & @MyWebUniversity

36+ years in IT

Software engineer, system administrator, system analyst and instructor.

Teacher at heart

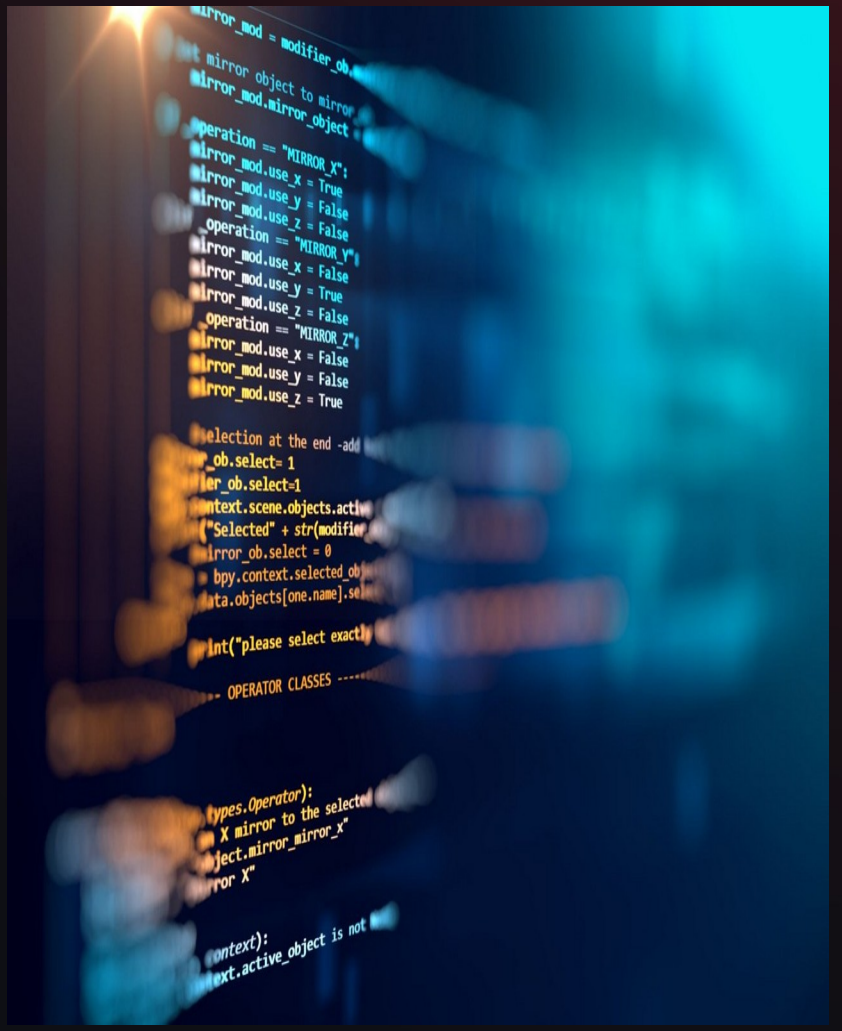
Taught computer science at National University, CSU Fullerton, Pasadena City College and Computer Learning Center.

MyWebUniversity.com

Free since August 2000: 2,600+ videos and 50,000+ searchable PDFs, in English and Dari.

Author

"The Direct Path to Linux Ubuntu", a free, 43-chapter Linux book.




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Linux Red Hat EL9 VM
UNIX AND LINUX HISTORY

HISTORY

Why Do Operating Systems Exist?

The manager

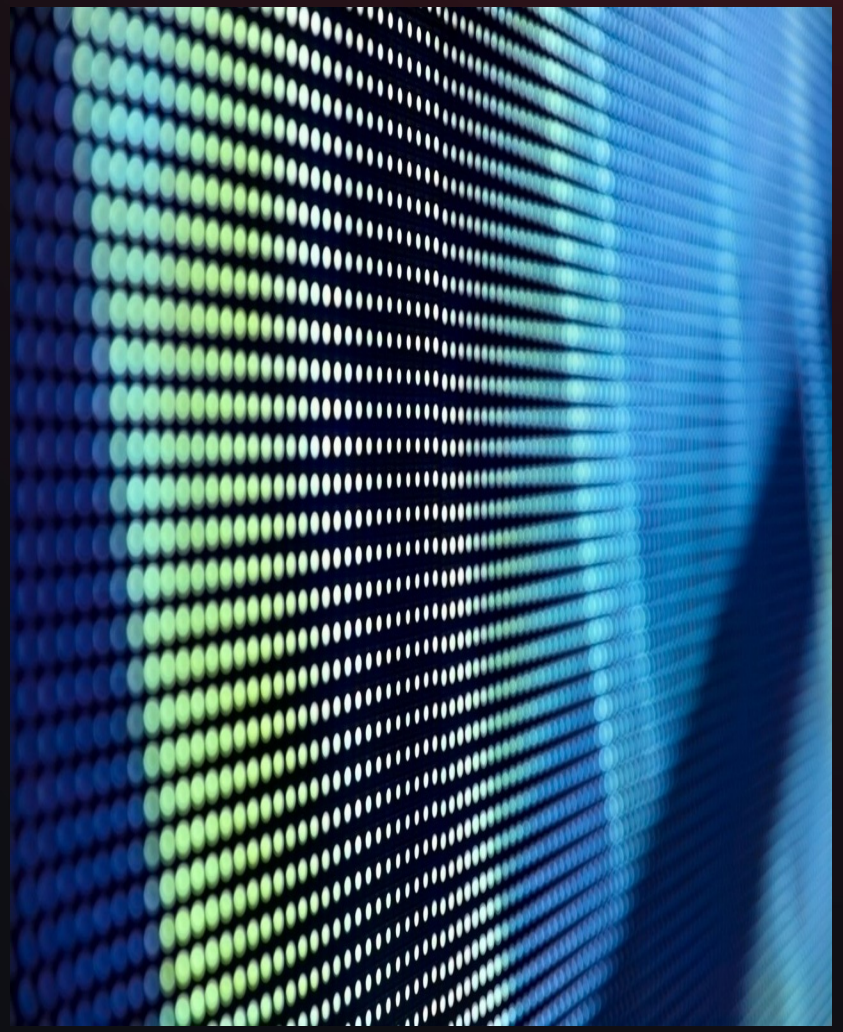
The operating system manages the CPU, memory, disks and network for every program.

The translator

Programs ask the OS for help; the OS talks to the hardware for them.

The security guard

It keeps users and programs from interfering with each other.



HISTORY

UNIX Origins & the Birth of Linux

1969	UNIX is born at AT&T Bell Labs (Ken Thompson & Dennis Ritchie)
1973	UNIX is rewritten in the C language, so it can move to new machines
1983	Richard Stallman starts the GNU project for free software
1991	Linus Torvalds, a student in Finland, releases the Linux kernel
1993	Red Hat is founded; Red Hat Enterprise Linux follows in 2002
2022	Red Hat Enterprise Linux 9 is released



HISTORY

Open Source Philosophy

Meaning of open source

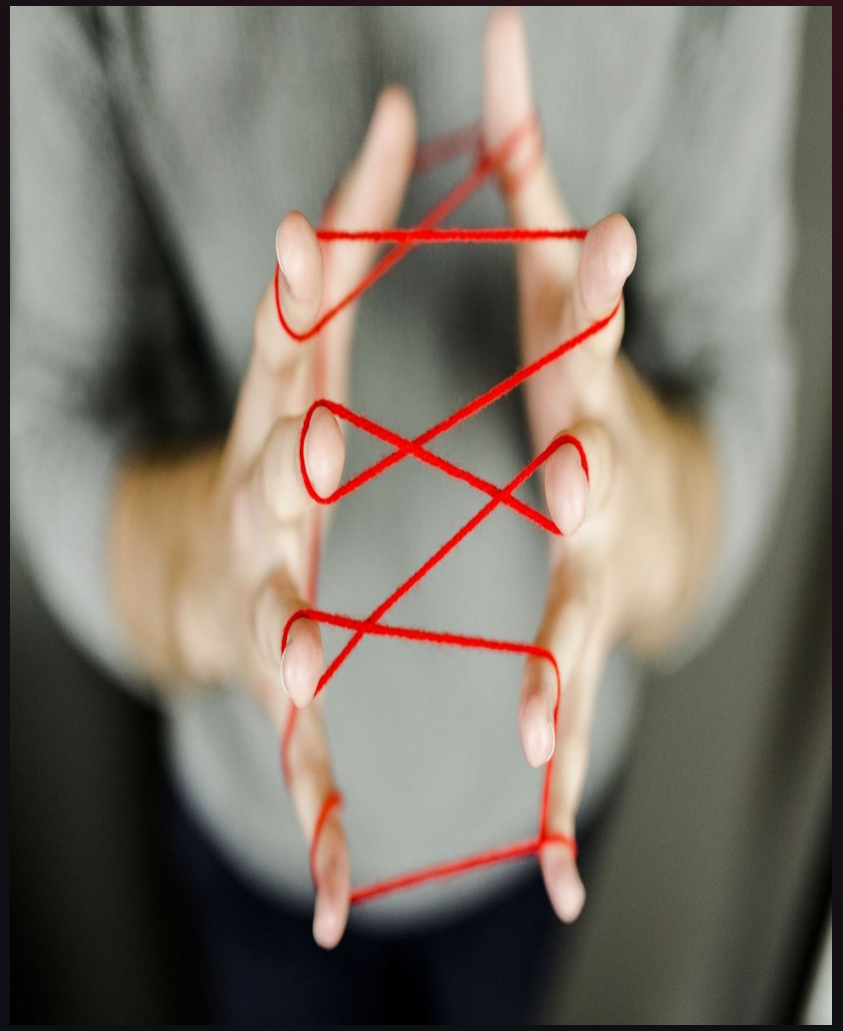
The source code is public: anyone can read it, learn from it, and improve it.

Community software

Thousands of developers and companies build Linux together.

Why it matters

More eyes on the code means faster fixes, better security, and no lock-in.



Linux Red Hat EL9 VM



RED HAT WEBSITES

RED HAT

What is Red Hat?

Enterprise Linux

Red Hat Enterprise Linux, RHEL, is built for businesses that cannot afford downtime.

Why companies trust it

Tested, certified, predictable releases, with security fixes for many years.

Support and stability

Paid subscriptions include expert support, and RHEL has a 10-year lifecycle.

IBM acquired Red Hat

In 2019, IBM bought Red Hat for about 34 billion dollars.



RED HAT

Why Learn RHEL 9?

Career value

RHEL skills are in demand for system administrator, DevOps and cloud jobs.

Modern standard

Current kernel, security features, containers and cloud-ready tools.

Long-term support

What you learn stays useful for years, and carries over to Rocky, AlmaLinux and Fedora.



RED HAT WEBSITES

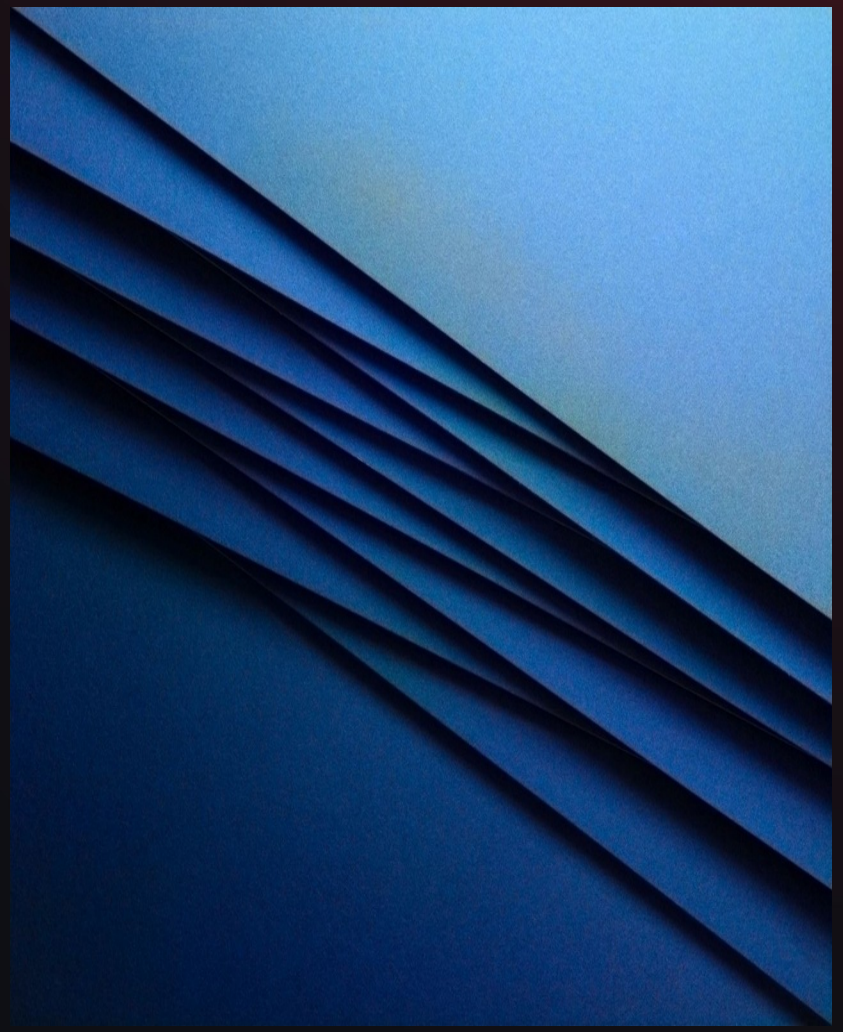
Red Hat Websites: Getting RHEL for Free

redhat.com
Product information and the RHEL 9 ISO download, after you log in.

developers.redhat.com
Sign up for the no-cost Red Hat Developer Subscription for Individuals.

Two ways to get an account
Create a Red Hat login directly, or join the developer program, then download.

The ISO file
A single DVD image file that contains the whole installer.



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STRUCTURE OF THIS COURSE

HOW WE LEARN

Course Structure

1 · Installation
Download RHEL 9, build a virtual machine, and log in.

2 · Basics
The terminal, navigation, files, and packages.

3 · Intermediate
Permissions, open files, shells, Python and htop.

4 · Advanced
Processes, the /proc file system, services, and debugging with gdb.

Practice path
Every command is hands-on. Try it, break it, fix it.



HOW WE LEARN

Is Linux User-Friendly?

A friendly desktop

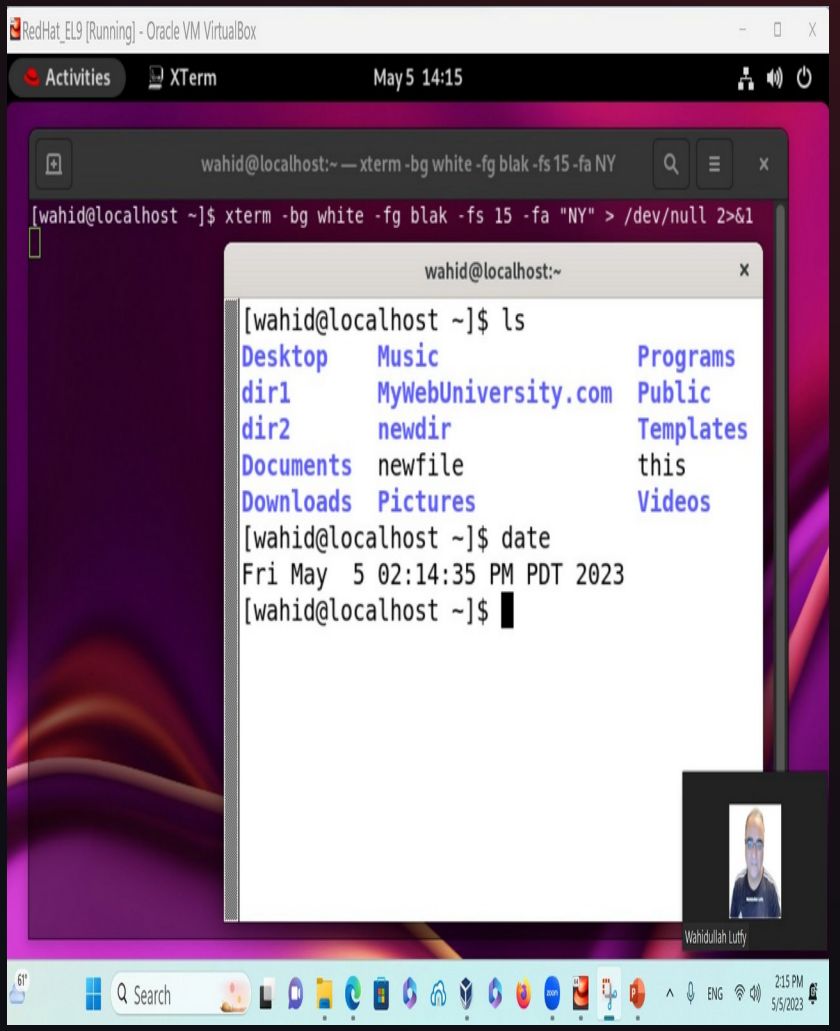
RHEL 9 includes the GNOME desktop, with windows, menus and an app store.

A powerful terminal

The command line is faster, repeatable, and works on remote servers.

Best of both

Use the desktop when it helps; learn the terminal because it is where the power is.




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RED HAT INSTALLATION

INSTALLATION

Linux on a Virtual Machine

What is a VM?

A complete computer that runs as a program inside your real computer.

Why we use it

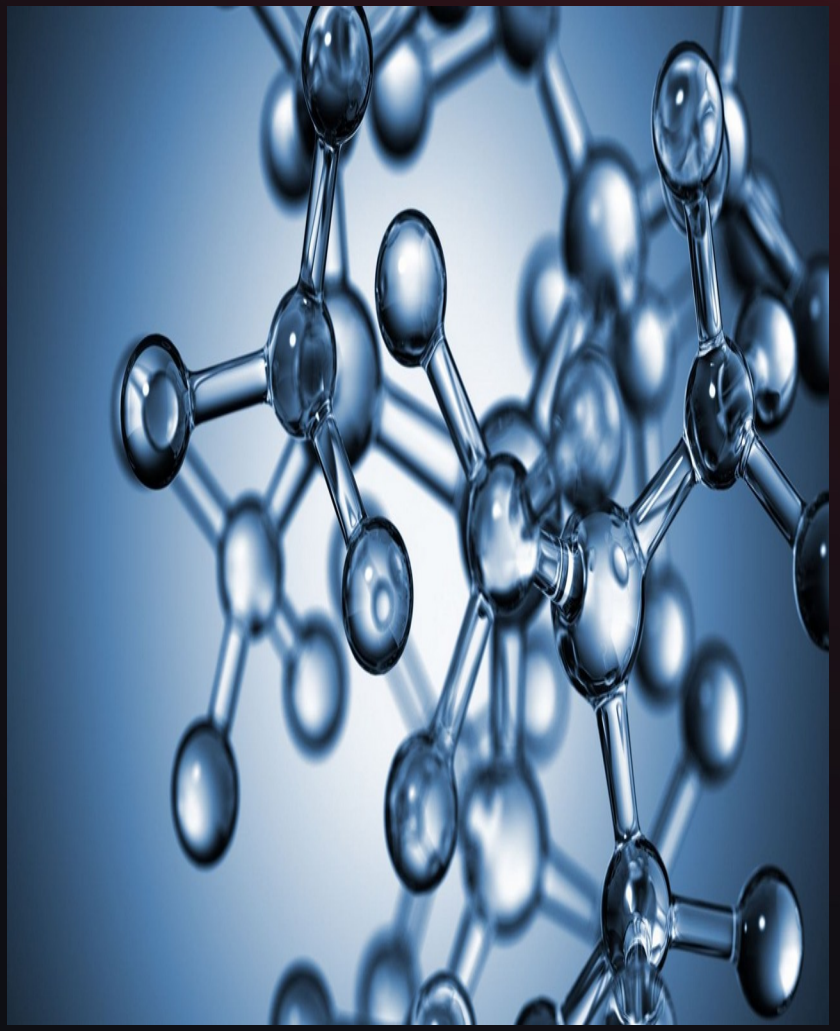
No need for a second PC, and no risk to your Windows system.

Safe learning

Snapshots let you undo mistakes. Break it, restore it, learn again.

Host and guest

Windows is the host. RHEL 9 is the guest running inside it.



INSTALLATION

Check Your Host: System Resources

Device Manager

In Windows, check your processors, memory and disk space before you start.

CPU

Give the VM 2 or more CPU cores, and keep the rest for Windows.

Memory (RAM)

4 GB for the VM is a comfortable minimum; 8 GB is even better.

Disk

At least 20 GB of free space; 30 to 40 GB gives you room to grow.



INSTALLATION

VirtualBox: Name, Type and Settings

1 · Name and OS

Name it RedHat_EL9, choose type Linux, version Red Hat (64-bit).

2 · Memory and CPUs

Set RAM and processors using the numbers we just planned.

3 · Virtual disk

Create a dynamically allocated disk of 20 GB or more.

4 · Attach the ISO

In Storage, insert the RHEL 9 ISO into the virtual DVD drive.

5 · Boot and install

Start the VM, choose Install, set your user and password, and reboot.



DID YOU KNOW?

A Word About Khwarizmi

Muhammad ibn Musa al-Khwarizmi

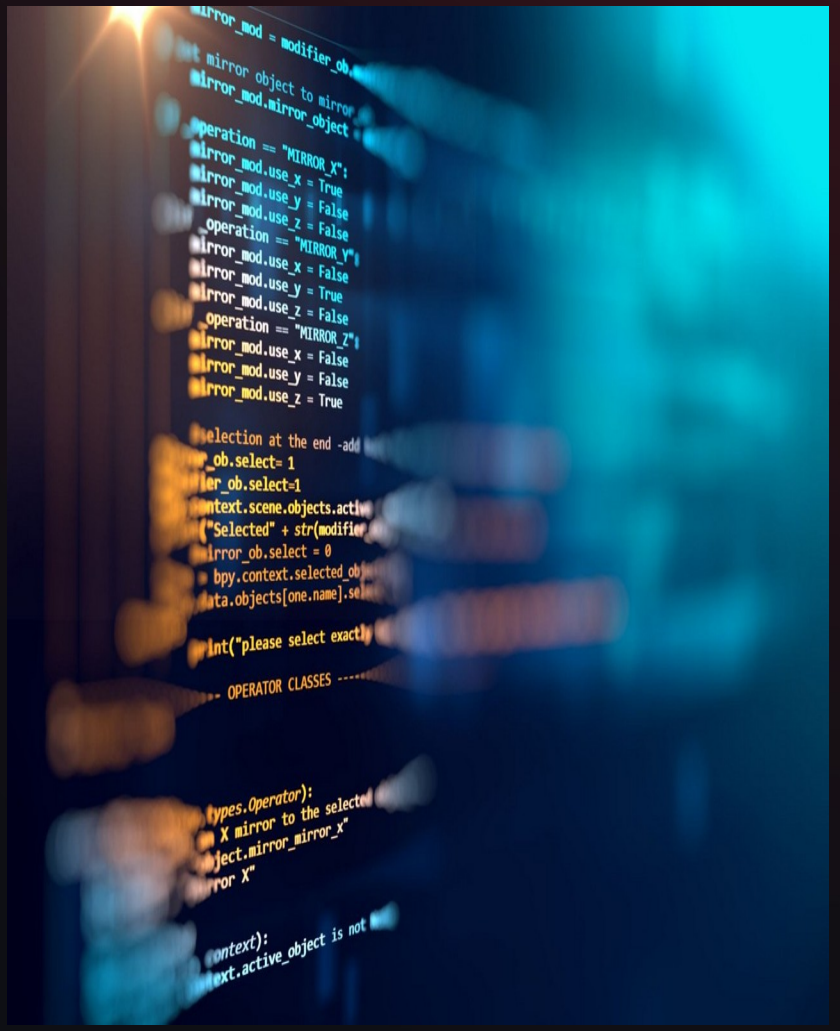
A 9th-century Persian mathematician and scholar from the region of Khwarazm.

Algorithm

The word "algorithm" comes from the Latin form of his name, "Algoritmi".

Algebra

"Algebra" comes from his famous book, al-Jabr.



INSTALLATION

First Login & Subscription Check

wahid@localhost:~

```
[wahid@localhost ~]$ cat /etc/redhat-release
Red Hat Enterprise Linux release 9.1 (Plow)

[wahid@localhost ~]$ sudo subscription-manager register
Registering to: subscription.rhsm.redhat.com
Username: your_redhat_login
[wahid@localhost ~]$ sudo subscription-manager status
Overall Status: Current

[wahid@localhost ~]$ whoami
wahid
[wahid@localhost ~]$ date
Fri May  5 02:14:35 PM PDT 2023
```

The prompt

[user@host directory]$ tells you who you are, which machine, and where you are.

subscription-manager

Connects this machine to your free Red Hat account, so it can receive software and updates.

sudo

Runs one command with administrator (root) power. It asks for your password.

INSTALLATION

Shutting Down the VM Safely

wahid@localhost:~

```
# Power off right now
[wahid@localhost ~]$ sudo poweroff

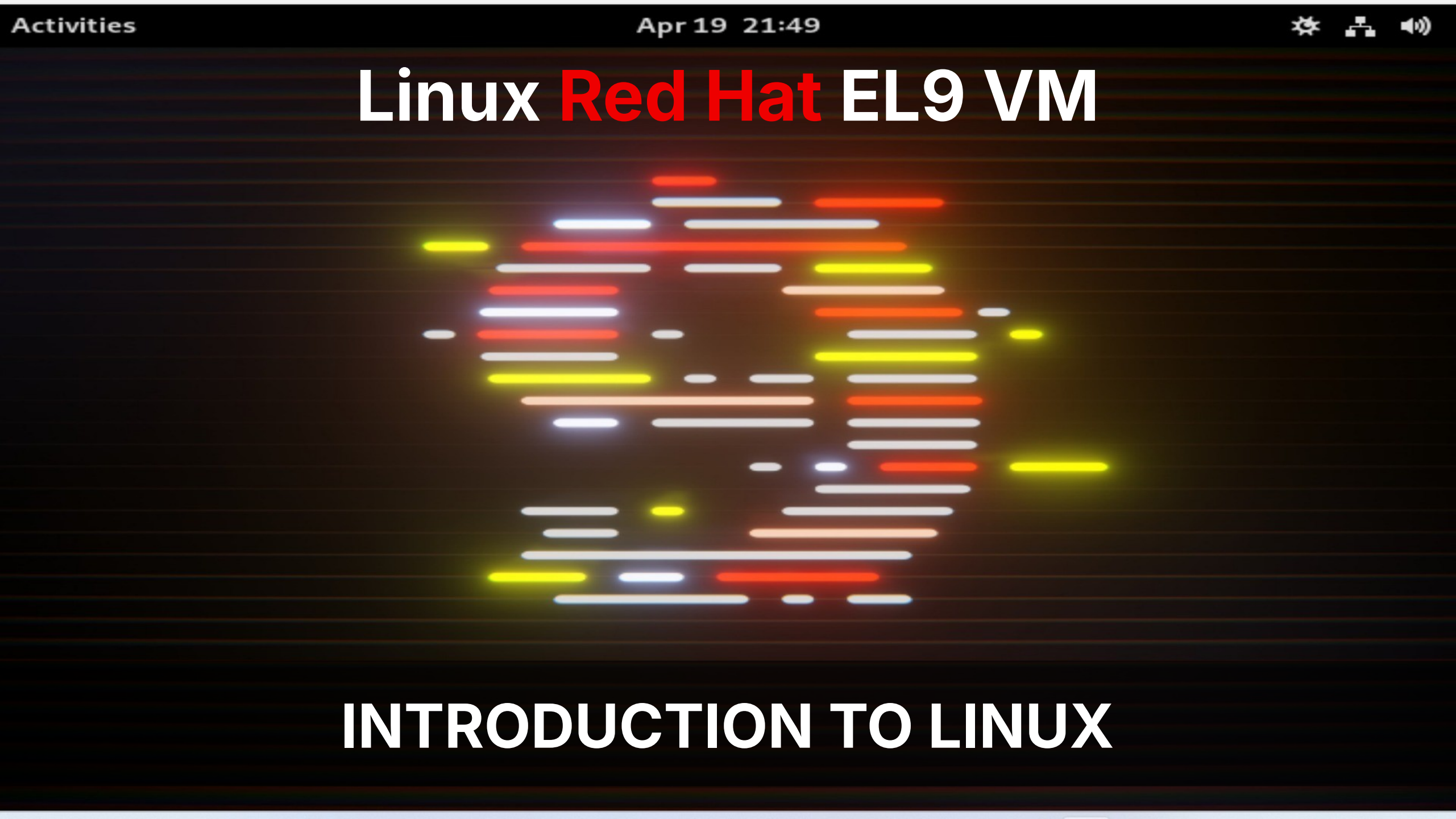
# Or schedule it, with a message to users
[wahid@localhost ~]$ sudo shutdown -h +5 "Saving work, shutting down"
# Restart instead
[wahid@localhost ~]$ sudo reboot
```

Why not just close the window?

Linux keeps data in memory; a clean shutdown writes everything safely to disk.

shutdown -h

-h means halt (power off). +5 waits five minutes; "now" means immediately.


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INTRODUCTION TO LINUX

INTRODUCTION

Linux Fundamentals

Kernel vs OS

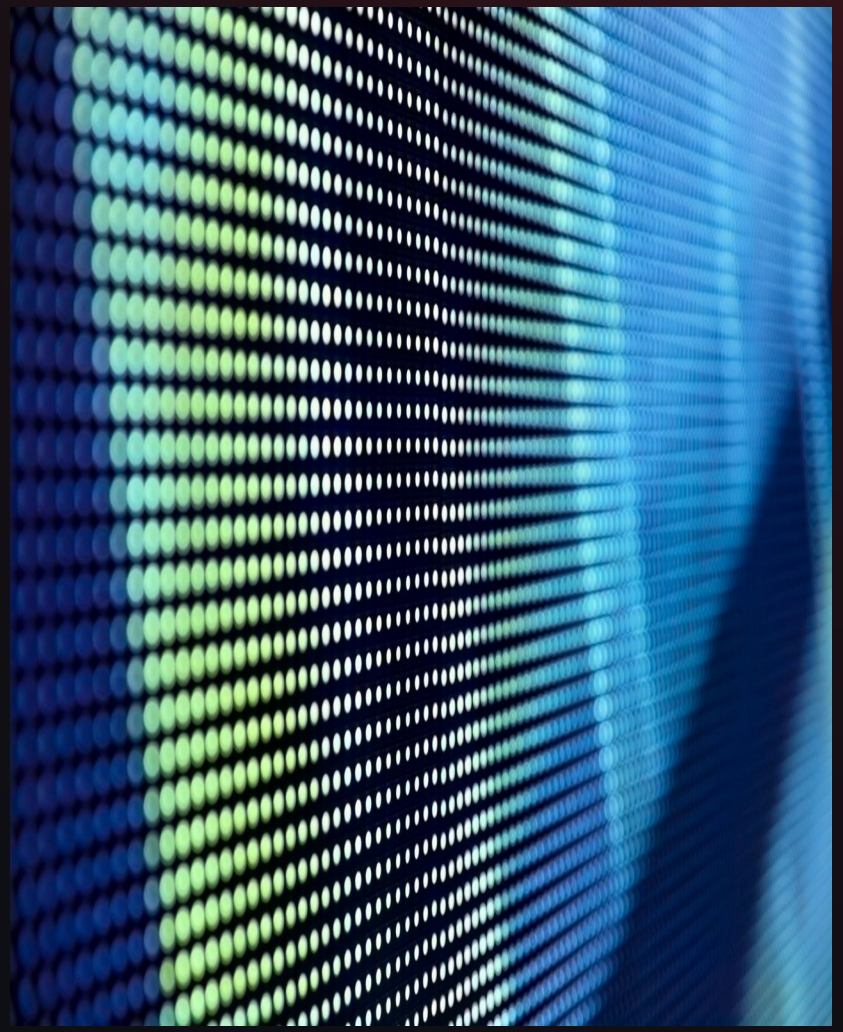
The kernel is the core that talks to hardware; the OS is the kernel plus tools, shell and apps.

Distributions

A distribution packages the kernel with software, an installer and updates.

Everything is a file

Documents, devices, even running processes appear as files you can read.



INTRODUCTION

The Linux File System

/ (root)
The top of the tree. Every file lives somewhere below it.

/home
Personal folders: /home/wahid holds my files.

/etc
System configuration files, mostly plain text.

/var
Changing data: logs, mail, caches.

/usr
Installed programs and libraries.

/tmp
Temporary files, cleaned up automatically.

/dev
Devices, like disks, shown as files.

/proc
Live information about the kernel and processes.

/boot
The kernel and files needed to start the system.

Linux Red Hat EL9 VM



LINUX RED HAT BASICS

BASICS

Command Line Basics

wahid@localhost:~

```
[wahid@localhost ~]$ pwd
/home/wahid

[wahid@localhost ~]$ ls
Desktop    Documents  Downloads  Music
Pictures   Public     Templates  Videos

[wahid@localhost ~]$ cd Documents
[wahid@localhost ~]$ pwd
/home/wahid/Documents
[wahid@localhost ~]$ cd ..        # up one level
[wahid@localhost ~]$ cd ~         # back home
```

Terminal role

A text window where you type commands and Linux replies.

pwd

Print Working Directory: where am I right now?

ls

List: what is in this folder?

cd

Change Directory: move somewhere else. ".." is up, "~" is home.

BASICS

Working with Files

wahid@localhost:~

```
[wahid@localhost ~]$ mkdir newdir          # make a directory
[wahid@localhost ~]$ touch newfile         # create an empty file

[wahid@localhost ~]$ cp newfile newdir/    # copy
[wahid@localhost ~]$ mv newfile notes.txt  # move or rename

[wahid@localhost ~]$ rm notes.txt          # delete a file
[wahid@localhost ~]$ rm -ri newdir         # delete a folder, asking
first
```

mkdir

Make a new directory (folder).

cp and mv

cp copies; mv moves, and is also how you rename.

rm: use with caution!

There is no recycle bin in the terminal. Deleted means gone.

BASICS

Installing Software with dnf and rpm

wahid@localhost:~

```
[wahid@localhost ~]$ dnf list installed | head -3
Installed Packages
NetworkManager.x86_64     1:1.40.0-1.el9   @anaconda
acl.x86_64                2.3.1-3.el9      @anaconda

[wahid@localhost ~]$ rpm -qa | wc -l
1426

[wahid@localhost ~]$ which gnome-software
/usr/bin/gnome-software
[wahid@localhost ~]$ gnome-software &      # open the Software app
```

dnf

The package manager: installs, updates and removes software, and handles dependencies.

rpm -qa | wc -l

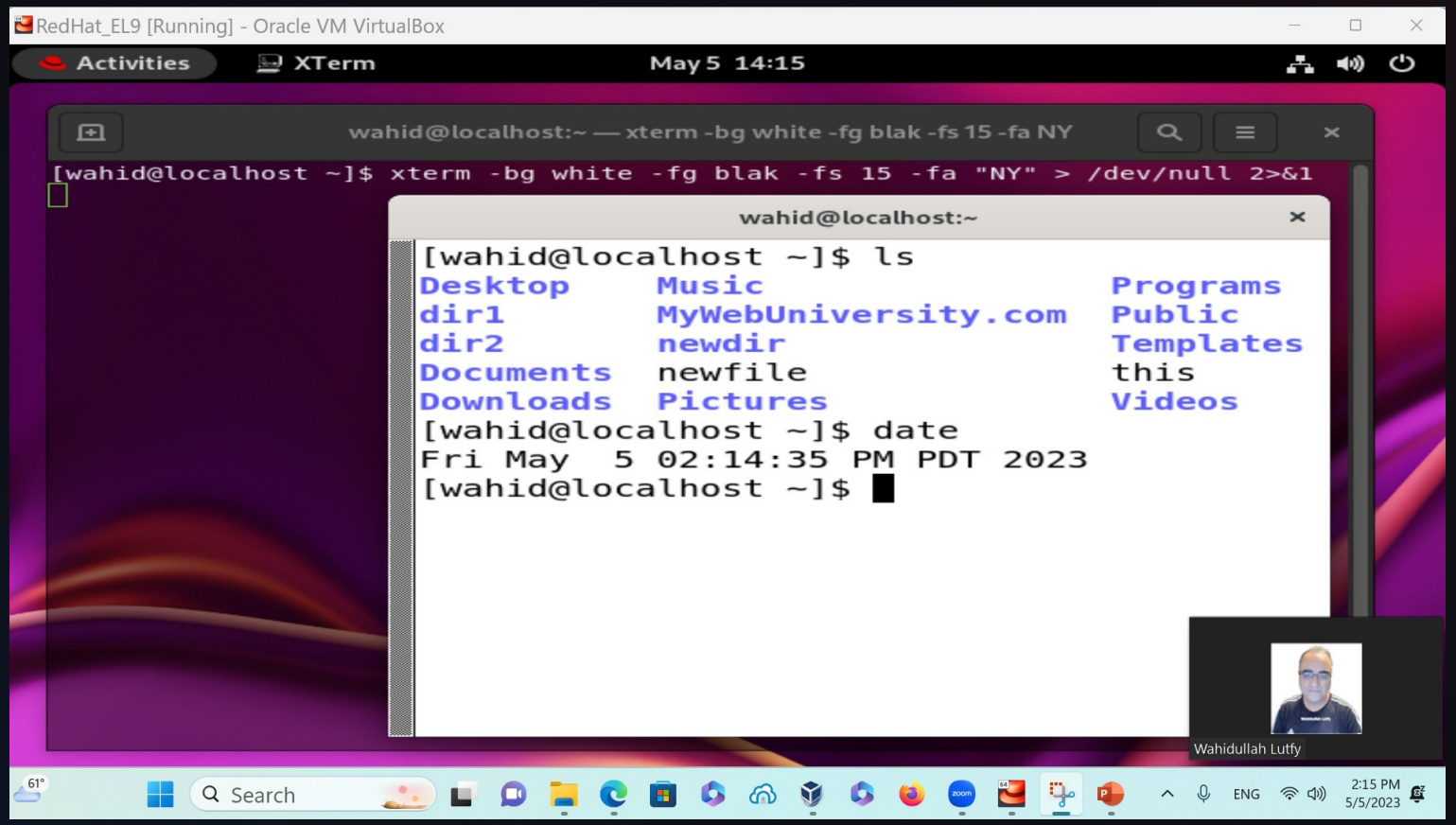
List every installed package, then count the lines.

gnome-software

The graphical Software center, if you prefer clicking.

BASICS

Terminals and xterm



Many terminals

GNOME Terminal is the default; xterm is the classic X terminal.

Customize it

xterm -bg white -fg black -fs 15 -fa "NY" sets colors, font size and font.

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LINUX RED HAT INTERMEDIATE

INTERMEDIATE

Linux Permissions

Users and groups
Every file has an owner (user) and a group.

r w x
read = 4, write = 2, execute = 1. Add them up for each set.

Three sets
Owner, group, others: -rwxr-xr-- = 754.

Security
Give only the access that is needed, nothing more.



INTERMEDIATE

umask, chmod, chown and chgrp

wahid@localhost:~

```
[wahid@localhost ~]$ umask
0022
[wahid@localhost ~]$ ls -l hello.sh
-rw-r--r--. 1 wahid wahid 42 May  5 hello.sh

[wahid@localhost ~]$ chmod 755 hello.sh       # rwx r-x r-x
[wahid@localhost ~]$ chmod u+x,g-w hello.sh   # add / remove with letters


[wahid@localhost ~]$ sudo chown root hello.sh
[wahid@localhost ~]$ sudo chgrp developers hello.sh
[wahid@localhost ~]$ ls -l hello.sh
-rwxr-xr-x. 1 root developers 42 May  5 hello.sh
```

umask

The default permissions taken away from every new file. 022 removes write for group and others.

chmod

Change mode: change the permissions, with numbers or letters.

chown / chgrp

Change the owner, or the group, of a file. Needs sudo.

INTERMEDIATE

List Open Files with lsof

wahid@localhost:~

```
[wahid@localhost ~]$ sudo dnf install lsof

[wahid@localhost ~]$ lsof -u wahid | head -3
COMMAND   PID  USER   FD   TYPE  NAME
bash     2731 wahid  cwd    DIR  /home/wahid
bash     2731 wahid  txt    REG  /usr/bin/bash

[wahid@localhost ~]$ sudo lsof -i :22        # who is using port 22?
[wahid@localhost ~]$ lsof +D /home/wahid/Documents
```

Why lsof?

"Device is busy"? lsof tells you exactly which program is holding a file.

Network too

Network connections are files too, so lsof -i shows them.

INTERMEDIATE

Update Your Shells & Change the Prompt

wahid@localhost:~

```
[wahid@localhost ~]$ sudo dnf update bash zsh
[wahid@localhost ~]$ echo $SHELL
/bin/bash

[wahid@localhost ~]$ export PS1="$ "
[wahid@localhost ~]$
[wahid@localhost ~]$ export PS1="[\u@\h \W]\$ "   # back to normal
```

The shell

The program that reads your commands. bash is the default; zsh is a popular alternative.

PS1

The variable that defines what your prompt looks like.

INTERMEDIATE

Python, pip, JupyterLab and IPython

wahid@localhost:~

```
[wahid@localhost ~]$ python3 --version
Python 3.9.14
[wahid@localhost ~]$ python3 -m venv ~/venv && source ~/venv/bin/activate


(venv) [wahid@localhost ~]$ pip install jupyterlab ipython
(venv) [wahid@localhost ~]$ jupyter lab       # opens in your browser

(venv) [wahid@localhost ~]$ ipython
In [1]: 2 ** 10
Out[1]: 1024
```

Python 3

Comes with RHEL 9, because system tools are written in it.

JupyterLab

Write and run code in your browser, with notes and charts.

IPython

A smarter interactive Python, with colors and Tab completion.

INTERMEDIATE

Monitor Your System with htop

wahid@localhost:~

```
[wahid@localhost ~]$ dnf list htop
Available Packages
htop.x86_64    3.2.1-1.el9    epel

[wahid@localhost ~]$ sudo dnf install htop
[wahid@localhost ~]$ htop
```

Where is htop?

htop comes from EPEL, the Extra Packages for Enterprise Linux repository.

Reading htop

CPU and memory bars at the top, processes below. F6 sorts, F9 ends a process, F10 quits.


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LINUX RED HAT ADVANCED

ADVANCED

Processes

What is a process?

A program that is running. The program is the recipe; the process is the cooking.

PID

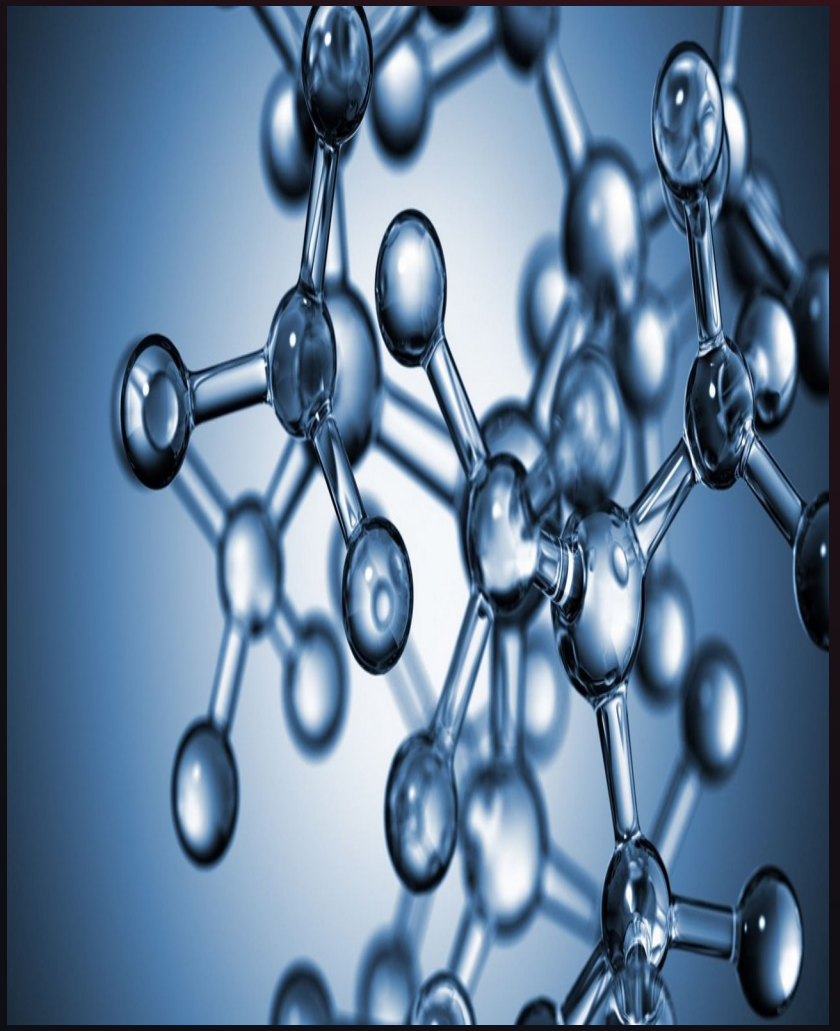
Every process gets a unique Process ID number.

Parents and children

Processes start other processes, forming a family tree.

Watch and control

ps, top, htop, kill, and the /proc file system.



ADVANCED

The /proc File System

wahid@localhost:~

```
[wahid@localhost ~]$ head -5 /proc/cpuinfo
processor  : 0
vendor_id  : GenuineIntel
model name : Intel(R) Core(TM) i7 CPU

[wahid@localhost ~]$ grep MemTotal /proc/meminfo
MemTotal:  4005020 kB
[wahid@localhost ~]$ cat /proc/version

[wahid@localhost ~]$ echo $$                    # PID of my shell
2731
[wahid@localhost ~]$ ls /proc/2731
cmdline  cwd  environ  exe  fd  maps  status ...
```

Not on disk

/proc is created live by the kernel, in memory.

A window into the kernel

Tools like ps and top read their information from here.

ADVANCED

pmap, pstree and pwdx

wahid@localhost:~

```
[wahid@localhost ~]$ pmap $$ | tail -1
 total           232768K

[wahid@localhost ~]$ pstree -p $$
bash(2731)───pstree(3120)
[wahid@localhost ~]$ pstree | head -3
systemd─┬─ModemManager───3*[{ModemManager}]
        ├─NetworkManager───2*[{NetworkManager}]

[wahid@localhost ~]$ pwdx $$
2731: /home/wahid
```

pmap

Shows the memory map of a process: which libraries and memory areas it uses.

pstree

Shows processes as a family tree. systemd is the ancestor of all.

pwdx

Shows the current working directory of any process.

ADVANCED

Services and systemd

wahid@localhost:~

```
[wahid@localhost ~]$ systemctl status sshd
● sshd.service - OpenSSH server daemon
   Active: active (running)

[wahid@localhost ~]$ sudo systemctl start httpd
[wahid@localhost ~]$ sudo systemctl enable httpd    # start at every boot
[wahid@localhost ~]$ sudo systemctl stop httpd
```

What are services?

Programs that run in the background, like a web server or SSH.

systemd

The first process (PID 1). It starts and supervises services.

Service control

systemctl start, stop, restart, enable, disable and status.

ADVANCED

Compile C with Debugging & Use gdb

wahid@localhost:~

```
[wahid@localhost ~]$ sudo dnf install gcc gdb
[wahid@localhost ~]$ cat hello.c
#include <stdio.h>
int main() { printf("Hello, RHEL 9!\n"); return 0; }

[wahid@localhost ~]$ gcc -g hello.c -o hello   # -g adds debug info
[wahid@localhost ~]$ ./hello
Hello, RHEL 9!



[wahid@localhost ~]$ gdb ./hello
(gdb) break main
(gdb) run
(gdb) next
(gdb) quit
```

gcc -g

Compiles your C code, and -g keeps the information a debugger needs.

gdb

The GNU Debugger: pause a program, step through it, and inspect variables.

ADVANCED

The g++ Compiler for C++

wahid@localhost:~

```
[wahid@localhost ~]$ sudo dnf install gcc-c++
[wahid@localhost ~]$ cat hello.cpp
#include <iostream>
int main() { std::cout << "Hello from C++\n"; }

[wahid@localhost ~]$ g++ -g hello.cpp -o hellocpp
[wahid@localhost ~]$ ./hellocpp
Hello from C++

[wahid@localhost ~]$ gdb ./hellocpp
(gdb) break main
(gdb) run
(gdb) print 6 * 7
$1 = 42
```

g++

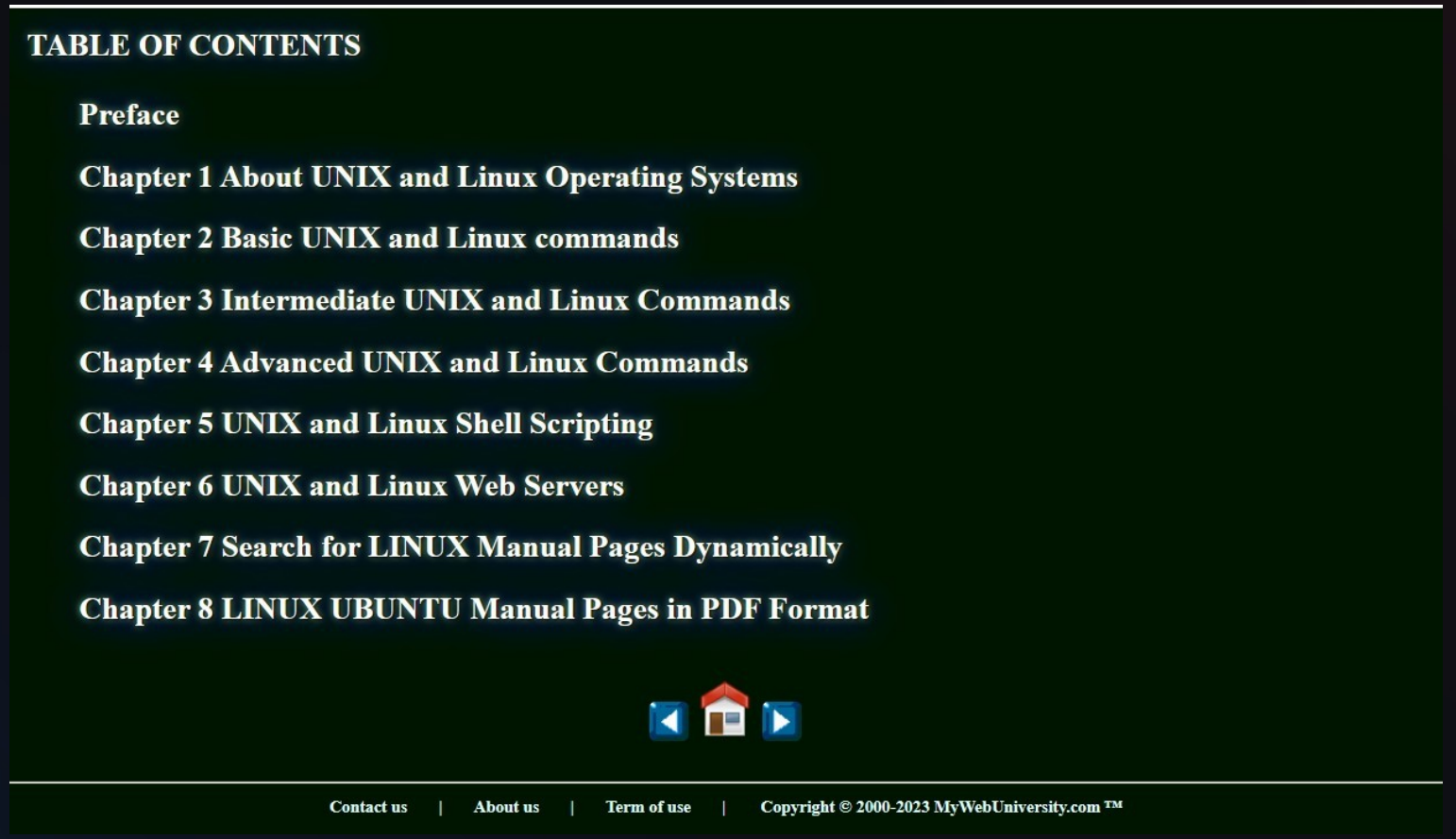
The GNU C++ compiler. Same idea as gcc, for C++ code.

Same debugger

gdb debugs C and C++ programs in exactly the same way.

PRACTICE

Practice These Commands at MyWebUniversity.com


TABLE OF CONTENTS

Preface

Chapter 1 About UNIX and Linux Operating Systems

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Chapter 7 Search for LINUX Manual Pages Dynamically

Chapter 8 LINUX UBUNTU Manual Pages in PDF Format

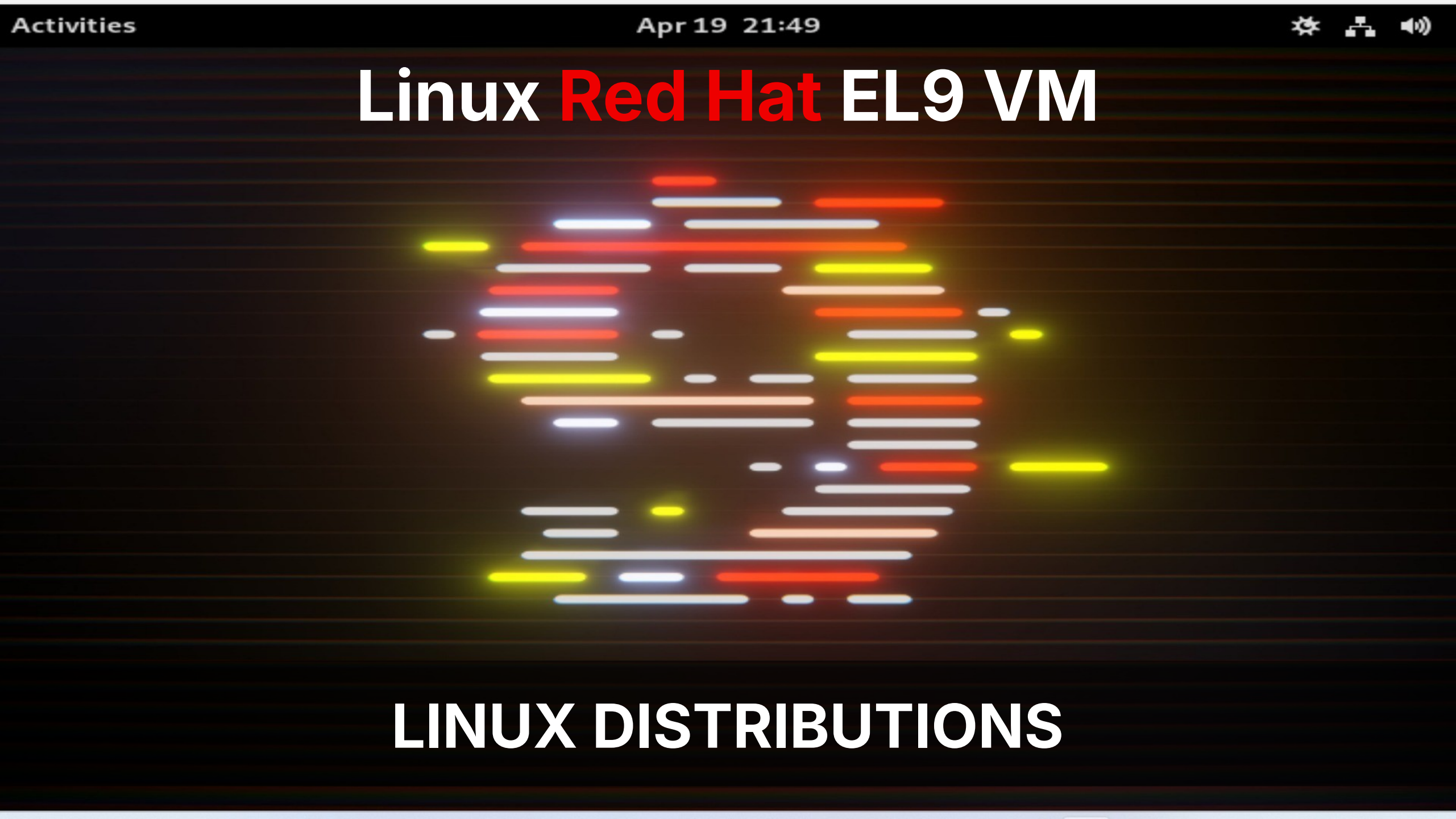
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The Direct Path to Linux Ubuntu

Free chapters with hundreds of command examples: chmod, df and more.

Chapter 4: Advanced Commands

Each chapter has matching videos on our YouTube channel.


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LINUX DISTRIBUTIONS

DISTRIBUTIONS

Linux Distribution Families

Red Hat family

Fedora, CentOS Stream, Rocky Linux, AlmaLinux and RHEL. Uses dnf and rpm.

Debian family

Debian, Ubuntu, Linux Mint and Kali Linux. Uses apt and .deb packages.

SUSE family

openSUSE and SUSE Linux Enterprise. Uses zypper.

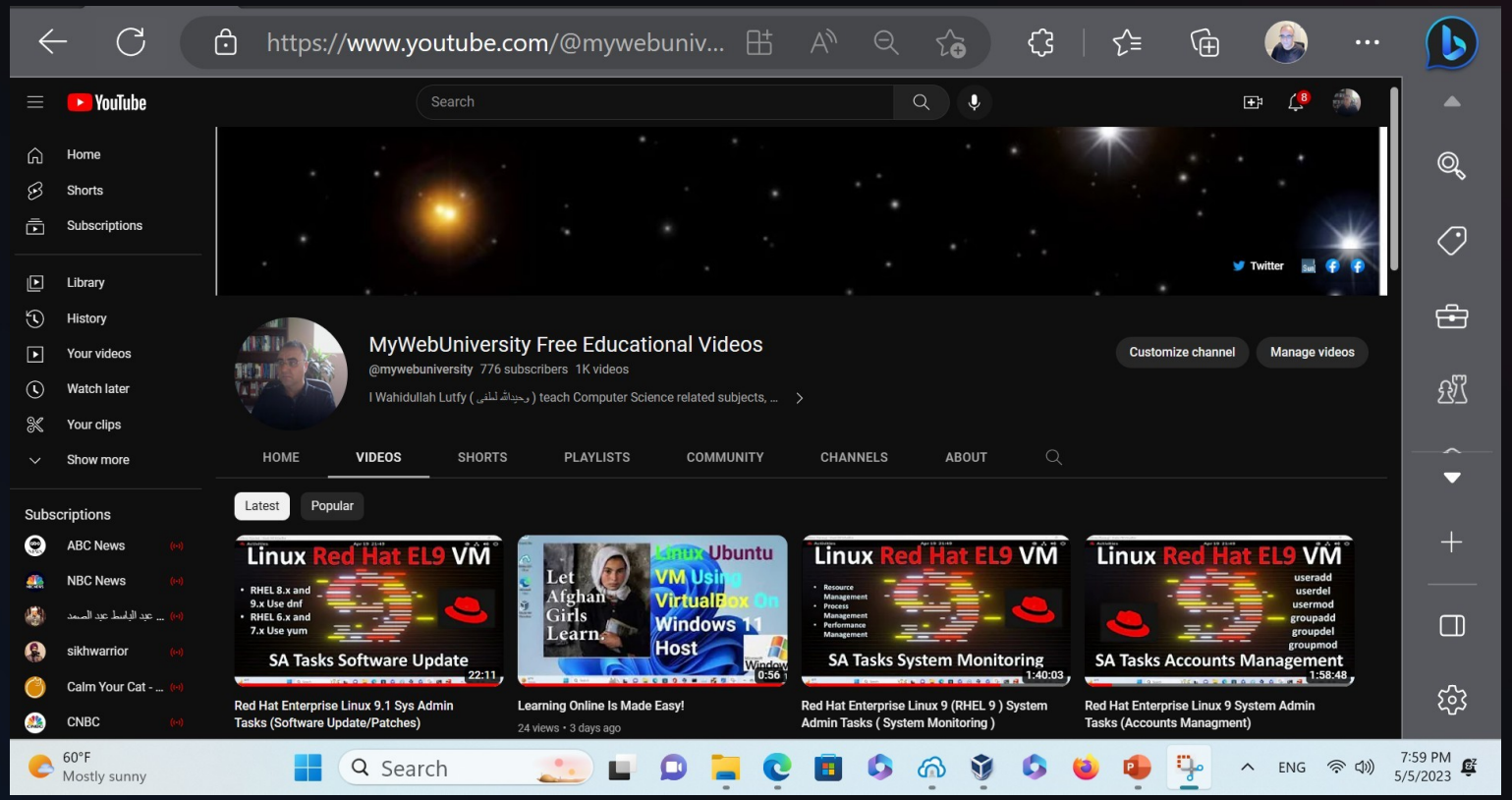
Same core skills

The terminal, files, permissions and processes work the same everywhere.



NEXT STEPS

Keep Learning: Book & YouTube Channel



YouTube.com/@MyWebUniversity

Red Hat system administration tasks, Linux, programming and more.

MyWebUniversity.com

The Direct Path to Linux Ubuntu, and thousands of free lessons and PDFs.

Next Steps

Practice

Use your VM every day. Repeat the commands until they feel natural.

Docs

Learn to read man pages and --help. Example: man chmod.

Confidence

Break things on purpose in your VM, then fix them. That is how experts are made.



A FINAL THOUGHT

What Is the Catch for Doing It for Free?

The catch

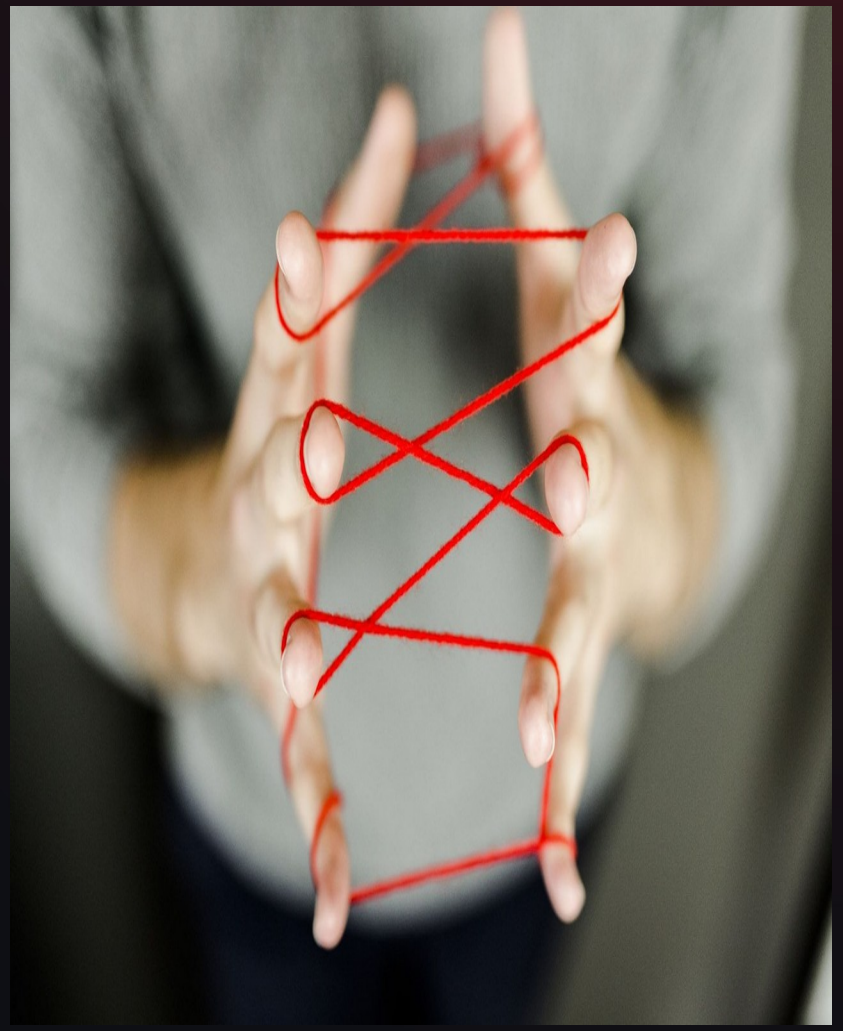
Pass your knowledge on to others.

Teach someone

Help a friend, a classmate or a colleague learn what you learned today.

By sharing, you care

Learning never stops. Every drop makes a river.



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Linux Red Hat EL9 VM



THANK YOU FOR WATCHING!