LINUX SERVER

Fundamentals | Administration| Web Server
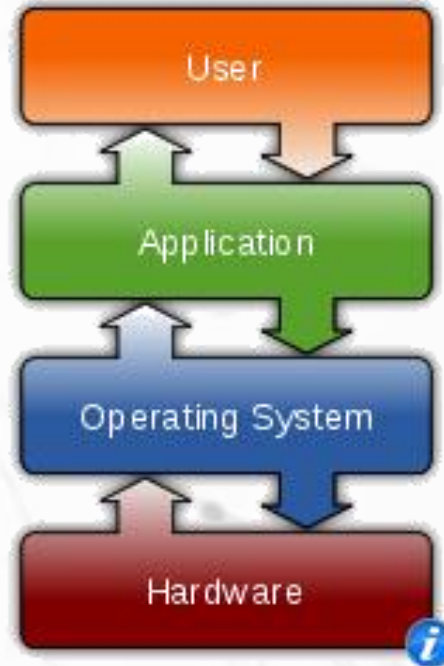
By Dr Nizam

About Linux

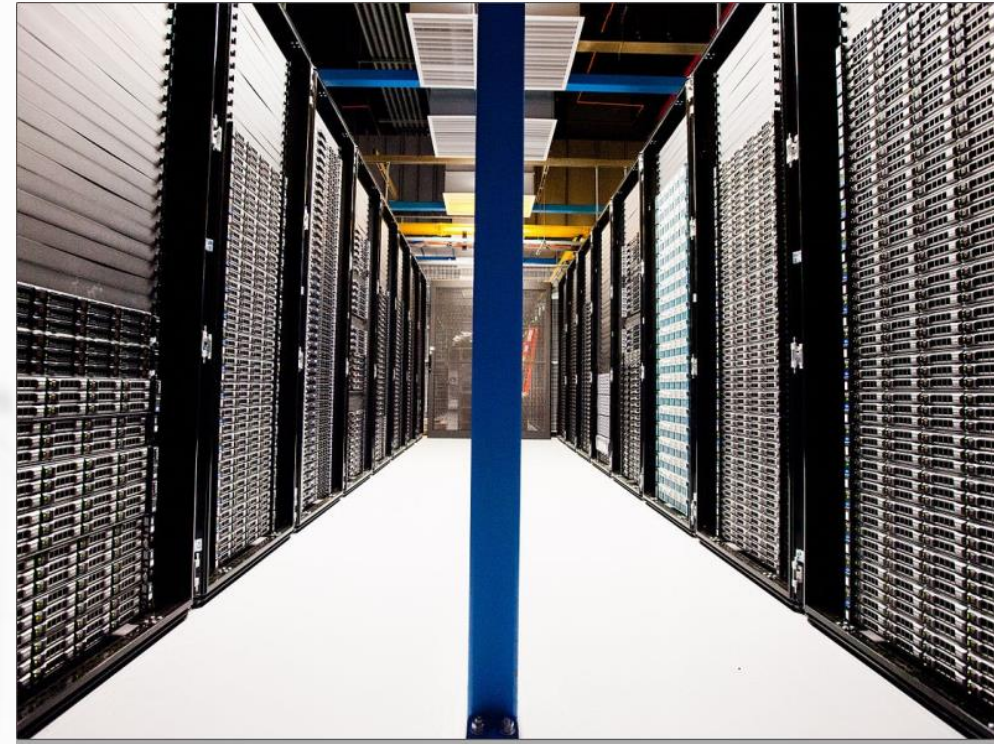## What is Linux?

It's an Operating System

The Most Common O/S Used By ~~BU Researchers~~ When Working on a Server or Computer Cluster

Operating systems

User

Application

Operating System

Hardware

Common features

- Process management
- Interrupts
- Memory management
- File system
- Device drivers
- Networking (TCP/IP, UDP)
- Security (Process/Memory protection)
- I/O

Operating System (OS)

- **Operating System**: Manages activities and resources of a computer.
  - software that acts as an interface between hardware and user
  - provides a layer of abstraction for application developers

- features provided by an operating system:
  - ability to execute programs   (and multi-tasking)
  - memory management   (and virtual memory)
  - file systems, disk and network access
  - an interface to communicate with hardware
  - a user interface   (often graphical)

- **kernel**: The lowest-level core of an operating system.

Story About Linux

- **Linux is a Unix clone** written from scratch by Linus Torvalds with assistance from a loosely-knit team of hackers across the Net.

- Unix is a multitasking, multi-user computer operating system originally developed in 1969 by a group of AT&T employees at Bell Labs.
    - written in a high-level language (C)
    - virtual memory
    - hierarchical file system; "everything" is a file
    - lots of small programs that work together to solve larger problems
    - security, users, access, and groups

- Linux and Unix strive to be POSIX compliant.

- **Over 70%** of the world's servers run some variant of Unix or Linux. The Android phone and the Kindle run Linux.
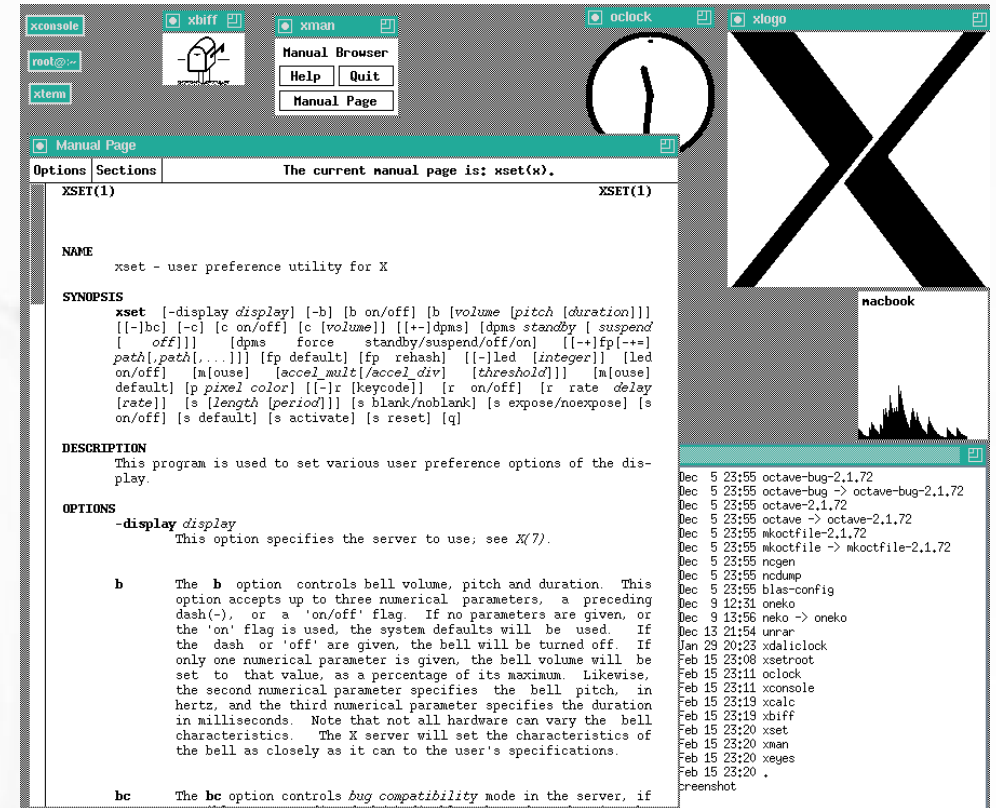
The Founding Father

Linux + GNU Utilities = Free Unix

"GNU's Not Unix!"

- Linux is an O/S core written by Linus Torvalds and others

- a set of small programs written by Richard Stallman and others. They are the GNU utilities.

What is Linux?

- **Linux**: A kernel for a Unix-like operating system.
  - commonly seen/used today in servers, mobile/embedded devices, ...

- **GNU**: A "free software" implementation of many Unix-like tools
  - many GNU tools are distributed with the Linux kernel
  - E.g; date, gcc,

- **distribution**: A pre-packaged set of Linux software.
  - examples: Ubuntu, Fedora

- key features of Linux:
  - **open source software**: source can be downloaded
  - free to use
  - constantly being improved/updated by the community

Linux Has Many Distributions → Distros

Linux Desktop

- X-windows

- window managers

- desktop environments
  - Gnome
  - KDE

Why should I learn to use a shell when GUIs exist?

Linux Shell

- **shell**: An interactive program/interpreter that uses user input to manage the execution of other programs.
  - A command processor, typically runs in a text window.
  - User types commands, the shell runs the commands
  - Several different shell programs exist:
    - `bash` : the default shell program on most Linux/Unix systems

206.189.80.102

QUIZ!

Session 1

Why use a shell?

- Why should I learn to use a shell when GUIs exist?
  - faster
  - work remotely
  - programmable
  - customizable
  - repeatable
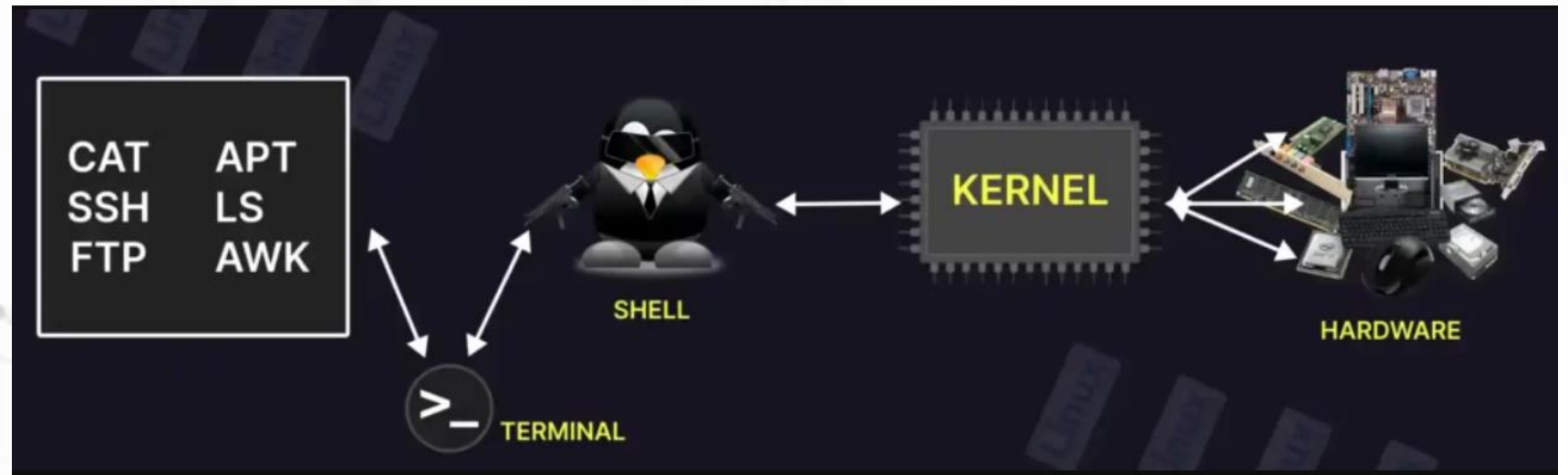
The shell is not all about commands!

Shell is divided into two categories:

- Command-Line Shell

- Graphical Shell
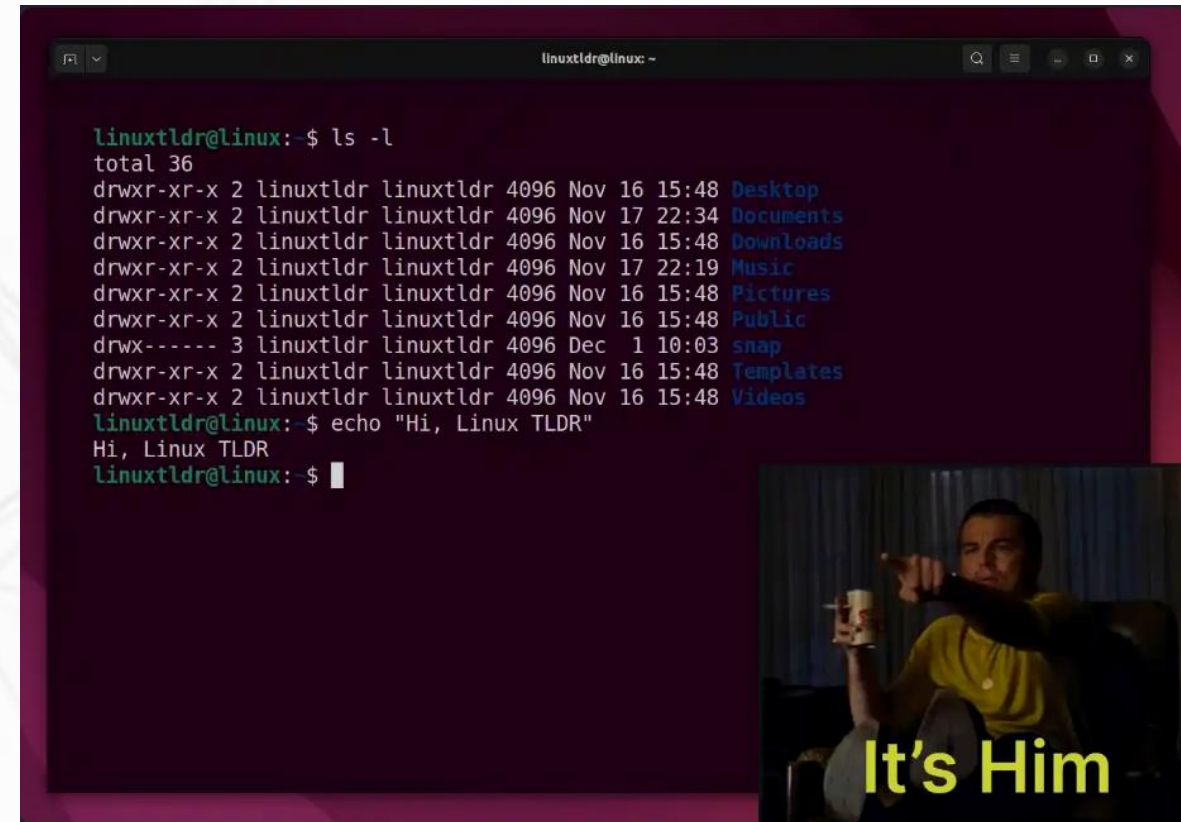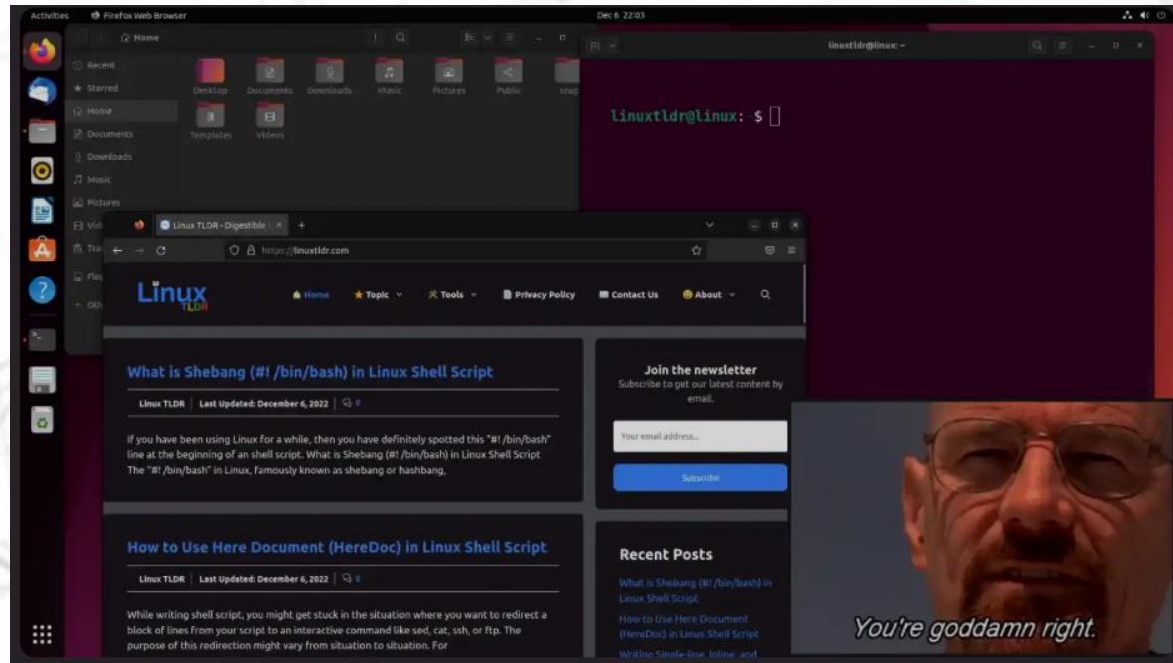
Shell commands

command	description
exit	logs out of the shell
ls	lists files in a directory
pwd	**p**rint the current **w**orking **d**irectory
cd	**c**hanges the working **d**irectory
man	brings up the manual for a command

```
$ pwd
/homes/iws/rea
$ cd CSE391
$ ls
file1.txt file2.txt
$ ls -l
-rw-r--r-- 1 rea      fac_cs 0 2016-03-29 17:45 file1.txt
-rw-r--r-- 1 rea      fac_cs 0 2016-03-29 17:45 file2.txt
$ cd ..
$ man ls
$ exit
```
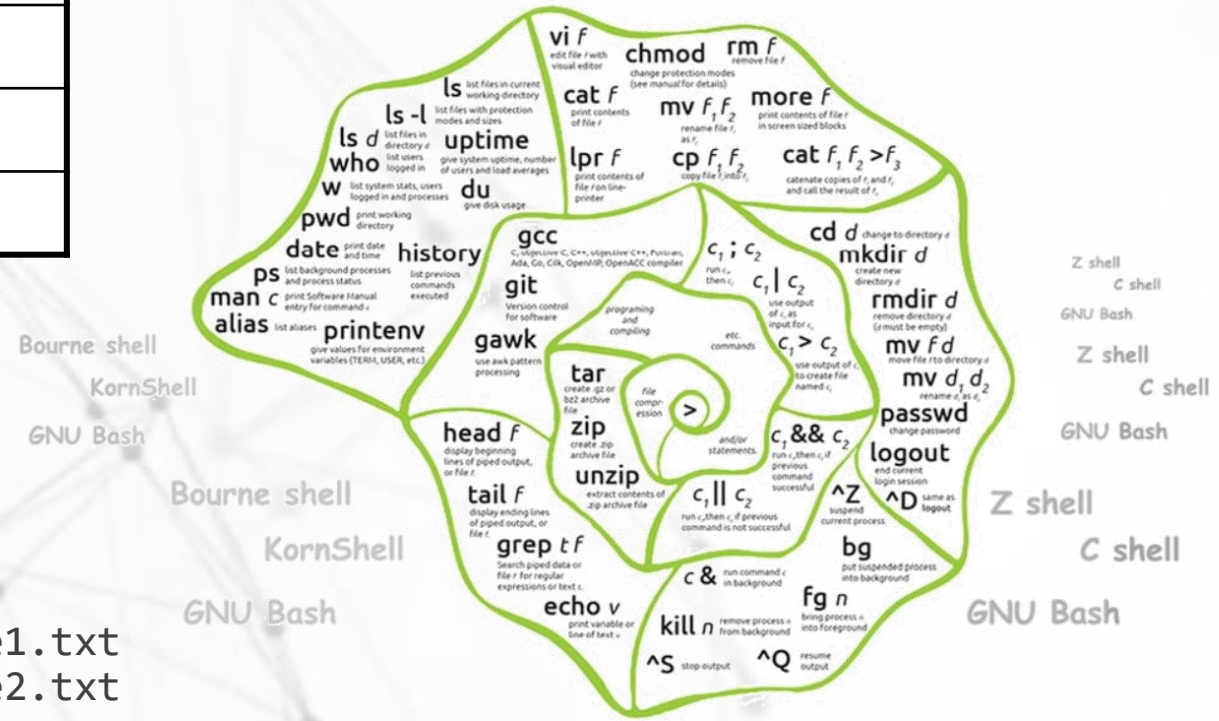
Tools to Execute Shell Via CLI
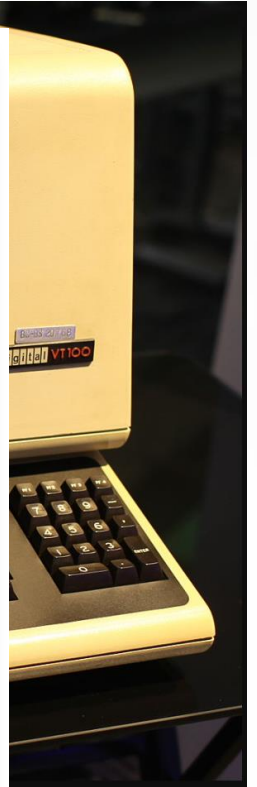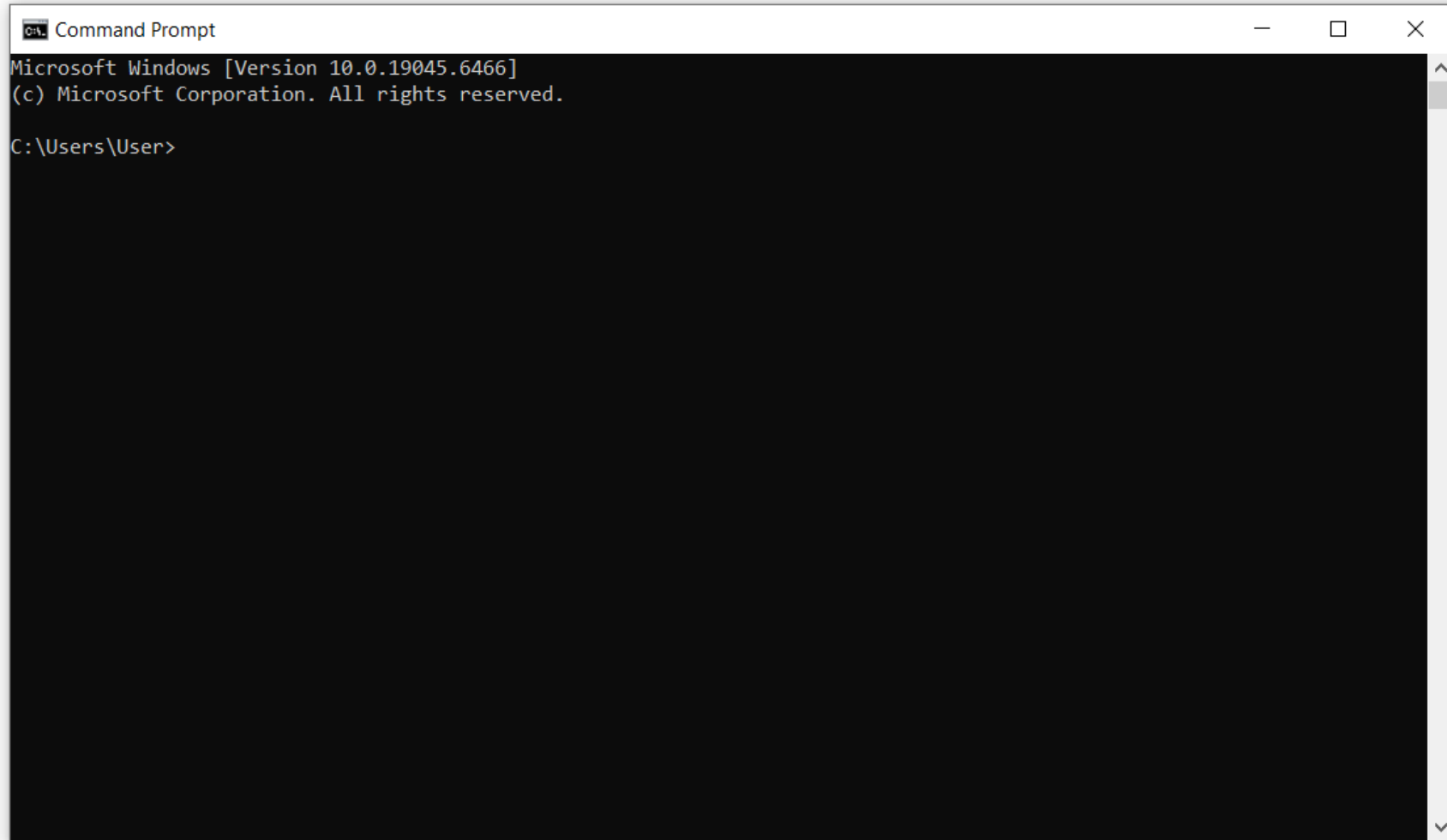
What is SSH?

- SSH, or **Secure Sh**... **ninistration protocol** that allows users to ... their remote servers over the internet.

- SSH service was ... placement for the unencrypted **Telnet**... niques to ensure that all communication ... erver happens in an encrypted manner.

- It provides a m... g a remote user, transferring inputs ... st, and relaying the output back to the ...

- **The default port fo**...

SSH CLIENT

SSH SERVER

Hello !

y6uW$i

Hello !

Encrypt

Decrypt

Public Key Exchange

What SSH Do?

- **Secure Communication**: A client and a server can communicate securely thanks to SSH. To prevent unwanted access to the data, it encrypts all information sent over the network, including passwords, usernames, and other private data.

- **Authentication**: SSH offers methods for confirming the legitimacy of the client and server. To confirm the parties' identities, it makes use of cryptographic keys. Only authorized users and servers can access the system thanks to this authentication procedure.

- **Data Transfer via Encryption**: SSH encrypts all data transferred between the client and server to prevent bad actors from listening in on it or altering it. The confidentiality and integrity of the data being transferred are guaranteed by this encryption.

- **Remote Access**: SSH is primarily used to enable safe remote access to computers, servers, and other resources. With SSH, users can safely run remote commands or access a server's command-line interface from a distance.

- **File Transfer**: SSH facilitates safe file transfers between computers by using programs such as Secure Copy Program (SCP) and SSH File Transfer Protocol (SFTP). With the help of these tools, users can safely move data between two remote servers or between a local computer and a distant server.

- **Tunneling**: The ability to build secure channels for the transmission of other network protocols over SSH is made possible by the functionality for tunneling provided by SSH. Services that might not be immediately accessible via the network, such as web servers, databases, and email servers, can now be accessed securely thanks to this capability.

The Linux File System

- The *Nix (Unix or Linux) file system is a hierarchical directory structure

- The structure resembles an upside down tree

- Directories are collections of files and other directories. The structure is recursive with many levels.

- Every directory has a parent except for the root directory.

- Many directories have children directories.

- Unlike Windows, with multiple drives and multiple file systems, a *Nix system only has ONE file system.

- The Linux Standard Base (LSB) specifies the structure of a Linux file system.
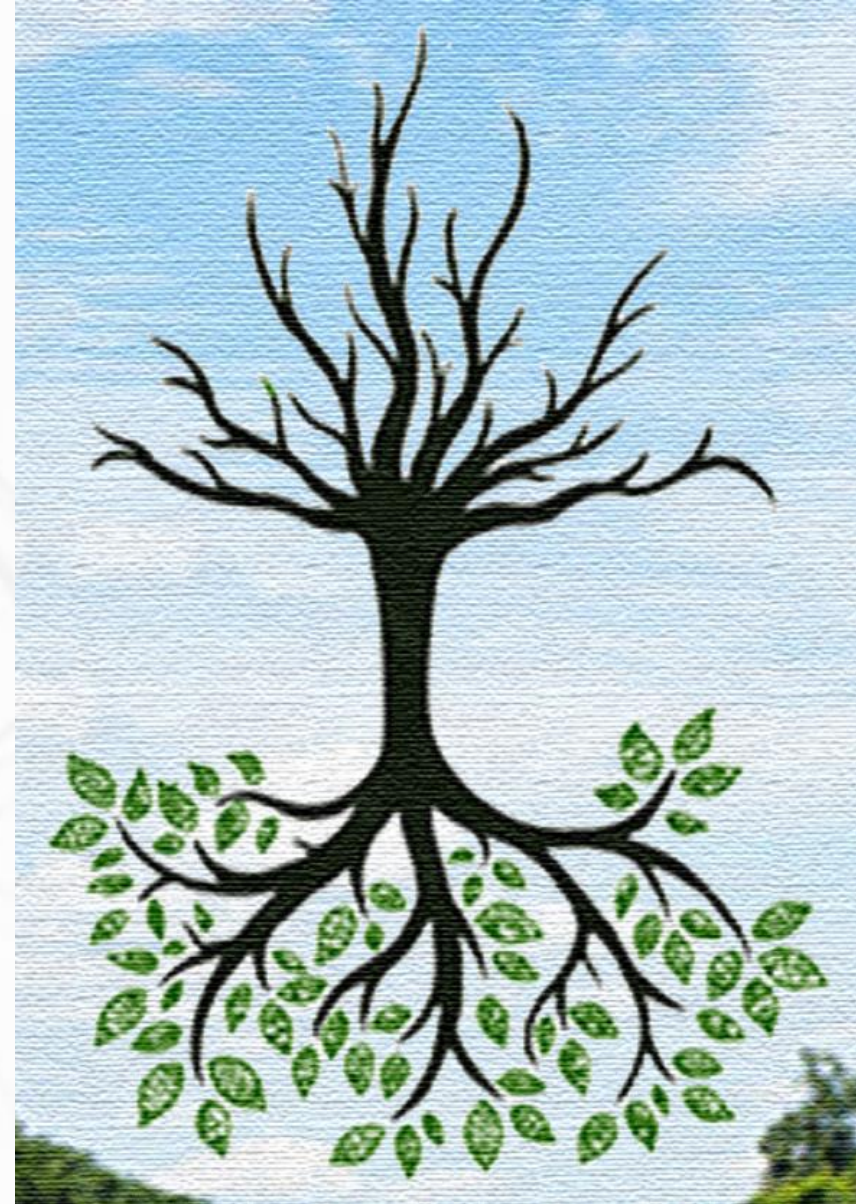
File System & Directory Structure
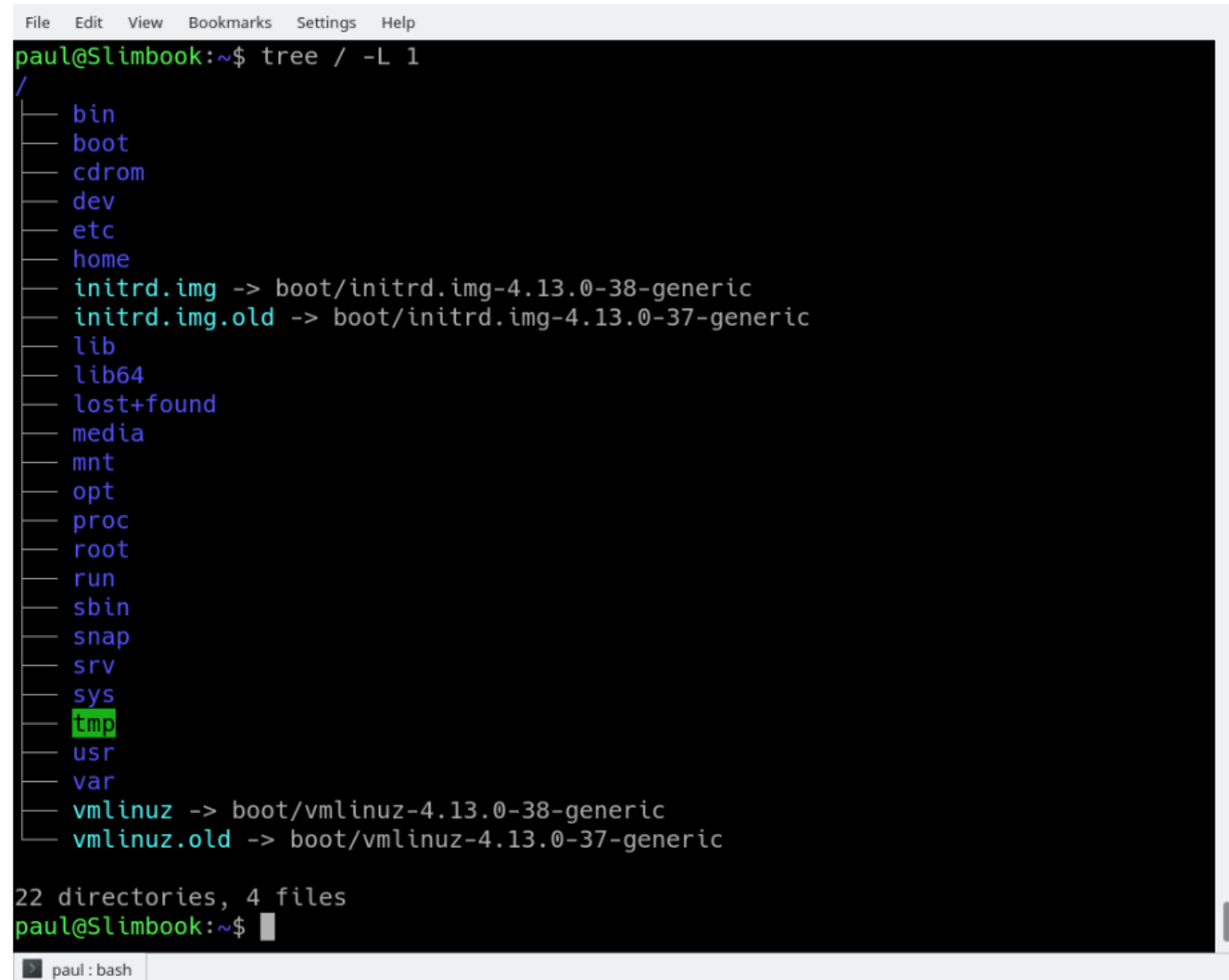
Figure 1. / (root) File System Tree. This tree chart shows a directory structure with the / (root) file system at the top, branching downward to directories and file systems. Directories branch to /bin, /dev, /etc, and /lib. File systems branch to /usr, /tmp, /var, and /home.
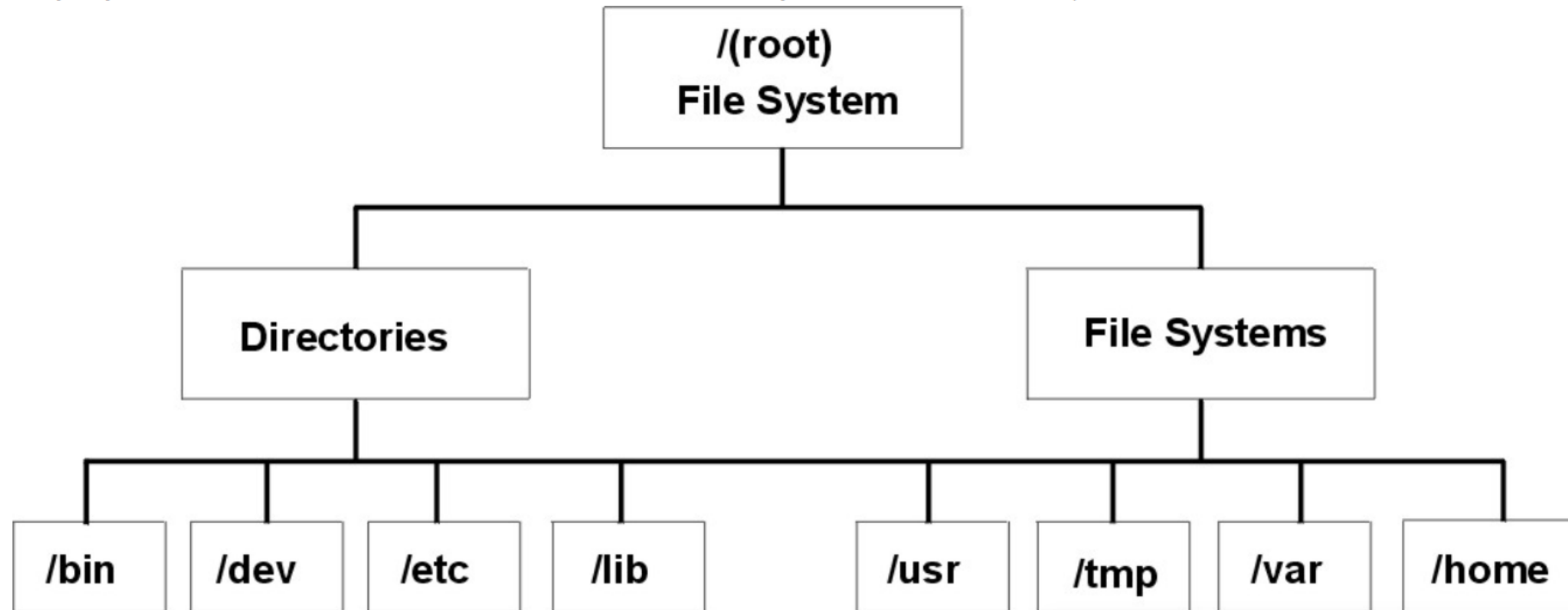
The directories on the right (/usr, /tmp, /var, and /home) are all file systems so they have separate sections of the hard disk allocated for their use. These file systems are mounted automatically when the system is started, so the end user does not see the difference between these file systems and the directories listed on the left (/bin, /dev, /etc, and /lib).

```
tree -L 1 /
```

And you should see what is shown in Figure 1.

```
File   Edit   View   Bookmarks   Settings   Help
paul@Slimbook:~$ tree / -L 1
/
├── bin
├── boot
├── cdrom
├── dev
├── etc
├── home
├── initrd.img -> boot/initrd.img-4.13.0-38-generic
├── initrd.img.old -> boot/initrd.img-4.13.0-37-generic
├── lib
├── lib64
├── lost+found
├── media
├── mnt
├── opt
├── proc
├── root
├── run
├── sbin
├── snap
├── srv
├── sys
├── tmp
├── usr
├── var
├── vmlinuz -> boot/vmlinuz-4.13.0-38-generic
└── vmlinuz.old -> boot/vmlinuz-4.13.0-37-generic

22 directories, 4 files
paul@Slimbook:~$
```
```
paul : bash
```

206.189.80.102

QUIZ!

Session 2

Linux Installation

Server Editions/Virtual Machine

Download – Virtualization Tools

https://www.virtualbox.org/
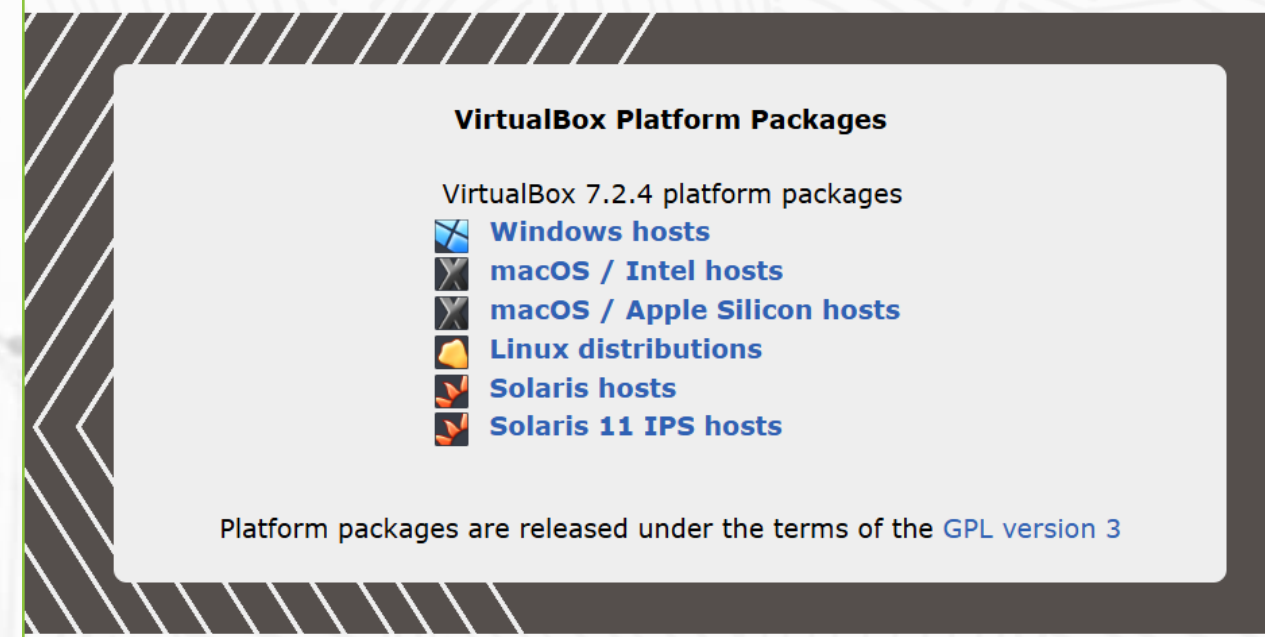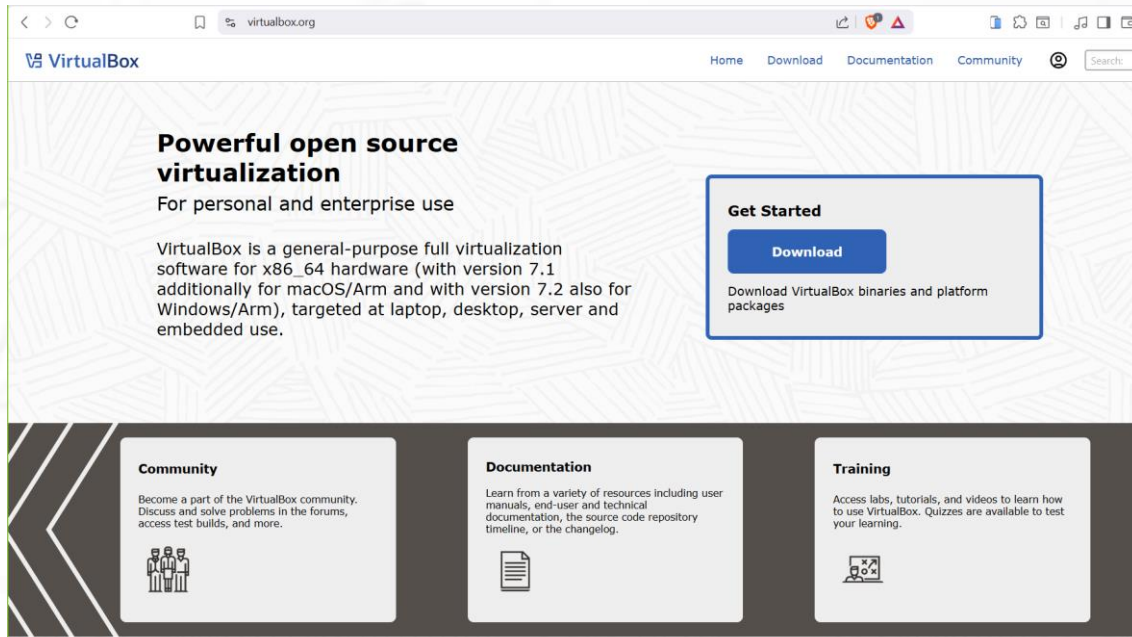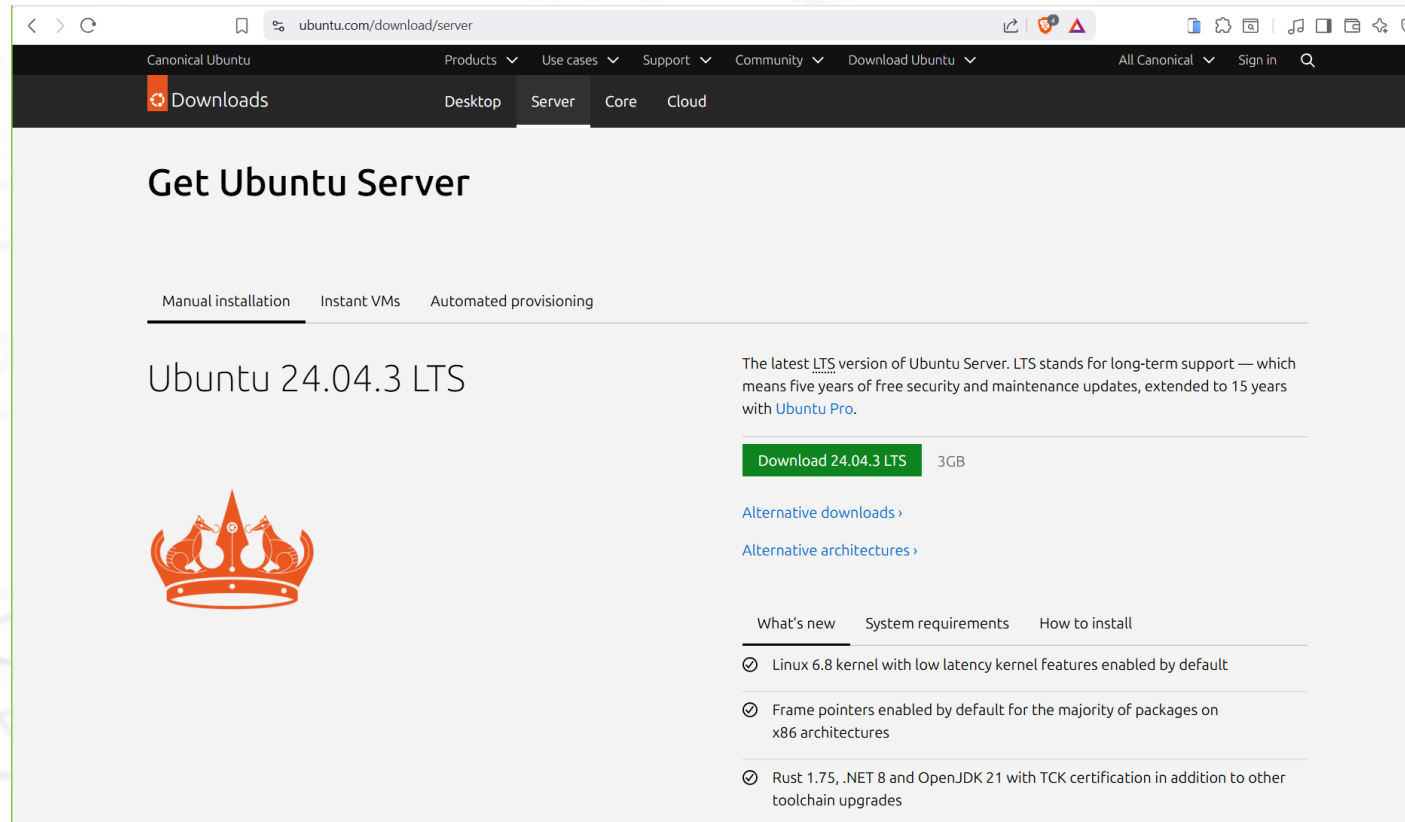
Install – Virtualization Tools
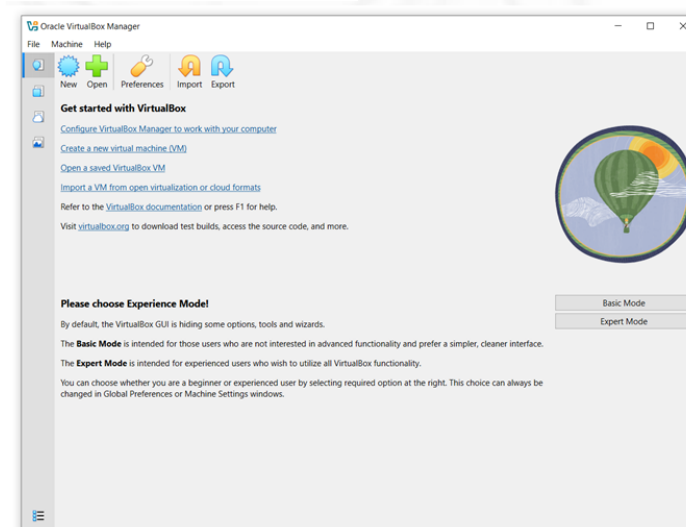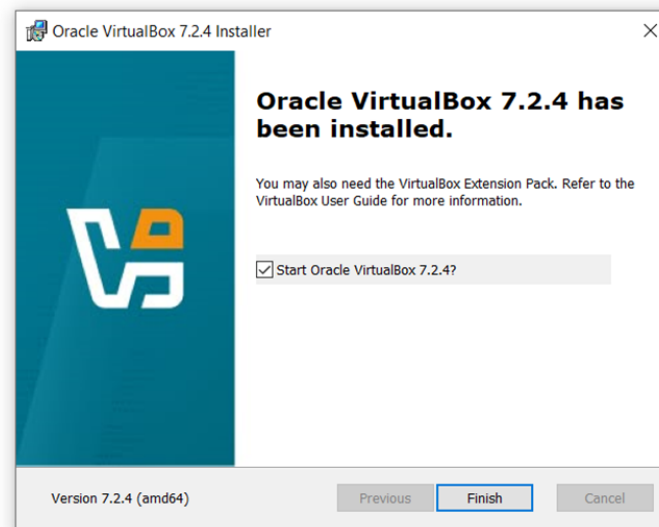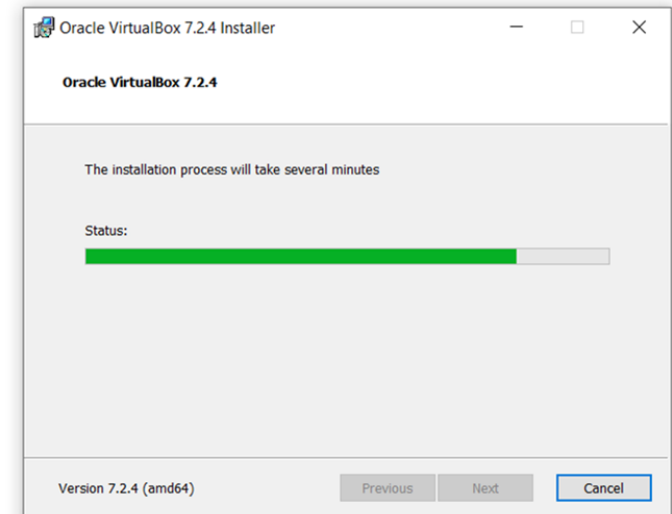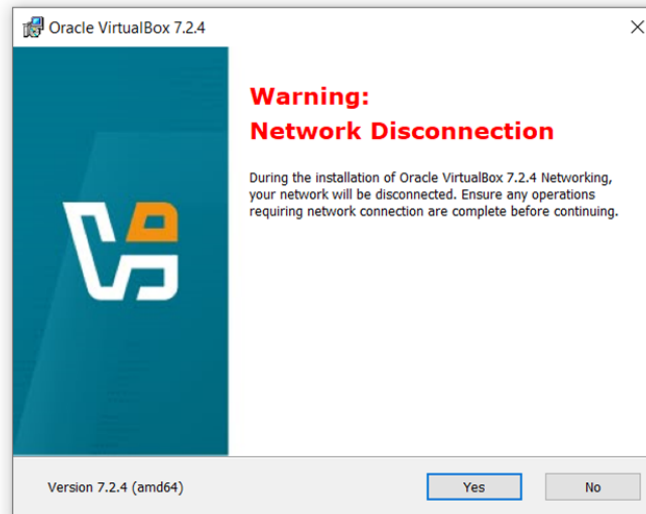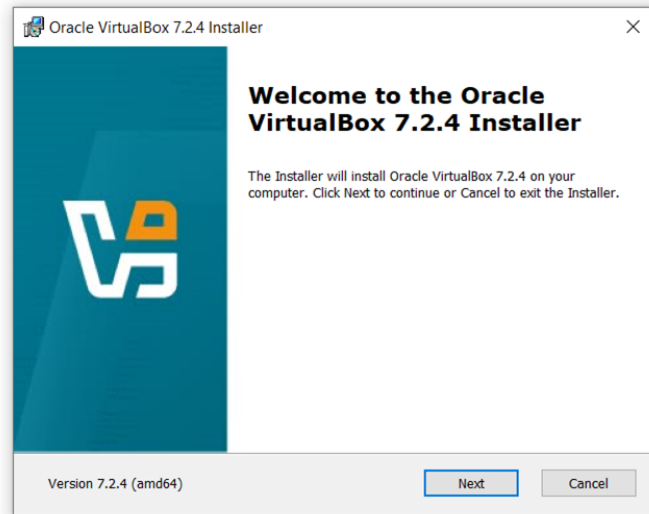
Download – Linux OS (Ubuntu Server 24.04.3 LTS)

https://ubuntu.com/download/server

Install Linux on a physical blade server via USB drive
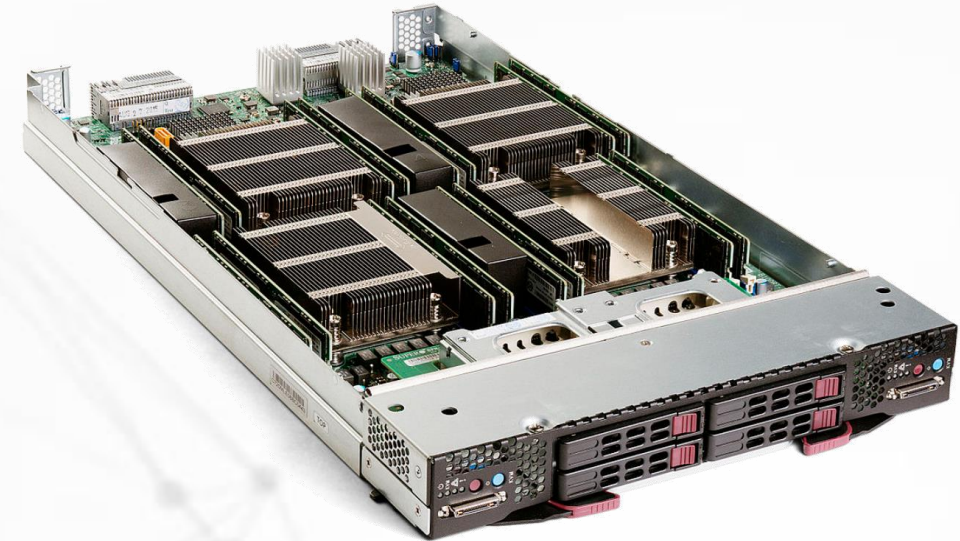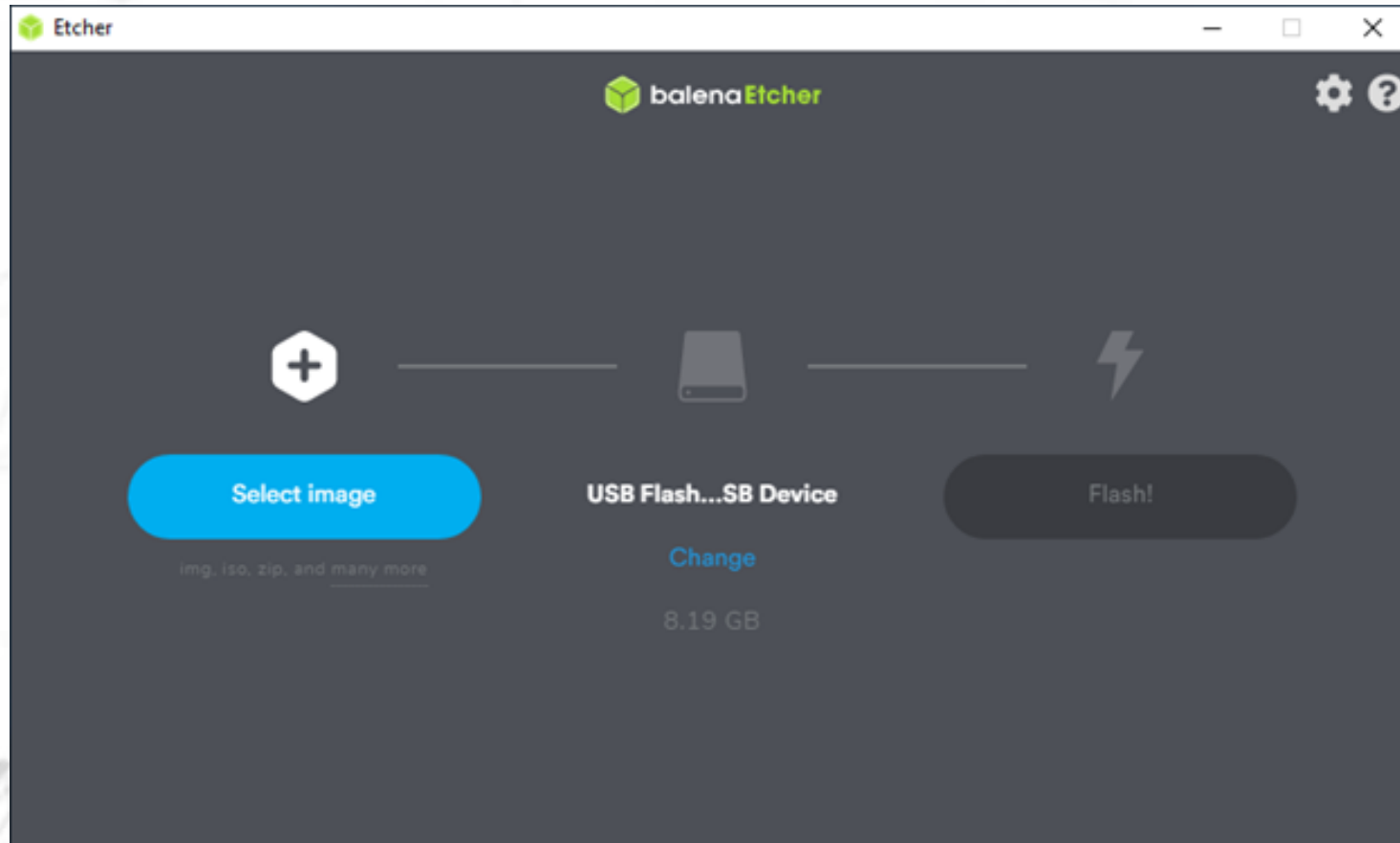
https://etcher.balena.io/

Build your own VM!

Virtual Machine – Oracle VirtualBox

Install Ubuntu on Virtual Machine
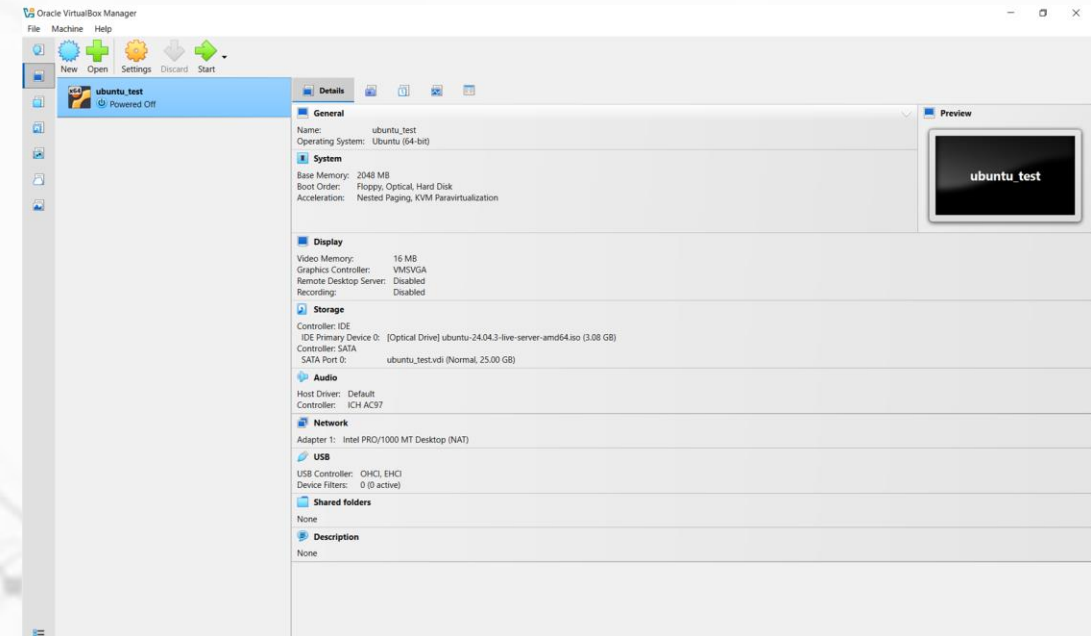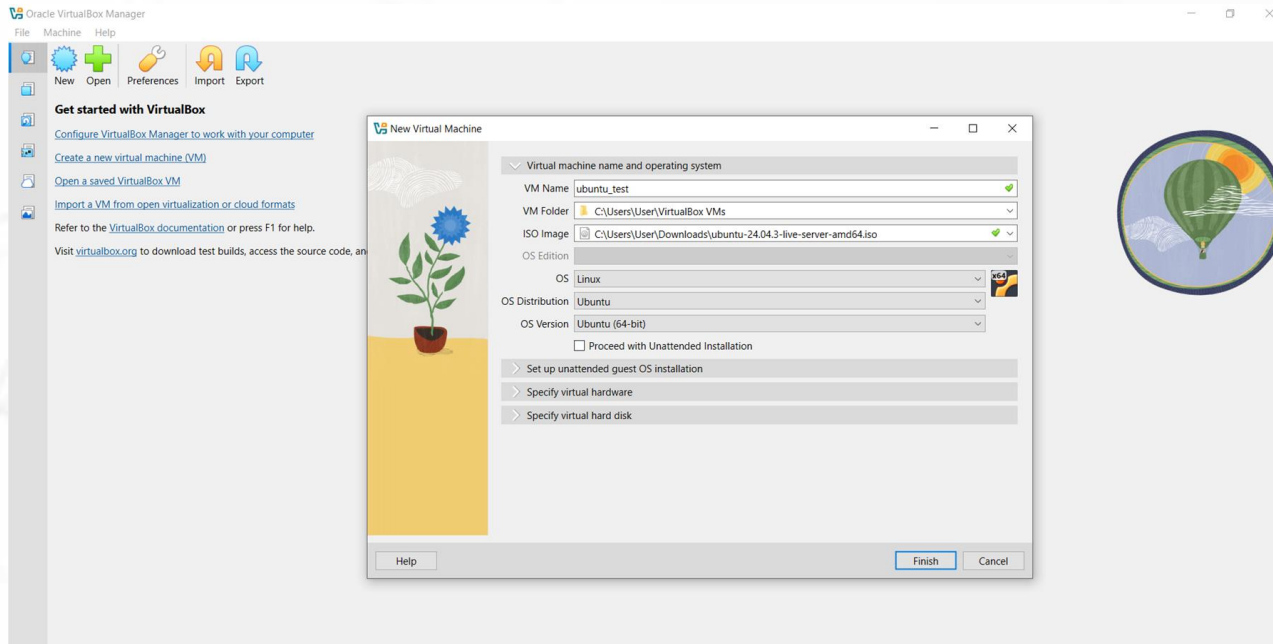
Configure – Hardware, Storage & Network
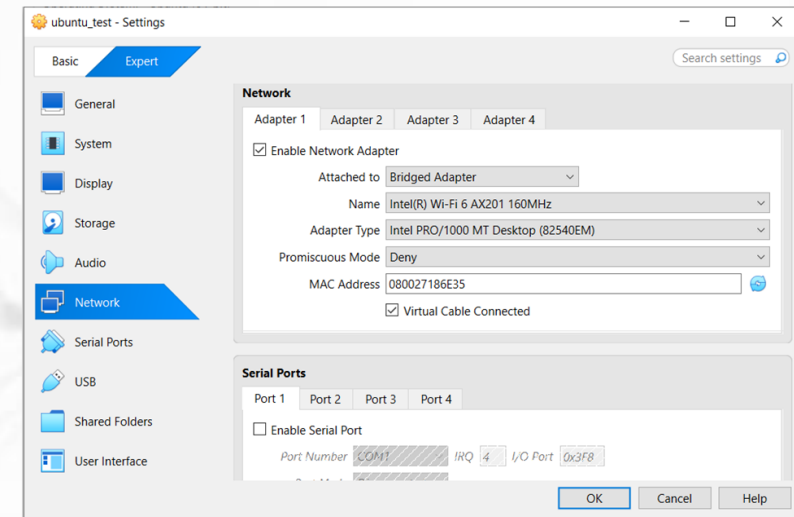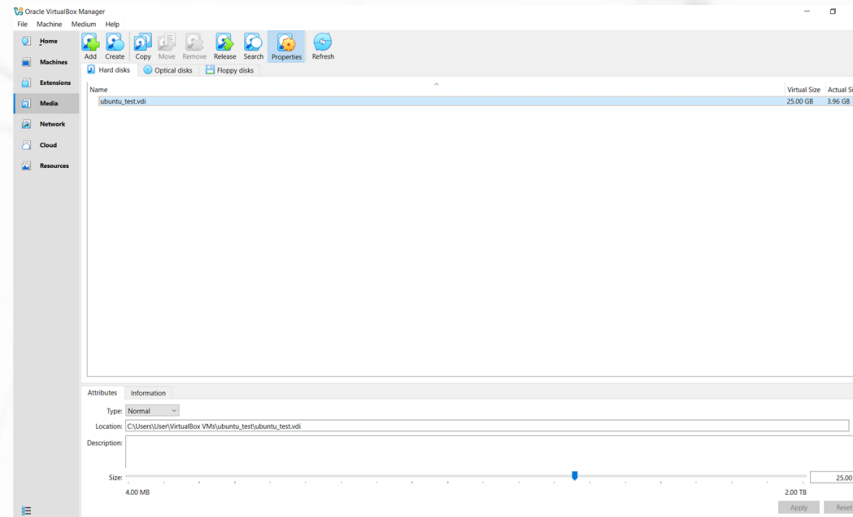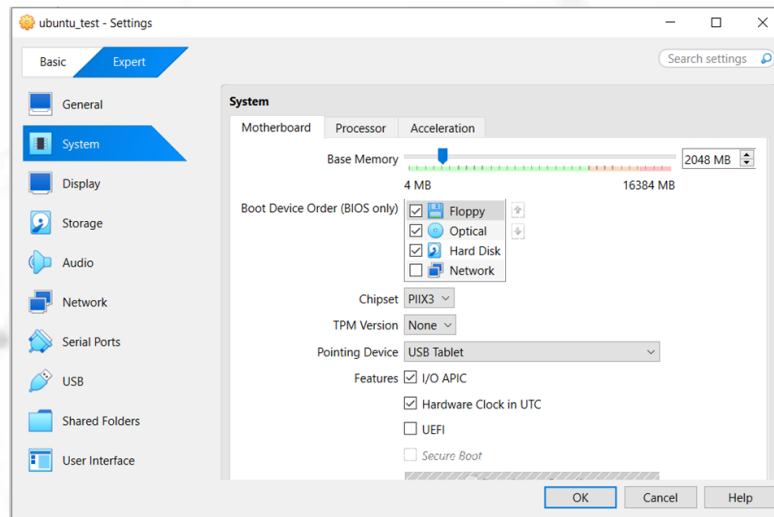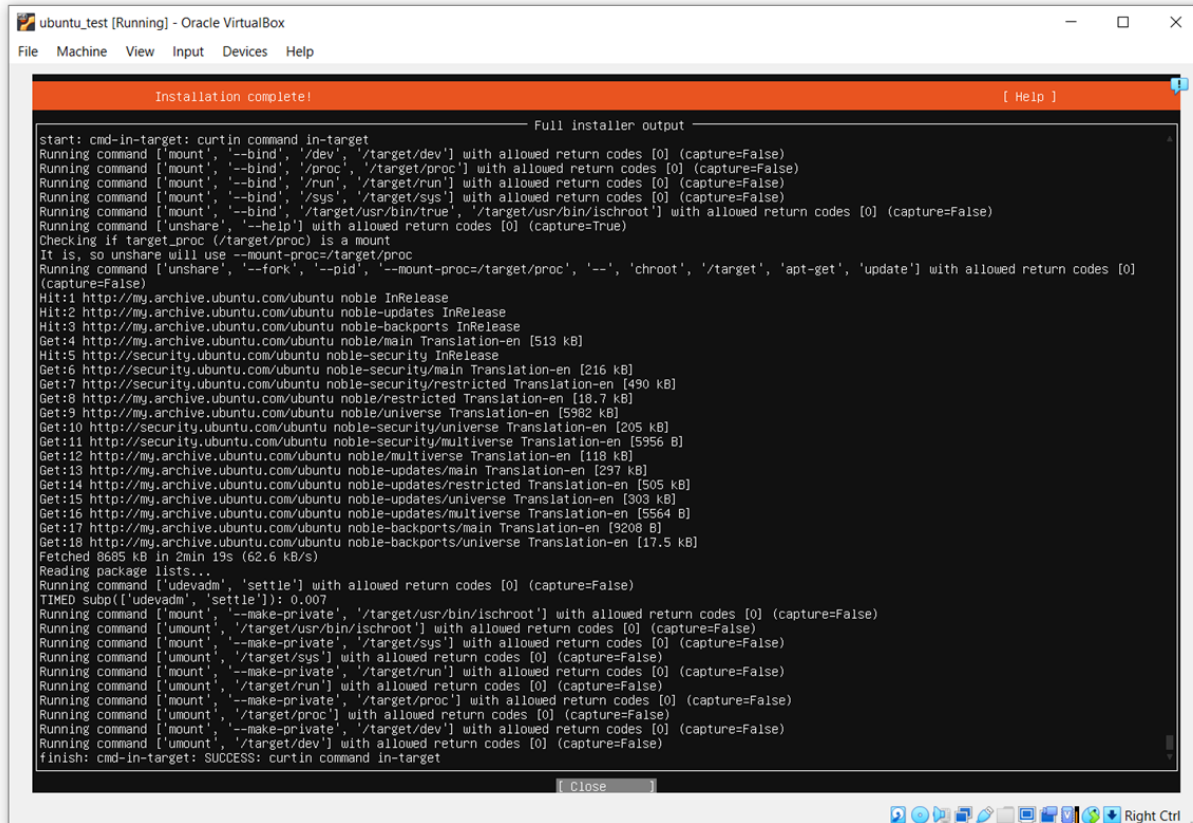
Start!
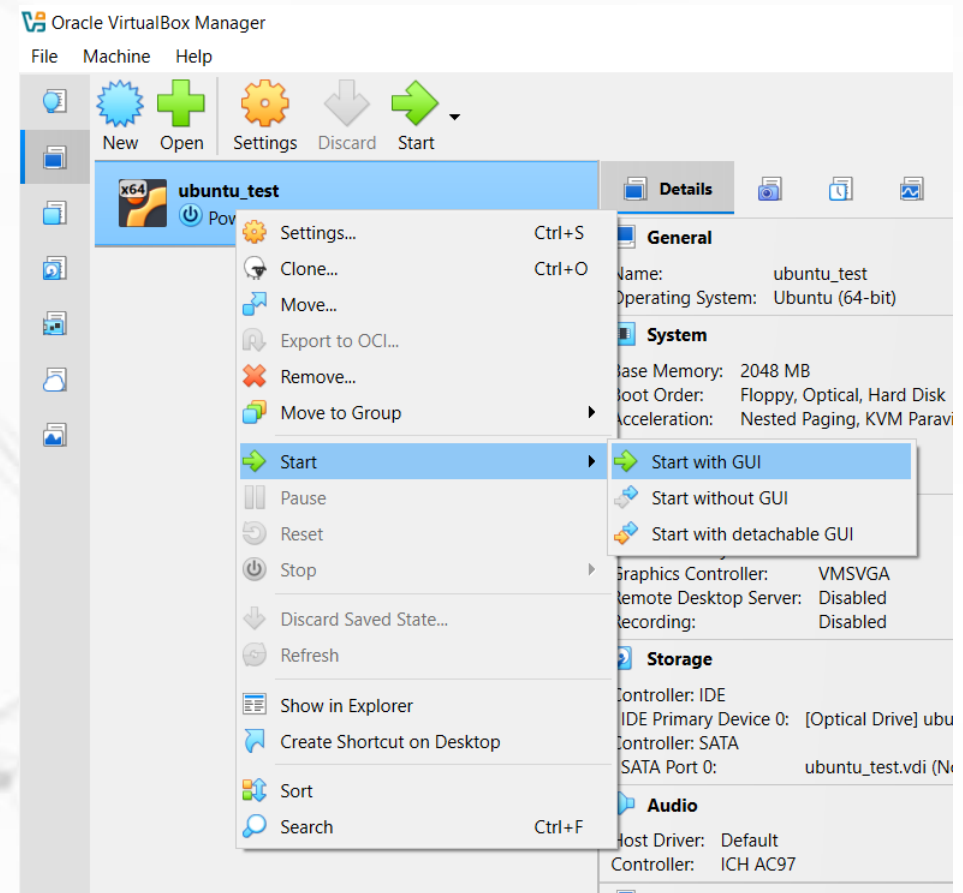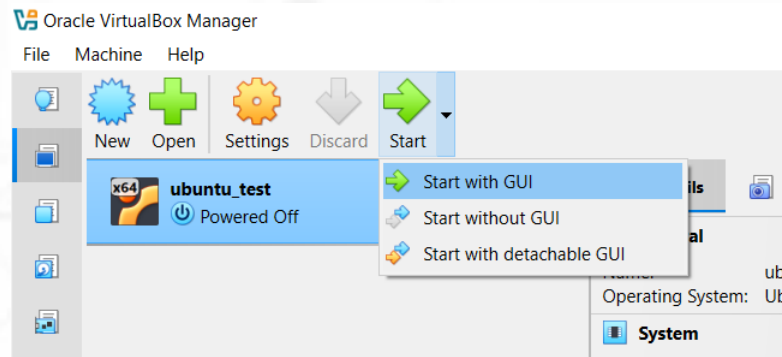
Installation step…
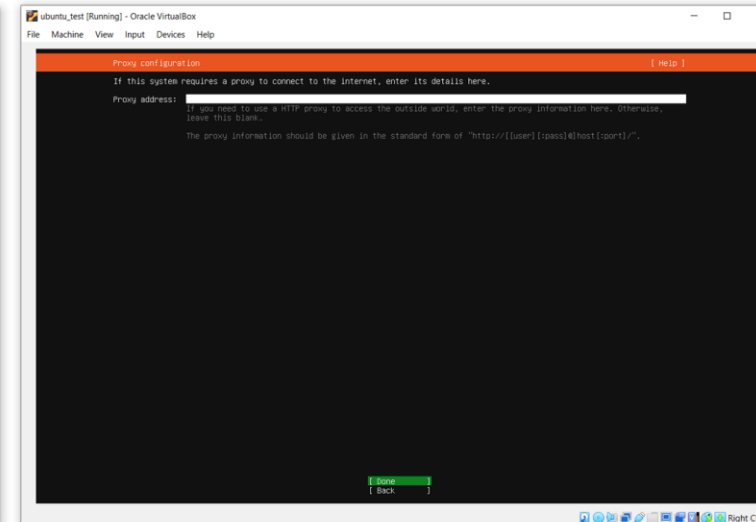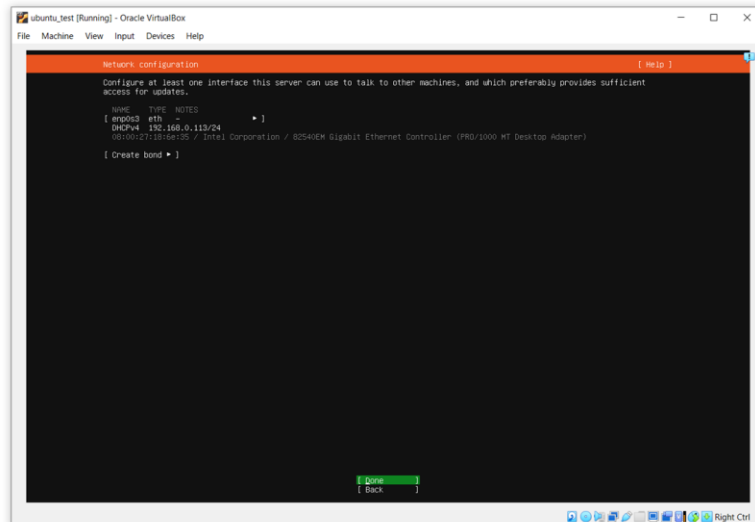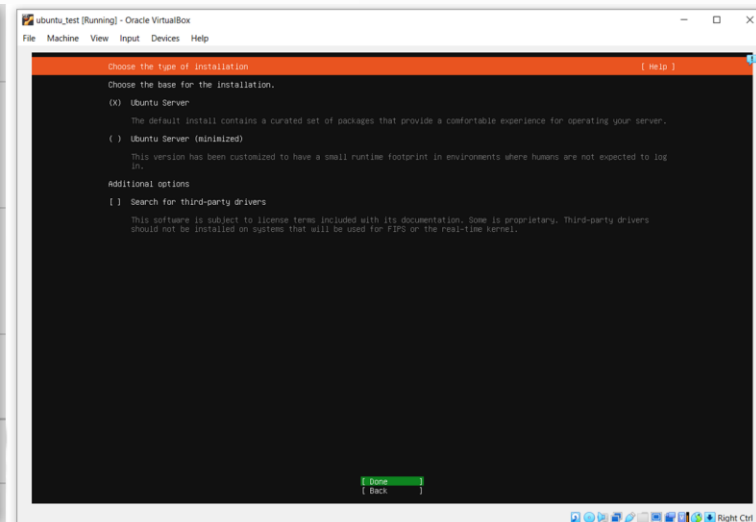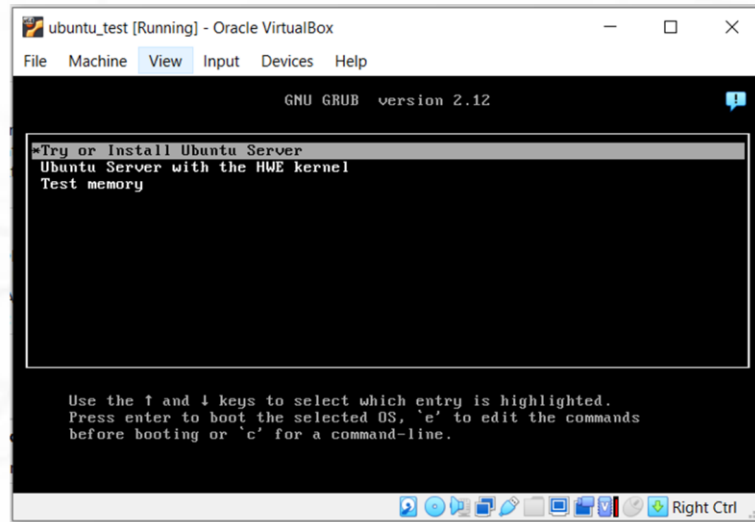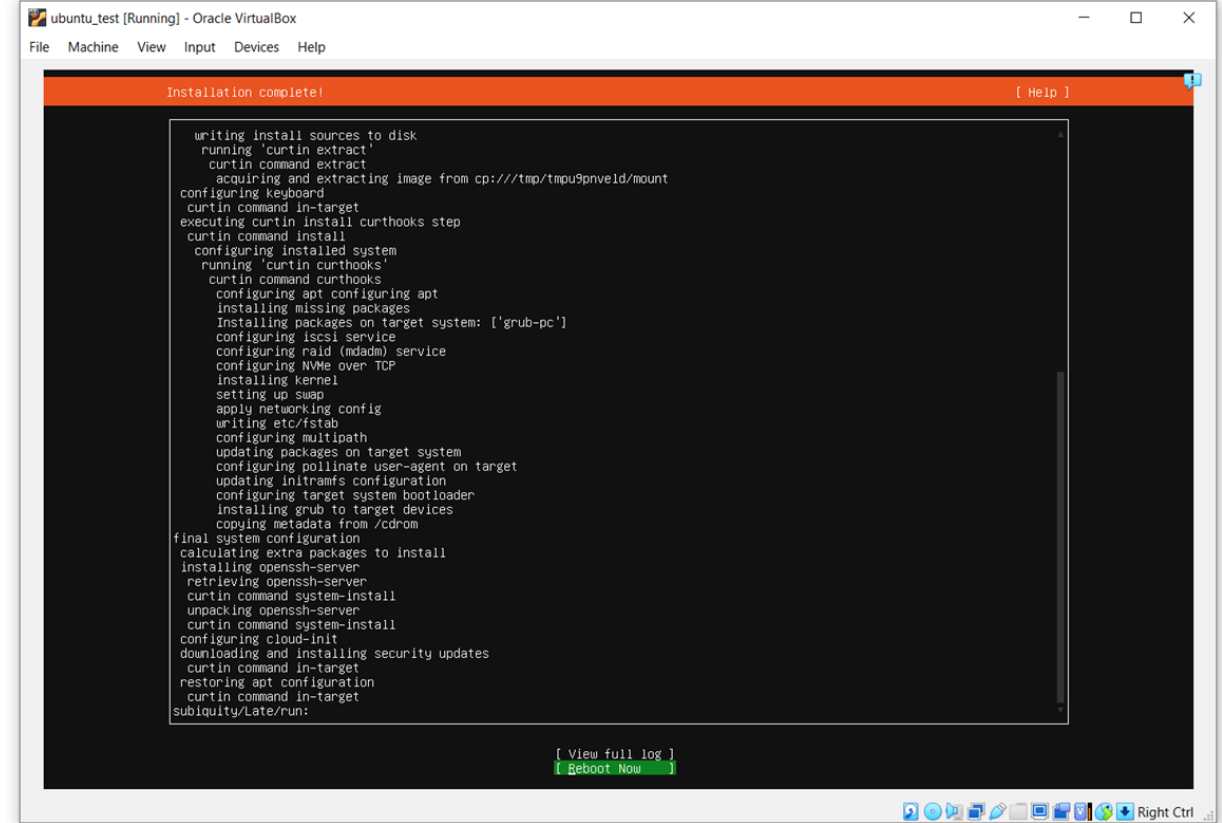
Installation complete!

Reboot!

Just press 'ENTER'

Just press 'ENTER'

Login

Success!

SSH to your….
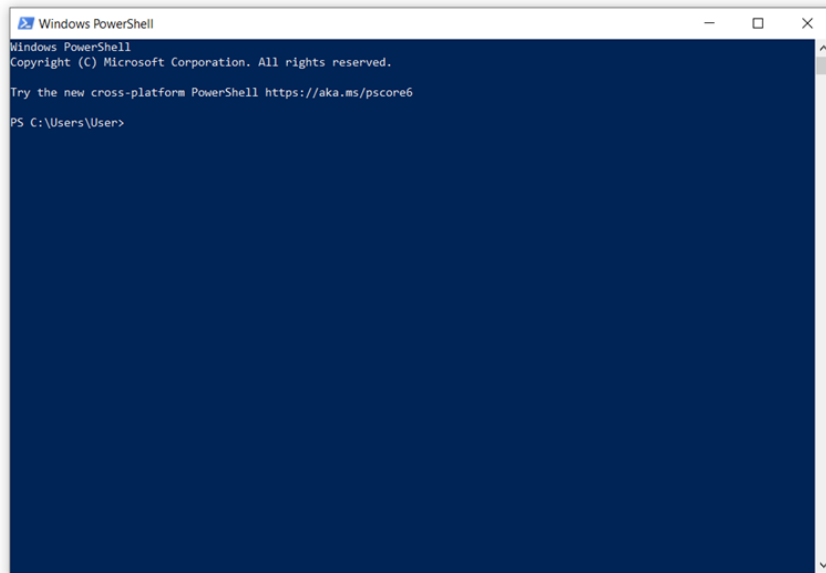
Virtual Machine | Server
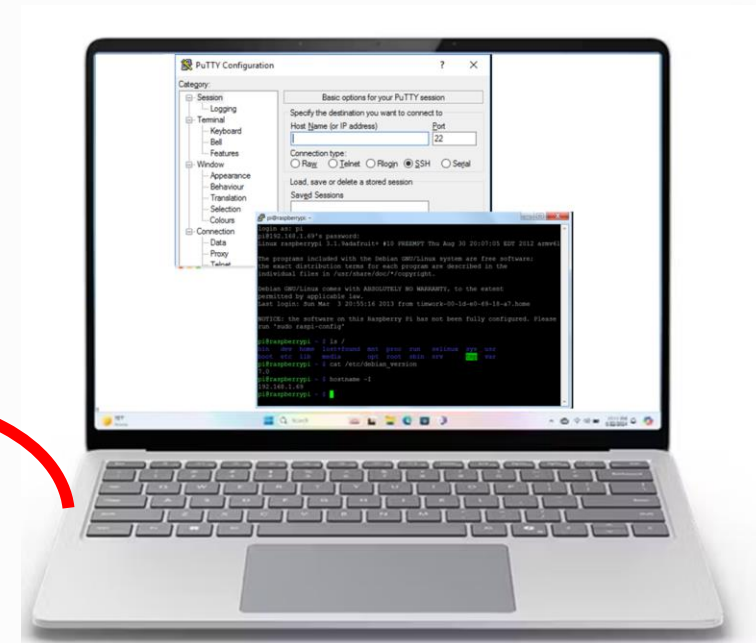
3 Famous tools

PowerShell   **Putty**   **MobaXterm**