LINUX ADMINISTRATION

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➢ OPERATING SYSTEM:

- An operating system is the software that directly manages a system's hardware and resources, like CPU, memory, and storage.
- Operating System acts as a communication bridge (interface) between the **user** and **computer h/w.**
- The OS sits between applications and hardware and makes the connections between all of your software and the physical resources that do the work.
- It is classified into **two types:**
  - GUI (Graphical User Interfaces)
  - CLI (Command Line Interfaces)

GRAPHICAL USER INTERFACE (GUI):

- GUI is a User-friendly Operating System.
- It is a type of user interface through which users interact with electronic devices via visual indicator representations.
- It uses icons, menus and a mouse (to click on the icon or pull down the menus) to manage interaction with the system.

COMMAND LINE INTERFACE (CLI):

- CLI is a text-based interface, it means non-user-friendly OS.
- CLI permits users to put in writing commands associate degree exceedingly in terminal or console window to interact with an operating system.
- It consumes low memory and faster than GUI.

FUNCTIONS OF OS:

- Security
- Error Detection
- Job Controlling
- Memory Management
- Process Management
- Device Management
- File Management

➢ WHAT IS LINUX:

- Linux is an **Open-Source Operating System** (OS) and **IT Infrastructure Platform**.
- It was developed by **Linus Torvalds** in 1991. First version released in 1994.
- Linux include Kernel, System User Space, and Applications.
- The heart of the OS is the **Linux Kernel**.
- The User space consists of all processes running outside the kernel. This includes the shell, daemons, processes.
- Linux can be used as a **Server** or a **Desktop**.

OPEN SOURCE:

- Linux is a free and released under the **GNU General Public License (GPL).**
- It means anyone can run, study, share, and modify the software. The modified code can also be redistributed, and even sold, but must be done so under the same license.
- The **Lesser Public License** is a free software license published by the **Free Software Foundation (FSF).**

WHY LINUX IS BETTER:

- Linux Protects your computer
- Freedom!
- Enjoy Free and Unlimited Support
- Don’t Pay $100 for your OS
- Annoying crashes & Reboots
- Too many Windows? Use Workspaces
- Pre-installed Powerful Tools
- Privacy
- Portability
- Hardware Support
- System Performance
- Free source Code

LINUX IN CLOUD:

- Sharing resources through hardwired connections is quickly being replaced with a delivery method that provides infrastructure, services, platforms, and applications on demand, across networks.
- Cloud computing is an act - the function of running a workload in a cloud.
- Clouds are environments - places where applications run.
- When it comes to Cloud, even on **Microsoft's Azure**, more than **60%** of the images are **Linux-based**.
- **AWS, GCP** & **Oracle** Platform offer up multiple distributions of Linux in their publicly available images.

LINUX INNOVATION:

- Web 2.0 built on top of Linux.
- The Cloud revolution was founded on Linux.
- Big data solutions, software-based storage appliances, Microservices, Containerized applications and software enabled networking are Linux based.
- The innovations of the future will be built using Linux.

LINUX FUTURE EXTENSIBILITY:

- Linux continues to be the operating system of the future, with more and more systems depending on its **Stability** and **Extensibility**.

LINUX DISTRIBUTIONS:

- A Linux distribution, or distro, is an installable operating system built from the **Linux kernel**, supporting **user programs**, and **libraries**. Each vendor or community's version is a distro.
- Different Linux distributions with different goals and criteria for selecting and supporting the software. Simply Linux Kernel plus Additional software.
- Each distribution can have a different focus.

- **Popular Linux Distributions are:**

RED HAT	**CENTOS**
FEDORA	**OEL**
UBUNTU	**LINUX MINT**
OPEN SUSE	**ARCH LINUX**
KALI LINUX	**MANDRIVA**
ANDROID	**GENTOO LINUX**
MX LINUX	**PUPPY LINUX**
SLACKWARE	**SOLUS**

➢ HOW TO CHOOSE A LINUX DISTRO:

- The right Linux distribution depends on your use case and tool requirements.
- Certain Linux distros work better for different purposes.
- Some distros are designed as desktop environments while others are designed to support backend IT systems (like enterprise or web servers).

ENTERPRISE VS. COMMUNITY LINUX DISTROS

COMMUNITY DISTRO:

- A community distro is a free Linux distro primarily supported and maintained by the open-source community.
- A community distro's direction is set by contributors, who choose and maintain packages from the wide variety of open-source options.

ENTERPRISE OR COMMERCIAL:

- Linux distro is available through a subscription from a vendor and does not rely solely on community support.

- The direction of an enterprise distro is set by a vendor, based on the needs of their customers.

BENEFITS:

- Enterprise distros are designed to meet business needs and concerns.
- For Example, Red Hat Enterprise Linux offers 10-year life cycle support, so you can better support long-term apps.
- an enterprise distro, you get patches, updates, upgrades, expert technical support, and access to training and resources.
- A community distro relies on forum-based support from its community members, and release cycles aren't always on a regular cadence.

➢ WHAT IS REDHAT LINUX:

- Red Hat, Inc. is an **American Multinational** software company providing **Open-Source** software products to the enterprise community.
- Founded in 1993, Red Hat has its corporate headquarters in **Raleigh, North Carolina**, with other offices worldwide.

RED HAT POPULARITY:

- **BANKS**
- **AIRLINES**
- **TELECOMS**
- **HEALTHCARE**

➢ WHY RED HAT ENTERPRICE LINUX (RHEL):

- RHEL is the world's leading enterprise Linux platform. It's an open-source Operating System (OS).
- Long-term support is an important feature.
- Vendors engage with Red Hat to ensure that RHEL can use the latest hardware and their software.
- It's the foundation from which you can scale existing apps—and roll out emerging technologies—across bare-metal, virtual, container, and all types of cloud environments.

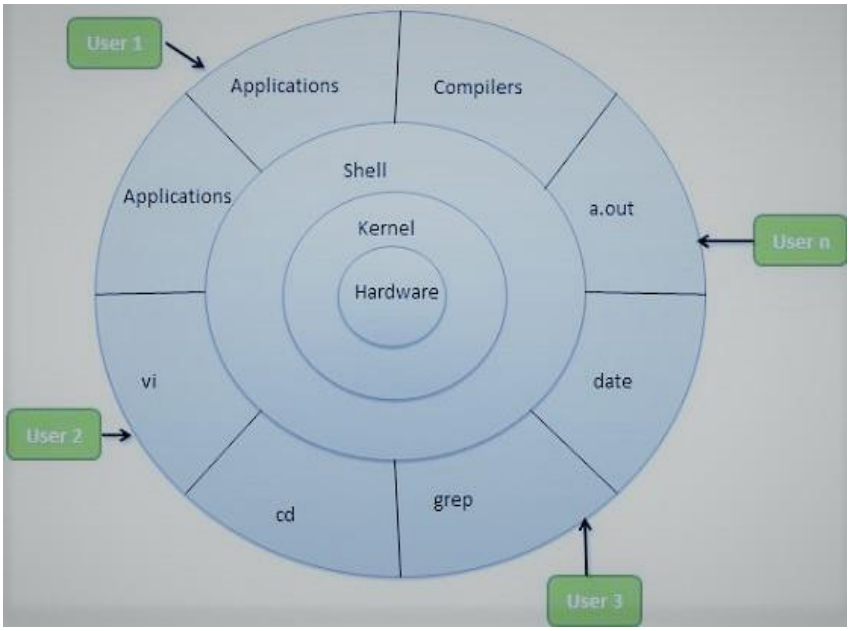
SUBSCRIPTION: You're paying for Expertise, Commitment, Assistance, and Engagement. Not the software License.

RED HAT ENTERPRICE LINUX (RHEL 9):

- Modern IT is Hybrid IT. But turning a sprawling ecosystem into a true hybrid environment requires an intelligent OS that makes those things possible. That OS is Red Hat Enterprise Linux 9.
- Traditional datacenters to public cloud services—into a true hybrid environment requires a few things. Scaling as needed. Moving workloads seamlessly. Developing and managing applications that run anywhere. There's an operating system that makes those things possible.
- Any Cloud and any workload only one OS is RHEL9.
- It is an intelligent OS for Hybrid cloud.

CERTIFIED IN THE CLOUD:

➢ LINUX ARCHITECTURE:



THE SHELL:

- Shell is like a Container.
- It's an Interface between users and Kernel.
- In Linux, we usually mean a command line shell.
- The default shell in Linux **BASH**, the **GNU Bourne Again Shell**.
- The shell is most commonly used to run commands.

TYPES OF LINUX SHELLS:

- GNOME (GNU Network Object Model Environment)
- KDE (K Desktop Environment)
- Sh (Bourne Shell)
- Bash (Bourne Again Shell)
- ksh (Korn Shell)
- scheme shell
- csh and tcsh (tenex-c-shell)
- zsh (z shell)
    - **Find your shell:**
      $echo $0

LINUX KERNEL:

- Kernel is a heart of Linux OS.
- The Linux kernel is the main component of a Linux operating system.
- It is the core interface between a computer's hardware and its processes.
- What the kernel does:
  - Memory management
  - Process Management
  - Device drivers
  - System calls and security

WHERE THE KERNEL FITS WITHIN THE OS:

- To put the kernel in context, you can think of a Linux machine as having 3 layers:
  - The hardware
  - The Linux kernel
  - User processes

KERNEL SPACE:

- The kernel provides abstraction for security, hardware, and internal data structures.

USER SPACE & PROCESSES:

USER SPACE:

- User Space consists of all processes running outside the Kernel.
- Most Unix-like operating systems (including Linux) come pre-packaged with all kinds of utilities, programming languages, and graphical tools - these are user space applications.

PROCESSES:

- A process is an instance of a computer program that is currently being executed.
- Each Process has its own a private virtual memory space, a security context, a state, a process id number.

TYPES OF PROCESS:

USER PROCESSES:

- Most processes in the system are user processes.
- A user process is one that is initiated by a regular user account and runs in user space.

DAEMON PROCESSES:

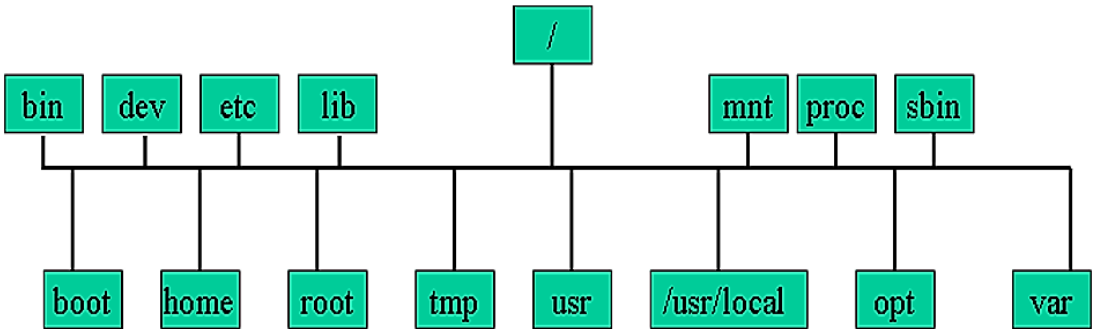
- A daemon process is an application that is designed to run in the background, typically managing some kind of ongoing service.
- A daemon process might listen for an incoming request for access to a service.
- For example, the httpd daemon listens for requests to view web pages.
- daemon processes are typically managed as services by the root user.

KERNEL PROCESSES:

- Kernel processes execute only in kernel space. They are similar to daemon processes.
- The primary difference is that kernel processes have full access to kernel data structures, which makes them more powerful than daemon processes that run-in user space.
- Kernel processes also are not as flexible as daemon processes. You can change the behaviour of a daemon process by changing configuration files and reloading the service.
- Changing kernel processes, however, may require recompiling the kernel.

➢ FILESYSTEM HIERARCHY STANDARD (FHS):

- Linux uses the FHS structure, which defines the names, locations, and permissions for file types & directories.



- **/ROOT** : Files belonging to the superuser (root). Login prompt is **"#"**.
- **/HOME** : Files belonging to users. The login prompt is **"$"**.
- **/BOOT** : Files needed to boot the system.
  Contains kernel, other files used during system startup.
- **/ETC** : System configuration files.
- **/USR** : Software, Libraries, read-only program data.
- **/BIN** : Used to store binaries (User Commands).
- **/SBIN** : Used to store super binaries (System Commands).
- **/LIB** : Library files for user applications.
- **/VAR** : Variable (Constantly changing) files, such as log files, printer spool. Etc.
- **/TMP** : Temporary files for users and programs. It allows all users to read and write.
- **/DEV** : Device files for system hardware and I/O.
- **/MNT** : Contains the mount points for file systems mounted after the system booted.
- **/OPT** : Optional directory for files and programs.
- **/PROC** : It means virtual file system. These are zero bytes in size, not used for storage. Its main purpose is to provide a file-based interface to hardware, memory, running processes, and other system components.
  /proc/devices, /proc/filesystems, /proc/mounts, /proc/partitions

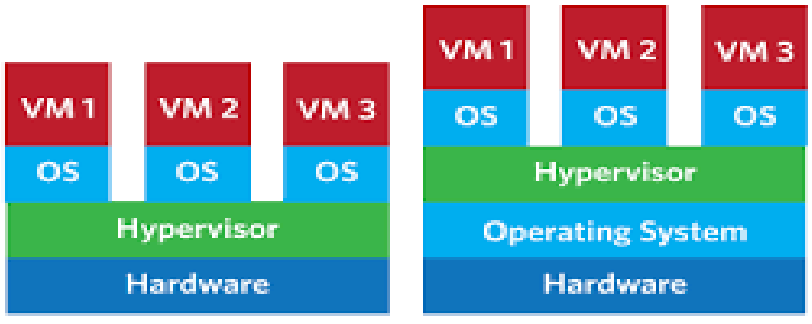
➢ HYPERVISORS:

- Hypervisors are software or firmware components that can virtualize system resources.
- A hypervisor is a hardware virtualization technique that allows multiple guest operating systems (OS) to run on a single host system at the same time.
- The guest OS shares the hardware of the host computer, have its own processor, memory and other hardware resources.
- A hypervisor is also known as a **virtual machine manager** (**VMM**).
- For the most part, cloud computing entails you being able to access a virtual machine for you to be able to do what you need to do anywhere.

HYPERVISOR TYPES:

- **TYPE-1:**
  - Type 1 hypervisors can run directly on the system hardware.
  - **Example:** VMware ESXI, Citrix XenServer, Microsoft Hyper-V, Linux KVM.

- **TYPE-2:**
  - Type 2 hypervisors run on a host operating system that provides virtualization services, such as I/O device support and memory management.
  - **Example:** VMware workstation, VMware player, Oracle virtual box.



Type 1 Hypervisor Type 2 Hypervisor

➢ VIRTUALIZATION:

- Virtualization is the process of creating a software-based, or virtual, representation of something, such as virtual applications, servers, storage and networks.
- It is the single most effective way to reduce IT expenses while boosting efficiency and agility for all size businesses.
- Virtualization can increase IT agility, flexibility and scalability while creating significant cost savings.

➢ VIRTUAL MACHINE (VM):

- A representation of a real machine using software that provides an operating environment which can run or host a guest operating system.

GUEST OPERATING SYSTEM:

- An operating system running in a virtual machine environment that would otherwise run directly on a separate physical system.

KEY PROPERTIES OF VIRTUAL MACHINES:

PARTITIONING:

- Run multiple operating systems on one physical machine.
- Divide system resources between virtual machines.

ISOLATION:

- Provide fault and security isolation at the hardware level.
- Preserve performance with advanced resource controls.

ENCAPSULATION:

- Save the entire state of a virtual machine to files.
- Move and copy virtual machines as easily as moving and copying files.

HARDWARE INDEPENDENCE:

- Provision or migrate any virtual machine to any physical server.

➢ HOST SYSTEM & HOST OPERATING SYSTEM:

- The physical computer on which you install Workstation Pro is called the **Host System** and its operating system is called the **host operating system**.

HOST SYSTEM REQUIREMENTS:

- **64-BIT PROCESSORS:**
  - AMD CPU with **AMD-V** support
  - Intel CPU with **VT-x** support
- **MEMORY:**
  - Minimum memory **2 GB**. **4 GB** and above is recommended.

VMWARE WORKSTATION PRO:

- VMware Workstation Pro is the industry standard for running multiple operating systems as virtual machines (VMs) on a single Linux/Windows.
- It helps you to create, configure, and manage virtual machines.

ORACLE VIRTUAL BOX:

- Oracle VM VirtualBox is cross-platform virtualization software.
- It allows users to extend their existing computer to run multiple operating systems including Microsoft Windows, Mac OS X, Linux, and Oracle Solaris, at the same time.
- It is designed for IT professionals and developers, Oracle VM VirtualBox is ideal for testing, developing, demonstrating, and deploying solutions across multiple platforms from one machine.

➢ RED HAT ENTERPRISE LINUX 9 (RHEL 9) INSTALLATION:

CREATE A NEW VM:

- To create a virtual machine using VMware Workstation / Oracle VirtualBox with given Configuration.

  - **Storage** **:** 50GB
  - **RAM** **:** 2GB
  - **Processor** **:** 1core

RECOMMENDED PARTITIONING SCHEME:

- Red Hat recommends that you create separate file systems at the following mount points.

  - /boot : 1G
  - / :8G
  - /home :3G
  - Swap :4G (2 times the amount of RAM size)

NOTE: However, if required, you can also create the file systems at **/usr, /var, and /tmp** mount points.