# Introduction to Linux

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# Linux OS and it's Major releases

- **Linus Benedict Torvalds** developed Linux in the year 1991 when he was an undergraduate student
- Linux is **UNIX-like** System but not a UNIX system. Unlike UNIX, it is open source (`github.com/torvalds/linux`)
- Considering the versions of Ubuntu there are around 52 major releases which includes the latest version 18.04

# Why Linux ?

- Open source Multi-user Operating System
  - User can add new features, implement new ideas. This way Linux gives more flexibility to the users
- Can be fitted from low end to high end systems
- Supports all major programming languages like C, C++, Python, Java, Perl etc
  - No need to worry about setting environment paths

# Why Linux ?

- Variety of distributions
- Best customer support from Linux forums(`askubuntu.com`)
  - We will be assisted with in minutes after posting a query in these forums.
- Security
  - Every user is assigned with minimum level of privileges over files of other users.
- Pre-installed with drivers

# Flavours of Linux

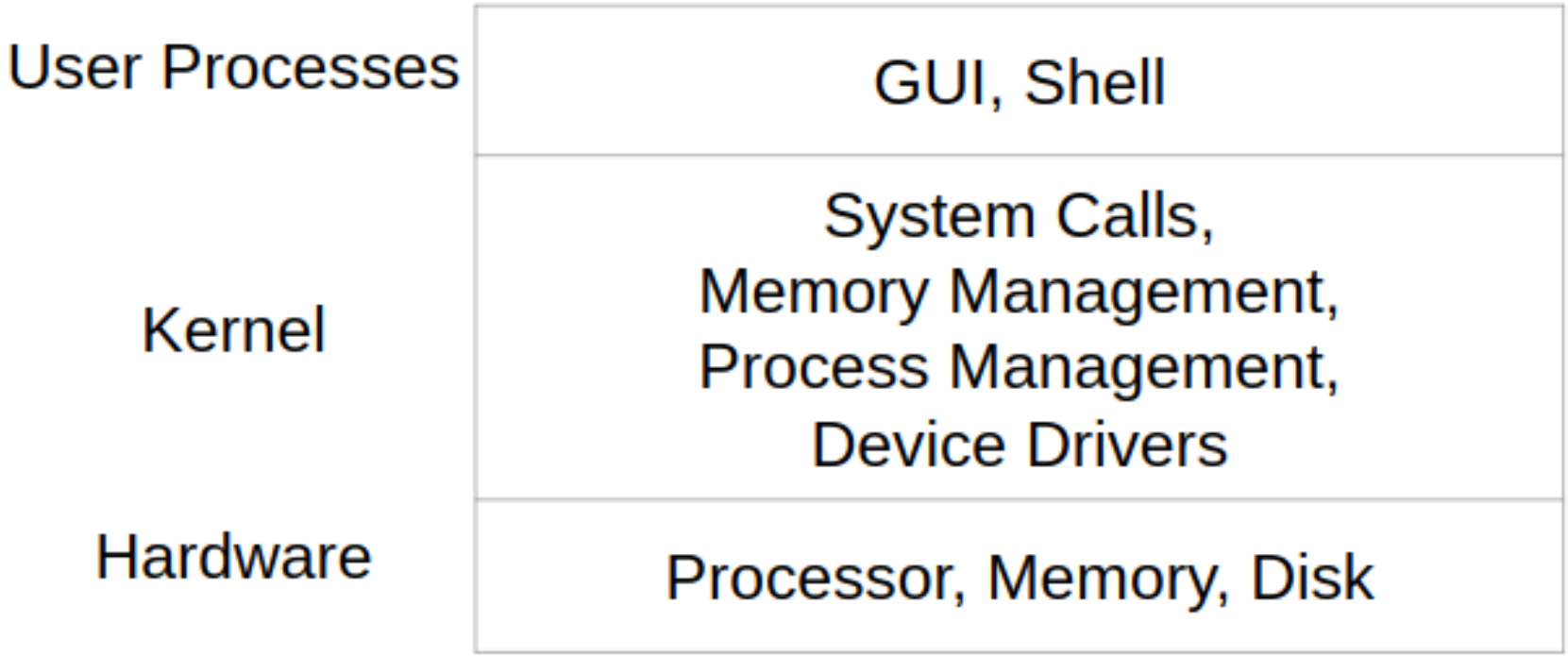
Below is the list of Linux flavours most people use:


Ubuntu




Mint

# Operating Systems overview



# List of Basic Commands

- **who**
  Displays who is logged on
- **date**
  Print or set the system date and time
- **uname**
  Prints system information
- **lscpu**
  Prints information about the CPU architecture
- **man** $<$ *command* $>$
  Opens the manual page of the command.

# File management and Tools

- **pwd**
  Returns the full path of the current directory

- **ls -la**
  List the files in the directory with permissions as well as author name

## Globbing/Wildcards

- ***(asterik)**
  Represent any number of characters

- **?(question mark**
  Represents a signle character

- **[] Square Brackets**
  Specifies the range

# File Management and Tools

- **mkdir**
  Create directory
- **cd directory_name**
  cd stands for Change Directory. This will make the user to switch the directory
- **touch** < *file_name* >
  Creates an empty file with the mentioned file name
- **echo** < *some_text* > » **welcome.txt**
  - Creates a new file welcome if it does not exist
  - Appends the text to the text file welcome.txt

# File management and Tools

- **cat -n** < *file_name* >
  Dumps the file content on to the terminal with line numbers at left margin

- **cp** < *source_file_path* >< *dest_path* >
  Copies file from source and paste into the destination

- **cp -r** < *source_dir_path* >< *dest_path* >
  Copies directory from source and paste into the destination

- **mv** < *source_file_path* >< *dest_path* >
  mv command just works like cut and paste. For moving directory use -r option.

- **rm -r** < *directory_name* >
  Removes the entire directory

# Search in a Directory

- **find** $< path > -name < file\_name >$
  This command returns all the directory paths in which the file exists

- **find** $< path >$ **-name *.jpg**
  This returns all the jpg files in the directory mentioned in the path

# Working with Text files

- **wc** $<$ *file_name* $>$
  This command will count the number of lines, number of words and number of characters in the text file

- **less**
  This command dumps the text content of the file onto the screen. The main use of this is to scroll the content.

- **head**
  This command prints the first part of a file

- **tail**
  This command prints the last part of a file

# Grep, Pipe and Redirection

- **grep -i linux linux_tutorial.txt**
  This command will finds all the lines which contain the linux in the linux_tutorial.txt

- **cat demo.txt | grep important**
  This will print all the lines which contain the word important in the text file demo.txt

- **Redirection », >**
  Redirection is change in standard input and output devices while executing a command.
  eg. ls -al » filelist
  dumps the output of ls command to filelist file

# Users and Groups on Linux

- Users
  - Root user or Super user
  - Other users
- Each user will have user ID as well as group ID to which he belongs to
- Set of users can form a group
- Root user can set privileges to individual user separately or user can set privileges to a group of users using group name and group ID

# Create and Delete Users, Groups

- **sudo useradd** $< user\_name >$
  Creates user

- **sudo userdel** $< user\_name >$
  Deletes user

- **sudo groupadd** $< group\_name >$
  Creates group

- **sudo groupdel** $< group\_name >$
  Deletes group

# Create Group and Add Users to Group

- **sudo adduser** $< user\_name >< group\_name >$
  Adds user with the specified name to the group with the specified name.

- Before deleting a group, delete all the users of the group without which it is not possible to delete a group.

- Adding, Deleting of users and groups must be done as a root user.

# File Permissions

- **ls -al**

$$-rw-r--r-x32\ \text{root root}\ 4096 - -- \text{abc.txt}$$

| | |
|---|---|
| r | File is readable |
| w | File is writable |
| x | File is executable |
| - | Nothing |

- **chmod 754** $< file\_name >$

  4 - Read

  2 - Write

  1 - Execute

  0 - No permission

  Each digit is a combination of these numbers. For example 7 is a combination of 4+2+1, 5 is a combination of 4+0+1 and 4 is a combination of 4+0+0.

# File Permissions

- **chmod a+wx** $<$ *file_name* $>$
  Add write and execute permissions to all the users for the file
- **chmod -R 754** $<$ *file_name* $>$
  Here from the above command sets permission as:
  RWX - For User
  RX - For a users of the group
  R - For other users

# Device and System Filesystem

- **Types of Devices**
  Character
  Block
  Pipe
  Socket

- **Listing the Device Filesystem**

- $ ls -l /dev

# Device Filesystem and System Filesystem

- **/dev vs /sys**
  /dev list devices in simple human readable form
  /sys list devices in machine readable form

- **Observing various attributes of device**
  $ udevadm info –query=all –name=/dev/mmcblk0

# Accessing RPi LED from sysfs

- **Accessing LEDs interface in sysfs**
  $ cd /sys/class/leds/led1
  $ ls
  brightness device max_brightness subsystem trigger uevent
  $ cat trigger
  none [mmc0] timer oneshot heartbeat backlight gpio cpu0 cpu1 cpu2 cpu3 default-on input
  $ sudo sh -c "echo none > trigger"
  $ sudo sh -c "echo 1 > brightness"
  $ sudo sh -c "echo 0 > brightness"

# udev

- **How device files are created?**
  udev receives event from kernel
  udev examines new device's characteristics, create a device file and perfom the device initialization

- **Monitoring the udev**
  $ udevadm monitor

# Start of the User Space

- **init-systemd System and Service Manager**
  starts and stops services

- **Listing the services running in system**
  $ sudo service –status-all
  more detailed list
  $ systemctl

# How init-systemd works?

- **Types of configuration files**
  .service
  .target
  .mount
  located at /lib/systemd/system directory

- **systemd tree**
  $ systemctl list-dependencies

- **systemd tree graphical representation**
  $ systemd-analyze plot > /home/pi/startup.svg

# Processes

- **top**
  This command lists the processes which are consuming relatively more resources with their names, IDs and % of memory occupied.

- **ps -A**
  This command lists all the processes.

- **killall** $<$ *process_name* $>$
  This command kills all the threads of the process with the mentioned name

# Processes

- **ps -A | grep chrome**
  This will show all the running threads which contain the word chrome along with the thread IDs.

- We can search for all the patterns on the content which is dumped on to the terminal after running a command can be easily located using pipe symbol along with grep.

# Software Installation

- **apt-get**
  This command is used along with one of the options install, remove, upgrade, update, autoremove, clean

- apt-cache
  Used to perform query regarding information on various packages installed

- **dpkg** Used to install and query information regarding downloaded packages

# Networking

- **Different layer in the Internet**
  1. Application Layer: Usually a protocol used by server to communicate HTTP, SSH and FTP
  2. Transport Layer: Breaking application data into packet and define data transmission characteristics
     TCP (Transmission Control Protocol)
  3. Internet Layer: Define how to move the packets from source to destination host
     IP (Internet Protocol)
  4. Host-to-Network Layer (Physical layer): Defines how to send packets from the Internet layer across the physical medium, such as Ethernet

# Configuring Networks

- **On linux, we connect to Internet layer and Physical layer only**
- **Common network interfaces names are** *eth*0 **and** *wlan*0
  $*ifconfig*
- "*lo*" is the IP address of localhost
- **ifconfig**
  - Stands for Interface Configuration
  - This command will show the ip address(Ethernet, WLAN) as well as the physical(MAC) address of the system
  - Used to view the network configuration of the system

# Configuring Static IP

1. Open the interfaces file in network
   **sudo nano /etc/network/interfaces**
2. edit the interfaces file as
   iface wlan0 inet static
   address 192.168.1.31
   netmask 255.255.255.0
   gateway 192.168.1.1

# SSH and SCP

- **ssh username@ip_address**
  Used to remote login to a system. After running this command enter the password of the remote system.

- **scp -r** $<$ *local_directory_path* $><$ *dest_user_name* $>$ **@** $<$ *dest_ipaddress* $>:<$ *dest_path* $>$
  This command is used to securely copy the local directory into remote location with the specified user name and ip address