

1- Refreshing package lists

```
ghannam@Ghannam:~$ sudo apt update
[sudo] password for ghannam:
Hit:1 http://eg.archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:3 http://eg.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:4 http://eg.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:5 http://security.ubuntu.com/ubuntu noble-security/main amd64 Components [21.5 kB]
Hit:6 https://ppa.launchpadcontent.net/mosquitto-dev/mosquitto-ppa/ubuntu noble InRelease
Get:7 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Components [212 B]
Get:8 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Components [52.3 kB]
Get:9 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Components [212 B]
Get:10 http://eg.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1,379 kB]
Hit:11 http://packages.ros.org/ros2/ubuntu noble InRelease
Get:12 http://eg.archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [175 kB]
Get:13 http://eg.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Components [212 B]
Get:14 http://eg.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1,471 kB]
Get:15 http://eg.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [377 kB]
Get:16 http://eg.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Components [940 B]
Get:17 http://eg.archive.ubuntu.com/ubuntu noble-backports/main amd64 Components [7,072 B]
Get:18 http://eg.archive.ubuntu.com/ubuntu noble-backports/restricted amd64 Components [216 B]
Get:19 http://eg.archive.ubuntu.com/ubuntu noble-backports/universe amd64 Components [19.2 kB]
Get:20 http://eg.archive.ubuntu.com/ubuntu noble-backports/multiverse amd64 Components [212 B]
Fetched 3,882 kB in 2s (1,716 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
402 packages can be upgraded. Run 'apt list --upgradable' to see them.
ghannam@Ghannam:~$
```

2- upgrading the system

```
ghannam@Ghannam:~$ sudo apt upgrade -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Calculating upgrade... Done
The following packages were automatically installed and are no longer required:
  libdlt2 libgl1-amd-headers libglapi-mesa
Use 'sudo apt autoremove' to remove them.
Get more security updates through Ubuntu Pro with 'esm-apps' enabled:
  libpc1-stereo1.14 libzvt-common liburiparser1 mosquitto-clients
  libpc1-keypoints1.14 libpc1-common1.14 libpc1-recognition1.14
  libpc1-sample-consensus1.14 mosquitto libbson1 libpc1-people1.14
  libpc1-tracking1.14 libpc1-features1.14 libpostproc57 libpc1-filters1.14
  libswscale-dev libpc1-surfaces1.14 libpc1-toi1.14 libavcodec60
  libgststreamer-plugins-bad1.0 libzvtb1.0 libpc1-visualization1.14
  libpc1-nli1.14 libavutil58 libpc1-kdtree1.14 libswscale7 libpc1-search1.14
  libavutil-dev libswresample4 libpc1-outofcore1.14 libpc1-segmentation1.14
  libpc1-apps1.14 libavformat60 libpc1-registration1.14 libmosquitto1
  libpc1-octree1.14 libpc1-dev libavformat-dev libavcodec-dev
  libswresample-dev liburiparser-dev libavfilter9
Learn more about Ubuntu Pro at https://ubuntu.com/pro
The following NEW packages will be installed:
  linux-headers-6.14.0-29-generic linux-hwe-6.14-headers-6.14.0-29 linux-hwe-6.14-tools-6.14.0-29 linux-image-6.14.0-29-generic linux-modules-6.14.0-29-generic
  linux-modules-extra-6.14.0-29-generic linux-tools-6.14.0-29-generic
The following packages have been kept back:
  libgl1-amd-headers
The following packages will be upgraded:
  base-files bluez-cups bluez-obsd cloud-init firmware-sof-signed fwupd gir1.2-gdkpixbuf-2.0 gir1.2-gtk-4.0 gir1.2-javascriptcoregtk-4.1 gir1.2-javascriptcoregtk-6.0
  gir1.2-mutter-14 gir1.2-webkit-6.0 gir1.2-webkit2-4.1 gnome-calculator gnome-initial-setup gnome-shell-extension-desktop-icons-ng gstreamer1.0-alsa gstreamer1.0-gl
  gstreamer1.0-pipewire gstreamer1.0-plugins-base gstreamer1.0-plugins-base-apps gstreamer1.0-plugins-good gstreamer1.0-x gvfs gvfs-backends gvfs-common gvfs-daemons gvfs-fuse
  gvfs-lbs intel-media-va-driver iproute2 iptutils-ping iptutils-tracepath jq language-pack-en language-pack-gnome-en language-pack-gnome-en-base libbluetooth
  libgl-mesa0 libfwupd2 libgdm-dev libgdm1 libgdk-pixbuf-2.0-0 libgdk-pixbuf2.0-bin libgdk-pixbuf2.0-common libgl1-mesa-dev libgl1-mesa-dri libglx-mesa0 libgststreamer-gli1.0-0
  libgststreamer-plugins-base1.0-0 libgststreamer-plugins-good1.0-0 libgtk-4-1 libgtk-4-bin libgtk-4-common libgtk-4-media-gstreamer libipa-hbac0t64 libjavascriptcoregtk-4.1-0
  libjavascriptcoregtk-6.0-1 libjq1 libldb2 libmalcontent-0.0 libmosquitto1 libmutter-14-0 libmysqlclient-dev libmysqlclient21 libnetplan1 libnss-sss libnss-systemd libpam-sss
  libpam-systemd libperl5.38t64 libpipewire-0.3-0t64 libpipewire-0.3-common libpipewire-0.3-modules libpoppler-cpp0t64 libpoppler-dev libpoppler-glib0t64 libpoppler-private-dev
  libpoppler134 libpsblclient0 libspa-0.2-bluetooth libspa-0.2-modules libsqlite3-0 libsqlite3-dev libsss-certmap0 libsss-idmap0 libsss-nss-idmap0 libsystemd-shared libsystemd0
  libzvtb1.0

```

3- Kernel Version

```
ghannam@Ghannam:~$ uname -r
6.14.0-24-generic
```

4- current user

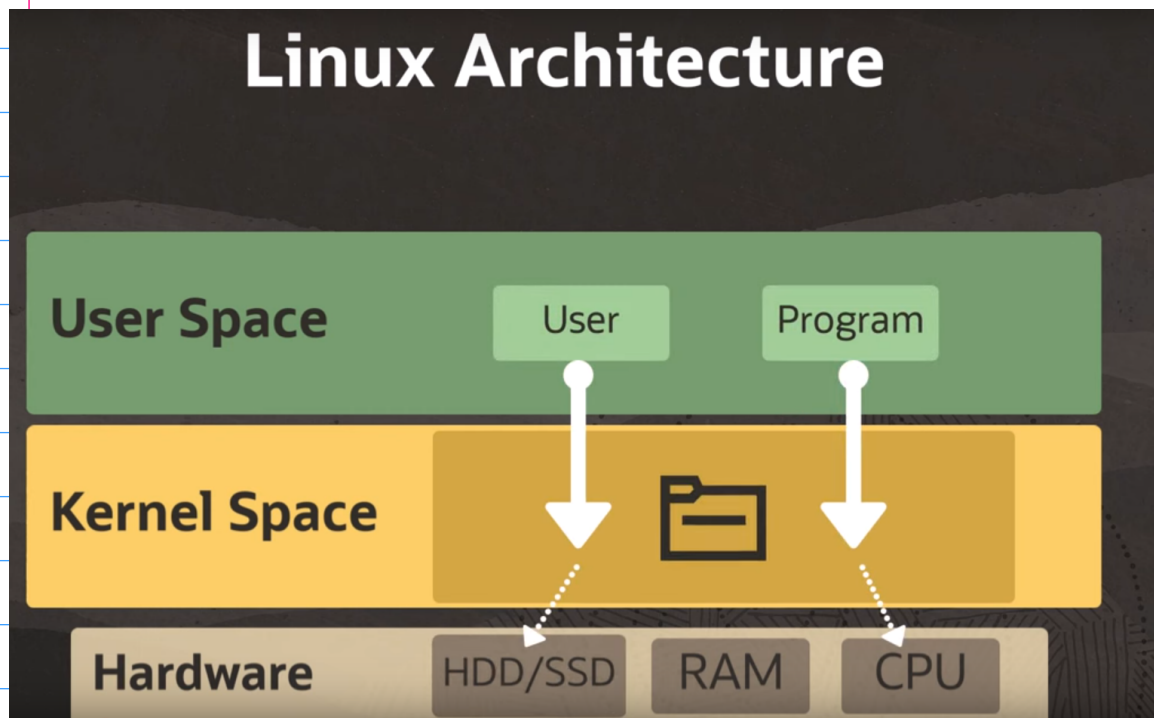
```
ghannam@Ghannam:~$ whoami
ghannam
```

5- Date

```
ghannam@Ghannam:~$ date
Sun Aug 31 09:46:05 PM EEST 2025
```

6- Create /home/<username>/iot_logger with subdirectories: logs, scripts, data.

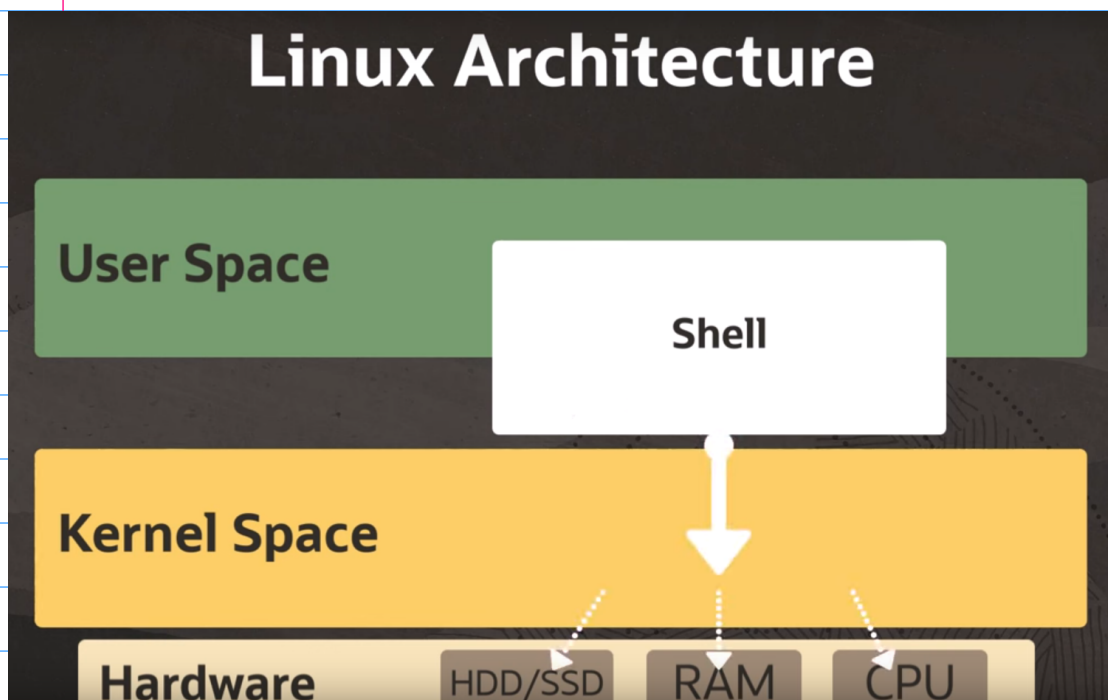
```
ghannam@Ghannam:~$ mkdir -p iot_logger/{logs,scripts,data}
```



Hardware: physical devices connected to the system such as hard drives, RAM, CPU and so on ..

kernel space: The core component of the OS, It manages the system resources, communicates with the hardware and it is responsible for memory, processes and file management

user space : It is about what's the user see like application, databases and files

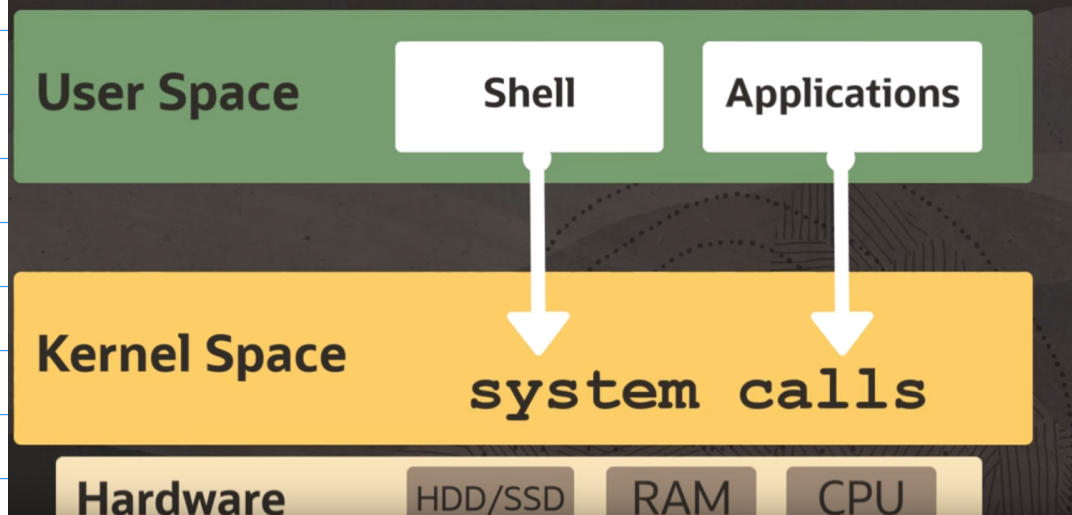


shell: as there's virtual space between the user space and kernel space the shell gives the user the way to provide input to the kernel

system call : it's the functions that the kernel run based on the request

- ex. open, read, write, close, exit
- linux kernel has over 300 system calls

Linux Architecture



1. / (root directory)

The top-level directory in Linux — everything starts from here.

All other directories (`/bin`, `/usr`, `/etc`, etc.) are subdirectories of `/`.

2. /bin (binary executables)

Contains essential user commands needed for basic operation, even if no other partitions are mounted.

Examples: `ls`, `cp`, `mv`, `rm`, `cat`, `bash`.

3. /sbin (system binaries)

Contains system administration commands and tools (mostly used by root).

Examples: `reboot`, `shutdown`, `fdisk`, `iptables`.

4. /usr (user programs & data)

Stores user-related programs and files, not essential for the system to boot.

Inside it:

`/usr/bin` → non-essential user programs (e.g., `python3`, `git`).

`/usr/sbin` → non-essential system binaries.

`/usr/lib` → libraries for `/usr/bin` programs.

5. /etc (configuration files)

Contains system-wide configuration files and settings.

Examples:

`/etc/passwd` → user accounts.

`/etc/hosts` → hostname mapping.

6. /var (variable data)

Stores files that change frequently (variable data).

Examples:

`/var/log` → system logs.

Why does Linux treat everything as a file?

In Linux (and Unix-like systems), the philosophy is “everything is a file” because it gives a unified way to access resources.

Difference between a program and a process:

Program

A set of instructions written in a file (usually stored on disk).

Process

An instance of a program in execution.