Lecture _9

LINUX essentials
Dr .Sara Mohamed

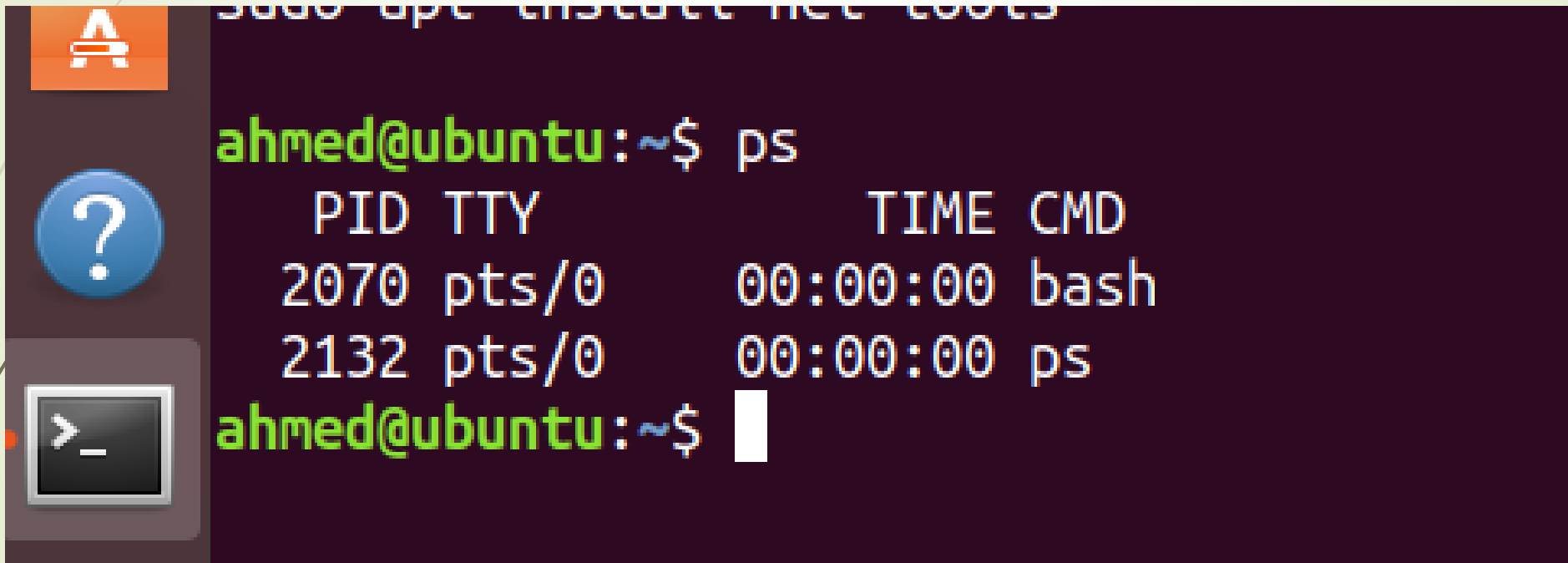# Viewing Processes

Viewing Processes

- Running a command results in something called a process. In the Linux operating system, processes are executed with the privileges of the user who executes the command. This allows for processes to be limited to certain capabilities based upon the user identity.

- Although there are exceptions, generally the operating system will differentiate users based upon whether they are the administrator. Typically, regular users, like the sysadmin user, cannot control another user's processes. Users who have administrative privileges, like the root account, can control any user processes, including stopping any user process.

The `ps` Command to List Running Processes in Linux

- Linux provides commands to view active processes and their details like PID, CPU, and memory usage.

- The most common command is ps, which shows currently running processes.

- Listing running processes in Linux helps you monitor and manage all active programs and system tasks.

- The ps command in Linux is used to display information about the currently running processes on the system.

The ps command can be used to list processes.

```
sudo apt install net-tools

ahmed@ubuntu:~$ ps
  PID TTY           TIME CMD
 2070 pts/0     00:00:00 bash
 2132 pts/0     00:00:00 ps
ahmed@ubuntu:~$
```

The ps command can be used to list processes.

- ps stands for process status.
- It shows details like PID, user, CPU, memory usage, and the command that started the process.
- By default, it displays processes running in the current shell.
- Use options to view more detailed or system-wide process information.

```
administrator@GFG19566-LAPTOP:~/practice$ ps
    PID TTY                TIME CMD
3028492 pts/0         00:00:02 bash
3118421 pts/0         00:00:00 ps
administrator@GFG19566-LAPTOP:~/practice$
```
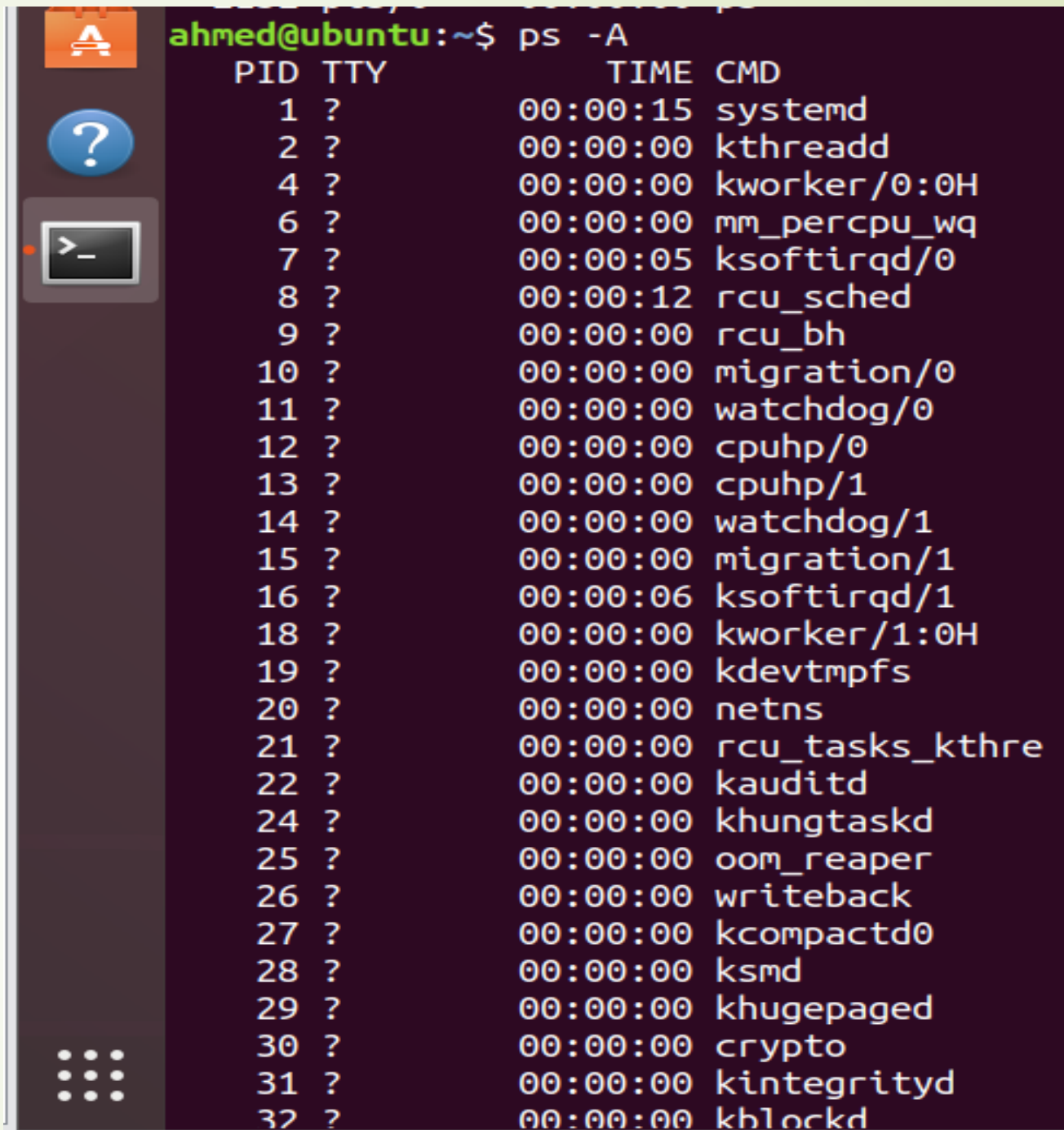
Result contains four columns of information. ,

•**PID -** the unique process ID

•**TTY -** terminal type that the user is logged into

•**TIME -** amount of CPU in minutes and seconds that the process has been running

•**CMD -** name of the command that launched the process.

Syntax of `ps` Command in Linux

▶ The ps command provides a snapshot of the current

processes on your system. The basic syntax is as follows:

```
ps [options]
```

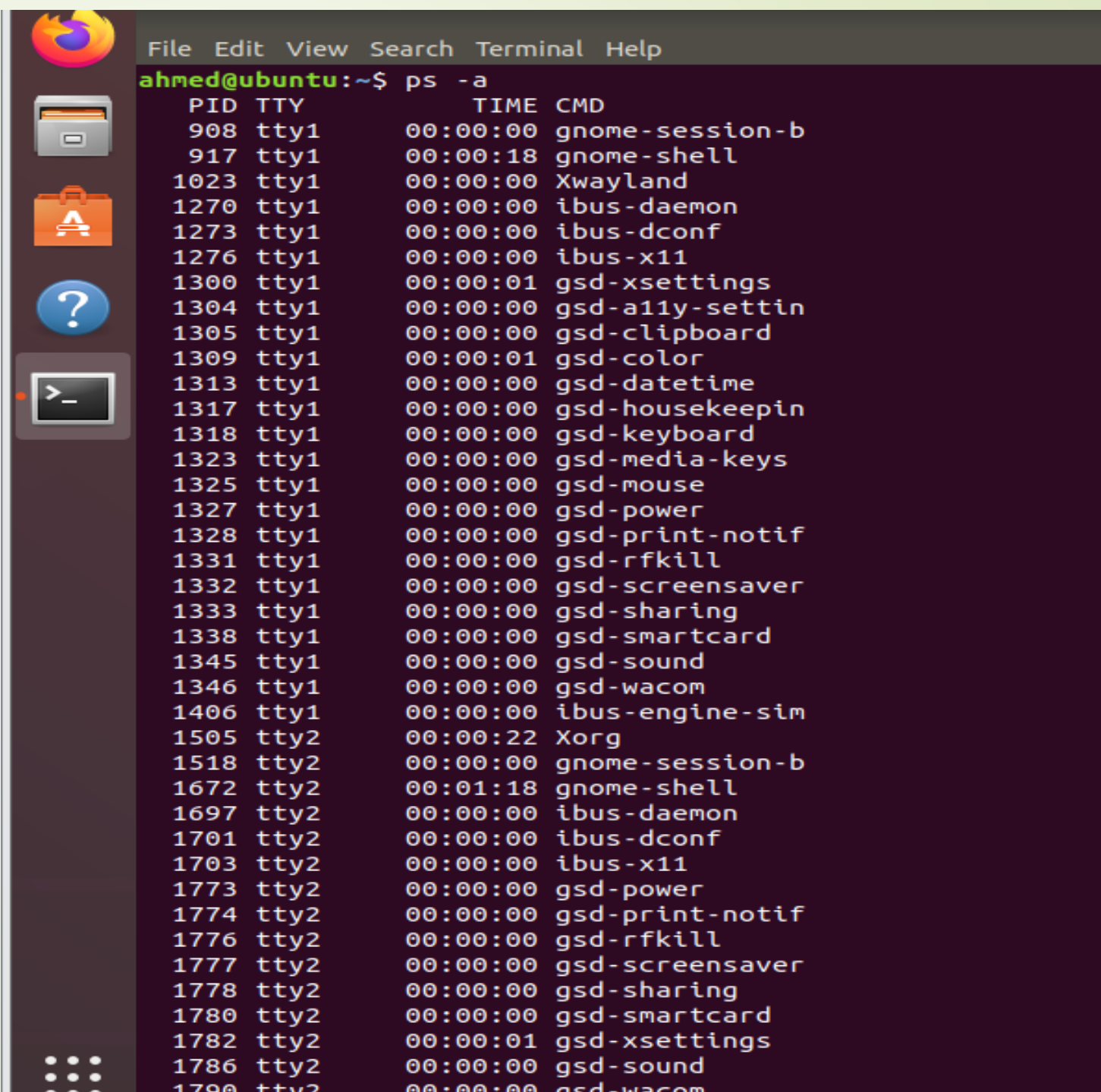# View All Running Processes in Linux.

```
ahmed@ubuntu:~$ ps -A
  PID TTY          TIME CMD
    1 ?        00:00:15 systemd
    2 ?        00:00:00 kthreadd
    4 ?        00:00:00 kworker/0:0H
    6 ?        00:00:00 mm_percpu_wq
    7 ?        00:00:05 ksoftirqd/0
    8 ?        00:00:12 rcu_sched
    9 ?        00:00:00 rcu_bh
   10 ?        00:00:00 migration/0
   11 ?        00:00:00 watchdog/0
   12 ?        00:00:00 cpuhp/0
   13 ?        00:00:00 cpuhp/1
   14 ?        00:00:00 watchdog/1
   15 ?        00:00:00 migration/1
   16 ?        00:00:06 ksoftirqd/1
   18 ?        00:00:00 kworker/1:0H
   19 ?        00:00:00 kdevtmpfs
   20 ?        00:00:00 netns
   21 ?        00:00:00 rcu_tasks_kthre
   22 ?        00:00:00 kauditd
   24 ?        00:00:00 khungtaskd
   25 ?        00:00:00 oom_reaper
   26 ?        00:00:00 writeback
   27 ?        00:00:00 kcompactd0
   28 ?        00:00:00 ksmd
   29 ?        00:00:00 khugepaged
   30 ?        00:00:00 crypto
   31 ?        00:00:00 kintegrityd
   32 ?        00:00:00 kblockd
```

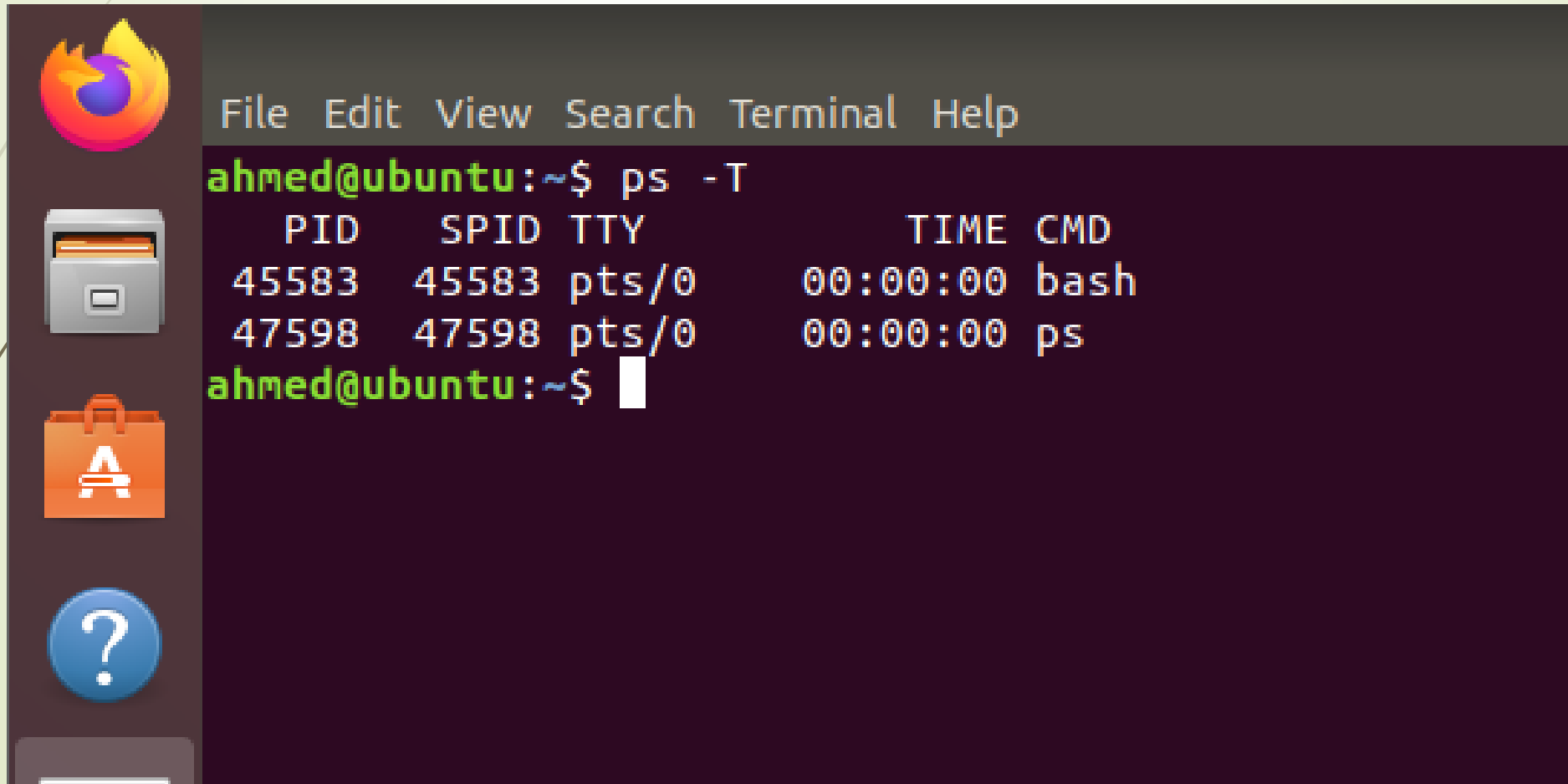# List Processes Not associated with a Terminal in Linux

displays a detailed snapshot of all running processes in the system including system, background, and user processes.

```
 2002 tty2       00:00:02 update-notifier
 45727 pts/0     00:00:00 ps
ahmed@ubuntu:~$ ps aux
USER         PID %CPU %MEM    VSZ    RSS TTY     STAT START   TIME COMMAND
root           1  0.5  0.4 225600   8508 ?       Ss   06:30   0:15 /sbin/init auto noprompt
root           2  0.0  0.0      0      0 ?       S    06:30   0:00 [kthreadd]
root           4  0.0  0.0      0      0 ?       I<   06:30   0:00 [kworker/0:0H]
root           6  0.0  0.0      0      0 ?       I<   06:30   0:00 [mm_percpu_wq]
root           7  0.1  0.0      0      0 ?       S    06:30   0:05 [ksoftirqd/0]
root           8  0.4  0.0      0      0 ?       I    06:30   0:13 [rcu_sched]
root           9  0.0  0.0      0      0 ?       I    06:30   0:00 [rcu_bh]
root          10  0.0  0.0      0      0 ?       S    06:30   0:00 [migration/0]
root          11  0.0  0.0      0      0 ?       S    06:30   0:00 [watchdog/0]
root          12  0.0  0.0      0      0 ?       S    06:30   0:00 [cpuhp/0]
root          13  0.0  0.0      0      0 ?       S    06:30   0:00 [cpuhp/1]
root          14  0.0  0.0      0      0 ?       S    06:30   0:00 [watchdog/1]
root          15  0.0  0.0      0      0 ?       S    06:30   0:00 [migration/1]
root          16  0.2  0.0      0      0 ?       S    06:30   0:06 [ksoftirqd/1]
root          18  0.0  0.0      0      0 ?       I<   06:30   0:00 [kworker/1:0H]
root          19  0.0  0.0      0      0 ?       S    06:30   0:00 [kdevtmpfs]
root          20  0.0  0.0      0      0 ?       I<   06:30   0:00 [netns]
root          21  0.0  0.0      0      0 ?       S    06:30   0:00 [rcu_tasks_kthre]
root          22  0.0  0.0      0      0 ?       S    06:30   0:00 [kauditd]
root          24  0.0  0.0      0      0 ?       S    06:30   0:00 [khungtaskd]
root          25  0.0  0.0      0      0 ?       S    06:30   0:00 [oom_reaper]
```

List All Processes Associated with this Terminal in Linux

View All Processes Owned By You

Package Management

- **Package management** is a system by which software can be installed, updated, queried or removed from a filesystem. In Linux, there are many different software package management systems, but the two most popular are those from Debian and Red Hat. The virtual machines for this course use Ubuntu, a derivative of Debian.

Installing Packages

➡ Package files are commonly installed by downloading them directly from repositories located on Internet servers. The Debian repositories contain more than 65,000 different packages of software.

it is good practice to use the refresh the list of available packages using the apt-get update command

```
ahmed@ubuntu:~$ sudo apt update
Hit:1 http://us.archive.ubuntu.com/ubuntu bionic InRelease
Get:2 http://us.archive.ubuntu.com/ubuntu bionic-updates InRelease [102 kB]
Get:3 http://security.ubuntu.com/ubuntu bionic-security InRelease [102 kB]
Get:4 http://us.archive.ubuntu.com/ubuntu bionic-backports InRelease [102 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu bionic-updates/main amd64 DEP-11 Metadata [297 kB]
Get:6 http://security.ubuntu.com/ubuntu bionic-security/main amd64 DEP-11 Metadata [76.9 kB]
Get:7 http://us.archive.ubuntu.com/ubuntu bionic-updates/restricted amd64 DEP-11 Metadata [212 B]
Get:8 http://us.archive.ubuntu.com/ubuntu bionic-updates/universe amd64 DEP-11 Metadata [303 kB]
Get:9 http://security.ubuntu.com/ubuntu bionic-security/restricted amd64 DEP-11 Metadata [212 B]
Get:10 http://security.ubuntu.com/ubuntu bionic-security/universe amd64 DEP-11 Metadata [61.8 kB]
Get:11 http://us.archive.ubuntu.com/ubuntu bionic-updates/multiverse amd64 DEP-11 Metadata [2,464 B]
Get:12 http://us.archive.ubuntu.com/ubuntu bionic-backports/main amd64 DEP-11 Metadata [8,084 B]
Get:13 http://us.archive.ubuntu.com/ubuntu bionic-backports/restricted amd64 DEP-11 Metadata [216 B]
Get:14 http://us.archive.ubuntu.com/ubuntu bionic-backports/universe amd64 DEP-11 Metadata [10.1 kB]
Get:15 http://us.archive.ubuntu.com/ubuntu bionic-backports/multiverse amd64 DEP-11 Metadata [216 B]
Get:16 http://security.ubuntu.com/ubuntu bionic-security/multiverse amd64 DEP-11 Metadata [2,464 B]
Fetched 1,068 kB in 2s (486 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
All packages are up to date.
ahmed@ubuntu:~$
```

```
bash: /usr/games/cowsay: No such file or directory
ahmed@ubuntu:~$ clear


ahmed@ubuntu:~$ sudo apt upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following NEW packages will be installed:
  bubblewrap distro-info fwupd-signed libbrotli1 libllvm10 libnetplan0 libwayland-egl1 libwoff1 libxmlb1 python3-click
  python3-colorama python3-dateutil python3-netifaces ubuntu-advantage-desktop-daemon ubuntu-pro-client
  ubuntu-pro-client-l10n xdg-desktop-portal xdg-desktop-portal-gtk
The following packages will be upgraded:
  appstream apt apt-config-icons apt-utils apturl apturl-common base-files bolt brltty command-not-found
  command-not-found-data console-setup console-setup-linux cups-pk-helper debconf debconf-i18n desktop-file-utils dmidecode
  dmsetup fonts-beng-extra fonts-deva-extra fonts-gujr-extra fonts-guru-extra fonts-liberation fonts-noto-cjk
  fonts-noto-color-emoji fonts-orya-extra friendly-recovery fwupd fwupdate fwupdate-signed gdb gdbserver gedit gedit-common
  gir1.2-dbusmenu-glib-0.4 gir1.2-geocodeglib-1.0 gir1.2-gmenu-3.0 gir1.2-gnomebluetooth-1.0 gir1.2-gnomedesktop-3.0
  gir1.2-goa-1.0 gir1.2-gtk-3.0 gir1.2-gweather-3.0 gir1.2-javascriptcoregtk-4.0 gir1.2-json-1.0 gir1.2-mutter-2
  gir1.2-nm-1.0 gir1.2-nma-1.0 gir1.2-notify-0.7 gir1.2-snapd-1 gir1.2-upowerglib-1.0 gir1.2-vte-2.91 gir1.2-webkit2-4.0
  gjs gkbd-capplet gnome-bluetooth gnome-control-center gnome-control-center-data gnome-control-center-faces
  gnome-desktop3-data gnome-disk-utility gnome-getting-started-docs gnome-initial-setup gnome-keyring gnome-keyring-pkcs11
  gnome-menus gnome-online-accounts gnome-session-bin gnome-session-common gnome-settings-daemon
  gnome-settings-daemon-schemas gnome-shell gnome-shell-common gnome-shell-extension-ubuntu-dock gnome-software
  gnome-software-common gnome-software-plugin-snap gnome-startup-applications gnome-terminal gnome-terminal-data
  gnome-user-docs gnome-user-guide grep grub-common grub-pc grub-pc-bin grub2-common gstreamer1.0-gl
```

Quick Summary

Term	What it does	Size	Effect on Version
Update	Fixes or improves current version	Small	Same major version
Upgrade	Moves to a new, bigger version	Large	Major new version

To search for keywords within these packages, you can use the apt-cache search command

```
apt-cache search [keyword]
```
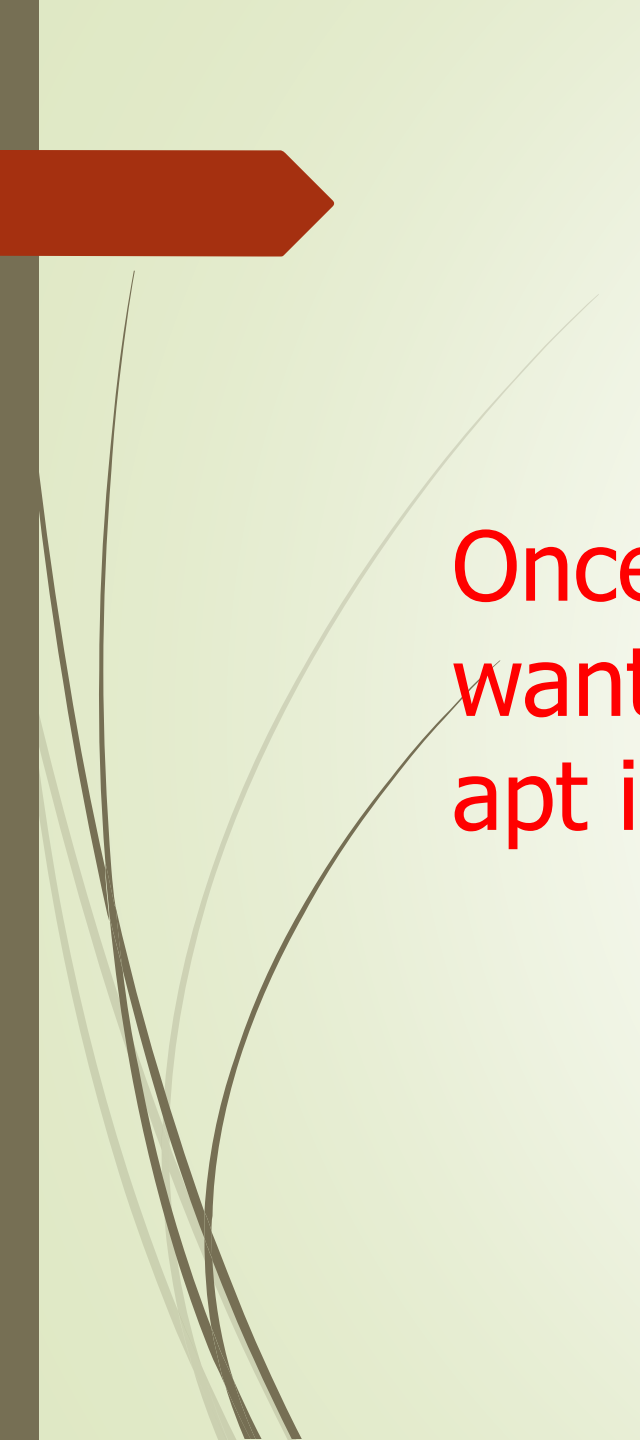
The keyword that is used should match part of the name or description of the package that is to be located. Multiple keywords can be used to further clarify the search; for example, the search term web server would provide better results than web or server.

To find packages associated with the cow keyword:

```
ahmed@ubuntu:~$ apt-cache search cow
devscripts - scripts to make the life of a Debian Package maintainer easier
4digits - guess-the-number game, aka Bulls and Cows
averell - incredibly stupid web server
cowbell - An easy-to-use tag editor for your music files
cowbuilder - pbuilder running on cowdancer
cowdancer - Copy-on-write directory tree utility
cowsay - configurable talking cow
cowsay-off - configurable talking cow (offensive cows)
dicoweb - RFC 2229 compliant modular dictionary server (web interface)
erlang-cowboy - Cowboy is a small, fast and modular HTTP server written in Erla
erlang-cowboy-doc - Documentation files for erlang-cowboy
erlang-cowboy-examples - Examples for erlang-cowboy
erlang-cowlib - Erlang library for manipulating web protocols
fl-cow - copy-on-write utility
libforks-perl - Perl module to emulate threads with fork
libguestfs0 - guest disk image management system - shared library
libmoox-struct-perl - simple lightweight record-like structures making sounds l
libnet-opensrs-perl - Perl interface for domain registration via the Tucows Ope
libqcow-dev - QEMU Copy-On-Write image format access library -- development fil
libqcow-utils - QEMU Copy-On-Write image format access library -- Utilities
libqcow1 - QEMU Copy-On-Write image format access library
libxml-catalog-perl - Perl module for resolving public and remapping system ide
libxray-absorption-perl - x-ray absorption data for the elements
minetest-mod-animals - Minetest mod providing animals
minetest-mod-mobf - Minetest mod providing a framework for creating mobs
netrek-client-cow - client for netrek online game
```

Once you've found the package that you want to install, you can install it with the apt install command

```
ahmed@ubuntu:~$ sudo apt install cowsay
Reading package lists... Done
Building dependency tree
Reading state information... Done
Suggested packages:
  filters cowsay-off
The following NEW packages will be installed:
  cowsay
0 upgraded, 1 newly installed, 0 to remove and 337 not upgraded.
Need to get 17.7 kB of archives.
After this operation, 89.1 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu bionic/universe amd64 cowsay all 3.03+dfsg2-4 [17.7 kB]
Fetched 17.7 kB in 0s (37.8 kB/s)
Selecting previously unselected package cowsay.
(Reading database ... 148805 files and directories currently installed.)
Preparing to unpack .../cowsay_3.03+dfsg2-4_all.deb ...
Unpacking cowsay (3.03+dfsg2-4) ...
Setting up cowsay (3.03+dfsg2-4) ...
Processing triggers for man-db (2.8.3-2) ...
ahmed@ubuntu:~$ cowsay "hello"
 _____
< hello >
 -------
        \   ^__^
         \  (oo)_____
            (__)\       )\/\
                ||----w |
                ||     ||
ahmed@ubuntu:~$
```
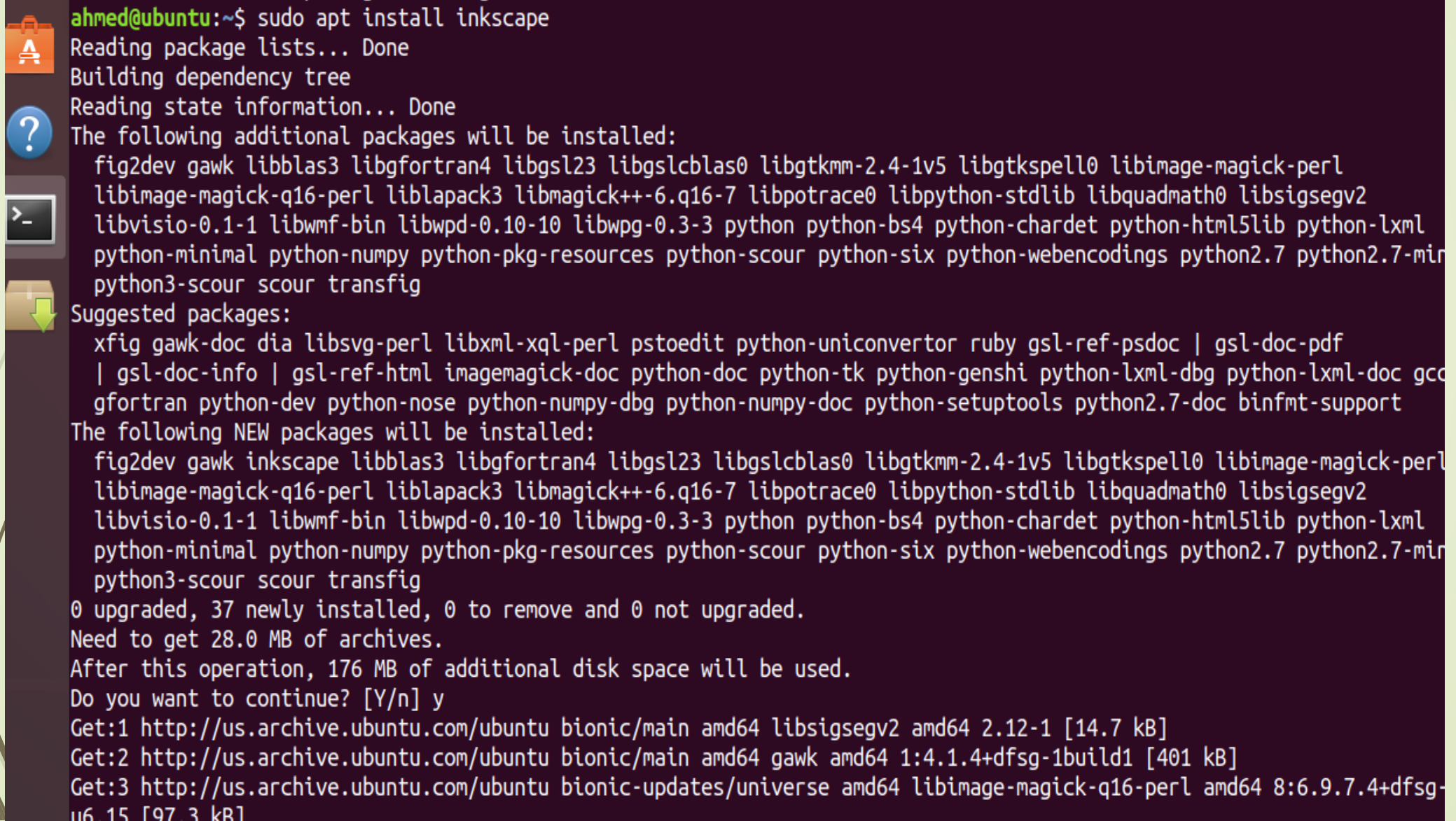
```
cowsay "hello, world"
```

```
 _____
< hello, world >
 -------------
        \   ^__^
         \  (oo)_____
            (__)\       )\/\
                ||----w |
                ||     ||
```

Example2: install inkscape program

```
ahmed@ubuntu:~$ sudo apt install inkscape
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  fig2dev gawk libblas3 libgfortran4 libgsl23 libgslcblas0 libgtkmm-2.4-1v5 libgtkspell0 libimage-magick-perl
  libimage-magick-q16-perl liblapack3 libmagick++-6.q16-7 libpotrace0 libpython-stdlib libquadmath0 libsigsegv2
  libvisio-0.1-1 libwmf-bin libwpd-0.10-10 libwpg-0.3-3 python python-bs4 python-chardet python-html5lib python-lxml
  python-minimal python-numpy python-pkg-resources python-scour python-six python-webencodings python2.7 python2.7-min
  python3-scour scour transfig
Suggested packages:
  xfig gawk-doc dia libsvg-perl libxml-xql-perl pstoedit python-uniconvertor ruby gsl-ref-psdoc | gsl-doc-pdf
  | gsl-doc-info | gsl-ref-html imagemagick-doc python-doc python-tk python-genshi python-lxml-dbg python-lxml-doc gcc
  gfortran python-dev python-nose python-numpy-dbg python-numpy-doc python-setuptools python2.7-doc binfmt-support
The following NEW packages will be installed:
  fig2dev gawk inkscape libblas3 libgfortran4 libgsl23 libgslcblas0 libgtkmm-2.4-1v5 libgtkspell0 libimage-magick-perl
  libimage-magick-q16-perl liblapack3 libmagick++-6.q16-7 libpotrace0 libpython-stdlib libquadmath0 libsigsegv2
  libvisio-0.1-1 libwmf-bin libwpd-0.10-10 libwpg-0.3-3 python python-bs4 python-chardet python-html5lib python-lxml
  python-minimal python-numpy python-pkg-resources python-scour python-six python-webencodings python2.7 python2.7-min
  python3-scour scour transfig
0 upgraded, 37 newly installed, 0 to remove and 0 not upgraded.
Need to get 28.0 MB of archives.
After this operation, 176 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://us.archive.ubuntu.com/ubuntu bionic/main amd64 libsigsegv2 amd64 2.12-1 [14.7 kB]
Get:2 http://us.archive.ubuntu.com/ubuntu bionic/main amd64 gawk amd64 1:4.1.4+dfsg-1build1 [401 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu bionic-updates/universe amd64 libimage-magick-q16-perl amd64 8:6.9.7.4+dfsg-
u6.15 [97.3 kB]
```
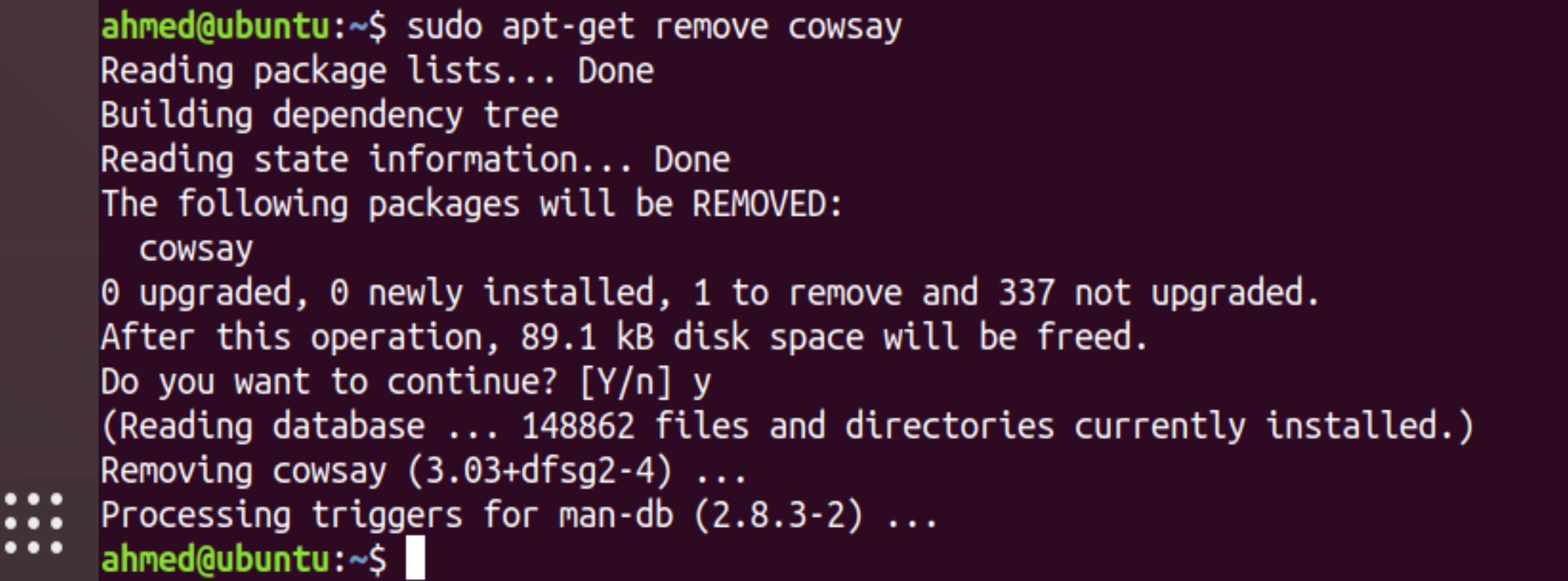
Removing Packages

- The apt-get command is able to either remove or purge a package.

- The difference between the two is that purging deletes all package files, while removing deletes all but the configuration files for the package.

- An administrator can execute the apt-get remove command to remove a package or the apt-get purge command to purge a package completely from the system.

For example, to purge cowsay completely, execute the following command.

```
apt-get remove [package]

apt-get purge [package]
```

```
ahmed@ubuntu:~$ sudo apt-get remove cowsay
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages will be REMOVED:
  cowsay
0 upgraded, 0 newly installed, 1 to remove and 337 not upgraded.
After this operation, 89.1 kB disk space will be freed.
Do you want to continue? [Y/n] y
(Reading database ... 148862 files and directories currently installed.)
Removing cowsay (3.03+dfsg2-4) ...
Processing triggers for man-db (2.8.3-2) ...
ahmed@ubuntu:~$
```
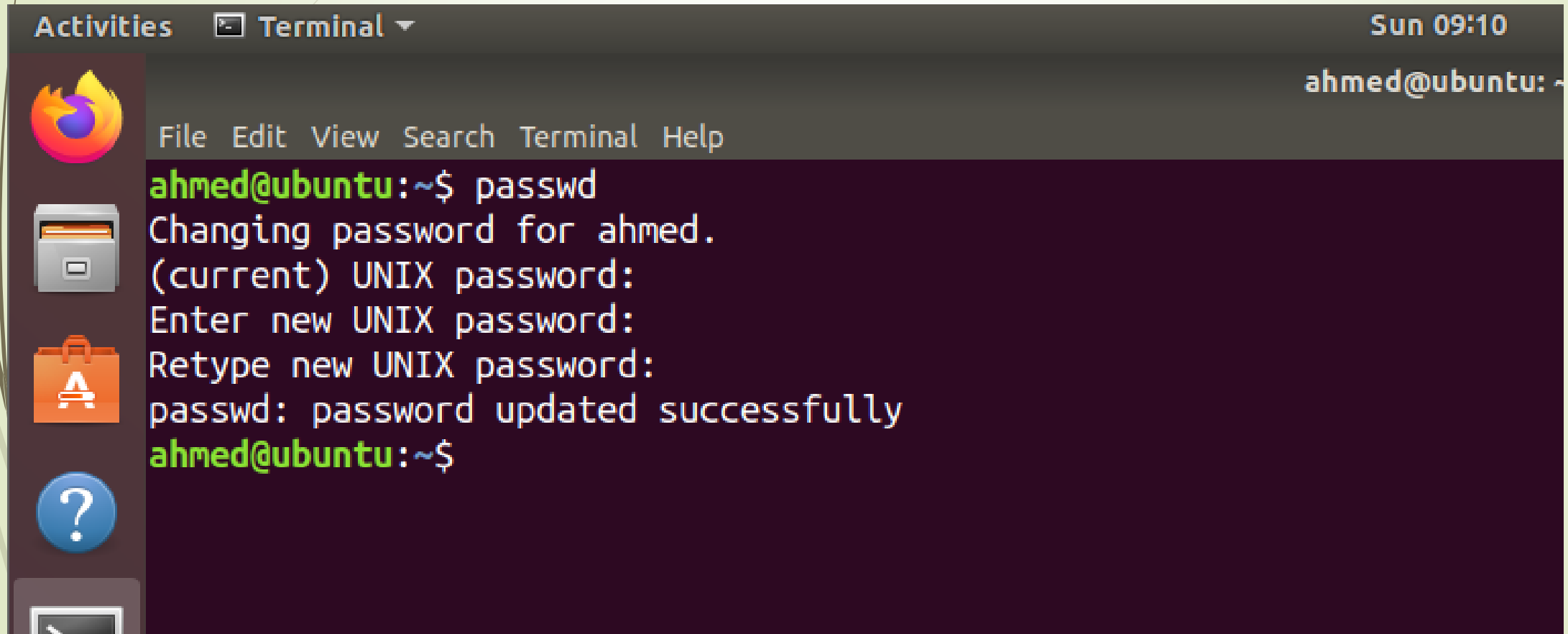
Removing the inkscape

Updating User Passwords

- The passwd command is used to update a user's password. Users can only change their own passwords, whereas the root user can update the password for any user.

```
passwd [OPTIONS] [USER]
```

Example to change password

File Edit View Search Terminal Help

```
ahmed@ubuntu:~$ passwd -S
ahmed P 12/07/2025 0 99999 7 -1
ahmed@ubuntu:~$
```

- **Sara:** The username
- **P=**Password status:
    - **P** = Password is set
    - **L** = Account is locked
    - **NP** = No password
- **12/13/2021:** The date when the password was last changed.
- **99999: Maximum days** the password is valid.
  99999 = the password practically never expires.
- **7: Warning days** before the password expires

File Edit View Search Terminal Help

```
ahmed@ubuntu:~$ passwd -S
ahmed P 12/07/2025 0 99999 7 -1
ahmed@ubuntu:~$ █
```

Summary

- User **sara** has a password.

- Last password change: **Dec 13, 2021**

- Password **never expires** (99999 days).

- User will be warned **7 days** before expiration.

- Account will **not** become inactive automatically;the user can still log in even if the password is expired..

ifconfig (interface configuration)

- ifconfig (interface configuration) is a network management tool. It is used to configure and view the status of the network interfaces in Linux operating systems. With ifconfig, you can assign IP addresses, enable or disable interfaces, routes, and more.

How to Install ifconfig

```
ahmed@ubuntu:~$ ifconfig

Command 'ifconfig' not found, but can be installed with:

sudo apt install net-tools

ahmed@ubuntu:~$ sudo apt install net-tools
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  libblas3 libgfortran4 libgsl23 libgslcblas0 libgtkmm-2.4-1v5 libgtkspell0 libimage-magick-perl libimage-magick-q16-perl
  liblapack3 libmagick++-6.q16-7 libpotrace0 libpython-stdlib libquadmath0 libvisio-0.1-1 libwpd-0.10-10 libwpg-0.3-3
  python python-bs4 python-chardet python-html5lib python-lxml python-minimal python-numpy python-pkg-resources
  python-scour python-six python-webencodings python2.7 python2.7-minimal python3-scour scour
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 194 kB of archives.
After this operation, 803 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu bionic/main amd64 net-tools amd64 1.60+git20161116.90da8a0-1ubuntu1 [194 kB]
Fetched 194 kB in 2s (98.2 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 151129 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20161116.90da8a0-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20161116.90da8a0-1ubuntu1) ...
Setting up net-tools (1.60+git20161116.90da8a0-1ubuntu1) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
ahmed@ubuntu:~$
```

```
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
ahmed@ubuntu:~$ ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.153.129  netmask 255.255.255.0  broadcast 192.168.153.255
        inet6 fe80::22f7:8e22:1cd9:c0c9  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:f7:ba:ba  txqueuelen 1000  (Ethernet)
        RX packets 149371  bytes 217080953 (217.0 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 23748  bytes 1821900 (1.8 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 840  bytes 82327 (82.3 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 840  bytes 82327 (82.3 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

ahmed@ubuntu:~$
```

Summary
•ens33 = your main network connection, active, has IP: 192.168.153.129.
•lo = internal system network, always present, IP: 127.0.0.1.

☑ **Network Interface: ens33**

- ❏ This is your main network card.
- ❏ UP, RUNNING → The network interface is active and working.
- ❏ netmask 255.255.255.0 → Subnet mask.
- ❏ broadcast 192.168.153.255 → Broadcast address.
- ❏ ether 00:0c:29:f7:ba:ba → MAC address.

Traffic:

- ❏ RX packets → Received packets (data coming to you).
- ❏ TX packets → Transmitted packets (data going out).
- ❏ No errors → Connection is healthy.

☑ **Loopback Interface: lo**

✓ This is the internal network of your computer.

✓ **inet 127.0.0.1** → Localhost (used for internal communication).IP

✓ Always **UP and RUNNING**.

✓ No errors → Works correctly.

✓ RX (Received data)

✓ TX (Transmitted)

References

- Ramses van Zon," Securing File Access Permissions on Linux ", SciNet HPC, University of Toronto ,27 October 2022.

- https://www.geeksforgeeks.org/linux-unix/ps-command-in-linux-with-examples/

- https://linuxize.com/post/ifconfig-command/