Linux Commands

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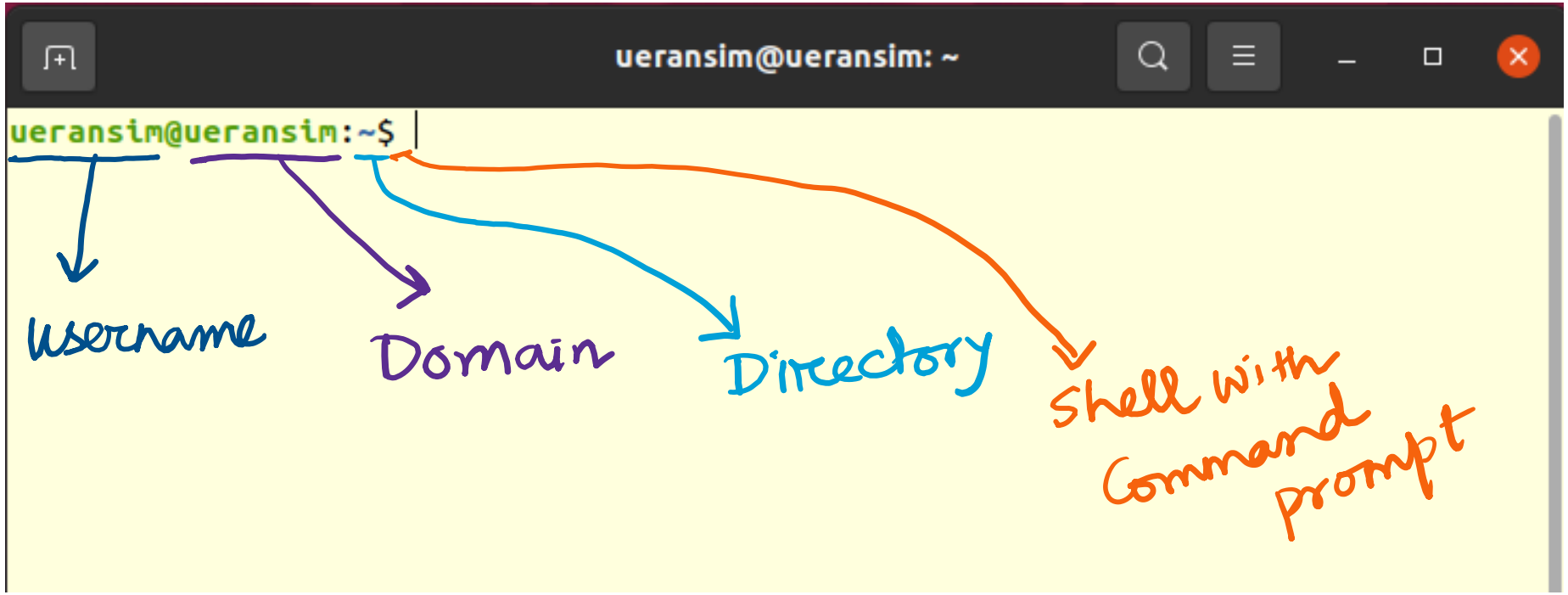
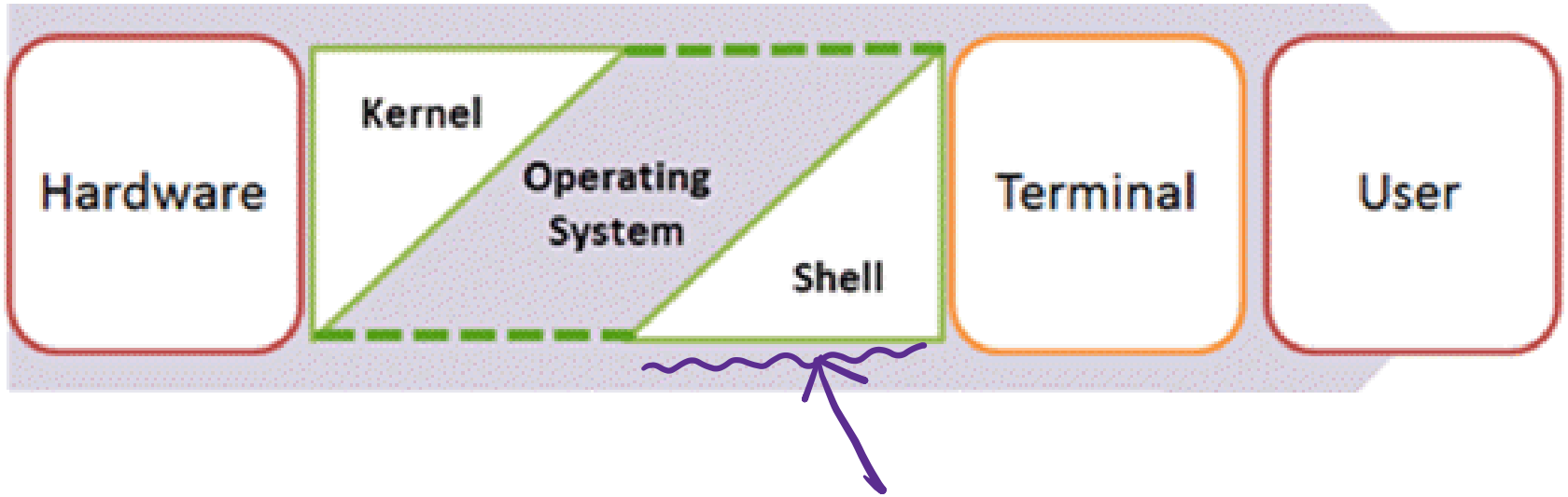
Opening a terminal



What happens when you open a terminal

- Linux/Unix starts another program called shell

- Where do we have the shell in systems?



Some facts: Kernel and Shell

- Kernel
  - Nucleus of a computer
  - Makes the communication between the hardware and software possible.
  - Innermost part of an operating system

- Shell
  - Outermost part of an operating system
  - Takes input from you in the form of commands, processes it, and then gives an output
  - Interface through which a user works on the programs, commands, and scripts
  - Accessed by a terminal that runs it

- When you run the terminal
  - The Shell issues **a command prompt (usually $)**

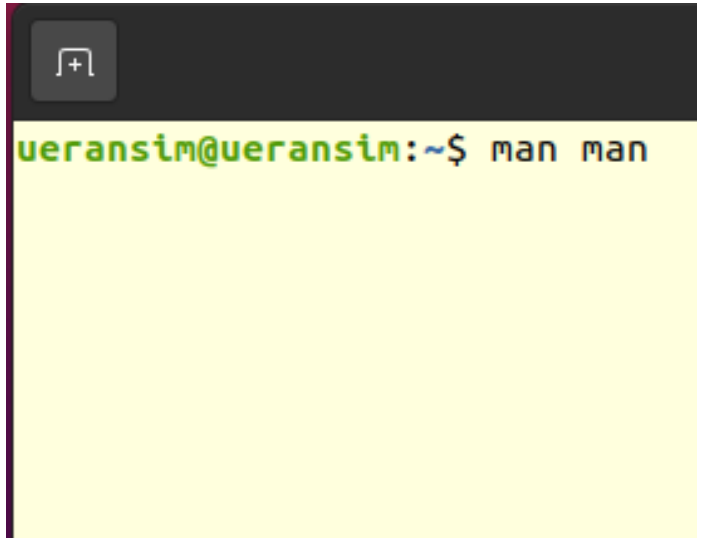
- The Shell wraps around the delicate interior of an Operating system protecting it from accidental damage. Hence the name **Shell**.

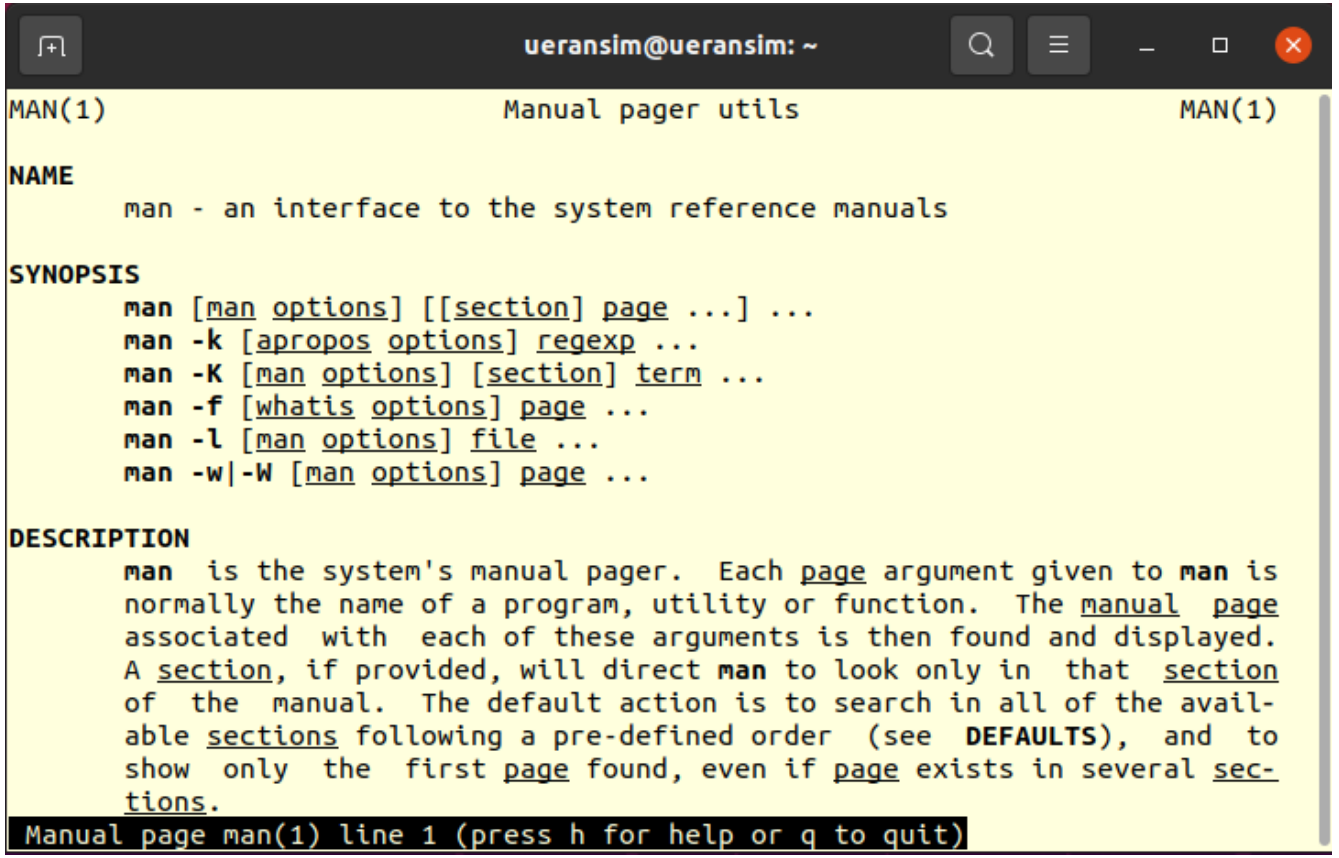
What does a shell do?

- Interprets user-commands
- Manages execution of the commands
- Shell commands are case-sensitive

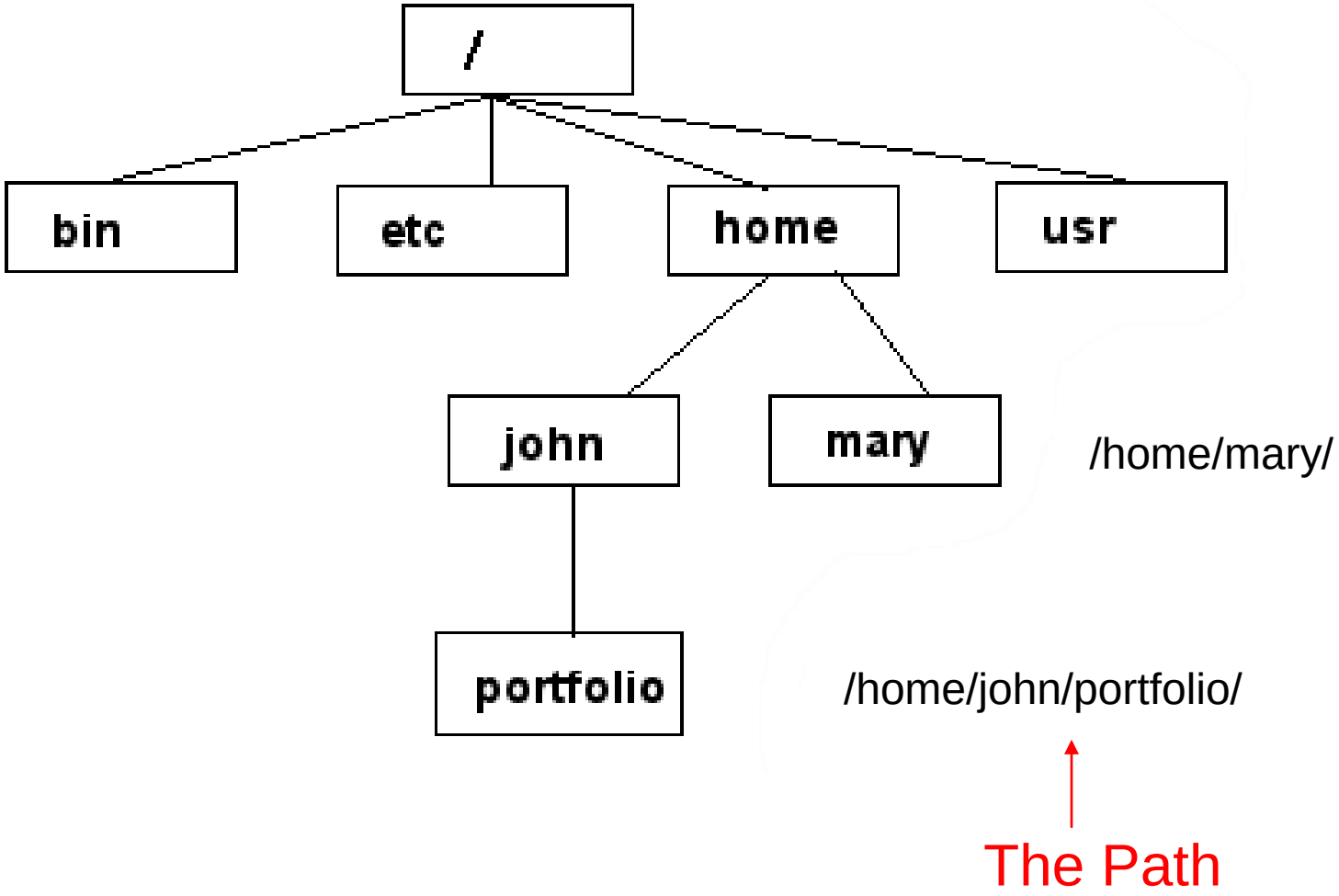
If I don’t know exact syntax of command

- Type man and the command





Linux filesystem

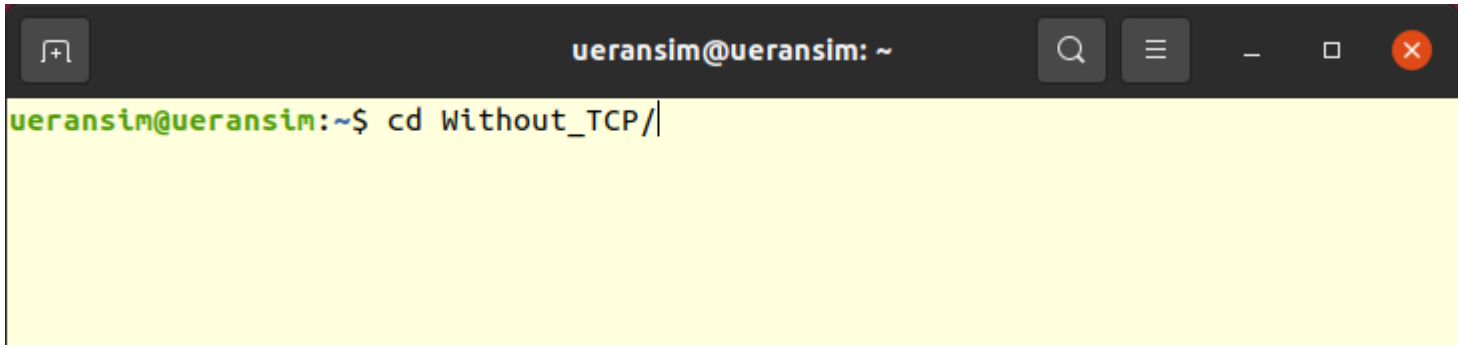


If I don’t know the path: Command *pwd*

```
ueransim@ueransim: ~
ueransim@ueransim:~$ pwd
/home/ueransim
ueransim@ueransim:~$
```

pwd: Present working directory

Command: *cd*



cd: change directory

Can I jump to another directory without going to the home directory?

Way 1

```
ueransim@ueransim: ~/Without_UDP
ueransim@ueransim:~/Without_TCP$ cd /home/ueransim/Without_UDP/
ueransim@ueransim:~/Without_UDP$
```

Need to give the absolute path

Way 2

```
ueransim@ueransim: ~/Without_UDP
ueransim@ueransim:~/Without_TCP$ cd ~/Without_UDP/
ueransim@ueransim:~/Without_UDP$
```

~ : location of the home directory

How to list contents of a directory

```
ueransim@ueransim: ~
ueransim@ueransim:~$ ls
Desktop    IDS_NAT  packet_size  snap       Videos
Documents  IPS_NAT  Pictures     Templates  Without_TCP
Downloads  Music    Public       UERANSIM   Without_UDP
ueransim@ueransim:~$
```

ls: lists contents of the directory

Can I see the contents of another directory?

```
ueransim@ueransim: ~
ueransim@ueransim:~$ ls
Desktop    IDS_NAT  packet_size  snap       Videos
Documents  IPS_NAT  Pictures     Templates  Without_TCP
Downloads  Music    Public       UERANSIM   Without_UDP
ueransim@ueransim:~$
```

Contents in current directory

```
ueransim@ueransim: ~
ueransim@ueransim:~$ ls Without_TCP/
output.txt  script_ditg_decode.py  Without_NAT_TCP.csv
ueransim@ueransim:~$
```

Contents in another directory

Can I see all files with *ls* command?

- *ls* has many options
  - *-l* long list (displays lots of info)
  - *-t* sort by modification time
  - *-S* sort by size
  - *-h* list file sizes in human-readable format
  - *-r* reverses the order

- Options can be combined: *ls -ltr*

```
ueransim@ueransim: ~/Without_UDP
ueransim@ueransim:~/Without_UDP$ ls -ltr
total 16
-rw-rw-r-- 1 ueransim ueransim 3353 Sep 27 19:33 script_ditg_decode.py
-rw-rw-r-- 1 ueransim ueransim 1683 Sep 28 12:17 output.txt
-rw-rw-r-- 1 ueransim ueransim 6342 Sep 28 12:17 Without_NAT_UDP.csv
ueransim@ueransim:~/Without_UDP$
```

If I only want to see files with a specific extension

```
ueransim@ueransim: ~/Without_UDP
ueransim@ueransim:~/Without_UDP$ ls -ltr
total 16
-rw-rw-r-- 1 ueransim ueransim 3353 Sep 27 19:33 script_ditg_decode.py
-rw-rw-r-- 1 ueransim ueransim 1683 Sep 28 12:17 output.txt
-rw-rw-r-- 1 ueransim ueransim 6342 Sep 28 12:17 Without_NAT_UDP.csv
ueransim@ueransim:~/Without_UDP$ ls *.py
script_ditg_decode.py
ueransim@ueransim:~/Without_UDP$
```

Showing the file(s) with .py extension only

How to create a new directory

```
ueransim@ueransim: ~
ueransim@ueransim:~$ mkdir Linux_commands
```

```
ueransim@ueransim: ~
ueransim@ueransim:~$ mkdir Linux_commands
ueransim@ueransim:~$ ls
Desktop    IDS_NAT         Music        Public     UERANSIM     Without_UDP
Documents  IPS_NAT         packet_size  snap       Videos
Downloads  Linux_commands  Pictures     Templates  Without_TCP
ueransim@ueransim:~$
```

mkdir: make directory

How to delete a directory?

Way 1

```
ueransim@ueransim: ~
ueransim@ueransim:~$ rmdir Linux_commands/
```

```
ueransim@ueransim: ~
ueransim@ueransim:~$ rmdir Linux_commands/
ueransim@ueransim:~$ ls
Desktop     IDS_NAT   packet_size   snap        Videos
Documents   IPS_NAT   Pictures      Templates   Without_TCP
Downloads   Music     Public        UERANSIM    Without_UDP
ueransim@ueransim:~$
```

Way 2

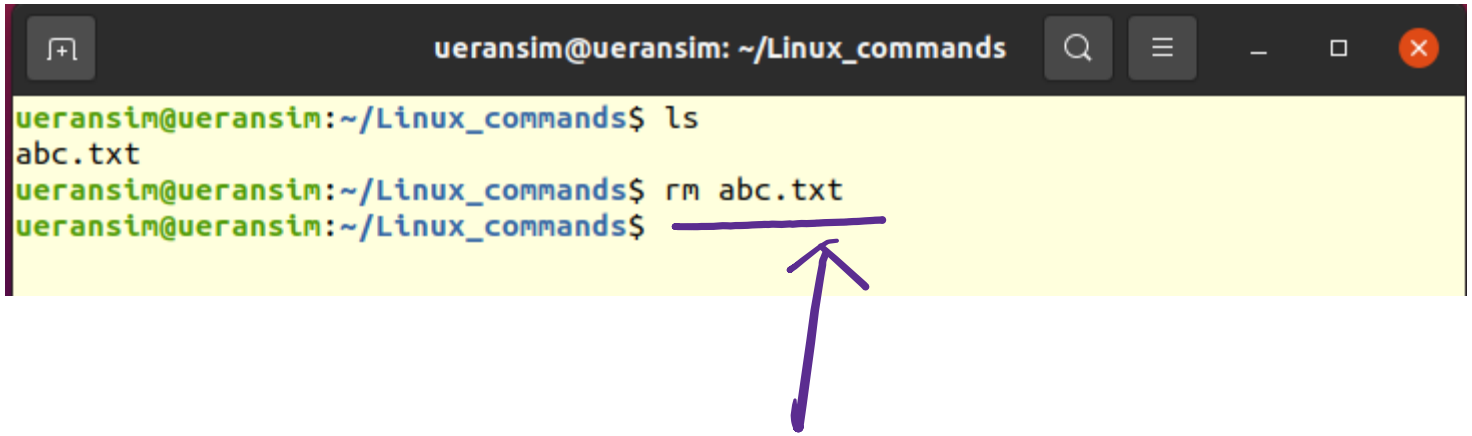
```
ueransim@ueransim: ~
ueransim@ueransim:~$ rm -r Linux_commands/
ueransim@ueransim:~$
```

-r or -R:

Recursively deletes any matching directories, subdirectories and files they contain

rm: remove

How to delete a file?



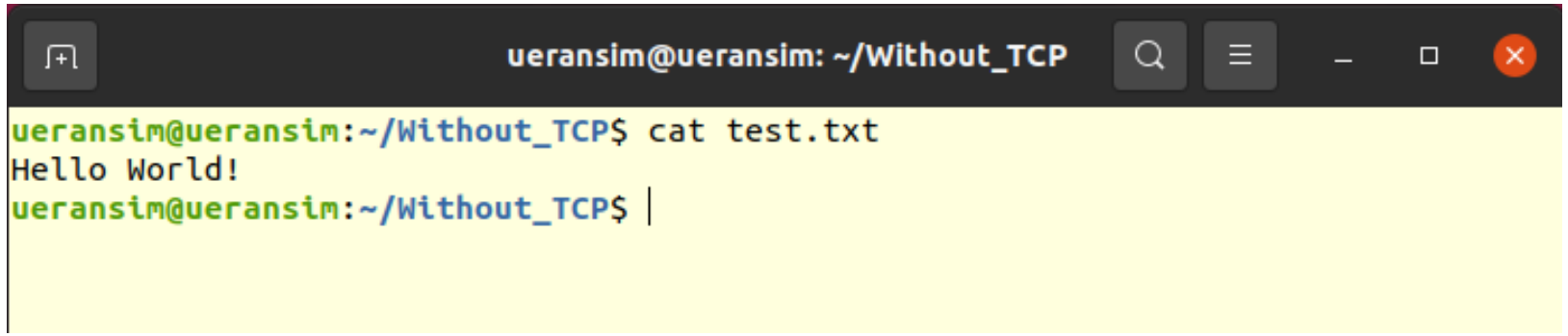
How to delete all files with a specific extension?

How to display contents of a file?

- cat
- less
- head
- tail

cat

- Dumps an entire file to standard output
- Good for displaying short, simple files



But if we have a file with large contents!

```
ueransim@ueransim: ~/Without_TCP

Packets dropped          =             0 (0.00 %)
Average loss-burst size  =      0.000000 pkt
-------------------------------------------------------


________________________________________________________
****************  TOTAL RESULTS   ******************

________________________________________________________
Number of flows          =             1
Total time               =     29.999994 s
Total packets            =        260739
Minimum delay            =     -0.000014 s
Maximum delay            =      0.158310 s
Average delay            =      0.000515 s
Average jitter           =      0.000055 s
Delay standard deviation =      0.005387 s
Bytes received           =     133939665
Average bitrate          =  35717.251143 Kbit/s
Average packet rate      =   8691.301738 pkt/s
Packets dropped          =             0 (0.00 %)
Average loss-burst size  =             0 pkt
Error lines              =             0
-------------------------------------------------------
ueransim@ueransim:~/Without_TCP$
```

Cannot see all content!

Command: *less*

- *less* displays a file, allowing forward/backward movement within it
- *return* scrolls forward one line
- *space* one page
- *y* scrolls back one line
- *b* one page
- use */* to search for a string
- Press *q* to quit

```
ueransim@ueransim: ~/Without_TCP
ueransim@ueransim:~/Without_TCP$ less output.txt

ITGDec version 2.8.1 (r1023)
Compile-time options: sctp dccp bursty multiport
---------------------------------------------------------
Flow number: 1
From 10.0.2.4:48164
To    10.0.2.4:8999
---------------------------------------------------------
Total time                =     29.999994 s
Total packets             =        260739
Minimum delay             =     -0.000014 s
Maximum delay             =      0.158310 s
Average delay             =      0.000515 s
Average jitter            =      0.000055 s
Delay standard deviation  =      0.005387 s
Bytes received            =     133939665
Average bitrate           =  35717.251143 Kbit/s
Average packet rate       =   8691.301738 pkt/s
Packets dropped           =             0 (0.00 %)
Average loss-burst size   =      0.000000 pkt
---------------------------------------------------------

output.txt
```

Command: *head*

- *head* displays the top part of a file
- By default it shows the first 10 lines
- *-n* option allows you to change the number of lines to display
- Example: *head -n50 file.txt* displays the first 50 lines of file.txt

```
ueransim@ueransim:~/Without_TCP$ head output.txt
ITGDec version 2.8.1 (r1023)
Compile-time options: sctp dccp bursty multiport
-------------------------------------------------------------
Flow number: 1
From 10.0.2.4:48164
To    10.0.2.4:8999
-------------------------------------------------------------
Total time                =     29.999994 s
Total packets             =        260739
Minimum delay             =     -0.000014 s
ueransim@ueransim:~/Without_TCP$
```

```
ueransim@ueransim: ~/Without_TCP

ueransim@ueransim:~/Without_TCP$ head -n15 output.txt
ITGDec version 2.8.1 (r1023)
Compile-time options: sctp dccp bursty multiport
---------------------------------------------------------
Flow number: 1
From 10.0.2.4:48164
To    10.0.2.4:8999
---------------------------------------------------------
Total time                =     29.999994 s
Total packets             =        260739
Minimum delay             =     -0.000014 s
Maximum delay             =      0.158310 s
Average delay             =      0.000515 s
Average jitter            =      0.000055 s
Delay standard deviation  =      0.005387 s
Bytes received            =     133939665
ueransim@ueransim:~/Without_TCP$
```

Command: *tail*

- Same as *head* but shows the *last 10 lines by default*

```
ueransim@ueransim: ~/Without_TCP
ueransim@ueransim:~/Without_TCP$ tail output.txt
Average delay            =      0.000515 s
Average jitter           =      0.000055 s
Delay standard deviation =      0.005387 s
Bytes received           =     133939665
Average bitrate          =  35717.251143 Kbit/s
Average packet rate      =   8691.301738 pkt/s
Packets dropped          =              0 (0.00 %)
Average loss-burst size  =              0 pkt
Error lines              =              0
-----------------------------------------------------------
ueransim@ueransim:~/Without_TCP$
```

- *tail –n12 test.txt shows last 12 lines*

File commands: copy, move, rename

- Copying a file: cp

```
ueransim@ueransim: ~/Without_TCP
ueransim@ueransim:~/Without_TCP$ cp output.txt copy_output.txt
ueransim@ueransim:~/Without_TCP$ ls
copy_output.txt  script_ditg_decode.py  Without_NAT_TCP.csv
output.txt       test.txt
ueransim@ueransim:~/Without_TCP$
```

Contents of both files are the same.

File commands: copy, move, rename

- Move or rename a file: mv

```
ueransim@ueransim: ~/Without_TCP
ueransim@ueransim:~/Without_TCP$ mv copy_output.txt ~/
ueransim@ueransim:~/Without_TCP$
```

→ move to another directory

```
ueransim@ueransim: ~/Without_TCP
ueransim@ueransim:~/Without_TCP$ mv output.txt output_new.txt
ueransim@ueransim:~/Without_TCP$ ls
output_new.txt  script_ditg_decode.py  test.txt  Without_NAT_TCP.csv
ueransim@ueransim:~/Without_TCP$
```

→ Rename a file

File permissions

```
ueransim@ueransim: ~/Without_TCP
ueransim@ueransim:~/Without_TCP$ ls -l
total 20
-rw-rw-r-- 1 ueransim ueransim 1683 Sep 28 20:43 output_new.txt
-rw-rw-r-- 1 ueransim ueransim 3353 Sep 27 20:21 script_ditg_decode.py
-rw-rw-r-- 1 ueransim ueransim   13 Oct  5 12:10 test.txt
-rw-rw-r-- 1 ueransim ueransim 6316 Sep 28 20:43 Without_NAT_TCP.csv
ueransim@ueransim:~/Without_TCP$
```

r – Read
W – write

total size in KB

Question: What is the size of an empty directory?

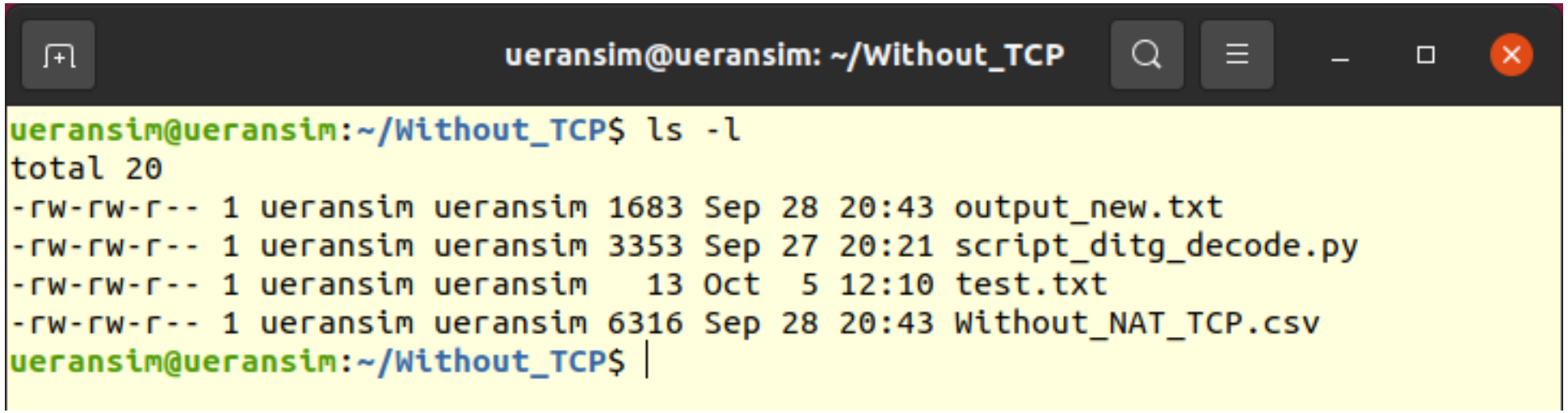
```
ueransim@ueransim: ~/Without_TCP
ueransim@ueransim:~/Without_TCP$ ls -as1
total 28
4 .
4 ..
4 output_new.txt
4 script_ditg_decode.py
4 test.txt
8 Without_NAT_TCP.csv
ueransim@ueransim:~/Without_TCP$
```

```
ueransim@ueransim: ~/Without_TCP
ueransim@ueransim:~/Without_TCP$ ls -as1
total 28
4 .
4 ..
4 output_new.txt
4 script_ditg_decode.py
4 test.txt
8 Without_NAT_TCP.csv
ueransim@ueransim:~/Without_TCP$
```

What are these?

File permissions

- Read: r
- Write: w
- Execute: x
  - In case of directory, *x* grants permission to list directory contents



```
ueransim@ueransim: ~
ueransim@ueransim:~$ ls -l
total 68
-rw-rw-r-- 1 ueransim ueransim 1683 Oct  5 13:55 copy_output.txt
drwxr-xr-x 2 ueransim ueransim 4096 May 29 09:44 Desktop
drwxr-xr-x 2 ueransim ueransim 4096 May 29 09:44 Documents
drwxr-xr-x 2 ueransim ueransim 4096 Sep 28 20:44 Downloads
drwxrwxr-x 2 ueransim ueransim 4096 Sep 27 10:41 IDS_NAT
drwxrwxr-x 2 ueransim ueransim 4096 Sep 30 21:50 IPS_NAT
drwxrwxr-x 2 ueransim ueransim 4096 Oct  5 12:05 Linux_commands
drwxr-xr-x 2 ueransim ueransim 4096 May 29 09:44 Music
drwxrwxr-x 2 ueransim ueransim 4096 Oct  1 01:03 packet_size
drwxr-xr-x 2 ueransim ueransim 4096 May 29 09:44 Pictures
drwxr-xr-x 2 ueransim ueransim 4096 May 29 09:44 Public
drwx------ 3 ueransim ueransim 4096 May 29 09:54 snap
drwxr-xr-x 2 ueransim ueransim 4096 May 29 09:44 Templates
drwxrwxr-x 9 ueransim ueransim 4096 May 29 09:54 UERANSIM
drwxr-xr-x 2 ueransim ueransim 4096 May 29 09:44 Videos
drwxrwxr-x 2 ueransim ueransim 4096 Oct  5 13:58 Without_TCP
drwxrwxr-x 2 ueransim ueransim 4096 Sep 30 20:51 Without_UDP
ueransim@ueransim:~$
```

The first letter indicates the type of file:

- `-` means it's a normal file
- `d` means it's a directory
- `l` means it's a link

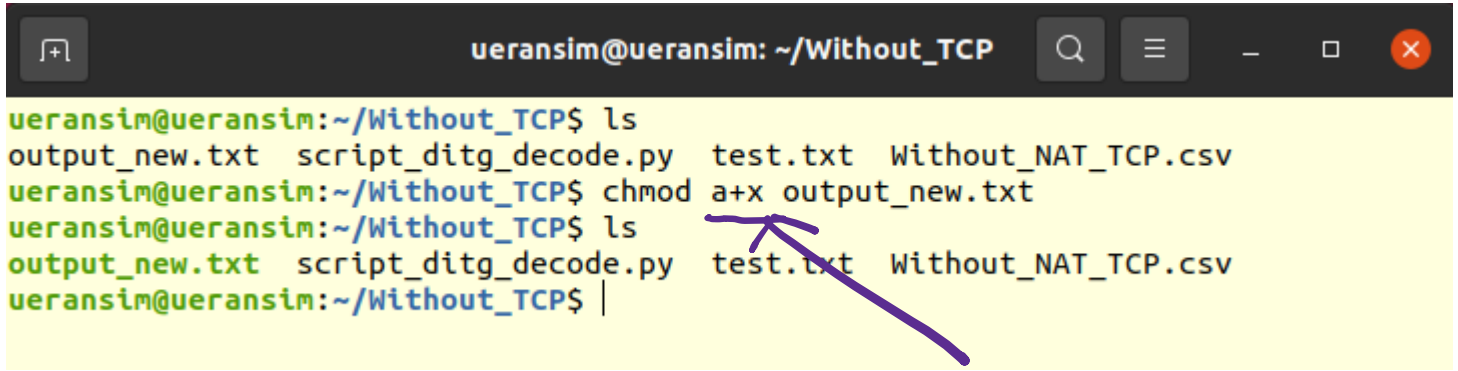
```
ueransim@ueransim:~/Without_TCP$ ls -l
total 20
-rw-rw-r-- 1 ueransim ueransim 1683 Sep 28 20:43 output_new.txt
-rw-rw-r-- 1 ueransim ueransim 3353 Sep 27 20:21 script_ditg_decode.py
-rw-rw-r-- 1 ueransim ueransim   13 Oct  5 12:10 test.txt
-rw-rw-r-- 1 ueransim ueransim 6316 Sep 28 20:43 Without_NAT_TCP.csv
ueransim@ueransim:~/Without_TCP$
```

owner group world.

if we have executable file : rwx

Can we change file permission?

- Using *chmod*
  - Syntax: chmod [**u**ser/**g**roup/**o**thers/**a**ll]+[permission] [file(s)]



observe: changes in color,

: what did we do with a +x ?

```
ueransim@ueransim: ~/Without_TCP
ueransim@ueransim:~/Without_TCP$ ls
output_new.txt  script_ditg_decode.py  test.txt  Without_NAT_TCP.csv
ueransim@ueransim:~/Without_TCP$ chmod a+x output_new.txt
ueransim@ueransim:~/Without_TCP$ ls
output_new.txt  script_ditg_decode.py  test.txt  Without_NAT_TCP.csv
ueransim@ueransim:~/Without_TCP$
```

- a stands for *all*
- u stands for *user*
- g stands for *group*
- o stands for *others*

+ : add permission ; − : remove permission

r, w, x : read, write, execute

Can we change the permission in another way?

- Using numbers:

```
1 if has execution permission
2 if has write permission
4 if has read permission
```

⇒ So, total number value can be 7

```
0 no permissions
1 can execute
2 can write
3 can write, execute → (2+1)
4 can read
5 can read, execute → (4+1)
6 can read, write → (4+2)
7 can read, write and execute → (4+2+1)
```

What about the users?

```
chmod 777 filename
chmod 755 filename
chmod 644 filename
```

owner group other

Command: *ps*

- List of user-initiated processes

```
ueransim@ueransim: ~
ueransim@ueransim:~$ ps
    PID TTY          TIME CMD
   1762 pts/0    00:00:00 bash
   3433 pts/0    00:00:00 ps
ueransim@ueransim:~$
```

Command: *ps ax*

- To list all processes

```
ueransim@ueransim:~$ ps ax
    PID TTY      STAT   TIME COMMAND
      1 ?        Ss     0:01 /sbin/init splash
      2 ?        S      0:00 [kthreadd]
      3 ?        I<     0:00 [rcu_gp]
      4 ?        I<     0:00 [rcu_par_gp]
      5 ?        I<     0:00 [slub_flushwq]
      6 ?        I<     0:00 [netns]
      8 ?        I<     0:00 [kworker/0:0H-events_highpri]
     10 ?        I<     0:00 [mm_percpu_wq]
     11 ?        S      0:00 [rcu_tasks_rude_]
     12 ?        S      0:00 [rcu_tasks_trace]
     13 ?        S      0:00 [ksoftirqd/0]
     14 ?        I      0:00 [rcu_sched]
     15 ?        S      0:00 [migration/0]
     16 ?        S      0:00 [idle_inject/0]
     18 ?        S      0:00 [cpuhp/0]
```

```
1225 ?        S<sl   0:02 /usr/bin/pulseaudio --daemonize=no --log-target=jo
1227 ?        SNsl   0:00 /usr/libexec/tracker-miner-fs
1229 ?        Ss     0:00 /usr/bin/dbus-daemon --session --address=systemd:
1246 ?        Ssl    0:00 /usr/libexec/gvfsd
1248 ?        Sl     0:00 /usr/bin/gnome-keyring-daemon --daemonize --login
1255 ?        Sl     0:00 /usr/libexec/gvfsd-fuse /run/user/1000/gvfs -f -o
1257 ?        Ssl    0:00 /usr/libexec/gvfs-udisks2-volume-monitor
1270 tty2     Ssl+   0:00 /usr/lib/gdm3/gdm-x-session --run-script env GNOME
1272 tty2     Sl+    0:21 /usr/lib/xorg/Xorg vt2 -displayfd 3 -auth /run/use
1273 ?        Ssl    0:00 /usr/libexec/gvfs-afc-volume-monitor
1280 ?        Ssl    0:00 /usr/libexec/gvfs-goa-volume-monitor
1284 ?        Sl     0:00 /usr/libexec/goa-daemon
1292 ?        Sl     0:00 /usr/libexec/goa-identity-service
1299 ?        Ssl    0:00 /usr/libexec/gvfs-mtp-volume-monitor
1303 ?        Ssl    0:00 /usr/libexec/gvfs-gphoto2-volume-monitor
1320 tty2     Sl+    0:00 /usr/libexec/gnome-session-binary --systemd --syst
1390 ?        Ssl    0:00 /usr/libexec/gvfsd-metadata
```

longer names are cut

To show all processes with full name

```
ueransim@ueransim: ~
ueransim@ueransim:~$ ps axww
```

```
   1649 ?        Sl     0:00 /usr/libexec/gsd-disk-utility-notify
   1650 ?        Sl     0:00 /usr/libexec/evolution-data-server/evolution-alarm
-notify
   1709 ?        Sl     0:00 /usr/libexec/gsd-printer
```

← shown in detail (no cut)

ps axww | grep "Visual Studio Code" → to search running process with phrase "visual..."

Command: *top*

- Shows the dynamic real-time information about the running processes

```
ueransim@ueransim: ~
top - 14:49:57 up  3:50,  1 user,  load average: 0.00, 0.03, 0.00
Tasks: 176 total,   1 running, 175 sleeping,   0 stopped,   0 zombie
%Cpu(s):  0.3 us,  0.7 sy,  0.0 ni, 98.6 id,  0.2 wa,  0.0 hi,  0.2 si,  0.0 st
MiB Mem :   1963.9 total,     70.9 free,    746.0 used,   1147.0 buff/cache
MiB Swap:   1162.4 total,   1161.4 free,      1.0 used.   1036.1 avail Mem

    PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
   1272 ueransim  20   0  278156  88672  48916 S   1.7   4.4   0:24.14 Xorg
   1458 ueransim  20   0 4219396 361444 125872 S   1.7  18.0   0:31.95 gnome-+
   1229 ueransim  20   0   13688  10452   3776 S   0.3   0.5   0:00.57 dbus-d+
   3431 root      20   0       0      0      0 I   0.3   0.0   0:00.20 kworke+
      1 root      20   0  168320  11544   8376 S   0.0   0.6   0:01.17 systemd
      2 root      20   0       0      0      0 S   0.0   0.0   0:00.00 kthrea+
      3 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 rcu_gp
      4 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 rcu_pa+
      5 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 slub_f+
      6 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 netns
      8 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 kworke+
     10 root       0 -20       0      0      0 I   0.0   0.0   0:00.00 mm_per+
```

How to kill a process?

- *kill <pid>*

```
kill -HUP <PID>
kill -INT <PID>
kill -KILL <PID>
kill -TERM <PID>
kill -CONT <PID>
kill -STOP <PID>
```

with flags

HUP ⇒ hung up

INT ⇒ interrupt

KILL ⇒ to kill, send to OS kernel (NOT to process)

TERM ⇒ terminate

CONT ⇒ to resume a stopped process

STOP ⇒ stops (but not terminate)
– send to OS kernel (NOT to a process)

- Can also use numbers:

`1` corresponds to `HUP`. `2` corresponds to `INT`. `9` corresponds to `KILL`. `15` corresponds to `TERM`. `18` corresponds to `CONT`. `15` corresponds to `STOP`.

Create a new file using *touch*

```
ueransim@ueransim: ~
ueransim@ueransim:~$ touch test.txt
ueransim@ueransim:~$ ls
copy_output.txt  Downloads  Linux_commands  Pictures  Templates  Videos
Desktop          IDS_NAT    Music           Public    test.txt   Without_TCP
Documents        IPS_NAT    packet_size     snap      UERANSIM   Without_UDP
ueransim@ueransim:~$ cat test.txt
ueransim@ueransim:~$
```

Write something into the file

empty

```
ueransim@ueransim: ~
ueransim@ueransim:~$ cat test.txt
ueransim@ueransim:~$ echo "Hello World" > test.txt
ueransim@ueransim:~$ cat test.txt
Hello World
ueransim@ueransim:~$
```

writing to the file test.txt

Written to the file

Write your own shell script

Create a file with *sh* extension

```
ueransim@ueransim: ~/script
ueransim@ueransim:~/script$ ls
ueransim@ueransim:~/script$ touch myscript.sh
ueransim@ueransim:~/script$ ls
myscript.sh
ueransim@ueransim:~/script$ cat myscript.sh
ueransim@ueransim:~/script$ ls -l
total 0
-rw-rw-r-- 1 ueransim ueransim 0 Oct  6 09:35 myscript.sh
ueransim@ueransim:~/script$
```

→ empty file

→ only read and write

NOT executable

Make *myscript.sh* executable

```
ueransim@ueransim: ~/script
ueransim@ueransim:~/script$ chmod +x myscript.sh
ueransim@ueransim:~/script$ ls -l
total 0
-rwxrwxr-x 1 ueransim ueransim 0 Oct  6 09:35 myscript.sh
ueransim@ueransim:~/script$
```

See the color!

Now, read, write, execute permission

Adding some commands to *myscript.sh*

```
ueransim@ueransim: ~/script
ueransim@ueransim:~/script$ nano myscript.sh
```

```
ueransim@ueransim: ~/script
  GNU nano 4.8                    myscript.sh
echo This is my first shell script
touch testfile
ls
echo End of my shell script
```

Run *myscript.sh*

```
ueransim@ueransim: ~/script
  GNU nano 4.8                    myscript.sh
echo This is my first shell script
touch testfile
ls
echo End of my shell script
```

What is done by this command?

```
ueransim@ueransim: ~/script
ueransim@ueransim:~/script$ nano myscript.sh
ueransim@ueransim:~/script$ ./myscript.sh
This is my first shell script
myscript.sh  testfile
End of my shell script
ueransim@ueransim:~/script$
```

ls

If I want to comment a line

```
ueransim@ueransim: ~/script
  GNU nano 4.8                    myscript.sh                    Modified
# echo This is my first shell script
touch testfile
ls
echo End of my shell script
```

put # before the line

```
ueransim@ueransim: ~/script
ueransim@ueransim:~/script$ nano myscript.sh
ueransim@ueransim:~/script$ ./myscript.sh
myscript.sh  testfile
End of my shell script
ueransim@ueransim:~/script$
```

Can I use variables in shell-scripts like programs?

- System-defined variable/ Environment variable
- User-defined variable

```
ueransim@ueransim: ~/script
GNU nano 4.8                    myscript.sh
# echo This is my first shell script
touch testfile
ls


# Accesssing Environment variable
echo $USER

#Creating and accessing user-defined variable
my_variable="Hello World!"
echo $my_variable


echo End of my shell script
```

```
ueransim@ueransim: ~/script
ueransim@ueransim:~/script$ ./myscript.sh
myscript.sh  testfile
ueransim
Hello World!
End of my shell script
ueransim@ueransim:~/script$
```

Shell-script interpreter

- Many Shells available in Linux
  - The bourne shell(sh)
  - The Korn Shell(ksh)
  - GNU Bourne-Again Shell(bash)

- Scripts written for the *sh shell* are called shell scripts, and they can be interpreted by both, the ksh and bash shells
- *ksh* and *bash* are improved versions of the original sh shell and they have more features than sh
- Bash is generally the default shell in most of the Linux Distributions and scripts written specifically for bash shell are called bash scripts.

Comparison in shell-scripts

- Integer comparison

Operator	Description
-eq	is equal to
-ne	is not equal to
-gt	is greater than
-ge	is greater than or equal to
-lt	is less than
-le	is less than or equal to

- String comparison

Operator	Description
==	is equal to
!=	is not equal to
\<	is less than, in ASCII alphabetical order
\>	is greater than, in ASCII alphabetical order

When do we need this?

Conditional *if* statement in shell-script

Syntax

```
if [ condition ]
then
#statements
fi
```

example:

```
#!/bin/sh
x=10
y=11
if [ $x -ne $y ]
then
echo "Not equal"
fi
```

→ interpreter

Conditional *if-else* statement in shell-script

Syntax

```
if [ condition ]
then
#set of statements if the condition is true
else
#set of statements if the condition is false
fi
```

```
#!/bin/sh
x=10
y=10
if [ $x -ne $y ]
then
echo "Not equal"
else
echo "They are equal"
fi
```

While loop statement in shell-script

Syntax

```
while [ condition ]
do
#set of statements
done
```

```
#!/bin/sh
x=2
while [ $x -lt 6 ]
do
echo $x
x=`expr $x + 1`
done
```

expression
- will be evaluated

For loop in shell-script

Syntax

```
for var in val1 val2 val3
do
#statements
done
```

```
#!/bin/sh
for var in 2 4 5 8
do
echo $var
done
```

Assignment 1: Basics on shell-script

- Write a shell script to display all file information in detail within the working directory
- Write a shell script to display the running processes in the system
- Write a shell script to create a file, write something into the file, and make the file executable

Assignment 2

- Suppose you need the following packages to execute your program:
  - Python3.6
  - Numpy

- Your task: Write a shell script to install the packages

Assignment 2: Steps for python installation

- Check whether python is already available
- If available, check the python version
- Compare the existing version with the required version
- If not available, install using "*sudo apt-get install python3.6*"
- Display the python version
- Note: you need to run your shell script using *sudo*

Assignment 2: Steps for numpy installation

- Check whether numpy is already installed
- If available, update the numpy to the latest version

Assignment 3

- Write a Shell script for reading and saving terminal output into a file
  - Hint: use *yourCommand 2>&1 | tee outputFile.txt*

  - *Tee:* The tee command is **normally used to split the output of a program so that it can be both displayed and saved in a file**.

More practice sets

- https://www.emertxe.com/embedded-systems/linux-systems/ls-assignments/