

Lab 2: Introduction to Linux -

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Exercise 3:

Q1. Identify how many CPUs are in your environment? What is a Linux kernel module?

- The number of CPUs can be checked by the list of following commands:

```
$ lscpu
```

```
$ lscpu | egrep 'Model name|Socket|Thread|NUMA|CPU\$(s\)'
```

```
$ lscpu -p
```

```

parth@GL62M-7RDX:~/Desktop$ lscpu
Architecture:          x86_64
CPU op-mode(s):        32-bit, 64-bit
Byte Order:            Little Endian
Address sizes:         39 bits physical, 48 bits virtual
CPU(s):                8
On-line CPU(s) list:   0-7
Thread(s) per core:    2
Core(s) per socket:    4
Socket(s):             1
NUMA node(s):          1
Vendor ID:             GenuineIntel
CPU family:            6
Model:                 158
Model name:            Intel(R) Core(TM) i7-7700HQ CPU @ 2.80GHz
Stepping:              9
CPU MHz:               2800.000
CPU max MHz:           3800.0000
CPU min MHz:           800.0000
BogoMIPS:              5599.85
Virtualization:        VT-x
L1d cache:             128 KiB
L1i cache:             128 KiB
L2 cache:              1 MiB
L3 cache:              6 MiB
NUMA node0 CPU(s):     0-7
Vulnerability Itlb multihit: KVM: Mitigation: VMX disabled
Vulnerability L1tf:      Mitigation; PTE Inversion; VMX conditional cache flushes, SMT vulnerable
Vulnerability Mds:       Mitigation; Clear CPU buffers; SMT vulnerable
Vulnerability Meltdown:  Mitigation; PTI
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Full generic retpoline, IBPB conditional, IBRS_FW, STIBP conditional, RSB filling
Vulnerability Srbds:     Mitigation; Microcode
Vulnerability Tsx async abort: Not affected
Flags:                  fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfperf pni pclmulqdq dtes64 monitor ds_cpl vmx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowpre fetch cpuid_fault epb invpcid_single pti ssbd ibrs ibpb stibp tpr_shadow vnmi flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep bmi2 erms invpcid mpx rdseed adx smap clflushopt intel_pt xsaveopt xsavec xgetbv1 xsaves dtherm ida arat pln pts hwp hwp_notify hwp_act_window hwp_epp md_clear flush_l1d

```

```

parth@GL62M-7RDX:~/Desktop$ lscpu | egrep 'Model name|Socket|Thread|NUMA|CPU(s\)'
CPU(s): 8
On-line CPU(s) list: 0-7
Thread(s) per core: 2
Socket(s): 1
NUMA node(s): 1
Model name: Intel(R) Core(TM) i7-7700HQ CPU @ 2.80GHz
NUMA node0 CPU(s): 0-7

```

```

parth@GL62M-7RDX:~/Desktop$ lscpu -p
# The following is the parsable format, which can be fed to other
# programs. Each different item in every column has an unique ID
# starting from zero.
# CPU,Core,Socket,Node,,L1d,L1i,L2,L3
0,0,0,0,,0,0,0,0
1,1,0,0,,1,1,1,0
2,2,0,0,,2,2,2,0
3,3,0,0,,3,3,3,0
4,0,0,0,,0,0,0,0
5,1,0,0,,1,1,1,0
6,2,0,0,,2,2,2,0
7,3,0,0,,3,3,3,0

```

The output clearly indicates that my system has:

1. CPU model: 2.80 GHz - Intel Core i7-7700HQ
 2. Socket: Single (1)
 3. CPU Core: 8
 4. Thread per core: 2
- a. Kernel model is an object file that contains code that can extend the kernel functionality at runtime without the need to reboot the system. It can be loaded and unloaded into the kernel upon demand. When a kernel module is no longer needed, it can be unloaded. Most of the device drivers are used in the form of kernel modules.
 - b. For example, one type of module is the device driver, which allows the kernel to access hardware connected to the system.
 - c. Without modules, we would have to build monolithic kernels and add new functionality directly into the kernel image. Besides having larger kernels, this has the disadvantage of requiring us to rebuild and reboot the kernel every time we want new functionality.

Q2 Which command will show statistics about your free/used memory? Describe all fields from the output of the command (for example point the difference between free and available)?

- The following command can be used: `$ free -t -m`

```
parth@GL62M-7RDX:~/Desktop$ free -t -m
```

| | total | used | free | shared | buff/cache | available |
|--------|-------|------|------|--------|------------|-----------|
| Mem: | 7873 | 2544 | 2461 | 631 | 2868 | 4424 |
| Swap: | 0 | 0 | 0 | | | |
| Total: | 7873 | 2544 | 2461 | | | |

The row “Mem” has several columns. They contain the following information:

1. Total : The total amount of RAM installed in the system. In this case it is almost 8GB.
2. Used : The total amount of RAM being used. It is calculated as: Total – (free + buffers + cache). In this case it is almost 2.5GB
3. Free : The amount of unused or free memory for the apps. In this case it is almost 2.5GB
4. Shared : The amount of memory mostly used by the tmpfs file systems. In other words, Shmem in /proc/meminfo. In this case it is 631MB
5. Buff/cache : It is the sum of buffers and cache. Buff is the amount of memory used by the Linux kernel for buffers. Cache is memory used by the page cache and slabs. In this case it is 2.8GB
6. Available : This is an estimation of how much memory is available for starting new applications on a Linux system, without swapping. In this case it is 4.4GB

The row “Swap” was created while solving the lab exercises and deleted afterwards therefore it is empty.

Q3 If you list the content of a directory using for example “ls -al” what do numbers in the column following after permissions information tell you?

- After running the command: \$ ls -al, I get the following output:

```
parth@GL62M-7RDX:~/Desktop$ ls -al
```

| total | 28 | | | | | | | | |
|------------|----|-------|-------|-------|--------------|-----------------|--|--|--|
| drwxr-xr-x | 4 | parth | parth | 4096 | Oct 25 19:44 | . | | | |
| drwxr-xr-x | 32 | parth | parth | 4096 | Oct 25 19:10 | .. | | | |
| drwxrwxr-x | 6 | parth | parth | 4096 | Oct 26 21:38 | Big_Data | | | |
| drwxrwxr-x | 2 | parth | parth | 4096 | Oct 19 22:06 | Learning_ruby | | | |
| -rw-r--r-- | 1 | parth | parth | 12288 | Oct 25 19:04 | .unique.txt.swp | | | |

The numbers in the column after permission are of hard links to the file or directory.

- a. For files, it is 1 ,unless you've created additional hard links to it with ln.
- b. For directories, it is 2 + the number of subdirectories. This is because a directory can be referred to either by its name in the parent directory, ... in itself, or .. in each subdirectory.

Q4 What is the sticky bit? Show the file or directory with your configured sticky bit.

- A Sticky bit is a permission bit that is set on a file or a directory that lets only the owner of the file/directory or the root user to delete or rename the file. No other user is given privileges to delete the file created by some other user.

Setting sticky bit permission using the following steps:

1. Create a directory and provide all the users read-write-execute access to it: `$ mkdir allAccess` `$ chmod 777 allAccess/` `$ ls -ld allAccess/`

```
parth@GL62M-7RDX:~/Desktop$ mkdir allAccess
parth@GL62M-7RDX:~/Desktop$ chmod 777 allAccess/
parth@GL62M-7RDX:~/Desktop$ ls -ld allAccess/
drwxrwxrwx 2 parth parth 4096 Oct 27 20:29 allAccess/
```

Output :

```
drwxrwxrwx 2 parth parth 4096 Oct 27 20:29 allAccess/
```

So we see that a directory named 'allAccess' is created and read-write-execute access to this directory is given to all the users through the chmod command.

2. Now, we create multiple files in this directory (with different users) such that all users have read-write-execute access to them: `$ ls -l allAccess/ - total 0`

Output: `-rwxrwxrwx 1 parth parth 0 Oct 27 20:30 user1`

`-rwxrwxrwx 1 david david 0 Oct 27 20:31 user_file_0`

`-rwxrwxrwx 1 paul paul 0 Oct 27 20:33 user_file_1`

The files `user_file_0` and `user_file_1` are created by different users but have read-write-execute access on for all the users. This means that the 'david' can delete or rename the file created by user 'paul'.

3. To prevent such a situation, a sticky bit can be set on the directory allAccess. We turn ON the sticky bit on the directory by using +t flag of chmod command. `$ chmod +t allAccess/`, `$ ls -ld allAccess/`

```
parth@GL62M-7RDX:~/Desktop$ chmod +t allAccess/
parth@GL62M-7RDX:~/Desktop$ ls -ld allAccess/
drwxrwxrwt 2 parth parth 4096 Oct 27 20:29 allAccess/
```

Output:

```
drwxrwxrwt 2 parth parth 4096 Oct 27 20:29 allAccess/
```

As a result, a permission bit 't' is introduced in the permission bits of the directory.

Q5 Which command will show the available disk space on the Unix/Linux system?

- df command - The df command stands for *disk free*, and it shows you the amount of space taken up by different drives. By default, df displays values in 1-kilobyte blocks.

```

parth@GL62M-7RDX:~/Desktop$ df
Filesystem      1K-blocks    Used Available Use% Mounted on
udev            3998960         0   3998960  0% /dev
tmpfs           806292      2236    804056  1% /run
/dev/sda1       960379920 29817364 881708132  4% /
tmpfs           4031456    97096   3934360  3% /dev/shm
tmpfs           5120         4      5116  1% /run/lock
tmpfs           4031456         0   4031456  0% /sys/fs/cgroup
/dev/loop3       128        128         0 100% /snap/bare/5
/dev/loop0      257408    257408         0 100% /snap/brave/134
/dev/loop5       56832     56832         0 100% /snap/core18/2128
/dev/loop2      101888    101888         0 100% /snap/core/11993
/dev/loop6       66816     66816         0 100% /snap/gtk-common-themes/1519
/dev/loop4       56832     56832         0 100% /snap/core18/2246
/dev/loop1      101888    101888         0 100% /snap/core/11798
/dev/loop7       52352     52352         0 100% /snap/snap-store/518
/dev/loop8       33152     33152         0 100% /snap/ruby/232
/dev/loop9      224256    224256         0 100% /snap/gnome-3-34-1804/72
/dev/loop10     224256    224256         0 100% /snap/gnome-3-34-1804/66
/dev/loop11      33280     33280         0 100% /snap/snapd/13270
/dev/loop13      33280     33280         0 100% /snap/snapd/13640
/dev/loop12      36864     36864         0 100% /snap/gh/416
/dev/loop14      66688     66688         0 100% /snap/gtk-common-themes/1515
/dev/loop16      63360     63360         0 100% /snap/core20/1169
/dev/loop17      52224     52224         0 100% /snap/snap-store/547
/dev/loop15     263296    263296         0 100% /snap/zoom-client/159
/dev/loop19     254592    254592         0 100% /snap/zoom-client/160
/dev/loop18      37504     37504         0 100% /snap/gh/448
/dev/nvme0n1p1   98304     30879     67425  32% /boot/efi
tmpfs           806288         40    806248  1% /run/user/1000

```

You can display disk usage in a more human-readable format by adding the `-h` option: `$ df -h`. This displays the size in kilobytes (K), megabytes (M), and gigabytes (G).

```
parth@GL62M-7RDX:~/Desktop$ df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            3.9G     0  3.9G   0% /dev
tmpfs           788M   2.2M  786M   1% /run
/dev/sda1       916G   29G  841G   4% /
tmpfs           3.9G   96M  3.8G   3% /dev/shm
tmpfs           5.0M   4.0K  5.0M   1% /run/lock
tmpfs           3.9G     0  3.9G   0% /sys/fs/cgroup
/dev/loop3      128K  128K     0 100% /snap/bare/5
/dev/loop0      252M  252M     0 100% /snap/brave/134
/dev/loop5       56M   56M     0 100% /snap/core18/2128
/dev/loop2      100M  100M     0 100% /snap/core/11993
/dev/loop6       66M   66M     0 100% /snap/gtk-common-themes/1519
/dev/loop4       56M   56M     0 100% /snap/core18/2246
/dev/loop1      100M  100M     0 100% /snap/core/11798
/dev/loop7       52M   52M     0 100% /snap/snap-store/518
/dev/loop8       33M   33M     0 100% /snap/ruby/232
/dev/loop9      219M  219M     0 100% /snap/gnome-3-34-1804/72
/dev/loop10     219M  219M     0 100% /snap/gnome-3-34-1804/66
/dev/loop11      33M   33M     0 100% /snap/snapd/13270
/dev/loop13      33M   33M     0 100% /snap/snapd/13640
/dev/loop12      36M   36M     0 100% /snap/gh/416
/dev/loop14      66M   66M     0 100% /snap/gtk-common-themes/1515
/dev/loop16      62M   62M     0 100% /snap/core20/1169
/dev/loop17      51M   51M     0 100% /snap/snap-store/547
/dev/loop15     258M  258M     0 100% /snap/zoom-client/159
/dev/loop19     249M  249M     0 100% /snap/zoom-client/160
/dev/loop18      37M   37M     0 100% /snap/gh/448
/dev/nvme0n1p1   96M   31M   66M  32% /boot/efi
tmpfs           788M   40K  788M   1% /run/user/1000
```

Q6 How to add a new system user without a home directory and login?

- We can use the `Adduser` or `useradd` for this task. The `useradd` is a command used for creating a user in any Linux-based operating system. It is a low-level or less secure command for creating a user because it only creates a user until we specify a flag. This command does not automatically create a home directory until a `-m` flag is specified.

- a. `-M` for creating a user without a Home directory
- b. `-no-create-home` is also used for not creating a home directory of a user

For example:

1. `$ useradd -M <username>` OR `$ useradd --no-create-home <username>`

2. `$ adduser --no-create-home <username>`

Q7 Explain the differences among the following umask values: 000, 002, 022, 027, 077, and 277.

- When a new file or directory is created it is restricted in a specific way by applying a permissions “mask” called the umask. The umask command basically sets the default permission or base permissions to the newly created files or folders on a Linux machine. Most of the Linux distros give 022 (0022) as default UMASK. The umask command is used to set this mask, or to show you its current value.

Following table will help clear this concept:

| Unmask | File Result | Directory Result |
|--------|-----------------|------------------|
| 000 | 666 rw- rw- rw- | 777 rwx rwx rwx |
| 002 | 664 rw- rw- r- | 775 rwx rwx r-x |
| 022 | 644 rw- r- r- | 755 rwx r-x r-x |
| 027 | 640 rw- r- -- | 750 rwx r-x -- |
| 077 | 600 rw--- -- | 700 rwx -- -- |
| 277 | 400 r- -- -- | 500 r-x -- -- |

Q8 You have already configured swap in the exercise and the next step to increase or resize you swap space x2. Provide steps to do so.

-

1. Make swapoff: `$ sudo swapoff /swapfile`
2. Resize: `$ sudo dd if=/dev/zero of=/swapfile bs=1M count=2048 oflag=append conv=notrunc`
The above command will append 2GB of zero bytes at the end of your swap file.
3. Setup the file: `$ sudo mkswap /swapfile`
4. Make swapon: `$ sudo swapon /swapfile`

1. Linux OS hardware drivers

```

parth@GLS2M-TRDX: /proc/1
[ 24.326100] kernel: audit: type=1400 audit(1635198519.015:3): apparmor="STATUS" operations="profile_load" profile="unconfined" name="lppaxdd" pid=910 comm="apparmor_parser"
parth@GLS2M-TRDX: /proc/1 dmesg
0.000000 microcode: microcode updated early to revision 0x4a, date = 2021-01-05
0.000000 Linux version 5.11.0-38-generic (build@lewis-and-kai) (gcc (Ubuntu 9.3.0-17ubuntu20-04) 9.3.0, GNU ld (GNU Binutils for Ubuntu) 2.34) #42-20.04.1-Ubuntu SMP Tue Sep 28 20:41:07 UTC 2021 (Ubuntu 5.11.0-38.42-20.04.1-generic 5.11.22)
0.000000 Command Line: BOOT_IMAGE=/boot/vmlinuz-5.11.0-38-generic root=UUID=08621126-c12a-42d7-b9b4-9948c874944e ro quiet splash vt.handoff=7
0.000000 KERNEL supported cpus:
0.000000   Intel GenuineIntel
0.000000   AMD AuthenticAMD
0.000000   Hygon HygonGenuine
0.000000   Centaur CentaurHauls
0.000000   Zhaoxin Shanghai
0.000000 x86/fpu: Supporting XSAVE feature 0x001: 'x87 floating point registers'
0.000000 x86/fpu: Supporting XSAVE feature 0x002: 'SSE registers'
0.000000 x86/fpu: Supporting XSAVE feature 0x004: 'AVX registers'
0.000000 x86/fpu: Supporting XSAVE feature 0x008: 'MPX bounds registers'
0.000000 x86/fpu: Supporting XSAVE feature 0x010: 'MPX CSR'
0.000000 x86/fpu: xstate_offset[3]: 576, xstate_size[3]: 256
0.000000 x86/fpu: xstate_offset[1]: 832, xstate_size[1]: 64
0.000000 x86/fpu: xstate_offset[4]: 896, xstate_size[4]: 64
0.000000 x86/fpu: Enabled xstate features 0x1f, context size is 960 bytes, using 'compacted' format.
0.000000 BIOS-provided physical RAM map:
0.000000 BIOS-e820: [mem 0x0000000000000000-0x00000000000057fff] usable
0.000000 BIOS-e820: [mem 0x00000000000058000-0x0000000000005bfff] reserved
0.000000 BIOS-e820: [mem 0x0000000000005c000-0x0000000000009dfff] usable
0.000000 BIOS-e820: [mem 0x0000000000009e000-0x0000000000000ffff] reserved
0.000000 BIOS-e820: [mem 0x000000000100000-0x000000000761bfff] usable
0.000000 BIOS-e820: [mem 0x000000000761b000-0x000000000761b5fff] ACPI NVS
0.000000 BIOS-e820: [mem 0x000000000761b6000-0x000000000761b5fff] reserved
0.000000 BIOS-e820: [mem 0x000000000761b7000-0x000000000761bcafff] usable
0.000000 BIOS-e820: [mem 0x000000000761ca000-0x00000000076173fff] reserved
0.000000 BIOS-e820: [mem 0x00000000076174000-0x0000000007617afff] ACPI data
0.000000 BIOS-e820: [mem 0x0000000007617b000-0x0000000007617afff] ACPI NVS
0.000000 BIOS-e820: [mem 0x0000000007617c000-0x00000000076173fff] reserved
0.000000 BIOS-e820: [mem 0x0000000007617d000-0x00000000076173fff] usable
0.000000 BIOS-e820: [mem 0x0000000007617f000-0x0000000007617ffff] reserved
0.000000 BIOS-e820: [mem 0x000000000e0000000-0x000000000ef0ffffff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef000000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0b1000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0b2000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0b3000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0b4000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0b5000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0b6000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0b7000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0b8000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0b9000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0ba000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0bb000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0bc000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0bd000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0be000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0bf000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0c0000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0c1000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0c2000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0c3000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0c4000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0c5000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0c6000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0c7000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0c8000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0c9000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0ca000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0cb000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0cc000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0cd000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0ce000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0cf000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0d0000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0d1000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0d2000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0d3000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0d4000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0d5000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0d6000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0d7000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0d8000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0d9000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0da000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0db000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e820: [mem 0x000000000ef0dc000-0x000000000ef0b0fff] reserved
0.000000 BIOS-e8
```

```

parth@GL62M-7RDX: /proc/i$
root@GL62M-7RDX: /proc/i$ cat /var/log/dmesg | grep -i usb
0.388820] kernel: ACPI: Power Resource [0000] on
0.414421] kernel: ACPI: bus type registered
0.414421] kernel: usbcore: registered new interface driver usbfs
0.414421] kernel: usbcore: registered new interface driver hub
0.414421] kernel: usbcore: registered new device driver
0.801331] kernel: ohci_hcd: USB 2.0 Enhanced Host Controller (EHCI) Driver
0.801359] kernel: ohci_hcd: USB 1.1 'Open' Host Controller (OHCI) Driver
0.801375] kernel: uhci_hcd: USB Universal Host Controller Interface driver
1.259292] kernel: usb_l1: New USB device found, idVendor=146b, idProduct=0000, bcdDevice=5.11
1.261571] kernel: usb_l1: New USB device strings: Mfr=3, Product=2, SerialNumber=1
1.261575] kernel: usb_l1: Product: XHCI Host Controller
1.261575] kernel: usb_l1: Manufacturer: Linux 5.11.0-38-generic xhci-hcd
1.261581] kernel: usb_l1: SerialNumber: 0000:00:14.0
1.261684] kernel: hub 1-0:1.0: USB hub found
1.267539] kernel: xhci_hcd 0000:00:14.0: new USB bus registered, assigned bus number 2
1.267545] kernel: usb 2:0:1.0: Host supports USB 3.0 SuperSpeed
1.267591] kernel: usb 2: New USB device found, idVendor=1d0b, idProduct=0003, bcdDevice=5.11
1.267595] kernel: usb 2: New USB device strings: Mfr=3, Product=2, SerialNumber=1
1.267598] kernel: usb 2: Product: XHCI Host Controller
1.267600] kernel: usb 2: Manufacturer: Linux 5.11.0-38-generic xhci-hcd
1.267601] kernel: usb 2: SerialNumber: 0000:00:14.0
1.267724] kernel: hub 2-0:1.0: USB hub found
1.406695] kernel: usb 1-3: New low-speed USB device number 2 using xhci_hcd
1.754917] kernel: usb 1-3: New USB device found, idVendor=c9f4, idProduct=03a0, bcdDevice=1.10
1.754923] kernel: usb 1-3: New USB device strings: Mfr=1, Product=2, SerialNumber=0
1.754925] kernel: usb 1-3: Product: HP Keyboard
1.754926] kernel: usb 1-3: Manufacturer: SHI
1.880745] kernel: usb 1-7: New full-speed USB device number 3 using xhci_hcd
2.032132] kernel: usb 1-7: New USB device found, idVendor=1f70, idProduct=ff00, bcdDevice=1.10
2.032141] kernel: usb 1-7: New USB device strings: Mfr=1, Product=1, SerialNumber=1
2.032149] kernel: usb 1-7: Product: MSI EPF USB
2.032154] kernel: usb 1-7: Manufacturer: MSI EPF USB
2.032157] kernel: usb 1-7: SerialNumber: MSI EPF USB
2.106827] kernel: usb 1-8: New low-speed USB device number 4 using xhci_hcd
2.313004] kernel: usb 1-8: New USB device found, idVendor=04ca, idProduct=0061, bcdDevice=1.00
2.313017] kernel: usb 1-8: New USB device strings: Mfr=1, Product=2, SerialNumber=0
2.313022] kernel: usb 1-8: Product: HP Optical Mouse
2.313026] kernel: usb 1-8: Manufacturer: Pixart
2.440824] kernel: usb 1-10: New full-speed USB device number 5 using xhci_hcd
2.598558] kernel: usb 1-10: New USB device found, idVendor=0807, idProduct=aa77, bcdDevice=0.01
2.598571] kernel: usb 1-10: New USB device strings: Mfr=0, Product=0, SerialNumber=0
2.728829] kernel: usb 1-12: New high-speed USB device number 6 using xhci_hcd
2.869474] kernel: usb 1-12: New USB device found, idVendor=0bda, idProduct=0129, bcdDevice=39.60
2.869492] kernel: usb 1-12: New USB device strings: Mfr=1, Product=2, SerialNumber=3
2.869497] kernel: usb 1-12: Product: USB 2.0-GW
2.869502] kernel: usb 1-12: Manufacturer: Generic
2.869505] kernel: usb 1-12: SerialNumber: 20100201396000000
2.878867] kernel: usbcore: registered new interface driver rtsx_usb
2.887770] kernel: usbcore: registered new interface driver usb_l1
2.887781] kernel: usbhid: USB HID core driver
2.889620] kernel: Input: SZH USB Keyboard as /dev/input/l0000:00/0000:00:14.0/0003:c0f4:03a0:0001/input/input7
2.891613] kernel: HID device 0003:c0f4:03a0:0001 (Input, HID v1.00 Keyboard [SZH USB Keyboard]) on usb 0000:00:14.0/input7
2.943918] kernel: Input: SZH USB Keyboard Consumer Control as /dev/input/l0000:00/0000:00:14.0/0003:c0f4:03a0:0002/input/input8

```

```
parth@GL62M-7RDX: /proc/1
parth@GL62M-7RDX: /proc/1$ lspci -b
Usage: lspci [<switches>]

Basic display modes:
-m          Produce machine-readable output (single -m for an obsolete format)
-t          Show bus tree

Display options:
-v          Be verbose (-vv or -vvv for higher verbosity)
-k          Show kernel drivers handling each device
-x          Show hex-dump of the standard part of the config space
-xxx       Show hex-dump of the whole config space (dangerous; root only)
-xxxx      Show hex-dump of the 4096-byte extended config space (root only)
-b          Bus-centric view (addresses and IRQ's as seen by the bus)
-d          Always show domain numbers
-p          Display bridge path in addition to bus and device number
-PP         Display bus path in addition to bus and device number

Resolving of device ID's to names:
-n          Show numeric ID's
-nn         Show both textual and numeric ID's (names & numbers)
-q          Query the PCI ID database for unknown ID's via DNS
-qQ         As above, but re-query locally cached entries
-Q          Query the PCI ID database for all ID's via DNS

Selection of devices:
-s [[[:<domain>]:]<bus>]:]<slot>][:<func>]] Show only devices in selected slots
-d [<vendor>]:<device>][:<class>]] Show only devices with specified ID's

Other options:
-i <file>   Use specified ID database instead of /usr/share/misc/pci.ids.gz
-p <file>   Look up kernel modules in a given file instead of default modules.pcmmap
-M          Enable 'bus mapping' mode (dangerous; root only)

PCI access options:
-A <method> Use the specified PCI access method (see '-A help' for a list)
-O <par>=<val> Set PCI access parameter (see '-O help' for a list)
-G          Enable PCI access debugging
-H <mode>   Use direct hardware access (<mode> = 1 or 2)
-F <file>   Read PCI configuration dump from a given file
parth@GL62M-7RDX: /proc/1$ lspci -t
Usage: lspci [<switches>]

Basic display modes:
-m          Produce machine-readable output (single -m for an obsolete format)
-t          Show bus tree

Display options:
-v          Be verbose (-vv or -vvv for higher verbosity)
-k          Show kernel drivers handling each device
-x          Show hex-dump of the standard part of the config space
-xxx       Show hex-dump of the whole config space (dangerous; root only)
-xxxx      Show hex-dump of the 4096-byte extended config space (root only)
-b          Bus-centric view (addresses and IRQ's as seen by the bus)
-d          Always show domain numbers
-p          Display bridge path in addition to bus and device number
-PP         Display bus path in addition to bus and device number
```

```
parth@GL62M-7RDX: /proc/1
I: If#=0x0 Ali=0 #EPs=1 Cls=09(hub ) Sub=00 Prot=00 Driver=hub
parth@GL62M-7RDX: /proc/1$ lsusb -v
Usage: lsusb [options]...
List USB devices
-V, --verbose          Increase verbosity (show descriptors)
-s [[[:bus:]]devnum] Show only devices with specified device and/or
                        bus numbers (in decimal)
-d vendor:[product] Show only devices with the specified vendor and
                        product ID numbers (in hexadecimal)
-D device              Show only devices with the specified device
                        number
-t, --tree             Selects which device lsusb will examine
                        Dump the physical USB device hierarchy as a tree
-V, --version          Show version of program
-h, --help             Show usage and help
parth@GL62M-7RDX: /proc/1$ lspci -v
Usage: lspci [<switches>]

Basic display modes:
-m          Produce machine-readable output (single -m for an obsolete format)
-t          Show bus tree

Display options:
-v          Be verbose (-vv or -vvv for higher verbosity)
-k          Show kernel drivers handling each device
-x          Show hex-dump of the standard part of the config space
-xxx       Show hex-dump of the whole config space (dangerous; root only)
-xxxx      Show hex-dump of the 4096-byte extended config space (root only)
-b          Bus-centric view (addresses and IRQ's as seen by the bus)
-d          Always show domain numbers
-p          Display bridge path in addition to bus and device number
-PP         Display bus path in addition to bus and device number

Resolving of device ID's to names:
-n          Show numeric ID's
-nn         Show both textual and numeric ID's (names & numbers)
-q          Query the PCI ID database for unknown ID's via DNS
-qQ         As above, but re-query locally cached entries
-Q          Query the PCI ID database for all ID's via DNS

Selection of devices:
-s [[[:<domain>]:]<bus>]:]<slot>][:<func>]] Show only devices in selected slots
-d [<vendor>]:<device>][:<class>]] Show only devices with specified ID's

Other options:
-i <file>   Use specified ID database instead of /usr/share/misc/pci.ids.gz
-p <file>   Look up kernel modules in a given file instead of default modules.pcmmap
-M          Enable 'bus mapping' mode (dangerous; root only)

PCI access options:
-A <method> Use the specified PCI access method (see '-A help' for a list)
```

```
parth@GL62M-7RDX: /proc/1$ usb-devices
T: Bus=01 Lev=00 Prnt=00 Port=00 Cnt=00 Dev#= 1 Spd=480 MxCh=16
D: Ver= 2.00 Cls=09(hub ) Sub=00 Prot=01 MxPS=64 #Cfgs= 1
P: Vendor=1d0b ProdID=0002 Rev=05.11
S: Manufacturer=Linux 5.11.0-38-generic xhci-hcd
S: Product=xHCI Host Controller
S: SerialNumber=0000:00:14.0
C: #Ifs= 1 Cfg#= 1 Atr=00 MxPwr=0mA
I: If#=0x0 Alt= 0 #EPs= 1 Cls=09(hub ) Sub=00 Prot=00 Driver=hub

T: Bus=01 Lev=01 Prnt=01 Port=09 Cnt=01 Dev#= 5 Spd=12 MxCh= 0
D: Ver= 2.00 Cls=00(wlcon) Sub=01 Prot=01 MxPS=64 #Cfgs= 1
P: Vendor=0807 ProdID=00a7 Rev=00.01
S: Manufacturer=Generic
S: Product=USB2.0-CRM
S: SerialNumber=2010020136000000
C: #Ifs= 1 Cfg#= 1 Atr=a0 MxPwr=500mA
I: If#=0x0 Alt= 0 #EPs= 3 Cls=00(wlcon) Sub=01 Prot=01 Driver=btusb

T: Bus=01 Lev=01 Prnt=01 Port=11 Cnt=02 Dev#= 6 Spd=480 MxCh= 0
D: Ver= 2.00 Cls=ff(vend.) Sub=ff Prot=ff MxPS=64 #Cfgs= 1
P: Vendor=0bda ProdID=0129 Rev=39.60
S: Manufacturer=Generic
S: Product=USB2.0-CRM
S: SerialNumber=2010020136000000
C: #Ifs= 1 Cfg#= 1 Atr=a0 MxPwr=500mA
I: If#=0x0 Alt= 0 #EPs= 3 Cls=ff(vend.) Sub=06 Prot=50 Driver=rtss_usb

T: Bus=01 Lev=01 Prnt=01 Port=02 Cnt=03 Dev#= 2 Spd=1.5 MxCh= 0
D: Ver= 1.10 Cls=00(>ifc ) Sub=00 Prot=00 MxPS= 8 #Cfgs= 1
P: Vendor=c0f4 ProdID=03a0 Rev=01.10
S: Manufacturer=SZH
S: Product=USB Keyboard
C: #Ifs= 2 Cfg#= 1 Atr=a0 MxPwr=98mA
I: If#=0x0 Alt= 0 #EPs= 1 Cls=03(HID ) Sub=01 Prot=01 Driver=usbhid
I: If#=0x1 Alt= 0 #EPs= 1 Cls=03(HID ) Sub=00 Prot=00 Driver=usbhid

T: Bus=01 Lev=01 Prnt=01 Port=06 Cnt=04 Dev#= 3 Spd=12 MxCh= 0
D: Ver= 1.10 Cls=00(>ifc ) Sub=00 Prot=00 MxPS= 8 #Cfgs= 1
P: Vendor=1770 ProdID=ff00 Rev=01.10
S: Manufacturer=MSI EPF USB
S: Product=MSI EPF USB
S: SerialNumber=MSI EPF USB
C: #Ifs= 1 Cfg#= 1 Atr=a0 MxPwr=2mA
I: If#=0x0 Alt= 0 #EPs= 1 Cls=03(HID ) Sub=00 Prot=00 Driver=usbhid

T: Bus=01 Lev=01 Prnt=01 Port=07 Cnt=05 Dev#= 4 Spd=1.5 MxCh= 0
D: Ver= 2.00 Cls=00(>ifc ) Sub=00 Prot=00 MxPS= 8 #Cfgs= 1
P: Vendor=04ca ProdID=0061 Rev=01.00
S: Manufacturer=PLXart
S: Product=USB Optical Mouse
C: #Ifs= 1 Cfg#= 1 Atr=a0 MxPwr=160mA
I: If#=0x0 Alt= 0 #EPs= 1 Cls=03(HID ) Sub=01 Prot=02 Driver=usbhid

T: Bus=02 Lev=00 Prnt=00 Port=00 Cnt=00 Dev#= 1 Spd=5000 MxCh= 8
D: Ver= 3.00 Cls=09(hub ) Sub=00 Prot=03 MxPS= 9 #Cfgs= 1
P: Vendor=1d0b ProdID=0003 Rev=05.11
```

```
parth@GL62M-7RDX: /proc/1$ cat /proc/meminfo
MemTotal: 8062928 kB
MemFree: 3718356 kB
MemAvailable: 5526448 kB
Buffers: 104032 kB
Cached: 2255116 kB
SwapCached: 0 kB
Active: 759284 kB
Inactive: 2835400 kB
Active(anon): 2884 kB
Inactive(anon): 1613444 kB
Active(file): 756400 kB
Inactive(file): 1221956 kB
Unevictable: 347800 kB
Mlocked: 32 kB
SwapTotal: 2097148 kB
SwapFree: 2097148 kB
Dirty: 192 kB
Writeback: 0 kB
AnonPages: 1583420 kB
Mapped: 658572 kB
Shmem: 384504 kB
KReclaimable: 110116 kB
Slab: 221020 kB
SReclaimable: 110116 kB
SUnreclaim: 110904 kB
KernelStack: 12576 kB
PageTables: 25632 kB
NFS_Unstable: 0 kB
Bounce: 0 kB
WritebackTmp: 0 kB
CommitLimit: 6128608 kB
Committed_AS: 6979552 kB
VmallocTotal: 34359738367 kB
VmallocUsed: 41908 kB
VmallocChunk: 0 kB
Percpu: 7072 kB
HardwareCorrupted: 0 kB
AnonHugePages: 0 kB
ShmemHugePages: 0 kB
ShmemPmdMapped: 0 kB
FileHugePages: 0 kB
FilePmdMapped: 0 kB
HugePages_Total: 0
HugePages_Free: 0
HugePages_Rsvd: 0
HugePages_Surp: 0
Hugepagesize: 2048 kB
Hugetlb: 0 kB
DirectMap4k: 281252 kB
DirectMap2M: 6973440 kB
DirectMap1G: 1048576 kB
parth@GL62M-7RDX: /proc$ cat /proc/swaps

```

| Filename | Type | Size | Used | Priority |
|-----------|------|---------|------|----------|
| /swapfile | file | 2097148 | 0 | -2 |

```
parth@GL62M-7RDX: /proc/1
parth@GL62M-7RDX:~$ lsmod
Module                  Size Used by
nf_conntrack            81920 4
xt_conntrack            16384 3
xt_MASQUERADE           20480 3
nf_conntrack_netlink    49152 0
nfnetlink               16384 2 nf_conntrack_netlink
xfrm_user               36864 1
xfrm_algo               16384 1 xfrm_user
xt_addrtype             16384 2
iptable_filter          16384 1
iptable_nat             16384 1
nf_nat                  45056 2 iptable_nat,xt_MASQUERADE
nf_conntrack            147456 4 xt_conntrack,nf_nat,nf_conntrack_netlink,xt_MASQUERADE
nf_defrag_ipv6          24576 1 nf_conntrack
nf_defrag_ipv4          16384 1 nf_conntrack
bpfilter               16384 0
br_netfilter            28672 0
bridge                 249056 1 br_netfilter
stp                     16384 1 bridge
llc                     16384 2 bridge,stp
aufs                   258048 0
vboxnetadp             28672 0
vboxnetflt             28672 0
vboxdrv                516096 2 vboxnetadp,vboxnetflt
ccm                    20480 6
cscac                  16384 5
algif_hash              16384 2
algif_skcipher          16384 2
af_alg                 28672 10 algif_hash,algif_skcipher
bnp                     24576 2
overlay                126976 0
nls_iso8859_1           16384 1
snd_hda_codec_hdmi      61440 1
snd_hda_codec_realtek   139264 1
snd_hda_codec_generic   81920 1 snd_hda_codec_realtek
ledtrig_audio           16384 1 snd_hda_codec_generic
snd_hda_intel           53248 3
snd_intel_dspcfg        28672 1 snd_hda_intel
soundwire_intel         40960 1 snd_intel_dspcfg
soundwire_generic_allocation 16384 1 soundwire_intel
soundwire_cadence       32768 1 soundwire_intel
snd_hda_codec           147456 4 snd_hda_codec_generic,snd_hda_codec_hdmi,snd_hda_intel,snd_hda_codec_realtek
snd_hda_core            94208 5 snd_hda_codec_generic,snd_hda_codec_hdmi,snd_hda_intel,snd_hda_codec,snd_hda_codec_realtek
snd_hwdsp              16384 1 snd_hda_codec
soundwire_bus           77824 3 soundwire_intel,soundwire_generic_allocation,soundwire_cadence
snd_soc_core            286720 1 soundwire_intel
lwlwm                  413696 0
snd_compress            28672 1 snd_soc_core
ac97_bus               16384 1 snd_soc_core
snd_pcn_dnaengine       16384 1 snd_soc_core
mac80211               1024000 1 lwlwm
snd_pcn                114688 8 snd_hda_codec_hdmi,snd_hda_intel,snd_hda_codec,soundwire_intel,snd_compress,snd_soc_core,snd_hda_core,snd_pcn_dnaengine
snd_seq_midi            20480 0
intel_rapl_msr          20480 0
libarc4                 16384 1 mac80211
```

```
parth@GL62M-7RDX: /proc/1
parth@GL62M-7RDX:~$ cat /proc/modules
rfcomm 81920 4 - Live 0x0000000000000000
xt_conntrack 16384 3 - Live 0x0000000000000000
xt_MASQUERADE 20480 3 - Live 0x0000000000000000
nf_conntrack_netlink 49152 0 - Live 0x0000000000000000
nfnetlink 16384 2 nf_conntrack_netlink, Live 0x0000000000000000
xfrm_user 36864 1 - Live 0x0000000000000000
xfrm_algo 16384 1 xfrm_user, Live 0x0000000000000000
xt_addrtype 16384 2 - Live 0x0000000000000000
iptable_filter 16384 1 - Live 0x0000000000000000
iptable_nat 16384 1 - Live 0x0000000000000000
nf_nat 45056 2 xt_MASQUERADE,iptable_nat, Live 0x0000000000000000
nf_conntrack 147456 4 xt_conntrack,xt_MASQUERADE,nf_conntrack_netlink,nf_nat, Live 0x0000000000000000
nf_defrag_ipv6 24576 1 nf_conntrack, Live 0x0000000000000000
nf_defrag_ipv4 16384 1 nf_conntrack, Live 0x0000000000000000
bpfilter 16384 0 - Live 0x0000000000000000
br_netfilter 28672 0 - Live 0x0000000000000000
bridge 249056 1 br_netfilter, Live 0x0000000000000000
stp 16384 1 bridge, Live 0x0000000000000000
llc 16384 2 bridge,stp, Live 0x0000000000000000
aufs 258048 0 - Live 0x0000000000000000
vboxnetadp 28672 0 - Live 0x0000000000000000 (OE)
vboxnetflt 28672 0 - Live 0x0000000000000000 (OE)
vboxdrv 516096 2 vboxnetadp,vboxnetflt, Live 0x0000000000000000 (OE)
ccm 20480 6 - Live 0x0000000000000000
cscac 16384 5 - Live 0x0000000000000000
algif_hash 16384 2 - Live 0x0000000000000000
algif_skcipher 16384 2 - Live 0x0000000000000000
af_alg 28672 10 algif_hash,algif_skcipher, Live 0x0000000000000000
bnp 24576 2 - Live 0x0000000000000000
overlay 126976 0 - Live 0x0000000000000000
nls_iso8859_1 16384 1 - Live 0x0000000000000000
snd_hda_codec_hdmi 61440 1 - Live 0x0000000000000000
snd_hda_codec_realtek 139264 1 - Live 0x0000000000000000
snd_hda_codec_generic 81920 1 snd_hda_codec_realtek, Live 0x0000000000000000
ledtrig_audio 16384 1 snd_hda_codec_generic, Live 0x0000000000000000
snd_hda_intel 53248 3 - Live 0x0000000000000000
snd_intel_dspcfg 28672 1 snd_hda_intel, Live 0x0000000000000000
soundwire_intel 40960 1 snd_intel_dspcfg, Live 0x0000000000000000
soundwire_generic_allocation 16384 1 soundwire_intel, Live 0x0000000000000000
soundwire_cadence 32768 1 soundwire_intel, Live 0x0000000000000000
snd_hda_codec 147456 4 snd_hda_codec_hdmi,snd_hda_codec_realtek,snd_hda_codec_generic,snd_hda_intel, Live 0x0000000000000000
snd_hda_core 94208 5 snd_hda_codec_generic,snd_hda_codec_hdmi,snd_hda_codec_realtek,snd_hda_codec_generic,snd_hda_intel,snd_hda_codec, Live 0x0000000000000000
snd_hwdsp 16384 1 snd_hda_codec, Live 0x0000000000000000
soundwire_bus 77824 3 soundwire_intel,soundwire_generic_allocation,soundwire_cadence, Live 0x0000000000000000
snd_soc_core 286720 1 soundwire_intel, Live 0x0000000000000000
lwlwm 413696 0 - Live 0x0000000000000000
snd_compress 28672 1 snd_soc_core, Live 0x0000000000000000
ac97_bus 16384 1 snd_soc_core, Live 0x0000000000000000
snd_pcn_dnaengine 16384 1 snd_soc_core, Live 0x0000000000000000
mac80211 1024000 1 lwlwm, Live 0x0000000000000000
snd_pcn 114688 8 snd_hda_codec_hdmi,snd_hda_intel,soundwire_intel,snd_hda_codec,snd_hda_core,snd_soc_core,snd_compress,snd_pcn_dnaengine, Live 0x0000000000000000
snd_seq_midi 20480 0 - Live 0x0000000000000000
intel_rapl_msr 20480 0 - Live 0x0000000000000000
libarc4 16384 1 mac80211, Live 0x0000000000000000
intel_rapl_common 24576 1 intel_rapl_msr, Live 0x0000000000000000
```

```
parth@GL62M-TRDX: /proc/1
parth@GL62M-TRDX:~$ cat /proc/interrupts
CPU0 CPU1 CPU2 CPU3 CPU4 CPU5 CPU6 CPU7
0: 7 0 0 0 0 0 0 0 IO-APIC 2-edge timer
1: 0 0 0 0 0 0 0 0 IO-APIC 1-edge tsc0
8: 1 0 0 0 0 0 0 0 IO-APIC 8-edge rtc0
9: 0 377 0 0 0 0 0 0 IO-APIC 9-fastest0 acpi
124: 0 0 0 0 0 0 0 211 IO-APIC 12-edge tsc0
16: 0 0 2 0 0 0 0 0 IO-APIC 16-fastest0 i801_smbus
120: 0 0 0 0 0 0 0 0 PCI-MSI 16384-edge PCIe PME
121: 0 0 0 0 0 0 0 0 PCI-MSI 458752-edge PCIe PME, aerdv
122: 0 0 0 0 0 0 0 0 PCI-MSI 464896-edge PCIe PME, aerdv
123: 0 0 0 0 0 0 0 0 PCI-MSI 475136-edge PCIe PME, aerdv
124: 0 8873 0 0 0 0 0 0 38205 PCI-MSI 376832-edge ahci[0000:00:17.0]
125: 0 0 0 0 20 0 0 0 PCI-MSI 2897152-edge nvme0q0
126: 627 0 0 435 0 0 11028 0 PCI-MSI 327680-edge xhci_hcd
127: 137 0 0 0 0 0 0 0 PCI-MSI 2897153-edge nvme0q1
128: 0 81 0 0 0 0 0 0 PCI-MSI 2897154-edge nvme0q2
129: 0 0 189 0 0 0 0 0 PCI-MSI 2897155-edge nvme0q3
130: 0 0 0 59 0 0 0 0 PCI-MSI 2897156-edge nvme0q4
131: 0 0 0 0 89 0 0 0 PCI-MSI 2897157-edge nvme0q5
132: 0 0 0 0 0 40 0 0 PCI-MSI 2897158-edge nvme0q6
133: 0 0 0 0 0 0 25 0 PCI-MSI 2897159-edge nvme0q7
134: 0 0 0 0 0 0 0 76 PCI-MSI 2897160-edge nvme0q8
135: 0 0 0 0 0 46 0 0 PCI-MSI 360448-edge mei_me
136: 0 774 28 0 823 0 396 98 PCI-MSI 1848576-edge lwlwlfl
137: 0 0 0 0 0 0 0 22 PCI-MSI 524288-edge nwk
138: 64003 0 0 0 0 0 0 0 PCI-MSI 32768-edge lg15
139: 0 2099 0 0 0 0 0 0 PCI-MSI 514048-edge snd_hda_intel:card0
140: 0 0 19 0 1136 0 76 0 PCI-MSI 1572864-edge enp3s0
141: 0 0 0 60 16409 0 0 0 PCI-MSI 1572865-edge enp3s0-tx-0
142: 0 0 0 4348 11 0 0 0 PCI-MSI 1572866-edge enp3s0-tx-1
143: 0 0 0 0 521 14 1057 0 PCI-MSI 1572867-edge enp3s0-tx-2
144: 0 1951 0 0 0 0 18 13 PCI-MSI 1572868-edge enp3s0-tx-3
NM1: 2 2 2 2 3 2 2 2 Non-maskable interrupts
LOC: 88451 67712 67257 58527 68013 69390 62555 68479 Local timer interrupts
SPU: 0 0 0 0 0 0 0 0 Spurious interrupts
PM1: 2 2 2 2 3 2 2 2 Performance monitoring interrupts
IM1: 30078 1412 1909 1131 1005 971 795 672 IRQ work interrupts
RTR: 5 0 0 0 0 0 0 0 APIC ICR read retries
RES: 1438 1284 1304 1216 1212 1442 1201 1380 Rescheduling interrupts
CAL: 24521 21645 23311 25384 23816 23130 24284 23361 Function call interrupts
TLB: 10933 21494 18911 20994 18375 18592 20410 18397 TLB shutdowns
TRM: 0 0 0 0 0 0 0 0 Thermal event interrupts
TMR: 0 0 0 0 0 0 0 0 Threshold APIC interrupts
DRR: 0 0 0 0 0 0 0 0 Deferred Error APIC interrupts
MCE: 0 0 0 0 0 0 0 0 Machine check exceptions
MCP: 3 4 4 4 4 4 4 4 Machine check polls
ERR: 0
MIS: 0
PIN: 0 0 0 0 0 0 0 0 Posted-interrupt notification event
NPI: 0 0 0 0 0 0 0 0 Nested posted-interrupt event
PDA: 0 0 0 0 0 0 0 0 Posted-interrupt wakeup event
parth@GL62M-TRDX:~$ cat /proc/dma
4: cascade
parth@GL62M-TRDX:~$ cat /proc/topopts
0000-0000 - PCI Bus 00000000
```

```
parth@GL62M-TRDX:~$ cd /proc
parth@GL62M-TRDX:~$ ls
1 12 1685 2539 2885 3215 415 53 977 loadavg
18 120 17 2554 2886 3219 4152 54 979 locks
1804 121 1744 2559 2887 34 4154 540 980 mdstat
1805 122 18 256 2890 347 416 544 981 meminfo
1807 123 187 2566 2893 35 4163 55 982 misc
1809 124 19 2572 2894 357 417 56 983 modules
1811 125 2 2576 2899 358 418 578 acpi mounts
1812 126 20 2580 29 36 419 58 asound ntr
1813 127 22 2588 2961 37 42 586 bootconfig net
1814 129 222 2595 2963 372 420 587 buddyinfo pagetypeinfo
1815 13 223 26 2904 374 421 588 bus partitions
1816 130 224 2602 2905 38 422 59 cgroups pressure
1820 132 225 2606 2909 383 423 6 cmline sched debug
1822 133 227 2612 291 39 424 60 consoles schedstat
1884 134 228 2631 2912 396 425 61 cpufreq scsi
1890 135 229 2634 2915 397 426 62 crypto self
1899 136 23 2636 2916 4 427 63 devices slabinfo
19 138 230 2659 2917 40 428 64 diskstats softirqs
1901 139 231 2735 293 4002 4285 648 dma stat
1903 14 232 2756 2934 401 43 649 driver swaps
1904 140 233 2761 294 4066 44 65 dynamic_debug sys
1917 141 234 2771 2941 407 4545 650 execdomains sysrq-trigger
1922 144 235 2778 2942 4073 4555 66 fb sysvipc
1946 148 236 2792 2958 4074 46 67 filesystems thread-self
1954 1481 238 28 3 4075 4600 68 fs timer_list
196 1496 24 2819 30 4078 4642 7 tty
1966 1498 240 2823 3018 4080 4667 74 lones uptime
1967 1499 242 2824 303 4086 47 760 topopts version
1968 15 243 2828 3044 4087 4745 762 irq version signature
1969 1500 244 2831 3060 4088 4753 77 kallsyms vmallocinfo
197 152 245 2841 3080 41 48 9 kcore vmstat
1970 1516 25 2844 31 4107 49 934 keys zoneinfo
1971 156 2516 2846 3122 411 4905 938 key-users
1972 1568 2524 2854 3194 413 4925 969 kmsg
1973 16 2525 2863 3199 4137 498 970 kpagecgroup
19 164 2533 2870 32 4138 50 971 kpagecount
19 165 2535 2884 3210 414 52 976 kpageflags
parth@GL62M-TRDX:~$ cat /proc/cpuidinfo
processor : 0
vendor_id : GenuineIntel
cpu family : 6
model : 158
model name : Intel(R) Core(TM) i7-7700HQ CPU @ 2.80GHz
stepping : 9
microcode : 0xea
cpu MHz : 2800.000
cache size : 6144 KB
physical id : 0
siblings : 8
core id : 0
cpu cores : 4
apicid : 0
initial apicid : 0
fpu : yes
```

2. Setting Permissions

```
parth@GL62M-TRDX: /home
parth@GL62M-TRDX:~/Desktop$ cd /home
parth@GL62M-TRDX:~/home$ mkdir /home/shared
mkdir: cannot create directory '/home/shared': Permission denied
parth@GL62M-TRDX:~/home$ sudo mkdir /home/shared
[sudo] password for parth:
parth@GL62M-TRDX:~/home$ ls -l
total 8
drwxr-xr-x 32 parth parth 4096 Oct 25 19:10 parth
drwxr-xr-x  2 root  root  4096 Oct 25 21:38 shared
parth@GL62M-TRDX:~/home$ groupadd users
groupadd: group 'users' already exists
parth@GL62M-TRDX:~/home$ less /etc/group
parth@GL62M-TRDX:~/home$ groups <name_of_the_user>
bash: syntax error near unexpected token 'newline'
parth@GL62M-TRDX:~/home$ groups parth
parth : parth adm cdrom sudo dip plugdev lpadmin lxd sambashare
parth@GL62M-TRDX:~/home$ groups root
root : root
parth@GL62M-TRDX:~/home$ useradd -m -G users david
useradd: Permission denied.
useradd: cannot lock /etc/passwd; try again later.
parth@GL62M-TRDX:~/home$ sudo useradd -m -G users david
parth@GL62M-TRDX:~/home$ useradd -m paul
useradd: Permission denied.
useradd: cannot lock /etc/passwd; try again later.
parth@GL62M-TRDX:~/home$ sudo useradd -m paul
parth@GL62M-TRDX:~/home$ passwd david
passwd: You may not view or modify password information for david.
parth@GL62M-TRDX:~/home$ sudo passwd david
New password:
Retype new password:
passwd: password updated successfully
parth@GL62M-TRDX:~/home$ sudo passwd paul
New password:
Retype new password:
passwd: password updated successfully
parth@GL62M-TRDX:~/home$ Schgrp users /home/shared
chmod: changing permissions of '/home/shared': Operation not permitted
parth@GL62M-TRDX:~/home$ chgrp users /home/shared
chgrp: changing group of '/home/shared': Operation not permitted
parth@GL62M-TRDX:~/home$ sudo chgrp users /home/shared
parth@GL62M-TRDX:~/home$ sudo chmod 750 /home/shared
parth@GL62M-TRDX:~/home$ sudo -u david -s
david@GL62M-TRDX:~/home$ id
uid=1001(david) gid=1001(david) groups=1001(david),100(users)
david@GL62M-TRDX:~/home$ cd /home/shared
david@GL62M-TRDX:~/home/shared$ touch davids_file
touch: cannot touch 'davids_file': Permission denied
parth@GL62M-TRDX:~/home/shared$ sudo touch davids_file
[sudo] password for david:
david is not in the sudoers file. This incident will be reported.
david@GL62M-TRDX:~/home/shared$ exit
exit
parth@GL62M-TRDX:~/home$ sudo -u paul -s
paul@GL62M-TRDX:~/home$ id
```

3. Setting SGID on a directory

```
david@GL62M-TRDX: /home/shared
parth@GL62M-TRDX:~/Desktop$ chmod 770 /home/shared
chmod: changing permissions of '/home/shared': Operation not permitted
parth@GL62M-TRDX:~/Desktop$
parth@GL62M-TRDX:~/Desktop$ sudo chmod 770 /home/shared
[sudo] password for parth:
parth@GL62M-TRDX:~/Desktop$ sudo -u david -s
david@GL62M-TRDX:~/home/parth/Desktop$ cd /home/shared
david@GL62M-TRDX:~/home/shared$ touch davids_file
david@GL62M-TRDX:~/home/shared$ ls -l
total 0
-rw-rw-r-- 1 david david 0 Oct 25 21:45 davids_file
david@GL62M-TRDX:~/home/shared$ exit
exit
parth@GL62M-TRDX:~/Desktop$ chmod 2770 /home/shared
chmod: changing permissions of '/home/shared': Operation not permitted
parth@GL62M-TRDX:~/Desktop$ sudo chmod 2770 /home/shared
parth@GL62M-TRDX:~/Desktop$ ls -l /home
total 16
drwxr-xr-x  2 david david 4096 Oct 25 21:43 david
drwxr-xr-x 32 parth parth 4096 Oct 25 19:10 parth
drwxrws---  2 paul  paul  4096 Oct 25 21:44 paul
drwxrws---  2 root  users 4096 Oct 25 21:45 shared
parth@GL62M-TRDX:~/Desktop$ sudo -u david -s
david@GL62M-TRDX:~/home/parth/Desktop$ cd /home/shared
david@GL62M-TRDX:~/home/shared$ touch newfile
david@GL62M-TRDX:~/home/shared$ ls -l
total 0
-rw-rw-r-- 1 david david 0 Oct 25 21:45 davids_file
-rw-rw-r-- 1 david users 0 Oct 25 21:46 newfile
david@GL62M-TRDX:~/home/shared$
```

4. chown and chgrp - umask - Using the du command - Using the df command

```
david@GL62M-TRDX: ~$ du -h
4.0M /usr/local/lib
44M /usr/local
david@GL62M-TRDX: ~$ du -h
4.0K ./newdir1
4.0K ./umask_test
28K
david@GL62M-TRDX: ~$ df -h
Filesystem      Size  Used Avail Use% Mounted on
udev            3.9G   0 3.9G   0% /dev
tmpfs           788M  2.2M 786M   1% /run
/dev/sda1       916G  29G 842G   4% /
tmpfs           3.9G  23M 3.9G   1% /dev/shm
tmpfs           5.0M  4.0K 5.0M   1% /run/lock
tmpfs           3.9G   0 3.9G   0% /sys/fs/cgroup
/dev/loop0      36M   36M   0 100% /snap/gh/416
/dev/loop3      128K  128K   0 100% /snap/bare/5
/dev/loop4      100M  100M   0 100% /snap/core/11798
/dev/loop5       62M   62M   0 100% /snap/core20/1169
/dev/loop1       100M  100M   0 100% /snap/core/11993
/dev/loop6       56M   56M   0 100% /snap/core18/2074
/dev/loop7      252M  252M   0 100% /snap/brave/134
/dev/loop8      219M  219M   0 100% /snap/gnome-3-34-1804/72
/dev/loop10      66M   66M   0 100% /snap/gtk-common-themes/1519
/dev/loop9       66M   66M   0 100% /snap/gtk-common-themes/1515
/dev/loop2       56M   56M   0 100% /snap/core18/2128
/dev/loop11      33M   33M   0 100% /snap/ruby/232
/dev/loop12      51M   51M   0 100% /snap/snap-store/547
/dev/loop13      33M   33M   0 100% /snap/snapd/13640
/dev/loop14      249M  249M   0 100% /snap/zoom-client/160
/dev/loop15      37M   37M   0 100% /snap/gh/448
/dev/loop16      219M  219M   0 100% /snap/gnome-3-34-1804/66
/dev/loop17      258M  258M   0 100% /snap/zoom-client/159
/dev/loop18      52M   52M   0 100% /snap/snap-store/518
/dev/loop19      33M   33M   0 100% /snap/snapd/13270
/dev/nvme0n1p1  96M   31M   66M  32% /boot/efi
tmpfs           788M  52K 788M   1% /run/user/1000
david@GL62M-TRDX: ~$ df -ht
Filesystem      Type      Size  Used Avail Use% Mounted on
udev            devtmpfs  3.9G   0 3.9G   0% /dev
tmpfs           tmpfs     788M  2.2M 786M   1% /run
/dev/sda1       ext4      916G  29G 842G   4% /
tmpfs           tmpfs     3.9G  20M 3.9G   1% /dev/shm
tmpfs           tmpfs     5.0M  4.0K 5.0M   1% /run/lock
tmpfs           tmpfs     3.9G   0 3.9G   0% /sys/fs/cgroup
/dev/loop0      squashfs  36M   36M   0 100% /snap/gh/416
/dev/loop3      squashfs  128K  128K   0 100% /snap/bare/5
/dev/loop4      squashfs  100M  100M   0 100% /snap/core/11798
/dev/loop5      squashfs   62M   62M   0 100% /snap/core20/1169
/dev/loop1      squashfs  100M  100M   0 100% /snap/core/11993
/dev/loop6      squashfs   56M   56M   0 100% /snap/core18/2074
/dev/loop7      squashfs  252M  252M   0 100% /snap/brave/134
/dev/loop8      squashfs  219M  219M   0 100% /snap/gnome-3-34-1804/72
/dev/loop10     squashfs   66M   66M   0 100% /snap/gtk-common-themes/1519
/dev/loop9      squashfs   66M   66M   0 100% /snap/gtk-common-themes/1515
/dev/loop2      squashfs   56M   56M   0 100% /snap/core18/2128
/dev/loop11     squashfs   33M   33M   0 100% /snap/ruby/232
```

```
david@GL62M-TRDX: ~$ chown david.david newfile
david@GL62M-TRDX: ~$ chown .users newfile
david@GL62M-TRDX: ~$ chgrp users newfile
david@GL62M-TRDX: ~$ cd -
0002
david@GL62M-TRDX: ~$ mkdir umask_test
david@GL62M-TRDX: ~$ ls -ld umask_test
drwxr-xr-x 2 david david 4096 Oct 25 21:48 umask_test
david@GL62M-TRDX: ~$ touch umask_file
david@GL62M-TRDX: ~$ ls -l umask_file
-rw-rw-r-- 1 david david 0 Oct 25 21:48 umask_file
david@GL62M-TRDX: ~$ umask 002
david@GL62M-TRDX: ~$ touch newfile1
david@GL62M-TRDX: ~$ mkdir newdir1
david@GL62M-TRDX: ~$ ls -l
total 8
drwxr-xr-x 2 david david 4096 Oct 25 21:49 newdir1
-rw-r--r-- 1 david david 0 Oct 25 21:49 newfile1
-rw-rw-r-- 1 david david 0 Oct 25 21:48 umask_file
drwxr-xr-x 2 david david 4096 Oct 25 21:48 umask_test
david@GL62M-TRDX: ~$ du -hx /usr/local
4.0K /usr/local/etc
4.0K /usr/local/src
40M /usr/local/sbin
4.0K /usr/local/games
4.0K /usr/local/include
8.0K /usr/local/share/fonts
4.0K /usr/local/share/sgml/misc
4.0K /usr/local/share/sgml/stylesheet
4.0K /usr/local/share/sgml/dtd
4.0K /usr/local/share/sgml/entities
4.0K /usr/local/share/sgml/declaration
24K /usr/local/share/sgml
4.0K /usr/local/share/man
4.0K /usr/local/share/ca-certificates
4.0K /usr/local/share/xml/misc
4.0K /usr/local/share/xml/schema
4.0K /usr/local/share/xml/entities
4.0K /usr/local/share/xml/declaration
28K /usr/local/share/xml
64K /usr/local/share
4.0K /usr/local/sbin
324K /usr/local/lib/python3.8/dist-packages/click/_pycache__
692K /usr/local/lib/python3.8/dist-packages/click
28K /usr/local/lib/python3.8/dist-packages/MarkupSafe-2.0.1.dist-info
64K /usr/local/lib/python3.8/dist-packages/itsdangerous/_pycache__
128K /usr/local/lib/python3.8/dist-packages/itsdangerous
472K /usr/local/lib/python3.8/dist-packages/jinja2/_pycache__
1084K /usr/local/lib/python3.8/dist-packages/jinja2
28K /usr/local/lib/python3.8/dist-packages/itsdangerous-2.0.1.dist-info
28K /usr/local/lib/python3.8/dist-packages/markupsafe/_pycache__
104K /usr/local/lib/python3.8/dist-packages/markupsafe
64K /usr/local/lib/python3.8/dist-packages/werkzeug/middleware/_pycache__
172K /usr/local/lib/python3.8/dist-packages/werkzeug/middleware
```

5. SWAP

```
parth@GL62M-TRDX: ~/Desktop
parth@GL62M-TRDX:~/Desktop$ chmod 600 /swapfile
chmod: changing permissions of '/swapfile': Operation not permitted
parth@GL62M-TRDX:~/Desktop$ sudo chmod 600 /swapfile
[sudo] password for parth:
parth@GL62M-TRDX:~/Desktop$ sudo mkswap /swapfile
mkswap: error: /swapfile is mounted; will not make swapspace
parth@GL62M-TRDX:~/Desktop$ swapon /swapfile
swapon: cannot open /swapfile: Permission denied
parth@GL62M-TRDX:~/Desktop$ sudo swapon /swapfile
swapon: /swapfile: swapon failed: Device or resource busy
parth@GL62M-TRDX:~/Desktop$ swapon --show
NAME        TYPE      SIZE USED Prio
/swapfile   file      2G      0B   -2
parth@GL62M-TRDX:~/Desktop$ free -h
               total        used        free      shared  buff/cache   available
Mem:           7.7Gi        1.9Gi        3.2Gi        430Mi        2.5Gi        5.1Gi
Swap:          2.0Gi          0B          2.0Gi
```