Assignment 13

Device Query

❖ Try the below mentioned commands, explain their task in one line and paste the output for each of them.

- All commands run under the WSL (windows subsystem for linux).

➢ **lshw (List Hardware)**

This command list all the hardware details of system. By default it give all of the information to get an specific information command can be filter as below :

sudo lshw -C [option]

Option	usage
network	Gets the details of the network hardware devices.
memory	Displays the details of RAM.
storage	Show the details of the storage.
system	show the details of the motherboard and other things.
multimedia	Details of the sound card of system.
display	Know more about what is powering the display output.
bridge	Displays info about the PCIe bridges.
bus	It will list down buses and their details.
CPU	List the processor details

Output :

```
kavan@Kavan:~$ lshw
WARNING: you should run this program as super-user.
kavan
    description: Computer
    width: 64 bits
    capabilities: smp vsyscall32
  *-core
       description: Motherboard
       physical id: 0
     *-memory
          description: System memory
          physical id: 0
          size: 8064MiB
     *-cpu
          product: 13th Gen Intel(R) Core(TM) i7-13620H
          vendor: Intel Corp.
          physical id: 1
          bus info: cpu@0
          version: 6.186.2
          width: 64 bits
          capabilities: fpu fpu_exception wp vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse sse2 ss ht syscall nx pdpe1gb rdtscp x86-64 constant_tsc rep_good nopl xtopology tsc_reliable nonstop_tsc cpuid pni pclmulqdq vmx ssse3 fma cx16 sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand hypervisor lahf_lm abm 3dnowprefetch ssbd ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi ept vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep bmi2 erms invpcid rdseed adx smap clflushopt clwb sha_ni xsaveopt xsavec xgetbv1 xsaves avx_vnni umip waitpkg gfni vaes vpclmulqdq rdpid movdiri movdir64b fsrm serialize flush_l1d arch_capabilities
          configuration: microcode=4294967295
     *-generic
```

description: System peripheral

product: Virtio file system

vendor: Red Hat, Inc.

physical id: 2

bus info: pci@4257:00:00.0

version: 01

width: 64 bits

clock: 33MHz

capabilities: bus_master cap_list

configuration: driver=virtio-pci latency=64

resources: iomemory:e0-df iomemory:e0-df iomemory:c0-bf irq:0 memory:e00000000-e00000fff memory:e00001000-e00001fff memory:c00000000-dfffffff

*-virtio1 UNCLAIMED

description: Virtual I/O device

physical id: 0

bus info: virtio@1

configuration: driver=virtiofs

*-display:0

description: 3D controller

product: Microsoft Corporation

vendor: Microsoft Corporation

physical id: 3

bus info: pci@8383:00:00.0

version: 00

width: 32 bits

clock: 33MHz

capabilities: bus_master cap_list

configuration: driver=dxgkrnl latency=0

resources: irq:0

```
   *-scsi
        description: SCSI storage controller
        product: Virtio console
        vendor: Red Hat, Inc.
        physical id: 4
        bus info: pci@8f33:00:00.0
        version: 01
        width: 64 bits
        clock: 33MHz
        capabilities: scsi bus_master cap_list
        configuration: driver=virtio-pci latency=64
        resources: iomemory:90-8f iomemory:90-8f iomemory:90-8f irq:0
memory:9ffe00000-9ffe00fff memory:9ffe01000-9ffe01fff memory:9ffe02000-9ffe02fff
      *-virtio0 UNCLAIMED
           description: Virtual I/O device
           physical id: 0
           bus info: virtio@0
           configuration: driver=virtio_console
   *-display:1
        description: 3D controller
        product: Microsoft Corporation
        vendor: Microsoft Corporation
        physical id: 5
        bus info: pci@abca:00:00.0
        version: 00
        width: 32 bits
        clock: 33MHz
        capabilities: bus_master cap_list
        configuration: driver=dxgkrnl latency=0
        resources: irq:0
```

*-pnp00:00

product: PnP device PNP0b00

physical id: 6

capabilities: pnp

configuration: driver=rtc_cmos

*-network

description: Ethernet interface

physical id: 1

logical name: eth0

serial: 00:15:5d:ba:ac:bb

size: 10Gbit/s

capabilities: ethernet physical

configuration: autonegotiation=off broadcast=yes driver=hv_netvsc driverversion=5.15.146.1-microsoft-standard-W duplex=full firmware=N/A ip=172.19.231.200 link=yes multicast=yes speed=10Gbit/s

WARNING: output may be incomplete or inaccurate, you should run this program as super-user.

- **lsusb (List USB Devices)**

The lsusb command is a utility in Linux that allows users to list the USB (Universal Serial Bus) devices connected to the system.

Output :

kavan@Kavan:~$ lsusb

Bus 002 Device 001: ID 1d6b:0003 Linux Foundation 3.0 root hub

Bus 001 Device 001: ID 1d6b:0002 Linux Foundation 2.0 root hub

- **lspci (List PCI Devices)**

The lspci (list PCI) command is a Linux utility that displays detailed information about all PCI buses and devices in the system. It is based on the libpci library, which provides access to the PCI configuration space on a variety of operating systems.

Output :

kavan@Kavan:~$ lspci

4257:00:00.0 System peripheral: Red Hat, Inc. Virtio file system (rev 01)

8383:00:00.0 3D controller: Microsoft Corporation Device 008e

8f33:00:00.0 SCSI storage controller: Red Hat, Inc. Virtio console (rev 01)

abca:00:00.0 3D controller: Microsoft Corporation Device 008e

- **lsblk (List Block Devices)**

The 'lsblk' stands for 'list block devices', The lsblk command is a Linux command-line utility that lists information about all block devices on the system. This includes hard disk drives (HDDs), solid-state drives (SSDs), optical drives, and other storage devices.

Output :

kavan@Kavan:~$ lsblk

NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINTS

sda 8:0 0 388.5M 1 disk

sdb 8:16 0 2G 0 disk [SWAP]

sdc 8:32 0 1T 0 disk /snap

/mnt/wslg/distro

/

- **lscpu (List CPU)**

The lscpu command displays a variety of information about the CPU architecture, including The number of CPUs, The number of threads, The number of cores, The number of sockets, The cache details, The CPU architecture, The CPU vendor, The CPU model, The CPU frequency, The CPU flags.

Output :

kavan@Kavan:~$ lscpu

Architecture: x86_64

CPU op-mode(s): 32-bit, 64-bit

Address sizes: 39 bits physical, 48 bits virtual

Byte Order: Little Endian

CPU(s): 16

On-line CPU(s) list: 0-15

Vendor ID: GenuineIntel

Model name: 13th Gen Intel(R) Core(TM) i7-13620H

CPU family: 6

Model: 186

Thread(s) per core: 2

Core(s) per socket: 8

Socket(s): 1

Stepping: 2

BogoMIPS: 5836.79

Flags: fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse sse2 ss ht syscall nx pdpe1gb rdtscp lm constant_tsc rep_good

nopl xtopology tsc_reliable nonstop_tsc cpuid pni pclmulqdq vmx ssse3 fma cx16 sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rd

rand hypervisor lahf_lm abm 3dnowprefetch ssbd ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi ept vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep bmi2 erms

invpcid rdseed adx smap clflushopt clwb sha_ni xsaveopt xsavec xgetbv1 xsaves avx_vnni umip waitpkg gfni vaes vpclmulqdq rdpid movdiri movdir64b fsrm seri

alize flush_l1d arch_capabilities

Virtualization features:

Virtualization: VT-x

Hypervisor vendor: Microsoft

Virtualization type: full

Caches (sum of all):

L1d: 384 KiB (8 instances)

L1i: 256 KiB (8 instances)

L2: 10 MiB (8 instances)

L3: 24 MiB (1 instance)

Vulnerabilities:

Gather data sampling: Not affected

Itlb multihit: Not affected

L1tf: Not affected

Mds: Not affected

Meltdown: Not affected

Mmio stale data: Not affected

Retbleed: Mitigation; Enhanced IBRS

Spec rstack overflow: Not affected

Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp

Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization

Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling, PBRSB-eIBRS SW sequence

Srbds: Not affected

Tsx async abort: Not affected

- **df (Disk Free)**

The df command in Linux is used to display the amount of disk space available on the filesystem. The FileSystem parameter specifies the name of the device on which the file system resides, the directory on which the file system is mounted, or the relative path name of a file system.

Output :

kavan@Kavan:~$ df

Filesystem 1K-blocks Used Available Use% Mounted on

none 3997904 4 3997900 1% /mnt/wsl

none 395990012 136101968 259888044 35% /usr/lib/wsl/drivers

none 3997904 0 3997904 0% /usr/lib/modules

```
none          3997904       0   3997904   0% /usr/lib/modules/5.15.146.1-microsoft-standard-WSL2
/dev/sdc     1055762868   1902524 1000156872   1% /
none          3997904      84   3997820   1% /mnt/wslg
none          3997904       0   3997904   0% /usr/lib/wsl/lib
rootfs        3994648    1884   3992764   1% /init
none          3997904     808   3997096   1% /run
none          3997904       0   3997904   0% /run/lock
none          3997904       0   3997904   0% /run/shm
tmpfs            4096       0      4096   0% /sys/fs/cgroup
none          3997904      76   3997828   1% /mnt/wslg/versions.txt
none          3997904      76   3997828   1% /mnt/wslg/doc
C:\         395990012 136101968  259888044  35% /mnt/c
D:\         601881596 406166716  195714880  68% /mnt/d
G:\          15728640  12185968    3542672  78% /mnt/g
H:\          15728640    458840   15269800   3% /mnt/h
I:\          15728640    786924   14941716   6% /mnt/i
J:\         395990012 149096372  246893640  38% /mnt/j
snapfuse          128      128        0 100% /snap/bare/5
snapfuse        75776    75776        0 100% /snap/core22/864
snapfuse        93952    93952        0 100% /snap/gtk-common-themes/1535
snapfuse        41856    41856        0 100% /snap/snapd/20290
snapfuse       134272   134272        0 100% /snap/ubuntu-desktop-installer/1276
snapfuse       134912   134912        0 100% /snap/ubuntu-desktop-installer/1286
```

- **ip a (IP Address)**

The ip a command in Linux is used to display the network interface addresses and routing table of the system. This will display a list of all the network interfaces on the system, along with their IP addresses, subnet masks, and default gateways.

Output :

kavan@Kavan:~$ ip a

1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000

link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00

inet 127.0.0.1/8 scope host lo

valid_lft forever preferred_lft forever

inet6 ::1/128 scope host

valid_lft forever preferred_lft forever

2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default qlen 1000

link/ether 00:15:5d:ba:ac:bb brd ff:ff:ff:ff:ff:ff

inet 172.19.231.200/20 brd 172.19.239.255 scope global eth0

valid_lft forever preferred_lft forever

inet6 fe80::215:5dff:feba:acbb/64 scope link

valid_lft forever preferred_lft forever

- **top**

The top command in Linux is a very useful tool for monitoring system performance. It provides a real-time view of running processes, CPU and memory usage, and other system information. the list shows the process ID (PID), username, CPU usage, memory usage, and command name.

Output :

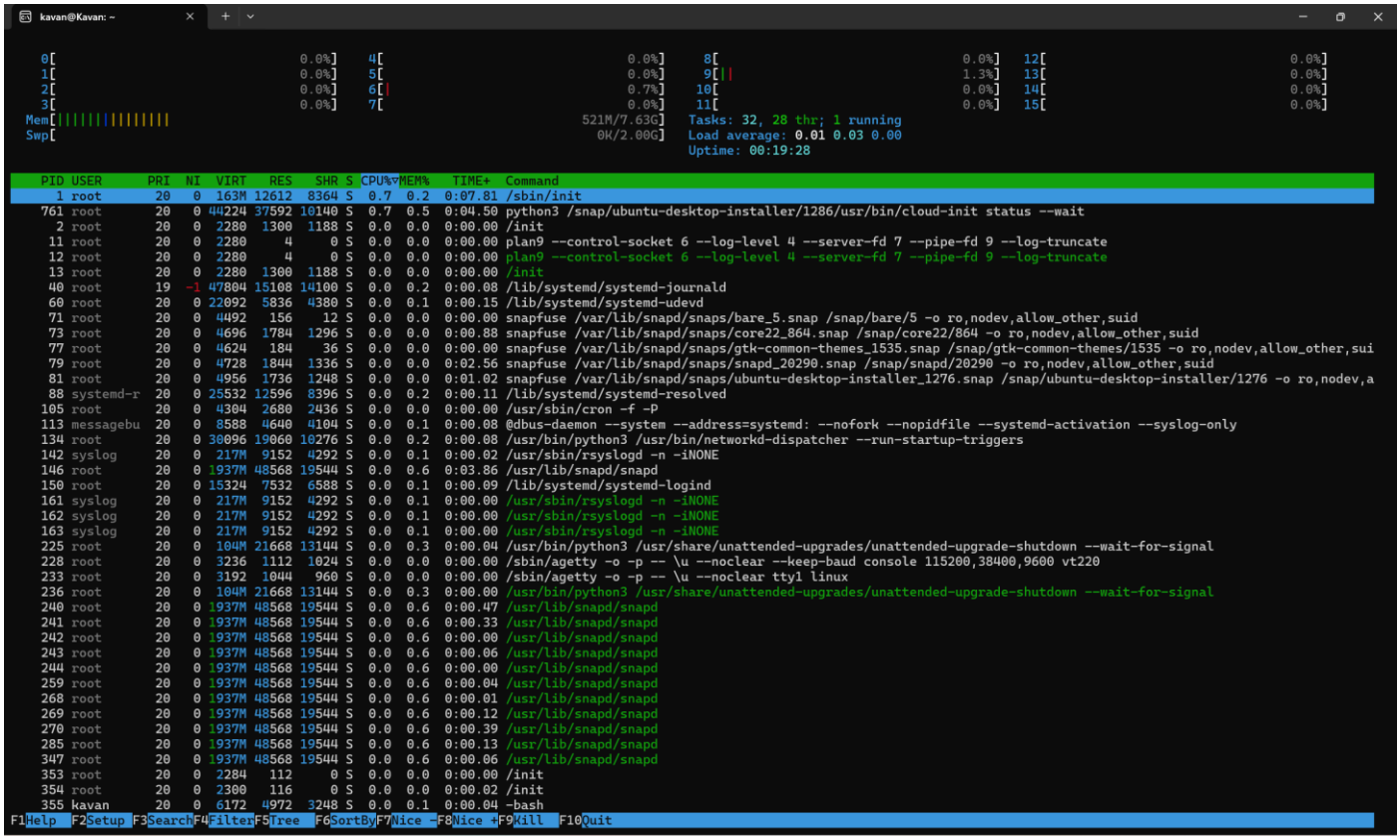
```
kavan@Kavan:~$ top
top - 20:14:07 up 41 min,  1 user,  load average: 0.02, 0.01, 0.00
Tasks:  33 total,   1 running,  32 sleeping,   0 stopped,   0 zombie
%Cpu(s):  0.1 us,  0.1 sy,  0.0 ni, 99.8 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
MiB Mem :   7808.4 total,   6951.5 free,    507.2 used,    349.7 buff/cache
MiB Swap:   2048.0 total,   2048.0 free,      0.0 used.   7071.6 avail Mem

    PID USER      PR  NI    VIRT    RES    SHR S  %CPU  %MEM     TIME+ COMMAND
      1 root      20   0  165860  11216   8244 S   1.0   0.1   0:21.48 systemd
    426 root      20   0   44224  38752  10428 S   0.7   0.5   0:12.13 python3
      2 root      20   0    2280   1300   1188 S   0.0   0.0   0:00.00 init-systemd(Ub
     11 root      20   0    2280      4      0 S   0.0   0.0   0:00.00 init
     40 root      19  -1   47732  15248  14248 S   0.0   0.2   0:00.09 systemd-journal
     60 root      20   0   22092   6040   4544 S   0.0   0.1   0:00.21 systemd-udevd
     71 root      20   0    4848   1808   1340 S   0.0   0.0   0:00.91 snapfuse
     72 root      20   0    4492    180     36 S   0.0   0.0   0:00.00 snapfuse
     75 root      20   0    4624    160      8 S   0.0   0.0   0:00.00 snapfuse
     80 root      20   0    4492    168     20 S   0.0   0.0   0:00.00 snapfuse
     83 root      20   0    4764   1764   1228 S   0.0   0.0   0:02.56 snapfuse
     87 root      20   0    4492    160      8 S   0.0   0.0   0:00.00 snapfuse
     89 root      20   0    4760   1780   1228 S   0.0   0.0   0:01.10 snapfuse
     96 systemd+  20   0   25532  12780   8492 S   0.0   0.2   0:00.09 systemd-resolve
    137 root      20   0    4304   2656   2416 S   0.0   0.0   0:00.00 cron
    143 message+  20   0    8584   4616   4072 S   0.0   0.1   0:00.02 dbus-daemon
    158 root      20   0   30096  19212  10432 S   0.0   0.2   0:00.06 networkd-dispat
    160 syslog    20   0  222400   7084   4272 S   0.0   0.1   0:00.02 rsyslogd
    162 root      20   0 2058580  48152  19360 S   0.0   0.6   0:00.73 snapd
    163 root      20   0   15324   7456   6512 S   0.0   0.1   0:00.07 systemd-logind
    217 root      20   0    4780   3352   3108 S   0.0   0.0   0:00.06 subiquity-serve
    225 root      20   0    3236   1084    996 S   0.0   0.0   0:00.00 agetty
    228 root      20   0    3192   1168   1080 S   0.0   0.0   0:00.00 agetty
    239 root      20   0  107224  21372  13268 S   0.0   0.3   0:00.04 unattended-upgr
    364 root      20   0  934936  87296  24796 S   0.0   1.1   0:04.26 python3.10
    369 root      20   0    2284    112      0 S   0.0   0.0   0:00.00 SessionLeader
    370 root      20   0    2300    116      0 S   0.0   0.0   0:00.00 Relay(371)
    371 kavan     20   0    6208   5064   3344 S   0.0   0.1   0:00.02 bash
    372 root      20   0    7516   4864   3948 S   0.0   0.1   0:00.00 login
    408 kavan     20   0   16916   9024   7564 S   0.0   0.1   0:00.03 systemd
    409 kavan     20   0  168912   3424     12 S   0.0   0.0   0:00.00 (sd-pam)
    414 kavan     20   0    6120   4968   3384 S   0.0   0.1   0:00.01 bash
  10182 kavan     20   0    7940   3700   3104 R   0.0   0.0   0:00.02 top
```

- **htop**

The htop command is a Linux system monitor that provides real-time information about the system's CPU usage, memory, and running processes. It is similar to the top command, but it offers a number of advantages, including:

A more user-friendly interface, The ability to sort processes by different criteria, The ability to kill processes directly from the htop interface, The ability to view detailed information about individual processes

Output :



➢ **nvidia-smi**

The nvidia-smi command is a Linux command-line utility that provides monitoring and management capabilities for NVIDIA GPUs. this displays an status of an NVIDIA GPU, such as its temperature, utilization, and memory usage.

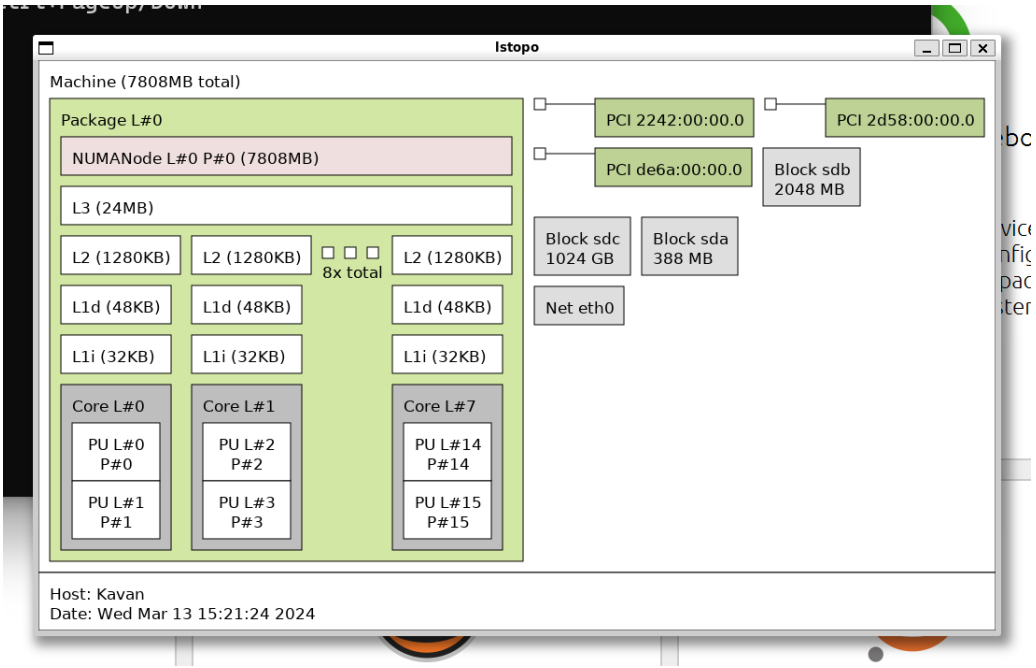
Output :

```
kavan@Kavan:~$ nvidia-smi
Wed Mar 13 20:32:45 2024
+-----------------------------------------------------------------------------------------+
| NVIDIA-SMI 550.60.01              Driver Version: 551.76         CUDA Version: 12.4     |
|-----------------------------------------+------------------------+----------------------+
| GPU  Name                 Persistence-M | Bus-Id          Disp.A | Volatile Uncorr. ECC |
| Fan  Temp   Perf          Pwr:Usage/Cap |           Memory-Usage | GPU-Util  Compute M. |
|                                         |                        |               MIG M. |
|=========================================+========================+======================|
|   0  NVIDIA GeForce RTX 4060 ...    On |   00000000:01:00.0  On |                  N/A |
| N/A   69C    P0             94W /  120W |    5205MiB /   8188MiB |     99%      Default |
|                                         |                        |                  N/A |
+-----------------------------------------+------------------------+----------------------+

+-----------------------------------------------------------------------------------------+
| Processes:                                                                              |
|  GPU   GI   CI        PID   Type   Process name                              GPU Memory |
|        ID   ID                                                               Usage      |
|=========================================================================================|
|  No running processes found                                                             |
+-----------------------------------------------------------------------------------------+
```

➢ lstopo

The lstopo command is a Linux command that displays the topology of a system. This means that it shows how the different hardware components of the system are connected to each other.

Output :



➢ numactl

The numactl command is a utility that allows users to control the NUMA (Non-Uniform Memory Access) policy for processes or shared memory. It can be used to set the memory and processor affinity of a process, as well as to set a persistent policy for shared memory segments or files.

Output :

kavan@Kavan:~$ numactl

usage: numactl [--all | -a] [--interleave= | -i <nodes>] [--preferred= | -p <node>]

[--physcpubind= | -C <cpus>] [--cpunodebind= | -N <nodes>]

[--membind= | -m <nodes>] [--localalloc | -l] command args ...

numactl [--show | -s]

numactl [--hardware | -H]

numactl [--length | -l <length>] [--offset | -o <offset>] [--shmmode | -M <shmmode>]

[--strict | -t]

[--shmid | -I <id>] --shm | -S <shmkeyfile>

[--shmid | -I <id>] --file | -f <tmpfsfile>

[--huge | -u] [--touch | -T]

memory policy | --dump | -d | --dump-nodes | -D

memory policy is --interleave | -i, --preferred | -p, --membind | -m, --localalloc | -l

<nodes> is a comma delimited list of node numbers or A-B ranges or all.

Instead of a number a node can also be:

netdev:DEV the node connected to network device DEV

file:PATH the node the block device of path is connected to

ip:HOST the node of the network device host routes through

block:PATH the node of block device path

pci:[seg:]bus:dev[:func] The node of a PCI device

<cpus> is a comma delimited list of cpu numbers or A-B ranges or all

all ranges can be inverted with !

all numbers and ranges can be made cpuset-relative with +

the old --cpubind argument is deprecated.

use --cpunodebind or --physcpubind instead

<length> can have g (GB), m (MB) or k (KB) suffixes

- **sar**

The sar (System Activity Reporter) command is used for monitoring system performance in Linux. It can be used to collect, report, and save system activity information, such as CPU usage, memory usage, I/O activity, and network traffic.

Output :

To generate a report of CPU usage every second for 5 seconds, used the following command:

sar -u 1 5

```
kavan@Kavan:~$ sar -u 1 5
Linux 5.15.146.1-microsoft-standard-WSL2 (Kavan)        03/13/24        _x86_64_        (16 CPU)

22:16:09        CPU     %user     %nice   %system   %iowait    %steal     %idle
22:16:10        all      0.12      0.00      0.06      0.00      0.00     99.81
22:16:11        all      0.06      0.00      0.12      0.00      0.00     99.81
22:16:12        all      0.06      0.00      0.00      0.00      0.00     99.94
22:16:13        all      0.06      0.00      0.06      0.00      0.00     99.87
22:16:14        all      0.12      0.00      0.00      0.00      0.00     99.88
Average:        all      0.09      0.00      0.05      0.00      0.00     99.86
```

To generate a report of memory usage every minute for 5 minutes, used the following command:

sar -r 60 5

```
kavan@Kavan:~$ sar -r 10 5
Linux 5.15.146.1-microsoft-standard-WSL2 (Kavan)        03/13/24        _x86_64_        (16 CPU)

22:16:18    kbmemfree   kbavail kbmemused  %memused kbbuffers  kbcached  kbcommit   %commit  kbactive   kbinact   kbdirty
22:16:28      6701132   7181868    508012      6.35     15140    662072    889324      8.81    135180    792420         0
22:16:38      6701196   7181932    507944      6.35     15140    662072    889324      8.81    135180    792484         0
22:16:48      6701200   7181936    507936      6.35     15140    662072    889324      8.81    135180    792488         0
22:16:58      6700988   7181724    508140      6.36     15140    662072    889324      8.81    135180    792488         0
22:17:08      6700508   7181248    508604      6.36     15148    662072    889324      8.81    135180    792472        20
Average:      6701005   7181742    508127      6.35     15142    662072    889324      8.81    135180    792470         4
```

To generate a report of I/O activity every 1 seconds for 5 seconds, used the following command:

sar -d 5 30

```
kavan@Kavan:~$ sar -d 1 5
Linux 5.15.146.1-microsoft-standard-WSL2 (Kavan)        03/13/24        _x86_64_        (16 CPU)

22:18:34          DEV       tps     rkB/s     wkB/s     dkB/s   areq-sz    aqu-sz     await     %util
22:18:35          sda      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
22:18:35          sdb      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
22:18:35          sdc      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

22:18:35          DEV       tps     rkB/s     wkB/s     dkB/s   areq-sz    aqu-sz     await     %util
22:18:36          sda      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
22:18:36          sdb      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
22:18:36          sdc      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

22:18:36          DEV       tps     rkB/s     wkB/s     dkB/s   areq-sz    aqu-sz     await     %util
22:18:37          sda      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
22:18:37          sdb      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
22:18:37          sdc      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

22:18:37          DEV       tps     rkB/s     wkB/s     dkB/s   areq-sz    aqu-sz     await     %util
22:18:38          sda      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
22:18:38          sdb      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
22:18:38          sdc      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

22:18:38          DEV       tps     rkB/s     wkB/s     dkB/s   areq-sz    aqu-sz     await     %util
22:18:39          sda      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
22:18:39          sdb      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
22:18:39          sdc      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00

Average:          DEV       tps     rkB/s     wkB/s     dkB/s   areq-sz    aqu-sz     await     %util
Average:          sda      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
Average:          sdb      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
Average:          sdc      0.00      0.00      0.00      0.00      0.00      0.00      0.00      0.00
```