

# Operating Systems - CS 304

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## 1

- (a) The commands `lscpu` & `more /proc/cpuinfo` was run (Figure 1 & Figure 2). The definitions of Processor and Cores are as follows:

- **Processor:** A processor (CPU) is the logic circuitry in a system that responds to instructions and processes some basic instructions that drive a computer. The CPU is perceived as the main and most crucial integrated circuitry (IC) chip in a computer. It is so because it is responsible for interpreting most of computers commands. CPUs perform most basic arithmetic, logic and I/O operations, as well as allocate commands for other chips and components running in a computer. It provides each processor with an identifying number. If there only exists a processor, then it will display 0. Whilst if more than one processor exist, it displays all processor information separately counting the processors using zero notation.
- **Cores:** A core, or CPU core, is the brain of a CPU. It receives instructions, and performs calculations, or operations, to satisfy those instructions. A CPU can possess multiple cores. A processor with two cores is called a dual-core processor; with four cores, a quad-core; six cores, hexa-core; eight cores, octa-core.

- (b) The following output is shown when `lscpu` is used (Figure 3):

```
Core(s) per socket:      4
Socket(s):                1
```

So, essentially we get  $(\text{Core(s) per socket}) \times \text{Socket(s)} = 4 \times 1 = 4$  cores.

- (c) After running the command `more /proc/cpuinfo | grep processor`, we get the following output: (Figure 4)

```

rishit@Rishit:~$ 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:                        142
Model name:                   Intel(R) Core(TM) i7-8550U CPU @ 1.80GHz
Stepping:                     10
CPU MHz:                      900.040
CPU max MHz:                  4000.0000
CPU min MHz:                  400.0000
BogoMIPS:                     3999.93
Virtualization:               VT-x
L1d cache:                    128 KiB
L1i cache:                    128 KiB
L2 cache:                     1 MiB
L3 cache:                     8 MiB
NUMA node0 CPU(s):           0-7
Vulnerability Itlb multihit:  KVM: Mitigation: Split huge pages
Vulnerability L1tf:           Mitigation; PTE Inversion; VMX conditional cach
e flushes, SMT vulnerable
Vulnerability Mds:            Mitigation; Clear CPU buffers; SMT vulnerable
Vulnerability Meltdown:       Mitigation; PTI
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled v
ia prctl and seccomp
Vulnerability Spectre v1:     Mitigation; usercopy/swapgs barriers and __user
pointer sanitization
Vulnerability Spectre v2:     Mitigation; Full generic retpoline, IBPB condit
ional, 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 mtr
r pge mca cmov pat pse36 clflush dts acpi mmx f
xsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rd
tscp lm constant_tsc art arch_perfmon pebs bts
rep_good nopl xtopology nonstop_tsc cpuid aperf
mperf pni pclmulqdq dtes64 monitor ds_cpl vmx e
st 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 i
brs ibpb stibp tpr_shadow vnmi flexpriority ept
vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep
bmi2 erms invpcid mpx rdseed adx smap clflusho
pt intel_pt xsaveopt xsavec xgetbv1 xsaves dthe
rm ida arat pln pts hwp hwp_notify hwp_act_wind
ow hwp_epp md_clear flush_l1d

```

Figure 1: lscpu Command

```

rishi@rishi:~$ more /proc/cpuinfo
processor       : 0
vendor_id      : GenuineIntel
cpu family     : 6
model          : 142
model name     : Intel(R) Core(TM) i7-8550U CPU @ 1.80GHz
stepping       : 10
microcode      : 0xe0
cpu MHz        : 2410.256
cache size     : 8192 KB
physical id    : 0
siblings       : 8
core id        : 0
cpu cores      : 4
apicid         : 0
initial apicid : 0
fpu            : yes
fpu_exception  : yes
cpuid level    : 22
wp             : yes
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 b
s 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 3dnowprefetch cpuid_fault epb invpcid_single pti ssbd tbsr tbbp stibp tpr_shadow vmm flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep bmi2 erms invpcid mpx rdseed
ad_ smap clflushopt intel_pt xsaveopt xsavec xgetbv1 xsaves dthera ida arat pln pts hwp hwp_notify hwp_act_window hwp_epp hwp_idle_clear flush_lid
bugs           : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swappgs itlb_multihit srbds
bogomips       : 3999.93
clflush size   : 64
cache alignment : 64
address sizes   : 39 bits physical, 48 bits virtual
power management:

processor       : 1
vendor_id      : GenuineIntel
cpu family     : 6
model          : 142
model name     : Intel(R) Core(TM) i7-8550U CPU @ 1.80GHz
stepping       : 10
microcode      : 0xe0
cpu MHz        : 1804.529
cache size     : 8192 KB
physical id    : 0
siblings       : 8
core id        : 1
cpu cores      : 4
apicid         : 2
initial apicid : 2
fpu            : yes
fpu_exception  : yes
cpuid level    : 22
wp             : yes
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 b
s 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 3dnowprefetch cpuid_fault epb invpcid_single pti ssbd tbsr tbbp stibp tpr_shadow vmm flexpriority ept vpid ept_ad fsgsbase tsc_adjust bmi1 avx2 smep bmi2 erms invpcid mpx rdseed
ad_ smap clflushopt intel_pt xsaveopt xsavec xgetbv1 xsaves dthera ida arat pln pts hwp hwp_notify hwp_act_window hwp_epp hwp_idle_clear flush_lid
bugs           : cpu_meltdown spectre_v1 spectre_v2 spec_store_bypass l1tf mds swappgs itlb_multihit srbds
bogomips       : 3999.93
clflush size   : 64
cache alignment : 64
address sizes   : 39 bits physical, 48 bits virtual
power management:

```

Figure 2: more /proc/cpuinfo Command

```

rishi@rishi:~$ 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

```

Figure 3: lscpu Command - Core Info

```

rishit@Rishit:~$ cat /proc/cpuinfo | grep processor
processor      : 0
processor      : 1
processor      : 2
processor      : 3
processor      : 4
processor      : 5
processor      : 6
processor      : 7
rishit@Rishit:~$ cat /proc/cpuinfo | grep processor | wc -l
8

```

Figure 4: `more /proc/cpuinfo | grep processor` Command - Processors Info

```

processor : 0
processor : 1
processor : 2
processor : 3
processor : 4
processor : 5
processor : 6
processor : 7

```

So essentially, to get total number, we can use `more /proc/cpuinfo | grep processor | wc -l`, we get **8** as the total number of processors.

- (d) After running the command `cat /proc/cpuinfo`, we get the following output for each processor: (Figure 5)

```

cpu MHz      : 900.040

```

- (e) Memory related information can be found using the `more /proc/meminfo` command. (Figure 6)

```

MemTotal:    16131444 kB

```

- (f) Memory related information can be found using the `more /proc/meminfo` command. (Figure 6)

```
rishit@Rishit:~$ cat /proc/cpuinfo
processor       : 0
vendor_id      : GenuineIntel
cpu family     : 6
model          : 142
model name     : Intel(R) Core(TM) i7-8550U CPU @ 1.80GHz
stepping       : 10
microcode      : 0xe0
cpu MHz        : 900.023
```

Figure 5: cat /proc/cpuinfo Command - Frequency of each processor

```
rishit@Rishit:~$ more /proc/meminfo
MemTotal:      16131444 kB
MemFree:       9298104 kB
```

Figure 6: more /proc/meminfo Command - Memory Information

```
MemFree:       92998104 kB
```

- (g) `vmstat` related information can be found on that link. Command used was `vmstat -f`.  
(Figure 7)

```
6848 forks
```

- (h) Context Switches since bootup information can be received using the command `more /proc/stat`: (Figure 8)

```
rishit@Rishit:~$ vmstat -f
6848 forks
```

Figure 7: `vmstat -f` Command - Fork Information

[illegible]

Figure 8: `more /proc/stat` Command - Context Switches Information

```
top - 20:00:45 up 1:19, 1 user, load average: 0.77, 0.98, 1.06
Tasks: 290 total, 3 running, 285 sleeping, 0 stopped, 2 zombie
%Cpu(s): 13.0 us, 0.2 sy, 0.0 ni, 86.5 id, 0.0 wa, 0.0 hi, 0.2 si, 0.0 st
MiB Mem : 15753.4 total, 9036.1 free, 3953.2 used, 2764.1 buff/cache
MiB Swap: 902.9 total, 902.9 free, 0.0 used. 11180.4 avail Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
7242	rishit	20	0	2356	584	520	R	99.7	0.0	0:12.55	cpu

Figure 9: `top` Command - PID Information

ctxt 27436672

2

- (a) Using the `top` command, the 1st line shows us that it is constant. (Figure 9)

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
7242	rishit	20	0	2356	584	520	R	99.7.0	0.0	0:12.55	cpu

```
PID = 7242 [Infinite Loop]
```

- (b) Using the above statistics, we can say that CPU consumes 99.7% and Memory consumption is 0.0% in this infinite loop. (Figure 9)
- (c) The tasks are running, it can be seen through the beginning lines of `top` command after the `cpu` executable is run. (Figure 9)

```
rishit@Rishit:~/Desktop/intro-code$ ps aux | grep cpu-print
rishit  7494 49.8  0.0  2488   708 pts/0    R+   20:10   0:14 ./cpu-print
rishit  7503  0.0  0.0 17664   716 pts/1    S+   20:10   0:00 grep --color=auto cpu-print
```

Figure 10: `ps aux | grep cpu-print` Command

Tasks: 290 total, 3 running, 285 sleeping, 0 stopped, 2 zombie

### 3

- (a) After executing `cpu-print` executable, it ran an infinite loop. To get the PID of this process, the command `ps aux | grep cpu-print` was used. The output was as follows: (Figure 10)

USER	PID	%CPU	%MEM	VSZ	RSS	TTY	STAT	START	TIME	COMMAND
rishit	7494	49.8	0.0	2488	708	pts/0	R+	20:10	0:14	./cpu-print

- (b) Here, using command `ps -o ppid= -p 7494`, we can find parent of process 61, i.e, 31 and further its parent to be 30 that is init process.

```
rishit  7494 107  0.0  2488   708 pts/0    R    20:26   0:04 ./cpu-print
```

- (c) After running command: `./cpu-print > /tmp/tmp.txt &`, a new process created with PID 7494. Now, using command `lsuf -p 7494` we get following output:

COMMAND	PID	USER	FD	TYPE	DEVICE	SIZE/OFF	NODE	NAME
cpu-print	7861	rishit	cwd	DIR	8,7	4096	268977	/home/rishit/Desktop/intro-code
cpu-print	7861	rishit	rtd	DIR	8,6	4096	2	/
cpu-print	7861	rishit	txt	REG	8,7	16752	277966	/home/rishit/Desktop/intro-code/cpu-print
cpu-print	7861	rishit	mem	REG	8,6	2029224	400776	/usr/lib/x86_64-linux-gnu/libc-2.31.so
cpu-print	7861	rishit	mem	REG	8,6	191472	400772	/usr/lib/x86_64-linux-gnu/ld-2.31.so
cpu-print	7861	rishit	0u	CHR	136,0	0t0	3	/dev/pts/0
cpu-print	7861	rishit	1w	REG	8,6	1111158784	264381	/tmp/tmp.txt
cpu-print	7861	rishit	2u	CHR	136,0	0t0	3	/dev/pts/0

```

rishit@Rishit:~/Desktop/intro-code$ ps aux | grep cpu-print
rishit  7861  107  0.0  2488   708 pts/0    R   20:26   0:04 ./cpu-print
rishit  7863   0.0  0.0 17664   668 pts/1    S+  20:26   0:00 grep --color=auto cpu-print
rishit@Rishit:~/Desktop/intro-code$ lsof -p 7861
COMMAND  PID  USER  FD  TYPE DEVICE SIZE/OFF  NODE NAME
cpu-print 7861 rishit cwd   DIR   8,7    4096 268977 /home/rishit/Desktop/intro-code
cpu-print 7861 rishit rtd   DIR   8,6    4096 2    /
cpu-print 7861 rishit txt   REG   8,7    16752 277966 /home/rishit/Desktop/intro-code/cpu-print
cpu-print 7861 rishit mem   REG   8,6   2029224 400776 /usr/lib/x86_64-linux-gnu/libc-2.31.so
cpu-print 7861 rishit mem   REG   8,6   191472 400772 /usr/lib/x86_64-linux-gnu/ld-2.31.so
cpu-print 7861 rishit 0u    CHR 136,0    0t0    3 /dev/pts/0
cpu-print 7861 rishit 1w    REG   8,6 1111158784 264381 /tmp/tmp.txt
cpu-print 7861 rishit 2u    CHR 136,0    0t0    3 /dev/pts/0

```

Figure 11: lsof -p Command

## 4

VmSize is same as same size of `int` array initialized. VmRSS is the measure of how much RAM the process is actually using. VmSize includes RSS, plus things like shared libraries and memory mapped files (which don't actually use RAM), as well as allocated, but unused, memory. Here, VmRSS is different because in `memory2.c`, the `int` array is actually accessed. Thus, RAM used more in `memory2.c` as array was actually being accessed and updated in it. The values for the `memory1.c` and `memory2.c` are as follows:

- The values for `memory1.c` are: VmSize (6276 kB) & VmRSS (4872 kB).
- The values for `memory2.c` are: VmSize (6272 kB) & VmRSS (4940 kB).

## 5

Executing command `iostat -xtc 1` for all stats regarding `./disk` (Figure 14). While executing `./disk1` is running the disk utilization is close to 95% (Figure 15). While executing `./disk1`, the idleness of the CPU is not 100%. So, the inference is that a process is running, but the disk utilization is  $\approx 0\%$ . It inturn translates that it can't be seen on the 1 second scale.

Once the file is in the cache section, it need not read from the disk. This is because of the fact that `./disk` is reading all the different files while `./disk1` is reading only 1 file repetitively. This 1 file is in the cache now so as to read faster. While 10000 files can't be put in cache so have to be read from the disk again and again in `./disk` case.



```

rishit@Rishit:~/Desktop/intro-code$ ps aux | grep memory1
rishit   5137  0.0  0.0  6276 4872 pts/1    S+   22:02   0:00 ./memory1
rishit   5281  0.0  0.0 17532  732 pts/2    S+   22:03   0:00 grep --color=auto memory1
rishit@Rishit:~/Desktop/intro-code$ more /proc/5137/status
Name:   memory1
Umask:  0022
State:  S (sleeping)
Tgid:   5137
Ngid:   0
Pid:    5137
PPid:   3117
TracerPid: 0
Uid:    1000    1000    1000    1000
Gid:    1000    1000    1000    1000
FDSize: 256
Groups: 4 24 27 30 46 118 129 1000
NSTgid: 5137
NSpid:  5137
NSpgid: 5137
NSSid:  3117
VmPeak:   6276 kB
VmSize:   6276 kB
VmLck:     0 kB
VmPin:     0 kB
VmHWM:   4872 kB
VmRSS:   4872 kB
RssAnon:           3980 kB
RssFile:           892 kB
RssShmem:           0 kB
VmData:    180 kB
VmStk:    3920 kB
VmExe:       8 kB
VmLib:   1644 kB
VmPTE:     52 kB
VmSwap:      0 kB
HugetlbPages:      0 kB
CoreDumping: 0
THP_enabled:  1
Threads:      1
SigQ:  0/62652
SigPnd: 0000000000000000
ShdPnd: 0000000000000000
SigBlk: 0000000000000000
SigIgn: 0000000000000000
SigCgt: 0000000000000000
CapInh: 0000000000000000
CapPrm: 0000000000000000
CapEff: 0000000000000000
CapBnd: 0000003fffffffff
CapAmb: 0000000000000000
NoNewPrivs: 0
Seccomp: 0
Speculation_Store_Bypass: thread vulnerable

```

Figure 12: more /proc/PID/status Command

```

rishit@Rishit:~/Desktop/intro-code$ ps aux| grep memory2
rishit    5138  0.0  0.0  6272 4940 pts/0    S+   22:02   0:00 ./memory2
rishit    5142  0.0  0.0 17532  724 pts/3    S+   22:02   0:00 grep --color=auto memory2
rishit@Rishit:~/Desktop/intro-code$ more /proc/5138/status
Name:      memory2
Umask:     0022
State:     S (sleeping)
Tgid:      5138
Ngid:      0
Pid:       5138
PPid:      3044
TracerPid: 0
Uid:       1000    1000    1000    1000
Gid:       1000    1000    1000    1000
FDSize:    256
Groups:    4 24 27 30 46 118 129 1000
NSTgid:    5138
NSpid:     5138
NSpgid:    5138
NSSid:     3044
VmPeak:    6272 kB
VmSize:    6272 kB
VmLck:     0 kB
VmPin:     0 kB
VmHWM:     4940 kB
VmRSS:     4940 kB
RssAnon:           3976 kB
RssFile:           964 kB
RssShmem:          0 kB
VmData:     180 kB
VmStk:     3916 kB
VmExe:       8 kB
VmLib:     1644 kB
VmPTE:      52 kB
VmSwap:     0 kB
HugetlbPages:      0 kB
CoreDumping: 0
THP_enabled: 1
Threads:      1
SigQ:      0/62652
SigPnd:    0000000000000000
ShdPnd:    0000000000000000
SigBlk:    0000000000000000
SigIgn:    0000000000000000
SigCgt:    0000000000000000
CapInh:    0000000000000000
CapPrm:    0000000000000000
CapEff:    0000000000000000
CapBnd:    0000003fffffffff
CapAmb:    0000000000000000
NoNewPrivs: 0
Seccomp:    0
Speculation_Store_Bypass: thread vulnerable

```

Figure 13: more /proc/PID/status Command

18/01/21 10:42:17 PM IST																				
avg-cpu:		%user	%nice	%system	%iowait	%steal	%idle													
		5.62	12.10	10.39	0.00	0.00	71.88													
Device	r/s	rkB/s	rrqm/s	%rrqm	r_await	rareq-sz	w/s	wkB/s	wrqm/s	%wrqm	w_await	wareq-sz	d/s	dkB/s	drqm/s	%drqm	d_await	dareq-sz	aqu-sz	%util
loop0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sda	99.00	9252.00	0.00	0.00	0.47	93.45	1.00	20.00	0.00	0.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.60

Figure 14: iostat -xtc 1 Command ./disk process

18/01/21 10:45:20 PM IST																				
avg-cpu:		%user	%nice	%system	%iowait	%steal	%idle													
		6.76	11.70	2.21	0.14	0.00	79.19													
Device	r/s	rkB/s	rrqm/s	%rrqm	r_await	rareq-sz	w/s	wkB/s	wrqm/s	%wrqm	w_await	wareq-sz	d/s	dkB/s	drqm/s	%drqm	d_await	dareq-sz	aqu-sz	%util
loop0	16.74	18.30	0.00	0.00	0.15	1.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18
loop1	0.09	1.69	0.00	0.00	0.46	18.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop10	0.07	0.19	0.00	0.00	0.17	2.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop11	0.10	1.69	0.00	0.00	0.66	17.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop12	0.12	1.70	0.00	0.00	0.70	14.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
loop13	0.09	1.68	0.00	0.00	0.61	18.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop14	0.09	1.69	0.00	0.00	0.64	19.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop15	0.09	1.66	0.00	0.00	0.75	17.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop16	0.09	1.68	0.00	0.00	0.34	18.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
loop17	0.10	1.68	0.00	0.00	0.40	17.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
loop18	0.06	0.19	0.00	0.00	0.22	2.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
loop19	0.03	0.08	0.00	0.00	0.67	2.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop2	0.03	0.09	0.00	0.00	0.05	2.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop20	0.08	0.55	0.00	0.00	0.33	6.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
loop21	0.07	0.54	0.00	0.00	0.18	7.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop22	0.03	0.08	0.00	0.00	0.06	2.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop23	0.02	0.07	0.00	0.00	0.07	2.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop24	0.01	0.01	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop3	0.10	1.70	0.00	0.00	0.25	17.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop4	0.06	0.19	0.00	0.00	0.19	3.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop5	0.06	0.19	0.00	0.00	0.08	3.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop6	0.07	0.54	0.00	0.00	0.22	7.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop7	0.03	0.06	0.00	0.00	0.06	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop8	0.03	0.08	0.00	0.00	0.05	2.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
loop9	0.09	1.71	0.00	0.00	0.15	19.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sda	140.43	10388.35	24.24	14.72	0.43	73.97	31.35	2683.65	25.75	45.10	0.97	85.60	0.00	0.00	0.00	0.00	0.00	0.00	0.01	13.06

Figure 15: iostat -xtc 1 Command ./disk1 process