ProcFS Overview

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Introduction

/proc is one of the filesystem which is also called as a process information pseudo-file system. It doesn’t contains the ‘real’ files but runtime system information i.e system memory , devices mounted , hardware configuration and more. A lot of system utilities are mainly call to the files in this directory.

The file size of all of the files in this directory have a file size of 0, with just exception of some files.

The directory name is /proc

You can go into the directory by doing cd /proc

These are the files present in the proc directory.

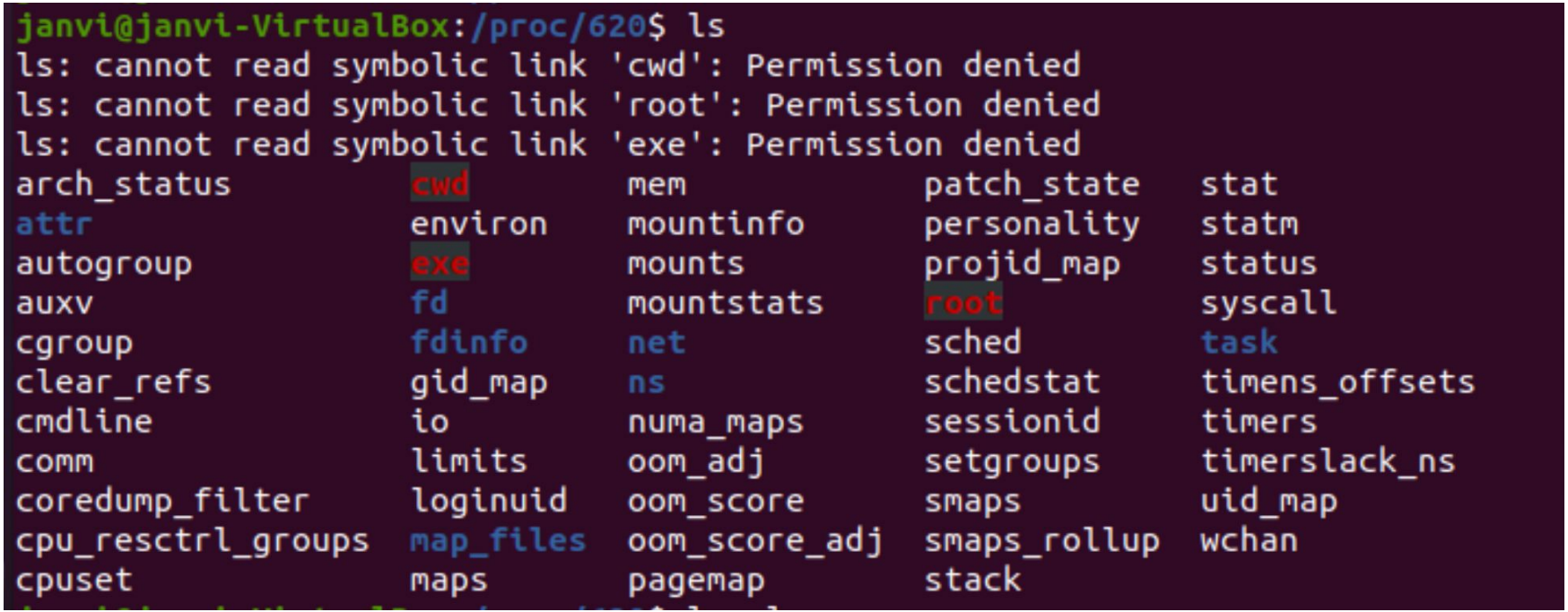
All the numbered files are the Process ID running itself.

```
janvi@janvi-VirtualBox:/proc$ ls
1       1268    14571   1622   25    338   771   asound          locks
10      1273    14579   1631   259   339   779   bootconfig      mdstat
100     1292    14587   1632   26    3573  780   buddyinfo       meminfo
101     1299    1469    1636   266   3591  781   bus             misc
102     13      1492    1642   27    4     782   cgroups         modules
10244   1304    1496    1644   275   546   786   cmdline         mounts
10288   13042   1497    1647   276   547   79    consoles        mtrr
103     1308    15      1662   277   579   792   cpuinfo         net
10332   13094   1501    1667   278   580   793   crypto          pagetypeinfo
10366   13109   1504    1687   28    583   794   devices         partitions
10398   13118   1513    169    280   588   795   diskstats       pressure
10455   1312    1519    17     281   593   80    dma             schedstat
11      13130   1524    170    282   594   81    driver          scsi
113     13139   1530    1734   29    595   82    dynamic_debug   self
116     13140   1539    1744   3     6     83    execdomains     slabinfo
117     13163   1548    18     30    604   84    fb              softirqs
11720   1320    1550    1842   306   613   848   filesystems     stat
1181    1325    1569    1846   307   617   85    fs              swaps
12      1327    1577    19     308   619   86    interrupts      sys
122     1332    1586    194    31    620   87    iomem           sysrq-trigger
123     1354    1587    195    312   623   89    ioports         sysvipc
1241    14      1588    2      32    629   9     irq             thread-self
1249    1421    1590    20     322   630   91    kallsyms        timer_list
1250    14333   1591    2000   325   631   92    kcore           tty
1255    1440    1592    2013   328   642   94    keys            uptime
12567   14449   1596    22     330   664   95    key-users       version
12568   1445    16      23     332   690   960   kmsg            version_signature
1257    1449    1601    235    334   700   97    kpagecgroup     vmallocinfo
```

Process Related Subdirectories

```
janvi@janvi-VirtualBox:/proc$ ls -l
total 0
dr-xr-xr-x  9 root                root                        0 Feb 16 11:09 1
dr-xr-xr-x  9 root                root                        0 Feb 16 11:09 10
dr-xr-xr-x  9 root                root                        0 Feb 16 11:09 10
0
dr-xr-xr-x  9 root                root                        0 Feb 16 11:09 10
1
dr-xr-xr-x  9 root                root                        0 Feb 16 11:09 10
2
dr-xr-xr-x  9 janvi               janvi                       0 Feb 17 00:34 10
244
dr-xr-xr-x  9 janvi               janvi                       0 Feb 17 00:34 10
288
dr-xr-xr-x  9 root                root                        0 Feb 16 11:09 10
3
dr-xr-xr-x  9 janvi               janvi                       0 Feb 17 00:34 10
332
dr-xr-xr-x  9 janvi               janvi                       0 Feb 17 00:34 10
366
dr-xr-xr-x  9 janvi               janvi                       0 Feb 17 00:34 10
398
dr-xr-xr-x  9 janvi               janvi                       0 Feb 17 00:34 10
455
dr-xr-xr-x  9 root                root                        0 Feb 16 11:09 11
dr-xr-xr-x  9 root                root                        0 Feb 16 11:09 11
3
dr-xr-xr-x  9 root                root                        0 Feb 16 11:09 11
6
```

All these files are having the size 0.But what these contains the information and how it contains information is that these files doesn't contain any sort of data , it just acts as a pointer to where the actual process are running. For example , I am just portraying one of the process ID files here. These are the files that are present in one of the Process ID directory.



All the files present in any of process id is there because of some purpose and contents that each of the file serve there. I am going to explain a few:

- cmdline - command line arguments
- cpu - current & the last cpu that was executed.
- cwd - path to the current working directory (Required root permission))
- environ - environment variables value
- exe - link to the executable of that particular process.
- mem - memory held by this process
- stat - status of the process
- statm - memory status information
- maps - memory maps to executables and library files.

These are some of the files and to get to know about more , we can refer to the man page of the proc.

```
janvi@janvi-VirtualBox:/proc/620$ cat status
Name:   snapd
Umask:  0022
State:  S (sleeping)
Tgid:   620
Ngid:   0
Pid:    620
PPid:   1
TracerPid:      0
Uid:    0       0       0       0
Gid:    0       0       0       0
FDSize: 64
Groups:
NStgid: 620
NSpid:  620
NSpgid: 620
NSsid:  620
VmPeak:   873452 kB
VmSize:   873452 kB
VmLck:         0 kB
VmPin:         0 kB
VmHWM:     39308 kB
VmRSS:     26316 kB
RssAnon:             16100 kB
RssFile:             10216 kB
```

Kernel data

Kernel Data files give the information about the running kernel . The files that will be present on the system can vary from the system to system as these files depend on the kernel configuration and the loaded modules .

Kernel info in /proc is stored in the files like :

- apm - advanced power management information
- buddyinfo - Kernel memory allocator information
- bus - Directory containing bus specific information
- cmdline - Kernel command line
- cpuinfo - Info about the CPU
- devices - available devices
- dma - Used DMS channels
- filesystems - supported filesystems
- driver - various drivers

- fb - FrameBuffer Devices
- Fs - file system parameters like ext4 , nfs and jbgd
- ide - info about the IDE subsystem
- Interrupts- interrupt usage
- iomem - Memory map
- Ioports - i/o port usage
- Irq - irq to cpu affinity
- Kcore - kernel core image
- Kmsg - kernel msgs
- Ksyms - kernel symbol table
- locks - kernel locks
- meminfo - memory info
- modules - loaded modules
- net - networking info
- pagetypeinfo -Additional Page allocator information
- partitions - table of partition known to the system

- pci - Deprecated info of PCI bus (new way -> /proc/bus/pci/, decoupled by lspci
- rtc - Real time clock
- scsi - SCSI info (see text)
- slabinfo - Slab pool info
- softirqs - softirq usage
- stat - Overall statistics
- swaps - Swap space utilization
- sysvipc - Info of SysVIPC Resources (msg, sem, shm)
- tty - Info of tty drivers
- uptime - Wall clock since boot, combined idle time of all cpus
- version - Kernel version
- video - bttv info of video resources
- vmallocinfo - Show vmalloced areas

IDE Devices in /proc/ide

This subdirectory /proc/ide contains information about all the IDE devices of which that particular kernel is aware. There is one subdirectory for each IDE controller , the file driver and a link to the IDE Device that points to the device directory in the controller specific subtree.

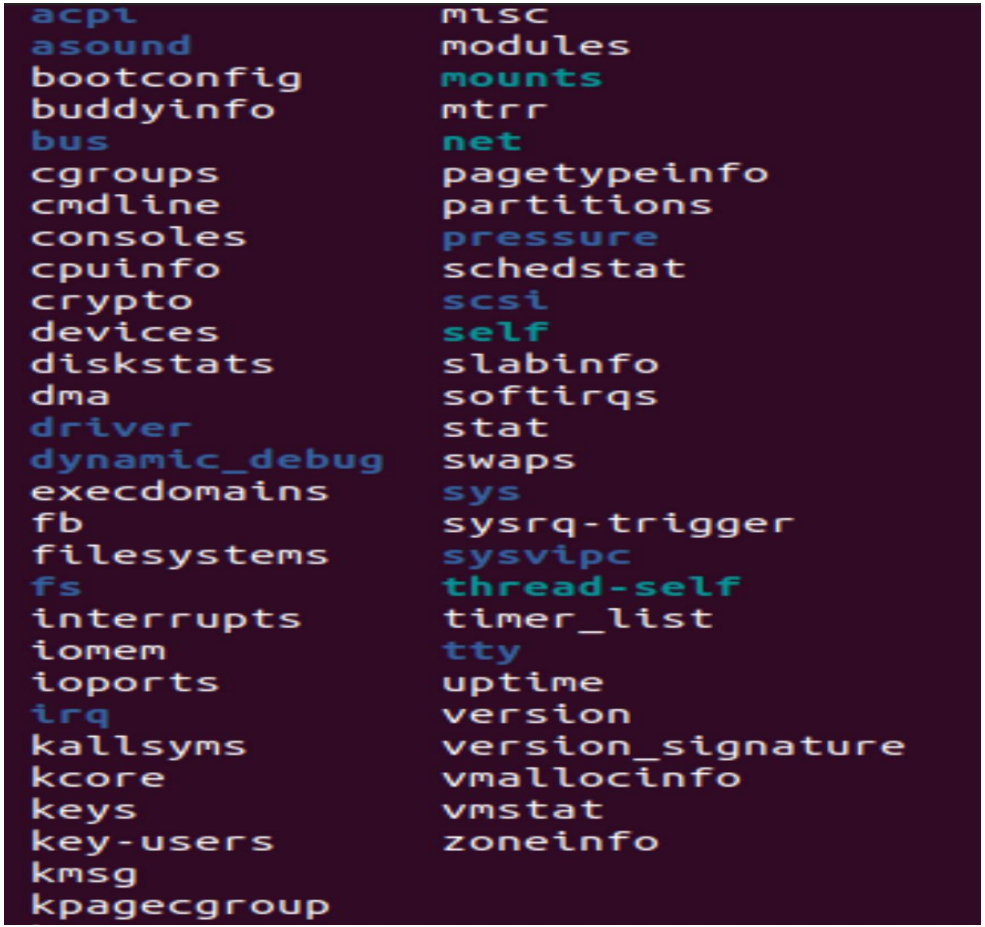
The file “ drivers” one contain the information about the drivers used for the IDE devices.

The subdirectory contains more information that can be found in the IDE controller . These are named ide0, ide1 and so on. IDE controller consists of info about these things:

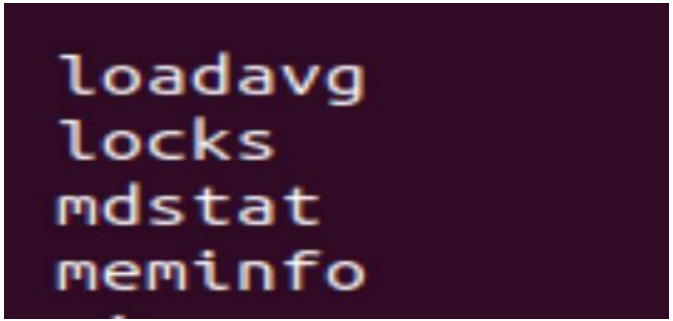
- Channel - IDE channel
- Config - configuration
- Mate - mate name
- Model - type/chipset of the IDE controller

The devices which are connected to these controller have separate subdirectories which consists of various files :

- cache - stores the cache
- capacity - capacity of the medium
- driver - file driver and the version
- geometry - physical and logical geometry of the device
- Identify - device identify block
- Media- media type
- Model - device identifier
- Settings - service setup
- smart_thresholds - ide disk management thresholds
- smart_values - ide disk management values



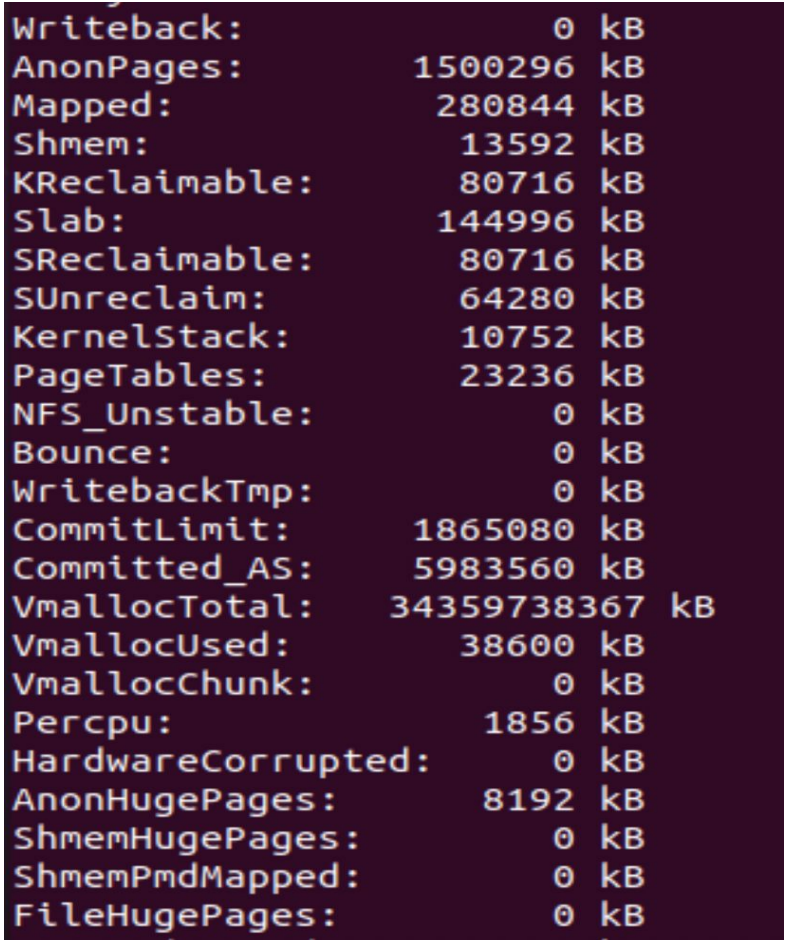
Kernel Data info file



meminfo

```
janvi@janvi-VirtualBox:/proc$ cat meminfo
MemTotal:        2811644 kB
MemFree:          140276 kB
MemAvailable:     972408 kB
Buffers:           46272 kB
Cached:           890376 kB
SwapCached:         5452 kB
Active:           894652 kB
Inactive:        1553536 kB
Active(anon):     394340 kB
Inactive(anon):  1127532 kB
Active(file):     500312 kB
Inactive(file):   426004 kB
Unevictable:          16 kB
Mlocked:              16 kB
SwapTotal:        459260 kB
SwapFree:           2844 kB
Dirty:               948 kB
```

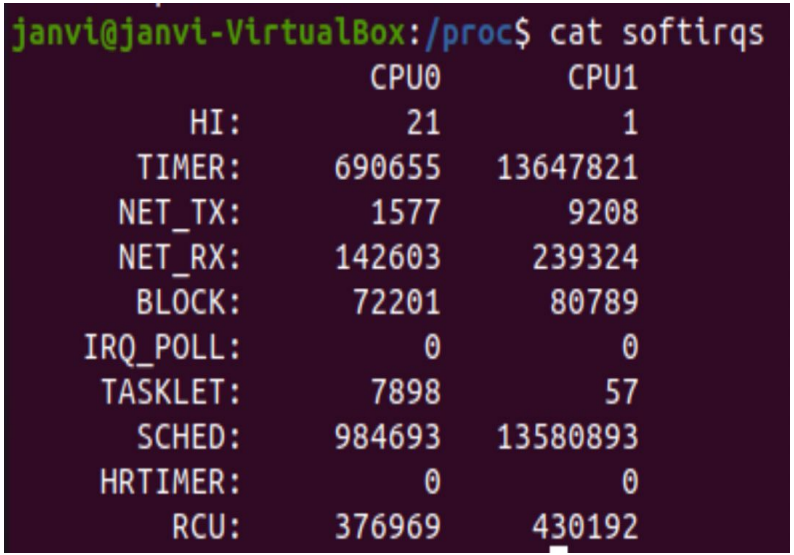
- MemTotal - Total Usage RAM
- MemFree - total sum of HighFree+LowFree
- MemAvailable - available memory for starting the new application.
- Buffers- Temporary storage
- Cached - in-memory cache for files.
- SwapCached - Memory that was once swapped out.
- Active -Memory used recently
- Inactive -memory used less recently
- HighTotal/Free -above ~860mb of physical memory.
- LowTotal/Free - which can be used for everything
- SwapTotal - total amount of swap space available
- SwapFree - memory evicted from the RAM
- Dirty - memory waiting to get written back to disk.



- **Writeback** Memory which is actively being written back to the disk
- **AnonPages** Non-file backed pages mapped into userspace page tables
- **HardwareCorrupted** The amount of RAM/memory in KB, the kernel identifies as corrupted.
- **AnonHugePages** Non-file backed huge pages mapped into user space page tables
- **Mapped** files which have been mapped, such as libraries
- **Shmem** Total memory used by shared memory (shmem) and tmpfs
- **ShmemHugePages** Memory used by shared memory (shmem) and tmpfs allocated with huge pages
- **ShmemPmdMapped** Shared memory mapped into userspace with huge pages
- **KReclaimable** Kernel allocations that the kernel will attempt to reclaim under memory pressure. Includes SReclaimable (below), and other direct allocations with a shrinker.
- **Slab**in-kernel data structures cache
- **SReclaimable** Part of Slab, that might be reclaimed, such as caches
- **SUnreclaim** Part of Slab, that cannot be reclaimed on memory pressure
- **PageTables** amount of memory dedicated to the lowest level of page tables.
- **NFS_Unstable** Always zero. Previous counted pages which had been written to the server, but has not been committed to stable storage.
- **Bounce** Memory used for block device “bounce buffers”
- **WritebackTmp** Memory used by FUSE for temporary writeback buffers
- **CommitLimit** this is the total amount of memory currently available to be allocated on the system.
- **Committed_AS t**he amount of memory presently allocated on the system.
- **mallocTotal** total size of vmalloc memory area
- **VmallocUsed** amount of vmalloc area which is used
- **VmallocChunk** largest contiguous block of vmalloc area which is free
- **Percpu** Memory allocated to the percpu allocator used to back percpu allocations. This stat excludes the cost of metadata.

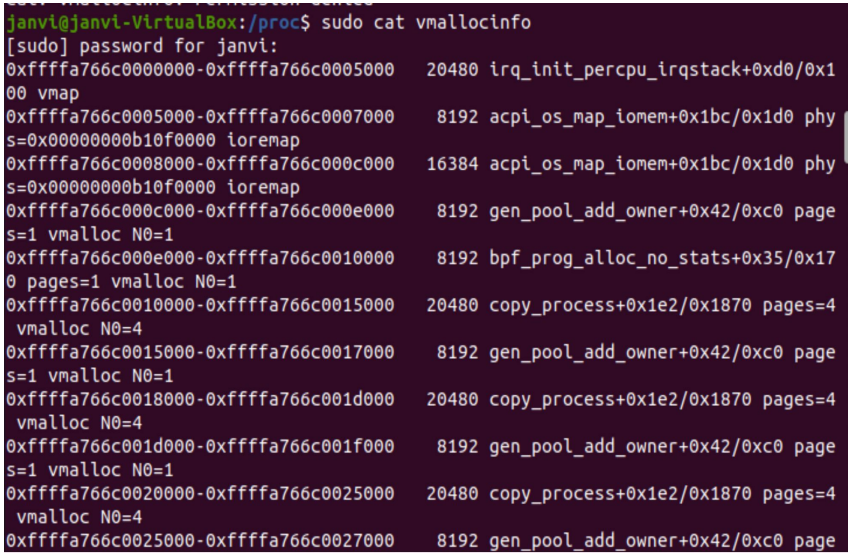
Softirqs:

Count of softirq handlers services for each CPU.



Vmallocinfo:

Provides information about vmalloced / vmaped areas.



Networking information with /proc/net

```
janvi@janvi-VirtualBox:/proc$ cd net
janvi@janvi-VirtualBox:/proc/net$ ls
anycast6      igmp              mcfilter   route         tcp6
arp           igmp6             mcfilter6  rt6_stats     udp
connector     ip6_flowlabel     netfilter  rt_acct       udp6
dev           ip6_mr_cache      netlink    rt_cache      udplite
dev_mcast     ip6_mr_vif        netstat    snmp          udplite6
dev_snmp6     ip_mr_cache       packet     snmp6         unix
fib_trie      ip_mr_vif         protocols  sockstat      wireless
fib_triestat  ip_tables_matches psched     sockstat6     xfrm_stat
icmp          ip_tables_names   ptype      softnet_stat
icmp6         ip_tables_targets raw        stat
if_inet6      ipv6_route        raw6       tcp
```

IPv6 info is present in the directory in the files:

- udp6 - UDP sockets (ipv6)
- tcp6 - TCP sockets
- raw6 - Raw device statistics
- igmp6 - IP multicast addresses which is joined by the host.
- If_inet6 - List of IPv6 interface addresses
- Ipv6_route Kernel routing table for IPv6
- Rt6_stats - Routing Statistics
- sockstat6 - Socket Statistics
- snmp6 - Snmp Data

Files that provide the Network information are:

- Arp- Kernel ARP table
- dev - network devices with statistics
- dev_mcast - multicast group
- dev_stat- network device status
- netstat- network statistics
- raw- raw device statistics
- route - kernel routing table
- rt_cache - Routing cache
- unix - unix domain sockets
- wireless - wireless interface data
- netlink - list of PF-NETLINK sockets
- Ip_mr_vifs - List of multicast virtual interfaces
- psched- packet scheduler parameter

SCSI Info

The primary file in this directory is the scsi which contains a list of every recognized scsi device. We can get to know about the model , type of device , vendor , scsi channel and ID data .

```
janvi@janvi-VirtualBox:/proc$ cd scsi
janvi@janvi-VirtualBox:/proc/scsi$ ls
device_info  scsi  sg
janvi@janvi-VirtualBox:/proc/scsi$ cat /proc/scsi/scsi
Attached devices:
Host: scsi1 Channel: 00 Id: 00 Lun: 00
  Vendor: VBOX     Model: CD-ROM           Rev: 1.0
  Type:   CD-ROM                           ANSI  SCSI revision: 05
Host: scsi2 Channel: 00 Id: 00 Lun: 00
  Vendor: ATA      Model: VBOX HARDDISK    Rev: 1.0
  Type:   Direct-Access                    ANSI  SCSI revision: 05
janvi@janvi-VirtualBox:/proc/scsi$ cd sg
janvi@janvi-VirtualBox:/proc/scsi/sg$ ls
allow_dio  debug  def_reserved_size  device_hdr  devices  device_strs  version
```

```
janvi@janvi-VirtualBox:/proc/scsi/sg$ ls
allow_dio  debug  def_reserved_size  device_hdr  devices  device_strs  version
janvi@janvi-VirtualBox:/proc/scsi/sg$ cat allow_dio
0
janvi@janvi-VirtualBox:/proc/scsi/sg$ cat debug
max_active_device=2  def_reserved_size=32768
janvi@janvi-VirtualBox:/proc/scsi/sg$ cat def_reserved_size
32768
janvi@janvi-VirtualBox:/proc/scsi/sg$ cat devices
1       0       0       0       5       1       1       0       1
2       0       0       0       0       1       32      0       1
janvi@janvi-VirtualBox:/proc/scsi/sg$ cat device_hdr
host    chan    id      lun     type    opens   qdepth  busy    online
janvi@janvi-VirtualBox:/proc/scsi/sg$ cat device_strs
VBOX            CD-ROM                  1.0
ATA             VBOX HARDDISK           1.0
janvi@janvi-VirtualBox:/proc/scsi/sg$ cat version
30536   3.5.36 [20140603]
```

```
janvi@janvi-VirtualBox:/proc/scsi$ cat device_info
'Aashima' 'IMAGERY 2400SP' 0x1
'CHINON' 'CD-ROM CDS-431' 0x1
'CHINON' 'CD-ROM CDS-535' 0x1
'DENON' 'DRD-25X' 0x1
'HITACHI' 'DK312C' 0x1
'HITACHI' 'DK314C' 0x1
'IBM' '2104-DU3' 0x1
'IBM' '2104-TU3' 0x1
'IMS' 'CDD521/10' 0x1
'MAXTOR' 'XT-3280' 0x1
'MAXTOR' 'XT-4380S' 0x1
```

Parallel Port

Parallel port includes the ability to share one port between multiple device drivers.

This directory contains information about the parallel ports of your system.

/proc/parport

Files included:

- autoprobe: Device ID information that has been acquired.
- devices : list of the device drivers that are using that port. A + will appear by the name of the device currently using the port.
- hardware: Parallel port;s base address
- irq: IRQ number that passport is using for that port.

TTY info in /proc/tty

TTy is basically an abstract device. It can be referred to as input device such as a serial port or a virtual teletype where it allows users to interact with the system.

This consist information about the available and actually used tty’s.

This consist of files for :

- Drivers: list of drivers and their usage.
- ldiscs : registered line disciplines
- driver/serial : usage statistic and status of single tty lines.

```
janvi@janvi-VirtualBox:/proc$ cd tty
janvi@janvi-VirtualBox:/proc/tty$ ls
driver  drivers  ldisc  ldiscs
janvi@janvi-VirtualBox:/proc/tty$ cat drivers
/dev/tty             /dev/tty        5       0 system:/dev/tty
/dev/console         /dev/console    5       1 system:console
/dev/ptmx            /dev/ptmx       5       2 system
/dev/vc/0            /dev/vc/0       4       0 system:vtmaster
ttyprintk            /dev/ttyprintk   5       3 console
max310x              /dev/ttyMAX   204 209-224 serial
serial               /dev/ttyS       4 64-111 serial
pty_slave            /dev/pts      136 0-1048575 pty:slave
pty_master           /dev/ptm      128 0-1048575 pty:master
unknown              /dev/tty        4 1-63 console
janvi@janvi-VirtualBox:/proc/tty$ cat ldiscs
n_tty        0
n_null      27
```

/proc/consoles

This shows registered console line.

```
janvi@janvi-VirtualBox:/proc$ cat  consoles
tty0                 -WU (EC p  )    4:2
```

Here , the operations , flags and major:minor are the devices and to that we have various flasga and operations attached to it.

- Operations: R- read operation , W - write operation , U - unblank
- Flags: E - enabled, C - preferred console , B - Primary Boot Console , p - printk buffer , b - braille device , a - safe to use.
- Major:minor : major and minor number of devices separated by a colon.

Kernel Statistics in /proc/stat

Information about kernel activity are available in the /proc/stat file.

```
janvi@janvi-VirtualBox:/proc$ cat stat
cpu  67002 4745 22574 9166242 2581 0 1653 0 0 0
cpu0 36907 2291 13215 4626895 1279 0 762 0 0 0
cpu1 30095 2454 9359 4539346 1302 0 890 0 0 0
intr 24440811 29 8782 0 0 0 0 0 0 0 0 0 0 2418 0 0 46733 0 0 28404 136975 14967
 118715 143 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
ctxt 25100066
btime 1645947184
processes 15967
procs_running 2
procs_blocked 0
softirq 25963687 22 12326356 9347 272192 138433 0 7076 12515512 0 694749
```

- CPU line: The stat files consists of columns that follows from left to right that shows the amount of time that the CPU has spent while performing these tasks.
  - user: normal processes executing in user mode
  - Nice:niced processes executing in user mode
  - system: processes that are executing in the kernel mode.
  - idle: twiddling thumbs
  - iowait: waiting for I/O to complete
  - irq: servicing interrupts
  - softirq: servicing softirqs
  - steal: involuntary wait
  - guest: running a normal guest
  - guest_nice: running a niced guest

- intr = count of interrupts serviced since the boot time.
- ctxt = total number of context switches across all CPUs.
- btime = This gives the time at which the system booted.
- processes = number of processes and thread created .
- procs_running = total number of threads that are running or ready to run
- procs_blocked = number of processes that are currently blocked or waiting for the I/O to complete.
- softirq = count of softirqs serviced since boot time.

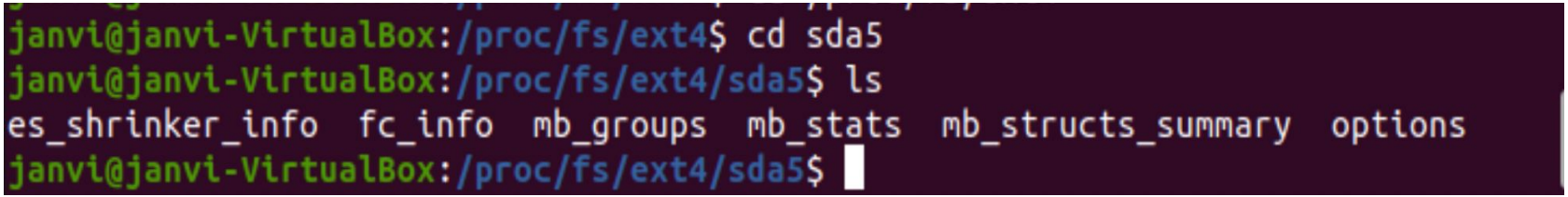
/proc/fs or ext4 file system

/proc/fs consist of the directories and information about the ext4 , jbd2 and nsfd file systems.

Information about mounted ext4 file systems can be found in /proc/fs/ext4.

Jbd2 is the kernel thread of ext4 for updating journals and it is a resource for the ext4 file system. This is for the block journaling which deals with I/O operations and provides a way to check the data integrity.

nfsd - this is a special filesystem that is used for controlling the Linux NFS Server.



```
janvi@janvi-VirtualBox:~$ cd /proc/fs
janvi@janvi-VirtualBox:/proc/fs$ ls
ext4  jbd2  nfsd
janvi@janvi-VirtualBox:/proc/fs$ cd ext4
janvi@janvi-VirtualBox:/proc/fs/ext4$ ls
sda5
janvi@janvi-VirtualBox:/proc/fs/ext4$ cd ..
janvi@janvi-VirtualBox:/proc/fs$ cd jbd2
janvi@janvi-VirtualBox:/proc/fs/jbd2$ ls
sda5-8
janvi@janvi-VirtualBox:/proc/fs/jbd2$ cd sda5-8
janvi@janvi-VirtualBox:/proc/fs/jbd2/sda5-8$ ls
info
janvi@janvi-VirtualBox:/proc/fs/jbd2/sda5-8$ cat info
7539 transactions (6980 requested), each up to 4096 blocks
average:
  0ms waiting for transaction
  0ms request delay
  996ms running transaction
  0ms transaction was being locked
  0ms flushing data (in ordered mode)
  0ms logging transaction
  1946us average transaction commit time
  280 handles per transaction
  8 blocks per transaction
  10 logged blocks per transaction
janvi@janvi-VirtualBox:/proc/fs/jbd2/sda5-8$ cd /proc/fs/nfsd
```