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I pledge my honor I have abided by the Stevens Honor System




The screenshot shows two terminal windows. The left window is titled 'jmeaharg1@debian: ~/jmeaharg1-pa4/driver' and the right window is titled 'jmeaharg1@debian: ~/jmeaharg1-pa4/src'. Both windows show the user 'jmeaharg1' with UID 1000 and GID 1000. The left window shows the user running 'id', 'uname -a', 'ls -l /dev/scull', and 'sudo insmod ./scull.ko'. The right window shows the user running './scull i' twice, which opens and closes the device. The output of the first './scull i' shows 'Device (/dev/scull) opened', 'state 0, cpu 0, prio 120, pid 3607, tgid 3607, nv 3, niv 1', and 'Device (/dev/scull) closed'. The output of the second './scull i' shows 'Device (/dev/scull) opened', 'state 0, cpu 2, prio 120, pid 3608, tgid 3608, nv 0, niv 0', and 'Device (/dev/scull) closed'.

```
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ id
uid=1000(jmeaharg1) gid=1000(jmeaharg1) groups=1000(jmeaharg1),27(sudo),999(vboxsf)
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ uname -a
Linux debian 5.10.0-21-amd64 #1 SMP Debian 5.10.162-1 (2023-01-21) x86_64 GNU/Linux
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ ls -l /dev/scull
crw-r--r-- 1 root root 247, 0 Mar 31 13:55 /dev/scull
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ sudo insmod ./scull.ko
jmeaharg1@debian:~/jmeaharg1-pa4/driver$

jmeaharg1@debian:~/jmeaharg1-pa4/src$ ./scull i
Device (/dev/scull) opened
state 0, cpu 0, prio 120, pid 3607, tgid 3607, nv 3, niv 1
Device (/dev/scull) closed
jmeaharg1@debian:~/jmeaharg1-pa4/src$ ./scull i
Device (/dev/scull) opened
state 0, cpu 2, prio 120, pid 3608, tgid 3608, nv 0, niv 0
Device (/dev/scull) closed
jmeaharg1@debian:~/jmeaharg1-pa4/src$
```

Showing that the /dev/scull special character file has been created with major number 247 and two calls to ./scull I produce the task_info fields



The screenshot shows two terminal windows. The left window is titled 'jmeaharg1@debian: ~/jmeaharg1-pa4/driver' and the right window is titled 'jmeaharg1@debian: ~/jmeaharg1-pa4/src'. Both windows show the user 'jmeaharg1' with UID 1000 and GID 1000. The left window shows the user running 'id', 'sudo insmod ./scull.ko', 'sudo rmmod scull', and 'sudo dmesg | tail -6'. The right window shows the user running './scull i' twice, which opens and closes the device. The output of the first './scull i' shows 'Device (/dev/scull) opened', 'state 0, cpu 0, prio 120, pid 4211, tgid 4211, nv 0, niv 0', and 'Device (/dev/scull) closed'. The output of the second './scull i' shows 'Device (/dev/scull) opened', 'state 0, cpu 3, prio 120, pid 4212, tgid 4212, nv 0, niv 0', and 'Device (/dev/scull) closed'. The output of the 'sudo dmesg | tail -6' command in the left window shows the following messages: '[1139.320144] scull open', '[1139.320198] scull close', '[1139.950319] scull open', '[1139.950393] scull close', '[1144.357704] Task 0: PID 4211, TGID 4211', and '[1144.357707] Task 1: PID 4212, TGID 4212'.

```
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ id
uid=1000(jmeaharg1) gid=1000(jmeaharg1) groups=1000(jmeaharg1),27(sudo),999(vboxsf)
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ sudo insmod ./scull.ko
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ sudo rmmod scull
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ sudo dmesg | tail -6
[ 1139.320144] scull open
[ 1139.320198] scull close
[ 1139.950319] scull open
[ 1139.950393] scull close
[ 1144.357704] Task 0: PID 4211, TGID 4211
[ 1144.357707] Task 1: PID 4212, TGID 4212
jmeaharg1@debian:~/jmeaharg1-pa4/driver$

jmeaharg1@debian:~/jmeaharg1-pa4/src$ ./scull i
Device (/dev/scull) opened
state 0, cpu 0, prio 120, pid 4211, tgid 4211, nv 0, niv 0
Device (/dev/scull) closed
jmeaharg1@debian:~/jmeaharg1-pa4/src$ ./scull i
Device (/dev/scull) opened
state 0, cpu 3, prio 120, pid 4212, tgid 4212, nv 0, niv 0
Device (/dev/scull) closed
jmeaharg1@debian:~/jmeaharg1-pa4/src$
```

Shows that I have implemented a linked list to keep track of ./scull i calls as shown by the sudo dmesg | tail -6 command

```
Activities Terminal Mar 31 14:07
jmeaharg1@debian: ~/jmeaharg1-pa4/driver
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ id
uid=1000(jmeaharg1) gid=1000(jmeaharg1) groups=1000(jmeaharg1),27(sudo),999(vboxsf)
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ sudo insmod ./scull.ko
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ sudo rmmod scull
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ sudo dmesg | tail -6
[ 1437.374172] scull open
[ 1437.374658] scull close
[ 1443.637341] Task 0: PID 4268, TGID 4268
[ 1443.637344] Task 1: PID 4269, TGID 4269
[ 1443.637345] Task 2: PID 4270, TGID 4270
[ 1443.637346] Task 3: PID 4271, TGID 4271
jmeaharg1@debian:~/jmeaharg1-pa4/driver$

jmeaharg1@debian: ~/jmeaharg1-pa4/src
jmeaharg1@debian:~/jmeaharg1-pa4/src$ ./scull p
Device (/dev/scull) opened
state 0, cpu 3, prio 120, pid 4268, tgid 4268, nv 0, niv 0
state 0, cpu 3, prio 120, pid 4268, tgid 4268, nv 0, niv 0
state 0, cpu 5, prio 120, pid 4269, tgid 4269, nv 0, niv 0
state 0, cpu 1, prio 120, pid 4270, tgid 4270, nv 0, niv 0
state 0, cpu 5, prio 120, pid 4269, tgid 4269, nv 0, niv 0
state 0, cpu 1, prio 120, pid 4270, tgid 4270, nv 0, niv 0
state 0, cpu 0, prio 120, pid 4271, tgid 4271, nv 0, niv 0
state 0, cpu 0, prio 120, pid 4271, tgid 4271, nv 0, niv 0
Device (/dev/scull) closed
jmeaharg1@debian:~/jmeaharg1-pa4/src$
```

Shows that I have implemented the `./scull p` command to create child processes that run the `./scull i` concurrently as shown by the different CPU usage command twice each and that my linked list only adds unique PID TGIDs.

```
Activities Terminal Mar 31 14:13
jmeaharg1@debian: ~/jmeaharg1-pa4/driver
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ id
uid=1000(jmeaharg1) gid=1000(jmeaharg1) groups=1000(jmeaharg1),27(sudo),999(vboxsf)
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ sudo insmod ./scull.ko
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ sudo rmmod scull
jmeaharg1@debian:~/jmeaharg1-pa4/driver$ sudo dmesg | tail -6
[ 1764.068237] scull open
[ 1764.068877] scull close
[ 1768.504405] Task 0: PID 4306, TGID 4304
[ 1768.504408] Task 1: PID 4307, TGID 4304
[ 1768.504409] Task 2: PID 4305, TGID 4304
[ 1768.504410] Task 3: PID 4308, TGID 4304
jmeaharg1@debian:~/jmeaharg1-pa4/driver$

jmeaharg1@debian: ~/jmeaharg1-pa4/src
jmeaharg1@debian:~/jmeaharg1-pa4/src$ ./scull t
Device (/dev/scull) opened
state 0, cpu 2, prio 120, pid 4306, tgid 4304, nv 0, niv 0
state 0, cpu 2, prio 120, pid 4306, tgid 4304, nv 0, niv 0
state 0, cpu 2, prio 120, pid 4307, tgid 4304, nv 0, niv 1
state 0, cpu 2, prio 120, pid 4307, tgid 4304, nv 0, niv 1
state 0, cpu 0, prio 120, pid 4305, tgid 4304, nv 3, niv 0
state 0, cpu 0, prio 120, pid 4305, tgid 4304, nv 3, niv 0
state 0, cpu 2, prio 120, pid 4308, tgid 4304, nv 0, niv 0
state 0, cpu 2, prio 120, pid 4308, tgid 4304, nv 0, niv 0
ioctl: Success
Device (/dev/scull) closed
jmeaharg1@debian:~/jmeaharg1-pa4/src$
```

Shows that I have implemented the `./scull t` command to create threads that run the `./scull i` command concurrently as shown by the consistent tgid number.