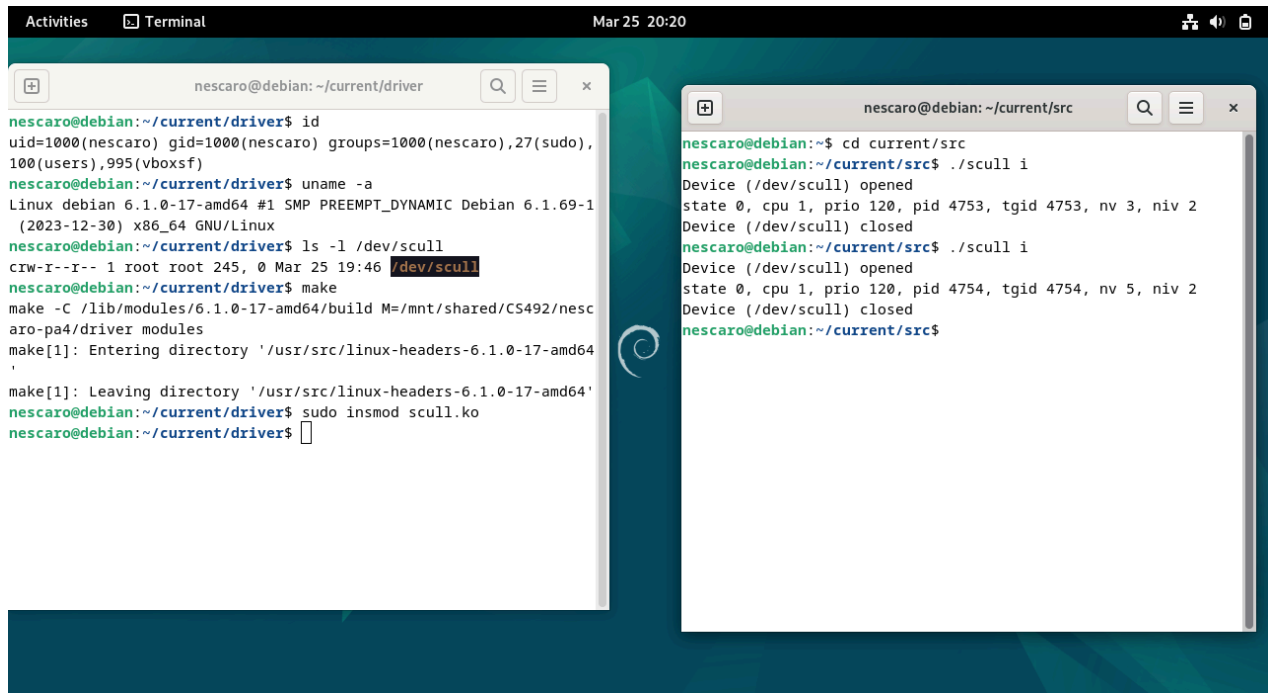


Nathaniel Escaro

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

Screenshots for PA4

This screenshot shows the existence of the scull character device and compiling and inserting the module into the kernel on the left terminal. The right terminal shows that the “i” command in the user mode program scull displays all fields of task_info struct.

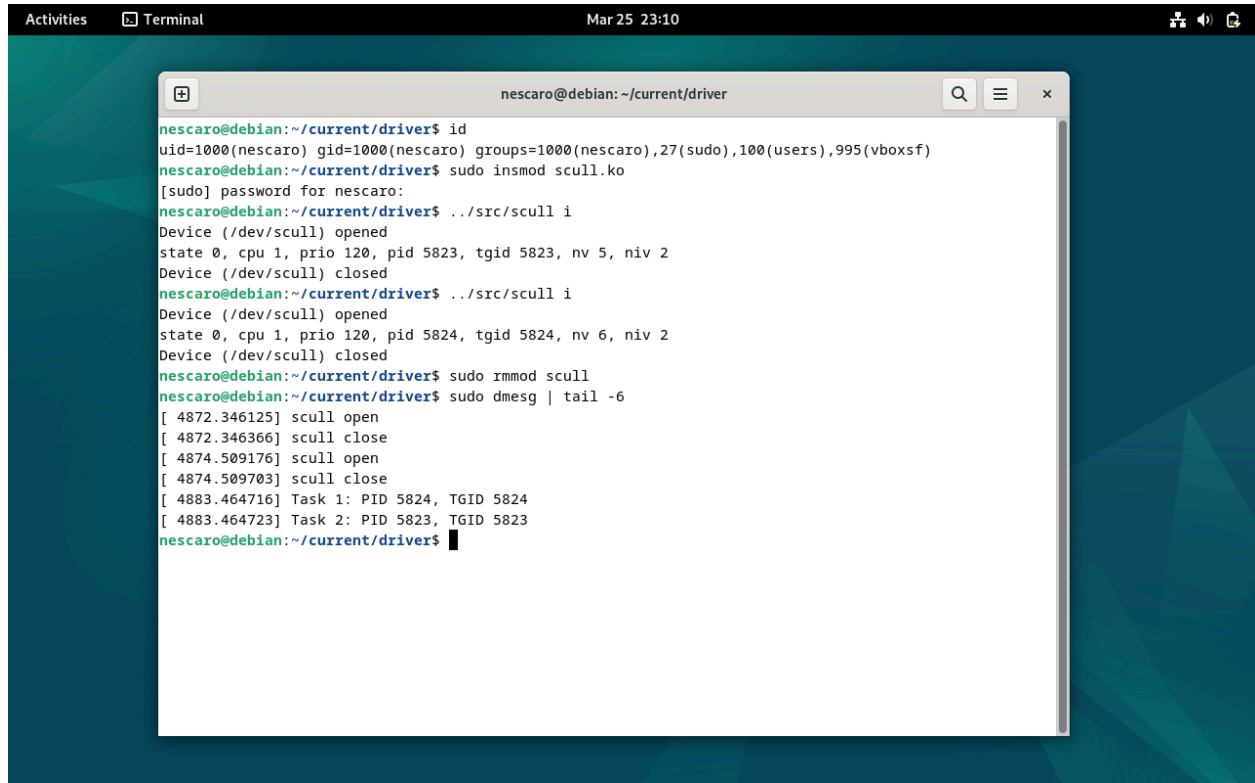


The image displays two terminal windows from a Linux desktop environment. The left window, titled 'nescaro@debian: ~/current/driver', shows the user running 'id', 'uname -a', 'ls -l /dev/scull', and 'make'. The 'ls' command shows the file '/dev/scull' with permissions 'crw-r--r--' and ownership 'root root'. The 'make' command successfully builds the module 'scull.ko'. The right window, titled 'nescaro@debian: ~/current/src', shows the user running './scull i' twice. Each execution prints the state of the device, including CPU, priority, PID, TID, and NV values, and confirms the device was opened and closed successfully.

```
nescaro@debian:~/current/driver$ id
uid=1000(nescaro) gid=1000(nescaro) groups=1000(nescaro),27(sudo),
100(users),995(vboxsf)
nescaro@debian:~/current/driver$ uname -a
Linux debian 6.1.0-17-amd64 #1 SMP PREEMPT_DYNAMIC Debian 6.1.69-1
(2023-12-30) x86_64 GNU/Linux
nescaro@debian:~/current/driver$ ls -l /dev/scull
crw-r--r-- 1 root root 245, 0 Mar 25 19:46 /dev/scull
nescaro@debian:~/current/driver$ make
make -C /lib/modules/6.1.0-17-amd64/build M=/mnt/shared/CS492/nesc
aro-pa4/driver modules
make[1]: Entering directory '/usr/src/linux-headers-6.1.0-17-amd64'
make[1]: Leaving directory '/usr/src/linux-headers-6.1.0-17-amd64'
nescaro@debian:~/current/driver$ sudo insmod scull.ko
nescaro@debian:~/current/driver$
```

```
nescaro@debian:~$ cd current/src
nescaro@debian:~/current/src$ ./scull i
Device (/dev/scull) opened
state 0, cpu 1, prio 120, pid 4753, tgid 4753, nv 3, niv 2
Device (/dev/scull) closed
nescaro@debian:~/current/src$ ./scull i
Device (/dev/scull) opened
state 0, cpu 1, prio 120, pid 4754, tgid 4754, nv 5, niv 2
Device (/dev/scull) closed
nescaro@debian:~/current/src$
```

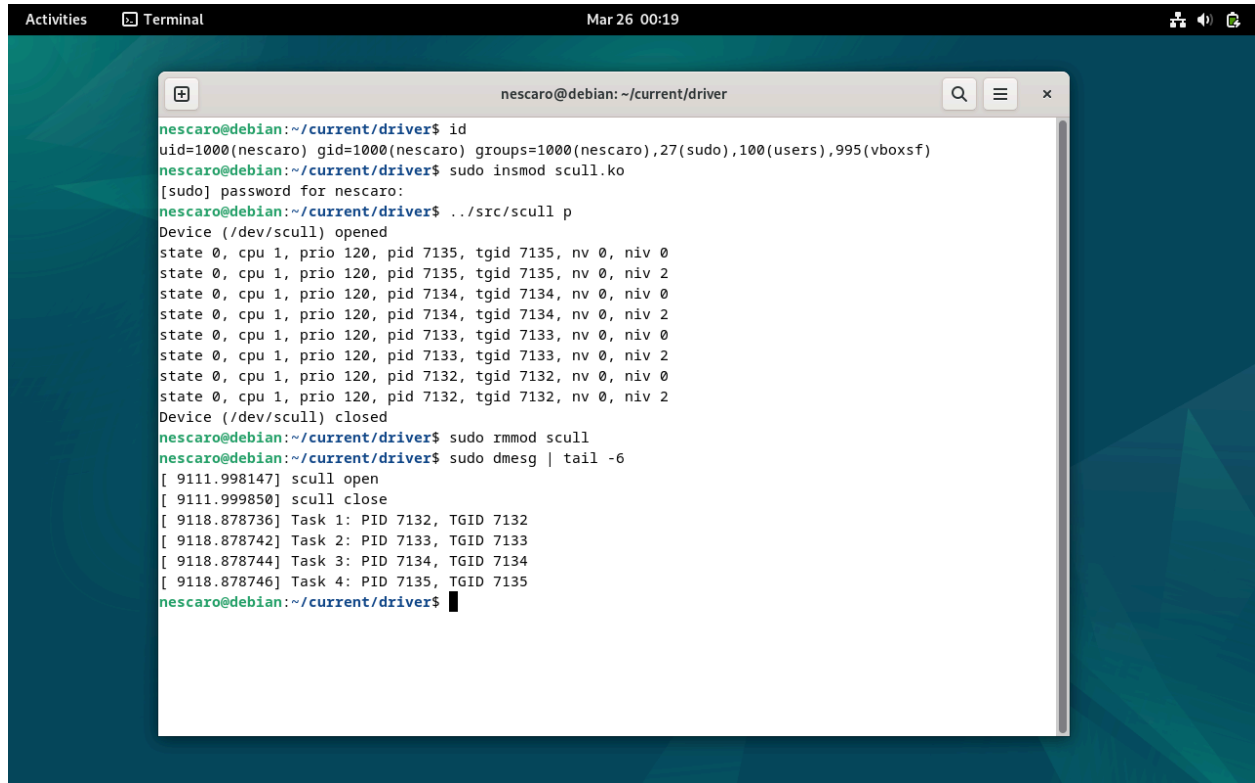
This screenshot shows that each “i” command appends to the linked list living inside the kernel, and that the contents of that list will be printed after the module is removed.



The screenshot shows a terminal window titled "nescaro@debian: ~/current/driver". The user runs several commands to interact with the kernel module 'scull'. The output shows the device being opened and closed multiple times, and the kernel log being checked with 'dmesg | tail -6' after removing the module. The log shows timestamps for 'scull open' and 'scull close' events, as well as task information for two tasks.

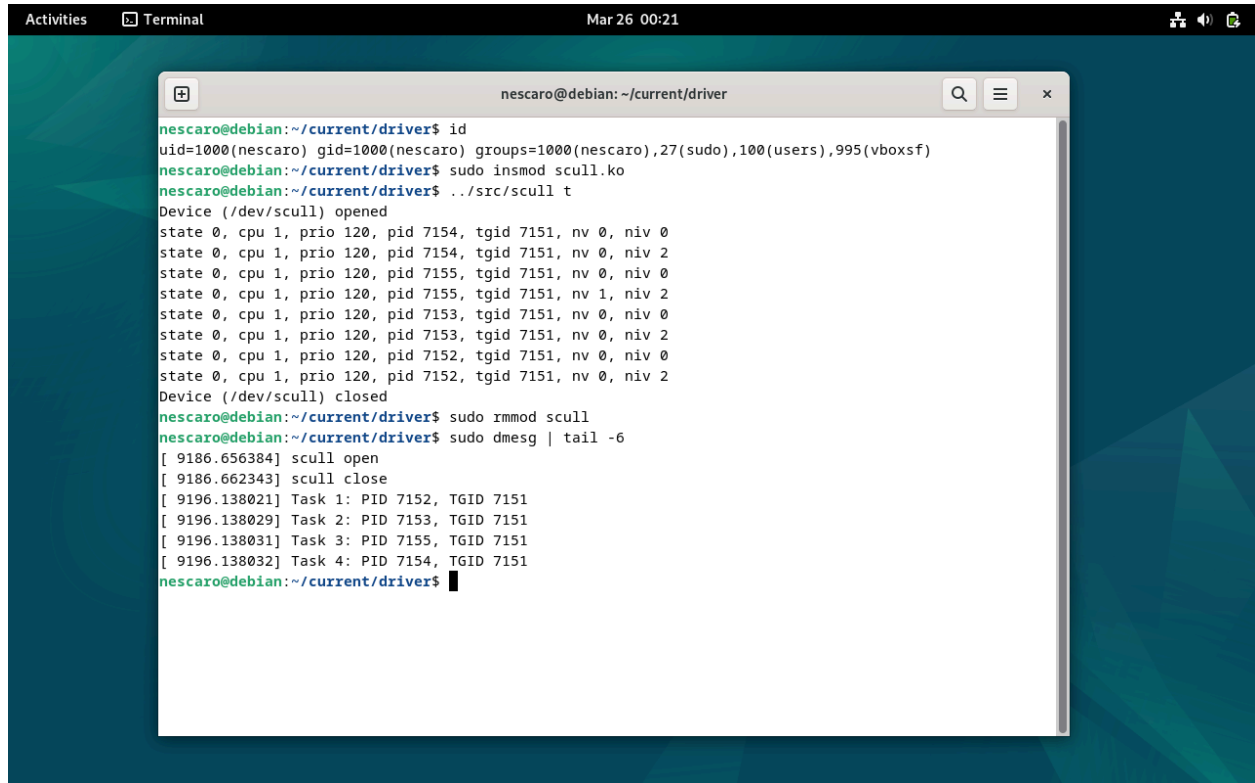
```
nescaro@debian:~/current/driver$ id
uid=1000(nescaro) gid=1000(nescaro) groups=1000(nescaro),27(sudo),100(users),995(vboxsf)
nescaro@debian:~/current/driver$ sudo insmod scull.ko
[sudo] password for nescaro:
nescaro@debian:~/current/driver$ ./src/scull i
Device (/dev/scull) opened
state 0, cpu 1, prio 120, pid 5823, tgid 5823, nv 5, niv 2
Device (/dev/scull) closed
nescaro@debian:~/current/driver$ ./src/scull i
Device (/dev/scull) opened
state 0, cpu 1, prio 120, pid 5824, tgid 5824, nv 6, niv 2
Device (/dev/scull) closed
nescaro@debian:~/current/driver$ sudo rmmod scull
nescaro@debian:~/current/driver$ sudo dmesg | tail -6
[ 4872.346125] scull open
[ 4872.346366] scull close
[ 4874.509176] scull open
[ 4874.509703] scull close
[ 4883.464716] Task 1: PID 5824, TGID 5824
[ 4883.464723] Task 2: PID 5823, TGID 5823
nescaro@debian:~/current/driver$
```

This screenshot shows that the “p” command for the scull program is implemented properly and that the linked list does not contain any duplicate entries for processes.



```
nescaro@debian: ~/current/driver
nescaro@debian:~/current/driver$ id
uid=1000(nescaro) gid=1000(nescaro) groups=1000(nescaro),27(sudo),100(users),995(vboxsf)
nescaro@debian:~/current/driver$ sudo insmod scull.ko
[sudo] password for nescaro:
nescaro@debian:~/current/driver$ ./src/scull p
Device (/dev/scull) opened
state 0, cpu 1, prio 120, pid 7135, tgid 7135, nv 0, niv 0
state 0, cpu 1, prio 120, pid 7135, tgid 7135, nv 0, niv 2
state 0, cpu 1, prio 120, pid 7134, tgid 7134, nv 0, niv 0
state 0, cpu 1, prio 120, pid 7134, tgid 7134, nv 0, niv 2
state 0, cpu 1, prio 120, pid 7133, tgid 7133, nv 0, niv 0
state 0, cpu 1, prio 120, pid 7133, tgid 7133, nv 0, niv 2
state 0, cpu 1, prio 120, pid 7132, tgid 7132, nv 0, niv 0
state 0, cpu 1, prio 120, pid 7132, tgid 7132, nv 0, niv 2
Device (/dev/scull) closed
nescaro@debian:~/current/driver$ sudo rmmod scull
nescaro@debian:~/current/driver$ sudo dmesg | tail -6
[ 9111.998147] scull open
[ 9111.999850] scull close
[ 9118.878736] Task 1: PID 7132, TGID 7132
[ 9118.878742] Task 2: PID 7133, TGID 7133
[ 9118.878744] Task 3: PID 7134, TGID 7134
[ 9118.878746] Task 4: PID 7135, TGID 7135
nescaro@debian:~/current/driver$
```

This screenshot shows that the “t” command for the scull program is implemented properly and that the linked list does not contain any duplicate entries for threads.

A terminal window titled 'nescaro@debian: ~/current/driver' showing the execution of a custom driver. The user runs 'id' showing they are nescaro. Then 'sudo insmod scull.ko' loads the driver. Then 't' is run, which prints state information for several threads. Then 'sudo rmmod scull' unloads the driver. Finally, 'sudo dmesg | tail -6' shows the kernel messages for the driver's open, close, and task execution events.

```
nescaro@debian:~/current/driver$ id
uid=1000(nescaro) gid=1000(nescaro) groups=1000(nescaro),27(sudo),100(users),995(vboxsf)
nescaro@debian:~/current/driver$ sudo insmod scull.ko
nescaro@debian:~/current/driver$ ./src/scull t
Device (/dev/scull) opened
state 0, cpu 1, prio 120, pid 7154, tgid 7151, nv 0, niv 0
state 0, cpu 1, prio 120, pid 7154, tgid 7151, nv 0, niv 2
state 0, cpu 1, prio 120, pid 7155, tgid 7151, nv 0, niv 0
state 0, cpu 1, prio 120, pid 7155, tgid 7151, nv 1, niv 2
state 0, cpu 1, prio 120, pid 7153, tgid 7151, nv 0, niv 0
state 0, cpu 1, prio 120, pid 7153, tgid 7151, nv 0, niv 2
state 0, cpu 1, prio 120, pid 7152, tgid 7151, nv 0, niv 0
state 0, cpu 1, prio 120, pid 7152, tgid 7151, nv 0, niv 2
Device (/dev/scull) closed
nescaro@debian:~/current/driver$ sudo rmmod scull
nescaro@debian:~/current/driver$ sudo dmesg | tail -6
[ 9186.656384] scull open
[ 9186.662343] scull close
[ 9196.138021] Task 1: PID 7152, TGID 7151
[ 9196.138029] Task 2: PID 7153, TGID 7151
[ 9196.138031] Task 3: PID 7155, TGID 7151
[ 9196.138032] Task 4: PID 7154, TGID 7151
nescaro@debian:~/current/driver$
```