

Joshua Meharg

I pledge my honor I have abided by the stevens honor system

This screenshot is showing that I properly compiled my kernel as shown by the `uname -a` showing I am using the `jmharg1-pa2` kernel.



The screenshot shows a terminal window within an Oracle VM VirtualBox environment. The window title is "Debian CS 492 [Running] - Oracle VM VirtualBox". The terminal output shows the results of the `uname -a` and `id` commands. The `uname -a` command shows the kernel version as `Linux debian 5.10.162-jmharg1-pa2 #1 SMP Sun Feb 19 23:55:07 EST 2023 x86_64 GNU/Linux`. The `id` command shows the user as `uid=1000(jmharg1) gid=1000(jmharg1) groups=1000(jmharg1),27(sudo),999(vboxsf)`. The terminal window is titled "jmharg1@debian: ~". The Debian logo is visible at the bottom of the window.

```
jmharg1@debian:~$ uname -a
Linux debian 5.10.162-jmharg1-pa2 #1 SMP Sun Feb 19 23:55:07 EST
2023 x86_64 GNU/Linux
jmharg1@debian:~$ id
uid=1000(jmharg1) gid=1000(jmharg1) groups=1000(jmharg1),27(sudo),999(vboxsf)
jmharg1@debian:~$
```

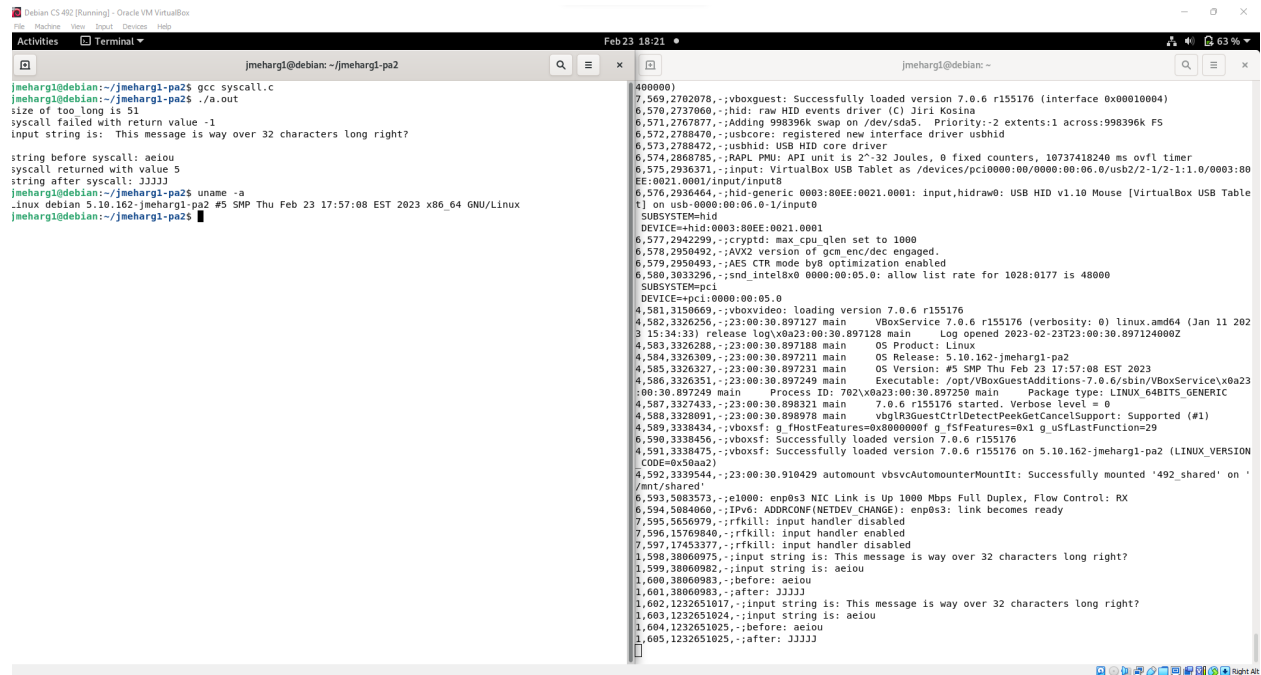
This screenshot shows that my kernel module is working as it shows the output when it loads with “Joshua Meharg(jmeharg1)” and when the module is unloaded it outputs the current message with PID and program name included.

```
Activities Terminal Feb 22 13:16 jmeharg1@debian: ~/jmeharg1-pa2/module

jmeharg1@debian:~/jmeharg1-pa2/modules$ uname -a
Linux debian 5.10.162-jmeharg1-pa2 #1 SMP Sun Feb 19 23:55:07 EST 2023 x86_64 GNU/Linux
jmeharg1@debian:~/jmeharg1-pa2/modules$ sudo insmod ./jmeharg1.ko
jmeharg1@debian:~/jmeharg1-pa2/modules$ sudo rmmod ./jmeharg1.ko
jmeharg1@debian:~/jmeharg1-pa2/modules$ sudo insmod ./jmeharg1.ko
jmeharg1@debian:~/jmeharg1-pa2/modules$ sudo rmmod ./jmeharg1.ko
jmeharg1@debian:~/jmeharg1-pa2/modules$

4,569,4485877,.-vboxguest: Successfully loaded version 7.0.6 r155176
4,570,4485951,.-vboxguest: misc device minor 61, IRQ 20, I/O port d040, MMIO at 00000000f0400000 (size 0x 400000)
7,571,4485953,.-vboxguest: Successfully loaded version 7.0.6 r155176 (interface 0x00010004)
6,572,4489870,.-usbcore: registered new interface driver usbhid
6,573,4489872,.-usbhid: USB HID core driver
6,574,4571427,.-input: VirtualBox USB Tablet as /devices/pci0000:00/0000:00:06.0/usb2/2-1/2-1:1.0/0003:80EE:0021.0001/input/input8
6,575,4572758,.-hid-generic 0003:80EE:0021.0001: input,hidraw0: USB HID v1.10 Mouse [VirtualBox USB Table] on usb-0000:00:06.0-l/input0
SUBSYSTEM=hid
DEVICE=hid:0003:80EE:0021.0001
6,576,4572989,.-RAPL PMU: API unit is 2^-32 Joules, 0 fixed counters, 10737418240 ms ovfl timer
6,577,4677858,.-cryptd: max cpu qlen set to 1000
6,578,4691051,.-AVX2 version of gcm enc/dec engaged.
6,579,4691053,.-AES CTR mode by8 optimization enabled
6,580,4847923,.-snd_intel8x0 0000:00:05.0: allow list rate for 1028:0177 is 48000
SUBSYSTEM=pci
DEVICE=pci:0000:00:05.0
6,581,5092236,.-e1000: enp0s3 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: RX
6,582,5092890,.-IPV6: ADDRCONF(NETDEV_CHANGE): enp0s3: link becomes ready
4,583,5412151,.-vboxvideo: loading version 7.0.6 r155176
4,584,5483808,.-:16:59:57.651398 main VBoxService 7.0.6 r155176 (verbosity: 0) linux.amd64 (Jan 11 2023 15:34:33) release log\x0a16:59:57.651400 main Log opened 2023-02-22T16:59:57.651393000Z
4,585,5483889,.-:16:59:57.651498 main OS Product: Linux
4,586,5483922,.-:16:59:57.651561 main OS Release: 5.10.162-jmeharg1-pa2
4,587,5483951,.-:16:59:57.651592 main OS Version: #1 SMP Sun Feb 19 23:55:07 EST 2023
4,588,5484049,.-:16:59:57.651620 main Executable: /opt/VBoxGuestAdditions-7.0.6/sbin/VBoxService\x0a16:59:57.651621 main Process ID: 957\x0a16:59:57.651622 main Package type: LINUX 64BITS_GENERIC
4,589,5488559,.-:16:59:57.656177 main 7.0.6 r155176 started. Verbose level = 0
4,590,5490804,.-:16:59:57.657612 main vbglR3GuestCtrlDetectPeekGetCancelSupport: Supported (#1)
4,591,5514186,.-vboxsf: g fHostFeatures=0x0000000f g fsfFeatures=0x1 g usfLastFunction=29
6,592,5514647,.-vboxsf: Successfully loaded version 7.0.6 r155176
4,593,5514672,.-vboxsf: Successfully loaded version 7.0.6 r155176 on 5.10.162-jmeharg1-pa2 (LINUX_VERSION_CODE=0x50aa2)
4,594,5516599,.-:16:59:57.683872 automount vbsvcAutomounterMountIt: Successfully mounted '492_shared' on '/mnt/shared'
7,595,9167807,.-rfrkill: input handler disabled
7,596,13116295,.-rfrkill: input handler enabled
7,597,15932466,.-rfrkill: input handler disabled
6,598,3503650114,.-e1000: enp0s3 NIC Link is Down
6,599,3509702119,.-e1000: enp0s3 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: RX
1,600,4240663903,.-Hello World from Joshua Meharg(jmeharg1)
1,601,4260602123,.-PID = 4882, program name = rmmod
1,602,4556654969,.-Hello World from Joshua Meharg(jmeharg1)
1,603,4562675734,.-PID = 5288, program name = rmmod
1,604,4567934795,.-Hello World from Joshua Meharg(jmeharg1)
1,605,4575420861,.-PID = 5299, program name = rmmod
```

This screenshot shows that my user program calling my system call works as it shows that the input arrays longer than 32 chars returns -1 and the valid input array is changed after the system call. You can also see at the kernel level the array being manipulated.



The screenshot shows a terminal window with two panes. The left pane shows a user program execution, and the right pane shows kernel logs.

Left Pane (User Program):

```
jmeahrg1@debian:~/jmeahrg1-pa2$ gcc syscall.c
jmeahrg1@debian:~/jmeahrg1-pa2$ ./a.out
size of too long is 51
syscall failed with return value -1
input string is: This message is way over 32 characters long right?

string before syscall: aeiou
syscall returned with value 5
string after syscall: JJJJJ
jmeahrg1@debian:~/jmeahrg1-pa2$ uname -a
Linux debian 5.10.162-jmeahrg1-pa2 #5 SMP Thu Feb 23 17:57:08 EST 2023 x86_64 GNU/Linux
jmeahrg1@debian:~/jmeahrg1-pa2$
```

Right Pane (Kernel Logs):

```
400000
7,569,2702078,-:vboxguest: Successfully loaded version 7.0.6 r155176 (interface 0x00010004)
6,570,2737060,-:hid: raw HID events driver (C) Jiri Kosina
6,571,2767877,-:Adding 998396k swap on /dev/sda5. Priority:-2 extents:1 across:998396k FS
6,572,2780470,-:usbcore: registered new interface driver usbhid
6,573,2788472,-:usbhid: USB HID core driver
6,574,2868785,-:RAPL PMU: API unit is 2^-32 Joules, 0 fixed counters, 10737418240 ms ovfl timer
6,575,2936371,-:input: VirtualBox USB Tablet as /devices/pci0000:00/0000:00:06:00/usb2/2-1/2-1:1.0/0003:00
EE:0021:0001/input/input8
6,576,2936464,-:hid-generic 0003:00EE:0021.0001: input,hidraw0: USB HID v1.10 Mouse [VirtualBox USB Table
t] on usb-0000:00:06:00-1/input0
SUBSYSTEM=hid
DEVICE=hid:0003:00EE:0021.0001
6,577,2942299,-:cryptd: max_cpu_qlen set to 1000
6,578,2950492,-:AVX2 version of gcm enc/dec engaged.
6,579,2950493,-:AES CTR mode by8 optimization enabled
6,580,3033296,-:snd_intel8x0 0000:00:05:0: allow list rate for 1028:0177 is 48000
SUBSYSTEM=pci
DEVICE=pci:0000:00:05:0
4,581,3130669,-:vboxvideo: loading version 7.0.6 r155176
4,582,3326256,-:23:00:30.897127 main VBoxService 7.0.6 r155176 (verbosity: 0) linux.amd64 (Jan 11 202
3 15:34:33) release log\x0a23:00:30.897128 main Log opened 2023-02-23T23:00:30.897124000Z
4,583,3326288,-:23:00:30.897188 main OS Product: Linux
4,584,3326309,-:23:00:30.897211 main OS Release: 5.10.162-jmeahrg1-pa2
4,585,3326327,-:23:00:30.897231 main OS Version: #5 SMP Thu Feb 23 17:57:08 EST 2023
4,586,3326351,-:23:00:30.897249 main Executable: /opt/VBoxGuestAdditions-7.0.6/sbin/VBoxService\x0a23
:00:30.897249 main Process ID: 702\x0a23:00:30.897250 main Package type: LINUX_64BITS_GENERIC
4,587,3327433,-:23:00:30.898321 main 7.0.6 r155176 started. Verbose level = 0
4,588,3328091,-:23:00:30.898978 main vbglR3GuestCtrlDetectPeekGetCancelSupport: Supported (#1)
4,589,3338434,-:vboxsf: g_fHostFeatures=0x0000000f g_fsFeatures=0x1 g_uSFLastFunction=29
6,590,3338456,-:vboxsf: Successfully loaded version 7.0.6 r155176
4,591,3338475,-:vboxsf: Successfully loaded version 7.0.6 r155176 on 5.10.162-jmeahrg1-pa2 (LINUX_VERSION
CODE=0x50a2)
4,592,3339544,-:23:00:30.910429 automount vbsvcAutomounterMountIt: Successfully mounted '492 shared' on '
/mnt/shared'
6,593,5083573,-:e1000: enp0s3 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: RX
6,594,5084060,-:IPv6: ADDRCONF(NETDEV_CHANGE): enp0s3: link becomes ready
7,595,5656979,-:rftkill: input handler disabled
7,596,15769840,-:rftkill: input handler enabled
7,597,17453377,-:rftkill: input handler disabled
1,598,38060975,-:input string is: This message is way over 32 characters long right?
1,599,38060982,-:input string is: aeiou
1,600,38060983,-:before: aeiou
1,601,38060983,-:after: JJJJJ
1,602,1232651017,-:input string is: This message is way over 32 characters long right?
1,603,1232651024,-:input string is: aeiou
1,604,1232651025,-:before: aeiou
1,605,1232651025,-:after: JJJJJ
```