

**PONTIFÍCIA UNIVERSIDADE CATÓLICA DE CAMPINAS**

**CENTRO DE CIÊNCIAS EXATAS, AMBIENTAIS E DE  
TECNOLOGIA**

<b>CHRISTOPHER OLIVEIRA</b>	<b>RA:18726430</b>
<b>GIULIANO SANFINS</b>	<b>RA:17142837</b>
<b>MATHEUS MORETTI</b>	<b>RA:18082974</b>
<b>MURILO ARAUJO</b>	<b>RA:17747775</b>
<b>VICTOR REIS</b>	<b>RA:18726471</b>

**SISTEMAS OPERACIONAIS B - EXPERIMENTO 2 –  
MÓDULOS DE KERNEL LINUX**

**CAMPINAS  
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## 1. INTRODUÇÃO

Este experimento consistiu no estudo mais aprofundado de um módulo de Kernel. Deste modo foi-nos dado conhecimento para a criação, compilação, instalação e remoção de um módulo, e assim criarmos módulos básicos, os famosos “*Hello World*”, para conhecer na prática como esta parte importante de um kernel realmente funciona. A habilidade adquirida neste experimento, será extremamente necessário para o caminhar do curso, onde será criado módulos mais complexos.

## 2. DISCUSSÃO

Primeiramente instalamos o “pacote” `sudo apt-get install build-essential kmod`, no qual disponibiliza os comandos `modprobe`, `insmod` e `depmod`, que foram muito importantes para o desenvolvimento dessa atividade.

Para começar as execuções, precisávamos elaborar e salvar na mesma pasta do arquivo que vamos executar o arquivo *Makefile*. Logo em seguida realizamos o comando “*make*” para realizar a compilação do *Makefile* e a conversão do arquivo “.c” em “.ko”, como foi o que aconteceu nos arquivos abaixo

Utilizamos o comando `sudo rmmod` para realizar remoções (descarrega) dos arquivos que gostaríamos de remover. E o comando `journalctl --since "1 hour ago" | grep kernel` para visualizar todos os registros importantes da execução. E por último o comando `sudo lsmod` tem o principal objetivo de carregar os módulos que já estão carregados no kernel atual instalado na máquina.

Desenvolvemos as atividades e todas as execuções dos programas, na ordem do *.pdf* disponibilizado pelo docente, abaixo pode se observar o resultado da execução do arquivo “*hello1-c*”:

```
khris@khris-VirtualBox: ~/develop/kernel/hello-1
khris@khris-VirtualBox:~/develop/kernel/hello-1$ sudo lsmod | grep hello
khris@khris-VirtualBox:~/develop/kernel/hello-1$ sudo insmod hello-1.ko
khris@khris-VirtualBox:~/develop/kernel/hello-1$ sudo lsmod | grep hello
hello_1                16384  0
khris@khris-VirtualBox:~/develop/kernel/hello-1$ journalctl --since "1 hour ago"
| grep kernel
Ago 30 16:29:54 khris-VirtualBox sudo[4498]:    khris : TTY=pts/4 ; PWD=/home/kh
ris/develop/kernel/hello-1 ; USER=root ; COMMAND=/sbin/modinfo hello-1.ko
Ago 30 16:30:32 khris-VirtualBox sudo[4501]:    khris : TTY=pts/4 ; PWD=/home/kh
ris/develop/kernel/hello-1 ; USER=root ; COMMAND=/sbin/lsmod
Ago 30 16:30:57 khris-VirtualBox sudo[4514]:    khris : TTY=pts/4 ; PWD=/home/kh
ris/develop/kernel/hello-1 ; USER=root ; COMMAND=/sbin/insmod hello-1.ko
Ago 30 16:30:57 khris-VirtualBox kernel: hello_1: loading out-of-tree module tai
nts kernel.
Ago 30 16:30:57 khris-VirtualBox kernel: hello_1: module license 'unspecified' t
aints kernel.
Ago 30 16:30:57 khris-VirtualBox kernel: Disabling lock debugging due to kernel
taint
Ago 30 16:30:57 khris-VirtualBox kernel: hello_1: module verification failed: si
gnature and/or required key missing - tainting kernel
Ago 30 16:30:57 khris-VirtualBox kernel: Hello world 1.
Ago 30 16:31:09 khris-VirtualBox sudo[4517]:    khris : TTY=pts/4 ; PWD=/home/kh
ris/develop/kernel/hello-1 ; USER=root ; COMMAND=/sbin/lsmod
khris@khris-VirtualBox:~/develop/kernel/hello-1$
```

Abaixo podemos analisar o resultado da execução do arquivo “*hello2-c*”, com a realização dos mesmos procedimentos:

```
khris@khris-VirtualBox: ~/develop/kernel/hello-2
Ago 30 16:30:57 khris-VirtualBox kernel: hello_1: loading out-of-tree module tai
nts kernel.
Ago 30 16:30:57 khris-VirtualBox kernel: hello_1: module license 'unspecified' t
aints kernel.
Ago 30 16:30:57 khris-VirtualBox kernel: Disabling lock debugging due to kernel
taint
Ago 30 16:30:57 khris-VirtualBox kernel: hello_1: module verification failed: si
gnature and/or required key missing - tainting kernel
Ago 30 16:30:57 khris-VirtualBox kernel: Hello world 1.
Ago 30 16:31:09 khris-VirtualBox sudo[4517]:    khris : TTY=pts/4 ; PWD=/home/kh
ris/develop/kernel/hello-1 ; USER=root ; COMMAND=/sbin/lsmod
Ago 30 16:39:09 khris-VirtualBox sudo[5227]:    khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod hello-1.ko
Ago 30 16:39:14 khris-VirtualBox sudo[5231]:    khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod hello-2.ko
Ago 30 16:39:14 khris-VirtualBox kernel: Hello, world 2
Ago 30 16:39:28 khris-VirtualBox sudo[5234]:    khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/lsmod
Ago 30 16:40:48 khris-VirtualBox sudo[5252]:    khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/rmmod hello-2
Ago 30 16:40:48 khris-VirtualBox kernel: Goodbye, world 2
Ago 30 16:40:51 khris-VirtualBox sudo[5255]:    khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/rmmod hello-2
khris@khris-VirtualBox:~/develop/kernel/hello-2$
```

Resultado da execução do arquivo “hello3-c”:

```
khris@khris-VirtualBox: ~/develop/kernel/hello-2
Procurar no seu computador tualBox kernel: Hello world 1.
Ago 30 16:31:09 khris-VirtualBox sudo[4517]: khris : TTY=pts/4 ; PWD=/home/kh
ris/develop/kernel/hello-1 ; USER=root ; COMMAND=/sbin/lsmmod
Ago 30 16:39:09 khris-VirtualBox sudo[5227]: khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod hello-1.ko
Ago 30 16:39:14 khris-VirtualBox sudo[5231]: khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod hello-2.ko
Ago 30 16:39:14 khris-VirtualBox kernel: Hello, world 2
Ago 30 16:39:28 khris-VirtualBox sudo[5234]: khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/lsmmod
Ago 30 16:40:48 khris-VirtualBox sudo[5252]: khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/rmmod hello-2
Ago 30 16:40:48 khris-VirtualBox kernel: Goodbye, world 2
Ago 30 16:40:51 khris-VirtualBox sudo[5255]: khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/rmmod hello-2
Ago 30 16:45:03 khris-VirtualBox sudo[5447]: khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod hello-3.ko
Ago 30 16:45:03 khris-VirtualBox kernel: Hello, world 3
Ago 30 16:45:17 khris-VirtualBox sudo[5450]: khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/lsmmod
Ago 30 16:47:44 khris-VirtualBox sudo[5473]: khris : TTY=pts/17 ; PWD=/home/k
hris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/rmmod hello_3
Ago 30 16:47:44 khris-VirtualBox kernel: Goodbye, world 3
khris@khris-VirtualBox:~/develop/kernel/hello-2$
```

Resultado da execução do arquivo “hello4-c”:

```
khris@khris-VirtualBox: ~/develop/kernel/hello-2
WARNING: modpost: missing MODULE_LICENSE() in /home/khris/develop/kernel/hello-2
/hello-1.o
see include/linux/module.h for more information
WARNING: modpost: missing MODULE_LICENSE() in /home/khris/develop/kernel/hello-2
/hello-2.o
see include/linux/module.h for more information
WARNING: modpost: missing MODULE_LICENSE() in /home/khris/develop/kernel/hello-2
/hello-3.o
see include/linux/module.h for more information
CC      /home/khris/develop/kernel/hello-2/hello-4.mod.o
LD [M]  /home/khris/develop/kernel/hello-2/hello-4.ko
make[1]: Leaving directory '/usr/src/linux-headers-4.15.0-45-generic'
khris@khris-VirtualBox:~/develop/kernel/hello-2$ sudo insmod hello-4.ko
khris@khris-VirtualBox:~/develop/kernel/hello-2$ sudo modinfo hello-4.ko
filename:      /home/khris/develop/kernel/hello-2/hello-4.ko
description:   A sample driver
author:        Bob Mottram
license:       GPL
srcversion:    EF1F975E5F6508E639C7524
depends:
retpoline:    Y
name:          hello_4
vermagic:     4.15.0-45-generic SMP mod_unload
khris@khris-VirtualBox:~/develop/kernel/hello-2$
```

Resultado da execução do arquivo “hello5-c”:

```
khris@khris-VirtualBox: ~/develop/kernel/hello-2
Ago 30 16:45:17 khris-VirtualBox sudo[5450]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/lsmmod
Ago 30 16:47:44 khris-VirtualBox sudo[5473]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/rmmod hello_3
Ago 30 16:47:44 khris-VirtualBox kernel: Goodbye, world 3
Ago 30 16:51:57 khris-VirtualBox sudo[5728]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod hello-4.ko
Ago 30 16:51:57 khris-VirtualBox kernel: Hello, world 4
Ago 30 16:52:59 khris-VirtualBox sudo[5734]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/modinfo hello-4.ko
Ago 30 17:00:05 khris-VirtualBox sudo[5966]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod hello-5.ko mystri
ng=bebop mybyte=255 myintArray=-1
Ago 30 17:00:05 khris-VirtualBox kernel: hello_5: unknown parameter 'mybyte' ign
ored
Ago 30 17:00:05 khris-VirtualBox kernel: Hello, world 5
Ago 30 17:00:05 khris-VirtualBox kernel: myshort is a short integer: 1
Ago 30 17:00:05 khris-VirtualBox kernel: myint is an integer: 420
Ago 30 17:00:05 khris-VirtualBox kernel: mylong is a long integer: 9999
Ago 30 17:00:05 khris-VirtualBox kernel: mystring is a string: bebop
Ago 30 17:00:05 khris-VirtualBox kernel: myintArray[0] = -1
Ago 30 17:00:05 khris-VirtualBox kernel: myintArray[1] = -1
Ago 30 17:00:05 khris-VirtualBox kernel: got 1 arguments for myintArray.
khris@khris-VirtualBox:~/develop/kernel/hello-2$
```

Resultado da execução do arquivo “startstop.c”:

```
khris@khris-VirtualBox: ~/develop/kernel/hello-2
Ago 30 17:03:57 khris-VirtualBox kernel: e1000: enp0s3 NIC Link is Down
Ago 30 17:03:57 khris-VirtualBox kernel: e1000 0000:00:03:0 enp0s3: Reset adapter
Ago 30 17:03:57 khris-VirtualBox kernel: usb 1-1: New USB device found, idVendor=80ee, idProduct=0021
Ago 30 17:03:57 khris-VirtualBox kernel: usb 1-1: New USB device strings: Mfr=1, Product=3, SerialNumber=0
Ago 30 17:03:57 khris-VirtualBox kernel: usb 1-1: Product: USB Tablet
Ago 30 17:03:57 khris-VirtualBox kernel: usb 1-1: Manufacturer: VirtualBox
Ago 30 17:03:57 khris-VirtualBox kernel: input: VirtualBox USB Tablet as /devices/pci0000:00/0000:00:06.0/usb1/1-1/1-1:1.0/0003:80EE:0021.0003/input/input9
Ago 30 17:03:57 khris-VirtualBox kernel: hid-generic 0003:80EE:0021.0003: input, hidraw0: USB HID v1.10 Mouse [VirtualBox USB Tablet] on usb-0000:00:06.0-1/input0
Ago 30 17:03:59 khris-VirtualBox kernel: e1000: enp0s3 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: RX
Ago 30 17:10:18 khris-VirtualBox sudo[6284]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod startstop.ko
Ago 30 17:10:18 khris-VirtualBox kernel: Hello, world - this is the kernel speaking
Ago 30 17:11:22 khris-VirtualBox sudo[6300]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/rmmod startstop
Ago 30 17:11:22 khris-VirtualBox kernel: Short is the life of a kernel module
khris@khris-VirtualBox:~/develop/kernel/hello-2$
```



Resultado da execução do arquivo “chardev.c”:

```
khris@khris-VirtualBox: ~/develop/kernel/hello-2
see include/linux/module.h for more information
WARNING: modpost: missing MODULE_LICENSE() in /home/khris/develop/kernel/hello-2/hello-2.o
see include/linux/module.h for more information
WARNING: modpost: missing MODULE_LICENSE() in /home/khris/develop/kernel/hello-2/hello-3.o
see include/linux/module.h for more information
WARNING: modpost: missing MODULE_LICENSE() in /home/khris/develop/kernel/hello-2/startstop.o
see include/linux/module.h for more information
  CC      /home/khris/develop/kernel/hello-2/chardev.mod.o
  LD [M]   /home/khris/develop/kernel/hello-2/chardev.ko
make[1]: Leaving directory '/usr/src/linux-headers-4.15.0-45-generic'
khris@khris-VirtualBox:~/develop/kernel/hello-2$ sudo insmod chardev.ko
[sudo] senha para khris:
Desculpe, tente novamente.
[sudo] senha para khris:
khris@khris-VirtualBox:~/develop/kernel/hello-2$ journalctl --since "1 hour ago"
| grep kernel
Ago 31 14:24:33 khris-VirtualBox sudo[7988]:    khris : TTY=pts/17 ; PWD=/home/k
khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod chardev.ko
Ago 31 14:24:33 khris-VirtualBox kernel: I was assigned major number 243.
Ago 31 14:24:33 khris-VirtualBox kernel: Device created on /dev/chardev
khris@khris-VirtualBox:~/develop/kernel/hello-2$
```

Resultado da execução do arquivo “procfs1.c”:

```
khris@khris-VirtualBox: ~/develop/kernel/hello-2
see include/linux/module.h for more information
WARNING: modpost: missing MODULE_LICENSE() in /home/khris/develop/kernel/hello-2/hello-3.o
see include/linux/module.h for more information
WARNING: modpost: missing MODULE_LICENSE() in /home/khris/develop/kernel/hello-2/procfs1.o
see include/linux/module.h for more information
WARNING: modpost: missing MODULE_LICENSE() in /home/khris/develop/kernel/hello-2/startstop.o
see include/linux/module.h for more information
  CC      /home/khris/develop/kernel/hello-2/procfs1.mod.o
  LD [M]   /home/khris/develop/kernel/hello-2/procfs1.ko
make[1]: Leaving directory '/usr/src/linux-headers-4.15.0-45-generic'
khris@khris-VirtualBox:~/develop/kernel/hello-2$ sudo insmod procfs1.ko
khris@khris-VirtualBox:~/develop/kernel/hello-2$ journalctl --since "1 hour ago"
| grep kernel
Ago 31 14:24:33 khris-VirtualBox sudo[7988]:    khris : TTY=pts/17 ; PWD=/home/k
khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod chardev.ko
Ago 31 14:24:33 khris-VirtualBox kernel: I was assigned major number 243.
Ago 31 14:24:33 khris-VirtualBox kernel: Device created on /dev/chardev
Ago 31 14:31:15 khris-VirtualBox sudo[8513]:    khris : TTY=pts/17 ; PWD=/home/k
khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs1.ko
Ago 31 14:31:16 khris-VirtualBox kernel: /proc/helloworld created
khris@khris-VirtualBox:~/develop/kernel/hello-2$
```

Resultado da execução do arquivo “procfs2”:

```
khris@khris-VirtualBox: ~/develop/kernel/hello-2
see include/linux/module.h for more information
WARNING: modpost: missing MODULE_LICENSE() in /home/khris/develop/kernel/hello-2/procfs2.o
see include/linux/module.h for more information
WARNING: modpost: missing MODULE_LICENSE() in /home/khris/develop/kernel/hello-2/startstop.o
see include/linux/module.h for more information
  CC      /home/khris/develop/kernel/hello-2/procfs2.mod.o
  LD [M]   /home/khris/develop/kernel/hello-2/procfs2.ko
make[1]: Leaving directory '/usr/src/linux-headers-4.15.0-45-generic'
khris@khris-VirtualBox:~/develop/kernel/hello-2$ sudo insmod procfs2.ko
khris@khris-VirtualBox:~/develop/kernel/hello-2$ journalctl --since "1 hour ago"
| grep kernel
Ago 31 14:24:33 khris-VirtualBox sudo[7988]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod chardev.ko
Ago 31 14:24:33 khris-VirtualBox kernel: I was assigned major number 243.
Ago 31 14:24:33 khris-VirtualBox kernel: Device created on /dev/chardev
Ago 31 14:31:15 khris-VirtualBox sudo[8513]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs1.ko
Ago 31 14:31:16 khris-VirtualBox kernel: /proc/helloworld created
Ago 31 14:34:56 khris-VirtualBox sudo[8740]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs2.ko
Ago 31 14:34:56 khris-VirtualBox kernel: /proc/buffer1k created
khris@khris-VirtualBox:~/develop/kernel/hello-2$
```

Resultado da execução do arquivo “procfs3.c”:

```
khris@khris-VirtualBox: ~/develop/kernel/hello-2
Ago 31 14:31:16 khris-VirtualBox kernel: /proc/helloworld created
Ago 31 14:34:56 khris-VirtualBox sudo[8740]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs2.ko
Ago 31 14:34:56 khris-VirtualBox kernel: /proc/buffer1k created
Ago 31 14:38:38 khris-VirtualBox sudo[8998]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs3.ko
khris@khris-VirtualBox:~/develop/kernel/hello-2$ sudo rmmod procfs3
khris@khris-VirtualBox:~/develop/kernel/hello-2$ journalctl --since "1 hour ago" |
grep kernel
Ago 31 14:24:33 khris-VirtualBox sudo[7988]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod chardev.ko
Ago 31 14:24:33 khris-VirtualBox kernel: I was assigned major number 243.
Ago 31 14:24:33 khris-VirtualBox kernel: Device created on /dev/chardev
Ago 31 14:31:15 khris-VirtualBox sudo[8513]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs1.ko
Ago 31 14:31:16 khris-VirtualBox kernel: /proc/helloworld created
Ago 31 14:34:56 khris-VirtualBox sudo[8740]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs2.ko
Ago 31 14:34:56 khris-VirtualBox kernel: /proc/buffer1k created
Ago 31 14:38:38 khris-VirtualBox sudo[8998]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs3.ko
Ago 31 14:39:47 khris-VirtualBox sudo[9013]: khris : TTY=pts/17 ; PWD=/home/khris/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/rmmod procfs3
khris@khris-VirtualBox:~/develop/kernel/hello-2$
```



Resultado da execução do arquivo "procfs4.c":

```
khmis@khmis-VirtualBox: ~/develop/kernel/hello-2
is/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs4.ko
khmis@khmis-VirtualBox:~/develop/kernel/hello-2$ sudo rmmmod procfs5
rmmmod: ERROR: Module procfs5 is not currently loaded
khmis@khmis-VirtualBox:~/develop/kernel/hello-2$ journalctl --since "1 hour ago" |
grep kernel
Ago 31 14:24:33 khmis-VirtualBox sudo[7988]:    khmis : TTY=pts/17 ; PWD=/home/khr
is/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod chardev.ko
Ago 31 14:24:33 khmis-VirtualBox kernel: I was assigned major number 243.
Ago 31 14:24:33 khmis-VirtualBox kernel: Device created on /dev/chardev
Ago 31 14:31:15 khmis-VirtualBox sudo[8513]:    khmis : TTY=pts/17 ; PWD=/home/khr
is/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs1.ko
Ago 31 14:31:16 khmis-VirtualBox kernel: /proc/helloworld created
Ago 31 14:34:56 khmis-VirtualBox sudo[8740]:    khmis : TTY=pts/17 ; PWD=/home/khr
is/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs2.ko
Ago 31 14:34:56 khmis-VirtualBox kernel: /proc/buffer1k created
Ago 31 14:38:38 khmis-VirtualBox sudo[8998]:    khmis : TTY=pts/17 ; PWD=/home/khr
is/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs3.ko
Ago 31 14:39:47 khmis-VirtualBox sudo[9013]:    khmis : TTY=pts/17 ; PWD=/home/khr
is/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/rmmmod procfs3
Ago 31 14:42:59 khmis-VirtualBox sudo[9249]:    khmis : TTY=pts/17 ; PWD=/home/khr
is/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/insmod procfs4.ko
Ago 31 14:46:09 khmis-VirtualBox sudo[9271]:    khmis : TTY=pts/17 ; PWD=/home/khr
is/develop/kernel/hello-2 ; USER=root ; COMMAND=/sbin/rmmmod procfs5
khmis@khmis-VirtualBox:~/develop/kernel/hello-2$
```

### **3. CONCLUSÃO**

Com esse experimento pudemos conhecer mais sobre o *linux* no que se diz respeito aos módulos de kernel, como criar, compilar, instalar e remover um módulo, habilidades que serão requisitadas no decorrer dos próximos experimentos. O objetivo principal do experimento de verificar, quase que minuciosamente, todos os processos referentes aos módulos de kernel antes apresentados, fora cumprido. Assim de forma geral inferimos que fora alcançado todos os objetivos propostos para esse experimento, tais como, entender de uma forma geral, os códigos dos módulos testes, entendendo o que eles propunham fazer e como era realizado, e aplicar a criação, compilação, instalação e remoção dos módulos testes.