

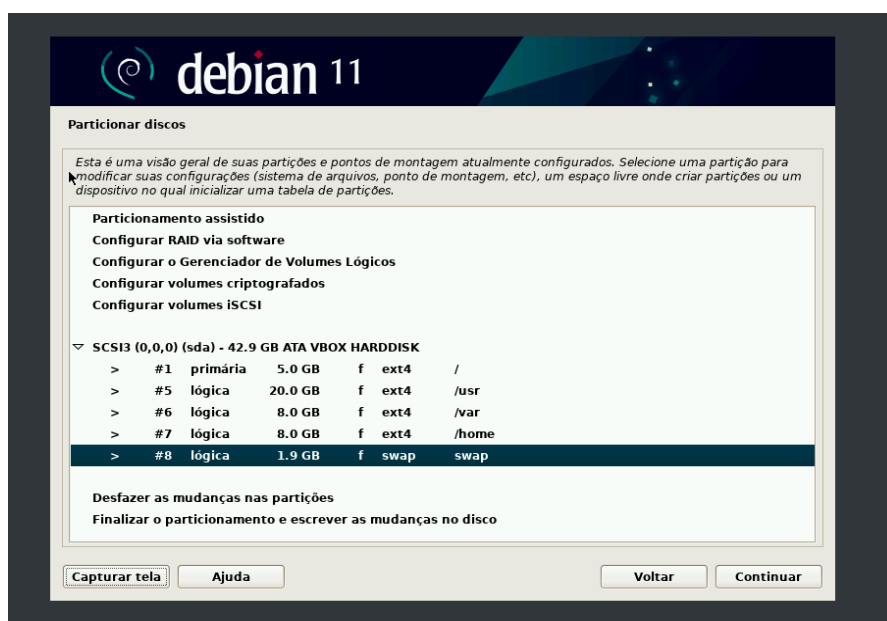
# Laboratório 1: Instalar e compilar o núcleo (kernel) Linux

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Este relatório tem o objetivo de apresentar os passos realizados em laboratório para a instalação e compilação do núcleo (Kernel) Linux. Para esse procedimento foi utilizado máquina virtual com 1GB ram, 43 GB de armazenamento, Versão do Linux instalado na VM: Debian 11.2.0 e Versão do kernel compilado: 5.16.14.

→ Instalação da máquina virtual:

## ◆ Particionamento do disco



## ◆ Configuração do endereço do repositório



→ Verificando a listagem de processos em execução:

### ◆ ps aux:

```
tuchins+ 793 0.1 2.0 301596 20724 7 SL 23:54 0:00 csd-ally-settings
tuchins+ 794 0.1 2.2 306560 22776 7 SL 23:54 0:00 csd-xsettings
tuchins+ 795 0.1 2.7 384008 27628 7 SL 23:54 0:00 csd-power
tuchins+ 796 0.1 2.3 301596 23288 7 SL 23:54 0:00 csd-housekeeping
tuchins+ 797 0.1 2.3 301644 23388 7 SL 23:54 0:00 csd-mouse
tuchins+ 800 0.1 2.5 309912 25148 7 SL 23:54 0:00 csd-print-notifications
tuchins+ 801 0.1 2.1 449040 21340 7 SL 23:54 0:00 csd-orientation
tuchins+ 802 0.1 2.3 375796 23992 7 SL 23:54 0:00 csd-xrandr
tuchins+ 805 0.1 2.3 380448 23456 7 SL 23:54 0:00 csd-sound
tuchins+ 808 0.1 2.1 227500 21716 7 SL 23:54 0:00 csd-clipboard
tuchins+ 809 0.1 2.2 301388 22528 7 SL 23:54 0:00 csd-screensaver-proxy
tuchins+ 811 0.2 3.2 330748 32236 7 SL 23:54 0:00 csd-background
tuchins+ 812 0.1 2.3 796592 23992 7 SL 23:54 0:00 csd-media-keys
tuchins+ 815 0.0 2.1 301598 21968 7 SL 23:54 0:00 csd-ally-keyboard
tuchins+ 817 0.1 2.2 450720 22308 7 SL 23:54 0:00 csd-color
tuchins+ 819 0.0 2.1 227440 21732 7 SL 23:54 0:00 csd-cursor
tuchins+ 822 0.0 2.2 375296 22616 7 SL 23:54 0:00 csd-automount
tuchins+ 824 0.1 2.2 301656 22028 7 SL 23:54 0:00 csd-keyboard
tuchins+ 832 0.0 0.4 155880 4988 7 SL 23:54 0:00 /usr/libexec/dconf-service
tuchins+ 840 0.0 0.7 247372 7232 7 Ssl 23:54 0:00 /usr/libexec/upower
tuchins+ 897 0.0 1.3 349768 13064 7 Ssl 23:54 0:00 /usr/libexec/gvfs-udisks2-volume-monitor
tuchins+ 903 0.1 1.1 243080 11396 7 Ssl 23:54 0:00 /usr/libexec/colord
tuchins+ 906 0.1 3.1 241512 31376 7 SL 23:54 0:00 cinnamon-launcher
tuchins+ 913 0.0 0.5 233176 5928 7 Ssl 23:54 0:00 /usr/libexec/gvfs-mtp-volume-monitor
tuchins+ 917 0.0 0.6 233396 6052 7 Ssl 23:54 0:00 /usr/libexec/gvfs-goa-volume-monitor
tuchins+ 921 0.1 3.2 550832 32100 7 SL 23:54 0:00 /usr/libexec/goa-daemon
tuchins+ 924 0.0 1.4 345128 14360 7 SL 23:54 0:00 /usr/lib/x86_64-linux-gnu/cinnamon-settings-daemon/csd-printer
tuchins+ 941 0.0 0.8 312424 8660 7 SL 23:54 0:00 /usr/libexec/goa-identity-service
tuchins+ 944 0.0 0.6 311892 6888 7 Ssl 23:54 0:00 /usr/libexec/gvfs-afc-volume-monitor
tuchins+ 954 0.0 0.6 235412 6308 7 Ssl 23:54 0:00 /usr/libexec/gvfs-gphoto2-volume-monitor
tuchins+ 955 9.7 17.0 3331860 170624 7 SL 23:54 0:11 cinnamon --replace
tuchins+ 970 0.1 2.4 375856 24064 7 SL 23:54 0:00 /usr/lib/x86_64-linux-gnu/xapps/sn-watcher/xapp-sn-watcher
tuchins+ 976 1.8 7.7 731540 77240 7 SL 23:54 0:02 /usr/bin/gnome-software --application-service
tuchins+ 978 0.5 4.1 631436 41048 7 SL 23:54 0:00 nemo-desktop
tuchins+ 979 0.4 4.1 471776 41004 7 SL 23:54 0:00 /usr/bin/python3 /usr/bin/blueman-applet
tuchins+ 980 0.1 3.0 314844 30420 7 SL 23:54 0:00 cinnamon-killer-daemon
tuchins+ 981 0.1 3.3 394644 33308 7 SL 23:54 0:00 nm-applet
tuchins+ 982 0.0 2.2 227592 22540 7 SL 23:54 0:00 /usr/lib/policykit-1-gnome/polkit-gnome-authentication-agent-1
tuchins+ 1000 0.3 2.2 377208 22072 7 Ssl 23:54 0:00 /usr/libexec/fwupd/fwupd
tuchins+ 1005 0.0 0.7 303272 7176 7 SL 23:54 0:00 /usr/libexec/gvfsd-trash --spawner :1.0 /org/gtk/gvfs/exec_spaw
tuchins+ 1019 0.0 0.5 159656 5952 7 Ssl 23:54 0:00 /usr/libexec/gvfsd-metadata
tuchins+ 1023 0.3 4.2 327588 42432 7 SL 23:54 0:00 /usr/bin/python3 /usr/bin/blueman-tray
tuchins+ 1028 0.0 0.5 45100 5104 7 Ss 23:54 0:00 /usr/libexec/bluetooth/obexd
tuchins+ 1047 4.1 2.8 372848 28092 7 Ssl 23:54 0:04 /usr/libexec/packagekitd
tuchins+ 1065 0.3 4.5 472780 45592 7 SL 23:54 0:00 cinnamon-screensaver
tuchins+ 1072 0.0 0.0 0 0 7 I 23:54 0:00 [kworker/u2:6-flush-8:0]
tuchins+ 1350 0.1 0.0 0 0 7 I 23:54 0:00 [kworker/0:4-events]
tuchins+ 1355 0.0 0.0 0 0 7 I 23:54 0:00 [kworker/u2:6-ext4-rsv-conversion]
tuchins+ 1356 1.8 5.0 552328 50596 7 Ssl 23:54 0:01 /usr/libexec/gnome-terminal-server
tuchins+ 1370 0.0 0.5 8136 5152 pts/0 S+ 23:54 0:00 bash
tuchins+ 1402 0.4 3.7 62720 37444 7 S 23:55 0:00 /usr/bin/python3 /usr/share/system-config-printer/applet.py
tuchins+ 1418 0.0 0.5 99824 5472 7 Ssl 23:55 0:00 dhclient enp0s8
tuchins+ 1450 0.0 0.5 99824 5740 7 Ssl 23:55 0:00 dhclient enp0s8
tuchins+ 1468 0.3 0.8 14504 8744 7 Ss 23:56 0:00 sshd: tuchinski [priv]
tuchins+ 1477 0.2 0.5 14716 8660 7 S 23:56 0:00 sshd: tuchinski@pts/1
tuchins+ 1478 0.1 0.4 7844 4664 pts/1 Ss 23:56 0:00 -bash
tuchins+ 1492 0.0 0.3 9784 3344 pts/1 R+ 23:56 0:00 ps aux
tuchinski@debian:~$
```

→ Verificando o espaço em disco:

### ◆ df -h

```
pexe@VMS0:~$ df -h
Sist. Arq. Tam. Usado Disp. Uso% Montado em
udev 473M 0 473M 0% /dev
tmpfs 98M 504K 98M 1% /run
/dev/sda1 4,6G 81M 4,2G 2% /
/dev/sda5 19G 946M 17G 6% /usr
tmpfs 489M 0 489M 0% /dev/shm
tmpfs 5,0M 0 5,0M 0% /run/lock
/dev/sda7 7,3G 40K 6,9G 1% /home
/dev/sda6 7,3G 175M 6,7G 3% /var
pexe@VMS0:~$
```

→ Escolha do tamanho das partições:

- ◆ Diretório "/" -> 5GB
  - alocado espaço conforme recomendações na documentação;
- ◆ Diretório "/usr" -> 20GB
  - deixado com o maior espaço por conta da necessidade de armazenamento para a compilação do kernel;
- ◆ Diretório "/home" -> 8GB;
  - alocado espaço suficiente para armazenar os arquivos do usuário;
- ◆ Área de troca(swap) -> 2GB
  - espaço alocado por ser duas vezes o tamanho da memória RAM, conforme recomendação.

→ Verificando a memória disponível:

◆ `free -b`

```
tuchinski@debian:~$ free -b
              total        used        free      shared  buff/cache   available
Mem.:    1023885312    437014528    297889792    11362304    288980992    431144960
Swap:     1999630336    447426560    1552203776
```

◆ `cat /proc/meminfo`

```
tuchinski@debian:~$ cat /proc/meminfo
MemTotal:        999888 kB
MemFree:         183992 kB
MemAvailable:    253424 kB
Buffers:         11756 kB
Cached:          182992 kB
SwapCached:      41564 kB
Active:          199040 kB
Inactive:        495680 kB
Active(anon):    103856 kB
Inactive(anon):  407204 kB
Active(file):     95184 kB
Inactive(file):  88476 kB
Unevictable:      32 kB
Mlocked:         32 kB
SwapTotal:       1952764 kB
SwapFree:        1511184 kB
Dirty:           5096 kB
Writeback:        0 kB
AnonPages:       460864 kB
Mapped:          68016 kB
Shmem:           11088 kB
KReclaimable:    26640 kB
Slab:            62972 kB
SReclaimable:    26640 kB
SUnreclaim:      36332 kB
KernelStack:     5904 kB
PageTables:      13816 kB
NFS_Unstable:    0 kB
Bounce:          0 kB
WritebackTmp:    0 kB
CommitLimit:     2452708 kB
Committed_AS:    3016064 kB
VmallocTotal:    34359738367 kB
VmallocUsed:      36552 kB
VmallocChunk:     0 kB
Percpu:          624 kB
HardwareCorrupted: 0 kB
AnonHugePages:   96256 kB
ShmemHugePages:  0 kB
ShmemPmdMapped:  0 kB
FileHugePages:   0 kB
FilePmdMapped:   0 kB
HugePages_Total: 0
HugePages_Free:  0
HugePages_Rsvd:  0
HugePages_Surp:  0
Hugepagesize:    2048 kB
Hugetlb:         0 kB
DirectMap4k:     106432 kB
DirectMap2M:     942080 kB
```

## → Comandos de rede:

### ◆ *ip address show*

```
tuchinski@debian:~$ ip address show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 08:00:27:f8:ee:d2 brd ff:ff:ff:ff:ff:ff
    inet 10.0.2.15/24 brd 10.0.2.255 scope global dynamic noprefixroute enp0s3
        valid_lft 83336sec preferred_lft 83336sec
    inet6 fe80::a00:27ff:fef8:eed2/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether 08:00:27:a7:bb:d2 brd ff:ff:ff:ff:ff:ff
    inet 192.168.56.101/24 brd 192.168.56.255 scope global dynamic enp0s8
        valid_lft 528sec preferred_lft 528sec
    inet6 fe80::a00:27ff:fea7:bbd2/64 scope link
        valid_lft forever preferred_lft forever
```

### ◆ *ip route*

```
tuchinski@debian:~$ ip route
default via 10.0.2.2 dev enp0s3 proto dhcp metric 100
10.0.2.0/24 dev enp0s3 proto kernel scope link src 10.0.2.15 metric 100
169.254.0.0/16 dev enp0s3 scope link metric 1000
192.168.56.0/24 dev enp0s8 proto kernel scope link src 192.168.56.101
```

### ◆ *cat /etc/resolv.conf*

```
tuchinski@debian:~$ cat /etc/resolv.conf
# Generated by NetworkManager
nameserver 10.0.2.3
```

### ◆ *cat /etc/network/interfaces*

```
tuchinski@debian:~$ cat /etc/network/interfaces
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback
```

### ◆ *ping google.com*

```
tuchinski@debian:~$ ping google.com
PING google.com (142.250.218.206) 56(84) bytes of data:
64 bytes from grul4s25-in-f14.1e100.net (142.250.218.206): icmp_seq=1 ttl=63 time=14.9 ms
64 bytes from grul4s25-in-f14.1e100.net (142.250.218.206): icmp_seq=2 ttl=63 time=15.5 ms
64 bytes from grul4s25-in-f14.1e100.net (142.250.218.206): icmp_seq=3 ttl=63 time=15.4 ms
64 bytes from grul4s25-in-f14.1e100.net (142.250.218.206): icmp_seq=4 ttl=63 time=15.3 ms
^C
--- google.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3021ms
rtt min/avg/max/mdev = 14.886/15.251/15.467/0.221 ms
```

## → Configuração dos repositórios do apt-get:

### ◆ `/etc/apt`

```
GNU nano 5.4 sources.list
# deb cdrom:[Debian GNU/Linux 11.2.0 _Bullseye_ - Official amd64 NETINST 20211218-11:12]/ bullseye main
# deb cdrom:[Debian GNU/Linux 11.2.0 _Bullseye_ - Official amd64 NETINST 20211218-11:12]/ bullseye main
deb http://deb.debian.org/debian/ bullseye main
deb-src http://deb.debian.org/debian/ bullseye main
deb http://security.debian.org/debian-security bullseye-security main
deb-src http://security.debian.org/debian-security bullseye-security main
# bullseye-updates, to get updates before a point release is made;
# see https://www.debian.org/doc/manuals/debian-reference/ch02.en.html#updates_and_backports
deb http://deb.debian.org/debian/ bullseye-updates main
deb-src http://deb.debian.org/debian/ bullseye-updates main
# This system was installed using small removable media
# (e.g. netinst, live or single CD). The matching "deb cdrom"
# entries were disabled at the end of the installation process.
# For information about how to configure apt package sources,
# see the sources.list(5) manual.
```

## → Verificando o kernel atual:

### ◆ `uname -a`

```
tuchinski@debian:/etc/apt$ uname -a
Linux debian 5.10.0-12-amd64 #1 SMP Debian 5.10.103-1 (2022-03-07) x86_64 GNU/Linux
```

## → Teste dos comandos

### ◆ `ls -l`

```
pexe@VMS0:~$ ls -l
total 0
pexe@VMS0:~$
```

### ◆ *cd diretório*

```
pexe@VMS0:~$ cd teste/  
pexe@VMS0:~/teste$ _
```

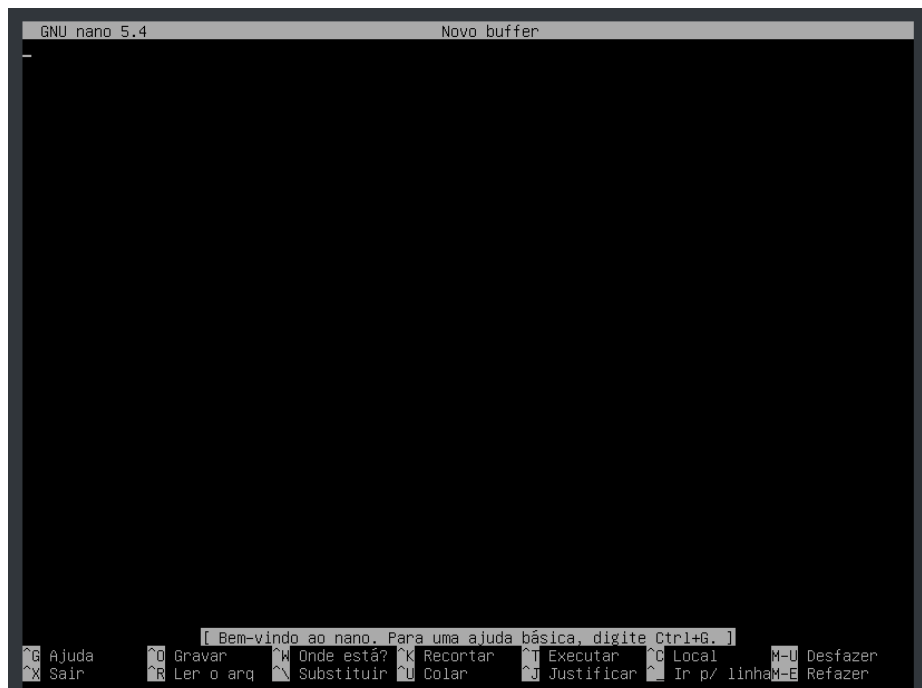
### ◆ *cat nome\_do\_arquivo*

```
pexe@VMS0:~$ cat teste.txt  
arquivo de teste  
pexe@VMS0:~$ _
```

◆ *rm nome\_do\_arquivo*

```
peixe@VMS0:~$ rm teste.txt  
peixe@VMS0:~$ _
```

◆ *pico ou nano*



```
GNU nano 5.4          Novo buffer  
_
```

Bem-vindo ao nano. Para uma ajuda básica, digite Ctrl+G.

Ctrl+G Ajuda	Ctrl+O Gravar	Ctrl+W Onde está?	Ctrl+K Recortar	Ctrl+T Executar	Ctrl+L Local	Ctrl+M-U Desfazer
Ctrl+X Sair	Ctrl+R Ler o arq	Ctrl+N Substituir	Ctrl+U Colar	Ctrl+J Justificar	Ctrl+I Ir p/ linha	Ctrl+M-E Refazer

◆ *cp nome\_de\_origem nome\_de\_destino*

```
pexe@VMS0:~$ cp teste.txt teste2.txt
pexe@VMS0:~$ ls
teste  teste2.txt  teste.txt
pexe@VMS0:~$ _
```

◆ *grep nome\_do\_arquivo*

```
pexe@VMS0:~$ grep teste.txt
_
```



◆ *head nome\_do\_arquivo*

```
root@debian:/home/tuchinski/Documentos# head teste.txt
testando comandos na VM

meio do arquivo

fim do arquivo
```

◆ *tail nome\_do\_arquivo*

```
peixe@VMS0:~$ tail teste.txt
arquivo de teste
peixe@VMS0:~$ _
```

◆ *mv nome\_de\_origem nome\_de\_destino*

```
pexe@VMS0:~$ mv teste.txt teste3.txt  
pexe@VMS0:~$
```

→ *compilando kernel:*

◆ *instalação das bibliotecas*

```
root@VMS0:~# apt-get install build-essential libncurses5-dev xz-utils libssl-dev bc bison libelf-dev
```

## ◆ baixando kernel

```
root@VMS0:~# wget https://cdn.kernel.org/pub/linux/kernel/v5.x/linux-11.2.0.tar.xz_
```

## ◆ make modules\_install

```
root@debian:/usr/src/linux-5.16.14# make modules_install
arch/x86/Makefile:142: CONFIG_X86_X32 enabled but no binutils support
INSTALL /lib/modules/5.16.14/kernel/arch/x86/crypto/aesni-intel.ko
INSTALL /lib/modules/5.16.14/kernel/arch/x86/crypto/crc32-pclmul.ko
INSTALL /lib/modules/5.16.14/kernel/arch/x86/crypto/crc32c-intel.ko
INSTALL /lib/modules/5.16.14/kernel/arch/x86/crypto/crct10dif-pclmul.ko
INSTALL /lib/modules/5.16.14/kernel/arch/x86/crypto/ghash-clmulni-intel.ko
INSTALL /lib/modules/5.16.14/kernel/arch/x86/events/rapl.ko
INSTALL /lib/modules/5.16.14/kernel/arch/x86/kernel/msr.ko
INSTALL /lib/modules/5.16.14/kernel/block/t10-pi.ko
INSTALL /lib/modules/5.16.14/kernel/crypto/crc32c-generic.ko
INSTALL /lib/modules/5.16.14/kernel/crypto/crct10dif-common.ko
INSTALL /lib/modules/5.16.14/kernel/crypto/crct10dif-generic.ko
INSTALL /lib/modules/5.16.14/kernel/crypto/cryptd.ko
INSTALL /lib/modules/5.16.14/kernel/crypto/crypto-simd.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/acpi/ac.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/acpi/battery.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/acpi/button.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/acpi/video.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/ata/acard-ahci.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/ata/ahci.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/ata/ata-generic.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/ata/ata_piix.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/ata/libahci.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/ata/libata.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/cdrom/cdrom.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/char/lp.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/char/ppdev.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/gpu/drm/drm.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/gpu/drm/drm_kms_helper.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/gpu/drm/ttm/ttm.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/gpu/drm/vmwgfx/vmwgfx.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/hid/hid-generic.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/hid/hid.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/hid/usbhid/usbhid.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/i2c/algos/i2c-algo-bit.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/i2c/busses/i2c-piix4.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/input/evdev.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/input/joydev.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/input/misc/pcspkr.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/input/mouse/psmouse.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/input/serio/serio_raw.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/media/cec/core/cec.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/net/ethernet/intel/e1000/e1000.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/parport/parport.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/parport/parport_pc.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/powercap/intel_rapl_common.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/powercap/intel_rapl_msr.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/scsi/scsi-common.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/scsi/scsi_mod.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/scsi/sd_mod.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/scsi/sg.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/scsi/sr_mod.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/thermal/intel/intel_powerclamp.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/usb/common/usb-common.ko
INSTALL /lib/modules/5.16.14/kernel/drivers/usb/core/usb-core.ko
```

◆ *make install*

→ Tamanho dos arquivos no diretório /boot:

◆ `ls -lh` no diretório `/boot` após compilação do kernel

→ Tamanho da pasta com os módulos compilados:

◆ *du -sh 5.16.14*

```
root@debian:/lib/modules# du -sh 5.16.14/
141M    5.16.14/
```

## Referências utilizadas

- <https://www.debian.org/releases/stable/amd64/apc.pt.html>
- [https://access.redhat.com/documentation/en-us/red\\_hat\\_enterprise\\_linux/6/html/installation\\_guide/s2-diskpartrecommend-x86](https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/6/html/installation_guide/s2-diskpartrecommend-x86)
- <https://kernel.org>
- <https://www.debian.org>