

```
muhammed@muhammed-VirtualBox:~$ nproc
```

```
4
```

```
muhammed@muhammed-VirtualBox:~$ free -m
```

	total	used	free	shared	buff/cache	available
Mem:	3935	644	2581	7	709	3061
Swap:	2047	0	2047			

```
muhammed@muhammed-VirtualBox:~$ uname -r
```

```
5.8.1
```

```
muhammed@muhammed-VirtualBox:~$ █
```



```
Reading package lists... Done
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following packages were automatically installed and are no longer required:
  chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi libgstreamer-plugins-bad1.0-0 libva-wayland2
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.
muhammed@muhammed-VirtualBox:~$ sudo apt clean && sudo apt autoremove -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages will be REMOVED:
  chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi libgstreamer-plugins-bad1.0-0 libva-wayland2
0 upgraded, 0 newly installed, 4 to remove and 0 not upgraded.
After this operation, 2,250 kB disk space will be freed.
(Reading database ... 189391 files and directories currently installed.)
Removing chromium-codecs-ffmpeg-extra (1:85.0.4183.83-0ubuntu0.20.04.2) ...
Removing gstreamer1.0-vaapi:amd64 (1.16.2-2) ...
Removing libgstreamer-plugins-bad1.0-0:amd64 (1.16.2-2.1ubuntu1) ...
Removing libva-wayland2:amd64 (2.7.0-2) ...
Processing triggers for libc-bin (2.31-0ubuntu9.2) ...
muhammed@muhammed-VirtualBox:~$ wget -P ~/ https://cdn.kernel.org/pub/linux/kernel/v5.x/linux-5.8.1.tar.xz
--2021-06-07 03:43:30-- https://cdn.kernel.org/pub/linux/kernel/v5.x/linux-5.8.1.tar.xz
Resolving cdn.kernel.org (cdn.kernel.org)... 199.232.81.176, 2a04:4e42:54::432
Connecting to cdn.kernel.org (cdn.kernel.org)|199.232.81.176|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 114458544 (109M) [application/x-xz]
Saving to: '/home/muhammed/linux-5.8.1.tar.xz'

linux-5.8.1.tar.xz          0%[
```



muhammed@muhammed-VirtualBox: ~



```
muhammed@muhammed-VirtualBox:~$ tar -xvf ~/linux-5.8.1.tar.xz -C ~/
```



muhammed@muhammed-VirtualBox: ~/linux-5.8.1



GNU nano 4.8

hello/hello.c

Modified

```
#include <linux/kernel.h>
#include <linux/syscalls.h>
```

```
SYSCALL_DEFINE0(hello)
```

```
{
    printk("Abdelrahman Muhammed Muhammed...\n");
    return 0;
}
```

^G Get Help
^X Exit

^O Write Out
^R Read File

^W Where Is
^_ Replace

^K Cut Text
^U Paste Text

^J Justify
^T To Spell

```
linux-5.8.1/usr/include/Makefile
linux-5.8.1/usr/initramfs_data.S
linux-5.8.1/virt/
linux-5.8.1/virt/Makefile
linux-5.8.1/virt/kvm/
linux-5.8.1/virt/kvm/Kconfig
linux-5.8.1/virt/kvm/async_pf.c
linux-5.8.1/virt/kvm/async_pf.h
linux-5.8.1/virt/kvm/coalesced_mmio.c
linux-5.8.1/virt/kvm/coalesced_mmio.h
linux-5.8.1/virt/kvm/eventfd.c
linux-5.8.1/virt/kvm/irqchip.c
linux-5.8.1/virt/kvm/kvm_main.c
linux-5.8.1/virt/kvm/vfio.c
linux-5.8.1/virt/kvm/vfio.h
linux-5.8.1/virt/lib/
linux-5.8.1/virt/lib/Kconfig
linux-5.8.1/virt/lib/Makefile
linux-5.8.1/virt/lib/irqbypass.c
```

```
muhammed@muhammed-VirtualBox:~$ uname -r
```

```
5.8.0-55-generic
```

```
muhammed@muhammed-VirtualBox:~$
```

```
muhammed@muhammed-VirtualBox:~$ cd ~/linux-5.8.1/
```



muhammed@muhammed-VirtualBox: ~/linux-5.8.1



muhammed@muhammed-VirtualBox:~/linux-5.8.1\$ ls

arch	CREDITS	fs	ipc	lib	mm	scripts	usr
block	crypto	hello	Kbuild	LICENSES	net	security	virt
certs	Documentation	include	Kconfig	MAINTAINERS	README	sound	
COPYING	drivers	init	kernel	Makefile	samples	tools	

muhammed@muhammed-VirtualBox:~/linux-5.8.1\$ nano hello/hello.c

muhammed@muhammed-VirtualBox:~/linux-5.8.1\$ nano hello/Makefile



muhammed@muhammed-VirtualBox: ~/linux-5.8.1



GNU nano 4.8

hello/Makefile

Modified

obj-y := hello.o

^G Get Help
^X Exit

^O Write Out
^R Read File

^W Where Is
^ Replace

^K Cut Text
^U Paste Text

^J Justify
^T To Spell


```
linux-5.8.1/virt/kvm/coalesced_mmio.c
linux-5.8.1/virt/kvm/coalesced_mmio.h
linux-5.8.1/virt/kvm/eventfd.c
linux-5.8.1/virt/kvm/irqchip.c
linux-5.8.1/virt/kvm/kvm_main.c
linux-5.8.1/virt/kvm/vfio.c
linux-5.8.1/virt/kvm/vfio.h
linux-5.8.1/virt/lib/
linux-5.8.1/virt/lib/Kconfig
linux-5.8.1/virt/lib/Makefile
linux-5.8.1/virt/lib/irqbypass.c
```

```
muhammed@muhammed:~/Desktop$ uname -r
```

```
5.8.0-55-generic
```

```
muhammed@muhammed:~/Desktop$ cd ~/linux-5.8.1/
```

```
muhammed@muhammed:~/linux-5.8.1$ ls
```

arch	certs	CREDITS	Documentation	fs	init	Kbuild	kernel	LICENSE
S	Makefile	net	samples	security	tools	virt		
block	COPYING	crypto	drivers	include	ipc	Kconfig	lib	MAINTAI
NERS	mm	README	scripts	sound	usr			

```
muhammed@muhammed:~/linux-5.8.1$ mkdir hello
```

```
muhammed@muhammed:~/linux-5.8.1$ cd hello
```

```
muhammed@muhammed:~/linux-5.8.1/hello$ gedit hello.c
```




GNU nano 4.8

Makefile

Modified

endif

endif

PHONY += prepare0

export MODORDER := \$(extmod-prefix)modules.order

export MODULES_NSDEPS := \$(extmod-prefix)modules.nsdeps

ifeq (\$(KBUILD_EXTMOD),)

core-y += kernel/ certs/ mm/ fs/ ipc/ security/ crypto/ block/ hello/

```
vmlinux-dirs := $(patsubst %/,%, $(filter %/, \  
    $(core-y) $(core-m) $(drivers-y) $(drivers-m) \  
    $(libs-y) $(libs-m)))
```

```
vmlinux-alldirs := $(sort $(vmlinux-dirs) Documentation \  
    $(patsubst %/,%, $(filter %/, $(core-) \  
    $(drivers-) $(libs-))))
```

subdir-modorder := \$(addsuffix modules.order, \$(filter %/, \

^G Get Help

^O Write Out

^W Where Is

^K Cut Text

^J Justify

^C Cur Pos

^X Exit

^R Read File

^_ Replace

^U Paste Text

^T To Spell

^ Go To Line

Open

*syscalls.h

/usr/src/linux-4.17.4/include/linux

Save

≡

-

□

✕

linux

Q

≡

wireless.h
wkup_m3_ipc.h
wl12xx.h
wm97xx.h
wmi.h
workqueue.h
writeback.h
ww_mutex.h
xarray.h
xattr.h
xxhash.h
xz.h
yam.h
z2_battery.h
zbud.h
zconf.h
zlib.h
zorro.h
zpool.h
zsmalloc.h
zstd.h
zutil.h

```
1250     return __close_fd(current->files, fd);
1251 }
1252
1253 extern long do_sys_open(int dfd, const char __user *filename, int flags,
1254                        umode_t mode);
1255
1256 static inline long ksys_open(const char __user *filename, int flags,
1257                             umode_t mode)
1258 {
1259     if (force_o_largefile())
1260         flags |= O_LARGEFILE;
1261     return do_sys_open(AT_FDCWD, filename, flags, mode);
1262 }
1263
1264 extern long do_sys_truncate(const char __user *pathname, loff_t length);
1265
1266 static inline long ksys_truncate(const char __user *pathname, loff_t length)
1267 {
1268     return do_sys_truncate(pathname, length);
1269 }
1270
1271 asmlinkage long sys_hello(void);
1272
```

C/ObjC Header ▾

Tab Width: 8 ▾

Ln 1270, Col 1 ▾

INS

fixp-arith.h

memblock.h

rtc.h



```
GNU nano 4.8 arch/x86/entry/syscalls/syscall_64.tbl Modified
434 common pidfd_open sys_pidfd_open
435 common clone3 sys_clone3
437 common openat2 sys_openat2
438 common pidfd_getfd sys_pidfd_getfd
439 common faccessat2 sys_faccessat2
440 common hello sys_hello
#
# x32-specific system call numbers start at 512 to avoid cache impact
# for native 64-bit operation. The __x32_compat_sys stubs are created
# on-the-fly for compat_sys_*( ) compatibility system calls if X86_X32
# is defined.
#
512 x32 rt_sigaction compat_sys_rt_sigaction
513 x32 rt_sigreturn compat_sys_x32_rt_sigreturn
514 x32 ioctl compat_sys_ioctl
515 x32 readv compat_sys_readv
516 x32 writev compat_sys_writev
517 x32 recvfrom compat_sys_recvfrom
518 x32 sendmsg compat_sys_sendmsg
519 x32 recvmsg compat_sys_recvmsg
```

^G Get Help

^O Write Out

^W Where Is

^K Cut Text

^J Justify

^C Cur Pos

^X Exit

^R Read File

^_ Replace

^U Paste Text

^T To Spell

^ Go To Line



```
HOSTCC  scripts/kconfig/lexer.lex.o
HOSTCC  scripts/kconfig/parser.tab.o
HOSTCC  scripts/kconfig/preprocess.o
HOSTCC  scripts/kconfig/symbol.o
HOSTCC  scripts/kconfig/util.o
HOSTLD  scripts/kconfig/mconf
```

```
scripts/kconfig/mconf Kconfig
```

```
#
```

```
# using defaults found in /boot/config-5.8.0-55-generic
```

```
#
```

```
/boot/config-5.8.0-55-generic:8467:warning: symbol value 'm' invalid for ASHMEM
```

```
/boot/config-5.8.0-55-generic:9474:warning: symbol value 'm' invalid for ANDROID_BINDER_IPC
```

```
/boot/config-5.8.0-55-generic:9475:warning: symbol value 'm' invalid for ANDROID_BINDERFS
```

```
*** End of the configuration.
```

```
*** Execute 'make' to start the build or try 'make help'.
```

```
muhammed@muhammed-VirtualBox:~/linux-5.8.1$ sudo make localmodconfig
```

```
HOSTCC  scripts/kconfig/conf.o
```

```
HOSTLD  scripts/kconfig/conf
```

```
using config: '.config'
```

```
Use of uninitialized value $ENV{"LMC_KEEP"} in split at ./scripts/kconfig/streamline_config.pl line 596.
```

```
System keyring enabled but keys "debian/canonical-certs.pem" not found. Resetting keys to default value.
```

```
*
```

```
* Restart config...
```

```
*
```

```
*
```

```
*
```

```
* PCI GPIO expanders
```

```
*
```

```
AMD 8111 GPIO driver (GPIO_AMD8111) [N/m/y/?] n
```

```
BT8XX GPIO abuser (GPIO_BT8XX) [N/m/y/?] (NEW) ☐
```

```
Surface 3 battery platform operation region support (SURFACE_3_POWER_OPREGION) [N/m/y/?] n
Power/home/volume buttons driver for Microsoft Surface Pro 3/4 tablet (SURFACE_PRO3_BUTTON) [N/m/y/?] n
MSI Laptop Extras (MSI_LAPTOP) [N/m/?] n
PC Engines APuv2/3 front button and LEDs driver (PCENGINES_APU2) [N/m/y/?] n
Samsung Laptop driver (SAMSUNG_LAPTOP) [N/m/?] n
Samsung Q10 Extras (SAMSUNG_Q10) [N/m/y/?] n
Toshiba Bluetooth RFKill switch support (TOSHIBA_BT_RFKILL) [N/m/y/?] n
Toshiba HDD Active Protection Sensor (TOSHIBA_HAPS) [N/m/y/?] n
CMPC Laptop Extras (ACPI_CMPC) [N/m/y/?] n
Compal (and others) Laptop Extras (COMPAL_LAPTOP) [N/m/?] n
Panasonic Laptop Extras (PANASONIC_LAPTOP) [N/m/y/?] n
Sony Laptop Extras (SONY_LAPTOP) [N/m/?] n
System76 ACPI Driver (SYSTEM76_ACPI) [N/m/y/?] n
Topstar Laptop Extras (TOPSTAR_LAPTOP) [N/m/y/?] n
I2C multi instantiate pseudo device driver (I2C_MULTI_INSTANTIATE) [N/m/y/?] n
Mellanox Technologies platform support (MLX_PLATFORM) [N/m/y/?] n
Intel Intelligent Power Sharing (INTEL_IPS) [N/m/y/?] n
Intel Rapid Start Technology Driver (INTEL_RST) [N/m/y/?] n
Intel Smart Connect disabling driver (INTEL_SMARTCONNECT) [N/m/y/?] n
Intel Turbo Boost Max Technology 3.0 enumeration driver (INTEL_TURBO_MAX_3) [Y/n/?] y
Intel Uncore frequency control driver (INTEL_UNCORE_FREQ_CONTROL) [N/m/y/?] n
Thermal driver for Intel Medfield platform (INTEL_MFLD_THERMAL) [N/m/y/?] n
power button driver for Intel MID platforms (INTEL_MID_POWER_BUTTON) [N/m/y/?] n
Intel PMC Core driver (INTEL_PMC_CORE) [Y/n/m/?] y
Intel P-Unit IPC Driver (INTEL_PUNIT_IPC) [N/m/y/?] n
Intel SCU PCI driver (INTEL_SCU_PCI) [Y/n/?] y
Intel SCU platform driver (INTEL_SCU_PLATFORM) [N/m/y/?] n
Intel SCU IPC utility driver (INTEL_SCU_IPC_UTIL) [N/m/y/?] n
#
# configuration written to .config
#
muhammed@muhammed-VirtualBox:~/linux-5.8.1$
```




```
INSTALL sound/pci/snd-intel8x0.ko
INSTALL sound/soundcore.ko
DEPMOD 5.8.1
```

```
muhammed@muhammed-VirtualBox:~/linux-5.8.1$ sudo make install -j4
```

```
sh ./arch/x86/boot/install.sh 5.8.1 arch/x86/boot/bzImage \
    System.map "/boot"
```

```
run-parts: executing /etc/kernel/postinst.d/apt-auto-removal 5.8.1 /boot/vmlinuz-5.8.1
```

```
run-parts: executing /etc/kernel/postinst.d/dkms 5.8.1 /boot/vmlinuz-5.8.1
```

```
* dkms: running auto installation service for kernel 5.8.1
```

[OK]

```
run-parts: executing /etc/kernel/postinst.d/initramfs-tools 5.8.1 /boot/vmlinuz-5.8.1
```

```
update-initramfs: Generating /boot/initrd.img-5.8.1
```

```
run-parts: executing /etc/kernel/postinst.d/unattended-upgrades 5.8.1 /boot/vmlinuz-5.8.1
```

```
run-parts: executing /etc/kernel/postinst.d/update-notifier 5.8.1 /boot/vmlinuz-5.8.1
```

```
run-parts: executing /etc/kernel/postinst.d/vboxadd 5.8.1 /boot/vmlinuz-5.8.1
```

```
VirtualBox Guest Additions: Building the modules for kernel 5.8.1.
```

```
VirtualBox Guest Additions: Look at /var/log/vboxadd-setup.log to find out what
went wrong
```

```
run-parts: executing /etc/kernel/postinst.d/zz-update-grub 5.8.1 /boot/vmlinuz-5.8.1
```

```
Sourcing file `/etc/default/grub'
```

```
Sourcing file `/etc/default/grub.d/init-select.cfg'
```

```
Generating grub configuration file ...
```

```
Found linux image: /boot/vmlinuz-5.8.1
```

```
Found initrd image: /boot/initrd.img-5.8.1
```

```
Found linux image: /boot/vmlinuz-5.8.0-55-generic
```

```
Found initrd image: /boot/initrd.img-5.8.0-55-generic
```

```
Found linux image: /boot/vmlinuz-5.8.0-43-generic
```

```
Found initrd image: /boot/initrd.img-5.8.0-43-generic
```

```
Found memtest86+ image: /boot/memtest86+.elf
```

```
Found memtest86+ image: /boot/memtest86+.bin
```

```
done
```

```
muhammed@muhammed-VirtualBox:~/linux-5.8.1$
```



```
INSTALL drivers/xen/xen-privcmd.ko
INSTALL fs/autofs/autofs4.ko
INSTALL fs/isofs/isofs.ko
INSTALL fs/nls/nls_iso8859-1.ko
INSTALL fs/nls/nls_utf8.ko
INSTALL kernel/configs.ko
INSTALL net/ipv4/netfilter/ip_tables.ko
INSTALL net/netfilter/x_tables.ko
INSTALL net/netfilter/xt_tcpudp.ko
INSTALL net/sched/sch_fq_codel.ko
INSTALL sound/ac97_bus.ko
INSTALL sound/core/seq/snd-seq.ko
INSTALL sound/core/snd-pcm.ko
INSTALL sound/core/snd-seq-device.ko
INSTALL sound/core/snd-timer.ko
INSTALL sound/core/snd.ko
INSTALL sound/pci/ac97/snd-ac97-codec.ko
INSTALL sound/pci/snd-intel8x0.ko
INSTALL sound/soundcore.ko
DEPMOD 5.8.1
```

```
muhammed@muhammed-VirtualBox:~/linux-5.8.1$ sudo update-grub
```

```
Sourcing file `/etc/default/grub'
```

```
Sourcing file `/etc/default/grub.d/init-select.cfg'
```

```
Generating grub configuration file ...
```

```
Found linux image: /boot/vmlinuz-5.8.0-55-generic
```

```
Found initrd image: /boot/initrd.img-5.8.0-55-generic
```

```
Found linux image: /boot/vmlinuz-5.8.0-43-generic
```

```
Found initrd image: /boot/initrd.img-5.8.0-43-generic
```

```
Found memtest86+ image: /boot/memtest86+.elf
```

```
Found memtest86+ image: /boot/memtest86+.bin
```

```
done
```

```
muhammed@muhammed-VirtualBox:~/linux-5.8.1$
```



```
[ 69.981255] 15:43:42.672091 main      vbglR3GuestCtrlDetectPeekGetCancelSuppo
rt: Supported (#1)
[ 86.562674] rfcill: input handler disabled
[ 97.509078] rfcill: input handler enabled
[ 99.478923] Service: Shared Clipboard
[ 99.482256] Service: Host Version Check
[ 99.484592] Service: Seamless
[ 99.486727] Service: Drag and Drop (DnD)
[ 99.488478] Service: Display SVGA X11
[ 99.506986] Worker loop running
[ 99.532316] VMWARE's ctrl extension is available. Major Opcode is 128.
[ 99.533277] Proxy window=6291457, root window=1330 ...
[ 99.533514] Started
[ 99.533592] 6.1.18r142142
[ 99.535775] Failed to register resizing support, rc=VERR_INVALID_FUNCTION
[ 99.584579] Denying userspace vmm call type 0x000051
[ 99.584913] Failed to get display change request, rc=VERR_ACCESS_DENIED
[ 102.956074] ISO 9660 Extensions: Microsoft Joliet Level 3
[ 103.005673] ISO 9660 Extensions: RRIP_1991A
[ 103.060794] Service: Shared Clipboard
[ 103.066363] rfcill: input handler disabled
[ 103.071809] Service: Host Version Check
[ 103.076316] Service: Seamless
[ 103.080965] Service: Drag and Drop (DnD)
[ 103.086164] Service: Display SVGA X11
[ 370.230174] Shared Clipboard: Converting VBox formats 0x5 to 'INVALID' for X
11 (idxFmtX11=0, fmtX11=0) failed, rc=VERR_NOT_SUPPORTED
[ 417.551053] Abdel Rahman Muhammed Muhammed...
muhammed@muhammed-VirtualBox:~$
```

References:

<http://rjaan.narod.ru/docs/admin/deb-recipes/debkbuidl/sysadmin-build-5s-kernel-in-debian.html>

<https://dev.to/jasper/adding-a-system-call-to-the-linux-kernel-5-8-1-in-ubuntu-20-04-lts-2ga8>

<https://medium.com/anubhav-shrimal/adding-a-hello-world-system-call-to-linux-kernel-dad32875872>