

AOS ASSIGNMENT 2

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ROLL: 2022202007

Setup

Oracle VirtualBox is used for installing Virtual Machine.

While installing, 4 CPU cores and a minimum of 40GB hard disk space are allotted to the VM.

Installing kernel linux 4.19.210

wget <https://cdn.kernel.org/pub/linux/kernel/v4.x/linux-4.19.210.tar.xz>

Extracting Kernel

```
sudo tar -xvf linux-4.19.210.tar.xz -C/usr/src/
```

Now all the files are extracted in /usr/src/linux-4.19.210

Question 1

1. Create directory madhusreehello, inside it madhusreehello.c

```
mkdir madhusreehello
cd madhusreehello
gedit madhusreehello.c
```

2. Code



3. Create Makefile

```
gedit Makefile
```

```
obj-y := madhusreehello.o
```

This is to ensure that the madhusreehello.c file is compiled and included in the kernel source code.

4. Go to parent and edit the makefile

```
cd ..
gedit Makefile
```

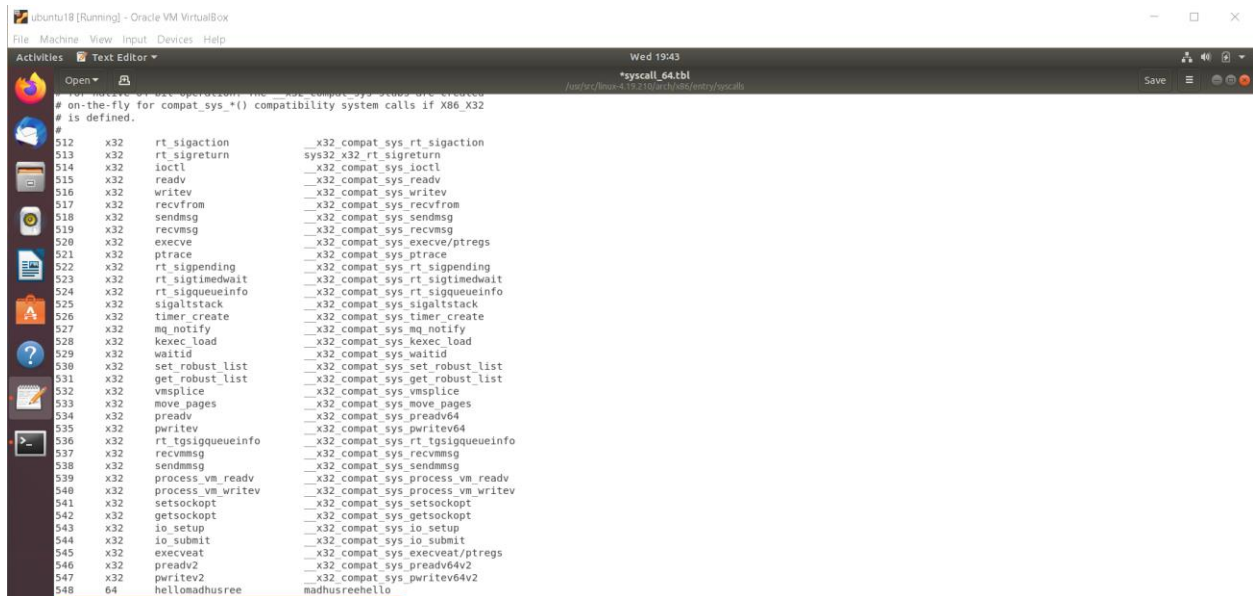
Change the line and add madhusreehello/ at the end

```
core-y += kernel/ mm/ fs/ ipc/ security/ crypto/ block/ madhusreehello/
```

This is to tell the compiler that the source files of our new system call (`madhusreehello()`) are present in the `madhusreehello` directory.

5. Add the new system call to the table of system calls

```
cd arch/x86/entry/syscalls/  
gedit syscall_64.tbl
```



The Syscall number is 548.

6. Add the syscall to the system call header file

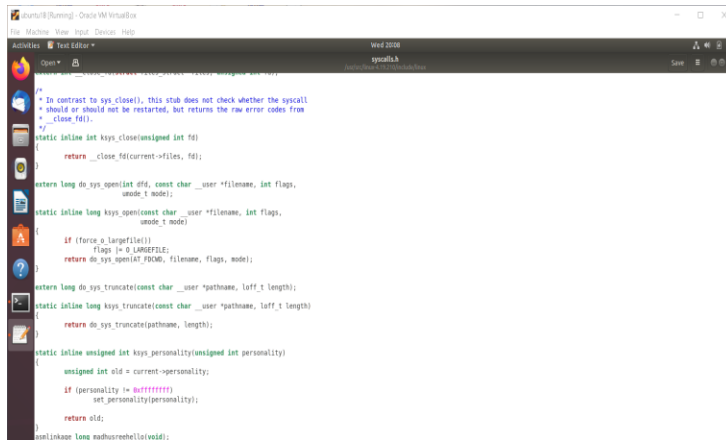
From `linux-4.19.210` directory

```
cd include/linux/  
gedit syscalls.h
```

Add

```
asmlinkage long madhusreehello(void);
```

Before `endif` in last line



7. Install essential packages

```
sudo apt-get install gcc
sudo apt-get install libncurses5-dev
sudo apt-get install bison
sudo apt-get install flex
sudo apt-get install libssl-dev
sudo apt-get install libelf-dev
sudo apt-get update
sudo apt-get upgrade
```

8. Compile the Kernel

```
sudo make -j4
```

-j 4 because we have allotted 4 cores to our VM. It will make the compilation process faster

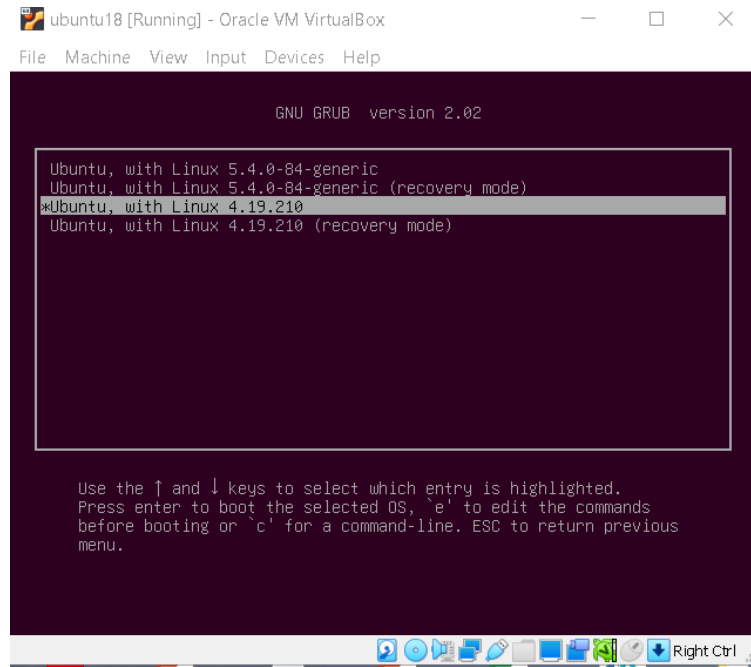
```
sudo make modules_install install
```

It will create some files under /boot/ directory and it will automatically make an entry in grub.cfg.

9. Reboot the system

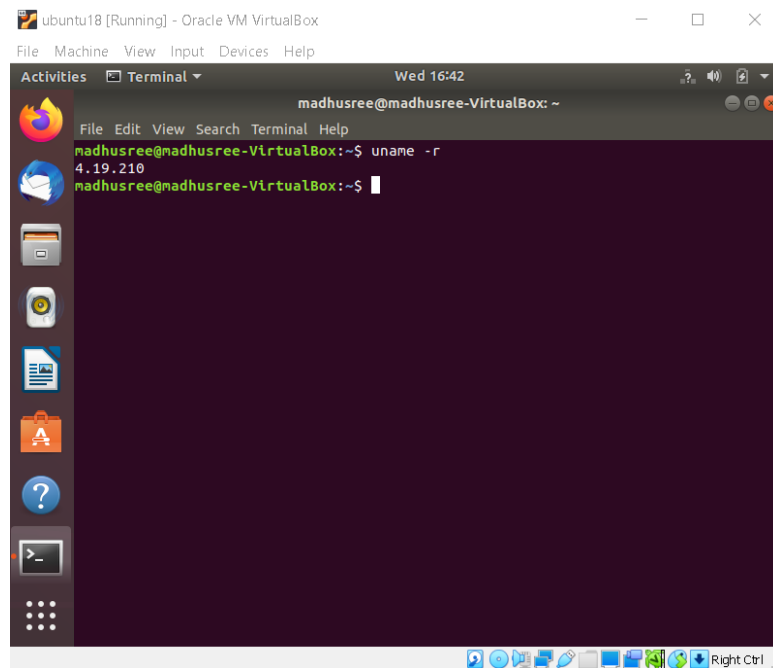
```
shutdown -r now
```


10.2 Select Ubuntu with Linux 4.19.210



11. Confirm the kernel

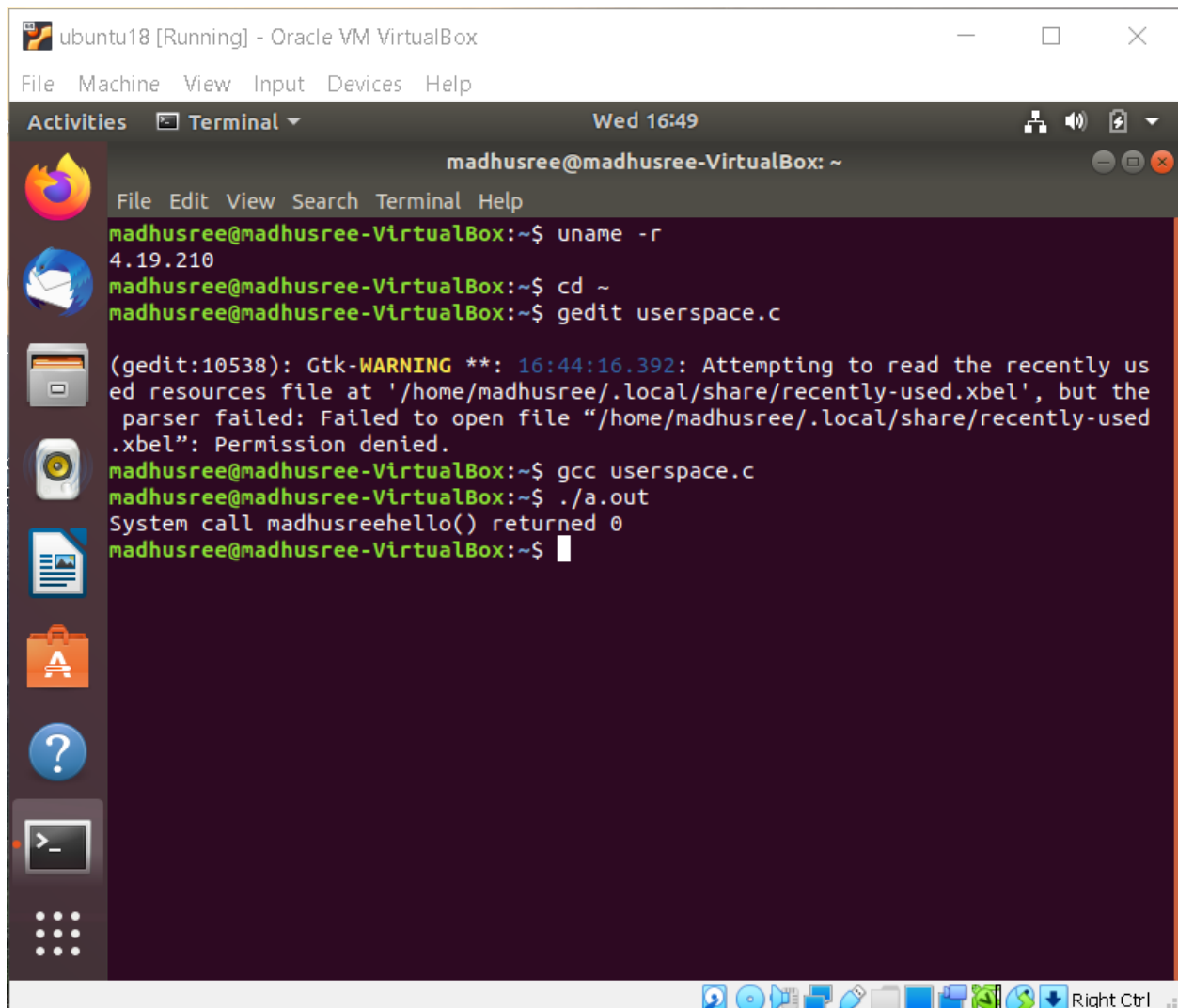
uname -r



12. Create madhusreehello.c in ~/home and add the code

```
#include <stdio.h>
#include<linux/kernel.h>
#include<sys/syscall.h>
#include<unistd.h>
int main(){
    long int ret_val = syscall(548);
    printf("System call madhusreehello() returned %ld\n", ret_val);
    return 0;
}
```

13. Compile and execute the code



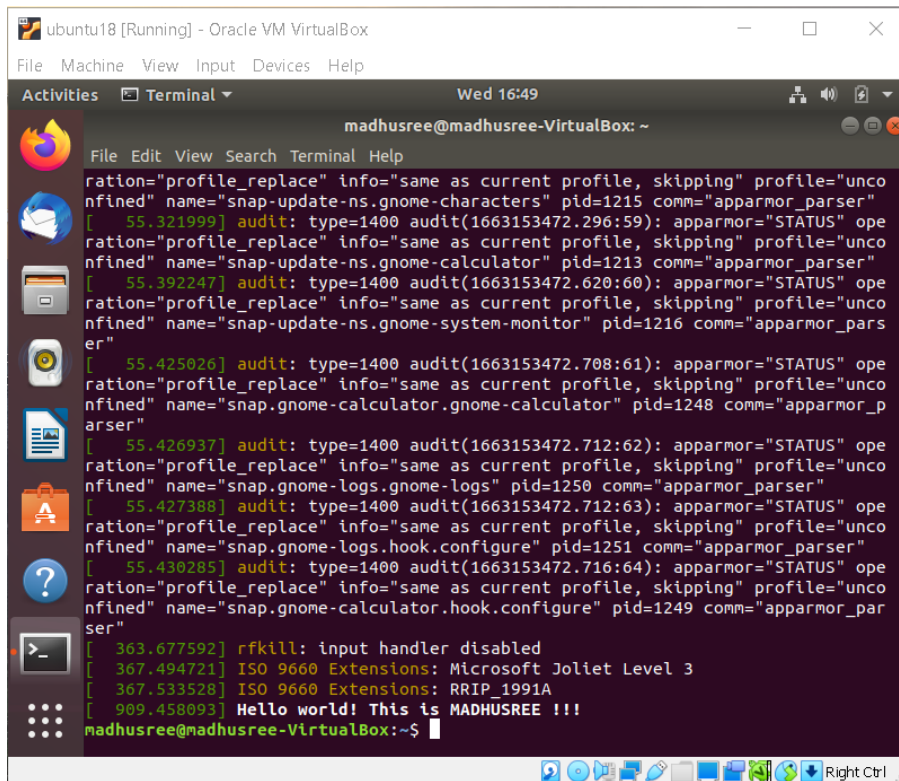
The screenshot shows a terminal window titled "ubuntu18 [Running] - Oracle VM VirtualBox". The terminal output is as follows:

```
madhusree@madhusree-VirtualBox: ~$ uname -r
4.19.210
madhusree@madhusree-VirtualBox:~$ cd ~
madhusree@madhusree-VirtualBox:~$ gedit userspace.c

(gedit:10538): Gtk-WARNING **: 16:44:16.392: Attempting to read the recently used resources file at '/home/madhusree/.local/share/recently-used.xbel', but the parser failed: Failed to open file "/home/madhusree/.local/share/recently-used.xbel": Permission denied.
madhusree@madhusree-VirtualBox:~$ gcc userspace.c
madhusree@madhusree-VirtualBox:~$ ./a.out
System call madhusreehello() returned 0
madhusree@madhusree-VirtualBox:~$
```

14. Check the log

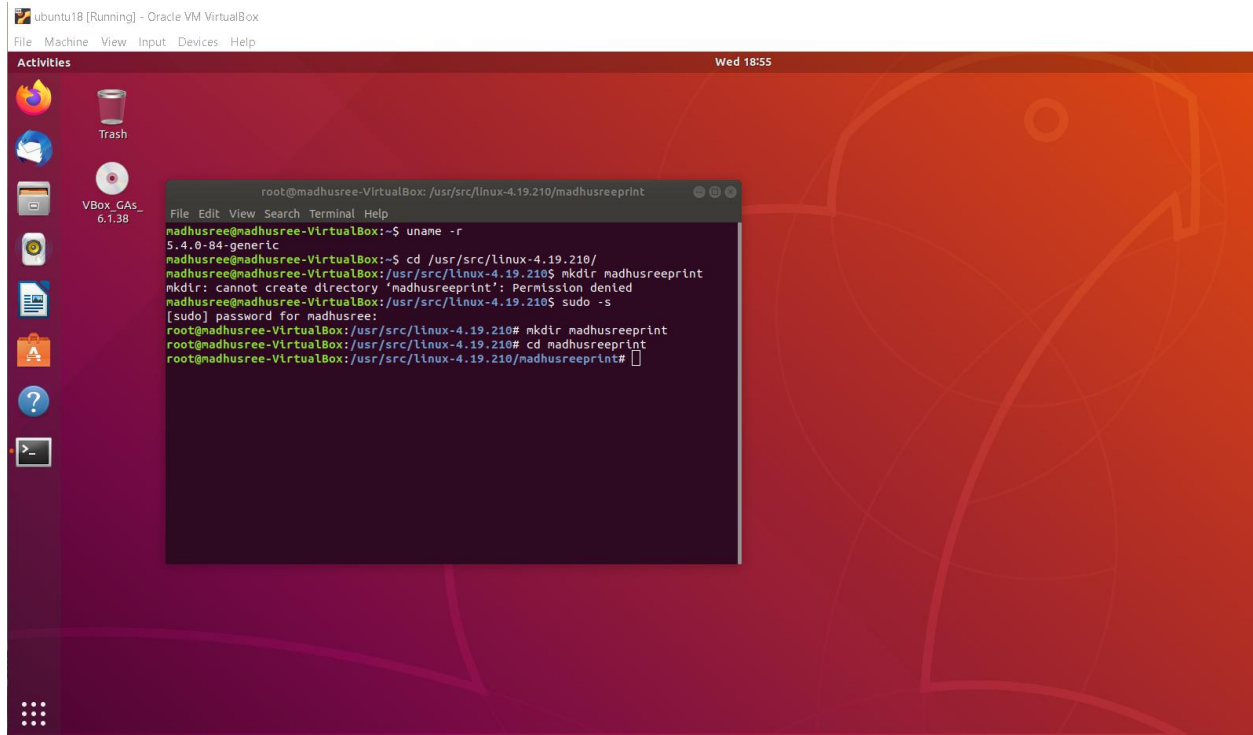
dmesg



```
ubuntu18 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Wed 16:49
madhusree@madhusree-VirtualBox: ~
File Edit View Search Terminal Help
ration="profile_replace" info="same as current profile, skipping" profile="unco
nfned" name="snap-update-ns.gnome-characters" pid=1215 comm="apparmor_parser"
[ 55.321999] audit: type=1400 audit(1663153472.296:59): apparmor="STATUS" ope
ration="profile_replace" info="same as current profile, skipping" profile="unco
nfned" name="snap-update-ns.gnome-calculator" pid=1213 comm="apparmor_parser"
[ 55.392247] audit: type=1400 audit(1663153472.620:60): apparmor="STATUS" ope
ration="profile_replace" info="same as current profile, skipping" profile="unco
nfned" name="snap-update-ns.gnome-system-monitor" pid=1216 comm="apparmor_pars
er"
[ 55.425026] audit: type=1400 audit(1663153472.708:61): apparmor="STATUS" ope
ration="profile_replace" info="same as current profile, skipping" profile="unco
nfned" name="snap.gnome-calculator.gnome-calculator" pid=1248 comm="apparmor_p
arser"
[ 55.426937] audit: type=1400 audit(1663153472.712:62): apparmor="STATUS" ope
ration="profile_replace" info="same as current profile, skipping" profile="unco
nfned" name="snap.gnome-logs.gnome-logs" pid=1250 comm="apparmor_parser"
[ 55.427388] audit: type=1400 audit(1663153472.712:63): apparmor="STATUS" ope
ration="profile_replace" info="same as current profile, skipping" profile="unco
nfned" name="snap.gnome-logs.hook.configure" pid=1251 comm="apparmor_parser"
[ 55.430285] audit: type=1400 audit(1663153472.716:64): apparmor="STATUS" ope
ration="profile_replace" info="same as current profile, skipping" profile="unco
nfned" name="snap.gnome-calculator.hook.configure" pid=1249 comm="apparmor_par
ser"
[ 363.677592] rfkill: input handler disabled
[ 367.494721] ISO 9660 Extensions: Microsoft Joliet Level 3
[ 367.533528] ISO 9660 Extensions: RRIP_1991A
[ 909.458093] Hello world! This is MADHUSREE !!!
madhusree@madhusree-VirtualBox:~$
```


Question 2

1. Create directory madhusreeprint, inside it madhusreeprint.c



2. Code

gedit madhusreeprint.c



```
#include <linux/kernel.h>
#include <linux/linkage.h>
#include <linux/syscalls.h>
#include <linux/uaccess.h>
/* function to print string to kernel */
/* syscall number 333 */
SYSCALL_DEFINE1(madhusreeprint,
                char __user *, src)
{
    char buf[256];

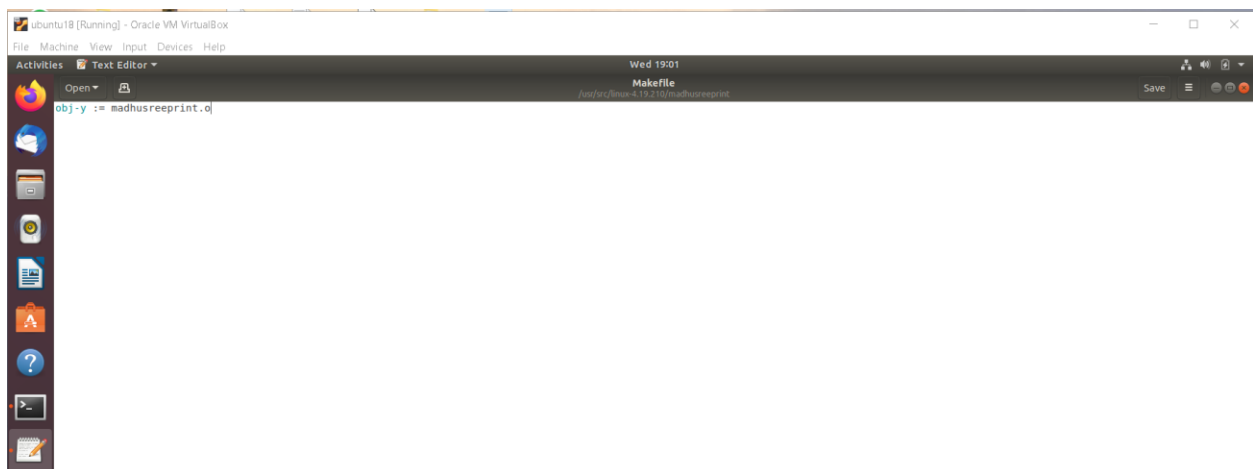
    if( copy_from_user(buf, src, 256) ){
        return -1;
    }

    printk("madhusreeprint() called with string: %s\n", buf);

    return 0;
}
```

3. Create Makefile

gedit Makefile



```
obj-y := madhusreeprint.o
```

This is to ensure that the madhusreeprint.c file is compiled and included in the kernel source code.

4. Go to parent and edit the makefile

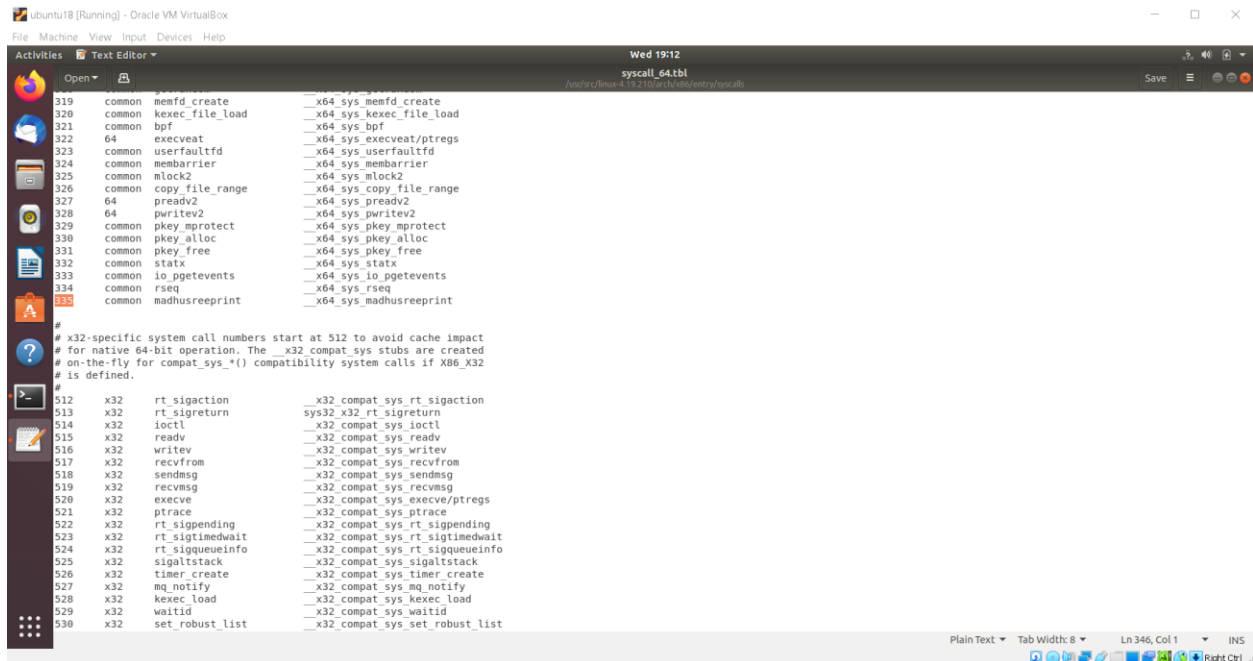
```
cd ..
gedit Makefile
```

Change the line and add madhusreeprint/ at the end

This is to tell the compiler that the source files of our new system call (`madhusreeprint()`) are present in the `madhusreeprint` directory.

5. Add the new system call to the table of system calls

```
cd arch/x86/entry/syscalls/  
gedit syscall_64.tbl
```



The Syscall number is 335.

6. Install essential packages

```
sudo apt-get install git fakeroot build-essential ncurses-dev xz-utils
libssl-dev bc
```

7. Compile the Kernel

```
sudo make -j4
```

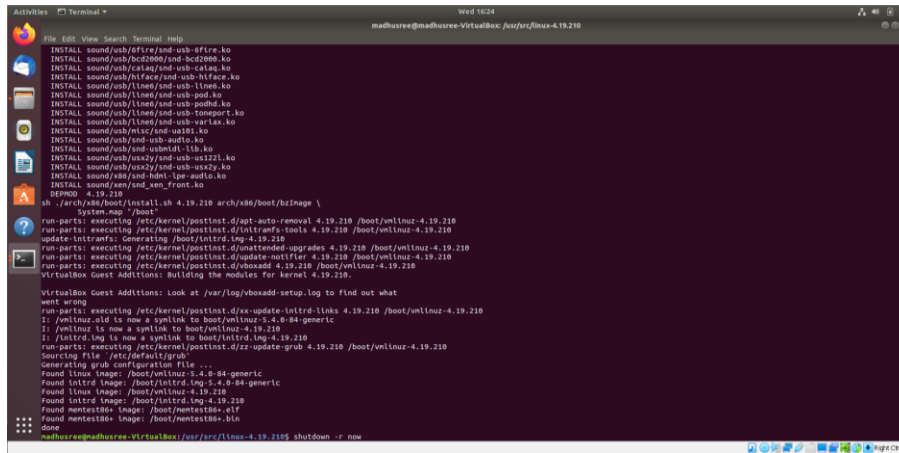
-j 4 because we have allotted 4 cores to our VM. It will make the compilation process faster

```
sudo make modules_install install
```

It will create some files under /boot/ directory and it will automatically make an entry in grub.cfg.

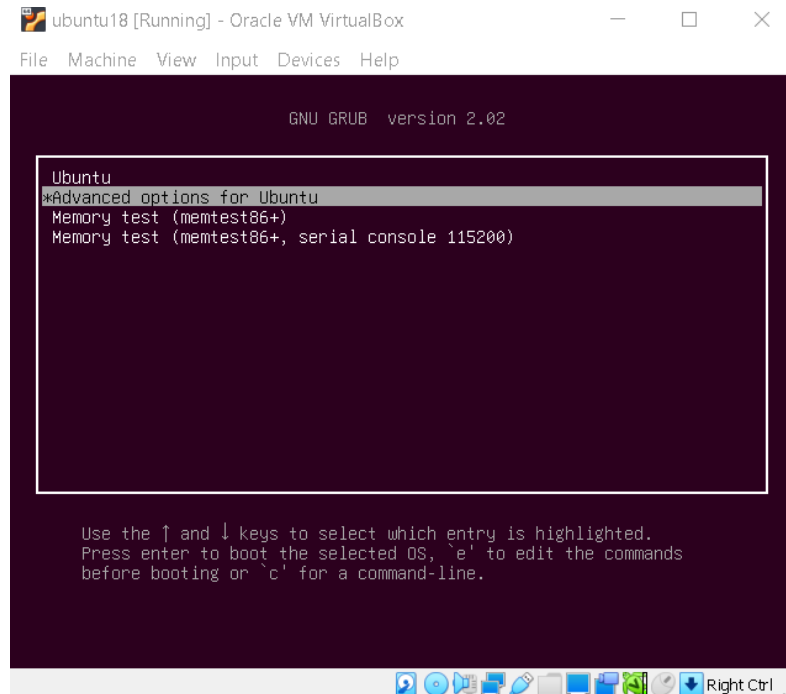
8. Reboot the system

```
shutdown -r now
```

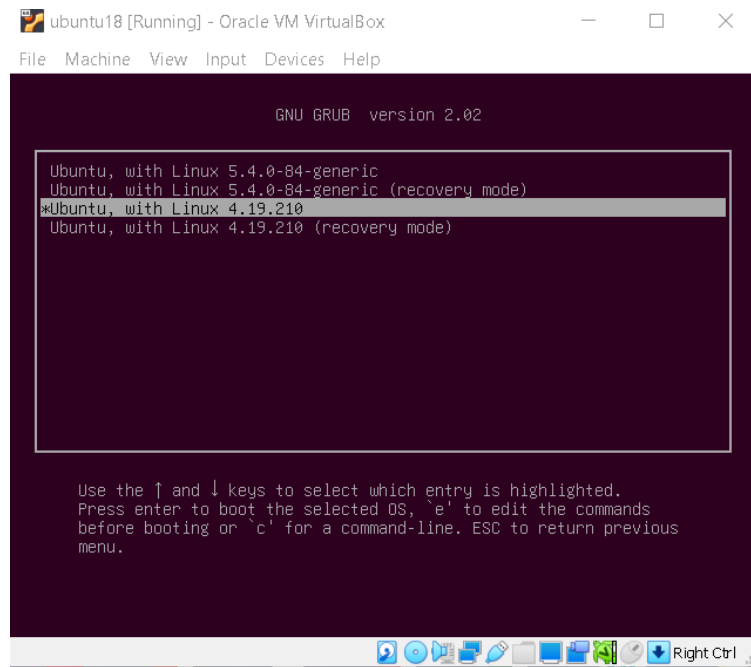


9. Boot the system using kernel linux-4.19.210

9.1. Select advanced options for Ubuntu

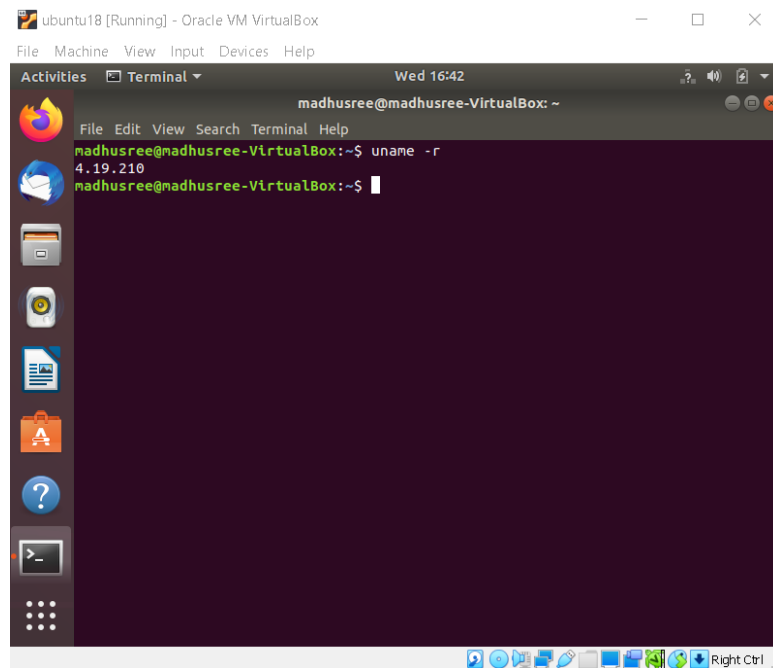


9.2 Select Ubuntu with Linux 4.19.210



10. Confirm the kernel

uname -r



11. Create madhusreeprint.c in ~/home and add the code

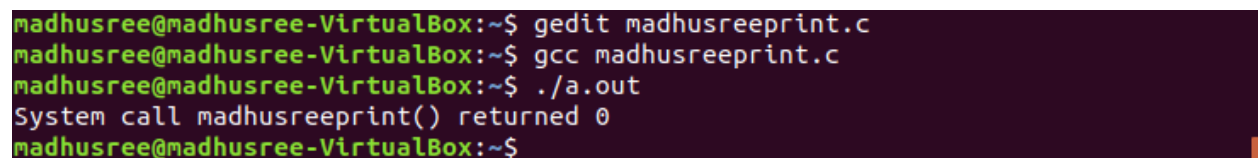


The screenshot shows a text editor window titled 'madhusreeprint.c' in a virtual machine environment. The code is as follows:

```
#include <stdio.h>
#include <linux/kernel.h>
#include <sys/syscall.h>
#include <unistd.h>

int main(){
    long int ret_val = syscall(335, "AOS_ASSIGNMENT 2");
    printf("System call madhusreeprint() returned %ld\n", ret_val);
    return 0;
}
```

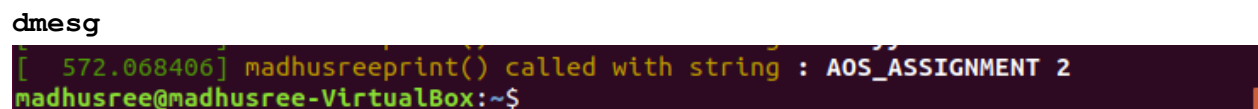
12. Compile and execute the code



The screenshot shows a terminal window with the following commands and output:

```
madhusree@madhusree-VirtualBox:~$ gedit madhusreeprint.c
madhusree@madhusree-VirtualBox:~$ gcc madhusreeprint.c
madhusree@madhusree-VirtualBox:~$ ./a.out
System call madhusreeprint() returned 0
madhusree@madhusree-VirtualBox:~$
```

13. Check the log



The screenshot shows a terminal window with the following command and output:

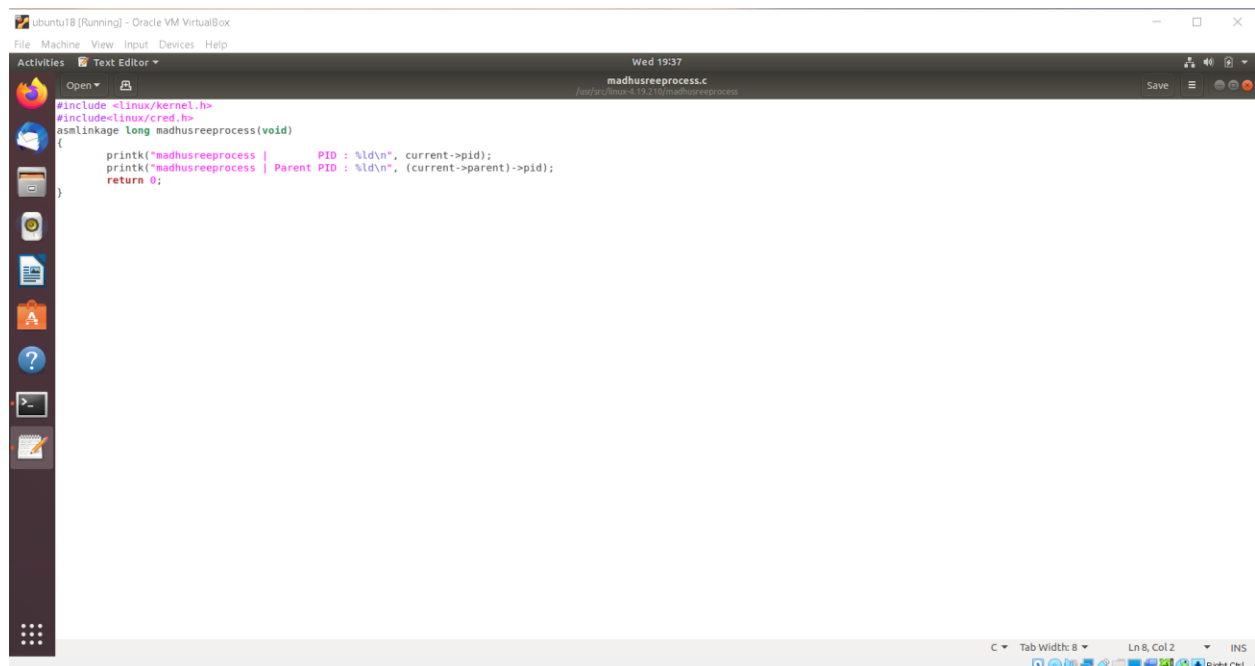
```
dmesg
[ 572.068406] madhusreeprint() called with string : AOS_ASSIGNMENT 2
madhusree@madhusree-VirtualBox:~$
```

Question 3

1. Create directory madhusreeprocess, inside it madhusreeprocess.c

```
mkdir madhusreeprocess
cd madhusreeprocess
gedit madhusreeprocess.c
```

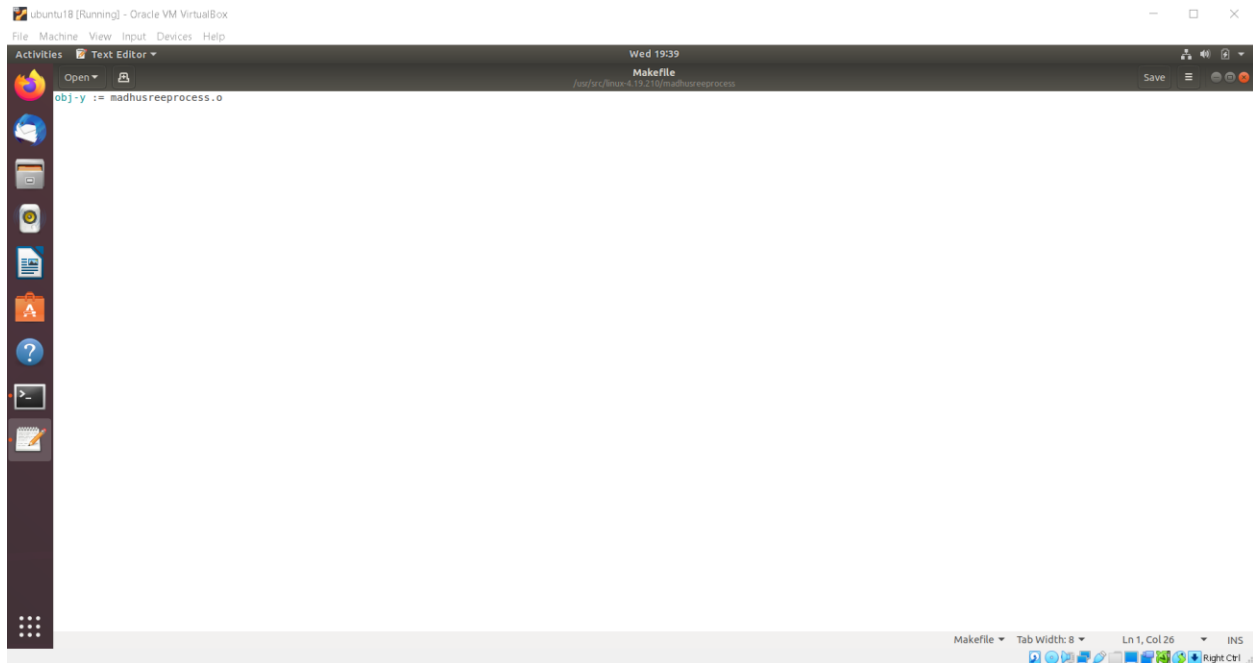
2.Code

A screenshot of a text editor window titled 'madhusreeprocess.c' within an Ubuntu 18.04 environment. The code defines a function 'madhusreeprocess' that prints the current process ID and its parent's PID. The code is as follows:

```
#include <linux/kernel.h>
#include <linux/cred.h>
asmLinkage long madhusreeprocess(void)
{
    printk("madhusreeprocess | PID : %ld\n", current->pid);
    printk("madhusreeprocess | Parent PID : %ld\n", (current->parent)->pid);
    return 0;
}
```

3.Create Makefile

```
gedit Makefile
```

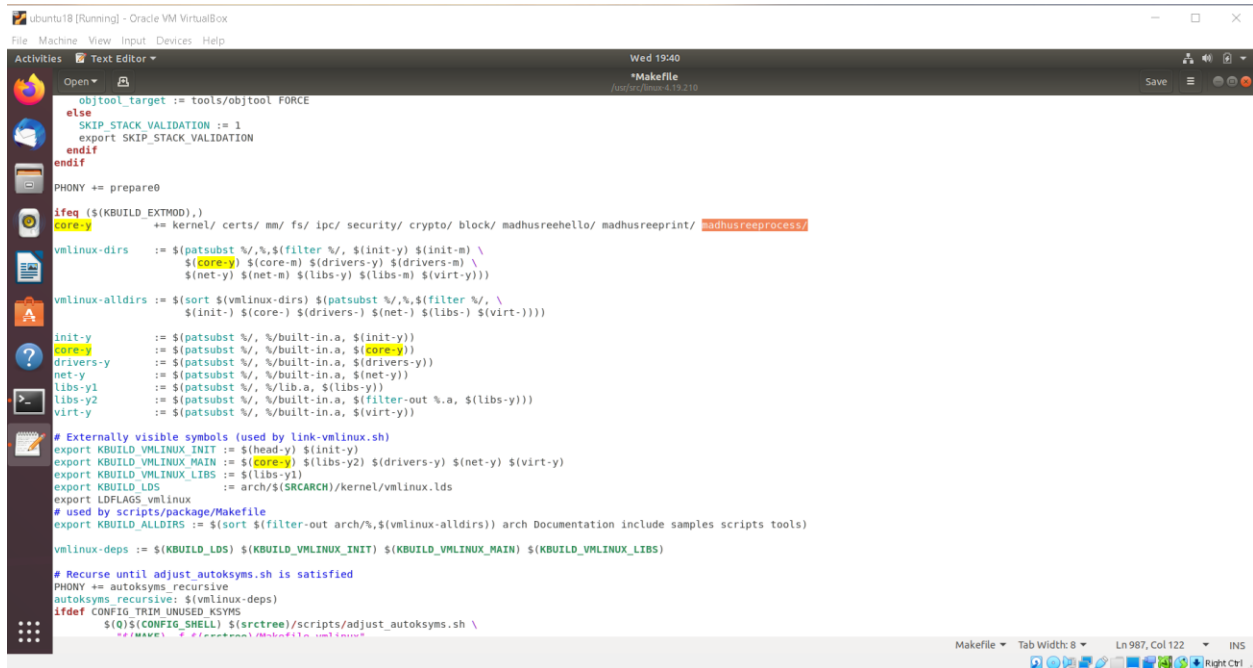



This is to ensure that the madhusreeprocess.c file is compiled and included in the kernel source code.

4.Go to parent and edit the makefile

```
cd ..  
gedit Makefile
```

Change the line and add madhusreeprocess/ at the end



```
objtool_target := tools/objtool FORCE
else
  SKIP_STACK_VALIDATION := 1
  export SKIP_STACK_VALIDATION
endif
endif

PHONY += prepare0

ifeq ($(KBUILD_EXTMOD),)
  core-y += kernel/ certs/ mm/ fs/ ipc/ security/ crypto/ block/ madhusreehello/ madhusreeprint/ madhusreeprocess/

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

vmlinux-alldirs := $(sort $(vmlinux-dirs) $(patsubst %/,%, $(filter %/, \
  $(init-y) $(core-y) $(drivers-y) $(net-y) $(libs-y) $(virt-y))))

init-y := $(patsubst %/, %, built-in.a, $(init-y))
core-y := $(patsubst %/, %, built-in.a, $(core-y))
drivers-y := $(patsubst %/, %, built-in.a, $(drivers-y))
net-y := $(patsubst %/, %, built-in.a, $(net-y))
libs-y1 := $(patsubst %/, %, lib.a, $(libs-y))
libs-y2 := $(patsubst %/, %, built-in.a, $(filter-out %.a, $(libs-y)))
virt-y := $(patsubst %/, %, built-in.a, $(virt-y))

# Externally visible symbols (used by link-vmlinux.sh)
export KBUILD_VMLINUX_INIT := $(head-y) $(init-y)
export KBUILD_VMLINUX_MAIN := $(core-y) $(libs-y2) $(drivers-y) $(net-y) $(virt-y)
export KBUILD_VMLINUX_LIBS := $(libs-y1)
export KBUILD_LDS := arch/$(SRCARCH)/kernel/vmlinux.lds
export LDLAGS_vmlinux
# used by scripts/package/Makefile
export KBUILD_ALLDIRS := $(sort $(filter-out arch/%, $(vmlinux-alldirs)) arch Documentation include samples scripts tools)

vmlinux-deps := $(KBUILD_LDS) $(KBUILD_VMLINUX_INIT) $(KBUILD_VMLINUX_MAIN) $(KBUILD_VMLINUX_LIBS)

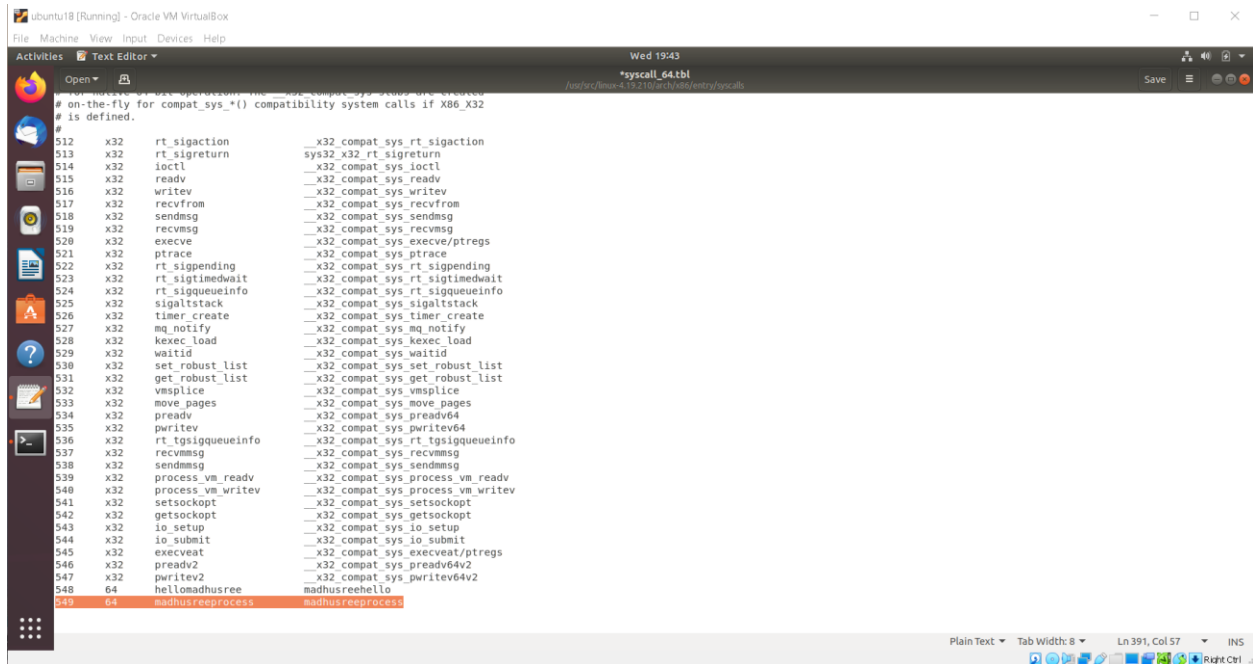
# Recurse until adjust_autoksyms.sh is satisfied
PHONY += autoksyms_recursive
autoksyms_recursive: $(vmlinux-deps)
ifdef CONFIG_TRIM_UNUSED_KSYMS
  $(Q)$(CONFIG_SHELL) $(srcroot)/scripts/adjust_autoksyms.sh \
    $(MAKE) -f $(srcroot)/Makefile -C $(srcroot)

Makefile Tab Width: 8 Ln 987, Col 122 INS
```

This is to tell the compiler that the source files of our new system call (madhusreeprocess()) are present in the madhusreeprocess directory.

5. Add the new system call to the table of system calls

```
cd arch/x86/entry/syscalls/
gedit syscall_64.tbl
```



The Syscall number is 549.

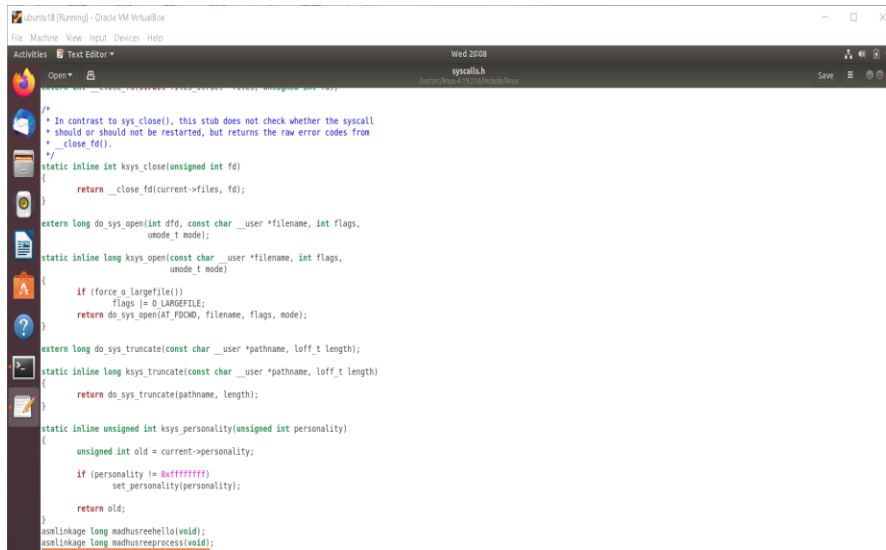
6. Add the syscall to the system call header file

From linux-4.19.210 directory
cd include/linux/
gedit syscalls.h

Add

asmlinkage long madhusreeprocess(void) ;

Before endif in last line



7. Compile the Kernel

```
sudo make -j4
```

-j 4 because we have allotted 4 cores to our VM. It will make the compilation process faster

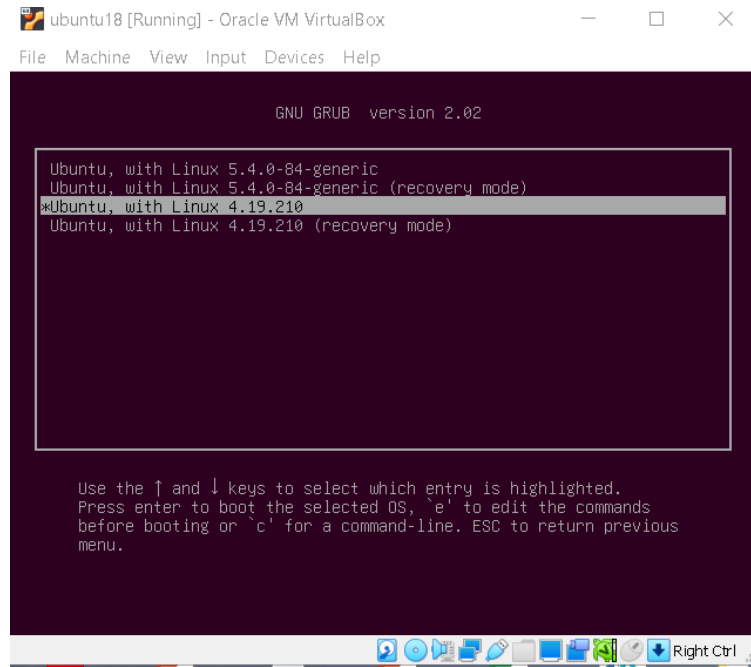
```
sudo make modules_install install
```

It will create some files under /boot/ directory and it will automatically make an entry in grub.cfg.

8. Reboot the system

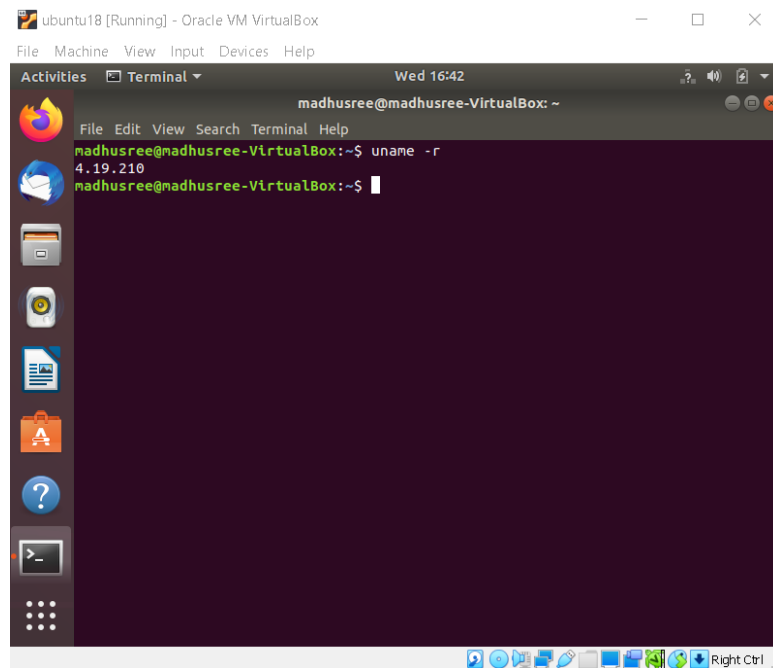
```
shutdown -r now
```


9.2 Select Ubuntu with Linux 4.19.210

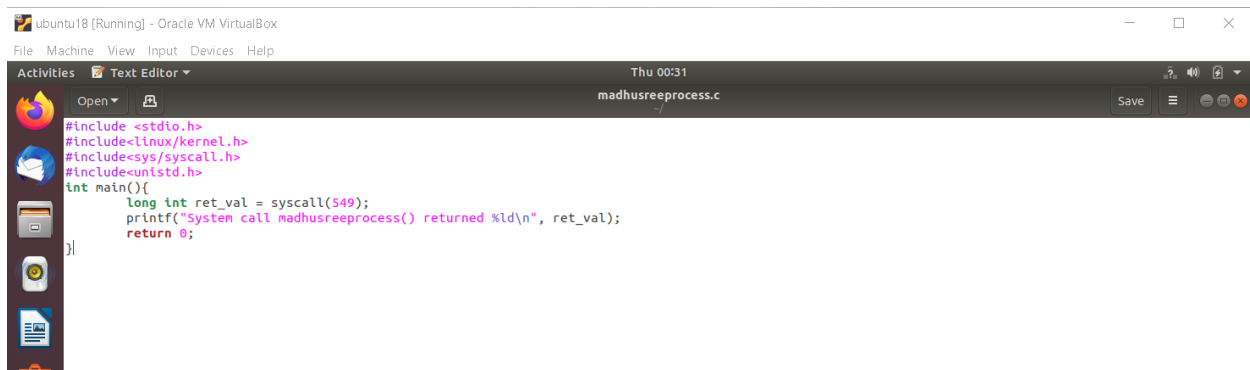


10. Confirm the kernel

uname -r



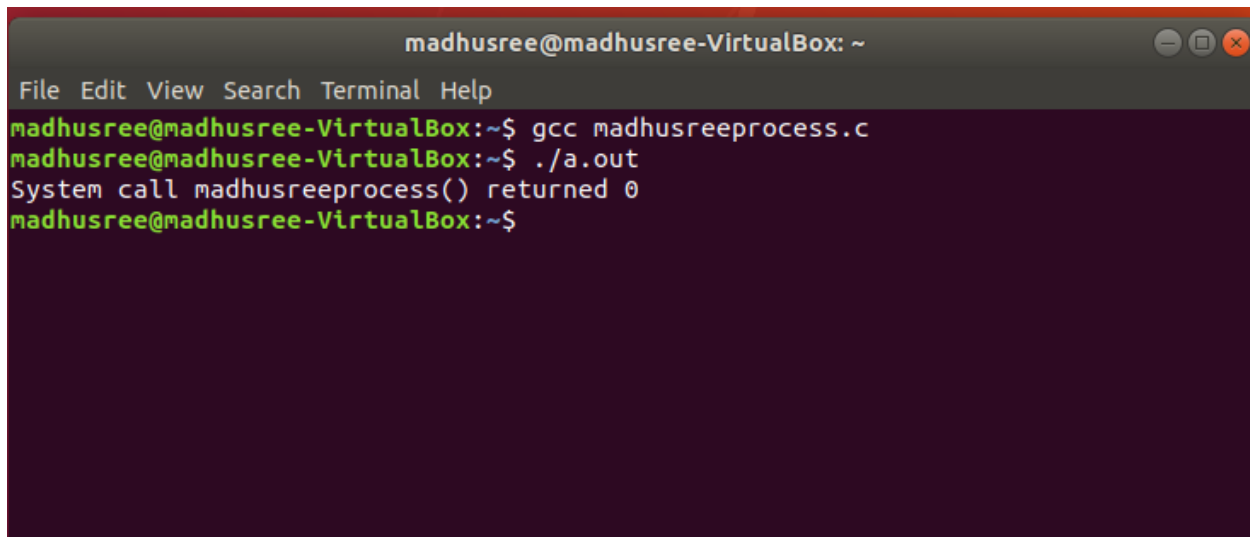
11. Create madhusreeprocess.c in ~/home and add the code

A screenshot of a text editor window titled 'madhusreeprocess.c' within an Ubuntu 18 virtual machine. The editor shows the following C code:

```
#include <stdio.h>
#include <linux/kernel.h>
#include <sys/syscall.h>
#include <unistd.h>

int main(){
    long int ret_val = syscall(549);
    printf("System call madhusreeprocess() returned %ld\n", ret_val);
    return 0;
}
```

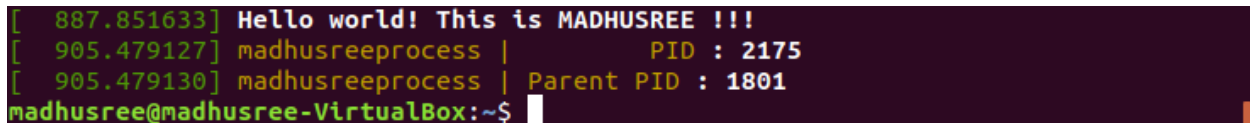
12. Compile and execute the code

A screenshot of a terminal window titled 'madhusree@madhusree-VirtualBox: ~'. The terminal shows the following commands and output:

```
File Edit View Search Terminal Help
madhusree@madhusree-VirtualBox:~$ gcc madhusreeprocess.c
madhusree@madhusree-VirtualBox:~$ ./a.out
System call madhusreeprocess() returned 0
madhusree@madhusree-VirtualBox:~$
```

13. Check the log

dmesg

A screenshot of a terminal window showing the output of the 'dmesg' command. The output is as follows:

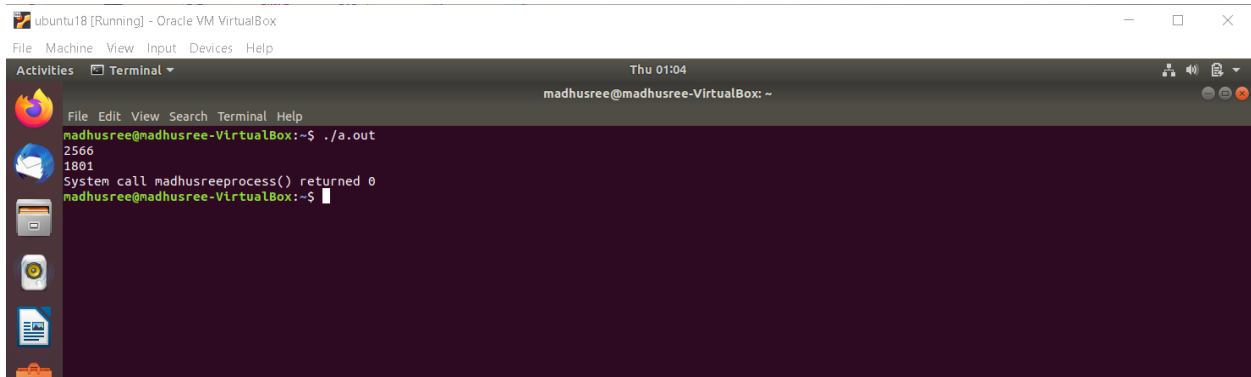
```
[ 887.851633] Hello world! This is MADHUSREE !!!
[ 905.479127] madhusreeprocess | PID : 2175
[ 905.479130] madhusreeprocess | Parent PID : 1801
madhusree@madhusree-VirtualBox:~$
```

Question: Are both the process ID s same

Answer:

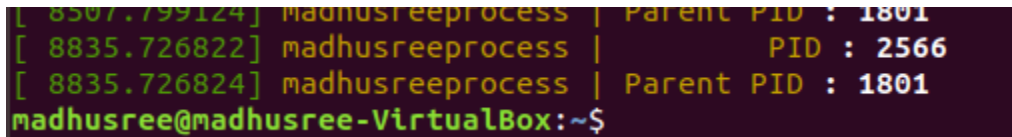
On executing getpid() and getppid()

Output



```
ubuntu18 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Thu 01:04
madhusree@madhusree-VirtualBox: ~
File Edit View Search Terminal Help
madhusree@madhusree-VirtualBox:~$ ./a.out
2566
1801
System call madhusreeprocess() returned 0
madhusree@madhusree-VirtualBox:~$
```

And output from system call on dmesg



```
[ 8507.799124] madhusreeprocess | Parent PID : 1801
[ 8835.726822] madhusreeprocess | PID : 2566
[ 8835.726824] madhusreeprocess | Parent PID : 1801
madhusree@madhusree-VirtualBox:~$
```

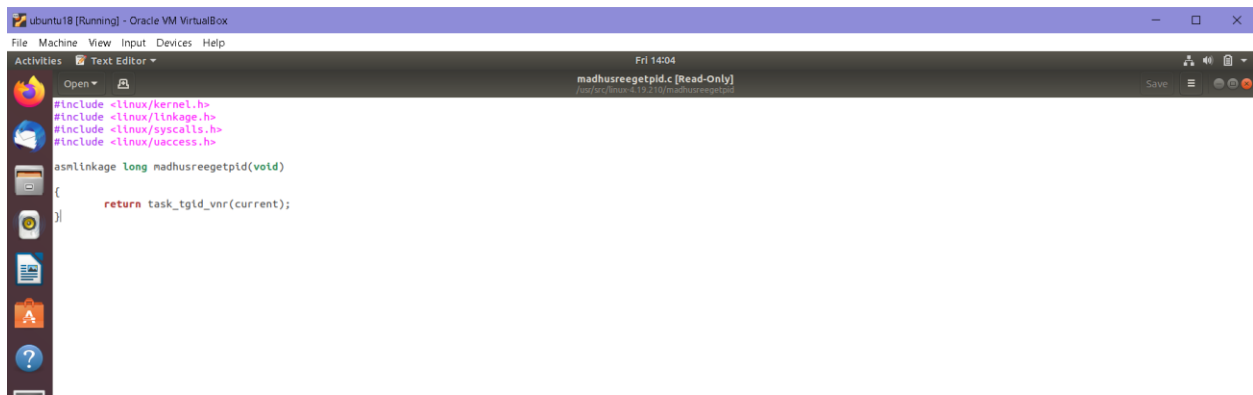
So getpid() and current->pid are the same.
getppid() and current->parent->pid are same.

Question 4

1. Create directory madhusreegetpid, inside it madhusreegetpid.c

```
mkdir madhusreegetpid
cd madhusreegetpid
gedit madhusreegetpid.c
```

2. Code

A screenshot of a text editor window titled 'madhusreegetpid.c [Read-Only]' with a timestamp of 'Fri 14:04'. The window shows the following C code:

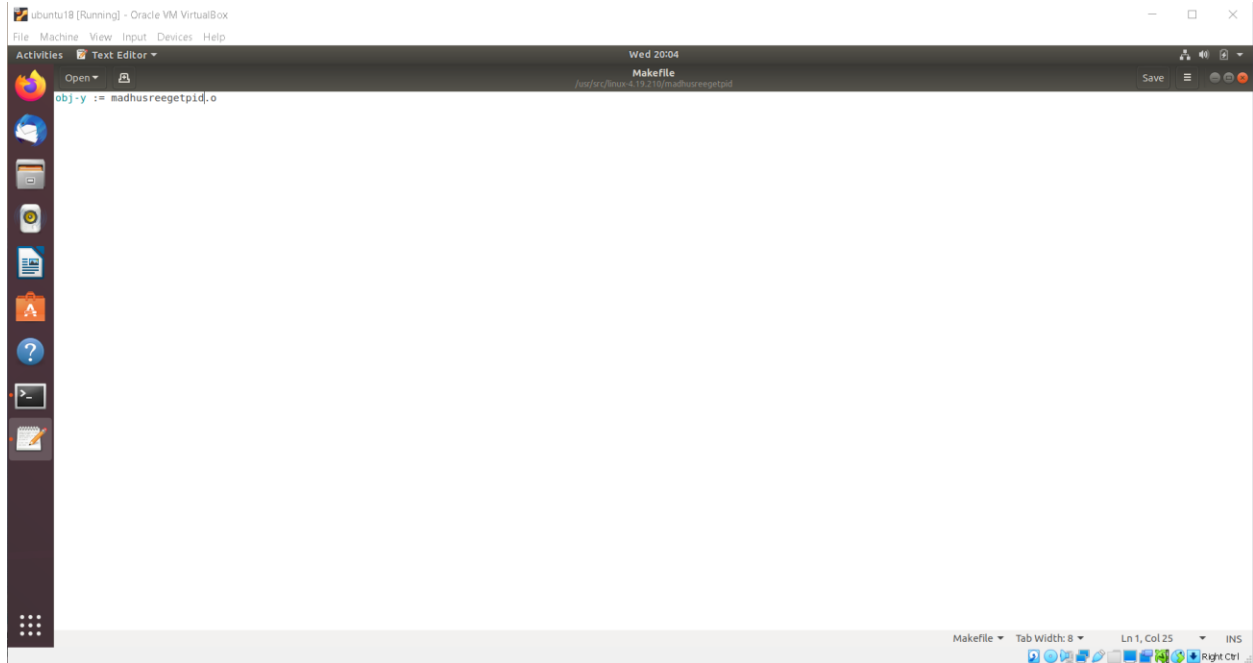
```
#include <linux/kernel.h>
#include <linux/linkage.h>
#include <linux/syscalls.h>
#include <linux/uaccess.h>

asmLinkage long madhusreegetpid(void)
{
    return task_tgid_vnr(current);
}
```

The editor has a menu bar with 'File', 'Machine', 'View', 'Input', 'Devices', and 'Help'. A sidebar on the left contains icons for various applications like Firefox, Files, and the Dash. The code is syntax-highlighted, with preprocessor directives in pink and function names in green.

3. Create Makefile

```
gedit Makefile
```

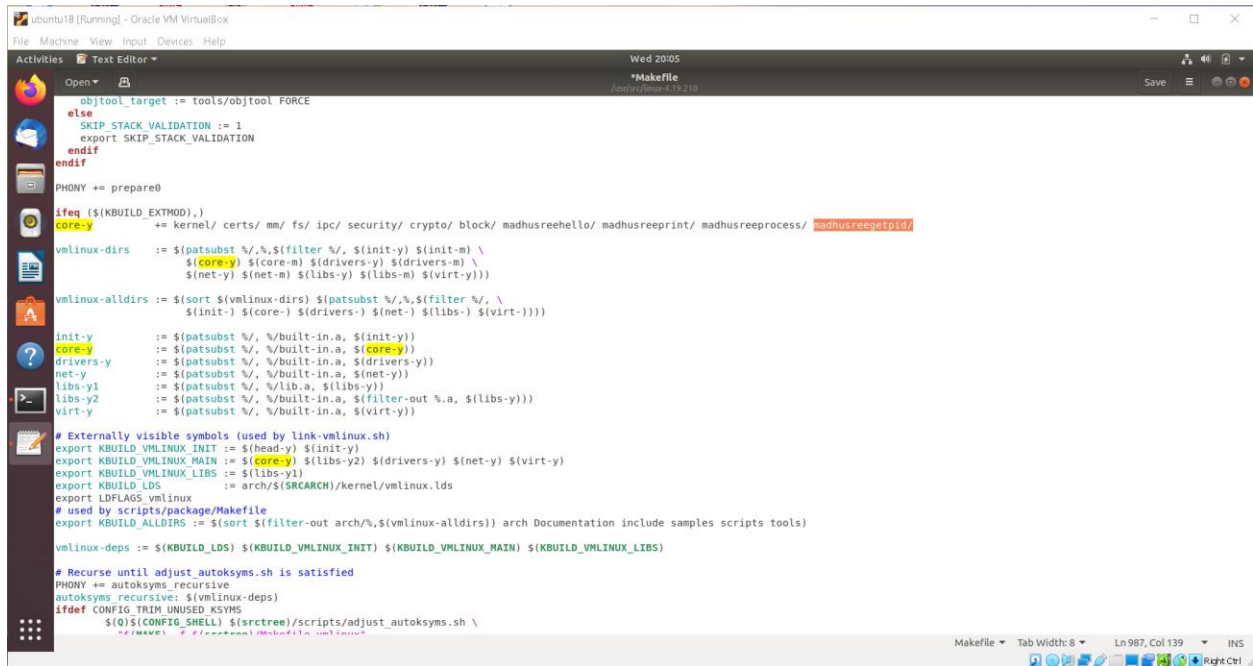


This is to ensure that the madhusreegetpid.c file is compiled and included in the kernel source code.

4.Go to parent and edit the makefile

```
cd ..  
gedit Makefile
```

Change the line and add madhusreegetpid/ at the end



```
objtool_target := tools/objtool FORCE
else
SKIP_STACK_VALIDATION := 1
export SKIP_STACK_VALIDATION
endif
endif

PHONY += prepare0

ifeq ($(KBUILD_EXTMOD),)
core-y += kernel/ certs/ mm/ fs/ ipc/ security/ crypto/ block/ madhusreehello/ madhusreeprint/ madhusreeprocess/ madhusreegetpid/

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

vmlinux-alldirs := $(sort $(vmlinux-dirs) $(patsubst %/, %,$(filter %/, \
$(init-y) $(core-y) $(drivers-y) $(net-y) $(libs-y) $(virt-y)))

init-y := $(patsubst %/, %/built-in.a, $(init-y))
core-y := $(patsubst %/, %/built-in.a, $(core-y))
drivers-y := $(patsubst %/, %/built-in.a, $(drivers-y))
net-y := $(patsubst %/, %/built-in.a, $(net-y))
libs-y1 := $(patsubst %/, %/lib.a, $(libs-y))
libs-y2 := $(patsubst %/, %/built-in.a, $(filter-out %.a, $(libs-y)))
virt-y := $(patsubst %/, %/built-in.a, $(virt-y))

# Externally visible symbols (used by link-vmlinux.sh)
export KBUILD_VMLINUX_INIT := $(head-y) $(init-y)
export KBUILD_VMLINUX_MAIN := $(core-y) $(libs-y2) $(drivers-y) $(net-y) $(virt-y)
export KBUILD_VMLINUX_LIBS := $(libs-y1)
export KBUILD_LDS := arch/$(SRCARCH)/kernel/vmlinux.lds
export LDFLAGS_vmlinux
# used by scripts/package/Makefile
export KBUILD_ALLDIRS := $(sort $(filter-out arch/%,$(vmlinux-alldirs)) arch Documentation include samples scripts tools)

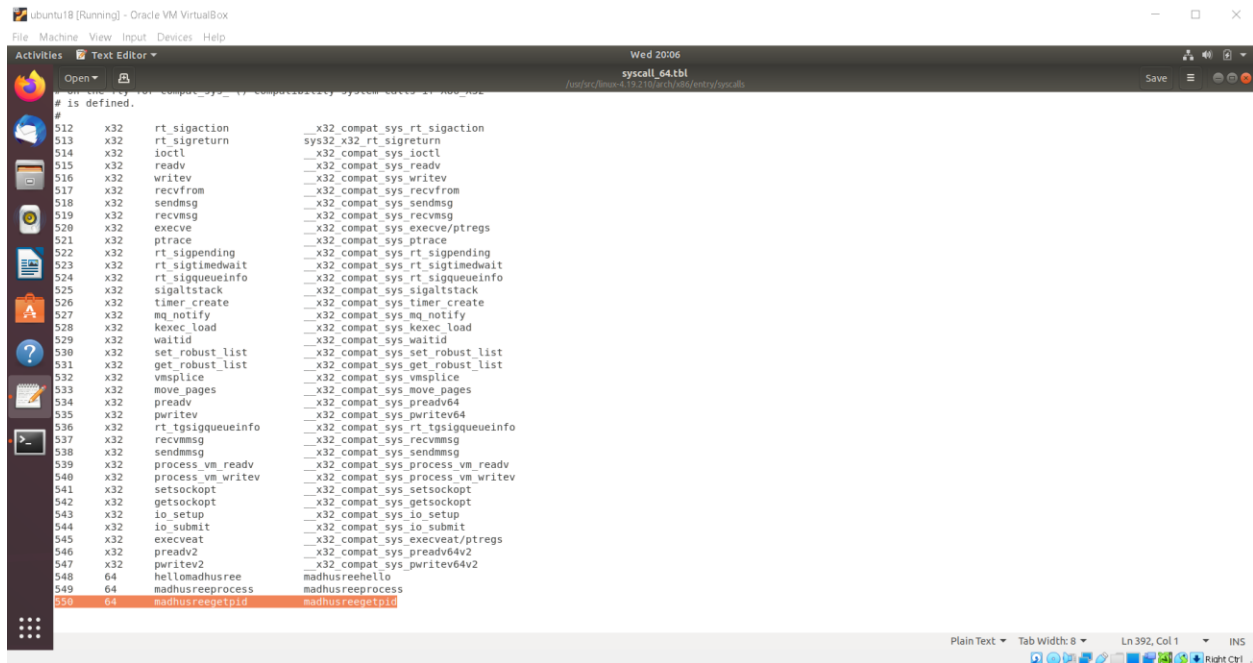
vmlinux-deps := $(KBUILD_LDS) $(KBUILD_VMLINUX_INIT) $(KBUILD_VMLINUX_MAIN) $(KBUILD_VMLINUX_LIBS)

# Recurse until adjust_autoksyms.sh is satisfied
PHONY += autoksyms_recursive
autoksyms_recursive: $(vmlinux-deps)
ifdef CONFIG_TRIM_UNUSED_KSYMS
$(Q)$(CONFIG_SHELL) $(srctree)/scripts/adjust_autoksyms.sh \
$(MAKE) -f $(srctree)/Makefile -C $(src) -j $(nproc) --
```

This is to tell the compiler that the source files of our new system call (madhusreegetpid()) are present in the madhusreegetpid directory.

5. Add the new system call to the table of system calls

```
cd arch/x86/entry/syscalls/
gedit syscall_64.tbl
```



The Syscall number is 550.

6. Add the syscall to the system call header file

From linux-4.19.210 directory

```
cd include/linux/
gedit syscalls.h
```

Add

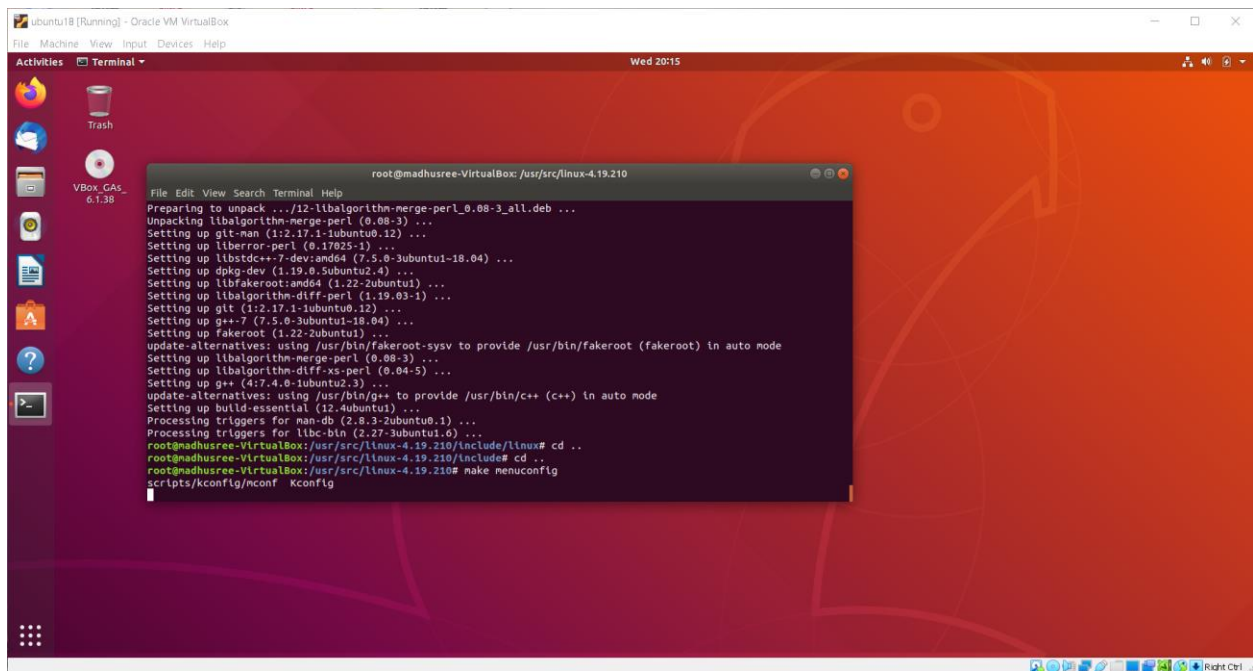
```
asmlinkage long madhusreegetpid(void);
```

Before endif in last line

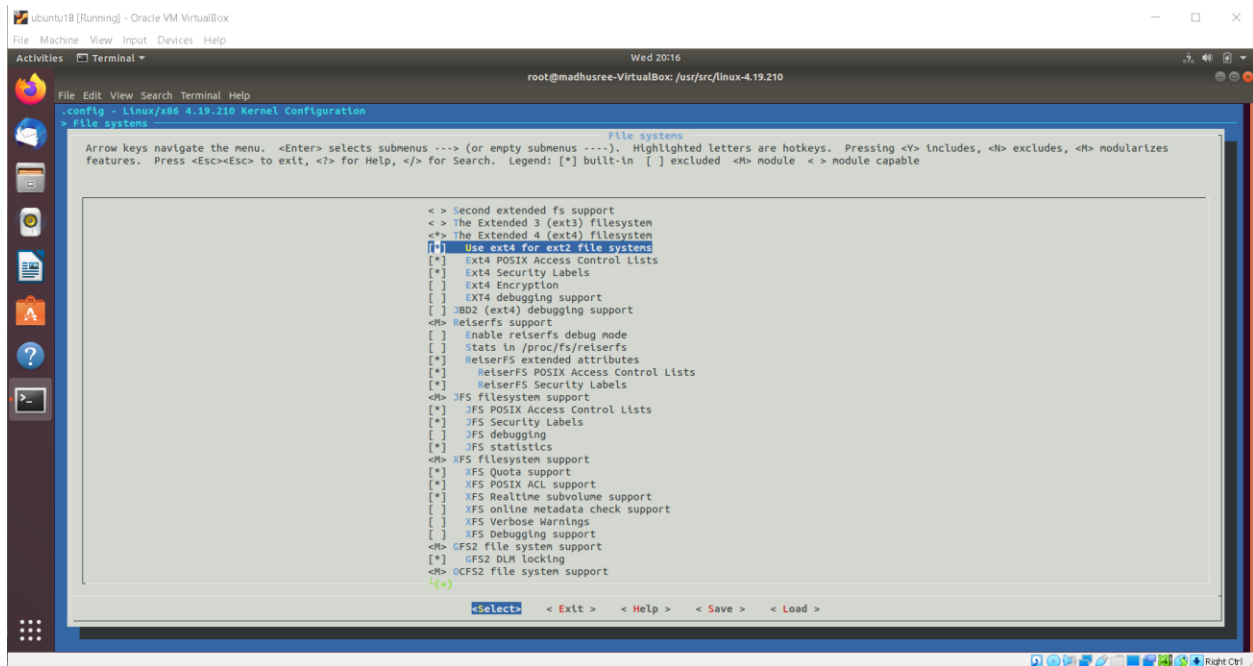


7. Compile the Kernel

sudo make menuconfig

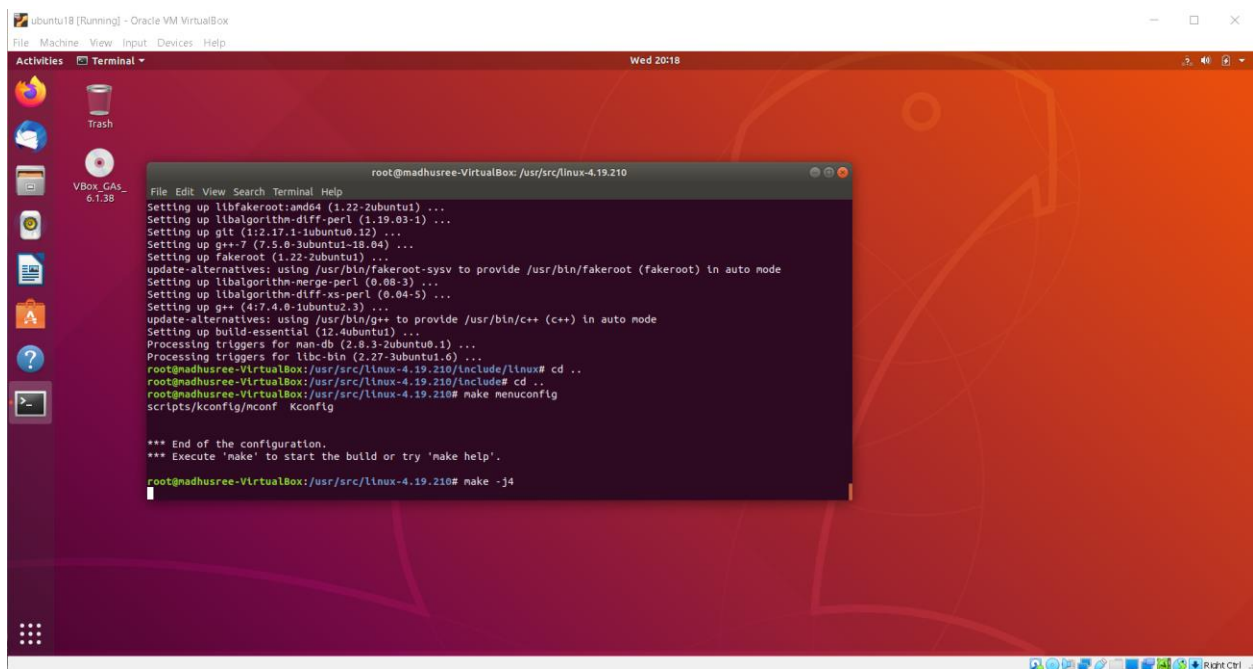


Check if ext4 is chosen in file systems



sudo make -j4

-j 4 because we have allotted 4 cores to our VM. It will make the compilation process faster

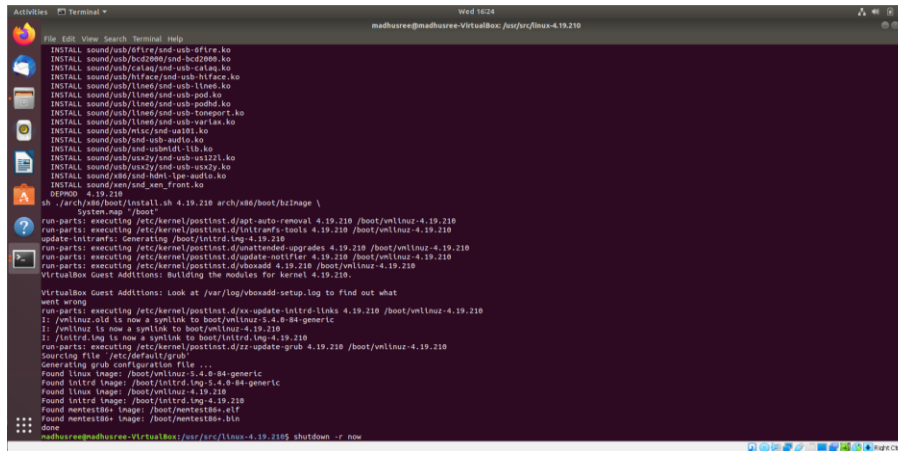


sudo make modules_install install

It will create some files under /boot/ directory and it will automatically make an entry in grub.cfg.

8. Reboot the system

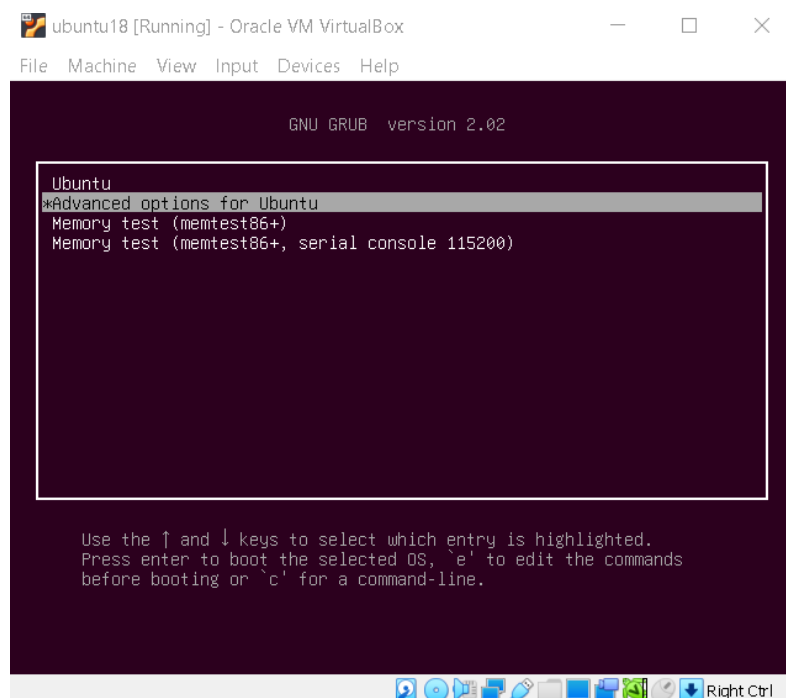
shutdown -r now



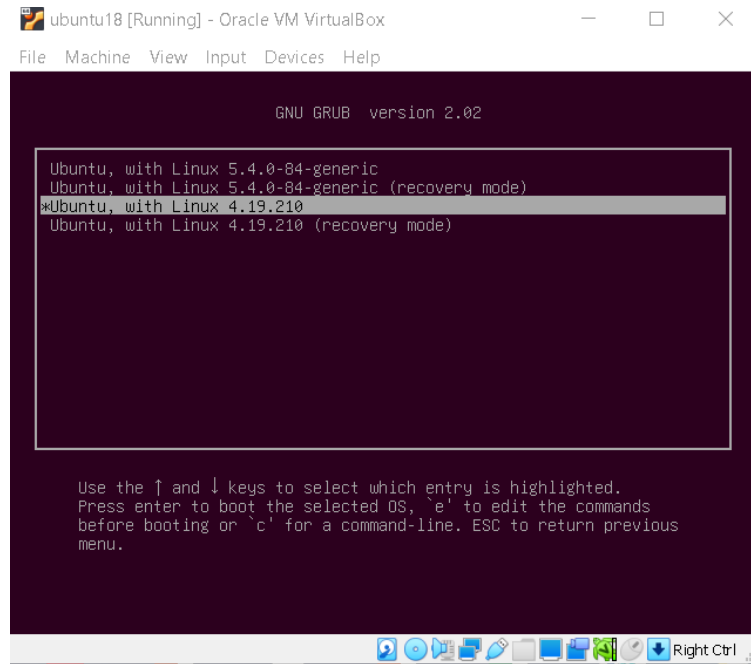
```
Activities Terminal
File Edit View Search Terminal Help
madhusree@madhusree-VirtualBox: /usr/src/linux-4.19.210
INSTALL sound/usb/lmi/snd-usb-6fire.ko
INSTALL sound/usb/lmi/snd-usb-6fire.ko
INSTALL sound/usb/lmi/snd-usb-6fire.ko
INSTALL sound/usb/lmi/snd-usb-6fire.ko
INSTALL sound/usb/lmi/snd-usb-6fire.ko
INSTALL sound/usb/lmi/snd-usb-6fire.ko
INSTALL sound/usb/lmi/snd-usb-6fire.ko
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INSTALL sound/usb/lmi/snd-usb-6fire.ko
INSTALL sound/usb/lmi/snd-usb-6fire.ko
INSTALL sound/usb/lmi/snd-usb-6fire.ko
DEPMOD 4.19.210
sh ./arch/arm/boot/install.sh 4.19.210 arch/arm/boot/zImage \
System.map "/boot"
run-parts: executing /etc/kernel/postinst.d/apt-auto-removal 4.19.210 /boot/vmlinuz-4.19.210
run-parts: executing /etc/kernel/postinst.d/initramfs-tools 4.19.210 /boot/vmlinuz-4.19.210
update-initramfs: Generating /boot/initrd.img-4.19.210
run-parts: executing /etc/kernel/postinst.d/unattended-upgrades 4.19.210 /boot/vmlinuz-4.19.210
run-parts: executing /etc/kernel/postinst.d/update-notifier 4.19.210 /boot/vmlinuz-4.19.210
run-parts: executing /etc/kernel/postinst.d/udevadm 4.19.210 /boot/vmlinuz-4.19.210
VirtualBox Guest Additions: Building the modules for kernel 4.19.210.
VirtualBox Guest Additions: Look at /var/log/vboxadd-setup.log to find out what
went wrong
run-parts: executing /etc/kernel/postinst.d/xs-update-initrd-links 4.19.210 /boot/vmlinuz-4.19.210
i: /vmlinuz.old is now a symlink to boot/vmlinuz-5.4.0-84-generic
i: /initrd is now a symlink to boot/initrd-4.19.210
i: /initrd.img is now a symlink to boot/initrd.img-4.19.210
run-parts: executing /etc/kernel/postinst.d/xx-update-grub 4.19.210 /boot/vmlinuz-4.19.210
Sourcing file /etc/default/grub
Generating grub configuration file ...
Found linux image: /boot/vmlinuz-5.4.0-84-generic
Found initrd image: /boot/initrd.img-5.4.0-84-generic
Found linux image: /boot/vmlinuz-4.19.210
Found initrd image: /boot/initrd.img-4.19.210
Found memtest86+ image: /boot/memtest86+.elf
Found memtest86+ image: /boot/memtest86+.bin
done
madhusree@madhusree-VirtualBox: /usr/src/linux-4.19.210$ shutdown -r now
```

9. Boot the system using kernel linux-4.19.210

9.1. Select advanced options for Ubuntu

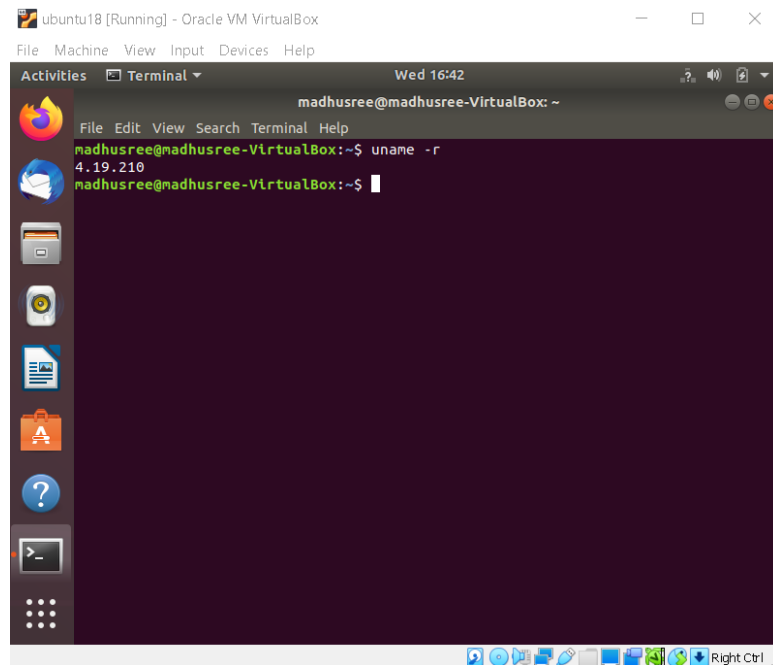


9.2 Select Ubuntu with Linux 4.19.210



10. Confirm the kernel

uname -r



11. Create madhusreegetpid.c in ~/home and add the code

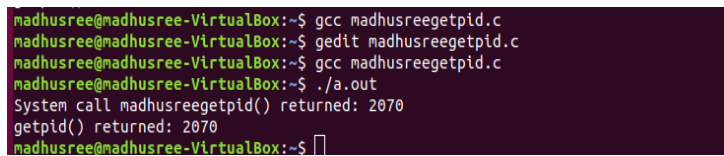


The screenshot shows a text editor window titled "Text Editor" with the file "madhusreegetpid.c" open. The code is as follows:

```
#include <stdio.h>
#include <linux/kernel.h>
#include <sys/syscall.h>
#include <unistd.h>

int main(){
    long int ret_val = syscall(550);
    printf("System call madhusreegetpid() returned: %ld\n", ret_val);
    printf("getpid() returned: %d\n", getpid());
    return 0;
}
```

12. Compile and execute the code



The screenshot shows a terminal window with the following commands and output:

```
madhusree@madhusree-VirtualBox:~$ gcc madhusreegetpid.c
madhusree@madhusree-VirtualBox:~$ gedit madhusreegetpid.c
madhusree@madhusree-VirtualBox:~$ gcc madhusreegetpid.c
madhusree@madhusree-VirtualBox:~$ ./a.out
System call madhusreegetpid() returned: 2070
getpid() returned: 2070
madhusree@madhusree-VirtualBox:~$
```