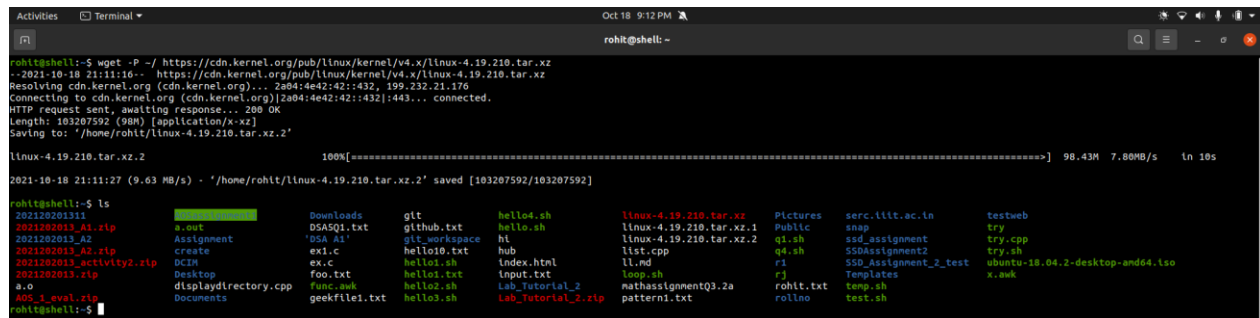


Assignment 2

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Step1:- I downloaded linux kernel 4.19.210 using “wget
<https://cdn.kernel.org/pub/linux/kernel/v4.x/linux-4.19.210.tar.xz>”



```
rohit@shell:~$ wget -P ~/ https://cdn.kernel.org/pub/linux/kernel/v4.x/linux-4.19.210.tar.xz
--2021-10-18 21:11:16-- https://cdn.kernel.org/pub/linux/kernel/v4.x/linux-4.19.210.tar.xz
Resolving cdn.kernel.org (cdn.kernel.org)... 2a04:4e42:42::432, 199.232.21.176
Connecting to cdn.kernel.org (cdn.kernel.org)[2a04:4e42:42::432]:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 103207592 (98M) [application/x-xz]
Saving to: '/home/rohit/linux-4.19.210.tar.xz.2'

linux-4.19.210.tar.xz.2      100%[=====] 98.43M  7.80MB/s   in 10s

2021-10-18 21:11:27 (9.63 MB/s) - '/home/rohit/linux-4.19.210.tar.xz.2' saved [103207592/103207592]

rohit@shell:~$ ls
202120201311  Downloads  git  hello4.sh  linux-4.19.210.tar.xz  Pictures  serc.lit.ac.in  testweb
2021202013_A1.zip  .out  DSASQ1.txt  github.txt  hello.sh  Public  snap  try
2021202013_A2  Assignment  'DSA A1'  git-workspace  hl  q1.sh  ssd_assignment  try.cpp
2021202013_A2.zip  create  ex1.c  hello10.txt  hub  q4.sh  SSDAssignment2  try.sh
2021202013_activity2.zip  DCIM  ex.c  hello1.sh  index.html  r1  SSD_Assignment_2_test  ubuntu-18.04.2-desktop-amd64.iso
2021202013.zip  Desktop  foo.txt  hello1.txt  input.txt  rj  Templates  x.awk
a.o  displaydirectory.cpp  func.awk  hello2.sh  Lab_Tutorial_2  rohit.txt  temp.sh
AOS_1_eval.zip  Documents  geekfile1.txt  hello3.sh  Lab_Tutorial_2.zip  pattern1.txt  rollno  test.sh
rohit@shell:~$
```

Step2:- Extracted kernel using this

```
rohit@shell:~$ tar -xvf linux-4.19.210.tar.xz
```

Now, we implement 4 system calls for different purposes and below are listed one by one with explanation.

Q1:- Created a system call “**rohithello()**” which when called print “hello world” on kernel log(dmesg).

-> I made directory name rohithello containing rohithello.c which is containing code to print hello world and Makefile to get rohithello.c compiled and included in kernel source code.

```
rohit@shell:~$ cd linux-4.19.210
rohit@shell:~/linux-4.19.210$ mkdir rohithello
rohit@shell:~/linux-4.19.210$ cd rohithello
rohit@shell:~/linux-4.19.210/rohithello$ touch rohithello.c
rohit@shell:~/linux-4.19.210/rohithello$ touch Makefile
rohit@shell:~/linux-4.19.210/rohithello$
```

-> Here I edited system Makefile because we need to tell the compiler that we have new system call which is present in rohithello directory.

```
PHONY += prepare0

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

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

-> Here I have added system call to system call header file.

```
    return old;
}
asmlinkage long rohithello(void);
```

-> Added new "rohithello" system call entry to system call table syscall_64.tbl , here 64 refers to 64bit system.

546	x32	preadv2	__x32_compat_sys_preadv64v2
547	x32	pwritev2	__x32_compat_sys_pwritev64v2
548	64	rohit1	rohithello

->Code of rohithello.c

```
1 #include <linux/kernel.h>
2
3 SYSCALL_DEFINE0(rohithello)
4 {
5     printk("Hello world\n");
6     return 0;
7 }
```

->code of Makefile

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

Q2:- System Call "rohitprint(string)" will take string as parameter and print it along message to linux log

-> Made file "rohitprint.c" in directory roithello

```
rohit@shell:~/linux-4.19.210/roithello$ touch rohitprint.c
rohit@shell:~/linux-4.19.210/roithello$
```

-> Made changes in Makefile in roithello directory

```
1 obj-y := roithello.o rohitprint.c
```

-> Here I have added system call to system call header file.

```
05 asmlinkage long roithello(void);
06 asmlinkage long rohitprint(char *);
07
08 #endif
```

-> Added new "rohitprint" system call entry to system call table syscall_64.tbl

547	x32	pwrttev2	__x32_compat_sys_pwrttev64v2
548	64	rohit1	roithello
549	64	rohit2	rohitprint

->Code of rohitprint.c

```

1 #include <linux/syscalls.h>
2 #include <linux/kernel.h>
3
4 SYSCALL_DEFINE1(rohitprint, char *,buf)
5 {
6     char buffer[256];
7     long copied = strncpy_from_user(buffer,buf, sizeof(buffer));
8     printk("Rohit's system call returned this\n");
9     return 0;
10 }

```

Q3:- This “rohitprocess()” system when called print parent and current process id.
The file containing code is in rohithello named rohitprocess.c

```

rohit@shell:~/linux-4.19.210/rohithello$ touch rohitprocess.c
rohit@shell:~/linux-4.19.210/rohithello$

```

-> Accordingly edited Makefile in rohithello to get it compiled and included in source code of kernel

```

1 obj-y := rohithello.o rohitprint.c rohitprocess.o

```

-> Here I have added system call to system call header file.

```

1295 asmlinkage long rohithello(void);
1296 asmlinkage long rohitprint(char *);
1297 asmlinkage long rohitprocess(void);
1298

```

> Added new “rohitprocess” system call entry to system call table syscall_64.tbl

389	548	64	rohit1	rohithello
390	549	64	rohit2	rohitprint
391	550	64	rohit3	rohitprocess

-> Code for "rohitprocess"

```
1 #include <linux/syscalls.h>
2 #include <linux/kernel.h>
3 #include <linux/cred.h>
4 #include <linux/sched.h>
5
6 SYSCALL_DEFINE0(rohitprocess)
7 {
8     printk("Parent Process Id: ",current->parent->pid);
9     printk("Child Process Id: ",current->pid);
10    return 0;
11 }
```

Q4:- This system call "rohitgetpid" calls another predefined system call "task_tgid_vnr(current)" which will return current process id.

-> Making rohitgetpid

```
rohit@shell:~/linux-4.19.210/rohithello$ touch rohitgetpid.c
rohit@shell:~/linux-4.19.210/rohithello$
```

-> Updating Makefile

```
1 obj-y := rohithello.o rohitprint.c rohitprocess.o rohitgetpid.o
```

-> Adding system call entry to system table

390	549	64	rohit2	rohitprint
391	550	64	rohit3	rohitprocess
392	551	64	rohit4	rohitgetpid

-> Adding system call to system call header file

```
5 asmlinkage long rohithello(void);
6 asmlinkage long rohitprint(char *);
7 asmlinkage long rohitprocess(void);
8 asmlinkage long rohitgetpid(void);
```

-> The following system call have following code

```
1 #include <linux/syscalls.h>
2 #include <linux/kernel.h>
3 #include <linux/cred.h>
4 #include <linux/sched.h>
5
6 SYSCALL_DEFINE0(rohitgetpid)
7 {
8     return task_tgid_vnr(current);
9 }
```