Yasin Balcancı
21501109

1)
Downloaded ISO file of the 16.04.5 version of Ubuntu.
Installed Ubuntu alongside with my pre-installed Windows 10. During installation, Ubuntu saw that there is already a Windows existing, it asked me if I want to override it or set up Ubuntu alongside it and because I already had an unused disk partition of 200GB, so it was easy to follow the basic steps and install Ubuntu.

10 commands learnt:
sudo
cd
ls
dir
mkdir
strace
chmod
apt-get
uname

2)
Linux kernel executable(vmlinuz) resides in directory /boot.
kernel version: 4.15.0-34

3)
Downloaded kernel source code from kernel.org (version: 4.14.72)
Subdirectories of the kernel directory:
arch, block, certs, crypto, Documentation, drivers, firmware, fs, include, init, ipc, kernel, lib, mm, net, samples, scripts, security, sound, tools, usr, virt

4)
Sample output of command strace mkdir new:

```
execve("/bin/mkdir", ["mkdir", "new"], [/* 70 vars */]) = 0
brk(NULL)                               = 0xa3c000
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
access("/etc/ld.so.preload", R_OK)      = -1 ENOENT (No such file or directory)
open("/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=99171, ...}) = 0
mmap(NULL, 99171, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f5f7d1f8000
close(3)                                = 0
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
open("/lib/x86_64-linux-gnu/libselinux.so.1", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\260Z\0\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=130224, ...}) = 0
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f5f7d1f7000
mmap(NULL, 2234080, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f5f7cdca000
mprotect(0x7f5f7cde9000, 2093056, PROT_NONE) = 0
mmap(0x7f5f7cfe8000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1e000) =
0x7f5f7cfe8000
mmap(0x7f5f7cfea000, 5856, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) =
0x7f5f7cfea000
close(3)                                = 0
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
open("/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\t\2\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0755, st_size=1868984, ...}) = 0
mmap(NULL, 3971488, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f5f7ca00000
mprotect(0x7f5f7cbc0000, 2097152, PROT_NONE) = 0
mmap(0x7f5f7cdc0000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1c0000) =
0x7f5f7cdc0000
mmap(0x7f5f7cdc6000, 14752, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) =
0x7f5f7cdc6000
close(3)                                = 0
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
open("/lib/x86_64-linux-gnu/libpcre.so.3", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0000\25\0\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=456632, ...}) = 0
mmap(NULL, 2552072, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f5f7c790000
mprotect(0x7f5f7c7fe000, 2097152, PROT_NONE) = 0
mmap(0x7f5f7c9fe000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x6e000) =
0x7f5f7c9fe000
```

```
close(3)                                = 0
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
open("/lib/x86_64-linux-gnu/libdl.so.2", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\240\r\0\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=14608, ...}) = 0
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f5f7d1f6000
mmap(NULL, 2109680, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f5f7c58c000
mprotect(0x7f5f7c58f000, 2093056, PROT_NONE) = 0
mmap(0x7f5f7c78e000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) =
0x7f5f7c78e000
close(3)                                = 0
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
open("/lib/x86_64-linux-gnu/libpthread.so.0", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\260`\0\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0755, st_size=138696, ...}) = 0
mmap(NULL, 2212904, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f5f7c36f000
mprotect(0x7f5f7c387000, 2093056, PROT_NONE) = 0
mmap(0x7f5f7c586000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x17000) =
0x7f5f7c586000
mmap(0x7f5f7c588000, 13352, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) =
0x7f5f7c588000
close(3)                                = 0
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f5f7d1f5000
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f5f7d1f3000
arch_prctl(ARCH_SET_FS, 0x7f5f7d1f3800) = 0
mprotect(0x7f5f7cdc0000, 16384, PROT_READ) = 0
mprotect(0x7f5f7c586000, 4096, PROT_READ) = 0
mprotect(0x7f5f7c78e000, 4096, PROT_READ) = 0
mprotect(0x7f5f7c9fe000, 4096, PROT_READ) = 0
mprotect(0x7f5f7cfe8000, 4096, PROT_READ) = 0
mprotect(0x611000, 4096, PROT_READ)     = 0
mprotect(0x7f5f7d211000, 4096, PROT_READ) = 0
munmap(0x7f5f7d1f8000, 99171)           = 0
set_tid_address(0x7f5f7d1f3ad0)         = 8942
set_robust_list(0x7f5f7d1f3ae0, 24)     = 0
rt_sigaction(SIGRTMIN, {0x7f5f7c374b50, [], SA_RESTORER|SA_SIGINFO, 0x7f5f7c380390}, NULL, 8) = 0
rt_sigaction(SIGRT_1, {0x7f5f7c374be0, [], SA_RESTORER|SA_RESTART|SA_SIGINFO, 0x7f5f7c380390}, NULL, 8) = 0
rt_sigprocmask(SIG_UNBLOCK, [RTMIN RT_1], NULL, 8) = 0
getrlimit(RLIMIT_STACK, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
statfs("/sys/fs/selinux", 0x7ffcab29e4f0) = -1 ENOENT (No such file or directory)
statfs("/selinux", 0x7ffcab29e4f0)      = -1 ENOENT (No such file or directory)
brk(NULL)                               = 0xa3c000
brk(0xa5d000)                           = 0xa5d000
open("/proc/filesystems", O_RDONLY)     = 3
fstat(3, {st_mode=S_IFREG|0444, st_size=0, ...}) = 0
read(3, "nodev\tsysfs\nnodev\trootfs\nnodev\tr"..., 1024) = 383
read(3, "", 1024)                       = 0
close(3)                                = 0
open("/usr/lib/locale/locale-archive", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=11654992, ...}) = 0
mmap(NULL, 11654992, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f5f7b851000
close(3)                                = 0
mkdir("new", 0777)                      = 0
close(1)                                = 0
close(2)                                = 0
exit_group(0)                           = ?
+++ exited with 0 +++
```

```
ybalcanci@ybalcanci:~/Desktop$ strace mkdir new
execve("/bin/mkdir", ["mkdir", "new"], [/* 70 vars */]) = 0
brk(NULL)                               = 0xa3c000
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
access("/etc/ld.so.preload", R_OK)      = -1 ENOENT (No such file or directory)
open("/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=99171, ...}) = 0
mmap(NULL, 99171, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f5f7d1f8000
close(3)                                = 0
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
open("/lib/x86_64-linux-gnu/libselinux.so.1", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\260Z\0\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=130224, ...}) = 0
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f5f7d1f7000
mmap(NULL, 2234080, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f5f7cdca000
mprotect(0x7f5f7cde9000, 2093056, PROT_NONE) = 0
mmap(0x7f5f7cfe8000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1e000) = 0x7f5f7cfe8000
mmap(0x7f5f7cfea000, 5856, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f5f7cfea000
close(3)                                = 0
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
open("/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\t\2\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0755, st_size=1868984, ...}) = 0
mmap(NULL, 3971488, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f5f7ca00000
mprotect(0x7f5f7cbc0000, 2097152, PROT_NONE) = 0
mmap(0x7f5f7cdc0000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1c0000) = 0x7f5f7cdc0000
mmap(0x7f5f7cdc6000, 14752, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f5f7cdc6000
close(3)                                = 0
access("/etc/ld.so.nohwcap", F_OK)      = -1 ENOENT (No such file or directory)
open("/lib/x86_64-linux-gnu/libpcre.so.3", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0000\25\0\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0644, st_size=456632, ...}) = 0
mmap(NULL, 2552072, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f5f7c790000
mprotect(0x7f5f7c7fe000, 2097152, PROT_NONE) = 0
mmap(0x7f5f7c9fe000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x6e000) = 0x7f5f7c9fe000
```

5)

-open() system call was called for files with 100, 1000, 10,000, 100,000 and 1,000,000 bytes; the time need for this process did not change much.
-read() system call was called for files with 100, 1000, 10,000, 100,000 and 1,000,000 bytes; the time need for this process did not change.
-write() system call was called for data with 100, 1000, 10,000, 100,000 and 1,000,000 bytes; the time need for this process changed as the amount of data changed. It took longer time for processes to be completed for the first time and then the time required decreased, but when the data amount were significantly big, the process took much longer time.

Bytes	open()*	read()	write()	mkdir()	getpid()
no byte parameter				11	2
100	14	1	64		
1000	2	1	17		
10000	10	1	22		
100000	5	1	157		
1000000	6	1	1014		

*open() also does not have a byte parameter. Shown bytes are the sizes of opened files.

Statistics:
open():
Mean: 7.4 , Standard Deviation: 4.18
read():
Mean: 1 , Standard Deviation: 0
write():
Mean: 254.8 , Standard Deviation: 382.9