

ECE 4310
Operating Systems for Embedded Application

Project 3

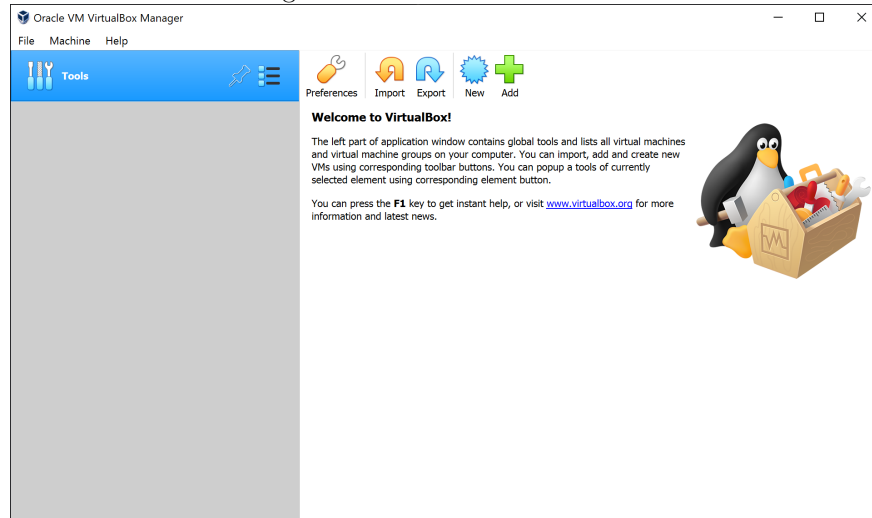
Choi Tim Antony Yung

May 13, 2021

1 Virtual Machine Initialization

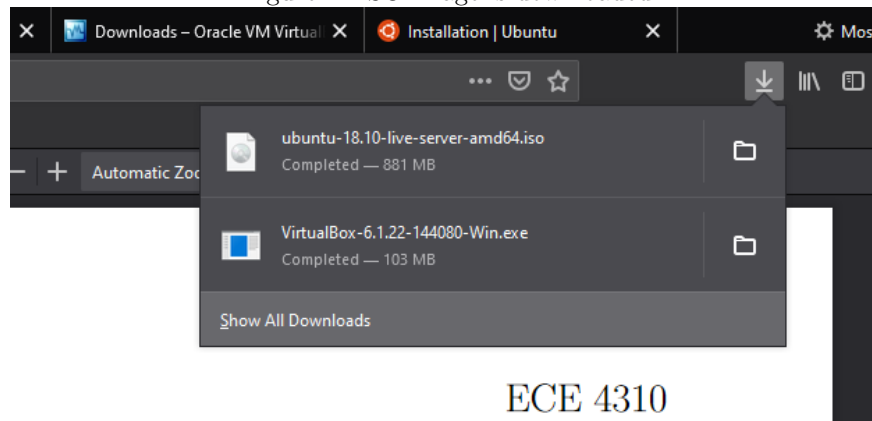
1.1 Download and install VirtualBox

Figure 1: VirtualBox is installed



1.2 Download Ubuntu Server 18.10

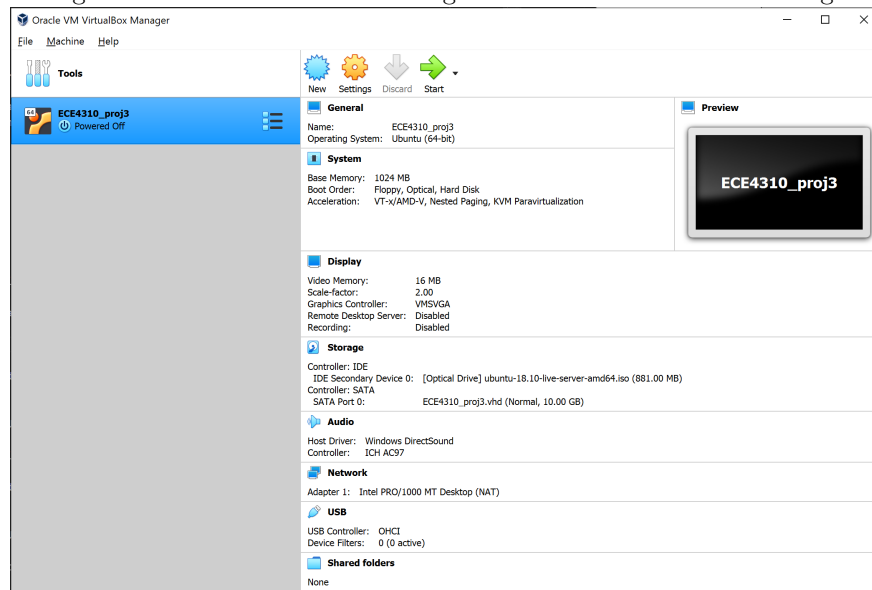
Figure 2: ISO image is downloaded



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1.3 Create VM

Figure 3: VM is created and configured to boot with Live CD image



1.4 Install Ubuntu

Figure 4: Ubuntu is being installed

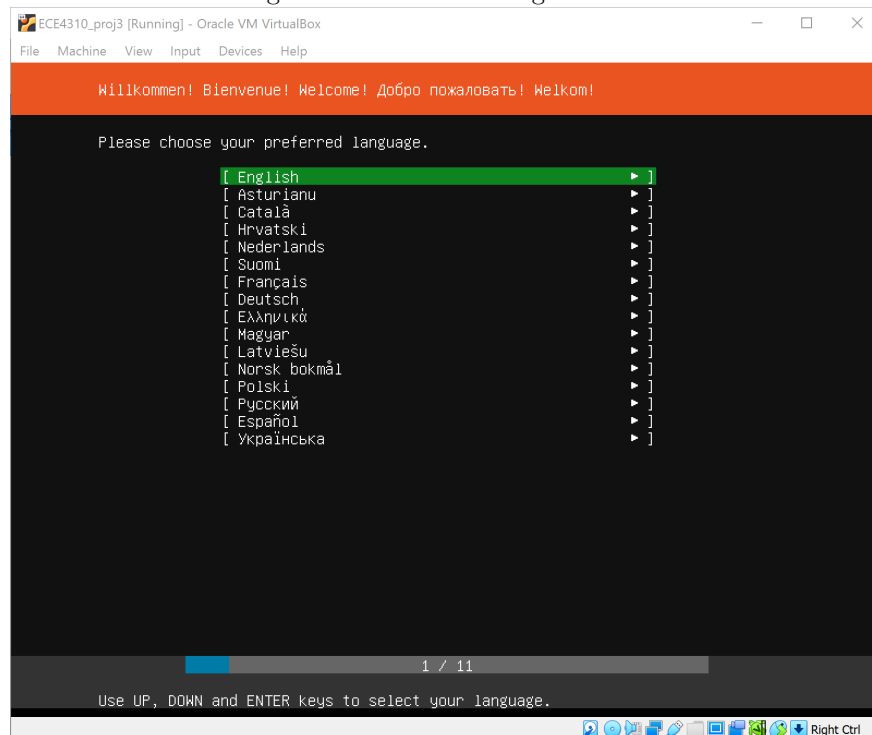


Figure 5: Ubuntu is being installed

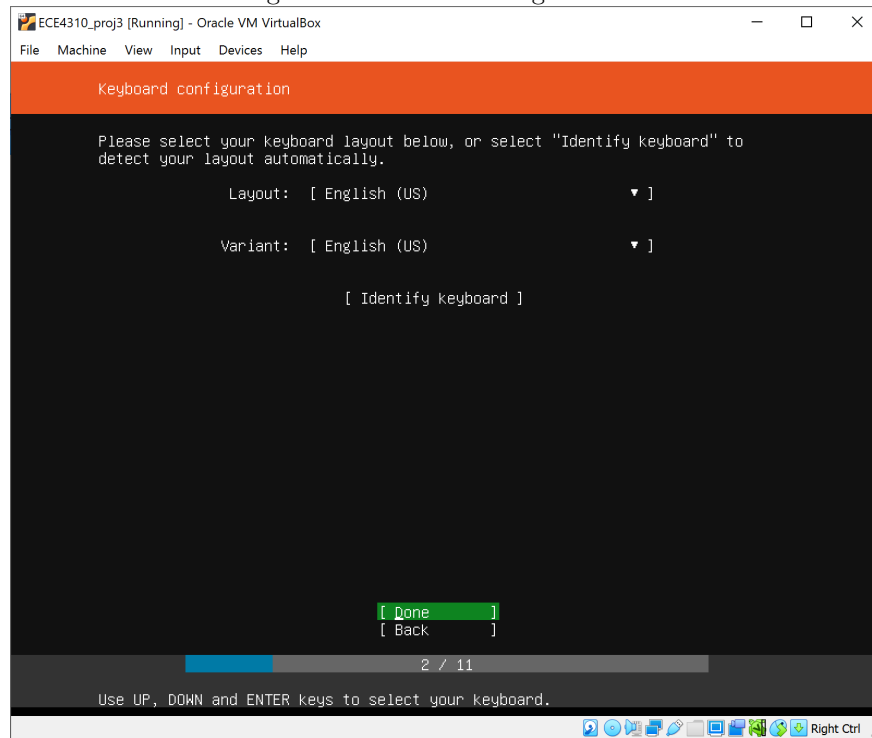


Figure 6: Ubuntu is being installed

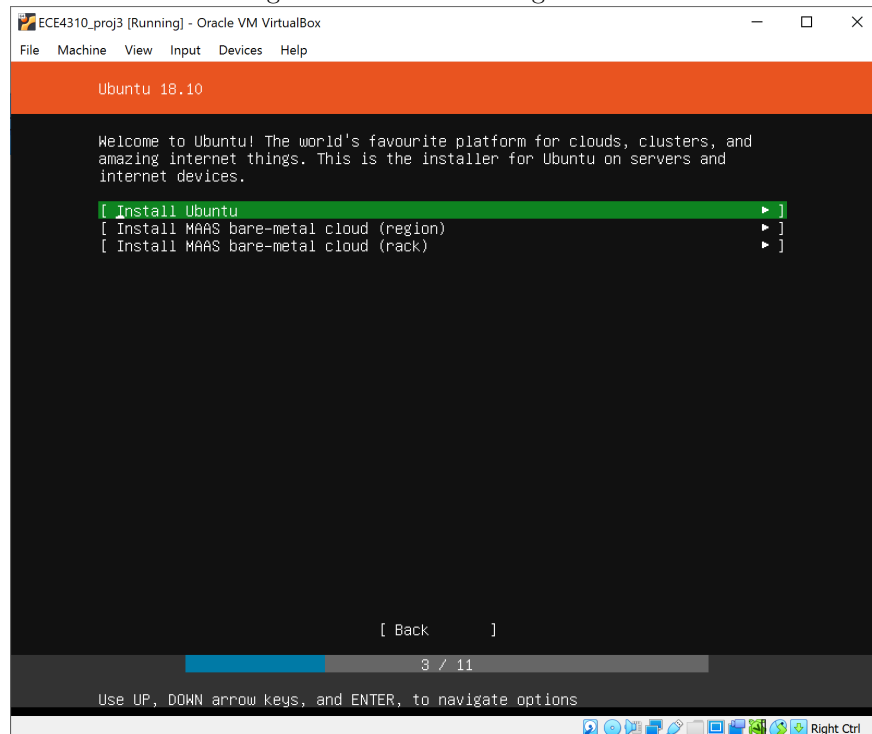


Figure 7: Ubuntu is being installed

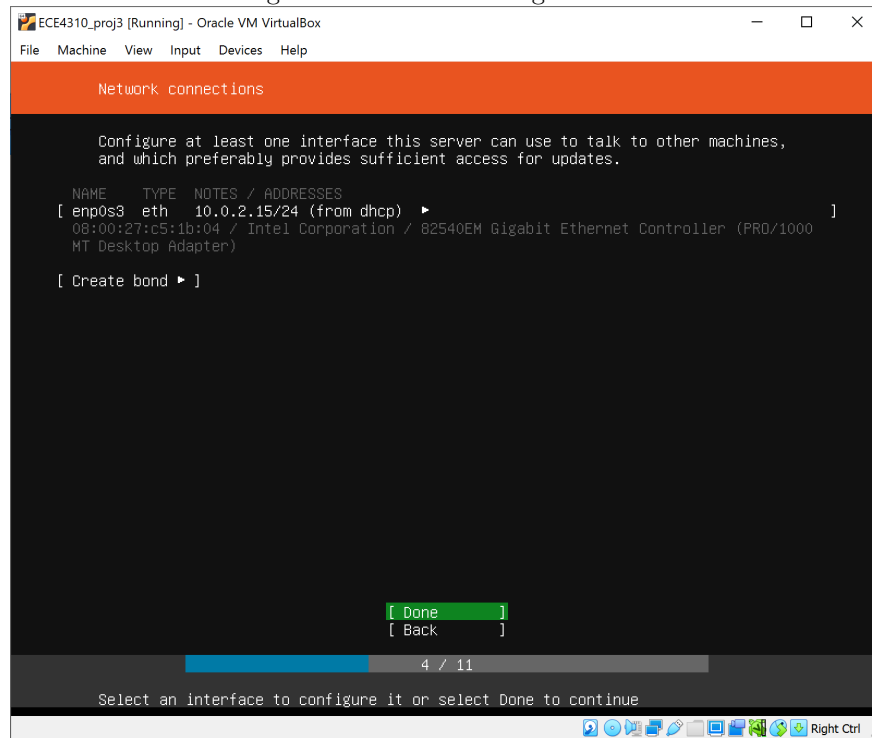


Figure 8: Ubuntu is being installed

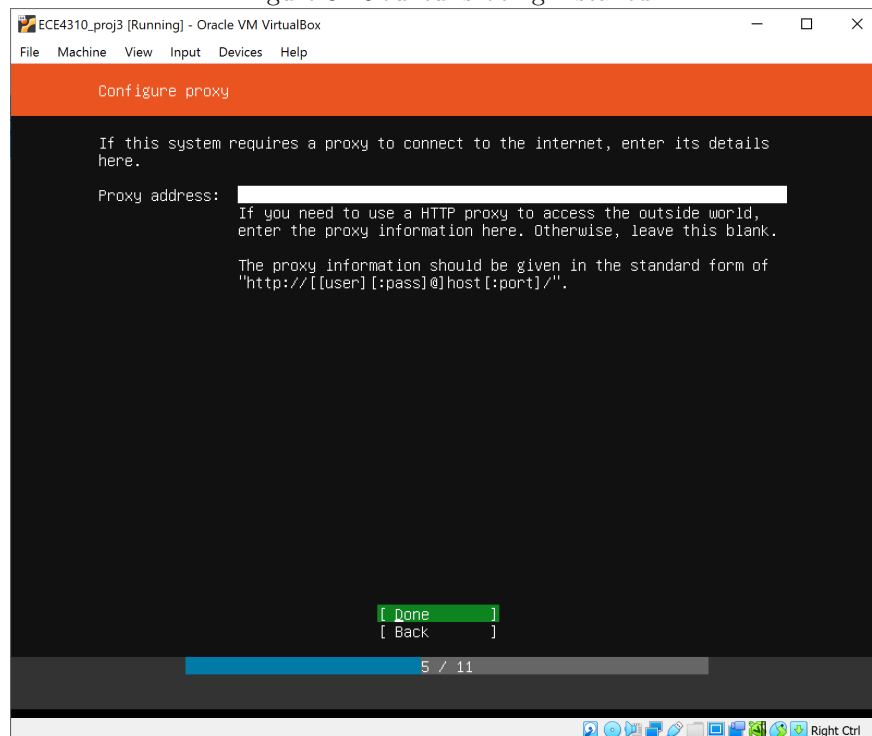


Figure 9: Ubuntu is being installed

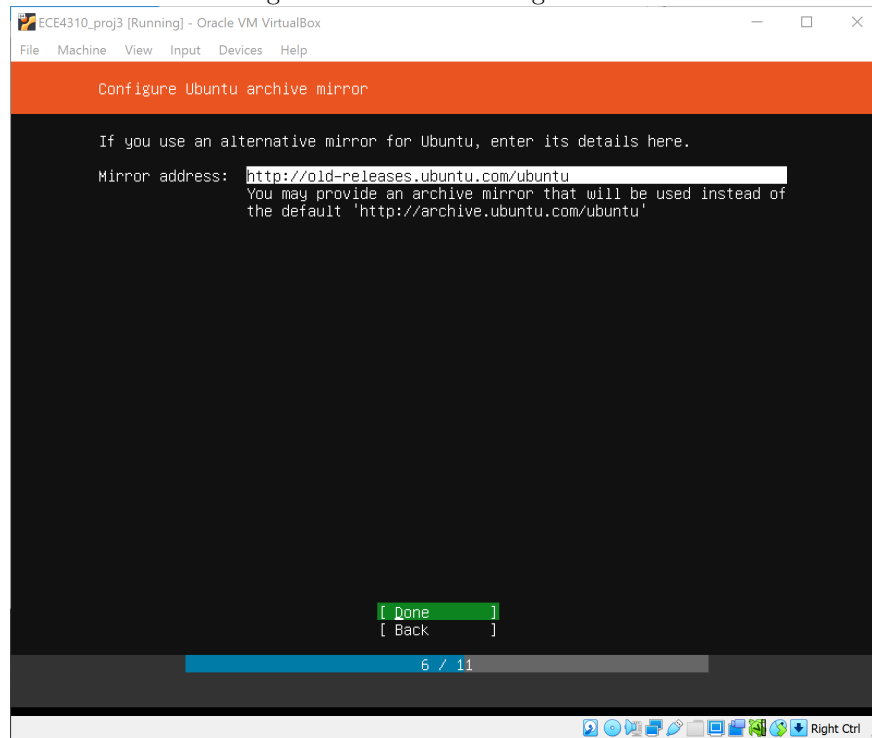


Figure 10: Ubuntu is being installed

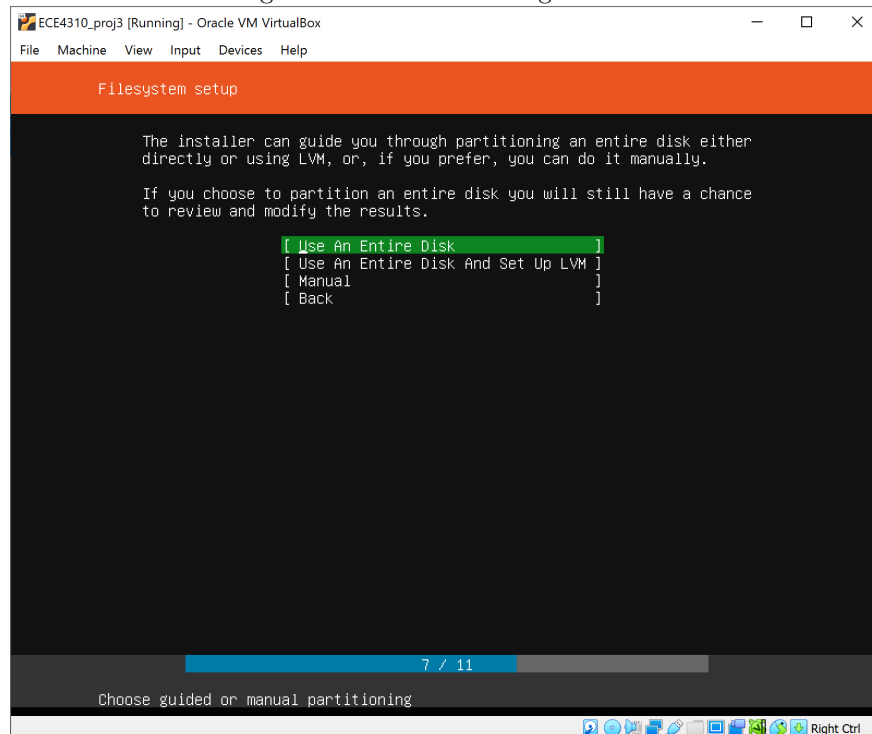


Figure 11: Ubuntu is being installed

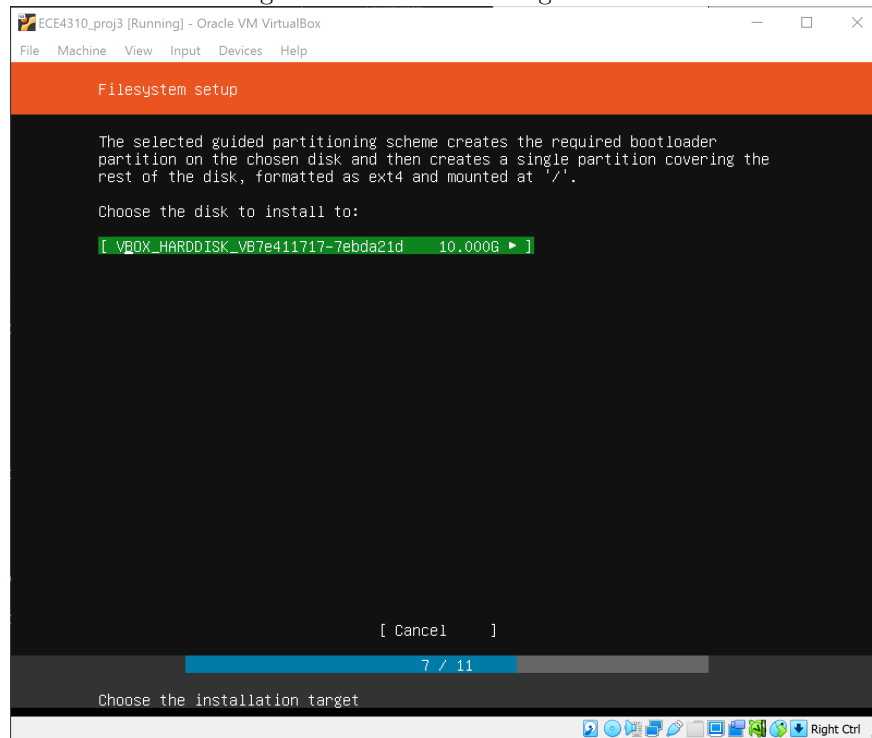


Figure 12: Ubuntu is being installed

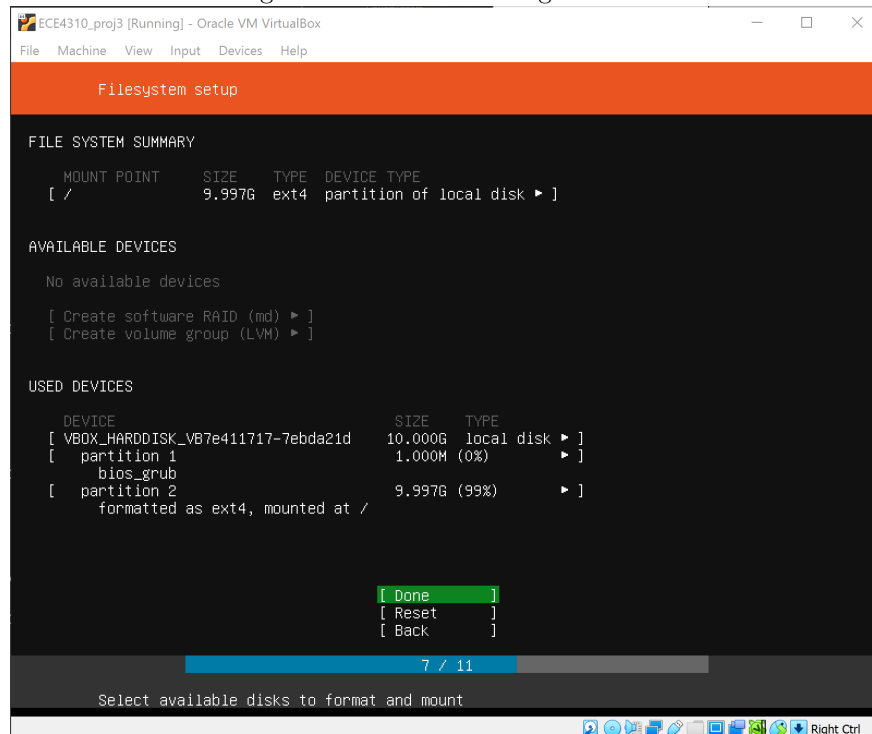


Figure 13: Ubuntu is being installed

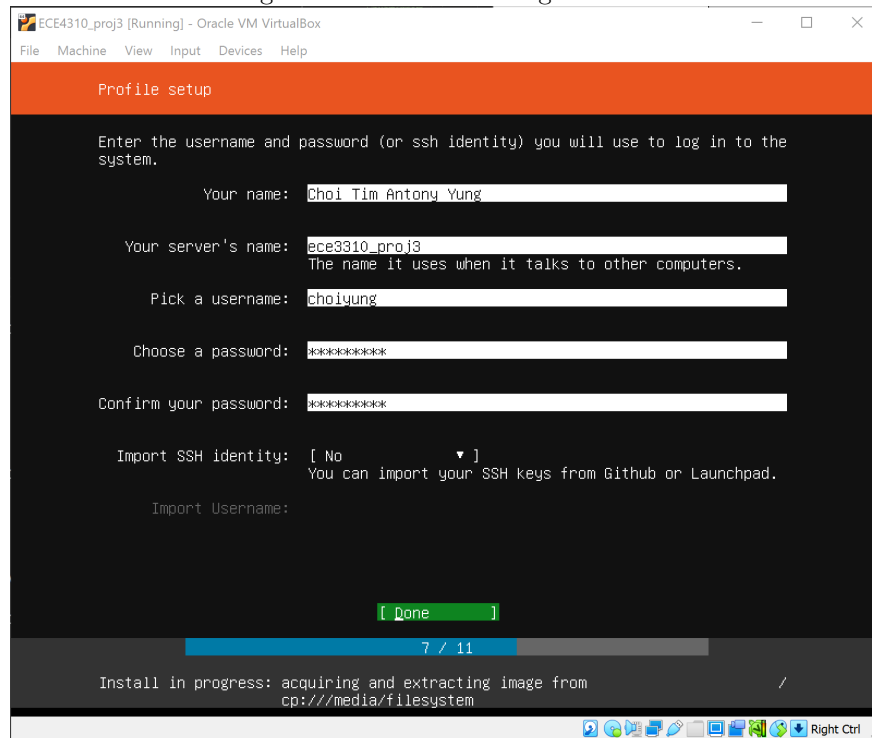


Figure 14: Ubuntu is being installed

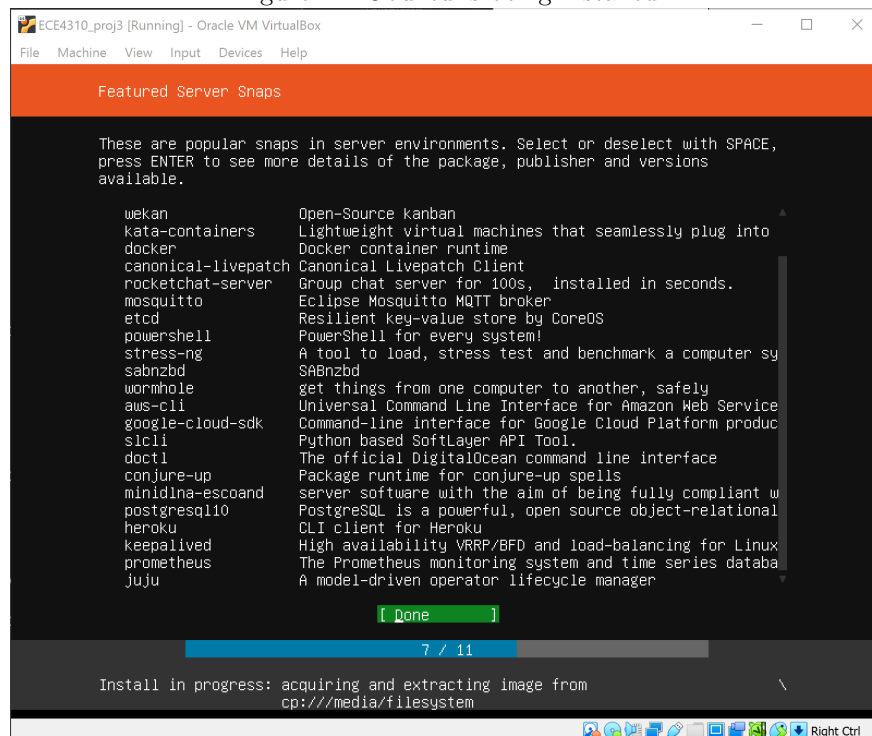
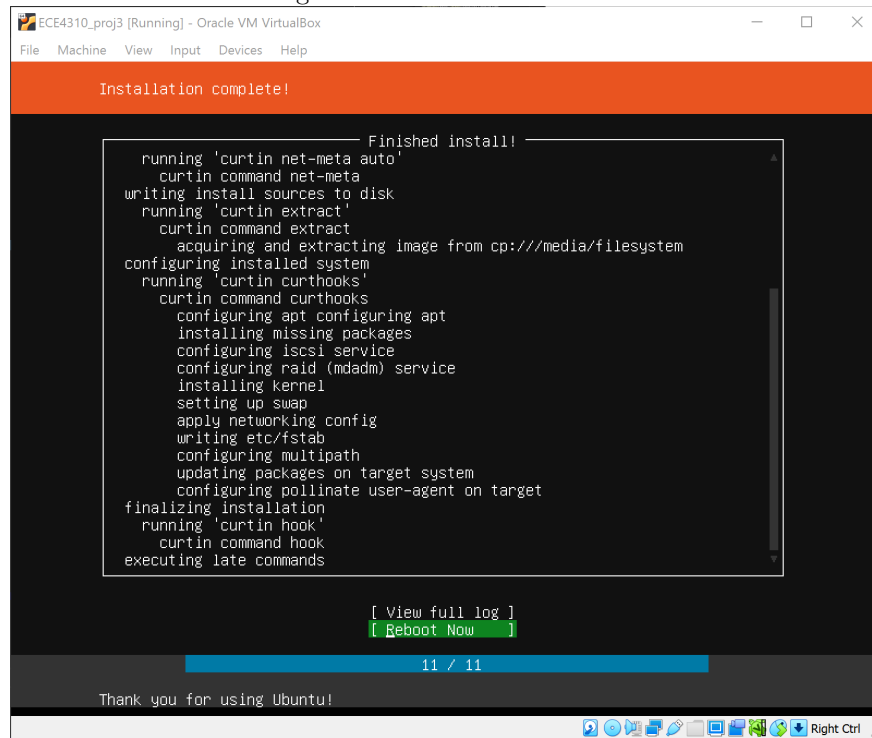
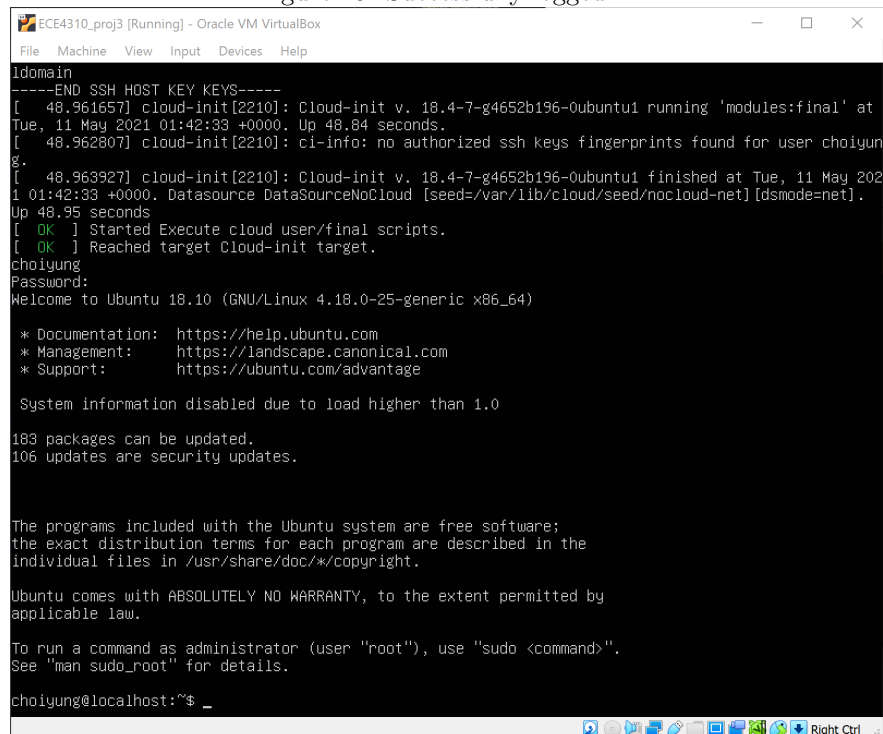


Figure 15: Ubuntu is installed



1.5 Reboot and Log in

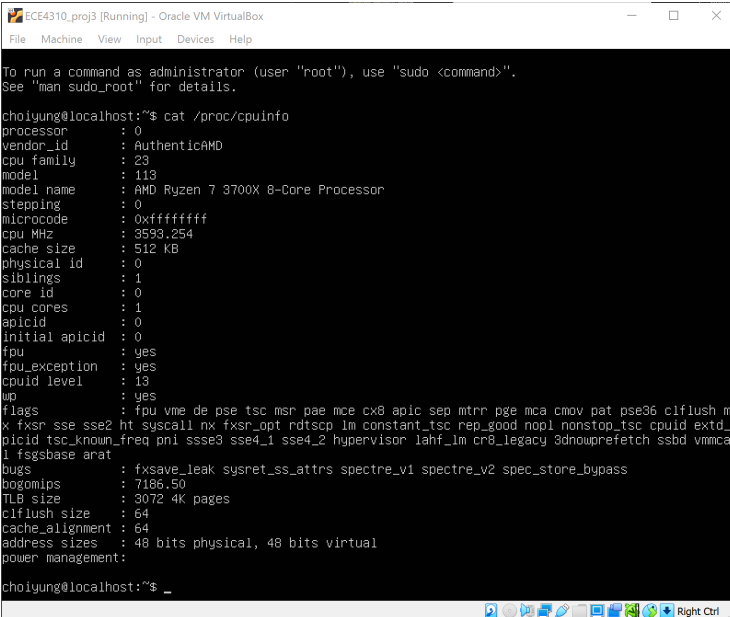
Figure 16: Successfully logged in



2 Virtual Machine Specifications

2.1 cat /proc/cpuinfo

Figure 17: Output of cat /proc/cpuinfo



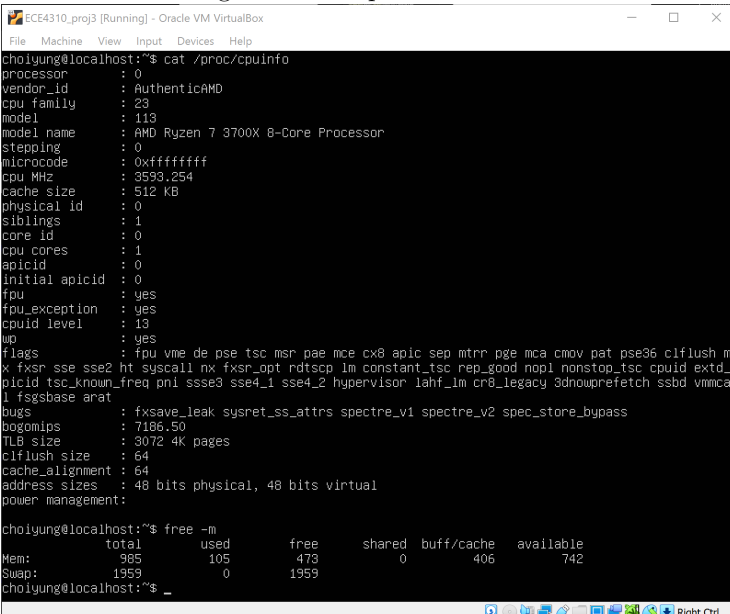
```
choiyung@localhost:~$ cat /proc/cpuinfo
processor       : 0
vendor_id      : AuthenticAMD
cpu family     : 23
model          : 113
model name     : AMD Ryzen 7 3700X 8-Core Processor
stepping       : 0
microcode      : 0xffffffff
cpu MHz        : 3593.254
cache size     : 512 KB
physical id    : 0
siblings       : 1
core id        : 0
cpu cores      : 1
apicid         : 0
initial apicid: 0
fpu            : yes
fpu_exception  : yes
cpuid level    : 13
wp             : yes
flags           : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mm
x fxsr sse sse2 ht syscall nx fxsr_opt rdtscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_a
picid tsc_known_freq pni ssse3 sse4_1 sse4_2 hypervisor lahf_lm cr8_legacy 3dnowprefetch ssbd vmxal
l fsgsbase arat
bugs           : fxsavleak sysret_ss_attrs spectre_v1 spectre_v2 spec_store_bypass
bogomips       : 7186.50
TLB size       : 3072 4K pages
clflush size   : 64
cache_alignment: 64
address sizes   : 48 bits physical, 48 bits virtual
power management:

choiyung@localhost:~$ _
```

1 CPU is assigned to my VM and it is an AMD Ryzen 7 3700X

2.2 cat free -m

Figure 18: Output of free -m



```
choiyung@localhost:~$ cat /proc/cpuinfo
processor       : 0
vendor_id      : AuthenticAMD
cpu family     : 23
model          : 113
model name     : AMD Ryzen 7 3700X 8-Core Processor
stepping       : 0
microcode      : 0xffffffff
cpu MHz        : 3593.254
cache size     : 512 KB
physical id    : 0
siblings       : 1
core id        : 0
cpu cores      : 1
apicid         : 0
initial apicid: 0
fpu            : yes
fpu_exception  : yes
cpuid level    : 13
wp             : yes
flags           : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mm
x fxsr sse sse2 ht syscall nx fxsr_opt rdtscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_a
picid tsc_known_freq pni ssse3 sse4_1 sse4_2 hypervisor lahf_lm cr8_legacy 3dnowprefetch ssbd vmxal
l fsgsbase arat
bugs           : fxsavleak sysret_ss_attrs spectre_v1 spectre_v2 spec_store_bypass
bogomips       : 7186.50
TLB size       : 3072 4K pages
clflush size   : 64
cache_alignment: 64
address sizes   : 48 bits physical, 48 bits virtual
power management:

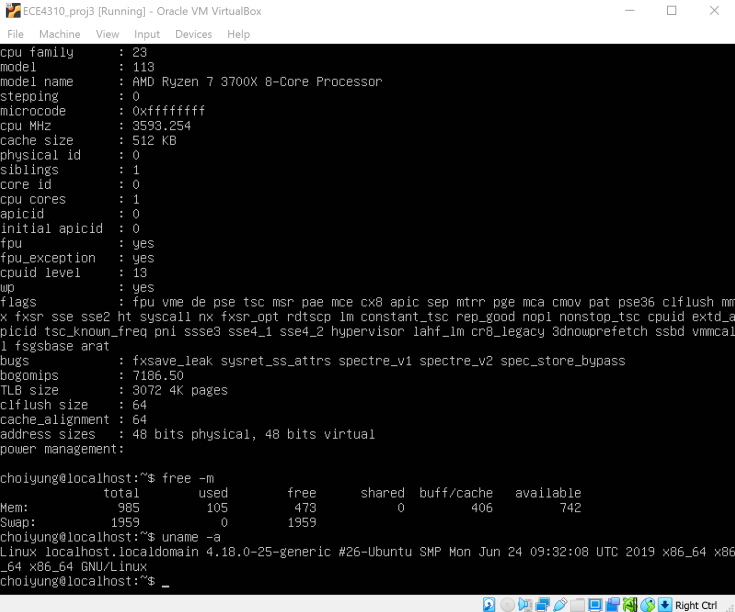
choiyung@localhost:~$ free -m
              total        used         free      shared  buff/cache   available
Mem:           985         105          473           0          406          742
Swap:          1959           0          1959

choiyung@localhost:~$ _
```

985 MB of memory is assigned to the VM

2.3 cat uname -a

Figure 19: Output of uname -a



```
ECE4310_proj3 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

cpu family      : 23
model          : 113
model name     : AMD Ryzen 7 3700X 8-Core Processor
stepping       : 0
microcode      : 0xffffffff
cpu MHz        : 3593.254
cache size     : 512 KB
physical id    : 0
siblings       : 1
core id        : 0
cpu cores      : 1
apicid         : 0
initial apicid : 0
fpu            : yes
fpu_exception  : yes
cpuid level    : 13
wp             : yes
flags          : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mm
x fxsr sse sse2 ht syscall nx fxsr_opt rdtscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_a
picid tsc_known_freq pni ssse3 sse4_1 sse4_2 hypervisorlahf_lm cr8_legacy 3dnowprefetch ssbd vmcal
l fsgsbase arat
bugs           : fxsavleak sysret_ss_attrs spectre_v1 spectre_v2 spec_store_bypass
bogomips       : 7186.50
TLB size       : 3072 4K pages
clflush size   : 64
cache_alignmen : 64
address sizes   : 48 bits physical, 48 bits virtual
power managemen:

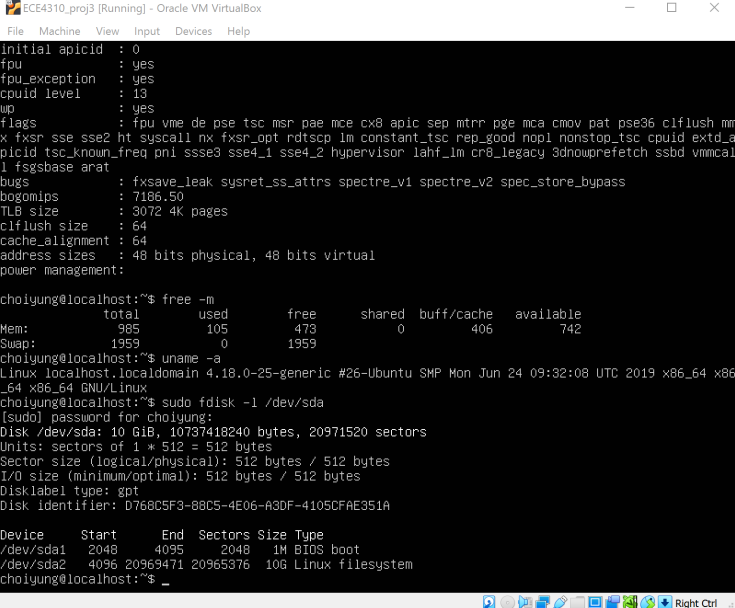
choiyung@localhost:~$ free -m
              total        used         free       shared    buff/cache   available
Mem:           985         105          473           0         406         742
Swap:          1959           0          1959

choiyung@localhost:~$ uname -a
Linux localhost.localdomain 4.18.0-25-generic #26-Ubuntu SMP Mon Jun 24 09:32:08 UTC 2019 x86_64 x86_64 x86_64 GNU/Linux
choiyung@localhost:~$ _
```

The linux kernel version is 4.18.0-25-generic

2.4 sudo fdisk -l /dev/sda

Figure 20: Output of sudo fdisk -l /dev/sda



```
ECE4310_proj3 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

initial apicid : 0
fpu            : yes
fpu_exception  : yes
cpuid level    : 13
wp             : yes
flags          : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mm
x fxsr sse sse2 ht syscall nx fxsr_opt rdtscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_a
picid tsc_known_freq pni ssse3 sse4_1 sse4_2 hypervisorlahf_lm cr8_legacy 3dnowprefetch ssbd vmcal
l fsgsbase arat
bugs           : fxsavleak sysret_ss_attrs spectre_v1 spectre_v2 spec_store_bypass
bogomips       : 7186.50
TLB size       : 3072 4K pages
clflush size   : 64
cache_alignmen : 64
address sizes   : 48 bits physical, 48 bits virtual
power managemen:

choiyung@localhost:~$ free -m
              total        used         free       shared    buff/cache   available
Mem:           985         105          473           0         406         742
Swap:          1959           0          1959

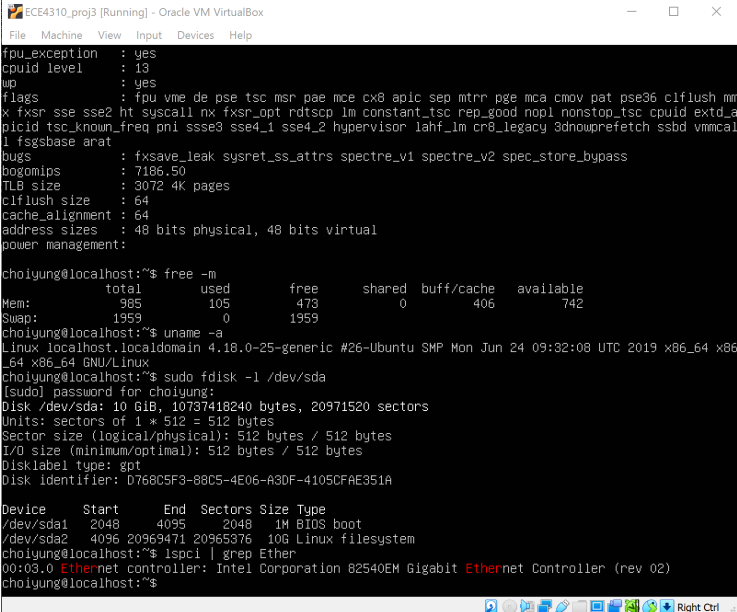
choiyung@localhost:~$ uname -a
Linux localhost.localdomain 4.18.0-25-generic #26-Ubuntu SMP Mon Jun 24 09:32:08 UTC 2019 x86_64 x86_64 x86_64 GNU/Linux
choiyung@localhost:~$ sudo fdisk -l /dev/sda
[sudo] password for choiyung:
Disk /dev/sda: 10 GiB, 10737418240 bytes, 20971520 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: D768C5F3-88C5-4E06-A30F-4105CFAE351A

Device      Start      End  Sectors  Size Type
/dev/sda1   2048     4095     2048    1M BIOS boot
/dev/sda2   4096 20969471 20965376 10G Linux filesystem
choiyung@localhost:~$ _
```

10737418240 bytes \approx 10 GB of disk space is allocated to the VM

2.5 lspci | grep Ether

Figure 21: Output of `lspci | grep Ether`



```

fpu_exception : yes
cpuid level   : 13
wp           : yes
flags        : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mm
x fxsr sse sse2 ht syscall nx fxsr_opt rdtscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_a
picid tsc_known_freq pni ssse3 sse4_1 sse4_2 hypervisor lahf_lm cr8_legacy 3dnowprefetch ssbd vmcal
l fsgsbase arat
bugs         : fxsavleak sysret_ss_attrs spectre_v1 spectre_v2 spec_store_bypass
bogomips     : 7186.50
TLB size     : 3072 4K pages
clflush size  : 64
cache_alignm : 64
address sizes : 48 bits physical, 48 bits virtual
power managem:

choiyung@localhost:~$ free -m
              total    used         free       shared    buff/cache   available
Mem:           985      105          473           0         406         742
Swap:          1959           0         1959

choiyung@localhost:~$ uname -a
Linux localhost.localdomain 4.18.0-25-generic #26-Ubuntu SMP Mon Jun 24 09:32:08 UTC 2019 x86_64 x86_64 x86_64 GNU/Linux
choiyung@localhost:~$ sudo fdisk -l /dev/sda
[sudo] password for choiyung:
Disk /dev/sda: 10 GiB, 10737418240 bytes, 20971520 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: D768C5F3-88C5-4E06-A30F-4105CFAE351A

Device      Start      End  Sectors Size Type
/dev/sda1    2048      4095      2048  1M BIOS boot
/dev/sda2    4096 20969471 20965376 10G Linux filesystem
choiyung@localhost:~$ lspci | grep Ether
00:03.0 Ethernet controller: Intel Corporation 82540EM Gigabit Ethernet Controller (rev 02)
choiyung@localhost:~$
```

An Intel Corporation 82540EM Gigabit Ethernet Controller (rev 02) network card is installed.