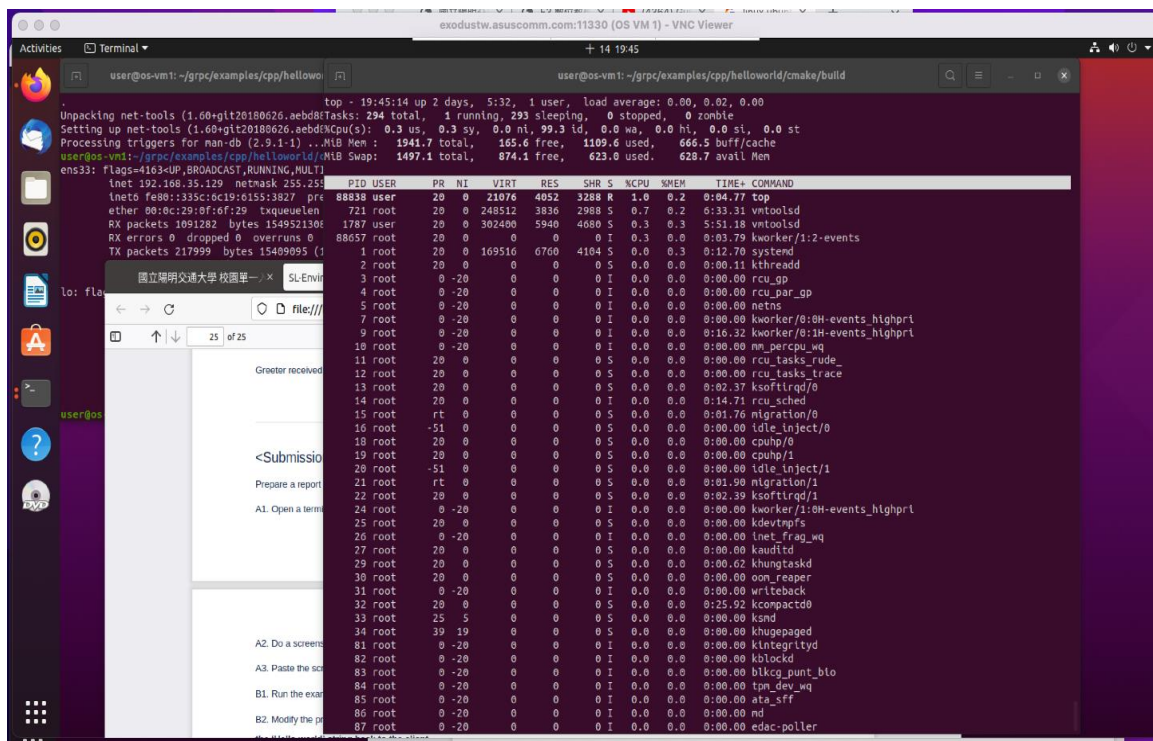


HW1: Environment Setup.

109550198 卜銳凱

Part A:

Screenshot of the whole Ubuntu desktop environment (including the terminal window running top).



```
top - 19:45:14 up 2 days, 5:32, 1 user, load average: 0.00, 0.02, 0.00
Tasks: 294 total, 1 running, 293 sleeping, 0 stopped, 0 zombie
Cpu(s):  0.3 us,  0.3 sy,  0.0 ni, 99.3 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st
Mem:   1941.7 total, 165.6 free, 1109.6 used, 666.5 buff/cache
Swap:  1497.1 total,  874.1 free,  623.0 used.

  PID USER      PR  NI    VIRT    RES    SHR   S  %CPU  %MEM     TIME+ COMMAND
 88838 user        20   0   21076   4052   3288  R   1.0   0.2   0:04.77 top
    1 root         0   0         0         0         0  S   0.0   0.0   0:00.00 kthreadd
    2 root         0   0         0         0         0  S   0.0   0.0   0:00.00 rcu_gp
    3 root         0  -20         0         0         0  S   0.0   0.0   0:00.00 rcu_par_gp
    4 root         0  -20         0         0         0  S   0.0   0.0   0:00.00 netns
    5 root         0  -20         0         0         0  S   0.0   0.0   0:00.00 kworker/0:0H-events_highpri
    6 root         0  -20         0         0         0  S   0.0   0.0   0:00.00 kworker/0:0H-events_highpri
    7 root         0  -20         0         0         0  S   0.0   0.0   0:00.00 idle_inject/0
    8 root         0  -20         0         0         0  S   0.0   0.0   0:00.00 cpuhp/0
    9 root         0  -20         0         0         0  S   0.0   0.0   0:00.00 cpuhp/1
   10 root         0  -20         0         0         0  S   0.0   0.0   0:00.00 idle_inject/1
   11 root        20   0         0         0         0  S   0.0   0.0   0:00.00 kworker/1:0H-events_highpri
   12 root        20   0         0         0         0  S   0.0   0.0   0:00.00 rcu_tasks_trace
   13 root        20   0         0         0         0  S   0.0   0.0   0:02.37 ksoftirqd/0
   14 root        20   0         0         0         0  S   0.0   0.0   0:14.71 rcu_sched
   15 root        rt   0         0         0         0  S   0.0   0.0   0:01.76 migration/0
   16 root       -51   0         0         0         0  S   0.0   0.0   0:00.00 kdevtmpfs
   17 root        20   0         0         0         0  S   0.0   0.0   0:00.00 kswapd0
   18 root        20   0         0         0         0  S   0.0   0.0   0:00.00 cpuhp/0
   19 root        20   0         0         0         0  S   0.0   0.0   0:00.00 cpuhp/1
   20 root       -51   0         0         0         0  S   0.0   0.0   0:00.00 idle_inject/1
   21 root        rt   0         0         0         0  S   0.0   0.0   0:01.90 migration/1
   22 root        20   0         0         0         0  S   0.0   0.0   0:02.39 ksoftirqd/1
   23 root        20   0         0         0         0  S   0.0   0.0   0:00.00 kworker/1:0H-events_highpri
   24 root        0  -20         0         0         0  S   0.0   0.0   0:00.00 kdevtmpfs
   25 root        20   0         0         0         0  S   0.0   0.0   0:00.00 kswapd0
   26 root        0  -20         0         0         0  S   0.0   0.0   0:00.00 inet_frag_wq
   27 root        20   0         0         0         0  S   0.0   0.0   0:00.00 kauditd
   28 root        20   0         0         0         0  S   0.0   0.0   0:00.00 kauditd
   29 root        20   0         0         0         0  S   0.0   0.0   0:00.02 khungtaskd
   30 root        20   0         0         0         0  S   0.0   0.0   0:00.00 oom_reaper
   31 root        0  -20         0         0         0  S   0.0   0.0   0:00.00 writeback
   32 root        20   0         0         0         0  S   0.0   0.0   0:25.92 kcompactd0
   33 root        25   5         0         0         0  S   0.0   0.0   0:00.00 ksmd
   34 root        30  19         0         0         0  S   0.0   0.0   0:00.00 khugepaged
   81 root        0  -20         0         0         0  S   0.0   0.0   0:00.00 kintegrityd
   82 root        0  -20         0         0         0  S   0.0   0.0   0:00.00 bblockd
   83 root        0  -20         0         0         0  S   0.0   0.0   0:00.00 blkcg_punt_blo
   84 root        0  -20         0         0         0  S   0.0   0.0   0:00.00 tpm_dev_wq
   85 root        0  -20         0         0         0  S   0.0   0.0   0:00.00 ata_sff
   86 root        0  -20         0         0         0  S   0.0   0.0   0:00.00 nd
   87 root        0  -20         0         0         0  S   0.0   0.0   0:00.00 edac-poller
```

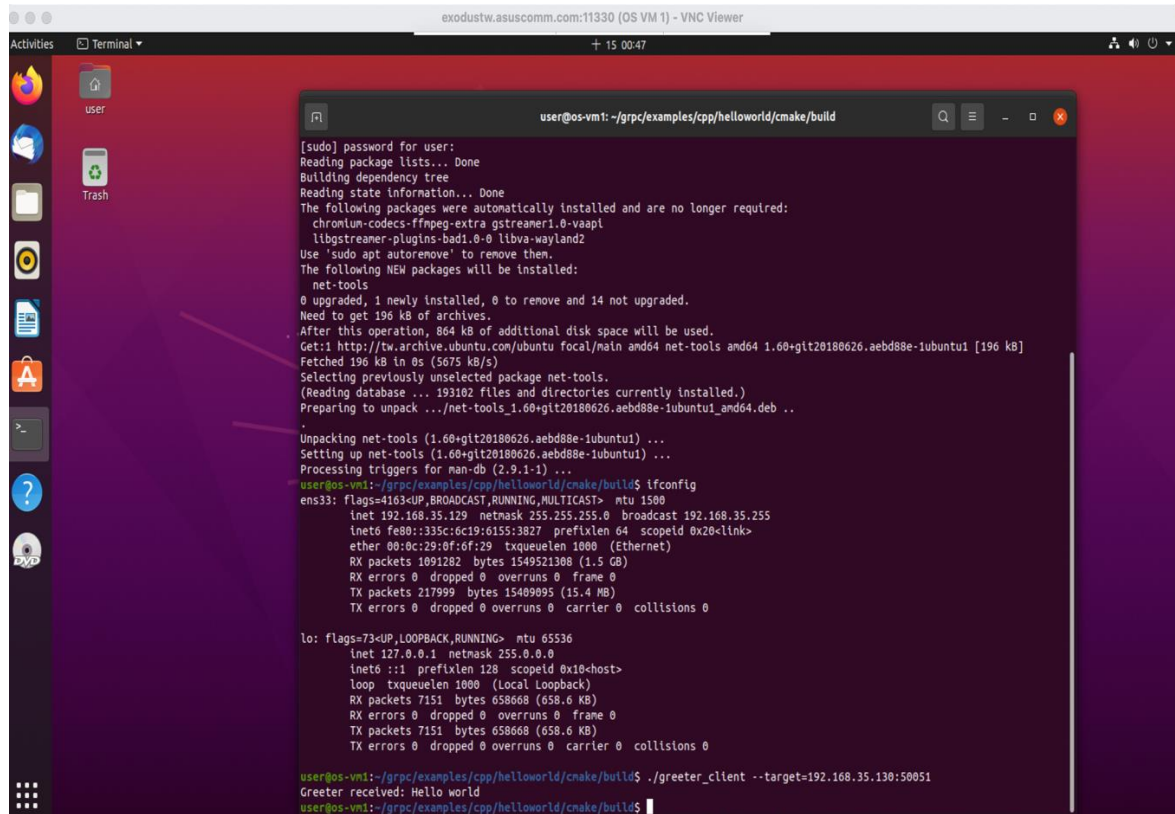
Part B:

Modification of the programs so that the client running in VM1 can send the “World” string to the Server in VM2, and the server can return the “Hello” string back to the client.

First, I run the example gRPC client program and the gRPC server program on two different machines.

I used \$ifconfig to find the IP addresses of both VMs. IP address plays an important role in communication between server-client models. Server-client model is a communication model for sharing the resource and providing the service to different machines. The server is the main system that provides the resources and different kinds of services when the client requests to use it.

After finding the IP addresses of both VMs, I used the IP address of the server-client which is VM2 in order to communicate with the client which is VM1. The client running in VM1 can send the “World” string to the server in VM2, and the server can return the “Hello world” string back to the client.



```
[sudo] password for user:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi
  libgstreamer-plugins-bad1.0-0 libva-wayland2
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  net-tools
0 upgraded, 1 newly installed, 0 to remove and 14 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://tw.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 kB]
Fetched 196 kB in 0s (5675 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 193102 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ..
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...
user@os-vmt:~/grpc/examples/cpp/helloworld/cmake/build$ ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.35.129 netmask 255.255.255.0 broadcast 192.168.35.255
    inet6 fe80::335c:6c19:6155:3827 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:0f:0f:29 txqueuelen 1000 (Ethernet)
    RX packets 1091282 bytes 1549521308 (1.5 GB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 217999 bytes 15409095 (15.4 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 7151 bytes 658608 (658.6 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 7151 bytes 658608 (658.6 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

user@os-vmt:~/grpc/examples/cpp/helloworld/cmake/build$ ./greeter_client --target=192.168.35.130:50051
Greeter received: Hello world
user@os-vmt:~/grpc/examples/cpp/helloworld/cmake/build$
```

exodusw.asuscomm.com:11331 (OS VM 2) - VNC Viewer
+ 15 01:02

Activities Terminal user

user@os-vm2: ~/grpc/examples/cpp/helloworld/cmake/build

```
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
chromium-codecs-ffmpeg-extra gstreamer1.0-vaapi
libgstreamer-plugins-bad1.0-0 libva-wayland2
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
net-tools
0 upgraded, 1 newly installed, 0 to remove and 14 not upgraded.
Need to get 196 kB of archives.
After this operation, 864 kB of additional disk space will be used.
Get:1 http://tw.archive.ubuntu.com/ubuntu focal/main amd64 net-tools amd64 1.60+git20180626.aebd88e-1ubuntu1 [196 k
B]
Fetched 196 kB in 1s (189 kB/s)
Selecting previously unselected package net-tools.
(Reading database ... 189436 files and directories currently installed.)
Preparing to unpack .../net-tools_1.60+git20180626.aebd88e-1ubuntu1_amd64.deb ...
Unpacking net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Setting up net-tools (1.60+git20180626.aebd88e-1ubuntu1) ...
Processing triggers for man-db (2.9.1-1) ...

user@os-vm2:~/grpc/examples/cpp/helloworld/cmake/build$ ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.35.130 netmask 255.255.255.0 broadcast 192.168.35.255
    inet6 fe80::a86d:3ebc:bfc5:fda3 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:73:15:19e txqueuelen 1000 (Ethernet)
    RX packets 1054789 bytes 1466058237 (1.4 GB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 198673 bytes 17114408 (17.1 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 8785 bytes 826614 (826.6 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 8785 bytes 826614 (826.6 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

user@os-vm2:~/grpc/examples/cpp/helloworld/cmake/build$ ./greeter_client --target=192.168.35.129:50051
Greeter received: Hello world
user@os-vm2:~/grpc/examples/cpp/helloworld/cmake/build$ ./greeter_server
Server listening on 0.0.0.0:50051
```