

## **CS3530 Hands-on Assignment for Nov 26th, 2020**

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**# Submission Deadline: 23:59 on Dec 4th (FRI), 2020)**

### **# General Information**

1. This assignment is a pair assignment. The same mark will be offered to the pair of students regardless of individual contributions.
2. The assignment is customized for Ubuntu + KVM environment. It is highly recommended for non-Ubuntu users to enable dual boot on your laptop computer and install Ubuntu. If you would like to work on another operating system and virtualization platform, you need to interpret the Ubuntu/KVM terminology to another environment's terminology.
3. Each pair can create a locally copy of this question file, give the answer to the local copy, and submit in a form of PDF file.
4. Only one submission is good enough as far as the student names and IDs are properly mentioned.
5. Do not send any private comment to separately mention the buddy.

## Prerequisite

This assignment assumes that the hand-on assignments 1 and 2 are completed. On your laptop computer, 2 (two) Ubuntu Servers should be already installed as VMs, say VM1 and VM2, using virt-manager, and can ping with each other as shown in Figure 1. Let us call this setup "your LAN". Note that the IP addresses given in the figure is just an example. Other IP addresses can be given to the VMs as far as they are consistent and working.

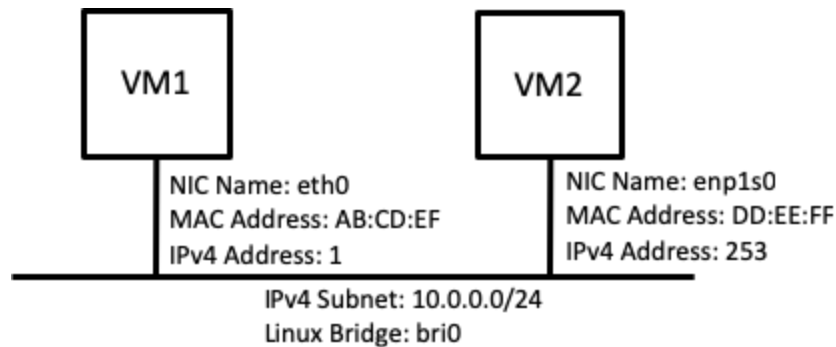


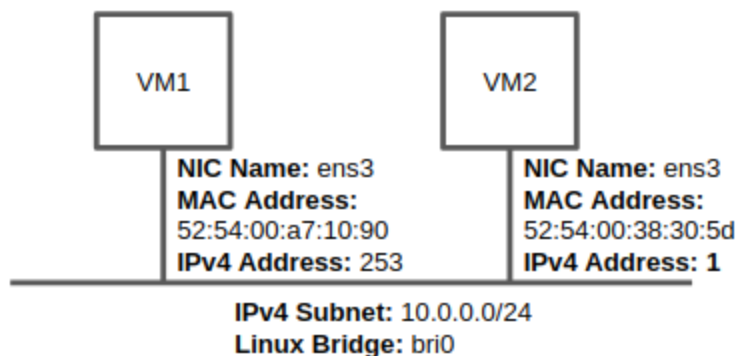
Figure 1. "Example" Network Configuration of 2 VMs connecting to the same Linux bridge and pinging with each other.

## # Part 1: Basic Networking

### Question 1.

Paste the pictorial illustration of your LAN (Network Diagram) with sufficient information about NIC Name, MAC Address, IPv4 Address, IPv4 Subnet, Linux Bridge those are used to form the network. If needed, you may locally download and edit the template file to prepare the network diagram.

### Answer to Question 1.



### Question 2.

Paste the screen capture of the terminal of VM1 showing the IPv4 address which you configure.

### Answer to Question 2.

IPv4 of VM1 is configured as : **10.0.0.253**

```
reethu@reethu:~$ ip addr show ens3
2: ens3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 52:54:00:a7:10:90 brd ff:ff:ff:ff:ff:ff
    inet 10.0.0.253/24 brd 10.0.0.255 scope global ens3
        valid_lft forever preferred_lft forever
    inet6 fe80::5054:ff:fea7:1090/64 scope link
        valid_lft forever preferred_lft forever
```

### Question 3.

Execute ping command from VM1 to VM2 with specifying the number of ICMP Echo Requests to be sent as 10 (ten). 1) Answer the average RTT in msec and 2) paste the screen capture of the terminal of VM1 including the command with appropriate options and the result including RTTs.

### Answer to Question 3.

1) Average RTT is **2.705** msec

```
reethu@reethu:~$ ping -c 10 10.0.0.1
PING 10.0.0.1 (10.0.0.1) 56(84) bytes of data.
 64 bytes from 10.0.0.1: icmp_seq=1 ttl=64 time=2.74 ms
 64 bytes from 10.0.0.1: icmp_seq=2 ttl=64 time=1.76 ms
 64 bytes from 10.0.0.1: icmp_seq=3 ttl=64 time=1.65 ms
 64 bytes from 10.0.0.1: icmp_seq=4 ttl=64 time=1.92 ms
 64 bytes from 10.0.0.1: icmp_seq=5 ttl=64 time=2.41 ms
 64 bytes from 10.0.0.1: icmp_seq=6 ttl=64 time=1.75 ms
 64 bytes from 10.0.0.1: icmp_seq=7 ttl=64 time=2.85 ms
 64 bytes from 10.0.0.1: icmp_seq=8 ttl=64 time=2.70 ms
 64 bytes from 10.0.0.1: icmp_seq=9 ttl=64 time=1.92 ms
 64 bytes from 10.0.0.1: icmp_seq=10 ttl=64 time=7.32 ms

--- 10.0.0.1 ping statistics ---
 10 packets transmitted, 10 received, 0% packet loss, time 9016ms
 rtt min/avg/max/mdev = 1.656/2.705/7.320/1.598 ms
```

### Question 4.

Run iperf using VM2 as the iperf server (receiver of the traffic) and VM1 as the iperf client (sender of the traffic). Specify the appropriate options (-t 20 -i 1) so that the benchmark lasts for

20 seconds showing the throughput every second. Paste the screen capture of the iperf result on VM1.

#### Answer to Question 4.

```
reethu@reethu:~$ iperf -c 10.0.0.1 -t 20 -i 1
-----
Client connecting to 10.0.0.1, TCP port 5001
TCP window size: 85.0 KByte (default)
-----
[ 3] local 10.0.0.253 port 38014 connected with 10.0.0.1 port 5001
[ ID] Interval      Transfer    Bandwidth
[ 3] 0.0- 1.0 sec   224 MBytes  1.88 Gbits/sec
[ 3] 1.0- 2.0 sec   135 MBytes  1.14 Gbits/sec
[ 3] 2.0- 3.0 sec   145 MBytes  1.21 Gbits/sec
[ 3] 3.0- 4.0 sec   228 MBytes  1.91 Gbits/sec
[ 3] 4.0- 5.0 sec   181 MBytes  1.52 Gbits/sec
[ 3] 5.0- 6.0 sec   204 MBytes  1.71 Gbits/sec
[ 3] 6.0- 7.0 sec   296 MBytes  2.48 Gbits/sec
[ 3] 7.0- 8.0 sec   147 MBytes  1.23 Gbits/sec
[ 3] 8.0- 9.0 sec   170 MBytes  1.43 Gbits/sec
[ 3] 9.0-10.0 sec   148 MBytes  1.24 Gbits/sec
[ 3] 10.0-11.0 sec   148 MBytes  1.24 Gbits/sec
[ 3] 11.0-12.0 sec   148 MBytes  1.24 Gbits/sec
[ 3] 12.0-13.0 sec   148 MBytes  1.24 Gbits/sec
[ 3] 13.0-14.0 sec   153 MBytes  1.28 Gbits/sec
[ 3] 14.0-15.0 sec   144 MBytes  1.21 Gbits/sec
[ 3] 15.0-16.0 sec   145 MBytes  1.22 Gbits/sec
[ 3] 16.0-17.0 sec   146 MBytes  1.22 Gbits/sec
[ 3] 17.0-18.0 sec   141 MBytes  1.18 Gbits/sec
[ 3] 18.0-19.0 sec   159 MBytes  1.33 Gbits/sec
[ 3] 19.0-20.0 sec   193 MBytes  1.62 Gbits/sec
[ 3] 0.0-20.0 sec   3.32 GBytes 1.43 Gbits/sec
reethu@reethu:~$
```

#### # Part 2: DNS and DHCP

In this part, you configure a DNS server and a DHCP server on VM1, and answer the following questions. The DNS server must be configured as a Primary and Authoritative DNS server for your LAN. Specifically, you can refer to "Installation", "Primary Server", and "Testing" in Ubuntu Server Reference [1] to perform the bare minimum configuration. DHCP server configuration can also be found as part of the same reference [2].

[1] <https://ubuntu.com/server/docs/service-domain-name-service-dns>

[2] <https://ubuntu.com/server/docs/network-dhcp>

#### Question 5.

Fill the table to plan your domain.

### Answer to Question 5.

Parameters	Value
Domain Name corresponding to your LAN. "cs3530" must not be included. Bring something else.	tadwai.com
IPv4 Address of DNS Server	10.0.0.253
Hostname of DNS Server	ns

### Question 6.

Run dig or nslookup command on VM2 and confirm that 1) the IPv4 address of VM1 is successfully resolved by its hostname, and 2) the hostname of VM1 is successfully resolved by its IPv4 address. Give the answer by pasting the screen capture of dig or nslookup commands executed on VM2.

### Answer to Question 6.

- 1) As we got the non-authoritative answer address as the IPv4 of VM1 we can say that IPv4 is successfully resolved by its hostname.

```
reethu@reethu:~$ nslookup ns.tadwai.com
Server:      127.0.0.53
Address:     127.0.0.53#53

Non-authoritative answer:
Name:   ns.tadwai.com
Address: 10.0.0.253
```

- 2) As we got the DNS-server name as "ns.tadwai.com", we can confirm that VM1 has successfully resolved its IPv4 address.

```
reethu1@reethu1:~$ dig -x 10.0.0.253

; <>> DiG 9.11.3-1ubuntu1.13-Ubuntu <>> -x 10.0.0.253
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 52389
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;253.0.0.10.in-addr.arpa.      IN      PTR

;; ANSWER SECTION:
253.0.0.10.in-addr.arpa. 7007 IN PTR ns.tadwai.com.

;; Query time: 4 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Tue Dec 01 12:59:04 UTC 2020
;; MSG SIZE rcvd: 79
```

### Question 7.

Configure DHCP server on VM1 so that VM2 in your LAN can configure IPv4 address, Subnet Mask and DNS server using DHCP. In this question, Default Gateway can be left without being mentioned because the router does not exist in your LAN. If VM2 uses static IPv4 address and DHCP Client at the same time, you may observe a NIC may have multiple IPv4 addresses.

### Answer to Question 7.

#### Netplan file of VM2 :

```
network:
  version: 2
  renderer: networkd
  ethernets:
    ens3:
      dhcp4: true
```

Even Though We haven't configured the DNS and IP addresses for VM1 we got the nameserver from the **dig** command as IP of VM1. Hence showing that DHCP is working.

```
reethu1@reethu1:~$ dig ns.tadwai.com

; <<>> DiG 9.11.3-1ubuntu1.13-Ubuntu <<>> ns.tadwai.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 52669
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:;; udp: 65494
;; QUESTION SECTION:
;ns.tadwai.com.                IN      A

;; ANSWER SECTION:
ns.tadwai.com.                7132    IN      A      10.0.0.253

;; Query time: 9 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Tue Dec 01 15:49:17 UTC 2020
;; MSG SIZE rcvd: 58
```

We configured the IP ranges as shown in the screenshot below.

```
default-lease-time 600;
max-lease-time 7200;
subnet 10.0.0.0 netmask 255.255.255.0{
range 10.0.0.190 10.0.0.200;
option routers 10.0.0.254;
option domain-name-servers ns.tadwai.com;
option domain-name "tadwai.com";}
```

We got IP4 of VM2 (10.0.0.193) which is dynamically allocated by DHCP in the correct range.

```
reethu1@reethu1:~$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: ens3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 52:54:00:38:30:5d brd ff:ff:ff:ff:ff:ff
    inet 10.0.0.193/24 brd 10.0.0.255 scope global ens3
        valid_lft forever preferred_lft forever
    inet6 fe80::5054:ff:fe38:305d/64 scope link
        valid_lft forever preferred_lft forever
```

Done!!