

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.

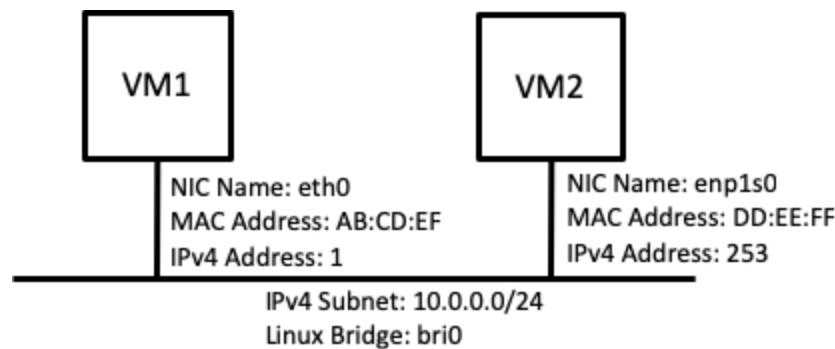


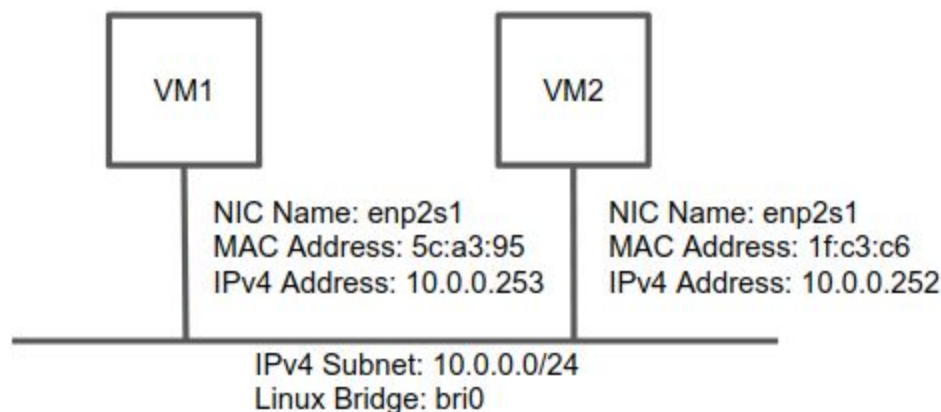
Figure 1. "Example" Network Configuration of 2 VMs connecting to the same Linux bridge and pinging with each other.

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.

```
server1@server1:~$ ip addr show enp2s1
2: enp2s1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 52:54:00:5c:a3:95 brd ff:ff:ff:ff:ff:ff
    inet 10.0.0.253/24 brd 10.0.0.255 scope global enp2s1
        valid_lft forever preferred_lft forever
    inet6 fe80::5054:ff:fe5c:a395/64 scope link
        valid_lft forever preferred_lft forever
server1@server1:~$
```

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.

Avg RTT = 1.569 ms

```
server1@server1:~$ ping 10.0.0.252 -c 10
PING 10.0.0.252 (10.0.0.252) 56(84) bytes of data.
 64 bytes from 10.0.0.252: icmp_seq=1 ttl=64 time=1.94 ms
 64 bytes from 10.0.0.252: icmp_seq=2 ttl=64 time=0.650 ms
 64 bytes from 10.0.0.252: icmp_seq=3 ttl=64 time=1.92 ms
 64 bytes from 10.0.0.252: icmp_seq=4 ttl=64 time=0.589 ms
 64 bytes from 10.0.0.252: icmp_seq=5 ttl=64 time=1.90 ms
 64 bytes from 10.0.0.252: icmp_seq=6 ttl=64 time=1.89 ms
 64 bytes from 10.0.0.252: icmp_seq=7 ttl=64 time=0.444 ms
 64 bytes from 10.0.0.252: icmp_seq=8 ttl=64 time=2.10 ms
 64 bytes from 10.0.0.252: icmp_seq=9 ttl=64 time=2.08 ms
 64 bytes from 10.0.0.252: icmp_seq=10 ttl=64 time=2.15 ms

--- 10.0.0.252 ping statistics ---
 10 packets transmitted, 10 received, 0% packet loss, time 9013ms
 rtt min/avg/max/mdev = 0.444/1.569/2.158/0.669 ms
server1@server1:~$
```

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.

```
server1@server1:~$ iperf -c 10.0.0.252 -i1 -t20
-----
Client connecting to 10.0.0.252, TCP port 5001
TCP window size: 85.0 KByte (default)
-----
[ 3] local 10.0.0.253 port 37684 connected with 10.0.0.252 port 5001
[ ID] Interval           Transfer             Bandwidth
[ 3] 0.0- 1.0 sec       113 MBytes          945 Mbits/sec
[ 3] 1.0- 2.0 sec       119 MBytes          1.00 Gbits/sec
[ 3] 2.0- 3.0 sec       95.4 MBytes         800 Mbits/sec
[ 3] 3.0- 4.0 sec       112 MBytes          941 Mbits/sec
[ 3] 4.0- 5.0 sec       112 MBytes          943 Mbits/sec
[ 3] 5.0- 6.0 sec       119 MBytes          996 Mbits/sec
[ 3] 6.0- 7.0 sec       119 MBytes          999 Mbits/sec
[ 3] 7.0- 8.0 sec       118 MBytes          987 Mbits/sec
[ 3] 8.0- 9.0 sec       108 MBytes          903 Mbits/sec
[ 3] 9.0-10.0 sec       117 MBytes          985 Mbits/sec
[ 3] 10.0-11.0 sec      118 MBytes          994 Mbits/sec
[ 3] 11.0-12.0 sec      111 MBytes          934 Mbits/sec
[ 3] 12.0-13.0 sec      116 MBytes          972 Mbits/sec
[ 3] 13.0-14.0 sec      117 MBytes          980 Mbits/sec
[ 3] 14.0-15.0 sec      120 MBytes          1.00 Gbits/sec
[ 3] 15.0-16.0 sec      118 MBytes          987 Mbits/sec
[ 3] 16.0-17.0 sec      112 MBytes          940 Mbits/sec
[ 3] 17.0-18.0 sec      115 MBytes          965 Mbits/sec
[ 3] 18.0-19.0 sec      118 MBytes          987 Mbits/sec
[ 3] 19.0-20.0 sec      111 MBytes          934 Mbits/sec
[ 3] 0.0-20.0 sec      2.23 GBytes         960 Mbits/sec
server1@server1:~$
```

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.	pingnetwork.com

IPv4 Address of DNS Server	10.0.0.253
Hostname of DNS Server	server1

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.

```
server2@server2:~$ dig pingnetwork.com ANY

; <<>> DiG 9.11.3-1ubuntu1.13-Ubuntu <<>> pingnetwork.com ANY
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 47329
;; flags: qr rd ra; QUERY: 1, ANSWER: 4, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;pingnetwork.com.                IN      ANY

;; ANSWER SECTION:
pingnetwork.com.                604800 IN      SOA     pingnetwork.com. root.pingnetwork.com. 8 604800 86400 2419200 604800
pingnetwork.com.                604800 IN      NS      server1.pingnetwork.com.
pingnetwork.com.                604800 IN      A       10.0.0.253
pingnetwork.com.                604800 IN      AAAA    ::1

;; Query time: 2 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Thu Dec 03 11:24:59 UTC 2020
;; MSG SIZE rcvd: 151

server2@server2:~$
```

```
server2@server2:~$ dig -x 10.0.0.253 ANY

; <<>> DiG 9.11.3-1ubuntu1.13-Ubuntu <<>> -x 10.0.0.253 ANY
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 44870
;; 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      ANY

;; ANSWER SECTION:
253.0.0.10.in-addr.arpa. 604800 IN      PTR     server1.pingnetwork.com.

;; Query time: 2 msec
;; SERVER: 127.0.0.53#53(127.0.0.53)
;; WHEN: Thu Dec 03 11:19:53 UTC 2020
;; MSG SIZE rcvd: 89

server2@server2:~$
```

Note: We used the ANY option to list all records that can be found.

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.

```
server2@server2:~$ ip addr show enp2s1
2: enp2s1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 52:54:00:1f:c3:c6 brd ff:ff:ff:ff:ff:ff
    inet 10.0.0.106/24 brd 10.0.0.255 scope global dynamic enp2s1
        valid_lft 599sec preferred_lft 599sec
    inet6 fe80::5054:ff:fe1f:c3c6/64 scope link
        valid_lft forever preferred_lft forever
server2@server2:~$ nslookup pingnetwork.com
Server:      127.0.0.53
Address:     127.0.0.53#53

Non-authoritative answer:
Name:   pingnetwork.com
Address: 10.0.0.253
Name:   pingnetwork.com
Address: ::1

server2@server2:~$
```

The IP address is “dynamic”. We see that VM2 got a DNS address also and is able to resolve pingnetwork.com.

Done!!