EE357 Computer Networks Lab 4

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Exercise 1 (30 points) Ping 10.0.0.111 from 10.0.0.112 (in your terminal of VM2) and use Wireshark to monitor the interfaces s2 and enp0s8, and describe the protocols used in this procedure and your findings.

Solution. As has been shown in Figure 1, we can ping 10.0.0.111 from 10.0.0.112. Figure 2 shows that interface s2 uses ICMP protocol for requesting and replying the ping command. For interface enp0s8, besides ICMP protocol, ARP protocol is also used in 3.

The Address Resolution Protocol (ARP) is a communication protocol used for discovering the link layer address, such as a MAC address, associated with a given internet layer address, typically an IPv4 address. Therefore s1 in our host can know how to reach s2 in the network.

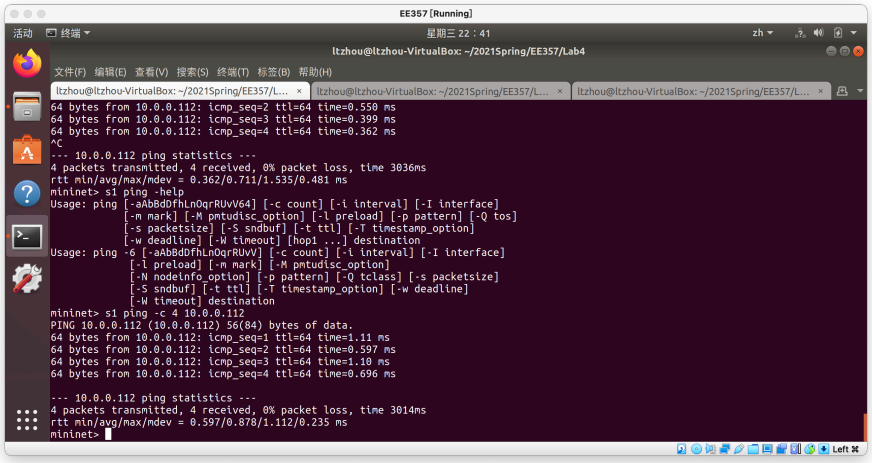

Figure 1: ping 10.0.0.112 from 10.0.0.111

□

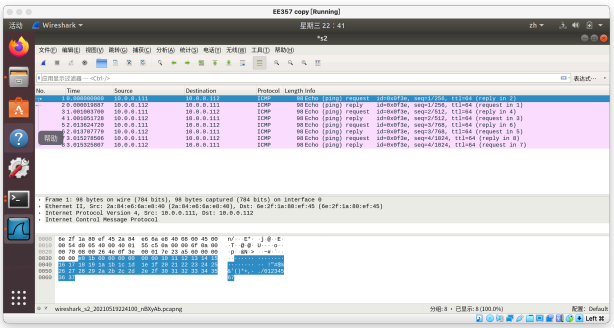

Figure 2: Wireshark result of s2 interface

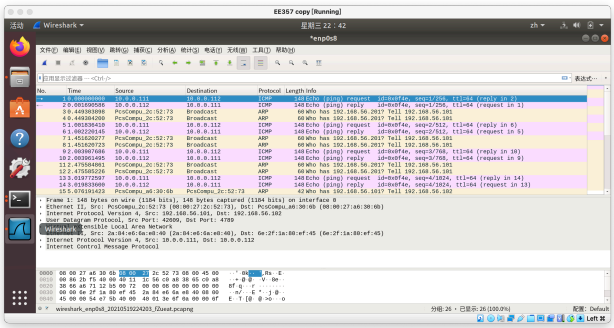

Figure 3: Wireshark result of enp0s8 interface

Exercise 2 (50 points) Use iperf to test the network bandwidth between the two virtual machines

1. Test the bandwidth between 192.168.56.101 and 192.168.56.102
2. Test the bandwidth between 10.0.0.1/10.0.0.2/10.0.0.111 and 10.0.0.3

Compare the above results and explain the reason. (Hint: you may need to specify a reasonable MTU size in order for your iperf to work in this case. Please also think about why.)

Solution.

We first test the bandwidth between 192.168.56.101 and 192.168.56.102 directly on the virtual machine, which shows that the bandwidth is about 3.38 Gbits/sec in Figure 4, 5.

Then we test the bandwidth between 10.0.0.1/10.0.0.2/10.0.0.111 and 10.0.0.3 using xterm in the MiniNet. However, the iperf fails in Figure 6, 7. This is because VXLAN adds 50 to 54 bytes of additional header information to the original Ethernet frame. We must increase the MTU of the underlying network.

In this case, configure the MTU of the physical interfaces that participate in the VXLAN network to be 2000 greater than the typical MTU of 1500, indicated in Figure 8. After the configuration, the iperf command succeeds and the bandwidths between 10.0.0.3 and 10.0.0.1/10.0.0.2/10.0.0.111 are 9.49 Mbits/sec, 9.49 Mbits/sec, and 9.52 Mbits/sec respectively, in Figure 9.

The bandwidth is smaller than we have configured in the MiniNet (10 Mbps) due to the overhead of data headers. The bandwidth of the switch s1 is slightly greater than host h1 and h2 because h1 and h2 requires an extra hop which may take up more bandwidth.

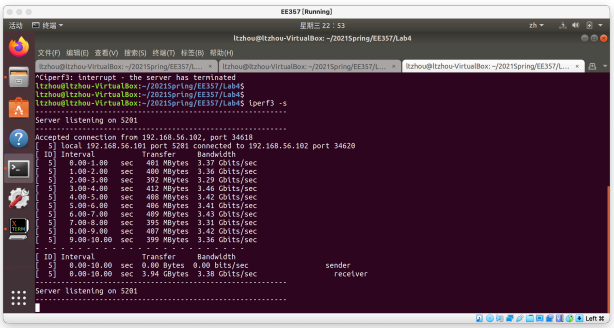

Figure 4: iperf result of 192.168.56.101

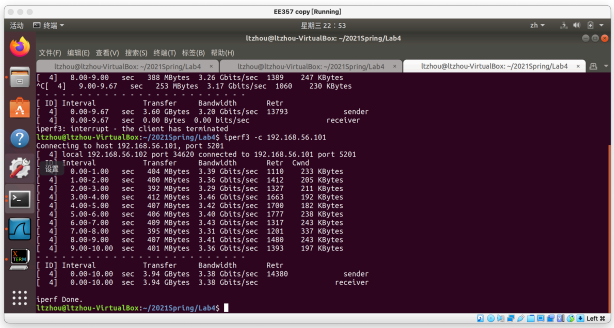

Figure 5: iperf result of 192.168.56.102

□

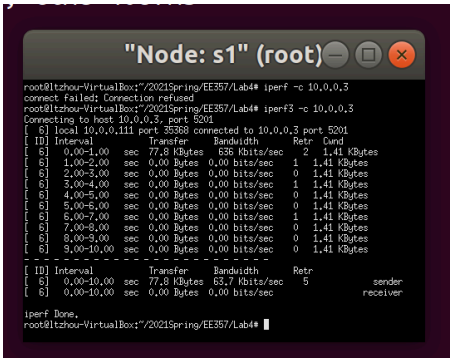

Figure 6: Failure of iperf measurement for 10.0.0.111

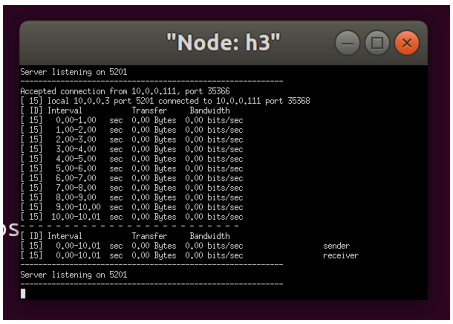

Figure 7: Failure of iperf measurement for 10.0.0.3

```
ltzhou@ltzhou-VirtualBox:~/2021Spring/EE357/Lab4$ ifconfig | grep mtu
br1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
enp0s8: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1600
lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
s1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
s1-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
s1-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
vxlan_sys_4789: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 65000
ltzhou@ltzhou-VirtualBox:~/2021Spring/EE357/Lab4$ sudo ifconfig enp0s8 mtu 2000 up
```

Figure 8: Change the MTU of the underlying physical interface

Exercise 3 (20 points) Similar to Q2, use ping to test the network latency and analyze your results.

Solution.

The latency between 192.168.56.101 and 192.168.56.102 is 0.836ms on average, shown in Figure 10.

The latency between 10.0.0.3 and 10.0.0.1/10.0.0.2/10.0.0.111 is 22.750, 22.686ms, and 12.009ms on average respectively, shown in Figure 11.

The latency between VXLAN network is larger than the true latency between two virtual machines as we configured in MiniNet. Receiving the first ping reply usually takes a much longer time than others, because for later connection, the target address has been cached. The time for h1 and h2 takes twice as much as that for s1, because they requires an extra hop to reach s2.

□

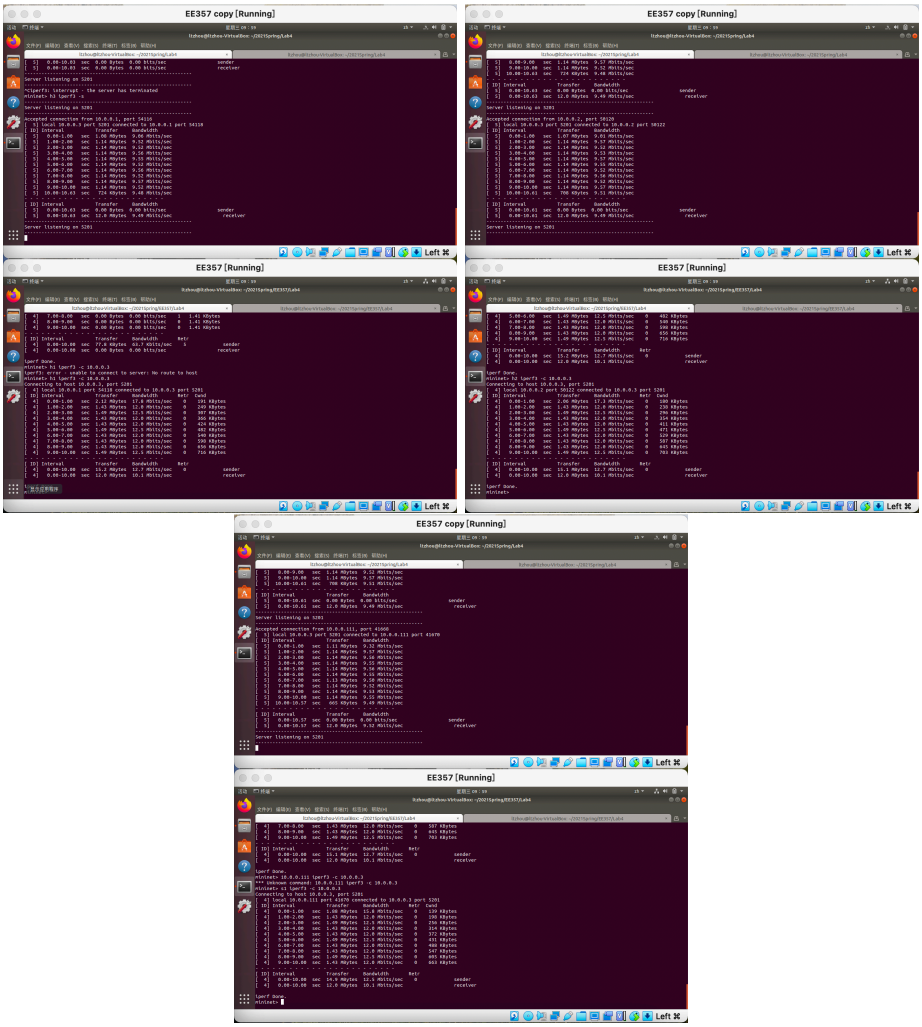

Figure 9: iperf measurement for 10.0.0.1, 10.0.0.2, 10.0.0.111 as clients and 10.0.0.3 as server

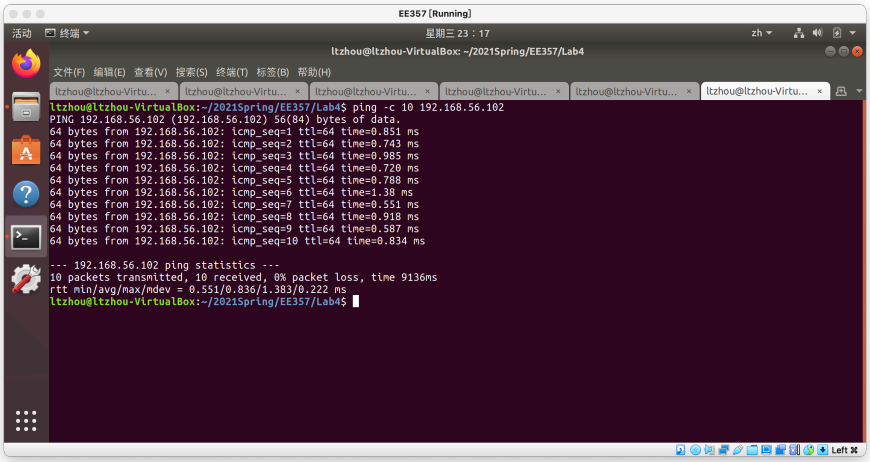

Figure 10: Ping latency between 192.168.56.101 and 192.168.56.102

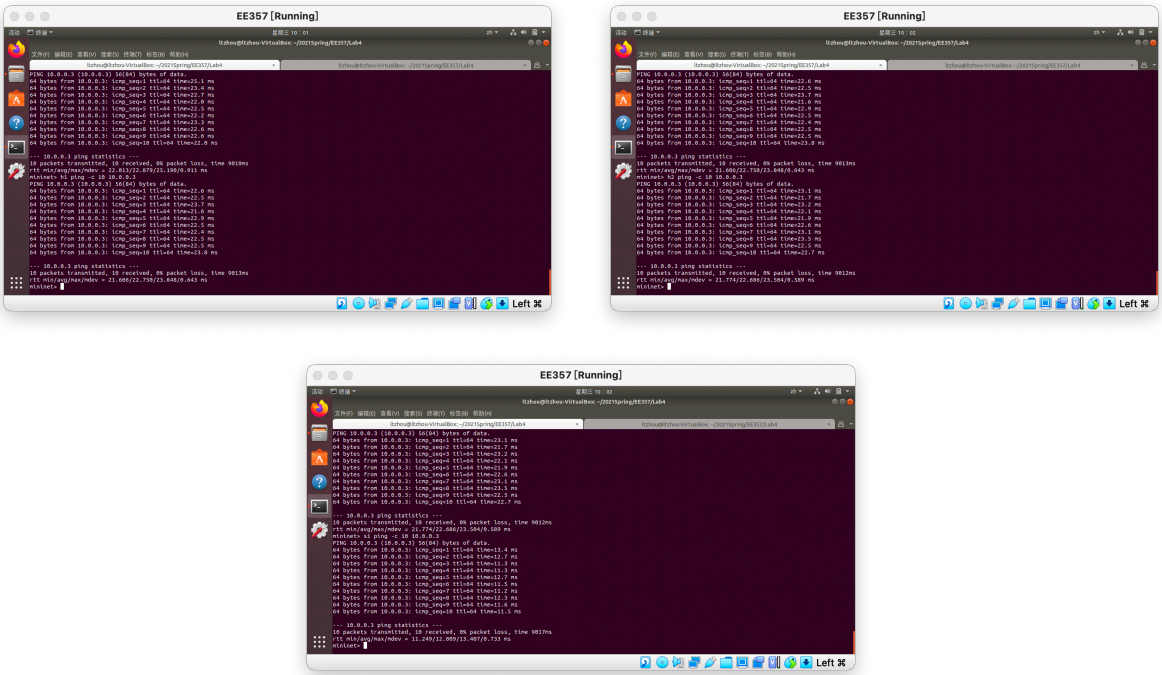

Figure 11: Ping latency from 10.0.0.1/10.0.0.2/10.0.0.111 to 10.0.0.3