

Computer Networks Lab
CS302

Lab - 6 Report

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QUESTIONS:

Part A 1. Print the list of network interfaces, their MAC addresses and their assigned IP addresses, if any.

```
mininet@mininet-vm:~$ ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    ether 08:00:27:29:5c:8a txqueuelen 1000 (Ethernet)
    RX packets 188 bytes 28950 (28.9 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 188 bytes 17801 (17.8 KB)
    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
    loop txqueuelen 1000 (Local Loopback)
    RX packets 28 bytes 2860 (2.8 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 28 bytes 2860 (2.8 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

mininet@mininet-vm:~$
```

The machine has one network interface (lo is the localhost interface) which is eth0.

The IP Address - 10.0.2.15

MAC Address - 08:00:27:29:5c:8a

2. Calculate the latency between mininet vm and www.rutgers.edu for 10 packets. Repeat the result for stanford.edu and www.google.co.in and compare the difference in latency.

```
mininet@mininet-vm:~$ ping www.rutgers.edu -c 10
PING www.rutgers.edu (128.6.46.88) 56(84) bytes of data.
64 bytes from www.rutgers.edu (128.6.46.88): icmp_seq=1 ttl=221 time=303 ms
64 bytes from www.rutgers.edu (128.6.46.88): icmp_seq=2 ttl=221 time=326 ms
64 bytes from www.rutgers.edu (128.6.46.88): icmp_seq=3 ttl=221 time=349 ms
64 bytes from www.rutgers.edu (128.6.46.88): icmp_seq=4 ttl=221 time=286 ms
64 bytes from www.rutgers.edu (128.6.46.88): icmp_seq=5 ttl=221 time=282 ms
64 bytes from www.rutgers.edu (128.6.46.88): icmp_seq=6 ttl=221 time=314 ms
64 bytes from www.rutgers.edu (128.6.46.88): icmp_seq=7 ttl=221 time=336 ms
64 bytes from www.rutgers.edu (128.6.46.88): icmp_seq=8 ttl=221 time=357 ms
64 bytes from www.rutgers.edu (128.6.46.88): icmp_seq=9 ttl=221 time=381 ms
64 bytes from www.rutgers.edu (128.6.46.88): icmp_seq=10 ttl=221 time=352 ms
```

```
--- www.rutgers.edu ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9013ms
rtt min/avg/max/mdev = 282.241/328.463/380.618/30.761 ms
mininet@mininet-vm:~$ _
```

```
mininet@mininet-vm:~$ ping www.stanford.edu -c 10
PING pantheon-systems.map.fastly.net (199.232.106.133) 56(84) bytes of data.
64 bytes from 199.232.106.133 (199.232.106.133): icmp_seq=1 ttl=54 time=27.8 ms
64 bytes from 199.232.106.133 (199.232.106.133): icmp_seq=2 ttl=54 time=29.8 ms
64 bytes from 199.232.106.133 (199.232.106.133): icmp_seq=3 ttl=54 time=30.0 ms
64 bytes from 199.232.106.133 (199.232.106.133): icmp_seq=4 ttl=54 time=29.6 ms
64 bytes from 199.232.106.133 (199.232.106.133): icmp_seq=5 ttl=54 time=27.7 ms
64 bytes from 199.232.106.133 (199.232.106.133): icmp_seq=6 ttl=54 time=40.9 ms
64 bytes from 199.232.106.133 (199.232.106.133): icmp_seq=7 ttl=54 time=29.9 ms
64 bytes from 199.232.106.133 (199.232.106.133): icmp_seq=8 ttl=54 time=29.9 ms
64 bytes from 199.232.106.133 (199.232.106.133): icmp_seq=9 ttl=54 time=30.3 ms
64 bytes from 199.232.106.133 (199.232.106.133): icmp_seq=10 ttl=54 time=28.1 ms
```

```
--- pantheon-systems.map.fastly.net ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9015ms
rtt min/avg/max/mdev = 27.719/30.406/40.948/3.634 ms
mininet@mininet-vm:~$
```

```
mininet@mininet-vm:~$ ping www.google.co.in -c 10
PING www.google.co.in (142.250.182.35) 56(84) bytes of data.
64 bytes from maa05s19-in-f3.1e100.net (142.250.182.35): icmp_seq=1 ttl=115 time=17.0 ms
64 bytes from maa05s19-in-f3.1e100.net (142.250.182.35): icmp_seq=2 ttl=115 time=34.3 ms
64 bytes from maa05s19-in-f3.1e100.net (142.250.182.35): icmp_seq=3 ttl=115 time=18.7 ms
64 bytes from maa05s19-in-f3.1e100.net (142.250.182.35): icmp_seq=4 ttl=115 time=17.9 ms
64 bytes from maa05s19-in-f3.1e100.net (142.250.182.35): icmp_seq=5 ttl=115 time=16.1 ms
64 bytes from maa05s19-in-f3.1e100.net (142.250.182.35): icmp_seq=6 ttl=115 time=16.5 ms
64 bytes from maa05s19-in-f3.1e100.net (142.250.182.35): icmp_seq=7 ttl=115 time=18.6 ms
64 bytes from maa05s19-in-f3.1e100.net (142.250.182.35): icmp_seq=8 ttl=115 time=16.7 ms
64 bytes from maa05s19-in-f3.1e100.net (142.250.182.35): icmp_seq=9 ttl=115 time=15.8 ms
64 bytes from maa05s19-in-f3.1e100.net (142.250.182.35): icmp_seq=10 ttl=115 time=18.4 ms
```

```
--- www.google.co.in ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9019ms
rtt min/avg/max/mdev = 15.839/19.014/34.336/5.204 ms
mininet@mininet-vm:~$ _
```

The Avg latency for rutgers.edu is 328.463 ms, stanford.edu is 30.406 ms and for google.co.in is 19.014 ms.

The difference between rutgers.edu and stanford.edu is 298.057 ms, stanford.edu and google.co.in is 11.392 ms, rutgers.edu and google.co.in is 309.449 ms.

Part B Create a simple two node network using "sudo mn" and do the following

a. Print the MAC address of host h1. Print the MAC addresses of switch s1.

Explain the different interfaces that s1 has.

```
mininet> h1 ifconfig
h1-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.0.1 netmask 255.0.0.0 broadcast 10.255.255.255
    ether 56:78:93:74:6f:f2 txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    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
    loop txqueuelen 1000 (Local Loopback)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

The mac address of h1-eth0 is 56:78:93:74:6f:f2

The Ip address of h1 eth0 is 10.0.0.1.

```

mininet> s1 ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    ether 08:00:27:29:5c:8a txqueuelen 1000 (Ethernet)
    RX packets 187 bytes 18638 (18.6 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 190 bytes 17466 (17.4 KB)
    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
    loop txqueuelen 1000 (Local Loopback)
    RX packets 217 bytes 14112 (14.1 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 217 bytes 14112 (14.1 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s1-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    ether 5e:30:81:00:b4:4e txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

s1-eth2: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    ether 7e:44:40:2c:f4:5b txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

```

The mac address of the switch s1 is 08:00:27:29:5c:8a

There are two extra interfaces now such as s1-eth0 and s2-eth0. The s1-eth0 is the interface between the switch and the host h1 and the s1-eth1 is the interface between the switch and the host h2. They have the details regarding those interfaces.

b. Ping h1 from h2 and view the ARP entries stored at hosts h1 and h2. 3. Measure the TCP throughput from h1 to h2 using iperf

The below image shows the ping operation from the node h1 to h2. Ping operation sends packets from h1 to h2.

```
mininet> h1 ping -c 10 h2
PING 10.0.0.2 (10.0.0.2) 56(84) bytes of data.
64 bytes from 10.0.0.2: icmp_seq=1 ttl=64 time=14.9 ms
64 bytes from 10.0.0.2: icmp_seq=2 ttl=64 time=0.545 ms
64 bytes from 10.0.0.2: icmp_seq=3 ttl=64 time=0.111 ms
64 bytes from 10.0.0.2: icmp_seq=4 ttl=64 time=0.101 ms
64 bytes from 10.0.0.2: icmp_seq=5 ttl=64 time=0.130 ms
64 bytes from 10.0.0.2: icmp_seq=6 ttl=64 time=0.112 ms
64 bytes from 10.0.0.2: icmp_seq=7 ttl=64 time=0.114 ms
64 bytes from 10.0.0.2: icmp_seq=8 ttl=64 time=0.113 ms
64 bytes from 10.0.0.2: icmp_seq=9 ttl=64 time=0.111 ms
64 bytes from 10.0.0.2: icmp_seq=10 ttl=64 time=0.129 ms

--- 10.0.0.2 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9182ms
rtt min/avg/max/mdev = 0.101/1.636/14.896/4.421 ms
```

After we ping h2 from h1 we use the command arp -a to see the arp table of both the nodes.

```
mininet> h1 arp -a
? (10.0.0.2) at 0e:dc:e1:87:00:6f [ether] on h1-eth0
mininet> h2 arp -a
? (10.0.0.1) at 56:78:93:74:6f:f2 [ether] on h2-eth0
```

```
mininet> iperf h1 h2
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['30.8 Gbits/sec', '30.8 Gbits/sec']
mininet> _
```

By running the command iperf h1 h2 we can find the throughput of the tcp connection. From this image we can see that the value here is 30.8 Gbit/sec.