CS352 – Summer 2021

Project 2

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1. Network Setup

(1)

```
C:\Users\yutin>ipconfig

Windows IP Configuration


Ethernet adapter VirtualBox Host-Only Network:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::c148:a8ae:eb8d:591c%44
   IPv4 Address. . . . . . . . . . . : 192.168.56.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :

Wireless LAN adapter Local Area Connection* 1:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter Local Area Connection* 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Ethernet adapter Ethernet 4:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . : hsd1.nj.comcast.net
   IPv6 Address. . . . . . . . . . . : 2601:84:4700:a70::dd14
   IPv6 Address. . . . . . . . . . . : 2601:84:4700:a70:e939:aa45:515e:72b6
   Temporary IPv6 Address. . . . . . : 2601:84:4700:a70:a15b:f3a9:2ebe:cb44
   Link-local IPv6 Address . . . . . : fe80::e939:aa45:515e:72b6%5
   IPv4 Address. . . . . . . . . . . : 10.0.0.235
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::3e9a:77ff:fef4:55af%5
                                       10.0.0.1

Ethernet adapter Bluetooth Network Connection:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
```

(2)a. www.rutgers.edu 20ms. www.berkley.edu 93ms. www.google.co.in 17ms.

```
C:\WINDOWS\system32>ping www.rutgers.edu -c 1

Pinging www.rutgers.edu [128.6.46.88] with 32 bytes of data:
Reply from 128.6.46.88: bytes=32 time=18ms TTL=239
Reply from 128.6.46.88: bytes=32 time=18ms TTL=239
Reply from 128.6.46.88: bytes=32 time=27ms TTL=239
Reply from 128.6.46.88: bytes=32 time=19ms TTL=239

Ping statistics for 128.6.46.88:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 18ms, Maximum = 27ms, Average = 20ms
```

```
C:\WINDOWS\system32>ping www.berkley.edu -c 1

Pinging www.berkley.edu [104.247.81.71] with 32 bytes of data:
Reply from 104.247.81.71: bytes=32 time=77ms TTL=53
Reply from 104.247.81.71: bytes=32 time=64ms TTL=53
Reply from 104.247.81.71: bytes=32 time=81ms TTL=53
Reply from 104.247.81.71: bytes=32 time=153ms TTL=53

Ping statistics for 104.247.81.71:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 64ms, Maximum = 153ms, Average = 93ms
```

```
C:\WINDOWS\system32>ping www.google.co.in -c 1

Pinging www.google.co.in [2607:f8b0:4006:81e::2003] with 32 bytes of data:
Reply from 2607:f8b0:4006:81e::2003: time=24ms
Reply from 2607:f8b0:4006:81e::2003: time=14ms
Reply from 2607:f8b0:4006:81e::2003: time=15ms
Reply from 2607:f8b0:4006:81e::2003: time=17ms

Ping statistics for 2607:f8b0:4006:81e::2003:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 14ms, Maximum = 24ms, Average = 17ms
```

(2) b. The webpage of Rutgers and Berkley have same domain. Now I am in New Jersey. The distance from client device that I made the request to Berkley server is father than the distance to Rutgers server, so the latency of www.berkley.edu is bigger than www.rutgers.edu. The webpage of google has different domain with other two.

(3) a.

```
C:\Users\yutin>tracert www.rutgers.edu

Tracing route to www.rutgers.edu [128.6.46.88]
over a maximum of 30 hops:

  1     2 ms     2 ms     2 ms  10.0.0.1
  2    15 ms    23 ms    11 ms  96.120.72.61
  3    22 ms    13 ms    12 ms  68.85.117.61
  4    13 ms    18 ms    12 ms  68.86.210.37
  5    17 ms    14 ms    18 ms  68.86.158.21
  6    22 ms    18 ms    14 ms  be-98-ar03.plainfield.nj.panjde.comcast.net [68.85.35.37]
  7   344 ms    16 ms    19 ms  be-31143-cs04.newark.nj.ibone.comcast.net [96.110.42.45]
  8    22 ms    14 ms    19 ms  be-1411-cr11.newark.nj.ibone.comcast.net [96.110.35.78]
  9    13 ms    13 ms    13 ms  be-302-cr12.newyork.ny.ibone.comcast.net [96.110.36.150]
 10    15 ms    17 ms    18 ms  be-1112-cs01.newyork.ny.ibone.comcast.net [96.110.35.129]
 11    29 ms     *     1912 ms  be-3111-pe11.111eighthave.ny.ibone.comcast.net [96.110.34.18]
 12    29 ms    20 ms    24 ms  nyk-b6-link.ip.twelve99.net [62.115.52.129]
 13     *        *        *     Request timed out.
 14    79 ms    31 ms    19 ms  phm-b2-link.ip.twelve99.net [62.115.121.159]
 15    20 ms    20 ms    20 ms  rutgers-ic338849-phm-b2.ip.twelve99-cust.net [213.248.68.155]
 16     *        *        *     Request timed out.
 17     *        *        *     Request timed out.
 18     *        *        *     Request timed out.
 19     *        *        *     Request timed out.
 20    31 ms    25 ms    27 ms  www.rutgers.edu [128.6.46.88]

Trace complete.
```

b. The first router is my local router where the internet provider comcast provide internet for me. The second one is from my local router to the point of presence router of the ISP for traveling the packets.

(4)

Domain Information

Name: ABC.COM

Registry Domain ID: 893646_DOMAIN_COM-VRSN

Domain Status:
clientTransferProhibited
serverDeleteProhibited
serverTransferProhibited
serverUpdateProhibited

Nameservers:
NS-1368.AWSDNS-43.ORG
NS-1869.AWSDNS-41.CO.UK
NS-318.AWSDNS-39.COM
NS-736.AWSDNS-28.NET

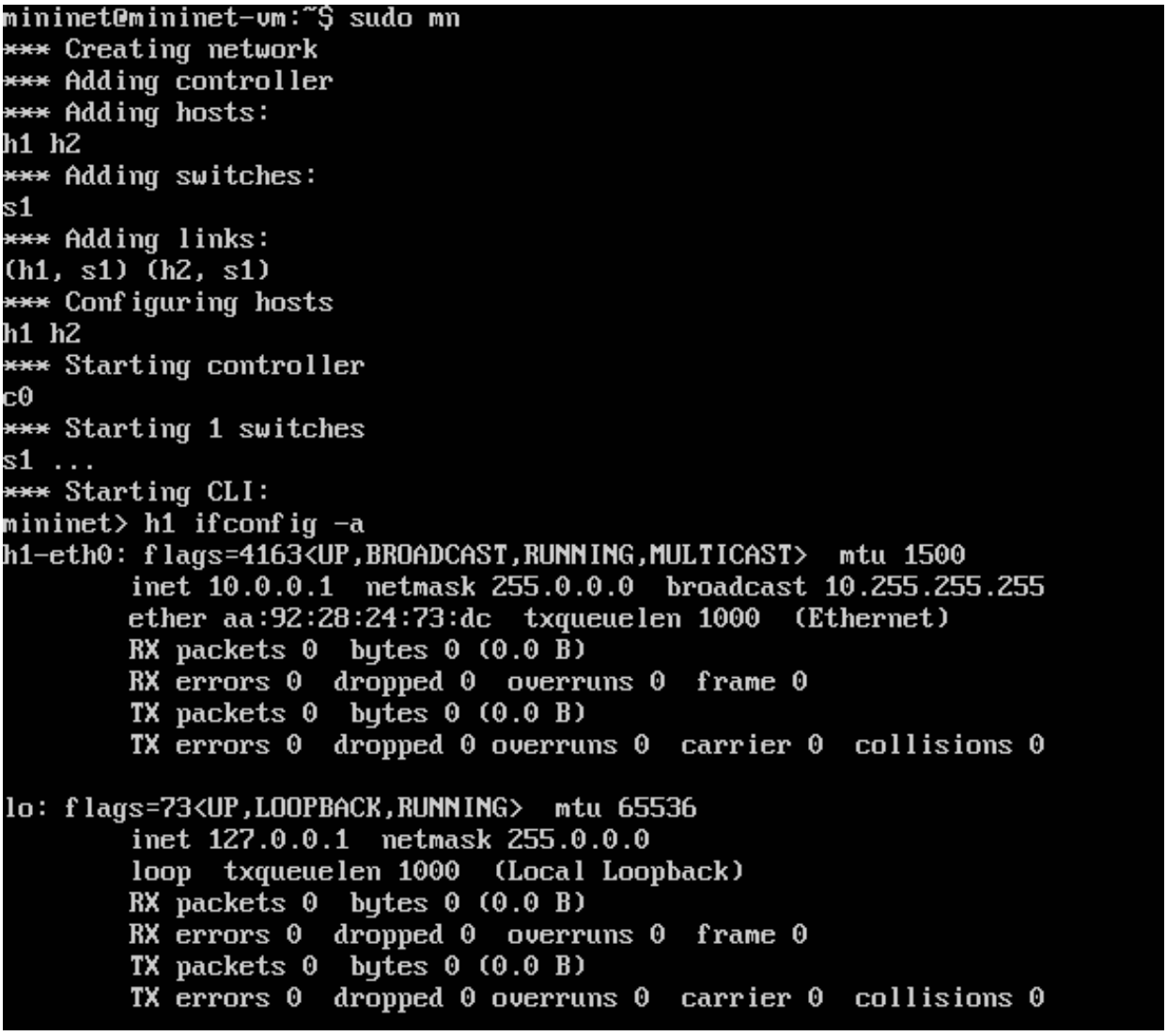
Dates

Registry Expiration: 2022-05-23 04:00:00 UTC

Created: 1996-05-22 04:00:00 UTC

2- Mininet

(1) a. The MAC address of host h1 is aa:92:28:24:73:dc.



The MAC address of switch s1 is 3a:48:de:80:dd:4b.

```
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 08:00:27:01:dc:fd  txqueuelen 1000  (Ethernet)
        RX packets 223  bytes 21546 (21.5 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 227  bytes 20702 (20.7 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 292  bytes 17948 (17.9 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 292  bytes 17948 (17.9 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

ovs-system: flags=4098<BROADCAST,MULTICAST>  mtu 1500
        ether a2:af:ab:92:bd:8c  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: flags=4098<BROADCAST,MULTICAST>  mtu 1500
        ether 3a:48:de:80:dd:4b  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-eth1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        ether 76:fa:fe:da:53:24  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 3e:8f:39:db:58:97  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
```

(1) b. The switch s1 has a loopback interface lo. It connects to h1-eth0 by interface s1-eth1 and h2-eth0 by s1-eth2.

(2) a.

```
mininet> h2 ping h1 -c 5
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=4.45 ms
64 bytes from 10.0.0.1: icmp_seq=2 ttl=64 time=0.873 ms
64 bytes from 10.0.0.1: icmp_seq=3 ttl=64 time=0.096 ms
64 bytes from 10.0.0.1: icmp_seq=4 ttl=64 time=0.095 ms
64 bytes from 10.0.0.1: icmp_seq=5 ttl=64 time=0.110 ms

--- 10.0.0.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4055ms
rtt min/avg/max/mdev = 0.095/1.124/4.450/1.689 ms
```

(2) b.

```
mininet> h1 arp
Address                  HWtype  HWaddress           Flags Mask            Iface
10.0.0.2                 ether   d2:96:20:f5:16:b5   C                     h1-eth0
mininet> h2 arp
Address                  HWtype  HWaddress           Flags Mask            Iface
10.0.0.1                 ether   aa:92:28:24:73:dc   C                     h2-eth0
```

(3)

```
mininet> iperf
*** Iperf: testing TCP bandwidth between h1 and h2
.*** Results: ['20.9 Gbits/sec', '20.9 Gbits/sec']
```

(4) a.

```
mininet> h2 ping h1 -c 5
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=85.6 ms
64 bytes from 10.0.0.1: icmp_seq=2 ttl=64 time=43.0 ms
64 bytes from 10.0.0.1: icmp_seq=3 ttl=64 time=42.6 ms
64 bytes from 10.0.0.1: icmp_seq=4 ttl=64 time=42.2 ms
64 bytes from 10.0.0.1: icmp_seq=5 ttl=64 time=41.9 ms

--- 10.0.0.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 41.892/51.073/85.593/17.263 ms
```

(4) b. Some pings took longer than others, because we create a new topology, everything has been reset to its initial state.

(5) a.

```
mininet> iperf
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['9.49 Mbits/sec', '11.9 Mbits/sec']
```

(5) b. Yes. It would be different if link latencies wre 20 ms instead of 100ms. It might be sightly higher.