

NSCap Lab Report

Lab3

Part 1

1. Take routing table screenshots

- before

```
mininet> r1 route
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
10.0.1.0       0.0.0.0         255.255.255.0   U        0      0      0 r1-eth0
192.168.1.0    0.0.0.0         255.255.255.192 U        0      0      0 r1-eth1
192.168.1.64   0.0.0.0         255.255.255.192 U        0      0      0 r1-eth2

mininet> r2 route
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
10.0.0.0       0.0.0.0         255.255.255.0   U        0      0      0 r2-eth0
10.0.1.0       0.0.0.0         255.255.255.0   U        0      0      0 r2-eth1

mininet> r3 route
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
10.0.0.0       0.0.0.0         255.255.255.0   U        0      0      0 r3-eth0
10.0.2.0       0.0.0.0         255.255.255.0   U        0      0      0 r3-eth1

mininet> r4 route
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
10.0.2.0       0.0.0.0         255.255.255.0   U        0      0      0 r4-eth0
140.114.0.0    0.0.0.0         255.255.255.0   U        0      0      0 r4-eth1
mininet>
```

- after

```
mininet> r1 route
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
10.0.1.0       0.0.0.0         255.255.255.0   U        0      0      0 r1-eth0
140.114.0.0    10.0.1.1        255.255.255.0   UG       20     0      0 r1-eth0
192.168.1.0    0.0.0.0         255.255.255.192 U        0      0      0 r1-eth1
192.168.1.64   0.0.0.0         255.255.255.192 U        0      0      0 r1-eth2

mininet> r2 route
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
10.0.0.0       0.0.0.0         255.255.255.0   U        0      0      0 r2-eth0
10.0.1.0       0.0.0.0         255.255.255.0   U        0      0      0 r2-eth1
140.113.0.0    10.0.1.2        255.255.0.0     UG       20     0      0 r2-eth1
140.114.0.0    10.0.0.2        255.255.255.0   UG       20     0      0 r2-eth0

mininet> r3 route
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
10.0.0.0       0.0.0.0         255.255.255.0   U        0      0      0 r3-eth0
10.0.2.0       0.0.0.0         255.255.255.0   U        0      0      0 r3-eth1
140.113.0.0    10.0.0.1        255.255.0.0     UG       20     0      0 r3-eth0
140.114.0.0    10.0.2.3        255.255.255.0   UG       20     0      0 r3-eth1

mininet> r4 route
Kernel IP routing table
Destination    Gateway         Genmask         Flags Metric Ref    Use Iface
10.0.2.0       0.0.0.0         255.255.255.0   U        0      0      0 r4-eth0
140.113.0.0    10.0.2.1        255.255.0.0     UG       20     0      0 r4-eth0
140.114.0.0    0.0.0.0         255.255.255.0   U        0      0      0 r4-eth1
mininet>
```

- We can see that the bgp protocol successfully modify the routing table of each

router.

2. Take screenshots of routes in zebra and bgpd daemons of r1~r4.

o r1

```
zebra> show ip route bgp
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, P - PIM, A - Babel, N - NHRP,
       > - selected route, * - FIB route

B>* 140.114.0.0/24 [20/0] via 10.0.1.1, r1-eth0, 00:16:29
zebra>
zebra> Connection closed by foreign host.
root@ubuntu:/home/tommytyc/NSCap/lab3# telnet 127.0.0.1 2605
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.

Hello, this is Quagga (version 1.2.4).
Copyright 1996-2005 Kunihiro Ishiguro, et al.

■ User Access Verification

Password:
r1> show ip bgp summary
BGP router identifier 10.0.1.2, local AS number 65000
RIB entries 3, using 336 bytes of memory
Peers 1, using 9088 bytes of memory

Neighbor      V      AS MsgRcvd MsgSent  TblVer  InQ OutQ Up/Down  State/P
fxRcd
10.0.1.1      4 65001   351    352      0   0   0 00:17:23    1

Total number of neighbors 1

Total num. Established sessions 1
Total num. of routes received    1
r1> █
```

o r2

```
zebra> show ip route bgp
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, P - PIM, A - Babel, N - NHRP,
       > - selected route, * - FIB route

B>* 140.113.0.0/16 [20/0] via 10.0.1.2, r2-eth1, 00:21:24
B>* 140.114.0.0/24 [20/0] via 10.0.0.2, r2-eth0, 00:21:19
zebra>
zebra> Connection closed by foreign host.
root@ubuntu:/home/tommytyc/NSCap/lab3# telnet 127.0.0.1 2605
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.

Hello, this is Quagga (version 1.2.4).
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■ User Access Verification

Password:
r2> show ip bgp summary
BGP router identifier 10.0.1.1, local AS number 65001
RIB entries 3, using 336 bytes of memory
Peers 2, using 18 KiB of memory

Neighbor      V      AS MsgRcvd MsgSent  TblVer  InQ OutQ Up/Down  State/P
fxRcd
10.0.0.2      4 65002   440    443      0   0   0 00:21:53    1
10.0.1.2      4 65000   440    443      0   0   0 00:21:53    1

Total number of neighbors 2

Total num. Established sessions 2
Total num. of routes received    2
r2> █
```

- o r3

```
zebra> show ip route bgp
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, P - PIM, A - Babel, N - NHRP,
       > - selected route, * - FIB route

B>* 140.113.0.0/16 [20/0] via 10.0.0.1, r3-eth0, 00:25:05
B>* 140.114.0.0/24 [20/0] via 10.0.2.3, r3-eth1, 00:25:10
zebra>
zebra> Connection closed by foreign host.
root@ubuntu:/home/tommytyc/NSCap/lab3# telnet 127.0.0.1 2605
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.

Hello, this is Quagga (version 1.2.4).
Copyright 1996-2005 Kunihiro Ishiguro, et al.
```

■ User Access Verification

```
Password:
r3> show ip bgp summary
BGP router identifier 10.0.2.1, local AS number 65002
RIB entries 3, using 336 bytes of memory
Peers 2, using 18 KiB of memory
```

Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/P
fxRcd									
10.0.0.1	4	65001	512	513	0	0	0	00:25:27	1
10.0.2.3	4	65003	511	514	0	0	0	00:25:27	1

```
Total number of neighbors 2
Total num. Established sessions 2
Total num. of routes received 2
r3>
```

- o r4

```
zebra> show ip route bgp
Codes: K - kernel route, C - connected, S - static, R - RIP,
       O - OSPF, I - IS-IS, B - BGP, P - PIM, A - Babel, N - NHRP,
       > - selected route, * - FIB route

B>* 140.113.0.0/16 [20/0] via 10.0.2.1, r4-eth0, 00:26:23
zebra>
zebra> Connection closed by foreign host.
root@ubuntu:/home/tommytyc/NSCap/lab3# telnet 127.0.0.1 2605
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.

Hello, this is Quagga (version 1.2.4).
Copyright 1996-2005 Kunihiro Ishiguro, et al.
```

■ User Access Verification

```
Password:
r4> show ip bgp summary
BGP router identifier 10.0.2.3, local AS number 65003
RIB entries 3, using 336 bytes of memory
Peers 1, using 9088 bytes of memory
```

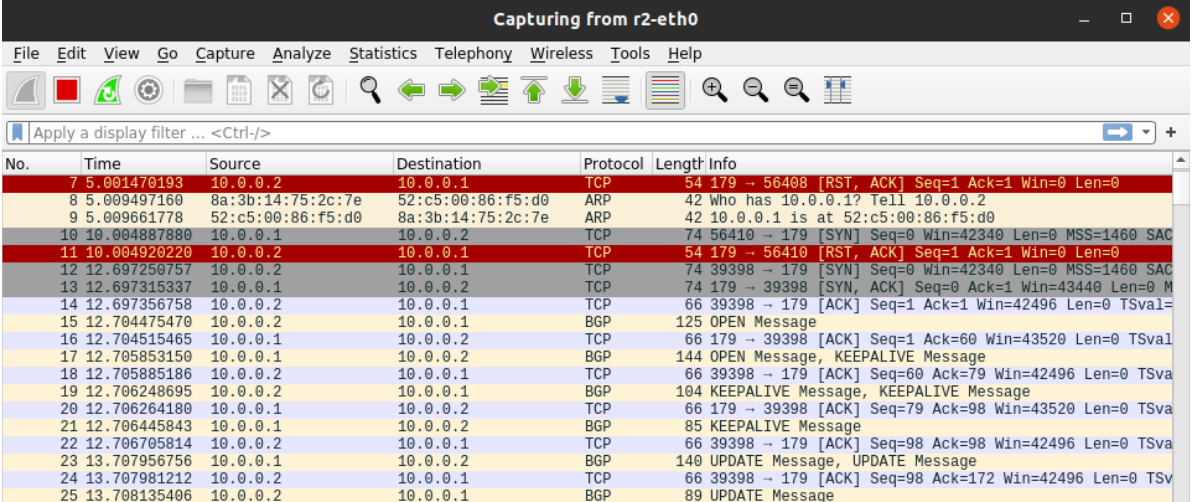
Neighbor	V	AS	MsgRcvd	MsgSent	TblVer	InQ	OutQ	Up/Down	State/P
fxRcd									
10.0.2.1	4	65002	538	539	0	0	0	00:26:45	1

```
Total number of neighbors 1
Total num. Established sessions 1
Total num. of routes received 1
r4>
```

- o We can see that the zebra and bgpd routing information have been updated.

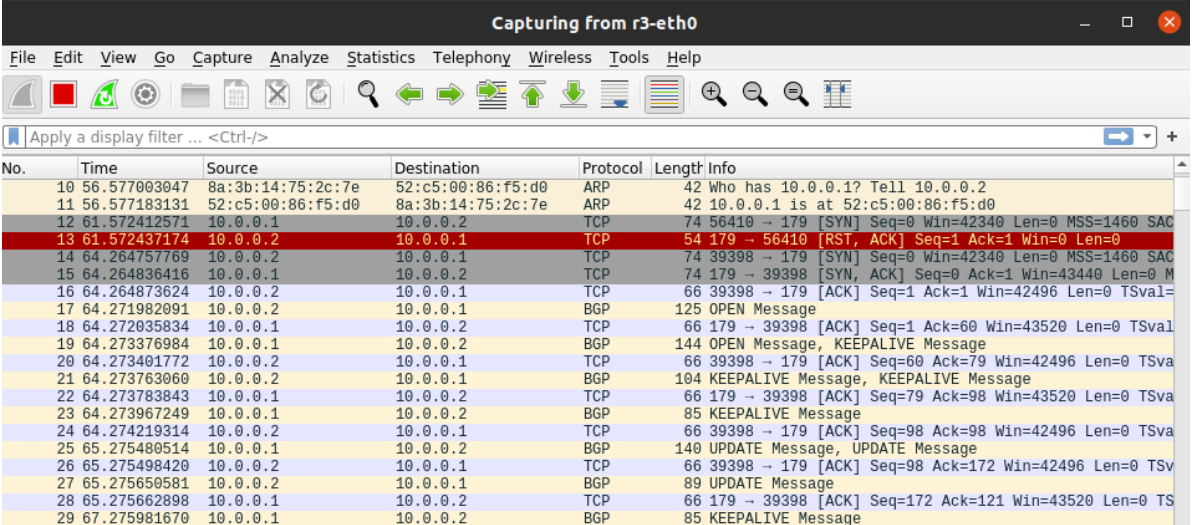
3. Capture BGP packets from wireshark and take screenshots to verify your answer to the questions.

- 3-1 Show BGP packets(OPEN, UPDATE, KEEPALIVE) exchanged by r2 and r3.



Wireshark interface showing a packet capture from r2-eth0. The display filter is 'Apply a display filter ... <Ctrl-/>'. The packet list shows 25 packets. The selected packet (No. 11) is a TCP RST, ACK from 10.0.0.2 to 10.0.0.1. The packet details pane shows the TCP header and the application layer data.

No.	Time	Source	Destination	Protocol	Length	Info
7	5.001470193	10.0.0.2	10.0.0.1	TCP	54	179 → 56408 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
8	5.009497160	8a:3b:14:75:2c:7e	52:c5:00:86:f5:d0	ARP	42	Who has 10.0.0.1? Tell 10.0.0.2
9	5.009661778	52:c5:00:86:f5:d0	8a:3b:14:75:2c:7e	ARP	42	10.0.0.1 is at 52:c5:00:86:f5:d0
10	10.004887880	10.0.0.1	10.0.0.2	TCP	74	56410 → 179 [SYN] Seq=0 Win=42340 Len=0 MSS=1460 SAC
11	10.004920220	10.0.0.2	10.0.0.1	TCP	54	179 → 56410 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
12	12.697250757	10.0.0.2	10.0.0.1	TCP	74	39398 → 179 [SYN] Seq=0 Win=42340 Len=0 MSS=1460 SAC
13	12.697315337	10.0.0.1	10.0.0.2	TCP	74	179 → 39398 [SYN, ACK] Seq=0 Ack=1 Win=43440 Len=0 M
14	12.697356758	10.0.0.2	10.0.0.1	TCP	66	39398 → 179 [ACK] Seq=1 Ack=1 Win=42496 Len=0 TSval=
15	12.704475470	10.0.0.2	10.0.0.1	BGP	125	OPEN Message
16	12.704515465	10.0.0.1	10.0.0.2	TCP	66	179 → 39398 [ACK] Seq=1 Ack=60 Win=43520 Len=0 TSval=
17	12.705853150	10.0.0.1	10.0.0.2	BGP	144	OPEN Message, KEEPALIVE Message
18	12.705885186	10.0.0.2	10.0.0.1	TCP	66	39398 → 179 [ACK] Seq=60 Ack=79 Win=42496 Len=0 TSva
19	12.706248695	10.0.0.2	10.0.0.1	BGP	104	KEEPALIVE Message, KEEPALIVE Message
20	12.706264180	10.0.0.1	10.0.0.2	TCP	66	179 → 39398 [ACK] Seq=79 Ack=98 Win=43520 Len=0 TSva
21	12.706445843	10.0.0.1	10.0.0.2	BGP	85	KEEPALIVE Message
22	12.706705814	10.0.0.2	10.0.0.1	TCP	66	39398 → 179 [ACK] Seq=98 Ack=98 Win=42496 Len=0 TSva
23	13.707956756	10.0.0.1	10.0.0.2	BGP	140	UPDATE Message, UPDATE Message
24	13.707981212	10.0.0.2	10.0.0.1	TCP	66	39398 → 179 [ACK] Seq=98 Ack=172 Win=42496 Len=0 TSv
25	13.708135406	10.0.0.2	10.0.0.1	BGP	89	UPDATE Message



Wireshark interface showing a packet capture from r3-eth0. The display filter is 'Apply a display filter ... <Ctrl-/>'. The packet list shows 29 packets. The selected packet (No. 13) is a TCP RST, ACK from 10.0.0.2 to 10.0.0.1. The packet details pane shows the TCP header and the application layer data.

No.	Time	Source	Destination	Protocol	Length	Info
10	56.577003047	8a:3b:14:75:2c:7e	52:c5:00:86:f5:d0	ARP	42	Who has 10.0.0.1? Tell 10.0.0.2
11	56.577183131	52:c5:00:86:f5:d0	8a:3b:14:75:2c:7e	ARP	42	10.0.0.1 is at 52:c5:00:86:f5:d0
12	61.572412571	10.0.0.1	10.0.0.2	TCP	74	56410 → 179 [SYN] Seq=0 Win=42340 Len=0 MSS=1460 SAC
13	61.572437174	10.0.0.2	10.0.0.1	TCP	54	179 → 56410 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
14	64.264757769	10.0.0.2	10.0.0.1	TCP	74	39398 → 179 [SYN] Seq=0 Win=42340 Len=0 MSS=1460 SAC
15	64.264836416	10.0.0.1	10.0.0.2	TCP	74	179 → 39398 [SYN, ACK] Seq=0 Ack=1 Win=43440 Len=0 M
16	64.264873624	10.0.0.2	10.0.0.1	TCP	66	39398 → 179 [ACK] Seq=1 Ack=1 Win=42496 Len=0 TSval=
17	64.271982091	10.0.0.2	10.0.0.1	BGP	125	OPEN Message
18	64.272035834	10.0.0.1	10.0.0.2	TCP	66	179 → 39398 [ACK] Seq=1 Ack=60 Win=43520 Len=0 TSval=
19	64.273376984	10.0.0.1	10.0.0.2	BGP	144	OPEN Message, KEEPALIVE Message
20	64.273401772	10.0.0.2	10.0.0.1	TCP	66	39398 → 179 [ACK] Seq=60 Ack=79 Win=42496 Len=0 TSva
21	64.273763060	10.0.0.2	10.0.0.1	BGP	104	KEEPALIVE Message, KEEPALIVE Message
22	64.273783843	10.0.0.1	10.0.0.2	TCP	66	179 → 39398 [ACK] Seq=79 Ack=98 Win=43520 Len=0 TSva
23	64.273967249	10.0.0.1	10.0.0.2	BGP	85	KEEPALIVE Message
24	64.274219314	10.0.0.2	10.0.0.1	TCP	66	39398 → 179 [ACK] Seq=98 Ack=98 Win=42496 Len=0 TSva
25	65.275480514	10.0.0.1	10.0.0.2	BGP	140	UPDATE Message, UPDATE Message
26	65.275498420	10.0.0.2	10.0.0.1	TCP	66	39398 → 179 [ACK] Seq=98 Ack=172 Win=42496 Len=0 TSv
27	65.275650581	10.0.0.2	10.0.0.1	BGP	89	UPDATE Message
28	65.275662898	10.0.0.1	10.0.0.2	TCP	66	179 → 39398 [ACK] Seq=172 Ack=121 Win=43520 Len=0 TS
29	67.275981670	10.0.0.1	10.0.0.2	BGP	85	KEEPALIVE Message

Capturing from r3-eth1

No.	Time	Source	Destination	Protocol	Length	Info
10	97.684555737	10.0.2.1	10.0.2.3	TCP	74	52696 → 179 [SYN] Seq=0 Win=42340 Len=0 MSS=1460 SAC
11	97.684606575	10.0.2.3	10.0.2.1	TCP	54	179 → 52696 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
12	97.792024513	76:bf:a6:b7:ed:dc	de:21:2b:f2:9d:3b	ARP	42	Who has 10.0.2.1? Tell 10.0.2.3
13	97.792068988	de:21:2b:f2:9d:3b	76:bf:a6:b7:ed:dc	ARP	42	10.0.2.1 is at de:21:2b:f2:9d:3b
14	101.424039906	10.0.2.3	10.0.2.1	TCP	74	38712 → 179 [SYN] Seq=0 Win=42340 Len=0 MSS=1460 SAC
15	101.424054803	10.0.2.1	10.0.2.3	TCP	74	179 → 38712 [SYN, ACK] Seq=0 Ack=1 Win=43440 Len=0 M
16	101.424063955	10.0.2.3	10.0.2.1	TCP	66	38712 → 179 [ACK] Seq=1 Ack=1 Win=42496 Len=0 TSval=
17	101.424105515	10.0.2.3	10.0.2.1	BGP	125	OPEN Message
18	101.424108750	10.0.2.1	10.0.2.3	TCP	66	179 → 38712 [ACK] Seq=1 Ack=60 Win=43520 Len=0 TSval=
19	101.424301337	10.0.2.1	10.0.2.3	BGP	144	OPEN Message, KEEPALIVE Message
20	101.424305737	10.0.2.3	10.0.2.1	TCP	66	38712 → 179 [ACK] Seq=60 Ack=79 Win=42496 Len=0 TSva
21	101.424374609	10.0.2.3	10.0.2.1	BGP	104	KEEPALIVE Message, KEEPALIVE Message
22	101.424377418	10.0.2.1	10.0.2.3	TCP	66	179 → 38712 [ACK] Seq=79 Ack=98 Win=43520 Len=0 TSva
23	101.424413620	10.0.2.1	10.0.2.3	BGP	85	KEEPALIVE Message
24	101.424416322	10.0.2.3	10.0.2.1	TCP	66	38712 → 179 [ACK] Seq=98 Ack=98 Win=42496 Len=0 TSva
25	102.425782335	10.0.2.1	10.0.2.3	BGP	144	UPDATE Message, UPDATE Message
26	102.425782453	10.0.2.3	10.0.2.1	BGP	144	UPDATE Message, UPDATE Message
27	102.425796464	10.0.2.1	10.0.2.3	TCP	66	179 → 38712 [ACK] Seq=176 Ack=176 Win=43520 Len=0 TS
28	102.425796836	10.0.2.3	10.0.2.1	TCP	66	38712 → 179 [ACK] Seq=176 Ack=176 Win=42496 Len=0 TS
29	104.425193784	10.0.2.1	10.0.2.3	BGP	85	KEEPALIVE Message
30	104.425194045	10.0.2.3	10.0.2.1	BGP	85	KEEPALIVE Message

- We can see that r2 and r3 send the bgp packet(OPEN, UPDATE, KEEP ALIVE) to each other to exchange routing information.
- 3-2 What will happen to the routing table if the r4 link is down?
- The r4 routing information will disappear if the link is down.

```
mininet> r1 route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
10.0.1.0 0.0.0.0 255.255.255.0 U 0 0 0 r1-eth0
192.168.1.0 0.0.0.0 255.255.255.192 U 0 0 0 r1-eth1
192.168.1.64 0.0.0.0 255.255.255.192 U 0 0 0 r1-eth2
mininet> r2 route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
10.0.0.0 0.0.0.0 255.255.255.0 U 0 0 0 r2-eth0
10.0.1.0 0.0.0.0 255.255.255.0 U 0 0 0 r2-eth1
140.113.0.0 10.0.1.2 255.255.0.0 UG 20 0 0 r2-eth1
mininet> r3 route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
10.0.0.0 0.0.0.0 255.255.255.0 U 0 0 0 r3-eth0
10.0.2.0 0.0.0.0 255.255.255.0 U 0 0 0 r3-eth1
140.113.0.0 10.0.0.1 255.255.0.0 UG 20 0 0 r3-eth0
mininet> r4 route
Kernel IP routing table
Destination Gateway Genmask Flags Metric Ref Use Iface
140.114.0.0 0.0.0.0 255.255.255.0 U 0 0 0 r4-eth1
mininet>
```

- 3-3 How does r3 know r4 is unreachable? Explain.
 - r4 will send NOTIFICATION bgp packets to r3 about the shut down of r4.
- 3-4 How does r2 know r4 is unreachable? Explain.
 - r3 will send UPDATE bgp packets with each other routers(including r2) about the new routing rule, which includes the information of the disappear of r4.

Part 2

1. Take screenshot of h4 curl result.

```
mininet> h4 curl 140.113.0.40:80
<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 3.2 Final//EN"><html>
<title>Directory listing for /</title>
<body>
<h2>Directory listing for /</h2>
<hr>
<ul>
<li><a href="/configs/">configs/</a>
<li><a href="/dhcpd.conf">dhcpd.conf</a>
<li><a href="/example.py">example.py</a>
<li><a href="/Lab3-Dynamic%20Routing%20and%20Network%20Address%20Translation.pdf">Lab3-Dynamic Routing and Network Address Translation.pdf</a>
<li><a href="/topology.py">topology.py</a>
</ul>
<hr>
</body>
</html>
mininet>
```

- We can see that h4 successfully reach the h3 http server and get the dir list.

2. Check the reachability and take screenshot.

```
mininet> h1 ping h4
PING 140.114.0.1 (140.114.0.1) 56(84) bytes of data.
64 bytes from 140.114.0.1: icmp_seq=1 ttl=60 time=1.13 ms
64 bytes from 140.114.0.1: icmp_seq=2 ttl=60 time=0.598 ms
^C
--- 140.114.0.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1003ms
rtt min/avg/max/mdev = 0.598/0.862/1.126/0.264 ms
mininet> h1 ping h4 -c 1
PING 140.114.0.1 (140.114.0.1) 56(84) bytes of data.
64 bytes from 140.114.0.1: icmp_seq=1 ttl=60 time=0.398 ms
--- 140.114.0.1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.398/0.398/0.398/0.000 ms
mininet> h2 ping h4 -c 1
PING 140.114.0.1 (140.114.0.1) 56(84) bytes of data.
64 bytes from 140.114.0.1: icmp_seq=1 ttl=60 time=1.62 ms
--- 140.114.0.1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 1.624/1.624/1.624/0.000 ms
mininet> h3 ping h4 -c 1
Serving HTTP on 0.0.0.0 port 8000 ...
140.114.0.1 - - [25/Mar/2021 15:16:27] "GET / HTTP/1.1" 200 -
PING 140.114.0.1 (140.114.0.1) 56(84) bytes of data.
64 bytes from 140.114.0.1: icmp_seq=1 ttl=60 time=0.958 ms
--- 140.114.0.1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 0.958/0.958/0.958/0.000 ms
mininet>
```

- The ping result shows that h1, h2, and h3 can get the ICMP reply of h4.

3. Run wireshark on r1 to take screenshot of input/output packets

- r1-eth0

26	20.141443312	140.113.0.30	140.114.0.1	ICMP	98 Echo (ping) request	id=0x3f62, seq=1/256, ttl=63 (reply in 2...
27	20.141543314	140.114.0.1	140.113.0.30	ICMP	98 Echo (ping) reply	id=0x3f62, seq=1/256, ttl=61 (request in...
28	21.015620724	10.0.1.1	10.0.1.2	BGP	85 KEEPALIVE Message	
29	21.016344735	10.0.1.2	10.0.1.1	BGP	85 KEEPALIVE Message	
30	21.016376535	10.0.1.1	10.0.1.2	TCP	66 179 → 36138 [ACK] Seq=153 Ack=153 Win=85 Len=0 TSval=30304521...	
31	23.828587249	140.113.0.40	140.114.0.1	ICMP	98 Echo (ping) request	id=0x3f66, seq=1/256, ttl=63 (reply in 3...
32	23.828701451	140.114.0.1	140.113.0.40	ICMP	98 Echo (ping) reply	id=0x3f66, seq=1/256, ttl=61 (request in...
33	24.019564468	10.0.1.1	10.0.1.2	BGP	85 KEEPALIVE Message	
34	24.020593083	10.0.1.2	10.0.1.1	BGP	85 KEEPALIVE Message	
35	24.020638383	10.0.1.1	10.0.1.2	TCP	66 179 → 36138 [ACK] Seq=172 Ack=172 Win=85 Len=0 TSval=30304551...	
36	27.020558821	10.0.1.1	10.0.1.2	BGP	85 KEEPALIVE Message	
37	27.021157130	10.0.1.2	10.0.1.1	BGP	85 KEEPALIVE Message	
38	27.021196631	10.0.1.1	10.0.1.2	TCP	66 179 → 36138 [ACK] Seq=191 Ack=191 Win=85 Len=0 TSval=30304581...	

▶ Frame 26: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface r1-eth0, id 0
▶ Ethernet II, Src: 7e:3d:9d:a4:a4:5d (7e:3d:9d:a4:a4:5d), Dst: 16:a9:2c:39:dd:fb (16:a9:2c:39:dd:fb)
▶ Internet Protocol Version 4, Src: 140.113.0.30, Dst: 140.114.0.1
▶ Internet Control Message Protocol

- o r1-eth1

1	0.000000000	192.168.1.6	140.114.0.1	ICMP	98 Echo (ping) request	id=0x3f62, seq=1/256, ttl=64 (reply in 2)
2	0.000138701	140.114.0.1	192.168.1.6	ICMP	98 Echo (ping) reply	id=0x3f62, seq=1/256, ttl=60 (request in...

- Frame 1: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface r1-eth1, id 0
 - Ethernet II, Src: e6:7f:07:54:6f:14 (e6:7f:07:54:6f:14), Dst: 36:7c:66:75:61:1c (36:7c:66:75:61:1c)
 - Internet Protocol Version 4, Src: 192.168.1.6, Dst: 140.114.0.1
 - Internet Control Message Protocol

- o r1-eth2

1	0.000000000	192.168.1.65	140.114.0.1	ICMP	98 Echo (ping) request	id=0x3f66, seq=1/256, ttl=64 (reply in 2)
2	0.000160302	140.114.0.1	192.168.1.65	ICMP	98 Echo (ping) reply	id=0x3f66, seq=1/256, ttl=60 (request in...

- Frame 1: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface r1-eth2, id 0
 - Ethernet II, Src: b2:d6:2f:c9:75:73 (b2:d6:2f:c9:75:73), Dst: 5a:73:fa:57:cf:b8 (5a:73:fa:57:cf:b8)
 - Internet Protocol Version 4, Src: 192.168.1.65, Dst: 140.114.0.1
 - Internet Control Message Protocol

- o We can see that the source ip and destination ip of h1 and h2 are changed after passing through r1, because we have configured NAT function on r1 to perform this kind of ip transformation.