

Computer Networks Laboratory Week #7

IPv4 Addressing and Static Routing using Hardware

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Task 1: Assigning IP addresses to all computers A, B, C and D (Source Host Ha, Router R1, Router R2, Destination Host Hd)

For Ha:

```
student@CSELAB: ~  
student@CSELAB:~$ ifconfig  
enp2s0    Link encap:Ethernet  HWaddr b8:ae:ed:a5:a6:53  
          inet addr:172.16.10.1  Bcast:172.16.10.255  Mask:255.255.255.0  
          inet6 addr: fe80::99b2:d2bd:fb5e:b38b/64 Scope:Link  
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
          RX packets:358 errors:0 dropped:0 overruns:0 frame:0  
          TX packets:351 errors:0 dropped:0 overruns:0 carrier:0  
          collisions:0 txqueuelen:1000  
          RX bytes:99474 (99.4 KB)  TX bytes:41879 (41.8 KB)  
  
lo        Link encap:Local Loopback  
          inet addr:127.0.0.1  Mask:255.0.0.0  
          inet6 addr: ::1/128 Scope:Host  
          UP LOOPBACK RUNNING  MTU:65536  Metric:1  
          RX packets:335 errors:0 dropped:0 overruns:0 frame:0  
          TX packets:335 errors:0 dropped:0 overruns:0 carrier:0  
          collisions:0 txqueuelen:1  
          RX bytes:23366 (23.3 KB)  TX bytes:23366 (23.3 KB)  
  
student@CSELAB:~$
```

For R1:

```
student@CSELAB: ~  
student@CSELAB:~$ ifconfig  
enp2s0    Link encap:Ethernet  HWaddr b8:ae:ed:a5:a6:70  
          inet addr:172.16.10.201  Bcast:172.16.10.255  Mask:255.255.255.0  
          inet6 addr: fe80::116e:60e7:a1b4:96d9/64 Scope:Link  
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
          RX packets:10969 errors:0 dropped:0 overruns:0 frame:0  
          TX packets:3773 errors:0 dropped:0 overruns:0 carrier:0  
          collisions:0 txqueuelen:1000  
          RX bytes:8052174 (8.0 MB)  TX bytes:571330 (571.3 KB)  
  
enxd03745b8d975 Link encap:Ethernet  HWaddr d0:37:45:b8:d9:75  
          inet addr:172.16.11.1  Bcast:172.16.11.255  Mask:255.255.255.0  
          inet6 addr: fe80::e7cd:b9a7:cf28:2a1f/64 Scope:Link  
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
          RX packets:26 errors:0 dropped:0 overruns:0 frame:0  
          TX packets:53 errors:0 dropped:0 overruns:0 carrier:0  
          collisions:0 txqueuelen:1000  
          RX bytes:4347 (4.3 KB)  TX bytes:8214 (8.2 KB)  
  
lo        Link encap:Local Loopback  
          inet addr:127.0.0.1  Mask:255.0.0.0  
          inet6 addr: ::1/128 Scope:Host  
          UP LOOPBACK RUNNING  MTU:65536  Metric:1  
          RX packets:7189 errors:0 dropped:0 overruns:0 frame:0  
          TX packets:7189 errors:0 dropped:0 overruns:0 carrier:0  
          collisions:0 txqueuelen:1  
          RX bytes:531121 (531.1 KB)  TX bytes:531121 (531.1 KB)
```

For R2:

```
student@CSELAB:~$ ifconfig
enp2s0      Link encap:Ethernet  HWaddr b8:ae:ed:a5:a6:7a
            inet addr:172.16.12.1  Bcast:172.16.12.255  Mask:255.255.255.0
            inet6 addr: fe80::a6b:3f68:fffb7:7585/64 Scope:Link
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
            RX packets:2508 errors:0 dropped:0 overruns:0 frame:0
            TX packets:439 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:258586 (258.5 KB)  TX bytes:53964 (53.9 KB)

enxd03745b7b332 Link encap:Ethernet  HWaddr d0:37:45:b7:b3:32
            inet addr:172.16.11.201 Bcast:172.16.11.255  Mask:255.255.255.0
            inet6 addr: fe80::8113:f0de:f59e:b7e/64 Scope:Link
            UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
            RX packets:47 errors:0 dropped:0 overruns:0 frame:0
            TX packets:43 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1000
            RX bytes:6298 (6.2 KB)  TX bytes:6205 (6.2 KB)

lo          Link encap:Local Loopback
            inet addr:127.0.0.1  Mask:255.0.0.0
            inet6 addr: ::1/128 Scope:Host
            UP LOOPBACK RUNNING  MTU:65536  Metric:1
            RX packets:353 errors:0 dropped:0 overruns:0 frame:0
            TX packets:353 errors:0 dropped:0 overruns:0 carrier:0
            collisions:0 txqueuelen:1
            RX bytes:25880 (25.8 KB)  TX bytes:25880 (25.8 KB)
```

For Hd:

```
student@CSELAB:~$ ip addr show
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp2s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000
    link/ether b8:ae:ed:f5:90:30 brd ff:ff:ff:ff:ff:ff
    inet 172.16.12.201/24 brd 172.16.12.255 scope global enp2s0
        valid_lft forever preferred_lft forever
    inet6 fe80::d793:85c3:c289:c4e2/64 scope link
        valid_lft forever preferred_lft forever
```

Task 2: Convert machines B and C into Routers

For both R1 and R2:

```
student@CSELAB:~$ sudo sysctl -w net.ipv4.conf.all.send_redirects=0
net.ipv4.conf.all.send_redirects = 0
student@CSELAB:~$ sudo sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
student@CSELAB:~$ sudo ip route add 172.16.12.0/24 via 172.16.11.201
student@CSELAB:~$ sudo ip route add 172.16.12.0/24 via 172.16.11.201
RTNETLINK answers: File exists
student@CSELAB:~$ ip route show
169.254.0.0/16 dev enp2s0 scope link metric 1000
172.16.10.0/24 dev enp2s0 proto kernel scope link src 172.16.10.201 metric 100
172.16.11.0/24 dev enx03745b8d975 proto kernel scope link src 172.16.11.1 metric 100
172.16.12.0/24 via 172.16.11.201 dev enx03745b8d975
student@CSELAB:~$
```

Task 3: Verifying the connection between Ha and Hd using ping command

At Ha:

```
student@CSELAB:~$ ping 172.16.10.1
PING 172.16.10.1 (172.16.10.1) 56(84) bytes of data.
64 bytes from 172.16.10.1: icmp_seq=1 ttl=62 time=0.738 ms
64 bytes from 172.16.10.1: icmp_seq=2 ttl=62 time=0.805 ms
64 bytes from 172.16.10.1: icmp_seq=3 ttl=62 time=0.819 ms
64 bytes from 172.16.10.1: icmp_seq=4 ttl=62 time=0.794 ms
^C
--- 172.16.10.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 2999ms
rtt min/avg/max/mdev = 0.738/0.789/0.819/0.030 ms
```

At Hd:

```
student@CSELAB: ~  
student@CSELAB:~$ ping 172.16.12.201  
PING 172.16.12.201 (172.16.12.201) 56(84) bytes of data.  
64 bytes from 172.16.12.201: icmp_seq=1 ttl=62 time=1.23 ms  
64 bytes from 172.16.12.201: icmp_seq=2 ttl=62 time=0.772 ms  
64 bytes from 172.16.12.201: icmp_seq=3 ttl=62 time=0.714 ms  
64 bytes from 172.16.12.201: icmp_seq=4 ttl=62 time=0.808 ms  
64 bytes from 172.16.12.201: icmp_seq=5 ttl=62 time=0.853 ms  
64 bytes from 172.16.12.201: icmp_seq=6 ttl=62 time=0.892 ms  
^C  
--- 172.16.12.201 ping statistics ---  
6 packets transmitted, 6 received, 0% packet loss, time 5001ms  
rtt min/avg/max/mdev = 0.714/0.879/1.239/0.173 ms  
student@CSELAB:~$ ping 172.16.12.1  
PING 172.16.12.1 (172.16.12.1) 56(84) bytes of data.  
64 bytes from 172.16.12.1: icmp_seq=1 ttl=63 time=0.528 ms  
64 bytes from 172.16.12.1: icmp_seq=2 ttl=63 time=0.615 ms  
64 bytes from 172.16.12.1: icmp_seq=3 ttl=63 time=0.634 ms  
64 bytes from 172.16.12.1: icmp_seq=4 ttl=63 time=0.496 ms  
64 bytes from 172.16.12.1: icmp_seq=5 ttl=63 time=0.633 ms  
^C  
--- 172.16.12.1 ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 3999ms  
rtt min/avg/max/mdev = 0.496/0.581/0.634/0.059 ms  
student@CSELAB:~$
```

Task 4: Inserting routing table entries on each system to direct ipv4 packets to ping across the networks

At Ha:

```
student@CSELAB: ~  
student@CSELAB:~$ sudo ip route add 172.16.12.0/24 via 172.16.10.201  
[sudo] password for student:  
student@CSELAB:~$ sudo ip route add 172.16.11.0/24 via 172.16.10.201  
student@CSELAB:~$ ip route show  
169.254.0.0/16 dev enp2s0 scope link metric 1000  
172.16.10.0/24 dev enp2s0 proto kernel scope link src 172.16.10.1 metric 100  
172.16.11.0/24 via 172.16.10.201 dev enp2s0  
172.16.12.0/24 via 172.16.10.201 dev enp2s0  
student@CSELAB:~$
```

At R1:

```
student@CSELAB:~$ sudo sysctl -w net.ipv4.conf.all.send_redirects=0
net.ipv4.conf.all.send_redirects = 0
student@CSELAB:~$ sudo sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
student@CSELAB:~$ sudo ip route add 172.16.12.0/24 via 172.16.11.201
student@CSELAB:~$ sudo ip route add 172.16.12.0/24 via 172.16.11.201
RTNETLINK answers: File exists
student@CSELAB:~$ ip route show
169.254.0.0/16 dev enp2s0 scope link metric 1000
172.16.10.0/24 dev enp2s0 proto kernel scope link src 172.16.10.201 metric 100
172.16.11.0/24 dev enxd03745b8d975 proto kernel scope link src 172.16.11.1 metric 100
172.16.12.0/24 via 172.16.11.201 dev enxd03745b8d975
student@CSELAB:~$
```

At R2:

```
student@CSELAB:~$ sudo ip route add 172.16.10.0/24 via 172.16.11.1
student@CSELAB:~$ ip route show
169.254.0.0/16 dev enxd03745b7b332 scope link metric 1000
172.16.10.0/24 via 172.16.11.1 dev enxd03745b7b332
172.16.11.0/24 dev enxd03745b7b332 proto kernel scope link src 172.16.11.201 metric 100
172.16.12.0/24 dev enp2s0 proto kernel scope link src 172.16.12.1 metric 100
```

At Hd:

```
student@CSELAB:~$ sudo ip route add 172.16.10.0/24 via 172.16.12.1
RTNETLINK answers: File exists
student@CSELAB:~$ sudo ip route add 172.16.11.0/24 via 172.16.12.1
RTNETLINK answers: File exists
student@CSELAB:~$ ip route show
169.254.0.0/16 dev enp2s0 scope link metric 1000
172.16.10.0/24 via 172.16.12.1 dev enp2s0
172.16.11.0/24 via 172.16.12.1 dev enp2s0
172.16.12.0/24 dev enp2s0 proto kernel scope link src 172.16.12.201 metric 1000
```


Task 5: After adding routing table entries again verify the connections from Ha and Hd using ping command

1. Testing path from Ha and Hd

```
student@CSELAB: ~  
student@CSELAB:~$ ping 172.16.12.201  
PING 172.16.12.201 (172.16.12.201) 56(84) bytes of data.  
64 bytes from 172.16.12.201: icmp_seq=1 ttl=62 time=1.23 ms  
64 bytes from 172.16.12.201: icmp_seq=2 ttl=62 time=0.772 ms  
64 bytes from 172.16.12.201: icmp_seq=3 ttl=62 time=0.714 ms  
64 bytes from 172.16.12.201: icmp_seq=4 ttl=62 time=0.808 ms  
64 bytes from 172.16.12.201: icmp_seq=5 ttl=62 time=0.853 ms  
64 bytes from 172.16.12.201: icmp_seq=6 ttl=62 time=0.892 ms  
^C  
--- 172.16.12.201 ping statistics ---  
6 packets transmitted, 6 received, 0% packet loss, time 5001ms  
rtt min/avg/max/mdev = 0.714/0.879/1.239/0.173 ms  
student@CSELAB:~$ ping 172.16.12.1  
PING 172.16.12.1 (172.16.12.1) 56(84) bytes of data.  
64 bytes from 172.16.12.1: icmp_seq=1 ttl=63 time=0.528 ms  
64 bytes from 172.16.12.1: icmp_seq=2 ttl=63 time=0.615 ms  
64 bytes from 172.16.12.1: icmp_seq=3 ttl=63 time=0.634 ms  
64 bytes from 172.16.12.1: icmp_seq=4 ttl=63 time=0.496 ms  
64 bytes from 172.16.12.1: icmp_seq=5 ttl=63 time=0.633 ms  
^C  
--- 172.16.12.1 ping statistics ---  
5 packets transmitted, 5 received, 0% packet loss, time 3999ms  
rtt min/avg/max/mdev = 0.496/0.581/0.634/0.059 ms  
student@CSELAB:~$
```

2. Testing path from Hd and Ha

```
student@CSELAB:~$ ip neigh show^C  
student@CSELAB:~$ ping 172.16.10.201  
PING 172.16.10.201 (172.16.10.201) 56(84) bytes of data.  
64 bytes from 172.16.10.201: icmp_seq=1 ttl=63 time=0.520 ms  
64 bytes from 172.16.10.201: icmp_seq=2 ttl=63 time=0.479 ms  
64 bytes from 172.16.10.201: icmp_seq=3 ttl=63 time=0.569 ms  
64 bytes from 172.16.10.201: icmp_seq=4 ttl=63 time=0.460 ms  
^C  
--- 172.16.10.201 ping statistics ---  
4 packets transmitted, 4 received, 0% packet loss, time 2999ms  
rtt min/avg/max/mdev = 0.460/0.507/0.569/0.041 ms  
student@CSELAB:~$ ping 172.16.10.1  
PING 172.16.10.1 (172.16.10.1) 56(84) bytes of data.  
64 bytes from 172.16.10.1: icmp_seq=1 ttl=62 time=0.738 ms  
64 bytes from 172.16.10.1: icmp_seq=2 ttl=62 time=0.805 ms  
64 bytes from 172.16.10.1: icmp_seq=3 ttl=62 time=0.819 ms  
64 bytes from 172.16.10.1: icmp_seq=4 ttl=62 time=0.794 ms  
^C  
--- 172.16.10.1 ping statistics ---  
4 packets transmitted, 4 received, 0% packet loss, time 2999ms  
rtt min/avg/max/mdev = 0.738/0.789/0.819/0.030 ms
```

Task 6: Check each system neighbour to verify the connections

At Ha:

```
student@CSELAB: ~  
student@CSELAB:~$ ip neigh show  
172.16.10.201 dev enp2s0 lladdr b8:ae:ed:a5:a6:70 STALE  
student@CSELAB:~$
```

At R1:

```
student@CSELAB:~$ ip neigh show  
172.16.10.1 dev enp2s0 lladdr b8:ae:ed:a5:a6:53 STALE  
172.16.11.201 dev enxd03745b8d975 lladdr d0:37:45:b7:b3:32 STALE  
student@CSELAB:~$
```

At R2:

```
student@CSELAB:~$ ip neigh show  
172.16.11.1 dev eth2 lladdr b8:a3:86:98:42:73 STALE  
172.16.12.201 dev eth1 lladdr 50:e5:49:1b:f0:c4 REACHABLE
```

At Hd:

```
student@CSELAB:~$ ip neigh show  
172.16.11.201 dev enp2s0 lladdr b8:ae:ed:a5:a6:7a STALE  
172.16.12.1 dev enp2s0 lladdr b8:ae:ed:a5:a6:7a STALE
```

Task 7: Capture packets from Ha and Hd using Wireshark

At Ha:

Terminal 1: \$ sudo wireshark

Terminal 2: \$ ping 172.16.12.201

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help						
<div> <div> </div> <div> <div>Apply a display filter ... <Ctrl-/></div> <div>Expression... +</div> </div> </div>						
No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	172.16.10.1	172.16.12.201	ICMP	100	Echo (ping) request id=0x0e1c, seq=1/256, ttl=64 (reply in 2)
2	0.000713218	172.16.12.201	172.16.10.1	ICMP	100	Echo (ping) reply id=0x0e1c, seq=1/256, ttl=62 (request in 1)
3	0.999751265	172.16.10.1	172.16.12.201	ICMP	100	Echo (ping) request id=0x0e1c, seq=2/512, ttl=64 (reply in 4)
4	1.000479331	172.16.12.201	172.16.10.1	ICMP	100	Echo (ping) reply id=0x0e1c, seq=2/512, ttl=62 (request in 3)
5	1.999694230	172.16.10.1	172.16.12.201	ICMP	100	Echo (ping) request id=0x0e1c, seq=3/768, ttl=64 (reply in 6)
6	2.000343705	172.16.12.201	172.16.10.1	ICMP	100	Echo (ping) reply id=0x0e1c, seq=3/768, ttl=62 (request in 5)
7	2.999694943	172.16.10.1	172.16.12.201	ICMP	100	Echo (ping) request id=0x0e1c, seq=4/1024, ttl=64 (reply in 8)
8	3.000275668	172.16.12.201	172.16.10.1	ICMP	100	Echo (ping) reply id=0x0e1c, seq=4/1024, ttl=62 (request in 7)
9	3.999691139	172.16.10.1	172.16.12.201	ICMP	100	Echo (ping) request id=0x0e1c, seq=5/1280, ttl=64 (reply in 10)
10	4.000232870	172.16.12.201	172.16.10.1	ICMP	100	Echo (ping) reply id=0x0e1c, seq=5/1280, ttl=62 (request in 9)
11	4.999753680	172.16.10.1	172.16.12.201	ICMP	100	Echo (ping) request id=0x0e1c, seq=6/1536, ttl=64 (reply in 12)
12	5.000448899	172.16.12.201	172.16.10.1	ICMP	100	Echo (ping) reply id=0x0e1c, seq=6/1536, ttl=62 (request in 11)
13	5.014837279	Elitegro_a5:a6:70		ARP	62	Who has 172.16.10.1? Tell 172.16.10.201
14	5.014853964	Elitegro_a5:a6:53		ARP	44	172.16.10.1 is at b8:ae:ed:a5:a6:53
15	5.999717573	172.16.10.1	172.16.12.201	ICMP	100	Echo (ping) request id=0x0e1c, seq=7/1792, ttl=64 (reply in 16)
16	6.000263568	172.16.12.201	172.16.10.1	ICMP	100	Echo (ping) reply id=0x0e1c, seq=7/1792, ttl=62 (request in 15)
<div> <div> <div>Frame 1: 100 bytes on wire (800 bits), 100 bytes captured (800 bits) on interface 0</div> <div>Linux cooked capture</div> <div> <div>Internet Protocol Version 4, Src: 172.16.10.1, Dst: 172.16.12.201</div> <div> <div>0100 = Version: 4</div> <div>.... 0101 = Header Length: 20 bytes (5)</div> <div>Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)</div> <div>Total Length: 84</div> <div>Identification: 0x7f3f (32575)</div> <div>Flags: 0x4000, Don't fragment</div> <div>Time to live: 64</div> <div>Protocol: ICMP (1)</div> <div>Header checksum: 0x4c7f [validation disabled]</div> <div>[Header checksum status: Unverified]</div> <div>Source: 172.16.10.1</div> <div>Destination: 172.16.12.201</div> </div> </div> </div> </div>						
<div> <div>Internet Control Message Protocol</div> </div>						
<div> <div> <div>0000 00 04 00 01 00 06 b8 ae ed a5 a6 53 00 00 08 00S....</div> <div>0010 45 00 00 54 7f 3f 40 00 40 01 4c 7f ac 10 0a 01 E..T.?.@.L.....</div> <div>0020 ac 10 0c c9 08 00 06 e3 0e 1c 00 01 8b 09 42 60B'</div> <div>0030 00 00 00 00 c2 c2 04 00 00 00 00 10 11 12 13!</div> <div>0040 14 15 16 17 18 19 1a 1b 1c 1d 1e 1f 20 21 22 23!#</div> </div> </div>						
Internet Control Message Protocol (icmp), 64 bytes				Packets: 16 · Displayed: 16 (100.0%)		Profile: Default

At R1:

\$ sudo wireshark

At enp2s0 interface:

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help						
<div> <div> <div>*enp2s0</div> <div> <div>File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help</div> <div> <div>Apply a display filter ... <Ctrl-/></div> <div>Expression... +</div> </div> </div> </div> </div>						
No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=1/256, ttl=64 (reply in 2)
2	0.000470722	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=1/256, ttl=62 (request in 1)
3	0.999677522	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=2/512, ttl=64 (reply in 4)
4	1.000234413	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=2/512, ttl=62 (request in 3)
5	1.999671172	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=3/768, ttl=64 (reply in 6)
6	2.000118781	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=3/768, ttl=62 (request in 5)
7	2.999617168	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=4/1024, ttl=64 (reply in 8)
8	3.000051480	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=4/1024, ttl=62 (request in 7)
9	3.999664997	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=5/1280, ttl=64 (reply in 10)
10	4.000009999	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=5/1280, ttl=62 (request in 9)
11	4.999675341	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=6/1536, ttl=64 (reply in 12)
12	5.000205549	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=6/1536, ttl=62 (request in 11)
13	5.014648561	Elitegro_a5:a6:70	Elitegro_a5:a6:53	ARP	42	Who has 172.16.10.1? Tell 172.16.10.201
14	5.014762755	Elitegro_a5:a6:53	Elitegro_a5:a6:70	ARP	60	172.16.10.1 is at b8:ae:ed:a5:a6:53
15	5.999659825	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=7/1792, ttl=64 (reply in 16)
16	6.000034823	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=7/1792, ttl=62 (request in 15)
17	6.999639461	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=8/2048, ttl=64 (reply in 18)
18	7.000096765	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=8/2048, ttl=62 (request in 17)
19	7.999628620	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=9/2304, ttl=64 (reply in 20)
20	8.000049775	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=9/2304, ttl=62 (request in 19)
21	8.999551282	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=10/2560, ttl=64 (reply in 22)
22	8.999976484	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=10/2560, ttl=62 (request in 21)
23	9.999631996	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=11/2816, ttl=64 (reply in 24)
24	10.000105764	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=11/2816, ttl=62 (request in 23)
25	10.999645812	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=12/3072, ttl=64 (reply in 26)
26	10.999937460	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=12/3072, ttl=62 (request in 25)
27	11.999693368	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=13/3328, ttl=64 (reply in 28)
28	12.000130769	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=13/3328, ttl=62 (request in 27)
29	12.999671191	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=14/3584, ttl=64 (reply in 30)
30	13.000101029	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=14/3584, ttl=62 (request in 29)
<div> <div> <div>Frame 13: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0</div> <div>Ethernet II, Src: Elitegro_a5:a6:53 (b8:ae:ed:a5:a6:53), Dst: Elitegro_a5:a6:70 (b8:ae:ed:a5:a6:70)</div> <div>Internet Protocol Version 4, Src: 172.16.10.1, Dst: 172.16.12.201</div> <div>Internet Control Message Protocol</div> </div> </div>						
<div> <div> <div>0000 b8 ae ed a5 a6 70 b8 ae ed a5 a6 53 00 00 45 00p...S..E</div> <div>0010 00 54 7f 3f 40 00 40 01 4c 7f ac 10 0a 01 ac 10 ..T.?.@.L.....</div> </div> </div>						
wireshark_enp2s0_20210305160444_HfxARK.pcapng				Packets: 40 · Displayed: 40 (100.0%)		Profile: Default

At enxd03745b8d975 interface:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=1/256, ttl=63 (reply in 2)
2	0.000042439	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=1/256, ttl=63 (request in 1)
3	0.999659893	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=2/512, ttl=63 (reply in 4)
4	1.000197845	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=2/512, ttl=63 (request in 3)
5	1.999658217	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=3/768, ttl=63 (reply in 6)
6	2.000083111	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=3/768, ttl=63 (request in 5)
7	2.999599710	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=4/1024, ttl=63 (reply in 8)
8	3.000021396	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=4/1024, ttl=63 (request in 7)
9	3.999653345	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=5/1280, ttl=63 (reply in 10)
10	3.999975577	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=5/1280, ttl=63 (request in 9)
11	4.999660866	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=6/1536, ttl=63 (reply in 12)
12	5.000166573	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=6/1536, ttl=63 (request in 11)
13	5.012915959	Tp-LinkT_b7:b3:32	Tp-LinkT_b8:d9:75	ARP	60	Who has 172.16.11.1? Tell 172.16.11.201
14	5.012944109	Tp-LinkT_b8:d9:75	Tp-LinkT_b7:b3:32	ARP	42	172.16.11.1 is at 00:37:45:b8:d9:75
15	5.999047753	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=7/1792, ttl=63 (reply in 16)
16	6.000003647	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=7/1792, ttl=63 (request in 15)
17	6.999623811	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=8/2048, ttl=63 (reply in 18)
18	7.000066363	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=8/2048, ttl=63 (request in 17)
19	7.999613955	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=9/2304, ttl=63 (reply in 20)
20	8.000015575	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=9/2304, ttl=63 (request in 19)
21	8.999533793	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=10/2560, ttl=63 (reply in 22)
22	8.999646349	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=10/2560, ttl=63 (request in 21)
23	9.999614866	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=11/2816, ttl=63 (reply in 24)
24	10.000075407	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=11/2816, ttl=63 (request in 23)
25	10.999628547	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=12/3072, ttl=63 (reply in 26)
26	10.999907415	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=12/3072, ttl=63 (request in 25)
27	11.014585482	Tp-LinkT_b8:d9:75	Tp-LinkT_b7:b3:32	ARP	42	Who has 172.16.11.201? Tell 172.16.11.1
28	11.014716389	Tp-LinkT_b7:b3:32	Tp-LinkT_b8:d9:75	ARP	60	172.16.11.201 is at 00:37:45:b7:b3:32
29	11.999078768	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=13/3328, ttl=63 (reply in 30)
30	12.000097992	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=13/3328, ttl=63 (request in 29)
31	12.999655946	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=14/3584, ttl=63 (reply in 32)
32	13.000070807	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=14/3584, ttl=63 (request in 31)
33	13.999653989	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=15/3840, ttl=63 (reply in 34)
34	13.999982457	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=15/3840, ttl=63 (request in 33)
35	14.999662077	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=16/4096, ttl=63 (reply in 36)
36	15.000140058	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=16/4096, ttl=63 (request in 35)

Frame 1: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0
Ethernet II, Src: Tp-LinkT_b8:d9:75 (d0:37:45:b8:d9:75), Dst: Tp-LinkT_b7:b3:32 (d0:37:45:b7:b3:32)
Internet Protocol Version 4, Src: 172.16.10.1, Dst: 172.16.12.201
Internet Control Message Protocol

wireshark_enxd03745b8d975_20210305160440_wg5277.pcapng

Packets: 36 · Displayed: 36 (100.0%)

Profile: Default

At R2:

\$ sudo wireshark

At enp2s0 interface:

ENPS250.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

icmp

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=1/256, ttl=6
2	0.000202422	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=1/256, ttl=6
3	0.999725908	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=2/512, ttl=6
4	0.999947400	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=2/512, ttl=6
5	1.999688243	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=3/768, ttl=6
6	1.999892830	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=3/768, ttl=6
7	2.999627007	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=4/1024, ttl=6
8	2.999815921	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=4/1024, ttl=6
9	3.999614613	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=5/1280, ttl=6
10	3.999783390	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=5/1280, ttl=6
11	4.999692229	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=6/1536, ttl=6
12	4.999915846	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=6/1536, ttl=6
13	5.001015774	Elitegro_f5:90:30	Elitegro_a5:a6:7a	ARP	60	Who has 172.16.12.1? Tell 172.16.12.201
14	5.001034110	Elitegro_a5:a6:7a	Elitegro_f5:90:30	ARP	42	172.16.12.1 is at b8:ae:ed:a5:a6:7a
15	5.999674668	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=7/1792, ttl=6
16	5.999795532	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=7/1792, ttl=6

Frame 1: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0
 Ethernet II, Src: Elitegro_a5:a6:7a (b8:ae:ed:a5:a6:7a), Dst: Elitegro_f5:90:30 (b8:ae:ed:f5:90:30)
 Internet Protocol Version 4, Src: 172.16.10.1, Dst: 172.16.12.201
 Internet Control Message Protocol

```

0000  b8 ae ed f5 90 30 b8 ae ed a5 a6 7a 08 00 45 00  ....0...z...E.
0010  00 54 7f 3f 40 00 3e 01 4e 7f ac 10 0a 01 ac 10  ..T?@>..N....
0020  0c c9 08 00 06 e3 0e 1c 00 01 8b 09 42 60 00 00  ...B...
0030  00 00 c2 c2 04 00 00 00 00 00 10 11 12 13 14 15  ....
0040  16 17 18 19 1a 1b 1c 1d 1e 1f 20 21 22 23 24 25  ....!#$%
0050  26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35  &'()*+,-./012345
0060  36 37 67
  
```

Ready to load or capture Packets: 44 · Displayed: 44 (100.0%) Profile: Default

At newenxdo3745b332 interface:

newenxdo3745b332.pcapng

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=1/256, ttl=6
2	0.000242441	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=1/256, ttl=6
3	0.999692832	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=2/512, ttl=6
4	0.999976675	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=2/512, ttl=6
5	1.999698783	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=3/768, ttl=6
6	1.999920926	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=3/768, ttl=6
7	2.999637491	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=4/1024, ttl=6
8	2.999842512	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=4/1024, ttl=6
9	3.999623987	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=5/1280, ttl=6
10	3.999812525	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=5/1280, ttl=6
11	4.999701769	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=6/1536, ttl=6
12	4.999949987	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=6/1536, ttl=6
13	5.012705577	Tp-LinkT_b7:b3:32	Tp-LinkT_b8:d9:75	ARP	42	Who has 172.16.11.1? Tell 172.16.11.201
14	5.012937833	Tp-LinkT_b8:d9:75	Tp-LinkT_b7:b3:32	ARP	60	172.16.11.1 is at d0:37:45:b8:d9:75
15	5.999682411	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=7/1792, ttl=6
16	5.999822286	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=7/1792, ttl=6
17	6.999641070	172.16.10.1	172.16.12.201	ICMP	98	Echo (ping) request id=0x0e1c, seq=8/2048, ttl=6
18	6.999889896	172.16.12.201	172.16.10.1	ICMP	98	Echo (ping) reply id=0x0e1c, seq=8/2048, ttl=6

Frame 8: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0
 Ethernet II, Src: Tp-LinkT_b7:b3:32 (d0:37:45:b7:b3:32), Dst: Tp-LinkT_b8:d9:75 (d0:37:45:b8:d9:75)
 Internet Protocol Version 4, Src: 172.16.12.201, Dst: 172.16.10.1
 Internet Control Message Protocol

```

0000  d0 37 45 b8 d9 75 d0 37 45 b7 b3 32 08 00 45 00  .7E..u.7E...E.
0010  00 54 01 ea 00 00 3f 01 0a d5 ac 10 0c c9 ac 10  ..T...?.....
0020  0a 01 00 00 c4 e1 0e 1c 00 04 8e 09 42 60 00 00  ...B...
0030  00 00 99 c1 04 00 00 00 00 00 10 11 12 13 14 15  ....
0040  16 17 18 19 1a 1b 1c 1d 1e 1f 20 21 22 23 24 25  ....!#$%
0050  26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35  &'()*+,-./012345
0060  36 37 67
  
```

Internet Control Message Protocol (icmp), 64 bytes Packets: 42 · Displayed: 42 (100.0%) · Dropped: 0 (0.0%) Profile: Default

At Hd:

Terminal 1: \$ sudo wireshark

The image shows a Wireshark packet capture window titled '*any'. The interface includes a menu bar (File, Edit, View, Go, Capture, Analyze, Statistics, Telephony, Wireless, Tools, Help) and a toolbar with various icons. The main display area is divided into three panes:

- Packet List:** A table showing 10 captured packets. All are ICMP Echo (ping) requests and replies between 172.16.10.1 and 172.16.12.201. The 'Info' column provides details like sequence numbers and TTL values.
- Packet Details:** A tree view for the selected packet (Frame 1). It shows the Ethernet II header, Internet Protocol Version 4 details (Source: 172.16.10.1, Destination: 172.16.12.201), and the Internet Control Message Protocol details.
- Packet Bytes:** A hex dump and ASCII representation of the selected packet's raw data.

The status bar at the bottom indicates 'Packets: 10 · Displayed: 10 (100.0%)' and 'Profile: Default'.