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Department of Computer Science and Engineering

UE17CS304

Computer Networks Laboratory

Lab Report

Week 1

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Semester 5 | Section 'C' | Number 22

Task 1

Input

```
ifconfig
ip addr show

sudo ifconfig enp2s0 10.0.3.22 netmask 255.255.255.0
sudo ip addr add 10.0.3.22/24 dev enp2s0

sudo ifconfig enp2s0 down
sudo ifconfig enp2s0 up

ip neigh
```

Step 1-4

```
student@CSELAB: ~
student@CSELAB:~$ ifconfig
enp2s0    Link encap:Ethernet  HWaddr b8:ae:ed:a5:a6:82
          inet addr:10.1.10.155  Bcast:10.1.10.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:294815 errors:0 dropped:0 overruns:0 frame:0
          TX packets:61525 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:110169808 (110.1 MB)  TX bytes:5514250 (5.5 MB)

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:23056 errors:0 dropped:0 overruns:0 frame:0
          TX packets:23056 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:2240107 (2.2 MB)  TX bytes:2240107 (2.2 MB)

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:a5:a6:82 brd ff:ff:ff:ff:ff:ff
    inet 10.1.10.155/24 brd 10.1.10.255 scope global dynamic enp2s0
        valid_lft 28500sec preferred_lft 28500sec

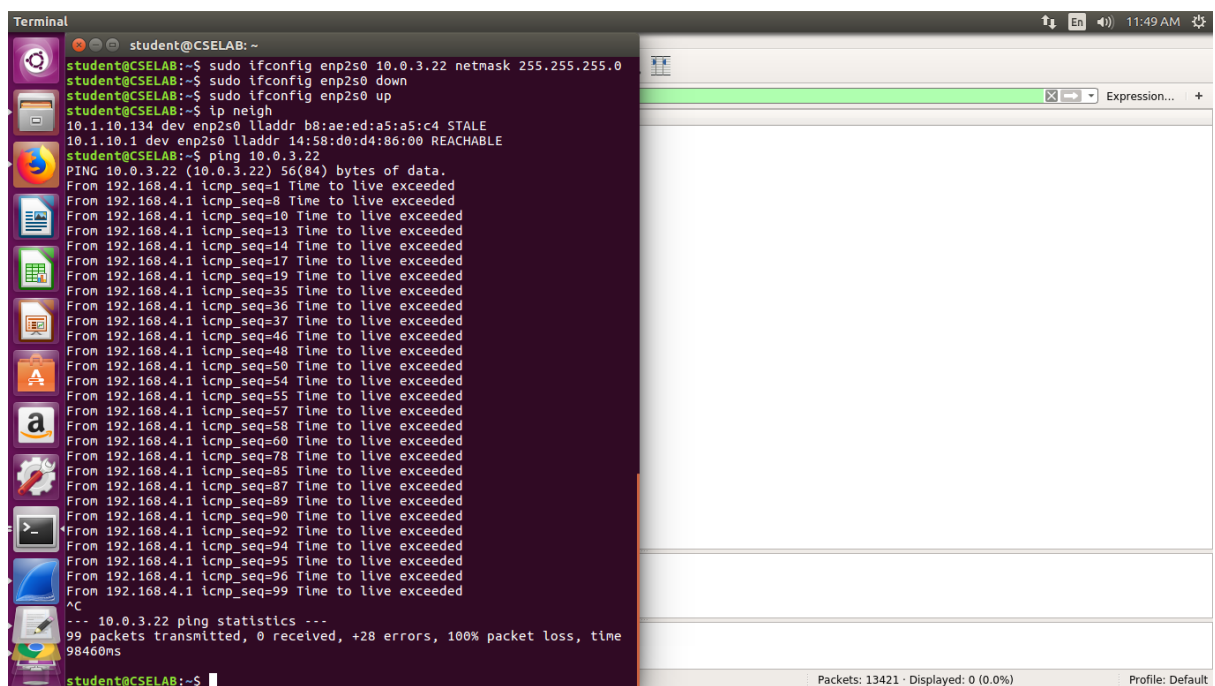
student@CSELAB:~$ sudo ifconfig enp2s0 10.0.3.22 netmask 255.255.255.0
student@CSELAB:~$ sudo ip addr add 10.0.3.22/24 dev enp2s0
RTNETLINK answers: File exists
student@CSELAB:~$ sudo ifconfig enp2s0 down
student@CSELAB:~$ sudo ifconfig enp2s0 up
student@CSELAB:~$ ip neigh
4.2.2.2 dev enp2s0  INCOMPLETE
student@CSELAB:~$
```

Task 2

Input

```
ping 10.0.3.22
```

Step 1 and 2



The screenshot shows a terminal window with the following commands and output:

```
student@CSELAB:~$ sudo ifconfig enp2s0 10.0.3.22 netmask 255.255.255.0
student@CSELAB:~$ sudo ifconfig enp2s0 down
student@CSELAB:~$ sudo ifconfig enp2s0 up
student@CSELAB:~$ ip neigh
10.1.10.134 dev enp2s0 lladdr b8:ae:ed:a5:a5:c4 STALE
10.1.10.1 dev enp2s0 lladdr 14:58:d0:d4:86:00 REACHABLE
student@CSELAB:~$ ping 10.0.3.22
PING 10.0.3.22 (10.0.3.22) 56(84) bytes of data:
From 192.168.4.1 icmp_seq=1 Time to live exceeded
From 192.168.4.1 icmp_seq=8 Time to live exceeded
From 192.168.4.1 icmp_seq=10 Time to live exceeded
From 192.168.4.1 icmp_seq=13 Time to live exceeded
From 192.168.4.1 icmp_seq=14 Time to live exceeded
From 192.168.4.1 icmp_seq=17 Time to live exceeded
From 192.168.4.1 icmp_seq=19 Time to live exceeded
From 192.168.4.1 icmp_seq=35 Time to live exceeded
From 192.168.4.1 icmp_seq=36 Time to live exceeded
From 192.168.4.1 icmp_seq=37 Time to live exceeded
From 192.168.4.1 icmp_seq=46 Time to live exceeded
From 192.168.4.1 icmp_seq=48 Time to live exceeded
From 192.168.4.1 icmp_seq=50 Time to live exceeded
From 192.168.4.1 icmp_seq=54 Time to live exceeded
From 192.168.4.1 icmp_seq=55 Time to live exceeded
From 192.168.4.1 icmp_seq=57 Time to live exceeded
From 192.168.4.1 icmp_seq=58 Time to live exceeded
From 192.168.4.1 icmp_seq=60 Time to live exceeded
From 192.168.4.1 icmp_seq=78 Time to live exceeded
From 192.168.4.1 icmp_seq=85 Time to live exceeded
From 192.168.4.1 icmp_seq=87 Time to live exceeded
From 192.168.4.1 icmp_seq=89 Time to live exceeded
From 192.168.4.1 icmp_seq=90 Time to live exceeded
From 192.168.4.1 icmp_seq=92 Time to live exceeded
From 192.168.4.1 icmp_seq=94 Time to live exceeded
From 192.168.4.1 icmp_seq=95 Time to live exceeded
From 192.168.4.1 icmp_seq=96 Time to live exceeded
From 192.168.4.1 icmp_seq=99 Time to live exceeded
^C
--- 10.0.3.22 ping statistics ---
99 packets transmitted, 0 received, +28 errors, 100% packet loss, time
98460ms
student@CSELAB:~$
```

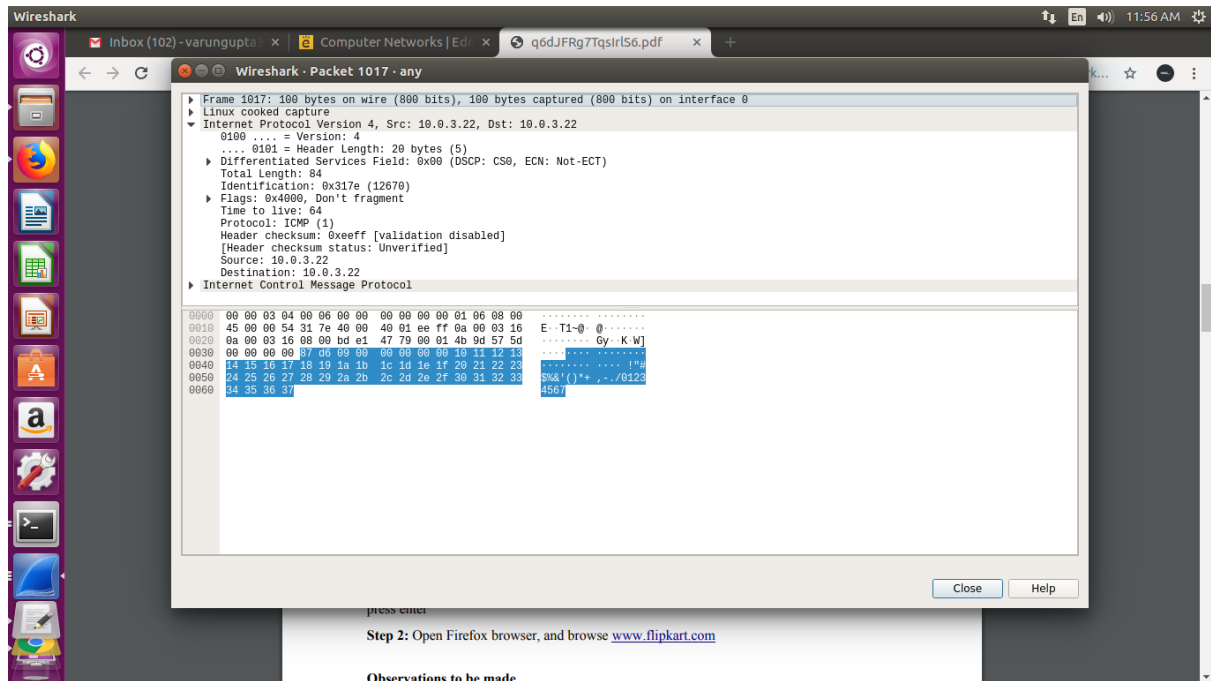
The terminal window is titled "Terminal" and shows the user "student" at "CSELAB". The output of the ping command shows that all 99 packets transmitted were lost, resulting in a 100% packet loss. The status bar at the bottom of the terminal window indicates "Packets: 13421 · Displayed: 0 (0.0%)" and "Profile: Default".

Step 3

The image shows a Kali Linux desktop environment. On the left is the Dash-to-Panel dock with icons for various applications. The main workspace contains two windows:

- Terminal Window:** The title bar reads "Terminal". The command prompt is "student@CSELAB: ~". The user has entered the command "ping 10.0.3.22". The output shows 24 successful ping requests, each with a response time between 0.018 ms and 0.029 ms. The statistics at the bottom indicate 24 packets transmitted, 24 received, 0% packet loss, and a round-trip time of 22999ms.
- Wireshark Window:** The title bar reads "Wireshark". The packet list on the left shows 24 packets of type "ICMP Echo (ping request)". The packet details pane on the right shows the structure of an ICMP Echo request, including the type (8), code (0), identifier (0), and sequence number (1). The packet bytes pane on the right shows the raw data in hexadecimal and ASCII.

Step 4



The screenshot shows the Wireshark interface with packet 1017 selected. The details pane for packet 1017 is expanded, showing the following information:

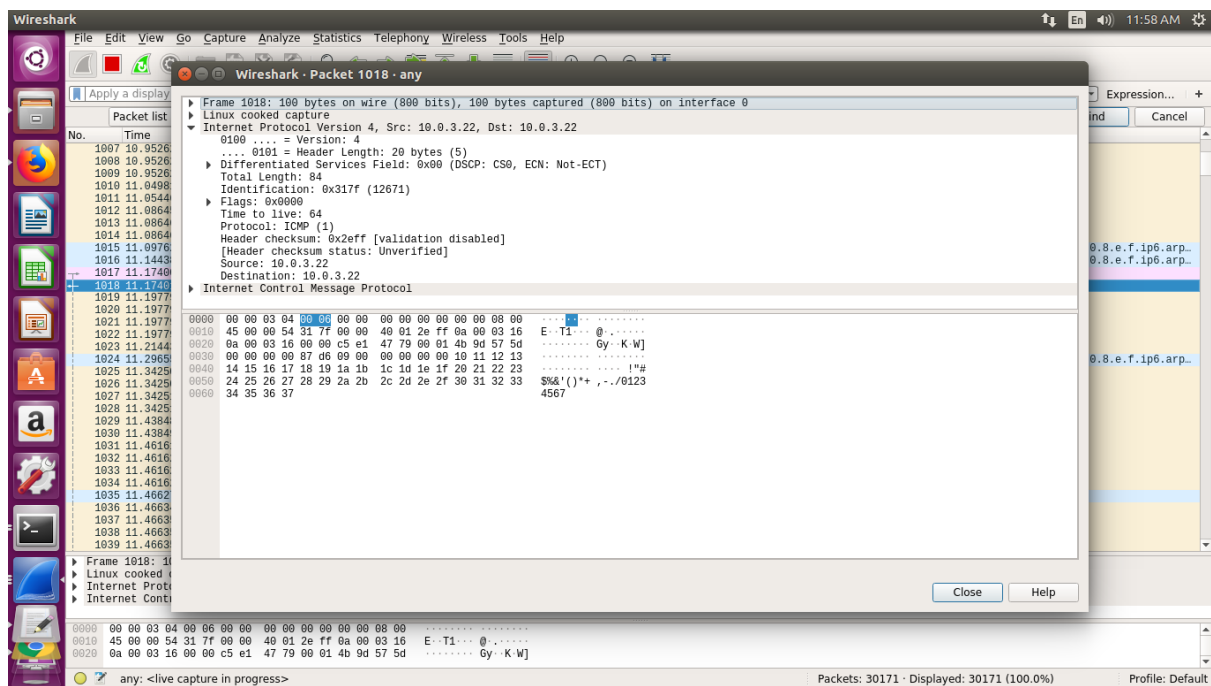
- Frame 1017: 100 bytes on wire (800 bits), 100 bytes captured (800 bits) on interface 0
- Linux cooked capture
- Internet Protocol Version 4, Src: 10.0.3.22, Dst: 10.0.3.22
 - 0100 ... = Version: 4
 - ... 0101 = Header Length: 20 bytes (5)
 - Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
 - Total Length: 84
 - Identification: 0x317e (12670)
 - Flags: 0x4000, Don't fragment
 - Time to live: 64
 - Protocol: ICMP (1)
 - Header checksum: 0xeeff [validation disabled]
 - [Header checksum status: Unverified]
 - Source: 10.0.3.22
 - Destination: 10.0.3.22
- Internet Control Message Protocol

The packet bytes pane shows the raw data in hexadecimal and ASCII. The ASCII column contains the text "E..T1..0..", "Gy..K..W", and "4567".

press enter

Step 2: Open Firefox browser, and browse www.flipkart.com

Observations to be made



The screenshot shows the Wireshark interface with packet 1018 selected. The details pane for packet 1018 is expanded, showing the following information:

- Frame 1018: 100 bytes on wire (800 bits), 100 bytes captured (800 bits) on interface 0
- Linux cooked capture
- Internet Protocol Version 4, Src: 10.0.3.22, Dst: 10.0.3.22
 - 0100 ... = Version: 4
 - ... 0101 = Header Length: 20 bytes (5)
 - Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
 - Total Length: 84
 - Identification: 0x317f (12671)
 - Flags: 0x0000
 - Time to live: 64
 - Protocol: ICMP (1)
 - Header checksum: 0x2eff [validation disabled]
 - [Header checksum status: Unverified]
 - Source: 10.0.3.22
 - Destination: 10.0.3.22
- Internet Control Message Protocol

The packet bytes pane shows the raw data in hexadecimal and ASCII. The ASCII column contains the text "E..T1..0..", "Gy..K..W", and "4567".

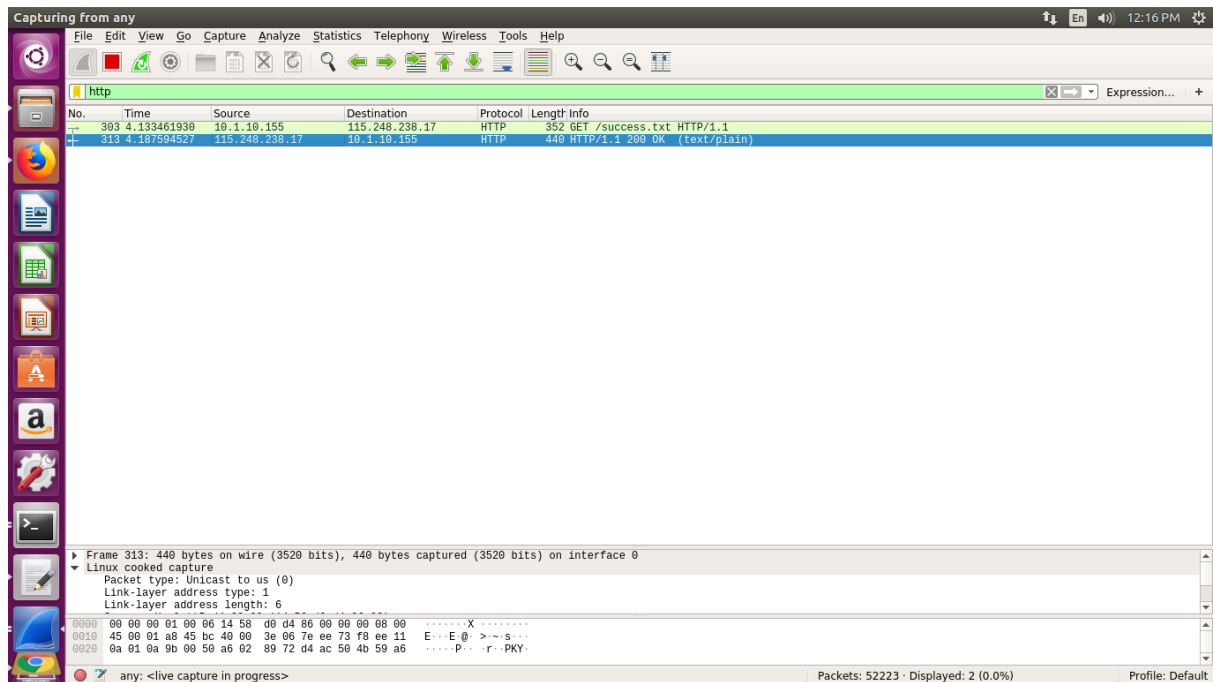
any: <live capture in progress>

Packets: 30171 · Displayed: 30171 (100.0%)

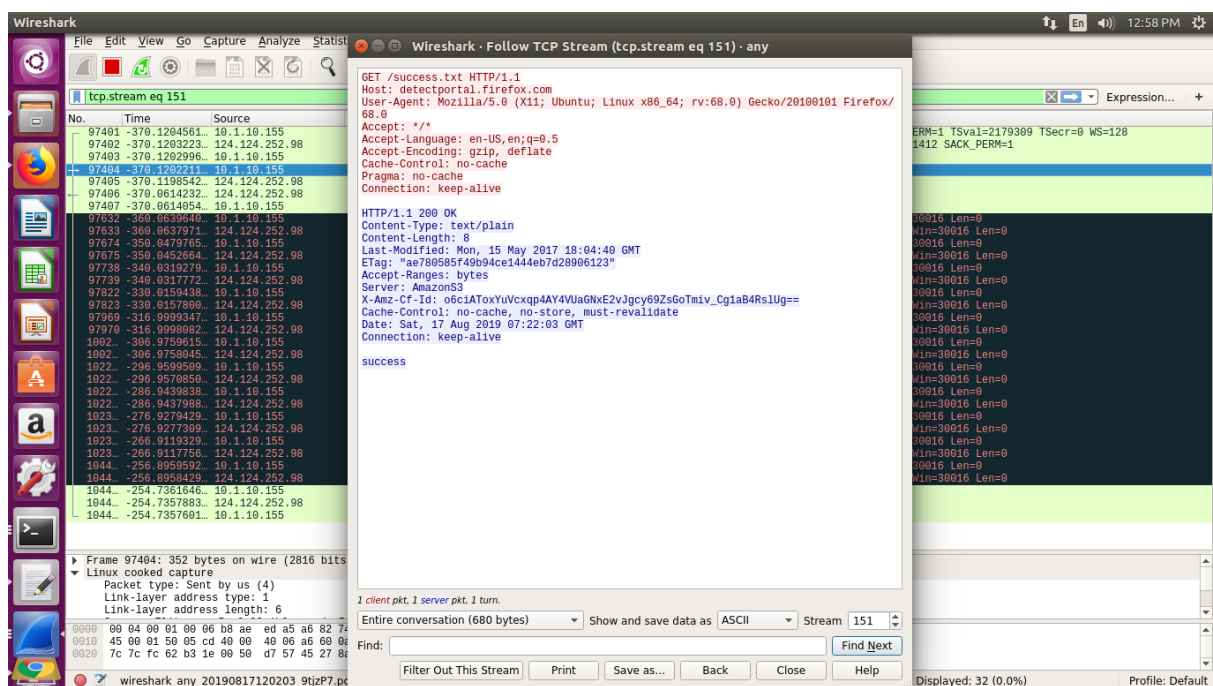
Profile: Default

Task 3

Step 1-4



Step 5



Task 4

Input

```
sudo tcpdump -D
sudo tcpdump -i any
sudo tcpdump -i any -c5 icmp
sudo tcpdump -i any -c10 -nn -A port 80
sudo tcpdump -i any -c10 -nn -w webserver.pcap port 80
```

Step 1, 2 and 3

```
student@CSELAB: ~
student@CSELAB:~$ sudo tcpdump -D
1.enp2s0 [Up, Running]
2.any (Pseudo-device that captures on all interfaces) [Up, Running]
3.lo [Up, Running, Loopback]
4.nflog (Linux netfilter log (NFLOG) interface)
5.nfqueue (Linux netfilter queue (NFQUEUE) interface)
6.usbmon1 (USB bus number 1)
7.usbmon2 (USB bus number 2)
8.usbmon3 (USB bus number 3)
9.usbmon4 (USB bus number 4)
student@CSELAB:~$ sudo tcpdump -i any
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes
12:57:15.861280 IP 10.1.10.156.mdns > 224.0.0.251.mdns: 0 [4q] [6n] ANY (QM)? 0.7.2.d.8.6.f.0.a.b.6.7.9.d.9.4.0.0.0.0.0.0.0.0.0.0.0.8.e.f.i.p6.arpa. ANY (QM)? linux-325.local. ANY (QM)? 8.7.c.8.6.d.b.2.2.6.9.1.d.5.2.9.0.0.0.0.0.0.0.0.0.0.0.0.0.8.e.f.i.p6.arpa. ANY (QM)? a.c.5.d.c.3.b.2.6.a.2.4.8.b.b.1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.8.e.f.i.p6.arpa. (313)
12:57:15.861651 IP localhost.42003 > CSELAB.domain: 52035+ PTR? 251.0.0.224.in-addr.arpa. (42)
12:57:15.861693 IP 10.1.10.155.48123 > ns2.rllinfo.net.domain: 56882+ PTR? 251.0.0.224.in-addr.arpa. (42)
12:57:15.862143 IP 10.1.10.139.mdns > 224.0.0.251.mdns: 0*- [0q] 3/0/0 (Cache flush) PTR linux-63.local., (Cache flush) PTR linux-63.local. (204)
12:57:15.883934 IP ns2.rllinfo.net.domain > 10.1.10.155.48123: 56882 NXDomain* 0/1/0 (99)
12:57:15.908306 IP localhost.41635 > CSELAB.domain: 19875+ PTR? 100.103.138.202.in-addr.arpa. (46)
12:57:15.908368 IP 10.1.10.155.48123 > ns2.rllinfo.net.domain: 23914+ PTR? 100.103.138.202.in-addr.arpa. (46)
12:57:15.994324 IP ec2-54-69-74-19.us-west-2.compute.amazonaws.com.https > 10.1.10.155.35302: Flags [P.], seq 193990480:193990547, ack 2467353577, win 35300, length 67
12:57:15.994349 IP 10.1.10.155.35302 > ec2-54-69-74-19.us-west-2.compute.amazonaws.com.https: Flags [.], ack 67, win 48008, length 0
12:57:15.994462 IP localhost.39320 > CSELAB.domain: 39929+ PTR? 19.74.69.54.in-addr.arpa. (42)
12:57:15.994514 IP 10.1.10.155.48123 > ns2.rllinfo.net.domain: 8957+ PTR? 19.74.69.54.in-addr.arpa. (42)
12:57:16.039747 IP ns2.rllinfo.net.domain > 10.1.10.155.48123: 8957 1/5/6 PTR ec2-54-69-74-19.us-west-2.compute.amazonaws.com. (324)
12:57:16.987819 ARP, Request who-has 10.1.10.95 tell 10.1.10.134, length 46
12:57:16.987939 IP localhost.52206 > CSELAB.domain: 33685+ PTR? 95.10.1.10.in-addr.arpa. (41)
12:57:16.988024 IP 10.1.10.155.48123 > ns2.rllinfo.net.domain: 21395+ PTR? 95.10.1.10.in-addr.arpa. (41)
12:57:17.009612 IP ns2.rllinfo.net.domain > 10.1.10.155.48123: 21395 NXDomain* 0/1/0 (109)
12:57:17.009686 IP CSELAB.domain > localhost.52206: 33685 NXDomain* 0/1/0 (109)
12:57:17.352330 IP 10.1.10.16.mdns > 224.0.0.251.mdns: 0*- [0q] 4/0/0 (Cache flush) AAAA fe80::c0d3:6e5d:70d:e96c, (Cache flush) PTR CSELAB-19.local., (Cache flush) A 10.1.10.16, (Cache flush) PTR CSELAB-19.local. (190)
12:57:17.352472 IP localhost.53661 > CSELAB.domain: 49044+ PTR? 16.10.1.10.in-addr.arpa. (41)
12:57:17.352515 IP 10.1.10.155.48123 > ns2.rllinfo.net.domain: 6334+ PTR? 16.10.1.10.in-addr.arpa. (41)
12:57:17.374451 IP ns2.rllinfo.net.domain > 10.1.10.155.48123: 6334 NXDomain* 0/1/0 (109)
12:57:17.374525 IP CSELAB.domain > localhost.53661: 49044 NXDomain* 0/1/0 (109)
12:57:18.011815 ARP, Request who-has 10.1.10.95 tell 10.1.10.134, length 46
12:57:18.207760 IP 10.1.10.155.57972 > 124.124.252.98.http: Flags [.], ack 283205788, win 30016, length 0
12:57:18.207962 IP 124.124.252.98.http > 10.1.10.155.57972: Flags [.], ack 1, win 30016, length 0
```

Step 4, 5 and 6

```
student@CSELAB: ~  
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes  
12:16:02.251063 ARP, Request who-has 192.168.3.5 tell 10.0.3.24, length 46  
12:16:02.251083 ARP, Request who-has b.resolvers.level3.net tell 10.0.3.24, length 46  
12:16:02.251085 ARP, Request who-has ns1.rillinfo.net tell 10.0.3.24, length 46  
12:16:02.251087 ARP, Request who-has ns2.rillinfo.net tell 10.0.3.24, length 46  
12:16:02.251416 IP localhost.51160 > CSELAB.domain: 25721+ PTR? 5.3.168.192.in-addr.arpa. (42)  
12:16:02.251464 IP 10.1.10.155.50621 > 192.168.3.5.domain: 41100+ PTR? 5.3.168.192.in-addr.arpa. (42)  
12:16:02.253900 IP localhost.57296 > CSELAB.domain: 46791+ PTR? 155.10.1.10.in-addr.arpa. (42)  
12:16:02.253958 IP 10.1.10.155.50621 > 192.168.3.5.domain: 10309+ PTR? 155.10.1.10.in-addr.arpa. (42)  
12:16:02.262259 ARP, Request who-has 10.1.10.149 tell 10.1.10.134, length 46  
12:16:02.262366 IP localhost.34406 > CSELAB.domain: 4256+ PTR? 149.10.1.10.in-addr.arpa. (42)  
12:16:02.262416 IP 10.1.10.155.50621 > 192.168.3.5.domain: 48886+ PTR? 149.10.1.10.in-addr.arpa. (42)  
12:16:02.262952 IP 192.168.3.5.domain > 10.1.10.155.50621: 48886 NXDomain 0/1/0 (110)  
12:16:02.263022 IP CSELAB.domain > localhost.34406: 4256 NXDomain 0/1/0 (110)  
12:16:02.268623 IP ns2.rillinfo.net.domain > 10.1.10.155.50621: 41100 ServFail 0/0/0 (42)  
12:16:02.288656 IP ns1.rillinfo.net.domain > 10.1.10.155.50621: 41100 ServFail 0/0/0 (42)  
12:16:02.291658 IP b.resolvers.level3.net.domain > 10.1.10.155.50621: 41100 NXDomain* 0/1/0 (101)  
^C  
16 packets captured  
59 packets received by filter  
36 packets dropped by kernel  
student@CSELAB:~$ sudo tcpdump -i any -c5 icmp  
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode  
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes  
^C  
0 packets captured  
1 packet received by filter  
0 packets dropped by kernel  
student@CSELAB:~$ sudo tcpdump -i any -c10 -nn -A port 80  
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode  
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes  
^C  
0 packets captured  
0 packets received by filter  
0 packets dropped by kernel  
student@CSELAB:~$ sudo tcpdump -i any -c10 -nn -A port 80  
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode  
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes  
^C  
0 packets captured  
0 packets received by filter  
0 packets dropped by kernel  
student@CSELAB:~$
```


Task 5

Input

```
sudo traceroute www.google.com
sudo traceroute -n www.google.com
sudo traceroute -I www.google.com
sudo traceroute -T www.google.com
```

Step 1

```
student@CSELAB: ~
0 packets captured
0 packets received by filter
0 packets dropped by kernel
student@CSELAB:~$ sudo tcpdump -i any -c10 -nn -A port 80
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on any, link-type LINUX_SLL (Linux cooked), capture size 262144 bytes
^C
0 packets captured
0 packets received by filter
0 packets dropped by kernel
student@CSELAB:~$ sudo traceroute www.google.com
traceroute to www.google.com (216.58.196.164), 30 hops max, 60 byte packets
 1  10.1.10.1 (10.1.10.1)  39.610 ms  39.617 ms  39.613 ms
 2  192.168.4.1 (192.168.4.1)  0.899 ms  0.906 ms  0.900 ms
 3  192.168.254.1 (192.168.254.1)  0.206 ms  0.219 ms  0.230 ms
 4  * * *
 5  * * *
 6  * * *
 7  * * *
 8  * * *
 9  * * *
10  * * *
11  * * *
12  * * *
13  * * *
14  * * *
15  * * *
16  * * *
17  * * *
18  * * *
19  * * *
20  * * *
21  * * *
22  * * *
23  * * *
24  * * *
25  * * *
26  * * *
27  * * *
28  * * *
29  * * *
30  * * *
```

Step 2

```
student@CSELAB: ~  
21 ***  
22 ***  
23 ***  
24 ***  
25 ***  
26 ***  
27 ***  
28 ***  
29 ***  
30 ***  
student@CSELAB:~$ sudo traceroute -n www.google.com  
traceroute to www.google.com (216.58.196.164), 30 hops max, 60 byte packets  
1 10.1.10.1 1.292 ms 1.287 ms 1.283 ms  
2 192.168.4.1 0.939 ms 0.947 ms 0.943 ms  
3 192.168.254.1 0.115 ms 0.335 ms 0.360 ms  
4 ***  
5 ***  
6 ***  
7 ***  
8 ***  
9 ***  
10 ***  
11 ***  
12 ***  
13 ***  
14 ***  
15 ***  
16 ***  
17 ***  
18 ***  
19 ***  
20 ***  
21 ***  
22 ***  
23 ***  
24 ***  
25 ***  
26 ***  
27 ***  
28 ***  
29 ***  
30 ***  
student@CSELAB:~$
```

Step 3, 4 and 5

```
student@CSELAB: ~  
6 ***  
7 ***  
8 ***  
9 ***  
10 ***  
11 ***  
12 ***  
13 ***  
14 ***  
15 ***  
16 ***  
17 ***  
18 ***  
19 ***  
20 ***  
21 ***  
22 ***  
23 ***  
24 ***  
25 ***  
26 ***  
27 ***  
28 ***  
29 ***  
30 ***  
student@CSELAB:~$ sudo traceroute -I www.google.com  
traceroute to www.google.com (172.217.160.196), 30 hops max, 60 byte packets  
1 10.1.10.1 (10.1.10.1) 1.295 ms 1.303 ms 1.303 ms  
2 192.168.4.1 (192.168.4.1) 0.824 ms 0.824 ms 0.824 ms  
3 192.168.254.1 (192.168.254.1) 0.138 ms 0.356 ms 0.368 ms  
4 1.6.180.188 (1.6.180.188) 2.507 ms * *  
5 100.66.8.23 (100.66.8.23) 17.342 ms 17.344 ms 17.575 ms  
6 100.66.8.23 (100.66.8.23) 15.771 ms 15.836 ms 16.083 ms  
7 72.14.210.200 (72.14.210.200) 15.781 ms 16.359 ms 16.408 ms  
8 108.170.248.209 (108.170.248.209) 17.079 ms 16.793 ms 17.126 ms  
9 216.239.47.151 (216.239.47.151) 16.492 ms 16.726 ms 16.726 ms  
10 bom07s16-in-f4.1e100.net (172.217.160.196) 16.087 ms 16.269 ms 16.271 ms  
student@CSELAB:~$ sudo traceroute -T www.google.com  
traceroute to www.google.com (172.217.160.196), 30 hops max, 60 byte packets  
1 10.1.10.1 (10.1.10.1) 1.115 ms 1.109 ms 1.110 ms  
2 192.168.4.1 (192.168.4.1) 0.866 ms 0.873 ms 0.870 ms  
3 bom07s16-in-f4.1e100.net (172.217.160.196) 0.160 ms 0.376 ms 0.176 ms  
student@CSELAB:~$
```

Task 6

Input

```
nmap www.pes.edu
nmap 163.53.78.128
nmap 192.168.1.1 192.168.1.2 192.168.1.3
```

Step 1, 2 and 3

```
student@CSELAB: ~
student@CSELAB:~$ nmap www.pes.edu
Starting Nmap 7.01 ( https://nmap.org ) at 2019-08-17 12:53 IST
Nmap scan report for www.pes.edu (52.172.204.196)
Host is up (0.026s latency).
Not shown: 998 filtered ports
PORT      STATE SERVICE
80/tcp    open  http
443/tcp    open  https
Nmap done: 1 IP address (1 host up) scanned in 4.29 seconds
student@CSELAB:~$ nmap 163.53.78.128
Starting Nmap 7.01 ( https://nmap.org ) at 2019-08-17 12:53 IST
Nmap scan report for 163.53.78.128
Host is up (0.00027s latency).
Not shown: 997 filtered ports
PORT      STATE SERVICE
80/tcp    open  http
443/tcp    open  https
587/tcp    open  submission
Nmap done: 1 IP address (1 host up) scanned in 4.77 seconds
student@CSELAB:~$ nmap 192.168.1.1 192.168.1.2 192.168.1.3
Starting Nmap 7.01 ( https://nmap.org ) at 2019-08-17 12:54 IST
Nmap done: 3 IP addresses (0 hosts up) scanned in 1.26 seconds
student@CSELAB:~$
```

Task 7

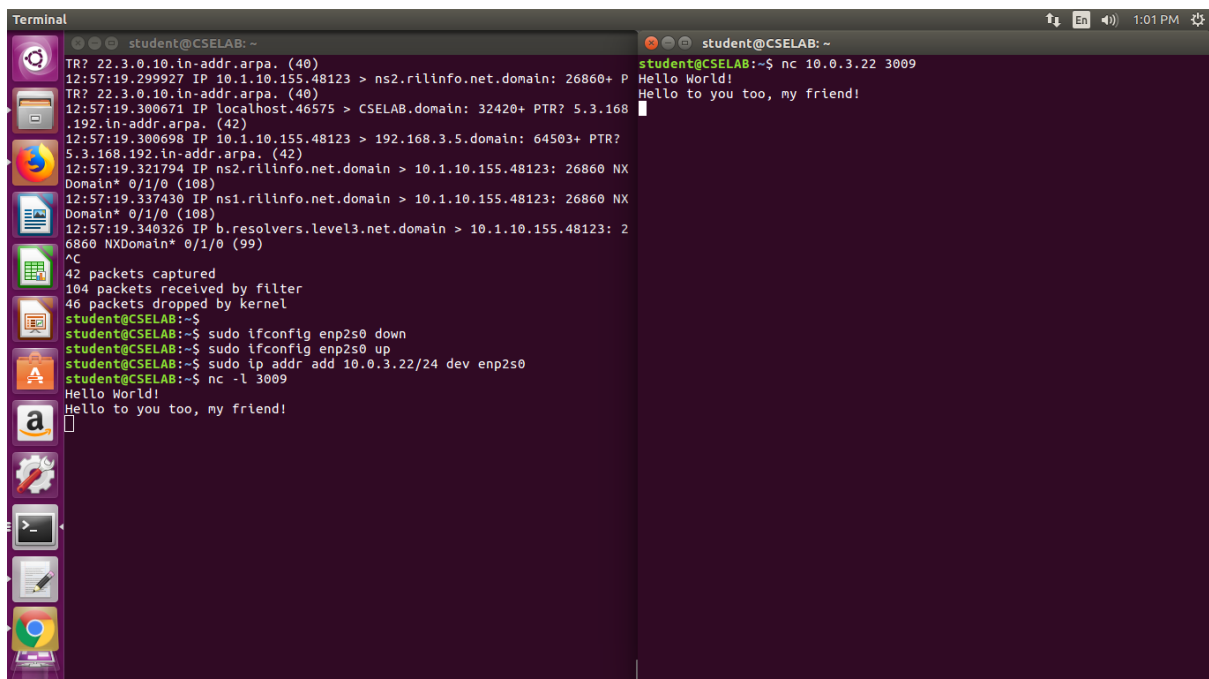
Input

```
nc -l 3009
nc 10.0.3.22 3009

sudo nc -l 3009 > vrg.me
sudo nc 10.0.3.22 3009 < me.vrg
cat vrg.me

nc -vn 10.0.3.22 80
while true; do sudo nc -lp 80 < index.html; done
```

Step A1



```
Terminal
student@CSELAB: ~
TR? 22.3.0.10.in-addr.arpa. (40)
12:57:19.299927 IP 10.1.10.155.48123 > ns2.rillinfo.net.domain: 26860+ P
TR? 22.3.0.10.in-addr.arpa. (40)
12:57:19.300671 IP localhost.46575 > CSELAB.domain: 32420+ PTR? 5.3.168
.192.in-addr.arpa. (42)
12:57:19.300698 IP 10.1.10.155.48123 > 192.168.3.5.domain: 64503+ PTR?
5.3.168.192.in-addr.arpa. (42)
12:57:19.321794 IP ns2.rillinfo.net.domain > 10.1.10.155.48123: 26860 NX
Domain* 0/1/0 (108)
12:57:19.337430 IP ns1.rillinfo.net.domain > 10.1.10.155.48123: 26860 NX
Domain* 0/1/0 (108)
12:57:19.340326 IP b.resolvers.level3.net.domain > 10.1.10.155.48123: 2
6860 NXDomain* 0/1/0 (99)
^C
42 packets captured
104 packets received by filter
46 packets dropped by kernel
student@CSELAB:~$
student@CSELAB:~$ sudo ifconfig enp2s0 down
student@CSELAB:~$ sudo ifconfig enp2s0 up
student@CSELAB:~$ sudo ip addr add 10.0.3.22/24 dev enp2s0
student@CSELAB:~$ nc -l 3009
Hello World!
Hello to you too, my friend!

student@CSELAB: ~
student@CSELAB:~$ nc 10.0.3.22 3009
Hello World!
Hello to you too, my friend!
```

Step A2

```
student@CSELAB: ~  
^[[A^[[A^C  
student@CSELAB:~$ nc -l 50000  
^[[A^C  
student@CSELAB:~$ sudo ip addr add 10.0.3.21 /24 dev enp2s0  
Error: either "local" is duplicate, or "/24" is a garbage.  
student@CSELAB:~$ sudo ip addr add 10.0.3.21/24 dev enp2s0  
student@CSELAB:~$ sudo ifconfig enp2s0 down  
student@CSELAB:~$ sudo ifconfig enp2s0 up  
student@CSELAB:~$ sudo ip addr add 10.0.3.21/24 dev enp2s0  
student@CSELAB:~$ ifconfig  
enp2s0    Link encap:Ethernet  HWaddr b8:ae:ed:a5:a7:03  
          inet addr:10.0.3.21  Bcast:0.0.0.0  Mask:255.255.255.0  
          inet6 addr: fe80::5f01:548e:8b59:62d2/64 Scope:Link  
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
          RX packets:223359 errors:0 dropped:0 overruns:0 frame:0  
          TX packets:26649 errors:0 dropped:0 overruns:0 carrier:0  
          collisions:0 txqueuelen:1000  
          RX bytes:41803828 (41.8 MB)  TX bytes:2486321 (2.4 MB)  
  
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:47555 errors:0 dropped:0 overruns:0 frame:0  
          TX packets:47555 errors:0 dropped:0 overruns:0 carrier:0  
          collisions:0 txqueuelen:1  
          RX bytes:3349259 (3.3 MB)  TX bytes:3349259 (3.3 MB)  
  
student@CSELAB:~$ nc -l 5500\  
> ^C  
student@CSELAB:~$ nc -l 5500  
^C  
student@CSELAB:~$ sudo ifconfig enp2s0 down  
student@CSELAB:~$ sudo ifconfig enp2s0 up  
student@CSELAB:~$ sudo ip addr add 10.0.3.21/24 dev enp2s0  
student@CSELAB:~$ nc -l 5500  
^C  
^C  
student@CSELAB:~$ sudo ifconfig enp2s0 down  
student@CSELAB:~$ sudo ifconfig enp2s0 up  
student@CSELAB:~$ sudo ip addr add 10.0.3.21/24 dev enp2s0  
student@CSELAB:~$ touch cat.txt
```

Step B

```
student@CSELAB: ~  
64 bytes from 10.0.3.22: icmp_seq=2 ttl=64 time=0.176 ms  
^C  
--- 10.0.3.22 ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 1000ms  
rtt min/avg/max/mdev = 0.176/0.244/0.312/0.068 ms  
student@CSELAB:~$ sudo nc 10.0.3.22 5500 < me.vrg  
bash: me.vrg: No such file or directory  
student@CSELAB:~$ sudo nc 10.0.3.22 5500 < me.vrg  
bash: me.vrg: No such file or directory  
student@CSELAB:~$ ping 10.0.3.22  
PING 10.0.3.22 (10.0.3.22) 56(84) bytes of data:  
64 bytes from 10.0.3.22: icmp_seq=1 ttl=64 time=0.197 ms  
64 bytes from 10.0.3.22: icmp_seq=2 ttl=64 time=0.219 ms  
^C  
--- 10.0.3.22 ping statistics ---  
2 packets transmitted, 2 received, 0% packet loss, time 1000ms  
rtt min/avg/max/mdev = 0.197/0.208/0.219/0.011 ms  
student@CSELAB:~$ sudo nc 10.0.3.22 5500 < me.vrg  
bash: me.vrg: No such file or directory  
student@CSELAB:~$ sudo nc 10.0.3.22 5500 < me.vrg  
bash: me.vrg: No such file or directory  
student@CSELAB:~$ sudo nc 10.0.3.22 5500 < a.b  
bash: a.b: No such file or directory  
student@CSELAB:~$ sudo nc 10.0.3.22 5500 < a.b  
bash: a.b: No such file or directory  
student@CSELAB:~$ ping 10.0.3.22  
PING 10.0.3.22 (10.0.3.22) 56(84) bytes of data:  
64 bytes from 10.0.3.22: icmp_seq=1 ttl=64 time=0.208 ms  
^[[Aping: sendmsg: Network is unreachable  
^C  
--- 10.0.3.22 ping statistics ---  
2 packets transmitted, 1 received, 50% packet loss, time 1000ms  
rtt min/avg/max/mdev = 0.208/0.208/0.208/0.000 ms  
student@CSELAB:~$ sudo nc 10.0.3.22 5500 < a.b  
bash: a.b: No such file or directory  
student@CSELAB:~$ cat text.txt  
cat: text.txt: No such file or directory  
student@CSELAB:~$ touch test.txt  
student@CSELAB:~$ sudo ifconfig enp2s0 down  
student@CSELAB:~$ sudo ifconfig enp2s0 up  
student@CSELAB:~$ sudo ip addr add 10.0.3.21/24 dev enp2s0  
student@CSELAB:~$ sudo nc 10.0.3.22 5500 < test.txt  
student@CSELAB:~$
```

Step C

Pinging one of Google's Standard Public IPs

```
varungupta3009@VRG: ~  
varungupta3009@VRG:~$ nc -vn 172.217.163.46 80  
Connection to 172.217.163.46 80 port [tcp/*] succeeded!  
^C  
varungupta3009@VRG:~$
```

test.html hosted on localhost



```
varungupta3009@VRG: ~  
GET / HTTP/1.1  
Host: localhost  
Connection: keep-alive  
Cache-Control: max-age=0  
Upgrade-Insecure-Requests: 1  
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/78.0.3888.0 Safari/537.36  
Sec-Fetch-Mode: navigate  
Sec-Fetch-User: ?1  
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,image/apng,*/*;q=0.8,application/signed-exchange;v=b3  
Sec-Fetch-Site: none  
Accept-Encoding: gzip, deflate, br  
Accept-Language: en-US,en;q=0.9  
  
GET / HTTP/1.1  
Host: localhost  
Connection: keep-alive  
Upgrade-Insecure-Requests: 1  
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/78.0.3888.0 Safari/537.36  
Sec-Fetch-Mode: navigate  
Sec-Fetch-User: ?1  
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,image/apng,*/*;q=0.8,application/signed-exchange;v=b3  
Sec-Fetch-Site: none  
Accept-Encoding: gzip, deflate, br  
Accept-Language: en-US,en;q=0.9
```