Command line tasks

System: Ubuntu 20.04

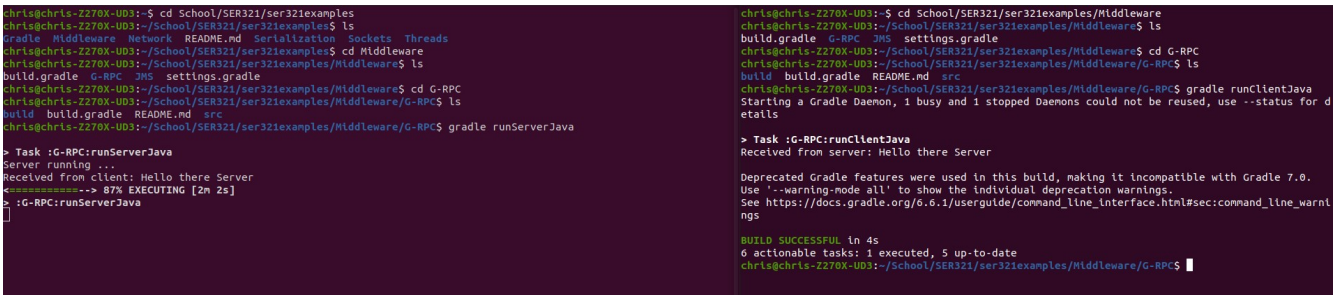
1. mkdir cli_assignment
2. cd cli_assignment
3. touch stuff.txt
4. cat >> stuff.txt
   line1
   line2
   line3
5. wc -w -l stuff.txt
6. cat >> stuff.txt
   new line
   another new line
7. mkdir draft
8. mv stuff.txt draft
9. cd draft
   touch .secret.txt
10. cp -r ../draft ../final
11. mv ../draft ../draft.remove
12. mv ../draft.remove ../final
13. ls -Rla
14. zcat NASA_access_log_Aug95.gz
15. gzip -d NASA_access_log_Aug95.gz
16. mv NASA_access_log_Aug95 logs.txt
17. mv logs.txt ~/School/SER321/cli_assignment
18. head -100 logs.txt
19. head -100 logs.txt >logs_top_100.txt
20. tail -100 logs.txt
21. tail -100 logs.txt >logs_bottom_100.txt
22. cat logs_top_100.txt logs_bottom_100.txt > logs_snapshot.txt
23. cat >> logs_snapshot.txt
    caburdet: This is a great assignment 5/18/2021
24. less logs.txt
25. cut -d '%' -f 1 marks.csv | sed "1 d"
26. cut -d '%' -f 4 marks.csv | sort -r
27. cat marks.csv | awk -F '%' '{sum += $3} END {print sum/NR}'
28. cat marks.csv | awk -F '%' '{sum += $3} END {print sum/NR}' > done.txt
29. mv done.txt final
30. mv final/done.txt final/avearge.txt

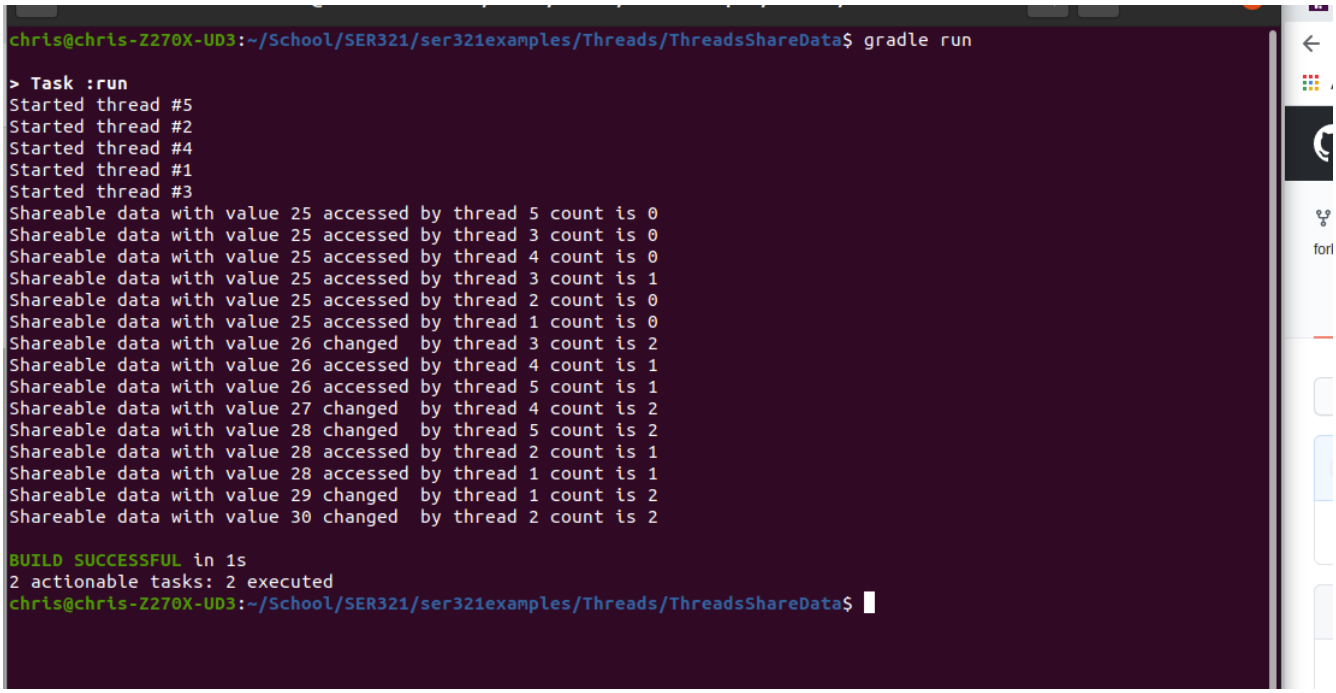
Some Setup and Examples

2.1. Setup a GitHub repo to submit your assignments

See github

2.2. Running examples





```
cdFirstThread: command not found
chris@chris-Z270X-UD3:~/School/SER321/ser321examples/Threads$ cd FirstThread
chris@chris-Z270X-UD3:~/School/SER321/ser321examples/Threads/FirstThread$ gradle run

> Task :run
Hello from 2 loop=0
Hello from 1 loop=0
Hello from 3 loop=0
Hello from 0 loop=0
Hello from 4 loop=0
Hello from 0 loop=1
Hello from 0 loop=2
Hello from 0 loop=3
Hello from 0 loop=4
Hello from 1 loop=1
Hello from 2 loop=1
Hello from 1 loop=2
Hello from 3 loop=1
Hello from 1 loop=3
Hello from 2 loop=2
Hello from 4 loop=1
Hello from 1 loop=4
Hello from 2 loop=3
Hello from 3 loop=2
Hello from 4 loop=2
Hello from 2 loop=4
Hello from 3 loop=3
Hello from 4 loop=3
Hello from 3 loop=4
Hello from 4 loop=4

BUILD SUCCESSFUL in 664ms
2 actionable tasks: 2 executed
chris@chris-Z270X-UD3:~/School/SER321/ser321examples/Threads/FirstThread$
```

2.3. Understanding Gradle

See Github

2.4. Set up your second system

Second System: AWS

Link: https://youtu.be/301RtncNGN0

Network Traffic

3.1. Explore the Data Link Layer with ARP

Step 1: Capture a Trace

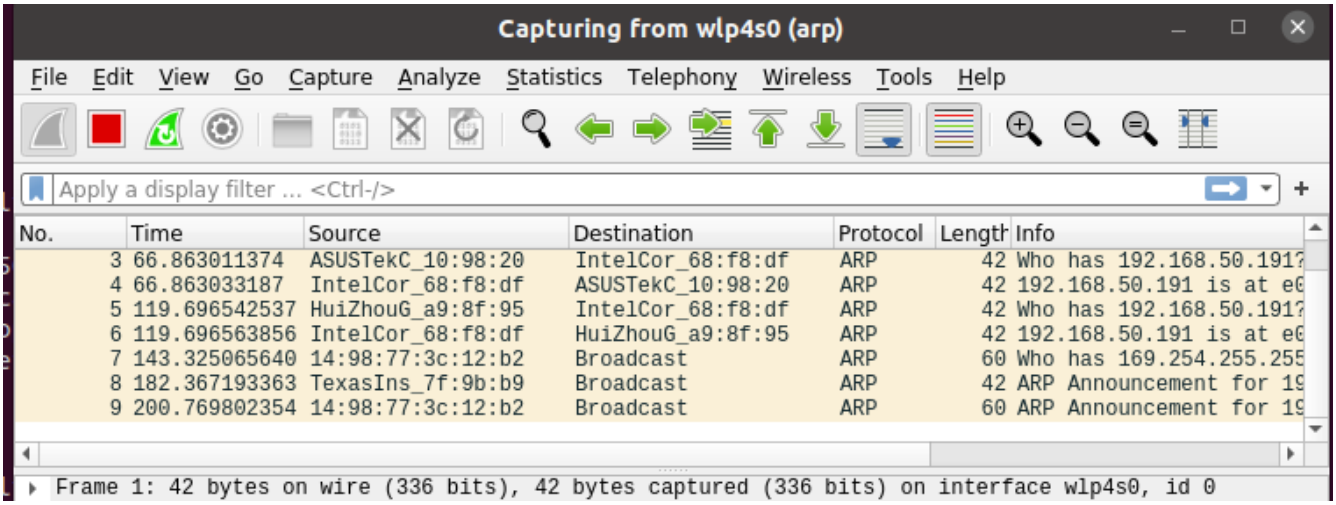
1.

```
chris@chris-Z270X-UD3:~/School/SER321/ser321examples/Sockets/JavaSimpleSock2$ ifconfig
enp0s31f6: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.50.70  netmask 255.255.255.0  broadcast 192.168.50.255
        inet6 fe80::6cb5:2c95:2189:ec94  prefixlen 64  scopeid 0x20<link>
        ether 1c:1b:0d:6f:bd:cb  txqueuelen 1000  (Ethernet)
        RX packets 6907973  bytes 9613858906 (9.6 GB)
        RX errors 0  dropped 82  overruns 0  frame 0
        TX packets 2583110  bytes 285261163 (285.2 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 16  memory 0xef400000-ef420000

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 88888  bytes 12075904 (12.0 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 88888  bytes 12075904 (12.0 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

wlp4s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.50.191  netmask 255.255.255.0  broadcast 192.168.50.255
        inet6 fe80::5826:9f62:8b04:9a28  prefixlen 64  scopeid 0x20<link>
        ether e0:d4:e8:68:f8:df  txqueuelen 1000  (Ethernet)
        RX packets 26555  bytes 3318249 (3.3 MB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 15761  bytes 2033158 (2.0 MB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

2.

```
    X25 (CCITT X.25)
chris@chris-Z270X-UD3:~/School/SER321/ser321examples/Sockets/JavaSimpleSock2$ route
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
default         RT-AX3000-9820  0.0.0.0         UG    100    0        0 enp0s31f6
default         RT-AX3000-9820  0.0.0.0         UG    600    0        0 wlp4s0
link-local      0.0.0.0         255.255.0.0     U     1000   0        0 enp0s31f6
192.168.50.0    0.0.0.0         255.255.255.0   U     100    0        0 enp0s31f6
192.168.50.0    0.0.0.0         255.255.255.0   U     600    0        0 wlp4s0
chris@chris-Z270X-UD3:~/School/SER321/ser321examples/Sockets/JavaSimpleSock2$
```

3.



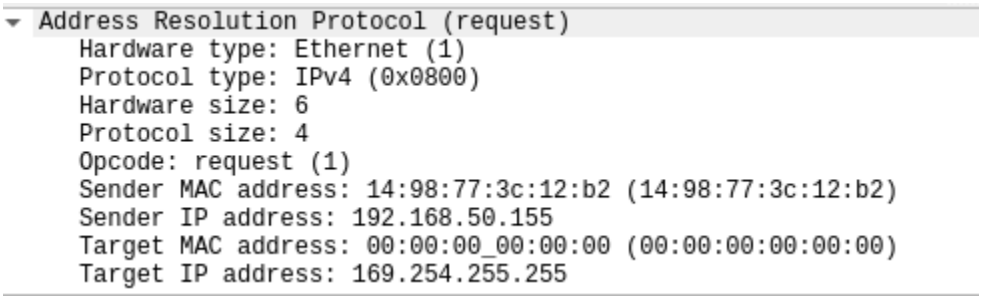
4.

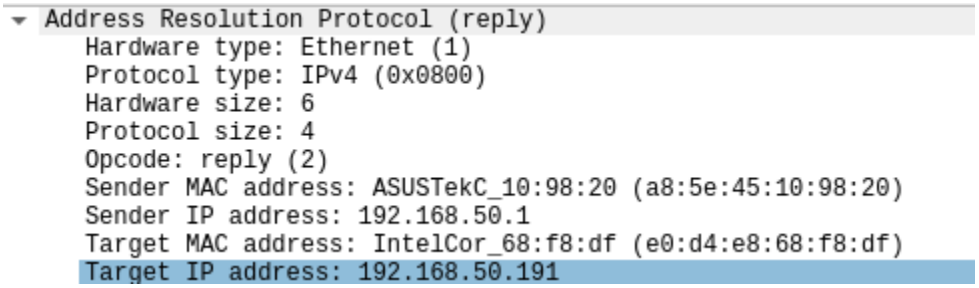
```
chris@chris-Z270X-UD3:~/School/SER321/ser321examples/Sockets/JavaSimpleSock2$ arp -a
LivingRoomTV (192.168.50.176) at 44:d8:78:a9:8f:95 [ether] on wlp4s0
RT-AX3000-9820 (192.168.50.1) at a8:5e:45:10:98:20 [ether] on wlp4s0
LivingRoomTV (192.168.50.176) at 44:d8:78:a9:8f:95 [ether] on enp0s31f6
RT-AX3000-9820 (192.168.50.1) at a8:5e:45:10:98:20 [ether] on enp0s31f6
```

```
hris@chris-Z270X-UD3:~/School/SER321/ser321examples/Sockets/JavaSimpleSock2$ sudo arp -d 192.168.50.1 && arp
a
sudo] password for chris:
ivingRoomTV (192.168.50.176) at 44:d8:78:a9:8f:95 [ether] on wlp4s0
T-AX3000-9820 (192.168.50.1) at <incomplete> on wlp4s0
ivingRoomTV (192.168.50.176) at 44:d8:78:a9:8f:95 [ether] on enp0s31f6
ivingRoomTV (192.168.50.176) at 44:d8:78:a9:8f:95 [ether] on enp0s31f6
```

5.

Step 2: Inspect the Trace





Step 3: Details of ARP over Ethernet

What opcode is used to indicate a request?
1

What opcode is used to indicate a reply?
2

How large is the ARP header for a request?
28 bytes

How large is the ARP header for a reply?
28bytes

What value is carried on a request for the unknown target MAC address?
00:00:00_00:00:00

What Ethernet Type value indicates that ARP is the higher layer protocol?
0x806

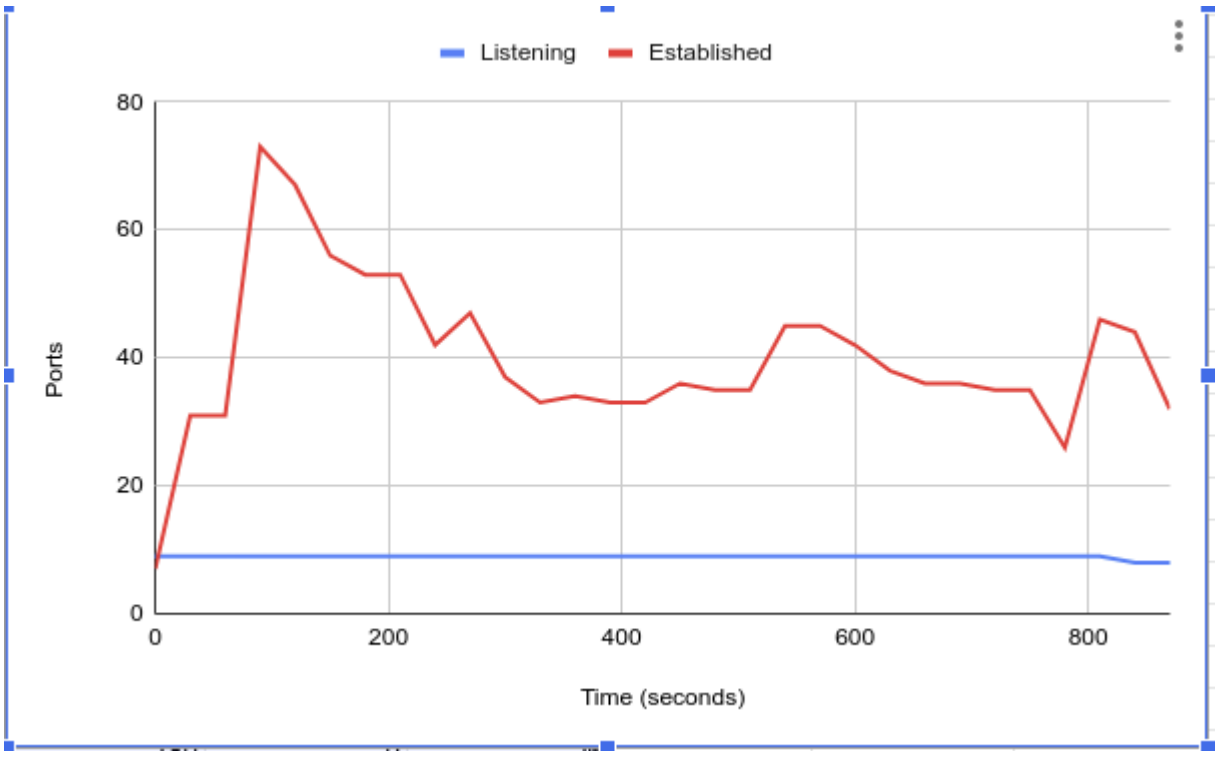
3.2 Understanding TCP Network Sockets

data:

```
    LISTEN :     9
ESTABLISHED :    7
    LISTEN :     9
ESTABLISHED :    31
    LISTEN :     9
ESTABLISHED :    31
    LISTEN :     9
ESTABLISHED :    73
    LISTEN :     9
ESTABLISHED :    67
    LISTEN :     9
ESTABLISHED :    56
    LISTEN :     9
ESTABLISHED :    53
    LISTEN :     9
ESTABLISHED :    53
    LISTEN :     9
ESTABLISHED :    42
    LISTEN :     9
ESTABLISHED :    47
    LISTEN :     9
ESTABLISHED :    37
    LISTEN :     9
ESTABLISHED :    33
    LISTEN :     9
ESTABLISHED :    34
    LISTEN :     9
ESTABLISHED :    33
    LISTEN :     9
ESTABLISHED :    33
    LISTEN :     9
ESTABLISHED :    36
    LISTEN :     9
ESTABLISHED :    30
    LISTEN :     9
ESTABLISHED :    36
    LISTEN :     9
ESTABLISHED :    35
    LISTEN :     9
ESTABLISHED :    35
    LISTEN :     9
ESTABLISHED :    45
    LISTEN :     9
ESTABLISHED :    45
```

LISTEN : 9
ESTABLISHED : 42
LISTEN : 9
ESTABLISHED : 38
LISTEN : 9
ESTABLISHED : 36
LISTEN : 9
ESTABLISHED : 36
LISTEN : 9
ESTABLISHED : 35
LISTEN : 9
ESTABLISHED : 35
LISTEN : 9
ESTABLISHED : 26
LISTEN : 9
ESTABLISHED : 46
LISTEN : 8
ESTABLISHED : 44
LISTEN : 8
ESTABLISHED : 32

graph:

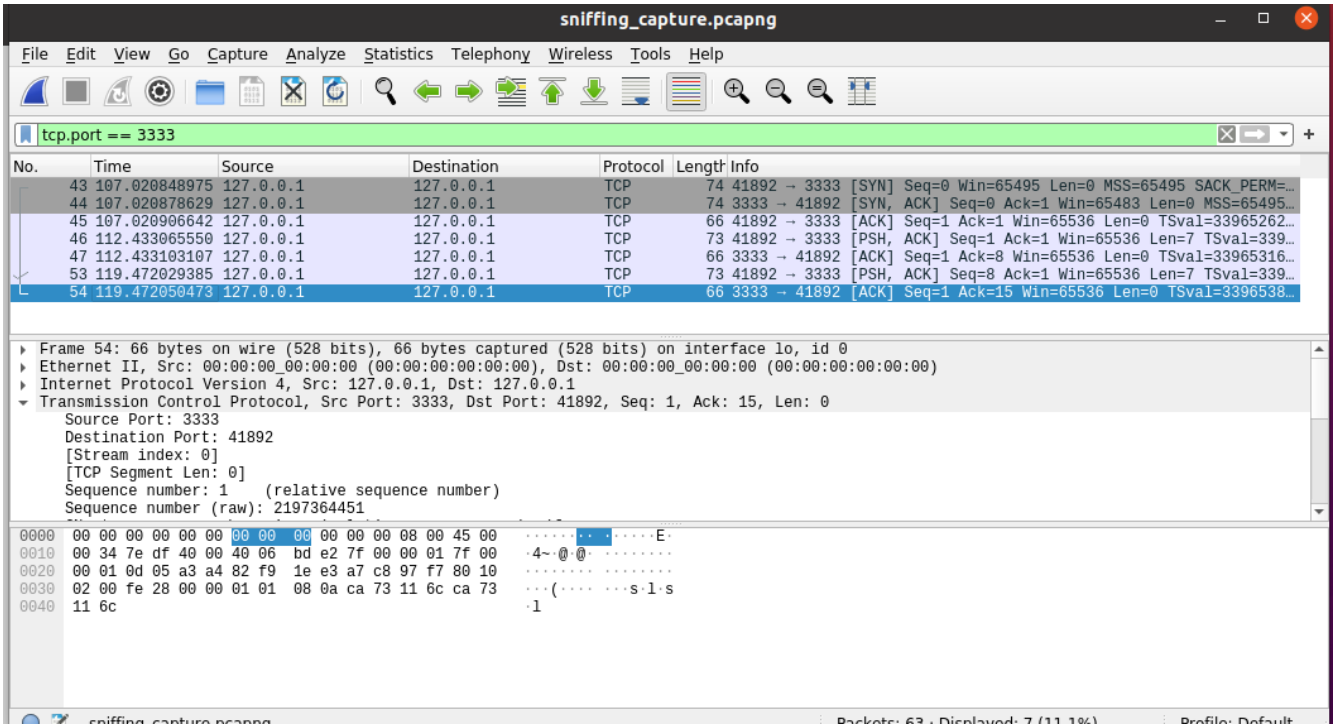


3.3 Sniffing TCP/UDP Traffic

Step 1: TCP

```
chris@chris-Z270X-UD3:~/School/SER321/ser321examples/Sockets/JavaSimpleSock2$ nc -k -l 3333
SER321
Rocks!
^C
```

```
chris@chris-Z270X-UD3:~$ nc 127.0.0.1 3333
SER321
Rocks!
^C
```



How many frames were needed to capture those 2 lines?
7

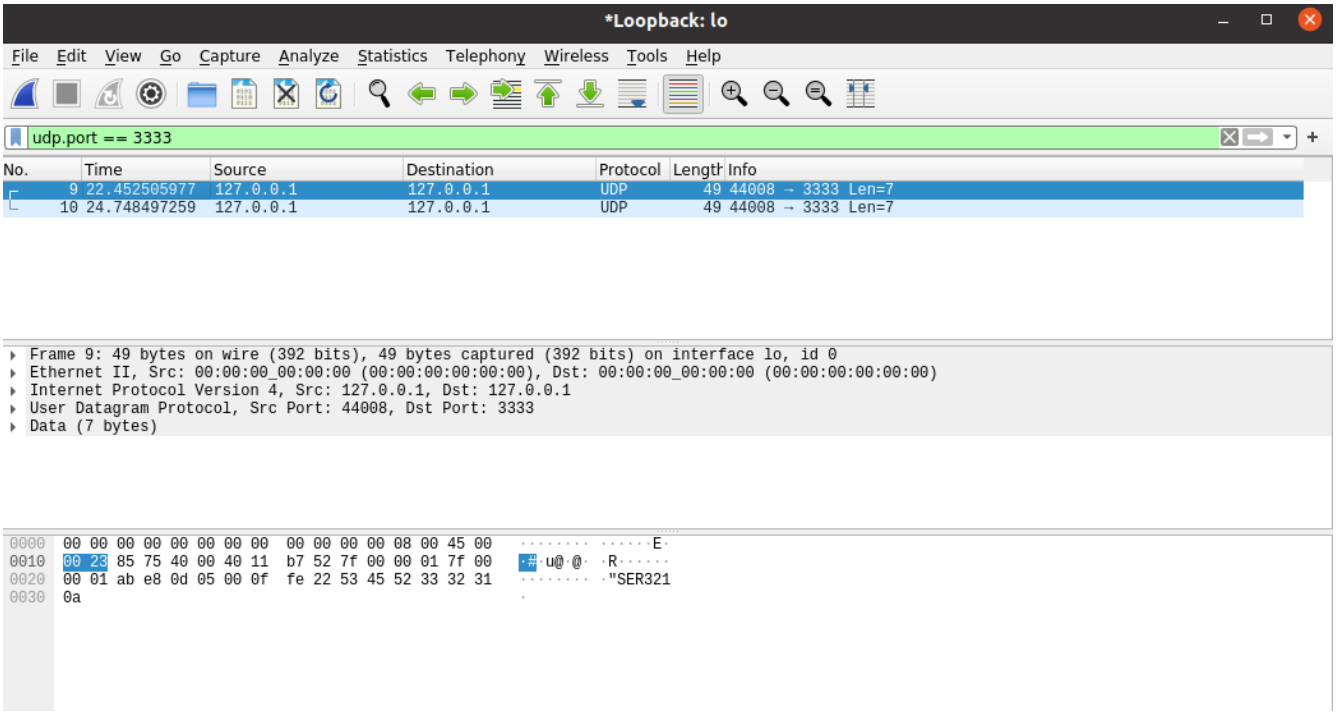
How many packets were needed to capture those 2 lines?
7

How many total bytes went over the wire? How much overhead was there
Total: 492 bytes
Data: 14 bytes
Overhead: 478 bytes

Step 2: UDP

```
chris@chris-Z270X-UD3:~/School/SER321$ nc -k -l -u 3333
^C
chris@chris-Z270X-UD3:~/School/SER321$
```

```
chris@chris-Z270X-UD3:~$ nc -u 127.0.0.1 3333
SER321
Rocks!
^C
```



How many frames were needed to capture those 2 lines?
2

How many packets were needed to capture those 2 lines?
2

How many total bytes went over the wire? How much overhead was there
Total: 98 bytes
Data: 14 bytes
Overhead: 84 bytes

What is the difference in relative overhead between UDP and TCP and why? Specifically, what kind of information was exchanged in TCP that was not exchanged in UDP? Show the relative parts of the packet traces.

3.4 Internet Protocol (IP) Routing

```
chris@chris-Z270X-UD3:~/School/SER321$ traceroute www.asu.edu
traceroute to www.asu.edu.cdn.cloudflare.net (104.16.51.14), 64 hops max
  1   192.168.50.1  4.203ms  5.136ms  3.573ms
  2   10.96.56.1  11.533ms  10.532ms  10.636ms
  3   100.127.78.58  13.267ms  11.383ms  10.945ms
  4   100.120.100.50  12.381ms  14.122ms  11.460ms
  5   68.1.4.42  90.715ms  54.387ms  56.074ms
  6   141.101.73.251  58.270ms  56.215ms  56.489ms
  7   104.16.51.14  56.500ms  57.038ms  56.587ms
```

```
chris@chris-Z270X-UD3:~/School/SER321$ traceroute www.asu.edu
traceroute to www.asu.edu.cdn.cloudflare.net (104.16.51.14), 64 hops max
  1   192.168.66.80  5.482ms  4.609ms  7.120ms
  2   192.168.50.1  12.374ms  18.511ms  17.581ms
  3   10.96.56.1  30.497ms  97.202ms  129.007ms
  4   100.127.78.58  21.900ms  34.374ms  16.507ms
  5   100.120.100.50  40.228ms  32.935ms  28.890ms
  6   68.1.4.42  81.390ms  79.002ms  86.369ms
  7   141.101.73.251  65.626ms  75.750ms  227.191ms
  8   104.16.51.14  130.762ms  164.402ms  81.578ms
```

```
caburdet@general5:~$ ping -c 5 www.asu.edu
PING www.asu.edu.cdn.cloudflare.net (104.16.51.14) 56(84) bytes of data.
64 bytes from 104.16.51.14 (104.16.51.14): icmp_seq=1 ttl=34 time=9.26 ms
64 bytes from 104.16.51.14 (104.16.51.14): icmp_seq=2 ttl=34 time=9.78 ms
64 bytes from 104.16.51.14 (104.16.51.14): icmp_seq=3 ttl=34 time=9.28 ms
64 bytes from 104.16.51.14 (104.16.51.14): icmp_seq=4 ttl=34 time=9.31 ms
64 bytes from 104.16.51.14 (104.16.51.14): icmp_seq=5 ttl=31 time=9.67 ms

--- www.asu.edu.cdn.cloudflare.net ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4006ms
rtt min/avg/max/mdev = 9.261/9.462/9.780/0.218 ms
```

Which is the fastest?
SSH

Which has the fewest hops?
SSH