

COMPUTER NETWORKS ASSIGNMENT  
RAGHAV RATHI

Ans1)

UDP Server.py

```
import socket
if __name__ == "__main__":
    host = "127.0.0.1"
    port = 4455
    server = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
    server.bind((host, port))
    while True:
        data, addr = server.recvfrom(1024)
        data = data.decode("utf-8")
        print(data)
        if data == "!EXIT":
            print("Client disconnected.")
            break
        print(f"Client: {data}")
        data = data.upper()
        data = data.encode("utf-8")
        server.sendto(data, addr)
```

UDP Client.py

```
import socket
if __name__ == "__main__":
    host = "127.0.0.1"
    port = 4455
    addr = (host, port)
    client = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
    while True:
        data = input("Enter a word: ")
        if data == "!EXIT":
            data = data.encode("utf-8")
            client.sendto(data, addr)
            print("Disconnected from the server.")
            break
        data = data.encode("utf-8")
        client.sendto(data, addr)
        data, addr = client.recvfrom(1024)
        data = data.decode("utf-8")
        print(f"Server: {data}")
```

```
In [4]: import socket

if __name__ == "__main__":
    host = "127.0.0.1"
    port = 4455
    addr = (host, port)

    client = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)

    while True:
        data = input("Enter a word: ")
        if data == "!EXIT":
            data = data.encode("utf-8")
            client.sendto(data, addr)

        print("Disconnected from the server.")
        break

        data = data.encode("utf-8")
        client.sendto(data, addr)

        data, addr = client.recvfrom(1024)
        data = data.decode("utf-8")
        print(f"Server: {data}")

Enter a word: raghavrathi@ufl.edu
Server: RAGHAVRATHI@UFL.EDU
Enter a word: hello raghav
Server: HELLO RAGHAV
Enter a word: !EXIT
Disconnected from the server.
```

```
In [ ]:
```

```
In [3]: import socket

if __name__ == "__main__":
    host = "127.0.0.1"
    port = 4455

    server = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
    server.bind((host, port))

    while True:
        data, addr = server.recvfrom(1024)
        data = data.decode("utf-8")
        print(data)

        if data == "!EXIT":
            print("Client disconnected.")
            break

        print(f"Client: {data}")

        data = data.upper()
        data = data.encode("utf-8")
        server.sendto(data, addr)

raghvrahi@ufl.edu
Client: raghavrathi@ufl.edu
hello raghav
Client: hello raghav
!EXIT
Client disconnected.
```

```
In [ ]:
```

udp.stream eq 2

No.	Time	Source	Destination	Protocol	Length	Info
21	13.166823	127.0.0.1	127.0.0.1	UDP	37	50050 → 4455 Len=5
22	13.166823	127.0.0.1	127.0.0.1	UDP	37	50050 → 50050 Len=5
44	13.166823	127.0.0.1	127.0.0.1	UDP	38	50050 → 4455 Len=6
46	13.166823	127.0.0.1	127.0.0.1	UDP	38	4455 → 50050 Len=6
<b>583</b>	<b>213.238292</b>	<b>127.0.0.1</b>	<b>127.0.0.1</b>	<b>UDP</b>	<b>51</b>	<b>50050 → 4455 Len=19</b>
584	213.239833	127.0.0.1	127.0.0.1	UDP	51	4455 → 50050 Len=19

```
> Frame 583: 51 bytes on wire (408 bits), 51 bytes captured (408 bits) on interface lo0, id 0
> Null/Loopback
> Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
> User Datagram Protocol, Src Port: 50050, Dst Port: 4455
> Data (19 bytes)

0000  02 00 00 00 45 00 00 2f  6f 16 00 00 40 11 00 00  ...E:/ o:@...
0010  7f 00 00 01 7f 00 00 01 c3 82 11 67 00 1b fe 2e  ....g...
0020  72 61 67 68 61 76 72 61 74 68 69 40 75 66 6c 2e  raghavra thi@ufl.
0030  65 64 75  edu
```

udp.stream eq 2

No.	Time	Source	Destination	Protocol	Length	Info
21	13.166823	127.0.0.1	127.0.0.1	UDP	37	50050 → 4455 Len=5
22	13.166823	127.0.0.1	127.0.0.1	UDP	37	50050 → 50050 Len=5
44	13.166823	127.0.0.1	127.0.0.1	UDP	38	50050 → 4455 Len=6
46	13.166823	127.0.0.1	127.0.0.1	UDP	38	4455 → 50050 Len=6
<b>583</b>	<b>213.238292</b>	<b>127.0.0.1</b>	<b>127.0.0.1</b>	<b>UDP</b>	<b>51</b>	<b>50050 → 4455 Len=19</b>
584	213.239833	127.0.0.1	127.0.0.1	UDP	51	4455 → 50050 Len=19

```
> Frame 584: 51 bytes on wire (408 bits), 51 bytes captured (408 bits) on interface lo0, id 0
> Null/Loopback
> Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
> User Datagram Protocol, Src Port: 4455, Dst Port: 50050
> Data (19 bytes)

0000  02 00 00 00 45 00 00 2f  1b dd 00 00 40 11 00 00  ...E:/ ...@...
0010  01 7f 00 00 00 01 11 67 c3 82 00 1b fe 2e 00 00 00  .
0020  52 41 47 48 41 58 52 41 54 48 49 40 55 48 4c 2e  RAGHAVRA THI@UFL.
0030  45 44 55  EDU
```

Ans2)

jupyter TCPClient Last Checkpoint: 17 minutes ago (autosaved) Logout

File Edit View Insert Cell Kernel Widgets Help Trusted Python 3 (ipykernel) O

In [5]:

```
from socket import *
serverName = '127.0.0.1'
serverPort = 9811 #first 4 digits of UFID
clientSocket = socket(AF_INET, SOCK_STREAM)
clientSocket.connect((serverName, serverPort))
sentence = input('Input lowercase sentence:')
clientSocket.send(sentence.encode())
modifiedSentence = clientSocket.recv(1024)
print('From Server: ', modifiedSentence.decode())
clientSocket.close()
```

Input lowercase sentence:raghavrathi@ufl.edu  
From Server: RAGHAVRATHI@UFL.EDU

In [ ]:

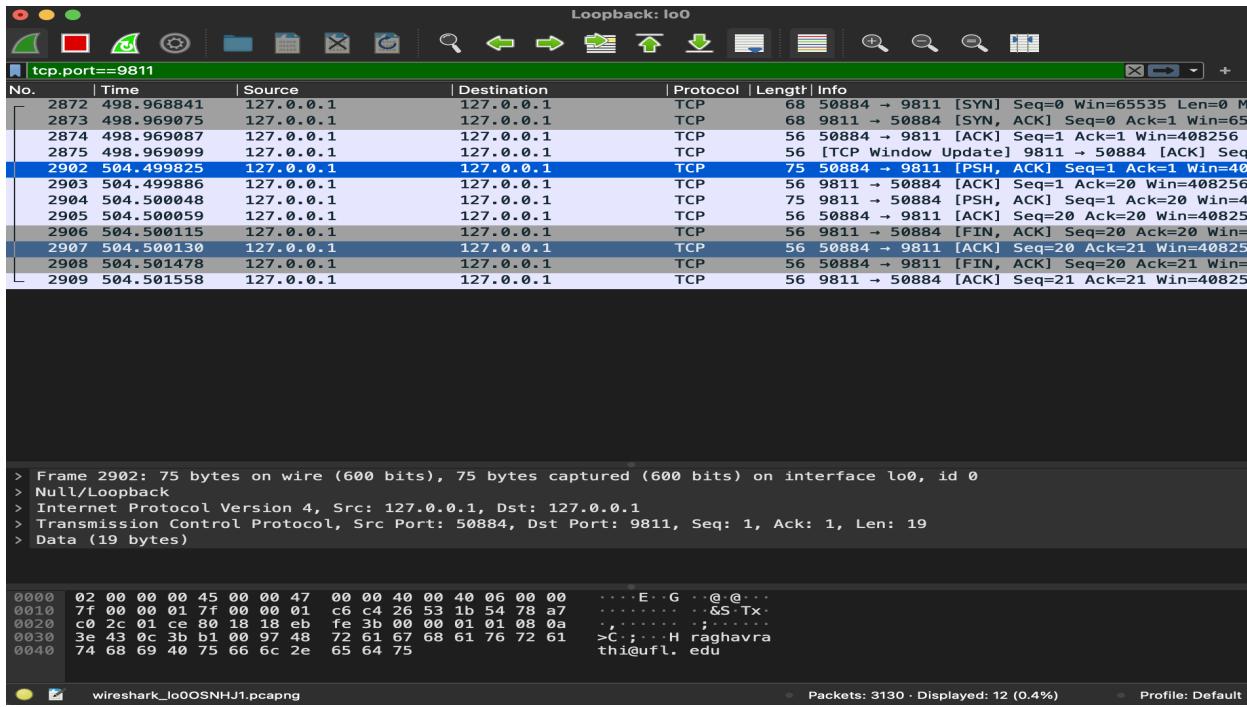
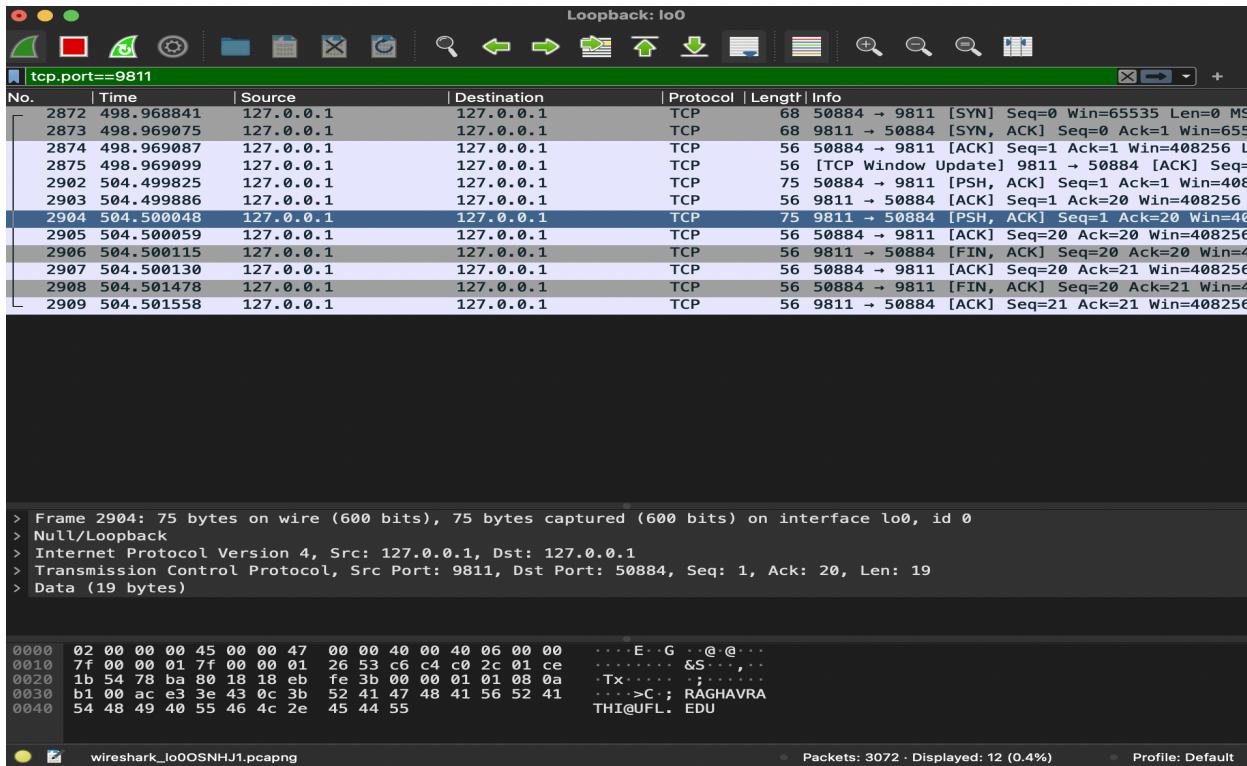
jupyter TCPClient Last Checkpoint: 10 minutes ago (autosaved) Logout

File Edit View Insert Cell Kernel Widgets Help Not Trusted Python 3 (ipykernel) O

In [\*]:

```
from socket import *
serverPort = 9811 #first 4 digits of UFID
serverSocket = socket(AF_INET, SOCK_STREAM)
serverSocket.bind(('', serverPort))
serverSocket.listen(1)
print('Server Ready')
while True:
    connectionSocket, addr = serverSocket.accept()
    sentence = connectionSocket.recv(1024).decode()
    capitalizedSentence = sentence.upper()
    connectionSocket.send(capitalizedSentence.encode())
    connectionSocket.close()
```

Server Ready



Ans3)

```
Last login: Sat Mar 26 21:58:42 on ttys000
(base) whiterose@MacBook-Pro ~ % arp -a
? (10.3.0.1) at 64:d1:54:cf:1a:c2 on en0 ifscope [ethernet]
? (10.3.0.6) at 34:2e:b7:d2:b5:90 on en0 ifscope [ethernet]
? (10.3.0.7) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.12) at 72:a1:84:74:73:77 on en0 ifscope [ethernet]
? (10.3.0.14) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.15) at 46:41:a3:41:80:92 on en0 ifscope [ethernet]
? (10.3.0.16) at c:96:e6:a0:dd:ff on en0 ifscope [ethernet]
? (10.3.0.24) at d6:9b:a9:b2:1b:8a on en0 ifscope [ethernet]
? (10.3.0.26) at 76:1c:74:71:61:0 on en0 ifscope [ethernet]
? (10.3.0.32) at 52:f6:4:95:1c:a7 on en0 ifscope [ethernet]
? (10.3.0.33) at 62:ee:d6:1a:c8:63 on en0 ifscope [ethernet]
? (10.3.0.41) at 72:8d:d7:da:26:62 on en0 ifscope [ethernet]
? (10.3.0.43) at da:4f:14:af:bc:39 on en0 ifscope [ethernet]
? (10.3.0.52) at 5e:b:6b:49:b:54 on en0 ifscope [ethernet]
? (10.3.0.55) at 7e:6d:39:2:d6:8 on en0 ifscope [ethernet]
? (10.3.0.56) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.59) at ca:93:73:36:46:6c on en0 ifscope [ethernet]
? (10.3.0.62) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.65) at d4:f5:47:4a:38:e on en0 ifscope [ethernet]
? (10.3.0.67) at d2:80:e3:f3:48:9d on en0 ifscope [ethernet]
? (10.3.0.71) at 62:e7:51:9b:2d:29 on en0 ifscope [ethernet]
? (10.3.0.76) at 86:ae:88:97:7f:d5 on en0 ifscope [ethernet]
? (10.3.0.77) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.78) at a4:97:b1:b9:83:c1 on en0 ifscope [ethernet]
? (10.3.0.79) at 82:f4:6a:41:c3:53 on en0 ifscope [ethernet]
? (10.3.0.80) at 6e:cb:62:c8:fb:d4 on en0 ifscope [ethernet]
? (10.3.0.81) at ec:2e:98:de:75:71 on en0 ifscope [ethernet]
? (10.3.0.82) at 4e:c6:53:ac:69:2f on en0 ifscope [ethernet]
? (10.3.0.84) at 86:ad:b:f8:f3:a0 on en0 ifscope [ethernet]
? (10.3.0.88) at c8:6c:3d:25:4b:23 on en0 ifscope [ethernet]
? (10.3.0.89) at ea:ee:1c:db:7e:13 on en0 ifscope [ethernet]
? (10.3.0.90) at e6:16:da:a:66:f on en0 ifscope [ethernet]
? (10.3.0.96) at 1a:ea:ed:1f:44:40 on en0 ifscope [ethernet]
? (10.3.0.98) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.101) at 1c:1b:b5:61:6e:c6 on en0 ifscope [ethernet]
? (10.3.0.104) at b6:b4:32:96:9b:fb on en0 ifscope [ethernet]
? (10.3.0.107) at 26:73:a4:2b:c6:5e on en0 ifscope [ethernet]
? (10.3.0.111) at 4c:79:6e:d7:af:f on en0 ifscope [ethernet]
? (10.3.0.114) at 3c:22:fb:9:97:fb on en0 ifscope [ethernet]
? (10.3.0.115) at 66:b8:f4:31:be:4d on en0 ifscope [ethernet]
? (10.3.0.117) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.118) at 58:2f:40:17:eb:eb on en0 ifscope [ethernet]
? (10.3.0.121) at 5e:84:a:6f:90:63 on en0 ifscope [ethernet]
? (10.3.0.122) at 72:8d:d7:da:26:62 on en0 ifscope [ethernet]
? (10.3.0.131) at ee:1:78:48:fe:5b on en0 ifscope [ethernet]
? (10.3.0.132) at 8:a6:bc:b7:ff:fe on en0 ifscope [ethernet]
? (10.3.0.141) at ae:73:e6:68:56:cf on en0 ifscope [ethernet]
? (10.3.0.142) at c8:9:a8:cd:b4:6e on en0 ifscope [ethernet]
? (10.3.0.147) at 86:b1:dd:bc:af:38 on en0 ifscope [ethernet]
? (10.3.0.152) at c0:21:d:d:f3:5e on en0 ifscope [ethernet]
? (10.3.0.156) at 2e:91:98:6b:5d:7e on en0 ifscope [ethernet]
? (10.3.0.157) at ce:ec:e6:e9:b7:63 on en0 ifscope [ethernet]
? (10.3.0.158) at c0:d2:f3:f2:b3:f7 on en0 ifscope [ethernet]
? (10.3.0.161) at 94:e2:3c:36:b9:a6 on en0 ifscope [ethernet]
? (10.3.0.165) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.166) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.168) at 4a:7d:5b:78:9b:2e on en0 ifscope [ethernet]
? (10.3.0.172) at 96:bf:ad:31:12:c7 on en0 ifscope [ethernet]
? (10.3.0.176) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.178) at 32:e8:92:ea:71:3d on en0 ifscope [ethernet]
? (10.3.0.180) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.184) at 3e:40:f4:56:32:cf on en0 ifscope [ethernet]
? (10.3.0.185) at 76:cf:1b:93:b2:7c on en0 ifscope [ethernet]
? (10.3.0.186) at 42:2:a:c2:b5:dc:ae on en0 ifscope [ethernet]
? (10.3.0.187) at 3c:a6:f6:32:10:b on en0 ifscope [ethernet]
? (10.3.0.188) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.189) at 6e:c2:74:23:e:6b on en0 ifscope [ethernet]
? (10.3.0.190) at 1e:40:18:e6:f0:31 on en0 ifscope [ethernet]
? (10.3.0.192) at 3e:74:99:ab:53:1d on en0 ifscope [ethernet]
? (10.3.0.193) at 3c:6:30:6:0:4b on en0 ifscope [ethernet]
? (10.3.0.197) at a2:1f:c3:99:6b:76 on en0 ifscope [ethernet]
? (10.3.0.199) at (incomplete) on en0 ifscope [ethernet]
? (10.3.0.201) at c6:fa:60:52:b6:5d on en0 ifscope [ethernet]
? (10.3.0.202) at e6:96:ef:96:e0:9a on en0 ifscope [ethernet]
```

ARP table lists the network interface, target system and physical (MAC) address of each system. There are arp query packets containing ip addresses, 10.3.0.1 to 10.3.0.202, destination mac address 64:d1:54:cf:1a:c2.

#### Ans4)

```
Last login: Sat Mar 26 21:51:41 on ttys000
[(base) whiterose@MacBook-Pro ~ % ifconfig -a
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> mtu 16384
    options=1203<RXCSUM,TXCSUM,TXSTATUS,SW_TIMESTAMP>
    inet 127.0.0.1 netmask 0xffff00000
        inetc 1::1 prefixlen 128
        inetc fe80::1%lo0 prefixlen 64 scopeid 0x1
        nd6 options=201<PERFORMNUD,DAD>
gif0: flags=8010<POINTOPOINT,MULTICAST> mtu 1280
stf0: flags=0<> mtu 1280
anpi1: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    options=400<CHANNEL_IO>
    ether fa:e8:7e:bd:56:be
    inetc fe80::f8e8:7eff:febd:56be%anpi1 prefixlen 64 scopeid 0x4
    nd6 options=201<PERFORMNUD,DAD>
    media: none
    status: inactive
anpi2: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    options=400<CHANNEL_IO>
    ether fa:e8:7e:bd:56:bf
    inetc fe80::f8e8:7eff:febd:56bf%anpi2 prefixlen 64 scopeid 0x5
    nd6 options=201<PERFORMNUD,DAD>
    media: none
    status: inactive
anpi0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    options=400<CHANNEL_IO>
    ether fa:e8:7e:bd:56:bd
    inetc fe80::f8e8:7eff:febd:56bd%anpi0 prefixlen 64 scopeid 0x6
    nd6 options=201<PERFORMNUD,DAD>
    media: none
    status: inactive
en4: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    options=400<CHANNEL_IO>
    ether fa:e8:7e:bd:56:9d
    nd6 options=201<PERFORMNUD,DAD>
    media: none
    status: inactive
en5: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    options=400<CHANNEL_IO>
    ether fa:e8:7e:bd:56:9e
    nd6 options=201<PERFORMNUD,DAD>
    media: none
    status: inactive
en6: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    options=400<CHANNEL_IO>
    ether fa:e8:7e:bd:56:9f
    nd6 options=201<PERFORMNUD,DAD>
    media: none
    status: inactive
en1: flags=8963<UP,BROADCAST,SMART,RUNNING,PROMISC,SIMPLEX,MULTICAST> mtu 1500
    options=460<TS04,TS06,CHANNEL_IO>
    ether 36:14:dd:1c:f5:c0
    media: autoselect <full-duplex>
    status: inactive
en2: flags=8963<UP,BROADCAST,SMART,RUNNING,PROMISC,SIMPLEX,MULTICAST> mtu 1500
    options=460<TS04,TS06,CHANNEL_IO>
    ether 36:14:dd:1c:f5:c4
    media: autoselect <full-duplex>
    status: inactive
en3: flags=8963<UP,BROADCAST,SMART,RUNNING,PROMISC,SIMPLEX,MULTICAST> mtu 1500
    options=460<TS04,TS06,CHANNEL_IO>
    ether 36:14:dd:1c:f5:c8
    media: autoselect <full-duplex>
    status: inactive
ap1: flags=8843<UP,BROADCAST,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    options=400<CHANNEL_IO>
    ether b2:f1:d8:0d:ee:f1
    nd6 options=201<PERFORMNUD,DAD>
    media: autoselect
    status: inactive
en0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    options=6463<RXCSUM,TXCSUM,TS04,TS06,CHANNEL_IO,PARTIAL_CSUM,ZEROINVERT_CSUM>
    ether b0:f1:d8:0d:ee:f1
    inetc fe80::467:1efd:2f1a:6b70%en0 prefixlen 64 secured scopeid 0xe
    inet 10.3.6.151 netmask 0xffffffff broadcast 10.3.7.255
    nd6 options=201<PERFORMNUD,DAD>
```

```
Last login: Sat Mar 26 21:54:47 on ttys000
(base) whiterose@MacBook-Pro ~ % netstat
Active Internet connections
Proto Recv-Q Send-Q Local Address           Foreign Address         (state)
tcp4       0      0  10.3.6.151.51149      ec2-34-225-26-11.https ESTABLISHED
tcp4       0      0  10.3.6.151.51146      9.11.221.35.bc.g.https ESTABLISHED
tcp4       0      0  10.3.6.151.51145      151.139.240.17.https ESTABLISHED
tcp4       0      0  10.3.6.151.51126      149.154.175.50.https ESTABLISHED
tcp4       0      0  10.3.6.151.51122      server-54-230-25.https ESTABLISHED
tcp4       0      0  10.3.6.151.51121      server-216-137-4.https ESTABLISHED
tcp4       0      0  10.3.6.151.51035      ya-in-f109.1e100.imaps ESTABLISHED
tcp4       0      0  10.3.6.151.51029      40.76.174.66.https ESTABLISHED
tcp4       0      0  10.3.6.151.50770      149.154.175.50.https ESTABLISHED
tcp4       0      0  10.3.6.151.50599      bs.yandex.ru.https ESTABLISHED
tcp4       0      0  10.3.6.151.50417      1.80.190.35.bc.g.https ESTABLISHED
tcp4       0      0  10.3.6.151.50120      25.25.190.35.bc..https ESTABLISHED
tcp4       0      0  10.3.6.151.49491      91.108.56.104.https ESTABLISHED
tcp4       0      0  10.3.6.151.65123      47.224.186.35.bc.https ESTABLISHED
tcp4       0      0  10.3.6.151.65118      ys-in-f188.1e100.5228 ESTABLISHED
tcp4       0      0  10.3.6.151.65115      149.154.175.55.https ESTABLISHED
tcp4       0      0  10.3.6.151.65114      149.154.175.55.https ESTABLISHED
tcp4       0      0  10.3.6.151.65110      91.108.56.104.https ESTABLISHED
tcp4       0      0  10.3.6.151.65103      162.159.136.234.https ESTABLISHED
tcp4       0      0  10.3.6.151.65034      whatsapp-cdn-shv.https ESTABLISHED
tcp4       0      0  10.3.6.151.64997      ec2-54-152-163-1.https ESTABLISHED
tcp4       0      0  localhost.49193        localhost.49198    ESTABLISHED
tcp4       0      0  localhost.49198        localhost.49193    ESTABLISHED
tcp4       0      0  10.3.6.151.49192      ec2-23-21-139-15.http CLOSE_WAIT
tcp4       0      0  10.3.6.151.49191      ec2-23-21-139-15.http CLOSE_WAIT
tcp4       0      0  10.3.6.151.49190      ec2-23-23-85-1.c.http CLOSE_WAIT
tcp4       0      0  10.3.6.151.49189      server-18-64-155.https CLOSE_WAIT
tcp4       0      0  10.3.6.151.49188      update.utorrent..http CLOSE_WAIT
tcp4       0      0  10.3.6.151.49187      ec2-50-17-220-15.http CLOSE_WAIT
tcp4       0      0  10.3.6.151.51147      ys-in-f109.1e100.imaps TIME_WAIT
tcp4       0      0  10.3.6.151.51076      104.18.70.113.https TIME_WAIT
tcp4       0      0  10.3.6.151.61860      40.97.154.242.443  ESTABLISHED
tcp4       0      0  10.3.6.151.61859      17.57.144.153.5223 ESTABLISHED
udp4       0      0  10.3.6.151.61654      yx-in-f147.1e100.https
udp4       0      0  10.3.6.151.54249      atl14s08-in-f10..https
udp4       0      0  10.3.6.151.65030      yr-in-f100.1e100.https
udp4       0      0  10.3.6.151.62440      atl26s18-in-f14..https
udp4       0      0  10.3.6.151.61449      yt-in-f93.1e100..https
udp4       0      0  10.3.6.151.51482      yb-in-f113.1e100.https
udp4       0      0  *.54502          *.*
udp6       0      0  fe80::581d:1bfff:.6882  *.*
udp4       0      0  *.*              *.*
udp4       0      0  *.62611          *.*
udp4       0      0  *.52091          *.*
udp6       0      0  *.63045          *.*
udp4       0      0  *.54429          *.*
udp4       0      0  10.3.6.151.56895  *.*
udp6       0      0  macbook-pro.6881  *.*
udp6       0      0  macbook-pro.6881  *.*
udp6       0      0  macbook-pro.6881  *.*
udp6       0      0  fe80::581d:1bfff:.6881  *.*
udp6       0      0  fe80::581d:1bfff:.6881  *.*
udp6       0      0  macbook-pro.6881  *.*
^C
(base) whiterose@MacBook-Pro ~ %
```