

Final Project

Computer Networking Course

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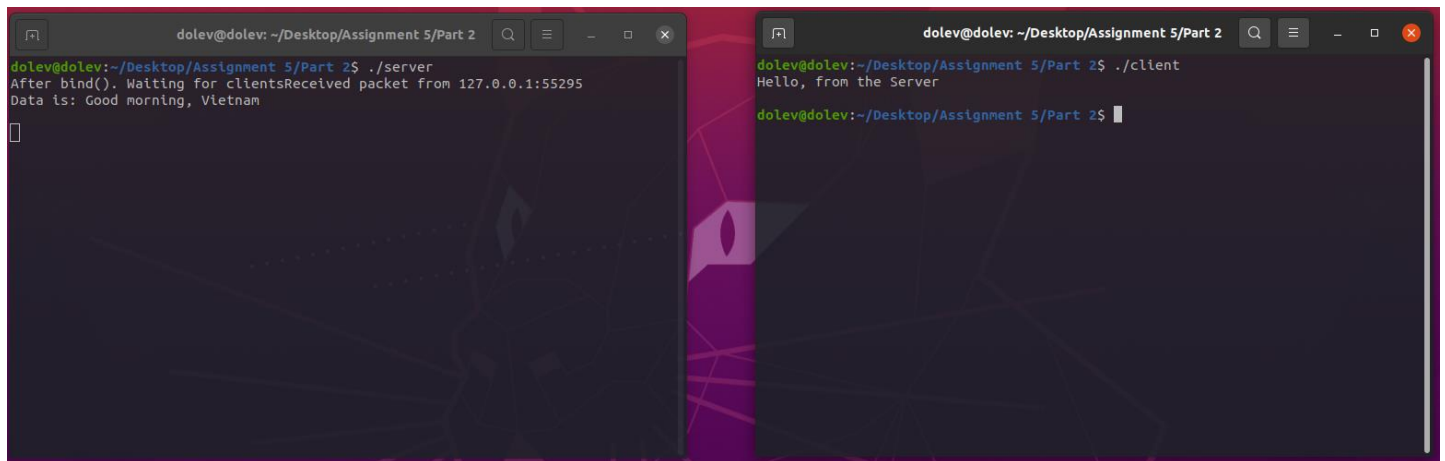
Part 1:

```
dolev@dolev: ~/Desktop/Assignment 5/Part 1
dolev@dolev:~/Desktop/Assignment 5/Part 1$ python3 UDPPingerClient.py
Request timed out
2 PING 0.00010323524475097656
3 PING 3.981590270996094e-05
4 PING 3.647804260253906e-05
5 PING 3.4332275390625e-05
Request timed out
Request timed out
8 PING 0.00018072128295898438
9 PING 8.296966552734375e-05
10 PING 7.867813110351562e-05
min: 3.4332275390625e-05 max: 0.00018072128295898438 average: 7.946150643484933e-05 loss:30%
dolev@dolev:~/Desktop/Assignment 5/Part 1$
```

```
dolev@dolev: ~/Desktop/Assignment 5/Part 1
dolev@dolev:~/Desktop/Assignment 5/Part 1$ python3 HeartbeatClient.py
PING loss: 0 time difference: 0.0001418590545654297
PING loss: 0 time difference: 4.50611145019531e-05
PING loss: 0 time difference: 3.62396240234375e-05
PING loss: 0 time difference: 3.719329833984375e-05
PING loss: 0 time difference: 3.743171691894531e-05
Request timed out
PING loss: 0 time difference: 0.00016236305236816406
PING loss: 0 time difference: 0.0001285076141357422
PING loss: 0 time difference: 0.00012493133544921875
PING loss: 0 time difference: 0.0001087188720703125
min: 9.775161743164062e-05 max: 0.000346606140136719 average: 0.00021179517110188803 loss:10%
dolev@dolev:~/Desktop/Assignment 5/Part 1$
```

Part 2:

Screen shot of two programs, client and server that used IPv4 :

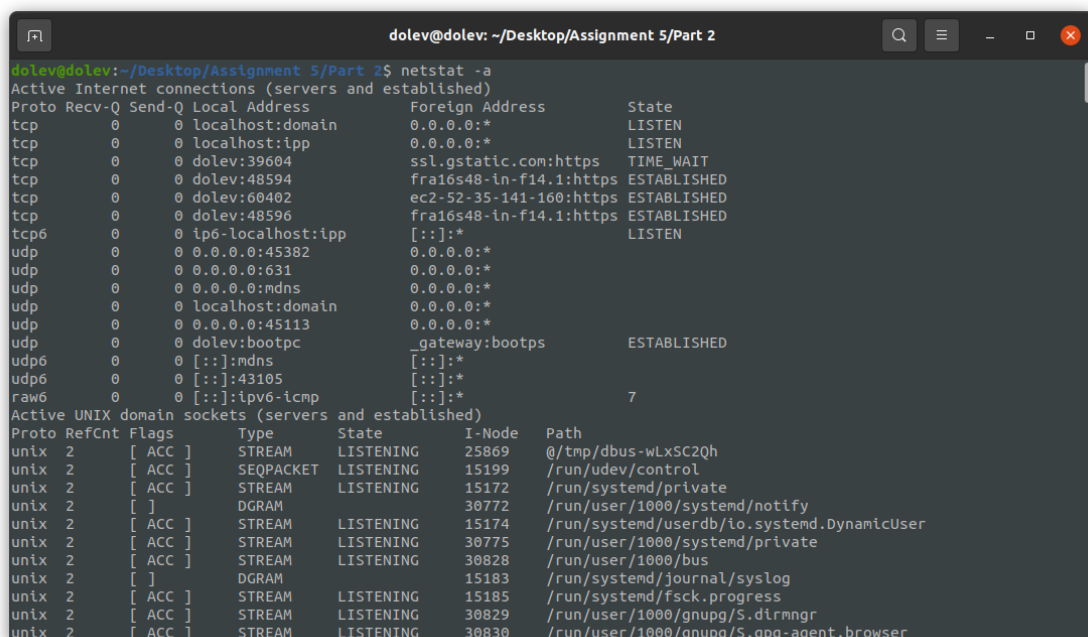


The image shows two terminal windows side-by-side. The left window is titled 'dolev@dolev: ~/Desktop/Assignment 5/Part 2' and shows the output of a server program. The right window is also titled 'dolev@dolev: ~/Desktop/Assignment 5/Part 2' and shows the output of a client program.

```
dolev@dolev:~/Desktop/Assignment 5/Part 2$ ./server
After bind(). Waiting for clients
Received packet from 127.0.0.1:55295
Data is: Good morning, Vietnam

dolev@dolev:~/Desktop/Assignment 5/Part 2$ ./client
Hello, from the Server
dolev@dolev:~/Desktop/Assignment 5/Part 2$
```

Screen shot of using the netstat -na command before running the programs :

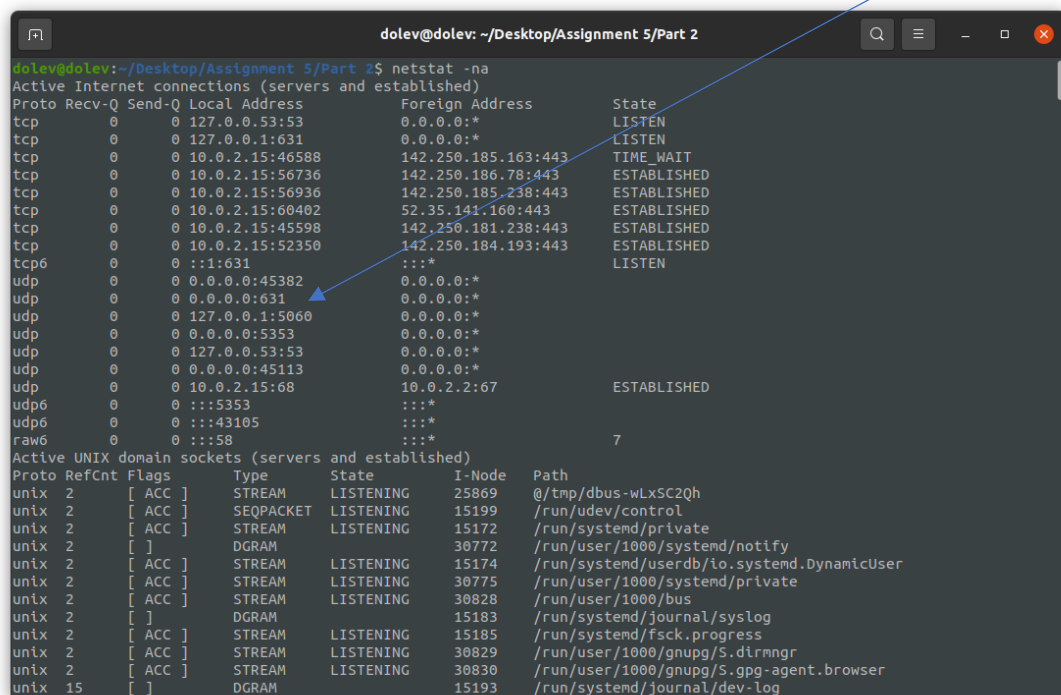


The image shows a terminal window titled 'dolev@dolev: ~/Desktop/Assignment 5/Part 2' displaying the output of the 'netstat -na' command. The output is divided into two sections: 'Active Internet connections (servers and established)' and 'Active UNIX domain sockets (servers and established)'. The first section lists various network protocols (tcp, tcp6, udp, udp6, raw6) and their states (LISTEN, ESTABLISHED, TIME_WAIT). The second section lists UNIX domain sockets and their states (LISTENING).

```
dolev@dolev:~/Desktop/Assignment 5/Part 2$ netstat -na
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 localhost:domain        0.0.0.0:*               LISTEN
tcp        0      0 localhost:ipp           0.0.0.0:*               LISTEN
tcp        0      0 dolev:39604             ssl.gstatic.com:https   TIME_WAIT
tcp        0      0 dolev:48594             fra16s48-in-f14.1:https ESTABLISHED
tcp        0      0 dolev:60402             ec2-52-35-141-160:https ESTABLISHED
tcp        0      0 dolev:48596             fra16s48-in-f14.1:https ESTABLISHED
tcp6       0      0 ip6-localhost:ipp      [::]:*                 LISTEN
udp        0      0 0.0.0.0:45382           0.0.0.0:*               LISTEN
udp        0      0 0.0.0.0:631            0.0.0.0:*               LISTEN
udp        0      0 0.0.0.0:mdns            0.0.0.0:*               LISTEN
udp        0      0 localhost:domain        0.0.0.0:*               LISTEN
udp        0      0 0.0.0.0:45113           0.0.0.0:*               LISTEN
udp        0      0 dolev:bootpc            _gateway:bootps        ESTABLISHED
udp6       0      0 [::]:mdns               [::]:*                 LISTEN
udp6       0      0 [::]:43105              [::]:*                 LISTEN
raw6       0      0 [::]:ipv6-icmp          [::]:*                 LISTEN

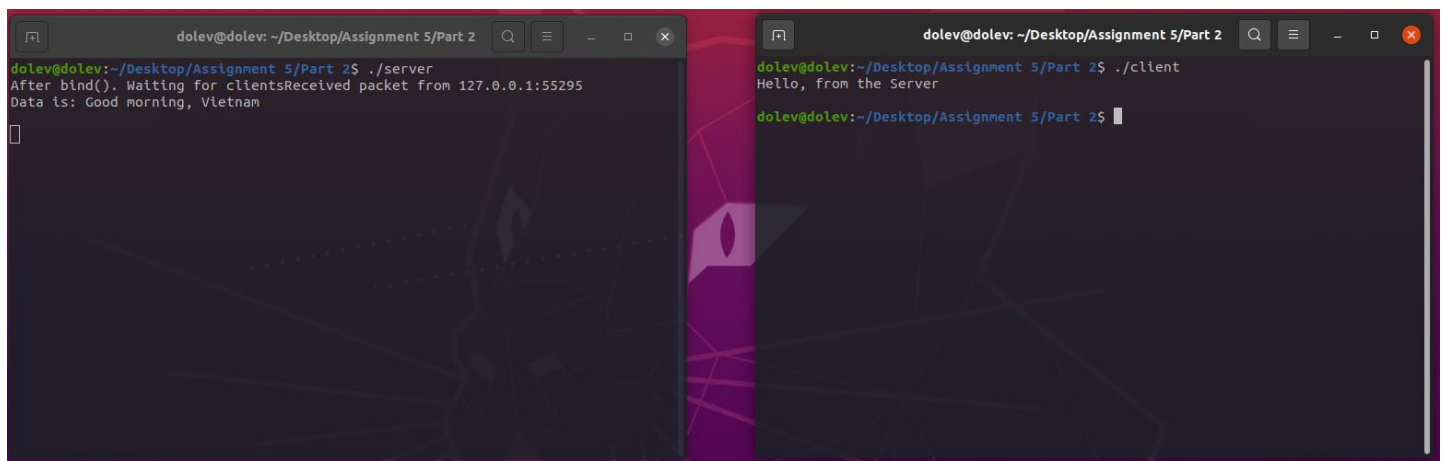
Active UNIX domain sockets (servers and established)
Proto RefCnt Flags   Type       State         I-Node  Path
unix  2      [ ACC ] STREAM    LISTENING   25869    @/tmp/dbus-wLx5C2Qh
unix  2      [ ACC ] SEQPACKET LISTENING   15199    /run/udev/control
unix  2      [ ACC ] STREAM    LISTENING   15172    /run/systemd/private
unix  2      [ ]      DGRAM     LISTENING   30772    /run/user/1000/systemd/notify
unix  2      [ ACC ] STREAM    LISTENING   15174    /run/systemd/userdb/io.systemd.DynamicUser
unix  2      [ ACC ] STREAM    LISTENING   30775    /run/user/1000/systemd/private
unix  2      [ ACC ] STREAM    LISTENING   30828    /run/user/1000/bus
unix  2      [ ]      DGRAM     LISTENING   15183    /run/systemd/journal/syslog
unix  2      [ ACC ] STREAM    LISTENING   15185    /run/systemd/fsck.progress
unix  2      [ ACC ] STREAM    LISTENING   30829    /run/user/1000/gnupg/S.dirmngr
unix  2      [ ACC ] STREAM    LISTENING   30830    /run/user/1000/gnupg/S.gpg-agent.browser
```

Screen shot of using the netstat -na command after running the programs :



```
dolev@dolev: ~/Desktop/Assignment 5/Part 2
dolev@dolev:~/Desktop/Assignment 5/Part 2$ netstat -na
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 127.0.0.53:53           0.0.0.0:*               LISTEN
tcp        0      0 127.0.0.1:631           0.0.0.0:*               LISTEN
tcp        0      0 10.0.2.15:46588         142.250.185.163:443     TIME_WAIT
tcp        0      0 10.0.2.15:56736         142.250.186.78:443     ESTABLISHED
tcp        0      0 10.0.2.15:56936         142.250.185.238:443     ESTABLISHED
tcp        0      0 10.0.2.15:60402         52.35.141.160:443      ESTABLISHED
tcp        0      0 10.0.2.15:45598         142.250.181.238:443     ESTABLISHED
tcp        0      0 10.0.2.15:52350         142.250.184.193:443     ESTABLISHED
tcp6       0      0 :::1:631                :::*                    LISTEN
udp        0      0 0.0.0.0:45382          0.0.0.0:*               LISTEN
udp        0      0 0.0.0.0:631            0.0.0.0:*               LISTEN
udp        0      0 127.0.0.1:5060          0.0.0.0:*               LISTEN
udp        0      0 0.0.0.0:5353            0.0.0.0:*               LISTEN
udp        0      0 127.0.0.53:53           0.0.0.0:*               LISTEN
udp        0      0 0.0.0.0:45113           0.0.0.0:*               LISTEN
udp        0      0 10.0.2.15:68            10.0.2.2:67             ESTABLISHED
udp6       0      0 :::5353                 :::*                    LISTEN
udp6       0      0 :::43105                :::*                    LISTEN
raw6       0      0 :::58                   :::*                    LISTEN
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Active UNIX domain sockets (servers and established)
Proto RefCnt Flags       Type       State      I-Node  Path
unix    2      [ ACC ] STREAM    LISTENING  25869    @/tmp/dbus-wLxSC2Qh
unix    2      [ ACC ] SEQPACKET LISTENING  15199    /run/udev/control
unix    2      [ ACC ] STREAM    LISTENING  15172    /run/systemd/private
unix    2      [   ] DGRAM          30772    /run/user/1000/systemd/notify
unix    2      [ ACC ] STREAM    LISTENING  15174    /run/systemd/userdb/io.systemd.DynamicUser
unix    2      [ ACC ] STREAM    LISTENING  30775    /run/user/1000/systemd/private
unix    2      [ ACC ] STREAM    LISTENING  30828    /run/user/1000/bus
unix    2      [   ] DGRAM          15183    /run/systemd/journal/syslog
unix    2      [ ACC ] STREAM    LISTENING  15185    /run/systemd/fscck.progress
unix    2      [ ACC ] STREAM    LISTENING  30829    /run/user/1000/gnupg/S.dirmngr
unix    2      [ ACC ] STREAM    LISTENING  30830    /run/user/1000/gnupg/S.gpg-agent.browse
unix   15      [   ] DGRAM          15193    /run/systemd/journal/dev-log
```

Screen shot of two programs, client and server that used IPv6 :



```
dolev@dolev:~/Desktop/Assignment 5/Part 2$ ./server
After bind(). Waiting for clients
Received packet from 127.0.0.1:55295
Data is: Good morning, Vietnam

dolev@dolev:~/Desktop/Assignment 5/Part 2$ ./client
Hello, from the Server

dolev@dolev:~/Desktop/Assignment 5/Part 2$
```