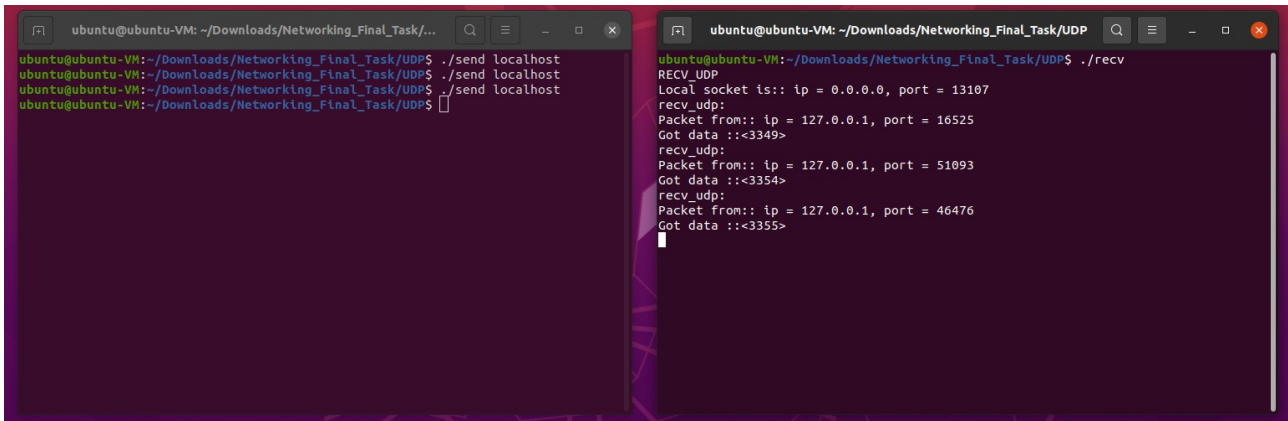


## UDP Programming

### Problem 1:

All necessary documentation, explanation and additional functions are written in send\_udp.c and recv\_udp.c code files.



The image shows two terminal windows from an Ubuntu VM. The left window shows the execution of the `./send` program three times, each sending a packet to `localhost`. The right window shows the execution of the `./recv` program, which receives three packets from `127.0.0.1` on ports 13107, 16525, and 51093. The data received in each packet is `<3349>`, `<3354>`, and `<3355>` respectively.

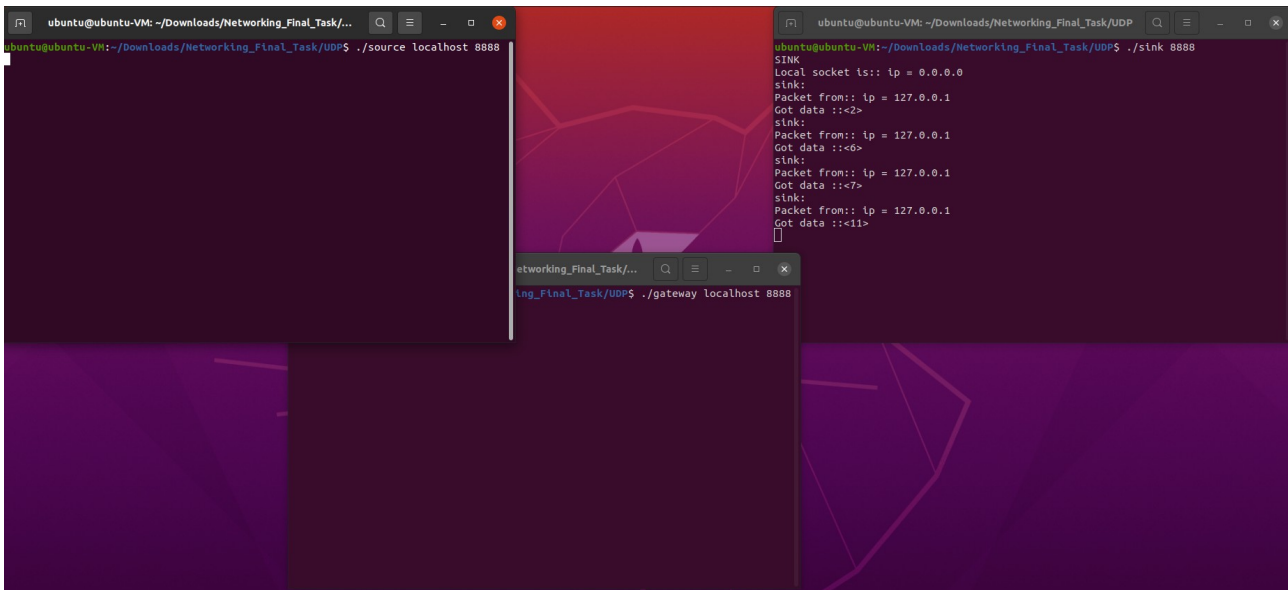
```
ubuntu@ubuntu-VM: ~/Downloads/Networking_Final_Task/UDP$ ./send localhost
ubuntu@ubuntu-VM: ~/Downloads/Networking_Final_Task/UDP$ ./send localhost
ubuntu@ubuntu-VM: ~/Downloads/Networking_Final_Task/UDP$ ./send localhost
ubuntu@ubuntu-VM: ~/Downloads/Networking_Final_Task/UDP$

ubuntu@ubuntu-VM: ~/Downloads/Networking_Final_Task/UDP$ ./recv
RECV_UDP
Local socket is:: ip = 0.0.0.0, port = 13107
recv_udp:
Packet from:: ip = 127.0.0.1, port = 16525
Got data ::<3349>
recv_udp:
Packet from:: ip = 127.0.0.1, port = 51093
Got data ::<3354>
recv_udp:
Packet from:: ip = 127.0.0.1, port = 46476
Got data ::<3355>
```

Each send execution sends one packet.

### Problem 2:

All necessary documentation, explanation and additional functions are written in source.c, gateway.c and sink.c code files.



The image shows three terminal windows. The top-left window shows the execution of `./source localhost 8888`. The top-right window shows the execution of `./sink 8888`, which receives four packets from `127.0.0.1` on port 8888 with data `<2>`, `<6>`, `<7>`, and `<11>`. The bottom window shows the execution of `./gateway localhost 8888`.

```
ubuntu@ubuntu-VM: ~/Downloads/Networking_Final_Task/UDP$ ./source localhost 8888

ubuntu@ubuntu-VM: ~/Downloads/Networking_Final_Task/UDP$ ./sink 8888
SINK
Local socket is:: ip = 0.0.0.0
sink:
Packet from:: ip = 127.0.0.1
Got data ::<2>
sink:
Packet from:: ip = 127.0.0.1
Got data ::<6>
sink:
Packet from:: ip = 127.0.0.1
Got data ::<7>
sink:
Packet from:: ip = 127.0.0.1
Got data ::<11>

ubuntu@ubuntu-VM: ~/Downloads/Networking_Final_Task/UDP$ ./gateway localhost 8888
```

Packets are sent from source to gateway, and are sent to sink from gateway with probability of 50% to be sent.

## TCP Programming

**Part A:**

## net\_client.c:

When running the client, an error is printed:

"Client is alive and establishing socket connection."

Error establishing communications: Connection refused"

After changing the IP\_ADDRESS to 127.0.0.1 the program works, receives 10 packets and prints: "Client has received X from socket." for each packet.

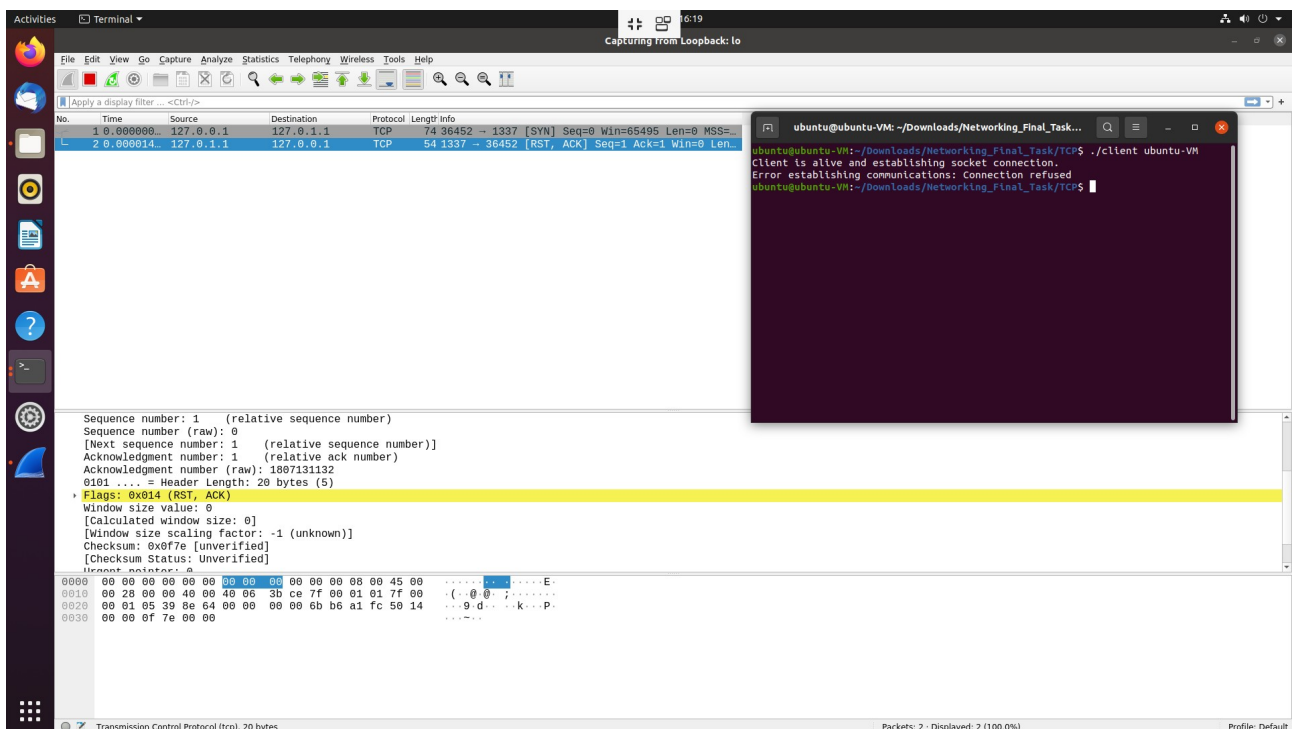
## net\_server.c:

When running the server, nothing happens at first.

after changing the PORT to 1337 the server sends 10 packets before closing and prints "Server has written X to socket." for each packet.

```
ubuntu@ubuntu-VM: ~/Downloads/Networking_Final_Task...  
ubuntu@ubuntu-VM:~/Downloads/Networking_Final_Task/TCP$ ./server  
Server has written 1 to socket.  
Server has written 2 to socket.  
Server has written 3 to socket.  
Server has written 4 to socket.  
Server has written 5 to socket.  
Server has written 6 to socket.  
Server has written 7 to socket.  
Server has written 8 to socket.  
Server has written 9 to socket.  
Server has written 10 to socket.  
ubuntu@ubuntu-VM:~/Downloads/Networking_Final_Task/TCP$  
  
ubuntu@ubuntu-VM:~/Downloads/Networking_Final_Task...  
ubuntu@ubuntu-VM:~/Downloads/Networking_Final_Task/TCP$ ./client ubuntu-VM  
Client is alive and establishing socket connection.  
Client has received 1 from socket.  
Client has received 2 from socket.  
Client has received 3 from socket.  
Client has received 4 from socket.  
Client has received 5 from socket.  
Client has received 6 from socket.  
Client has received 7 from socket.  
Client has received 8 from socket.  
Client has received 9 from socket.  
Client has received 10 from socket.  
Exiting now.  
ubuntu@ubuntu-VM:~/Downloads/Networking_Final_Task/TCP$
```

When only the client is executed, a SYN request is sent through the socket but there is no server on the other side to reply with SYN-ACK so the connection is refused.



## Part B:

The result we get from <http://www.yahoo.com> is:

```
ubuntu@ubuntu-VN: ~/Downloads/Networking_Final_Task/TCP$ ./web_client http://www.yahoo.com
GET / HTTP/1.0
Host: www.yahoo.com
Content-Type: text/plain

HTTP/1.0 301 Moved Permanently
Date: Sat, 13 Aug 2022 13:22:21 GMT
Server: ATS
Cache-Control: no-store, no-cache
Content-Type: text/html
Content-Language: en
Connection: keep-alive
Content-Security-Policy: frame-ancestors 'self' https://*.builtbygrrPZwls.com https://*.rtvals.com https://*.engadget.com https://*.inteknow.com https://*.autoblog.com https://*.techcrunch.com https://
*.yahoo.com https://*.aol.com https://*.huffingtonpost.com https://*.oath.com https://*.search.yahoo.com https://*.search.aolPZw.com https://*.search.huffpost.com https://*.onsearch.com https://*.veriz
onmedia.com https://*.publishing.oath.com https://*.autoblog.com; sandbox allow-forms allow-same-origin allow-scripts allow-popups allow-popups-to-escape-sandbox allow-presentation; PZwreport-uri https:
//csp.yahoo.com/beacon/csp?src=ats&site=frontpage&region=US&lang=en-US&device=kyrid=Br6vehhF9cd&partner=;
X-Frame-Options: SAMEORIGIN
X-XSS-Protection: 1; report="https://csp.yahoo.com/beacon/csp?src=fp-hpkp-www"
Location: https://wwwPZw.yahoo.com/
Content-Length: 8

redirect
ubuntu@ubuntu-VN: ~/Downloads/Networking_Final_Task/TCP$
```

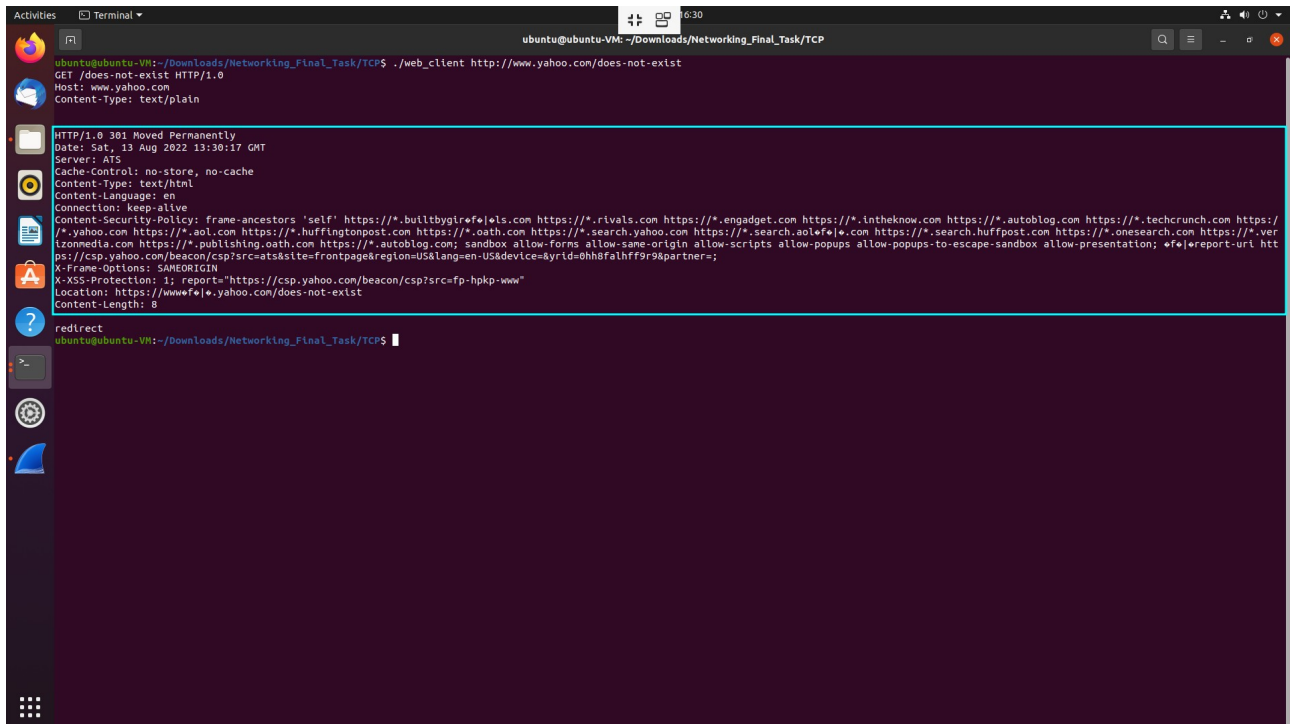
We get 301 Moved Permanently since yahoo uses HTTPS protocol which is the secure version of HTTP, therefore we can't reach the website. However, when trying to access a website that use HTTP, we get 200 OK:

```
ubuntu@ubuntu-VN: ~/Downloads/Networking_Final_Task/TCP$ ./web_client http://httpforever.com
GET / HTTP/1.0
Host: httpforever.com
Content-Type: text/plain

HTTP/1.1 200 OK
Date: Sat, 13 Aug 2022 13:27:11 GMT
Content-Type: text/html
Connection: close
Last-Modified: Mon, 23 Jul 2018 09:25:52 GMT
Referrer-Policy: strict-origin-when-cross-origin
X-Frame-Options: SAMEORIGIN
X-XSS-Protection: 1; mode=block; p;Sreport=https://scotthelme.report-uri.com/r/d/xss/enforce
X-Content-Type-Options: nosniff
Feature-Policy: accelerometer 'none'; camera 'none'; geolocation 'none'; gyroscope 'none'; magnetometer 'none'; microphone 'none'; payment 'none'; usb 'none'
Content-Security-Policy: default-src 'self'; script-src cdnjs.cloudflare.com 'self'; style-src cdnjs.cloudflare.com 'self'; fonts.googleapis.com 'unsafe-inline'; font-src fonts.googleapis.com fonts.g
static.com cdnjs.cloudflare.com; report-uri https://scotthelme.rp;Sreport-uri.com/r/d/csp/enforce
Cache-Control: max-age=86400
CF-Cache-Status: HIT
Age: 5408
Report-To: [{"endpoints":[{"url":"https://a.nel.cloudflare.com/report/v3?s=MLkNwbsN2B1TcB4V8j3M6CEP6WpKawBY12vy0.0000032TSNYKvb8ZrYbPDCGf310VWGBsKHSOWSnPY1Cp;SMAC4Nbxupgu7TRYZa0HTZ9o0KsaY2Dp
8Np5p8aw0z8D04x2B5d0wQ30"}], "group": "cf-nel", "max_age": 604800}]
NEL: {"success_fraction": 0, "report_to": "cf-nel", "max_age": 604800}
Server: cloudflare
CF-RAY: 73a1c966eff7d98-TLV
alt-svc: h3=":443"; ma=86400, h3-29=":443p;S"; ma=86400

<!DOCTYPE HTML>
<html>
  <head>
    <title>HTTP Forever</title>
    <meta http-equiv="content-type" content="text/html; charset=utf-8" />
    <meta name="description" content="" />
    <meta name="keywords" content="" />
    <!-- [If Ite IE 8]><script src="css/le/html5shiv.js"></script><![endif]-->
    <script src="https://cdnjs.cloudflare.com/ajax/libs/jquery/3.3.1/jquery.min.js" integrity="sha256-FgPcb/KJQlNFou9ita3Zo/NMZxltwRo80tmkMRDAu8=" crossorigin="anonymous"></script>
    <script src="https://cdnjs.cloudflare.com/ajax/libs/skel/3.0.1/skel.min.js" integrity="sha256-3e+NvQqD/ye3y1qRwPKEUre51OCLSMHpc2nZFX74E=" crossorigin="anonymous"></script>
    <script src="https://cdnjs.cloudflare.com/ajax/libs/skel-layers/2.2.1/skel.min.js" integrity="sha1:5e256-0xgf/clpbscdlAaU0AALWmpfPy9V5CqvZejXSEfcw=" crossorigin="anonymous"></script>
    <script src="js/init.min.js"></script>
    <noscript>
      <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/skel-layers/2.2.1/skel.min.css" integrity="sp;Ssha256-HoTbojxjAGielQhgAD2nqldFwCOWoIPnr7mC7qBs=" crossorigin="
n="anonymous" />
      <link rel="stylesheet" href="css/style.min.css" />
      <link rel="stylesheet" href="css/style-wide.min.css" />
    </noscript>
    <!-- [If Ite IE 8]><link rel="stylesheet" href="css/le/v8.min.css" /><![endif]-->
  </head>
  <body class="landing">
    <!-- Banner -->
    <section id="banner">
      <h2>HTTP FOREVER</h2>
      <p>A reliably insecure connection</p>
    </section>
    <!-- One -->
```

When trying to access <http://www.yahoo.com/does-not-exist> we get:



```
ubuntu@ubuntu-VM: ~/Downloads/Networking_Final_Task/TCP$ ./web_client http://www.yahoo.com/does-not-exist
GET /does-not-exist HTTP/1.0
Host: www.yahoo.com
Content-Type: text/plain

HTTP/1.0 301 Moved Permanently
Date: Sat, 13 Aug 2022 13:30:17 GMT
Server: ATS
Cache-Control: no-store, no-cache
Content-Type: text/html
Content-Language: en
Connection: keep-alive
Content-Security-Policy: frame-ancestors 'self' https://*.builtbygiraffe.com https://*.rivals.com https://*.engadget.com https://*.inteknow.com https://*.autoblog.com https://*.techcrunch.com https://
*.yahoo.com https://*.aol.com https://*.huffingtonpost.com https://*.oath.com https://*.search.yahoo.com https://*.search.aol.com https://*.search.huffpost.com https://*.onsearch.com https://*.ver
izonmedia.com https://*.publishing.oath.com https://*.autoblog.com; sandbox allow-forms allow-same-origin allow-scripts allow-popups allow-popups-to-escape-sandbox allow-presentation; *report-uri htt
ps://csp.yahoo.com/beacon/csp?src=ats&site=Frontpage&region=US&lang=en-US&device=ayrid=bhh6fahf9r3&partner=;
X-Frame-Options: SAMEORIGIN
X-XSS-Protection: 1; report="https://csp.yahoo.com/beacon/csp?src=fp-hp&hp-ww"
Location: https://www.yahoo.com/does-not-exist
Content-Length: 0

redirect
ubuntu@ubuntu-VM: ~/Downloads/Networking_Final_Task/TCP$
```

since we are getting redirected back to the homepage [www.yahoo.com](http://www.yahoo.com) so we get the same message as before.