

CS3530-Computer Networks-1

Team Members:

Sai Balam K- ES18BTECH11011

G V Sathwik Reddy- CS18BTECH11014

P V Asish- CS18BTECH11037

P Sai Srikar- CS18BTECH11034

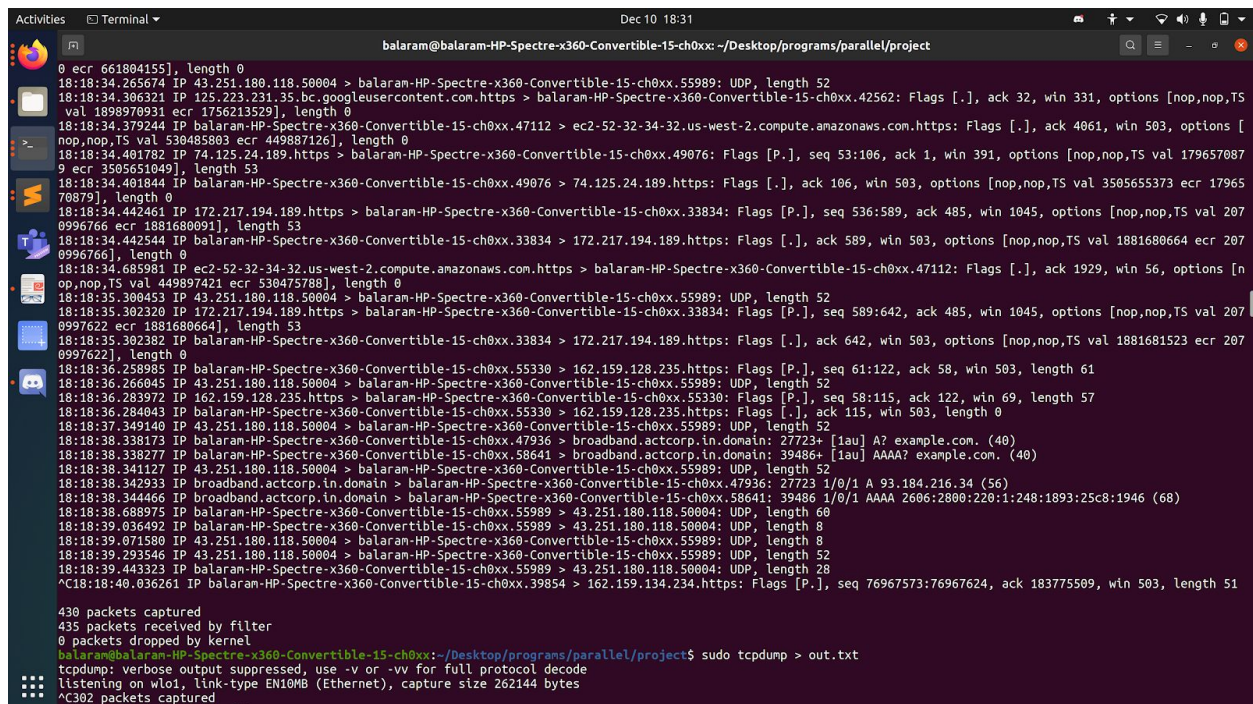
Sai Nishith J- CS18BTECH11018

B Sai Laxman- EE18BTECH11049

Design

1) getaddrinfo() integrated in code to get the ip from the host name passed as the command line argument. Can see the pic attached below of tcpdump

tcpdump collected on wlo1 while program for getaddrinfo() request was sent on another terminal



```
balaram@balaram-HP-Spectre-x360-Convertible-15-ch0xx: ~/Desktop/programs/parallel/project
0 ecr 661804155], length 0
18:18:34.265674 IP 43.251.180.118.50004 > balaram-HP-Spectre-x360-Convertible-15-ch0xx.55989: UDP, length 52
18:18:34.306321 IP 125.223.231.35.bc.googleusercontent.com.https > balaram-HP-Spectre-x360-Convertible-15-ch0xx.42562: Flags [..], ack 32, win 331, options [nop,nop,TS val 1898970931 ecr 1756213529], length 0
18:18:34.379244 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.47112 > ec2-52-32-34-32.us-west-2.compute.amazonaws.com.https: Flags [..], ack 4061, win 503, options [nop,nop,TS val 530485903 ecr 449887126], length 0
18:18:34.401782 IP 74.125.24.189.https > balaram-HP-Spectre-x360-Convertible-15-ch0xx.49076: Flags [P.], seq 53:106, ack 1, win 391, options [nop,nop,TS val 179657087 9 ecr 3505651049], length 53
18:18:34.401844 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.49076 > 74.125.24.189.https: Flags [..], ack 106, win 503, options [nop,nop,TS val 3505655373 ecr 17965 70879], length 0
18:18:34.442461 IP 172.217.194.189.https > balaram-HP-Spectre-x360-Convertible-15-ch0xx.33834: Flags [P.], seq 536:589, ack 485, win 1045, options [nop,nop,TS val 207 0996766 ecr 1881680091], length 53
18:18:34.442544 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.33834 > 172.217.194.189.https: Flags [..], ack 589, win 503, options [nop,nop,TS val 1881680664 ecr 207 0996766], length 0
18:18:34.685981 IP ec2-52-32-34-32.us-west-2.compute.amazonaws.com.https > balaram-HP-Spectre-x360-Convertible-15-ch0xx.47112: Flags [..], ack 1929, win 56, options [nop,nop,TS val 449897421 ecr 530475788], length 0
18:18:35.300453 IP 43.251.180.118.50004 > balaram-HP-Spectre-x360-Convertible-15-ch0xx.55989: UDP, length 52
18:18:35.302320 IP 172.217.194.189.https > balaram-HP-Spectre-x360-Convertible-15-ch0xx.33834: Flags [P.], seq 589:642, ack 485, win 1045, options [nop,nop,TS val 207 0997622 ecr 1881680664], length 53
18:18:35.302382 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.33834 > 172.217.194.189.https: Flags [..], ack 642, win 503, options [nop,nop,TS val 1881681523 ecr 207 0997622], length 0
18:18:36.258985 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.55330 > 162.159.128.235.https: Flags [P.], seq 61:122, ack 58, win 503, length 61
18:18:36.266045 IP 43.251.180.118.50004 > balaram-HP-Spectre-x360-Convertible-15-ch0xx.55989: UDP, length 52
18:18:36.283972 IP 162.159.128.235.https > balaram-HP-Spectre-x360-Convertible-15-ch0xx.55330: Flags [P.], seq 58:115, ack 122, win 69, length 57
18:18:36.284043 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.55330 > 162.159.128.235.https: Flags [..], ack 115, win 503, length 0
18:18:37.349140 IP 43.251.180.118.50004 > balaram-HP-Spectre-x360-Convertible-15-ch0xx.55989: UDP, length 52
18:18:38.338173 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.47936 > broadband.actcorp.in.domain: 27723+ [1au] A? example.com. (40)
18:18:38.338277 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.58641 > broadband.actcorp.in.domain: 39486+ [1au] AAAA? example.com. (40)
18:18:38.341127 IP 43.251.180.118.50004 > balaram-HP-Spectre-x360-Convertible-15-ch0xx.55989: UDP, length 52
18:18:38.342933 IP broadband.actcorp.in.domain > balaram-HP-Spectre-x360-Convertible-15-ch0xx.58641: 27723 1/0/1 A 93.184.216.34 (56)
18:18:38.344466 IP broadband.actcorp.in.domain > balaram-HP-Spectre-x360-Convertible-15-ch0xx.58641: 39486 1/0/1 AAAA 2606:2800:220:1:248:1893:25c8:1946 (68)
18:18:38.688975 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.55989 > 43.251.180.118.50004: UDP, length 60
18:18:39.036492 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.55989 > 43.251.180.118.50004: UDP, length 8
18:18:39.071580 IP 43.251.180.118.50004 > balaram-HP-Spectre-x360-Convertible-15-ch0xx.55989: UDP, length 8
18:18:39.293546 IP 43.251.180.118.50004 > balaram-HP-Spectre-x360-Convertible-15-ch0xx.55989: UDP, length 52
18:18:39.443323 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.55989 > 43.251.180.118.50004: UDP, length 28
^C18:18:40.036261 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.39854 > 162.159.134.234.https: Flags [P.], seq 76967573:76967624, ack 183775509, win 503, length 51

430 packets captured
435 packets received by filter
0 packets dropped by kernel
balaram@balaram-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/parallel/project$ sudo tcpdump -i wlo1 -s 0 -w out.txt
tcpdump: verbose output suppressed, use -v or -vv for full protocol decode
listening on wlo1, link-type EN10MB (Ethernet), capture size 262144 bytes
^C302 packets captured
```

U can see the magnified image below here sending a DNS query about the host name through the internet which is going to my ISP.

```
18:18:38.338173 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.47936 > broadband.actcorp.in.domain: 27723+ [1au] A? example.com. (40)
18:18:38.338277 IP balaram-HP-Spectre-x360-Convertible-15-ch0xx.58641 > broadband.actcorp.in.domain: 39486+ [1au] AAAA? example.com. (40)
```

I get back the answer to the query which you can see in the 2nd image below.

```
18:18:38.341127 IP 43.251.180.118.50004 > balaram-HP-Spectre-x360-Convertible-15-ch0xx.55989: UDP, length 52
18:18:38.342933 IP broadband.actcorp.in.domain > balaram-HP-Spectre-x360-Convertible-15-ch0xx.47936: 27723 1/0/1 A 93.184.216.34 (56)
18:18:38.344466 IP broadband.actcorp.in.domain > balaram-HP-Spectre-x360-Convertible-15-ch0xx.58641: 39486 1/0/1 AAAA 2606:2800:220:1:248:1893:25c8:1946 (68)
```

We can see that we get back the ip address related to the query both ipv4 and ipv6

2) Other features added in the code provided are:

i) adding timestamp while sending the code in echo mode which we can know when we sent the message when we get back the echo client:

```

balaran@balaran-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/code_main$ python3 main_server.py -e -6 12345
Echo mode
Connected to ::1 40974
Message from ::1 : hello at 16:37:43

Connected to ::1 40976
Message from ::1 : hjwefcjkcw at 16:38:01

Connected to ::1 40978
Message from ::1 : jhwdfchjkwe at 16:38:04
[]

balaran@balaran-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/code_main$ python3 main_client.py -e -s -6 ip6-localhost 12345
Connected to ip6-localhost 12345
Type: jhwdfchjkwe
Received: hjwefcjkcw at 16:38:01

balaran@balaran-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/code_main$

```

U can observe the time stamp mentioned in the echo of the client as well as the server which receives the echo

ii)file transfer using sockets can be useful in file transfer through socket programming which will be a very useful transfer of file from one to another place.

```

balaran@balaran-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/code_main$ python3 main_server.py -f -6 12345
Connection closed
Connection Timeout
balaran@balaran-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/code_main$ ls
client.key  main_client.py  server.key  tt
client.pem  main_server.py  server.pem  ttrecv
balaran@balaran-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/code_main$ python3 main_server.py -f -6 12345
Connected to ::1 41006
Received ttrecv file

balaran@balaran-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/code_main$ python3 main_client.py -f tt -6 ip6-localhost 12345
Connected to ip6-localhost 12345
tt transfer done
tt transfer done
balaran@balaran-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/code_main$ ls
client.key  main_client.py  server.key  tt
client.pem  main_server.py  server.pem  ttrecv
balaran@balaran-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/code_main$

```

U can see in the image before and after ls command the file transfer done, added rcv at end of rcv to know explicit way that file is received

iii) getaddrinfo in the client program to get the information according to the hostname instead of passing the ip address. Get addrinfo integrated on the client side

```

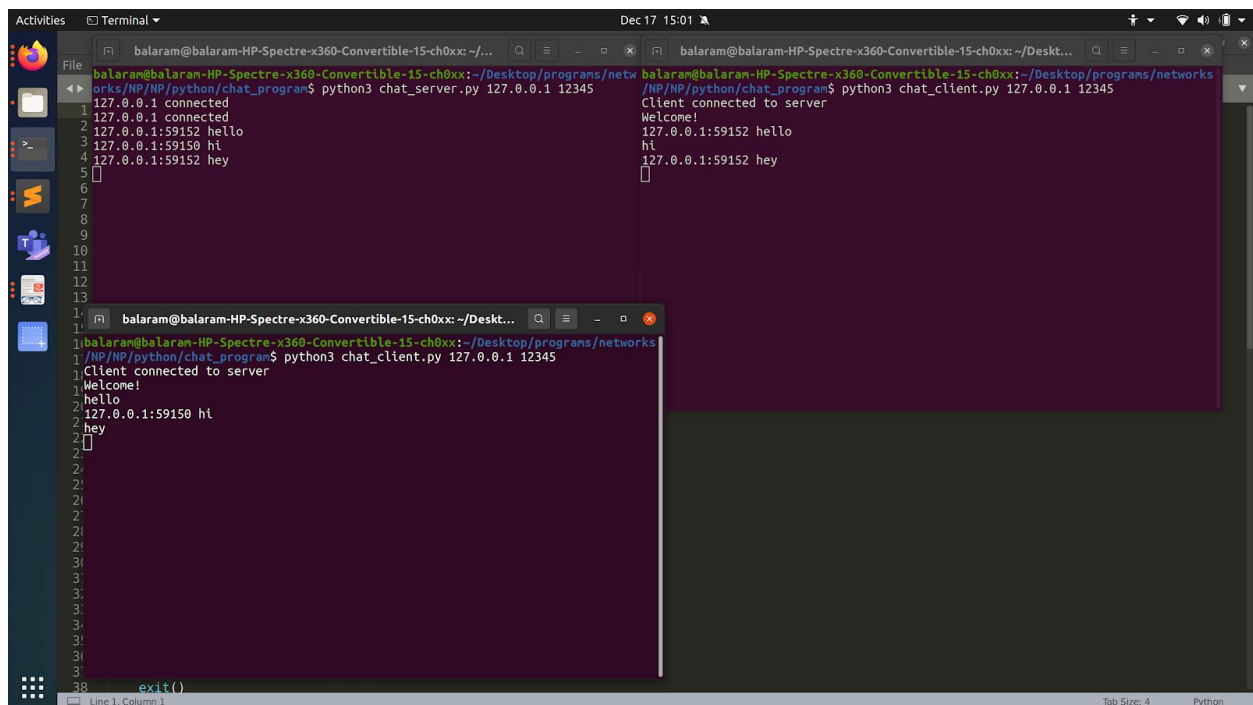
balaran@balaran-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/NP/NP/python/code_main$ python3 main_client.py -i example.com 12345
ipv-4 address= 93.184.216.34
port= 12345
ipv-6 address= 2606:2800:220:1:248:1893:25c8:1946
port= 12345

Addrinfo Result
[(<AddressFamily.AF_INET: 2>, <SocketKind.SOCK_STREAM: 1>, 6, '', ('93.184.216.34', 12345)), (<AddressFamily.AF_INET: 2>, <SocketKind.SOCK_DGRAM: 2>, 17, '', ('93.184.216.34', 12345)), (<AddressFamily.AF_INET: 2>, <SocketKind.SOCK_RAW: 3>, 0, '', ('93.184.216.34', 12345)), (<AddressFamily.AF_INET6: 10>, <SocketKind.SOCK_STREAM: 1>, 6, '', ('2606:2800:220:1:248:1893:25c8:1946', 12345, 0, 0)), (<AddressFamily.AF_INET6: 10>, <SocketKind.SOCK_DGRAM: 2>, 17, '', ('2606:2800:220:1:248:1893:25c8:1946', 12345, 0, 0))]
balaran@balaran-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/NP/NP/python/code_main$

```

Both the ipv-4 and ipv-6 are printed correspondingly by resolving the hostname using getaddrinfo() from client side

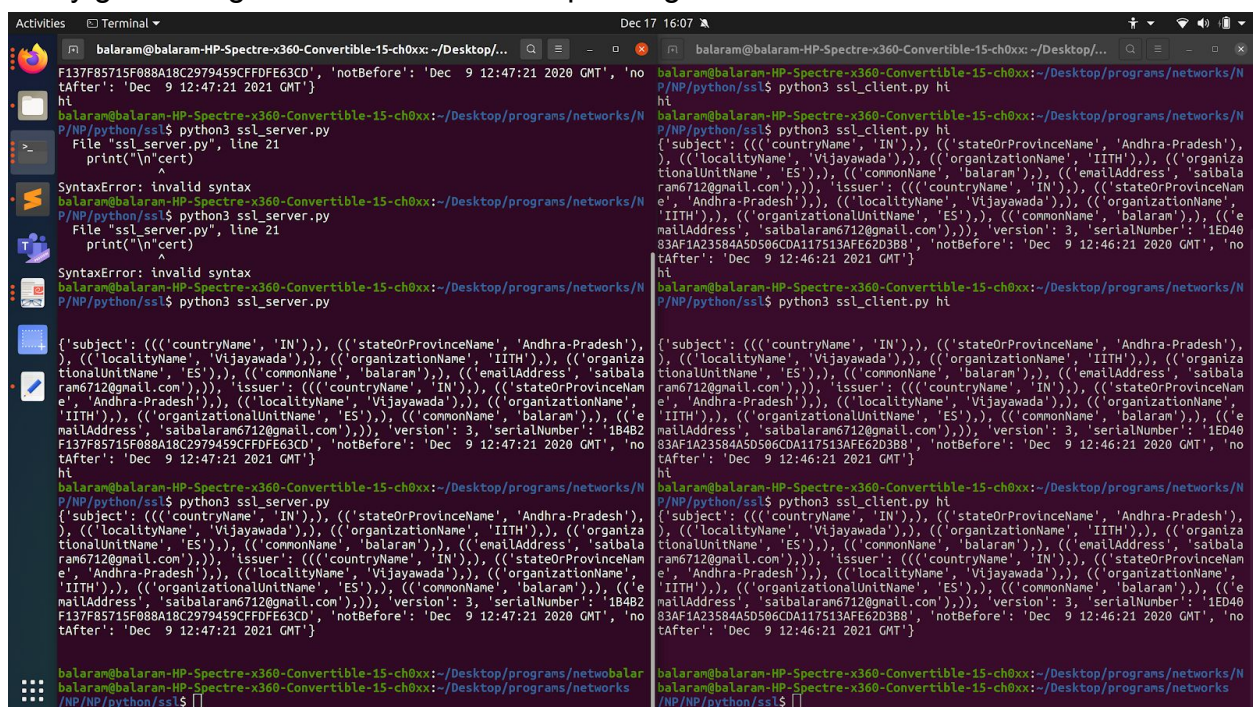
iv) chat room creation using sockets so that multiple people can chat at one time, where a server receives the messages from clients and the message is sent to other clients and also these messages are recorded in the server as well.



```
balaram@balaram-HP-Spectre-x360-Convertible-15-ch0xx: ~/Desktop/programs/networks
1 balaram@balaram-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks$ python3 chat_server.py 127.0.0.1 12345
2 127.0.0.1 connected
3 127.0.0.1:59152 hello
4 127.0.0.1:59150 hi
5 127.0.0.1:59152 hey
6
7
8
9
10
11
12
13
14 balaram@balaram-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks$ python3 chat_client.py 127.0.0.1 12345
1 Client connected to server
2 Welcome!
3 hello
4 127.0.0.1:59150 hi
5 hey
6
7
8
9
10
11
12
13
14 exit()
```

The top left corner in image shows the server receiving messages and printing them and also sending them to all other clients

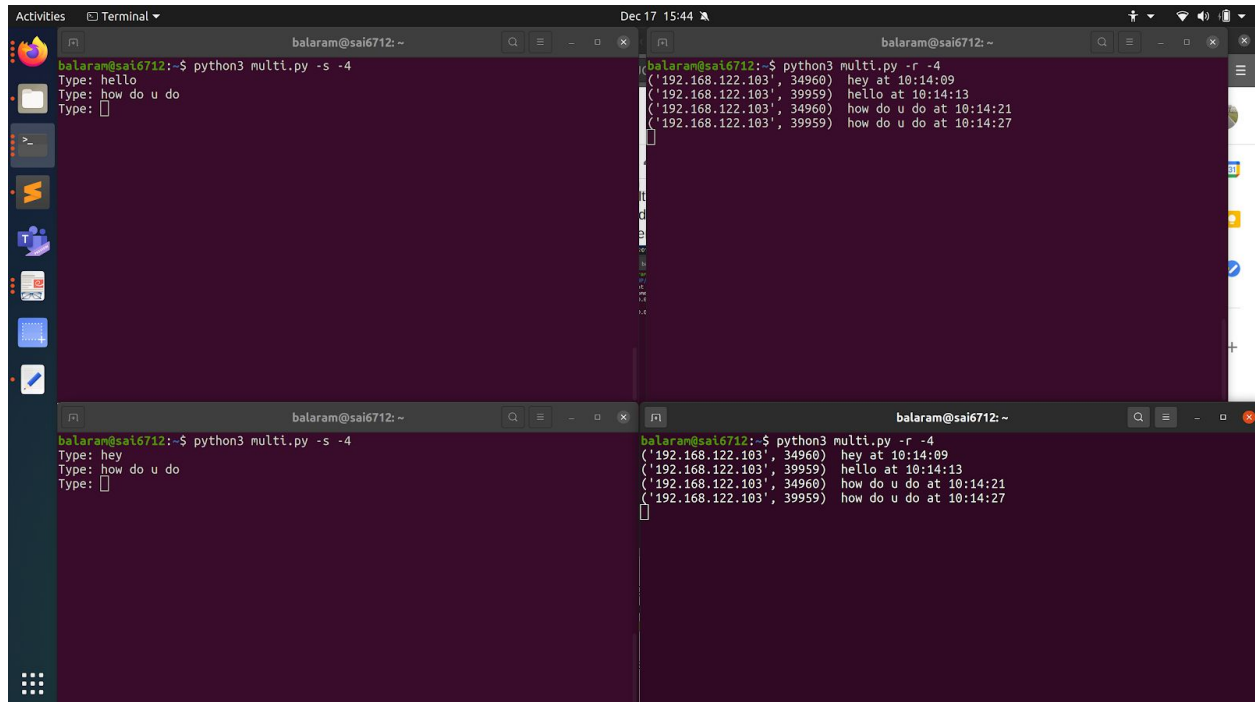
v) communication from server to client by establishing a handshake connection through ssl by generating certificates and corresponding communication.



```
F137F85715F088A18C2979459CFFDFE63CD', 'notBefore': 'Dec 9 12:47:21 2020 GMT', 'no
tAfter': 'Dec 9 12:47:21 2021 GMT'}
ht
balaram@balaram-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/ssl$ python3 ssl_server.py
File "ssl_server.py", line 21
print("\n cert")
^
SyntaxError: invalid syntax
balaram@balaram-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/ssl$ python3 ssl_server.py
File "ssl_server.py", line 21
print("\n cert")
^
SyntaxError: invalid syntax
balaram@balaram-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/ssl$ python3 ssl_server.py
{'subject': (((('countryName', 'IN')), (('stateOrProvinceName', 'Andhra-Pradesh'),
), (('localityName', 'Vijayawada')), (('organizationName', 'IITH')), (('organiza
tionalUnitName', 'ES')), (('commonName', 'balaram')), (('emailAddress', 'saibala
ram6712@gmail.com'))), 'issuer': (((('countryName', 'IN')), (('stateOrProvinceNam
e', 'Andhra-Pradesh')), (('localityName', 'Vijayawada')), (('organizationName',
'IITH')), (('organizationalUnitName', 'ES')), (('commonName', 'balaram')), (('e
mailAddress', 'saibalaran6712@gmail.com'))), 'version': 3, 'serialNumber': '1B482
F137F85715F088A18C2979459CFFDFE63CD', 'notBefore': 'Dec 9 12:47:21 2020 GMT', 'no
tAfter': 'Dec 9 12:47:21 2021 GMT'}
ht
balaram@balaram-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/ssl$ python3 ssl_server.py
{'subject': (((('countryName', 'IN')), (('stateOrProvinceName', 'Andhra-Pradesh'),
), (('localityName', 'Vijayawada')), (('organizationName', 'IITH')), (('organiza
tionalUnitName', 'ES')), (('commonName', 'balaram')), (('emailAddress', 'saibala
ram6712@gmail.com'))), 'issuer': (((('countryName', 'IN')), (('stateOrProvinceNam
e', 'Andhra-Pradesh')), (('localityName', 'Vijayawada')), (('organizationName',
'IITH')), (('organizationalUnitName', 'ES')), (('commonName', 'balaram')), (('e
mailAddress', 'saibalaran6712@gmail.com'))), 'version': 3, 'serialNumber': '1B482
F137F85715F088A18C2979459CFFDFE63CD', 'notBefore': 'Dec 9 12:47:21 2020 GMT', 'no
tAfter': 'Dec 9 12:47:21 2021 GMT'}
ht
balaram@balaram-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/ssl$ python3 ssl_client.py hi
{'subject': (((('countryName', 'IN')), (('stateOrProvinceName', 'Andhra-Pradesh'),
), (('localityName', 'Vijayawada')), (('organizationName', 'IITH')), (('organiza
tionalUnitName', 'ES')), (('commonName', 'balaram')), (('emailAddress', 'saibala
ram6712@gmail.com'))), 'issuer': (((('countryName', 'IN')), (('stateOrProvinceNam
e', 'Andhra-Pradesh')), (('localityName', 'Vijayawada')), (('organizationName',
'IITH')), (('organizationalUnitName', 'ES')), (('commonName', 'balaram')), (('e
mailAddress', 'saibalaran6712@gmail.com'))), 'version': 3, 'serialNumber': '1ED40
83AF1A23584A5D586CDA117513AFE62D3B8', 'notBefore': 'Dec 9 12:46:21 2020 GMT', 'no
tAfter': 'Dec 9 12:46:21 2021 GMT'}
ht
balaram@balaram-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/ssl$ python3 ssl_client.py hi
{'subject': (((('countryName', 'IN')), (('stateOrProvinceName', 'Andhra-Pradesh'),
), (('localityName', 'Vijayawada')), (('organizationName', 'IITH')), (('organiza
tionalUnitName', 'ES')), (('commonName', 'balaram')), (('emailAddress', 'saibala
ram6712@gmail.com'))), 'issuer': (((('countryName', 'IN')), (('stateOrProvinceNam
e', 'Andhra-Pradesh')), (('localityName', 'Vijayawada')), (('organizationName',
'IITH')), (('organizationalUnitName', 'ES')), (('commonName', 'balaram')), (('e
mailAddress', 'saibalaran6712@gmail.com'))), 'version': 3, 'serialNumber': '1ED40
83AF1A23584A5D586CDA117513AFE62D3B8', 'notBefore': 'Dec 9 12:46:21 2020 GMT', 'no
tAfter': 'Dec 9 12:46:21 2021 GMT'}
ht
balaram@balaram-HP-Spectre-x360-Convertible-15-ch0xx:~/Desktop/programs/networks/N
P/NP/python/ssl$
```

Ssl connection and communication through handshake between server and client by sending a sample message echo it

vi) Multicast UDP broadcast where a sender sends the message or any data to a group ip address where some clients or receivers will be receiving on this group ip address to receive the data through that group ip.



```
balaram@sai6712:~$ python3 multi.py -s -4
Type: hello
Type: how do u do
Type:

balaram@sai6712:~$ python3 multi.py -s -4
Type: hey
Type: how do u do
Type:

balaram@sai6712:~$ python3 multi.py -r -4
('192.168.122.103', 34960) hey at 10:14:09
('192.168.122.103', 39959) hello at 10:14:13
('192.168.122.103', 34960) how do u do at 10:14:21
('192.168.122.103', 39959) how do u do at 10:14:27

balaram@sai6712:~$ python3 multi.py -r -4
('192.168.122.103', 34960) hey at 10:14:09
('192.168.122.103', 39959) hello at 10:14:13
('192.168.122.103', 34960) how do u do at 10:14:21
('192.168.122.103', 39959) how do u do at 10:14:27
```

The 2 left side terminals are senders to the group sending their message

The 2 right side terminals are receivers to the group which will listen to the group ip and receive correspondingly.

vi) supporting ipv6 for these mentioned functions by mentioning about the usage of ipv6

```
balaram@sai6712:~$ python3 multi.py -s -6
Type: hey
Type:

balaram@sai6712:~$ python3 multi.py -r -6
('fe80::5054:ff:fec8:f328', 57535, 0, 2) hey at 10:18:27
('fe80::5054:ff:fec8:f328', 41783, 0, 2) hey there at 10:18:34
No sender
Listening Timeout
balaram@sai6712:~$

balaram@sai6712:~$ python3 multi.py -s -6
Type: hey there
Type:

balaram@sai6712:~$ python3 multi.py -r -6
('fe80::5054:ff:fec8:f328', 57535, 0, 2) hey at 10:18:27
('fe80::5054:ff:fec8:f328', 41783, 0, 2) hey there at 10:18:34
No sender
Listening Timeout
balaram@sai6712:~$ vim multi.py
balaram@sai6712:~$
```

You can also observe that the multicast supports ipv6 as well and also the time out as there is no response from the senders which can be quite useful for less wastage of time in some cases.

Various files are there in the file with various functions but the main_server and main_client has the features which can be run correspondingly. The ipv6 for all the functions are supported in main_server.py and main_client.py. Broadcast of messages to a group can be quite useful rather than sending the same message multiple times. Ssl connection which allows secure communication is key in terms of privacy. Also some programs also have time out features which end after some time of running if not active things are going on and exit for some of the clients sending messages. Some other features can be ssl file transfer and echo loop and using the connection created in chat mode for secure communication.

The readme.md file has the instructions on executing correspondingly the files and also can be observed in the files.

Q3: Without explicit mention of ipv4 or ipv6 can be done by running 2 threads in server to resolve the ip address accordingly and getaddrinfo() in client side to create the socket accordingly and implemented an echo server which sends and gets back the text from the terminal side. Present in the files server_gen.py and client_gen.py.

Files submitted:

main_server.py, main_client.py, multicast.py, the other functional files

main_server.py and main_client.py contains the functionalities which can be used by passing corresponding arguments

Sources and References:

- 1) For programming in python using sockets [<https://docs.python.org/3/library/socket.html>]
- 2) For ssl [[ssl and sockets](#)]
- 3) For multiple clients [[Multithreading python](#)]
- 4) For some references [<https://beej.us/guide/bgnet/html/>]
- 5) getaddrinfo in python [[Getaddrinfo function](#), [getaddrinfo another ref](#)]
- 6) Multicast [<https://pymotw.com/2/socket/multicast.html>], [[Multi cast stack overflow](#)]
- 7) Time out error [[timeout command](#)]
- 8) Multiple clients [[Multi](#)]
- 9) file transfer [[files and sockets](#)]
- 10) Time <https://stackoverflow.com/questions/415511/how-to-get-the-current-time-in-python>