

## LAB – 4

### SOCKET PROGRAMMING USING PYTHON

#### CONNECTION ORIENTED:

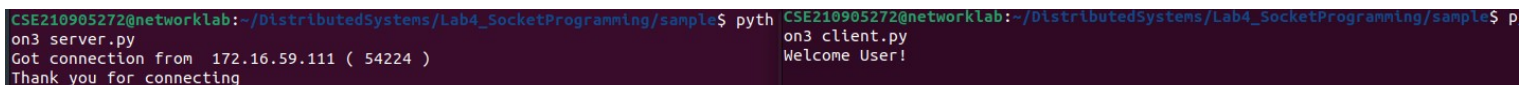
server.py

```
import socket
host = socket.gethostname()
port=12345
s=socket.socket()
s.bind((host,port))
s.listen(5)
conn,addr = s.accept()
print('Got connection from ',addr[0], '(', addr[1], ')')
print("Thank you for connecting")
while True:
    data=conn.recv(1024)
    if not data: break
    conn.sendall(data)
conn.close()
```

client.py

```
import socket
host = socket.gethostname()
port=12345
s=socket.socket()
s.connect((host,port))

print('Welcome User!')
data=s.recv(1024)
s.close()
```

A terminal window with a dark purple background. The prompt is 'CSE210905272@networklab:~/DistributedSystems/Lab4\_SocketProgramming/sample\$'. The user runs 'python3 server.py' and the output is 'Got connection from 172.16.59.111 ( 54224 )' followed by 'Thank you for connecting' on a new line. The user then runs 'python3 client.py' and the output is 'Welcome User!' on a new line.

```
CSE210905272@networklab:~/DistributedSystems/Lab4_SocketProgramming/sample$ python3 server.py
Got connection from 172.16.59.111 ( 54224 )
Thank you for connecting
CSE210905272@networklab:~/DistributedSystems/Lab4_SocketProgramming/sample$ python3 client.py
Welcome User!
```

#### CONNECTION LESS:

server.py

```
import socket
sock =socket.socket(socket.AF_INET,socket.SOCK_DGRAM)# For UDP
udp_host = socket.gethostname()# Host IP
udp_port = 12345# specified port to connect
```

```

sock.bind((udp_host, udp_port))
while True:
    print("Waiting for client...")
    data,addr = sock.recvfrom(1024)#receive data from client
    print("Received Messages:",data.decode()," from",addr)

```

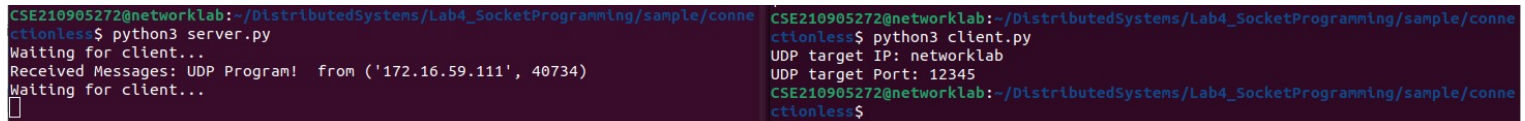
client.py

```

import socket
sock = socket.socket(socket.AF_INET,socket.SOCK_DGRAM)# For UDP
udp_host = socket.gethostname()# Host IP
udp_port = 12345# specified port to connect

msg = "UDP Program!"
print("UDP target IP:", udp_host)
print("UDP target Port:", udp_port)
sock.sendto(msg.encode(),(udp_host,udp_port))

```



```

CSE210905272@networklab:~/DistributedSystems/Lab4_SocketProgramming/sample/conne
ctionless$ python3 server.py
Waiting for client...
Received Messages: UDP Program! from ('172.16.59.111', 40734)
Waiting for client...

CSE210905272@networklab:~/DistributedSystems/Lab4_SocketProgramming/sample/conne
ctionless$ python3 client.py
UDP target IP: networklab
UDP target Port: 12345
CSE210905272@networklab:~/DistributedSystems/Lab4_SocketProgramming/sample/conne
ctionless$

```

**Q)# Write a program where client can send a message to the server and the server can receive the message and send, or echo, it back to the client**

client.py

```

import socket
HOST = '127.0.0.1' # The server's hostname or IP address
PORT = 2053
# The port used by the server
with socket.socket(socket.AF_INET, socket.SOCK_STREAM) as s:
    s.connect((HOST, PORT))
    s.sendall(b'Hello, world')
    data = s.recv(1024)
    print('Received Connection')
    print('Server:', data.decode())

```

server.py

```

import socket
HOST = '127.0.0.1' # Standard loopback interface address (localhost)
PORT = 2053
# Port to listen on (non-privileged ports are > 1023)
with socket.socket(socket.AF_INET, socket.SOCK_STREAM) as s:
    s.bind((HOST, PORT))
    s.listen()
    conn, addr = s.accept()
    with conn:
        print('Connected by', addr)
        while True:
            data = conn.recv(1024)

```

```

        if data:
            print("Client: ",data.decode())
        data = input("Enter message to client:");
        if not data:
            break;
# sending message as bytes to client.
        conn.sendall(bytearray(data, 'utf-8'));

    conn.close()

```

The screenshot shows two terminal windows. The left window, titled 'CSE210905272@networklab: ~/DistributedSystems/Lab4\_Soc...', shows the execution of a Python server script. It prompts for a message and receives 'hey'. The right window, titled 'CSE210905272@networklab', shows the execution of a Python client script, which prints 'Received Connection' and 'Server: hey'.

```

CSE210905272@networklab:~/DistributedSystems/Lab4_SocketProgramming/sample/echo$ python3 server.py
Connected by ('127.0.0.1', 40976)
Client: Hello, world
Enter message to client:hey

CSE210905272@networklab:~/DistributedSystems/Lab4_SocketProgramming/sample/echo$ python3 client.py
Received Connection
Server: hey

```

**Q)Write a program to create TCP time server in Python**  
**server.py**

```

import socket
import time

# create a socket object
serversocket = socket.socket(
    socket.AF_INET, socket.SOCK_STREAM)
# get local machine name
host = socket.gethostname()
port = 9991
# bind to the port
serversocket.bind((host, port))
# queue up to 5 requests
serversocket.listen(5)
while True:
    # establish a connection
    clientsocket,addr = serversocket.accept()
    print("Got a connection from %s" % str(addr))
    currentTime = time.ctime(time.time()) + "\r\n"
    clientsocket.send(currentTime.encode('ascii'))
    clientsocket.close()

```

**client.py**

```

import socket
# create a socket object
s = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
# get local machine name
host = socket.gethostname()
port = 9991
# connection to hostname on the port.
s.connect((host, port))
# Receive no more than 1024 bytes
tm = s.recv(1024)
print(' Current time from Sever :', tm.decode())
s.close()

```

<pre> CSE210905272@networklab:~/DistributedSystems/Lab4_SocketProgramming/sample/time\$ python3 server.py Got a connection from ('172.16.59.111', 46374) </pre>	<pre> cd ../time CSE210905272@networklab:~/DistributedSystems/Lab4_So python3 client.py Current time from Sever : Thu Feb 1 09:31:17 2024 </pre>
---	--

**Q)Write a TCP chat server in python using socket programming.**

### Server.py

```

import socket
HOST = '127.0.0.1' # Standard loopback interface address (localhost)
PORT = 31621 # Port to listen on (non-privileged ports are > 1023)
s = socket.socket()
s.bind((HOST, PORT))
s.listen()
print("\nWaiting for incoming connections...\n")
conn, addr = s.accept()
print("Received connection from ", addr[0], "(", addr[1], ")\n")
s_name = conn.recv(1024)
s_name = s_name.decode()
print(s_name, "has connected to the chat room\nEnter [e] to exit chat room\n")
name = input(str("Enter your name: "))
conn.send(name.encode())
while True:
    message = input(str("Me : "))
    if message == "[e]":
        message = "Left chat room!"
        conn.send(message.encode())
        print("\n")
        break
    conn.send(message.encode())
    message = conn.recv(1024)
    message = message.decode()
    print(s_name, ":", message)

```

### Client.py

```

import socket
HOST = '127.0.0.1' # Standard loopback interface address (localhost)
PORT = 31621
# Port to listen on (non-privileged ports are > 1023)
s = socket.socket()
name = input(str("\nEnter your name: "))
print("\nTrying to connect to ", HOST, "(", PORT, ")\n")
s.connect((HOST, PORT))
print("Connected...\n")
s.send(name.encode())
s_name = s.recv(1024)
s_name = s_name.decode()
print(s_name, "has joined the chat room\nEnter [e] to exit chat room\n")
while True:
    message = s.recv(1024)
    message = message.decode()

```

```

print(s_name, ":", message)
message = input(str("Me : "))
if message == "[e]":
    message = "Left chat room!"
    s.send(message.encode())
    print("\n")
    break
s.send(message.encode())

```

```

CSE210905272@networklab:~/DistributedSystems/Lab4_SocketPrograms$ cd ../tcpchat
CSE210905272@networklab:~/DistributedSystems/Lab4_SocketPrograms$ python3 server.py
Waiting for incoming connections...
Received connection from 127.0.0.1 ( 42808 )
sat has connected to the chat room
Enter [e] to exit chat room
Enter your name: wick
Me : hey
sat : hey
Me : e
sat : e
Me : [e]

CSE210905272@networklab:~/DistributedSystems/Lab4_SocketPrograms$ python3 client.py
Enter your name: sat
Trying to connect to 127.0.0.1 ( 31621 )
Connected...
wick has joined the chat room
Enter [e] to exit chat room
hey
wick : hey
Me : e
wick : e
Me : wick : Left chat room!
Me : [e]

```

## Q)Forking/ Threading (Concurrent Server)

### server.py

```

import socket
import os
from _thread import *
ServerSocket = socket.socket()
host = '127.0.0.1'
port = 11596
ThreadCount = 0
try:
    ServerSocket.bind((host, port))
except socket.error as e:
    print(str(e))
print("Waitting for a Connection..")
ServerSocket.listen(5)
def threaded_client(connection):
    connection.send(str.encode('Welcome to the Server'))
    while True:
        data = connection.recv(2048)
        print('Received from client : ' + str(ThreadCount) + data.decode())
        Inputs = input('Server Says: ')
        if not data:
            break
        connection.sendall(Inputs.encode())
    connection.close()
while True:
    Client, address = ServerSocket.accept()
    print('Connected to: ' + address[0] + ':' + str(address[1]))

```

```

        start_new_thread(threaded_client, (Client, ))
        ThreadCount += 1
        print('Thread Number: ' + str(ThreadCount))
ServerSocket.close()

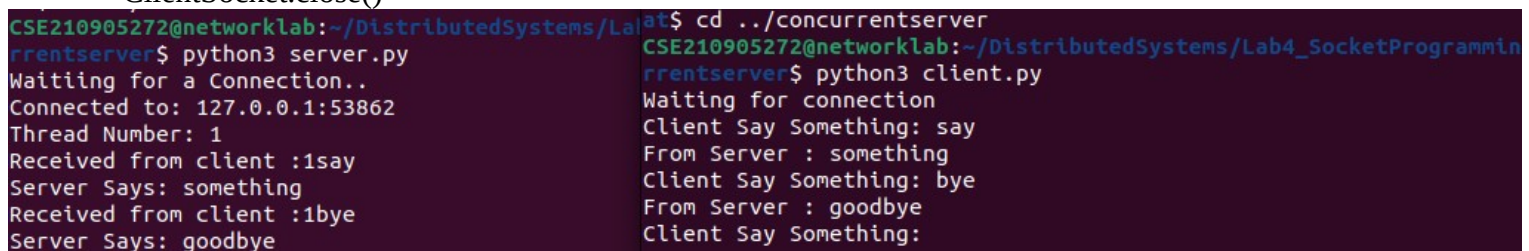
```

#### client.py

```

import socket
ClientSocket = socket.socket()
host = '127.0.0.1'
port = 11596
print('Waiting for connection')
try:
    ClientSocket.connect((host, port))
except socket.error as e:
    print(str(e))
Response = ClientSocket.recv(1024)
while True:
    Input = input('Client Say Something: ')
    ClientSocket.send(str.encode(Input))
    Response = ClientSocket.recv(1024)
    print('From Server : ' + Response.decode())
ClientSocket.close()

```



```

CSE210905272@networklab:~/DistributedSystems/Lab4_SocketProgramming$ cd ../concurrentserver
CSE210905272@networklab:~/DistributedSystems/Lab4_SocketProgramming$ python3 server.py
CSE210905272@networklab:~/DistributedSystems/Lab4_SocketProgramming$ python3 client.py
rrrentserver$ python3 server.py
rrrentserver$ python3 client.py
Waiting for a Connection..
Waiting for connection
Connected to: 127.0.0.1:53862
Client Say Something: say
Thread Number: 1
From Server : something
Received from client :1say
Client Say Something: bye
Server Says: something
From Server : goodbye
Received from client :1bye
Client Say Something:
Server Says: goodbye

```

## EXERCISE:

**Q1)Write a UDP time server to display the current time and day.**

#### Server.py

```

import socket
import time
udp_host = socket.gethostname()# Host IP
udp_port = 12345# specified port to connect

with socket.socket(socket.AF_INET, socket.SOCK_DGRAM) as s:
    s.bind((udp_host, udp_port))
    print(f"UDP server listening on {udp_host}:{udp_port}")

    while True:
        data, addr = s.recvfrom(1024)
        print(f"Received request from {addr}")

```

```
now = time.ctime(time.time()) + "\r\n"
```

```
s.sendto(now.encode(), addr)
```

client.py

```
import socket
```

```
udp_host = socket.gethostname()# Host IP
```

```
udp_port = 12345# specified port to connect
```

```
with socket.socket(socket.AF_INET, socket.SOCK_DGRAM) as s:
```

```
# Send a request to the server
```

```
s.sendto(b", (udp_host, udp_port))
```

```
# Wait for a response from the server
```

```
data, _ = s.recvfrom(1024)
```

```
print(f"Received time and day of week from server: {data.decode()}")
```

```
CSE210905272@networklab:~/DistributedSystems/Lab4_SoCSE210905272@networklab:~/DistributedSystems/La
client.py server.py
Received time from server: Thu Feb  1 10:18:07 2024 UDP server listening on networklab:12345
Received request from ('172.16.59.111', 46475)
```

**Q2)Write a UDP simple chat program for message send and receive.**

Client.py

```
import socket
```

```
udp_host = socket.gethostname()# Host IP
```

```
udp_port = 12345# specified port to connect
```

```
addr = (udp_host, udp_port)
```

```
with socket.socket(socket.AF_INET, socket.SOCK_DGRAM) as s:
```

```
# Send a request to the server
```

```
s.sendto(b", addr)
```

```
# Wait for a response from the server
```

```
# data, _ = s.recvfrom(1024)
```

```
now=input("Enter some text to send:")
```

```
s.sendto(now.encode(), addr)
```

```
print(f"Client Sent: {now}")
```

```
data, _ = s.recvfrom(1024)
```

```
print(f"Client Received: {data}")
```

Server.py

```
import socket
```

```
udp_host = socket.gethostname()# Host IP
```

```
udp_port = 12345# specified port to connect
```

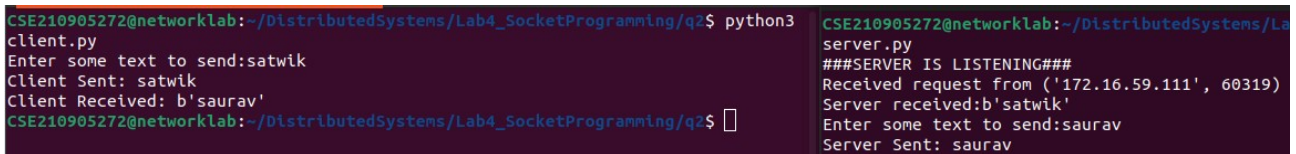
```
# Create a UDP socket
```

```
with socket.socket(socket.AF_INET, socket.SOCK_DGRAM) as s:
```



```
s.bind((udp_host, udp_port))
print("###SERVER IS LISTENING###")
```

```
while True:
    # Receive a request
    data, addr = s.recvfrom(1024)
    print(f"Received request from {addr}")
    data1, _ = s.recvfrom(1024)
    print(f"Server received:{data1}")
    now=input("Enter some text to send:")
    s.sendto(now.encode(), addr)
    print(f"Server Sent: {now}")
```



The screenshot shows two terminal windows. The left window is the client terminal running 'client.py', showing the user entering 'satwik' and the server responding with 'b'saurav''. The right window is the server terminal running 'server.py', showing the server listening, receiving a request from '172.16.59.111', receiving 'b'satwik', and sending 'saurav' back.

.

**Q3)Write a TCP/UDP peer to peer chat system between two different machines.**

#### Server.py

```
import socket
serv = ('172.16.59.52', 9991)
HOST, PORT = serv[0], serv[1]
s = socket.socket()
s.bind(serv)
s.listen()
print("waiting for incoming connections\n")
conn, addr = s.accept()
print("received connection from ", addr[0], "(" , addr[1], ") \n")
s_name = conn.recv(1024).decode()
print(s_name, "has connected to the chat room")
print("enter 'bye' to exit chat room\n")
name = input(str("enter your name: "))
conn.send(name.encode())
while True:
    msg = conn.recv(1024).decode()
    if(msg=='bye'):
        conn.close()
        break
    print(s_name, ":", msg)
    msg = input(str("me: "))
    if msg == "bye":
        conn.send(msg.encode())
        print("\n")
        conn.close()
        break
```



```
conn.send(msg.encode())
```

### client.py

```
import socket
serv = ('172.16.59.52', 9991)
HOST, PORT = serv[0], serv[1]
s = socket.socket()
name = input(str("\nEnter your name: "))
print("\nTrying to connect to ", HOST, "(" , PORT, ")\n")
s.connect(serv)
print("Connected...\n")
s.send(name.encode())
s_name = s.recv(1024).decode()
print(s_name, "has connected to the chat room")
print("\nEnter 'bye' to exit chat room\n")
while True:
    msg = str(input("Me : "))
    if msg == "bye":
        print("Left chat room")
        s.send(msg.encode())
        print("\n")
        s.close()
        break
    s.send(msg.encode())
    msg = s.recv(1024).decode()
    if(msg=='bye'):
        print("exit initiated by server ")
        s.close()
        break
    print(s_name, ":", msg)
```

```
CSE210905272@networklab:~/Downloads$ python3 q3_c.py
```

```
Enter your name: Satwik
```

```
Trying to connect to 172.16.59.52 ( 9991 )
```

```
Connected...
```

```
Drishaan has connected to the chat room
```

```
Enter 'bye' to exit chat room
```

```
Me : Hello
```

```
Drishaan : Hi! How are you?
```

```
Me : Lab 4 different devices
```

```
Drishaan : Connected
```

```
Me : bye
```

```
Left chat room
```

```
210905282_drishaan@networklab: ~/Documents/dsl/lab4
```

```
210905282_drishaan@networklab:~/Documents/dsl/lab4$ python3 q3_s.py
```

```
waiting for incoming connections
```

```
received connection from 172.16.59.111 ( 51070 )
```

```
Satwik has connected to the chat room
```

```
enter 'bye' to exit chat room
```

```
enter your name: Drishaan
```

```
Satwik : Hello
```

```
me: Hi! How are you?
```

```
Satwik : Lab 4 different devices
```

```
me: Connected
```

```
210905282_drishaan@networklab:~/Documents/dsl/lab4$
```

**Q4)Try to debug the error in the code and execute it.**

Server.py

```
import socket
```

```
serverIP = 'localhost'
```

```
serverPort = 16000
```

```
serverSock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
```

```
serverSock.bind((serverIP, serverPort))
```

```
serverSock.listen(1)
```

```
print("TCP server has started and is ready to receive")
```

```
while True:
```

```
    connection, addr = serverSock.accept()
```

```
    # data = connection.recv(1024)
```

```
    data = connection.recv(1024).decode()
```

```
    if not data: break
```

```
    temp = [float(x) for x in data.split(' ')]
```

```
    print("Received data:", temp)
```

```
    length = len(temp)
```

```
    maximum = max(temp)
```

```
    minimum = min(temp)
```

```
    total = sum(temp)
```

```
    mean = total/length
```

```
    msg = str(total) + " " + str(minimum) + " " + str(maximum) + " " + str(mean)
```

```
    # connection.send(str(msg))
```

```
    connection.send(str(msg).encode())
```

Client.py

```
import socket
```

```
serverIP = 'localhost'
```

```
serverPort = 16000
```

```
clientSock = socket.socket(socket.AF_INET, socket.SOCK_STREAM)
```

```
clientSock.connect((serverIP, serverPort))
```

```
message = input("Input integers with space in between: ").encode()
```

```
# clientSock.connect((serverIP, serverPort))
```

```
# message = raw_input("Input integers with space in between: ")
```

```
#message2 = input("Enter the length of the set: ").encode()
```

```
clientSock.send(message)
```

```
#clientSock.send(message2)
```

```
#data = clientSock.recv(1024)
```

```
data = clientSock.recv(1024).decode()
```

```
temp = [float(x) for x in data.split(' ')]

print("The total of all numbers is: " + str(temp[0]))
print("The lowest number is: " + str(temp[1]))
print("The highest number is: " + str(temp[2]))
print("The mean is: " + str(temp[3]))

clientSock.close()
```