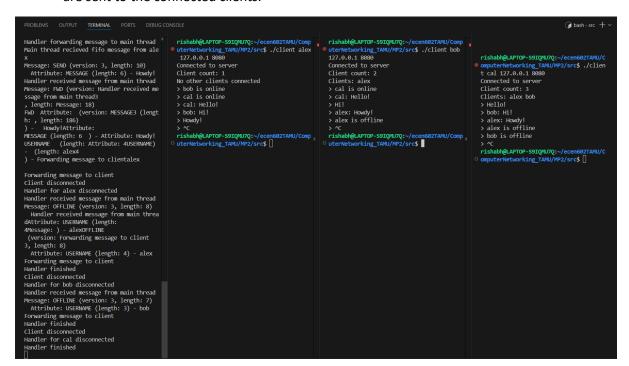# TCP Simple Broadcast Chat Server and Client
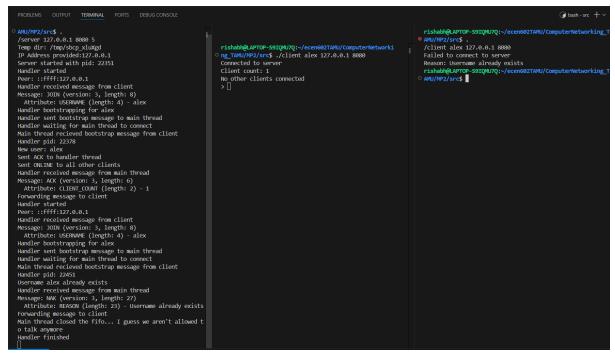
ECEN 602 Network Programming Assignment 2

Team ID: 9

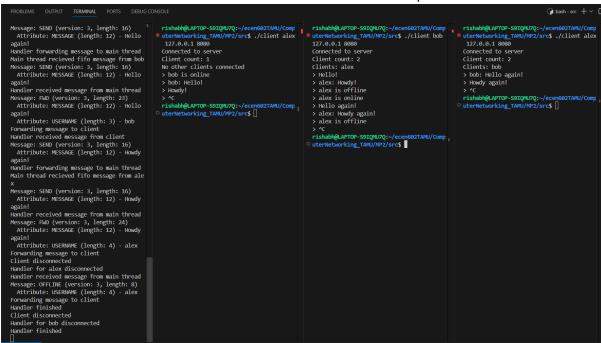Below are the test cases performed on the TCP Simple Broadcast Chat Server and Client:

1. Normal operation of the chat client with three clients connected:
   a. Server is run using IP address 127.0.0.1, port 8080, and max clients limit of 5.
   b. Clients "alex", "bob", and "cal" connect to the server.
   c. The server handles all 3 clients simultaneously and messages from each of the clients are broadcasted to the other 2 clients.
   d. All 3 clients disconnect one by one. When a client disconnects, Offline notifications are sent to the connected clients.

2. Server rejects a client with a duplicate username:
   a. Server is run using IP address 127.0.0.1, port 8080, and max clients limit of 5.
   b. A client with username "alex" connects to the server. Server accepts the connection.
   c. A new client with the same username "alex" tries to connect to the server. It fails to connect as the server rejects the client with a reason "Username already exists".

```
AMU/MP2/src$ .
/server 127.0.0.1 8080 5
Temp dir: /tmp/sbcp_xluXgd
IP Address provided:127.0.0.1
Server started with pid: 22351
Handler started
Peer: ::ffff:127.0.0.1
Handler received message from client
Message: JOIN (version: 3, length: 8)
  Attribute: USERNAME (length: 4) - alex
Handler bootstrapping for alex
Handler sent bootstrap message to main thread
Handler waiting for main thread to connect
Main thread recieved bootstrap message from client
Handler pid: 22378
New user: alex
Sent ACK to handler thread
Sent ONLINE to all other clients
Handler received message from main thread
Message: ACK (version: 3, length: 6)
  Attribute: CLIENT_COUNT (length: 2) - 1
Forwarding message to client
Handler started
Peer: ::ffff:127.0.0.1
Handler received message from client
Message: JOIN (version: 3, length: 8)
  Attribute: USERNAME (length: 4) - alex
Handler bootstrapping for alex
Handler sent bootstrap message to main thread
Handler waiting for main thread to connect
Main thread recieved bootstrap message from client
Handler pid: 22451
Username alex already exists
Handler received message from main thread
Message: NAK (version: 3, length: 27)
  Attribute: REASON (length: 23) - Username already exists
Forwarding message to client
Main thread closed the fifo... I guess we aren't allowed t
o talk anymore
Handler finished
```

```
rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/ComputerNetworki
ng_TAMU/MP2/src$ ./client alex 127.0.0.1 8080
Connected to server
Client count: 1
No other clients connected
> 
```

```
rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/ComputerNetworking_T
AMU/MP2/src$ .
/client alex 127.0.0.1 8080
Failed to connect to server
Reason: Username already exists
rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/ComputerNetworking_T
AMU/MP2/src$ 
```

3. Server allows a previously used username to be reused:
    a. Server is run using IP address 127.0.0.1, port 8080, and max clients limit of 5.
    b. Clients "alex" and "bob" connect to the server and start chatting.
    c. Client "alex" disconnects from the server. Server clears all its resources.
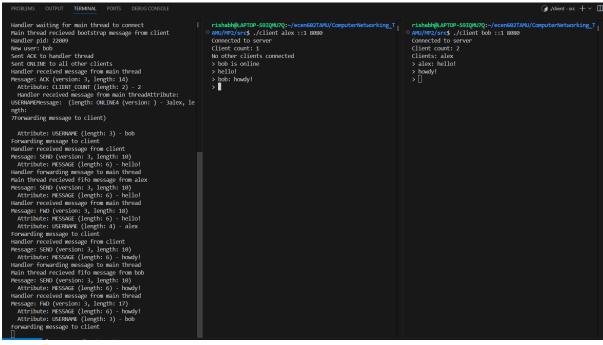   d. A new client named "alex" connects to the server. Server accepts the connection.


```
Message: SEND (version: 3, length: 16)
  Attribute: MESSAGE (length: 12) - Hello
again!
Handler forwarding message to main thread
Main thread recieved fifo message from bob
Message: SEND (version: 3, length: 16)
  Attribute: MESSAGE (length: 12) - Hello
again!
Handler received message from main thread
Message: FWD (version: 3, length: 23)
  Attribute: MESSAGE (length: 12) - Hello
again!
  Attribute: USERNAME (length: 3) - bob
Forwarding message to client
Handler received message from client
Message: SEND (version: 3, length: 16)
  Attribute: MESSAGE (length: 12) - Howdy
again!
Handler forwarding message to main thread
Main thread recieved fifo message from ale
x
Message: SEND (version: 3, length: 16)
  Attribute: MESSAGE (length: 12) - Howdy
again!
Handler received message from main thread
Message: FWD (version: 3, length: 24)
  Attribute: MESSAGE (length: 12) - Howdy
again!
  Attribute: USERNAME (length: 4) - alex
Forwarding message to client
Client disconnected
Handler for alex disconnected
Handler received message from main thread
Message: OFFLINE (version: 3, length: 8)
  Attribute: USERNAME (length: 4) - alex
Forwarding message to client
Handler finished
Client disconnected
Handler for bob disconnected
Handler finished
```

```
rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/Comp
uterNetworking_TAMU/MP2/src$ ./client alex
127.0.0.1 8080
Connected to server
Client count: 1
No other clients connected
> bob is online
> bob: Hello!
> Howdy!
> ^C
rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/Comp
uterNetworking_TAMU/MP2/src$ 
```

```
rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/Comp
uterNetworking_TAMU/MP2/src$ ./client bob
127.0.0.1 8080
Connected to server
Client count: 2
Clients: alex
> Hello!
> alex: Howdy!
> alex is offline
> alex is online
> Hello again!
> alex: Howdy again!
> alex is offline
> ^C
rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/Comp
uterNetworking_TAMU/MP2/src$ 
```

```
rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/Comp
uterNetworking_TAMU/MP2/src$ ./client alex
127.0.0.1 8080
Connected to server
Client count: 2
Clients: bob
> bob: Hello again!
> Howdy again!
> ^C
rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/Comp
uterNetworking_TAMU/MP2/src$ 
```

4. Server rejects the client because it exceeds the maximum number of clients allowed:
    a. Server is run using IP address 127.0.0.1, port 8080, and max clients limit of 2.
    b. Clients "alex" and "bob" connect to the server and start chatting.
    c. Client "cal" tries to connect to the server. It fails to connect as the server rejects the client with a reason "Maximum clients limit".

PROBLEMS OUTPUT TERMINAL PORTS DEBUG CONSOLE   bash - src

```
    Attribute: MESSAGE (length: 6) - hello!        rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/Comp       rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/Comp      rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/Comp
Handler received message from main thread          uterNetworking_TAMU/MP2/src$ ./client alex        uterNetworking_TAMU/MP2/src$ ./client bob       uterNetworking_TAMU/MP2/src$ ./client cal
Message: FWD (version: 3, length: 17)               127.0.0.1 8080                                   127.0.0.1 8080                                 127.0.0.1 8080
    Attribute: MESSAGE (length: 6) - hello!         Connected to server                             Connected to server                          Failed to connect to server
    Attribute: USERNAME (length: 3) - bob           Client count: 1                                 Client count: 2                              Reason: Maximum connected clients limit
Forwarding message to client                        No other clients connected                      Clients: alex                                rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/Comp
Handler received message from client                > bob is online                                 > hello!                                      uterNetworking_TAMU/MP2/src$
Message: SEND (version: 3, length: 10)              > bob: hello!                                    > alex: howdy!
    Attribute: MESSAGE (length: 6) - howdy!         > howdy!                                         >
Handler forwarding message to main thread           >
Main thread recieved fifo message from ale
x
Message: SEND (version: 3, length: 10)
    Attribute: MESSAGE (length: 6) - howdy!
Handler received message from main thread
Message: FWD (version: 3, length: 18)
    Attribute: MESSAGE (length: 6) - howdy!
    Attribute: USERNAME (length: 4) - alex
Forwarding message to client
Handler started
Peer: ::ffff:127.0.0.1
Handler received message from client
Message: JOIN (version: 3, length: 7)
    Attribute: USERNAME (length: 3) - cal
Handler bootstrapping for cal
Handler sent bootstrap message to main thr
ead
Handler waiting for main thread to connect
Main thread recieved bootstrap message fro
m client
Handler pid: 20075
Maximum connected clients limit reachedHan
dler received message from main thread
Message: NAK (version: 3, length: 36)
    Attribute: REASON (length: 32) - Maximum
 connected clients limit
Forwarding message to client
Main thread closed the fifo... I guess we
aren't allowed to talk anymore
Handler finished
```

5. **Bonus Feature IPv4 and IPv6**

   Server uses IPv6 address and clients connect to it:
   a. Server is run using IPv6 address ::1, port 8080, and max clients limit of 5.
   b. Clients "alex" and "bob" connect to the server and start chatting. Server functions normally and broadcasts the messages as expected.

PROBLEMS OUTPUT TERMINAL PORTS DEBUG CONSOLE   ./client - src

```
Handler waiting for main thread to connect        rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/ComputerNetworking_T       rishabh@LAPTOP-S9IQMU7Q:~/ecen602TAMU/ComputerNetworking_T
Main thread recieved bootstrap message from client  AMU/MP2/src$ ./client alex ::1 8080                            AMU/MP2/src$ ./client bob ::1 8080
Handler pid: 22009                                   Connected to server                                          Connected to server
New user: bob                                        Client count: 1                                             Client count: 2
Sent ACK to handler thread                           No other clients connected                                  Clients: alex
Sent ONLINE to all other clients                     > bob is online                                             > alex: hello!
Handler received message from main thread            > hello!                                                    > howdy!
Message: ACK (version: 3, length: 14)                > bob: howdy!                                                >
    Attribute: CLIENT_COUNT (length: 2) - 2          >
    Handler received message from main threadAttribute:
USERNAMEMessage:  (length: ONLINE4 (version: ) - 3alex, le
ngth:
7Forwarding message to client)

    Attribute: USERNAME (length: 3) - bob
Forwarding message to client
Handler received message from client
Message: SEND (version: 3, length: 10)
    Attribute: MESSAGE (length: 6) - hello!
Handler forwarding message to main thread
Main thread recieved fifo message from alex
Message: SEND (version: 3, length: 10)
    Attribute: MESSAGE (length: 6) - hello!
Handler received message from main thread
Message: FWD (version: 3, length: 18)
    Attribute: MESSAGE (length: 6) - hello!
    Attribute: USERNAME (length: 4) - alex
Forwarding message to client
Handler received message from client
Message: SEND (version: 3, length: 10)
    Attribute: MESSAGE (length: 6) - howdy!
Handler forwarding message to main thread
Main thread recieved fifo message from bob
Message: SEND (version: 3, length: 10)
    Attribute: MESSAGE (length: 6) - howdy!
Handler received message from main thread
Message: FWD (version: 3, length: 17)
    Attribute: MESSAGE (length: 6) - howdy!
    Attribute: USERNAME (length: 3) - bob
Forwarding message to client
```

6. **Bonus feature 1**
   a. Server sends ACK message with total client count (including the new client) and list of usernames of connected clients. The clients display the 'Client count' and 'Clients' when they connect to the server. (Refer image from test 1)
   b. Server sends a NAK message to reject a client's JOIN message request when either the username is already in use, or the max connect clients limit is reached. The NAK contains a "reason" attribute. (Refer image from test 2 and test 4)

c. Server sends an ONLINE message to all the connected clients when a new client connects. The ONLINE message contains the username of the new client. We see the connected clients displaying the username of the new client in their terminal output. (Refer image from test 1)

d. Server sends an OFFLINE message which notifies the connected clients that a client has disconnected from the server. It contains the username of the disconnecting clients. The clients display the username on the terminal. (Refer image from test 1)

7. **Bonus feature 2**

a. Client sends IDLE message to the server if no messages are typed in by the user for 10 seconds. The server sends the IDLE message to the other clients.

b. All other clients display the username which is idle.

Architecture of the TCP Simple Broadcast Chat Server and Client