1. Develop Language

I use python 3.7 for program.

2. Program Design

For the first part, the programming consists of two parts, the client and the server.

Since both receiving and input message will block the thread, the client is designed to contain two threads. One is used to receive user input and send it to the correct socket connection, and the other is used to receive the data obtained by the socket and print it to the screen.

The server is designed as a multithreaded program that can handle multiple client requests simultaneously. When the client initiates a connection, the server starts a new thread in which it accepts socket commands. And according to the command type, give the correct response to client.

The second part is about P2P. In the first part, the client is not listening on any local ports. In order to implement p2p messaging, it need to open another server at the client side so that it can accept socket connections from other clients. Assume user A and user B want to use p2p messages, First, A needs to send a request to the server in part 1. The server sends **private** command to B. Then, B will start a new thread locally to accept the p2p connection, and send port number to server. The port can be setting by starting client with argument **private_port** . The server will send another command **private_info** which include private port information to A. In this way, A knows what port that B is listening on. The last, A can start a connection to B without through server.

3. Message Format

All messages are passed in string format. The string consists of two parts, the command and the command arguments. For example, the command **message <user> <message>**, the key word **message** is command, and the **<user>** and **<message>** is arguments. The server will parse all parameters and give the correct response to client.