CN Lab Project

Team member: Kathit Joshi

i) Abstract and Title:

Secure TCP Socket Calculator with Multiserver Capabilities:

It has two parts: a server and a client that can support numerous instances at the same time and enable flexible and secure interaction.

Server Side
When you run the server, you give it the IP address and the port number on the same command line. This allows for easy startup of multiple instances of the server, each possibly listening on different ports or IP addresses. The server waits for incoming connections on the specified address and will service incoming calculation requests from the clients.

Client Side
The user interface of the client program is user-friendly and interactive. When it starts, it asks the user to input the IP address and the port number of the intended server to connect to. This will implement the multi-server nature of the system.

When connected, the user accepts commands to perform the calculations from the user in the straightforward format of an operator followed by two consecutive numbers, with a space between them (e.g., + 3 4 for "add 3 and 4"). This string of commands is transmitted to the server.

Communication and Security
Client and server communicate over raw sockets, providing a simple, low-level mechanism for data exchange. For security and confidentiality of the data being exchanged, the client wraps its connection within an SSL context. This enables data in transit to be encrypted so that it cannot be eavesdropped upon.

Workflow Summary
The user begins the server by providing IP and port.
A client begins and prompts the user for the server's IP and the port to attach.
The user input from the client is in the format <operator> <num1> <num2> (i.e., / 7 5 for 7/5 result).
The command is transmitted securely on the network to the server.
The server computes the calculation and returns the result.

The client presents the result back to the user in an interactive manner.

This layout provides a seamless, adaptable, and secure system for the execution of basic calculations among different servers and clients. There is also a server.log file which keeps logs of the connections, results of the multi-server-client communication.

ii) *Screenshots:*

Terminal 1 (Client):

```
kathit@kathit-pop-os:/media/sf_SharedFilesWithLinux/SecureTCP_Calculator_MultiServer$ python3 SecureTCPClient.py
Enter server IP (default 127.0.0.1): 0.0.0.0
Enter server port (default 8000): 9000
Enter operation (e.g. + 2 3) or 'quit': + 2 3
Result: 5
Enter operation (e.g. + 2 3) or 'quit': - 5 4
Result: 1
Enter operation (e.g. + 2 3) or 'quit': * 8 3
Result: 24
Enter operation (e.g. + 2 3) or 'quit': + Hello world
Result: Helloworld
Enter operation (e.g. + 2 3) or 'quit': quit
Result: Connection closed.
kathit@kathit-pop-os:/media/sf_SharedFilesWithLinux/SecureTCP_Calculator_MultiServer$
```


Terminal 2 (Server):

```
kathit@kathit-pop-os:/media/sf_SharedFilesWithLinux/SecureTCP_Calculator_MultiServer$ python3 SecureTCPServer.py 127.0.0.2 8001
Server listening on 127.0.0.2:8001
Connected by ('127.0.0.1', 52394)
Connection closed for ('127.0.0.1', 52394)
```

Workspaces   Applications   Apr 25 11:29 AM ●

server.log
sf_SharedFilesWithLinux /media/sf_SharedFilesWithLinux/SecureTCP_Calculator_MultiServer

```
 1 2025-04-11 14:47:38,555 - Server started and listening on 0.0.0.0:9000
 2 2025-04-11 14:47:54,049 - Connection established with ('127.0.0.1', 48668)
 3 2025-04-11 14:48:04,435 - Server started and listening on 127.0.0.2:8001
 4 2025-04-11 14:48:23,992 - Connection established with ('127.0.0.1', 45236)
 5 2025-04-11 14:48:37,758 - Operation from ('127.0.0.1', 48668): b'+ 2 3' -> Result: 5
 6 2025-04-11 14:48:52,007 - Operation from ('127.0.0.1', 48668): b'* 7 8' -> Result: 56
 7 2025-04-11 14:49:06,562 - Connection closed for ('127.0.0.1', 48668)
 8 2025-04-11 14:49:16,550 - Operation from ('127.0.0.1', 45236): b'** 2 3' -> Result: 8
 9 2025-04-11 14:49:19,412 - Operation from ('127.0.0.1', 45236): b'/ 4 2' -> Result: 2.0
10 2025-04-11 14:49:24,544 - Operation from ('127.0.0.1', 45236): b'% 5 2' -> Result: 1
11 2025-04-11 14:49:26,246 - Connection closed for ('127.0.0.1', 45236)
12 2025-04-22 10:20:54,059 - Server started and listening on 127.0.0.2:8001
13 2025-04-22 10:21:12,704 - Connection established with ('127.0.0.1', 49162)
14 2025-04-22 10:21:18,256 - Operation from ('127.0.0.1', 49162): b'+ 2 3' -> Result: 6
15 2025-04-22 10:21:24,989 - Operation from ('127.0.0.1', 49162): b'+ Hello world' -> Result: Helloworld
16 2025-04-22 10:21:40,480 - Server started and listening on 0.0.0.0:9000
17 2025-04-22 10:21:57,018 - Connection established with ('127.0.0.1', 45088)
18 2025-04-22 10:22:00,843 - Operation from ('127.0.0.1', 45088): b'% 3 2' -> Result: 1
19 2025-04-22 10:22:05,002 - Connection closed for ('127.0.0.1', 45088)
20 2025-04-22 10:22:10,201 - Connection closed for ('127.0.0.1', 49162)
21 2025-04-25 11:23:57,398 - Server started and listening on 0.0.0.0:9000
22 2025-04-25 11:24:06,210 - Connection established with ('127.0.0.1', 52364)
23 2025-04-25 11:24:14,639 - Server started and listening on 127.0.0.2:8001
24 2025-04-25 11:24:27,593 - Connection established with ('127.0.0.1', 52394)
25 2025-04-25 11:24:32,242 - Operation from ('127.0.0.1', 52364): b'+ 2 3' -> Result: 5
26 2025-04-25 11:24:35,734 - Operation from ('127.0.0.1', 52364): b'- 5 4' -> Result: 1
27 2025-04-25 11:24:50,838 - Operation from ('127.0.0.1', 52364): b'* 8 3' -> Result: 24
28 2025-04-25 11:24:56,810 - Operation from ('127.0.0.1', 52394): b'** 2 3' -> Result: 8
29 2025-04-25 11:25:04,500 - Operation from ('127.0.0.1', 52394): b'/ 4 5' -> Result: 0.8
30 2025-04-25 11:25:10,193 - Operation from ('127.0.0.1', 52394): b'% 5 3' -> Result: 2
31 2025-04-25 11:25:25,269 - Operation from ('127.0.0.1', 52364): b'+ Hello world' -> Result: Helloworld
32 2025-04-25 11:25:34,795 - Connection closed for ('127.0.0.1', 52364)
33 2025-04-25 11:25:37,876 - Connection closed for ('127.0.0.1', 52394)
```

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