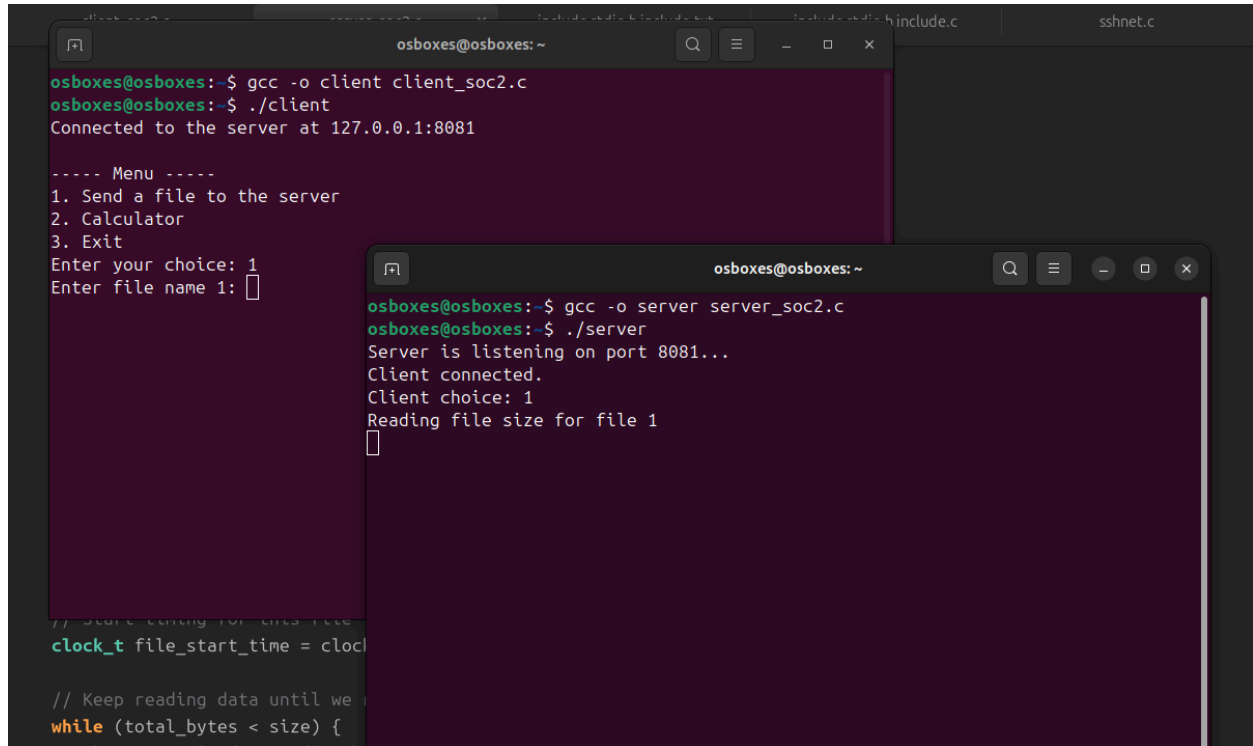


Nini ola

Csc 5250 Midterm

Requirement 0: use one linux machine and sockets sent/received correctly

a. Setup picture



The screenshot shows two terminal windows on a Linux system. The top window is the client program, and the bottom window is the server program. Both are running on a machine named 'osboxes'.

```
osboxes@osboxes:~$ gcc -o client client_soc2.c
osboxes@osboxes:~$ ./client
Connected to the server at 127.0.0.1:8081

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 1
Enter file name 1: 
```

```
osboxes@osboxes:~$ gcc -o server server_soc2.c
osboxes@osboxes:~$ ./server
Server is listening on port 8081...
Client connected.
Client choice: 1
Reading file size for file 1

```

Requirement one: document programs and verify the sockets are sent; programs must be in c

1. **Server code documentation and verification:** This C program is a TCP server that performs two key tasks:
 - a. File Transfer: Receives up to 3 files from the client.
 - b. Calculator: Performs arithmetic operations (add, subtract, multiply, divide) on two numbers received from the client. The server runs indefinitely, handling client choice until the connection is closed.
 - c. Functions:
 - i. **Receive_file:** Handles receiving a file from the client.
 1. Parameters:
 - a. **sock:** Client socket file descriptor.
 - b. **file_index:** Index of the file being received.
 - c. **total_bytes_received:** Pointer to track total bytes received.
 - d. **total_time_taken:** Pointer to track total time taken.
 2. Procedure:
 - a. Receives the file sent by client and print the bytes

- b. Prints the total bytes and time taken
 - ii. **receiveNumCalculator**: Handles basic arithmetic calculations based on client input.
 - 1. Parameters:
 - a. **sock**: Client socket.
 - b. **calculator_time_taken**: Pointer to track total time for the calculation.
 - 2. Procedure:
 - i. Receives two numbers and performs operations (add, subtract, multiply, divide) based on the client's request.
 - ii. Handles division by zero and invalid operations.
 - iii. Sends the result of the operation back to the client.
 - iv. Tracks time taken for the session.
 - iii. **Main**: Entry point of the program. It initializes the server, listens for client connections, and processes requests.
 - 1. Procedure:
 - a. Creates and binds a TCP socket to port **8081**.
 - b. Accepts client connections in a loop.
 - c. Based on the client's choice:
 - i. Calls **receive_file** for file transfer (up to 3 files).
 - ii. Calls **receiveNumCalculator** for arithmetic operations.
 - iii. Closes the connection when the client opts to exit.
 - d. Tracks and logs total bytes sent/received and time taken for each client session.
 - d. Verification of working socket

```
osboxes@osboxes:~$ gcc -o client client_soc2.c
osboxes@osboxes:~$ ./client
Connected to the server at 127.0.0.1:8081

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 1
Enter file name 1: 

osboxes@osboxes:~$ gcc -o server server_soc2.c
osboxes@osboxes:~$ ./server
Server is listening on port 8081...
Client connected.
Client choice: 1
Reading file size for file 1

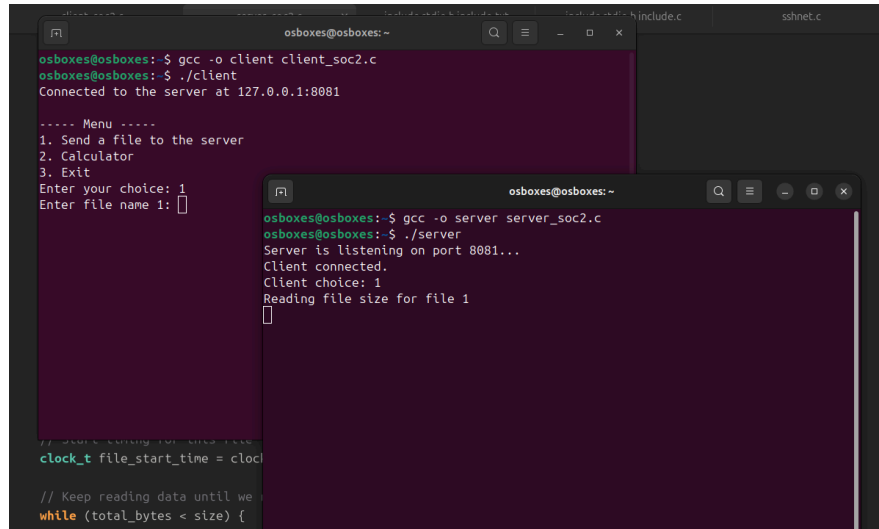
```

e. Server loop:

2. Client code documentation and verification: This program is a client-side socket application that communicates with a server. It has 3 key tasks

1. **file Sending:** The program allows the user to send up to three files, checking each file's existence before sending.
2. **Calculator:** The client can perform arithmetic operations with server-side computation.
3. **Exit:** The user can choose to terminate the connection gracefully.
4. Functions:
 - a. `display_menu()`
 - i. Purpose: Displays the menu options for the user to either send a file, use a calculator, or exit the program.
 - ii. Returns: The selected option (1, 2, or 3), or -1 for invalid input.
 - b. `file_exists(const char *filename)`
 - i. Purpose: Checks if the specified file exists in the system.
 - ii. Returns: 1 if the file exists, 0 otherwise.
 - c. `send_file(int sock, const char *filename)`
 - i. Purpose: Sends the specified file to the server in binary format.
 - ii. Sends the file size to the server.
 - iii. Sends the file data in chunks.
 - iv. Prints the file type (JPG, DOCX, or unknown).
 - v. Receives the number of bytes processed by the server.
 - d. `read_integer(const char *prompt)`
 - i. Purpose: Prompts the user to input an integer value.
 - ii. Returns: The integer entered by the user after validation.
 - e. `read_operation(char *operation)`
 - i. Purpose: Reads and validates a mathematical operation (add, subtract, multiply, divide) or stop command.
 - ii. Returns: Stores the valid operation in the `operation`
 - iii.
 - iv. parameter.
 - f. `Calculator(int sock)`
 - i. Purpose: Handles a series of calculator operations between the client and the server.
 - ii. Sends two numbers to the server.
 - iii. Continuously reads valid operations and sends them to the server.
 - iv. Receives and displays the result from the server.
 - v. Tracks total bytes sent during the calculation process.
 - g. `main()`
 - i. Purpose: The main function handles socket creation, connection to the server, and the main loop that allows the user to:

- ii. Send files (up to 3) to the server.
 - iii. Use the calculator function
 - iv. Exit and close the connection/Socket that connects to server
5. Socket verification and error checking
- a. Working socket



The image shows two terminal windows side-by-side. The left window is the client, and the right window is the server. Both are running on a system named 'osboxes'.

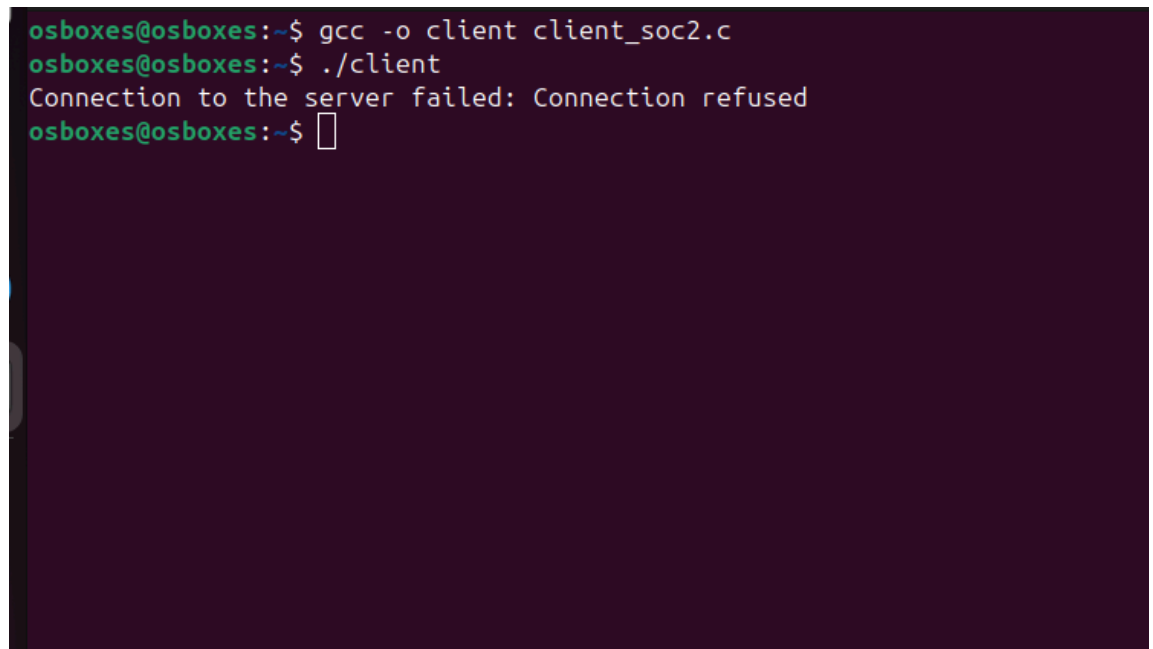
```
osboxes@osboxes:~$ gcc -o client client_soc2.c
osboxes@osboxes:~$ ./client
Connected to the server at 127.0.0.1:8081

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 1
Enter file name 1: 
```

```
osboxes@osboxes:~$ gcc -o server server_soc2.c
osboxes@osboxes:~$ ./server
Server is listening on port 8081...
Client connected.
Client choice: 1
Reading file size for file 1

```

- b.
- c. Error if socket doesn't work



The image shows a single terminal window on a system named 'osboxes'. The user has compiled and run the client program, but the connection to the server failed.

```
osboxes@osboxes:~$ gcc -o client client_soc2.c
osboxes@osboxes:~$ ./client
Connection to the server failed: Connection refused
osboxes@osboxes:~$ 
```

Requirement 3: error checking for doug terminology

- a. Error checking for choice

```

osboxes@osboxes:~$ ^C
osboxes@osboxes:~$ gcc -o client client_soc2.c
osboxes@osboxes:~$ ./client
Connected to the server at 127.0.0.1:8081

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 212
Invalid input, please enter a single number (1, 2, or 3).

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: fecegr
Invalid input, please enter a single number (1, 2, or 3).

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 1dcww
Invalid input, please enter a single number (1, 2, or 3).

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 1
Enter file name 1: ^C
osboxes@osboxes:~$ gcc -o client client_soc2.c

```

```

osboxes@osboxes:~$ gcc -o client client_soc2.c
osboxes@osboxes:~$ ./client
Connected to the server at 127.0.0.1:8081

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 2
Calculator: enter num1: 

```

b. Error checking for filenames

```

osboxes@osboxes:~$ gcc -o client client_soc2.c
osboxes@osboxes:~$ ./client
Connected to the server at 127.0.0.1:8081

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 1
Enter file name 1: fefwfe
Error: File 'fefwfe' does not exist. Please try again.
Enter file name 1: 123242
Error: File '123242' does not exist. Please try again.
Enter file name 1: a111.docx
Sending file size for a111.docx
Sending file a111.docx as byte array
File a111.docx sent successfully. File type: DOCX (2)
Received 1116863 bytes for file a111.docx
Enter file name 2: building1.jpg
Sending file size for building1.jpg
Sending file building1.jpg as byte array
File building1.jpg sent successfully. File type: JPG (1)
Received 23531 bytes for file building1.jpg
Enter file name 3: building1.jpg
Error: File 'building1.jpg' does not exist. Please try again.
Enter file name 3: building1.jpg
Sending file size for building1.jpg
Sending file building1.jpg as byte array
File building1.jpg sent successfully. File type: JPG (1)
Received 23531 bytes for file building1.jpg
Received 1163925 bytes for files
Time taken for file: 144.09 milliseconds

```

c. Error checking for numbers sending

```

Enter your choice: ^C
osboxes@osboxes:~$ ./client
Connected to the server at 127.0.0.1:8081

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 2
Calculator: enter num1: ^[wwe
Invalid input. Please enter a valid number.
Calculator: enter num1: wxw';
Invalid input. Please enter a valid number.
Calculator: enter num1: 23
Number 1 sent: 23 (sent 3 bytes)
Calculator: enter num2: fd
Invalid input. Please enter a valid number.
Calculator: enter num2: s3
Invalid input. Please enter a valid number.
Calculator: enter num2: 2df
Invalid input. Please enter a valid number.
Calculator: enter num2: 45
Number 2 sent: 45 (sent 3 bytes)
Server response: Numbers received: 23.000000 and 45.000000. Please enter a calculation or type 'stop' to exit.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: fefde
Invalid operation. Please enter 'add', 'subtract', 'multiply', 'divide', or 'stop'.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: efe
Invalid operation. Please enter 'add', 'subtract', 'multiply', 'divide', or 'stop'.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: +
Invalid operation. Please enter 'add', 'subtract', 'multiply', 'divide', or 'stop'.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: add
Result: 68.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: subtract

```

d. Error checking for calculation type

```

Invalid input. Please enter a valid number.
Calculator: enter num2: s3
Invalid input. Please enter a valid number.
Calculator: enter num2: 2df
Invalid input. Please enter a valid number.
Calculator: enter num2: 45
Number 2 sent: 45 (sent 3 bytes)
Server response: Numbers received: 23.000000 and 45.000000. Please enter a calculation or type 'stop' to exit.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: fefde
Invalid operation. Please enter 'add', 'subtract', 'multiply', 'divide', or 'stop'.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: efe
Invalid operation. Please enter 'add', 'subtract', 'multiply', 'divide', or 'stop'.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: +
Invalid operation. Please enter 'add', 'subtract', 'multiply', 'divide', or 'stop'.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: add
Result: 68.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: subtract
Result: -22.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: stop
Total bytes sent during calculator operations: 24

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: Invalid input, please enter a single number (1, 2, or 3).

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: ^[[B^[[A^[[A

```

Requirement 3: Total bytes sent and time taken for send 3 files:


```
Oct 22 20:51
osboxes@osboxes: ~
Time taken for file: 18.16 milliseconds
Total bytes for program Received 1163925 bytes
Total Time taken for : 18.16 milliseconds

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: Invalid input, please enter a single number (1, 2, or 3).

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 2
Calculator: enter num1: 54
Number 1 sent: 54 (sent 3 bytes)
Calculator: enter num2: 2
Number 2 sent: 2 (sent 2 bytes)
Server response: Numbers received: 54.000000 and 2.000000. Please enter a calculation or type 'stop' to exit.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: add
Result: 56.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: subtraact
Invalid operation. Please enter 'add', 'subtract', 'multiply', 'divide', or 'stop'.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: divide
Result: 27.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: multiply
Result: 108.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: stop
Total bytes sent during calculator operations: 30
Total bytes for program Received 1163955 bytes
Total Time taken for : 19.42 milliseconds
```

```
Oct 22 20:51
osboxes@osboxes: ~
3. Exit
Enter your choice: 2
Calculator: enter num1: 54
Number 1 sent: 54 (sent 3 bytes)
Calculator: enter num2: 2
Number 2 sent: 2 (sent 2 bytes)
Server response: Numbers received: 54.000000 and 2.000000. Please enter a calculation or type 'stop' to exit.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: add
Result: 56.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: subtraact
Invalid operation. Please enter 'add', 'subtract', 'multiply', 'divide', or 'stop'.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: divide
Result: 27.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: multiply
Result: 108.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: stop
Total bytes sent during calculator operations: 30
Total bytes for program Received 1163955 bytes
Total Time taken for : 19.42 milliseconds

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: Invalid input, please enter a single number (1, 2, or 3).

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 1
Enter file name 1: 
```


Requirement5: Must run a.b.c

- A.b.c on server

```
Oct 22 21:14
osboxes@osboxes: ~
osboxes@osboxes:~$ gcc -o server server_soc22.c
osboxes@osboxes:~$ ./server
Server is listening on port 8081...
Client connected.
Client choice: 1
Reading file size for file 1
Receiving file 1 as 'received_file1'...
File 1 received successfully as 'received_file1'
File 1: Total bytes received: 1116863, Time taken: 17.17 milliseconds
Reading file size for file 2
Receiving file 2 as 'received_file2'...
File 2 received successfully as 'received_file2'
File 2: Total bytes received: 23531, Time taken: 12.81 milliseconds
Reading file size for file 3
Receiving file 3 as 'received_file3'...
File 3 received successfully as 'received_file3'
File 3: Total bytes received: 20201, Time taken: 0.69 milliseconds
Total bytes received for all files: 1160595
Total time taken to receive all files: 67.59 milliseconds
Overall total bytes received: 1160595
Overall total time taken: 67.59 milliseconds
Client choice: 2
Number 1: 43.000000
Number 2: 2.000000
Stopping calculations as requested by the client.
Total time taken for calculator function: 0.26 milliseconds
Overall total bytes received: 1160609
Overall total time taken: 67.86 milliseconds
Client choice: 3
Client requested to exit.
```

- A.b.c. on client

```
Oct 22 21:13
osboxes@osboxes: ~
Enter your choice: Invalid input, please enter a single number (1, 2, or 3).

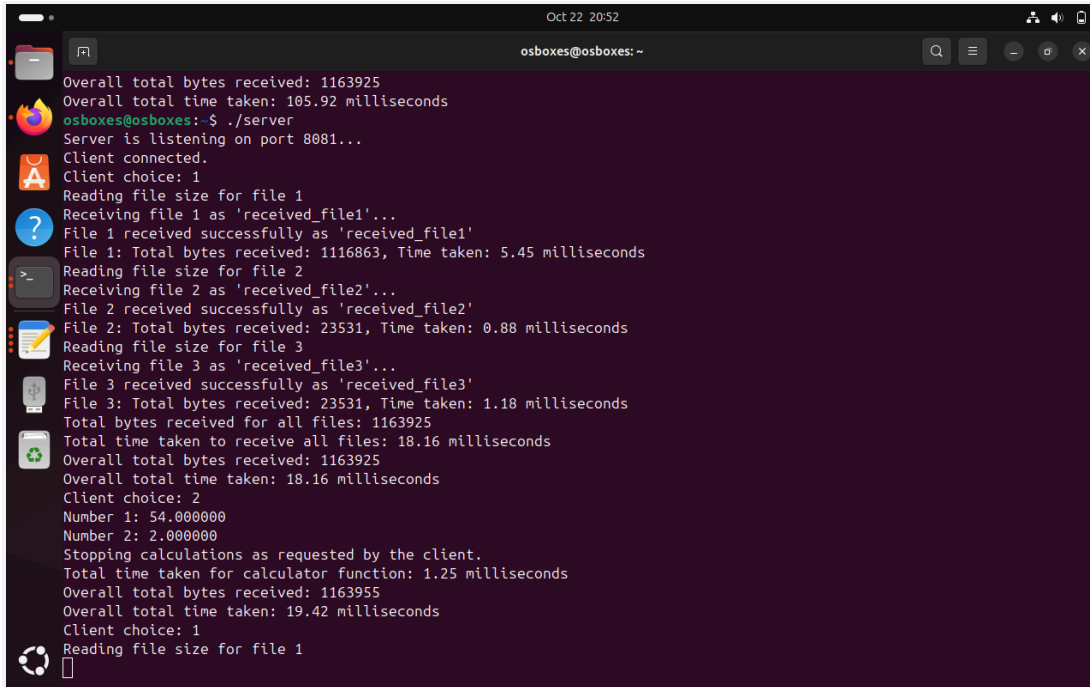
----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 2
Calculator: enter num1: 43
Number 1 sent: 43 (sent 3 bytes)
Calculator: enter num2: 2
Number 2 sent: 2 (sent 2 bytes)
Server response: Numbers received: 43.000000 and 2.000000. Please enter a calculation or type 'stop' to exit.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: add
Result: 45.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: stop
Total bytes sent during calculator operations: 14
Total bytes for program Received 1160609 bytes
Total Time taken for : 67.86 milliseconds

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: Invalid input, please enter a single number (1, 2, or 3).

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 3
Disconnecting from the server.
osboxes@osboxes:~$
```

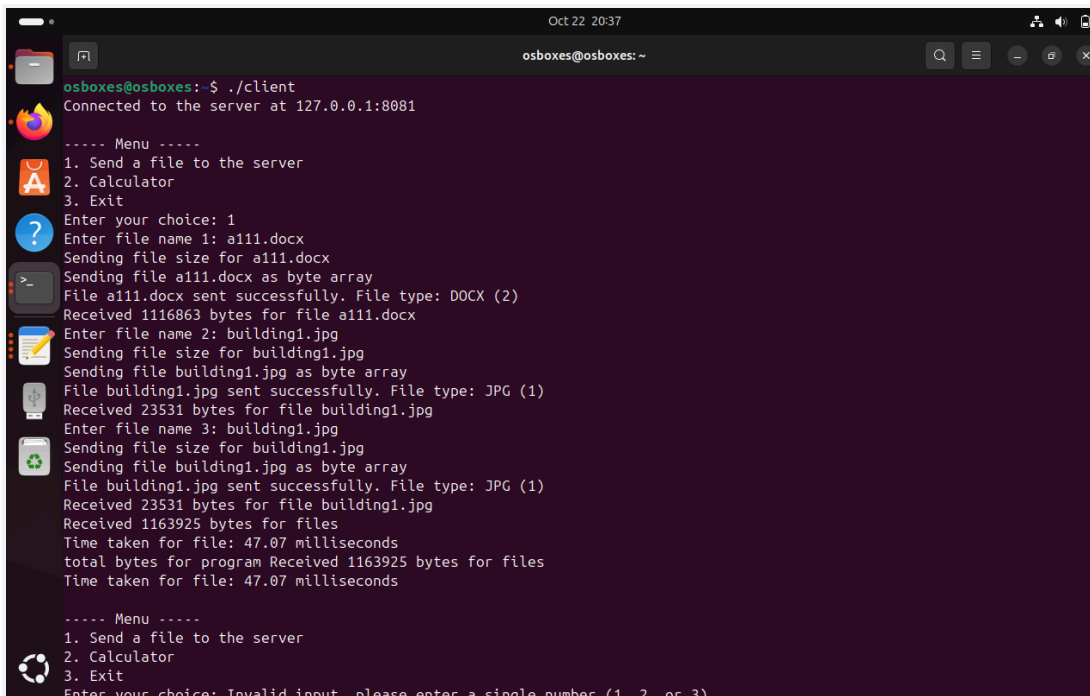
Requirement 6: Capture an image of your working client and server (a digital image will do)

g. Working server

A terminal window titled 'osboxes@osboxes: ~' showing the execution of a server program. The program starts by displaying overall statistics: 1163925 bytes received and 105.92 ms taken. It then listens on port 8081. A client connects, and the server prompts for a choice. Choice 1 leads to receiving three files: 'received_file1' (1116863 bytes, 5.45 ms), 'received_file2' (23531 bytes, 0.88 ms), and 'received_file3' (23531 bytes, 1.18 ms). After receiving all files, it shows a total of 1163925 bytes and 18.16 ms. Choice 2 triggers a calculator function, which calculates 54.000000 + 2.000000 = 56.000000. Choice 3 leads to receiving file 1 again. The terminal output is as follows:

```
Overall total bytes received: 1163925
Overall total time taken: 105.92 milliseconds
osboxes@osboxes:~$ ./server
Server is listening on port 8081...
Client connected.
Client choice: 1
Reading file size for file 1
Receiving file 1 as 'received_file1'...
File 1 received successfully as 'received_file1'
File 1: Total bytes received: 1116863, Time taken: 5.45 milliseconds
Reading file size for file 2
Receiving file 2 as 'received_file2'...
File 2 received successfully as 'received_file2'
File 2: Total bytes received: 23531, Time taken: 0.88 milliseconds
Reading file size for file 3
Receiving file 3 as 'received_file3'...
File 3 received successfully as 'received_file3'
File 3: Total bytes received: 23531, Time taken: 1.18 milliseconds
Total bytes received for all files: 1163925
Total time taken to receive all files: 18.16 milliseconds
Overall total bytes received: 1163925
Overall total time taken: 18.16 milliseconds
Client choice: 2
Number 1: 54.000000
Number 2: 2.000000
Stopping calculations as requested by the client.
Total time taken for calculator function: 1.25 milliseconds
Overall total bytes received: 1163955
Overall total time taken: 19.42 milliseconds
Client choice: 1
Reading file size for file 1
```

h. Working client :

A terminal window titled 'osboxes@osboxes: ~' showing the execution of a client program. The client connects to the server at 127.0.0.1:8081. It displays a menu with three options: 1. Send a file to the server, 2. Calculator, and 3. Exit. The user chooses 1, enters file names 'a111.docx' and 'building1.jpg', and sends them as byte arrays. The client receives confirmation from the server for each file. It then chooses 2, uses the calculator, and finally chooses 3 to exit. The terminal output is as follows:

```
osboxes@osboxes:~$ ./client
Connected to the server at 127.0.0.1:8081

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 1
Enter file name 1: a111.docx
Sending file size for a111.docx
Sending file a111.docx as byte array
File a111.docx sent successfully. File type: DOCX (2)
Received 1116863 bytes for file a111.docx
Enter file name 2: building1.jpg
Sending file size for building1.jpg
Sending file building1.jpg as byte array
File building1.jpg sent successfully. File type: JPG (1)
Received 23531 bytes for file building1.jpg
Enter file name 3: building1.jpg
Sending file size for building1.jpg
Sending file building1.jpg as byte array
File building1.jpg sent successfully. File type: JPG (1)
Received 23531 bytes for file building1.jpg
Received 1163925 bytes for files
Time taken for file: 47.07 milliseconds
total bytes for program Received 1163925 bytes for files
Time taken for file: 47.07 milliseconds

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: Invalid input, please enter a single number (1, 2, or 3).
```

```
Oct 22 20:51
osboxes@osboxes: ~
Time taken for file: 18.16 milliseconds
Total bytes for program Received 1163925 bytes
Total Time taken for : 18.16 milliseconds

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: Invalid input, please enter a single number (1, 2, or 3).

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 2
Calculator: enter num1: 54
Number 1 sent: 54 (sent 3 bytes)
Calculator: enter num2: 2
Number 2 sent: 2 (sent 2 bytes)
Server response: Numbers received: 54.000000 and 2.000000. Please enter a calculation or type 'stop' to exit.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: add
Result: 56.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: subtract
Invalid operation. Please enter 'add', 'subtract', 'multiply', 'divide', or 'stop'.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: divide
Result: 27.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: multiply
Result: 108.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: stop
Total bytes sent during calculator operations: 30
Total bytes for program Received 1163955 bytes
Total Time taken for : 19.42 milliseconds
```

```
Oct 22 20:51
osboxes@osboxes: ~
3. Exit
Enter your choice: 2
Calculator: enter num1: 54
Number 1 sent: 54 (sent 3 bytes)
Calculator: enter num2: 2
Number 2 sent: 2 (sent 2 bytes)
Server response: Numbers received: 54.000000 and 2.000000. Please enter a calculation or type 'stop' to exit.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: add
Result: 56.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: subtract
Invalid operation. Please enter 'add', 'subtract', 'multiply', 'divide', or 'stop'.
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: divide
Result: 27.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: multiply
Result: 108.000000
Enter operation (add, subtract, multiply, divide) or type 'stop' to exit: stop
Total bytes sent during calculator operations: 30
Total bytes for program Received 1163955 bytes
Total Time taken for : 19.42 milliseconds

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: Invalid input, please enter a single number (1, 2, or 3).

----- Menu -----
1. Send a file to the server
2. Calculator
3. Exit
Enter your choice: 1
Enter file name 1: 
```

2. Attach source code, output file, and related images to a single file (i.e., zip all files into one

Sources:

[c - Sending images over sockets - Stack Overflow](#)