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CSE 344 – System Programming

Homework 4 Report

General Information

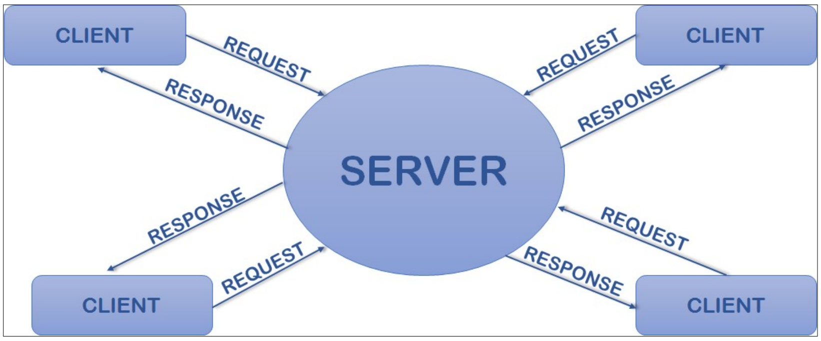
- The implementation of upload and download commands are missing. All commands are received from the client and sent to the server.
- I couldn't handle signals like Ctrl+C. (You can see the structure in the code, but I commented it out because it didn't work.) However, the "kill" request from the client is successful.
- In the server, I keep a separate temp for each connected client. But, when a client disconnects, the temps can get mixed up, and sometimes it can mistakenly display the number of a client that has disconnected. But that's not the case, you can see it from the client PIDs.
- Every time a client connects, I open a log file with the client's PID and also print the PID on the screen to ensure control.
- In the server log, I keep the server PID when the server is started. This allows clients to read it and connect.
- The "Connect/tryConnect" variable that I receive during client connection doesn't actually have any function. If the server PID is correct, it connects; otherwise, it doesn't connect.
- I try to make lots of error check in the assignment.
- I tried my best but however there are still places in the code where it may fail.

System Architecture

The system consists of two main components: a server and clients.

The server provides a service that manages access to files for multiple clients and handles their requests.

The client is a program that sends file operation requests to the server and receives responses from the server.



- **Server Architecture:**

  - The server starts in the main function.

  - The server has a signal handler. (but not working)

  - The server creates and opens a server FIFO (named pipe) for communication with clients.

  - The server defines variables necessary to manage a set of FIFOs and file operations.

  - The server enters a loop waiting for client connections. Within the loop, the server waits for client connections, reads the client's request, and assigns a thread from the thread pool to handle the client connection.

  - Each client connection, the server is managed by a separate thread using the clientHandler function. This function handles the client's requests and performs the required operations based on the received command.

  - The server implements a thread pool to handle multiple client connections concurrently. The size of the thread pool is determined by the poolSize parameter provided as a command-line argument. Threads from the pool are assigned to handle client connections as they become available.

  - The server cleans up the server FIFO and other resources, and continues the loop.

  - The server stops accepting new connections when a user specified maximum number of clients is reached.

- **Client Architecture:**

  - The client is a program that connects to the server and sends requests for file operations.

  - The client receives user commands and uses a FIFO to communicate with the server.

  - The client parses user input to generate requests and sends them to the server.

  - The client receives responses from the server and prints them to the screen or writes them to files.

  - The client allows the user to terminate the communication with the server using special commands like "quit" or "killServer".

Design Decisions and Implementation Details

- I had created separate functions for everything while designing, which made it look organized. However, I couldn't communicate sometimes with the server . But when I did everything in the main function, there was no problem. Therefore, the readability of the code became a bit low.

- **header.h**

  - It contains #define statements to define constants such as buffer sizes or maximum number of clients.

  - It includes struct definitions for data structures used in the client - server communication, such as message formats.

- **biboServer.c**

  - The server program starts by creating a server FIFO using the mkfifo system call.

  - It opens the server FIFO using the open system call, enabling it to read client requests.

  - The server initialize a counter variable, such as num_clients, to keep track of the number of connected clients.

  - It uses loop to continuously accept client connections with thread.

  - The thread pool is implemented using a fixed-size thread pool model. The server creates a pool of threads at startup, and each thread is responsible for handling client connections.

  - Inside the thread function, the server opens the client FIFO using the open system call.

  - The server reads the client's request from the client FIFO and handles it accordingly.

  - It performs file operations or other tasks based on the received request.

  - The server then writes the response to the client FIFO using the write system call.

  - The server handles multiple client requests in a loop until it receives a termination signal or reaches a client limit.

- **biboClient.c**

  - The client program likely starts by creating a FIFO for receiving responses from the server, using the mkfifo system call.

  - It then opens the server FIFO using the open system call, allowing the client to write requests to the server.

  - To send a request, the client use the write system call to write data to the server FIFO.

  - After sending the request, the client reads the response from its specific FIFO(created with client's PID) using the open and read system calls.

  - The client may have a loop that allows it to send multiple requests and receive corresponding responses until it decides to stop or terminate.

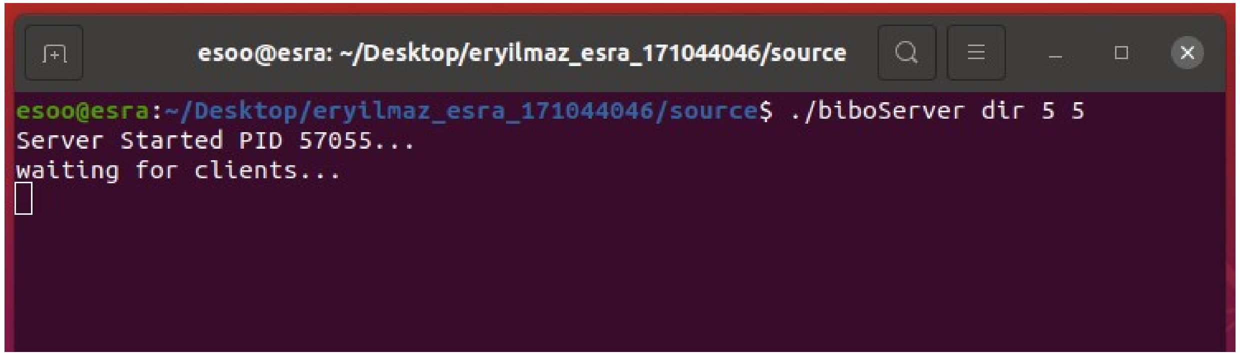
- **makefile**

  - It compiles the project as a whole.

Tests

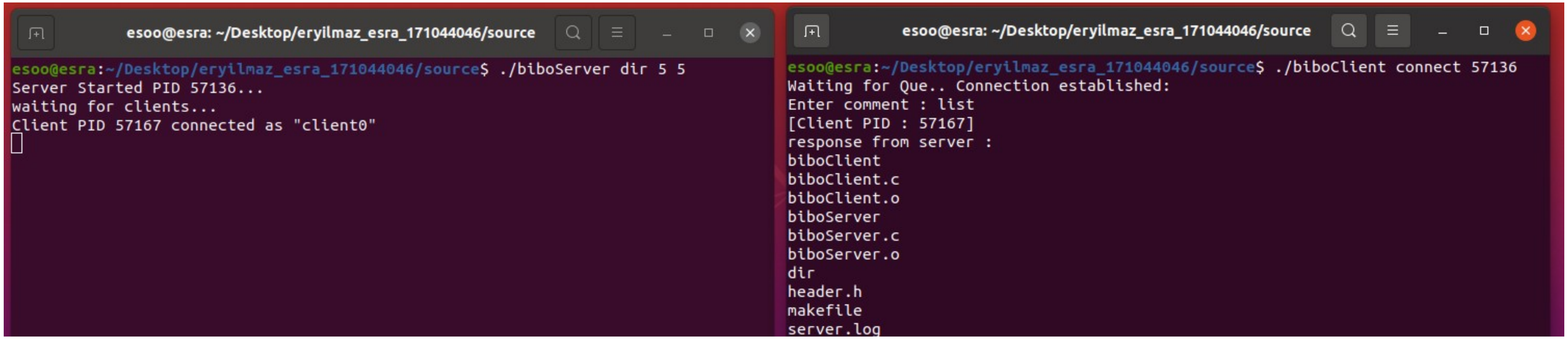
- Usage :

Firstly we start our server.



```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir 5 5
Server Started PID 57055...
waiting for clients...
```

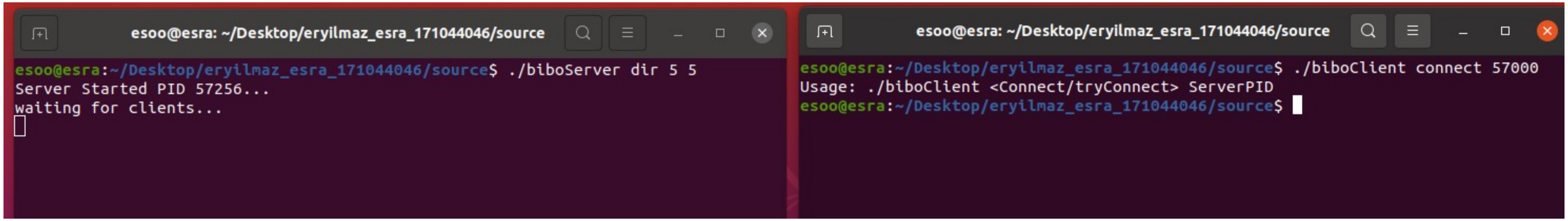
We can connect client to the server.



```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir 5 5
Server Started PID 57136...
waiting for clients...
Client PID 57167 connected as "client0"
```

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 57136
Waiting for Que.. Connection established:
Enter comment : list
[Client PID : 57167]
response from server :
biboClient
biboClient.c
biboClient.o
biboServer
biboServer.c
biboServer.o
dir
header.h
makefile
server.log
```

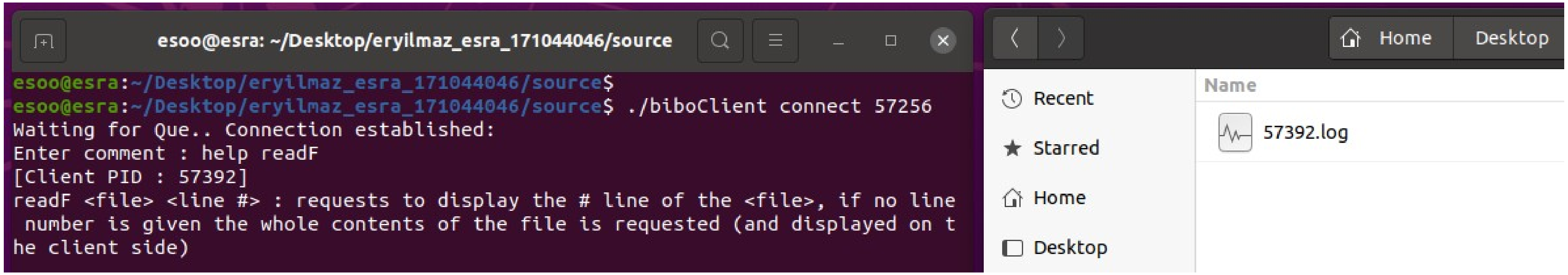
The client should enter the correct server PID


esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir 5 5
Server Started PID 57256...
waiting for clients...
```

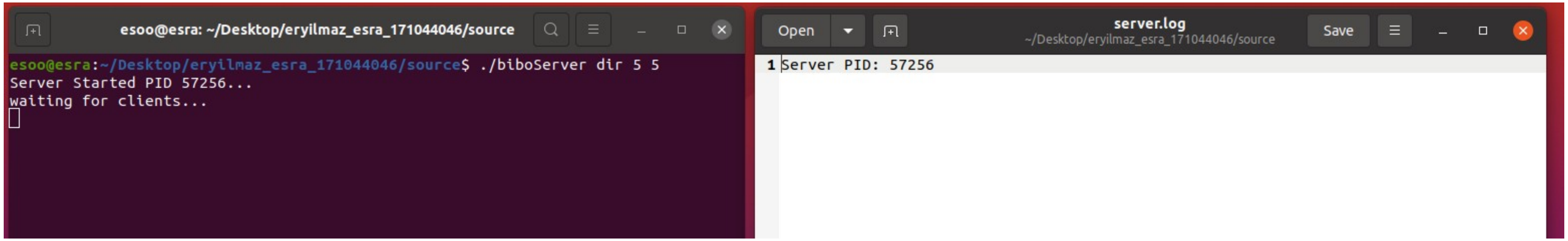
```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 57000
Usage: ./biboClient <Connect/tryConnect> ServerPID
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$
```

A log file is created when the client connects and the name of the created log file is the client's PID.



```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 57256
Waiting for Que.. Connection established:
Enter comment : help readF
[Client PID : 57392]
readF <file> <line #> : requests to display the # line of the <file>, if no line
 number is given the whole contents of the file is requested (and displayed on t
he client side)
```

Server log

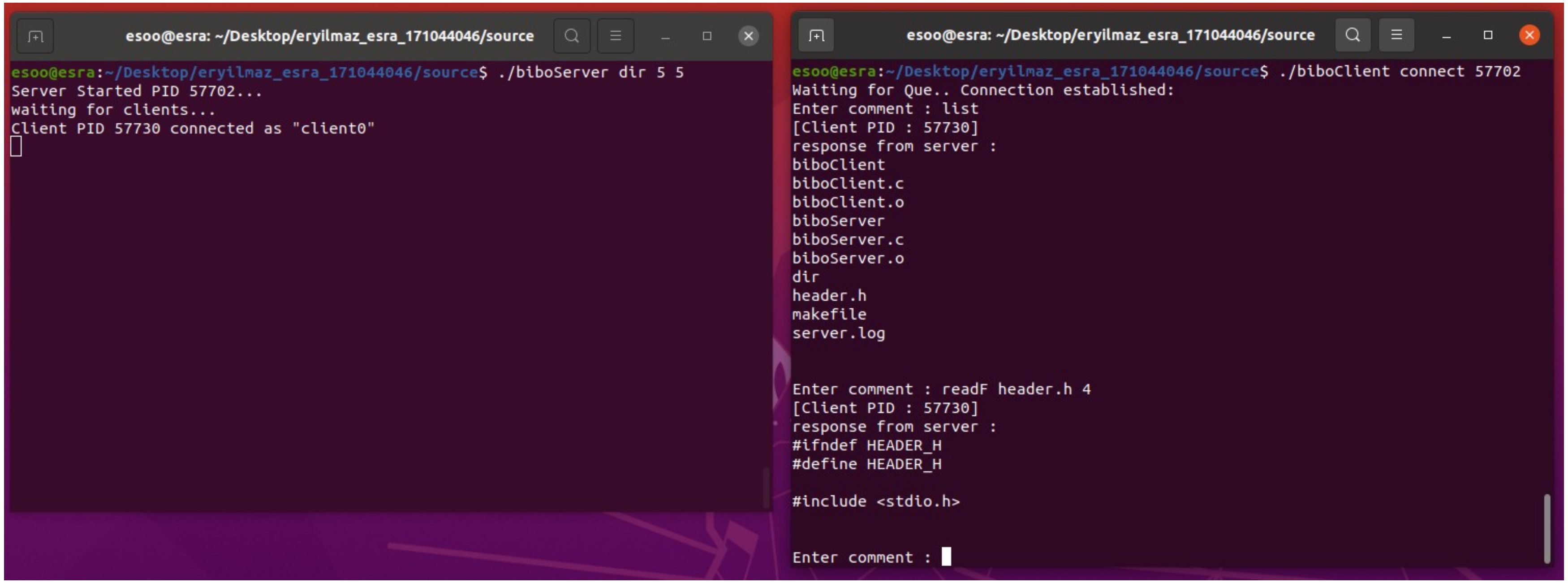

esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
Open
server.log
~/Desktop/eryilmaz_esra_171044046/source
Save

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir 5 5
Server Started PID 57256...
waiting for clients...
```

```
Server PID: 57256
```

List

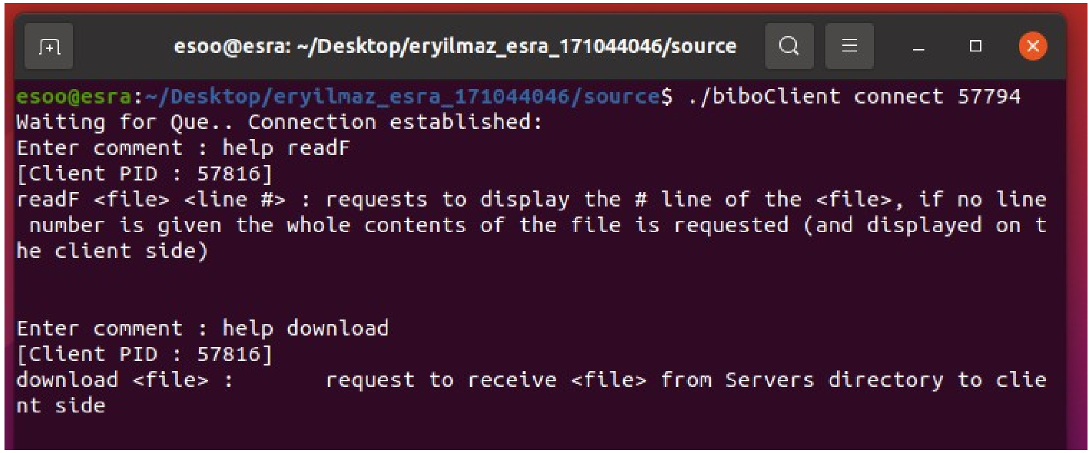
ReadF


esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir 5 5
Server Started PID 57702...
waiting for clients...
Client PID 57730 connected as "client0"
```

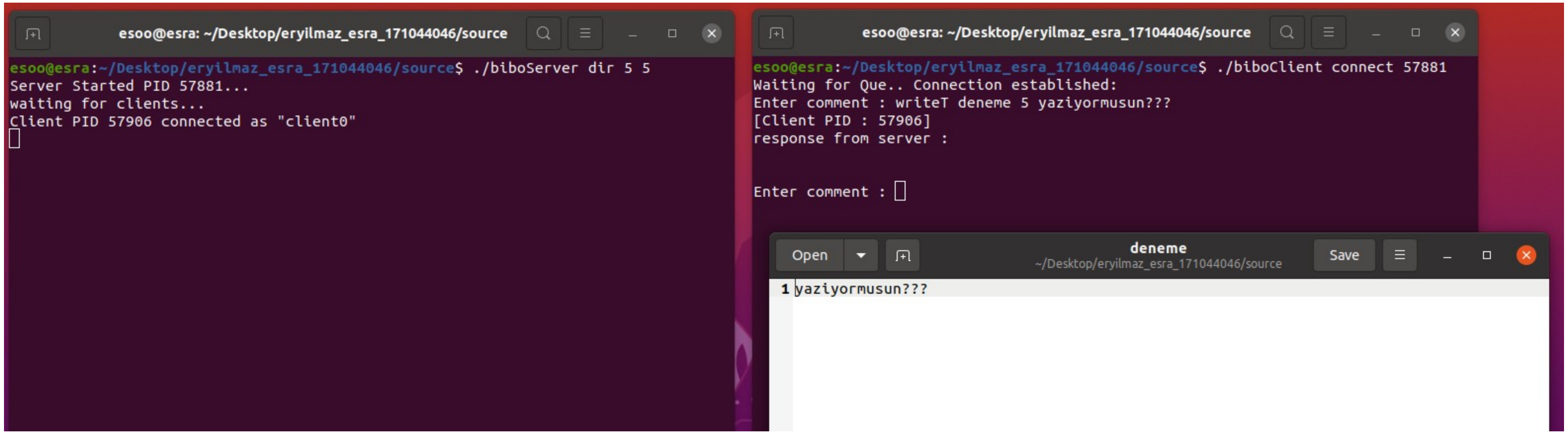
```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 57702
Waiting for Que.. Connection established:
Enter comment : list
[Client PID : 57730]
response from server :
biboClient
biboClient.c
biboClient.o
biboServer
biboServer.c
biboServer.o
dir
header.h
makefile
server.log


Enter comment : readF header.h 4
[Client PID : 57730]
response from server :
#ifndef HEADER_H
#define HEADER_H

#include <stdio.h>


Enter comment :
```

Help



```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 57794
Waiting for Que.. Connection established:
Enter comment : help readF
[Client PID : 57816]
readF <file> <line #> : requests to display the # line of the <file>, if no line
 number is given the whole contents of the file is requested (and displayed on t
he client side)


Enter comment : help download
[Client PID : 57816]
download <file> :       request to receive <file> from Servers directory to clie
nt side
```

Write

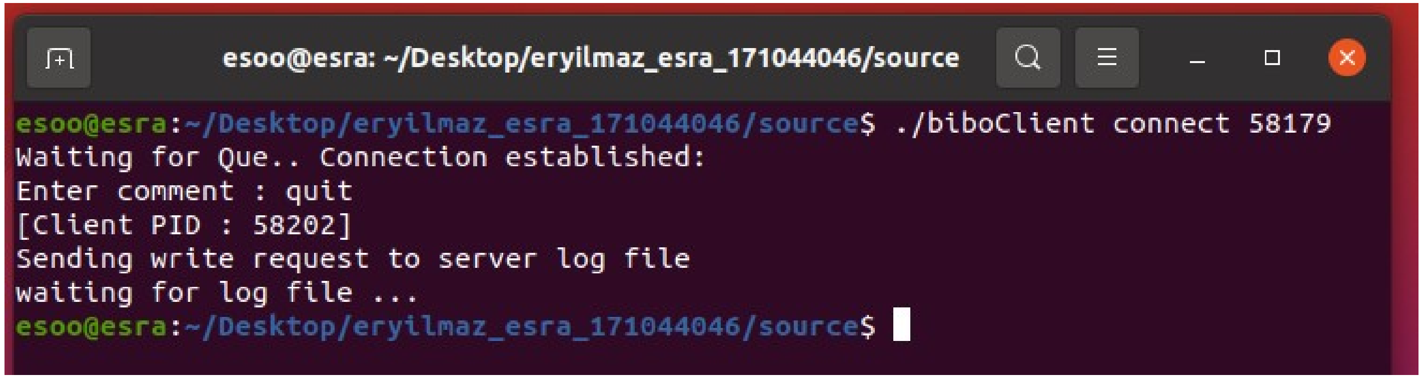

esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
Open
deneme
~/Desktop/eryilmaz_esra_171044046/source
Save

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir 5 5
Server Started PID 57881...
waiting for clients...
Client PID 57906 connected as "client0"
```

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 57881
Waiting for Que.. Connection established:
Enter comment : writeT deneme 5 yaziyormusun???
[Client PID : 57906]
response from server :


Enter comment :
```

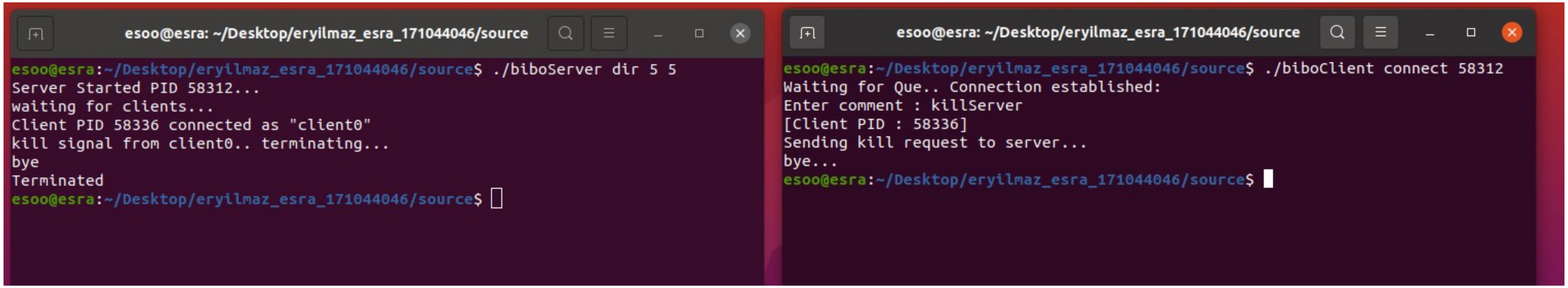
```
yaziyormusun???
```

Quit



```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 58179
Waiting for Que.. Connection established:
Enter comment : quit
[Client PID : 58202]
Sending write request to server log file
waiting for log file ...
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ 
```

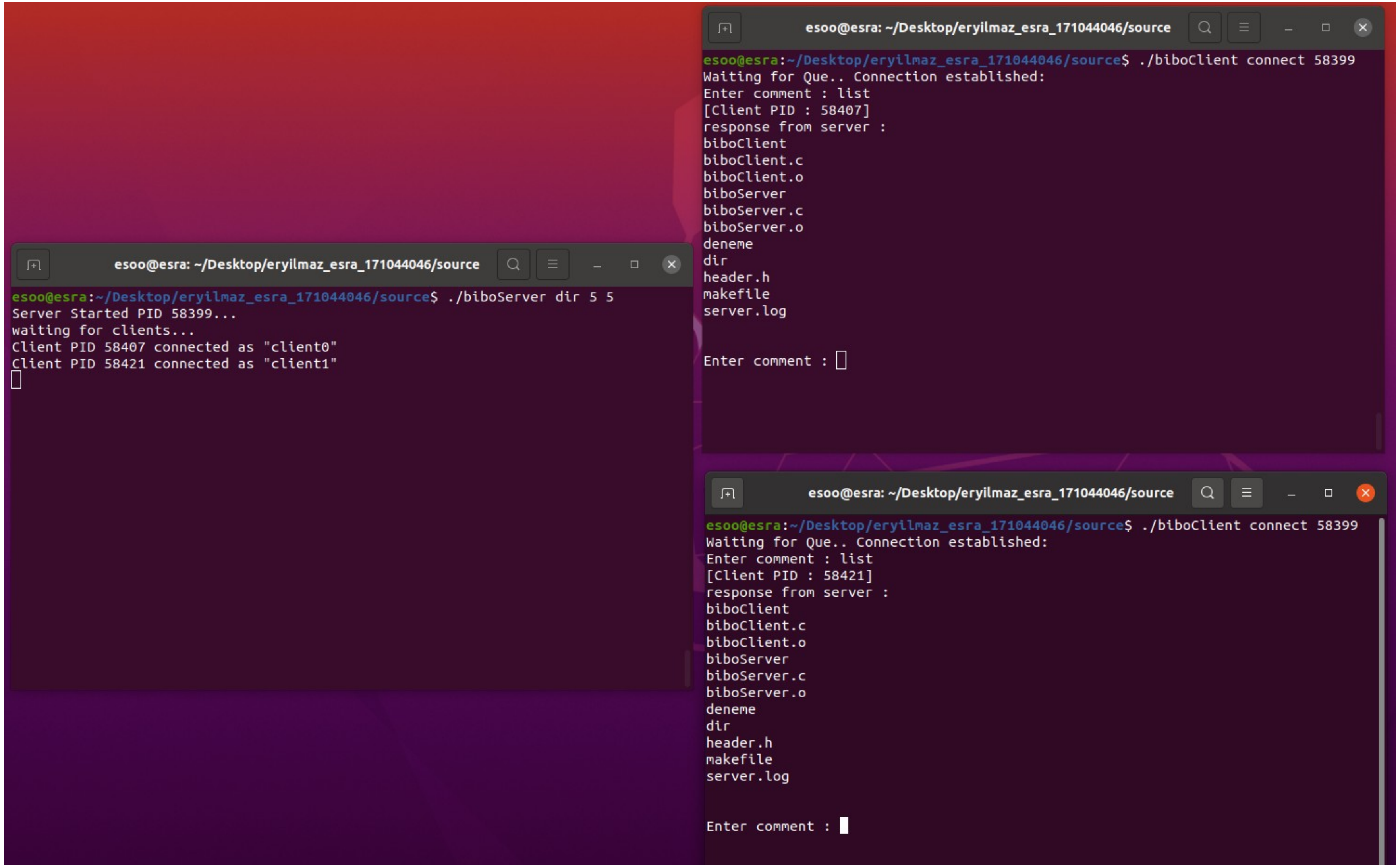
KillServer


esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir 5 5
Server Started PID 58312...
waiting for clients...
Client PID 58336 connected as "client0"
kill signal from client0.. terminating...
bye
Terminated
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ 
```

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 58312
Waiting for Que.. Connection established:
Enter comment : killServer
[Client PID : 58336]
Sending kill request to server...
bye...
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ 
```

Connecting multiple clients



esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir 5 5
Server Started PID 58399...
waiting for clients...
Client PID 58407 connected as "client0"
Client PID 58421 connected as "client1"
```

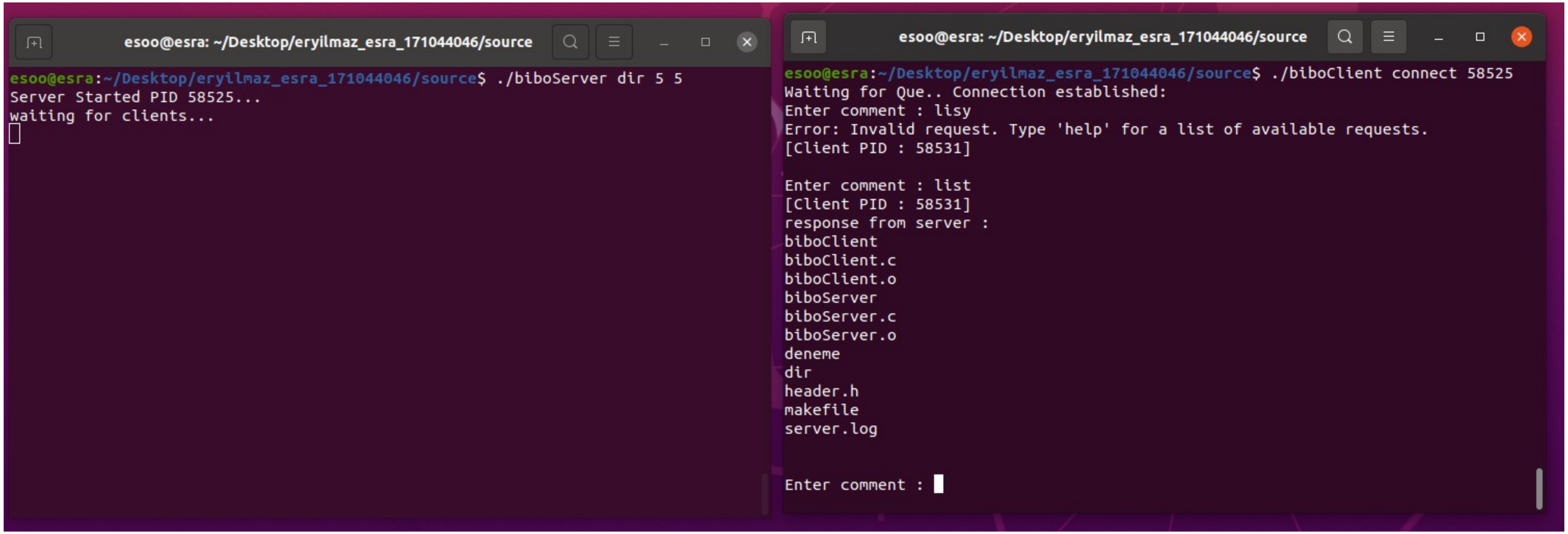
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 58399
Waiting for Que.. Connection established:
Enter comment : list
[Client PID : 58407]
response from server :
biboClient
biboClient.c
biboClient.o
biboServer
biboServer.c
biboServer.o
deneme
dir
header.h
makefile
server.log

Enter comment :
```

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 58399
Waiting for Que.. Connection established:
Enter comment : list
[Client PID : 58421]
response from server :
biboClient
biboClient.c
biboClient.o
biboServer
biboServer.c
biboServer.o
deneme
dir
header.h
makefile
server.log

Enter comment :
```

It may not always works properly. For example :

It didn’t give any response from server side. (It should write : Client PID ... connected...)



esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir 5 5
Server Started PID 58525...
waiting for clients...
```

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 58525
Waiting for Que.. Connection established:
Enter comment : lisy
Error: Invalid request. Type 'help' for a list of available requests.
[Client PID : 58531]

Enter comment : list
[Client PID : 58531]
response from server :
biboClient
biboClient.c
biboClient.o
biboServer
biboServer.c
biboServer.o
deneme
dir
header.h
makefile
server.log


Enter comment :
```