

CSE 344 – System Programming

Midterm Project Report

16.05.2023

✚ General Information

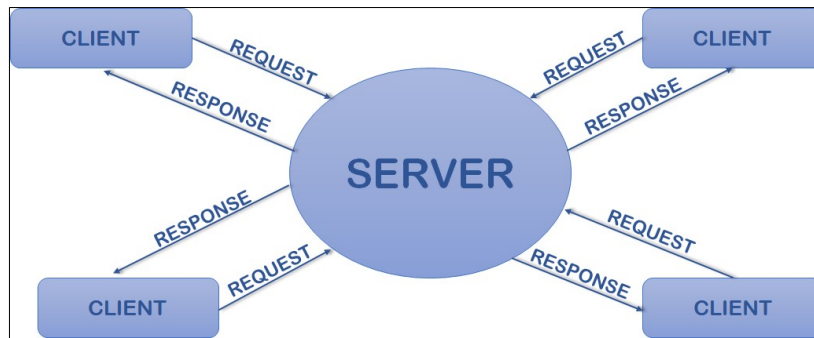
- The implementation of upload and download commands are missing. All commands are received from the client and sent to the server, but I ran out of time to implement them.
- I couldn't handle signals like Ctrl+C. (You can see the structure in the code, but I commented it out because it didn't work.) 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.
- Each client connection, the server creates a child process and hands over the client connection to this process.
- The child process reads and processes client requests, and sends responses back to the client.
- 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.

- I have used some inter-process communication methods, mainly FIFOs and pipes. Although there are signals available, as I mentioned before, they do not function properly. However, there are "quit" and "kill" requests.

- **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 by forking child processes for each client.

- Inside the child process, the server opens the client FIFO using the open system call.

- The server reads the client's request from the client FIFO and processes 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.

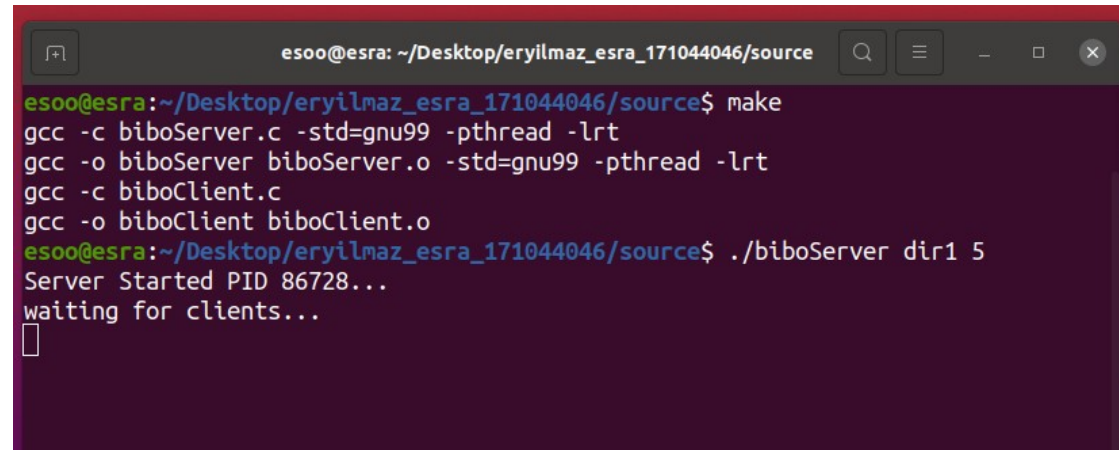
- **makefile**

- It compiles the project as a whole.

🚧 Tests

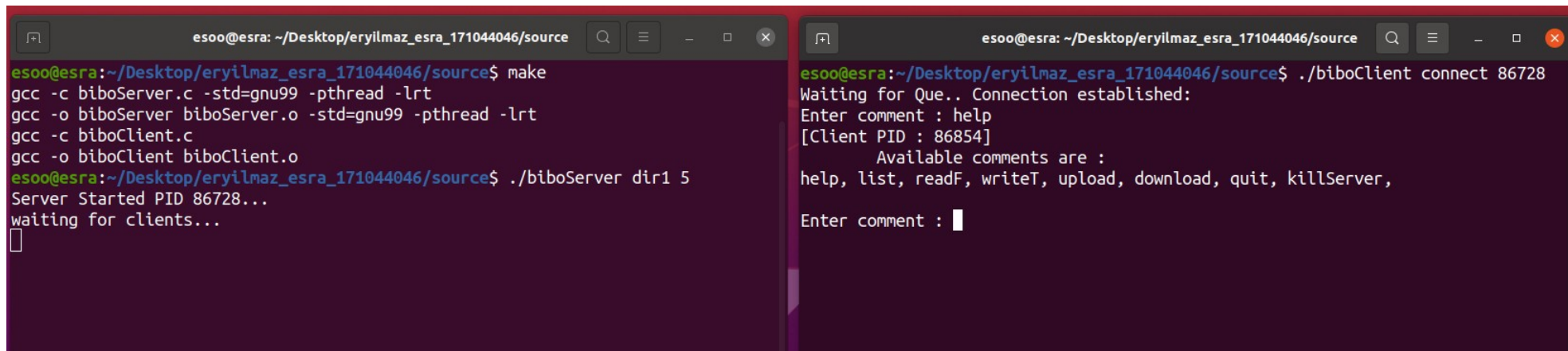
- Usage :

Firstly we start our server.



```
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ make
gcc -c biboServer.c -std=gnu99 -pthread -lrt
gcc -o biboServer biboServer.o -std=gnu99 -pthread -lrt
gcc -c biboClient.c
gcc -o biboClient biboClient.o
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir1 5
Server Started PID 86728...
waiting for clients...
█
```

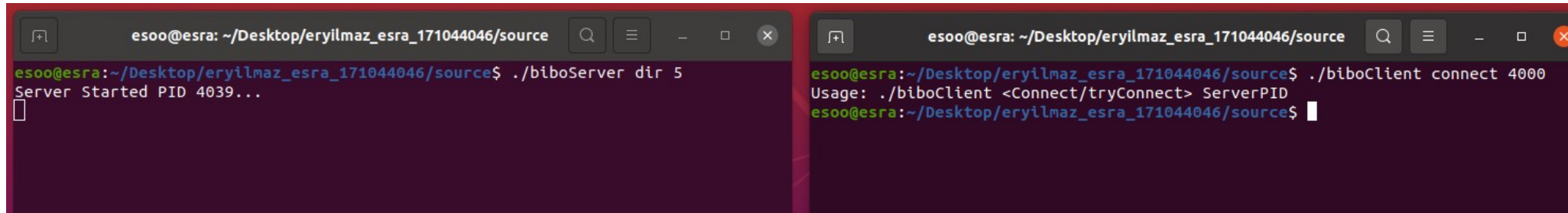
We can connect client to the server.



```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ make
gcc -c biboServer.c -std=gnu99 -pthread -lrt
gcc -o biboServer biboServer.o -std=gnu99 -pthread -lrt
gcc -c biboClient.c
gcc -o biboClient biboClient.o
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir1 5
Server Started PID 86728...
waiting for clients...
█

esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 86728
Waiting for Que.. Connection established:
Enter comment : help
[Client PID : 86854]
    Available comments are :
help, list, readF, writeT, upload, download, quit, killServer,
Enter comment : █
```

The client should enter the correct server PID

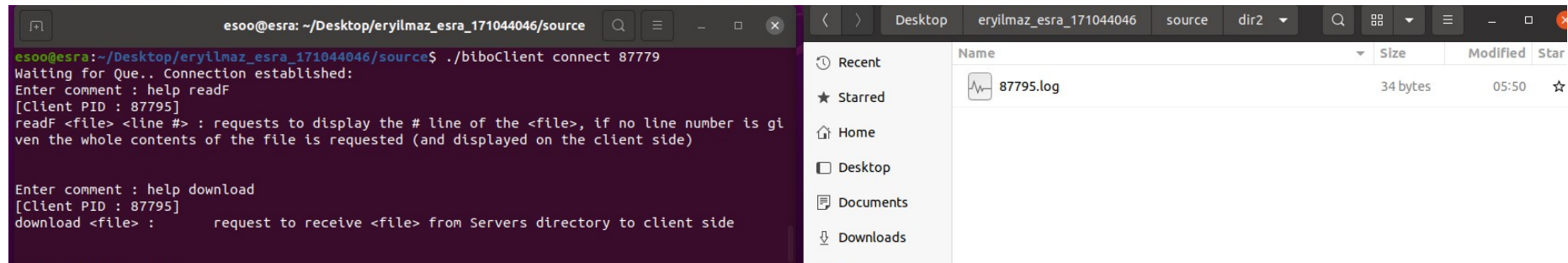


The image shows two terminal windows side-by-side. The left window shows the command `./biboServer dir 5` being executed, resulting in the output `Server Started PID 4039...`. The right window shows the command `./biboClient connect 4000` being executed, with the usage information `Usage: ./biboClient <Connect/tryConnect> ServerPID` displayed below it.

```
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir 5
Server Started PID 4039...
█

esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 4000
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.



The image shows a terminal window and a file explorer. The terminal window shows the command `./biboClient connect 87779` being executed, resulting in the output `Waiting for Que.. Connection established:`. The file explorer shows a file named `87795.log` in the `Desktop` directory, with a size of 34 bytes and a modification time of 05:50.

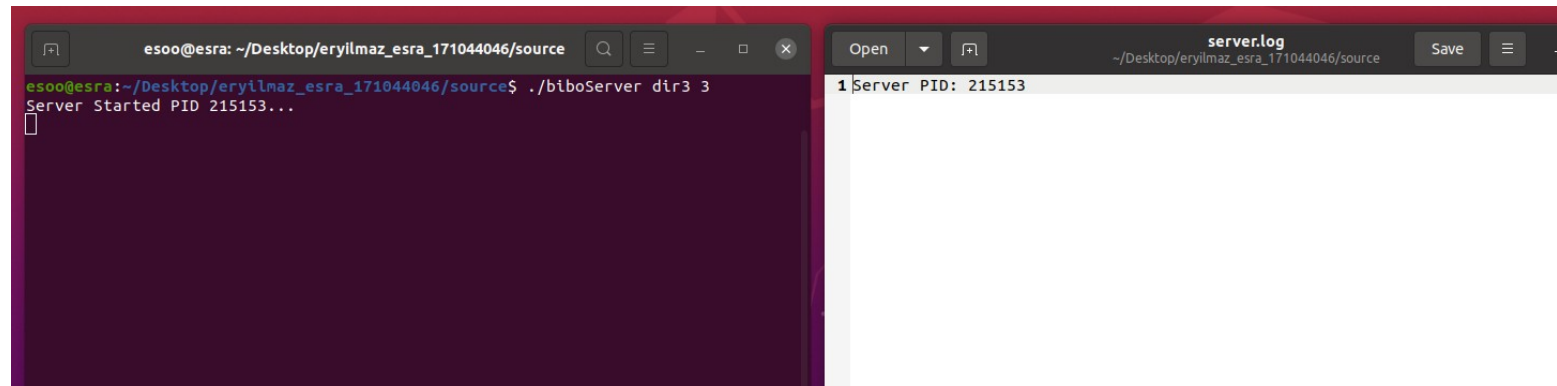
```
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 87779
Waiting for Que.. Connection established:
Enter comment : help readF
[Client PID : 87795]
readF <file> <line #> : requests to display the # line of the <file>, if no line number is gi
ven the whole contents of the file is requested (and displayed on the client side)

Enter comment : help download
[Client PID : 87795]
download <file> :      request to receive <file> from Servers directory to client side
```

File Explorer: Desktop / eryilmaz_esra_171044046 / source / dir2

Name	Size	Modified	Star
87795.log	34 bytes	05:50	☆

Server log



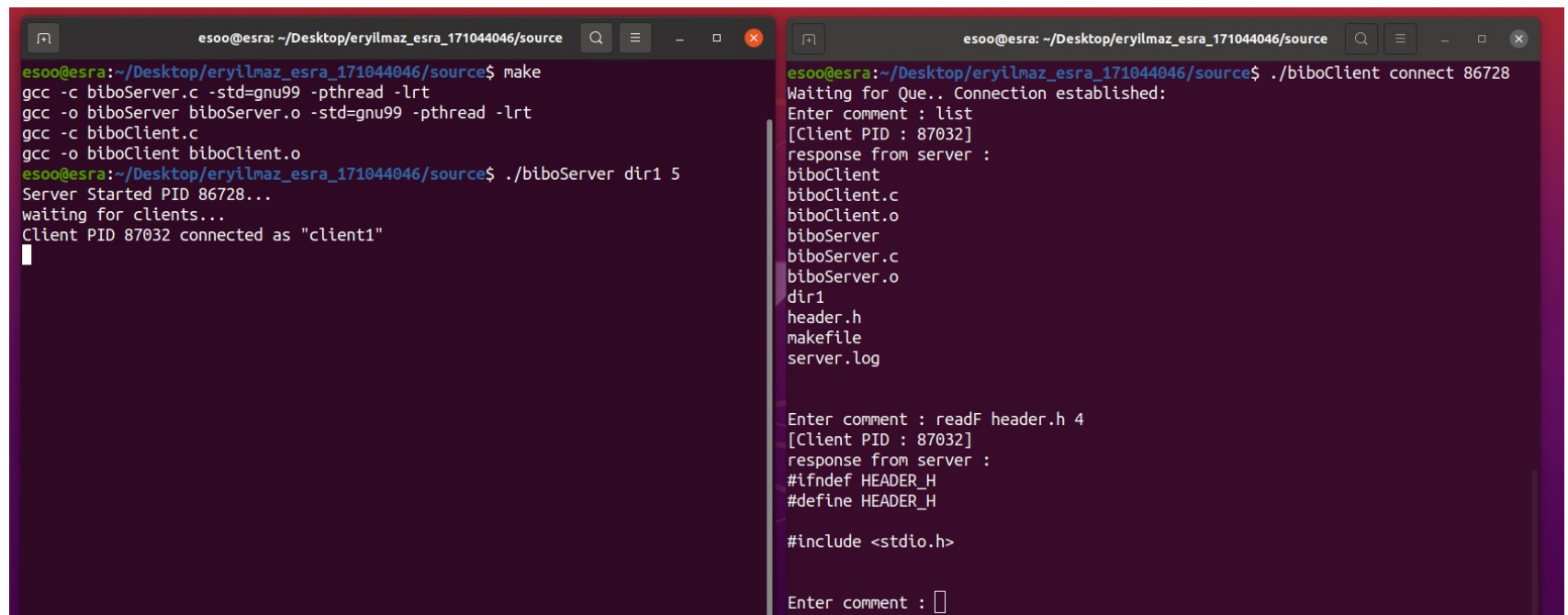
The image shows a terminal window on the left and a log file named 'server.log' on the right. The terminal window title is 'esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source'. The terminal output shows the command './biboServer dir3 3' being executed, resulting in 'Server Started PID 215153...'. The log file 'server.log' shows the entry '1 Server PID: 215153'.

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir3 3
Server Started PID 215153...
```

```
server.log
1 Server PID: 215153
```

List

ReadF



The image shows two terminal windows. The left window shows the compilation of 'biboServer.c' and 'biboClient.c' using 'gcc' with flags '-std=gnu99', '-pthread', and '-lrt'. It then shows the execution of './biboServer dir1 5', which starts the server with PID 86728 and waits for clients. A client with PID 87032 connects as 'client1'. The right window shows the execution of './biboClient connect 86728', which establishes a connection. The client then enters the command 'list', and the server responds with a list of files: 'biboClient', 'biboClient.c', 'biboClient.o', 'biboServer', 'biboServer.c', 'biboServer.o', 'dir1', 'header.h', 'makefile', and 'server.log'. The client then enters the command 'readF header.h 4', and the server responds with the content of 'header.h', which is '#ifndef HEADER_H', '#define HEADER_H', and '#include <stdio.h>'. The client then enters the command 'Enter comment : '.

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ make
gcc -c biboServer.c -std=gnu99 -pthread -lrt
gcc -o biboServer biboServer.o -std=gnu99 -pthread -lrt
gcc -c biboClient.c
gcc -o biboClient biboClient.o
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir1 5
Server Started PID 86728...
waiting for clients...
Client PID 87032 connected as "client1"
```

```
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 86728
Waiting for Que.. Connection established:
Enter comment : list
[Client PID : 87032]
response from server :
biboClient
biboClient.c
biboClient.o
biboServer
biboServer.c
biboServer.o
dir1
header.h
makefile
server.log

Enter comment : readF header.h 4
[Client PID : 87032]
response from server :
#ifndef HEADER_H
#define HEADER_H

#include <stdio.h>

Enter comment :
```


Help

```
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 87779
Waiting for Que.. Connection established:
Enter comment : help readF
[Client PID : 87795]
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 : 87795]
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$ make
gcc -c biboServer.c -std=gnu99 -pthread -lrt
gcc -o biboServer biboServer.o -std=gnu99 -pthread -lrt
gcc -c biboClient.c
gcc -o biboClient biboClient.o
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir1 5
Server Started PID 86728...
waiting for clients...
Client PID 87032 connected as "client1"

```

```
Enter comment : writeT deneme 5 yaziyormusunn??
[Client PID : 87032]
response from server :

Enter comment :
```

```
deneme
~/Desktop/eryilmaz_esra_171044046/source
1 yaziyormusunn??
```


Quit

```
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir 10
Server Started PID 4570...
waiting for clients...
Client PID 4574 connected as "client1"
client1 disconnected..
[]

esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 4570
Waiting for Que.. Connection established:
Enter comment : quit
[Client PID : 4574]
Sending write request to server log file
waiting for log file ...
response from server :

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

KillServer

```
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ make
gcc -c biboServer.c -std=gnu99 -pthread -lrt
gcc -o biboServer biboServer.o -std=gnu99 -pthread -lrt
gcc -c biboClient.c
gcc -o biboClient biboClient.o
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir1 5
Server Started PID 86728...
waiting for clients...
Client PID 87032 connected as "client1"
kill signal from client1.. terminating...
bye
Terminated
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$

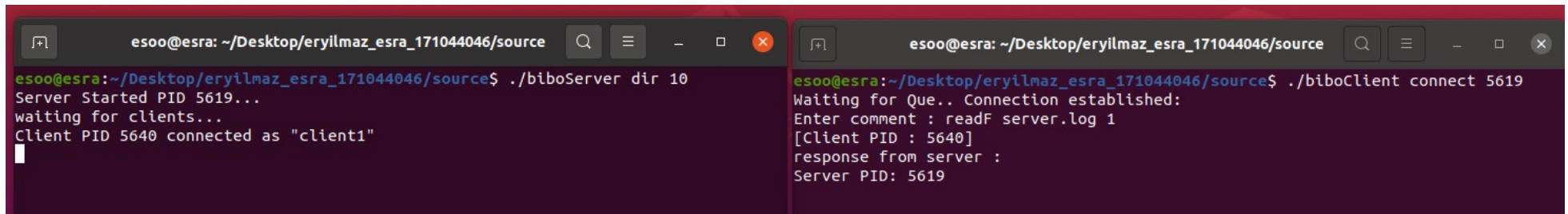
Enter comment : killServer
[Client PID : 87032]
Sending kill request to server...
bye...
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$
```

Connecting multiple clients

```
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source  
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboserver dir 10  
Server Started PID 5212...  
waiting for clients...  
Client PID 5235 connected as "client1"  
Client PID 5263 connected as "client2"  
  
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboclient connect 5212  
Waiting for Que.. Connection established:  
Enter comment : list  
[Client PID : 5235]  
response from server :  
♦♦t♦l♦*♦C♦T♦~♦♦biboclient  
biboclient.c  
biboclient.o  
biboserver  
biboserver.c  
biboserver.o  
deneme  
dir  
header.h  
makefile  
server.log  
  
Enter comment : 
```

It may not always work properly. For example :

It didn't give any response.



The image shows two terminal windows side-by-side. The left window shows the execution of a server program, and the right window shows the execution of a client program.

```
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboServer dir 10
Server Started PID 5619...
waiting for clients...
Client PID 5640 connected as "client1"
█
```

```
esoo@esra: ~/Desktop/eryilmaz_esra_171044046/source
esoo@esra:~/Desktop/eryilmaz_esra_171044046/source$ ./biboClient connect 5619
Waiting for Que.. Connection established:
Enter comment : readF server.log 1
[Client PID : 5640]
response from server :
Server PID: 5619
```