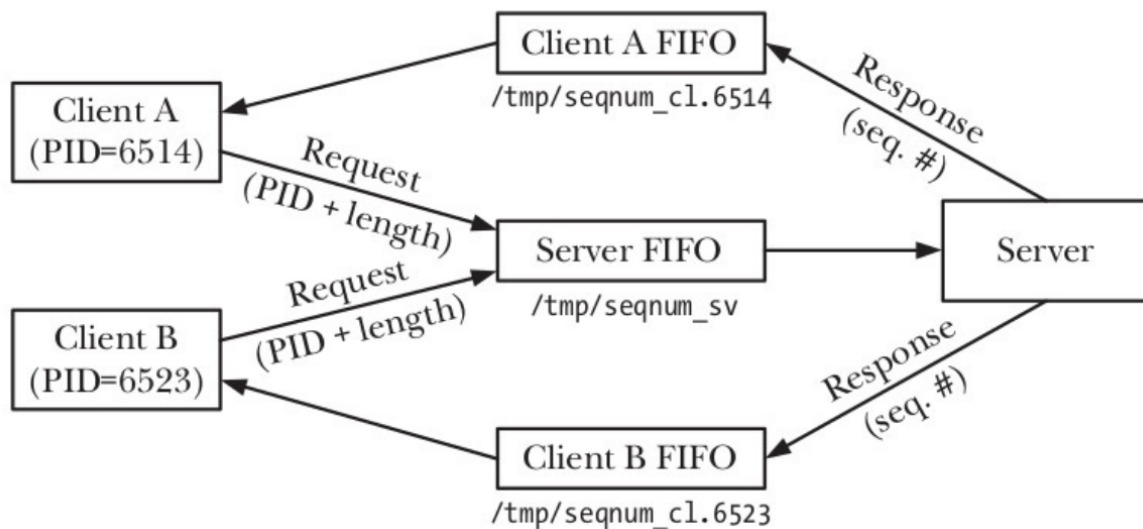


# CSE 344 HW4 REPORT

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# OverAll Design

In this project I used the structure of single-server , multiple-client application:



There is a one server FIFO with named server.PID that accepts the connection requests.

```
typedef struct connectionReq {
    pid_t client_pid;
    int try_flag;
} connectionReq;

typedef struct Request {
    request_type request;
    char filename[256];
    u_int64_t offset;
    char string[8192];
    char client_dir[256];
} Request;
```

My connection requests are consist of client\_pid (needed to open client FIFO which is named client.PID) and try\_flag for the determine if the request is tryConnect or connect. After the connection established. Program uses Request structure to send its requests.

When the server wake up, it generates a thread pool with the given size. Each thread in the pool starts to wait until a connection request comes to request queue in a condition wait. In the main thread server reads its FIFO in a while-true loop. If there are clients their number is less than max\_number then server accepts the connection, otherwise adds request to queue if it is try\_flag is 0, else rejects the request.

Server Side:

```
init_server();

while (1) {
    connectionReq req;
    read(server_fifo_fd, &req, sizeof(connectionReq));

    if (current_clients == max_clients) {
        printf("Connection request PID %d ... Queue is FULL\n", req.client_pid);
        if (req.try_flag) {
            handle_rejected(req.client_pid);
            continue;
        }
    }

    pthread_mutex_lock(&queue_mutex);
    enqueue(&request_queue, req.client_pid);
    pthread_mutex_unlock(&queue_mutex);
    pthread_cond_signal(&queue_not_empty);
}

close_server();
```

```
void* worker_thread(void* arg) {
    while (1) {
        if (kill_flag) {
            pthread_exit(NULL);
        }

        pthread_mutex_lock(&queue_mutex);

        while (is_queue_empty(&request_queue) || current_clients == max_clients) {
            if (kill_flag) {
                pthread_mutex_unlock(&queue_mutex);
                pthread_exit(NULL);
            }

            pthread_cond_wait(&queue_not_empty, &queue_mutex);
        }

        pid_t client_pid = dequeue(&request_queue);
        current_clients++;
        pthread_mutex_unlock(&queue_mutex);

        //Connect to client and start to serve
    }
}
```

To able to provide synchronization between threads when using sharing data (request\_queue), server program uses pthread\_mutex to access data and pthread\_cond variable to check if the data is ready or not in the queue.

## Client Side:

```
// create connection request struct
connectionReq req;
req.client_pid = getpid();
if (strcmp(argv[1], "connect") == 0)
    req.try_flag = 0; // client will wait in the queue
else if (strcmp(argv[1], "tryConnect") == 0)
    req.try_flag = 1; // client will not wait in the queue
else {~

snprintf(client_fifo, sizeof(client_fifo), "/tmp/client.%d", getpid());
if (mkfifo(client_fifo, 0666) == -1) {~

char server_fifo[256];
snprintf(server_fifo, sizeof(server_fifo), "/tmp/server.%d", server_pid);
// send connection request to server
server_fifo_fd = open(server_fifo, O_WRONLY);
if (server_fifo_fd == -1) {
    perror("open server fifo");
    unlink(client_fifo);
    exit(1);
}
if (write(server_fifo_fd, &req, sizeof(connectionReq)) == -1) {
    perror("write");
    close(server_fifo_fd);
    unlink(client_fifo);
    exit(1);
}
```

To be able to keep any number of requests, queue was implemented as linked-list. Queue only keeps client pid as data.

There is also a log file for the server that logs the client requests. To provide any data corruption on the log file I used unnamed semaphore as mutex and server initialize the mutex with pshared arguments as 0 to be able to use between threads.

```
typedef struct node {
    int data;
    struct node* next;
} node_t;

typedef struct {
    node_t* head;
    node_t* tail;
} queue_t;
```

```
void log_message(const char *message) {
    time_t now = time(NULL);
    struct tm *tm_info = localtime(&now);
    char timestamp[20];
    strftime(timestamp, 20, "%Y-%m-%d %H:%M:%S", tm_info);
    char log_msg[1024];
    snprintf(log_msg, sizeof(log_msg), "[%s] %s\n", timestamp, message);
    sem_wait(log_mutex);
    write(log_fd, log_msg, strlen(log_msg));
    sem_post(log_mutex);
}
```

After the connection established, client and server threads use the client FIFO respectively. First one side opens the FIFO for writing other side opens for reading then, writing side closes and opens for reading, reading side closes and opens for writing. Before client sends any commands to server it waits the user input.

```
110 while(running)
111 {
112     // open client fifo for writing
113     client_fifo_fd = open(client_fifo, O_WRONLY | O_CREAT, 0666);
114     if (client_fifo_fd == -1) {~
115
116     Request req;
117     printf("Enter a command: ");
118     char input[BUFSIZE];
119     fgets(input, sizeof(input), stdin);
120     fflush(stdin);
121     input[strlen(input) - 1] = '\0';
122     //parse command according to space character
123     char *token = strtok(input, " ");
124     if (token == NULL){~
125
126     char* command = malloc(strlen(token) + 1);
127     strcpy(command, token);
128     command[strlen(token)] = '\0';
129
130     if (strcmp(command, "help") == 0){~
131
132     else if(strcmp(command,"list") == 0){~
133
134     else if(strcmp(command,"readF") == 0){~
135
136     else if(strcmp(command, "writeT") == 0){~
137
138     else if(strcmp(command, "quit") == 0){~
139
140     else if(strcmp(command, "killServer") == 0){~
141
142     else if(strcmp(command, "download") == 0){~
143
144     else if(strcmp(command, "upload")== 0){~
145
146     else
147         printf("Invalid command!\n");
148 }
```

To provide synchronization between the server's threads when access to files on the server directory, named semaphores was used to avoid any race condition and data corruption.

Semaphores are named with file names on the server to be able to sure correct semaphore(mutex) is locked and opened. Before the termination of the server program unlink them using the files names on the server.

To be able to cleanup threads when client sends killServer commands to server or any SIGINT, SIGTERM, SIGQUIT signal arrives the server, Program keeps the array of the client file descriptors and closes them after cancel the threads in the pool.

```
void close_server(){
    kill_flag = 1;
    close(server_fifo_fd);
    close(log_fd);
    unlink(server_fifo_path);

    // Cancel threads
    for (int i = 0; i < thread_pool_size; i++) {
        pthread_cancel(thread_pool[i]);
    }

    for (int i = 0; i < max_clients; i++)
        close(client_fds[i]);

    DIR* dir = opendir(working_dir);
    if (dir == NULL) {
        perror("opendir");
        exit(1);
    }
    struct dirent* entry;
    while ((entry = readdir(dir)) != NULL) {
        if (strcmp(entry->d_name, ".") == 0 || strcmp(entry->d_name, "..") == 0) {
            continue;
        }
        char semaphore_name[256];
        strcpy(semaphore_name, "/");
        strcat(semaphore_name, entry->d_name);
        sem_unlink(semaphore_name);
    }

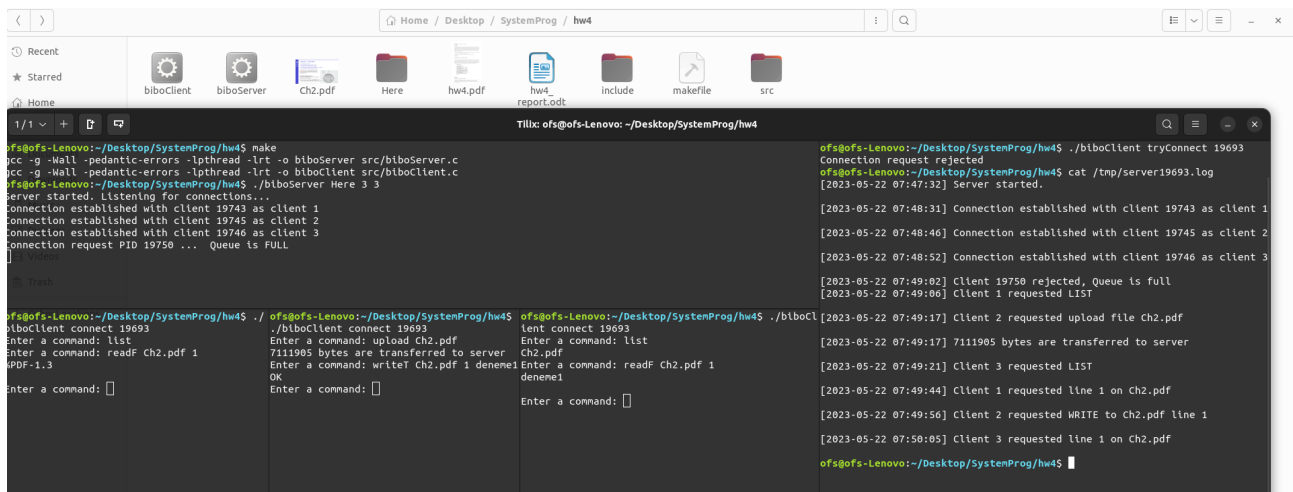
    free(client_fds);
    free(thread_pool);
    sem_destroy(log_mutex);
    pthread_mutex_destroy(&queue_mutex);
    pthread_cond_destroy(&queue_cond);
    empty_queue(&request_queue);
    exit(0);
}

void handle_server_kill(int sig){
    close_server();
}

struct sigaction sigact;
sigact.sa_handler = handle_server_kill;
sigemptyset(&sigact.sa_mask);
sigact.sa_flags = 0;
sigaction(SIGINT, &sigact, NULL);
sigaction(SIGTERM, &sigact, NULL);
sigaction(SIGQUIT, &sigact, NULL);
```

# TEST CASES:

## 1- Open server for existing directory, shows all commands are working.



The screenshot shows a file manager window at the top with icons for 'biboClient', 'biboServer', 'ch2.pdf', 'Here', 'hw4.pdf', 'hw4\_report.odt', 'include', 'makefile', and 'src'. Below it, a terminal window titled 'Tilix: ofs@ofs-Lenovo: ~/Desktop/SystemProg/hw4' displays the following commands and output:

```
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ make
gcc -g -Wall -pedantic-errors -lpthread -lrt -o biboServer src/biboServer.c
gcc -g -Wall -pedantic-errors -lpthread -lrt -o biboClient src/biboClient.c
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ ./biboServer Here 3 3
Server started. Listening for connections...
Connection established with client 17433 as client 1
Connection established with client 1745 as client 2
Connection established with client 1746 as client 3
Connection request PID 1750 ... Queue is FULL

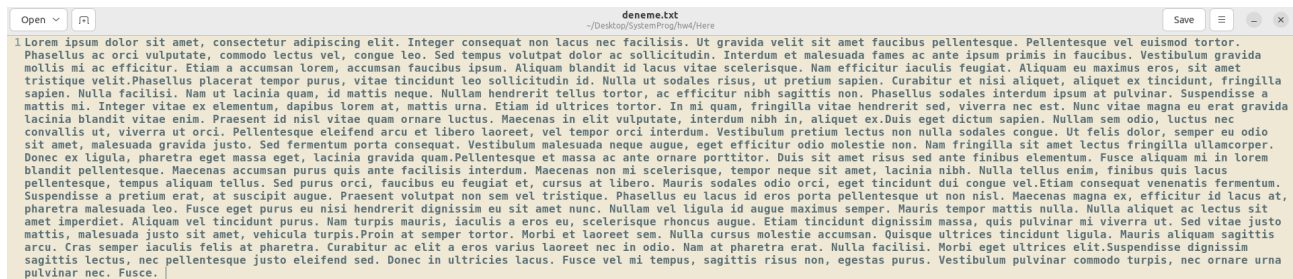
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ ./biboClient connect 19693
biboClient connect 19693
Enter a command: list
Enter a command: readF ch2.pdf 1
PDF-1.3
Enter a command:

ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ ./biboClient connect 19693
./biboClient connect 19693
Enter a command: upload ch2.pdf
711905 bytes are transferred to server
Enter a command: writeF ch2.pdf 1 deneme1
OK
Enter a command:

ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ ./biboClient connect 19693
biboClient connect 19693
Enter a command: list
ch2.pdf
Enter a command: readF ch2.pdf 1
deneme1
Enter a command:

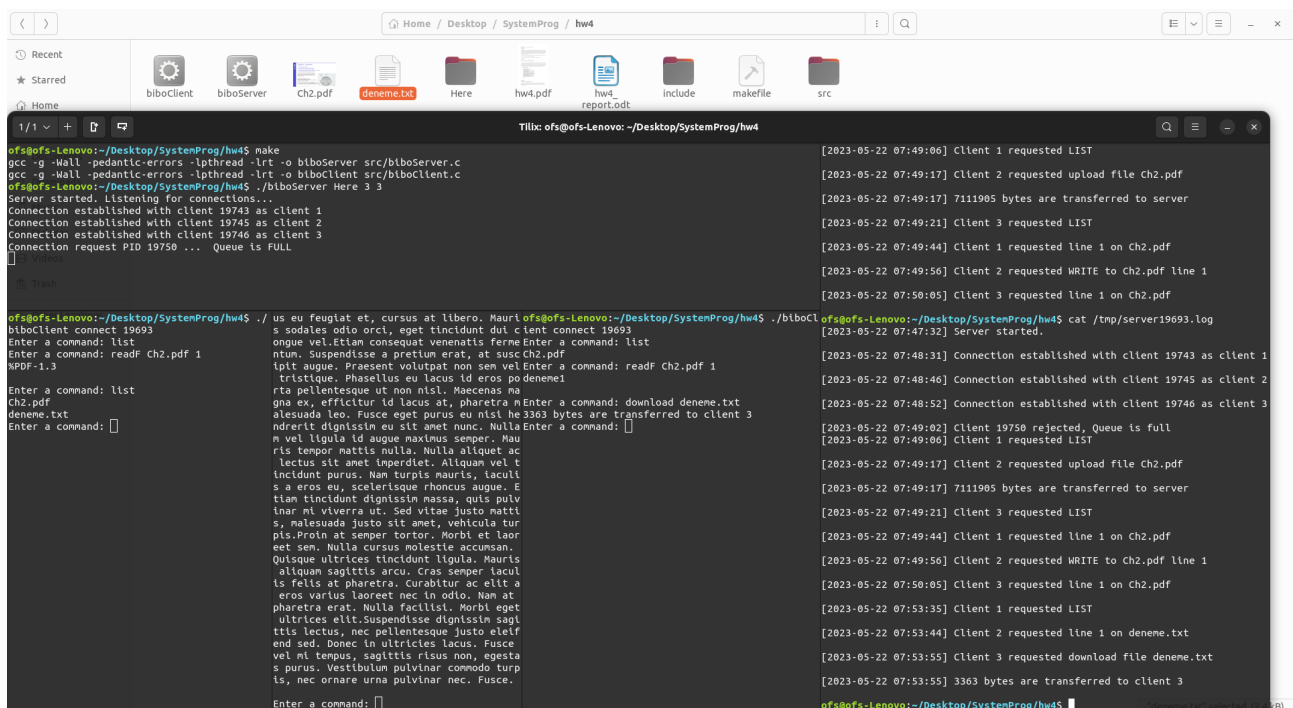
[2023-05-22 07:47:32] Server started.
[2023-05-22 07:48:31] Connection established with client 17433 as client 1
[2023-05-22 07:48:46] Connection established with client 1745 as client 2
[2023-05-22 07:48:52] Connection established with client 1746 as client 3
[2023-05-22 07:49:02] Client 1750 rejected, Queue is full
[2023-05-22 07:49:06] Client 1 requested LIST
[2023-05-22 07:49:17] Client 2 requested upload file ch2.pdf
[2023-05-22 07:49:17] 711905 bytes are transferred to server
[2023-05-22 07:49:21] Client 3 requested LIST
[2023-05-22 07:49:44] Client 1 requested line 1 on ch2.pdf
[2023-05-22 07:49:56] Client 2 requested WRITE to ch2.pdf line 1
[2023-05-22 07:50:05] Client 3 requested line 1 on ch2.pdf
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$
```

Now adding deneme.txt to Here directory manually to test download option.



The screenshot shows a text editor window titled 'deneme.txt' with the following content:

```
1 Lorem ipsum dolor sit amet, consectetur adipiscing elit. Integer consequat non lacus nec facilisis. Ut gravida velit sit amet faucibus pellentesque. Pellentesque vel euismod tortor.
Phasellus ac orci vulputate, commodo lectus vel, congue leo. Sed tempus volutpat dolor ac sollicitudin. Interdum et malesuada fames ac ante ipsum primis in faucibus. Vestibulum gravida
mollis mi ac efficitur. Etiam a accumsan lorem, accumsan faucibus ipsum. Aliquam blandit id lacus vitae scelerisque. Nam efficitur iaculis feugiat. Aliquam eu maximus eros, sit amet
tristique velit. Phasellus placerat tempor purus, vitae tincidunt leo sollicitudin id. Nulla ut sodales risus, ut pretium sapien. Curabitur et nisi aliquet, aliquet ex tincidunt, fringilla
sapien. Nulla facilisi. Nam ut lacinia quam, id mattis neque. Nullam hendrerit tellus tortor, ac efficitur nibh sagittis non. Phasellus sodales interdum ipsum at pulvinar. Suspendisse a
mattis mi. Integer vitae ex elementum, dapibus lorem at, mattis urna. Etiam id ultrices tortor. In mi quam, fringilla vitae hendrerit sed, viverra nec est. Nunc vitae magna eu erat gravida
lacinia blandit vitae enim. Praesent id nisl vitae quam ornare luctus. Maecenas in elit vulputate, interdum nibh in, aliquet ex. Duis eget dictum sapien. Nullam sem odio, luctus nec
convallis ut, viverra ut orci. Pellentesque eleifend arcu et libero laoreet, vel tempor orci interdum. Vestibulum pretium lectus non nulla sodales congue. Ut felis dolor, semper eu odio
sit amet, malesuada gravida justo. Sed fermentum porta consequat. Vestibulum malesuada neque augue, eget efficitur odio molestie non. Nam fringilla sit amet lectus fringilla ullamcorper.
Donec ex ligula, pharetra eget massa eget, lacinia gravida quam. Pellentesque et massa ac ante ornare porttitor. Duis sit amet risus sed ante finibus elementum. Fusce aliquam mi in lorem
blandit pellentesque. Maecenas accumsan purus quis ante facilisis interdum. Maecenas non mi scelerisque, tempor neque sit amet, lacinia nibh. Nulla tellus enim, finibus quis lacus
pellentesque, tempus aliquam tellus. Sed purus orci, faucibus eu feugiat et, cursus at libero. Mauris sodales odio orci, eget tincidunt dui congue vel. Etiam consequat venenatis fermentum.
Suspendisse a pretium erat, at suscipit augue. Praesent volutpat non sem vel tristique. Phasellus eu lacus id eros porta pellentesque ut non nisl. Maecenas magna ex, efficitur id lacus at,
pharetra malesuada leo. Fusce eget purus eu nisi hendrerit dignissim eu sit amet nunc. Nullam vel ligula id augue maximus semper. Mauris tempor mattis nulla. Nulla aliquet ac lectus sit
amet imperdiet. Aliquam vel tincidunt purus. Nam turpis mauris, iaculis a eros eu, scelerisque rhoncus augue. Etiam tincidunt dignissim massa, quis pulvinar mi viverra ut. Sed vitae justo
mattis, malesuada justo sit amet, vehicula turpis. Proin at semper tortor. Morbi et laoreet sem. Nulla cursus molestie accumsan. Quisque ultrices tincidunt ligula. Mauris aliquam sagittis
arcu. Cras semper iaculis felis at pharetra. Curabitur ac elit a eros varius laoreet nec in odio. Nam at pharetra erat. Nulla facilisi. Morbi eget ultrices elit. Suspendisse dignissim
sagittis lectus, nec pellentesque justo eleifend sed. Donec in ultricies lacus. Fusce vel mi tempus, sagittis risus non, egestas purus. Vestibulum pulvinar commodo turpis, nec ornare urna
pulvinar nec. Fusce.
```



The screenshot shows a file manager window at the top with icons for 'biboClient', 'biboServer', 'ch2.pdf', 'deneme.txt', 'Here', 'hw4.pdf', 'hw4\_report.odt', 'include', 'makefile', and 'src'. Below it, a terminal window titled 'Tilix: ofs@ofs-Lenovo: ~/Desktop/SystemProg/hw4' displays the following commands and output:

```
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ make
gcc -g -Wall -pedantic-errors -lpthread -lrt -o biboServer src/biboServer.c
gcc -g -Wall -pedantic-errors -lpthread -lrt -o biboClient src/biboClient.c
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ ./biboServer Here 3 3
Server started. Listening for connections...
Connection established with client 17433 as client 1
Connection established with client 1745 as client 2
Connection established with client 1746 as client 3
Connection request PID 1750 ... Queue is FULL

ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ ./biboClient connect 19693
biboClient connect 19693
Enter a command: list
Enter a command: readF ch2.pdf 1
PDF-1.3
Enter a command: list
ch2.pdf
deneme.txt
Enter a command:

ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ ./biboClient connect 19693
./biboClient connect 19693
Enter a command: list
ch2.pdf
deneme.txt
Enter a command:

[2023-05-22 07:49:06] Client 1 requested LIST
[2023-05-22 07:49:17] Client 2 requested upload file ch2.pdf
[2023-05-22 07:49:17] 711905 bytes are transferred to server
[2023-05-22 07:49:21] Client 3 requested LIST
[2023-05-22 07:49:44] Client 1 requested line 1 on ch2.pdf
[2023-05-22 07:49:56] Client 2 requested WRITE to ch2.pdf line 1
[2023-05-22 07:50:05] Client 3 requested line 1 on ch2.pdf
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ ./biboClient connect 19693
biboClient connect 19693
Enter a command: list
ch2.pdf
deneme.txt
Enter a command:

[2023-05-22 07:49:06] Client 1 requested LIST
[2023-05-22 07:49:17] Client 2 requested upload file ch2.pdf
[2023-05-22 07:49:17] 711905 bytes are transferred to server
[2023-05-22 07:49:21] Client 3 requested LIST
[2023-05-22 07:49:44] Client 1 requested line 1 on ch2.pdf
[2023-05-22 07:49:56] Client 2 requested WRITE to ch2.pdf line 1
[2023-05-22 07:50:05] Client 3 requested line 1 on ch2.pdf
[2023-05-22 07:53:35] Client 1 requested LIST
[2023-05-22 07:53:44] Client 2 requested line 1 on deneme.txt
[2023-05-22 07:53:55] Client 3 requested download file deneme.txt
[2023-05-22 07:53:55] 3363 bytes are transferred to client 3
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$
```

## 2- Sending 50 connect requests and test if they are in the queue

```
TiX: of@of-Lenovo: ~/Desktop/SystemProg/hw4$
Connection request PID 20603 ... Queue is FULL
Connection request PID 20605 ... Queue is FULL
Connection request PID 20606 ... Queue is FULL
Connection request PID 20607 ... Queue is FULL
Connection request PID 20608 ... Queue is FULL
Connection request PID 20609 ... Queue is FULL
Connection request PID 20604 ... Queue is FULL
Connection request PID 20610 ... Queue is FULL
Connection request PID 20611 ... Queue is FULL
Connection request PID 20612 ... Queue is FULL
Connection request PID 20613 ... Queue is FULL
Connection request PID 20615 ... Queue is FULL
Connection request PID 20614 ... Queue is FULL
Connection request PID 20616 ... Queue is FULL
Connection request PID 20617 ... Queue is FULL
Connection request PID 20619 ... Queue is FULL
Connection request PID 20621 ... Queue is FULL
Connection request PID 20620 ... Queue is FULL
Connection request PID 20618 ... Queue is FULL
Connection request PID 20622 ... Queue is FULL
Connection request PID 20623 ... Queue is FULL
Connection request PID 20624 ... Queue is FULL
Client 1 disconnected
Connection established with client 20575 as client 4
Client 2 disconnected
Connection established with client 20576 as client 5

of@of-Lenovo:~/Desktop/SystemProg/hw4$
itae justo mattis, malesuada
enProg/hw4$ ^C
        justo sit amet, vehicula tu
of@of-Lenovo:~/Desktop/SystemProg/hw4$
        rplis.Proin at semper tortor.
of@of-Lenovo:~/Desktop/SystemProg/hw4$
        morbi et laoreet sem. Nulla of@of-Lenovo:~/Desktop/SystemProg/hw4$
        cursus molestie accumsan. of@of-Lenovo:~/Desktop/SystemProg/hw4$ ./biboclient connect 1969
enProg/hw4$ ./biboclient connect 1969
        usque ultrices tincidunt li3
        gula. Mauris aliquam sagittitEnter a command: list
        s. Enter. Cras semper laculis ch2.pdf
        Enter a command: readf Ch2.pdf
        felis at pharetra. Curabitur Enter a command: readf Ch2.pdf 1
        ac elit et eros varius laoreetene1
        et nec in odio. Nam at phare
        tra erat. Nulla facilisi. Mo Enter a command: download deneme.
        rbi eget ultrices elit.Suspe.txt
        ndisse dignissim sagittis le3363 bytes are transferred to cli
        ctus, nec pellentesque justoest c
        eleifend sed. Donec in ultr Enter a command:
        icies lacus. Fusce vel ni te
        mpus, sagittis risus non, eg
        estas purus. Vestibulum pulv
        lnar commodo turpis, nec orn
        are urna pulvinar nec. Fusce
        .

        Enter a command: quit
        Bye
of@of-Lenovo:~/Desktop/SystemProg/hw4$
of@of-Lenovo:~/Desktop/SystemProg/hw4$
of@of-Lenovo:~/Desktop/SystemProg/hw4$

server19693.log
[2023-05-22 07:47:32] Server started.
[2023-05-22 07:48:31] Connection established with
client 19743 as client 1
[2023-05-22 07:48:46] Connection established with
client 19745 as client 2
[2023-05-22 07:48:52] Connection established with
client 19746 as client 3
[2023-05-22 07:49:02] Client 19750 rejected, Queue
is full
[2023-05-22 07:49:06] Client 1 requested LIST
[2023-05-22 07:49:17] Client 2 requested upload fl
le ch2.pdf
[2023-05-22 07:49:17] 711905 bytes are transfe
red to server
[2023-05-22 07:49:21] Client 3 requested LIST
[2023-05-22 07:49:44] Client 1 requested line 1 on
ch2.pdf
[2023-05-22 07:49:56] Client 2 requested WRITE to
ch2.pdf line 1
[2023-05-22 07:50:05] Client 3 requested line 1 on
ch2.pdf
[2023-05-22 07:53:35] Client 1 requested LIST
[2023-05-22 07:53:44] Client 2 requested line 1 on
deneme.txt
[2023-05-22 07:53:55] Client 3 requested download
file deneme.txt
[2023-05-22 07:53:55] 3363 bytes are transferred t
o client 3
[2023-05-22 07:59:12] Client 1 disconnected
[2023-05-22 07:59:12] Connection established with
client 20575 as client 4
[2023-05-22 07:59:15] Client 2 disconnected
[2023-05-22 07:59:15] Connection established with
client 20576 as client 5

of@of-Lenovo:~/Desktop/SystemProg/hw4$ Enter a co
mmand:
of@of-Lenovo:~/Desktop/SystemProg/hw4$
```

### 3-Sending killServer request

```
Tiffs@ofs-Lenovo: ~/Desktop/SystemProg/hw4$
Connection request PID 20608 ... Queue is FULL
Connection request PID 20609 ... Queue is FULL
Connection request PID 20604 ... Queue is FULL
Connection request PID 20610 ... Queue is FULL
Connection request PID 20611 ... Queue is FULL
Connection request PID 20612 ... Queue is FULL
Connection request PID 20613 ... Queue is FULL
Connection request PID 20615 ... Queue is FULL
Connection request PID 20614 ... Queue is FULL
Connection request PID 20616 ... Queue is FULL
Connection request PID 20617 ... Queue is FULL
Connection request PID 20619 ... Queue is FULL
Connection request PID 20621 ... Queue is FULL
Connection request PID 20620 ... Queue is FULL
Connection request PID 20618 ... Queue is FULL
Connection request PID 20622 ... Queue is FULL
Connection request PID 20623 ... Queue is FULL
Connection request PID 20624 ... Queue is FULL
Client 1 disconnected
Connection established with client 20575 as client 4
Client 2 disconnected
Connection established with client 20576 as client 5
Tifs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ ps
    PID TTY          TIME CMD
   18399 pts/1    00:00 bash
   20801 pts/1    00:00 ps
Tifs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ 
Tifs@ofs-Lenovo:~/Desktop/SysPr
itae justo mattis, malesuada
Justo sit amet, vehicula tu
rps.Proin at semper tortor.
Morbi et laoreet sen. Nulla of
ofs-Lenovo:~/Desktop/SystemPr
cursum molestie consequat. Qo
g/hw4$ ./biboclient connect 1969
utque ultrices tincidunt l!3
guia. Mauris aliquam sagittit
Enter a command: readf Ch2.pd
s arcu. Cras semper laculis Ch2.pdf
fells at pharetra. Curabitur Enter a command: readf Ch2.pdf i
ac elit a eros varius laore denenei
et nec in odio. Nam at phare
tra erat. Nulla facilisi. No Enter a command: download denene.
ribi eget ultrices elit.Suspend
nidisse dignissim sagittis le3363 bytes are transferred to cli
ctus, nec pellentesque Justont 3
eleifend sed. Donec in ultr Enter a command: killServer
icies lacus. Fusce vel mi teBye
mptus, sagittis risus non, eg ofs-Lenovo:~/Desktop/SystemPr
estas purus. Vestibulum pulv or/hw4$ 
linar conmodo turpis, nec orn
are urna pulvinar nec. Fusce
.
Enter a command: quit
Bye
ofs-Lenovo:~/Desktop/SysPr
tenProg/hw4$ 

[2023-05-22 07:48:31] Connection established with
client 19743 as client 1
[2023-05-22 07:48:46] Connection established with
client 19745 as client 2
[2023-05-22 07:49:52] Connection established with
client 19746 as client 3
[2023-05-22 07:49:02] Client 19750 rejected, Queue
is full
[2023-05-22 07:49:06] Client 1 requested LIST
[2023-05-22 07:49:17] Client 2 requested upload fl
le Ch2.pdf
[2023-05-22 07:49:17] 711905 bytes are transferre
d to server
[2023-05-22 07:49:21] Client 3 requested LIST
[2023-05-22 07:49:44] Client 1 requested line 1 on
Ch2.pdf
[2023-05-22 07:49:56] Client 2 requested WRITE to
Ch2.pdf Line 1
[2023-05-22 07:50:05] Client 3 requested line 1 on
ch2.pdf
[2023-05-22 07:53:35] Client 1 requested LIST
[2023-05-22 07:53:44] Client 2 requested line 1 on
deneme.txt
[2023-05-22 07:53:55] Client 3 requested download
file deneme.txt
[2023-05-22 07:53:55] 3363 bytes are transferred t
o client 3
[2023-05-22 07:59:12] Client 1 disconnected
[2023-05-22 07:59:12] Connection established with
client 20575 as client 4
[2023-05-22 07:59:15] Client 2 disconnected
[2023-05-22 07:59:15] Connection established with
client 20576 as client 5
[2023-05-22 08:00:11] Client 3 requested KILL
Command 'list' not found, did you mean:
command 'l!st' from snap n!st (master)
command 'fl!st': from deb mnh (0.4-4)
command 'fll!st': from deb mnh (1.7-1+11)
command 'lift' from deb lift (2.6-0.1)
```

## 4- Invalid file name

ofs@ofs-Lenovo: ~/Desktop/SystemProg/hw4

```
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ make
gcc -g -Wall -pedantic-errors -lpthread -lrt -o biboServer src/biboServer.c
gcc -g -Wall -pedantic-errors -lpthread -lrt -o biboClient src/biboClient.c
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ ./biboServer here 3 3
Server started. Listening for connections...
Connection established with client 23751 as client 1
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$
```

ofs@ofs-Lenovo: ~/Desktop/SystemProg/hw4

```
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ ./biboClient connect 23723
Enter a command: list
Enter a command: upload deneme
Invalid file name!
Enter a command: list
Enter a command: download deneme
Invalid file name!
Enter a command: killServer
Bye
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$
```

ofs@ofs-Lenovo: ~/Desktop/SystemProg/hw4

```
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$ cat /tmp/server23723.log
[2023-05-22 08:21:09] Server started.
[2023-05-22 08:21:39] Connection established with client 23751 as client 1
[2023-05-22 08:21:43] Client 1 requested LIST
[2023-05-22 08:21:48] Client 1 requested upload file deneme
[2023-05-22 08:21:50] Client 1 requested LIST
[2023-05-22 08:21:53] Client 1 requested download file deneme
[2023-05-22 08:22:19] Client 1 requested KILL
[2023-05-22 08:22:19] Server closed.
ofs@ofs-Lenovo:~/Desktop/SystemProg/hw4$
```