CSE 344

FINAL

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Content

1- System Architecture and Problem Solution Approach

- In my system, Clients sharing same resource on server side, and they are synchronized with client directory. If one client changes something, other clients are affected by that. At first, client and server files are merged. Operations are update, add file, delete file. If maximum capacity is reached on server side, clients are refused. Otherwise they are synchronized.

- Server and clients are communicate with stream sockets. Server creates a thread for each client. And communication happen between client and respective thread. Communication is happening in an order, and I defined message formats for each type of message. Server write/read using that format, and client write/read using that format also. I serialized the messages to a string in order to communicate. All messages at most 1024 byte. If there are files that are greater than 1024, they will be sent 1024 byte by 1204 byte.

- For monitoring, I don’t use inotify library because it is not posix compliant. So I write my own checker. In order to do that, I held a previous and current file list. This list holds all the files, and each element of that list holds file information like modification time, file size, file type etc... And each iteration, I fill that list, switching with previous one then compare those. If there is a change, inform the client or server about that change. The receiver of the change takes that file information and compares it with its file list. And acts according to the result of the comparison. But communication does not end here. Server thread and client must inform each other all the time. Like “DONE”, “FAIL”, “ACCEPT”. If server detects change, sends that change info to the client, and client compares the respective file, with itself change must be performed, client sends “ACCEPT” message to the server. Then server sends the file. During file sending, Client must send a message which means that file sending operation is done. And both sides might face an error, in order to provide consistency, they must inform other about that error. File that wanted to send might be deleted during sending, or updated, etc. Also, there is a case happening when detecting if a file is changed or not. If file is changed, operating system truncates it for a short time, loads the file into the file system and updates it again. The case is modification might be detected during that process, and it can say that file size is 0. I solved it with waiting a little bit to make sure if a file size is really 0 or not.

- Since clients are sharing same files on server side, this means that threads are sharing same resources, and this needs to be synchronized. I solved this problem as reader writer problem. If a thread updates the server directory like writing/deleting other threads must wait. If some thread modify the files, nobody can read. If there are no writers, then everybody can read the files.

2 – Implementation Details and Requirements Met

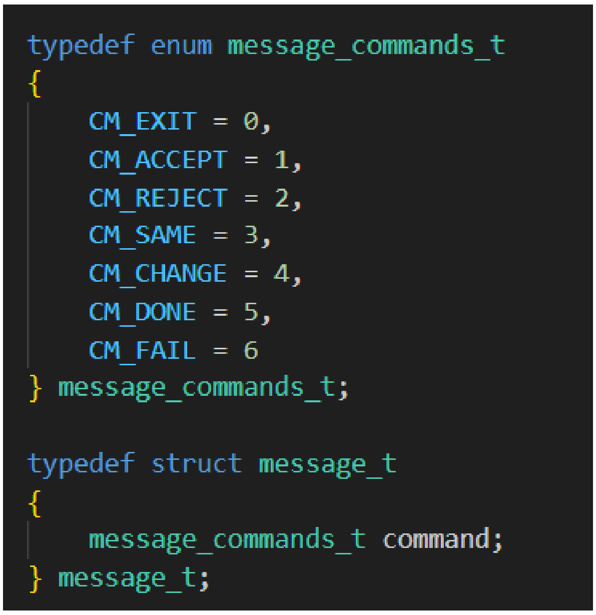
1- Requirements Met

- Both client and server side can add/delete/modify file, and it is updated to last change.
- Both client and server side can add/delete/modify a directory.

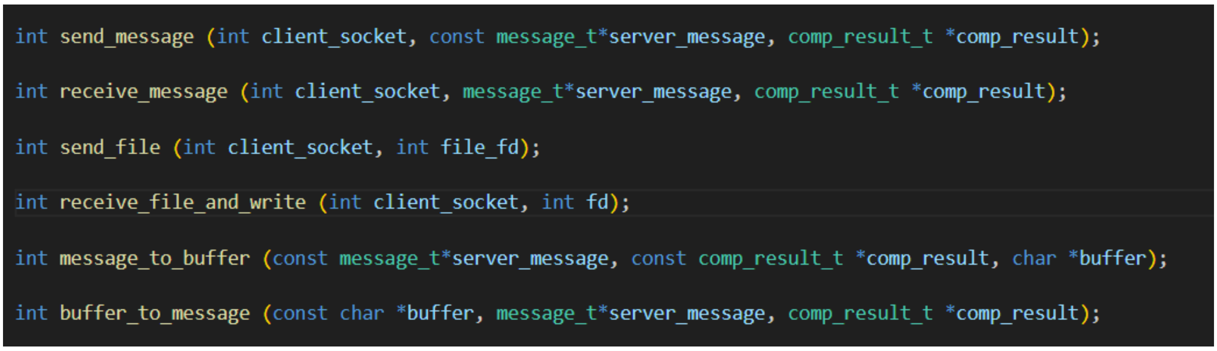
- Client can connect to the server using only port, or port and ip address if they are on different devices.
- Clients terminate if they get SIGINT, and server terminates if it gets SIGINT. If server gets SIGINT all clients are terminated, if client gets SIGINT, respective thread of that client is put to sleep.
- There are no memory leak.
- No race condition, deadlock.
- Log file is provided on clients directory.

2- Implementation Details

a- Message Formats

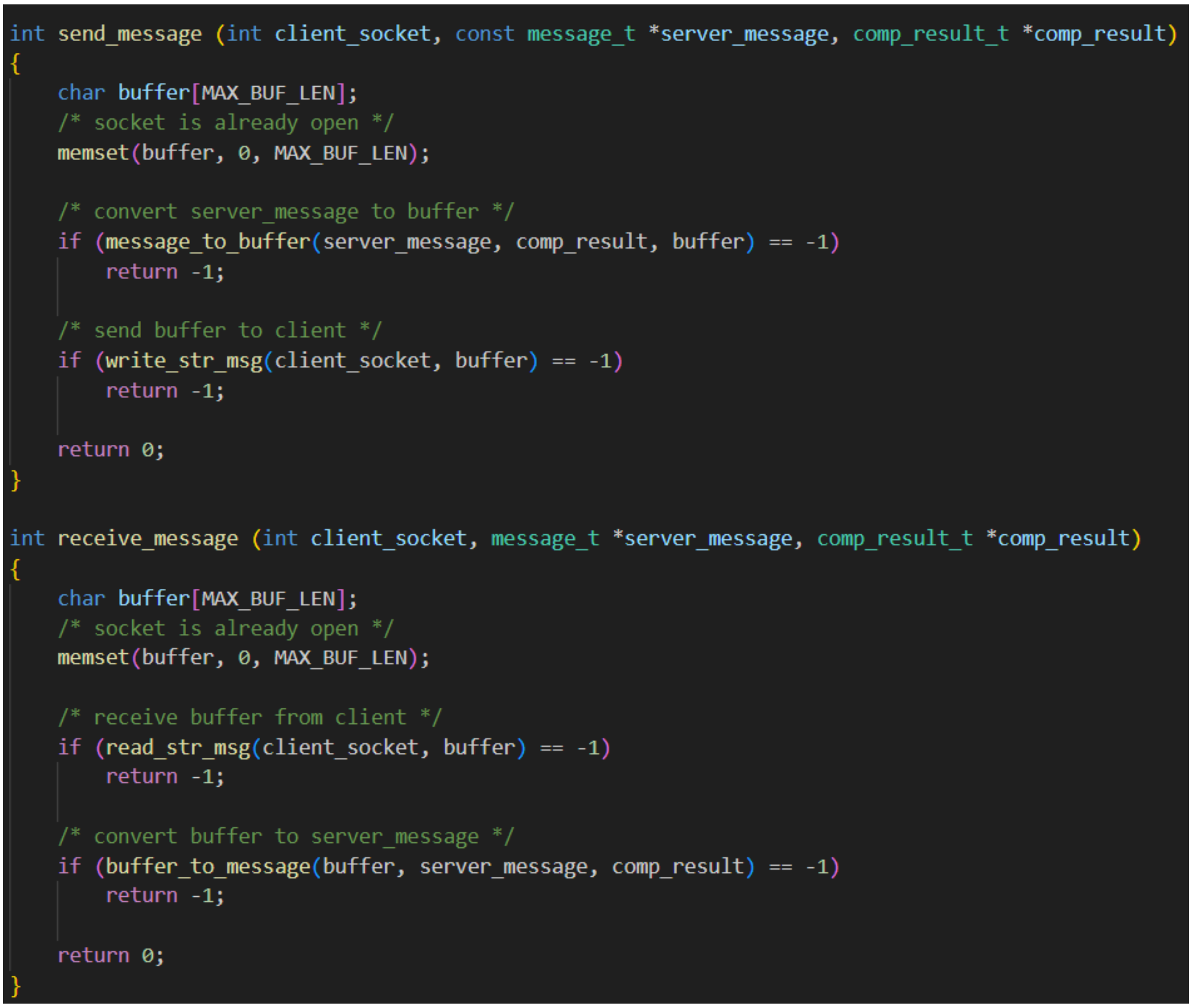


```
typedef enum message_commands_t
{
    CM_EXIT = 0,
    CM_ACCEPT = 1,
    CM_REJECT = 2,
    CM_SAME = 3,
    CM_CHANGE = 4,
    CM_DONE = 5,
    CM_FAIL = 6
} message_commands_t;

typedef struct message_t
{
    message_commands_t command;
} message_t;
```



```
int send_message (int client_socket, const message_t*server_message, comp_result_t *comp_result);

int receive_message (int client_socket, message_t*server_message, comp_result_t *comp_result);

int send_file (int client_socket, int file_fd);

int receive_file_and_write (int client_socket, int fd);

int message_to_buffer (const message_t*server_message, const comp_result_t *comp_result, char *buffer);

int buffer_to_message (const char *buffer, message_t*server_message, comp_result_t *comp_result);
```

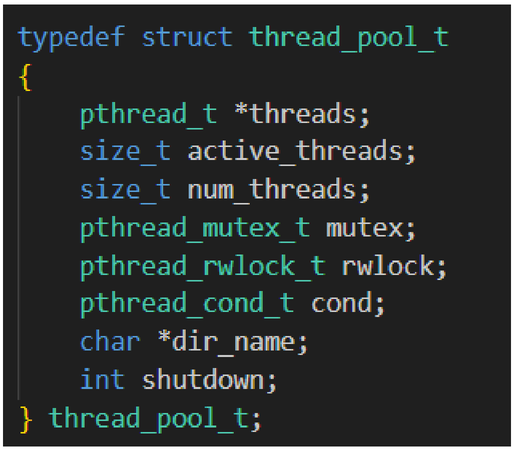
- Communication functionalities, and message structure to communicate. Both server and client use those functions.



```c
int send_message (int client_socket, const message_t *server_message, comp_result_t *comp_result)
{
    char buffer[MAX_BUF_LEN];
    /* socket is already open */
    memset(buffer, 0, MAX_BUF_LEN);

    /* convert server_message to buffer */
    if (message_to_buffer(server_message, comp_result, buffer) == -1)
        return -1;

    /* send buffer to client */
    if (write_str_msg(client_socket, buffer) == -1)
        return -1;

    return 0;
}

int receive_message (int client_socket, message_t *server_message, comp_result_t *comp_result)
{
    char buffer[MAX_BUF_LEN];
    /* socket is already open */
    memset(buffer, 0, MAX_BUF_LEN);

    /* receive buffer from client */
    if (read_str_msg(client_socket, buffer) == -1)
        return -1;

    /* convert buffer to server_message */
    if (buffer_to_message(buffer, server_message, comp_result) == -1)
        return -1;

    return 0;
}
```

- Sending and receiving message through socket.

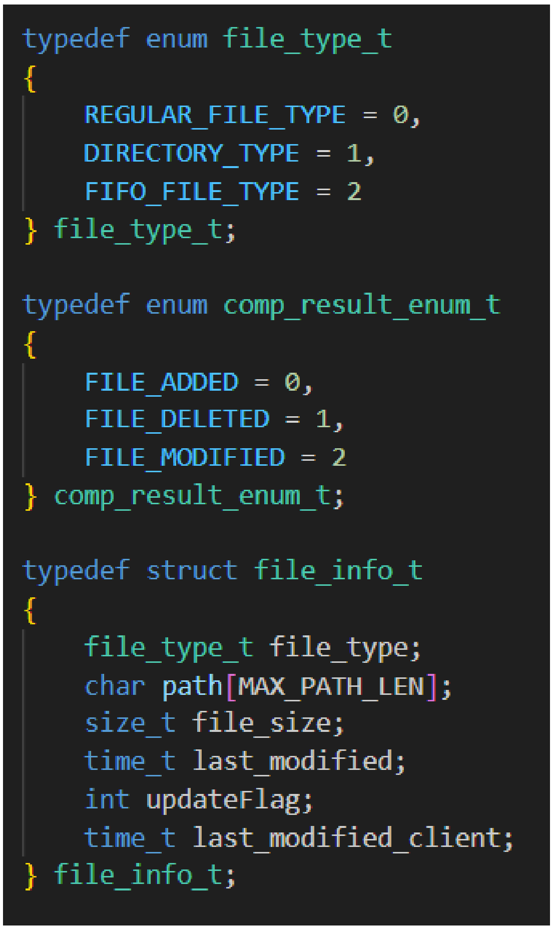
b- Thread pool



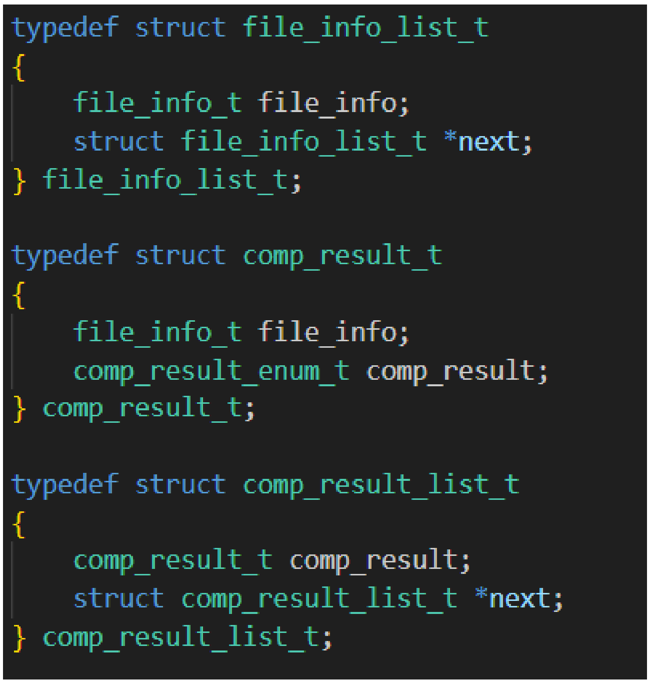
```c
typedef struct thread_pool_t
{
    pthread_t *threads;
    size_t active_threads;
    size_t num_threads;
    pthread_mutex_t mutex;
    pthread_rwlock_t rwlock;
    pthread_cond_t cond;
    char *dir_name;
    int shutdown;
} thread_pool_t;
```

- Thread pool structure is like that, there is mutex for critical actions and read/write lock. Conditional variable is used when a thread is put to sleep. Dir name is path of the server folder.

c- Directory Monitoring

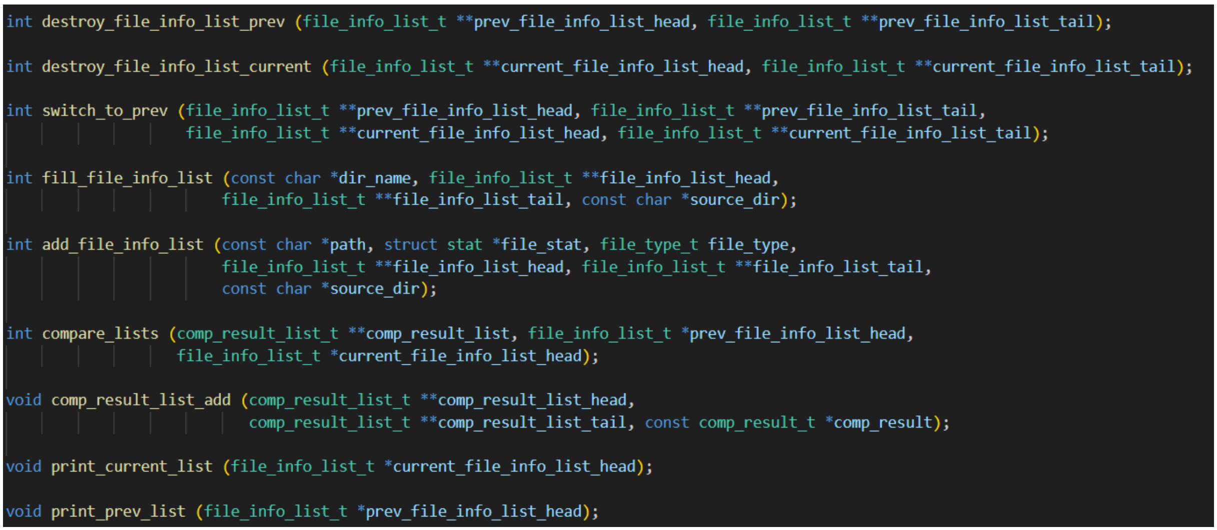


```c
typedef enum file_type_t
{
    REGULAR_FILE_TYPE = 0,
    DIRECTORY_TYPE = 1,
    FIFO_FILE_TYPE = 2
} file_type_t;

typedef enum comp_result_enum_t
{
    FILE_ADDED = 0,
    FILE_DELETED = 1,
    FILE_MODIFIED = 2
} comp_result_enum_t;

typedef struct file_info_t
{
    file_type_t file_type;
    char path[MAX_PATH_LEN];
    size_t file_size;
    time_t last_modified;
    int updateFlag;
    time_t last_modified_client;
} file_info_t;
```

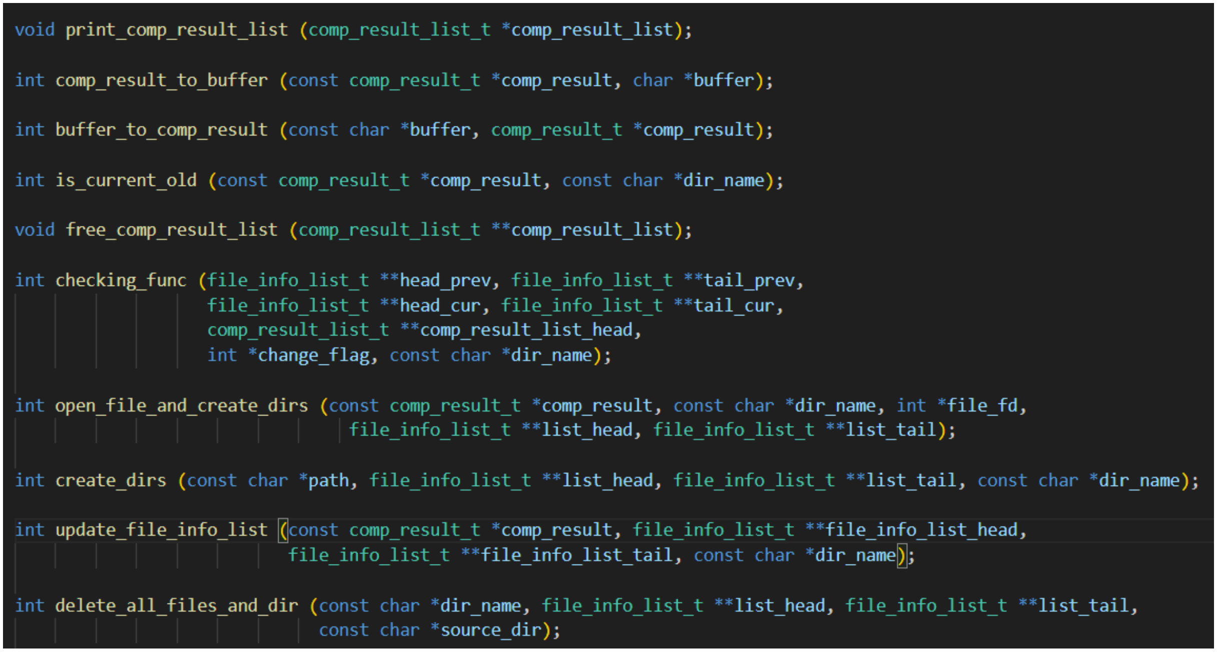


```c
typedef struct file_info_list_t
{
    file_info_t file_info;
    struct file_info_list_t *next;
} file_info_list_t;

typedef struct comp_result_t
{
    file_info_t file_info;
    comp_result_enum_t comp_result;
} comp_result_t;

typedef struct comp_result_list_t
{
    comp_result_t comp_result;
    struct comp_result_list_t *next;
} comp_result_list_t;
```

- Files in directory fill that structure. Both server and client use these structures. Comparison results are held in a list, and they are sent to receiver (server or directory) to update other side if it is possible. File list is used for monitoring the directory.



```c
int destroy_file_info_list_prev (file_info_list_t **prev_file_info_list_head, file_info_list_t **prev_file_info_list_tail);

int destroy_file_info_list_current (file_info_list_t **current_file_info_list_head, file_info_list_t **current_file_info_list_tail);

int switch_to_prev (file_info_list_t **prev_file_info_list_head, file_info_list_t **prev_file_info_list_tail,
                    file_info_list_t **current_file_info_list_head, file_info_list_t **current_file_info_list_tail);

int fill_file_info_list (const char *dir_name, file_info_list_t **file_info_list_head,
                        file_info_list_t **file_info_list_tail, const char *source_dir);

int add_file_info_list (const char *path, struct stat *file_stat, file_type_t file_type,
                        file_info_list_t **file_info_list_head, file_info_list_t **file_info_list_tail,
                        const char *source_dir);

int compare_lists (comp_result_list_t **comp_result_list, file_info_list_t *prev_file_info_list_head,
                  file_info_list_t *current_file_info_list_head);

void comp_result_list_add (comp_result_list_t **comp_result_list_head,
                           comp_result_list_t **comp_result_list_tail, const comp_result_t *comp_result);

void print_current_list (file_info_list_t *current_file_info_list_head);

void print_prev_list (file_info_list_t *prev_file_info_list_head);
```

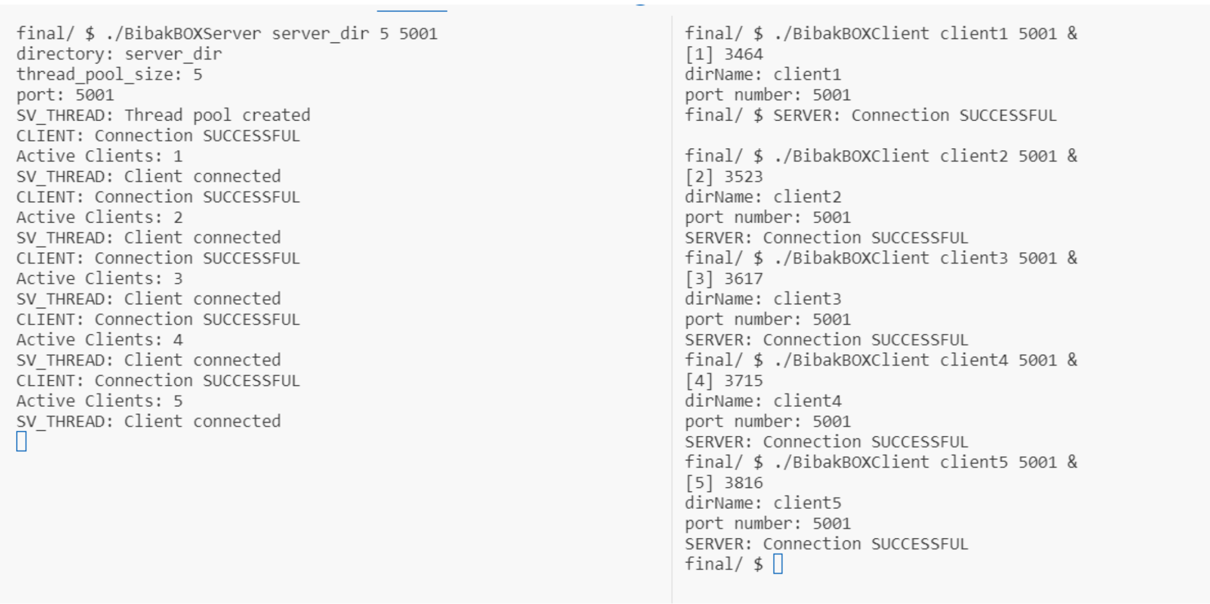


```c
void print_comp_result_list (comp_result_list_t *comp_result_list);

int comp_result_to_buffer (const comp_result_t *comp_result, char *buffer);

int buffer_to_comp_result (const char *buffer, comp_result_t *comp_result);

int is_current_old (const comp_result_t *comp_result, const char *dir_name);

void free_comp_result_list (comp_result_list_t **comp_result_list);

int checking_func (file_info_list_t **head_prev, file_info_list_t **tail_prev,
                   file_info_list_t **head_cur, file_info_list_t **tail_cur,
                   comp_result_list_t **comp_result_list_head,
                   int *change_flag, const char *dir_name);

int open_file_and_create_dirs (const comp_result_t *comp_result, const char *dir_name, int *file_fd,
                               file_info_list_t **list_head, file_info_list_t **list_tail);

int create_dirs (const char *path, file_info_list_t **list_head, file_info_list_t **list_tail, const char *dir_name);

int update_file_info_list (const comp_result_t *comp_result, file_info_list_t **file_info_list_head,
                           file_info_list_t **file_info_list_tail, const char *dir_name);

int delete_all_files_and_dir (const char *dir_name, file_info_list_t **list_head, file_info_list_t **list_tail,
                              const char *source_dir);
```

- Those are the functionalities of the file operations.

3 – Test Plans

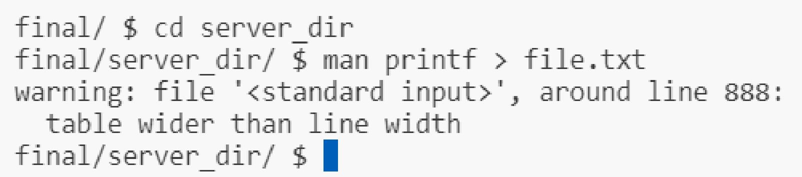
a. Functionality Testing



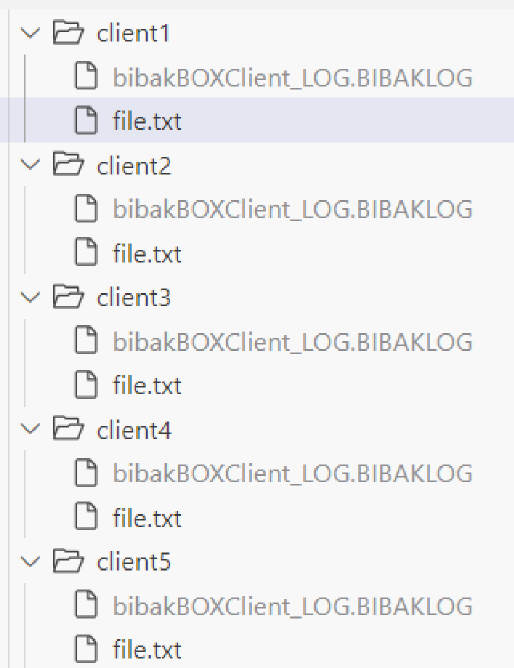
```
final/ $ ./BibakBOXServer server_dir 5 5001
directory: server_dir
thread_pool_size: 5
port: 5001
SV_THREAD: Thread pool created
CLIENT: Connection SUCCESSFUL
Active Clients: 1
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 2
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 3
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 4
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 5
SV_THREAD: Client connected
```

```
final/ $ ./BibakBOXClient client1 5001 &
[1] 3464
dirName: client1
port number: 5001
final/ $ SERVER: Connection SUCCESSFUL

final/ $ ./BibakBOXClient client2 5001 &
[2] 3523
dirName: client2
port number: 5001
SERVER: Connection SUCCESSFUL
final/ $ ./BibakBOXClient client3 5001 &
[3] 3617
dirName: client3
port number: 5001
SERVER: Connection SUCCESSFUL
final/ $ ./BibakBOXClient client4 5001 &
[4] 3715
dirName: client4
port number: 5001
SERVER: Connection SUCCESSFUL
final/ $ ./BibakBOXClient client5 5001 &
[5] 3816
dirName: client5
port number: 5001
SERVER: Connection SUCCESSFUL
final/ $
```

- Clients are connected to the server.

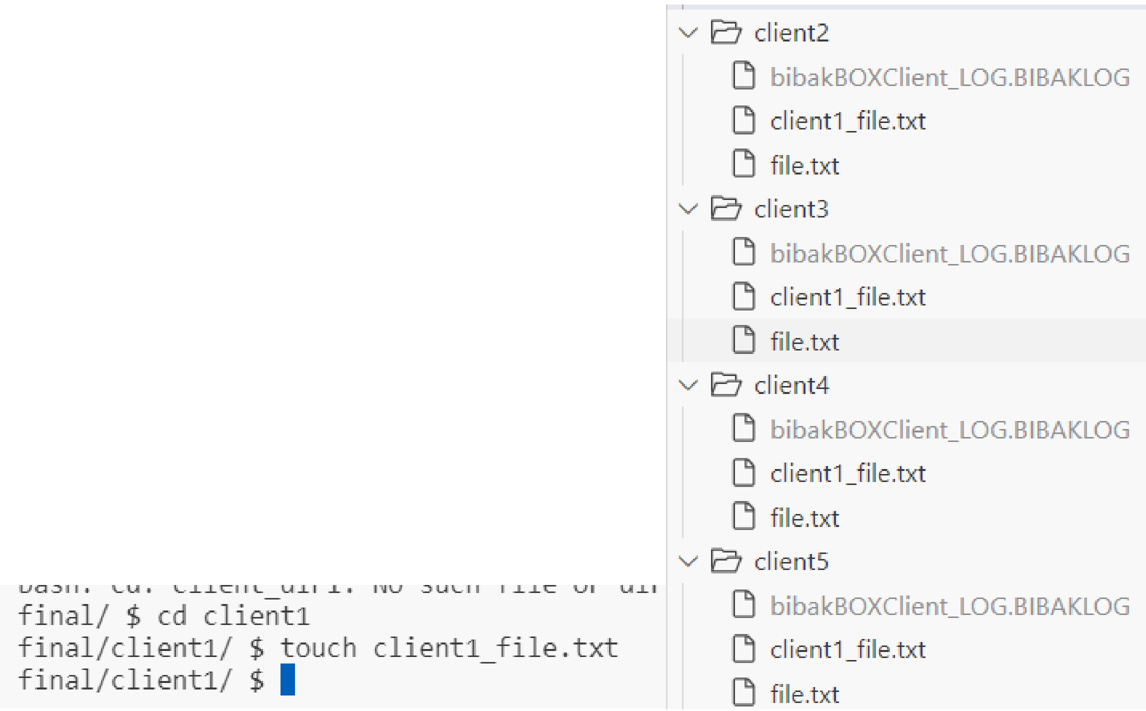


```
final/ $ cd server_dir
final/server_dir/ $ man printf > file.txt
warning: file '<standard input>', around line 888:
  table wider than line width
final/server_dir/ $
```



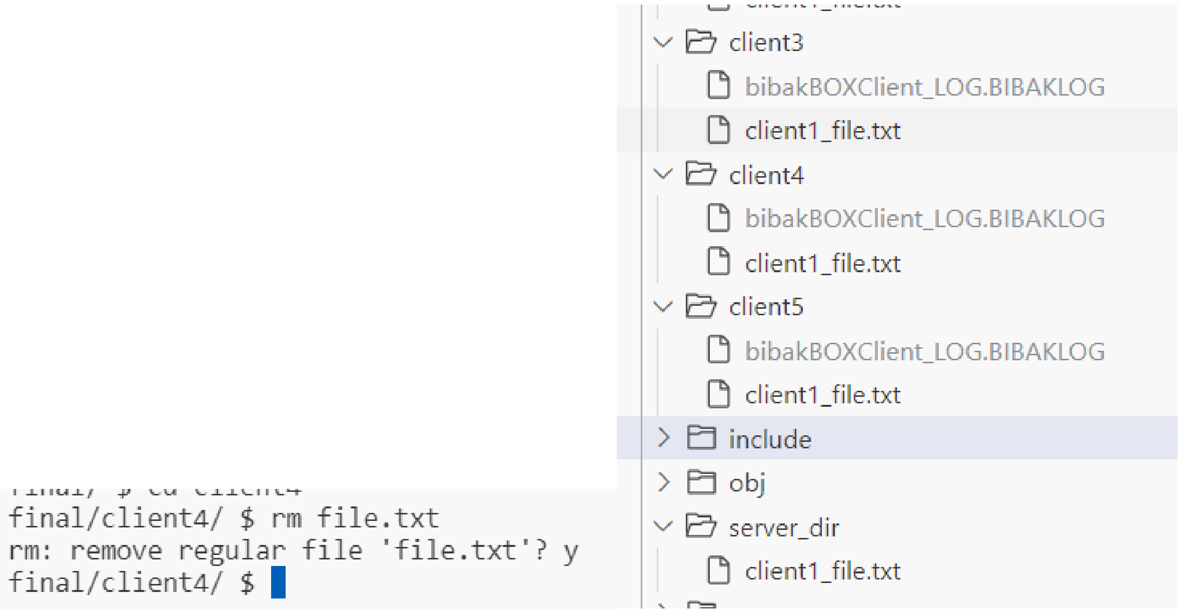
```
client1
    bibakBOXClient_LOG.BIBAKLOG
    file.txt
client2
    bibakBOXClient_LOG.BIBAKLOG
    file.txt
client3
    bibakBOXClient_LOG.BIBAKLOG
    file.txt
client4
    bibakBOXClient_LOG.BIBAKLOG
    file.txt
client5
    bibakBOXClient_LOG.BIBAKLOG
    file.txt
```

File is created on server directory, and all clients have that file.



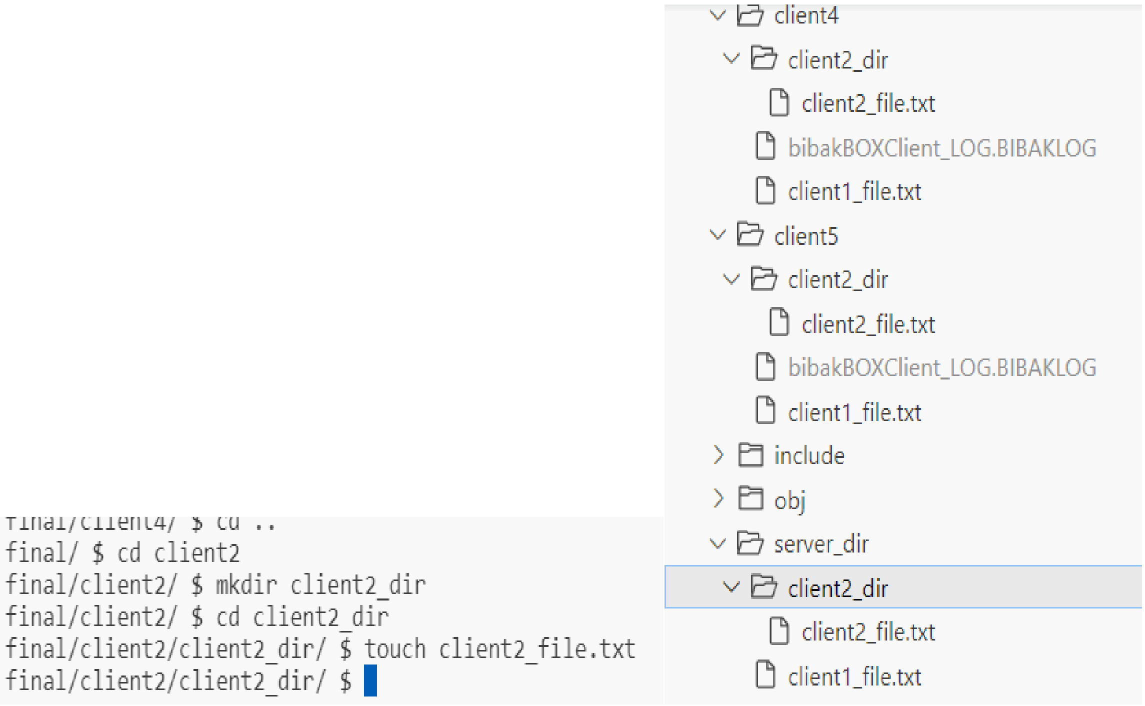
```
bash: cd: client_dir1: No such file or dir
final/ $ cd client1
final/client1/ $ touch client1_file.txt
final/client1/ $ 
```

- File is created in client1 and all clients and server have that file.



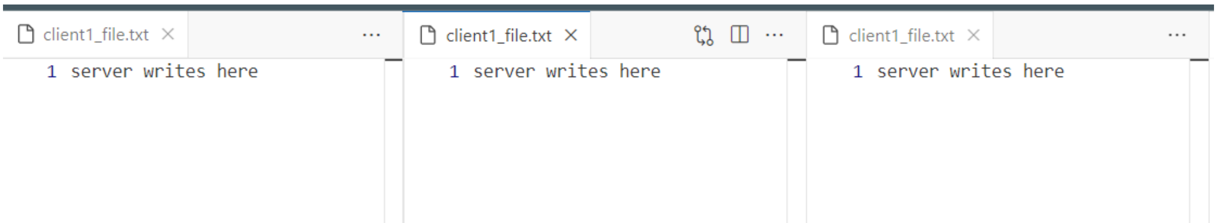
```
final/ $ cd client4
final/client4/ $ rm file.txt
rm: remove regular file 'file.txt'? y
final/client4/ $ 
```

- Client 4 removes a file, and it is removed from all clients and server.



```
final/client4/ $ cd ..
final/ $ cd client2
final/client2/ $ mkdir client2_dir
final/client2/ $ cd client2_dir
final/client2/client2_dir/ $ touch client2_file.txt
final/client2/client2_dir/ $
```

- Directory is created in client2 and client2 file is added to it. And every client and server synchronized with it.

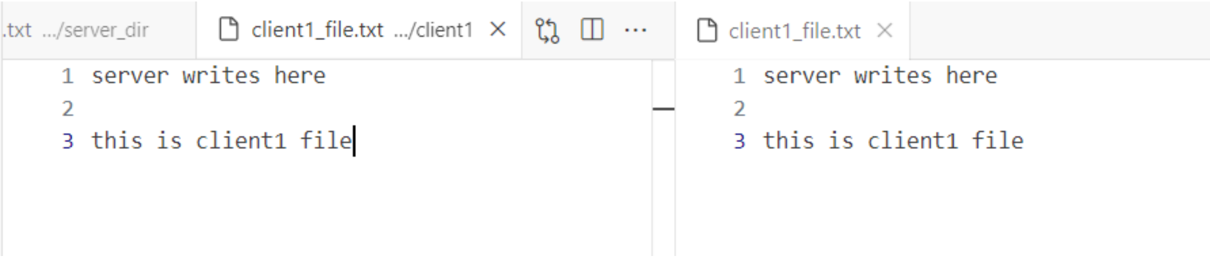


```
server writes here
```

```
server writes here
```

```
server writes here
```

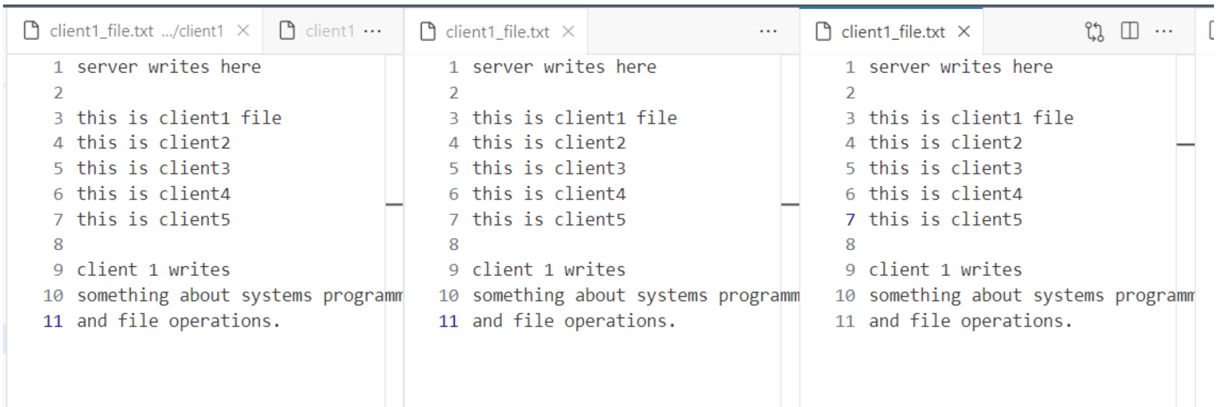
- Server written something to the client1_file



```
server writes here

this is client1 file
```

```
server writes here

this is client1 file
```

- Client 1 writes something to that file.

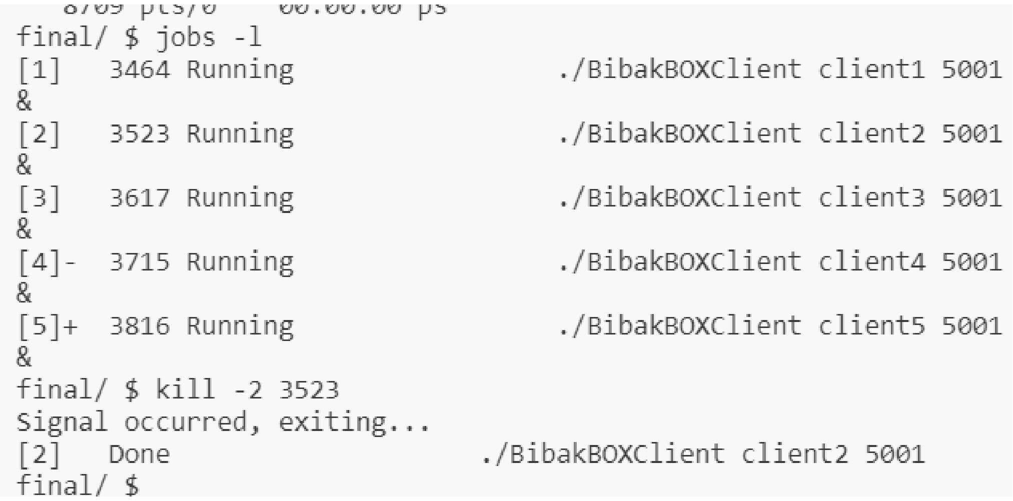


```
server writes here

this is client1 file
this is client2
this is client3
this is client4
this is client5

client 1 writes
something about systems programm
and file operations.
```

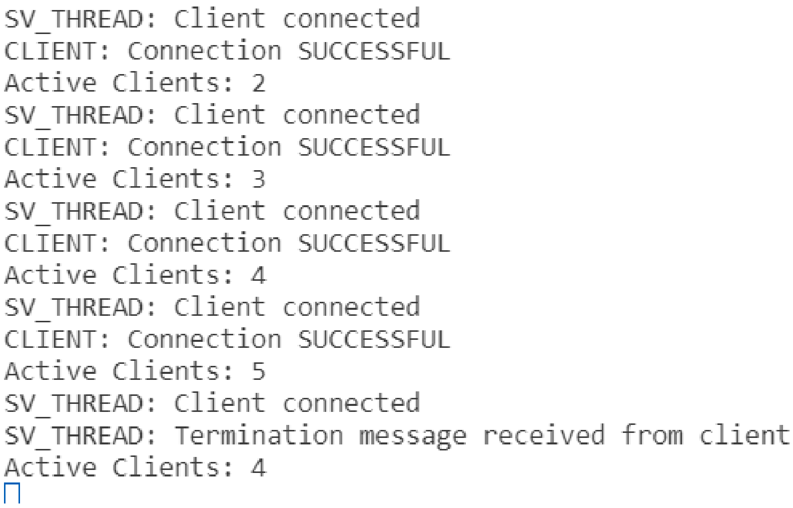
```
server writes here

this is client1 file
this is client2
this is client3
this is client4
this is client5

client 1 writes
something about systems programm
and file operations.
```

```
server writes here

this is client1 file
this is client2
this is client3
this is client4
this is client5

client 1 writes
something about systems programm
and file operations.
```

- Some other things are written, and synchronized between all clients.

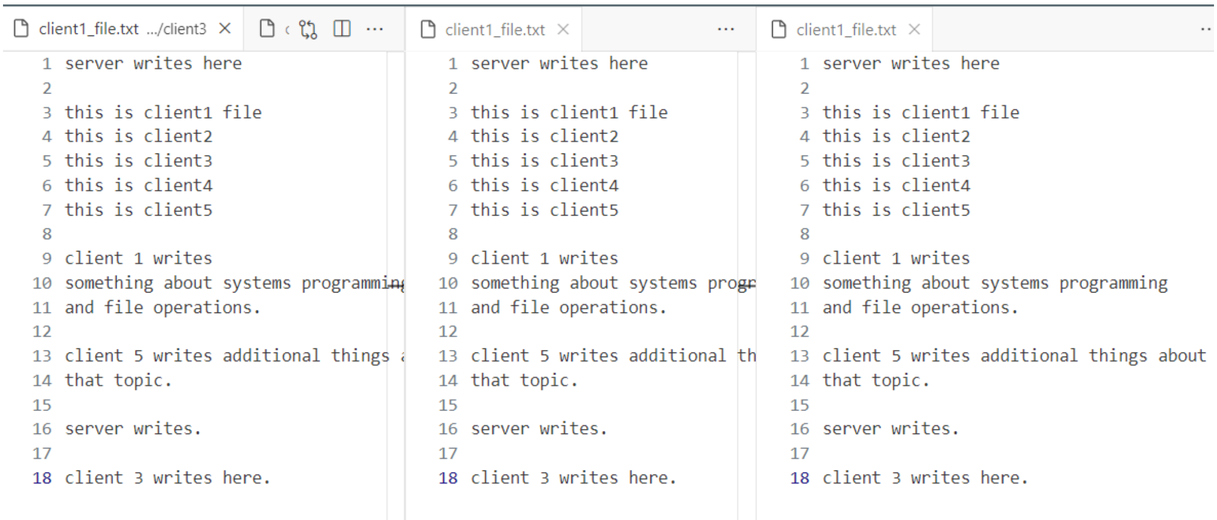


```
  8709 pts/0    00:00:00 ps
final/ $ jobs -l
[1]   3464 Running                 ./BibakBOXClient client1 5001
&
[2]   3523 Running                 ./BibakBOXClient client2 5001
&
[3]   3617 Running                 ./BibakBOXClient client3 5001
&
[4]-  3715 Running                 ./BibakBOXClient client4 5001
&
[5]+  3816 Running                 ./BibakBOXClient client5 5001
&
final/ $ kill -2 3523
Signal occurred, exiting...
[2]   Done                    ./BibakBOXClient client2 5001
final/ $
```



```
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 2
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 3
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 4
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 5
SV_THREAD: Client connected
SV_THREAD: Termination message received from client
Active Clients: 4
```

- Client 2 is terminated with SIGINT.

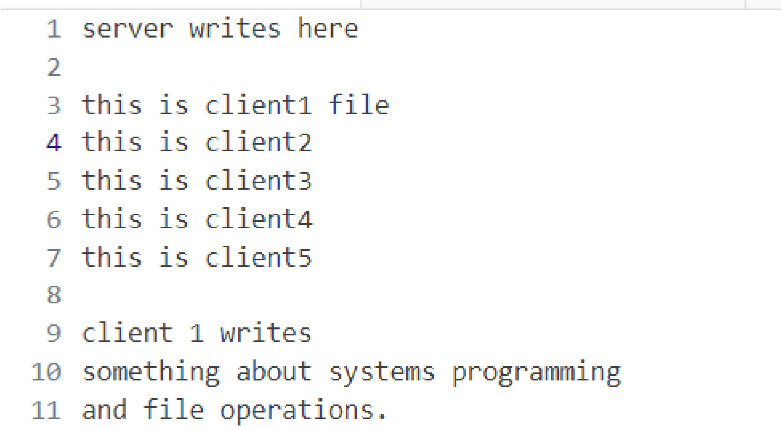


```
server writes here

this is client1 file
this is client2
this is client3
this is client4
this is client5

client 1 writes
something about systems programming
and file operations.

client 5 writes additional things a
that topic.

server writes.

client 3 writes here.
```

```
server writes here

this is client1 file
this is client2
this is client3
this is client4
this is client5

client 1 writes
something about systems progr
and file operations.

client 5 writes additional th
that topic.

server writes.

client 3 writes here.
```

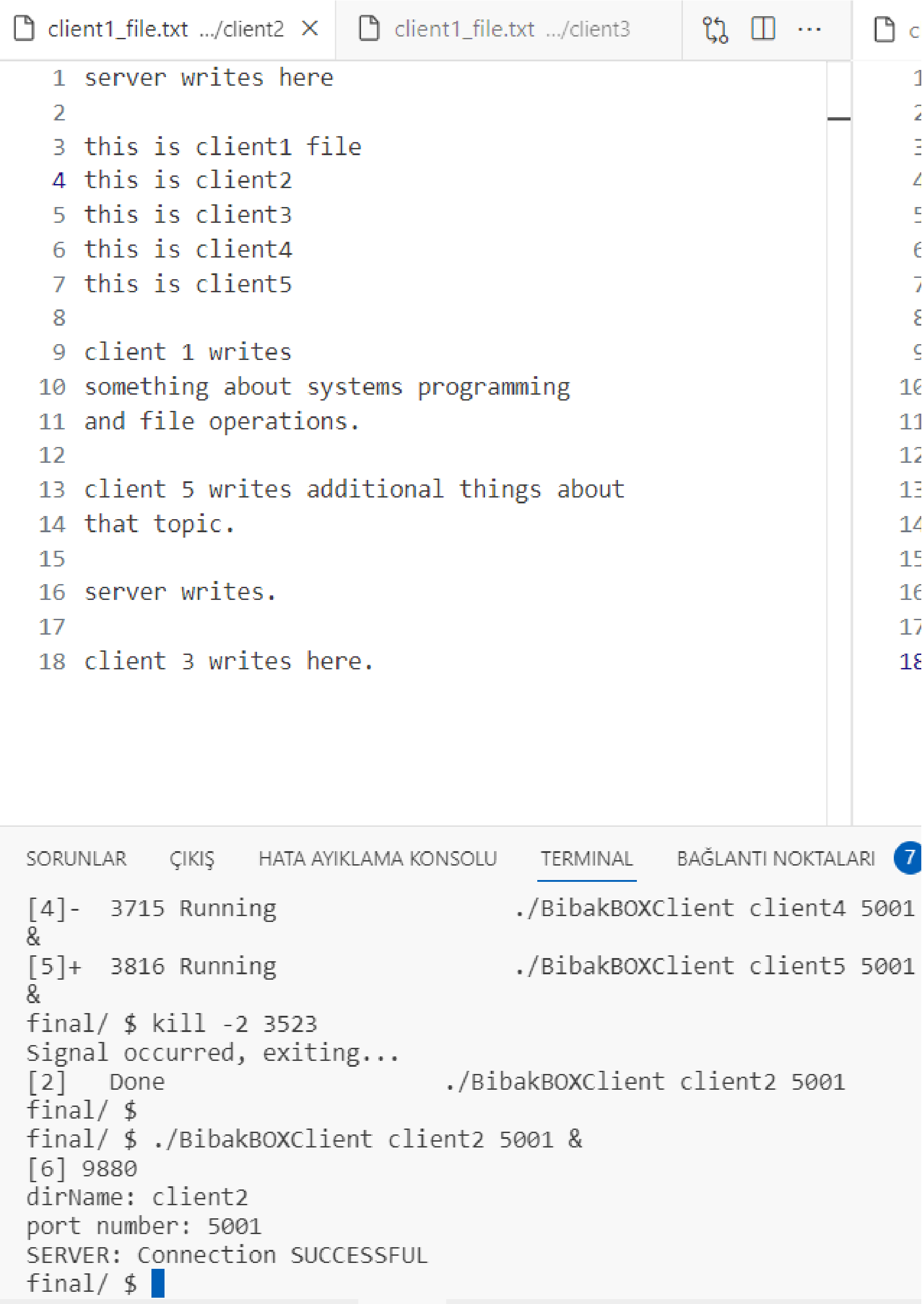
```
server writes here

this is client1 file
this is client2
this is client3
this is client4
this is client5

client 1 writes
something about systems programming
and file operations.

client 5 writes additional things about
that topic.

server writes.

client 3 writes here.
```

- Additional things are written to client 2 directory.



```
server writes here

this is client1 file
this is client2
this is client3
this is client4
this is client5

client 1 writes
something about systems programming
and file operations.
```

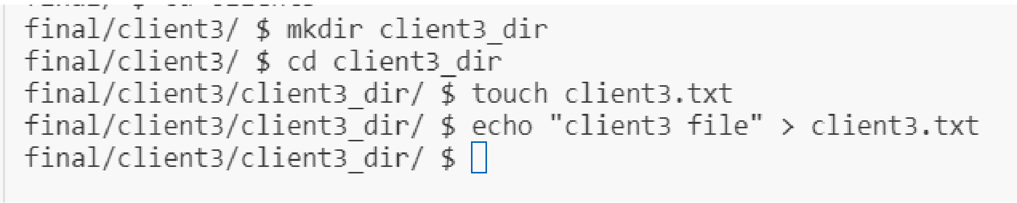
- Client 2 is not synchronized as expected



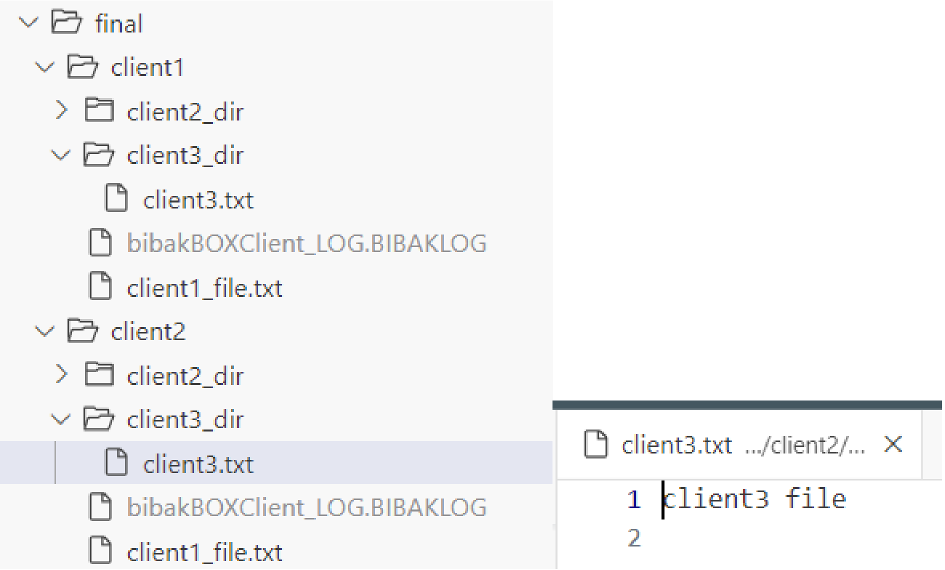
```
server writes here

this is client1 file
this is client2
this is client3
this is client4
this is client5

client 1 writes
something about systems programming
and file operations.

client 5 writes additional things about
that topic.

server writes.

client 3 writes here.
```

```
[4]-  3715 Running                 ./BibakBOXClient client4 5001
&
[5]+  3816 Running                 ./BibakBOXClient client5 5001
&
final/ $ kill -2 3523
Signal occurred, exiting...
[2]   Done                    ./BibakBOXClient client2 5001
final/ $
final/ $ ./BibakBOXClient client2 5001 &
[6] 9880
dirName: client2
port number: 5001
SERVER: Connection SUCCESSFUL
final/ $
```

- After client 2 connects to the server it is synchronized again.



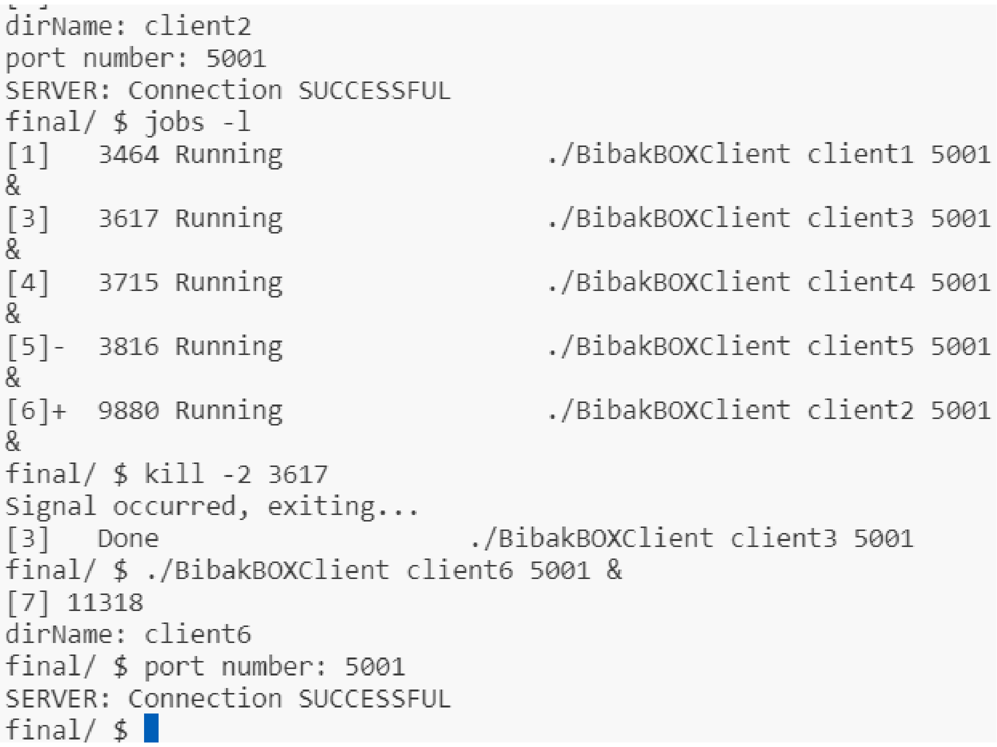
```
final/ $ cd client3
final/client3/ $ mkdir client3_dir
final/client3/ $ cd client3_dir
final/client3/client3_dir/ $ touch client3.txt
final/client3/client3_dir/ $ echo "client3 file" > client3.txt
final/client3/client3_dir/ $ 
```



```
final
  client1
    client2_dir
    client3_dir
      client3.txt
    bibakBOXClient_LOG.BIBAKLOG
    client1_file.txt
  client2
    client2_dir
    client3_dir
      client3.txt
    bibakBOXClient_LOG.BIBAKLOG
    client1_file.txt
```

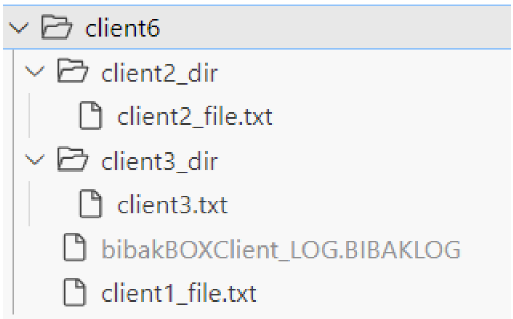
```
client3 file
```

- Client 3 directory is created and file added to it. It is synchronized within all clients, and server.



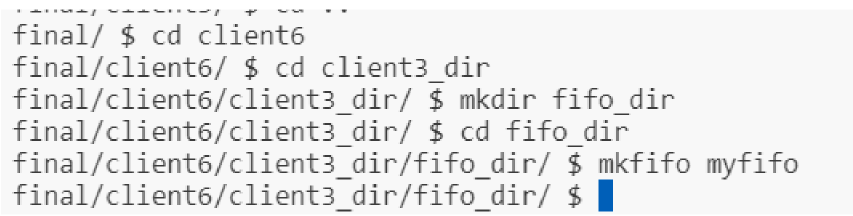
```
dirName: client2
port number: 5001
SERVER: Connection SUCCESSFUL
final/ $ jobs -l
[1]   3464 Running                 ./BibakBOXClient client1 5001
&
[3]   3617 Running                 ./BibakBOXClient client3 5001
&
[4]   3715 Running                 ./BibakBOXClient client4 5001
&
[5]-  3816 Running                 ./BibakBOXClient client5 5001
&
[6]+  9880 Running                 ./BibakBOXClient client2 5001
&
final/ $ kill -2 3617
Signal occurred, exiting...
[3]   Done                    ./BibakBOXClient client3 5001
final/ $ ./BibakBOXClient client6 5001 &
[7] 11318
dirName: client6
final/ $ port number: 5001
SERVER: Connection SUCCESSFUL
final/ $ 
```

- Client 3 disconnects and client 6 connects.

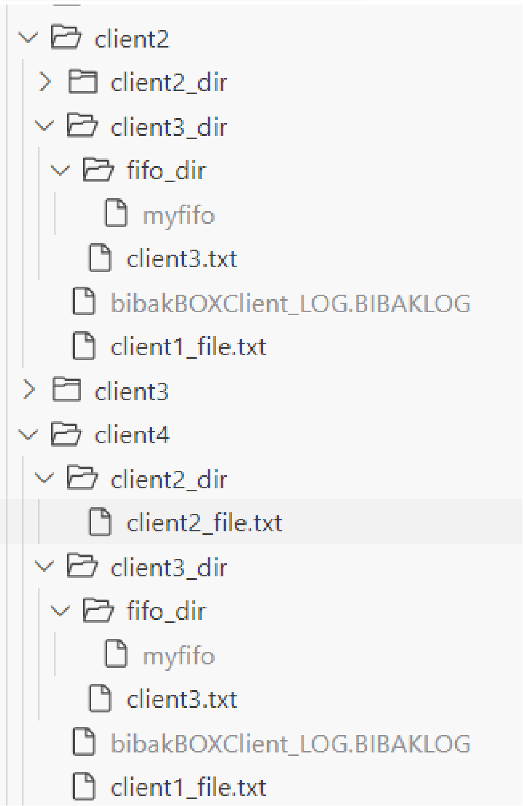


```
client6
  client2_dir
    client2_file.txt
  client3_dir
    client3.txt
  bibakBOXClient_LOG.BIBAKLOG
  client1_file.txt
```

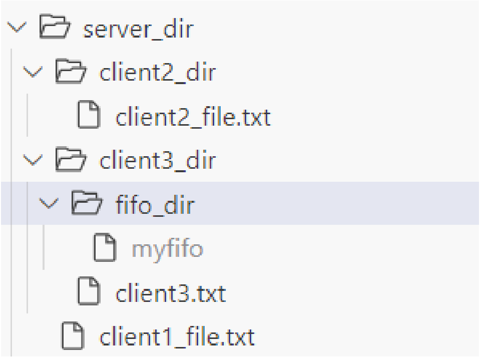
Client 6 is synchronized.



```
final/ $ cd client6
final/client6/ $ cd client3_dir
final/client6/client3_dir/ $ mkdir fifo_dir
final/client6/client3_dir/ $ cd fifo_dir
final/client6/client3_dir/fifo_dir/ $ mkfifo myfifo
final/client6/client3_dir/fifo_dir/ $
```

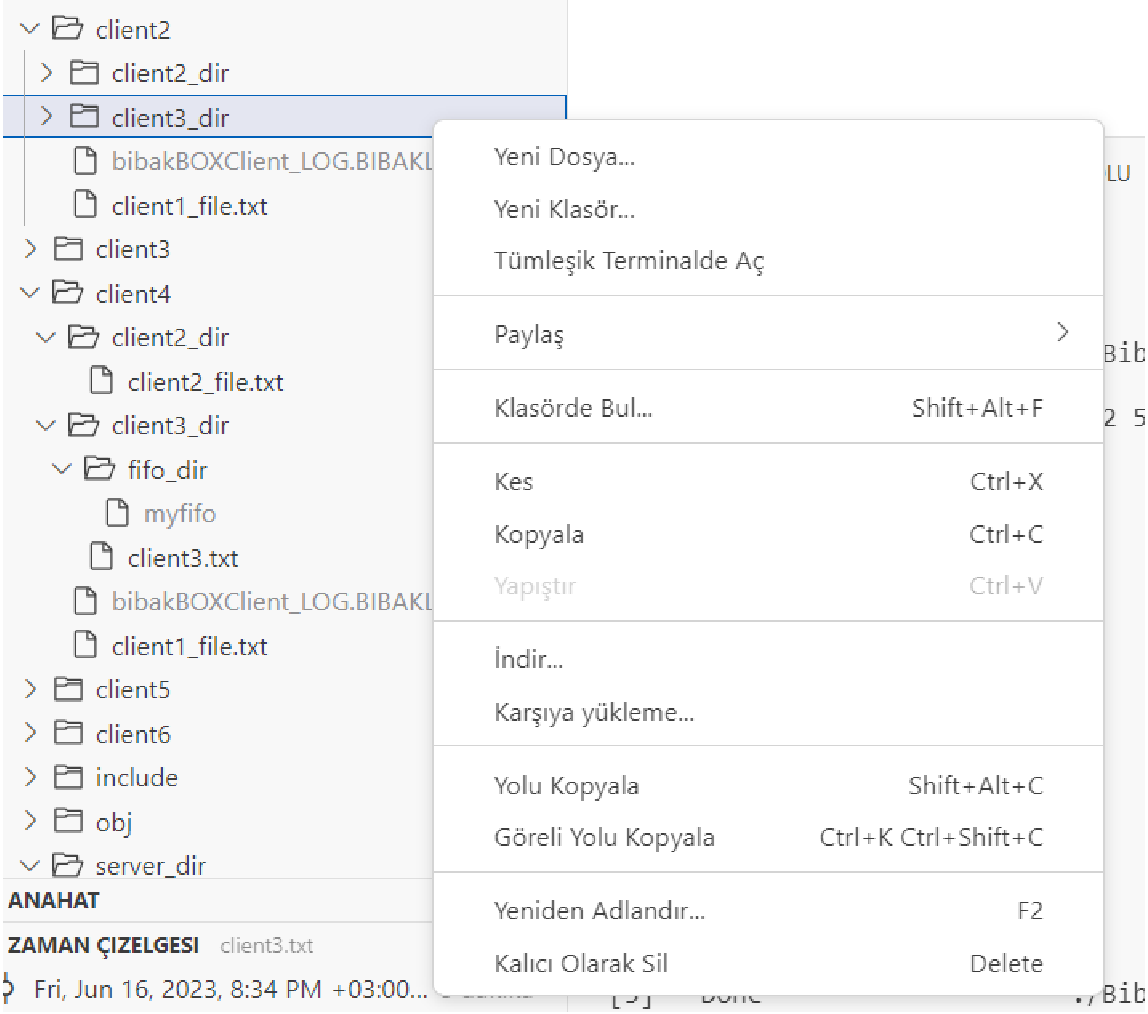


```
client2
  client2_dir
  client3_dir
    fifo_dir
      myfifo
    client3.txt
  bibakBOXClient_LOG.BIBAKLOG
  client1_file.txt
client3
client4
  client2_dir
    client2_file.txt
  client3_dir
    fifo_dir
      myfifo
    client3.txt
  bibakBOXClient_LOG.BIBAKLOG
  client1_file.txt
```

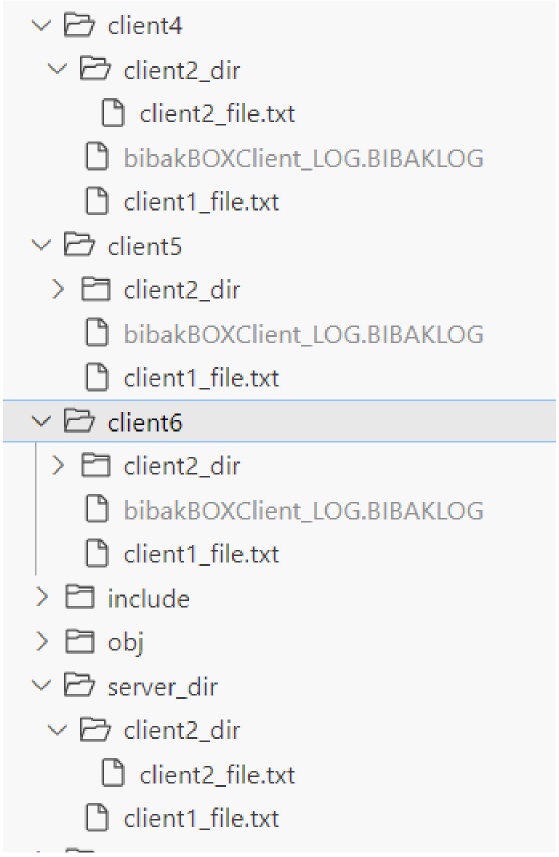


```
server_dir
  client2_dir
    client2_file.txt
  client3_dir
    fifo_dir
      myfifo
    client3.txt
  client1_file.txt
```

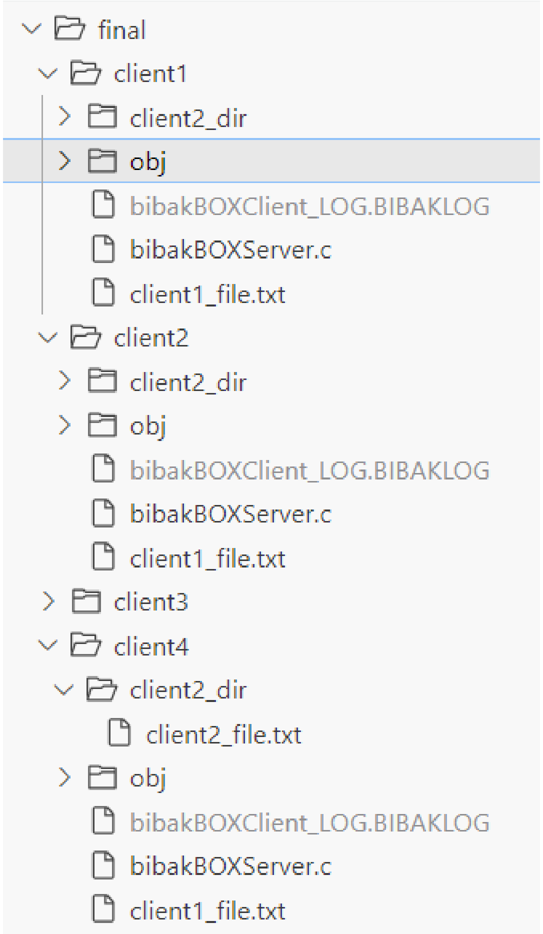
- Client 6 creates a directory and creates fifo inside it.



- Client 2 removes all client 3 directory.

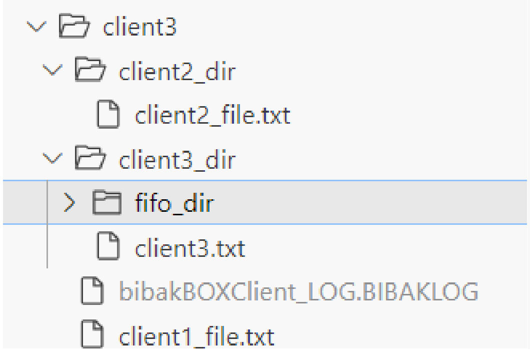


Directory and file is removed on all clients.

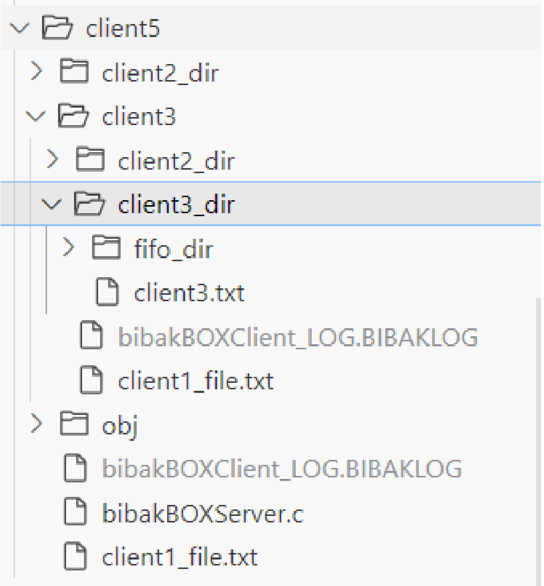


```
final
  client1
    client2_dir
    obj
    bibakBOXClient_LOG.BIBAKLOG
    bibakBOXServer.c
    client1_file.txt
  client2
    client2_dir
    obj
    bibakBOXClient_LOG.BIBAKLOG
    bibakBOXServer.c
    client1_file.txt
  client3
  client4
    client2_dir
      client2_file.txt
    obj
    bibakBOXClient_LOG.BIBAKLOG
    bibakBOXServer.c
    client1_file.txt
```

- Other files and directories are added, and they are synchronized.

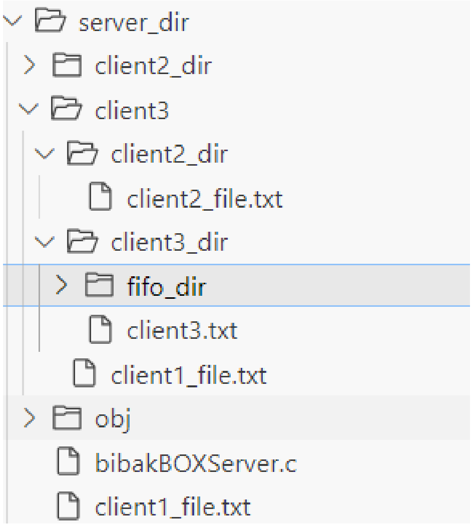


```
client3
  client2_dir
    client2_file.txt
  client3_dir
    fifo_dir
    client3.txt
  bibakBOXClient_LOG.BIBAKLOG
  client1_file.txt
```



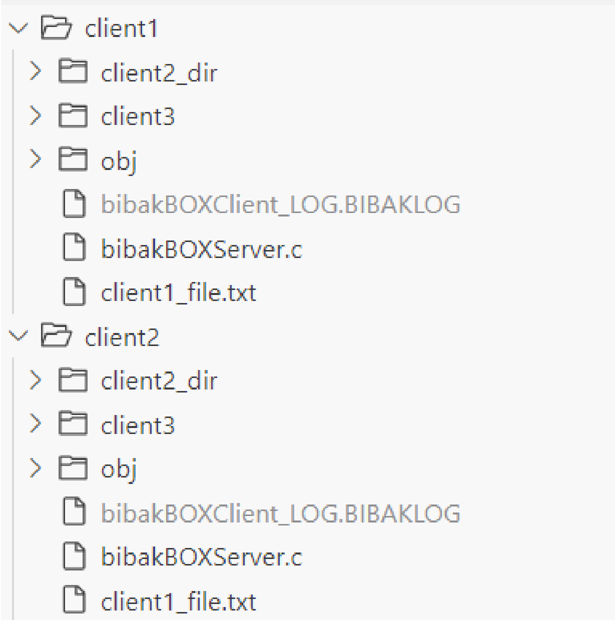
```
client5
  client2_dir
  client3
    client2_dir
    client3_dir
      fifo_dir
      client3.txt
    bibakBOXClient_LOG.BIBAKLOG
    client1_file.txt
  obj
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
```

- Client 3 directory is added to client 5 directory.

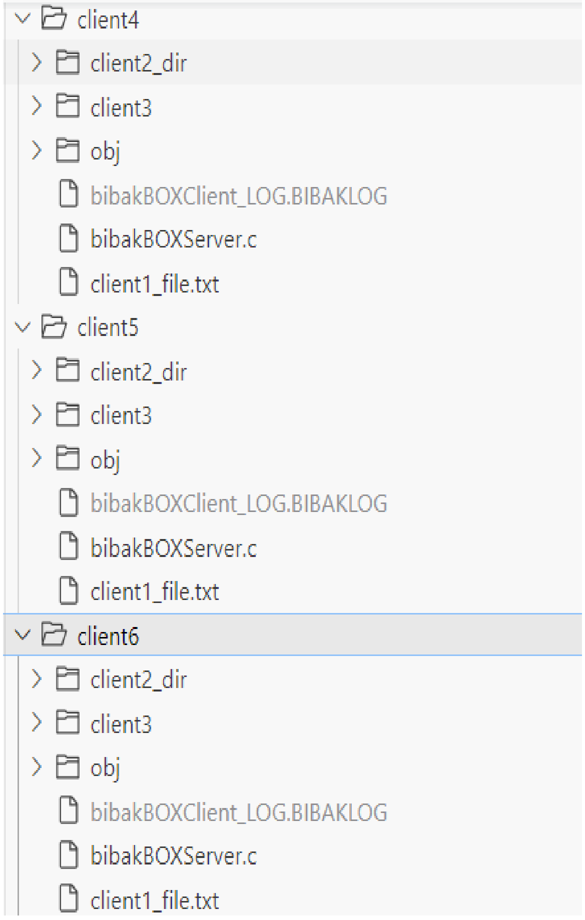


```
server_dir
  client2_dir
  client3
    client2_dir
      client2_file.txt
    client3_dir
      fifo_dir
      client3.txt
    client1_file.txt
  obj
  bibakBOXServer.c
  client1_file.txt
```

Server is synchronized.

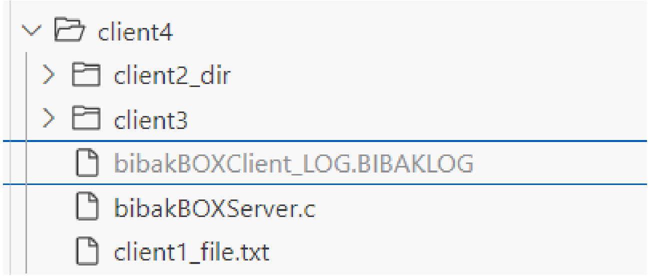


```
client1
  client2_dir
  client3
  obj
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
client2
  client2_dir
  client3
  obj
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
```



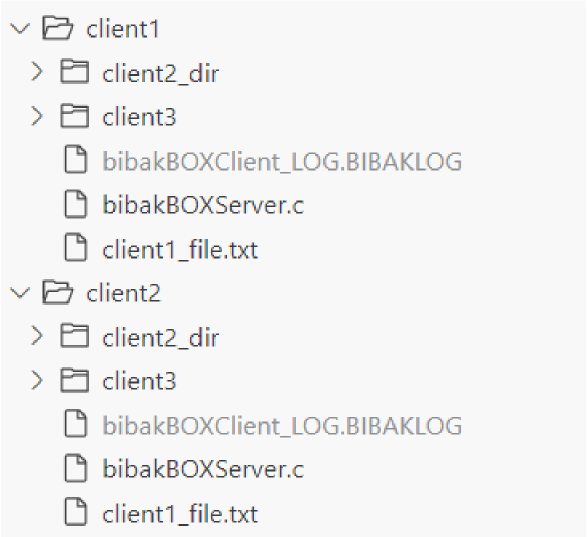
```
client4
  client2_dir
  client3
  obj
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
client5
  client2_dir
  client3
  obj
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
client6
  client2_dir
  client3
  obj
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
```

- Other clients are synchronized.



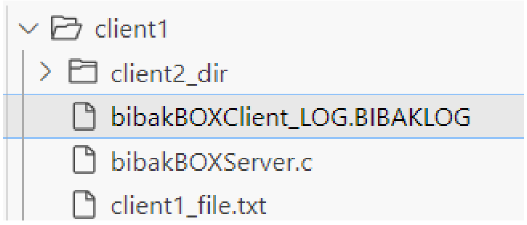
```
client4
  client2_dir
  client3
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
```

Client 4 removes obj directory.



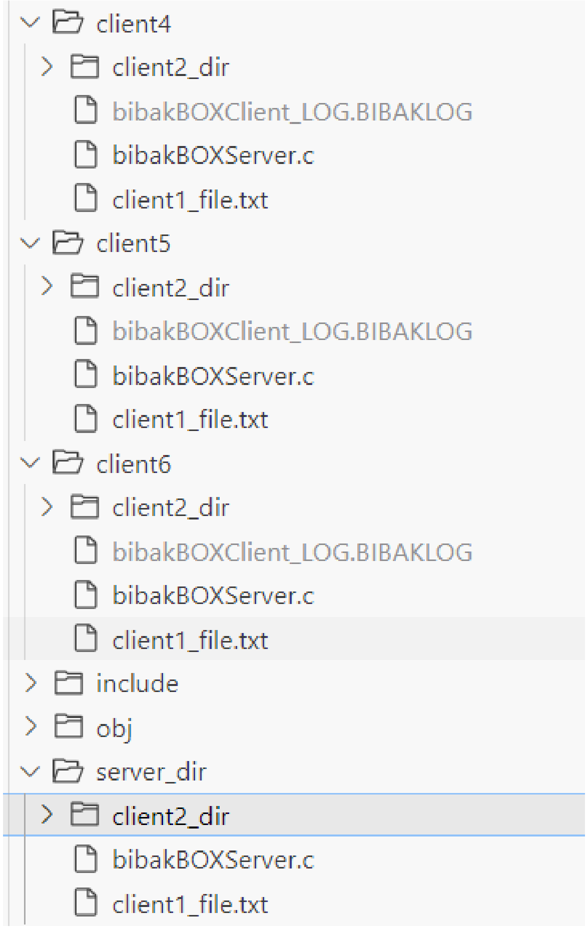
```
client1
  client2_dir
  client3
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
client2
  client2_dir
  client3
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
```

other clients are synchronized



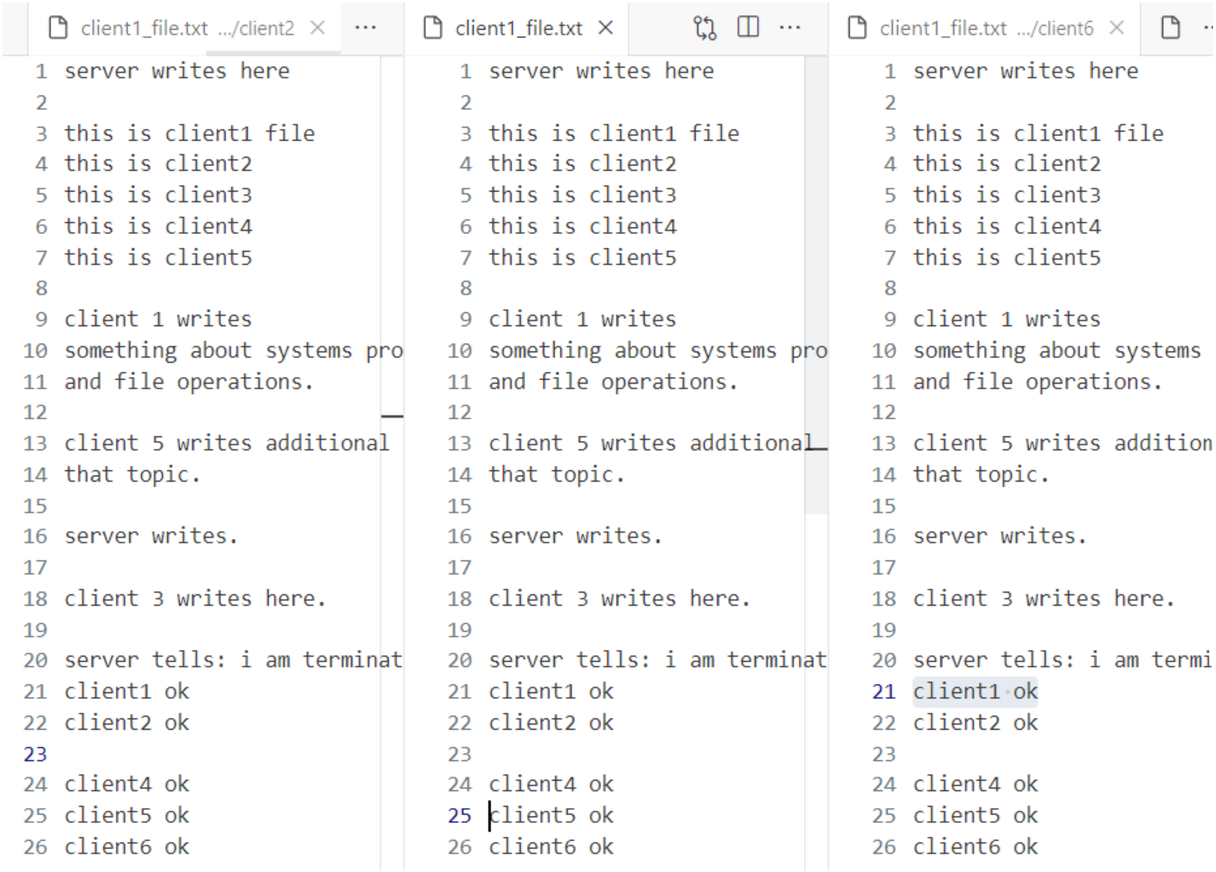
```
client1
  client2_dir
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
```

Client 1 removed client 3 directory.



```
client4
  client2_dir
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
client5
  client2_dir
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
client6
  client2_dir
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXServer.c
  client1_file.txt
include
obj
server_dir
  client2_dir
  bibakBOXServer.c
  client1_file.txt
```

It is also synchronized.

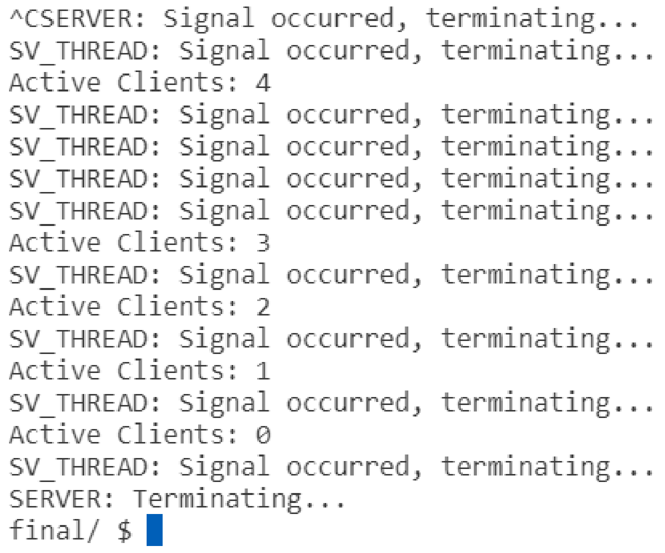


```
server writes here

this is client1 file
this is client2
this is client3
this is client4
this is client5

client 1 writes
something about systems pro
and file operations.

client 5 writes additional
that topic.

server writes.

client 3 writes here.

server tells: i am terminat
client1 ok
client2 ok

client4 ok
client5 ok
client6 ok
```

```
server writes here

this is client1 file
this is client2
this is client3
this is client4
this is client5

client 1 writes
something about systems pro
and file operations.

client 5 writes additional
that topic.

server writes.

client 3 writes here.

server tells: i am terminat
client1 ok
client2 ok

client4 ok
client5 ok
client6 ok
```

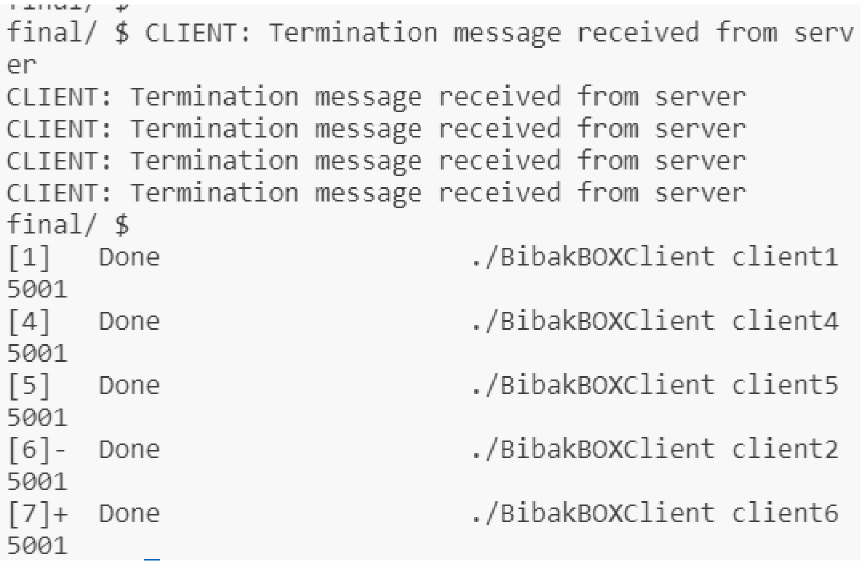
```
server writes here

this is client1 file
this is client2
this is client3
this is client4
this is client5

client 1 writes
something about systems
and file operations.

client 5 writes addition
that topic.

server writes.

client 3 writes here.

server tells: i am termi
client1 ok
client2 ok

client4 ok
client5 ok
client6 ok
```

- Clients and server are writing to the file and it is still synchronizing.



```
^CSERVER: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 4
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 3
SV_THREAD: Signal occurred, terminating...
Active Clients: 2
SV_THREAD: Signal occurred, terminating...
Active Clients: 1
SV_THREAD: Signal occurred, terminating...
Active Clients: 0
SV_THREAD: Signal occurred, terminating...
SERVER: Terminating...
final/ $
```

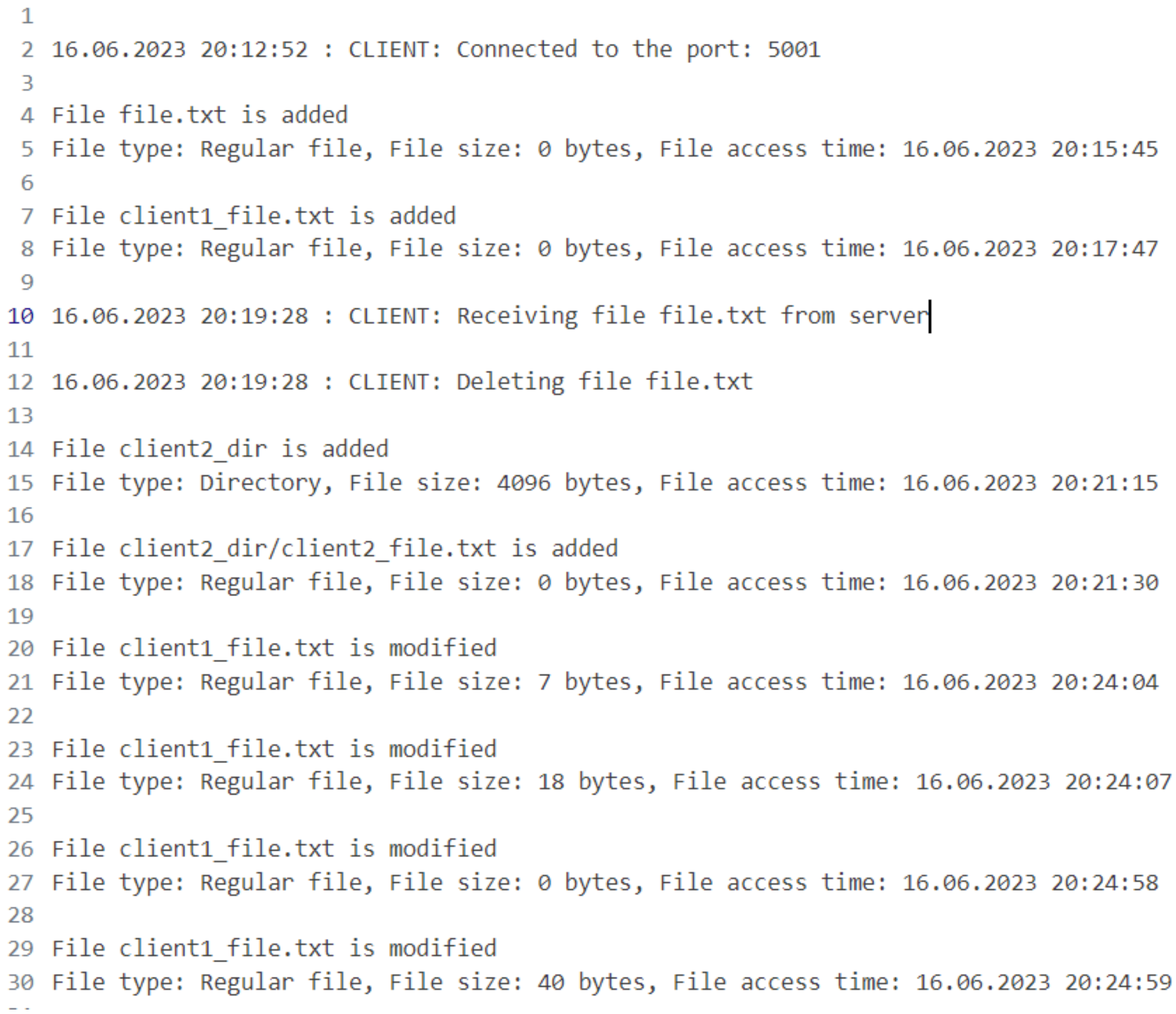
Server gets SIGINT



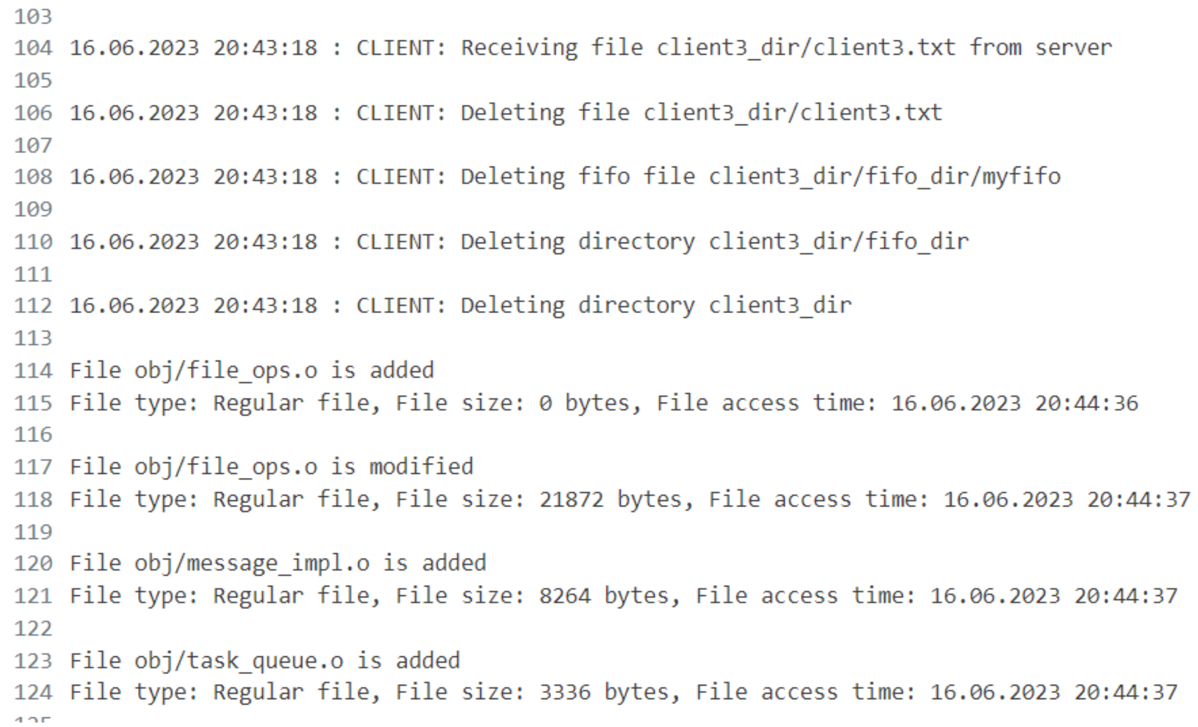
```
final/ $
final/ $ CLIENT: Termination message received from serv
er
CLIENT: Termination message received from server
CLIENT: Termination message received from server
CLIENT: Termination message received from server
CLIENT: Termination message received from server
final/ $
[1]   Done                    ./BibakBOXClient client1
5001
[4]   Done                    ./BibakBOXClient client4
5001
[5]   Done                    ./BibakBOXClient client5
5001
[6]-  Done                    ./BibakBOXClient client2
5001
[7]+  Done                    ./BibakBOXClient client6
5001
```

All other clients are terminated after that message.

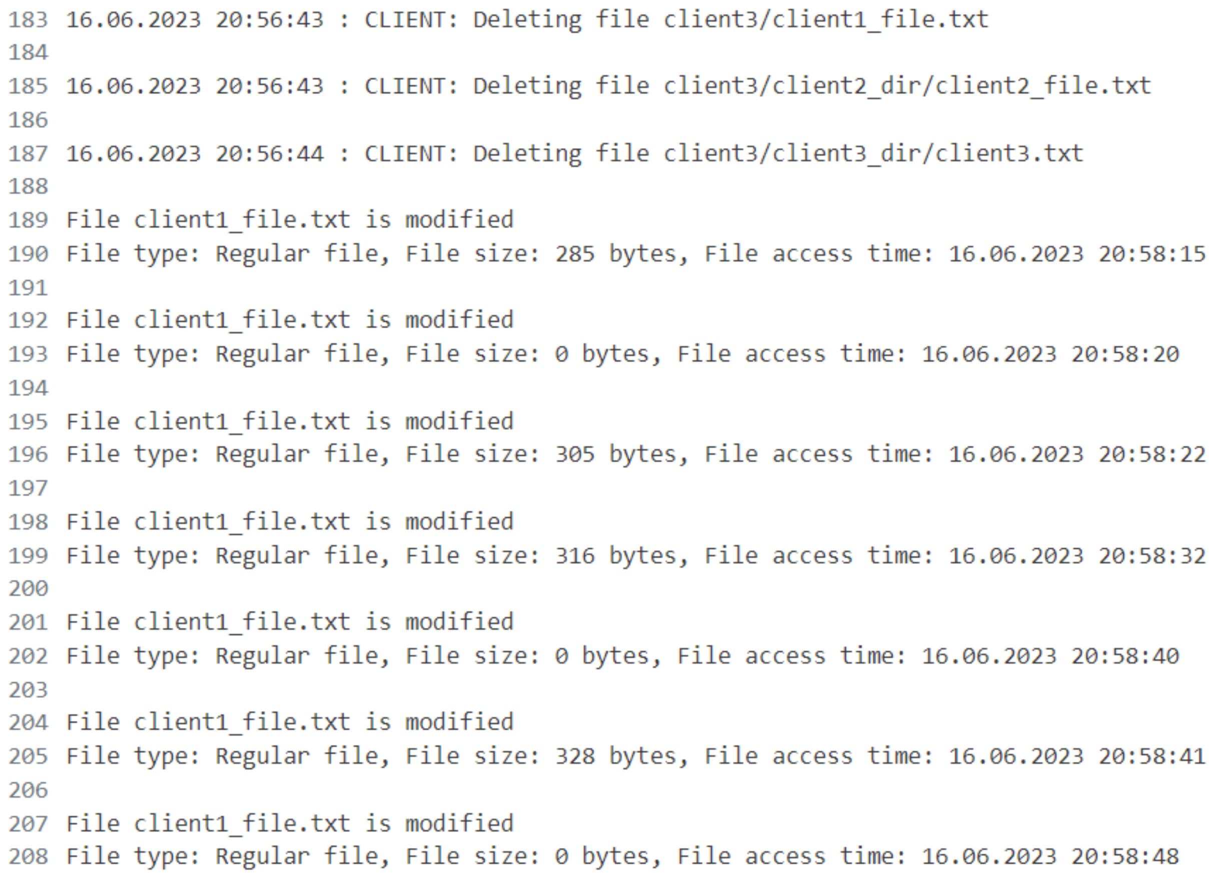
Some parts of log file of CLIENT1



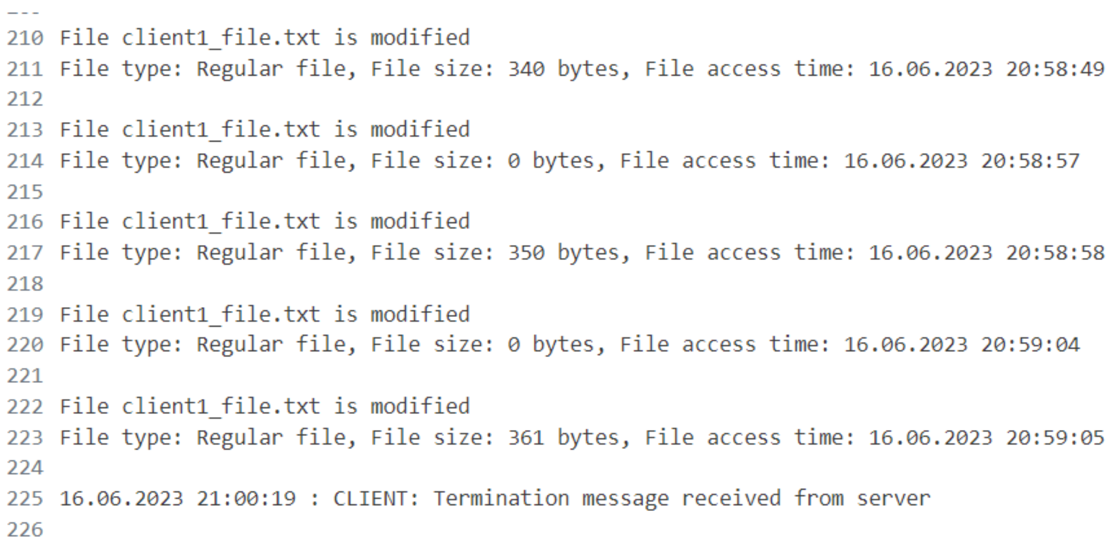
```

16.06.2023 20:12:52 : CLIENT: Connected to the port: 5001

File file.txt is added
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 20:15:45

File client1_file.txt is added
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 20:17:47

16.06.2023 20:19:28 : CLIENT: Receiving file file.txt from server

16.06.2023 20:19:28 : CLIENT: Deleting file file.txt

File client2_dir is added
File type: Directory, File size: 4096 bytes, File access time: 16.06.2023 20:21:15

File client2_dir/client2_file.txt is added
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 20:21:30

File client1_file.txt is modified
File type: Regular file, File size: 7 bytes, File access time: 16.06.2023 20:24:04

File client1_file.txt is modified
File type: Regular file, File size: 18 bytes, File access time: 16.06.2023 20:24:07

File client1_file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 20:24:58

File client1_file.txt is modified
File type: Regular file, File size: 40 bytes, File access time: 16.06.2023 20:24:59
```



```

16.06.2023 20:43:18 : CLIENT: Receiving file client3_dir/client3.txt from server

16.06.2023 20:43:18 : CLIENT: Deleting file client3_dir/client3.txt

16.06.2023 20:43:18 : CLIENT: Deleting fifo file client3_dir/fifo_dir/myfifo

16.06.2023 20:43:18 : CLIENT: Deleting directory client3_dir/fifo_dir

16.06.2023 20:43:18 : CLIENT: Deleting directory client3_dir

File obj/file_ops.o is added
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 20:44:36

File obj/file_ops.o is modified
File type: Regular file, File size: 21872 bytes, File access time: 16.06.2023 20:44:37

File obj/message_impl.o is added
File type: Regular file, File size: 8264 bytes, File access time: 16.06.2023 20:44:37

File obj/task_queue.o is added
File type: Regular file, File size: 3336 bytes, File access time: 16.06.2023 20:44:37
```

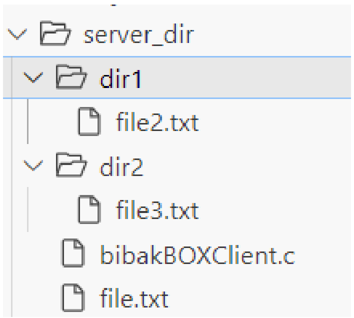


```
16.06.2023 20:56:43 : CLIENT: Deleting file client3/client1_file.txt

16.06.2023 20:56:43 : CLIENT: Deleting file client3/client2_dir/client2_file.txt

16.06.2023 20:56:44 : CLIENT: Deleting file client3/client3_dir/client3.txt

File client1_file.txt is modified
File type: Regular file, File size: 285 bytes, File access time: 16.06.2023 20:58:15

File client1_file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 20:58:20

File client1_file.txt is modified
File type: Regular file, File size: 305 bytes, File access time: 16.06.2023 20:58:22

File client1_file.txt is modified
File type: Regular file, File size: 316 bytes, File access time: 16.06.2023 20:58:32

File client1_file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 20:58:40

File client1_file.txt is modified
File type: Regular file, File size: 328 bytes, File access time: 16.06.2023 20:58:41

File client1_file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 20:58:48
```

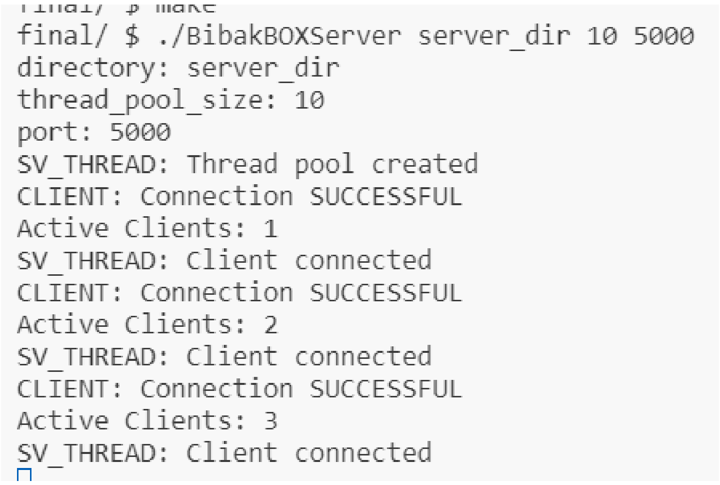


```
File client1_file.txt is modified
File type: Regular file, File size: 340 bytes, File access time: 16.06.2023 20:58:49

File client1_file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 20:58:57

File client1_file.txt is modified
File type: Regular file, File size: 350 bytes, File access time: 16.06.2023 20:58:58

File client1_file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 20:59:04

File client1_file.txt is modified
File type: Regular file, File size: 361 bytes, File access time: 16.06.2023 20:59:05

16.06.2023 21:00:19 : CLIENT: Termination message received from server
```

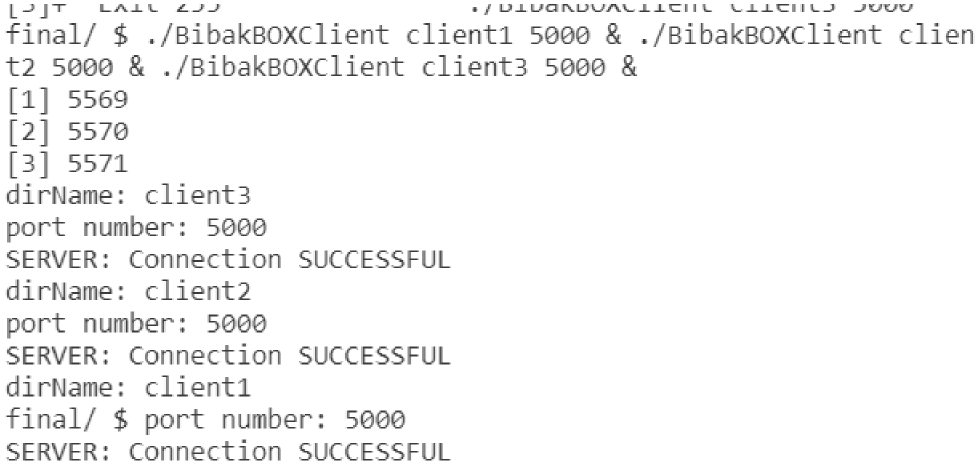
b. Test with 10 Clients



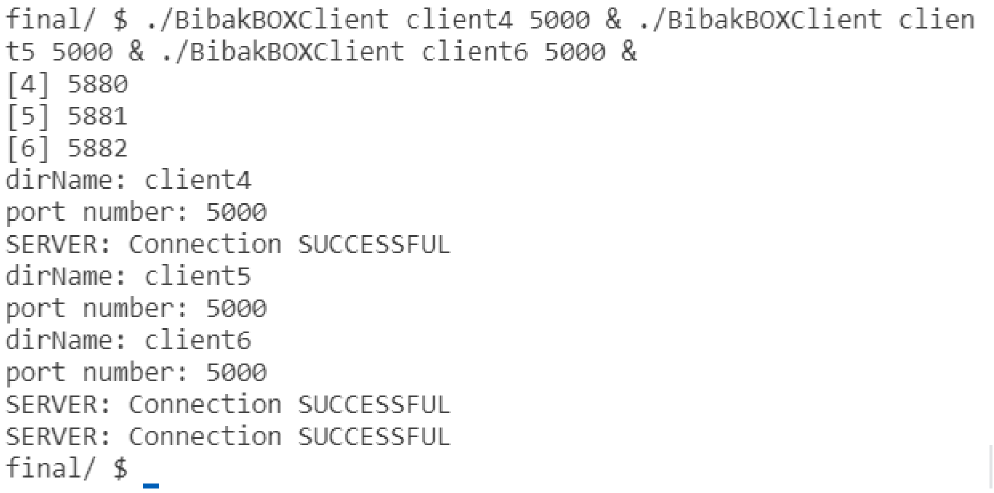
Initial server directory.



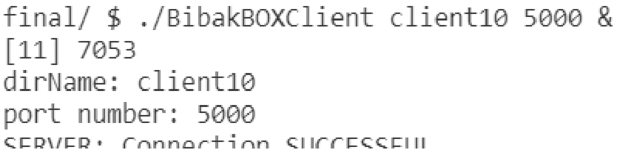
```
final/ $ make
final/ $ ./BibakBOXServer server_dir 10 5000
directory: server_dir
thread_pool_size: 10
port: 5000
SV_THREAD: Thread pool created
CLIENT: Connection SUCCESSFUL
Active Clients: 1
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 2
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 3
SV_THREAD: Client connected
```



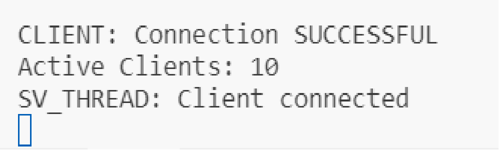
```
[3]+  Exit 255                ./BibakBOXClient client3 5000
final/ $ ./BibakBOXClient client1 5000 & ./BibakBOXClient clien
t2 5000 & ./BibakBOXClient client3 5000 &
[1] 5569
[2] 5570
[3] 5571
dirName: client3
port number: 5000
SERVER: Connection SUCCESSFUL
dirName: client2
port number: 5000
SERVER: Connection SUCCESSFUL
dirName: client1
final/ $ port number: 5000
SERVER: Connection SUCCESSFUL
```



```
final/ $ ./BibakBOXClient client4 5000 & ./BibakBOXClient clien
t5 5000 & ./BibakBOXClient client6 5000 &
[4] 5880
[5] 5881
[6] 5882
dirName: client4
port number: 5000
SERVER: Connection SUCCESSFUL
dirName: client5
port number: 5000
dirName: client6
port number: 5000
SERVER: Connection SUCCESSFUL
SERVER: Connection SUCCESSFUL
final/ $ _
```

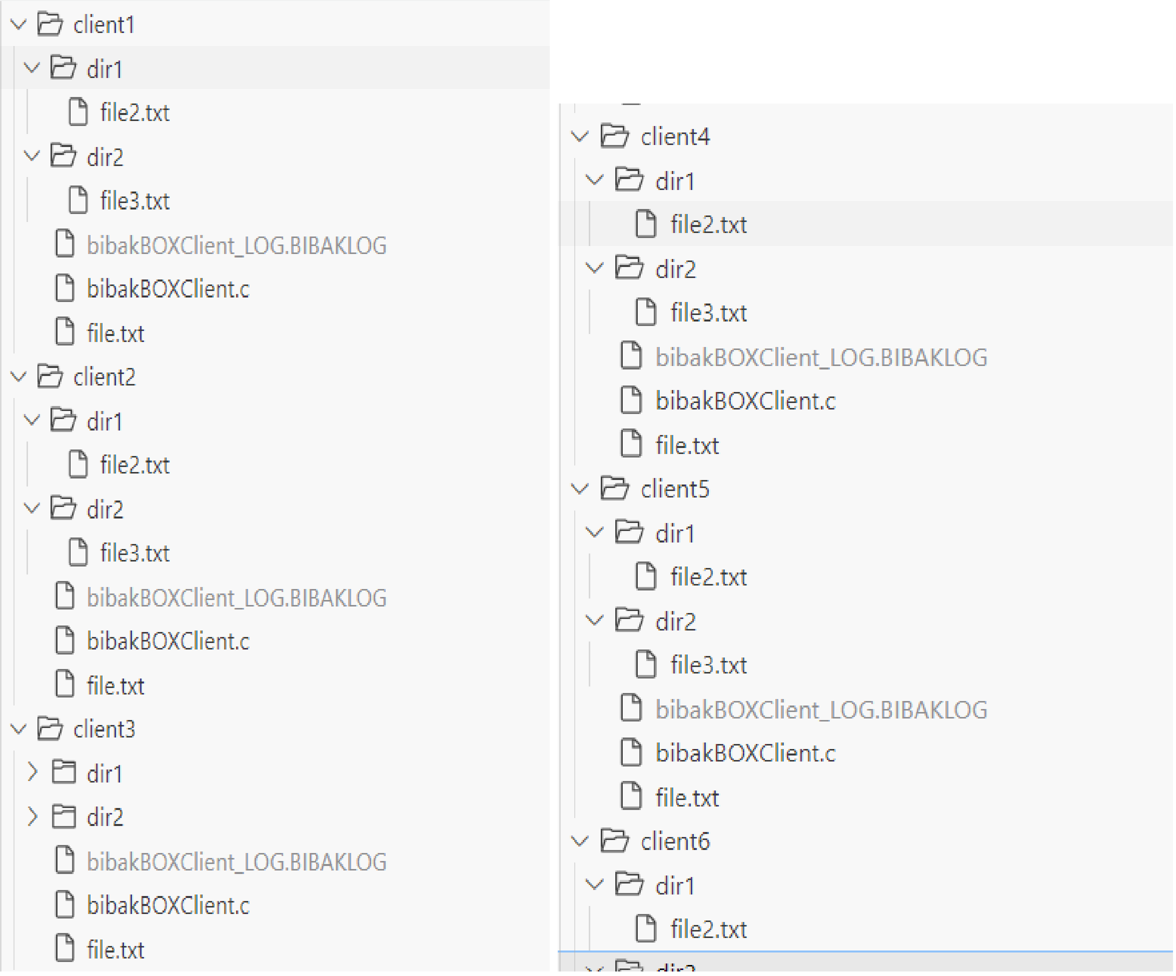


```
final/ $ ./BibakBOXClient client10 5000 &
[11] 7053
dirName: client10
port number: 5000
SERVER: Connection SUCCESSFUL
```



```
CLIENT: Connection SUCCESSFUL
Active Clients: 10
SV_THREAD: Client connected
```

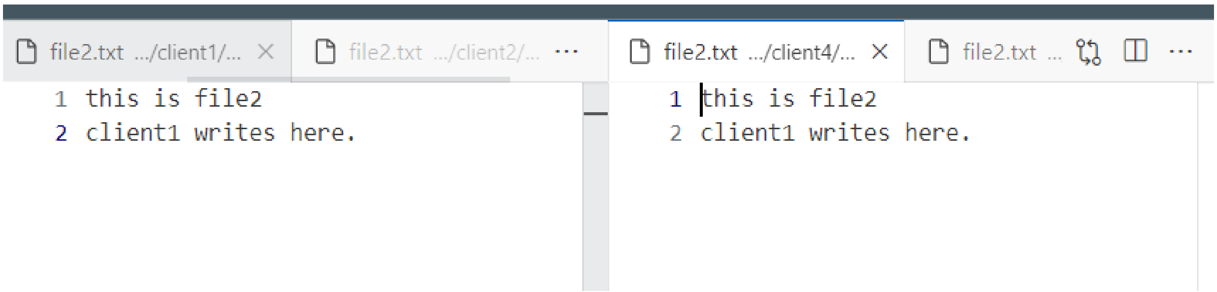
- 10 clients are connected.



```
client1
  dir1
    file2.txt
  dir2
    file3.txt
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  file.txt
client2
  dir1
    file2.txt
  dir2
    file3.txt
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  file.txt
client3
  dir1
  dir2
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  file.txt
```

```
client4
  dir1
    file2.txt
  dir2
    file3.txt
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  file.txt
client5
  dir1
    file2.txt
  dir2
    file3.txt
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  file.txt
client6
  dir1
    file2.txt
  dir2
```

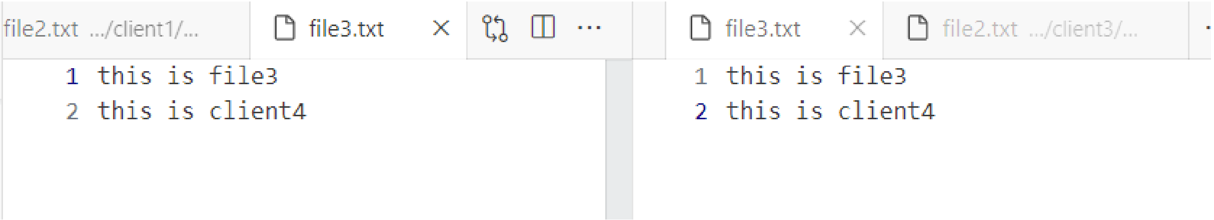
- Directories are synchronized.


file2.txt .../client1/...
file2.txt .../client2/...
file2.txt .../client4/...
file2.txt ...

```
this is file2
client1 writes here.
```

```
this is file2
client1 writes here.
```

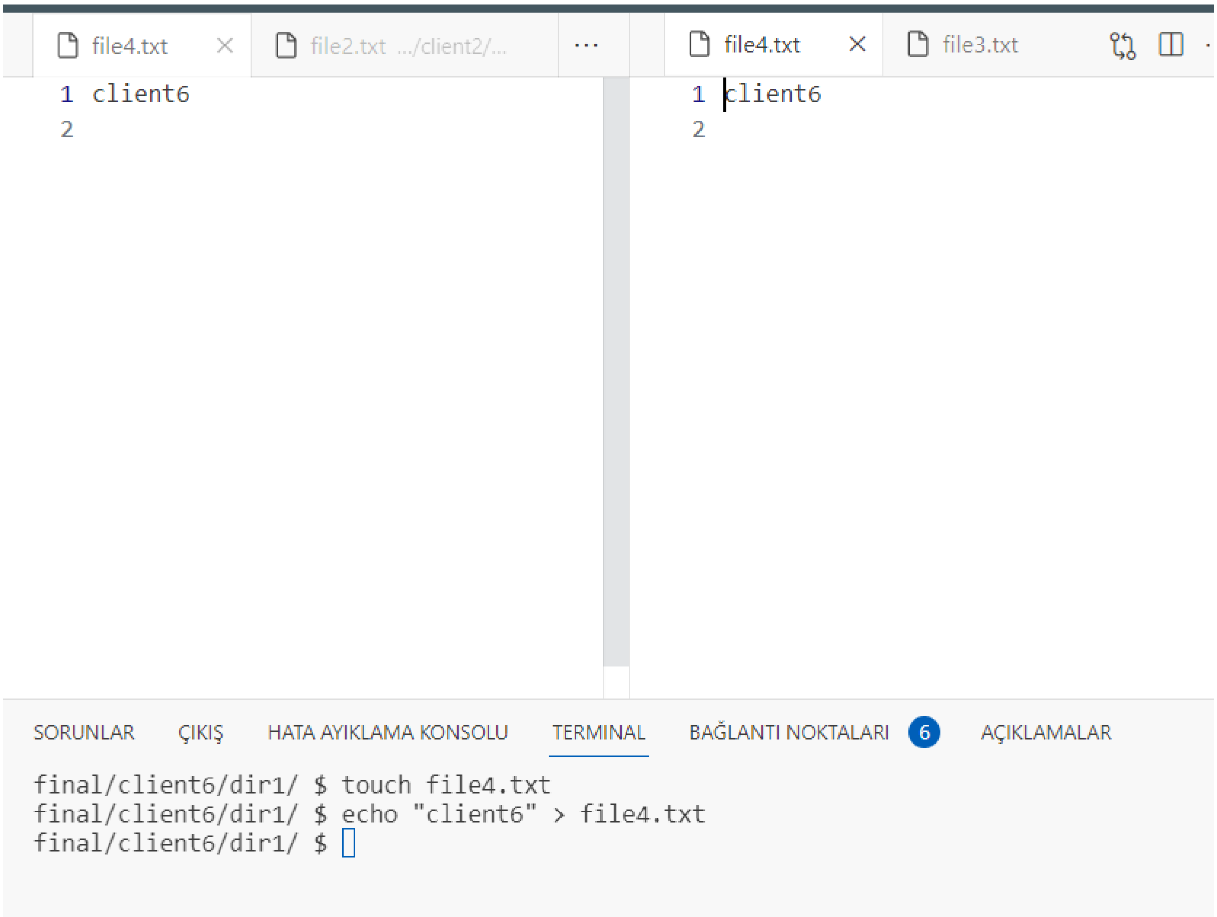
- Client 1 writes and updates.



```
this is file3
this is client4
```

```
this is file3
this is client4
```

- Client 4 writes and updates

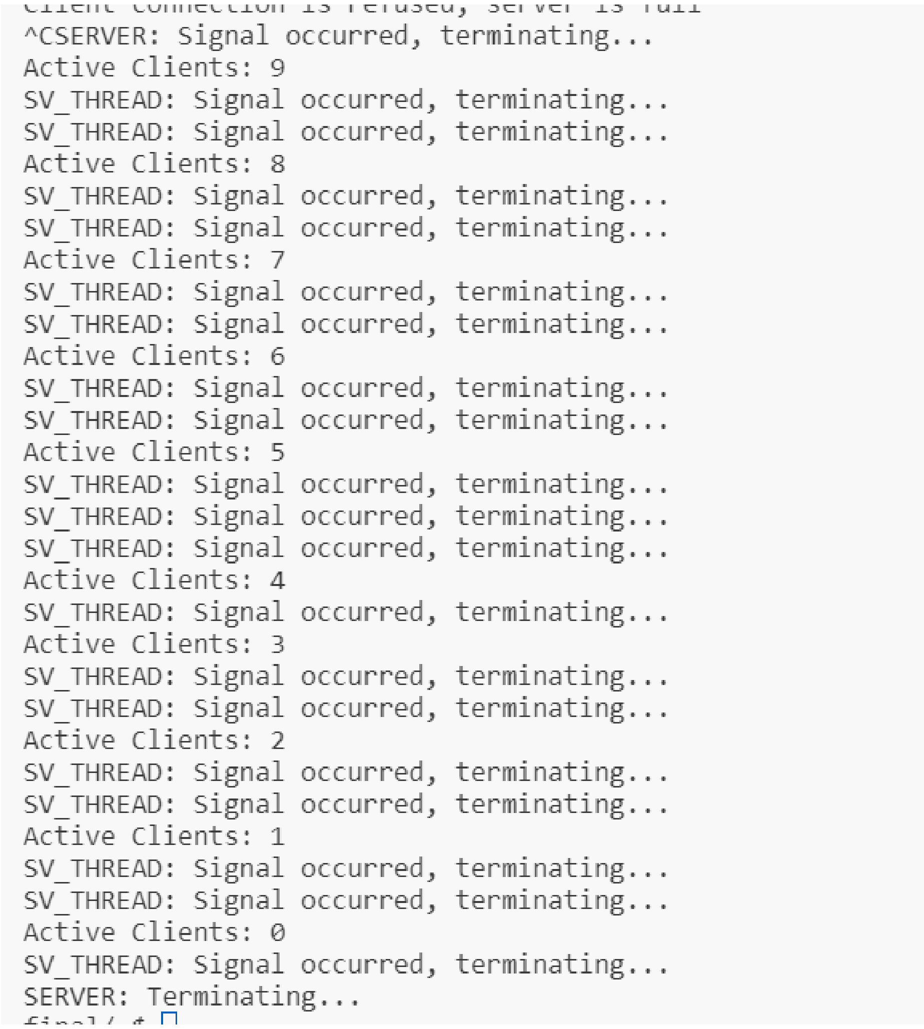


```
1 client6
2
```

```
1 client6
2
```

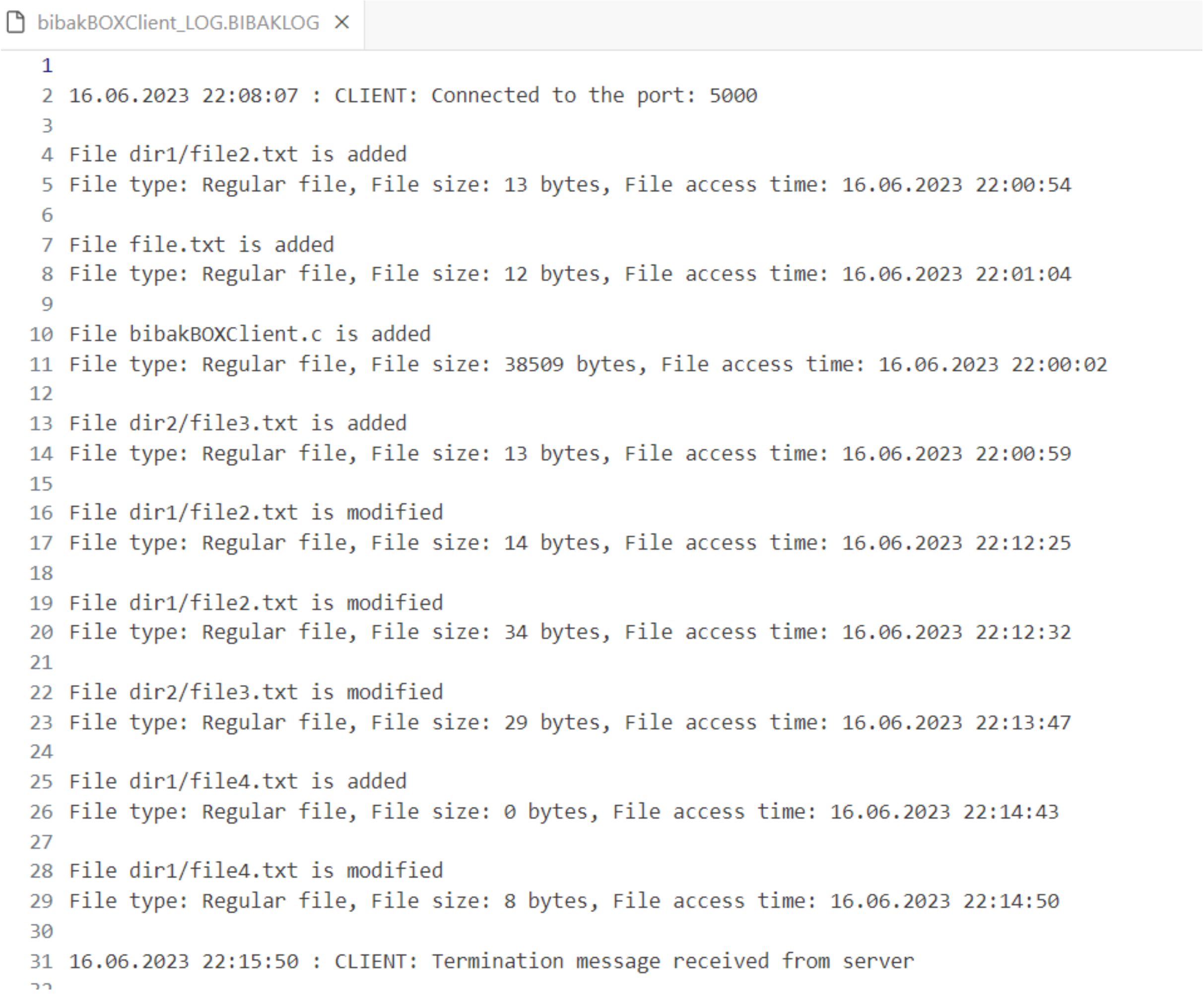
```
final/client6/dir1/ $ touch file4.txt
final/client6/dir1/ $ echo "client6" > file4.txt
final/client6/dir1/ $ 
```

- Client 6 creates file, and it is synchronized.



```
Client connection is refused, server is full
^CSERVER: Signal occurred, terminating...
Active Clients: 9
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 8
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 7
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 6
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 5
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 4
SV_THREAD: Signal occurred, terminating...
Active Clients: 3
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 2
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 1
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 0
SV_THREAD: Signal occurred, terminating...
SERVER: Terminating...
final/ $
```

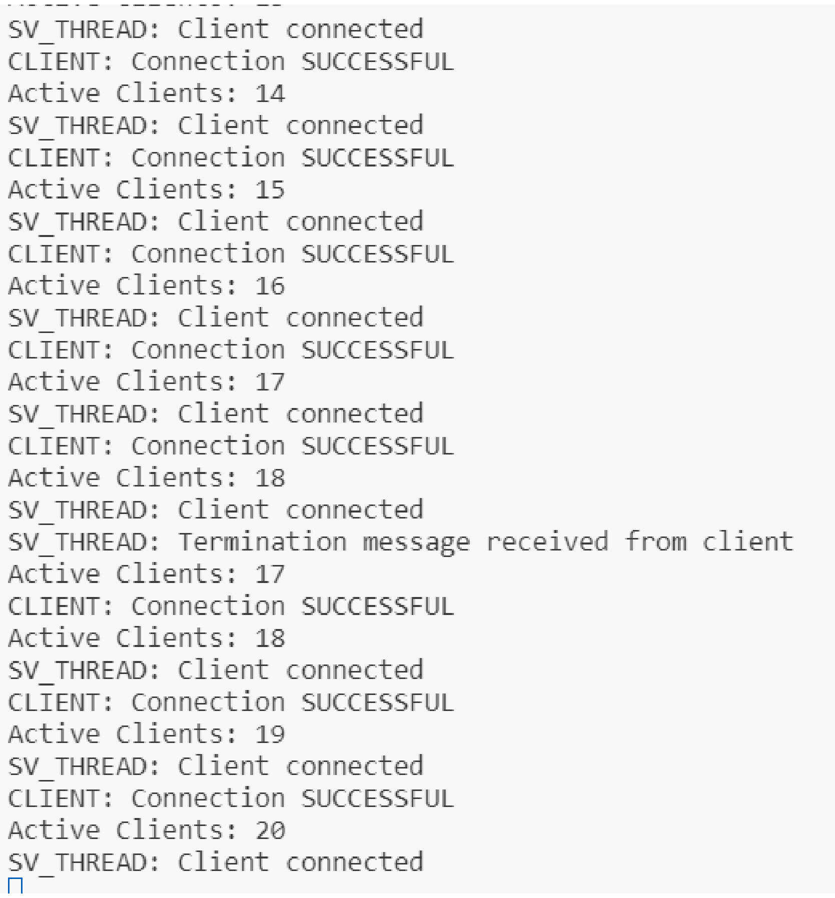
- Server terminated.



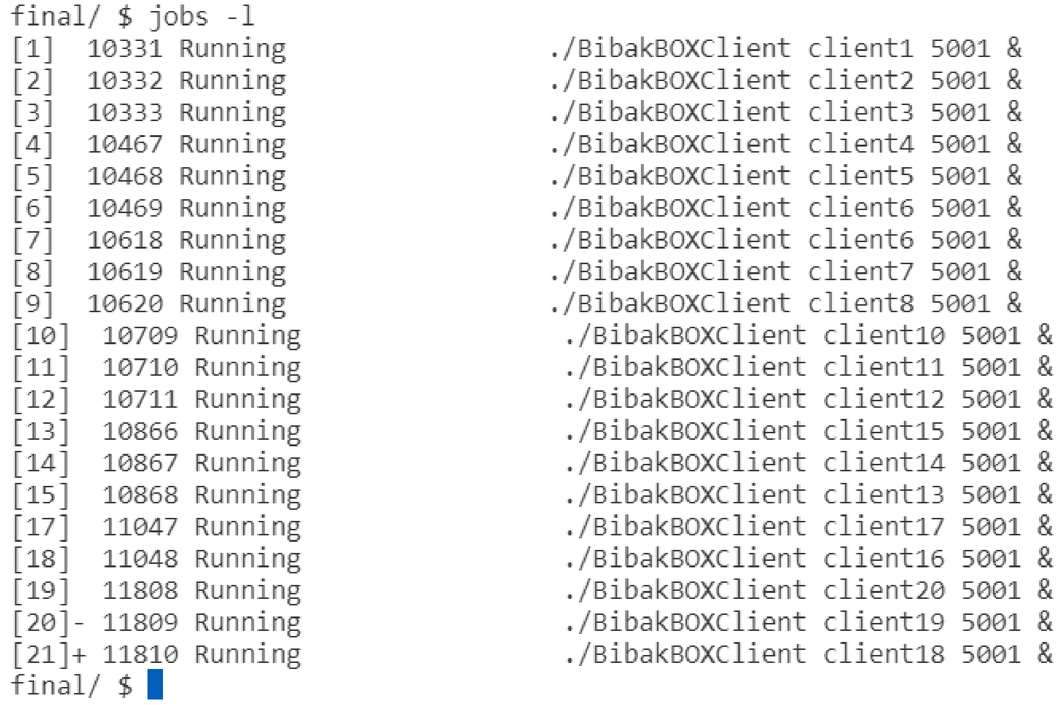
```

16.06.2023 22:08:07 : CLIENT: Connected to the port: 5000

File dir1/file2.txt is added
File type: Regular file, File size: 13 bytes, File access time: 16.06.2023 22:00:54

File file.txt is added
File type: Regular file, File size: 12 bytes, File access time: 16.06.2023 22:01:04

File bibakBOXClient.c is added
File type: Regular file, File size: 38509 bytes, File access time: 16.06.2023 22:00:02

File dir2/file3.txt is added
File type: Regular file, File size: 13 bytes, File access time: 16.06.2023 22:00:59

File dir1/file2.txt is modified
File type: Regular file, File size: 14 bytes, File access time: 16.06.2023 22:12:25

File dir1/file2.txt is modified
File type: Regular file, File size: 34 bytes, File access time: 16.06.2023 22:12:32

File dir2/file3.txt is modified
File type: Regular file, File size: 29 bytes, File access time: 16.06.2023 22:13:47

File dir1/file4.txt is added
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:14:43

File dir1/file4.txt is modified
File type: Regular file, File size: 8 bytes, File access time: 16.06.2023 22:14:50

16.06.2023 22:15:50 : CLIENT: Termination message received from server
```

- Log file of client3.

c. Test with 20 clients

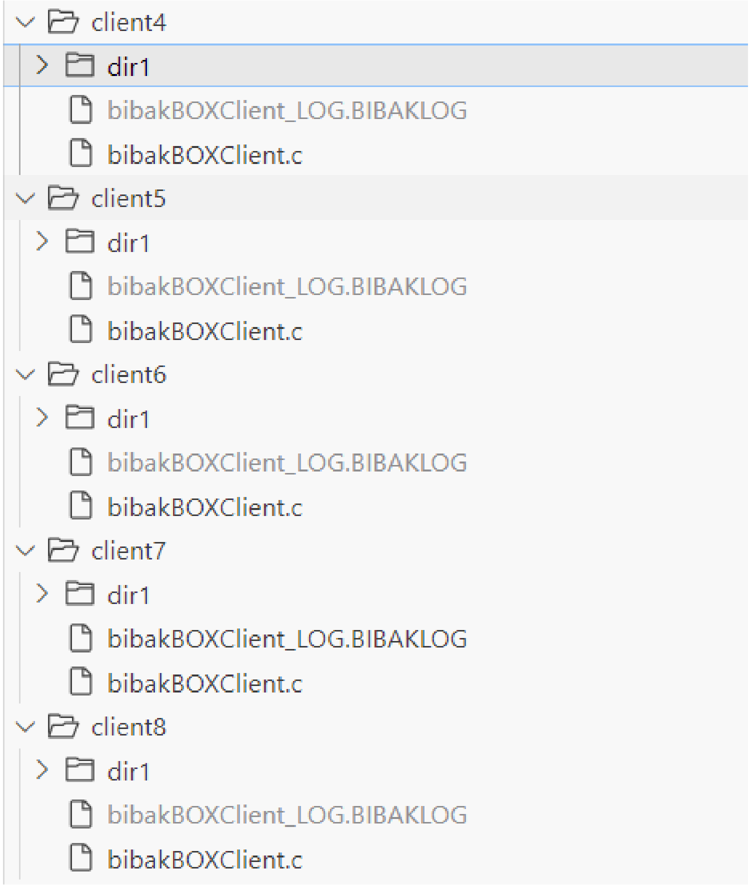


```
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 14
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 15
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 16
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 17
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 18
SV_THREAD: Client connected
SV_THREAD: Termination message received from client
Active Clients: 17
CLIENT: Connection SUCCESSFUL
Active Clients: 18
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 19
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 20
SV_THREAD: Client connected
```



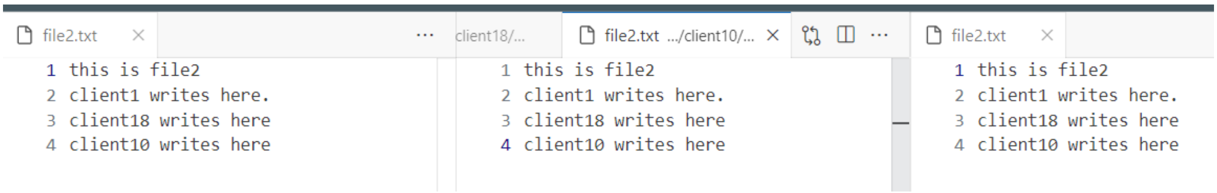
```
final/ $ jobs -l
[1]  10331 Running                 ./BibakBOXClient client1 5001 &
[2]  10332 Running                 ./BibakBOXClient client2 5001 &
[3]  10333 Running                 ./BibakBOXClient client3 5001 &
[4]  10467 Running                 ./BibakBOXClient client4 5001 &
[5]  10468 Running                 ./BibakBOXClient client5 5001 &
[6]  10469 Running                 ./BibakBOXClient client6 5001 &
[7]  10618 Running                 ./BibakBOXClient client6 5001 &
[8]  10619 Running                 ./BibakBOXClient client7 5001 &
[9]  10620 Running                 ./BibakBOXClient client8 5001 &
[10]  10709 Running                 ./BibakBOXClient client10 5001 &
[11]  10710 Running                 ./BibakBOXClient client11 5001 &
[12]  10711 Running                 ./BibakBOXClient client12 5001 &
[13]  10866 Running                 ./BibakBOXClient client15 5001 &
[14]  10867 Running                 ./BibakBOXClient client14 5001 &
[15]  10868 Running                 ./BibakBOXClient client13 5001 &
[17]  11047 Running                 ./BibakBOXClient client17 5001 &
[18]  11048 Running                 ./BibakBOXClient client16 5001 &
[19]  11808 Running                 ./BibakBOXClient client20 5001 &
[20]- 11809 Running                 ./BibakBOXClient client19 5001 &
[21]+ 11810 Running                 ./BibakBOXClient client18 5001 &
final/ $
```

- 20 Clients connected to the server.



```
client4
  dir1
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
client5
  dir1
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
client6
  dir1
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
client7
  dir1
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
client8
  dir1
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
```

dir2 and file.txt is removed.



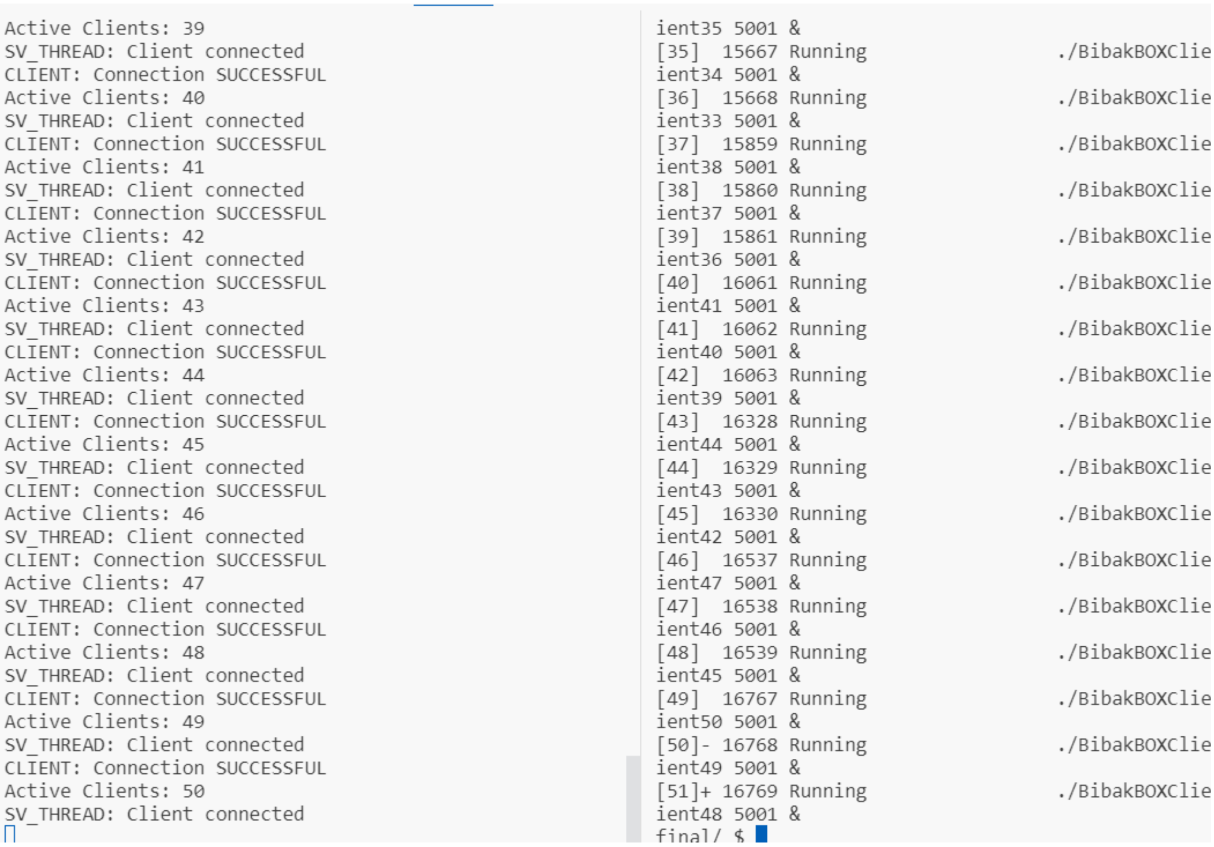
```
this is file2
client1 writes here.
client18 writes here
client10 writes here
```

```
this is file2
client1 writes here.
client18 writes here
client10 writes here
```

```
this is file2
client1 writes here.
client18 writes here
client10 writes here
```

- Client10 writes and it is synchronized

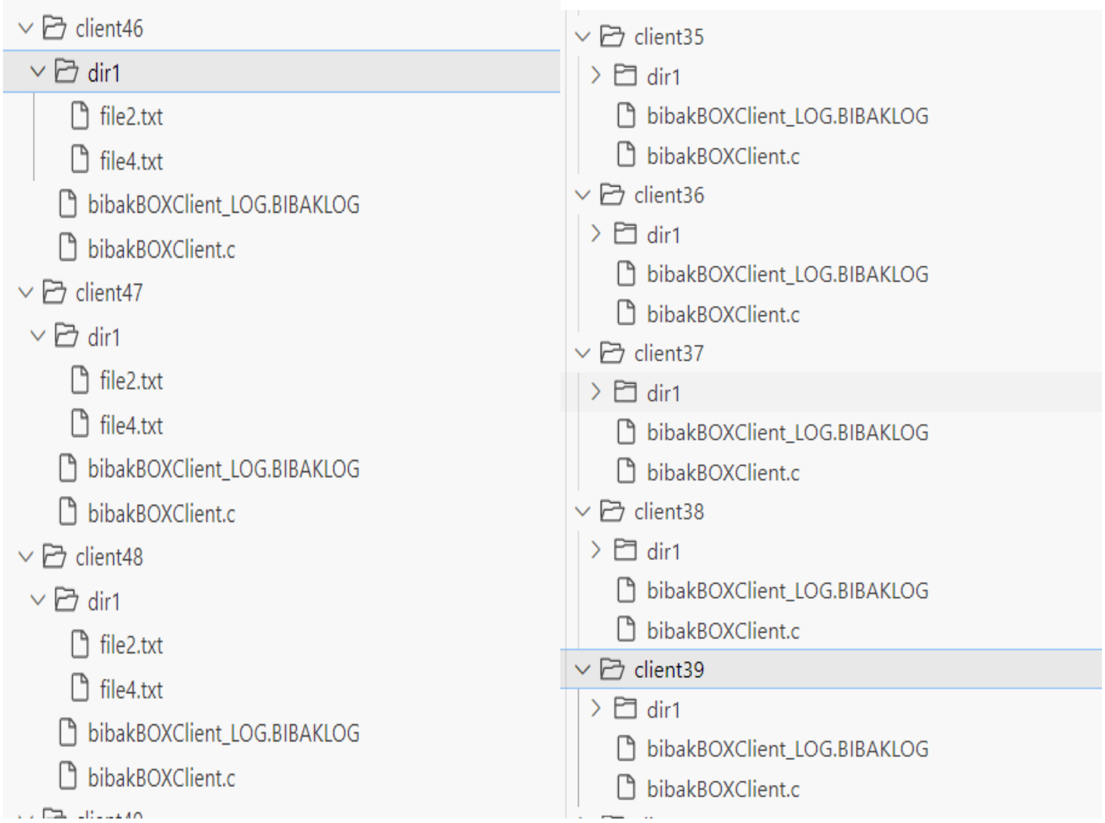
d. Test with 50 clients



```
Active Clients: 39
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 40
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 41
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 42
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 43
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 44
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 45
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 46
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 47
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 48
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 49
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 50
SV_THREAD: Client connected
```

```
ient35 5001 &
[35]  15667 Running                 ./BibakBOXClie
ient34 5001 &
[36]  15668 Running                 ./BibakBOXClie
ient33 5001 &
[37]  15859 Running                 ./BibakBOXClie
ient38 5001 &
[38]  15860 Running                 ./BibakBOXClie
ient37 5001 &
[39]  15861 Running                 ./BibakBOXClie
ient36 5001 &
[40]  16061 Running                 ./BibakBOXClie
ient41 5001 &
[41]  16062 Running                 ./BibakBOXClie
ient40 5001 &
[42]  16063 Running                 ./BibakBOXClie
ient39 5001 &
[43]  16328 Running                 ./BibakBOXClie
ient44 5001 &
[44]  16329 Running                 ./BibakBOXClie
ient43 5001 &
[45]  16330 Running                 ./BibakBOXClie
ient42 5001 &
[46]  16537 Running                 ./BibakBOXClie
ient47 5001 &
[47]  16538 Running                 ./BibakBOXClie
ient46 5001 &
[48]  16539 Running                 ./BibakBOXClie
ient45 5001 &
[49]  16767 Running                 ./BibakBOXClie
ient50 5001 &
[50]- 16768 Running                 ./BibakBOXClie
ient49 5001 &
[51]+ 16769 Running                 ./BibakBOXClie
ient48 5001 &
final/ $
```

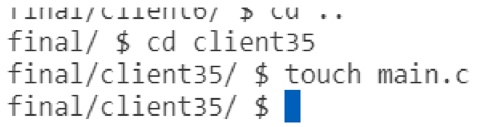
- 50 clients are connected



```
client46
  dir1
    file2.txt
    file4.txt
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
client47
  dir1
    file2.txt
    file4.txt
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
client48
  dir1
    file2.txt
    file4.txt
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
```

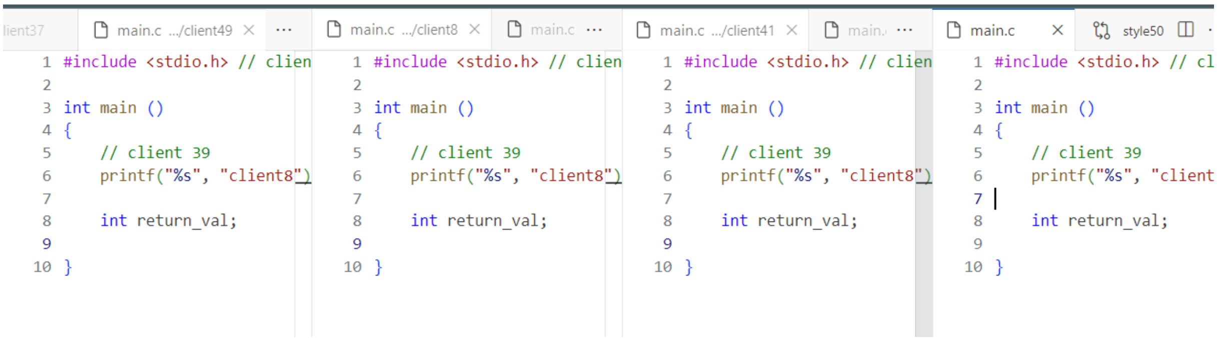
```
client35
  dir1
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
client36
  dir1
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
client37
  dir1
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
client38
  dir1
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
client39
  dir1
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
```

- They are synchronized



```
final/client8/ $ cd ..
final/ $ cd client35
final/client35/ $ touch main.c
final/client35/ $
```

Client 35 created main.c



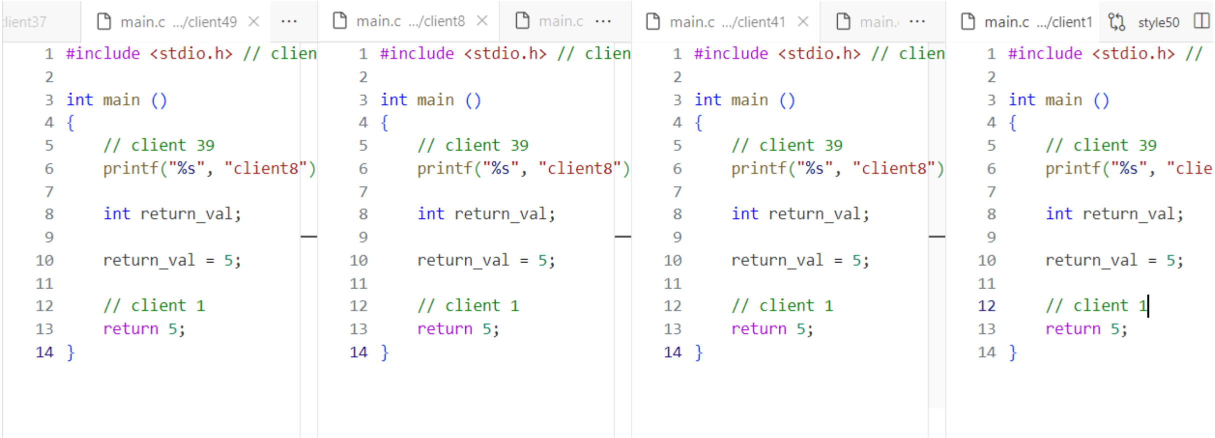
```
#include <stdio.h> // clien

int main ()
{
    // client 39
    printf("%s", "client8")

    int return_val;

}
```

```
#include <stdio.h> // clien

int main ()
{
    // client 39
    printf("%s", "client8")

    int return_val;

}
```

```
#include <stdio.h> // clien

int main ()
{
    // client 39
    printf("%s", "client8")

    int return_val;

}
```

```
#include <stdio.h> // cl

int main ()
{
    // client 39
    printf("%s", "client

    int return_val;

}
```

- Different clients write different things.



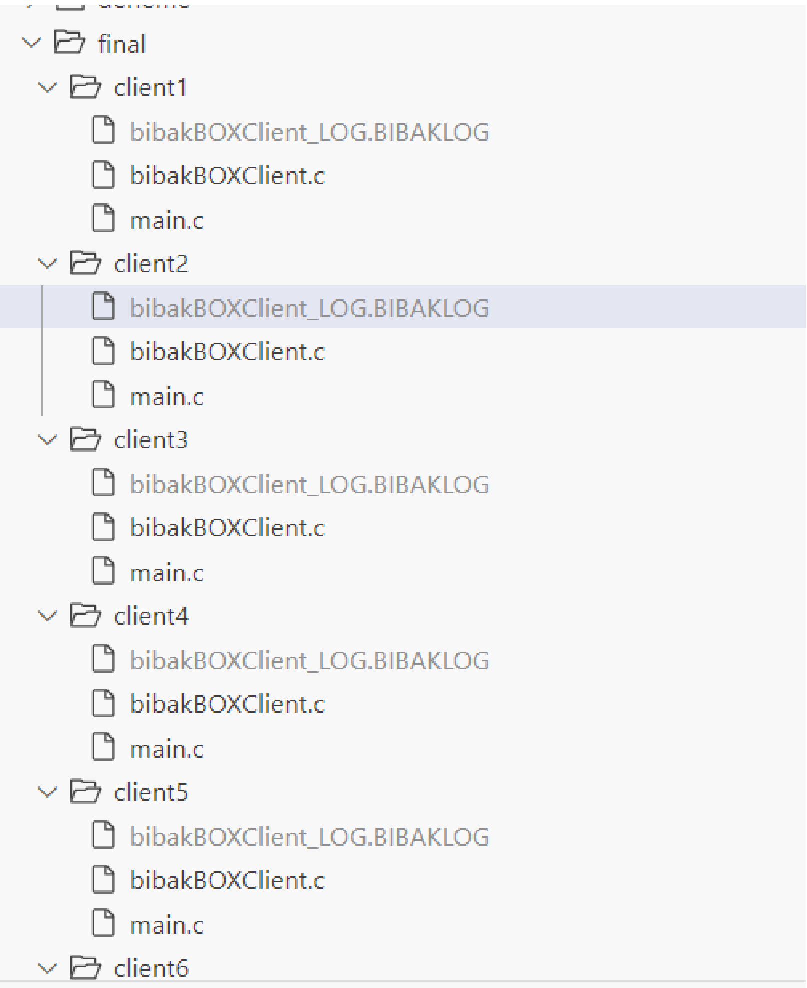
```
#include <stdio.h> // clien

int main ()
{
    // client 39
    printf("%s", "client8")

    int return_val;

    return_val = 5;

    // client 1
    return 5;
}
```

```
#include <stdio.h> // clien

int main ()
{
    // client 39
    printf("%s", "client8")

    int return_val;

    return_val = 5;

    // client 1
    return 5;
}
```

```
#include <stdio.h> // clien

int main ()
{
    // client 39
    printf("%s", "client8")

    int return_val;

    return_val = 5;

    // client 1
    return 5;
}
```

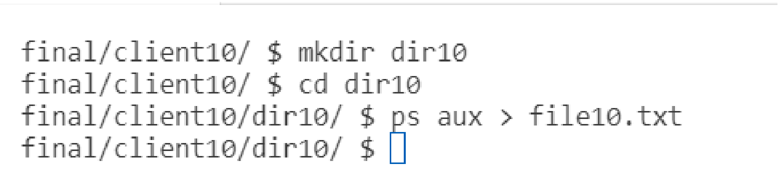
```
#include <stdio.h> //

int main ()
{
    // client 39
    printf("%s", "clie

    int return_val;

    return_val = 5;

    // client 1
    return 5;
}
```

- Client1 also writes



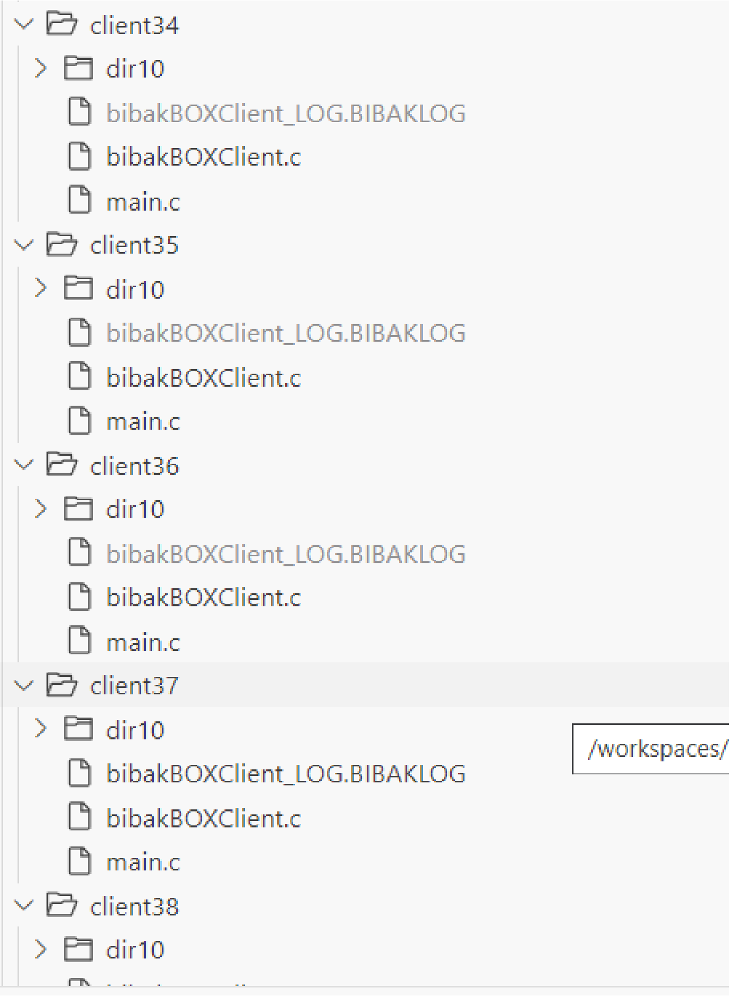
```
final
  client1
    bibakBOXClient_LOG.BIBAKLOG
    bibakBOXClient.c
    main.c
  client2
    bibakBOXClient_LOG.BIBAKLOG
    bibakBOXClient.c
    main.c
  client3
    bibakBOXClient_LOG.BIBAKLOG
    bibakBOXClient.c
    main.c
  client4
    bibakBOXClient_LOG.BIBAKLOG
    bibakBOXClient.c
    main.c
  client5
    bibakBOXClient_LOG.BIBAKLOG
    bibakBOXClient.c
    main.c
  client6
```

Client2 removed dir1.



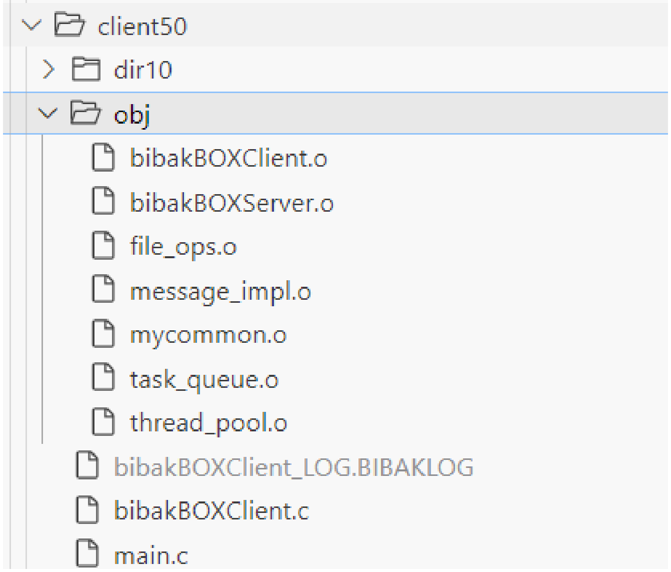
```
final/client10/ $ mkdir dir10
final/client10/ $ cd dir10
final/client10/dir10/ $ ps aux > file10.txt
final/client10/dir10/ $ 
```

- Client 10 created dir10, and created a file.



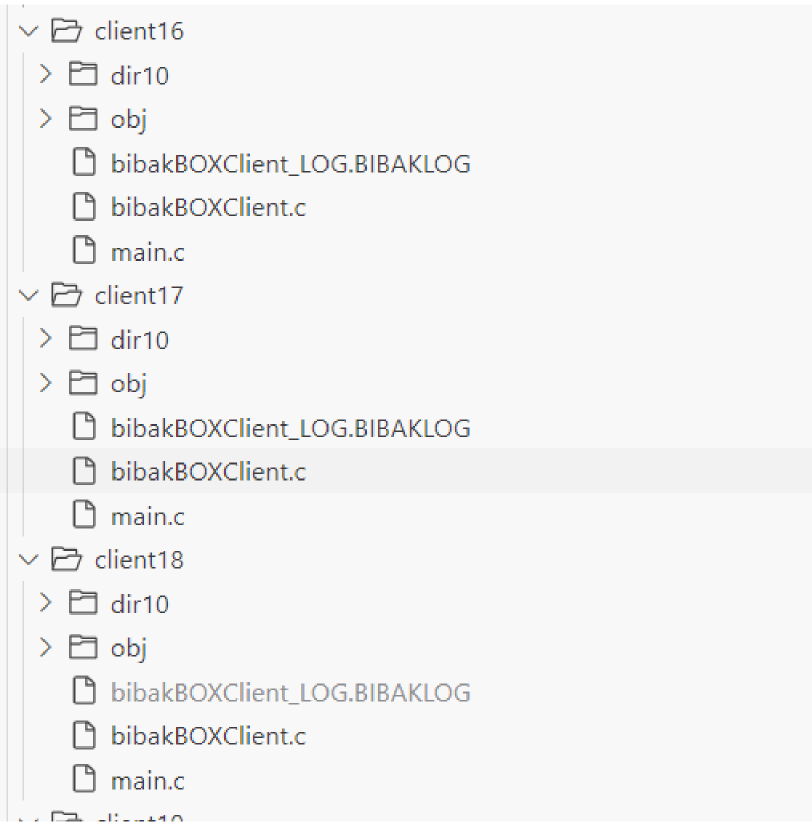
```
client34
  dir10
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  main.c
client35
  dir10
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  main.c
client36
  dir10
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  main.c
client37
  dir10                                /workspaces/
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  main.c
client38
  dir10
```

Other clients are synchronized.



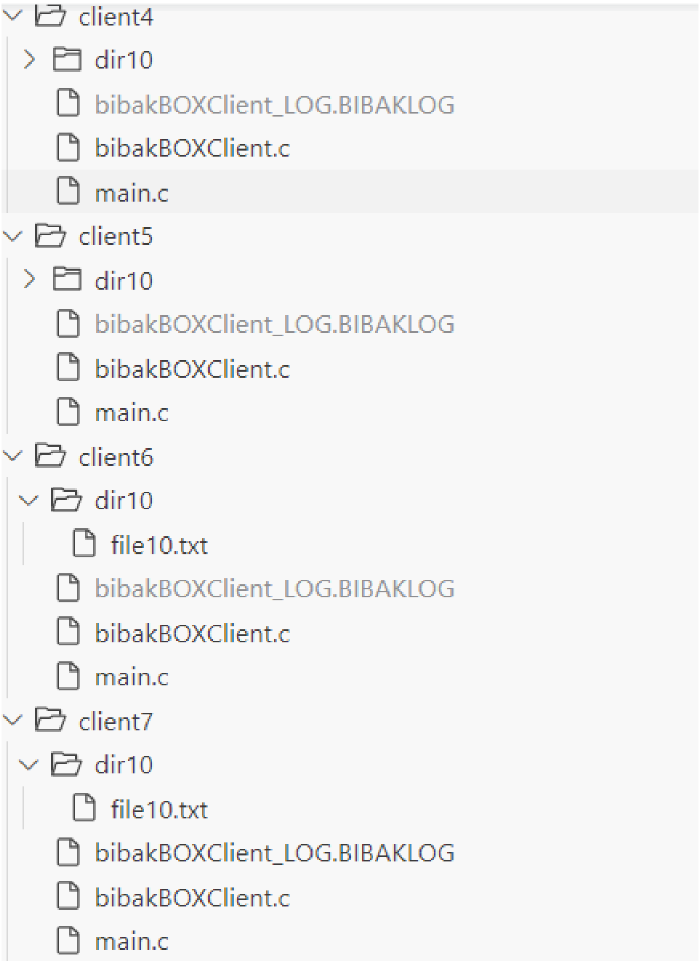
```
client50
  dir10
  obj
    bibakBOXClient.o
    bibakBOXServer.o
    file_ops.o
    message_impl.o
    mycommon.o
    task_queue.o
    thread_pool.o
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  main.c
```

Client 50 adds obj directory.



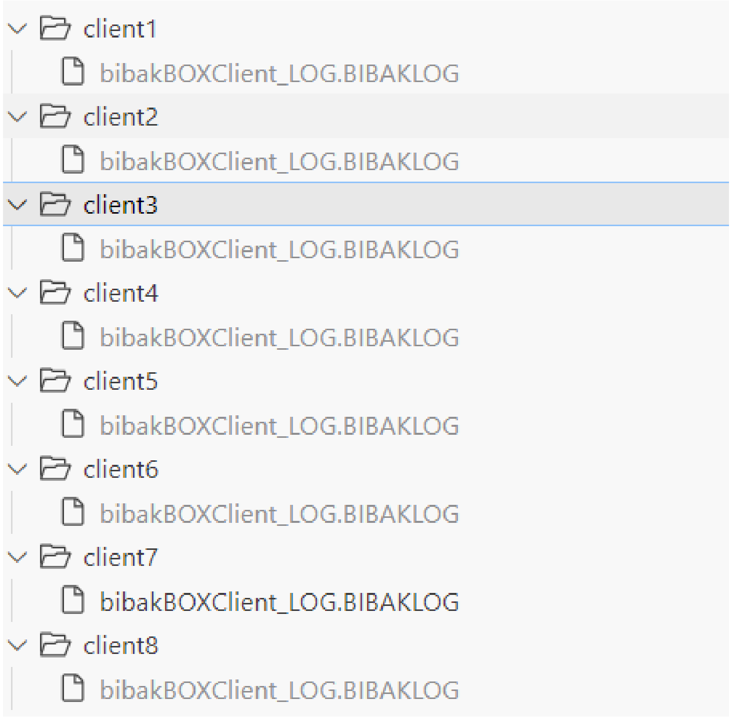
```
client16
  dir10
  obj
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  main.c
client17
  dir10
  obj
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  main.c
client18
  dir10
  obj
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  main.c
client19
```

Other clients are synchronized.



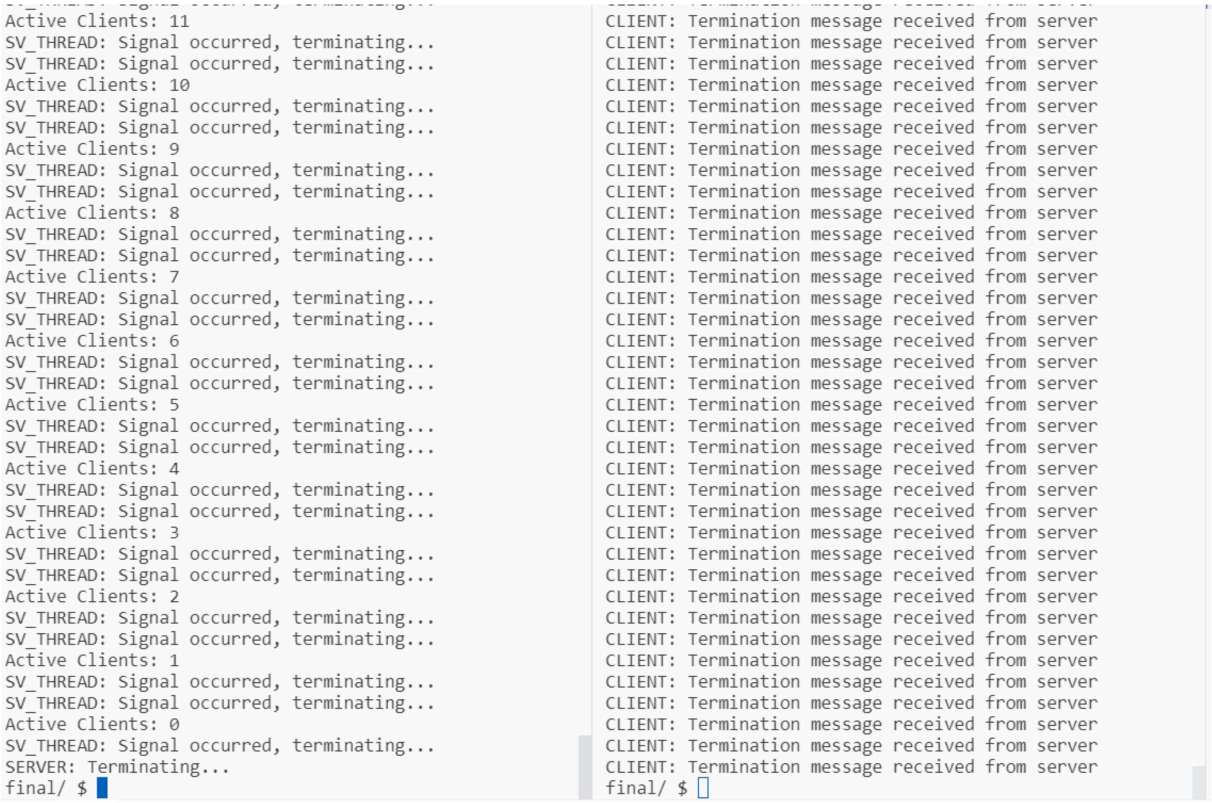
```
client4
  dir10
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  main.c
client5
  dir10
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  main.c
client6
  dir10
    file10.txt
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  main.c
client7
  dir10
    file10.txt
  bibakBOXClient_LOG.BIBAKLOG
  bibakBOXClient.c
  main.c
```

obj directory is removed, and all clients synchronized.



```
client1
  bibakBOXClient_LOG.BIBAKLOG
client2
  bibakBOXClient_LOG.BIBAKLOG
client3
  bibakBOXClient_LOG.BIBAKLOG
client4
  bibakBOXClient_LOG.BIBAKLOG
client5
  bibakBOXClient_LOG.BIBAKLOG
client6
  bibakBOXClient_LOG.BIBAKLOG
client7
  bibakBOXClient_LOG.BIBAKLOG
client8
  bibakBOXClient_LOG.BIBAKLOG
```

client2 removed all files.



```
SV_THREAD: Signal occurred, terminating...
Active Clients: 11
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 10
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 9
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 8
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 7
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 6
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 5
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 4
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 3
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 2
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 1
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 0
SV_THREAD: Signal occurred, terminating...
SERVER: Terminating...
final/ $
```

```
CLIENT: Termination message received from server
CLIENT: Termination message received from server
CLIENT: Termination message received from server
CLIENT: Termination message received from server
CLIENT: Termination message received from server
CLIENT: Termination message received from server
CLIENT: Termination message received from server
CLIENT: Termination message received from server
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CLIENT: Termination message received from server
CLIENT: Termination message received from server
CLIENT: Termination message received from server
CLIENT: Termination message received from server
CLIENT: Termination message received from server
final/ $
```
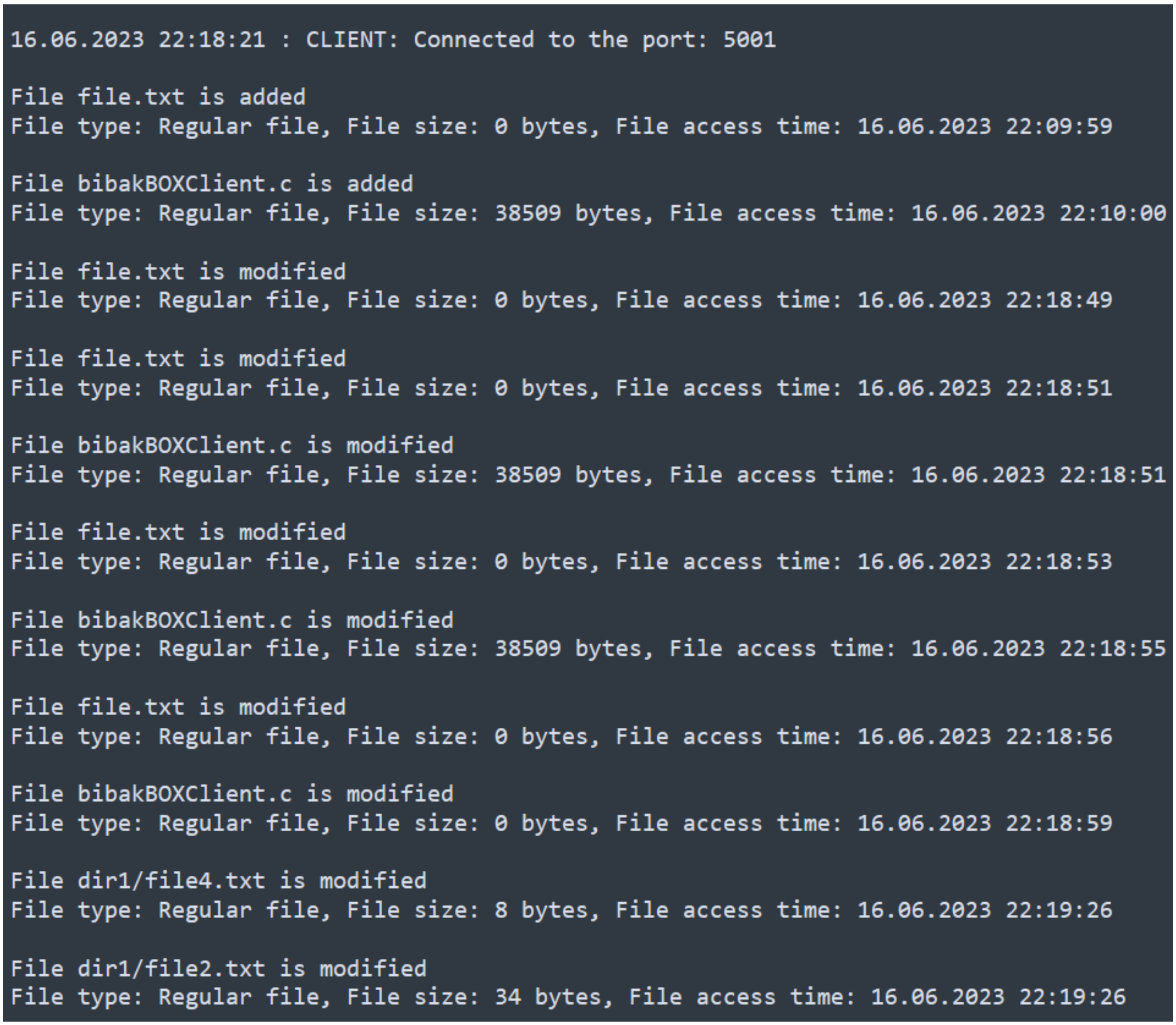
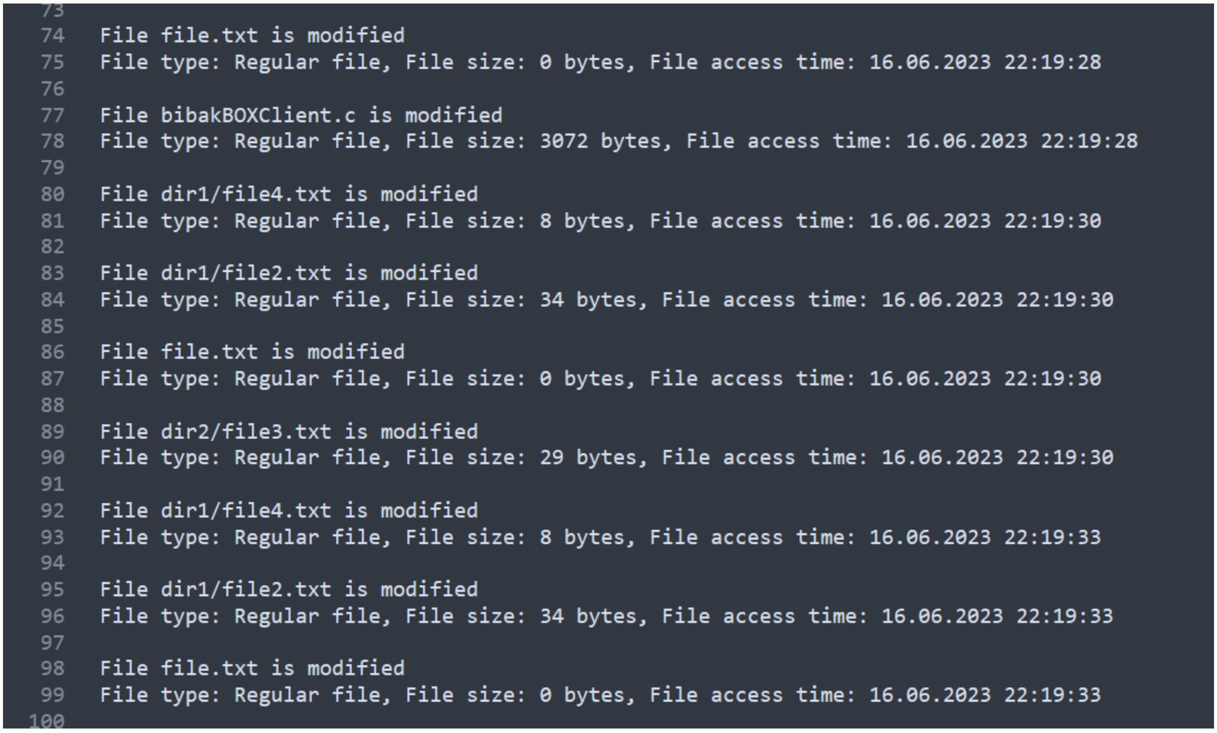
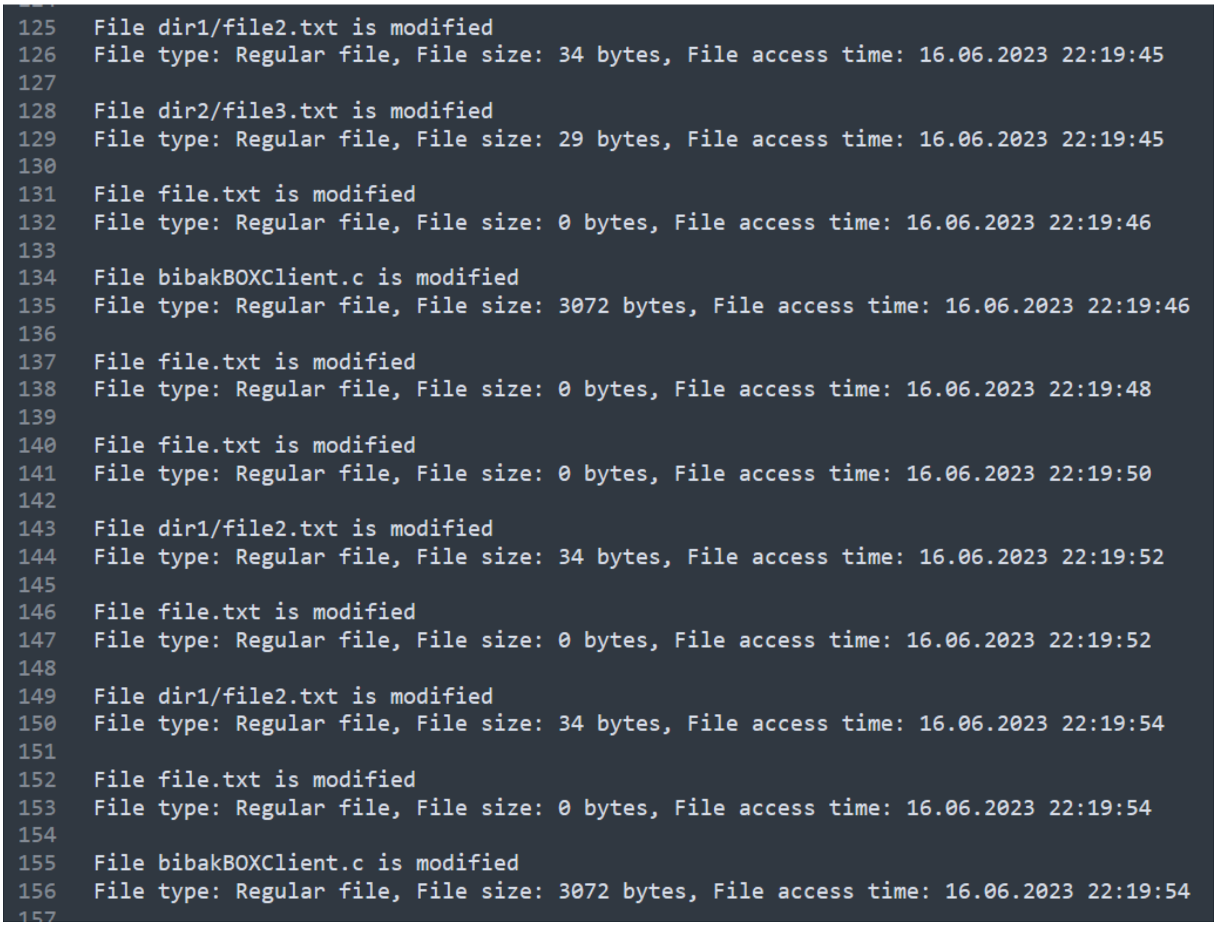

- Server terminated, and all clients are terminated.



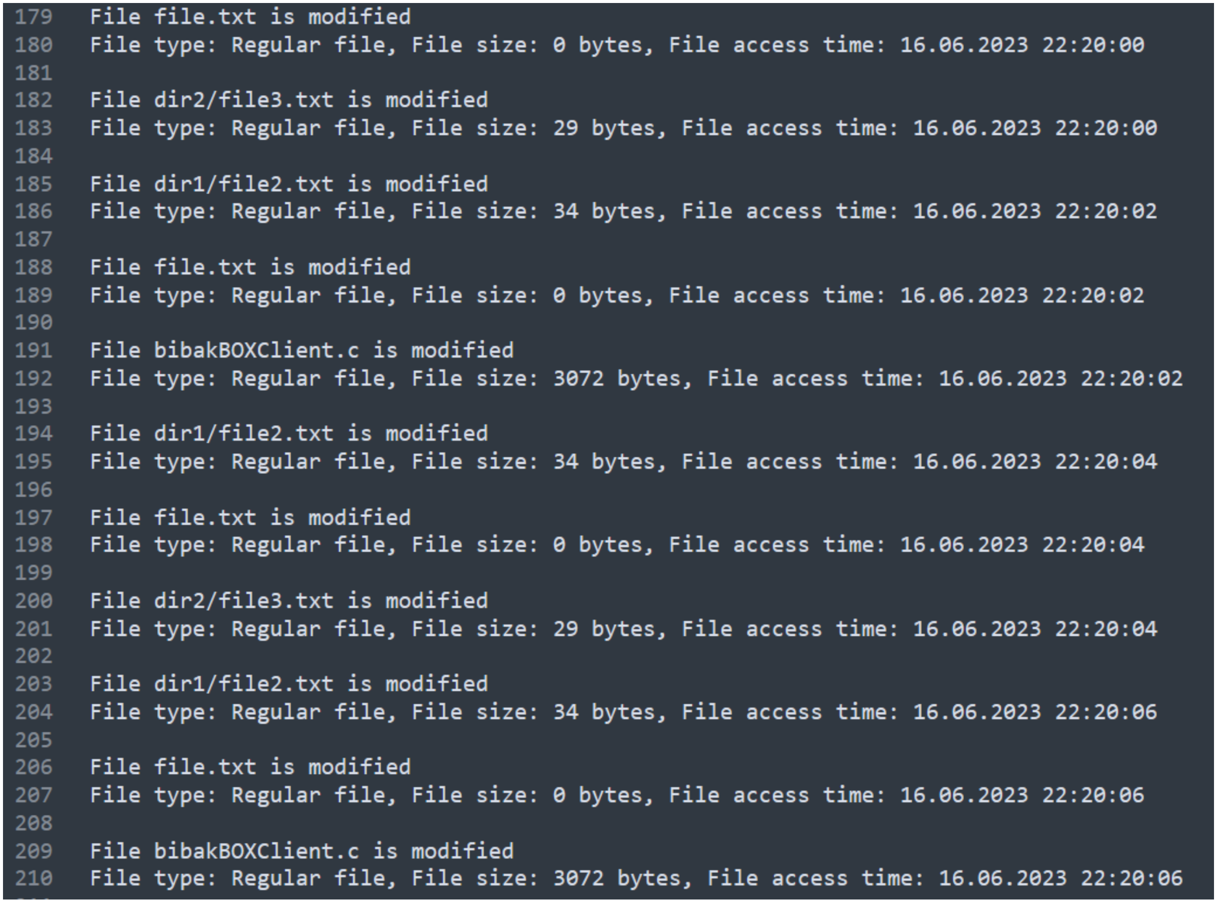
```
16.06.2023 22:18:21 : CLIENT: Connected to the port: 5001

File file.txt is added
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:09:59

File bibakBOXClient.c is added
File type: Regular file, File size: 38509 bytes, File access time: 16.06.2023 22:10:00

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:18:49

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:18:51

File bibakBOXClient.c is modified
File type: Regular file, File size: 38509 bytes, File access time: 16.06.2023 22:18:51

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:18:53

File bibakBOXClient.c is modified
File type: Regular file, File size: 38509 bytes, File access time: 16.06.2023 22:18:55

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:18:56

File bibakBOXClient.c is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:18:59

File dir1/file4.txt is modified
File type: Regular file, File size: 8 bytes, File access time: 16.06.2023 22:19:26

File dir1/file2.txt is modified
File type: Regular file, File size: 34 bytes, File access time: 16.06.2023 22:19:26
```



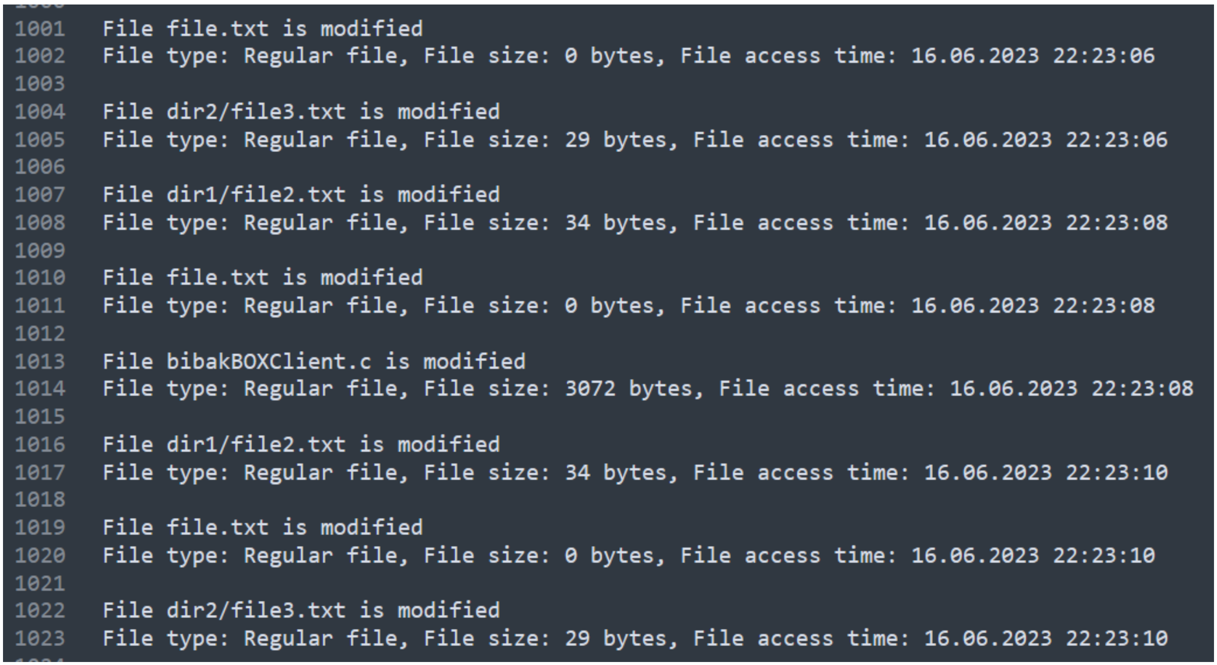
```

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:19:28

File bibakBOXClient.c is modified
File type: Regular file, File size: 3072 bytes, File access time: 16.06.2023 22:19:28

File dir1/file4.txt is modified
File type: Regular file, File size: 8 bytes, File access time: 16.06.2023 22:19:30

File dir1/file2.txt is modified
File type: Regular file, File size: 34 bytes, File access time: 16.06.2023 22:19:30

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:19:30

File dir2/file3.txt is modified
File type: Regular file, File size: 29 bytes, File access time: 16.06.2023 22:19:30

File dir1/file4.txt is modified
File type: Regular file, File size: 8 bytes, File access time: 16.06.2023 22:19:33

File dir1/file2.txt is modified
File type: Regular file, File size: 34 bytes, File access time: 16.06.2023 22:19:33

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:19:33

```



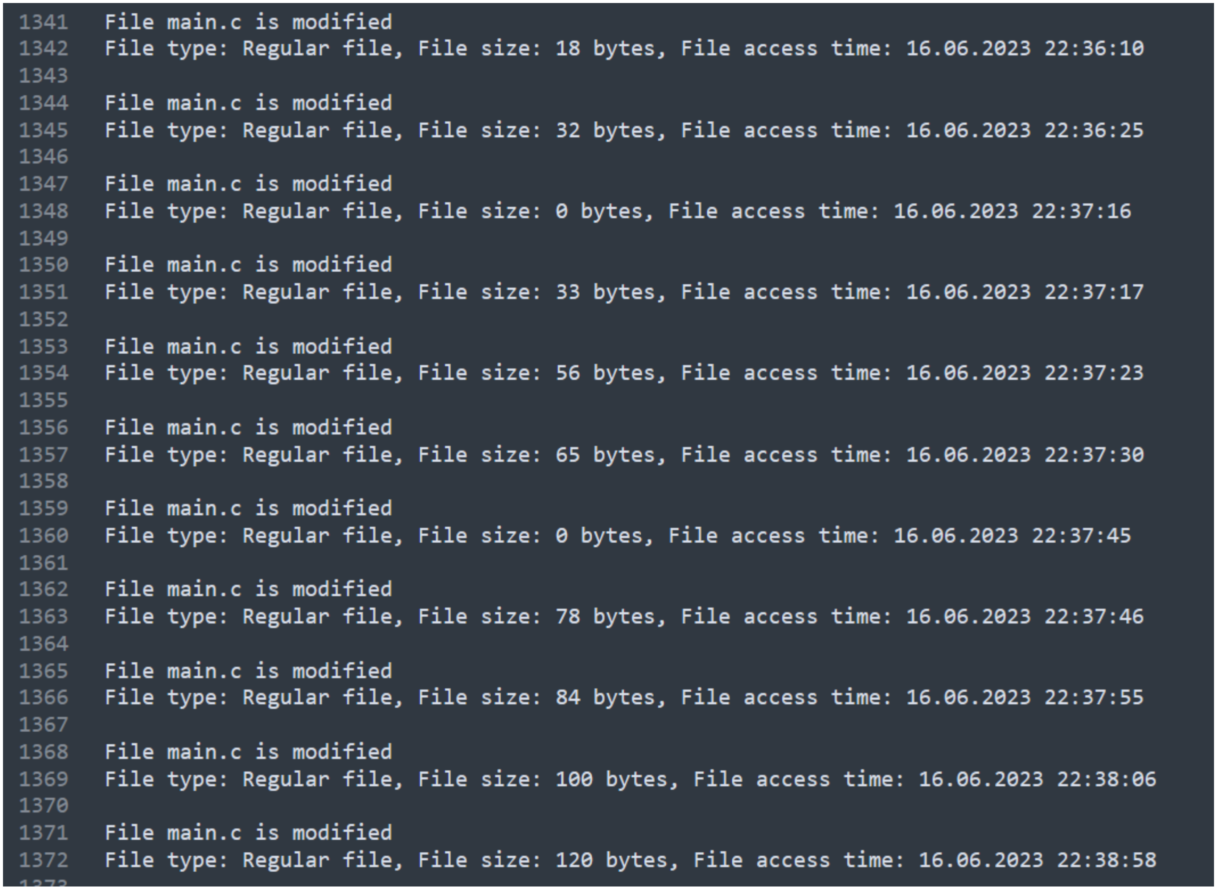
```
File dir1/file2.txt is modified
File type: Regular file, File size: 34 bytes, File access time: 16.06.2023 22:19:45

File dir2/file3.txt is modified
File type: Regular file, File size: 29 bytes, File access time: 16.06.2023 22:19:45

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:19:46

File bibakBOXClient.c is modified
File type: Regular file, File size: 3072 bytes, File access time: 16.06.2023 22:19:46

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:19:48

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:19:50

File dir1/file2.txt is modified
File type: Regular file, File size: 34 bytes, File access time: 16.06.2023 22:19:52

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:19:52

File dir1/file2.txt is modified
File type: Regular file, File size: 34 bytes, File access time: 16.06.2023 22:19:54

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:19:54

File bibakBOXClient.c is modified
File type: Regular file, File size: 3072 bytes, File access time: 16.06.2023 22:19:54
```



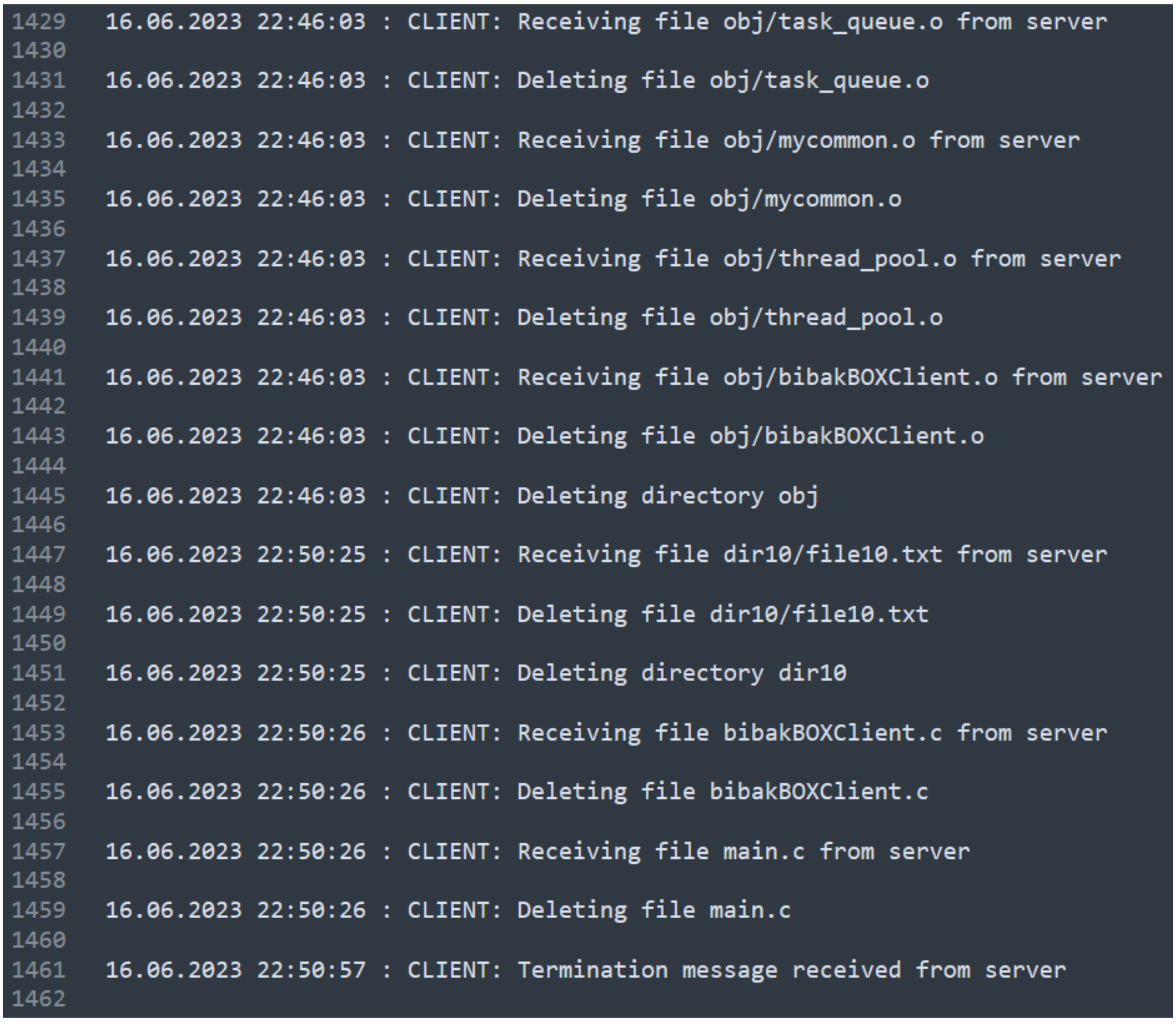
```
File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:20:00

File dir2/file3.txt is modified
File type: Regular file, File size: 29 bytes, File access time: 16.06.2023 22:20:00

File dir1/file2.txt is modified
File type: Regular file, File size: 34 bytes, File access time: 16.06.2023 22:20:02

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:20:02

File bibakBOXClient.c is modified
File type: Regular file, File size: 3072 bytes, File access time: 16.06.2023 22:20:02

File dir1/file2.txt is modified
File type: Regular file, File size: 34 bytes, File access time: 16.06.2023 22:20:04

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:20:04

File dir2/file3.txt is modified
File type: Regular file, File size: 29 bytes, File access time: 16.06.2023 22:20:04

File dir1/file2.txt is modified
File type: Regular file, File size: 34 bytes, File access time: 16.06.2023 22:20:06

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:20:06

File bibakBOXClient.c is modified
File type: Regular file, File size: 3072 bytes, File access time: 16.06.2023 22:20:06
```



```
File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:23:06

File dir2/file3.txt is modified
File type: Regular file, File size: 29 bytes, File access time: 16.06.2023 22:23:06

File dir1/file2.txt is modified
File type: Regular file, File size: 34 bytes, File access time: 16.06.2023 22:23:08

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:23:08

File bibakBOXClient.c is modified
File type: Regular file, File size: 3072 bytes, File access time: 16.06.2023 22:23:08

File dir1/file2.txt is modified
File type: Regular file, File size: 34 bytes, File access time: 16.06.2023 22:23:10

File file.txt is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:23:10

File dir2/file3.txt is modified
File type: Regular file, File size: 29 bytes, File access time: 16.06.2023 22:23:10
```



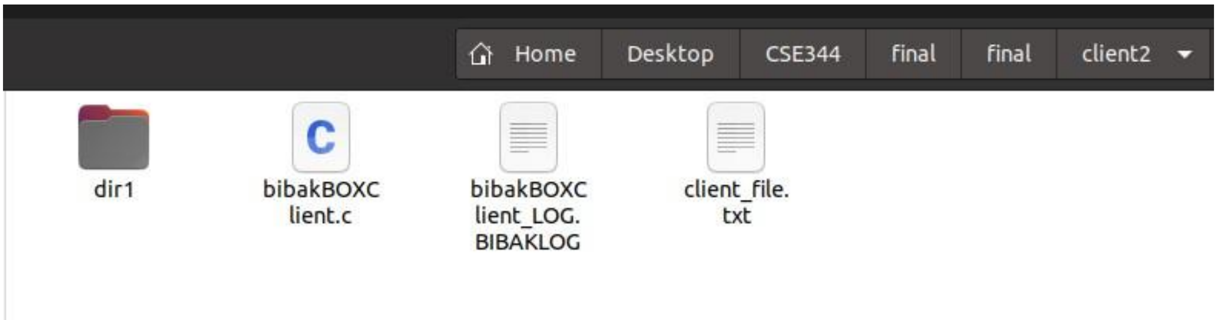
```
File main.c is modified
File type: Regular file, File size: 18 bytes, File access time: 16.06.2023 22:36:10

File main.c is modified
File type: Regular file, File size: 32 bytes, File access time: 16.06.2023 22:36:25

File main.c is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:37:16

File main.c is modified
File type: Regular file, File size: 33 bytes, File access time: 16.06.2023 22:37:17

File main.c is modified
File type: Regular file, File size: 56 bytes, File access time: 16.06.2023 22:37:23

File main.c is modified
File type: Regular file, File size: 65 bytes, File access time: 16.06.2023 22:37:30

File main.c is modified
File type: Regular file, File size: 0 bytes, File access time: 16.06.2023 22:37:45

File main.c is modified
File type: Regular file, File size: 78 bytes, File access time: 16.06.2023 22:37:46

File main.c is modified
File type: Regular file, File size: 84 bytes, File access time: 16.06.2023 22:37:55

File main.c is modified
File type: Regular file, File size: 100 bytes, File access time: 16.06.2023 22:38:06

File main.c is modified
File type: Regular file, File size: 120 bytes, File access time: 16.06.2023 22:38:58
```

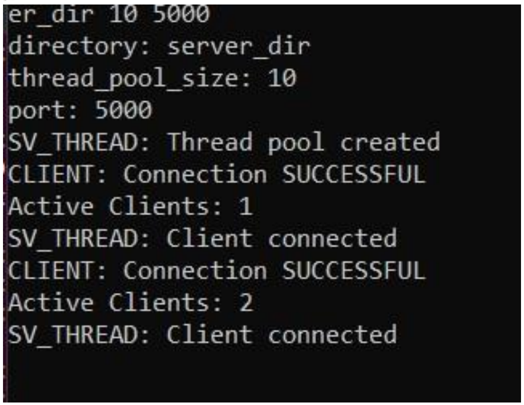


```
16.06.2023 22:46:03 : CLIENT: Receiving file obj/task_queue.o from server

16.06.2023 22:46:03 : CLIENT: Deleting file obj/task_queue.o

16.06.2023 22:46:03 : CLIENT: Receiving file obj/mycommon.o from server

16.06.2023 22:46:03 : CLIENT: Deleting file obj/mycommon.o

16.06.2023 22:46:03 : CLIENT: Receiving file obj/thread_pool.o from server

16.06.2023 22:46:03 : CLIENT: Deleting file obj/thread_pool.o

16.06.2023 22:46:03 : CLIENT: Receiving file obj/bibakBOXClient.o from server

16.06.2023 22:46:03 : CLIENT: Deleting file obj/bibakBOXClient.o

16.06.2023 22:46:03 : CLIENT: Deleting directory obj

16.06.2023 22:50:25 : CLIENT: Receiving file dir10/file10.txt from server

16.06.2023 22:50:25 : CLIENT: Deleting file dir10/file10.txt

16.06.2023 22:50:25 : CLIENT: Deleting directory dir10

16.06.2023 22:50:26 : CLIENT: Receiving file bibakBOXClient.c from server

16.06.2023 22:50:26 : CLIENT: Deleting file bibakBOXClient.c

16.06.2023 22:50:26 : CLIENT: Receiving file main.c from server

16.06.2023 22:50:26 : CLIENT: Deleting file main.c

16.06.2023 22:50:57 : CLIENT: Termination message received from server

```

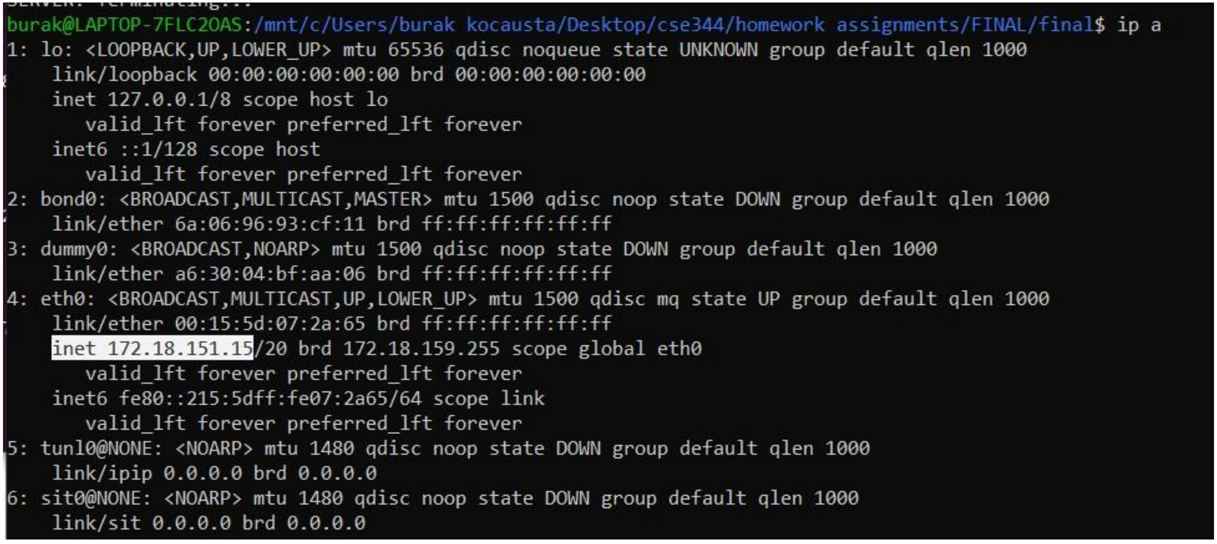
- Some parts of client1 log file. Full file is shared with report.

e. Test with different machines



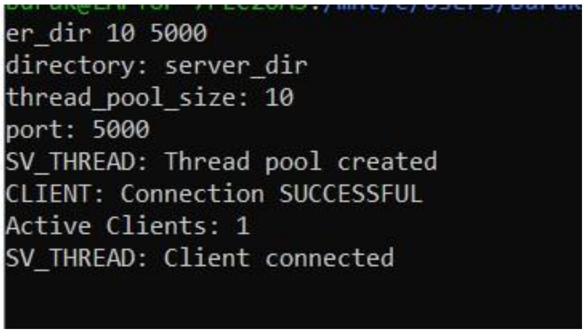


```
er_dir 10 5000
directory: server_dir
thread_pool_size: 10
port: 5000
SV_THREAD: Thread pool created
CLIENT: Connection SUCCESSFUL
Active Clients: 1
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 2
SV_THREAD: Client connected
```

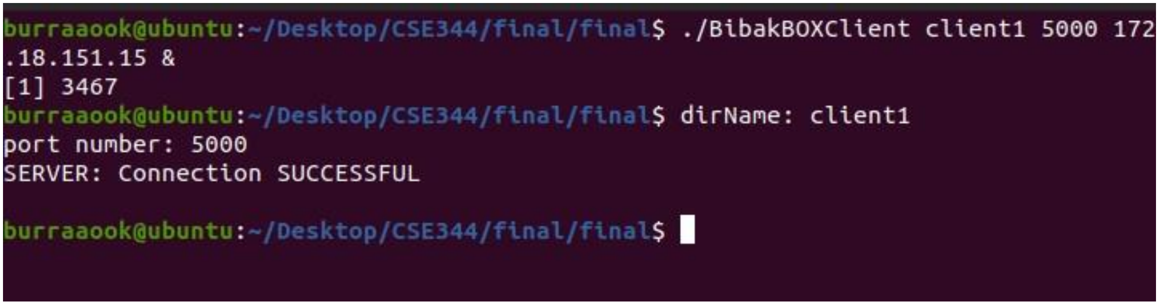


```
SERVER: Terminating...
burak@LAPTOP-7FLC2OAS:/mnt/c/Users/burak kocausta/Desktop/cse344/homework assignments/FINAL/final$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: bond0: <BROADCAST,MULTICAST,MASTER> mtu 1500 qdisc noop state DOWN group default qlen 1000
    link/ether 6a:06:96:93:cf:11 brd ff:ff:ff:ff:ff:ff
3: dummy0: <BROADCAST,NOARP> mtu 1500 qdisc noop state DOWN group default qlen 1000
    link/ether a6:30:04:bf:aa:06 brd ff:ff:ff:ff:ff:ff
4: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default qlen 1000
    link/ether 00:15:5d:07:2a:65 brd ff:ff:ff:ff:ff:ff
    inet 172.18.151.15/20 brd 172.18.159.255 scope global eth0
       valid_lft forever preferred_lft forever
    inet6 fe80::215:5dff:fe07:2a65/64 scope link
       valid_lft forever preferred_lft forever
5: tunl0@NONE: <NOARP> mtu 1480 qdisc noop state DOWN group default qlen 1000
    link/ipip 0.0.0.0 brd 0.0.0.0
6: sit0@NONE: <NOARP> mtu 1480 qdisc noop state DOWN group default qlen 1000
    link/sit 0.0.0.0 brd 0.0.0.0
```

- IP address of the server.

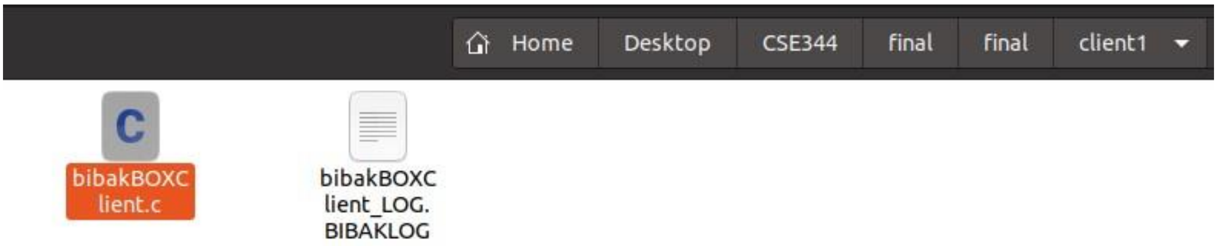


```
er_dir 10 5000
directory: server_dir
thread_pool_size: 10
port: 5000
SV_THREAD: Thread pool created
CLIENT: Connection SUCCESSFUL
Active Clients: 1
SV_THREAD: Client connected
```

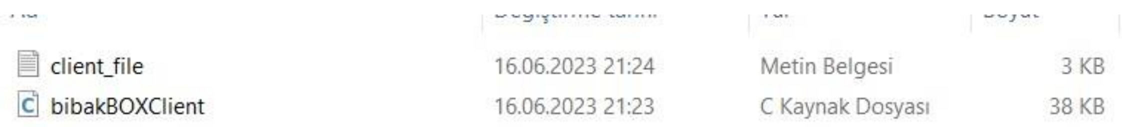


```
burraaook@ubuntu:~/Desktop/CSE344/final/final$ ./BibakBOXClient client1 5000 172
.18.151.15 &
[1] 3467
burraaook@ubuntu:~/Desktop/CSE344/final/final$ dirName: client1
port number: 5000
SERVER: Connection SUCCESSFUL

burraaook@ubuntu:~/Desktop/CSE344/final/final$ 
```

- Server started and client connected

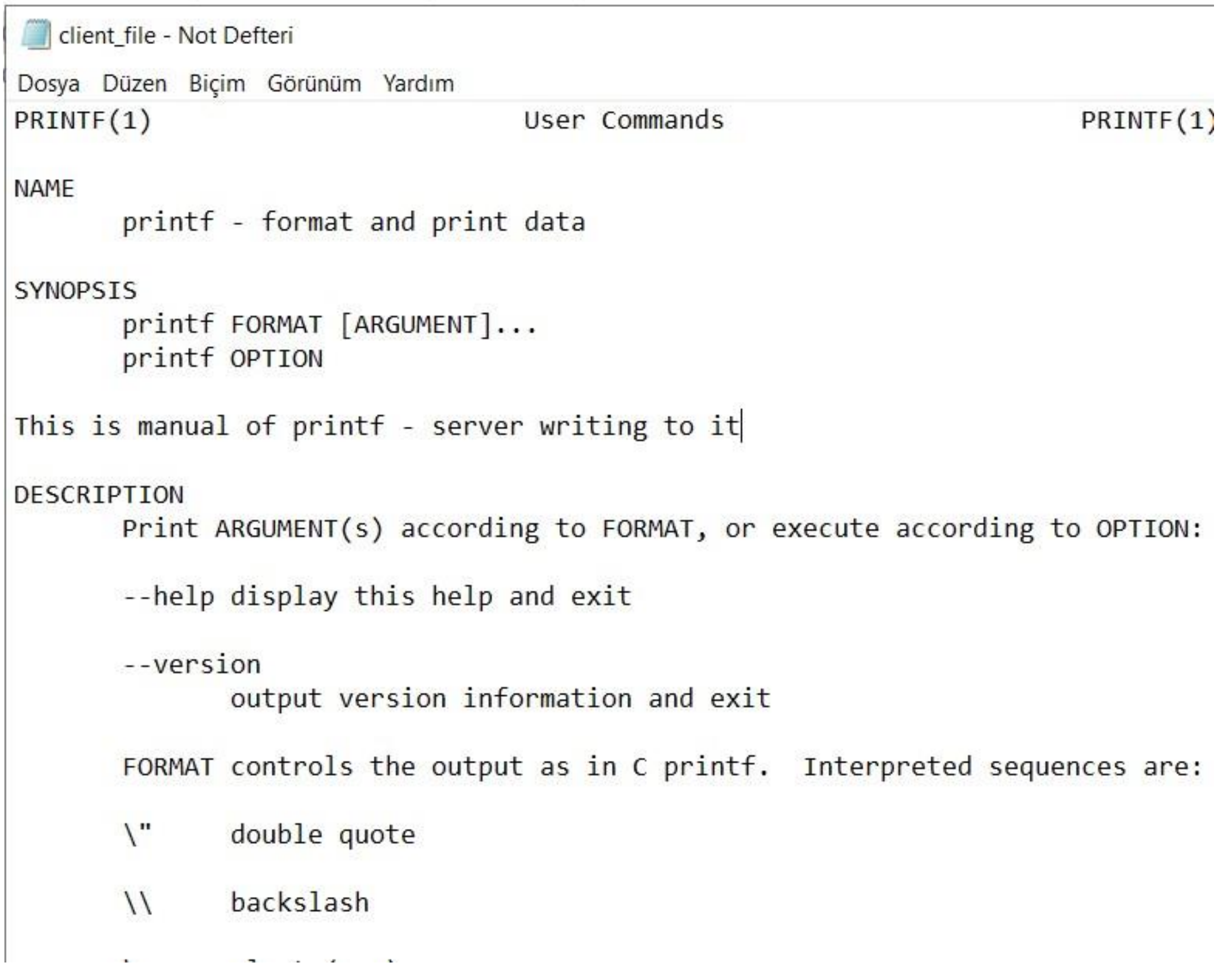


- Files of client 1
- Manual of printf written client file



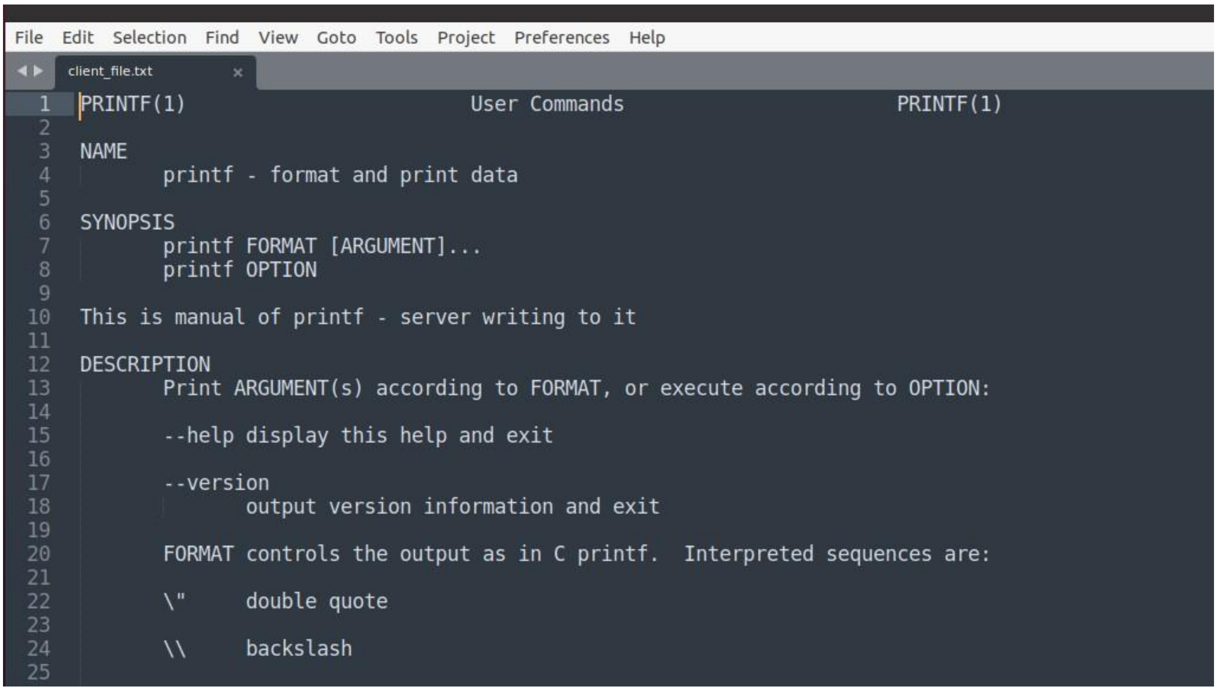
client_file	16.06.2023 21:24	Metin Belgesi	3 KB
bibakBOXClient	16.06.2023 21:23	C Kaynak Dosyası	38 KB

- Files synchronized with server.



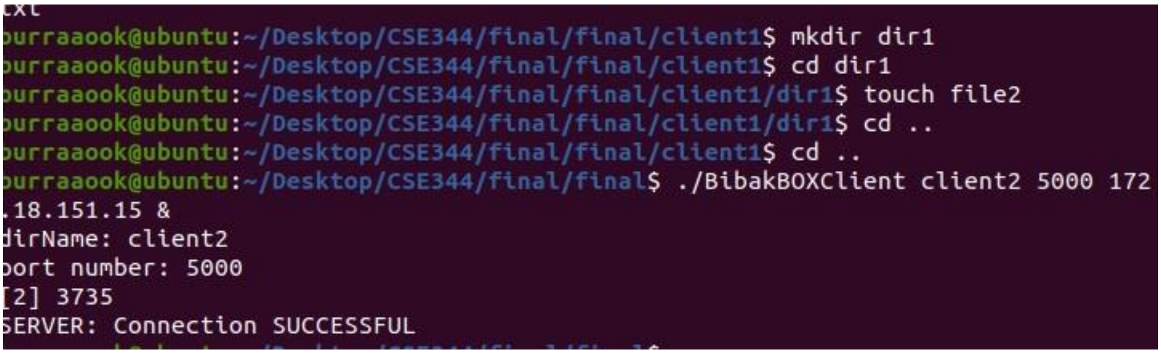
```
PRINTF(1)                        User Commands                       PRINTF(1)

NAME
       printf - format and print data

SYNOPSIS
       printf FORMAT [ARGUMENT]...
       printf OPTION

This is manual of printf - server writing to it

DESCRIPTION
       Print ARGUMENT(s) according to FORMAT, or execute according to OPTION:

       --help display this help and exit

       --version
              output version information and exit

       FORMAT controls the output as in C printf.  Interpreted sequences are:

       \"     double quote

       \\     backslash
```

- Server updates the file


File Edit Selection Find View Goto Tools Project Preferences Help
client_file.txt

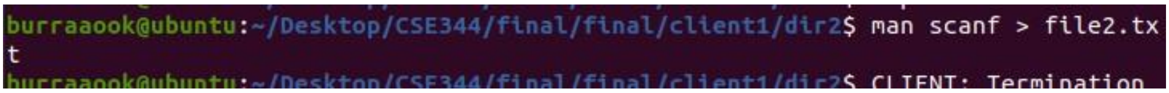
```
PRINTF(1)                        User Commands                       PRINTF(1)

NAME
       printf - format and print data

SYNOPSIS
       printf FORMAT [ARGUMENT]...
       printf OPTION

This is manual of printf - server writing to it

DESCRIPTION
       Print ARGUMENT(s) according to FORMAT, or execute according to OPTION:

       --help display this help and exit

       --version
              output version information and exit

       FORMAT controls the output as in C printf.  Interpreted sequences are:

       \"     double quote

       \\     backslash

```

- It is updated on client also

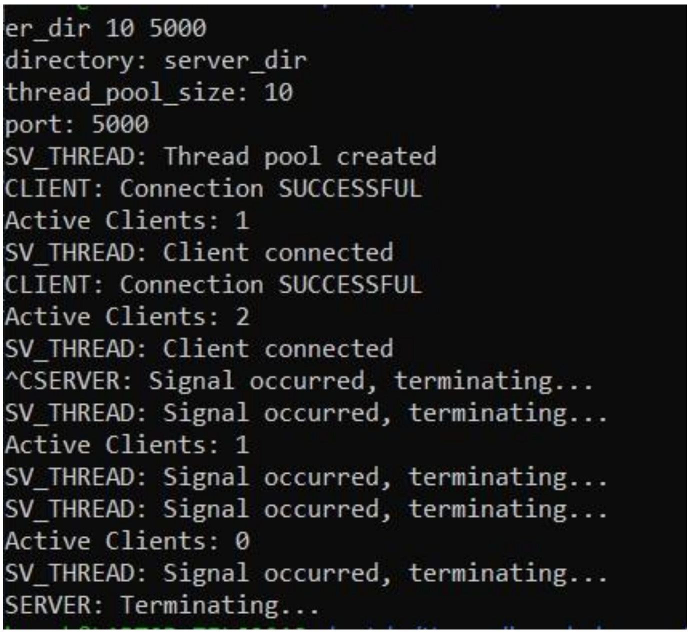


```
txt
burraaook@ubuntu:~/Desktop/CSE344/final/final/client1$ mkdir dir1
burraaook@ubuntu:~/Desktop/CSE344/final/final/client1$ cd dir1
burraaook@ubuntu:~/Desktop/CSE344/final/final/client1/dir1$ touch file2
burraaook@ubuntu:~/Desktop/CSE344/final/final/client1/dir1$ cd ..
burraaook@ubuntu:~/Desktop/CSE344/final/final/client1$ cd ..
burraaook@ubuntu:~/Desktop/CSE344/final/final$ ./BibakBOXClient client2 5000 172
.18.151.15 &
dirName: client2
port number: 5000
[2] 3735
SERVER: Connection SUCCESSFUL
```

- Client 2 is connected.

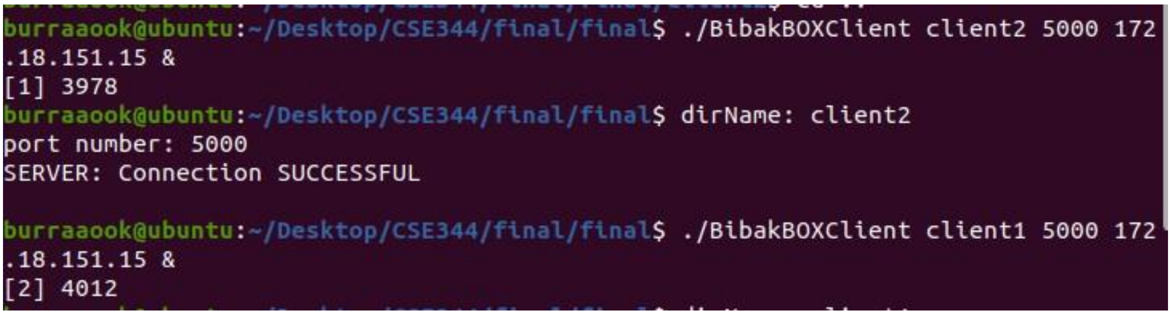


```
burraaook@ubuntu:~/Desktop/CSE344/final/final/client1/dir2$ man scanf > file2.tx
t
burraaook@ubuntu:~/Desktop/CSE344/final/final/client1/dir2$ CLIENT: Termination
```



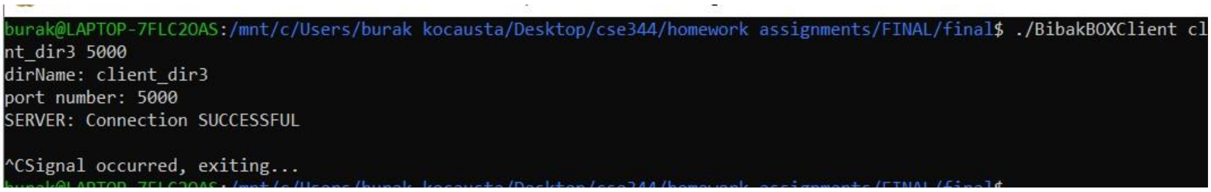
```
er_dir 10 5000
directory: server_dir
thread_pool_size: 10
port: 5000
SV_THREAD: Thread pool created
CLIENT: Connection SUCCESSFUL
Active Clients: 1
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 2
SV_THREAD: Client connected
^CSERVER: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 1
SV_THREAD: Signal occurred, terminating...
SV_THREAD: Signal occurred, terminating...
Active Clients: 0
SV_THREAD: Signal occurred, terminating...
SERVER: Terminating...
```

Server is terminated.



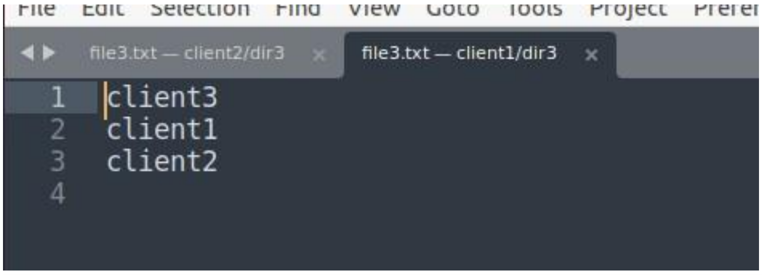
```
burraaook@ubuntu:~/Desktop/CSE344/final/final$ ./BibakBOXClient client2 5000 172
.18.151.15 &
[1] 3978
burraaook@ubuntu:~/Desktop/CSE344/final/final$ dirName: client2
port number: 5000
SERVER: Connection SUCCESSFUL

burraaook@ubuntu:~/Desktop/CSE344/final/final$ ./BibakBOXClient client1 5000 172
.18.151.15 &
[2] 4012
```

- Clients are connected again.

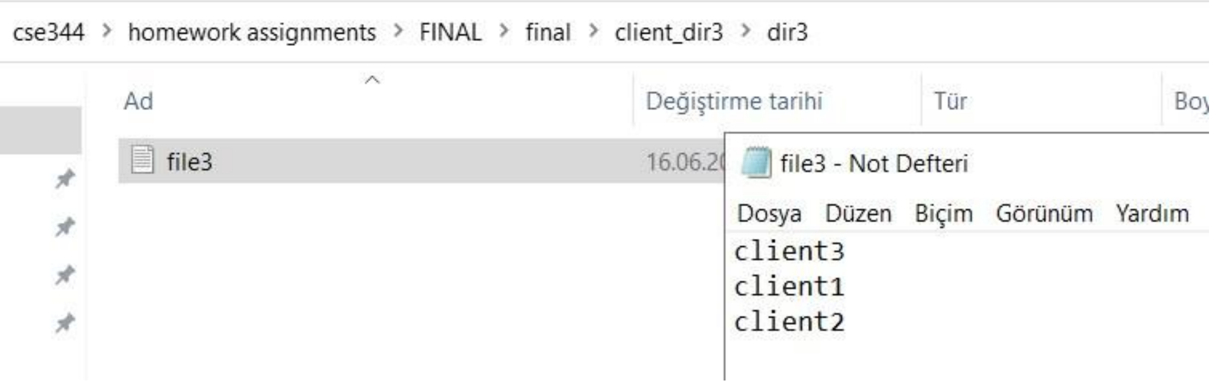


```
burak@LAPTOP-7FLC2OAS:/mnt/c/Users/burak kocausta/Desktop/cse344/homework assignments/FINAL/final$ ./BibakBOXClient cl
nt_dir3 5000
dirName: client_dir3
port number: 5000
SERVER: Connection SUCCESSFUL

^CSignal occurred, exiting...
burak@LAPTOP-7FLC2OAS:/mnt/c/Users/burak kocausta/Desktop/cse344/homework assignments/FINAL/final$
```

- Client 3 connected.



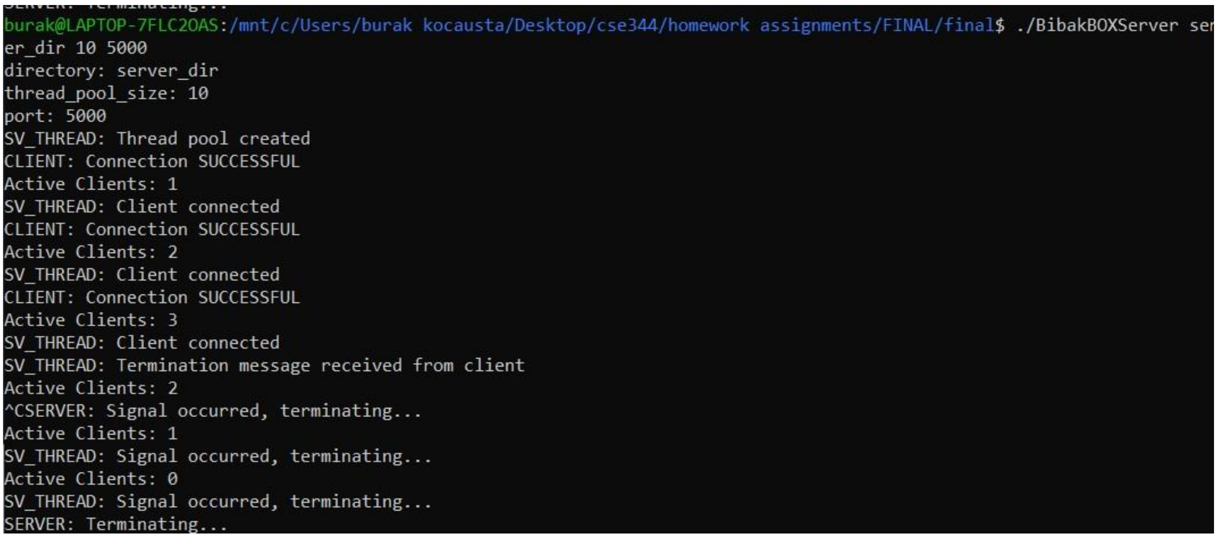
```
client3
client1
client2

```



cse344 › homework assignments › FINAL › final › client_dir3 › dir3
Ad
Değiştirme tarihi
Tür
Boy
file3
16.06.20
file3 - Not Defteri
Dosya Düzen Biçim Görünüm Yardım

```
client3
client1
client2
```

- Files are synchronized with client1, client2, client3.



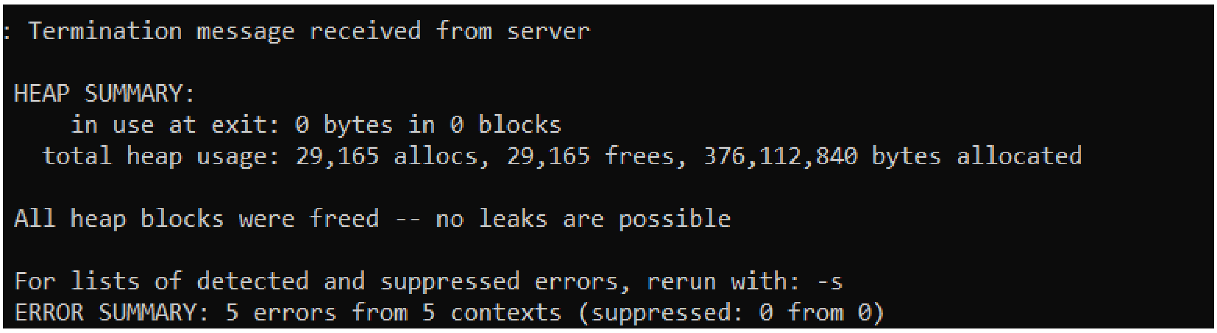
```
SERVER: Terminating...
burak@LAPTOP-7FLC2OAS:/mnt/c/Users/burak kocausta/Desktop/cse344/homework assignments/FINAL/final$ ./BibakBOXServer ser
er_dir 10 5000
directory: server_dir
thread_pool_size: 10
port: 5000
SV_THREAD: Thread pool created
CLIENT: Connection SUCCESSFUL
Active Clients: 1
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 2
SV_THREAD: Client connected
CLIENT: Connection SUCCESSFUL
Active Clients: 3
SV_THREAD: Client connected
SV_THREAD: Termination message received from client
Active Clients: 2
^CSERVER: Signal occurred, terminating...
Active Clients: 1
SV_THREAD: Signal occurred, terminating...
Active Clients: 0
SV_THREAD: Signal occurred, terminating...
SERVER: Terminating...
```

- Server terminated.

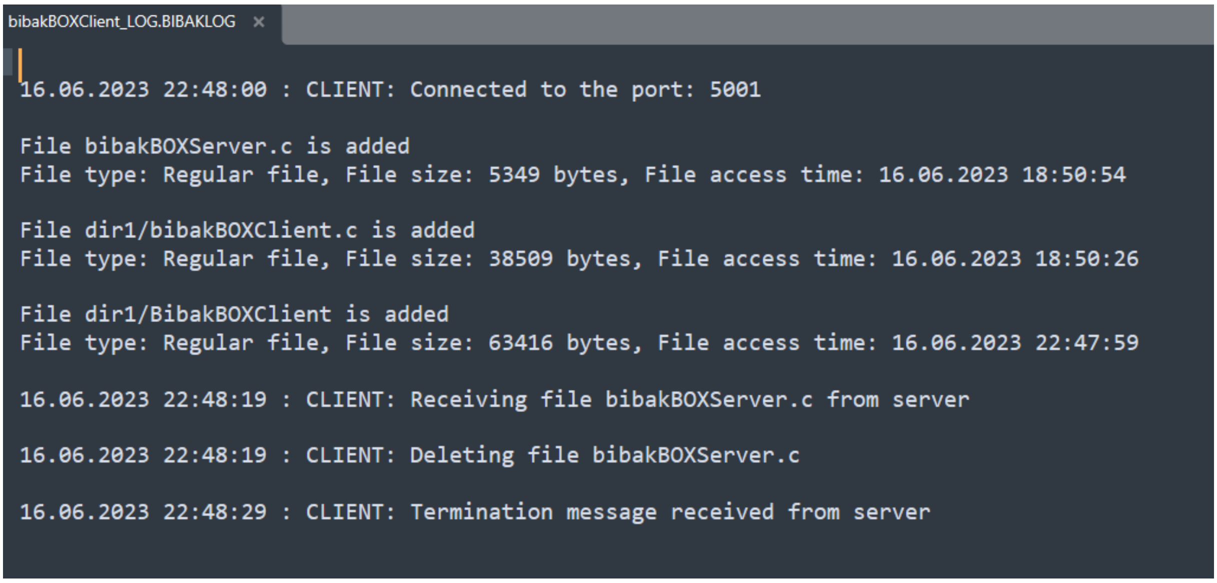
Memory Leak Test

Server can be run with make valgrind

Client can be run with make valgrind2



```
: Termination message received from server

 HEAP SUMMARY:
     in use at exit: 0 bytes in 0 blocks
   total heap usage: 29,165 allocs, 29,165 frees, 376,112,840 bytes allocated

 All heap blocks were freed -- no leaks are possible

 For lists of detected and suppressed errors, rerun with: -s
 ERROR SUMMARY: 5 errors from 5 contexts (suppressed: 0 from 0)
```



```
16.06.2023 22:48:00 : CLIENT: Connected to the port: 5001

File bibakBOXServer.c is added
File type: Regular file, File size: 5349 bytes, File access time: 16.06.2023 18:50:54

File dir1/bibakBOXClient.c is added
File type: Regular file, File size: 38509 bytes, File access time: 16.06.2023 18:50:26

File dir1/BibakBOXClient is added
File type: Regular file, File size: 63416 bytes, File access time: 16.06.2023 22:47:59

16.06.2023 22:48:19 : CLIENT: Receiving file bibakBOXServer.c from server

16.06.2023 22:48:19 : CLIENT: Deleting file bibakBOXServer.c

16.06.2023 22:48:29 : CLIENT: Termination message received from server
```

- Log file of this test.