GIT Department of Computer Engineering

CSE 344 – Spring 2022

Final Project #Report

Okan Torun

1801042662

Client

First of all, I started by reading the request file in the client file, I read all the requests in the request file and assigned the relevant values to the request struct, and after that I created one thread per request as requested. After the threads were created, I checked with the **synchronization barrier**. And at the same time, I opened socket connections. After that, all threads simultaneously sent a connection to the server.

```
typedef struct request {
    char transactionCount[64];
    char realEstate[128];
    char endDate[128];
    char startDate[128];
    int startDay;
    int startMonth;
    int startYear;
    int endDay;
    int endMonth;
    int endYear;
    char city[128];
    int thrNum;
}request;
```

How do I know where the request came from?

I have defined a common struct named **common_structure**. There is a buffer and an int value in this struct. Before sending the value from the request and the servant to the server, I fill the inside of this struct according to them. If the request sends request, I make distinct 1, if it sends servant, I do 2. On the other hand, I send the struct information of the servant or client to char *buffer by casting. Thus, after the Server receives a message with read, it understands who the message is coming from with distinct in this struct, and **casts the buffer with a struct suitable** for it and continues the process.

```c
typedef struct common_structure {
    char info[10000];
    int distinct;
}common_structure;
```

```c
common_structure common_structure_obj;
common_structure_obj.distinct=1;
memcpy(common_structure_obj.info,&requestObj,sizeof(requestObj));
send(sockFd, (char *)&common_structure_obj, sizeof(common_structure_obj), 0);
```

Client threads send all requests and now wait only for replies to return.

Server

In the Servant process, I create the given number of threads first, then I create the socket connections. Then I am constantly waiting for the request in an infinite loop with the process. I created a queue structure to store the incoming accepts and I store the incoming int values in this queu. Threads are mutex in an infinite while It is waiting in a locked way with. In order to avoid busy waiting, I process pthread_cond_broadcast after adding each element to the queu and wake up the threads. If there is a queue element, the threads take care of their work and when there are no more elements, they switch to the wait position.

```c
while(TRUE){
    if ((socket_arr[socketCounter]
        = accept(server_fd, (struct sockaddr*)&address,
                 (socklen_t*)&addrlen))< 0) {
        perror("accept");
        exit(EXIT_FAILURE);
    }
    enqueue(queue, socket_arr[socketCounter]);
    socketCounter++;
    pthread_cond_broadcast(&cond);
}
```

The socket value I get from the queue tells me which request or servant I will deal with. I read this value answer with the common strut and cast it into the relevant struct according to the distinct value.

```
my_new_socket = dequeue(queue);
read(my_new_socket,&common_structure_obj, sizeof( common_structure_obj ));
```

How does the Servant transfer its information to the server?

At the beginning, all the servants connect to the server with the relevant port and transfer the information about the dataset they created to the Server. As the transferred information, I sent a struct containing the list of cities where the servant is responsible and the unique port number of the servant. I created the unique port number based on the value range that the servant is responsible for.
If there is a city in the request, the server checks if there is a city in that range by looking at the information from the servant, and sends that request to the servant it finds suitable. If the city is not specified, it sends the request to all the servants and collects the results and forwards it to the request threads.

```
typedef struct my_servant {
    char responsibleCities[128][64];
    char IP[32];
    int citySize;
    int uniquePort;
}my_servant;
```

Servant

As soon as the Servant processes start, it reads the dataset in the relevant directory with scandir. And I store this information in the BST structure I created. Afterwards, I read the data in the subdirectory of each city folder and store them in the linked_list in BST. After this process, I send the necessary information by sending a connection to the server. Then the servant process is waiting for a request from the server in an endless loop, and I am looking for an answer to this request by creating a new thread for each request. I calculate the data and send it back to the server.

What data structure did I use to store the file information?

I stored the filenames in BST because they are ordered in alphabetical order and the searched city is reached faster. I defined a linked_list in BST, so I access the subdirectories of the relevant city and store the data I access in an array.

```
struct node
{
    int cityId;
    char cityName[128];
    struct linked_list_node *subdirectory;
    struct node *right_child;
    struct node *left_child;
};
```

```
struct linked_list_node {
    int realEstateSize;
    char fileName[32];
    int day;
    int month;
    int year;
    char **realEstate;
    struct linked_list_node* next;
};
```

TEST CASES

```
#!/bin/bash

PORT=33000

./server -p $PORT -t 11 &
sleep 1
./servant -d dataset -c 1-9 -r 127.0.0.1 -p $PORT &
./servant -d dataset -c 10-18 -r 127.0.0.1 -p $PORT &
./servant -d dataset -c 19-27 -r 127.0.0.1 -p $PORT &
./servant -d dataset -c 28-36 -r 127.0.0.1 -p $PORT &
./servant -d dataset -c 37-45 -r 127.0.0.1 -p $PORT &
./servant -d dataset -c 46-54 -r 127.0.0.1 -p $PORT &
./servant -d dataset -c 55-63 -r 127.0.0.1 -p $PORT &
./servant -d dataset -c 64-72 -r 127.0.0.1 -p $PORT &
./servant -d dataset -c 73-81 -r 127.0.0.1 -p $PORT &
sleep 3
./client -r requestFile -q $PORT -s 127.0.0.1

```

```
okan@okan-ABRA-A5-V16-4:~/Desktop/final$ sh script.sh
Servant 33011 : loaded dataset, cities ADANA-ARDAHAN
Servant 33011 present at port 33011 handling cities ADANA-ARDAHAN
Servant 33011 : listening at port 33011
Servant 33101 : loaded dataset, cities KASTAMONU-KUTAHYA
Servant 33029 : loaded dataset, cities ARTVIN-BITLIS
Servant 33119 : loaded dataset, cities MALATYA-ORDU
Servant 33101 present at port 33101 handling cities KASTAMONU-KUTAHYA
Servant 33047 : loaded dataset, cities BOLU-DUZCE
Servant 33101 : listening at port 33101
Servant 33119 : listening at port 33119
Servant 33047 : listening at port 33047
Servant 33029 present at port 33029 handling cities ARTVIN-BITLIS
Servant 33029 : listening at port 33029
Servant 33119 present at port 33119 handling cities MALATYA-ORDU
Servant 33047 present at port 33047 handling cities BOLU-DUZCE
Servant 33083 : loaded dataset, cities HATAY-KARS
Servant 33083 : listening at port 33083
Servant 33083 present at port 33083 handling cities HATAY-KARS
Servant 33065 : loaded dataset, cities EDIRNE-HAKKARI
Servant 33065 present at port 33065 handling cities EDIRNE-HAKKARI
Servant 33065 : listening at port 33065
Servant 33137 : loaded dataset, cities OSMANIYE-SIVAS
Servant 33137 present at port 33137 handling cities OSMANIYE-SIVAS
Servant 33137 : listening at port 33137
Servant 33155 : loaded dataset, cities TEKIRDAG-ZONGULDAK
Servant 33155 present at port 33155 handling cities TEKIRDAG-ZONGULDAK
Servant 33155 : listening at port 33155
Client: I have loaded 10 requests and I'm creating 10 threads.
Client-Thread-0: Thread-0 has been created
Client-Thread-1: Thread-1 has been created
Client-Thread-2: Thread-2 has been created
Client-Thread-3: Thread-3 has been created
Client-Thread-4: Thread-4 has been created
Client-Thread-5: Thread-5 has been created
Client-Thread-6: Thread-6 has been created
Client-Thread-7: Thread-7 has been created
Client-Thread-8: Thread-8 has been created
Client-Thread-9: Thread-9 has been created
Client-Thread-7: I am requesting transactionCount AMBAR 28-01-2044 13-09-2050 AKSARAY
Client-Thread-3: I am requesting transactionCount BAG 01-12-2004 27-09-2089 ADIYAMAN
Client-Thread-9: I am requesting transactionCount IMALATHANE 04-06-2004 11-11-2011 ISPARTA
Client-Thread-6: I am requesting transactionCount FABRIKA 22-07-2004 11-05-2072 ANKARA
Client-Thread-8: I am requesting transactionCount VILLA 22-04-2049 20-03-2061
Client-Thread-4: I am requesting transactionCount FIDANLIK 02-09-2016 12-09-2081 BALIKESIR
Client-Thread-1: I am requesting transactionCount MERA 03-02-2018 09-11-2050
Client-Thread-2: I am requesting transactionCount DUKKAN 20-04-2000 23-01-2031 KILIS
```

```
Contacting ALL servants
Response received : 1, forwarded to client
Request arrived “transactionCount FIDANLIK 02-09-2016 12-09-2081 BALIKESIR
Client-Thread-8: The server’s response to “/transactionCount VILLA 22-04-2049 20-03-2061” is 243
Contacting servant 33029
Client-Thread-8: Terminating
Response received : 2, forwarded to client
Client-Thread-4: The server’s response to “/transactionCount FIDANLIK 02-09-2016 12-09-2081 BALIKESIR” is 3
Client-Thread-4: Terminating
Request arrived “transactionCount IMALATHANE 04-06-2004 11-11-2011 ISPARTA
Contacting servant 33083
Response received : 3, forwarded to client
Client-Thread-9: The server’s response to “/transactionCount IMALATHANE 04-06-2004 11-11-2011 ISPARTA” is 4
Client-Thread-9: Terminating
Request arrived “transactionCount MERA 03-02-2018 09-11-2050
Contacting ALL servants
Response received : 4, forwarded to client
Client-Thread-1: The server’s response to “/transactionCount MERA 03-02-2018 09-11-2050” is 243
Client-Thread-1: Terminating
Request arrived “transactionCount DUKKAN 20-04-2000 23-01-2031 KILIS
Contacting servant 33101
Response received : 5, forwarded to client
Client-Thread-2: The server’s response to “/transactionCount DUKKAN 20-04-2000 23-01-2031 KILIS” is 1
Client-Thread-2: Terminating
Request arrived “transactionCount FABRIKA 22-07-2004 11-05-2072 ANKARA
Contacting servant 33011
Response received : 6, forwarded to client
Client-Thread-6: The server’s response to “/transactionCount FABRIKA 22-07-2004 11-05-2072 ANKARA” is 4
Client-Thread-6: Terminating
Request arrived “transactionCount BAG 01-12-2004 27-09-2089 ADIYAMAN
Contacting servant 33011
Response received : 7, forwarded to client
Client-Thread-3: The server’s response to “/transactionCount BAG 01-12-2004 27-09-2089 ADIYAMAN” is 5
Client-Thread-3: Terminating
Client-Thread-7: The server’s response to “/transactionCount AMBAR 28-01-2044 13-09-2050 AKSARAY” is 0
Request arrived “transactionCount VILLA 22-04-2049 20-03-2061
Client-Thread-7: Terminating
Contacting ALL servants
Response received : 8, forwarded to client
Client-Thread-0: I am requesting transactionCount TARLA 01-01-2073 30-12-2074 ADANA
Client-Thread-5: I am requesting transactionCount BAHCE 02-03-2005 17-01-2084
Request arrived “transactionCount BAHCE 02-03-2005 17-01-2084
Contacting ALL servants
Client-Thread-0: The server’s response to “/transactionCount TARLA 01-01-2073 30-12-2074 ADANA” is 0
Client-Thread-0: Terminating
Response received : 9, forwarded to client
Client-Thread-5: The server’s response to “/transactionCount BAHCE 02-03-2005 17-01-2084” is 243
Request arrived “transactionCount MERA 03-02-2018 09-11-2050
Client-Thread-5: Terminating
Contacting ALL servants
Client: All threads have terminated, goodbye.
```

Error:

```
okan@okan-ABRA-A5-V16-4:~/Desktop/final$ ./servant -d dataset -c 0-10 -r 127.0.0.1 -p 8080
Please enter the correct city value range.
```