System Programming Final Report

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1   HOW TO SOLVE THIS PROBLEM

Firstly, I create binary search tree some different data structure for the servant program because insertion complexity time of it is log n and it is sensible to use because of data. Binary search tree data structure has insert and search function to use. In servant program , I firstly separete the given parameters and read dataset to the tree. Then it supplies port that is unique. How it is unique? I thought that processes has unique pid and I take the pid and modula of half of the maximum port number and if it is same as the given port number then change it. This is my solution. After that servant process open a socket connection and send the pid , port number and cities that responsible for. After that In a while loop it listens unique port number and creates new thread to handle that connection. After that it reads the coming data and search in the tree and return the result to the server program. In servant signal handler, waits threads with join and print the information ,after that freeing data and finishes the program. For reading data from dataset , I use function in utility file.In utility I create functions to read data for servant and client and servant. In server program , creates connection for client and servant, after that it creates threads in thread pool. In while loop, server connects to client and server and it adds this connection to queue and in thread it reads this connections from queue. If all threads are full by checking active variable for that, then server waits until anyone is available. If queue is empty then it waits until it has one. By the way , In thread function , it reads from that file decriptor. If first word is transactionCount then program knows that that is client and the server thread handling this connection will first decide which servant processes it must communicate with (based on the servant dataset information). Then the thread handling this connection will open up connection(s) to the servant(s) involved (one by one), collect the responses, and respond with the cumulative answer to the client. If there is no servant that can satisfy the request it will return an error to the client. If it is servant then, It will learn servants dataset information like (pid , port, citites) and keep it in array. If city is not indicated then server thread handling that connection will open up connections to the all servants and adding the result. Otherwise it only connecting responsible

servant and results of them will write the client file decriptor to give answer. In server signal handler , it will send SIGINT signal to all servants. In client file , I separete the given parameters. After that I get the request from file. Then creting request number of thread. In thread I use syncronization barrier from the slayts. Connects the ip and port to send its requests.It writes requests and reads the result to print STDOUT.

2 DESIGN DECISIONS

- I print to stdout or stderr using printf function.

- I use sig_atomic value for signal handler.

- I use mutex and condition variable and initilize them statically.

- I print the timestamp at the beginning of each line of server.

- I use sigaction for handling SIGINT.

- I use getopt function to take arguments from user.

- I read the file with fgets function.

- I create a unique port using process id.

- I use pid by using proc.

- I use Binary Search Tree for data structure.

- I use return for thread instead of pthread exit function.

3 WHICH REQUIREMENTS I ACHIEVED

I achieved all requirements of the final project. I achived creating thread, waiting threads with join function, synchronization barrier part,syncronization queue part , printing timestamp, data structure ,connecting socket, synchronization, reading file and writing file,conditional variables and mutexes ,reading and writing to socket, SIGINT handler, checking arguments. I achieved all requirements in all files of this final .

4 Output For Given Script

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mustafatokgoz@ubuntu:~/Masaüstü/ders/System-Programming/final/FinalProject$ ./script.sh
Servant 15983: loaded dataset, cities ARTVIN-BITLIS
Servant 15983: listening at port 34968
Thu Jun 16 00:54:53 2022 , Servant 15983 present at port 34968 handling cities ARTVIN-BITLIS
Servant 15987: loaded dataset, cities KASTAMONU-KUTAHYA
Servant 15984: loaded dataset, cities BOLU-DUZCE
Servant 15984: listening at port 34970
Thu Jun 16 00:54:53 2022 , Servant 15984 present at port 34970 handling cities BOLU-DUZCE
Servant 15982: loaded dataset, cities ADANA-ARDAHAN
Servant 15982: listening at port 34966
Thu Jun 16 00:54:53 2022 , Servant 15982 present at port 34966 handling cities ADANA-ARDAHAN
Servant 15986: loaded dataset, cities HATAY-KARS
Servant 15986: listening at port 34974
Thu Jun 16 00:54:53 2022 , Servant 15986 present at port 34974 handling cities HATAY-KARS
Servant 15990: loaded dataset, cities TEKIRDAG-ZONGULDAK
Servant 15990: listening at port 34982
Thu Jun 16 00:54:53 2022 , Servant 15990 present at port 34982 handling cities TEKIRDAG-ZONGULDAK
Servant 15988: loaded dataset, cities MALATYA-ORDU
Servant 15988: listening at port 34978
Thu Jun 16 00:54:53 2022 , Servant 15988 present at port 34978 handling cities MALATYA-ORDU
Servant 15989: loaded dataset, cities OSMANIYE-SIVAS
Servant 15989: listening at port 34980
Thu Jun 16 00:54:53 2022 , Servant 15989 present at port 34980 handling cities OSMANIYE-SIVAS
Servant 15985: loaded dataset, cities EDIRNE-HAKKARI
Servant 15985: listening at port 34972
Thu Jun 16 00:54:53 2022 , Servant 15985 present at port 34972 handling cities EDIRNE-HAKKARI
Servant 15987: listening at port 34976
Thu Jun 16 00:54:53 2022 , Servant 15987 present at port 34976 handling cities KASTAMONU-KUTAHYA
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-9: I am requesting "/transactionCount IMALATHANE 04-06-2004 11-11-2011 ISPARTA"
Thu Jun 16 00:54:56 2022 , Request arrived "transactionCount IMALATHANE 04-06-2004 11-11-2011 ISPARTA"
Thu Jun 16 00:54:56 2022 , Contacting servant 15986
Thu Jun 16 00:54:56 2022 , Response received: 4, 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
Client-Thread-0: I am requesting "/transactionCount TARLA 01-01-2073 30-12-2074 ADANA "
Thu Jun 16 00:54:56 2022 , Request arrived "transactionCount TARLA 01-01-2073 30-12-2074 ADANA "
Thu Jun 16 00:54:56 2022 , Contacting servant 15982
Client-Thread-0: The server's response to "/transactionCount TARLA 01-01-2073 30-12-2074 ADANA " is 3
Thu Jun 16 00:54:56 2022 , Response received: 3, forwarded to client
Client-Thread-0: Terminating
Client-Thread-1: I am requesting "/transactionCount MERA 03-02-2018 09-11-2050 "
Thu Jun 16 00:54:56 2022 , Request arrived "transactionCount MERA 03-02-2018 09-11-2050 "
Thu Jun 16 00:54:56 2022 , Contacting ALL servants
Thu Jun 16 00:54:56 2022 , Response received: 158, forwarded to client
Client-Thread-1: The server's response to "/transactionCount MERA 03-02-2018 09-11-2050 " is 158
Client-Thread-1: Terminating
Client-Thread-2: I am requesting "/transactionCount DUKKAN 20-04-2000 23-01-2031  KILIS"
Thu Jun 16 00:54:56 2022 , Request arrived "transactionCount DUKKAN 20-04-2000 23-01-2031  KILIS"
Thu Jun 16 00:54:56 2022 , Contacting servant 15987
Thu Jun 16 00:54:56 2022 , Response received: 1, 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
Client-Thread-3: I am requesting "/transactionCount BAG 01-12-2004 27-09-2089 ADIYAMAN"
Thu Jun 16 00:54:56 2022 , Request arrived "transactionCount BAG 01-12-2004 27-09-2089 ADIYAMAN"
Thu Jun 16 00:54:56 2022 , Contacting servant 15982
Thu Jun 16 00:54:56 2022 , Response received: 5, 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-4: I am requesting "/transactionCount FIDANLIK 02-09-2016 12-09-2081 BALIKESIR"
Thu Jun 16 00:54:56 2022 , Request arrived "transactionCount FIDANLIK 02-09-2016 12-09-2081 BALIKESIR"
Thu Jun 16 00:54:56 2022 , Contacting servant 15983
Thu Jun 16 00:54:56 2022 , Response received: 3, 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
Client-Thread-5: I am requesting "/transactionCount BAHCE 02-03-2005 17-01-2084"
Thu Jun 16 00:54:56 2022 , Request arrived "transactionCount BAHCE 02-03-2005 17-01-2084"
Thu Jun 16 00:54:56 2022 , Contacting ALL servants
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Thu Jun 16 00:54:56 2022 , Contacting ALL servants
Thu Jun 16 00:54:56 2022 , Response received: 343, forwarded to client
Client-Thread-5: The server's response to "/transactionCount BAHCE 02-03-2005 17-01-2084" is 343
Client-Thread-5: Terminating
Client-Thread-6: I am requesting "/transactionCount FABRIKA 22-07-2004 11-05-2072 ANKARA"
Thu Jun 16 00:54:56 2022 , Request arrived "transactionCount FABRIKA 22-07-2004 11-05-2072 ANKARA"
Thu Jun 16 00:54:56 2022 , Contacting servant 15982
Thu Jun 16 00:54:56 2022 , Response received: 4, 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
Client-Thread-7: I am requesting "/transactionCount AMBAR 28-01-2044 13-09-2050 AKSARAY"
Thu Jun 16 00:54:56 2022 , Request arrived "transactionCount AMBAR 28-01-2044 13-09-2050 AKSARAY"
Thu Jun 16 00:54:56 2022 , Contacting servant 15982
Thu Jun 16 00:54:56 2022 , Response received: 0, forwarded to client
Client-Thread-7: The server's response to "/transactionCount AMBAR 28-01-2044 13-09-2050 AKSARAY" is 0
Client-Thread-7: Terminating
Client-Thread-8: I am requesting "/transactionCount VILLA 22-04-2049 20-03-2061"
Thu Jun 16 00:54:56 2022 , Request arrived "transactionCount VILLA 22-04-2049 20-03-2061"
Thu Jun 16 00:54:56 2022 , Contacting ALL servants
Client-Thread-8: The server's response to "/transactionCount VILLA 22-04-2049 20-03-2061" is 29
Client-Thread-8: Terminating
Thu Jun 16 00:54:56 2022 , Response received: 29, forwarded to client
Client: All threads have terminated, goodbye
mustafatokgoz@ubuntu:~/Masaüstü/ders/System-Programming/final/FinalProject$
mustafatokgoz@ubuntu:~/Masaüstü/ders/System-Programming/final/FinalProject$ kill -2 15968
Thu Jun 16 00:56:23 2022 , SIGINT has been received. I handled a total of 10 requests. Goodbye.
Servant 15984: termination message received, handled 3 requests in total.
Servant 15983: termination message received, handled 4 requests in total.
Servant 15982: termination message received, handled 7 requests in total.
Servant 15990: termination message received, handled 3 requests in total.
Servant 15986: termination message received, handled 4 requests in total.
Servant 15989: termination message received, handled 3 requests in total.
Servant 15988: termination message received, handled 3 requests in total.
Servant 15985: termination message received, handled 3 requests in total.
Servant 15987: termination message received, handled 4 requests in total.
mustafatokgoz@ubuntu:~/Masaüstü/ders/System-Programming/final/FinalProject$
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