

**CMSC 621**  
**Advance Operating System**  
**Project Work-1**  
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**Description of project design:**

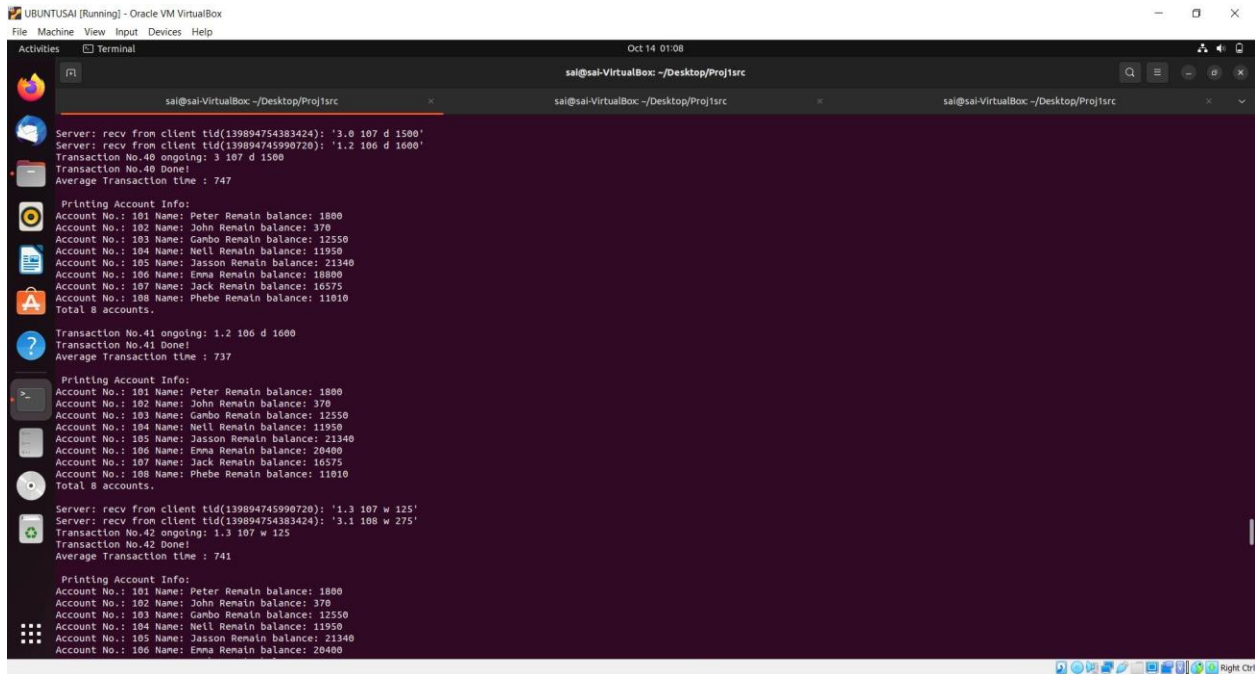
The implemented project namely “Centralized Multi-User Concurrent Bank Account Manager” has been designed in a way that it used various concepts such as Sockets, Processes, Threads, and Synchronization. It has been implemented through connection-oriented communication where the processes system calls used are socket(), bind(), listen(), accept(), connect(), close().

Using the system calls, a basic client-server program was created initially. Upon creating it, then used the concept of multithreading to implement process synchronization. Later, added the concepts of lock/unlock using a mutex. Lastly, for scalability, firstly we sent multiple client requests, and then the requests were sent at a different periodic rate.

Describing the code design, at the client side the first few lines are system calls, and then using the file stream functions the “transactions.txt” file was read, and each line is sent to the server. On the server side, firstly a mutex was created for a client, upon creation of the mutex, a function was defined to find whether the requested account exists or not, if not so it creates a new account. Then another function was defined to print the initial account information, then an arithmetic user-defined function was designed to compute the “Withdrawal” & “Deposit” operations. Later, after the computation average transaction time is calculated and displayed, then upon single transaction completion, the updated account information was displayed using a user-defined function.

Then the main logic is defined where the transactions are handled using the “sleep” function, and the transaction status is printed. The above-mentioned functions are related to handling various account information and their status upon each request. After implementing these all the processes system calls were implemented and then we made use of the multithreading concept. After all the processes had been done, we close the respective sockets. For both the codes, the port number and IP address should be given at command line arguments as input.





UBUNTUSAI [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal

Oct 14 01:08

sai@sai-VirtualBox: ~/Desktop/Proj1src

```
Server: rcv from client tld(139894754383424): '3.0 107 d 1500'
Server: rcv from client tld(139894754383424): '1.2 106 d 1600'
Transaction No.40 ongoing: 3 107 d 1500
Transaction No.40 Done!
Average Transaction time : 747

Printing Account Info:
Account No.: 101 Name: Peter Remain balance: 1800
Account No.: 102 Name: John Remain balance: 370
Account No.: 103 Name: Gambo Remain balance: 12550
Account No.: 104 Name: Nell Remain balance: 11950
Account No.: 105 Name: Jasson Remain balance: 21340
Account No.: 106 Name: Enna Remain balance: 20400
Account No.: 107 Name: Jack Remain balance: 16575
Account No.: 108 Name: Phebe Remain balance: 11010
Total 8 accounts.

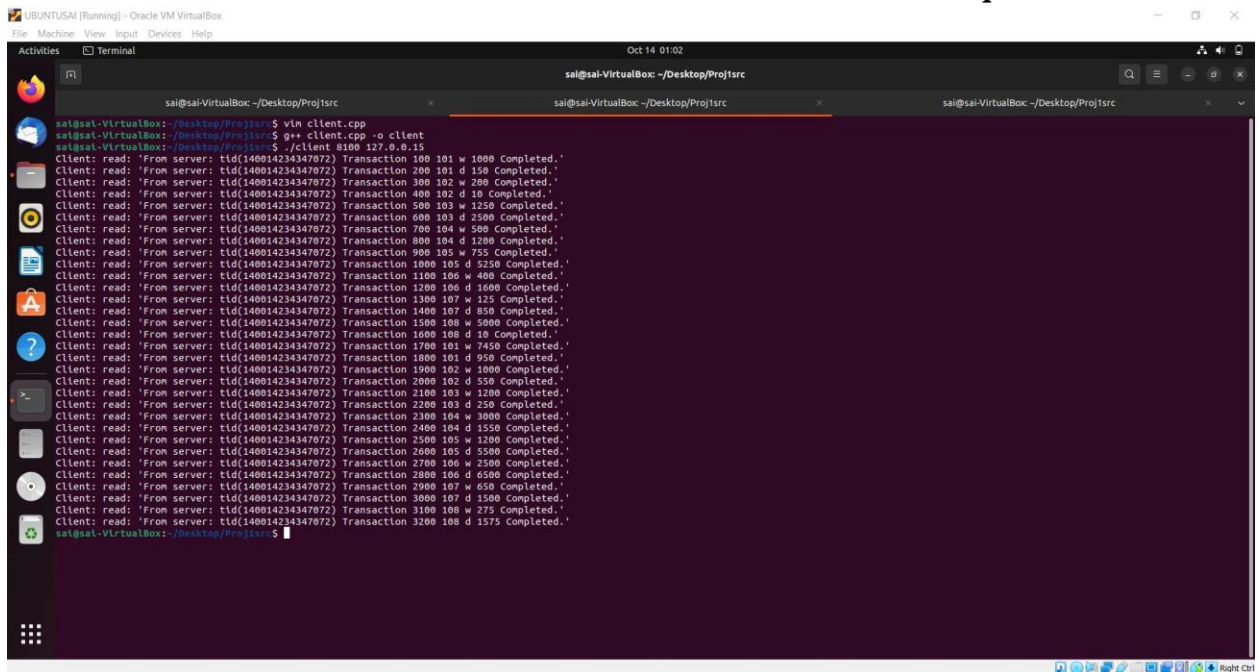
Transaction No.41 ongoing: 1.2 106 d 1600
Transaction No.41 Done!
Average Transaction time : 737

Printing Account Info:
Account No.: 101 Name: Peter Remain balance: 1800
Account No.: 102 Name: John Remain balance: 370
Account No.: 103 Name: Gambo Remain balance: 12550
Account No.: 104 Name: Nell Remain balance: 11950
Account No.: 105 Name: Jasson Remain balance: 21340
Account No.: 106 Name: Enna Remain balance: 20400
Account No.: 107 Name: Jack Remain balance: 16575
Account No.: 108 Name: Phebe Remain balance: 11010
Total 8 accounts.

Server: rcv from client tld(139894754383424): '1.3 107 w 125'
Server: rcv from client tld(139894754383424): '3.1 108 w 275'
Transaction No.42 ongoing: 1.3 107 w 125
Transaction No.42 Done!
Average Transaction time : 741

Printing Account Info:
Account No.: 101 Name: Peter Remain balance: 1800
Account No.: 102 Name: John Remain balance: 370
Account No.: 103 Name: Gambo Remain balance: 12550
Account No.: 104 Name: Nell Remain balance: 11950
Account No.: 105 Name: Jasson Remain balance: 21340
Account No.: 106 Name: Enna Remain balance: 20400
```

The above three screenshots describe the multi-client request



UBUNTUSAI [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal

Oct 14 01:02

sai@sai-VirtualBox: ~/Desktop/Proj1src

```
sai@sai-VirtualBox:~/Desktop/Proj1src$ ./vln client.cpp
sai@sai-VirtualBox:~/Desktop/Proj1src$ g++ client.cpp -o client
sai@sai-VirtualBox:~/Desktop/Proj1src$ ./client 8100 127.0.0.15
Client: read: 'From server: tld(140014234347072) Transaction 100 101 w 1000 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 200 101 d 150 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 300 102 w 200 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 400 102 d 10 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 500 103 w 1250 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 600 103 d 2500 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 700 104 w 500 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 800 104 d 1200 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 900 105 w 750 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 1000 105 d 5250 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 1100 106 w 400 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 1200 106 d 1600 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 1300 107 w 125 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 1400 107 d 850 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 1500 108 w 5000 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 1600 108 d 10 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 1700 101 w 7450 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 1800 101 d 950 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 1900 102 w 1000 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 2000 102 d 550 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 2100 103 w 1200 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 2200 103 d 250 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 2300 104 w 3000 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 2400 104 d 1550 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 2500 105 w 1200 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 2600 105 d 5500 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 2700 106 w 2500 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 2800 106 d 6500 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 2900 107 w 650 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 3000 107 d 1500 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 3100 108 w 275 Completed.'
Client: read: 'From server: tld(140014234347072) Transaction 3200 108 d 1575 Completed.'
sai@sai-VirtualBox:~/Desktop/Proj1src$
```

```
sa@sa-VirtualBox: ~/Desktop/Proj1src
sa@sa-VirtualBox:~/Desktop/Proj1src$ g++ client.cpp -o client
sa@sa-VirtualBox:~/Desktop/Proj1src$ ./client 8100 127.0.0.15
Client: read: 'From server: ttd(140014234347072) Transaction 100 101 w 1000 Completed.'
Client: read: 'From server: ttd(140014234347072) Transaction 200 101 d 150 Completed.'
Client: read: 'From server: ttd(140014234347072) Transaction 300 102 w 200 Completed.'
Client: read: 'From server: ttd(140014234347072) Transaction 400 102 d 10 Completed.'
Client: read: 'From server: ttd(140014234347072) Transaction 500 103 w 1250 Completed.'
Client: read: 'From server: ttd(140014234347072) Transaction 600 103 d 2500 Completed.'
Client: read: 'From server: ttd(140014234347072) Transaction 700 104 w 500 Completed.'
Client: read: 'From server: ttd(140014234347072) Transaction 800 104 d 1200 Completed.'
Client: read: 'From server: ttd(140014234347072) Transaction 900 105 w 755 Completed.'
```

```
sa@sa-VirtualBox: ~/Desktop/Proj1src
sa@sa-VirtualBox:~/Desktop/Proj1src$
Server: rcv from client ttd(140014234347072): '700 104 w 500'
Transaction No.6 ongoing: 700 104 w 500
Transaction No.6 Done!
Average Transaction time : 1881

Printing Account Info:
Account No.: 101 Name: Peter Remain balance: 9150
Account No.: 102 Name: John Remain balance: 1010
Account No.: 103 Name: Ganbo Remain balance: 12250
Account No.: 104 Name: Nell Remain balance: 12000
Account No.: 105 Name: Jasson Remain balance: 13000
Account No.: 106 Name: Enna Remain balance: 14000
Account No.: 107 Name: Jack Remain balance: 15000
Account No.: 108 Name: Phebe Remain balance: 16000
Total 8 accounts.

Server: rcv from client ttd(140014234347072): '800 104 d 1200'
Transaction No.7 ongoing: 800 104 d 1200
Transaction No.7 Done!
Average Transaction time : 1742

Printing Account Info:
Account No.: 101 Name: Peter Remain balance: 9150
Account No.: 102 Name: John Remain balance: 1010
Account No.: 103 Name: Ganbo Remain balance: 12250
Account No.: 104 Name: Nell Remain balance: 12700
Account No.: 105 Name: Jasson Remain balance: 13000
Account No.: 106 Name: Enna Remain balance: 14000
Account No.: 107 Name: Jack Remain balance: 15000
Account No.: 108 Name: Phebe Remain balance: 16000
Total 8 accounts.

Server: rcv from client ttd(140014234347072): '900 105 w 755'
```

The above three depict a normal client-server transaction with single request.