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Buffer = 10

Test #	1	2	3	Average
Client send time (ms)	10	9	10	9.6
Client receive time (ms)	10	9	11	9
Server time (ms)	18	19	20	19

Buffer = 20

Test #	1	2	3	Average
Client send time (ms)	7	6	7	6.6
Client receive time (ms)	8	7	6	7
Server time (ms)	14	12	13	13

Concurrency issues

After multiple test cases, we can observe that the outputs do not always show the same running time. This issue might be due to each thread starting at the same time, meaning that these threads would have access to the same account.txt and transaction.txt files concurrently, this introduces a shared resource scenario that may lead to more concurrency issues. Additionally, improper synchronization may cause different running times when multiple threads concurrently access shared resources.

Changing the buffer size from 10 to 20 – What we observed

When changing the size of network buffers from 10 to 20, we can observe a slight difference between running times. We created 3 separate test cases for each buffer size to get a better understanding of how the running times differ. First, we found that the average running time for the client send thread with buffer size of 20 was 3 ms faster than that with a buffer size of 10. Second, we found that the average running time for the client receiving thread with a buffer size of 20 was 2 ms faster than that with a buffer size of 10. Third, we found that the average running time for the server thread with a buffer size of 20 was 6 ms faster than that with a buffer size of 10.

Changing the buffer size from 10 to 20 – Reason for results

The reason why the running time was slightly faster when we changed the network buffer size from 10 to 20 might be because by increasing the buffer size, we are allowing the network to hold more data at any given time. With a larger buffer size, there's a higher chance that packets won't be discarded due to the buffer overflowing at the receiving end. This reduced packet loss leads to overall better performance. Another reason why there might be a difference in running times would be due to different hardware being used to run the code, some machines are more powerful than others which would lead to faster running times. In our case, we only used a MacBook Air with an M2 chip to run the code, but if we were to run the code on a different laptop, we would get different running times.