Assignment 2: Susmita Mondal (20310071)

Client-server programming (TCP and UDP Sockets)

Prerequisite 1 and 2 (a &b [“truncate” is used and the size is verified]) is done and a test file named Test.txt (10 KB) has been created.

3) To evaluate the following aspects, the Table has been created

File Name	Original File Size	TCP Connection Time Taken (Seconds)	UDP Connection Time Taken (Seconds)	TCP Connection Throughput (KB/s)	UDP Connection Throughput (KB/s)	Remarks	TCP Connection Received File Size	UDP Connection Received File Size
Anthem.txt	127.8 KiB (130,855 bytes)	0.0025 0.0005 0.0032 Avg. = 0.0011	0.0025 0.0027 0.1622 Avg. = 0.0558	49847.992 216055.15 38882.671 Avg. = 86640.94	47.556 47.551 44.043 Avg. = 46.38		127.8 KiB No Change	93.0 KiB 27% Less Size
Candide.txt	224.4 KiB (229,736 bytes)	0.0048 0.0009 0.0010 Avg. = 0.0022	0.0408 0.0028 0.0025 Avg. = 0.0154	47155.802 229611.617 218107.611 Avg. = 164958.34	103.034 114.704 114.719 Avg. = 110.82		224.4 KiB No Change	205.4 KiB) 224.4 KiB Avg. = 214.9 KiB [4% to 8% Less Size]
Carmilla.txt	176.7 KiB (180,908 bytes)	0.0044 0.0010 0.0014 Avg. = 0.0023	0.0026 0.0051 0.0064 Avg. = 0.0047	40362.785 165118.883 125567.15 Avg. = 110349.61	47.553 47.494 47.462 Avg. = 47.50		176.7 KiB No Change	93.0 KiB 47% Less Size
Dracula.txt	860.8 KiB (881,473 bytes)	0.0091 0.0037	0.0099 0.0050	95974.429 234802.103	297.428 156.185		860.8 KiB No Change	583.8 KiB 305.8 KiB

		0.0064 Avg. = 0.0064	0.0053 Avg. = 0.0067	135716.927 Avg. = 155497.82	224.58 Avg. = 220.06			439.8 KiB Avg. = 443.13 KiB [32% to 64% Less Size]
Leviathan.txt	1.2 MiB (1,254,930 bytes)	0.0095 0.0051 0.0056 Avg. = 0.0067	0.0225 0.0181 0.0153 Avg. = 0.0186	130853.515 243640.913 221666.384 Avg. = 198720.27	467.074 396.54 475.834 Avg. = 446.48	Largest of the 5 Files	1.2 MiB No Change	922.5 KiB 781.5 KiB 936.5 KiB Avg. = 880.17 KiB [23% to 36% Less Size]
Test.txt	10.0 KiB (10,240 bytes)	0.0009 0.0003 0.0007 Avg. = 0.0006	0.0061 0.0026 0.0137 Avg. = 0.0075	8417.378 22590.229 10690.647 Avg. = 13899.42	5.104 5.113 5.085 Avg. = 5.101	Smallest of the 5 Files	10.0 KiB No Change	10.0 KiB No Change

3)1. Time comparison

File Name	TCP	UDP	Remarks
Leviathan.txt - Largest of the 5 Files	0.0067 Seconds	0.0186 Seconds	TCP is faster in both the cases compared to UDP connection.
Test.txt (10 KB)	0.0006 Seconds	0.0075 Seconds	

3)2. Achieved throughput comparison:

File Name	TCP	UDP	Remarks
Anthem.txt	86640.94 KB/s	46.38 KB/s	TCP connection has better throughput in all the cases
Candide.txt	164958.34 KB/s	110.82 KB/s	
Carmilla.txt	110349.61 KB/s	47.50 KB/s	

Dracula.txt	155497.82 KB/s	220.06 KB/s	compared to UDP connection.
Leviathan.txt	198720.27 KB/s	446.48 KB/s	
Test.txt	13899.42 KB/s	5.101 KB/s	

3)3. File size comparison:

File Name	Original Size	TCP	UDP	Remarks
Anthem.txt	127.8 KiB	127.8 KiB	93.0 KiB [27% Less Size]	TCP connection has no change in the file sizes for all the cases. But UDP connection file transfer has some amount of difference in the sizes for all the files.
Candide.txt	224.4 KiB	224.4 KiB	214.9 KiB [4-8% Less Size]	
Carmilla.txt	176.7 KiB	176.7 KiB	93.0 KiB [47% Less Size]	
Dracula.txt	860.8 KiB	860.8 KiB	443.13 KiB [32-64% Less Size]	
Leviathan.txt	1.2 MiB	1.2 MiB	881.17 KiB [23-36% Less Size]	
Test.txt	10 KiB	10 KiB	10 KiB [No Change]	

In case of small sized files, in both the cases no data is lost. Less data size can be termed as data loss. In comparison to the original file, there are significant number of differences. The next segment highlights some high-level differences. It is true for every file generated by TCP and UDP connections.

3)4. For the comparison of “wc” and “diff”, I used <u>one TCP</u> and <u>one UDP</u> text file with <u>one original</u> text file for simplicity and the table has been created according to that. But this comparison is possible for every file generated by the TCP and UDP connection.

File Name = Anthem.txt	TCP (Process ID: 12944) “wc”	UDP (Process ID:15348) “wc”	TCP (Process ID: 12944) “diff” with the original file	UDP (Process ID:) “diff” with the original file
“wc” -c Byte count: 130855 -l Line count: 2535 -m: 130179	-c: 130855 -l: 2535 -m: 130179 -w: 22249 No Change	-c: 95232 -l: 1861 -m: 94638 -w: 16372 Difference is there	No Change	• Context (-c): 1859,2535 • Unified (-u): -1859,677 +1859,4 • Case insensitive (-i): 1862,2535c1862 • Diff: 1862,2535c1862

Character count					Difference is there
-w Word count	22249				

TCP file transfer is more reliable than UDP file transfer. No significant difference is there between the original file and the file downloaded by TCP connection. But there is significant number of differences between original file and the file downloaded using a UDP connection.

Experimentation with socket configurations.

- File size is 10KB for every experiment = Test.txt
- File size is 10KB for every experiment = Leviathan.txt
- Packet tracing is done by the loop back address in the Wireshark
  - To know the difference better, table has been created

A.

Client Buffer Size	Server Buffer Size	TCP Packet Exchange	UDP Packet Exchange	Original File Size	TCP File Size	UDP File Size	"diff" output for TCP and original file	"diff" output for UDP and original file
2048 Bytes	1024 Bytes	18	6	10 KiB	No Change in File Size	No Change in File Size	No Difference	No Difference
		102	480	1.2 MiB	No Change	645.0 KiB [Loss]	No Difference	11044,20693c11044 – Signifies Difference

B.

Client Buffer Size	Server Buffer Size	TCP Packet Exchange	UDP Packet Exchange	Original File Size	TCP File Size	UDP File Size	"diff" output for TCP and original file	"diff" output for UDP and original file
512 Bytes	1024 Bytes	41	20	10 KiB	No Change in File Size	No Change in File Size	No Difference	No Difference
		95	2452	1.2 MiB	No Change	572.0 KiB [Loss]	No Difference	1725,4374c1725– Signifies Difference

C.

Client Buffer Size	Server Buffer Size	TCP Packet Exchange	UDP Packet Exchange	Original File Size	TCP File Size	UDP File Size	"diff" output for TCP and original file	"diff" output for UDP and original file
2048 Bytes	512 Bytes	30	21	10 KiB	No Change in File Size	No Change in File Size	No Difference	No Difference
		88	2453	1.2 MiB	No Change	808.0 KiB [Loss]	No Difference	22002,23001c14828– Signifies Difference

D.

Client Buffer Size	Server Buffer Size	TCP Packet Exchange	UDP Packet Exchange	Original File Size	TCP File Size	UDP File Size	"diff" output for TCP and original file	"diff" output for UDP and original file
1024 Bytes	1024 Bytes	28	11	10 KiB	No Change in File Size	No Change in File Size	No Difference	No Difference
		930	1227	1.2 MiB	No Change	No Change	No Difference	No Significant Difference

- In case of UDP "diff" with original file, it shows more than 1 differences in various places of the files. I have highlighted only 1 of the differences.
- Though TCP takes more packets in case of smaller data, but it provides reliable data transmission without any loss of data.

E. There are 2 possible cases I noticed.

1) If I try to run all the server and client programs concurrently it might run but shows "port unreachable" and received data is of 0 Byte in one of the processes.

2) If I try to run TCP server-client in one window and UDP server-client in another window of the IDLE, it shows "address in use" in one of the processes.

I think it is not possible because it uses loop back address and only 1 process and only one thread which is running occupying the port and address. So, 2 simultaneous operations cannot run together.