IP Project 2 Report

Point to Multipoint File Transfer System

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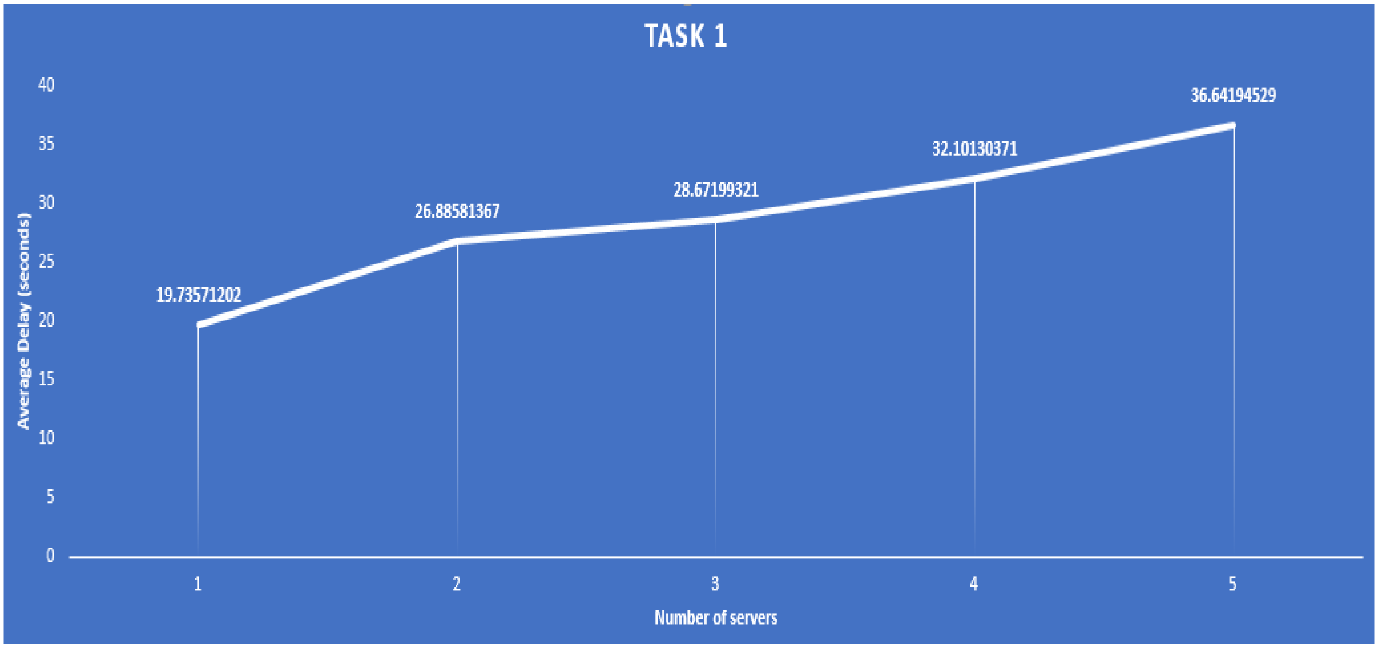
Task 1: Effect of the Receiver Set Size n

For this first task, set the MSS to 500 bytes and the loss probability p = 0.05. Run the P2MP-FTP protocol to transfer the file you selected, and vary the number of receivers n = 1, 2, 3, 4, 5. For each value of n, transmit the file 5 times, time the data transfer (i.e., delay), and compute the average delay over the five transmissions. Plot the average delay against n and submit the plot with your report. Explain how the value of n affects the delay and the shape of the curve.



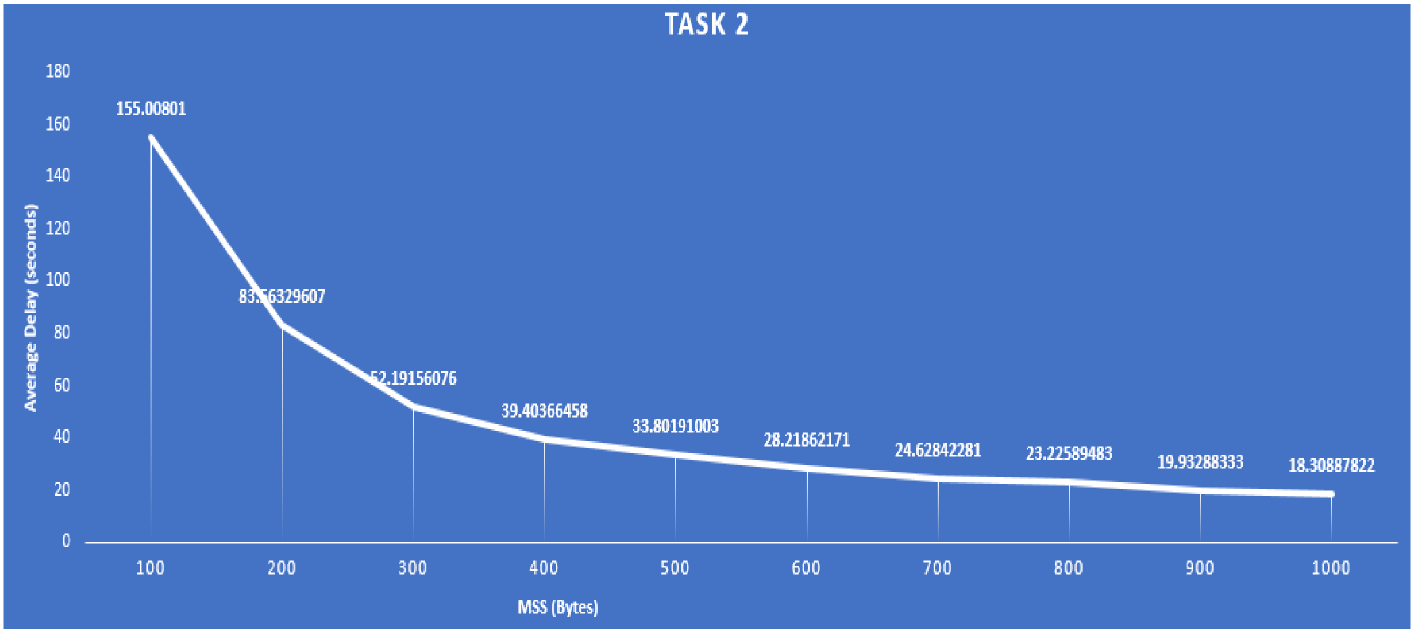
Note : The readings for the graph are as per 1 MB file.

As per the implementation, the client has to wait for a timeout to occur if the acknowledgement is not received from any of the servers. Hence, with the increase in the number of servers, the chances of an acknowledgement not being received from any of the servers increases, thereby the number of retransmissions increases. Hence, the average delay would increase with the number of servers. Also, the client has to send each segment of MSS bytes to each of the servers so the overall time to send and receive the acknowledgement over the network increases with the increase in the number of servers.

As per the observation, with the increase in the number of servers, the average delay to send the 1 MB file to all the servers increases. As the number of servers increases, the chances of drop increase since each server is made to run with a probability ‘p’ and takes a decision whether to process the segment or not on the basis of a comparison between a random number ‘r’ generated between 0 and 1, and ‘p’. If r<=p, the segment is not processed, and the server keeps waiting for the segment to get retransmitted from the client. Hence, retransmissions are more prevalent in the network as segment losses would now occur randomly at multiple servers. Hence, the observed increase in average delay in this case is justified.

Task 2: Effect of MSS

In this experiment, let the number of receivers n = 3 and the loss probability p = 0.05. Run the P2MP-FTP protocol to transfer the same file, and vary the MSS from 100 bytes to 1000 bytes in increments of 100 bytes. For each value of MSS, transmit the file 5 times, and compute the average delay over the five transmissions.Plot the average delay against the MSS value, and submit the plot with your report. Discuss the shape of the curve; are the results expected?



Note : The readings for the graph are as per 1 MB file.

As per the observation, with the linear increase in the MSS, the average delay to transmit the 1 MB file for three servers decreases.

The number of segments to be sent by the client to each server increases with a decrease in the MSS. This means that after sending each segment, the client will have to wait for an acknowledgement from each of the servers. This increases the number of times the client will have to wait for a segment to get acknowledged thereby increasing the overall delay.

With the increase in the MSS, the number of segments for transmitting the file decreases. Hence, there are fewer number of retransmissions in case of any drop as compared with the counterparts of low MSS. Hence, the average delay for 1000 MSS is the lowest, i.e., 18.3 seconds.

Task 3: Effect of Loss Probability p

For this task, set the MSS to 500 bytes and the number of receivers n = 3. Run the P2MP-FTP protocol to transfer the same file, and vary the loss probability from p = 0.01 to p = 0.10 in increments of 0.01. For each value of p transmit the file 5 times, and compute the average delay over the five transfers. Plot the average delay against p, and submit the plot with your report. Discuss and explain the results and shape of the curve.

Note : The readings for the graph are as per 1 MB file.

Since the number we are generating for a segment drop in this project is random (between 0 and 1) , we cannot predict the occurrence of any particular number. For this task, the probability is varying, starting from 0.01 to 0.1. With the increase in the probability, the chances of the random number generated to be less than the probability 'p' increases thereby causing the segment to get discarded. This will lead to a retransmission from the client to take place thereby increasing the delay.

If any segment is dropped, the client has to wait for a timeout to occur in order to understand that the segment is lost. Hence, the average delay for transmitting a file increases.

Therefore, we can predict that the time taken to transmit 1 MB file with low packet drop probability (0.01) will be lower than the time taken to transmit the file with high packet drop probability (0.1).

As per our observation, the average delay for transmitting 1 MB file increases with the increase in loss probability. The same can be verified from the chart.

RTT and timeout values

In our case, the client was running on a machine connected on wireless LAN and the servers were running on machines connected on a wired network.

The average RTT observed between the client and each of the servers is 3ms. So, the total average RTT considering 5 servers is (3*5) = 15ms. Taking this into consideration, we have set the timeout as 20ms (a little more than total average RTT).

```
C:\Users\nikle>ping 152.14.142.223

Pinging 152.14.142.223 with 32 bytes of data:
Reply from 152.14.142.223: bytes=32 time=2ms TTL=58
Reply from 152.14.142.223: bytes=32 time=3ms TTL=58
Reply from 152.14.142.223: bytes=32 time=3ms TTL=58
Reply from 152.14.142.223: bytes=32 time=5ms TTL=58

Ping statistics for 152.14.142.223:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 5ms, Average = 3ms

C:\Users\nikle>ping 152.14.142.225

Pinging 152.14.142.225 with 32 bytes of data:
Reply from 152.14.142.225: bytes=32 time=3ms TTL=58
Reply from 152.14.142.225: bytes=32 time=4ms TTL=58
Reply from 152.14.142.225: bytes=32 time=3ms TTL=58
Reply from 152.14.142.225: bytes=32 time=3ms TTL=58

Ping statistics for 152.14.142.225:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 4ms, Average = 3ms

C:\Users\nikle>ping 152.14.142.228

Pinging 152.14.142.228 with 32 bytes of data:
Reply from 152.14.142.228: bytes=32 time=3ms TTL=58
Reply from 152.14.142.228: bytes=32 time=4ms TTL=58
Reply from 152.14.142.228: bytes=32 time=4ms TTL=58
Reply from 152.14.142.228: bytes=32 time=3ms TTL=58

Ping statistics for 152.14.142.228:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 4ms, Average = 3ms
```

```
C:\Users\nikle>ping 152.14.142.224

Pinging 152.14.142.224 with 32 bytes of data:
Reply from 152.14.142.224: bytes=32 time=4ms TTL=58
Reply from 152.14.142.224: bytes=32 time=2ms TTL=58
Reply from 152.14.142.224: bytes=32 time=3ms TTL=58
Reply from 152.14.142.224: bytes=32 time=3ms TTL=58

Ping statistics for 152.14.142.224:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 4ms, Average = 3ms

C:\Users\nikle>ping 152.14.142.226

Pinging 152.14.142.226 with 32 bytes of data:
Reply from 152.14.142.226: bytes=32 time=3ms TTL=58
Reply from 152.14.142.226: bytes=32 time=4ms TTL=58
Reply from 152.14.142.226: bytes=32 time=4ms TTL=58
Reply from 152.14.142.226: bytes=32 time=3ms TTL=58

Ping statistics for 152.14.142.226:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 4ms, Average = 3ms
```

Conclusion

As more number of servers come into the system, the time to transfer the entire file to all the servers increases. The maximum segment size also plays an important role in file transfer because of the underlying network to transmit each segment successfully. All this is tested by incorporating a loss probability at each of the servers and then accepting or discarding segments by comparing a random number generated with the loss probability. In conclusion, the overall time for transferring a file in a point to multipoint system increases with an increase in the number of servers, decrease in the maximum segment size (MSS) or an increase in the loss probability.