OS LAB

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Q1)

Setup Description:

The server and client is run on two different machines in SL2. The files are assumed to be stored in the /tmp directory. Both the machines have a Intel Core i5-3330 CPU @ 3.00GHz × 4 processor. Both the machines are 64-bit OS type. They have a memory of 7.7 GiB and a Disk memory of 58.9 GiB.

The maximum reading bandwidth of the disk on the server is 180 MBps. This was found by running the disk.c file from lab1 for which disk I/O is the bottleneck and then running `iostat -x 1 120` to check the rate at which data is being read.

iperf: We can iperf on both the server and client, and found out that the network bandwidth measured by it is near about 116 MBps
In our program, we are observing a throughput of around 560-800 Mbits/sec. The network bandwidth of 932 Mbps corresponds to approximately 58 requests transferred per second.

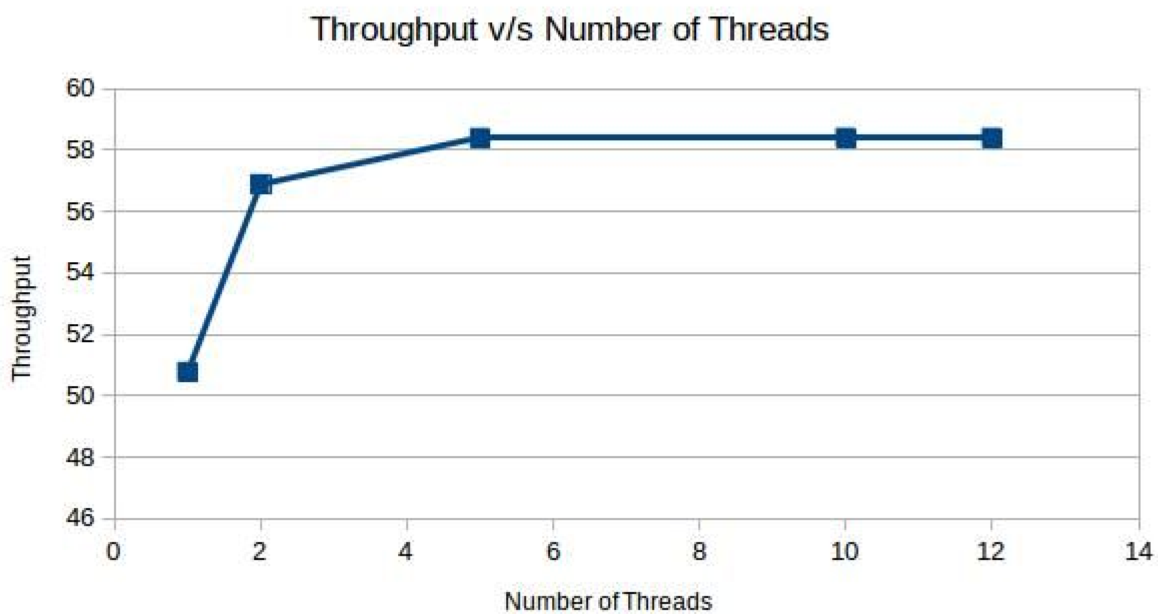
The observed bandwidth is slightly lesser than the maximum network bandwidth. This may be because the files are first accessed from the disk and this increases the time it takes for the files to reach to the client side thereby reducing the throughput.

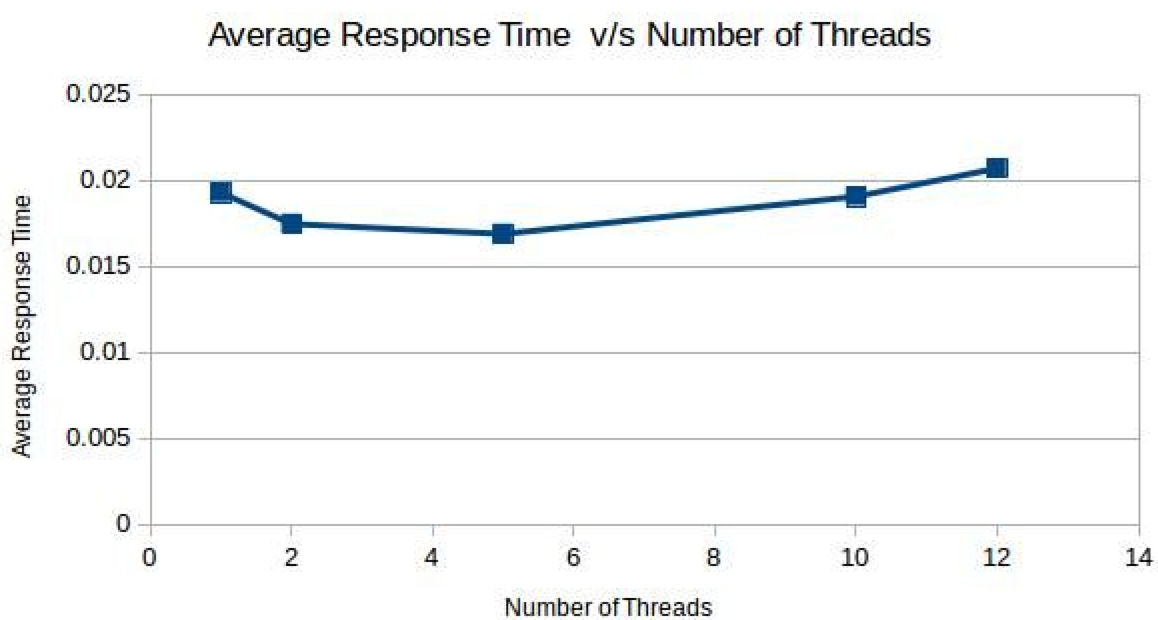
Q2)

a) The lowest value of N that saturates the server is . 5
The observed values are :

N	Throughput	Average Response time
1	50.762987	0.019271
2	56.884281	0.017460

5	58.383034	0.016881
10	58.391303	0.019057
12	58.391425	0.020695





b) For lower values of N than optimal value:

Throughput trend: We can see that the throughput increases from 50 to 58 before reaching 5

Avg response time: We can observe that the avg response time doesn't follow any specific trend until the optimal value is reached

For larger values of N than optimal value:

Throughput : The throughput remains almost constant near about 58 after the optimal value is reached

Avg response time: The average response time increases after the optimal value.

Explanation for this trend:

If the number of threads increase, there is an increase in the number of file requests, but there is a limit on the number of requests depending on the network bandwidth, so as a result of this the requests start getting queued up because of which there is a visible increase in the average response time.

c)

The bottleneck is the network bandwidth. By running iperf, we found that the maximum number of requests per second that can be sent is around 58 files. The throughput we obtain at the optimal value of 5 threads is also very close to the same value 58. Hence, the network bandwidth serves as the bottleneck.

d)

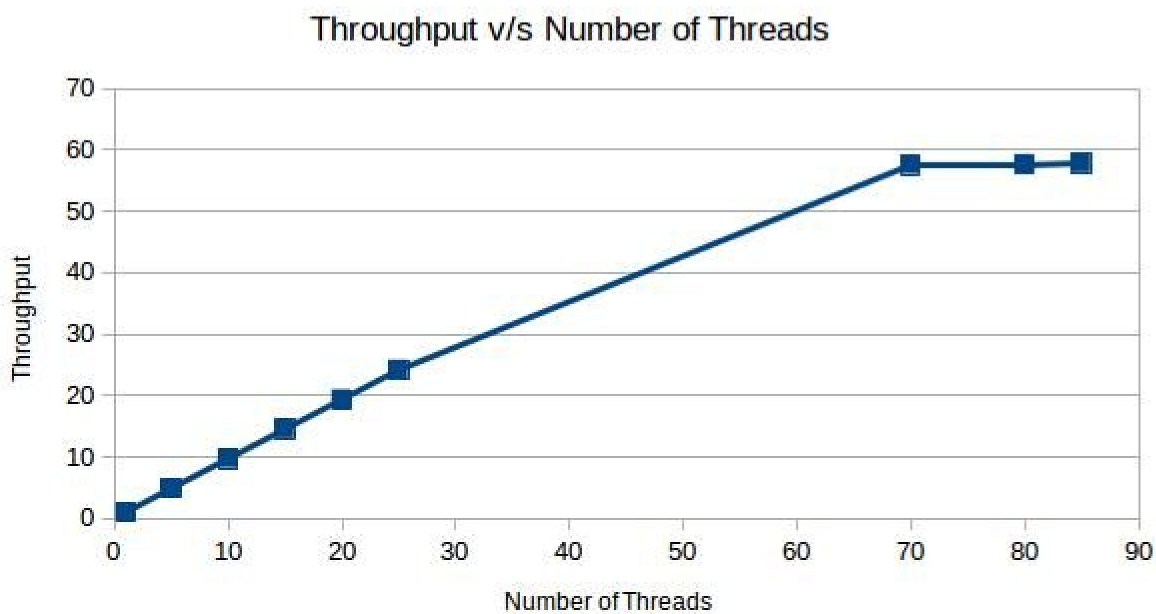
The server throughput at saturation is near about 58 req/sec. This number is equal to the number of files which can be sent per second equal to the bottleneck resource, the network bandwidth

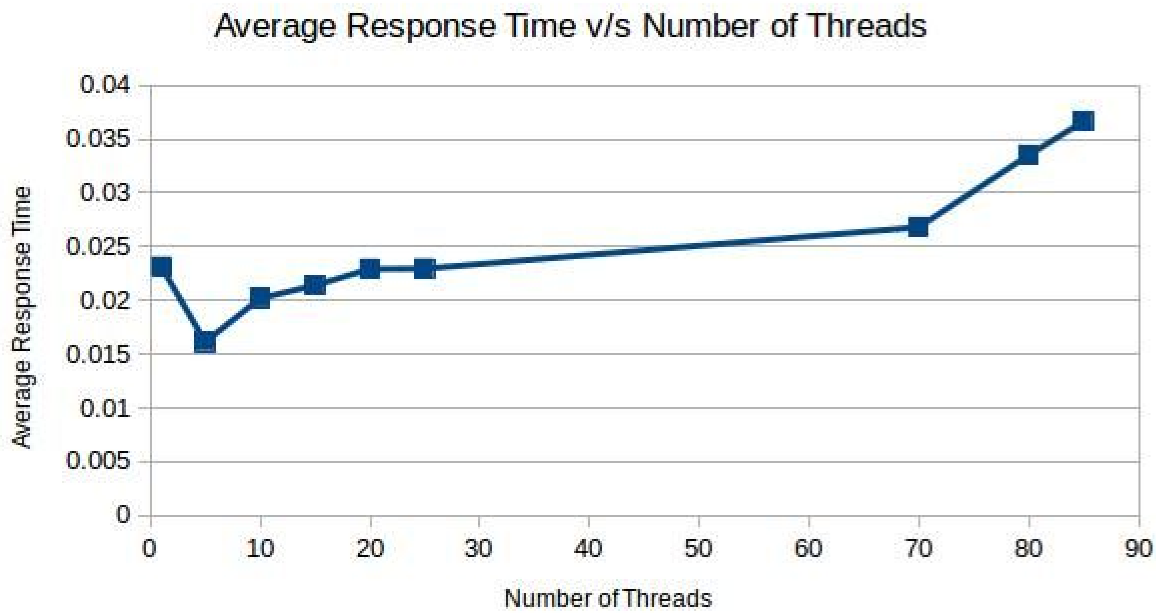
Q3)

a) The optimal value of N is : 70
The observed readings are:

N	Throughput	Avg. Response Time
1	0.976910	0.023119
5	4.880979	0.016125
10	9.695967	0.020202

15	14.510598	0.021397
20	19.339642	0.022913
25	24.145801	0.022938
70	57.564122	0.026804
80	57.662449	0.033495
85	57.815209	0.036647





b)

For lower values of N than optimal value:

Throughput trend: We can see that the throughput increases from 4 to 58 before reaching the optimal value

Avg response time: We can observe that the avg response time doesn't follow any specific trend until the optimal value is reached

For larger values of N than optimal value:

Throughput : The throughput remains almost constant near about 58 after the optimal value is reached

Avg response time: The average response time increases after the optimal value.

c)

The bottleneck is the network bandwidth. By running iperf, we found that the maximum number of requests per second that can be sent is around 58 files. The throughput we obtain at the optimal value of 75 threads is also very close to the same value 58. Hence, the network bandwidth serves as the bottleneck.

d)

The server throughput at saturation is near about 58 req/sec. This number is equal to the number of files which can be sent per second equal to the bottleneck resource, the network bandwidth

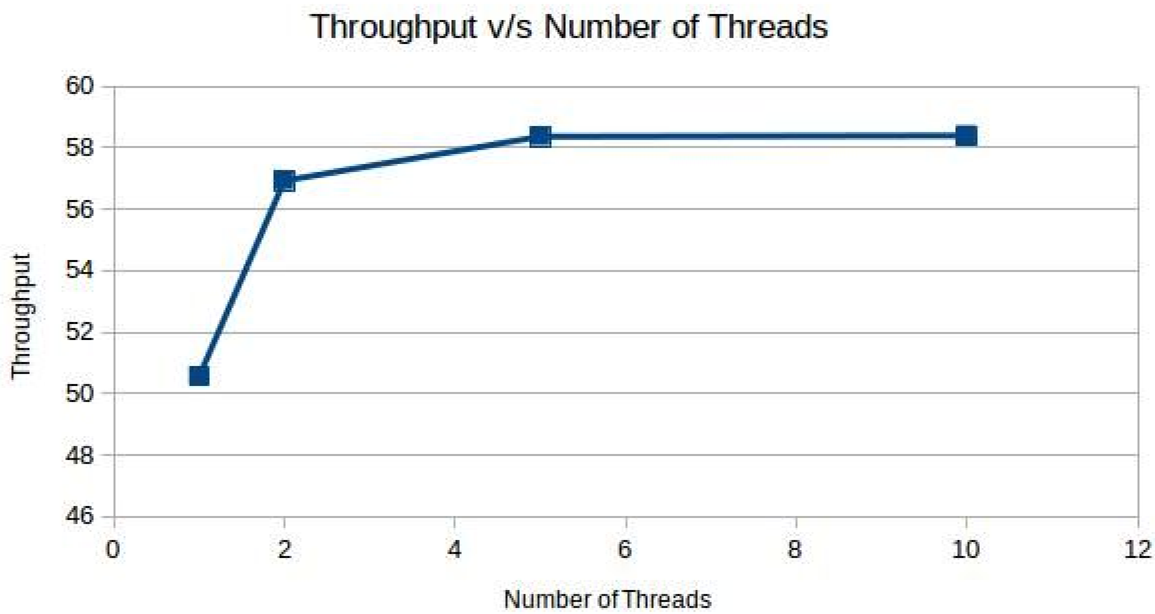
Q4)

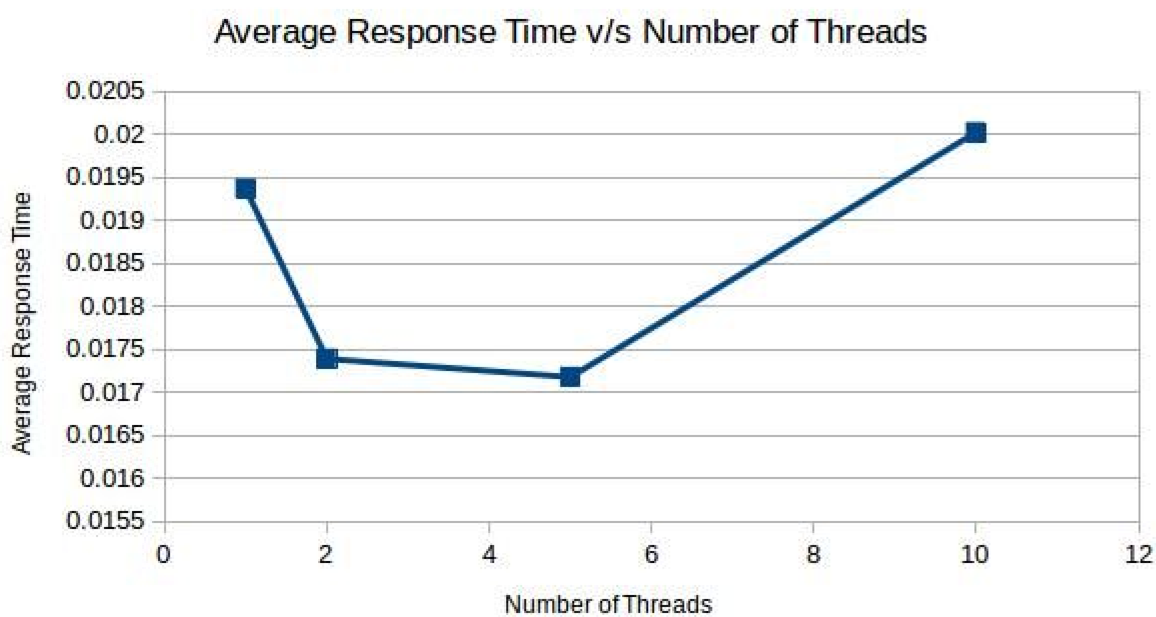
a)

The optimal value of N is : 5

The observed readings are:

N	Throughput	Avg. Response Time
1	50.555192	0.019366
2	56.927846	0.017390
5	58.362972	0.017178
10	58.391911	0.020022





b)For lower values of N than optimal value:

Throughput trend: We can see that the throughput increases from 50 to 58 before reaching 5

Avg response time: We can observe that the avg response time doesn't follow any specific trend until the optimal value is reached

For larger values of N than optimal value:

Throughput : The throughput remains almost constant near about 58 after the optimal value is reached

Avg response time: The average response time increases after the optimal value.

Explanation for this trend:

If the number of threads increase, there is an increase in the number of file requests, but there is a limit on the number of requests depending on the network bandwidth, so as a result of this the requests start getting queued up because of which there is a visible increase in the average response time.

c)The bottleneck is the network bandwidth. By running iperf, we found that the maximum number of requests per second that can be sent is around 58 files. The throughput we obtain at the optimal value of 5 threads is also very close to the same value 58. Hence, the network bandwidth serves as the bottleneck.

d)

The server throughput at saturation is near about 58 req/sec. This number is equal to the number of files which can be sent per second equal to the bottleneck resource, the network bandwidth