OS LAB 2

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Q.1 For this experiment we have arranged the server on a laptop and the client on a lab machine. They are connected by the ethernet cables available inside the lab.

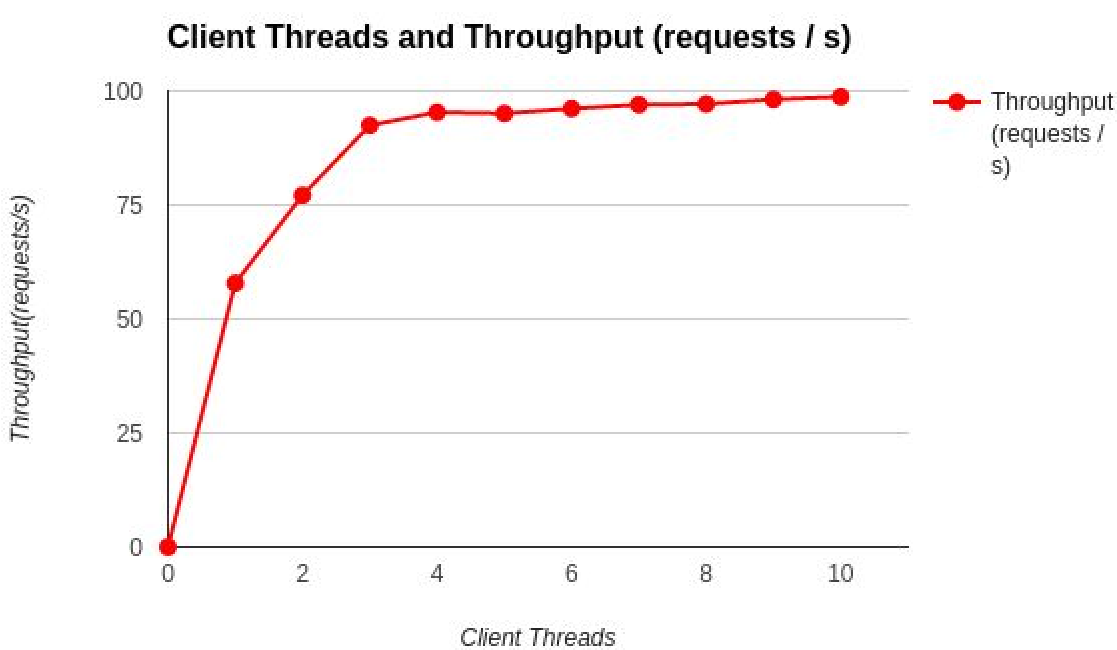
Server machine(Laptop): 7.7 GB RAM, i5-4210U CPU, Linux - 64bit.
Client machine : lab machine in SL 2
Ethernet cable : cable in lab SL 2

(i) The maximum read bandwidth of the disk on the server is 440 MB/s (observed under r/s while running “iostat x 1”). Since the files used on the server to download are 2 MB, it corresponds to approx. 220 requests/s.

(ii) The maximum network bandwidth that we get between the client and the server is 220 MB/s (observed by running “iperf -s” on server machine and “iperf -c host” on the client machine, where host is the ip address of the server). For 2 MB files used in experiment, it corresponds to approx 110 requests/s.

Q.2

a.) N = 5 saturates server.
b.) As value of N increases from N = 5; throughput is almost constant.
For N < 5; throughput increases.



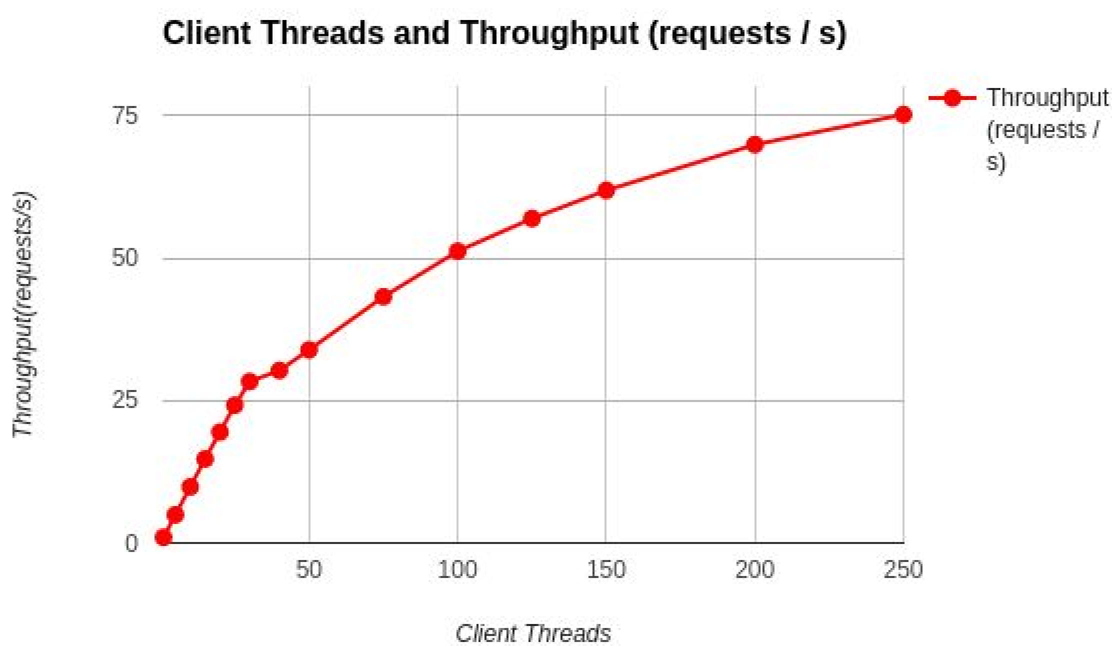
c.) Network Bandwidth is bottleneck when server is operating at saturation.
From question 1; Data rate at maximum utilization of network bandwidth is significantly less than maximum read bandwidth of disk on server. Thus Network is the bottleneck. (commands used iostat; same as question 1.

d.) Each file has size 2 Mb; throughput at saturation is around 100 requests per sec.
Amount of data sent = 2 Mb * 100 = 200 Mb per sec
From question 1; it can be seen that data rate at maximum network bandwidth is same as amount of data sent at saturation; which justifies that Network bandwidth is the bottleneck.

Q.3

a.) As N increases; throughput increases.
From Q.2, part c; it can be deduced that network will be bottleneck in this case also.
From graph in Q.3, part b; it can be seen that saturation of 100 requests per second will be when N is around 500.

b.) As N increases from N = 1; throughput increases.



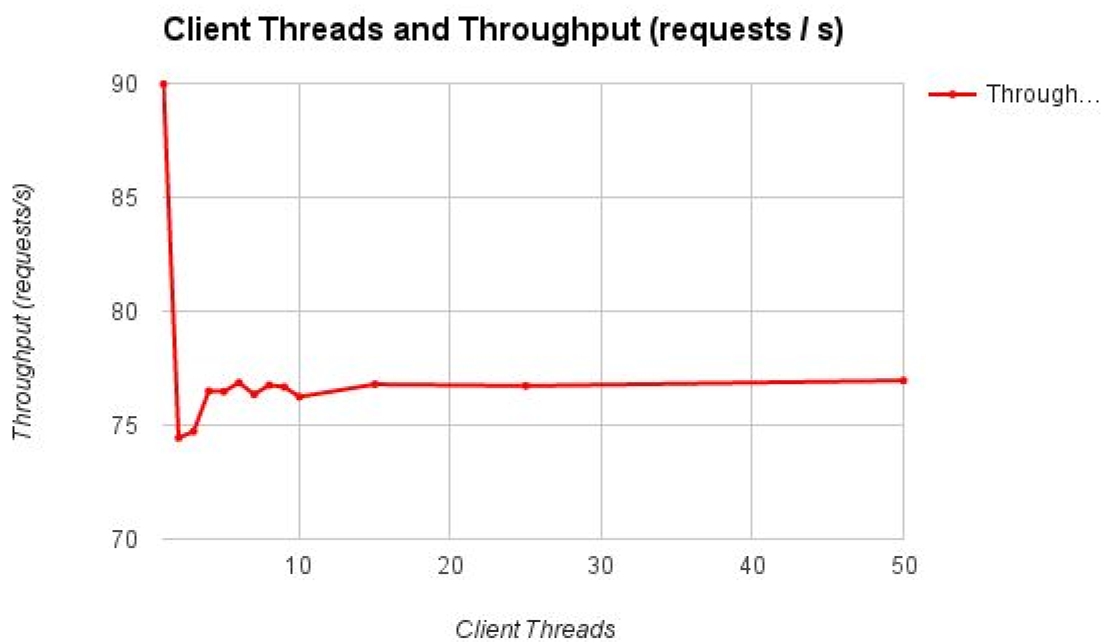
c.) Neither network nor disk read is bottleneck in this case. Each tread sleeps for 1 sec after sending one request; and number of threads are less so per second requests sent are much less than network bandwidth or disk read rate.

d.) From graph it is clear that for N < 50; there are less than 50 requests per second which converts into 2 Mb * 50 = 100 Mbps. From question 1, maximum network bandwidth is 220 Mbps and disk read is 440 Mbps; thus neither of two are bottleneck. Which justifies part c.

Q.4

a.) For this setup N saturates at around 5.

b.) The maximum value of N is actually observed at N=1(throughput~90req/s) and then it remains almost constant from N=2 (throughput~76.5req/s)



c.) Here we can observe that the server bottlenecks at its reading ability from its cache. Because it has cached the fixed file and since the same memory address is being read by multiple processes, the scheduler is used to its maximum from the very beginning.

d.) Each file has size 2 Mb; throughput at saturation is around 76 requests per sec.
Amount of data sent = 2 Mb * 76 = 152 Mb per sec
From question 1; it can be seen that neither data rate at maximum network bandwidth nor the nor disk read bandwidth is around the amount of data sent at saturation. This justifies that neither Network bandwidth nor the disk read is the bottleneck.
Instead it seems to be more of an issue of simultaneous reading of the same memory address by multiple process on the server side. Hence a saturated result is obtained right from the very beginning.