Report

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Question 1

Setup – Two laptops connected using Ethernet cable

(i)

Maximum disk read bandwidth in server - 43.160 MBps
File Size - 2MB
Approximate no of requests per sec that can be served - 21.58 req /sec
Commands used – Ran the *'disk.c'* program from Lab1 and measured the bandwidth using *iostat –x 1*

(ii)

Maximum network bandwidth between the devices – 11.8 MBps
File Size – 2MB
Approximate no of requests per sec that can be served – 5.9 req/sec
Justification- We are using 100Mbps Ethernet link that offers nearly 94.4 Mbps maximum network bandwidth
Commands used – *iperf –s on server*
iperf –c < I.P. of server > -i 2

Question 2

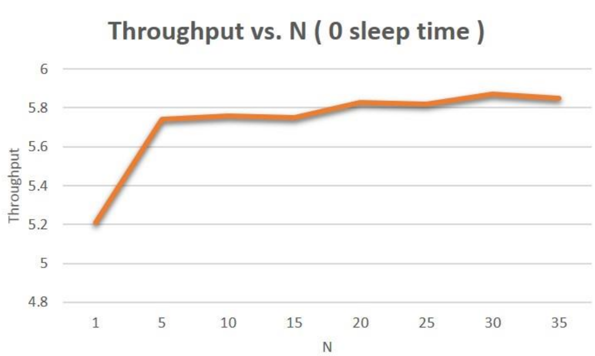
Parameters-

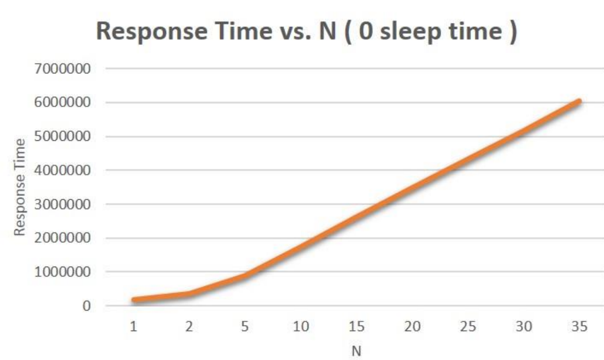
- Read mode - "random"
- sleep time - 0
- Experiment duration - 120 sec

Observations-

N	1	2	5	10	15	20	25	30	35
Throughput(req/s)	5.21	5.69	5.74	5.76	5.75	5.83	5.82	5.87	5.85
Response time(s)	0.18	0.35	0.87	1.74	2.61	3.47	4.32	5.17	6.05

Graphs-





(a) Optimal value of N at saturation – 5

(b) For the values lower than N the throughput rapidly increases and response time also increases almost linearly. For the values higher than N, throughput is almost constant or increases at very low rate and response time linearly increases.

(c) Network is the bottleneck resource at the saturation. We used *nload* tool to measure network usages. For the optimal value of N, average network usage were constant and almost equal to the maximum network bandwidth. Whereas the Disk reading was still much below its maximum bandwidth.

(d) Server throughput at saturation- 5.74
Justification - As the network becomes the bottleneck, for the optimal value of N (= 5) throughput is approximately equal to the maximum network bandwidth. Also as we saw earlier at maximum network bandwidth the no. of requests that can be served per sec was 5.9, which is almost achieved at N=5.

Question 3

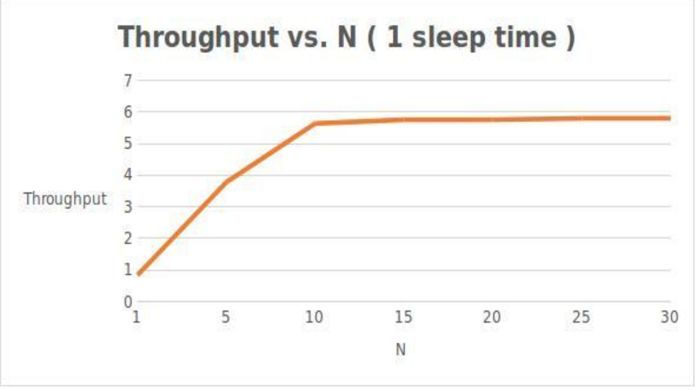
Parameters-

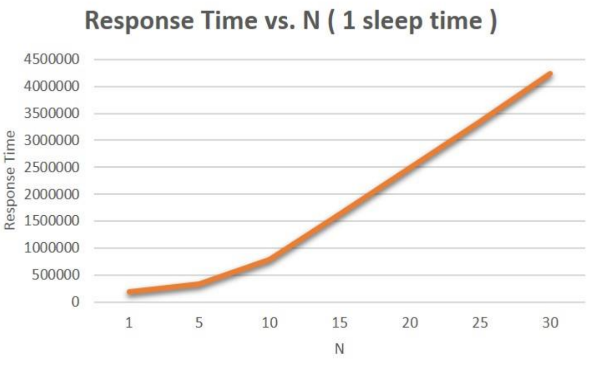
- Read mode - "random"
- sleep time - 1
- Experiment duration - 120 sec

Observations-

N	1	5	10	15	20	25	30
Throughput(req/s)	0.84	3.78	5.64	5.77	5.78	5.80	5.81
Response time(s)	0.19	0.33	0.78	1.62	2.49	3.35	4.23

Graphs-





(a) Optimal value of N at saturation – 15.
We see that number of clients required to reach saturation of throughput has increased. This can be explained by the fact that, now the client threads sleep in between requests, so this allows the server to relax and hence it can serve more requests now in that sleep time.

(b) For the values lower than N the throughput rapidly increases and response time also increases almost linearly. For the values higher than N, throughput is almost constant or increases at very low rate and response time linearly increases.

(c)
Network is the bottleneck resource at the saturation. We used *nload* tool to measure network usages. For the optimal value of N, average network usage were constant and almost equal to the maximum network bandwidth.

(d)
Server throughput at saturation- 5.77
Justification - As the network becomes the bottleneck, for the optimal value of N (= 15) throughput is approximately equal to the maximum network bandwidth. Also as we saw earlier at maximum network bandwidth the no. of requests that can be served per sec was 5.9, which is almost achieved at N=15.

Question 4

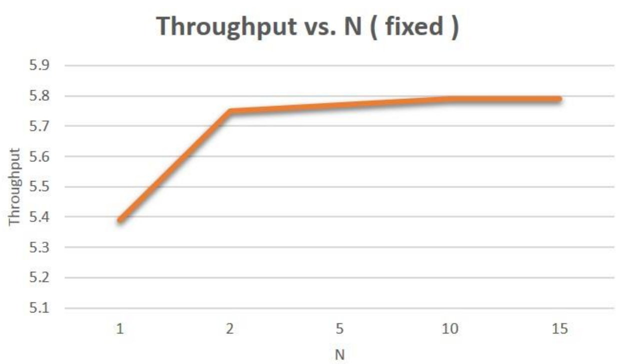
Parameters-

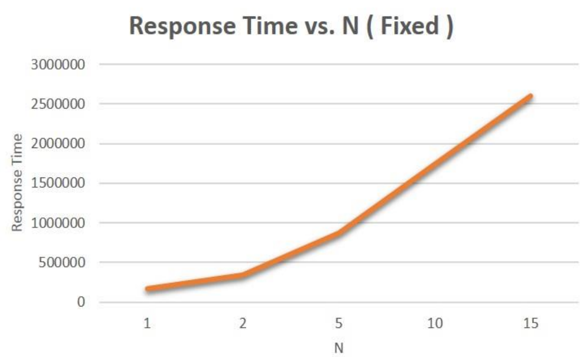
- Read mode - “fixed”
- sleep time - 0
- Experiment duration - 120 sec

Observations-

N	1	2	5	10	15
Throughput(req/s)	5.39	5.75	5.77	5.79	5.79
Response time(s)	0.17	0.34	0.86	1.73	2.60

Graphs-





(a)

Optimal value of N at saturation – 2
Here we see that the saturation is achieved at less number of clients as we are fetching the same file again and again, so it is present in the cache. Hence the server can complete the request at lesser response time, which leads to earlier saturation of the server.

(b)

For the values lower than N the throughput rapidly increases and response time also increases almost linearly. For the values higher than N, throughput is almost constant or increases at very low rate and response time linearly increases.

(c)

Network is the bottleneck resource at the saturation. We used *nload* tool to measure network usages.For the optimal value of N, average network usage were constant and almost equal to the maximum network bandwidth.

(d)

Server throughput at saturation- 5.75
Justification - As the network becomes the bottleneck, for the optimal value of N (= 2) throughput is approximately equal to the maximum network bandwidth. Also as we saw earlier at maximum network bandwidth the no. of requests that can be served per sec was 5.9, which is almost achieved at N=2.

Additional Observations:

Waiting for terminated processes has been adequately taken care of, but towards the end some zombie processes remain (equal to the number of threads in client program). This can be explained as, the accept system call is a blocking system call, hence the further execution of the program stops there. Hence the part of code which waits for the dead processes is not executed in the last iteration.