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CSC 573- Internet Protocols
Project 2 Report

Selective-Repeat ARQ protocol

Task 1:

File Size: 1,078,895 bytes (1.02 MB)

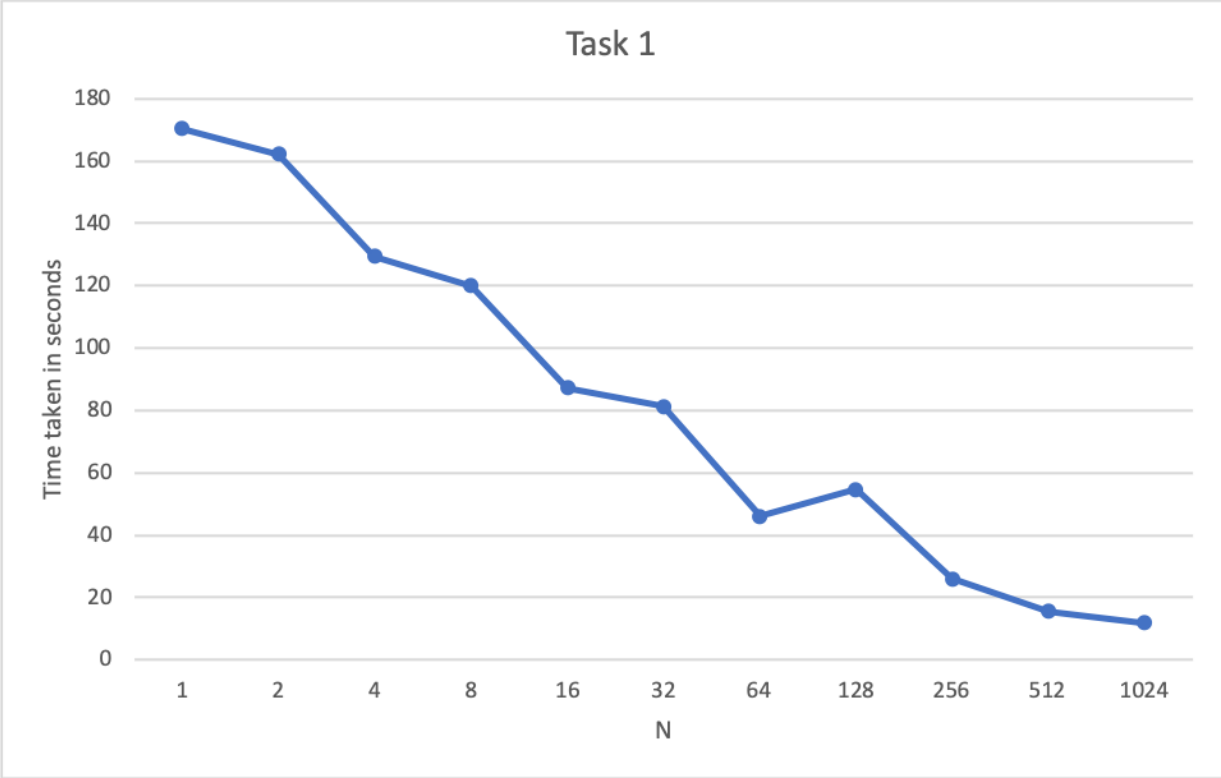
RTT between Client and Server:

```
Prashanths-MacBook-Pro:Selective-Repeat-ARQ prashanthm$ host 152.7.99.129
129.99.7.152.in-addr.arpa domain name pointer vclv99-129.hpc.ncsu.edu.
Prashanths-MacBook-Pro:Selective-Repeat-ARQ prashanthm$ traceroute vclv99-129.hpc.ncsu.edu
traceroute to vclv99-129.hpc.ncsu.edu (152.7.99.129), 64 hops max, 52 byte packets
 1  192.168.0.1 (192.168.0.1)  2.798 ms  3.800 ms  6.557 ms
 2  * * *
 3  cpe-174-111-116-185.triad.res.rr.com (174.111.116.185)  35.680 ms  31.792 ms  35.837 ms
 4  cpe-024-025-063-142.ec.res.rr.com (24.25.63.142)  15.977 ms  15.759 ms  13.163 ms
 5  be31.drhmncev01r.southeast.rr.com (24.93.64.184)  21.749 ms  25.175 ms  20.042 ms
 6  gig10-0-0.chrlncsa-rtr1.carolina.rr.com (24.93.64.27)  21.392 ms  23.434 ms  21.760 ms
 7  cpe-024-074-247-097.carolina.res.rr.com (24.74.247.97)  22.086 ms
    cpe-024-074-247-065.carolina.res.rr.com (24.74.247.65)  28.721 ms  21.964 ms
 8  rrcs-24-172-68-237.midsouth.biz.rr.com (24.172.68.237)  22.199 ms
    rrcs-24-172-68-245.midsouth.biz.rr.com (24.172.68.245)  34.346 ms
    rrcs-24-172-68-237.midsouth.biz.rr.com (24.172.68.237)  20.494 ms
 9  rrcs-98-101-20-135.midsouth.biz.rr.com (98.101.20.135)  23.985 ms  36.669 ms
    rrcs-98-101-20-133.midsouth.biz.rr.com (98.101.20.133)  22.061 ms
10  rrcs-24-172-64-46.midsouth.biz.rr.com (24.172.64.46)  25.714 ms  19.348 ms  21.641 ms
11  rtp-gw-to-hntvl-ip-asr-gw.ncren.net (128.109.9.5)  30.742 ms  24.104 ms  32.497 ms
12  ncsu-gw-1-to-rtp-gw.ncren.net (128.109.18.110)  26.735 ms  27.307 ms  25.577 ms
13  152.1.6.69 (152.1.6.69)  26.300 ms  28.418 ms  30.607 ms
14  * * *
15  * * *
Prashanths-MacBook-Pro:Selective-Repeat-ARQ prashanthm$
```

MSS: 500 bytes
p = 0.05

N	Data Transfer Time (seconds)	Average(seconds)
1	173.039	170.322
	184.143	
	158.253	
	169.942	
	166.234	
2	162.727	162.160
	142.395	
	160.001	
	166.284	
	179.397	
4	121.390	129.455
	134.430	
	124.517	
	137.242	
	129.697	
8	117.888	119.951
	114.893	
	126.713	
	115.951	
	124.313	
16	76.247	87.270
	91.576	
	105.068	
	86.348	
	77.115	
32	66.961	81.198
	87.438	
	85.343	
	83.875	
	82.375	
64	45.728	46.124
	46.126	
	48.852	
	43.748	
	46.167	

N	Data Transfer Time (seconds)	Average(seconds)
128	52.706	54.612
	51.659	
	55.747	
	56.836	
	56.115	
256	21.671	26.035
	21.738	
	18.540	
	20.622	
	22.609	
512	13.399	15.4718
	15.745	
	16.906	
	15.597	
	15.712	
1024	9.240	11.757
	12.341	
	12.419	
	12.349	
	12.438	



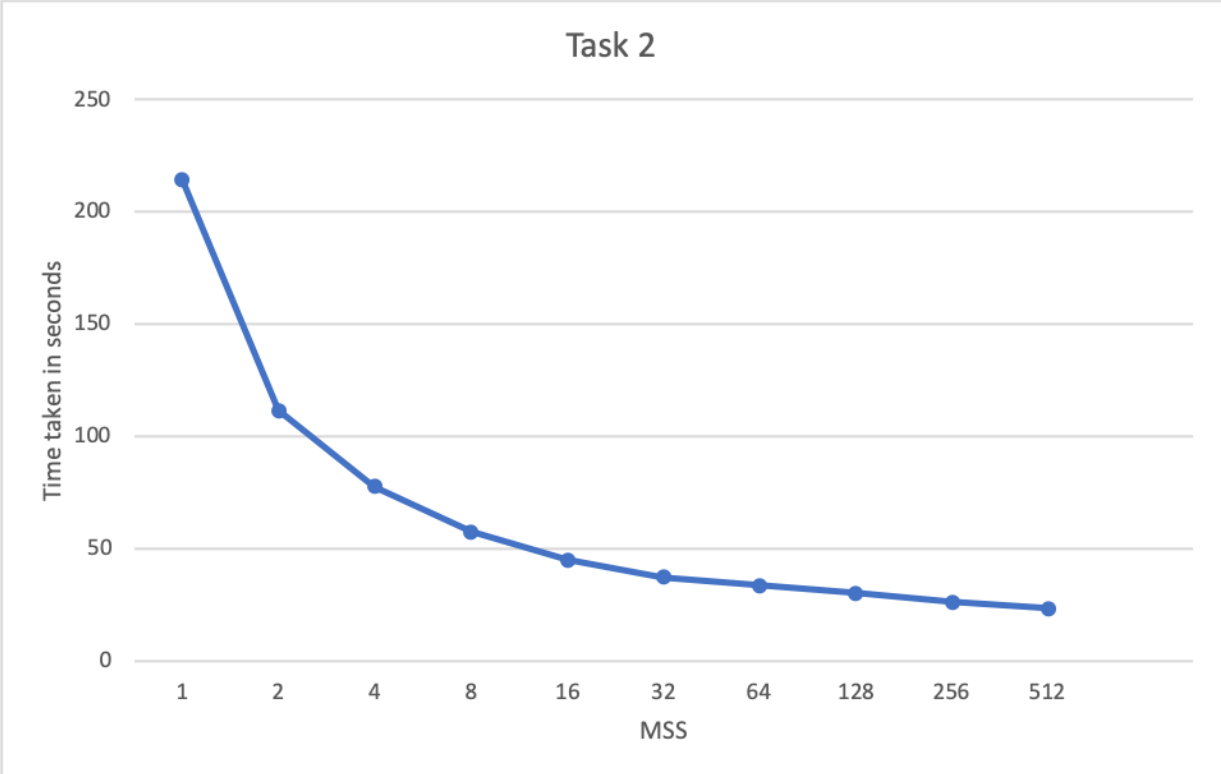
The above graph is obtained by keeping MSS and p as constant, while varying N. As per Selective Repeat ARQ protocol, the sender will only send the packets for which the ACK have not been received. So there's retransmission of packets that have successfully acknowledged. So we see a decrease in the time taken to transfer file as the N increases. As increases, more number of packets are received by the server at a time

and only re- receives the only packets that are lost (here number of packets dropped on value ‘p’ isn’t affected which was affected in case of Go-Back-N ARQ). So effectively decreasing the time taken to transfer for larger values of N. At N = 128, we have seen an anomaly where the time taken has increased compared to N = 64. We are speculating this due to there were more packets dropped during that run (as dropping packets is on randomly generated value ‘p’).

Task 2:
N = 64
p = 0.05

MSS	Data Transfer Time	Average
100	218.331	214.228
	217.972	
	218.173	
	211.422	
	205.243	
200	104.415	111.5692
	109.522	
	111.905	
	117.326	
	114.678	
300	76.952	77.778
	74.274	
	81.089	
	83.183	
	73.396	
400	52.205	57.501
	59.773	
	59.329	
	50.401	
	65.799	
500	40.336	45.134
	49.573	
	43.915	
	47.876	
	43.970	
600	38.691	37.247
	34.414	
	34.313	
	36.353	
	42.467	
700	29.065	33.600
	35.964	
	33.183	
	37.225	
	32.563	

MSS	Data Transfer Time	Average
800	27.823	30.305
	32.135	
	27.145	
	30.131	
	33.293	
900	26.909	26.306
	25.873	
	23.759	
	29.191	
	25.802	
1000	23.867	23.369
	22.708	
	25.642	
	21.878	
	22.750	



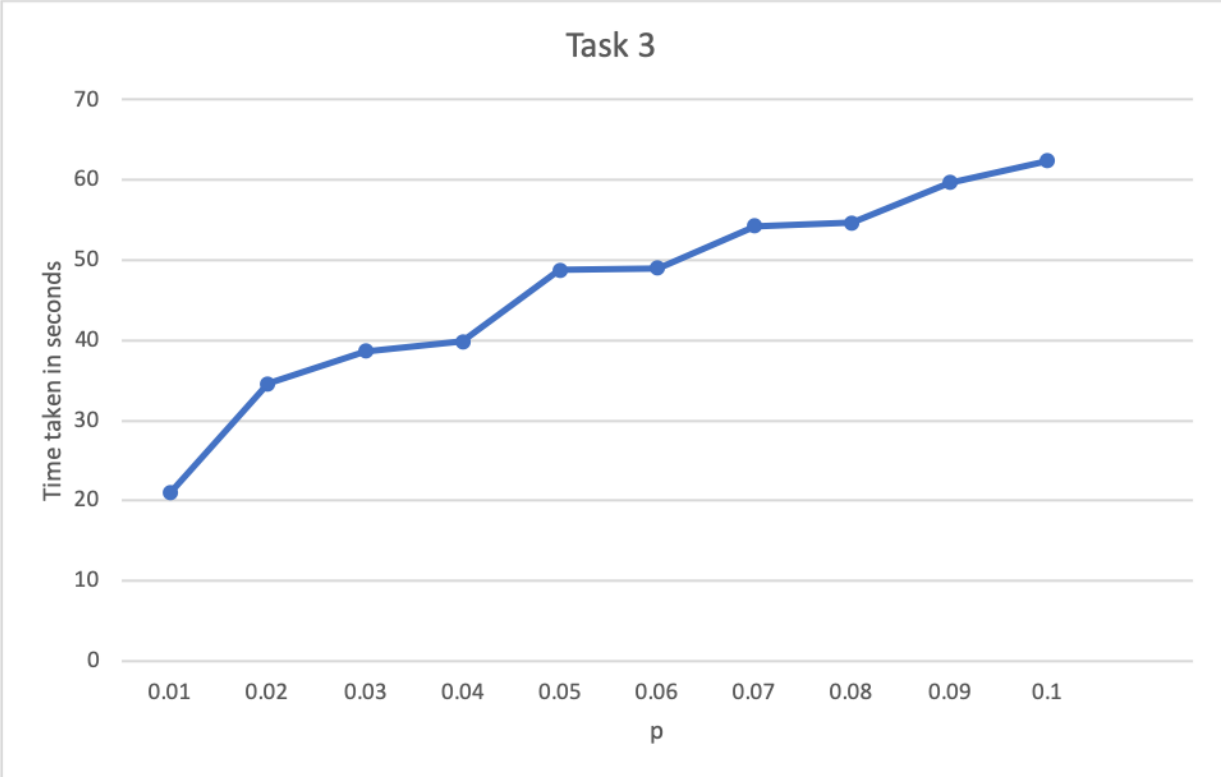
The above graph is obtained keeping N and 'p' as constant while varying MSS exponentially. As you can see from the graph, there's a downward trend in the time taken to transfer the file as the size of the segment increases. This is observed because, sending a large packet at time causes more data bytes to be transferred at a time, meaning larger throughput. The probability drop factor (p) doesn't affect the transfer rate as we are

keeping N as constant(even if it wasn't, Selective Repeat protocol comes into picture which only retransmits packets that are lost). Hence as the size of MSS increases the time taken to transfer data decreases.

Task 3:
MSS = 500
N = 64

p	Data Transfer Time	Average
0.01	18.222	21.0542
	18.924	
	23.176	
	23.991	
	20.958	
0.02	29.705	34.558
	37.647	
	33.224	
	36.722	
	35.495	
0.03	39.741	38.624
	40.529	
	36.688	
	38.811	
	37.353	
0.04	39.640	39.866
	42.482	
	39.846	
	38.658	
	38.708	
0.05	47.778	48.729
	48.771	
	46.647	
	51.854	
	48.598	
0.06	49.283	49.020
	48.765	
	44.014	
	50.841	
	52.197	
0.07	56.000	54.224
	49.689	
	55.994	
	56.319	
	53.118	

p	Data Transfer Time	Average
0.08	54.598	54.637
	53.878	
	55.083	
	57.993	
	51.636	
0.09	65.234	59.697
	55.395	
	61.202	
	58.721	
	57.936	
0.10	60.168	62.370
	64.825	
	67.638	
	62.060	
	57.160	



The above graph is drawn keeping MSS and N as constant while linearly increasing ‘p’. As the ‘p’ increases, higher the chance to generate random number from 0 to ‘p’. So higher the random number generated, greater is the chance of packet being dropped. This is clearly evident from the graph and is independent of N and MSS.

Also in Go-Back-N ARQ, the graph is linearly increasing, but the values of time are much higher. This is because of retransmissions of packets that could have been acknowledged properly. But in Selective Repeat ARQ, only the lost packets are retransmitted, leading to decreased time of transfer. But on an overview both the protocols, time taken to transfer the file increases, as ‘p’ increases.