

CS359 Computer Networks Lab

Assignment 5

Implementation of sliding window protocol
(Go back N and Selective Repeat)

Name: M Maheeth Reddy	Roll No.: 1801CS31	Date: 20-Feb-2021
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Introduction: To demonstrate the mentioned sliding window protocols, I have written two sets of programs (each set contains one client-side code and server-side code). One set is for each protocol. The client sends a file (gistfile.txt) in the form of packets to the server and is reconstructed at the server end.

Files Included:

gbn-client.c - for client side code for Go-Back-N protocol	sr-client.c - for client side code for Selective Repeat protocol
gbn-server.c - for server side code for Go-Back-N protocol	sr-server.c - for server side code for Selective Repeat protocol
gistfile.txt – input text file	

Go Back N:

Compilation: gcc gbn-server.c -o gbn-server

gcc gbn-client.c -o gbn-client

Execution: ./gbn-server

./gbn-client (execute server before client)

Sample Session:

Client side

```
Sending packet 3054...
Acknowledgement 3054 received
Sending packet 3055...
Acknowledgement 3055 received
Sending packet 3056...
Acknowledgement 3056 received
Sending packet 3057...
Acknowledgement 3057 received
Sending packet 3058...
Acknowledgement 3058 received
Sending packet 3059...
Acknowledgement 3059 received
Sending packet 3060...
Acknowledgement 3060 received
Sending packet 3061...
Acknowledgement 3061 received
Sending packet 3062...
Acknowledgement 3062 received
Sending packet 3063...
Acknowledgement 3063 received
Sending packet 3064...
Acknowledgement 3064 received
Sending packet 3065...
Acknowledgement 3065 received
Sending packet 3066...
Acknowledgement 3066 received
Sending packet 3067...
Acknowledgement 3067 received
Sending packet 3068...
Acknowledgement 3068 received
Sending packet 3069...
Acknowledgement 3069 received
Sending packet 3070...
Acknowledgement 3070 received
Sending packet 3071...
Acknowledgement 3071 received
Sending packet 3072...
Acknowledgement 3072 received
[maheeth@maheeth-PC:~/D/netlab5]-[01:17:13 IST]
->$
```

Server side

```
4705073558122375415417200921965563405533347843275197814453910296613637292816403322858
277400213988846375567124674868467361795016
474572838515685283202962908042906475735120765699184181768011549531548203964479548944
488439788311653187692817074819840714497361
5386314847182104599263810424039609228765878994123179215715094367283327303020988006589
792974721368333841513658700314945433634456
3685020221252259142980926069027074077129168059113331677771782227727933843623094566219
277157186574916058687802285827552124321505
079455861793177558832003907432025223801480259783659063482422749703483529574186006183
975509386008848443692647358501225142361167
3942679708028160995866607265771564423203677879968679929985370044267348240320617033379
072586756373490054605230219409903866795469

Sending acknowledgement 3070...
Acknowledgement 3070 sent
Receiving Packet 3071...
Data: 75365992767649831303159493838751879456865029941663203261892112803779336877309
8414146080238151293907791693215256965266724046409
029237782563096623515868324151297109194453992960065707699283877623772501033680549048
220288927590692487589517712276010516389098
414177627623117777410741182897322646935774432337593489702909715834793849902052358894
916963594941828827118210427424755222982593
0263099400776234259640984881940007947968250580544744304077736076557953616095573458814
306253535718606350692981622255928001096507
0588327094996262431505059042095661828596107333578122924612340170790916991622052806671
333685104366780235136494027277232872825498
1523246308282008538061408160202517775966824053244715248653671495274650673682535042749
033828795099010214859776685551489176975506
5811209762314534687747281829159103097186141033482266881873367741901377849867980657673
782571505747169485443159028925476795003998
9634367858634565656906133482371306765239555613722480562207025106068336976469898723556
66869136182759934303798798405762012284113
Sending acknowledgement 3071...
Acknowledgement 3071 sent
Receiving Packet 3072...
Data: file transfer complete
Sending acknowledgement 3072...
Acknowledgement 3072 sent
[maheeth@maheeth-PC:~/D/netlab5]-[01:17:13 IST]
->$
```

Wireshark Packet Capture for Go-Back-N:

No.	Time	Source	Destination	Protocol	Length Info
1	0.000000000	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
2	0.000131173	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
3	0.000570043	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
4	0.000688354	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
5	0.000715806	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
6	0.000753870	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
7	0.000770726	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
8	0.000808069	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
9	0.000822771	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
10	0.000867480	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
11	0.000888405	127.0.0.1	127.0.0.1	WireGuard	1078 Transport Data, receiver=0x34303636, counter=3832899979206275383, datalen=1004
12	0.000999110	127.0.0.1	127.0.0.1	WireGuard	1078 Transport Data, receiver=0x656E6F64, counter=5845942272, datalen=1004
13	0.007071916	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
14	0.007106087	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
15	0.007123264	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
16	0.007151738	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
17	0.007165976	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
18	0.007193743	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
19	0.007215202	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
20	0.007269126	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
21	0.007331788	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
22	0.007364003	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
23	0.007381956	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
24	0.007420444	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
25	0.007431951	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
26	0.007466874	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
27	0.007484538	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
28	0.007526592	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
29	0.007539051	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
30	0.007573512	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
31	0.007592822	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
32	0.007615028	127.0.0.1	127.0.0.1	UDP	1078 8080 → 42392 Len=1036
33	0.007627353	127.0.0.1	127.0.0.1	UDP	1078 42392 → 8080 Len=1036
▶ Frame 3: 1078 bytes on wire (8624 bits), 1078 bytes captured (8624 bits) on interface lo, id 0					
▶ Ethernet II, Src: 00:00:00:00:00:00 (00:00:00:00:00:00), Dst: 00:00:00:00:00:00 (00:00:00:00:00:00)					
▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1					
▶ User Datagram Protocol, Src Port: 42392, Dst Port: 8080					
▼ Data (1036 bytes)					
Data: 0000000039323534383333539373434353838383736323936373238373336333537383939...					
[Length: 1036]					
0020	00 01 a5 98 1f 90 04 14 02 28 00 00 00 00 39 32(1...92			
0030	35 34 30 33 35 39 37 34 34 35 38 38 38 37 36 32	54835974 45080702			
0040	09 36 37 32 30 37 30 36 35 35 37 30 39 39 35 37	00720706 35700057			
0050	34 31 31 38 38 36 30 32 34 36 39 38 35 35 34 31	41188002 40985541			
0060	35 37 33 39 33 38 34 39 34 39 34 36 30 34 32 32	57393849 49486422			
0070	38 30 32 34 39 36 32 39 33 39 35 35 30 36 38 38	00249629 39550600			
Data (data.data), 1,036 bytes					
Packets: 6148 · Displayed: 6148 (100.0%) · Dropped: 0 (0.0%)					
Profile: Default					

Selective Repeat:

Compilation: gcc sr-server.c -o sr-server

```
gcc sr-client.c -o sr-client
```

Execution: `./sr-server`

`./sr-client` (execute server before client)

Sample Session:

Client Side

```
Sending packet 3054...
Acknowledgement 3054 received
Sending packet 3055...
Acknowledgement 3055 received
Sending packet 3056...
Acknowledgement 3056 received
Sending packet 3057...
Acknowledgement 3057 received
Sending packet 3058...
Acknowledgement 3058 received
Sending packet 3059...
Acknowledgement 3059 received
Sending packet 3060...
Acknowledgement 3060 received
Sending packet 3061...
Acknowledgement 3061 received
Sending packet 3062...
Acknowledgement 3062 received
Sending packet 3063...
Acknowledgement 3063 received
Sending packet 3064...
Acknowledgement 3064 received
Sending packet 3065...
Acknowledgement 3065 received
Sending packet 3066...
Acknowledgement 3066 received
Sending packet 3067...
Acknowledgement 3067 received
Sending packet 3068...
Acknowledgement 3068 received
Sending packet 3069...
Acknowledgement 3069 received
Sending packet 3070...
Acknowledgement 3070 received
Sending packet 3071...
Acknowledgement 3071 received
Sending packet 3072...
Acknowledgement 3072 received
[maheeth@maheeth-PC:~/D/netlab5]-[04:21:50 IST]
```

Server Side

```

7075073558122375415u17200912965563405533347843275197814453910296613637292816403322858
277480213988486375567124674868467361795016
4475472838515685283209269848429864757351207656991841817680115495315482039644479549849
4884397883116518789281707848198067144097361
5386314847182104559926381042403960922876587899412317921571589436728332730302098006589
792974713683384113683704314945433634656
368502022125252914298092660927070071291680591133316777178222772933843623094566219
277157186574916058687802285827552124321581
07945586179317575883260390734205232801488259783659063482427249783483529574186006183
9755693680084843692647358501225142361167
394267978608216899586660726577156442320637789968679929985370044267348240320617033379
072586756373490654605230219409983866795469

Sending acknowledgement 3070...
Acknowledgement 3070 sent
Receiving Packet 3071...
Data: 7536599276749831303159493838751879456865029941663203261892112803779336877309
8414460802381512939071761693215256965266672406409
0292377825630966235158683241512971919445399296006578769928387762377250183368059048
220288927590692487589517712276010516389098
414117776276231777741074182897322646933774432337593489782909715834793849902052358894
1696635949041828827182104274015542522982593
0263990007862242564608948041900007947968250580544744304077736076557953616095573458814
360253357186063506289186213235592808106507
05883270949562623156859042089561805807333578122924612340178790916991622052806671
33368510436678023513649402777232872825498
1523246382820805380614806162825177596682405344715248653671495274650673682535042749
033827859989010214859776685551489176975586
581120976231453466774128182915910397186141033482266881873367741903177849867980657673
7825715857471694854415902892547675980398
9634378586345656690613348237130676523955613722480562207025106068336976496898723556
68689136182759934340379879840576201228413
Sending acknowledgement 3071...
Acknowledgement 3071 sent
Receiving Packet 3072...
Data: file transfer complete
Sending acknowledgement 3072...
Acknowledgement 3072 sent
[maheeth@maheeth-PC:~/D/netlab5]-[04:21:50 IST]

```

Wireshark Packet Capture for Selective Repeat:

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
2	0.002454916	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
3	0.005706839	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
4	0.005871929	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
5	0.005895937	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
6	0.005940475	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
7	0.005954054	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
8	0.005990488	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
9	0.006022222	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
10	0.006040550	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
11	0.006062567	127.0.0.1	127.0.0.1	WireGuard	1078	Transport Data, receiver=0x34303636, counter=3832899979206275383, datalen=1004
12	0.006126392	127.0.0.1	127.0.0.1	WireGuard	1078	Transport Data, receiver=0x6560F64, counter=0, datalen=1004
13	0.006141603	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
14	0.006166566	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
15	0.006176035	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
16	0.006212999	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
17	0.006225459	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
18	0.006267687	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
19	0.006283085	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
20	0.006328990	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
21	0.006342348	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
22	0.006374485	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
23	0.006391442	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
24	0.006422972	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
25	0.006435309	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
26	0.006462615	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
27	0.006477705	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
28	0.006515706	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
29	0.006531753	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
30	0.006557566	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
31	0.006568528	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
32	0.006604056	127.0.0.1	127.0.0.1	UDP	1078	8080 → 38373 Len=1036
33	0.006620008	127.0.0.1	127.0.0.1	UDP	1078	38373 → 8080 Len=1036
▶ Frame 3: 1078 bytes on wire (8624 bits), 1078 bytes captured (8624 bits) on interface lo, id 0						
Ethernet II, Src: 00:00:00:00:00:00 (00:00:00:00:00:00), Dst: 00:00:00:00:00:00 (00:00:00:00:00:00)						
Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1						
User Datagram Protocol, Src Port: 38373, Dst Port: 8080						
Data (1036 bytes)						
Data: 000000003932353438333539373434353838383736323936373238373336333537383939_						
[Length: 1036]						
0020	00 01 95 e5 1f 90 04 14 02 28 50 00 00 00 39 32(.....92				
0030	35 64 00 00 00 00 00 00 00 00 00 00 00 00 00 00				
0040	39 36 37 32 38 37 33 36 33 35 37 38 39 39 35 37	94835974 40888762				
0050	34 31 31 38 38 36 30 32 34 36 39 38 35 35 34 31	41180602 40985541				
0060	35 37 33 39 33 38 34 39 34 39 34 38 36 34 32 32	57393849 49486422				
0070	38 30 32 34 39 36 32 39 33 39 35 35 36 36 38 38	80249629 39550688				
Data (data.data), 1.036 bytes						
Packets: 6148 · Displayed: 6148 (100.0%) · Dropped: 0 (0.0%)						
Profile: Default						