

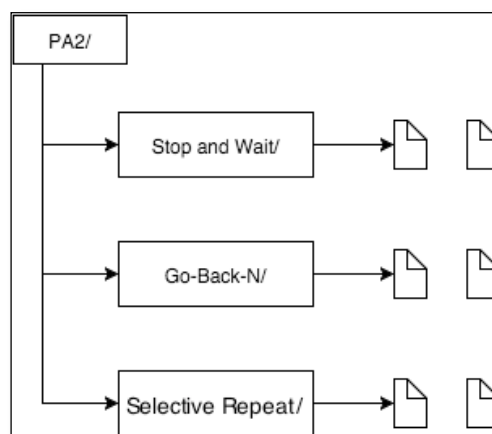
PA2 Report

Before all:

This report contains three parts to explain and report our programs, results and statistics:

- Part1 Stop and wait (It isn't required any designation according to criteria)
- Part2 Go-Back-N
- Part3 Selective Repeat (CS655 extension)

Our gsubmit accounts are “yt80” and “rexwang”. Each part above has instructions to run our program, our output results, logistics and statistics. And our structure of files are as follows, and among the files we **only modified** “StudentNetworkSimulator.java” files for each approach, which can be compiled to: “StudentNetworkSimulator.class”.



Compile Instructions for all:

According to our file structure showed above, we created separate folders for each transport method. Set Go-Back-N as example, as “main ()”

function is included in “Project.java”, to compile, use “javac Project.java”. To start simulator, use “java Project”. The compilation processes of S&W and SR are very similar except “cd” in different directories.

```
[→ PA2 ls
Go-Back-N          Selective Repeat Stop and Wait
[→ PA2 cd Go-Back-N
[→ Go-Back-N ls
Event.class        OSIRandom.class
Event.java         OSIRandom.java
EventList.class    OutputFile
EventList.java     Packet.class
EventListImpl.class Packet.java
EventListImpl.java Project.java
Message.class      StudentNetworkSimulator.class
Message.java       StudentNetworkSimulator.java
NetworkSimulator.class compile.txt
NetworkSimulator.java
[→ Go-Back-N javac Project.java
[→ Go-Back-N java Project
-- * Network Simulator v1.0 * --
Enter number of messages to simulate (> 0): [10]
```

Additionally, we produced a graph generator to produce statistical images to show our simulation results. This generator is made by R language and used “ggplot2”, “lattice” R packages to plot. To run this generator, it is important to revise the “setwd” function:

```
1 #Graph Generator for CS655 PA2 -Wang Chengchen & Xu yiteng|
2
3 #Initialization:
4 setwd("~/Google Drive/courses/Networks/PHW2/Graph Generator")
5 rm(list = ls())
6 #Include packages:
7 library(ggplot2)
8 library(lattice)
9 library(reshape)
10
11 #Read in Data:
12 raw_sr_co0<-read.csv("sr_corrupt=0/sr_corrupt=0data.csv")
13 raw_sr_lo0<-read.csv("sr_loss=0/sr_loss=0data.csv")
14 raw_gbn_co0<-read.csv("gbn_corrupt=0/gbn_corrupt=0data.csv")
15 raw_gbn_lo0<-read.csv("gbn_loss=0/gbn_loss=0data.csv")
16
17 #====Statistics--SR vs. GBN====:
18
19 #1. Throughput SR vs. GBN under Corruption:
20 tempdata1<-data.frame(raw_sr_lo0$corrupt,raw_sr_lo0$tput,raw_sr_lo0$tput_ci)
```

setwd("~/Google Drive/courses/Networks/PHW2/Graph Generator")

to your own workspace and copy data files to the same directory. The result images should be produced in the same directory.

Part1. Stop and Wait

Working correctness:

No loss and no corruption: works correctly (for sample outputs see the appendix)

Loss and no corruption: works correctly (for sample outputs see the appendix)

Corruption and no loss: works correctly (for sample outputs see the appendix)

Both Loss and corruption: works correctly (for sample outputs see the appendix)

Part 2. Go-Back-N

Working correctness:

No loss and no corruption: works correctly (for sample outputs see the appendix)

Loss and no corruption: works correctly (for sample outputs see the appendix)

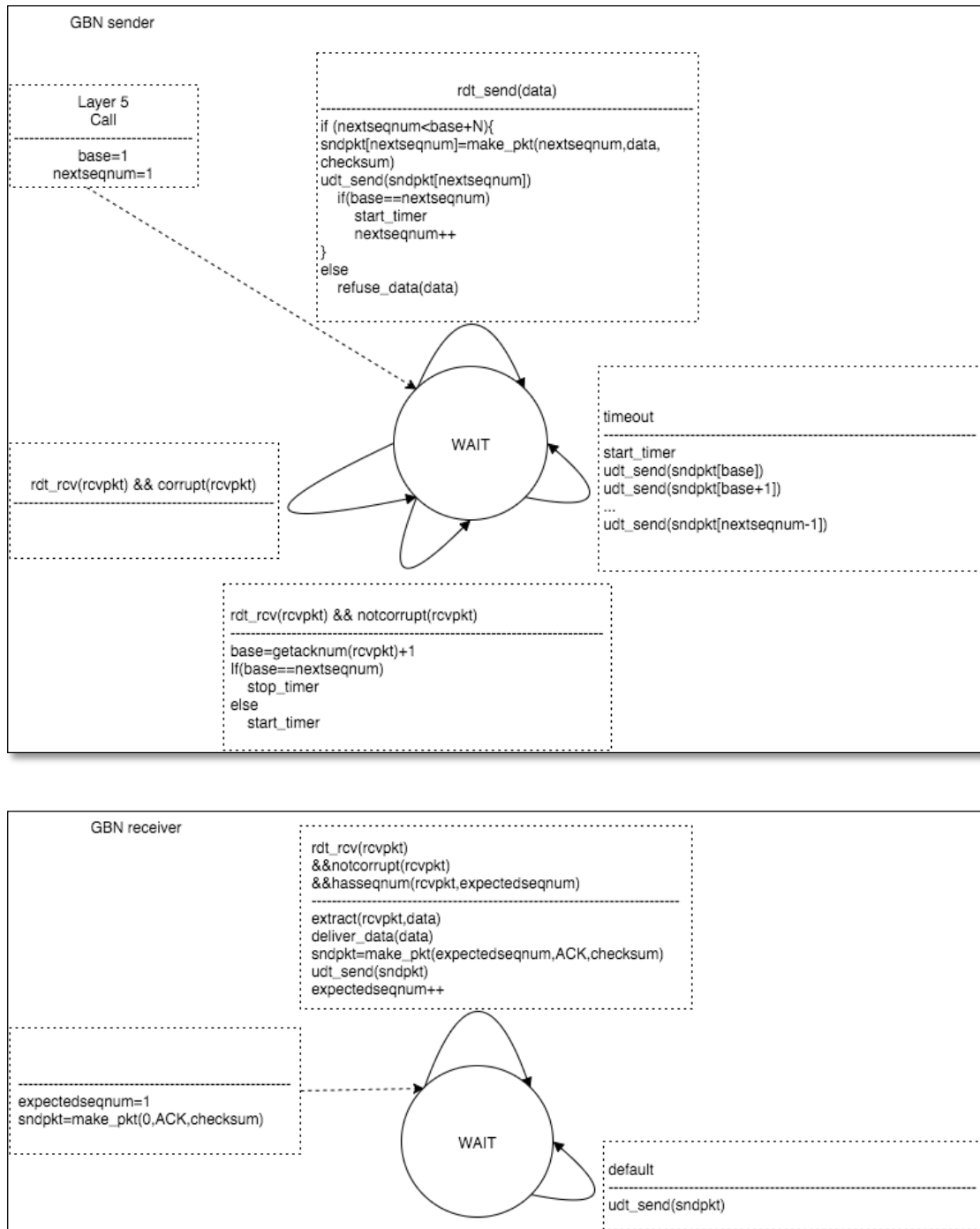
Corruption and no loss: works correctly (for sample outputs see the appendix)

Both Loss and corruption: works correctly (for sample outputs see the appendix)

Logistics:

- Design &How it works: (Checksum as a function)

Our student-simulator of GBN method is designed following these FSM diagrams which describe GBN sender and GBN receiver:



More specifically, we designed 13 functions to realize GBN method:

```
protected int calculate_checksum(int seqnum, Message m, int ack)
```

The function calculates the checksum for a packet, it simply add up the value of 'sequence number', 'ack number' and message's ASCII. For example, if seqnum=0, acknum=0, message= 'd', then the checksum will be

$0+0+100*20=2000$ since 'd'=100 and there are 20 'd' character.

```
protected Packet make_pkt(int seqnum, Message m, int ack)
```

It simply use the three parameter to construct a new Packet, except that it invoke calculate_checksum() to get the checksum.

```
protected void aOutput(Message message)
```

When layer 5 has packets arrived, it invokes this function to deal with the packet. If the sender has space to send the packet, i.e. the window is not full, it sends the packet and put the packet into a waiting list to wait for the ack. If the sender cannot send the message, it put the packet into a buffer until the sending window is available.

```
protected boolean no_corrupt(Packet p)
```

This function is invoked by alnput() and blnput(). Whenever a packet arrived, the entity must check whether it is intact or not. The function simply computes the checksum again to see whether it is the same as original checksum.

```
protected boolean judge_in(int first, int last, int ack)
```

This function is used to check whether the ack number is within sender's window. It is a little bit tricky because it has to consider wrap around case. In normal case, the base is smaller than the base+N, when $\text{base} \leq \text{acknum} \leq \text{base}+N$, it returns true. In wrap around case, the base is bigger than base+N, when $\text{acknum} \geq \text{base}$ or $\text{acknum} \leq \text{base}+N$, return true. So it must use different logic to determine whether it is within the window.

```
protected void aInput(Packet packet)
```

This function is invoked when there is packet arrived at A. The sender checks if it is a valid one. In GBN, since it uses accumulative acknowledge, it

can always slide the window. In SR, the window can be moved only when the base have been acked.

protected void Timeout_retransmit()

When timer times out, this function is invoked to retransmit the packet.

In GBN, it transmits all the packets in the window. In SR, it retransmits a specific packet.

protected void aTimerInterrupt()

Start new timer and invoke Timeout_retransmit().

protected void aInit()

Initiate the base value and window size.

protected boolean is_froma_Valid(Packet p)

It is only used in GBN, it can be used to determine whether the packet just arrived is not corrupt and has expected sequence number.

protected void bInput(Packet packet)

When a packet arrives at B, this function is invoked. It checks whether this is the packet with valid sequence number. If receiver's window can slide, then the packets can be deliver to layer 5.

protected void bInit()

Initiate the expect_seqnum and other necessary parameter.

protected void Simulation_done()

This function is to finish the whole simulation: when simulation ends, it is invoked to collect statistics like rtt, average time, retransmit packets and etc.

- Possible tradeoffs & Extensions: (Dealing with wrapped seq nos, adding conn establish, or storing 000 packets at receiver)

It is a little bit tricky because it has to consider wrap around case. In normal case, the base is smaller than the base+N, when $\text{base} \leq \text{acknum} \leq \text{base} + N$,

it returns true. In wrap around case, the base is bigger than $\text{base} + N$, when $\text{acknum} \geq \text{base}$ or $\text{acknum} < \text{base} + N$, return true.

In GBN's initial step, the receiver sets the expected sequence number to 1, so that when the sender's packet is not valid, it can send a ack packet for sequence number 0, which does not exist in A. Since A begin with sequence number 1, when A receive ack 0, it can detect its error.

Statistics:

- Justification for retransmission timer:

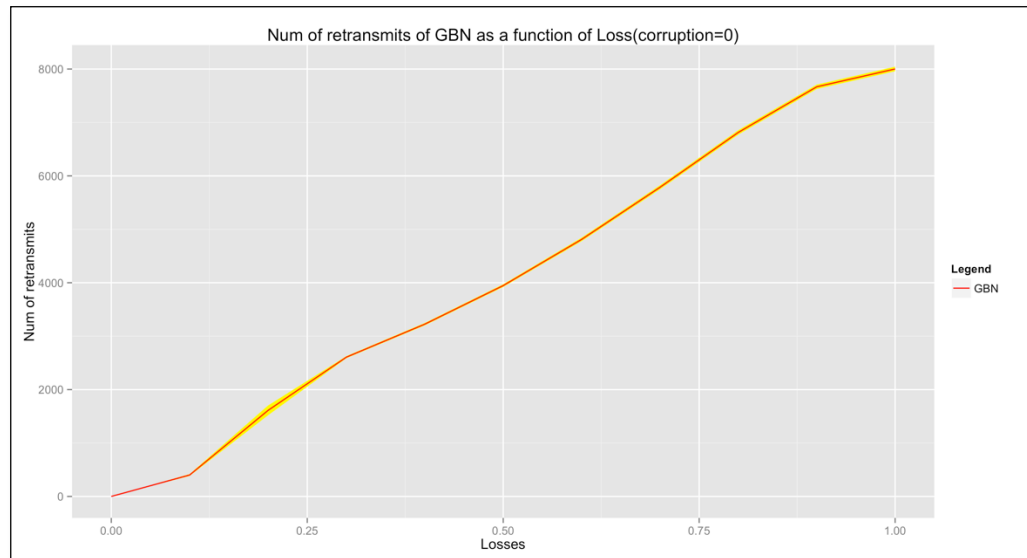
Under normal situations, the RTT is 10, and the maximum could be 20, so we set a static timer be 20.

- #retransmits under no loss& no corruption:

loss	corrupt	original	original_ci	retransmit	retransmit_ci
0	0.0	1000.00000	0.0000000	0.000	0.00000

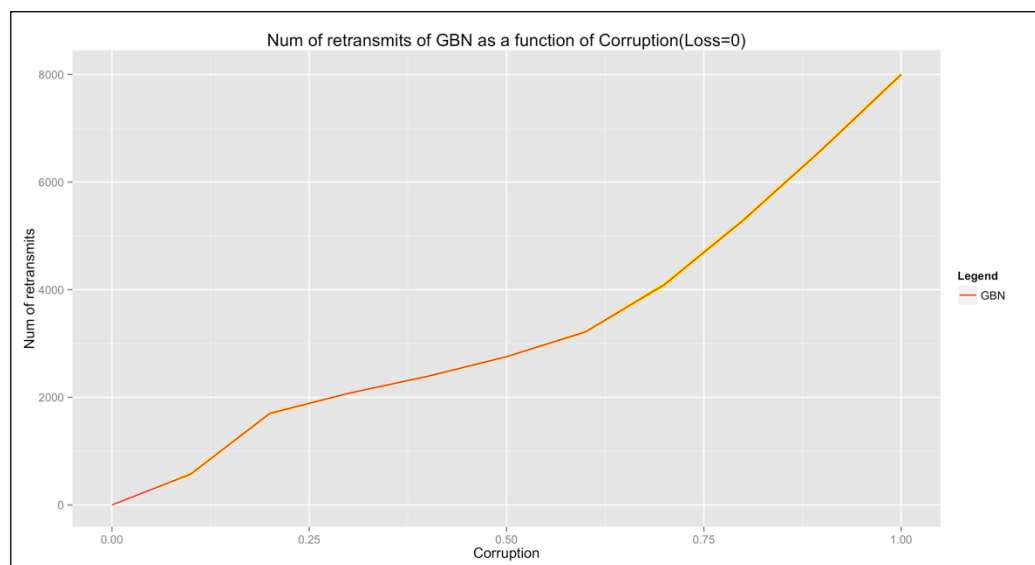
Our result showed that the number of retransmits under no loss & no corruption is 0. It's reasonable. But under some special situations, such as when the arrival rate is very high, the channel is crowded, thus the arrival time would higher than the RTT, which leads to a non-zero # retransmits.

- #retransmits as function of loss:



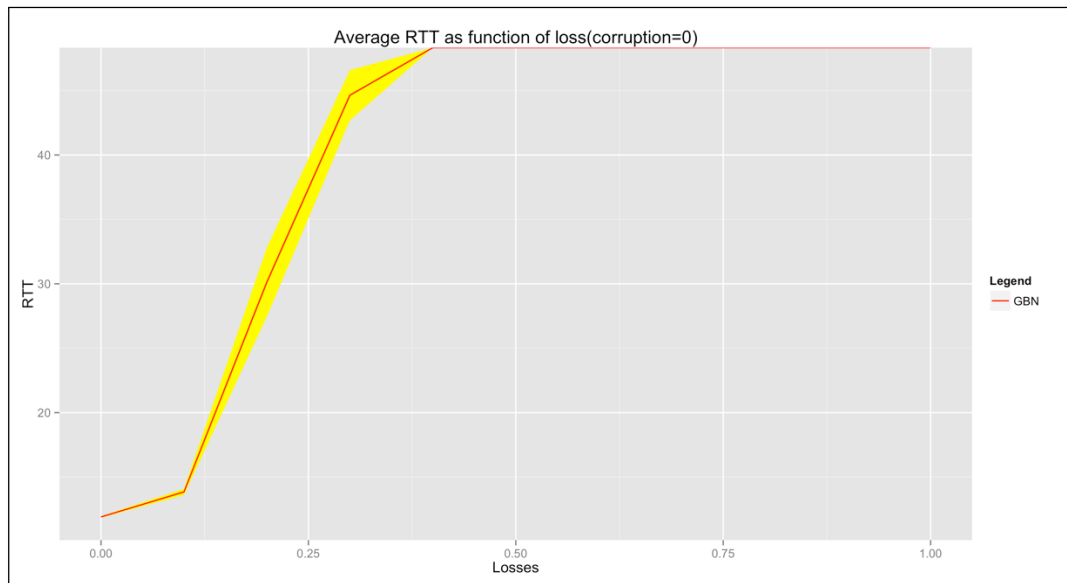
The number of retransmits is increasing when loss rate is increasing.

- #retransmits as function of corruption:

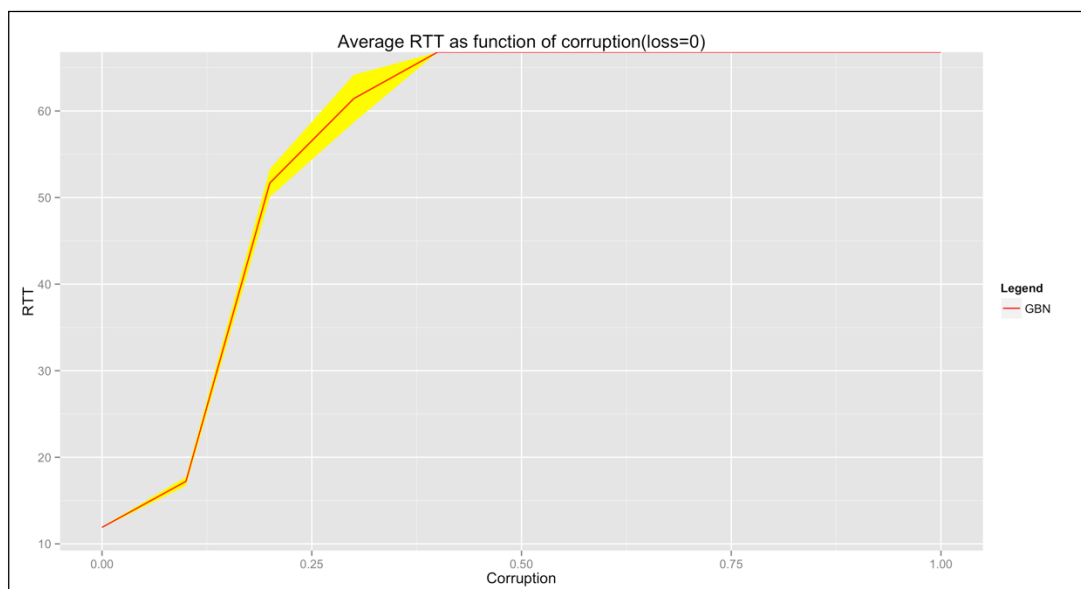


The number of retransmits is increasing when corruption rate is increasing.

- Average RTT as function of loss/corruption:

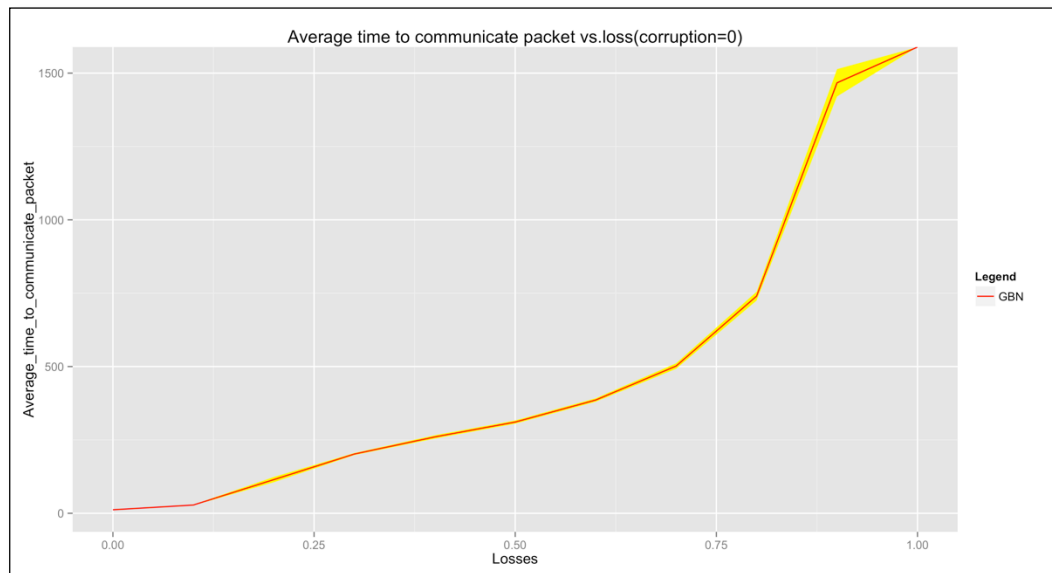


Infinite time when loss rate > 0.4 (This is due to we use static timer, so when loss rate is increasing, packets being retransmitted are rapidly growing, so RTT increases near to infinite)



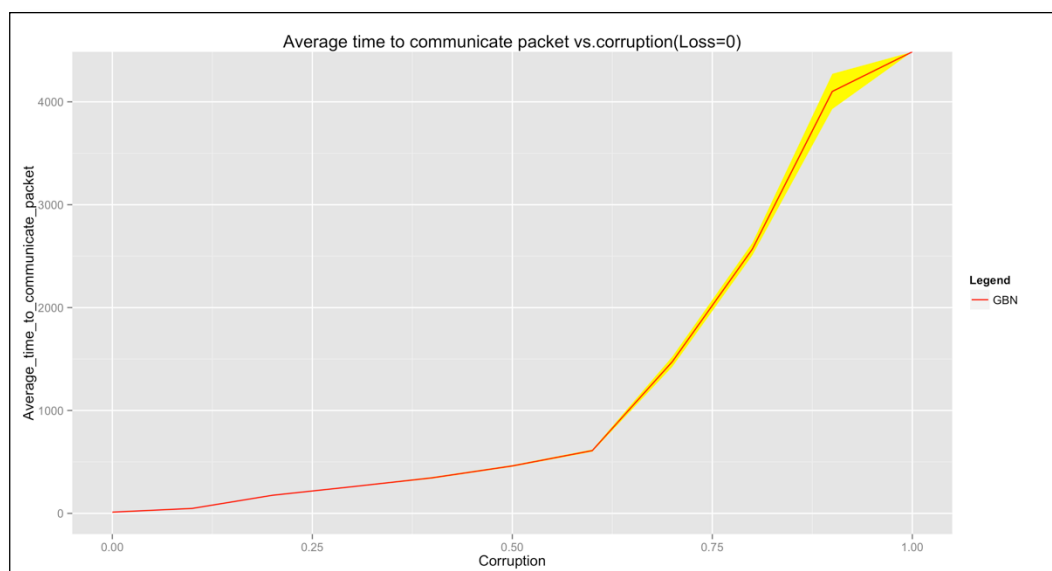
Infinite time when corruption rate > 0.4 (This is due to we use static timer, so when corruption rate is increasing, packets being retransmitted are rapidly growing, so RTT increases near to infinite)

- Average time to communicate packet vs. loss:



The average time to communicate packet is increasing when loss rate is increasing. And we get infinite time when loss rate=1.0

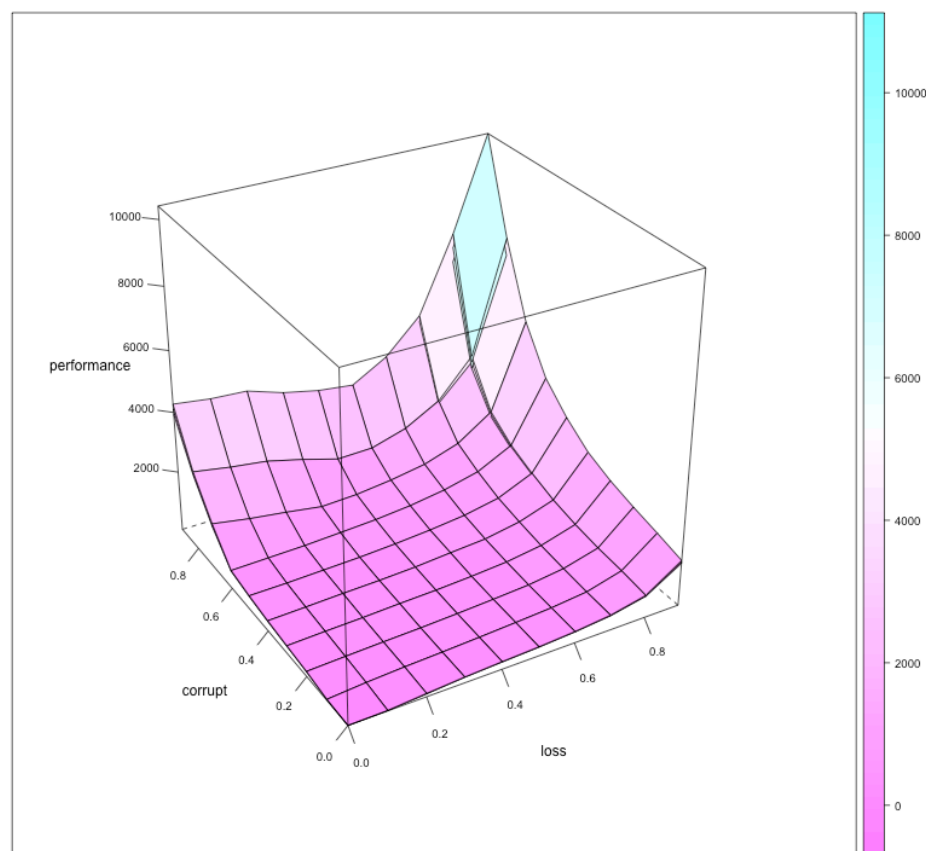
- Average time to communicate packet vs. corruption:



The average time to communicate packet is increasing when corruption rate is increasing. And we get infinite time when corruption rate=1.0

- Evidence of several runs: Actually, the images above are results of 30 times experiments. The yellow-areas are 90% confidence interval of Go-Back-N method (red lines).

GBN-Method: Average time to communicate a packet vs
LOSS+CORRUPTION (3D):



The reason why the left of this image seems a little bit strange is discussed late in SR's 3D image part. And actually, above image contains two faces reflect 30-time-run-experiments 90% confidence intervals, but they are not easy to observe, so we provide parts of our confidence intervals (the whole dataset has 100 rows):

	loss ↕	corrupt ↕	performance ↕	performance_ci ↕
1	0.0	0.0	11.90270	0.06155935
2	0.0	0.1	48.28502	2.89217321
3	0.0	0.2	175.78683	4.29941215
4	0.0	0.3	259.23915	4.69082902
5	0.0	0.4	345.67628	8.36602826
6	0.0	0.5	461.13767	8.92479084
7	0.0	0.6	610.19271	11.10132284
8	0.0	0.7	1474.05896	50.34963433
9	0.0	0.8	2567.55290	61.52635399
10	0.0	0.9	4101.01296	171.79535110
11	0.1	0.0	28.12349	1.51532850
12	0.1	0.1	135.80135	8.80649100
13	0.1	0.2	224.78838	4.08869553
14	0.1	0.3	303.62949	6.22706121
15	0.1	0.4	384.14514	7.31271214
16	0.1	0.5	479.04530	8.41895290
17	0.1	0.6	633.49051	17.46808280
18	0.1	0.7	1282.11513	37.95615175
19	0.1	0.8	2361.50475	67.90068410
20	0.1	0.9	3994.96710	122.34137160
21	0.2	0.0	114.71901	9.21311957
22	0.2	0.1	205.33651	3.60397861
23	0.2	0.2	269.94718	4.07576618

Error Conditions:

Our simulator is well-tested, and sample runs are included in the appendixes.

Part 3. Selective Repeat

Working correctness:

No loss and no corruption: works correctly (for sample outputs see the appendix)

Loss and no corruption: works correctly (for sample outputs see the appendix)

Corruption and no loss: works correctly (for sample outputs see the appendix)

Both Loss and corruption: works correctly (for sample outputs see the appendix)

Logistics:

- Design &How it works:

Our student-simulator of SR method is designed based on GBN but there are some differences, the actions are as follows:

Sender actions:

1. Data received from above. When data is received from above, the SR sender checks the next available sequence number for the packet. If the sequence number is within the sender's window, the data is packetized and sent; otherwise it is either buffered or returned to the upper layer for later transmission, as in GBN.
2. Timeout. Timers are again used to protect against lost packets. However, each packet must now have its own logical timer, since only a single packet will be transmitted on timeout. A single hardware timer can be used to mimic the operation of multiple logical timers.
3. ACK received. If an ACK is received, the SR sender marks that packet as having been received, provided it is in the window. If the packet's sequence number is equal to send_base, the window base is moved forward to the unacknowledged packet with the smallest sequence number. If the window moves and there are untransmitted packets with sequence numbers that now fall within the window, these packets are transmitted.

Receiver actions:

1. Packet with sequence number in $[rcv_base, rcv_base+N-1]$ is correctly received. In this case, the received packet falls within the receiver's window and a selective ACK packet is returned to the sender. If the packet was not previously received, it is buffered. If this packet has a sequence number equal to the base of the receive window, then this packet, and any previously buffered and consecutively numbered (beginning with rcv_base) packets are delivered to the upper layer. The receive window is then moved forward by the number of packets delivered to the upper layer. As an example, consider Figure 3.26. When a packet with a sequence number of $rcv_base=2$ is received, it and packets 3, 4, and 5 can be delivered to the upper layer.
2. Packet with sequence number in $[rcv_base-N, rcv_base-1]$ is correctly received. In this case, an ACK must be generated, even though this is a packet that the receiver has previously acknowledged.
3. Otherwise. Ignore the packet.

More specifically, we designed 12 functions to realize SR method:

```
protected int calculate_checksum(int seqnum, Message m, int ack)
```

The same as GBN.

```
protected Packet make_pkt(int seqnum, Message m, int ack)
```

The same as GBN.

```
protected void aOutput(Message message)
```

The same as GBN.

```
protected boolean no_corrupt(Packet p)
```

The same as GBN.

```
protected boolean judge_in(int first, int last, int ack)
```

The same as GBN.

```
protected void aInput(Packet packet)
```

In SR, even if it receives a valid ack, it cannot always let the window moves on because the ack is selective. It has to wait until the base has been acked.

```
protected void Timeout_retransmit()
```

In SR, the timer is for a specific packet only. So every time a timeout occurs, only one packet is retransmitted.

```
protected void aTimerInterrupt()
```

Invoke Timeout_retransmit()..

```
protected void aInit()
```

Initialize values.

```
protected void bInput(Packet packet)
```

In SR, the receiver must keep track of a list of packets instead of a expect_seqnum in GBN. When the base packet arrives, it can deliver a bunch of packets to layer 5 if the packets of consecutive sequence number have arrived.

```
protected void bInit()
```

Initialize base and window size.

```
protected void Simulation_done()
```

The same as GBN.

- Differences between SR & GBN: This has been discussed during our explanations of designation and functions of SR and GBN.

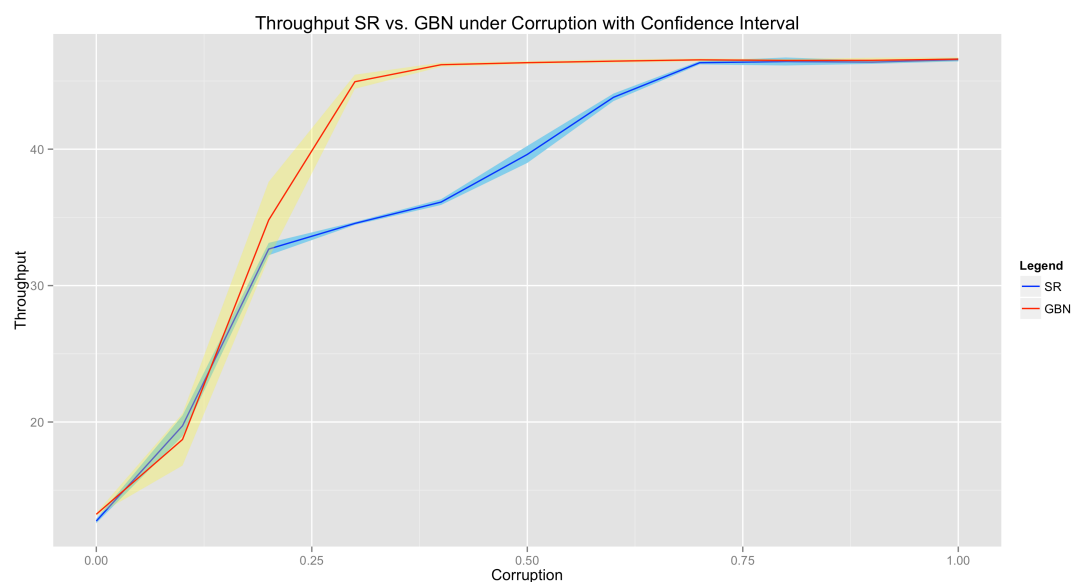
Statistics:

- SR vs. GBN

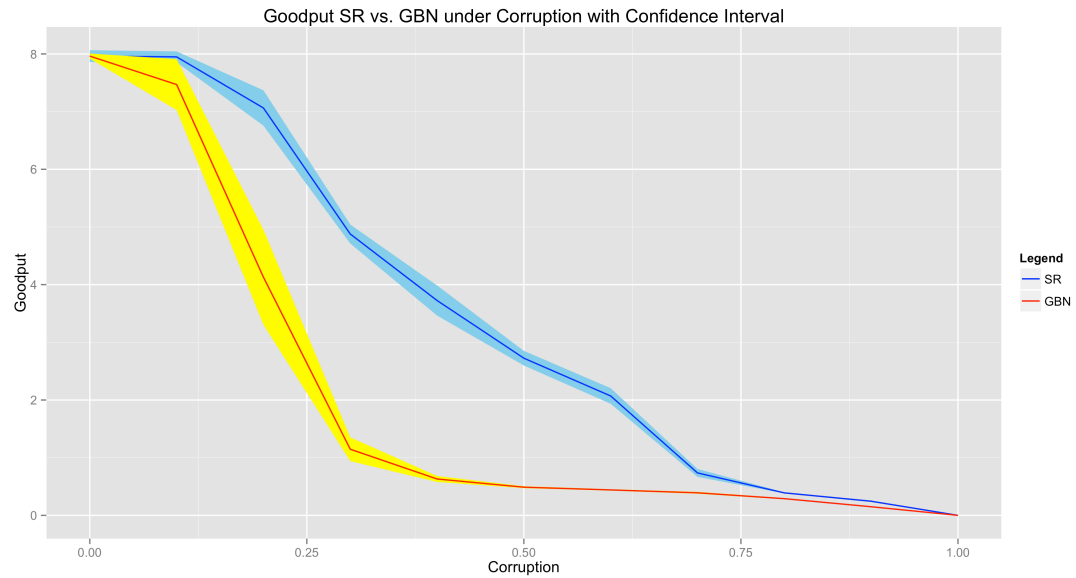
Throughput/Goodput/average packet delay under Corruption:

(random seed:58 messagenum:1000 wsize:8 interarrival:20.0

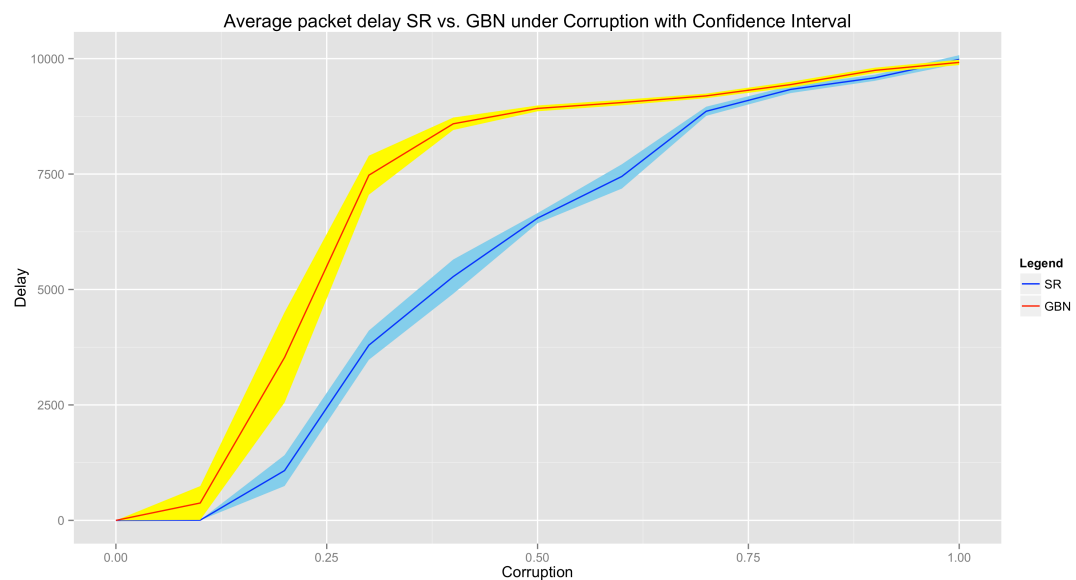
timeer:20.0 repeat time:30)



As the corruption rate is increasing, the throughput is increasing rapidly for both GBN and SR.



As the corruption rate is increasing, the goodput is decreasing for both GBN and SR, while SR shows a little better performance.

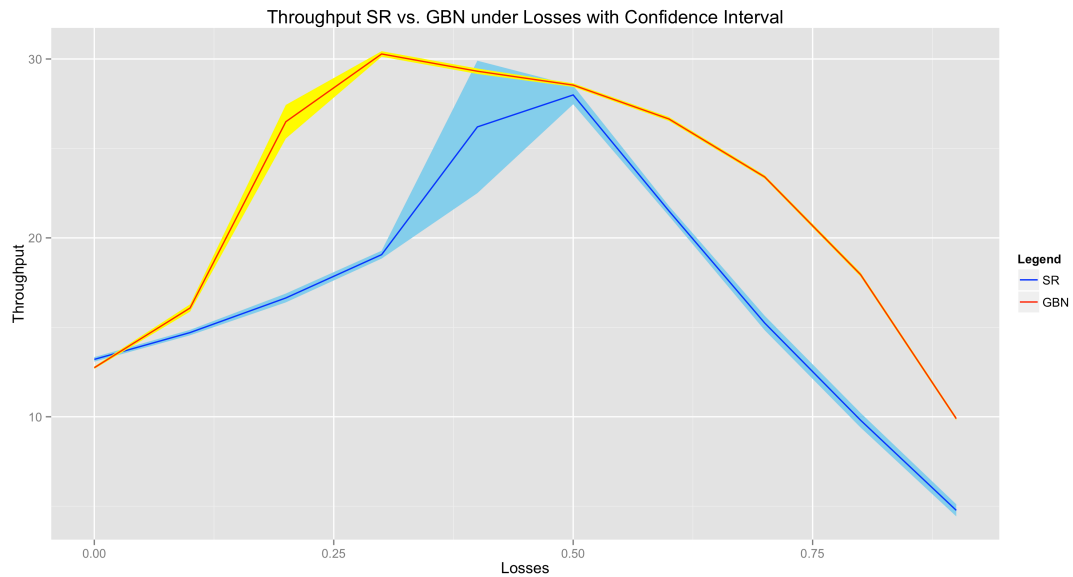


As the corruption rate is increasing, the delay is increasing rapidly for both GBN and SR, while SR performances a bit better.

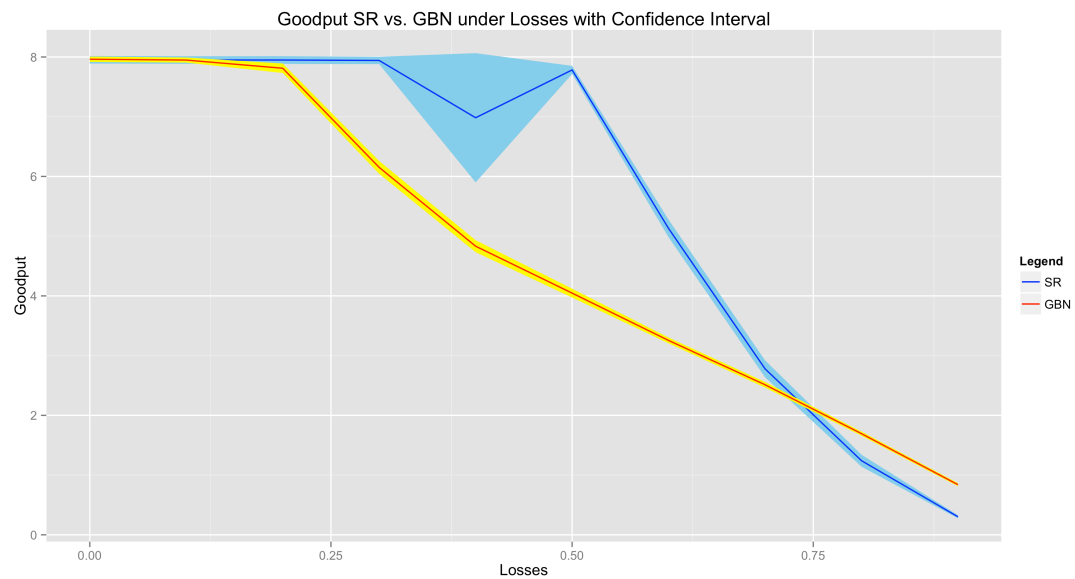
Throughput/Goodput/average packet delay under Losses:

(random seed:58 messagenum:1000 wsize:8 interarrival:20.0)

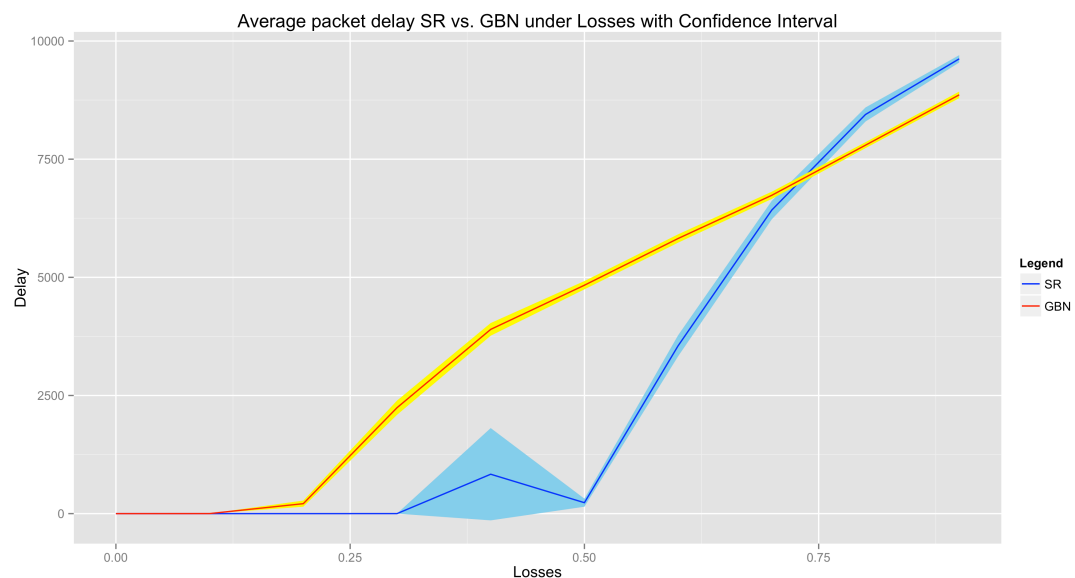
timeer:20.0 repeat time:30)



As the loss rate is increasing, the throughput is increasing rapidly for both GBN and SR, then decrease as the average time to transmit a packet far exceed the arrival rate of packets. When the loss rate is low, before another packet comes from layer 5, the sender must send the packets for more times in order to let the receiver to successfully deliver a ack packet. So the throughput is increasing. But when the loss rate increase, the sender is always sending packets without rest. So in a certain time period, the higher the loss rate, the fewer the packet can be received by B.



As the loss rate is increasing, the goodput is decreasing for both GBN and SR. Compared with GBN, SR shows better result.

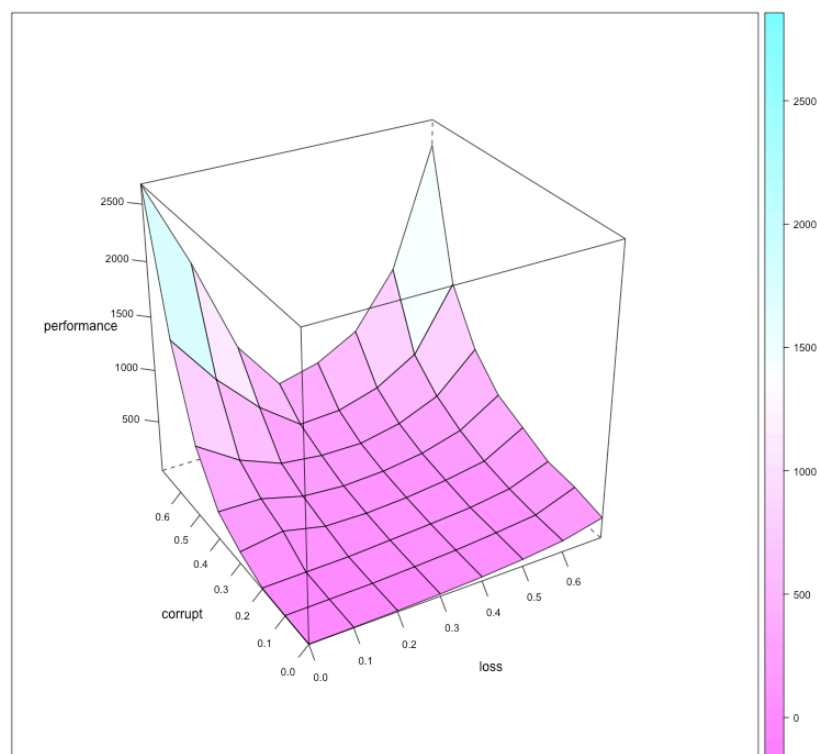


As the loss rate is increasing, the delay is increasing rapidly for both GBN and SR. GBN's delay is worse than SR.

- Evidence of several runs: Actually, the images above are results of 30 times experiments. The sky-blue-areas are 90% confidence interval

of Selective-Repeat method and yellow-areas are 90% confidence interval of Go-Back-N method.

SR-Method: Average time to communicate a packet vs
LOSS+CORRUPTION (3D):



Note that the reason why when corrupt increasing, and loss =0, the performance is also increasing is that corrupted packets would occupy the channel and influence the total time, while lost packets would not occupy the channel, and this image shows this truth. Actually, above image contains two faces reflect 30-time-run-experiments 90% confidence intervals, but they are not easy to observe, so we provide parts of our confidence intervals (the whole dataset has 100 rows):

	loss	corrupt	performance	performance_ci
1	0.0	0.0	12.75504	0.8428553
2	0.0	0.1	16.51157	1.0358250
3	0.0	0.2	23.13586	1.4726252
4	0.0	0.3	124.12303	109.3664437
5	0.0	0.4	274.29304	128.1222291
6	0.0	0.5	682.06753	301.7673724
7	0.0	0.6	1469.87106	616.7261754
8	0.0	0.7	2670.64337	757.8312616
9	0.1	0.0	17.28567	1.2605894
10	0.1	0.1	22.57380	1.7406547
11	0.1	0.2	31.91092	5.4840728
12	0.1	0.3	185.77665	164.3891006
13	0.1	0.4	268.66376	171.1941995
14	0.1	0.5	424.46783	285.1026502
15	0.1	0.6	994.83717	371.3141095
16	0.1	0.7	1892.97427	706.8461796
17	0.2	0.0	23.62781	1.6755713
18	0.2	0.1	29.05956	2.0203986
19	0.2	0.2	38.89791	3.2000854
20	0.2	0.3	98.16514	72.9800226
21	0.2	0.4	163.58448	52.1326288
22	0.2	0.5	268.37262	69.2088000
23	0.2	0.6	611.20703	164.6835791
24	0.2	0.7	1004.77884	318.2816009

Error Conditions:

Our simulator is well-tested, and sample runs are included in the appendixes.

Appendixes:

Stop and Wait outputs:

```

Enter number of messages to simulate (> 0): {10} 20
Enter packet loss probability (0.0 for no loss): {0.0} 0.2
Enter packet corruption probability (0.0 for no corruption): {0.0} 0.2
Enter average time between messages from sender's layer 5 (> 0.0): {1000} 10
Enter window size (> 0): {8} 1
Enter retransmission timeout (>0.0) {15.0} 20
Enter trace level (>= 0): {0} 2
Enter random seed: {0} 2233

EVENT time: 9.181188390758996  type: 1  entity: 0
from a:seqnum: 1  acknum: 0  checksum: 1941  payload: aaaaaaaaaaaaaaaaaa
toLayer3: packet being corrupted

EVENT time: 11.710562456129644  type: 1  entity: 0
unable to send packet:bbbbbbbbbbbbbbbbbbbb

```

EVENT time: 14.562120426038392 type: 2 entity: 1
from b:seqnum: 0 acknum: 0 checksum: 0

EVENT time: 17.07113864558855 type: 2 entity: 0

EVENT time: 29.176305429242838 type: 1 entity: 0
unable to send packet:cccccccccccccccccc

EVENT time: 29.181188390758997 type: 0 entity: 0
from a(retransmit):seqnum: 1 acknum: 0 checksum: 1941 payload:
aaaaaaaaaaaaaaaaaaaa

EVENT time: 31.21677297280801 type: 1 entity: 0
unable to send packet:dddddddddddddddddd

EVENT time: 38.109714041566214 type: 2 entity: 1
from b:seqnum: 0 acknum: 1 checksum: 1

EVENT time: 46.13483077486496 type: 1 entity: 0
unable to send packet:eeeeeeeeeeeeeeeeee

EVENT time: 46.5004425183874 type: 2 entity: 0
from a:seqnum: 0 acknum: 0 checksum: 1960 payload: bbbbbbbbbbbbbbbbbbbb

EVENT time: 51.34907071138645 type: 2 entity: 1
from b:seqnum: 0 acknum: 0 checksum: 0
toLayer3: packet being lost

EVENT time: 55.99475081637013 type: 1 entity: 0
unable to send packet:fffffffffffffffffff

EVENT time: 58.93307290871914 type: 1 entity: 0
unable to send packet:gggggggggggggggggggg

EVENT time: 66.5004425183874 type: 0 entity: 0
from a(retransmit):seqnum: 0 acknum: 0 checksum: 1960 payload:
bbbbbbbbbbbbbbbbbbbb

EVENT time: 74.73049104281748 type: 2 entity: 1
from b:seqnum: 0 acknum: 0 checksum: 0

EVENT time: 76.96890163884396 type: 1 entity: 0
unable to send packet:hhhhhhhhhhhhhhhhh

EVENT time: 78.77010406811732 type: 1 entity: 0
unable to send packet:iiiiiiiiiiii

EVENT time: 80.87911618396558 type: 2 entity: 0
from a:seqnum: 1 acknum: 0 checksum: 1981 payload: ccccccccccccccccccc

EVENT time: 83.2260811181982 type: 2 entity: 1
from b:seqnum: 0 acknum: 1 checksum: 1

EVENT time: 87.2836695455794 type: 2 entity: 0
from a:seqnum: 0 acknum: 0 checksum: 2000 payload: ddddddddddddddddddd

EVENT time: 91.16245002594074 type: 1 entity: 0
unable to send packet:jjjjjjjjjjjjjjjjjj

EVENT time: 91.48490859706412 type: 2 entity: 1
from b:seqnum: 0 acknum: 0 checksum: 0

EVENT time: 94.58906826990571 type: 1 entity: 0
unable to send packet:kkkkkkkkkkkkkkkkkk

EVENT time: 97.80190435499131 type: 2 entity: 0
from a:seqnum: 1 acknum: 0 checksum: 2021 payload: eeeeeeeeeeeeeeeeeee
toLayer3: packet being corrupted

EVENT time: 102.11615344706566 type: 1 entity: 0
unable to send packet:llllllllllll

EVENT time: 103.34214300973541 type: 2 entity: 1
from b:seqnum: 0 acknum: 0 checksum: 0

EVENT time: 111.03247169408246 type: 2 entity: 0

EVENT time: 112.80312509537035 type: 1 entity: 0
unable to send packet:mmmmmmmmmmmmmmmmmmmm

EVENT time: 116.5202795495468 type: 1 entity: 0
unable to send packet:nnnnnnnnnnnnnnnnnn

EVENT time: 117.80190435499131 type: 0 entity: 0
from a(retransmit):seqnum: 1 acknum: 0 checksum: 2021 payload:
eeeeeeeeeeeeeeeeee

EVENT time: 121.73918881801814 type: 2 entity: 1

```
from b:seqnum: 0  acknum: 1  checksum: 1

EVENT time: 125.75090792565692  type: 2  entity: 0
from a:seqnum: 0  acknum: 0  checksum: 2040  payload: ffffffffffffffffff

EVENT time: 129.61638233588673  type: 1  entity: 0
unable to send packet:ooooooooooooooooooooo

EVENT time: 130.2945036164434  type: 1  entity: 0
unable to send packet:pppppppppppppppppppp

EVENT time: 131.47956785790583  type: 2  entity: 1
from b:seqnum: 0  acknum: 0  checksum: 0

EVENT time: 137.23734244819485  type: 2  entity: 0
from a:seqnum: 1  acknum: 0  checksum: 2061  payload: gggggggggggggggggggg
toLayer3: packet being lost

EVENT time: 149.75249488814967  type: 1  entity: 0
unable to send packet:qqqqqqqqqqqqqqqqqqqq

EVENT time: 157.23734244819485  type: 0  entity: 0
from a(retransmit):seqnum: 1  acknum: 0  checksum: 2061  payload:
gggggggggggggggggggggg

EVENT time: 161.76680806909394  type: 2  entity: 1
from b:seqnum: 0  acknum: 1  checksum: 1

EVENT time: 163.75988036744286  type: 1  entity: 0
unable to send packet:rrrrrrrrrrrrrrrrrrrr

EVENT time: 166.41080965605644  type: 2  entity: 0
from a:seqnum: 0  acknum: 0  checksum: 2080  payload: hhhhhhhhhhhhhhhhhhhh
toLayer3: packet being lost

EVENT time: 179.7424237800226  type: 1  entity: 0
unable to send packet:ssssssssssssssssssss

EVENT time: 184.223761711478  type: 1  entity: 0
unable to send packet:tttttttttttttttttttt

EVENT time: 186.41080965605644  type: 0  entity: 0
from a(retransmit):seqnum: 0  acknum: 0  checksum: 2080  payload:
hhhhhhhhhhhhhhhhhhhh
```



```
EVENT time: 193.76961577196573 type: 2 entity: 1
from b:seqnum: 0 acknum: 0 checksum: 0
toLayer3: packet being corrupted
```

```
EVENT time: 195.22751548814355 type: 1 entity: 0
```

GBN outputs:

```
Enter number of messages to simulate (> 0): [10] 20
Enter packet loss probability (0.0 for no loss): [0.0] 0.2
Enter packet corruption probability (0.0 for no corruption): [0.0] 0.2
Enter average time between messages from sender's layer 5 (> 0.0): [1000] 10
Enter window size (> 0): [8] 8
Enter retransmission timeout (>0.0) [15.0] 20
Enter trace level (>= 0): [0] 2
Enter random seed: [0] 2233

EVENT time: 9.181188390758996 type: 1 entity: 0
from a:seqnum: 1 acknum: 0 checksum: 1941 payload: aaaaaaaaaaaaaaaaaaaa
time:9.181188390758996
toLayer3: packet being corrupted

EVENT time: 11.710562456129644 type: 1 entity: 0
from a:seqnum: 2 acknum: 0 checksum: 1962 payload: bbbbbbbbbbbbbbbbbbbb
time:11.710562456129644

EVENT time: 14.562120426038392 type: 2 entity: 1
invalid packet recieved by B, seqnum: 1 acknum: 0 checksum: 1941
payload: ?aaaaaaaaaaaaaaaaaaa ,time:14.562120426038392
from b:seqnum: 0 acknum: 0 checksum: 0

EVENT time: 17.07113864558855 type: 2 entity: 1
invalid packet recieved by B, seqnum: 2 acknum: 0 checksum: 1962 payload:
bbbbbbbbbbbbbbbbbbbb ,time:17.07113864558855
from b:seqnum: 0 acknum: 0 checksum: 0

EVENT time: 23.490646076845607 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 0 checksum: 0 ,time:23.490646076845607

EVENT time: 29.176305429242838 type: 1 entity: 0
from a:seqnum: 3 acknum: 0 checksum: 1983 payload: cccccccccccccccccccc
time:29.176305429242838
```

EVENT time: 31.21677297280801 type: 1 entity: 0
from a:seqnum: 4 acknum: 0 checksum: 2004 payload: dddddddddddddddddd
time:31.21677297280801
toLayer3: packet being lost

EVENT time: 31.8813745536668 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 0 checksum: 0 ,time:31.8813745536668

EVENT time: 34.02493362224189 type: 2 entity: 1
invalid packet recieved by B, seqnum: 3 acknum: 0 checksum: 1983 payload:
cccccccccccccccccc ,time:34.02493362224189
from b:seqnum: 0 acknum: 0 checksum: 0

EVENT time: 42.254982146671956 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 0 checksum: 0 ,time:42.254982146671956

EVENT time: 46.13483077486496 type: 1 entity: 0
from a:seqnum: 5 acknum: 0 checksum: 2025 payload: eeeeeeeeeeeeeeeeeee
time:46.13483077486496

EVENT time: 52.28345591601307 type: 2 entity: 1
invalid packet recieved by B, seqnum: 5 acknum: 0 checksum: 2025 payload:
eeeeeeeeeeeeeeeeee ,time:52.28345591601307
from b:seqnum: 0 acknum: 0 checksum: 0

EVENT time: 54.63042085024568 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 0 checksum: 0 ,time:54.63042085024568

EVENT time: 55.99475081637013 type: 1 entity: 0
from a:seqnum: 6 acknum: 0 checksum: 2046 payload: ffffffffffffffffff
time:55.99475081637013

EVENT time: 58.93307290871914 type: 1 entity: 0
from a:seqnum: 7 acknum: 0 checksum: 2067 payload: gggggggggggggggggggg
time:58.93307290871914

EVENT time: 60.052339243751334 type: 2 entity: 1
invalid packet recieved by B, seqnum: 6 acknum: 0 checksum: 2046 payload:
fffffffffffffffffff ,time:60.052339243751334
from b:seqnum: 0 acknum: 0 checksum: 0

EVENT time: 64.25357829523605 type: 2 entity: 1
invalid packet recieved by B, seqnum: 7 acknum: 0 checksum: 2067 payload:

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ack recieved by A, seqnum: 0 acknum: 0 checksum: 0 ,time:88.59651478621784

EVENT time: 90.3810541093173 type: 2 entity: 1
packet recieved by B, seqnum: 1 acknum: 0 checksum: 1941 payload:
aaaaaaaaaaaaaaaaaaaaa ,time:90.3810541093173
from b:seqnum: 0 acknum: 1 checksum: 1
toLayer3: packet being corrupted

EVENT time: 91.16245002594074 type: 1 entity: 0
wait for window to slide in a:jjjjjjjjjjjjjjjjjj time:91.16245002594074

EVENT time: 94.58906826990571 type: 1 entity: 0
wait for window to slide in a:kkkkkkkkkkkkkkkkkk time:94.58906826990571

EVENT time: 96.1097140415662 type: 2 entity: 1
packet recieved by B, seqnum: 2 acknum: 0 checksum: 1962 payload:
bbbbbbbbbbbbbbbbbbbb ,time:96.1097140415662
from b:seqnum: 0 acknum: 2 checksum: 2

EVENT time: 99.88720358897672 type: 2 entity: 0
corrupted ack recieved by A, seqnum: 0 acknum: 999999 checksum:
1 ,time:99.88720358897672

EVENT time: 101.6675313577685 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 2 checksum: 2 ,time:101.6675313577685
from a:seqnum: 0 acknum: 0 checksum: 2100 payload: 
time:101.6675313577685
from a:seqnum: 1 acknum: 0 checksum: 2121 payload: jjjjjjjjjjjjjjjjjj
time:101.6675313577685

EVENT time: 101.86748863185522 type: 2 entity: 1
packet recieved by B, seqnum: 3 acknum: 0 checksum: 1983 payload:
cccccccccccccccccc ,time:101.86748863185522
from b:seqnum: 0 acknum: 3 checksum: 3

EVENT time: 102.11615344706566 type: 1 entity: 0
wait for window to slide in a:llllllllll time:102.11615344706566

EVENT time: 103.60249641407513 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 3 checksum: 3 ,time:103.60249641407513
from a:seqnum: 2 acknum: 0 checksum: 2142 payload: kkkkkkkkkkkkkkkkkk
time:103.60249641407513

EVENT time: 106.3969542527543 type: 2 entity: 1

invalid packet recieved by B, seqnum: 5 acknum: 0 checksum: 2025 payload:
eeeeeeeeeeeeeeeeeeee ,time:106.3969542527543
from b:seqnum: 0 acknum: 3 checksum: 3

EVENT time: 111.04095583971679 type: 2 entity: 1

invalid packet recieved by B, seqnum: 6 acknum: 0 checksum: 2046 payload:
ffffffffffffffffffff ,time:111.04095583971679
from b:seqnum: 0 acknum: 3 checksum: 3

EVENT time: 111.99844355601672 type: 2 entity: 0

ack recieved by A, seqnum: 0 acknum: 3 checksum: 3 ,time:111.99844355601672

EVENT time: 112.80312509537035 type: 1 entity: 0

wait for window to slide in a:mmmmmmmmmmmmmmmmmmmmmmmm
time:112.80312509537035

EVENT time: 113.09347819452498 type: 2 entity: 0

ack recieved by A, seqnum: 0 acknum: 3 checksum: 3 ,time:113.09347819452498

EVENT time: 116.5202795495468 type: 1 entity: 0

wait for window to slide in a:nnnnnnnnnnnnnnnnnnnn time:116.5202795495468

EVENT time: 118.39976195562609 type: 2 entity: 1

invalid packet recieved by B, seqnum: 8 acknum: 0 checksum: 2088 payload:
hhhhhhhhhhhhhhhhhhhh ,time:118.39976195562609
from b:seqnum: 0 acknum: 3 checksum: 3
toLayer3: packet being corrupted

EVENT time: 121.0227668080691 type: 2 entity: 0

corrupted ack recieved by A, seqnum: 0 acknum: 3 checksum:
3 ,time:121.0227668080691

EVENT time: 123.49119541001618 type: 2 entity: 1

invalid packet recieved by B, seqnum: 0 acknum: 0 checksum: 2100 payload:
iiiiiiiiiiii ,time:123.49119541001618
from b:seqnum: 0 acknum: 3 checksum: 3

EVENT time: 125.77855769524217 type: 2 entity: 1

invalid packet recieved by B, seqnum: 1 acknum: 0 checksum: 2121 payload:
jjjjjjjjjjjjjjjjjjjj ,time:125.77855769524217
from b:seqnum: 0 acknum: 3 checksum: 3

EVENT time: 127.97726371044038 type: 2 entity: 0

ack recieved by A, seqnum: 0 acknum: 3 checksum: 3 ,time:127.97726371044038

EVENT time: 129.61638233588673 type: 1 entity: 0
wait for window to slide in a:oooooooooooooooooooo time:129.61638233588673

EVENT time: 130.2945036164434 type: 1 entity: 0
wait for window to slide in a:pppppppppppppppppppp time:130.2945036164434

EVENT time: 135.03640858180486 type: 2 entity: 1
invalid packet recieved by B, seqnum: 2 acknum: 0 checksum: 2142 payload:
kkkkkkkkkkkkkkkkkkkk ,time:135.03640858180486
from b:seqnum: 0 acknum: 3 checksum: 3
toLayer3: packet being corrupted

EVENT time: 136.7874080629902 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 3 checksum: 3 ,time:136.7874080629902

EVENT time: 146.75032807397687 type: 2 entity: 0
corrupted ack recieved by A, seqnum: 0 acknum: 3 checksum:
3 ,time:146.75032807397687

EVENT time: 149.75249488814967 type: 1 entity: 0
wait for window to slide in a:qqqqqqqqqqqqqqqqqqqq time:149.75249488814967

EVENT time: 156.7874080629902 type: 0 entity: 0
from a(re):seqnum: 4 acknum: 0 checksum: 2004 payload: ddddddddddddddddddd
time:156.7874080629902
from a(re):seqnum: 5 acknum: 0 checksum: 2025 payload: eeeeeeeeeeeeeeeeeee
time:156.7874080629902
toLayer3: packet being lost
from a(re):seqnum: 6 acknum: 0 checksum: 2046 payload: fffffffffffffffffffff
time:156.7874080629902
from a(re):seqnum: 7 acknum: 0 checksum: 2067 payload: gggggggggggggggggggg
time:156.7874080629902
from a(re):seqnum: 8 acknum: 0 checksum: 2088 payload: hhhhhhhhhhhhhhhhhhhh
time:156.7874080629902
from a(re):seqnum: 0 acknum: 0 checksum: 2100 payload: iiii
time:156.7874080629902
toLayer3: packet being lost
from a(re):seqnum: 1 acknum: 0 checksum: 2121 payload: jjjjjjjjjjjjjjjjjj
time:156.7874080629902
from a(re):seqnum: 2 acknum: 0 checksum: 2142 payload: kkkkkkkkkkkkkkkkkkk
time:156.7874080629902
toLayer3: packet being lost

EVENT time: 163.43894772179328 type: 2 entity: 1
packet recieved by B, seqnum: 4 acknum: 0 checksum: 2004 payload:
dddddddddddddddddd ,time: 163.43894772179328
from b:seqnum: 0 acknum: 4 checksum: 4

EVENT time: 163.75988036744286 type: 1 entity: 0
wait for window to slide in a:rrrrrrrrrrrrrrrrrr time: 163.75988036744286

EVENT time: 172.4361400189215 type: 2 entity: 1
invalid packet recieved by B, seqnum: 6 acknum: 0 checksum: 2046 payload:
ffffffffffffffffffff ,time: 172.4361400189215
from b:seqnum: 0 acknum: 4 checksum: 4

EVENT time: 172.893185216834 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 4 checksum: 4 ,time: 172.893185216834
from a:seqnum: 3 acknum: 0 checksum: 2163 payload: 
time: 172.893185216834
toLayer3: packet being lost

EVENT time: 174.65538499099705 type: 2 entity: 1
invalid packet recieved by B, seqnum: 7 acknum: 0 checksum: 2067 payload:
gggggggggggggggggggg ,time: 174.65538499099705
from b:seqnum: 0 acknum: 4 checksum: 4

EVENT time: 178.8726157414472 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 4 checksum: 4 ,time: 178.8726157414472

EVENT time: 179.22934659871214 type: 2 entity: 1
invalid packet recieved by B, seqnum: 8 acknum: 0 checksum: 2088 payload:
hhhhhhhhhhhhhhhhhhhh ,time: 179.22934659871214
from b:seqnum: 0 acknum: 4 checksum: 4

EVENT time: 179.7424237800226 type: 1 entity: 0
wait for window to slide in a:ssssssssssssssssss time: 179.7424237800226

EVENT time: 180.89107943968017 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 4 checksum: 4 ,time: 180.89107943968017

EVENT time: 184.223761711478 type: 1 entity: 0
wait for window to slide in a:tttttttttttttttttt time: 184.223761711478

EVENT time: 188.94891201513718 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 4 checksum: 4 ,time: 188.94891201513718

```

EVENT time: 188.95028534806363 type: 2 entity: 1
invalid packet recieved by B, seqnum: 1 acknum: 0 checksum: 2121 payload:
jjjjjjjjjjjjjjjjjjjj ,time: 188.95028534806363
from b:seqnum: 0 acknum: 4 checksum: 4

EVENT time: 195.22751548814355 type: 1 entity: 0

```

SR outputs:

```

Enter number of messages to simulate (> 0): [10] 20
Enter packet loss probability (0.0 for no loss): [0.0] 0.2
Enter packet corruption probability (0.0 for no corruption): [0.0] 0.2
Enter average time between messages from sender's layer 5 (> 0.0): [1000] 10
Enter window size (> 0): [8] 8
Enter retransmission timeout (>0.0) [15.0] 20
Enter trace level (>= 0): [0] 2
Enter random seed: [0] 2233

EVENT time: 9.181188390758996 type: 1 entity: 0
from a:seqnum: 1 acknum: 0 checksum: 1941 payload:
aaaaaaaaaaaaaaaaaaaaa ,time: 9.181188390758996
toLayer3: packet being corrupted

EVENT time: 11.710562456129644 type: 1 entity: 0
from a:seqnum: 2 acknum: 0 checksum: 1962 payload:
bbbbbbbbbbbbbbbbbbbb ,time: 11.710562456129644

EVENT time: 14.562120426038392 type: 2 entity: 1
corrupt packet recieved by B, seqnum: 1 acknum: 0 checksum: 1941
payload: ?aaaaaaaaaaaaaaaaaaaaa ,time: 14.562120426038392

EVENT time: 17.07113864558855 type: 2 entity: 1
packet recieved by B, seqnum: 2 acknum: 0 checksum: 1962 payload:
bbbbbbbbbbbbbbbbbbbb ,time: 17.07113864558855
from b:seqnum: 0 acknum: 2 checksum: 2 ,time: 17.07113864558855

EVENT time: 25.999664296395764 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 2 checksum: 2 ,time: 25.999664296395764

EVENT time: 29.176305429242838 type: 1 entity: 0
from a:seqnum: 3 acknum: 0 checksum: 1983 payload:
cccccccccccccccccccc ,time: 29.176305429242838

EVENT time: 29.181188390758997 type: 0 entity: 0
from a(re):seqnum: 1 acknum: 0 checksum: 1941 payload:

```



```
aaaaaaaaaaaaaaaaaaaaa ,time:29.181188390758997

EVENT time: 31.21677297280801  type: 1  entity: 0
from  a:seqnum:    4          acknum:    0          checksum:    2004          payload:
dddddddddddddddddd ,time:31.21677297280801
toLayer3: packet being lost

EVENT time: 37.567033906064026  type: 2  entity: 1
packet recieved by B, seqnum: 3  acknum: 0  checksum: 1983  payload:
cccccccccccccccccc ,time:37.567033906064026
from b:seqnum: 0  acknum: 3  checksum: 3 ,time:37.567033906064026

EVENT time: 42.41566209906308  type: 2  entity: 1
packet recieved by B, seqnum: 1  acknum: 0  checksum: 1941  payload:
aaaaaaaaaaaaaaaaaaaaa ,time:42.41566209906308
from b:seqnum: 0  acknum: 1  checksum: 1 ,time:42.41566209906308

EVENT time: 45.79708243049409  type: 2  entity: 0
ack recieved by A, seqnum: 0  acknum: 3  checksum: 3 ,time:45.79708243049409

EVENT time: 46.13483077486496  type: 1  entity: 0
from  a:seqnum:    5          acknum:    0          checksum:    2025          payload:
eeeeeeeeeeeeeeeeeee ,time:46.13483077486496

EVENT time: 48.48179570909757  type: 2  entity: 1
packet recieved by B, seqnum: 5  acknum: 0  checksum: 2025  payload:
eeeeeeeeeeeeeeeeeee ,time:48.48179570909757
from b:seqnum: 0  acknum: 5  checksum: 5 ,time:48.48179570909757

EVENT time: 49.181188390759004  type: 0  entity: 0
from  a(re):seqnum:    1          acknum:    0          checksum:    1941          payload:
aaaaaaaaaaaaaaaaaaaaa ,time:49.181188390759004

EVENT time: 51.216772972808016  type: 0  entity: 0
from  a(re):seqnum:    4          acknum:    0          checksum:    2004          payload:
dddddddddddddddddd ,time:51.216772972808016

EVENT time: 51.9457075716422  type: 2  entity: 0
ack recieved by A, seqnum: 0  acknum: 1  checksum: 1 ,time:51.9457075716422

EVENT time: 53.38242744224373  type: 2  entity: 1
packet recieved by B, seqnum: 1  acknum: 0  checksum: 1941  payload:
aaaaaaaaaaaaaaaaaaaaa ,time:53.38242744224373
from  b(unexpected seqnum):seqnum:    0          acknum:    1          checksum:
```

```
1 ,time:53.38242744224373
toLayer3: packet being corrupted

EVENT time: 55.99475081637013  type: 1  entity: 0
from  a:seqnum: 6      acknum: 0      checksum: 2046      payload:
ffffffffffffffff ,time:55.99475081637013

EVENT time: 56.00329599902341  type: 2  entity: 0
ack recieved by A, seqnum: 0  acknum: 5  checksum: 5 ,time:56.00329599902341

EVENT time: 58.93307290871914  type: 1  entity: 0
from  a:seqnum: 7      acknum: 0      checksum: 2067      payload:
gggggggggggggggggggg ,time:58.93307290871914

EVENT time: 59.69942320017091  type: 2  entity: 1
packet recieved by B, seqnum: 4  acknum: 0  checksum: 2004  payload:
dddddddddddddddd ,time:59.69942320017091
from b:seqnum: 0  acknum: 4  checksum: 4 ,time:59.69942320017091

EVENT time: 61.54353465376751  type: 2  entity: 0
corrupt acked recieved by A, seqnum: 0  acknum: 1  checksum:
1 ,time:61.54353465376751

EVENT time: 65.55525376140629  type: 2  entity: 0
ack recieved by A, seqnum: 0  acknum: 4  checksum: 4 ,time:65.55525376140629

EVENT time: 67.38975188451796  type: 2  entity: 1
packet recieved by B, seqnum: 6  acknum: 0  checksum: 2046  payload:
ffffffffffffffff ,time:67.38975188451796
from b:seqnum: 0  acknum: 6  checksum: 6 ,time:67.38975188451796

EVENT time: 71.32703634754479  type: 2  entity: 1
packet recieved by B, seqnum: 7  acknum: 0  checksum: 2067  payload:
gggggggggggggggggggg ,time:71.32703634754479
from b:seqnum: 0  acknum: 7  checksum: 7 ,time:71.32703634754479

EVENT time: 73.11841181676687  type: 2  entity: 0
ack recieved by A, seqnum: 0  acknum: 6  checksum: 6 ,time:73.11841181676687

EVENT time: 76.96890163884396  type: 1  entity: 0
from  a:seqnum: 8      acknum: 0      checksum: 2088      payload:
hhhhhhhhhhhhhhhhhh ,time:76.96890163884396
toLayer3: packet being lost
```

EVENT time: 78.77010406811732 type: 1 entity: 0
from a:seqnum: 9 acknum: 0 checksum: 2109 payload:
,time:78.77010406811732

EVENT time: 78.87618640705588 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 7 checksum: 7 ,time:78.87618640705588

EVENT time: 83.2995696890164 type: 2 entity: 1
packet recieved by B, seqnum: 9 acknum: 0 checksum: 2109 payload:
,time:83.2995696890164
from b:seqnum: 0 acknum: 9 checksum: 9 ,time:83.2995696890164

EVENT time: 87.94357127597888 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 9 checksum: 9 ,time:87.94357127597888

EVENT time: 91.16245002594074 type: 1 entity: 0
from a:seqnum: 10 acknum: 0 checksum: 2130 payload:
jjjjjjjjjjjjjjjjjj ,time:91.16245002594074
toLayer3: packet being lost

EVENT time: 94.58906826990571 type: 1 entity: 0
from a:seqnum: 11 acknum: 0 checksum: 2151 payload:
kkkkkkkkkkkkkkkkkk ,time:94.58906826990571

EVENT time: 96.96890163884396 type: 0 entity: 0
from a(re):seqnum: 8 acknum: 0 checksum: 2088 payload:
hhhhhhhhhhhhhhhhhh ,time:96.96890163884396
toLayer3: packet being corrupted

EVENT time: 101.94787438581501 type: 2 entity: 1
packet recieved by B, seqnum: 11 acknum: 0 checksum: 2151 payload:
kkkkkkkkkkkkkkkkkk ,time:101.94787438581501
from b:seqnum: 0 acknum: 11 checksum: 11 ,time:101.94787438581501

EVENT time: 102.11615344706566 type: 1 entity: 0
from a:seqnum: 12 acknum: 0 checksum: 2172 payload:
,time:102.11615344706566

EVENT time: 103.72820215460679 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 11 checksum: 11 ,time:103.72820215460679

EVENT time: 111.16245002594074 type: 0 entity: 0
from a(re):seqnum: 10 acknum: 0 checksum: 2130 payload:
jjjjjjjjjjjjjjjjjj ,time:111.16245002594074

EVENT time: 111.45402386547443 type: 2 entity: 1
corrupt packet recieved by B, seqnum: 8 acknum: 999999 checksum: 2088 payload:
hhhhhhhhhhhhhhhhhhhh ,time: 111.45402386547443

EVENT time: 112.80312509537035 type: 1 entity: 0
from a:seqnum: 13 acknum: 0 checksum: 2193 payload:
mmmmmmmmmmmmmmmmmmmmmmmmmmmm ,time: 112.80312509537035

EVENT time: 116.5202795495468 type: 1 entity: 0
from a:seqnum: 14 acknum: 0 checksum: 2214 payload:
nnnnnnnnnnnnnnnnnnnnnnnnnnnnnn ,time: 116.5202795495468

EVENT time: 116.54545731986451 type: 2 entity: 1
packet recieved by B, seqnum: 12 acknum: 0 checksum: 2172 payload:
||||||| ,time: 116.54545731986451
from b:seqnum: 0 acknum: 12 checksum: 12 ,time: 116.54545731986451

EVENT time: 116.96890163884396 type: 0 entity: 0
from a(re):seqnum: 8 acknum: 0 checksum: 2088 payload:
hhhhhhhhhhhhhhhhhhhhhhhhhhhhhh ,time: 116.96890163884396

EVENT time: 118.8328196050905 type: 2 entity: 1
packet recieved by B, seqnum: 10 acknum: 0 checksum: 2130 payload:
jjjjjjjjjjjjjjjjjjjj ,time: 118.8328196050905
from b:seqnum: 0 acknum: 10 checksum: 10 ,time: 118.8328196050905
toLayer3: packet being corrupted

EVENT time: 120.56782738731042 type: 2 entity: 1
packet recieved by B, seqnum: 13 acknum: 0 checksum: 2193 payload:
mmmmmmmmmmmmmmmmmmmmmmmmmmmm ,time: 120.56782738731042
from b:seqnum: 0 acknum: 13 checksum: 13 ,time: 120.56782738731042

EVENT time: 122.11615344706566 type: 0 entity: 0
from a(re):seqnum: 12 acknum: 0 checksum: 2172 payload:
||||||| ,time: 122.11615344706566

EVENT time: 122.14694662312694 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 12 checksum: 12 ,time: 122.14694662312694

EVENT time: 124.76995147556994 type: 2 entity: 0
corrupt acked recieved by A, seqnum: 0 acknum: 10 checksum:
10 ,time: 124.76995147556994

EVENT time: 129.25601977599413 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 13 checksum: 13 ,time: 129.25601977599413

EVENT time: 129.61638233588673 type: 1 entity: 0
from a:seqnum: 15 acknum: 0 checksum: 2235 payload:
ooooooooooooooooooooo ,time: 129.61638233588673
toLayer3: packet being corrupted

EVENT time: 129.8256782738731 type: 2 entity: 1
packet recieved by B, seqnum: 14 acknum: 0 checksum: 2214 payload:
nnnnnnnnnnnnnnnnnnnn ,time: 129.8256782738731
from b:seqnum: 0 acknum: 14 checksum: 14 ,time: 129.8256782738731

EVENT time: 130.2945036164434 type: 1 entity: 0
wait for window to slide in a:pppppppppppppppppppp time: 130.2945036164434

EVENT time: 130.92071291238136 type: 2 entity: 1
packet recieved by B, seqnum: 8 acknum: 0 checksum: 2088 payload:
hhhhhhhhhhhhhhhhhhhh ,time: 130.92071291238136
from b:seqnum: 0 acknum: 8 checksum: 8 ,time: 130.92071291238136
toLayer3: packet being lost

EVENT time: 131.16245002594076 type: 0 entity: 0
from a(re):seqnum: 10 acknum: 0 checksum: 2130 payload:
jjjjjjjjjjjjjjjjjjjj ,time: 131.16245002594076

EVENT time: 136.47721793267618 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 14 checksum: 14 ,time: 136.47721793267618

EVENT time: 136.96890163884396 type: 0 entity: 0
from a(re):seqnum: 8 acknum: 0 checksum: 2088 payload:
hhhhhhhhhhhhhhhhhhhh ,time: 136.96890163884396

EVENT time: 139.7308572649312 type: 2 entity: 1
packet recieved by B, seqnum: 12 acknum: 0 checksum: 2172 payload:
||||||| ,time: 139.7308572649312
from b(unexpected seqnum):seqnum: 0 acknum: 12 checksum:
12 ,time: 139.7308572649312

EVENT time: 144.30481887264628 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 12 checksum: 12 ,time: 144.30481887264628

EVENT time: 149.61638233588673 type: 0 entity: 0
from a(re):seqnum: 15 acknum: 0 checksum: 2235 payload:

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ooooooooooooooooooooo ,time: 149.61638233588673
toLayer3: packet being lost

EVENT time: 149.69377727591785 type: 2 entity: 1
corrupt packet recieved by B, seqnum: 15 acknum: 0 checksum: 2235
payload: ?ooooooooooooooooooooo ,time: 149.69377727591785

EVENT time: 149.75249488814967 type: 1 entity: 0
wait for window to slide in a:qqqqqqqqqqqqqqqqqq time: 149.75249488814967

EVENT time: 151.16245002594076 type: 0 entity: 0
from a(re):seqnum: 10 acknum: 0 checksum: 2130 payload:
jjjjjjjjjjjjjjjjjj ,time: 151.16245002594076

EVENT time: 156.96890163884396 type: 0 entity: 0
from a(re):seqnum: 8 acknum: 0 checksum: 2088 payload:
hhhhhhhhhhhhhhhhhh ,time: 156.96890163884396
toLayer3: packet being lost

EVENT time: 158.69096957304606 type: 2 entity: 1
packet recieved by B, seqnum: 10 acknum: 0 checksum: 2130 payload:
jjjjjjjjjjjjjjjjjj ,time: 158.69096957304606
from b(unexpected seqnum):seqnum: 0 acknum: 10 checksum:
10 ,time: 158.69096957304606

EVENT time: 160.91021454512162 type: 2 entity: 1
packet recieved by B, seqnum: 8 acknum: 0 checksum: 2088 payload:
hhhhhhhhhhhhhhhhhh ,time: 160.91021454512162
from b(unexpected seqnum):seqnum: 0 acknum: 8 checksum:
8 ,time: 160.91021454512162

EVENT time: 163.75988036744286 type: 1 entity: 0
wait for window to slide in a:rrrrrrrrrrrrrrrrrr time: 163.75988036744286

EVENT time: 168.1452070680868 type: 2 entity: 0
ack recieved by A, seqnum: 0 acknum: 10 checksum: 10 ,time: 168.1452070680868

EVENT time: 169.61638233588673 type: 0 entity: 0
from a(re):seqnum: 15 acknum: 0 checksum: 2235 payload:
ooooooooooooooooooooo ,time: 169.61638233588673
toLayer3: packet being lost

EVENT time: 170.6311532944731 type: 2 entity: 1
packet recieved by B, seqnum: 10 acknum: 0 checksum: 2130 payload:
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jjjjjjjjjjjjjjjjjjjj ,time: 170.6311532944731
from  b(unexpected seqnum):seqnum: 0      acknum: 10      checksum:
10 ,time: 170.6311532944731

EVENT time: 174.12463759269997 type: 2 entity: 0
ack recieved by A, seqnum: 0  acknum: 8  checksum: 8 ,time: 174.12463759269997
from  a:seqnum: 0      acknum: 0      checksum: 2240      payload:
pppppppppppppppppppppp ,time: 174.12463759269997
from  a:seqnum: 1      acknum: 0      checksum: 2261      payload:
qqqqqqqqqqqqqqqqqqqq ,time: 174.12463759269997
from  a:seqnum: 2      acknum: 0      checksum: 2282      payload:
rrrrrrrrrrrrrrrrrrrr ,time: 174.12463759269997
toLayer3: packet being corrupted

EVENT time: 176.14310129093295 type: 2 entity: 0
ack recieved by A, seqnum: 0  acknum: 10  checksum: 10 ,time: 176.14310129093295

EVENT time: 179.7424237800226 type: 1 entity: 0
from  a:seqnum: 3      acknum: 0      checksum: 2303      payload:
ssssssssssssssssssss ,time: 179.7424237800226

EVENT time: 182.18247016815698 type: 2 entity: 1
packet recieved by B, seqnum: 0  acknum: 0  checksum: 2240  payload:
pppppppppppppppppppppp ,time: 182.18247016815698
from b:seqnum: 0  acknum: 0  checksum: 0 ,time: 182.18247016815698

EVENT time: 184.223761711478 type: 1 entity: 0
from  a:seqnum: 4      acknum: 0      checksum: 2324      payload:
tttttttttttttttttttt ,time: 184.223761711478

EVENT time: 189.61638233588673 type: 0 entity: 0
from  a(re):seqnum: 15  acknum: 0      checksum: 2235      payload:
ooooooooooooooooooooo ,time: 189.61638233588673

EVENT time: 189.75798821985535 type: 2 entity: 1
packet recieved by B, seqnum: 1  acknum: 0  checksum: 2261  payload:
qqqqqqqqqqqqqqqqqqqq ,time: 189.75798821985535
from b:seqnum: 0  acknum: 1  checksum: 1 ,time: 189.75798821985535

EVENT time: 190.18070009460737 type: 2 entity: 0
ack recieved by A, seqnum: 0  acknum: 0  checksum: 0 ,time: 190.18070009460737

EVENT time: 192.0714438306833 type: 2 entity: 1
corrupt packet recieved by B, seqnum: 2  acknum: 0  checksum: 2282
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EVENT time: 195.22751548814355 type: 1 entity: 0