Computer Communication and Networking (ITCS-6166/8166)

Implementation and Simulation of Go-Back-N (GBN) and Selective Repeat (SR) Protocols

In this project, sliding window protocol Go-Back-N (GBN) and Selective Repeat (SR) using an unreliable channel i.e. UDP are implemented. The checksum of the segment is also computed. GBN and SR both are sliding window protocols but both operate differently.

Simulation with Go-Back-N:

Go-Back-N is a transport layer protocol which Is used to send a number of frames of specific window size. This can be implemented under unreliable conditions as it can send frames without receiving acknowledgement (ACK) packet from the receiver. Considering conditions of error i.e. one with checksum error, with lost packet and lost ACK along with the ideal case of no fault, simulation is as follows.

1. Ideal case without no errors:

Sender

```
ck@ck-Inspiron-5559:~/ccn/projects/2Project/Chinmay$ javac Sender.java
ck@ck-Inspiron-5559:~/ccn/projects/2Project/Chinmay$ java Sender gbn.txt 3000 50
GBN
4
4
1000
500
Data size: 500 bytes
Number of packets to send: 50
Checksum = 13768

Sending packet with number 0
Timer Started
Checksum = 13768

Sending packet with number 1
Timer Started
Checksum = 13768

Sending packet with number 2
Timer Started
Checksum = 13768

Sending packet with number 3
Timer Started
Received ACK for 1
Checksum = 13768

Sending packet with number 4
Timer Started
Received ACK for 2
Checksum = 13768
```

Receiver

```
ck@ck-Inspiron-5559:~/ccn/projects/2Project/Chinmay$ javac Receiver.java
ck@ck-Inspiron-5559:~/ccn/projects/2Project/Chinmay$ java Receiver gbn.txt 3000
GBN
4
4
1000
500

Waiting for packet0
Packet Number 0 Received (last: false )
Packed Number 0 stored in buffer
Sending ACK to Sequence 1 with 48 bytes

Waiting for packet1
Packet Number 1 Received (last: false )
Packed Number 1 stored in buffer
Sending ACK to Sequence 2 with 48 bytes

Waiting for packet2
Packet Number 2 Received (last: false )
Packed Number 2 stored in buffer
Sending ACK to Sequence 3 with 48 bytes

Waiting for packet3
Packet Number 3 Received (last: false )
Packed Number 3 stored in buffer
Sending ACK to Sequence 4 with 48 bytes
```

2. With Checksum/Bit error:

If the receiver receives any packet with checksum error, it discards the packet at receiver end and sends ACK with same packet again to the receiver.

Sender

```
Sending packet with number 6
Timer Started
Checksum = 13768

[X] Checksum changed for packet number 7

Sending packet with number 7
Timer Started
Received ACK for 5
Checksum = 13768

Sending packet with number 8
Timer Started
Received ACK for 5
Received ACK for 5
Received ACK for 5
```

Receiver

```
ck@ck-Inspiron-5559:~/ccn/projects/2Project/Chinmay$ java Receiver gbn.txt 3000
GBN
4
4
1000
500

Waiting for packet0
Packet Number 1 Received (last: false )
Packet Discarded (Checksum Error)
Sending ACK to Sequence 0 with 48 bytes

Waiting for packet0
Packet Number 2 Received (last: false )
Packet Discarded (not in order)
Sending ACK to Sequence 0 with 48 bytes

Waiting for packet0
Packet Number 3 Received (last: false )
Packet Discarded (not in order)
Sending ACK to Sequence 0 with 48 bytes
```

3. Lost Packet:

While if the packet is lost then the sender keeps on sending the unsent packet in the frame and once it receives the ACK for lost packet again, after sending all packets it will send again all the packets from the packet with sequence no of lost packet.

Sender

```
Resending packet with number 14
Timer Restarted
Received ACK for 12
Checksum = 13768

Sending packet with number 15
[X] Lost packet with number 15
Received ACK for 14
Checksum = 13768

Sending packet with number 16
Timer Started
Checksum = 13768

Sending packet with number 17
Timer Started
Received ACK for 15
Checksum = 13768

Sending packet with number 18
Timer Started
Received ACK for 15
```

Receiver

```
Waiting for packet34
Packet Number 34 Received (last: false )
Packed Number 34 stored in buffer
Sending ACK to Sequence 35 with 48 bytes

Waiting for packet35
Packet Number 36 Received (last: false )
Packet Discarded (not in order)
Sending ACK to Sequence 35 with 48 bytes

Waiting for packet35
Packet Number 37 Received (last: false )
Packet Discarded (Checksum Error)
Sending ACK to Sequence 35 with 48 bytes

Waiting for packet35
Packet Number 38 Received (last: false )
Packet Discarded (Checksum Error)
Sending ACK to Sequence 35 with 48 bytes

Waiting for packet35
Packet Number 35 Received (last: false )
Packed Number 35 stored in buffer
[X] ACK Lost with Sequence Number 36
Sending ACK to Sequence 36 with 48 bytes

Waiting for packet36
Packet Number 36 Received (last: false )
Packed Number 36 stored in buffer
Sending ACK to Sequence 37 with 48 bytes

Waiting for packet37
Packet Number 37 Received (last: false )
Packed Number 37 stored in buffer
Sending ACK to Sequence 38 with 48 bytes
```

4.Lost ACK

Sender

```
Sending packet with number 15
[X] Lost packet with number 15
Received ACK for 14
Checksum = 13768

Sending packet with number 16
Timer Started
Checksum = 13768

Sending packet with number 17
Timer Started
Received ACK for 15
Checksum = 13768

Sending packet with number 18
Timer Started
Received ACK for 15
Received ACK for 15
```

Receiver

```
Waiting for packet35
Packet Number 35 Received (last: false )
Packed Number 35 stored in buffer
[X] ACK Lost with Sequence Number 36
Sending ACK to Sequence 36 with 48 bytes

Waiting for packet36
Packet Number 36 Received (last: false )
Packed Number 36 stored in buffer
Sending ACK to Sequence 37 with 48 bytes

Waiting for packet37
Packet Number 37 Received (last: false )
Packed Number 37 stored in buffer
Sending ACK to Sequence 38 with 48 bytes

Waiting for packet38
Packet Number 38 Received (last: false )
Packed Number 38 stored in buffer
Sending ACK to Sequence 39 with 48 bytes

Waiting for packet39
Packet Number 39 Received (last: false )
```

Simulation with Selective Repeat:

Selective Repeat is part of the automatic repeat-request (ARQ). When this protocol is used for the delivery of messages, the sending process continues to send a number of frames specified by a window size even after a frame loss. Unlike Go-Back-N ARQ, the receiving process will continue to accept and acknowledge frames sent after an initial error; this is the general case of the sliding window protocol with both transmit and receive window sizes greater than 1.

1. Ideal case without no errors:

Sender

```
ck@ck-Inspiron-5559:~/ccn/projects/2Project/Chinmay$ java Sender sr.txt 3000 50
SR
4
4
1000
500
Data size: 500 bytes
Number of packets to send: 50
Checksum Generated is = 30892

Sending Packet, Pcket Number 0
Checksum Generated is = 30892

Sending Packet, Pcket Number 1
Checksum Generated is = 30892

Sending Packet, Pcket Number 2
Checksum Generated is = 30892

Sending Packet, Pcket Number 3
Received ACK for 0
LAST SENT = 4
SEND BASE = 1
ACKS =
0
0
0
0


 (Next Packet Transmission)
```

Receiver

```
ck@ck-Inspiron-5559:~/ccn/projects/2Project/Chinmay$ java Receiver sr.txt 3000
SR
4
4
1000
500
SR
4
4
1000
500
Packet Number 0 Received (last: false )

GENERATED ACK  0
Packet stored in buffer
Sending ACK to Sequence 0
Waiting for:
1
2
3
4
setACK:
0
0
0
0
Packet Number 1 Received (last: false )

GENERATED ACK  1
Packet stored in buffer
Sending ACK to Sequence 1
Waiting for:
2
3
4
5
setACK:
```

2. With Checksum/Bit error:

Sender

```
 (Next Packet Transmission)


Checksum Generated is = 30892
CHECKSUM CHANGED

Sending Packet, Pcket Number 7
Received ACK for 4
LAST SENT = 8
SEND BASE = 5
ACKS =
0
0
0
0


 (Next Packet Transmission)


Checksum Generated is = 30892

Sending Packet, Pcket Number 8
Received ACK for 5
```

Receiver

```
Waiting for:
7
8
9
10
setACK:
0
0
0
0
Packet Number 7 Received (last: false )

[X] CHECKSUM ERROR --(Packet Discarded)--

[X] Lost ACK with Sequence Number 6
Waiting for:
7
8
9
10
setACK:
0
0
0
0
Packet Number 8 Received (last: false )

GENERATED ACK  8
Packet stored in buffer
```

3. Lost Packet:

Sender

```
Sending Packet, Pcket Number 11
Checksum Generated is = 30892

Sending Packet, Pcket Number 12
Checksum Generated is = 30892

[X] Lost Packet, Packet Number 13
Checksum Generated is = 30892

CHECKSUM CHANGED

Sending Packet, Pcket Number 14
Received ACK for 11
LAST SENT = 15
SEND BASE = 12
ACKS =
0
0
0
0


 (Next Packet Transmission)
```

Receiver

```
setACK:
0
0
0
0
Packet Number 12 Received (last: false )

GENERATED ACK  12
Packet stored in buffer
Sending ACK to Sequence 12
Waiting for:
13
14
15
16
setACK:
0
0
0
0
Packet Number 14 Received (last: false )

[X] CHECKSUM ERROR --(Packet Discarded)--
Sending ACK to Sequence 12
Waiting for:
13
14
15
16
setACK:
0
0
0
0
Packet Number 15 Received (last: false )

GENERATED ACK  15
Packet stored in buffer
Sending ACK to Sequence 15
Waiting for:
13
14
```

4.Lost ACK

Sender

```
 (Next Packet Transmission)


Received ACK for 21
LAST SENT = 28
SEND BASE = 24
ACKS =
0
0
0
0


 (Next Packet Transmission)


Timer Expired

Resending Packet, Packet Number: 24
Timer Restarted

Resending Packet, Packet Number: 25
Timer Restarted

Resending Packet, Packet Number: 26
Timer Restarted

Resending Packet, Packet Number: 27
Timer Restarted
LAST SENT = 28
SEND BASE = 24
ACKS =
0
0
0
0
```

Receiver

```
GENERATED ACK  20
Packet stored in buffer
Sending ACK to Sequence 20
Waiting for:
18
19
20
21
setACK:
0
1
1
0
Packet Number 21 Received (last: false )

[X] CHECKSUM ERROR --(Packet Discarded)--
[X] Lost ACK with Sequence Number 20
Waiting for:
18
19
20
21
setACK:
0
1
0
0
Packet Number 18 Received (last: false )

GENERATED ACK  18
Packet stored in buffer
Sending ACK to Sequence 18
Waiting for:
20
21
22
23
setACK:
```