PROGRAMMAZIONE DI RETI REPORT ASSIGNMENT 3

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1 Premessa

Nel terzo assignment viene richiesto di implementare, a livello di trasporto, le funzioni lato receiver (A) e lato sender (B) utilizzando la tecnica Go-back-n. Con questo principio di trasferimento dati applichiamo la risoluzione dei problemi in pipeline. In questo caso sarà quindi necessario inserire le finestre per verificare il corretto invio e la corretta recezione dei pacchetti, anche se non ordinata.

Il GBN è un protocollo a sequenza scorrevole basato su ACK e privo di NACK. Il mittente può trasmettere al più n pacchetti senza ricevere gli ACK.

Ogni pacchetto ha un numero di sequenza, grazie a questo è possibile riconoscere i pacchetti che possono essere inviati e ricevuti. Un pacchetto sarà quindi inviato, o ricevuto, se e solo se il suo numero di sequenza è contenuto nella finestra di invio, o di recezione. Il numero di sequenza può essere pari, al massimo, a due volte la dimensione delle finestre.

2 Task 1

2.1 Strutture Dati Utilizzate

Per la corretta implementazione del protocollo descritto abbiamo utilizzato due distinte strutture dati, una per il sender e una per il receiver, contenenti una finestra per memorizzare i messaggi inviati e ricevuti, e tutte le variabili necessarie per verificare l'intergrità e le varie statistiche sui pacchetti. Per portare a termine l'assignement abbiamo implementato diverse funzioni utili e spesso utilizzate all'interno del codice.

- ullet calcChecksumo calcola il checksum del pacchetto
- isCorrupt→ controlla se un pacchetto è corrotto
- isWithinWindow→ controlla se un pacchetto è all'interno della finestra specificata
- checkCorrectAck→ calcola il numero di acknowledge corretto da inviare
- \bullet sendToLayer5 \rightarrow invia il pacchetto in ordine corretto al Layer5

2.2 Descrizione delle routine

A output()

La prima operazione che svolge questa routine è la memorizzazione del messaggio passatogli dal Layer5 nel buffer dei messaggi da inviare.

Una volta memorizzato il messaggio, si controlla se il prossimo SEQ_NUM è all'interno della finestra di invio, se ciò si verifica si procede con la creazione del pacchetto (seq_num, payload, checksum).

Al termine della creazione vengono richiamate in successione tolayer3() e start-timer(), che rispettivamente inviano il pacchetto al receiver (B) e fanno partire il timer del sender (A).

Tenendo conto delle specifiche date se la nostra versione del protocolla raggiunge un buffer di 50 elementi l'intero processo termina.

A input()

Questa funzione viene richiamata quando un messaggio proveniente del receiver passa attraverso il layer3. Inizialmente la funzione controlla se il pacchetto in arrivo è corrotto, se non lo è procede, verificando se appartiene alla finestra dei pacchetti inviati precedentemente, in tal caso accetta l'ACK inviato da (B), altrimenti procede a scartarlo. Successivamente viene eseguito un ulteriore controllo: nel caso in cui il numero dell'ACK sia superiore al SEQ_NUM dei pacchetti inviati, si procede a shiftare la finestra. In questo caso, infatti, si riceve un ACK cumulativo per il quale tutti i pacchetti sono stati recapitati con successo. Infine si controlla la presenza di nuovi pacchetti da inviare nel msg buffer.

A timerinterrupt()

Richiamata nel momento in cui il timer del sender (A) scade. Si procede col rispedire tutti i pacchetti presenti nella finestra di invio che non hanno ricevuto un ACK, successivamente resetta e avvia il timer in attesa dei nuovi ACK da parte del receiver.

A init()

Questa funzione inizializza le strutture e le variabili del sender.

B input()

Questa funzione viene richiamata al momento della recezione di un pacchetto. In primo luogo viene effettuato un controllo tramite checksum, nel caso risulti corrotto si procede con l'invio di un ACK duplicato per segnalare ad A, la presenza di un errore. Se il pacchetto risulta integro si procede controllando il SEQ_NUM, questa verifica è utile per evitare che, una volta raggiunto il massimo SEQ_NUM, esso venga resettato prima di aver ricevuto tutti gli ACK dei pacchetti inviati dal sender.

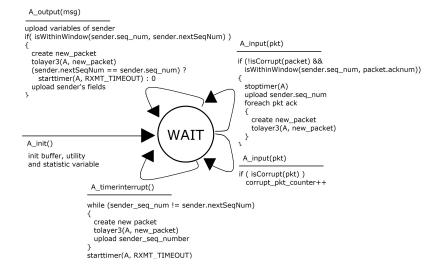
Calcolato il corretto ACK da inviare, viene creato il pachetto e spedito al sender. Ad ogni invio di ACK verso il sender, viene richiamata la funzione (send toLayer5) che invia al Layer5 solo i messaggi, non ancora inviati.

B_init()

Questa funzione inizializza le strutture e le variabili del receiver.

2.3 Modello a Stati Finiti

Rappresentazione del comportamento del sender e del receiver attraverso una macchina a stati finiti.



2.4 Test netsimulator.c

2.4.1 Utilizzo di un timer statico

Nel nostro programma è presente un unico timer statico, univoco per tutti i pacchetti da inviare/ricevere. Il nostro programma presenta delle restrizioni, in quanto il protocollo selective repeat necessita di un singolo timer per ogni pacchetto inviato.

Come possiamo notare, la funzione A_input blocca il timer dopo la recezione di un ACK corretto e lo avvia solo nel caso in cui alcuni pacchetti siano già stati inviati, ma dei quali non abbiamo ancora ricevuto l'ACK. Inoltre, il timer viene avviato dalla funzione A_output solo nel caso in cui il pacchetto sia posto nella prima posizione della finestra.

Se avessimo avuto a disposizione n timer, uno per ogni pacchetto inviato, avremmo dovuto gestire in modo diverso l'avvio e il blocco del timer.

2.4.2 Caso 1

Probabilità di corruzione o perdita di pacchetti 0

```
Enter number of messages to simulate: 3
Enter packet loss probability [enter 0.0 for no loss]:0.0 Enter packet corruption probability [0.0 for no corruption]:0.0 Enter average time between messages from sender's layer5 [> 0.0]:10
Enter window size [>0]:10
Enter retransmission timeout [> 0.0]:20
Enter trace level:2
Enter random seed: [>0]:2233
EVENT time: 6.100040, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5...
####[DEBUG] DATA\Longrightarrow aaaaaaaaaaaaaaaaaa
A: Sending new DATA to B..
Packet SEQ_NUM=> 0
Packet ACK = 0
Packet Msg=> aaaaaaaaaaaaaaaaaaa
EVENT time: 8.261361, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5...
A: Sending new DATA to B...
Packet SEQ NUM=> 1
Packet ACK 0
EVENT time: 10.094729,
                          type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM\Rightarrow 0
Packet SEQ_NUM=> 0
Packet ACK > 0
Packet Msg=> aaaaaaaaaaaaaaaaaaa
B: Sending ACK to A...
Packet ACK 0
EVENT time: 12.437849, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 1
Packet SEQ_NUM=> 1
Packet ACK=> 0
```

```
B: Sending ACK to A... Packet SEQ_NUM=> 0
Packet ACK=> 1
EVENT time: 14.666768, type: 2, from
layer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 0
A: Checking ACK from B...
A: Sending new DATA to B...
Packet SEQ NUM=> 2
Packet ACK=> 0
Packet\ Msg\!\!=\!\!>\ ccccccccccccc
EVENT time: 18.409314, type: 2, from
layer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM
 \!\!\!=\!\!\!>0
Packet ACK=> 1
A: Checking ACK from B...
B: Receiving DATA from A...
Expected SEQ_NUM=> 2
Packet SEQ_NUM=> 2
Packet ACK 0
Packet ACK => 2
EVENT time: 22.796655, type: 2, fromlayer3 entity: 0
A: Receiving ACK from B...
Packet SEQ_NUM=> 0
Packet ACK => 2
A: Checking ACK from B...
EVENT time: 27.757805, type: 1, from layer 5 entity: 0 Simulator terminated at time 27.757805108798
     END SIMULATION STATISTICS ==
   Messages arrived to A:
```

 $\frac{3}{0}$

3

0

Packets sent from A: Packets retransmitted:

Correct acks:

Corrupted packets:

2.4.3 Caso 2

Probabilità di corruzione o perdita di pacchetti 0.2

```
Enter number of messages to simulate: 50
Enter packet loss probability [enter 0.0 for no loss]:0.2
Enter packet corruption probability [0.0 for no corruption]:0.2
Enter average time between messages from sender's layer5 [> 0.
Enter window size [>0]:8
Enter retransmission timeout [> 0.0]:20
Enter retransmission timeout [> 0.0]:20
 Enter trace level:2 Enter random seed: [>0]:2233
EVENT time: 9.181188, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####|DEBUG| DATA=> aaaaaaaaaaaaaaaaa
A: Sending new DATA to B...
Packet SEQ NUM=> 0
Packet ACK=> 0
 Packet Msg⇒ aaaaaaaaaaaaaaaaaaa
TOLAYER3: packet being corrupted
EVENT time: 14.562120, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 0
Packet ACK=> 0
Packet ACK=> 0
Packet Msg=> ?aaaaaaaaaaaaaa
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
EVENT time: 23.490646, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 29.176305, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####DEBUG| DATA=> cccccccccccccccc
A: Sending new DATA to B...
Packet SEQ NUM=> 2
Packet ACK=> 0
Packet Msg=> cccccccccccccccccccccccc
EVENT time: 31.881375, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM=> 0
```

```
Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 38.082522, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 46.134831, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
#####DEBUG| DATA=> eeeeeeeeeeeeeeee
A: Sending new DATA to B...
Packet SEQ NUME> 4
Packet ACK=> 0
Packet Msg=> eeeeeeeeeeeeeee
EVENT time: 46.456221, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 48.403607, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 0
Packet SEQ_NUM=> 2
Packet ACK=> 0
Packet ACK=> 0
Packet Msg=> ccccccccccccccccccccccccc:
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
Packet ACK=> 15
TOLAYER3: packet being corrupted
EVENT time: 53.943846, t
A: Receiving ACK from B..
Packet SEQ NUM=> 0
Packet ACK=> 15
                                            type: 2, fromlayer3 entity: 0
```

```
A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 55.994751, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####DEBUG| DATA=> fffffffffffffff
A: Sending new DATA to B...
Packet SEQ NUM=> 5
Packet ACK=> 0
Packet Msg=> ffffffffffffffffff
 EVENT time: 57.067568, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 4
Packet ACK=> 0
Packet Msg=> eeeeeeeeeeeeeeee
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
 EVENT time: 58.933073, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####DEBUG| DATA=> ggggggggggggggggggg
A: Sending new DATA to B...
Packet SEQ NUM=> 6
Packet ACK=> 0
  EVENT time: 61.711570, type: 2, from
layer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 64.757897, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 0
Packet SEQ_NUM=> 0
Packet ACK=> 0
Packet Msg=> aaaaaaaaaaaaaaaaaa
B: Sending ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 4
 EVENT time: 72.116703, t
A: Receiving ACK from B..
Packet SEQ NUM=> 0
Packet ACK=> 4
                                                     type: 2, fromlayer3 entity: 0
```

```
A: Checking ACK from B...
EVENT time: 72.706900, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM
\Longrightarrow 5
 B: Resending previous ACK to A...

Packet SEQ NUM=> 0

Packet ACK=> 4

TOLAYER3: packet being corrupted
B: Resending previous ACK to A.
Packet SEQ_NUM=> 0
Packet ACK=> 4
EVENT time: 78.770104, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5...  
####DEBUG| DATA=> iiiiiiiiiiiiiiiiiiiiiii  
A: Sending new DATA to B...  
Packet SEQ NUM=> 8  
Packet ACK=> 0  
Packet Msg=> iiiiiiiiiiiiiiiiii  
TOLAYER3: packet being corrupted
EVENT time: 81.622852, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 999999 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 5
 EVENT time: 84.193335, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 5
Expected SEQ NUM=> 5
Packet SEQ NUM=> 4
Packet ACK=> 0
Packet Msg=> eeeeeeeeeeeeeee
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 4
EVENT time: 84.245857, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 4 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 5
EVENT time: 88.722800, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...

Expected SEQ_NUM=> 5
Packet SEQ_NUM=> 5
Packet ACK=> 0
Packet Msg=> ffffffffffffffff
B: Sending ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 5
TOLAYER3: packet being lost
                          TOLAYER3: packet being lost
EVENT time: 90.503128, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 6 Packet SEQ_NUM=> 0 Packet ACK=> 0 Packet Msg=> aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaB: Resending previous ACK to A... Packet SEQ_NUM=> 0 Packet ACK=> 5
EVENT time: 91.162450, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5... ####DEBUG| DATA=> jjjjjjjjjjjjjjjj A: Sending new DATA to B... Packet SEQ NUM=> 9 Packet ACK=> 0
```

```
Packet Msg=> jjjjjjjjjjjjjjjjjj
EVENT time: 93.056001, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 4 A: Rejecting ACK from B... Waiting for new ACK 5
B: Resending previous ACK to A...

Packet SEQ NUM=> 0

Packet ACK=> 5

TOLAYER3: packet being lost
EVENT time: 99.707541, type: 2, fromlayer3 entity: 0
A: Receiving ACK from B...
Packet SEQ_NUM=> 0
Packet ACK=> 4
A: Rejecting ACK from B... Waiting for new ACK 5
EVENT time: 102.116153, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####DEBUG| DATA=> 111111111111111111
A: Sending new DATA to B...
Packet SEQ NUM=> 11
Packet ACK=> 0
Packet Msg=> 11111111111111111
EVENT time: 108.704733, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 5 A: Checking ACK from B...
```

```
EVENT time: 108.874783, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 6
Packet SEQ NUM=> 4
Packet ACK=> 0
Packet Msg=> eceeeeeeeeeeeee
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 5
TOLAYER3: packet being corrupted
EVENT time: 110.723197, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 5 A: Rejecting ACK from B... Waiting for new ACK 6
EVENT time: 112.803125, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####DEBUG| DATA=> minimum minimum min
A: Sending new DATA to B...
Packet SSQ NUM=> 12
Packet ACK=> 0
Packet Msg=> minimum minimum min
EVENT time: 114.476272, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM=> 6 Packet SEQ NUM=> 5 Packet ACK=> 0 Packet Msg=> fffffffffffffffff B: Resending previous ACK to A... Packet SEQ NUM=> 0 Packet ACK=> 5
EVENT time: 118.781030, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 5
 A: Rejecting ACK from B... Waiting for new ACK 6
EVENT time: 121.094485, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 5 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 6
```

```
A: Resending DATA to B...
Packet SEQ_NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjjj
A: Resending DATA to B...
EVENT time: 129.092715, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 5 A: Rejecting ACK from B... Waiting for new ACK 6
B: Resending previous ACK to A...

Packet SEQ NUM=> 0

Packet ACK=> 7

TOLAYER3: packet being corrupted
EVENT time: 132.239540, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 8
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 7
EVENT time: 136.813501, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 8
Packet SEQ NUM=> 5
Packet ACK=> 0
Packet Msg=> ffffffffffffffff
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 7
TOLAYER3: packet being lost
EVENT time: 146.534440, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 8
```

```
EVENT time: 148.838313, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 7 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 8
 EVENT time: 149.752495, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> qqqqqqqqqqqqqqqqqq
EVENT time: 152.335032, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 7 A: Rejecting ACK from B... Waiting for new ACK 8
EVENT time: 155.988678, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 8
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 7
EVENT time: 161.074862, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM\Longrightarrow 0 Packet ACK\Longrightarrow 7 A: Rejecting ACK from B... Waiting for new ACK 8
EVENT time: 161.968108, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 8
Packet SEQ NUM=> 10
Packet ACK=> 0
Packet Msg=> kkkkkkkkkkkkkkkkk
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 7
 EVENT time: 163.194952, type: 2, from
layer3 entity: 0 A: Receiving ACK from B...
```

```
A: Rejecting ACK from B... Waiting for new ACK 8
EVENT time: 169.296335, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM=> 0 Packet ACK=> 7
 A: Rejecting ACK from B... Waiting for new ACK 8
EVENT time: 172.704428, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 8
Packet SEQ_NUM=> 12
Packet ACK=> 0
Packet Msg=> nnumnnumnnumnnumn
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 7
TOLAYER3: packet being corrupted
EVENT time: 179.742424, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> sssssssssssssssssssss
EVENT time: 180.429090, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM\Longrightarrow 0 Packet ACK\Longrightarrow 999999 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 8
```

```
Packet ACK=> 7
 EVENT time: 184.223762, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> tttttttttttttttttttt
 EVENT time: 185.130222, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 7 A: Rejecting ACK from B... Waiting for new ACK 8
TOLAYER3: packet being lost
EVENT time: 194.677297, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 8
Packet SEQ_NUM=> 7
Packet ACK=> 0
Packet Msg=> hhhhhhhhhhhhhhhhhh
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 7
 EVENT time: 195.227515, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####[DEBUG] DATA=> uuuuuuuuuuuuuuuuuu
 EVENT time: 198.590075, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 8
 Expected SEQ NUM=> 8
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 7
TOLAYER3: packet being lost
```

```
A: Resending DATA to B...
EVENT time: 202.373119, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 7 A: Rejecting ACK from B... Waiting for new ACK 8
EVENT time: 208.307169, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 8
Packet SEQ_NUM=> 10
Packet ACK=> 0
Packet Msg=> kkkkkkkkkkkkkkkkk
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 7
TOLAYER3: packet being lost
                 TOLAYER3: packet being lost
EVENT time: 210.173742, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 8
Packet SEQ_NUM=> 11
Packet ACK=> 0
Packet Msg=> 111111111111111111
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 7
EVENT time: 210.404859, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 7 A: Rejecting ACK from B... Waiting for new ACK 8
TOLAYER3: packet being corrupted
EVENT time: 212.843837, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM=> 0 Packet ACK=> 7
A: Rejecting ACK from B... Waiting for new ACK 8
EVENT time: 213.113193, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> wwwwwwwwwwwwwwwwww
EVENT time: 216.117252, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 7 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 8
EVENT time: 219.602985, type: 0, timerinterrupt entity: 0
```

```
EVENT time: 222.198309, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 7 A: Rejecting ACK from B... Waiting for new ACK 8
EVENT time: 225.182501, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 7 A: Rejecting ACK from B... Waiting for new ACK 8
EVENT time: 225.314493, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 8
Packet SEQ NUM=> 8
Packet ACK=> 0
Packet Msg=> iiiiiiiiiiiiiiiii
B: Sending ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being corrupted
                          TOLAYER3: packet being corrupted
EVENT time: 230.471297, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being lost
 EVENT time: 234.619037, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 8
EVENT time: 237.011322, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 0
Packet SEQ_NUM=> 10
Packet ACK=> 0
Packet Msg=> kkkkkkkkkkkkkkkkk
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
```

```
EVENT time: 238.976409, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> yyyyyyyyyyyyyyyyyy
```

```
EVENT time: 248.886959, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
EVENT time: 255.556902, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 256.468184, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: Packet ACK=> 15
                      TOLAYER3: packet being lost
EVENT time: 257.676931, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 0
Packet SEQ_NUM=> 10
Packet ACK=> 0
Packet Msg=> kkkkkkkkkkkkkkkkkk
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
EVENT time: 258.153813, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 261.053499, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> aaaaaaaaaaaaaaaaaa
EVENT time: 263.923948, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM\Longrightarrow 0 Packet ACK\Longrightarrow 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 266.369518, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 0
Packet Msg=> 11111111111111111
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being corrupted
                      TOLAYER3: packet being corrupted
 EVENT time: 266.408704, type: 0, timerinterrupt entity: 0
```

```
EVENT time: 272.493423, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 0
Packet SEQ_NUM=> 12
Packet ACK=> 0
Packet Msg=> munimimimimimim
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
EVENT time: 274.250191, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM\Longrightarrow 0 Packet ACK\Longrightarrow 15 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 279.036195, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 282.487869, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> cccccccccccccccccccc
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
```

```
EVENT time: 286.452223, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> eeeeeeeeeeeeee
 EVENT time: 287.584857, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 295.676412, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 8
Packet ACK=> 0
Packet Msg=> iiiiiiiiiiiiiiiii
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being lost
 EVENT time: 296.296396, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM\Rightarrow 0 Packet ACK\Rightarrow 15 A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 299.465712, type: 2, fromlayer3 entity: 0
A: Receiving ACK from B...
Packet SEQ NUM=> 0
Packet ACK=> 15
  A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 304.919706, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM

Dacket SEQ NUM

10 Packet SEQ NUM

Packet ACK

Packet ACK

10 Packet ACK
```

```
Packet Msg=> kkkkkkkkkkkkkkkkkkkkk
 B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being lost
EVENT time: 306.408704, type: 0, timerinterrupt
A: Resending DATA to B...
Packet SEQ_NUM=> 0
Packet ACK=> 0
Packet Msg=> qqqqqqqqqqqqqqqqq
A: Resending DATA to B...
Packet Msg=> www.www.www.www.www.
A: Resending DATA to B...
Packet SEQ_NUM=> 7
Packet ACK=> 0
Packet Msg=> xxxxxxxxxxxxxxxxxxxx
TOLAYER3: packet being corrupted
B: Resending previous ACK to A...

Packet SEQ NUM=> 0

Packet ACK=> 15

TOLAYER3: packet being lost
EVENT time: 316.611591, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 0
 B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
EVENT time: 319.884732, type: 2, fromlayer3 entity: 0
A: Receiving ACK from B...
Packet SEQ NUM=> 0
Packet ACK=> 15
 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 326.408704, type: 0, timerinterrupt entity: 0 A: Resending DATA to B... Packet SEQ NUM=> 0 Packet ACK=> 0 Packet Msg=> qqqqqqqqqqqqqqqqq
```

```
Packet Msg=> fifififififififififified and solve the second of the second
  EVENT time: 329.033265, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 0
  EVENT time: 332.181433, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM=> 0 Packet ACK=> 15
    A: Rejecting ACK from B... Waiting for new ACK 0
  EVENT time: 333.913480, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 8
Packet ACK=> 0
Packet Msg=> iiiiiiiiiiiiiiiii
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being corrupted
   EVENT time: 336.670797, type: 2, fromlayer3 entity: 0
A: Receiving ACK from B...
Packet SEQ NUM=> 0
Packet ACK=> 15
A: ACK is corrupted.
A: Rejecting ACK from B... Waiting for new ACK 0
   EVENT time: 337.110508, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> hhhhhhhhhhhhhhhhhh
   EVENT time: 339.312113, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5... ####[DEBUG] DATA=> iiiiiiiiiiiiiiiiiii
  EVENT time: 342.044923, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 0
Packet SEQ_NUM=> 10
Packet ACK=> 0
Packet Msg=> kkkkkkkkkkkkkkkkkk
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
```

```
EVENT time: 346.236763, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5... ####[DEBUG] DATA=> jjjjjjjjjjjjjjjjjj
EVENT time: 347.519242, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 349.014801, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 11
Packet ACK=> 0
Packet Msg=> 11111111111111111
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
 EVENT time: 351.114841, type: 1, fromlayer5 entity: 0
 A: Receiving MSG from layer 5...
#####[DEBUG] DATA=> 1111111111111111111111
TOLAYER3: packet being lost
K=> 15
TOLAYER3: packet being lost
EVENT time: 357.522538, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
```

```
EVENT time: 359.007538, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 0
Packet SEQ_NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
EVENT time: 360.371197, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 10
Packet ACK=> 0
Packet Msg=> ?kkkkkkkkkkkkkkkk
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being corrupted
 EVENT time: 361.511612, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
 B: Resending previous ACK to A..
Packet SEQ_NUM=> 0
Packet ACK=> 15
B: Resending previous ACK to A...

Packet SEQ NUM=> 0

Packet ACK=> 15

TOLAYER3: packet being corrupted
 EVENT time: 371.298196, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B...
```

```
Packet SEQ_NUM=> 0 
Packet ACK=> 15 
A: ACK is corrupted. 
A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 375.055300, type: 2, from
layer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM
> 0 Packet SEQ_NUM
> 15
A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 381.441237, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 0
```

```
EVENT time: 391.438765, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM=> 0 Packet ACK=> 15
  A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 395.090182, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5... ####[DEBUG] DATA=> qqqqqqqqqqqqqqqqqq
 EVENT time: 396.155217, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 4
Packet ACK=> 999999
Packet Msg=> uuuuuuuuuuuuuuuuu
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
Packet ACK=> 15
TOLAYER3: packet being lost
 EVENT time: 396.334910, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 403.214087, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 5
Packet ACK=> 0
Packet Msg=> vvvvvvvvvvvvvvvvvv
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
 EVENT time: 405.235572, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
entity: 0
 EVENT time: 408.216193, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5...
```

```
####[DEBUG] DATA=> rrrrrrrrrrrrrrrrrr
 EVENT time: 409.179235, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 0
 B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
 EVENT time: 410.865810, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> sssssssssssssssssssss
EVENT time: 417.181799, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM=> 0 Packet SEQ NUM=> 999999 Packet ACK=> 0 Packet Msg=> qqqqqqqqqqqqqqq B: Resending previous ACK to A... Packet SEQ NUM=> 0 Packet ACK=> 15
EVENT time: 418.295083, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 423.140416, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
entity: 0
```

```
Packet ACK=> 0
  EVENT time: 427.209204, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 0
Packet Msg=> ?tttttttttttttttt
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
 EVENT time: 429.294809, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 429.757988, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> ttttttttttttttttttt
 EVENT time: 431.964721, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 0
 Expected SEQ NUM=> 0
Packet SEQ NUM=> 4
Packet ACK=> 0
Packet Msg=> uuuuuuuuuuuuuuuuu
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being lost
 EVENT time: 437.869564, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15
  A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 439.039521, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM\Rightarrow 0 Packet SEQ NUM\Rightarrow 5 Packet ACK\Rightarrow 0 Packet Msg\Rightarrow vvvvvvvvvvvvvvvv B: Resending previous ACK to A... Packet SEQ NUM\Rightarrow 0 Packet ACK\Rightarrow 15
 EVENT time: 440.957030, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 441.809137, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> uuuuuuuuuuuuuuuuu
```

```
EVENT time: 448.985961, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 6
Packet ACK=> 0
Packet Msg=> wwwwwwwwwwwwwww
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
Packet ACK=> 15
TOLAYER3: packet being corrupted
EVENT time: 450.611225, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 450.684713, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 0
 Expected SEQ NUM=> 0
Packet SEQ NUM=> 1
Packet ACK=> 0
Packet Msg=> ?rrrrrrrrrrrrrr
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being corrupted
EVENT time: 454.903653, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 459.634999, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####[DEBUG] DATA=> vvvvvvvvvvvvvvvvvv
EVENT time: 461.602435, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 0
 B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
```

```
EVENT time: 468.156743, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 468.725242, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5... ####[DEBUG] DATA=> wwwwwwwwwwwwwwwwwww
TOLAYER3: packet being corrupted
 EVENT time: 474.928190, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 6
Packet ACK=> 0
Packet Msg=> wwwwwwwwwwwwwww
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
EVENT time: 476.754021, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 477.079592, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 7
Packet ACK=> 0
Packet Msg=> xxxxxxxxxxxxxxxx
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being lost
EVENT time: 479.288125, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 0
Packet SEQ_NUM=> 0
Packet ACK=> 0
Packet Msg=> qqqqqqqqqqqqqqqq
B: Sending ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 2
TOLAYER3: packet being lost
EVENT time: 480.036775, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 485.864040, type: 2, fromlayer3 entity: 0
```

```
A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
entity: 0
EVENT time: 492.281869, type: 1, fromlayer5 entity: 0 Simulator terminated at time 492.281868953520
      END SIMULATION STATISTICS ==
    Messages arrived to A:
Packets sent from A:
Packets retransmitted:
Correct acks:
Corrupted packets:
                               50 \\ 191 \\ 164
```

2.4.4 Caso 3

Probabilità di corruzione o perdita di pacchetti 0.5

```
EVENT time: 9.181188, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5...  
#####DEBUG| DATA=> aaaaaaaaaaaaaaa
A: Sending new DATA to B...  
Packet SEQ NUM=> 0  
Packet ACK=> 0  
Packet MSg=> aaaaaaaaaaaaaaaaaaaaaa  
TOLAYER3: packet being corrupted
EVENT time: 14.562120, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 0
 Expected SEQ_NUM=> 0
Packet SEQ_NUM=> 0
Packet ACK=> 0
Packet Msg=> ?aaaaaaaaaaaaaaaaaaa
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
EVENT time: 23.490646, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 31.216773, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5...  
####DEBUG| DATA\Rightarrow dddddddddddddddd A: Sending new DATA to B...  
Packet SEQ NUM\Rightarrow 3  
Packet ACK\Rightarrow 0  
Packet Msg\Rightarrow ddddddddddddddddd  
TOLAYER3: packet being lost
EVENT time: 31.881375, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 34.024934, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM\Rightarrow 0 Packet SEQ NUM\Rightarrow 2 Packet ACK\Rightarrow 0 Packet ACK 0 Packet ACK 0 Packet Msg\Rightarrow ? ccccccccccccc B: Resending previous ACK to A...
```

```
EVENT time: 48.403607, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 48.481796, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 4
Packet ACK=> 0
Packet ACK=> 0
Packet Msg=> eeeeeeeeeeeeee
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being corrupted
EVENT time: 52.539384, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM=> 0 Packet ACK=> 15 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 0
```

```
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
EVENT time: 69.251381, type: 2, from
layer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM=> 0 Packet ACK=> 15
 A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 72.929991, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 0 Packet SEQ_NUM=> 4 Packet ACK=> 0 Packet Msg=> eeeeeeeeeeeeeeee B: Resending previous ACK to A... Packet SEQ_NUM=> 0 Packet ACK=> 15
```

```
\begin{array}{ll} {\tt Packet} & {\tt SEQ\_NUM}\!\!\!\!=> 0 \\ {\tt Packet} & {\tt ACK}\!\!\!\!=> 15 \end{array}
 EVENT time: 77.573992, type: 2, from
layer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15
 A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 78.770104, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####[DEBUG] DATA=> iiiiiiiiiiiiiiiiiii
 EVENT time: 82.595935, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...

Expected SEQ_NUM=> 0
Packet SEQ_NUM=> 0
Packet ACK=> 0
Packet Msg=> ?aaaaaaaaaaaaaaa
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
 EVENT time: 84.932798, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: Rejecting ACK from B... Waiting for new ACK 0
 EVENT time: 86.713126, type: 2, from
layer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM=
0 Packet ACK=
) 15
 A: Rejecting ACK from B... Waiting for new ACK 0
 B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 15
                  ₹ NUN=> 0
K=> 15
TOLAYER3: packet being corrupted
```

```
EVENT time: 91.162450, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> jjjjjjjjjjjjjjjjj
EVENT time: 93.445143, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 999999 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 94.540178, type: 2, from
layer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15
A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 94.589068, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> kkkkkkkkkkkkkkkkkk
EVENT time: 102.116153, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####[DEBUG] DATA=> 1111111111111111111111
EVENT time: 102.389325, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 7
Packet ACK=> 0
Packet Msg=> 7hhhhhhhhhhhhhhhh
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being corrupted
TOLAYER3: packet being lost
EVENT time: 105.012329, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 0
```

```
EVENT time: 115.669546, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 0
Packet SEQ NUM=> 4
Packet ACK=> 0
Packet Msg=> eceeeeeeeeeeee
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 15
TOLAYER3: packet being corrupted
EVENT time: 120.243507, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 15 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 0
EVENT time: 125.757103, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM\Rightarrow 0 Packet SEQ NUM\Rightarrow 0 Packet ACK\Rightarrow 0 Packet Msg\Rightarrow aaaaaaaaaaaaaaaaaaa B: Sending ACK to A... Packet SEQ NUM\Rightarrow 0 Packet ACK\Rightarrow 2
```

```
EVENT time: 144.530168, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 3
Packet SEQ NUM=> 3
Packet ACK=> 0
Packet Msg=> ?ddddddddddddddddd
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 2
TOLAYER3: packet being lost
EVENT time: 149.752495, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> qqqqqqqqqqqqqqqqqqq
EVENT time: 151.181707, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 3
Packet SEQ_NUM=> 4
Packet ACK=> 0
Packet Msg=> ? eeeeeeeeeeeeee
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 2
EVENT time: 155.478042, type: 0, timerinterrupt entity: 0 A: Resending DATA to B... Packet SEQ_NUM=> 3 Packet ACK=> 0 Packet Msg=> dddddddddddddddddd TOLAYER3: packet being lost A: Resending DATA to B...
```

```
EVENT time: 159.179937, type: 2, from
layer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM=> 0 Packet ACK=> 2
A: Rejecting ACK from B... Waiting for new ACK 3
EVENT time: 162.398144, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 3
Packet SEQ NUM=> 7
Packet ACK=> 0
Packet Msg=> hhhhhhhhhhhhhhhh
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 2
TOLAYER3: packet being lost
```

```
A: Resending DATA to B...

Packet SEQ NUM=> 8

Packet ACK=> 0

Packet Msg=> iiiiiiiiiiiiiiiiiii

TOLAYER3: packet being corrupted

A: Resending DATA to B...

Packet SEQ NUM=> 9

Packet ACK=> 0

Packet Msg=> jijjjjjjjjjjjjjj

TOLAYER3: packet being lost

A: Resending DATA to B...

Packet SEQ NUM=> 10

Packet SEQ NUM=> 10

Packet Msg=> kkkkkkkkkkkkkkkkkk

TOLAYER3: packet being lost
 EVENT time: 177.297037, type: 2, fromlayer3 entity: 0
A: Receiving ACK from B...
Packet SEQ NUM=> 0
Packet ACK=> 2
A: ACK is corrupted.
A: Rejecting ACK from B... Waiting for new ACK 3
EVENT time: 177.831812, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 3
Packet SEQ_NUM=> 4
Packet ACK=> 0
Packet Msg=> eeeeeeeeeeeeeeee
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 2
TOLAYER3: packet being corrupted
                                   TOLAYER3: packet being corrupted
EVENT time: 179.698386, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 2 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 3
 EVENT time: 179.742424, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####[DEBUG] DATA=> ssssssssssssssssssss
EVENT time: 179.850276, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 3
Packet SEQ NUM=> 5
Packet ACK=> 0
Packet Msg=> ?ffffffffffffffff
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 2
TOLAYER3: packet being corrupted
EVENT time: 180.913175, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM\Longrightarrow 0 Packet ACK\Longrightarrow 999999 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 3
 EVENT time: 184.223762, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5... ####[DEBUG] DATA=> ttttttttttttttttttt
EVENT time: 187.908109, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 3
Packet SEQ NUM=> 6
Packet ACK=> 0
Packet Msg=> ?gggggggggggggggggggggggggggggggg:
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 2
TOLAYER3: packet being lost
 EVENT time: 195.227515, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5...
```

```
####|DEBUG| DATA=> uuuuuuuuuuuuuuuuu
EVENT time: 197.797082, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 3
TOLAYER3: packet being corrupted
B: Resending previous ACK to A...

Packet SEQ NUM=> 0

Packet ACK=> 2

TOLAYER3: packet being lost
EVENT time: 201.244911, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 2 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 3
EVENT time: 206.023499, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 3 Packet SEQ_NUM=> 6
```

```
EVENT time: 213.113193, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> wwwwwwwwwwwwwwwwww
 EVENT time: 214.461470, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 3
Packet SEQ_NUM=> 9
Packet ACK=> 999999
Packet ACK=> 999999
Packet Msg=> jjjjjjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 2
 EVENT time: 214.763329, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 2 A: Rejecting ACK from B... Waiting for new ACK 3
entity: 0
 Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjjjjj
TOLAYER3: packet being lost
A: Resending DATA to B...
Packet SQD_NUM=> 10
Packet ACK=> 0
Packet Msg=> kkkkkkkkkkkkkkkk
TOLAYER3: packet being corrupted
 EVENT time: 216.883419, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 2 A: Rejecting ACK from B... Waiting for new ACK 3
 EVENT time: 223.711081, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 3
Packet SEQ NUM=> 3
Packet ACK=> 0
Packet Msg=> ?dddddddddddddddddd
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 2
TOLAYER3: packet being computed
                             TOLAYER3: packet being corrupted
 EVENT time: 227.996368, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 3
Packet SEQ NUM=> 999999
Packet ACK=> 0
Packet Msg=> eeeeeeeeeeeeeee
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 2
```

TOLAYER3: packet being lost EVENT time: 228.899197, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 2 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 3 EVENT time: 229.307016, type: 2, from layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 3 Expected SEQ_NUM=> 3 Packet SEQ_NUM=> 5 Packet ACK=> 0 Packet Msg=> ?ffffffffffffffff B: Resending previous ACK to A... Packet SEQ_NUM=> 0 Packet ACK=> 2 TOLAYER3: packet being lost EVENT time: 231.909146, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM=> 3 Packet SEQ NUM=> 7 Packet ACK=> 0 Packet Msg=> hhhhhhhhhhhhhhhhhh B: Resending previous ACK to A... Packet SEQ NUM=> 0 Packet ACK=> 2 Packet ACK=> 2 TOLAYER3: packet being lost EVENT time: 238.976409, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5... ####[DEBUG] DATA=> yyyyyyyyyyyyyyyyyyy EVENT time: 241.626240, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM=> 3 Packet SEQ NUM=> 8 Packet ACK=> 0 Packet Msg=> ? iiiiiiiiiiiiiiiii B: Resending previous ACK to A... Packet SEQ NUM=> 0 Packet ACK=> 2 TOLAYER3: packet being lost

TOLAYER3: packet being lost

```
EVENT time: 253.799860, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> zzzzzzzzzzzzzzzzzz
EVENT time: 254.358287, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 3
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> ?jjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 2
TOLAYER3: packet being lost
EVENT time: 256.361644, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 3
Packet SEQ NUM=> 10
Packet ACK=> 0
Packet ACK=> 0
Packet Msg=> kkkkkkkkkkkkkkkk
B: Resending previous ACK to A...
Packet SCQ NUM=> 0
Packet ACK=> 2
TOLAYER3: packet being corrupted
 EVENT time: 261.053499, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> aaaaaaaaaaaaaaaaaaa
 EVENT time: 264.111026, type: 2, fromlayer3 entity: 0
A: Receiving ACK from B...
Packet SEQ NUM=> 999999
Packet ACK=> 2
A: ACK is corrupted.
A: Rejecting ACK from B... Waiting for new ACK 3
EVENT time: 264.988311, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 3 Packet SEQ_NUM=> 3
```

```
Packet ACK=> 0
Packet Msg=> dddddddddddddddddd
B: Sending ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 4
                                                        TOLAYER3: packet being lost
   EVENT time: 270.145116, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM\Rightarrow 5 Packet SEQ NUM\Rightarrow 5 Packet ACK\Rightarrow 0 Packet Msg\Rightarrow ffffffffffffffff B: Sending ACK to A... Packet SEQ NUM\Rightarrow 0 Packet ACK\Rightarrow 0 Packet ACK\Rightarrow 0 Packet SEQ NUM\Rightarrow 0 Packet ACK\Rightarrow 7

← 7

TOLAYER3: packet being lost

TOLAYE
    EVENT time: 282.336344, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 8
Packet SEQ NUM=> 10
Packet ACK=> 0
Packet Msg=> ?kkkkkkkkkkkkkkkkkk
     B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 7
                                                      TOLAYER3: packet being lost
    EVENT time: 282.487869, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> cccccccccccccccccccc
    EVENT time: 283.681600, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM\Rightarrow 8 Packet SEQ NUM\Rightarrow 3 Packet ACK\Rightarrow 0 Packet Msg\Rightarrow ?ddddddddddddddddddd
     B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 7
TOLAYER3: packet being lost
    EVENT time: 285.729545, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5...
```

```
####[DEBUG] DATA=> ddddddddddddddddddd
     EVENT time: 286.452223, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> eeeeeeeeeeeeeee
    EVENT time: 289.782983, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 8
Packet SEQ_NUM=> 4
Packet ACK=> 0
Packet Msg=> ? eeeeeeeeeeeeee
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 7
EVENT time: 297.507645, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 8
Packet SEQ NUM=> 7
Packet ACK=> 0
Packet Msg=> ?hhhhhhhhhhhhhhhh
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 7
TOLAYER3: packet being lost
    EVENT time: 297.814722, type: 2, fromlayer3 entity: 0
A: Receiving ACK from B...
Packet SEQ_NUM=> 0
Packet ACK=> 7
A: Rejecting ACK from Section ACK from Secti
      A: Rejecting ACK from B... Waiting for new ACK 8
     B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 7
TOLAYER3: packet being lost
     EVENT time: 305.988678, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A...
```

```
EVENT time: 314.681265, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 8
Packet SEQ_NUM=> 7
Packet ACK=> 0
Packet Msg=> hhhhhhhhhhhhhhhhh
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 7
 EVENT time: 317.120243, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 7 A: Rejecting ACK from B... Waiting for new ACK 8
 EVENT time: 320.805170, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 8
Packet SEQ NUM=> 8
Packet ACK=> 0
Packet Msg=> iiiiiiiiiiiiiiiiii
B: Sending ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 8
Packet ACK=> 8
TOLAYER3: packet being lost
 TOLAYER3: packet being corrupted
```

```
EVENT time: 331.442610, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM\Rightarrow 0 Packet ACK\Rightarrow 8 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 8
 EVENT time: 332.157018, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 9
Packet SEQ_NUM=> 14
Packet ACK=> 0
Packet Msg=> ?ooooooooooooooo
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 8
EVENT time: 337.110508, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> hhhhhhhhhhhhhhhhhh
 EVENT time: 339.312113, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####[DEBUG] DATA=> iiiiiiiiiiiiiiiiiiii
 \stackrel{\longleftarrow}{\mathrm{N=>}} 8
TOLAYER3: packet being lost
 EVENT time: 343.964812, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM=> 9 Packet SEQ NUM=> 8 Packet SEQ NUM=> 8 Packet ACK=> 0
```

```
Packet Msg=> iiiiiiiiiiiiiiiiiii
 B: Resending previous ACK to A...

Packet SEQ NUM=> 0

Packet ACK=> 8

TOLAYER3: packet being corrupted
 EVENT time: 346.236763, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####[DEBUG] DATA=> jjjjjjjjjjjjjjjjj
EVENT time: 348.632435, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM=> 0 Packet ACK=> 8 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 9
EVENT time: 350.655232, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5... ####[DEBUG] DATA=> kkkkkkkkkkkkkkkkkk
EVENT time: 353.208106, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM\Rightarrow 9 Packet SEQ_NUM\Rightarrow 10 Packet ACK\Rightarrow 0 Packet Msg\Rightarrow ?kkkkkkkkkkkkkkkkk
 B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 8
TOLAYER3: packet being lost
EVENT time: 361.475265, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5... ####[DEBUG] DATA=> mmnnmmnnmmnnmmnmmn
```

```
EVENT time: 367.595782, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 9
Packet SEQ NUM=> 10
Packet ACK=> 0
Packet Msg=> kkkkkkkkkkkkkkkkk
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 8
 EVENT time: 374.448927, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ_NUM\Longrightarrow 0 Packet ACK\Longrightarrow 8 A: Rejecting ACK from B... Waiting for new ACK 9
 EVENT time: 375.949705, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 9
Packet SEQ NUM=> 12
Packet ACK=> 0
Packet ACK=> 0
Packet Msg=> nummnummnummn
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 8
TOLAYER3: packet being lost
  EVENT time: 378.933897, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 9
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjjj
B: Sending ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 10
```

TOLAYER3: packet being corrupted EVENT time: 384.209723, type: 1, from layer5 entity: 0 A: Receiving MSG from layer 5... ####[DEBUG] DATA=> ooooooooooooooooooo EVENT time: 385.186071, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM=> 11 Packet SEQ NUM=> 10 Packet ACK=> 0 Packet Msg=> kkkkkkkkkkkkkkkkk B: Resending previous ACK to A... Packet SEQ NUM=> 0 Packet ACK=> 10 TOLAYER3: packet being lost EVENT time: 386.407239, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM \Longrightarrow 0 Packet ACK \Longrightarrow 10 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 9 EVENT time: 395.090182, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5... ####[DEBUG] DATA=> qqqqqqqqqqqqqqqqqq entity: 0 EVENT time: 400.287393, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM=> 11 Packet SEQ NUM=> 0 Packet ACK=> 0 Packet Msg=> qqqqqqqqqqqqqqqq B: Sending ACK to A...

```
EVENT time: 401.538438, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 4
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> ?jjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
Packet ACK=> 3
TOLAYER3: packet being lost
  EVENT time: 410.842982, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 4
Packet SEQ_NUM=> 10
Packet ACK=> 0
Packet Msg=> ?kkkkkkkkkkkkkkk
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being lost
                         TOLAYER3: packet being lost
  EVENT time: 410.865810, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> ssssssssssssssssssss
EVENT time: 420.240364, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 4
Packet SEQ_NUM=> 12
Packet ACK=> 0
Packet Msg=> mmmmmmmmmmmmm
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being lost
                         \stackrel{\longleftarrow}{\mathrm{N=>}} 3
TOLAYER3: packet being lost
  EVENT time: 424.314432, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ NUM
 = 4 Packet SEQ NUM
 = 13 Packet ACK
 = 0
```

```
Packet Msg=> ?nnnnnnnnnnnnnnnnn
  B: Resending previous ACK to A...

Packet SEQ NUM=> 0

Packet ACK=> 3

TOLAYER3: packet being lost
 EVENT time: 427.908048, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM\Rightarrow 0 Packet ACK\Rightarrow 3 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 9
 EVENT time: 428.738639, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 4
 Expected SEQ NUM=> 4
Packet SEQ NUM=> 0
Packet ACK=> 0
Packet Msg=> ?qqqqqqqqqqqqqqqq
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being lost
 EVENT time: 429.757988, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> ttttttttttttttttttt
 EVENT time: 436.710227, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 4
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
 EVENT time: 438.233741, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 4
Packet SEQ_NUM=> 10
Packet ACK=> 0
Packet Msg=> kkkkkkkkkkkkkkkkk
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being lost
TOLAYER3: packet being lost
```

```
EVENT time: 440.711997, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 4
Packet SEQ_NUM=> 11
Packet ACK=> 999999
Packet Msg=> 111111111111111111
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 3

TOLAYER3: packet being lost
 EVENT time: 440.908994, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 3 A: Rejecting ACK from B... Waiting for new ACK 9
 EVENT time: 441.809137, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> uuuuuuuuuuuuuuuuu
 EVENT time: 456.672750, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 4
Packet SEQ NUM=> 12
Packet ACK=> 0
Packet Msg=> nummnummnummnummmm
B: Resending previous ACK to A
  B: Resending previous ACK to A..
Packet SEQ_NUM=> 0
Packet ACK=> 3
 EVENT time: 456.955931, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 3 A: Rejecting ACK from B... Waiting for new ACK 9
```

```
A: Resending DATA to B...
A: Resending DATA to b...

Packet SEQ_NUM=> 0

Packet ACK=> 0

Packet Msg=> qqqqqqqqqqqqqqqq

TOLAYER3: packet being corrupted
EVENT time: 459.634999, type: 1, fromlayer5 entity: 0 A: Receiving MSG from layer 5... ####[DEBUG] DATA=> vvvvvvvvvvvvvvvvvvv
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 3
event time: 465.667470, type: 2, fromlayer3 entity: 0
A: Receiving ACK from B...
Packet SEQ NUM=> 0
Packet ACK=> 3
A: Reject
A: Rejecting ACK from B... Waiting for new ACK 9
EVENT time: 467.905942, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 3 A: Rejecting ACK from B... Waiting for new ACK 9
EVENT time: 468.410504, type: 2, fromlayer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 4
EVENT time: 468.725242, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> wwwwwwwwwwwwwwwww
EVENT time: 470.561907, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 3 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 9
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being corrupted
```

```
EVENT time: 478.249763, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 3 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 9
 EVENT time: 491.328166, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 4
Packet SEQ NUM=> 0
Packet ACK=> 0
Packet ACK=> 0
Packet Msg=>?qaqqqqqqqqqqqqq
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
Packet ACK=> 3
TOLAYER3: packet being lost
 EVENT time: 492.281869, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####[DEBUG] DATA=> yyyyyyyyyyyyyyyyyy
 EVENT time: 492.596026, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 3 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 9
EVENT time: 497.156804, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 4
Packet SEQ_NUM=> 10
Packet ACK=> 0
Packet Msg=> ?kkkkkkkkkkkkkkkk
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being lost
                               TOLAYER3: packet being lost
EVENT time: 498.238075, type: 0, timerinterrupt entity: 0
A: Resending DATA to B...
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjj
A: Resending DATA to B...
Packet SEQ NUM=> 10
Packet ACK=> 0
Packet Msg=> kkkkkkkkkkkkkkkk
TOLAYER3: packet being corrupted
A: Resending DATA to B...
Packet SEQ_NUM=> 11
```

```
EVENT time: 501.912320, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 4
Packet SEQ NUM=> 1
Packet ACK=> 0
Packet Msg=> 11111111111111111
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
EVENT time: 505.060488, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 3 A: Rejecting ACK from B... Waiting for new ACK 9
EVENT time: 510.593585, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> zzzzzzzzzzzzzzzzzz
```

```
K=> 3
TOLAYER3: packet being lost
EVENT time: 523.719565, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 4
Packet SEQ NUM=> 0
Packet ACK=> 0
Packet ACK=> 0
Packet Msg=> qqqqqqqqqqqqqqq
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being corrupted
EVENT time: 525.418317, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 4
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> ? jjjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being lost
B: Resending previous ACK to A...

Packet SEQ NUM=> 0

Packet ACK=> 3

TOLAYER3: packet being corrupted
EVENT time: 530.508744, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> aaaaaaaaaaaaaaaaaaa
EVENT time: 532.596179, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 3 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 9
EVENT time: 535.960234, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 3 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 9
EVENT time: 538.238075, type: 0, timerinterrupt entity: 0
A: Resending DATA to B...
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjj
A: Resending DATA to B...
Packet SEQ NUM=> 10
Packet ACK=> 0
Packet Msg=> kkkkkkkkkkkkkkk

TOLAYER3: packet being lost
A: Resending DATA to B...
Packet SEQ_NUM=> 11
```

```
EVENT time: 539.733482, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 3 A: Rejecting ACK from B... Waiting for new ACK 9
 EVENT time: 547.423322, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 4
Packet SEQ NUM=> 99999
Packet ACK=> 0
Packet Msg=> qqqqqqqqqqqqqqqqq
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
Packet ACK=> 3
TOLAYER3: packet being lost
EVENT time: 549.631855, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 4
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being lost
                       TOLAYER3: packet being lost
EVENT time: 557.155461, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...

Expected SEQ NUM=> 4
Packet SEQ NUM=> 10
Packet ACK=> 0
Packet Msg=> ?kkkkkkkkkkkkkkkk
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being lost
 EVENT time: 557.962584, type: 1, fromlayer5 entity: 0
A: Receiving MSG from layer 5...
####[DEBUG] DATA=> ccccccccccccccccc
entity: 0
```

```
A: Resending DATA to B...
EVENT time: 566.619587, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ_NUM=> 4
Packet SEQ_NUM=> 11
Packet ACK=> 0
Packet Msg=> 11111111111111111
B: Resending previous ACK to A...
Packet SEQ_NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being corrupted
              TOLAYER3: packet being corrupted
EVENT time: 572.523759, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 3 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 9
EVENT time: 575.875118, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5...  
####[DEBUG] DATA=> eeeeeeeeeeeeeee
```

```
\stackrel{\longleftarrow}{\text{N=}}>3 TOLAYER3: packet being lost
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being lost
EVENT time: 587.005097, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 4
Packet SEQ NUM=> 0
Packet ACK=> 0
Packet ACK=> 0
Packet Msg=> qqqqqqqqqqqqqqqq
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being corrupted
EVENT time: 588.922758\,, type: 2, from
layer3 entity: 1 B: Receiving DATA from A... Expected SEQ_NUM=> 4
Expected SEQ NUM=> 9
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjjj
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
TOLAYER3: packet being lost
EVENT time: 590.575274, type: 1, from
layer5 entity: 0 A: Receiving MSG from layer 5... ####[DEBUG] DATA=> hhhhhhhhhhhhhhhhhhhhh
EVENT time: 594.940977, type: 2, fromlayer3 entity: 0 A: Receiving ACK from B... Packet SEQ NUM=> 0 Packet ACK=> 3 A: ACK is corrupted. A: Rejecting ACK from B... Waiting for new ACK 9
EVENT time: 596.481521, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 4
Packet SEQ NUM=> 10
Packet ACK=> 0
Packet Msg=> ?kkkkkkkkkkkkkkkkkk
B: Resending previous ACK to A...

Packet SEQ NUM=> 0

Packet ACK=> 3

TOLAYER3: packet being lost
EVENT time: 598.238075, type: 0, timerinterrupt entity: 0
A: Resending DATA to B...
Packet SEQ NUM=> 9
Packet ACK=> 0
Packet Msg=> jjjjjjjjjjjjjjjj
TOLAYER3: packet being lost
A: Resending DATA to B...
```

```
EVENT time: 604.876370, type: 2, fromlayer3 entity: 1
B: Receiving DATA from A...
Expected SEQ NUM=> 4
Packet SEQ NUM=> 12
Packet ACK=> 0
Packet Msg=> numnumumumumum
B: Resending previous ACK to A...
Packet SEQ NUM=> 0
Packet ACK=> 3
Packet ACK=> 3
TOLAYER3: packet being lost
EVENT time: 607.538072, type: 1, fromlayer5 entity: 0 Simulator terminated at time 607.538071840571
           END SIMULATION STATISTICS
       Messages arrived to A:
Packets sent from A:
Packets retransmitted:
Correct acks:
Corrupted packets:
                                                    60 |
232 |
215
19
78
```