

Networks Project Report

TA:

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Team Name:

Triple A

Team Members:

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Pseudocode for sender:

```
1
2
3
4 [Class] RDTSender:
5     [Attribute] sequence = '0'
6     [Attribute] net_srv
7
8     [Method] Constructor(net_srv):
9         initialize net_srv
10
11     [Method] get_checksum(data):
12         return ASCII code of data
13
14     [Method] clone_packet(packet):
15         pkt_clone = copy of packet
16         return pkt_clone
17
18     [Method] is_corrupted(reply):
19         return True if reply's checksum not equal ASCII code of reply's ack else False
20
21     [Method] is_expected_seq(reply, exp_seq):
22         return True if reply's ack equals exp_seq else False
23
24     [Method] make_pkt(seq, data, checksum):
25         packet = {sequence_number: seq, data: data, checksum: checksum}
26         return packet
27
28     [Method] rdt_send(process_buffer):
29         for each character in process_buffer:
30             checksum = get_checksum(character)
31             pkt = make_pkt(sequence, character, checksum)
32             cloned_pkt = clone_packet(pkt)
33             reply = net_srv.udt_send(pkt)
34
35             while reply is corrupted or reply's sequence is not as expected:
36                 pkt = clone_packet(cloned_pkt)
37                 reply = net_srv.udt_send(pkt)
38
39             update sequence
40
41             print 'Sender Done!'
42
43
44
45
46
```

Pseudocode for receiver:

```

1 [Class] RDTRceiver:
2     [Attribute] sequence = '0'
3
4     [Method] Constructor():
5         Initialize sequence to '0'
6
7     [Method] is_corrupted(packet):
8         Return True if packet's checksum is not equal to ASCII code of packet's data, else return False
9
10    [Method] is_expected_seq(rcv_pkt, exp_seq):
11        Return True if rcv_pkt's sequence number equals exp_seq, else return False
12
13    [Method] make_reply_pkt(seq, checksum):
14        Create and return a reply packet with ack = seq and checksum = checksum
15
16    [Method] rdt_rcv(rcv_pkt):
17        If the received packet is not corrupted and has the expected sequence number:
18            Create a reply packet with the current sequence and its ASCII code as checksum
19            Update the sequence number
20            Deliver the received data to the ReceiverProcess in the application layer
21        Else:
22            Create a reply packet with the opposite sequence number and its ASCII code as checksum
23
24        Return the reply packet
25
26

```

Test Cases:

Message 1: 'Hello Everyone' (With rel=0.3)

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
● (base) PS C:\Users\lgchehata\Desktop\GUC\Sem 5\Networks\Project\Milestone 1\Solution\Networks> py main.py msg='Hello Everyone' rel=0.3 delay=0 debug=0
{'msg': 'Hello Everyone', 'rel': '0.3', 'delay': '0', 'debug': '0'}
Sender is sending: Hello Everyone
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 'H', 'checksum': 72}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': '_', 'checksum': 72}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '4'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'b', 'checksum': 72}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '7'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'H', 'checksum': 62}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '9'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'H', 'checksum': 55}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '4'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'H', 'checksum': 49}
Expected Sequence: 0
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': '5', 'checksum': 72}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '\x03', 'checksum': 49}
Packet Sent
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
network layer receiver Packet Corrupted {'ack': '\x08', 'checksum': 48}
Packet Sent
network layer render Packet corrupted {'sequence_number': '5', 'data': 'H', 'checksum': 72}
Expected Sequence: 1
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'e', 'checksum': 101}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '1', 'data': '8', 'checksum': 101}

```

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
network layer receiver Packet Corrupted {'ack': '0', 'checksum': '8'}
Packet Sent
Expected Sequence: 1
receiver reply with ack: 1 and checksum: 49
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 'l', 'checksum': 108}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'l', 'checksum': 108}
Expected Sequence: 0
Packet Sent
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'l', 'checksum': 108}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '1', 'data': 'z', 'checksum': 108}
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '\x03', 'checksum': 48}
Packet Sent
Expected Sequence: 1
receiver reply with ack: 1 and checksum: 49
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 'o', 'checksum': 111}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'o', 'checksum': 111}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '9'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '8', 'data': 'o', 'checksum': 111}
Expected Sequence: 0
Packet Sent
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': ' ', 'checksum': 32}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '1', 'data': 'D', 'checksum': 32}
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '0', 'checksum': '2'}
Packet Sent
Expected Sequence: 1
```

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
Expected Sequence: 1
receiver reply with ack: 1 and checksum: 49
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 'E', 'checksum': 69}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'm', 'checksum': 69}
Expected Sequence: 0
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'E', 'checksum': 79}
Expected Sequence: 0
Packet Sent
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
network layer receiver Packet Corrupted {'ack': '\x08', 'checksum': 48}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '6', 'data': 'E', 'checksum': 69}
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '\x08', 'checksum': 48}
Packet Sent
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '0', 'checksum': '7'}
Packet Sent
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '\x03', 'checksum': 48}
Packet Sent
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '\x06', 'checksum': 48}
Packet Sent
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '0', 'checksum': '7'}
Packet Sent
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '0', 'checksum': '9'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'f', 'checksum': 69}
Expected Sequence: 1
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'v', 'checksum': 118}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '1', 'data': 'd', 'checksum': 118}
Expected Sequence: 1
```

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
network layer receiver Packet Corrupted {'ack': '\x08', 'checksum': 48}
Packet Sent
Expected Sequence: 1
reciever reply with ack: 1 and checksum: 49
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '9'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '1', 'data': 'Q', 'checksum': 118}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '\x05', 'checksum': 49}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '1', 'data': 'M', 'checksum': 118}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '6'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '1', 'data': '|', 'checksum': 118}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '5'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '9', 'data': 'v', 'checksum': 118}
Expected Sequence: 0
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 'e', 'checksum': 101}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '7', 'data': 'e', 'checksum': 101}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '8'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'e', 'checksum': 119}
Expected Sequence: 0
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'e', 'checksum': 81}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '\x07', 'checksum': 49}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'p', 'checksum': 101}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '4'}
Packet Sent
Expected Sequence: 0
reciever reply with ack: 0 and checksum: 48
network layer receiver Packet Corrupted {'ack': '0', 'checksum': '5'}

```

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'e', 'checksum': 56}
Expected Sequence: 1
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'r', 'checksum': 114}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '1', 'data': 'r', 'checksum': 115}
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '0', 'checksum': '3'}
Packet Sent
Expected Sequence: 1
reciever reply with ack: 1 and checksum: 49
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 'y', 'checksum': 121}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '3', 'data': 'y', 'checksum': 121}
Expected Sequence: 0
Packet Sent
network layer render Packet Corrupted {'sequence_number': '4', 'data': 'y', 'checksum': 121}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '3'}
Packet Sent
Expected Sequence: 0
reciever reply with ack: 0 and checksum: 48
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'o', 'checksum': 111}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '1', 'data': 'o', 'checksum': 61}
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '\x08', 'checksum': 48}
Packet Sent
Expected Sequence: 1
reciever reply with ack: 1 and checksum: 49
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '2'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '9', 'data': 'o', 'checksum': 111}
Expected Sequence: 0
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 'n', 'checksum': 110}
Packet Sent
Expected Sequence: 0

```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS

powershell + - [] ... ^ x

```
reciever reply with ack: 0 and checksum: 48
network layer receiver Packet Corrupted {'ack': '0', 'checksum': '5'}
Packet Sent
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '\x03', 'checksum': 48}
Packet Sent
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '0', 'checksum': '6'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'n', 'checksum': 64}
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '0', 'checksum': '8'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'R', 'checksum': 110}
Expected Sequence: 1
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'e', 'checksum': 101}
Packet Sent
Expected Sequence: 1
reciever reply with ack: 1 and checksum: 49
network layer receiver Packet Corrupted {'ack': '\x04', 'checksum': 49}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '1', 'data': 'e', 'checksum': 53}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '\x06', 'checksum': 49}
Packet Sent
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '2'}
Packet Sent
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '3'}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '1', 'data': 'e', 'checksum': 91}
Expected Sequence: 0
Sender Done!
Receiver received: ['H', 'e', 'l', 'l', 'o', ' ', ' ', 'E', 'v', 'e', 'n', 'y', 'o', 'n', 'e']
```

Message 2: 'I am a GUC Student' (With rel=0.8)

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS powershell + - [ ] [ ] ... ^ x
• (base) PS C:\Users\gcchata\Desktop\GUC\Sem 5\Networks\Project\Milestone 1\Solution\Networks> py main.py msg='I am a GUC Student' rel=0.8 delay=0 debug=0
{'msg': 'I am a GUC Student', 'rel': '0.8', 'delay': '0', 'debug': '0'}
Sender is sending: I am a GUC Student
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 'I', 'checksum': 73}
Packet Sent
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': ' ', 'checksum': 32}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '4', 'data': ' ', 'checksum': 32}
Expected Sequence: 1
network layer receiver Packet Corrupted {'ack': '\x04', 'checksum': 48}
Packet Sent
Expected Sequence: 1
receiver reply with ack: 1 and checksum: 49
network layer receiver Packet Corrupted {'ack': '\x08', 'checksum': 49}
Packet Sent
Expected Sequence: 0
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 'a', 'checksum': 97}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'a', 'checksum': 60}
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '\x08', 'checksum': 49}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': '5', 'checksum': 97}
Expected Sequence: 0
Packet Sent
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'm', 'checksum': 109}
Packet Sent
Expected Sequence: 1
receiver reply with ack: 1 and checksum: 49
network layer receiver Packet Corrupted {'ack': '1', 'checksum': '2'}
Packet Sent
Expected Sequence: 0
network layer receiver Packet Corrupted {'ack': '\t', 'checksum': 49}
```

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS powershell + - [ ] [ ] ... ^ x
network layer receiver Packet Corrupted {'ack': '\t', 'checksum': 49}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '1', 'data': 'm', 'checksum': 109}
Expected Sequence: 0
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': ' ', 'checksum': 32}
Packet Sent
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
network layer receiver Packet Corrupted {'ack': '\x02', 'checksum': 48}
Packet Sent
Expected Sequence: 1
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'a', 'checksum': 97}
Packet Sent
Expected Sequence: 1
receiver reply with ack: 1 and checksum: 49
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': ' ', 'checksum': 32}
Packet Sent
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'G', 'checksum': 71}
Packet Sent
Expected Sequence: 1
receiver reply with ack: 1 and checksum: 49
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 'U', 'checksum': 85}
Packet Sent
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'C', 'checksum': 67}
Packet Sent
Expected Sequence: 1
receiver reply with ack: 1 and checksum: 49
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': ' ', 'checksum': 32}
Packet Sent
Expected Sequence: 0
```

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'S', 'checksum': 83}
Packet Sent
Expected Sequence: 1
receiver reply with ack: 1 and checksum: 49
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 't', 'checksum': 116}
Packet Sent
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'u', 'checksum': 117}
Packet Sent
Expected Sequence: 1
receiver reply with ack: 1 and checksum: 49
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 'd', 'checksum': 100}
Packet Sent
network layer render Packet Corrupted {'sequence_number': '0', 'data': 'd', 'checksum': 100}
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 'e', 'checksum': 101}
Packet Sent
Expected Sequence: 1
receiver reply with ack: 1 and checksum: 49
sender expected sequence: 0
sender sending packet: {'sequence_number': '0', 'data': 'n', 'checksum': 110}
Packet Sent
Expected Sequence: 0
receiver reply with ack: 0 and checksum: 48
sender expected sequence: 1
sender sending packet: {'sequence_number': '1', 'data': 't', 'checksum': 116}
Packet Sent
Expected Sequence: 1
receiver reply with ack: 1 and checksum: 49
Sender Done!
Receiver received: ['I', ' ', ' ', 'a', 'm', ' ', ' ', 'a', ' ', ' ', 'g', 'u', 'c', ' ', ' ', 's', 't', 'u', 'd', 'e', 'n', 't']
```

Contribution:

The project was split evenly among all 3 members of the team. We worked on the code together by using vscode live share extension (which allows all of us to make changes to all project file simultaneously) and the report was evenly distributed among us.

Changes Made to Skeleton Code:

Sender side:

- 1. Added get_checksum Body, that calculates the checksum using “ord()”
- 2. Added is_corrupted Body, that checks whether or not the reply packet is corrupted by comparing the “checksum” value inside of “Reply” packet with the value of calculating the checksum by using “ord()”. If they are equal then the reply packet is *not* Corrupted, otherwise it is corrupted

3. Added `is_expected_seq` Body, that compares the expected sequence number (from the function input) with the “acknowledgement” from the reply packet, if they are equal, then the function returns true, otherwise false.
4. Added `rdt_send` Body, which is responsible for sending the sender packet. This function calls all other functions implemented previously, by basically checking if the reply packet is corrupted or has an unexpected sequence number, if any of those conditions are true the sender clones the packet and resends it again, until it receives the correct acknowledgement from the receiver.

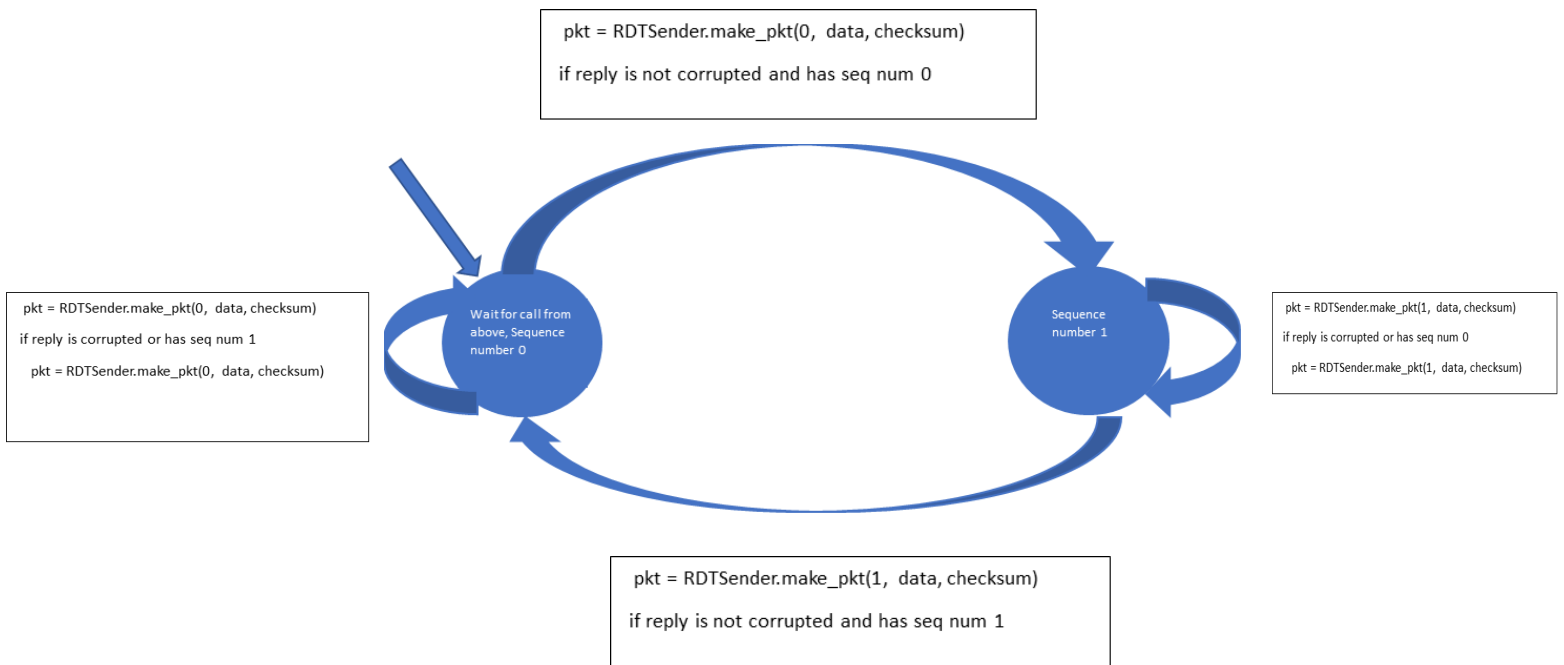
Receiver Side:

1. `is_corrupted` Method:
 - Placeholder ``pass`` replaced with logic to check packet integrity.
 - Compares packet checksum to ASCII value of its data for corruption detection.
2. `is_expected_seq` Method:
 - Placeholder ``pass`` replaced with logic to verify received sequence number.
 - Compares received packet's sequence number with expected sequence number.
3. `rdt_rcv` Method:
 - Print statement added to display the expected sequence number.
 - Logic added to check packet corruption and verify sequence number.
 - If packet isn't corrupted and has the expected sequence number:
 - Displays acknowledgment and checksum information.
 - Creates a reply packet with sequence and its ASCII value as checksum.
 - Updates receiver's sequence to the opposite value ('0' if '1', and vice versa).
 - Delivers data to the application layer.
 - If packet is corrupted or doesn't match the expected sequence number:
 - Creates a reply packet with acknowledgment and checksum of '0' if current sequence is '1', or '1' if current sequence is '0'.

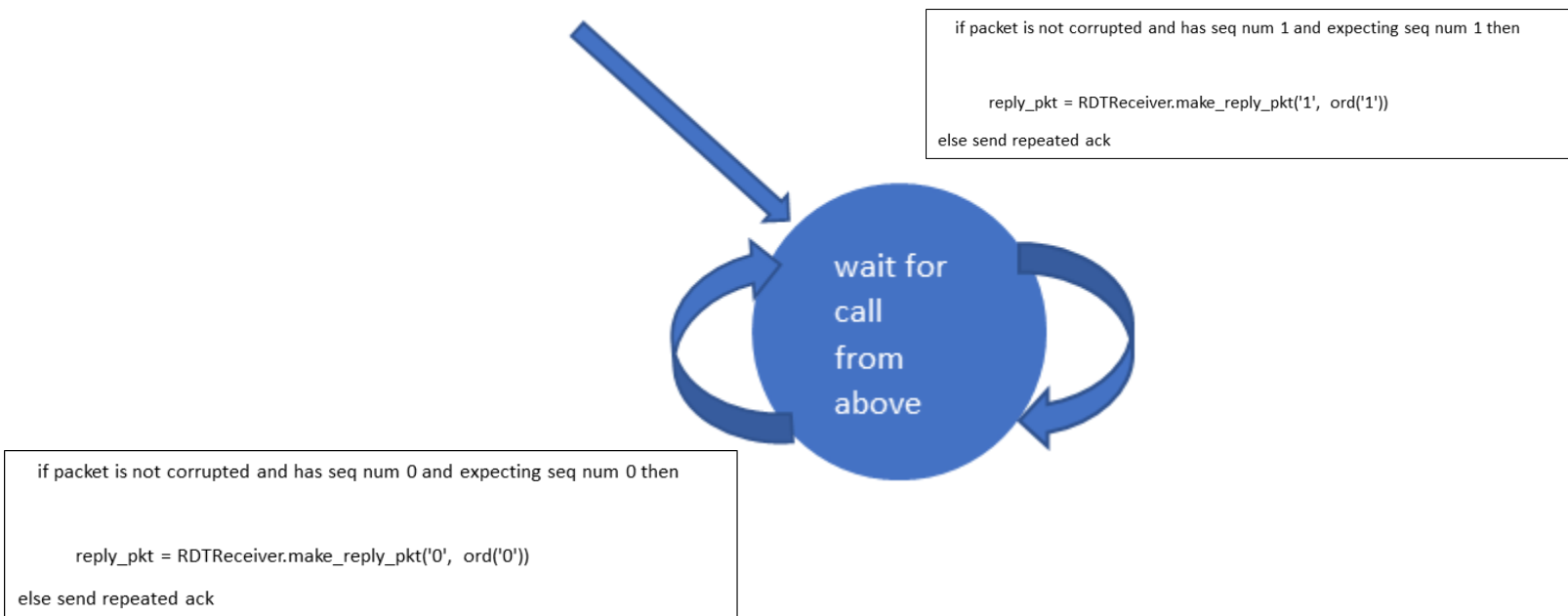
Note Regarding Network Layer:

No Changes were made to the Network Layer.

State Diagrams:



Sender Side



Receiver Side