Reliable UDP echo server

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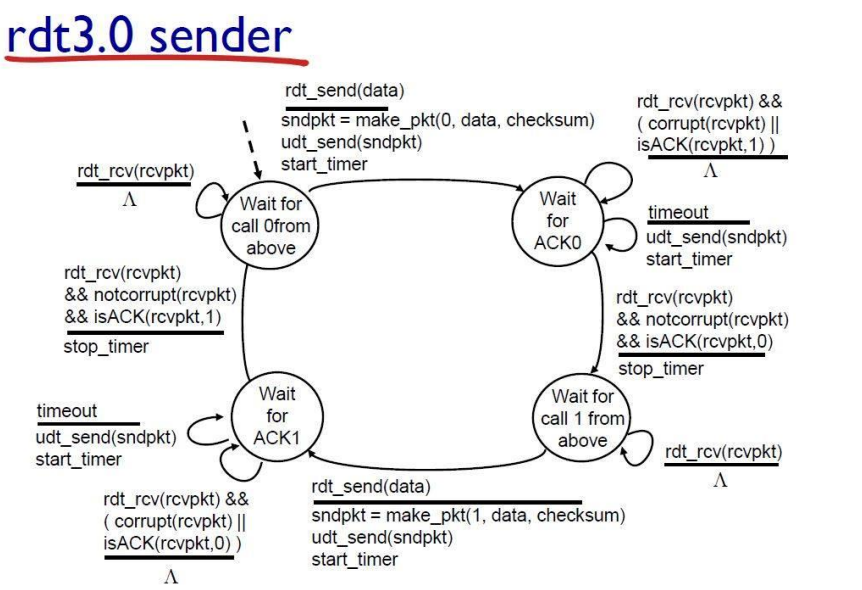
Protocol:

In order to make our UDP echo server connection more reliable and stateful like TCP, we had to implement some features in our application layer.

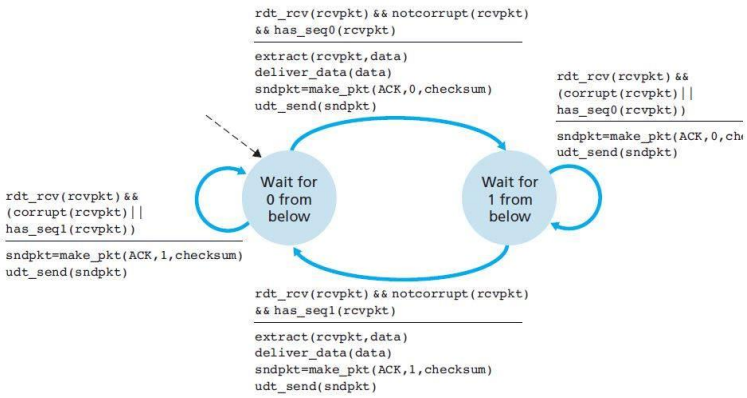
Features:

- Sequence number for each message that flips every successful acknowledge, to avoid message loss or duplicates.
- Timeout to re-send the message that wasn't acknowledged by the server or the client.
- Logs printed on the server's console.

State diagram we used



Transport Layer 3-39



Client code:

```
import socket

serverName = 'localhost'
serverPort = 12000
clientSocket = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
clientSocket.settimeout(10)
sentAck = "0,ACK"

clientSocket.settimeout(0.2)

seqSnd = 0
seqRcvd = 0




def isACK(packet):
    packet = packet.decode("UTF-8")
    arr = packet.split(",")
    if arr[1] == "ACK" and int(arr[0]) == seqSnd:
        return 1
    else:
        return 0


def verifySeq(packet):
    global seqRcvd
    packet = packet.decode("UTF-8")
    arr = packet.split(",")
    if int(arr[0]) == seqRcvd:
        return 1
    else:
        return 0


def receive():
    global sentAck
    global seqRcvd
    data, clientAddress = clientSocket.recvfrom(2048)
    print("Packet Recived : " + data.decode('UTF-8'))
    if verifySeq(data):
        sentAck = createPacket("ACK", seqRcvd)
        print("ACK to send: " + sentAck)
        clientSocket.sendto(sentAck.encode('UTF-8'), (serverName, serverPort))
        data = data.decode("UTF-8")
        arr = data.split(",")
        seqRcvd = 1 - seqRcvd
        return arr[1]
    clientSocket.sendto(sentAck.encode('UTF-8'), (serverName, serverPort))
    return receive()


def sendPacket(packet):
    global seqSnd
    try:
        print("packet to be sent : " + packet)
        clientSocket.sendto(packet.encode('UTF-8'), (serverName, serverPort))
        ack = clientSocket.recv(2048)
```

```
        print("ACK recived : " + ack.decode("UTF-8"))
        if not (isACK(ack)):
            ack = clientSocket.recv(2048)
        else:
            seqSnd = 1 - seqSnd
    except socket.timeout:
        sendPacket(packet)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def createPacket(data, seq):
    print(data)

    packet = str(seq) + ',' + str(data)
    return packet


while 1:
    try:

        k = input("Enter data to be sent : ")
        packet_to_send = createPacket(k, seqSnd)
        sendPacket(packet_to_send)
        print("Receiving....")
        k = receive()
        print("data recived : " + k)
        print("---------------------------------")
    except socket.error as exc:
        print("Server isn't working")
```
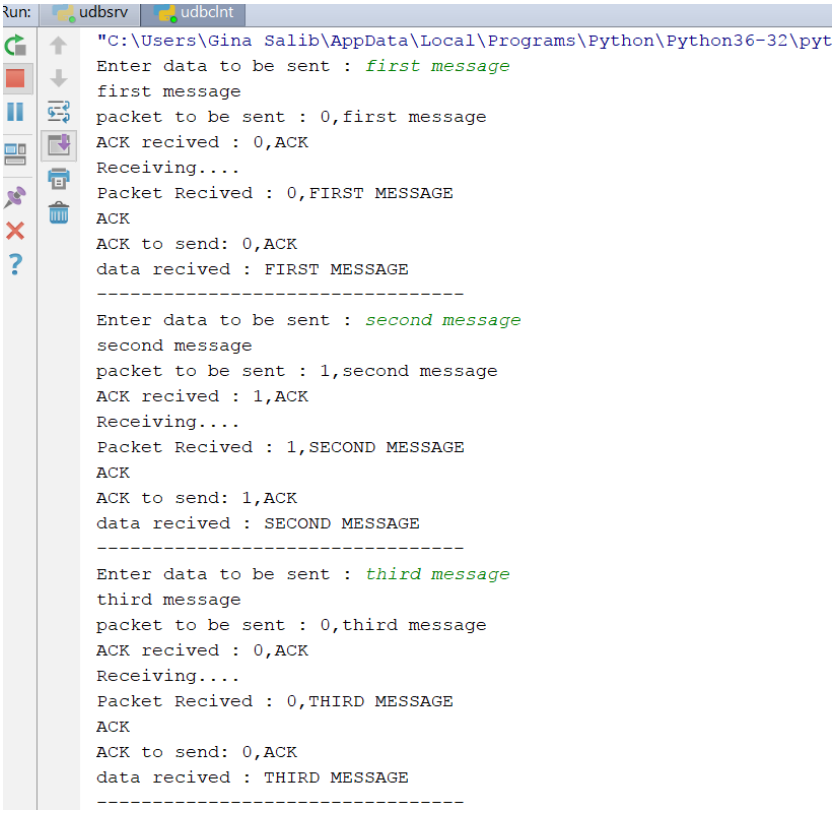

Server code:

```
ack = "ACK"
sentAck = "0,ACK"
serverPort = 12000
serverSocket = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
serverSocket.bind(('', serverPort))
print("the server is ready  ")
seqSnd = 0
seqRcvd = 0
while 1:
    try:
        serverSocket.settimeout(0.2)


        def isACK(packet):
            global seqSnd
            packet = packet.decode("UTF-8")
            arr = packet.split(",")
            if arr[1] == "ACK" and int(arr[0]) == seqSnd:
                return 1
            else:
                return 0


        def verifySeq(packet):
            global seqRcvd
            packet = packet.decode("UTF-8")
            arr = packet.split(",")
```

```
        if int(arr[0]) == seqRcvd:
            return 1
        else:
            return 0


    def receive():
        global sentAck
        global seqRcvd
        data, clientAddress = serverSocket.recvfrom(2048)
        print("packet received: " + data.decode("UTF-8"))
        if verifySeq(data):
            sentAck = createPacket(ack, seqRcvd)
            print("ACK Packet to send : " + sentAck)
            serverSocket.sendto(sentAck.encode('UTF-8'), clientAddress)
            data = data.decode("UTF-8")
            arr = data.split(",")
            seqRcvd = 1 - seqRcvd
            return arr[1], clientAddress
        serverSocket.sendto(sentAck.encode('UTF-8'), clientAddress)
        return receive()


    def sendPacket(packet, clientAddress):
        global seqSnd
        try:
            print("Packet to send as a response : " + packet)
            serverSocket.sendto(packet.encode('UTF-8'), clientAddress)
            ack = serverSocket.recv(2048)
            print("ACK received: " + ack.decode('UTF-8'))
            if not (isACK(ack)):
                ack = serverSocket.recv(2048)
            else:
                seqSnd = 1 - seqSnd
        except socket.timeout:
            sendPacket(packet, clientAddress)


    def createPacket(data, seq):

        packet = str(seq) + ',' + str(data)
        return packet


    while 1:
        k, clientAddress = receive()
        print("data from the packet : " + k)
        packet_to_send = createPacket(k.upper(), seqSnd)
        sendPacket(packet_to_send, clientAddress)
        print("---------------------------------")
except socket.timeout:
    x = 1
```

Sample run

Client screenshot:



Server screenshot: