Programming Assignment 1 – CSE232

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Part (a)

Initially both client and server are run on the same machine, the server in this case is the localhost.
The client sends 10 pings to the server and the if the response time exceeds 1 second, the package is assumed to be dropped.

Server - localhost, port number - 12000

```
server_addr = ("localhost",12000)
client_socket.settimeout(1)
ping_count =0
RTT_list = []
lost_package=0
```

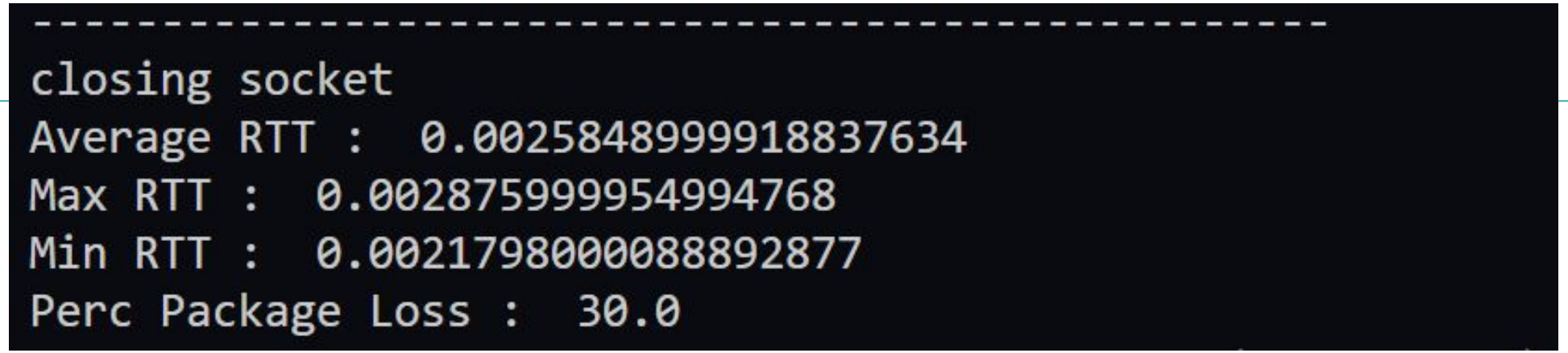
Output for part1(a)

Successful Ping - Packet not dropped

```
Message sent to server

Message :  Ping_Number: 0 Time: Tue Sep 17 11:13:59 2024

Message received from the server  PING_NUMBER: 0 TIME: TUE SEP 17 11:13:59 2024
Round Trip Time :  0.008270999998785555
Start Time: 424934.2721867
End Time: 424934.2804577
```

Packet dropped

```
Message sent to server

Message :  Ping_Number: 7 Time: Tue Sep 17 11:13:01 2024

 Requested Time out for :  7
```



Socket is closed after 10 pings.

The Average RTT is calculated after 10 pings, only those packets that weren't dropped are considered in RTT calculation.

30 perc Package loss means 3 packets out of 10 were dropped by the server.

Incorporating Repetition time

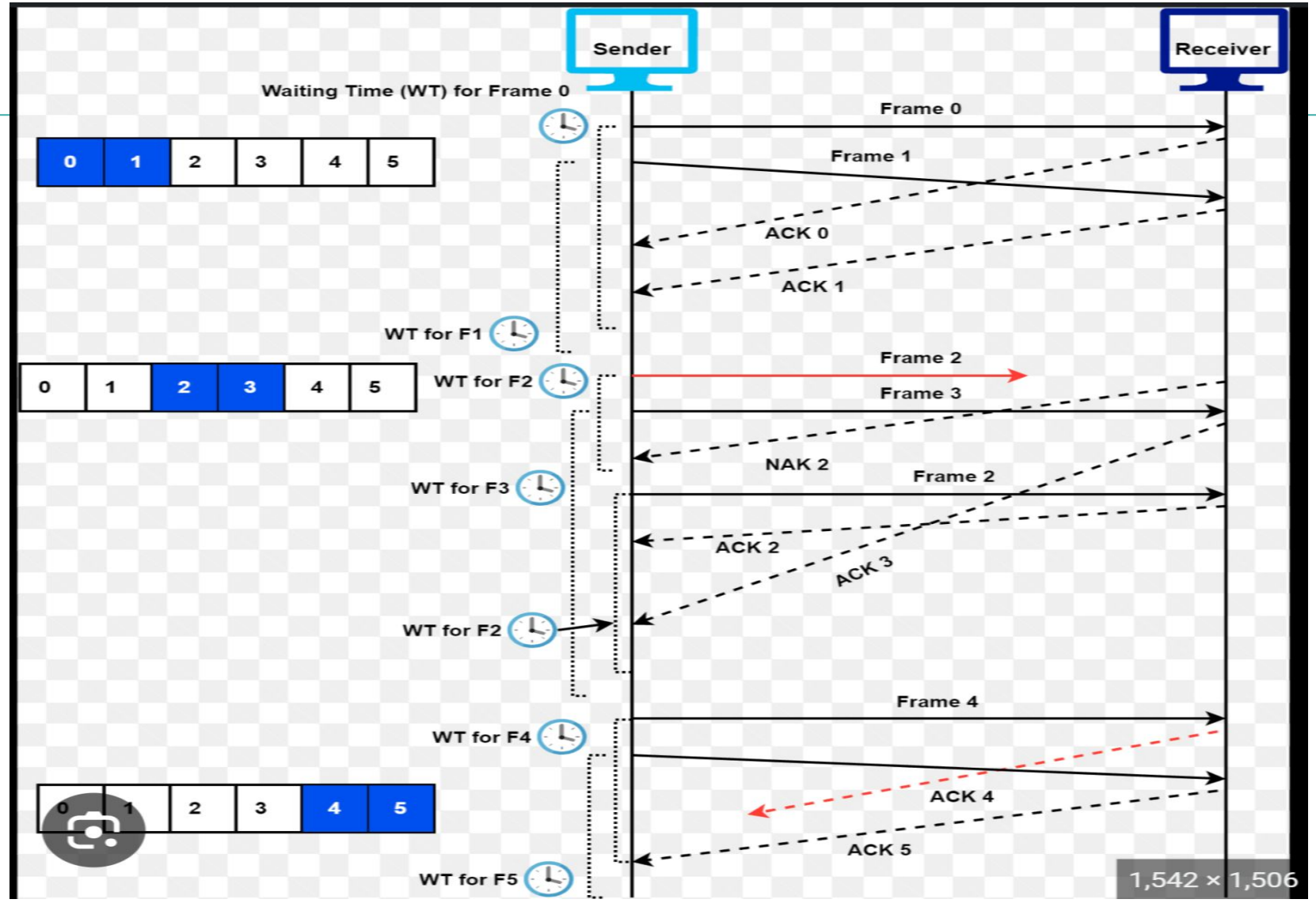
```
repetition_time = 2
```

```
time.sleep(repetition_time)
```

A constant value for repetition time is added in the code. It should be less than or equal to timeout, otherwise client wont be able to understand if ping got dropped or not.

Repetition introduces a delay between consecutive pings, ensuring the client waits a specified interval (e.g., 2 second) before sending the next ping to the server.

```
[Fri Sep 20 23:30:46 2024] Sending message: Ping_Number: 8 Time: Fri Sep 20 23:30:46 2024
[Fri Sep 20 23:30:46 2024] Message received from server: PING_NUMBER: 8 TIME: FRI SEP 20 23:30:46 2024
Round Trip Time:  0.0062719999987166375
Start Time: 36166.2727069
End Time: 36166.2789789
-------------------------------------------------
[Fri Sep 20 23:30:48 2024] Sending message: Ping_Number: 9 Time: Fri Sep 20 23:30:48 2024
[Fri Sep 20 23:30:48 2024] Message received from server: PING_NUMBER: 9 TIME: FRI SEP 20 23:30:48 2024
Round Trip Time:  0.005789799994090572
Start Time: 36168.2807679
End Time: 36168.2865577
```


Sender
Receiver
Waiting Time (WT) for Frame 0
0 1 2 3 4 5
Frame 0
Frame 1
ACK 0
ACK 1
WT for F1
0 1 2 3 4 5
WT for F2
Frame 2
Frame 3
NAK 2
WT for F3
Frame 2
ACK 2
ACK 3
WT for F2
Frame 4
WT for F4
0 1 2 3 4 5
ACK 4
ACK 5
WT for F5
1,542 × 1,506

Part(b) – UDP heartbeat Application

Successful message sent to server without the packet being dropped, the Time difference between the message sent from client and server is reported by the server.

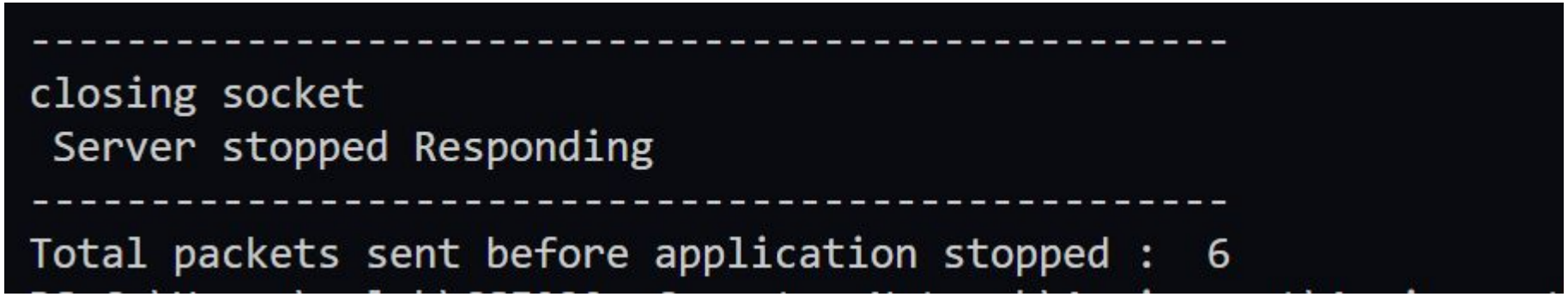
```
Message sent to server

Message :  2  Time: 2024-09-17 11:22:22.978964

Message received from the server :  Time difference is 0:00:00.001570
```

The consecutive packet losses are reported after each packet transmission, pings are sent to the server until 3 consecutive packet losses are reported.

The client assumes the server to stop working after 3 consecutive server losses.

```
-----------------------------------------------
Message sent to server

Message :  3  Time: 2024-09-17 11:27:18.567268

 Requested Time out for :  3
 Consecutive losses till now :  1
-----------------------------------------------
Message sent to server

Message :  4  Time: 2024-09-17 11:27:19.575527

 Requested Time out for :  4
 Consecutive losses till now :  2
-----------------------------------------------
Message sent to server

Message :  5  Time: 2024-09-17 11:27:20.589139

 Requested Time out for :  5
 Consecutive losses till now :  3
-----------------------------------------------
closing socket
```

Closed Server



The total packets, sent before 3 consecutive packet drops are observed, are reported.

We tried the udp heartbeat application multiple times, in different instances different answers were obtained for total number of packets such as 6,14 and 67 in three different instances.