

1. File transmit + handshake

Server

```
m108-2@m108-2:~/Desktop/file&hand$ ./server
-----Parameter-----
Port number : 3456
The RTT delay : 15 ms
Threshold : 65536 bytes
MSS : 1024 bytes
Receive buffer size : 524288 bytes
Server's IP address : 0.0.0.0
Server's port number : 3456
-----Three-way handshake-----
Receive a packet(SYN) from 127.0.0.1 : 47556
    Receive a packet (seq_num = 89384, ack_num = 0)
Send a packet(SYN/ACK) to 127.0.0.1 : 47556
Receive a packet(ACK) from 127.0.0.1 : 47556
    Receive a packet (seq_num = 89385, ack_num = 89385)
-----Three-way handshake finish successfully-----
-----Start to transmit Data-----
client index : 1
source port : 50361
destination port : 3456
Sequence number : 1
ACK number : 100
Transmit data : ConnectOK
KID socket created at port : 3457
```

```
-----Start to transmit Data-----
client index : 1
source port : 50361
destination port : 3456
Sequence number : 1
ACK number : 100
Transmit data : ConnectOK
KID socket created at port : 3457
source port : 50361
destination port : 3456
Sequence number : 1
ACK number : 100
Transmit data : V1.mp4
Data pointer to 1004 with data buffer : 0
Send Pkt : 1
Data pointer to 2008 with data buffer : FFFFFFFAD
Send Pkt : 2
Data pointer to 3012 with data buffer : FFFFFFFC5
Send Pkt : 3
Data pointer to 4016 with data buffer : 1
Send Pkt : 4
Data pointer to 5020 with data buffer : 74
Send Pkt : 5
Data pointer to 6024 with data buffer : 4E
Send Pkt : 6
Data pointer to 7028 with data buffer : 4E
Send Pkt : 7
Data pointer to 8032 with data buffer : FFFFFFFDD
Send Pkt : 8
Data pointer to 9036 with data buffer : 61
Send Pkt : 9
Data pointer to 10040 with data buffer : FFFFFFFE0
```

Client

```
m108-2@m108-2:~/Desktop/file&hand$ ./client 127.0.0.1 3456
-----Parameter-----
Port number : 3456
The RTT delay : 15 ms
Threshold : 65536 bytes
MSS : 1024 bytes
Receive buffer size : 524288 bytes
Server's IP address : 0.0.0.0
Server's port number : 3456
-----Three-way handshake-----
Send a packet(SYN) to 127.0.0.1 : 3456
Receive a packet(SYN/ACK) from 127.0.0.1 : 3456
    Receive a packet (seq_num = 89384, ack_num = 89385)
Send a packet(ACK) to 127.0.0.1 : 3456
-----Three-way handshake finish successfully-----
-----PKT-----
source port : 3456
destination port : 50361
Sequence number : 1
ACK number : 0
Transmit data flag: 1298
Please choose whhich video you want to get (V1,V2,V3,V4) :
```

```
-----PKT-----
source port : 3456
destination port : 50361
Sequence number : 2238
ACK number : 0
Transmit data flag: 1280
-----PKT-----
source port : 3456
destination port : 50361
Sequence number : 2239
ACK number : 0
Transmit data flag: 1280
-----PKT-----
source port : 3456
destination port : 50361
Sequence number : 2240
ACK number : 0
Transmit data flag: 1280
-----PKT-----
source port : 3456
destination port : 50361
Sequence number : 2241
ACK number : 0
Transmit data flag: 1280
-----PKT-----
source port : 3456
destination port : 50361
Sequence number : 2242
ACK number : 0
Transmit data flag: 1280
-----PKT-----
source port : 3456
destination port : 50361
Sequence number : 2243
ACK number : 0
Transmit data flag: 1280
-----PKT-----
source port : 3456
destination port : 50361
Sequence number : 2244
ACK number : 0
Transmit data flag: 1280
-----PKT-----
```

2. Slow start & Congestion avoidance

Server

```
send pkt : 1224
cwnd : 6
send pkt : 1225
cwnd : 6
send pkt : 1226
cwnd : 6
send pkt : 1227
cwnd : 6
send pkt : 1228
-----Loss PKT at 1229 -----
cwnd : 6
send pkt : 1229
With cwnd : 6
count the acks : 6 1224 1229 1223 1225 ACK
With cwnd : 6
count the acks : 6 1224 1229 1225 1227 ACK
With cwnd : 6
count the acks : 6 1224 1229 1227 1228 ACK
----- SLOW START -----
cwnd : 1
send pkt : 1229
----- Please Retransmit immediately -----
cwnd : 1
send pkt : 1229
With cwnd : 1
count the acks : 1 1229 1229 1229 1229 ACK
----- CONGESTION AVOIDANCE -----
cwnd : 2
send pkt : 1230
cwnd : 2
send pkt : 1231
With cwnd : 2
count the acks : 2 1230 1231 1231 1231 ACK
cwnd : 3
send pkt : 1232
cwnd : 3
send pkt : 1233
cwnd : 3
send pkt : 1234
With cwnd : 3
count the acks : 3 1232 1234 1231 1233 ACK
With cwnd : 3
count the acks : 3 1232 1234 1234 1234 ACK
cwnd : 4
send pkt : 1235
cwnd : 4
send pkt : 1236
cwnd : 4
```

Client

```
----- First receive-----
Receive pkt at sequence number :2342 with data : 75
Send pkt at sequence number :2342 with flag : 1280
Receive pkt at sequence number : 2343 with flag : 1280
----- First receive-----
Receive pkt at sequence number :2343 with data : C
----- First receive-----
Receive pkt at sequence number :2344 with data : 2C
Send pkt at sequence number :2344 with flag : 1280
Receive pkt at sequence number : 2345 with flag : 1280
----- First receive-----
Receive pkt at sequence number :2345 with data : 79
----- First receive-----
Receive pkt at sequence number :2346 with data : FFFFFFFE
Send pkt at sequence number :2346 with flag : 1280
Receive pkt at sequence number : 2347 with flag : 1280
----- First receive-----
Receive pkt at sequence number :2347 with data : FFFFFFFA5
-----TIME OUT-----
Send pkt at sequence number :2347 with flag : 1280
Receive pkt at sequence number : 2348 with flag : 1280
----- First receive-----
Receive pkt at sequence number :2348 with data : FFFFFFFC8
----- First receive-----
Receive pkt at sequence number :2349 with data : 22
Send pkt at sequence number :2349 with flag : 1280
Receive pkt at sequence number : 2350 with flag : 1280
----- First receive-----
Receive pkt at sequence number :2350 with data : FFFFFFFF81
----- First receive-----
Receive pkt at sequence number :2351 with data : FFFFFFFA7
```

3. Duplicated ACK & TAHOE

Server

```
send pkt : 3977
-----WAITING FOR ACK-----
Status : 1 with Duplicated ACK : 2
cwnd : 1
send pkt : 3977
-----WAITING FOR ACK-----
Status : 1 with Duplicated ACK : 3
----- FAST RECOVERY -----
----- WITH TAHOE -----
cwnd : 1
send pkt : 3977
-----WAITING FOR ACK-----
Status : 2 with Duplicated ACK : 4
cwnd : 2
send pkt : 3977
cwnd : 2
send pkt : 3978
-----WAITING FOR ACK-----
With cwnd : 2
count the acks : 2 3977 3978 3976 3977 ACK
----- CONGESTION AVOIDANCE -----
cwnd : 1
send pkt : 3978
-----WAITING FOR ACK-----
Status : 1 with Duplicated ACK : 1
cwnd : 1
send pkt : 3978
-----WAITING FOR ACK-----
With cwnd : 1
count the acks : 1 3978 3978 3977 3993 ACK
cwnd : 1
send pkt : 3994
-----WAITING FOR ACK-----
Status : 1 with Duplicated ACK : 1
cwnd : 1
send pkt : 3994
-----WAITING FOR ACK-----
Status : 1 with Duplicated ACK : 2
cwnd : 1
send pkt : 3994
-----WAITING FOR ACK-----
Status : 1 with Duplicated ACK : 3
----- FAST RECOVERY -----
----- WITH TAHOE -----
cwnd : 1
send pkt : 3994
```

Client

```
----- First receive-----
Receive pkt at sequence number :3835 with data : 39
Send pkt at sequence number :3835 with flag : 1280
Receive pkt at sequence number : 3834 with flag : 1280
Receive pkt at sequence number : 3835 with flag : 1280
Receive pkt at sequence number : 3836 with flag : 1280
----- First receive-----
Receive pkt at sequence number :3836 with data : 61
Send pkt at sequence number :3836 with flag : 1280
Receive pkt at sequence number : 3834 with flag : 1280
Receive pkt at sequence number : 3835 with flag : 1280
Receive pkt at sequence number : 3836 with flag : 1280
Receive pkt at sequence number : 3837 with flag : 1280
----- First receive-----
Receive pkt at sequence number :3837 with data : FFFFFFF8
Send pkt at sequence number :3837 with flag : 1280
Receive pkt at sequence number : 3834 with flag : 1280
Receive pkt at sequence number : 3835 with flag : 1280
Receive pkt at sequence number : 3836 with flag : 1280
Receive pkt at sequence number : 3837 with flag : 1280
Receive pkt at sequence number : 3833 with flag : 1280
Receive pkt at sequence number : 3834 with flag : 1280
Receive pkt at sequence number : 3835 with flag : 1280
Receive pkt at sequence number : 3836 with flag : 1280
```

4. RENO

Server

```
Status : 1 with Duplicated ACK : 2
cwnd : 1
send pkt : 2996
-----WAITING FOR ACK-----
Status : 1 with Duplicated ACK : 3
----- FAST RECOVERY -----
----- WITH Reno -----
cwnd : 3
send pkt : 2996
cwnd : 3
send pkt : 2997
cwnd : 3
send pkt : 2998
-----WAITING FOR ACK-----
With cwnd : 3
count the acks : 3 2996 2998 2995 2996 ACK
----- CONGESTION AVOIDANCE -----
cwnd : 1
send pkt : 2997
-----WAITING FOR ACK-----
Status : 1 with Duplicated ACK : 1
cwnd : 1
send pkt : 2997
-----WAITING FOR ACK-----
Status : 1 with Duplicated ACK : 2
cwnd : 1
send pkt : 2997
-----WAITING FOR ACK-----
Status : 1 with Duplicated ACK : 3
----- FAST RECOVERY -----
----- WITH Reno -----
cwnd : 3
send pkt : 2997
cwnd : 3
send pkt : 2998
cwnd : 3
send pkt : 2999
```

Client

```
----- First receive-----
Receive pkt at sequence number :2992 with data : 6A
Send pkt at sequence number :2992 with flag : 1280
Receive pkt at sequence number : 2992 with flag : 1280
Receive pkt at sequence number : 2992 with flag : 1280
Receive pkt at sequence number : 2992 with flag : 1280
Receive pkt at sequence number : 2993 with flag : 1280
----- First receive-----
Receive pkt at sequence number :2993 with data : FFFFFFFD6
----- First receive-----
Receive pkt at sequence number :2994 with data : FFFFFFFEA
Send pkt at sequence number :2994 with flag : 1280
Receive pkt at sequence number : 2992 with flag : 1280
Receive pkt at sequence number : 2993 with flag : 1280
Receive pkt at sequence number : 2994 with flag : 1280
Receive pkt at sequence number : 2995 with flag : 1280
----- First receive-----
Receive pkt at sequence number :2995 with data : FFFFFFF96
Send pkt at sequence number :2995 with flag : 1280
Receive pkt at sequence number : 2993 with flag : 1280
Receive pkt at sequence number : 2994 with flag : 1280
Receive pkt at sequence number : 2995 with flag : 1280
Receive pkt at sequence number : 2996 with flag : 1280
----- First receive-----
Receive pkt at sequence number :2996 with data : FFFFFFFE0
Send pkt at sequence number :2996 with flag : 1280
Receive pkt at sequence number : 2993 with flag : 1280
Receive pkt at sequence number : 2994 with flag : 1280
Receive pkt at sequence number : 2995 with flag : 1280
Receive pkt at sequence number : 2996 with flag : 1280
Receive pkt at sequence number : 2997 with flag : 1280
```