

Computer Network Homework

Step 1:

• 1.

```
multiclient_server.py | handle_request
1 import socket # base module
2 from random import randint
3 import dns.resolver # for ip query, first run pip3 install dnspython
4 import threading # for each client
5 import struct # for data unpacking
6 from segment import Segment # my TCP packet structure
7 # 1-1 set arguments
8 max_rtt = 15/1000 # sec
9 # in bytes
10 max_seg_size = 1024
11 threshold = 64*1024 # ssthresh
12 buffer_size = 512*1024
13 tcp_header_len = struct.calcsize('!HHLLBBHHH')
14
15 def rand_chksum():
16     '''set 25% for better debugging'''
17     return int(randint(1,1000000) > 750000)

clients.py | new_client
1 import socket # base module
2 from segment import Segment # my TCP packet structure
3 import struct # for data unpacking
4 import threading # for multiclient
5 from random import randint
6 # socket.socket() will create a TCP socket (default)
7 # socket.socket(socket.AF_INET, socket.SOCK_STREAM) to explicitly define a TCP socket
8 udp_host = socket.gethostbyname(socket.gethostname()) # host IP
9 udp_port = 12345 # main server port port to connect
10 # 1-1 set arguments
11 max_rtt = 15/1000 # sec
12 # in bytes
13 max_seg_size = 1024
14 threshold = 64*1024 # ssthresh
15 buffer_size = 512*1024
16 tcp_header_len = struct.calcsize('!HHLLBBHHH')
17
```

```
howhow@DESKTOP-7E4S3U5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$ python3 ./multiclient_server.py
[ Main Thread ('127.0.0.1', 12345) ] Waiting for clients' command...
[ ]
```

```
howhow@DESKTOP-7E4S3U5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$ python3 clients.py
How many clients: 1
Input commands in the following form: cmdln[cmdln]
video@filename
drg@domain_name
math@formula
A + B
A - B
A * B
A / B
A ** B
Input command: video@1.mp4
```

• 2.

after a few output...

```
TERMINAL  DEBUG CONSOLE  PROBLEMS  OUTPUT
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) with packet loss ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13559, ACK = 5259 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13560, ACK = 5259 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13561, ACK = 5259 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13562, ACK = 5262 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13563, ACK = 5262 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13564, ACK = 5262 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13565, ACK = 5265 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13566, ACK = 5265 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13567, ACK = 5265 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) with packet loss ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13568, ACK = 5268 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13569, ACK = 5268 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13570, ACK = 5268 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13571, ACK = 5271 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13572, ACK = 5271 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13573, ACK = 5271 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13574, ACK = 5274 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13575, ACK = 5274 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13576, ACK = 5274 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13577, ACK = 5277 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13578, ACK = 5277 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13579, ACK = 5277 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) with packet loss ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13580, ACK = 5280 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13581, ACK = 5280 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13582, ACK = 5280 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) with packet loss ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13583, ACK = 5283 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13584, ACK = 5283 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13585, ACK = 5283 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13586, ACK = 5286 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13587, ACK = 5286 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13588, ACK = 5286 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13589, ACK = 5289 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13590, ACK = 5289 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13591, ACK = 5289 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13592, ACK = 5292 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13593, ACK = 5292 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13594, ACK = 5292 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13595, ACK = 5295 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13596, ACK = 5295 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13597, ACK = 5295 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) with packet loss ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13598, ACK = 5298 ]
[ SERVER ('0.0.0.0', 55911): RESPONSE video request to ('127.0.0.1', 55910) with SEQ = 13599, ACK = 5298 ]
[ SERVER ('0.0.0.0', 55911): ACK from ('127.0.0.1', 55910) ]
[ SERVER ('0.0.0.0', 55911): REQUEST of video from ('127.0.0.1', 55910) done ]

[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5258, ACK = 13559
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5261, ACK = 13562
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ] with packet loss
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5264, ACK = 13565
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5267, ACK = 13568
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5270, ACK = 13571
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ] with packet loss
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5273, ACK = 13574
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5276, ACK = 13577
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5279, ACK = 13580
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5282, ACK = 13583
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5285, ACK = 13586
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ] with packet loss
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5288, ACK = 13589
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5291, ACK = 13592
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5294, ACK = 13595
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5297, ACK = 13598
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ]
[ CLIENT ('0.0.0.0', 55910): RECEIVE segment ] with packet loss
[ CLIENT ('0.0.0.0', 55910): ACK to ('127.0.0.1', 55911) ] with SEQ = 5299, ACK = 13600
[ CLIENT ('0.0.0.0', 55910): RESPONSE from ('127.0.0.1', 55911) ] request for video: "1.mp4" done!
```

have the same hash value compare to the origin video file

```
howhow@DESKTOP-7E4S3U5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$ sha256sum 55910_1.mp4
../1.mp4 | awk '{print $1}' | uniq
2d84bc64b2e81b257ee450841b715f00e6f8d2e5b0f1af4e5b4a6738aff9800d
howhow@DESKTOP-7E4S3U5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$
```

clients each do multiple jobs

```

TERMINAL      DEBUG CONSOLE    PROBLEMS      OUTPUT
howhaw@DESKTOP-7E4S3U5:/mnt/d/College/3-2/Computer network/project/computer_network/8073040022$ python3 ./multiclient_server.py
[ Main Thread ('127.0.1.1', 12345) ] Waiting for clients' command...
[ Main Thread ('127.0.1.1', 12345): SYN REQUEST from ('127.0.0.1', 55996) ]
[ Main Thread ('127.0.1.1', 12345) ] Waiting for clients' command...
[ SERVER ('0.0.0.0', 55998): SYN ACK to ('127.0.0.1', 55996) ] with SEQ = 495, ACK = 1166
[ Main Thread ('127.0.1.1', 12345): SYN REQUEST from ('127.0.0.1', 55997) ]
[ SERVER ('0.0.0.0', 55998): REQUEST from ('127.0.0.1', 55996) ]
[ Main Thread ('127.0.1.1', 12345) ] Waiting for clients' command...
[ SERVER ('0.0.0.0', 55998): SYN ACK to ('127.0.0.1', 55997) ] with SEQ = 9664, ACK = 9346
[ SERVER ('0.0.0.0', 55998): RESPONSE math request to ('127.0.0.1', 55996) ] with SEQ = 496, ACK = 1167
[ SERVER ('0.0.0.0', 55998): REQUEST of math from ('127.0.0.1', 55996) done ]
[ SERVER ('0.0.0.0', 55998): ACK from ('127.0.0.1', 55996) ]
[ SERVER ('0.0.0.0', 55998): REQUEST from ('127.0.0.1', 55997) ]
[ SERVER ('0.0.0.0', 55998): RESPONSE math request to ('127.0.0.1', 55996) ] with SEQ = 497, ACK = 1168
[ SERVER ('0.0.0.0', 55998): RESPONSE math request to ('127.0.0.1', 55997) ] with SEQ = 9665, ACK = 9347
[ SERVER ('0.0.0.0', 55998): REQUEST of math from ('127.0.0.1', 55996) done ]
[ SERVER ('0.0.0.0', 55998): REQUEST of math from ('127.0.0.1', 55997) done ]
[ SERVER ('0.0.0.0', 55998): ACK from ('127.0.0.1', 55996) ]
[ SERVER ('0.0.0.0', 55998): ACK from ('127.0.0.1', 55997) ]
[ SERVER ('0.0.0.0', 55998): RESPONSE math request to ('127.0.0.1', 55997) ] with SEQ = 9666, ACK = 9348
[ SERVER ('0.0.0.0', 55998): REQUEST of math from ('127.0.0.1', 55997) done ]
[ SERVER ('0.0.0.0', 55998): ACK from ('127.0.0.1', 55997) ]
]

howhaw@DESKTOP-7E4S3U5:/mnt/d/College/3-2/Computer network/project/computer_network/8073040022$ python3 clients.py
How many clients: 2
Input commands in the following form: cmdln[cmdln]
video@filename
dns@domain name
math@formula
A + B
A - B
A * B
A / B
A ** B
Input command: math@5+3-2*3/6|math@5**2**0.5
Input commands in the following form: cmdln[cmdln]
video@filename
dns@domain name
math@formula
A + B
A - B
A * B
A / B
A ** B
Input command: math@5**2**0.5|math@5+3-2*3/6
[ CLIENT ('0.0.0.0', 55996): SYN REQUEST to SERVER ('127.0.1.1', 12345) ] with SEQ = 1165, ACK = 0
[ CLIENT ('0.0.0.0', 55997): SYN REQUEST to SERVER ('127.0.1.1', 12345) ] with SEQ = 9345, ACK = 0
[ CLIENT ('0.0.0.0', 55996): receive SYN ACK ]
[ CLIENT ('0.0.0.0', 55996): REQUEST to SERVER ('127.0.0.1', 55998) ] with SEQ = 1166, ACK = 496
[ CLIENT ('0.0.0.0', 55997): receive SYN ACK ]
[ CLIENT ('0.0.0.0', 55996): RESPONSE from ('127.0.0.1', 55998) ] 5+3-2*3/6 = 7.0
[ CLIENT ('0.0.0.0', 55997): REQUEST to SERVER ('127.0.0.1', 55998) ] with SEQ = 9346, ACK = 9665
[ CLIENT ('0.0.0.0', 55996): ACK to ('127.0.0.1', 55998) ] with SEQ = 1167, ACK = 497
[ CLIENT ('0.0.0.0', 55996): RESPONSE from ('127.0.0.1', 55998) ] 5**2**0.5 = 5.0
[ CLIENT ('0.0.0.0', 55996): ACK to ('127.0.0.1', 55998) ] with SEQ = 1168, ACK = 498
[ CLIENT ('0.0.0.0', 55997): RESPONSE from ('127.0.0.1', 55998) ] 5**2**0.5 = 5.0 with packet loss
[ CLIENT ('0.0.0.0', 55997): ACK to ('127.0.0.1', 55998) ] with SEQ = 9347, ACK = 9666
[ CLIENT ('0.0.0.0', 55997): RESPONSE from ('127.0.0.1', 55998) ] 5+3-2*3/6 = 7.0 with packet loss
[ CLIENT ('0.0.0.0', 55997): ACK to ('127.0.0.1', 55998) ] with SEQ = 9348, ACK = 9667
howhaw@DESKTOP-7E4S3U5:/mnt/d/College/3-2/Computer network/project/computer_network/8073040022$

TERMINAL      DEBUG CONSOLE    PROBLEMS      OUTPUT
howhaw@DESKTOP-7E4S3U5:/mnt/d/College/3-2/Computer network/project/computer_network/8073040022$ python3 ./multiclient_server.py
[ Main Thread ('127.0.1.1', 12345) ] Waiting for clients' command...
[ Main Thread ('127.0.1.1', 12345): SYN REQUEST from ('127.0.0.1', 63157) ]
[ Main Thread ('127.0.1.1', 12345) ] Waiting for clients' command...
[ SERVER ('0.0.0.0', 63158): SYN ACK to ('127.0.0.1', 63157) ] with SEQ = 118, ACK = 4741
[ SERVER ('0.0.0.0', 63158): REQUEST from ('127.0.0.1', 63157) ]
[ SERVER ('0.0.0.0', 63158): RESPONSE dns request to ('127.0.0.1', 63157) ] with SEQ = 119, ACK = 4742
[ SERVER ('0.0.0.0', 63158): REQUEST of dns from ('127.0.0.1', 63157) done ]
[ SERVER ('0.0.0.0', 63158): ACK from ('127.0.0.1', 63157) ]
]

howhaw@DESKTOP-7E4S3U5:/mnt/d/College/3-2/Computer network/project/computer_network/8073040022$ python3 clients.py
How many clients: 1
Input commands in the following form: cmdln[cmdln]
video@filename
dns@domain name
math@formula
A + B
A - B
A * B
A / B
A ** B
Input command: dns@google.com
[ CLIENT ('0.0.0.0', 63157): SYN REQUEST to SERVER ('127.0.1.1', 12345) ] with SEQ = 4740, ACK = 0
[ CLIENT ('0.0.0.0', 63157): receive SYN ACK ]
[ CLIENT ('0.0.0.0', 63157): REQUEST to SERVER ('127.0.0.1', 63158) ] with SEQ = 4741, ACK = 119
[ CLIENT ('0.0.0.0', 63157): RESPONSE from ('127.0.0.1', 63158) ] The IP address of "google.com" is 172.217.27.142 with packet loss
[ CLIENT ('0.0.0.0', 63157): ACK to ('127.0.0.1', 63158) ] with SEQ = 4742, ACK = 120
howhaw@DESKTOP-7E4S3U5:/mnt/d/College/3-2/Computer network/project/computer_network/8073040022$
```

- 3.

- 4. above covered (Step 1:3)
- 5. above covered
- 6. above covered

Step 2.

- above covered (Step 1:2-4)

Step 3.

- above covered (Step 1:2-4)

Step 4.

- above covered (modified the rate to 25% to better present)

Step 5.

- above covered(Step 1:2-2)

Step 9. (Partial)

- 2. code:

```
#####
##### standard input #####
#####
# client_num=input('How many clients: ')
# for i in range(int(client_num)):
#     print('Input commands in the following form: cmdln{|cmdln}')
#     print('video@filename')
#     print('dns@domain_name')
#     print('math@formula')
#     print('\tA + B')
#     print('\tA - B')
#     print('\tA * B')
#     print('\tA / B')
#     print('\tA ** B')
#     cmdlns = input('Input command: ')
#     cmdlns_list.append(cmdlns)

#####
##### n clients #####
#####
n=100
for i in range(n):
    cmdlns_list.append('video@1.mp4')
```

have the same hash value compare to the origin video file

```
howhow@DESKTOP-7E4SJU5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$ sha256sum *1.mp4 ../1
.mp4 | awk '{print $1}' | uniq
2d84bc64b2e81b257eea50841b715f00e6f8d2e5b0f1af4e5b4a6738aff9800d
howhow@DESKTOP-7E4SJU5:/mnt/d/College/3-2/Computer network/project/computer_network/B073040022$
```