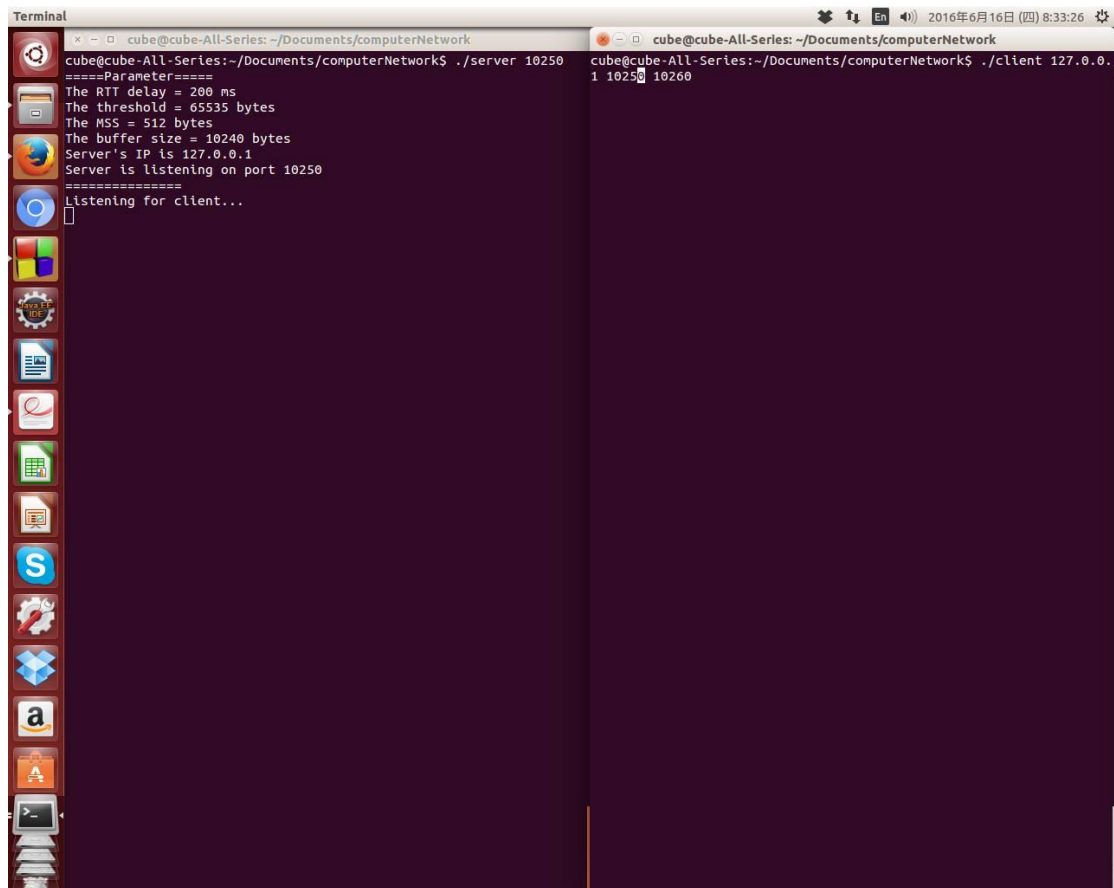


1. make clear all
2. 執行 server program : `./server <port>`,
執行 client program : `./client <destination ip addr> <destination port> <source port>`



The image shows two terminal windows side-by-side. The left window is titled 'cube@cube-All-Series: ~/Documents/computerNetwork' and shows the output of the `./server 10250` command. The output displays several parameters: 'The RTT delay = 200 ms', 'The threshold = 65535 bytes', 'The MSS = 512 bytes', and 'The buffer size = 10240 bytes'. It then states 'Server's IP is 127.0.0.1' and 'Server is listening on port 10250'. The right window is also titled 'cube@cube-All-Series: ~/Documents/computerNetwork' and shows the output of the `./client 127.0.0.1 10250 10260` command. The output shows '1 10250 10260'.

```
cube@cube-All-Series:~/Documents/computerNetwork$ ./server 10250
====Parameter====
The RTT delay = 200 ms
The threshold = 65535 bytes
The MSS = 512 bytes
The buffer size = 10240 bytes
Server's IP is 127.0.0.1
Server is listening on port 10250
=====
Listening for client...
[]

cube@cube-All-Series:~/Documents/computerNetwork$ ./client 127.0.0.1 10250 10260
1 10250 10260
```

3. Three way handshake 之後開始傳送檔案

```
Terminal
cube@cubc-All-Series: ~/Documents/computerNetwork
cube@cubc-All-Series:~/Documents/computerNetwork$ ./server 10250
=====Parameter=====
The RTT delay = 200 ms
The threshold = 65535 bytes
The MSS = 512 bytes
The buffer size = 10240 bytes
Server's IP is 127.0.0.1
Server is listening on port 10250
=====
Listening for client...
=====Start the three-way handshake=====
Receive a packet(SYN) from 127.0.0.1 : 10260
    Receive a packet (seq_num = 9798, ack_num = 0)
Send a packet(SYN/ACK) to 127.0.0.1 : 10260
    Send a packet (seq_num = 0, ack_num = 9799)
Receive a packet(ACK) from 127.0.0.1 : 10260
    Receive a packet (seq_num = 9799, ack_num = 1)
=====Complete the three-way handshake=====
Start to send the file, the file size is 10243 bytes
*****Slow Start*****
cwnd = 1, rwnd = 10240, threshold = 65535
    Send a packet at : 1 byte
cwnd = 2, rwnd = 10239, threshold = 65535
    Send a packet at : 2 byte
    Receive a packet (seq_num = 9800, ack_num = 4)
cwnd = 4, rwnd = 10238, threshold = 65535
    Send a packet at : 4 byte
    [

cube@cubc-All-Series:~/Documents/computerNetwork$ ./client 127.0.0.1 10250 10260
-----NAT translation table-----
WAN side addr | LAN side addr
192.168.0.1 : 10260 192.168.0.2 : 10260
192.168.0.1 : 10265 192.168.0.3 : 10265
Client's IP is 192.168.0.2
=====Start the three-way handshake=====
Send a packet(SYN) to 127.0.0.1 : 10250
Receive a packet(SYN/ACK) from 127.0.0.1 : 10250
    Receive a packet (seq_num = 0, ack_num = 9799)
Send a packet(ACK) to 127.0.0.1 : 10250
=====Complete the three-way handshake=====
Receive a file from 127.0.0.1 : 10250
    Receive a packet (seq_num = 1, ack_num = 9800)
    Receive a packet (seq_num = 2, ack_num = 9800)
    Receive a packet (seq_num = 4, ack_num = 9801)
```

```
Terminal
cube@cubc-All-Series: ~/Documents/computerNetwork
cube@cubc-All-Series:~/Documents/computerNetwork$ ./server 10250
cwnd = 8, rwnd = 10236, threshold = 65535
    Send a packet at : 8 byte
    Receive a packet (seq_num = 9801, ack_num = 16)
cwnd = 16, rwnd = 10232, threshold = 65535
    Send a packet at : 16 byte
cwnd = 32, rwnd = 10224, threshold = 65535
    Send a packet at : 32 byte
    Receive a packet (seq_num = 9802, ack_num = 64)
cwnd = 64, rwnd = 10208, threshold = 65535
    Send a packet at : 64 byte
cwnd = 128, rwnd = 10176, threshold = 65535
    Send a packet at : 128 byte
    Receive a packet (seq_num = 9803, ack_num = 256)
cwnd = 256, rwnd = 10112, threshold = 65535
    Send a packet at : 256 byte
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
    Receive a packet (seq_num = 9804, ack_num = 1024)
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
    Receive a packet (seq_num = 9805, ack_num = 2048)
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
    Receive a packet (seq_num = 9806, ack_num = 3072)
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
    Receive a packet (seq_num = 9807, ack_num = 4096)
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
    Receive a packet (seq_num = 9808, ack_num = 5120)
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
    Receive a packet (seq_num = 9809, ack_num = 6144)
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
    Receive a packet (seq_num = 9810, ack_num = 7168)
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
    Send a packet at : 512 byte

cube@cubc-All-Series:~/Documents/computerNetwork$ ./client 127.0.0.1 10250 10260
-----NAT translation table-----
WAN side addr | LAN side addr
192.168.0.1 : 10260 192.168.0.2 : 10260
192.168.0.1 : 10265 192.168.0.3 : 10265
Client's IP is 192.168.0.2
=====Start the three-way handshake=====
Send a packet(SYN) to 127.0.0.1 : 10250
Receive a packet(SYN/ACK) from 127.0.0.1 : 10250
    Receive a packet (seq_num = 0, ack_num = 9799)
Send a packet(ACK) to 127.0.0.1 : 10250
=====Complete the three-way handshake=====
Receive a file from 127.0.0.1 : 10250
    Receive a packet (seq_num = 1, ack_num = 9800)
    Receive a packet (seq_num = 2, ack_num = 9800)
    Receive a packet (seq_num = 4, ack_num = 9801)
    Receive a packet (seq_num = 8, ack_num = 9801)
    Receive a packet (seq_num = 16, ack_num = 9802)
    Receive a packet (seq_num = 32, ack_num = 9802)
    Receive a packet (seq_num = 64, ack_num = 9803)
    Receive a packet (seq_num = 128, ack_num = 9803)
    Receive a packet (seq_num = 256, ack_num = 9804)
    Receive a packet (seq_num = 512, ack_num = 9804)
    Receive a packet (seq_num = 1024, ack_num = 9805)
    Receive a packet (seq_num = 1536, ack_num = 9805)
    Receive a packet (seq_num = 2048, ack_num = 9806)
    Receive a packet (seq_num = 2560, ack_num = 9806)
    Receive a packet (seq_num = 3072, ack_num = 9807)
    Receive a packet (seq_num = 3584, ack_num = 9807)
    Receive a packet (seq_num = 4096, ack_num = 9808)
    Receive a packet (seq_num = 4608, ack_num = 9808)
    Receive a packet (seq_num = 5120, ack_num = 9809)
    Receive a packet (seq_num = 5632, ack_num = 9809)
    Receive a packet (seq_num = 6144, ack_num = 9810)
    Receive a packet (seq_num = 6656, ack_num = 9810)
    Receive a packet (seq_num = 7168, ack_num = 9811)
    Receive a packet (seq_num = 7680, ack_num = 9811)
```

4. Four way handshake,結束程式

```
Terminal
cube@cubc-All-Series: ~/Documents/computerNetwork

cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
Receive a packet (seq_num = 9806, ack_num = 3072)
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
Receive a packet (seq_num = 9807, ack_num = 4096)
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
Receive a packet (seq_num = 9808, ack_num = 5120)
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
Receive a packet (seq_num = 9809, ack_num = 6144)
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
Receive a packet (seq_num = 9810, ack_num = 7168)
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
Receive a packet (seq_num = 9811, ack_num = 8192)
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
Receive a packet (seq_num = 9812, ack_num = 9216)
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 512 byte
Receive a packet (seq_num = 9813, ack_num = 10240)
cwnd = 512, rwnd = 9984, threshold = 65535
Send a packet at : 4 byte
=====Start the four-way handshake=====
Send a packet(FIN) to 127.0.0.1 : 10260
Send a packet (seq_num = 10244, ack_num = 9814)
Receive a packet(ACK) from 127.0.0.1 : 10260
Receive a packet (seq_num = 9814, ack_num = 10245)
Receive a packet(FIN) from 127.0.0.1 : 10260
Receive a packet (seq_num = 9814, ack_num = 10245)
Send a packet(ACK) to 127.0.0.1 : 10260
Send a packet (seq_num = 10245, ack_num = 9815)
=====Complete the four-way handshake=====
cube@cubc-All-Series:~/Documents/computerNetwork$

cube@cubc-All-Series:~/Documents/computerNetwork$ ./client 127.0.0.1 10250 10260
-----NAT translation table-----
WAN side addr | LAN side addr
192.168.0.1 : 10260 192.168.0.2 : 10260
192.168.0.1 : 10265 192.168.0.3 : 10265
Client's IP is 192.168.0.2
=====Start the three-way handshake=====
Send a packet(SYN) to 127.0.0.1 : 10250
Receive a packet(SYN/ACK) from 127.0.0.1 : 10250
Receive a packet (seq_num = 0, ack_num = 9799)
Send a packet(ACK) to 127.0.0.1 : 10250
=====Complete the three-way handshake=====
Receive a file from 127.0.0.1 : 10250
Receive a packet (seq_num = 1, ack_num = 9800)
Receive a packet (seq_num = 2, ack_num = 9800)
Receive a packet (seq_num = 4, ack_num = 9801)
Receive a packet (seq_num = 8, ack_num = 9801)
Receive a packet (seq_num = 16, ack_num = 9802)
Receive a packet (seq_num = 32, ack_num = 9802)
Receive a packet (seq_num = 64, ack_num = 9803)
Receive a packet (seq_num = 128, ack_num = 9803)
Receive a packet (seq_num = 256, ack_num = 9804)
Receive a packet (seq_num = 512, ack_num = 9804)
Receive a packet (seq_num = 1024, ack_num = 9805)
Receive a packet (seq_num = 1536, ack_num = 9805)
Receive a packet (seq_num = 2048, ack_num = 9806)
Receive a packet (seq_num = 2560, ack_num = 9806)
Receive a packet (seq_num = 3072, ack_num = 9807)
Receive a packet (seq_num = 3584, ack_num = 9807)
Receive a packet (seq_num = 4096, ack_num = 9808)
Receive a packet (seq_num = 4608, ack_num = 9808)
Receive a packet (seq_num = 5120, ack_num = 9809)
Receive a packet (seq_num = 5632, ack_num = 9809)
Receive a packet (seq_num = 6144, ack_num = 9810)
Receive a packet (seq_num = 6656, ack_num = 9810)
Receive a packet (seq_num = 7168, ack_num = 9811)
Receive a packet (seq_num = 7680, ack_num = 9811)
Receive a packet (seq_num = 8192, ack_num = 9812)
Receive a packet (seq_num = 8704, ack_num = 9812)
Receive a packet (seq_num = 9216, ack_num = 9813)
Receive a packet (seq_num = 9728, ack_num = 9813)
Receive a packet (seq_num = 10240, ack_num = 9814)
=====Start the four-way handshake=====
Receive a packet(FIN) from 127.0.0.1 : 10250
Receive a packet (seq_num = 10244, ack_num = 9814)
Send a packet(ACK) to 127.0.0.1 : 10250
Send a packet(FIN) to 127.0.0.1 : 10250
Receive a packet(ACK) from 127.0.0.1 : 10250
Receive a packet (seq_num = 10245, ack_num = 9815)
=====Complete the four-way handshake=====
cube@cubc-All-Series:~/Documents/computerNetwork$
```