

# Computer Networks Lab7

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## 1 Solo Portion

### 1.1 Conversation

- 我的 endtoend 成功与另一个进程里的副本进行了通讯 (server端选择的偶数为1042)
  - server发送了消息"hello from server 1", client接收到了该消息并显示在了命令行输出里
  - client发送了消息"hello from client 2", server接收到了该消息并显示在了它的命令行输出里
  - server和client均用ctrl+D关闭bytestream并退出

```
lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 1042
DEBUG: Network interface has Ethernet address 02:00:00:dc:98:83 and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:94:22:a9 and IP address 10.0.0.172
DEBUG: adding route 172.16.0.0/12 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 192.168.0.0/16 => 10.0.0.192 on interface 1
DEBUG: Network interface has Ethernet address ba:2f:ba:27:d0:09 and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...
DEBUG: minnow new connection from 192.168.0.50:54037.
```

```
lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend client cs144.keithw.org 1043
DEBUG: Network interface has Ethernet address 02:00:00:38:98:30 and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:10:6b:ca and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address 22:1b:df:f8:fa:5f and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:54037...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
```

```
lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 1042
DEBUG: Network interface has Ethernet address 02:00:00:90:27:88 and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:83:8d:12 and IP address 10.0.0.172
DEBUG: adding route 172.16.0.0/12 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 192.168.0.0/16 => 10.0.0.192 on interface 1
DEBUG: Network interface has Ethernet address 2e:dc:11:0d:a1:da and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...
DEBUG: minnow new connection from 192.168.0.50:14301.
hello from server 1
```

```
• lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend client cs144.keithw.org 1043
DEBUG: Network interface has Ethernet address 02:00:00:78:62:d9 and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:3c:23:98 and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address 3e:5b:94:78:1a:80 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:14301...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
hello from server 1
█
```

```
• lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend client cs144.keithw.org 1043
DEBUG: Network interface has Ethernet address 02:00:00:69:13:4e and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:77:16:5d and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address e2:e2:45:53:71:86 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:15481...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
hello from server 1
hello from client 2
█
```

```
• lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 1042
DEBUG: Network interface has Ethernet address 02:00:00:20:13:98 and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:d6:38:9a and IP address 10.0.0.172
DEBUG: adding route 172.16.0.0/12 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 192.168.0.0/16 => 10.0.0.192 on interface 1
DEBUG: Network interface has Ethernet address 56:e7:e6:b7:b4:01 and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...
DEBUG: minnow new connection from 192.168.0.50:15481.
hello from server 1
hello from client 2
█
```

```
• lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 1042
DEBUG: Network interface has Ethernet address 02:00:00:20:13:98 and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:d6:38:9a and IP address 10.0.0.172
DEBUG: adding route 172.16.0.0/12 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 192.168.0.0/16 => 10.0.0.192 on interface 1
DEBUG: Network interface has Ethernet address 56:e7:e6:b7:b4:01 and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...
DEBUG: minnow new connection from 192.168.0.50:15481.
hello from server 1
hello from client 2
DEBUG: Outbound stream to 172.16.0.100 finished.
DEBUG: minnow outbound stream to 192.168.0.50:15481 finished (0 seqnos still in flight).
DEBUG: minnow inbound stream from 192.168.0.50:15481 finished cleanly.
DEBUG: Inbound stream from 172.16.0.100 finished.
DEBUG: minnow waiting for clean shutdown... DEBUG: minnow outbound stream to 192.168.0.50:15481 has been fully acknowledged.
DEBUG: minnow TCP connection finished cleanly.
done.
Exiting... done.
```

```
• lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend client cs144.keithw.org 1043
DEBUG: Network interface has Ethernet address 02:00:00:69:13:4e and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:77:16:5d and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address e2:e2:45:53:71:86 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:15481...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
hello from server 1
hello from client 2
DEBUG: Outbound stream to 172.16.0.100 finished.
DEBUG: minnow outbound stream to 172.16.0.100:1234 finished (0 seqnos still in flight).
DEBUG: minnow inbound stream from 172.16.0.100:1234 finished cleanly.
DEBUG: Inbound stream from 172.16.0.100 finished.
DEBUG: minnow waiting for clean shutdown... DEBUG: minnow outbound stream to 172.16.0.100:1234 has been fully acknowledged.
DEBUG: minnow TCP connection finished cleanly.
done.
Exiting... done.
```

## 1.2 File Transfer

- 我的 endtoend 的client端成功接收了由另一个进程里的副本server端发送的1MB文件，两个文件的哈希值一致（server端选择的偶数为1042）
  - server端用 `dd if=/dev/urandom bs=1M count=1 of=/tmp/big.txt` 命令生成了一个大小为1MB的随机文件，并将其发送给client，client接收到了该文件并将其保存在本地的 `/tmp/big-received.txt` 文件中
  - 我用 `sha256sum` 命令分别计算了client接收后的文件的哈希值和server发送的文件的哈希值，并进行比较，结果一致
  - server和client均用ctrl+D关闭bytestream并退出

```
• lefty777@EDVAC-2023:~/minnow/build$ dd if=/dev/urandom bs=1M count=1 of=/tmp/big.txt
1+0 records in
1+0 records out
1048576 bytes (1.0 MB, 1.0 MiB) copied, 0.00956305 s, 110 MB/s
• lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 1042 < /tmp/big.txt
DEBUG: Network interface has Ethernet address 02:00:00:bc:b9:71 and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:5d:d7:0e and IP address 10.0.0.172
DEBUG: adding route 172.16.0.0/12 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 192.168.0.0/16 => 10.0.0.192 on interface 1
DEBUG: Network interface has Ethernet address c6:7f:c0:a7:f9:b4 and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...
DEBUG: minnow new connection from 192.168.0.50:20431.
DEBUG: minnow inbound stream from 192.168.0.50:20431 finished cleanly.
DEBUG: Inbound stream from 172.16.0.100 finished.
```

```
• lefty777@EDVAC-2023:~/minnow/build$ </dev/null ./apps/endtoend client cs144.keithw.org 1043 > /tmp/big-received.txt
DEBUG: Network interface has Ethernet address 02:00:00:4f:b9:3f and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:06:7a:db and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address 1a:a1:1b:ba:7e:eb and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:20431...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
DEBUG: Outbound stream to 172.16.0.100 finished.
DEBUG: minnow outbound stream to 172.16.0.100:1234 finished (0 seqnos still in flight).
DEBUG: minnow outbound stream to 172.16.0.100:1234 has been fully acknowledged.
```

```
• lefty777@EDVAC-2023:~/minnow/build$ dd if=/dev/urandom bs=1M count=1 of=/tmp/big.txt
1+0 records in
1+0 records out
1048576 bytes (1.0 MB, 1.0 MiB) copied, 0.00956305 s, 110 MB/s
• lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 1042 < /tmp/big.txt
DEBUG: Network interface has Ethernet address 02:00:00:bc:b9:71 and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:5d:d7:0e and IP address 10.0.0.172
DEBUG: adding route 172.16.0.0/12 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 192.168.0.0/16 => 10.0.0.192 on interface 1
DEBUG: Network interface has Ethernet address c6:7f:c0:a7:f9:b4 and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...
DEBUG: minnow new connection from 192.168.0.50:20431.
DEBUG: minnow inbound stream from 192.168.0.50:20431 finished cleanly.
DEBUG: Inbound stream from 172.16.0.100 finished.
DEBUG: Outbound stream to 172.16.0.100 finished.
DEBUG: minnow waiting for clean shutdown... DEBUG: minnow outbound stream to 192.168.0.50:20431 finished (63000 seqnos still in flight).
DEBUG: minnow outbound stream to 192.168.0.50:20431 has been fully acknowledged.
DEBUG: minnow TCP connection finished cleanly.
done.
Exiting... done.
• lefty777@EDVAC-2023:~/minnow/build$
```

```

• lefty777@EDVAC-2023:~/minnow/build$ </dev/null ./apps/endtoend client cs144.keithw.org 1043 > /tmp/big-received.txt
DEBUG: Network interface has Ethernet address 02:00:00:4f:b9:3f and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:06:7a:db and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address 1a:a1:1b:ba:7e:eb and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:20431...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
DEBUG: Outbound stream to 172.16.0.100 finished.
DEBUG: minnow outbound stream to 172.16.0.100:1234 finished (0 seqnos still in flight).
DEBUG: minnow outbound stream to 172.16.0.100:1234 has been fully acknowledged.
DEBUG: minnow inbound stream from 172.16.0.100:1234 finished cleanly.
DEBUG: Inbound stream from 172.16.0.100 finished.
DEBUG: minnow waiting for clean shutdown... DEBUG: minnow TCP connection finished cleanly.
done.
Exiting... done.
• lefty777@EDVAC-2023:~/minnow/build$

```

```

• lefty777@EDVAC-2023:~/minnow$ sha256sum /tmp/big.txt
7c7e2d6958e665faef7fe4a0020787af0f152a115f3aff5225a36a0cf34f1f6e /tmp/big.txt
• lefty777@EDVAC-2023:~/minnow$ sha256sum /tmp/big-received.txt
7c7e2d6958e665faef7fe4a0020787af0f152a115f3aff5225a36a0cf34f1f6e /tmp/big-received.txt

```

## 1.3 Code Changes

我未对源码作出修改，直接完成了测试

# 2 Group Portion

## 2.1 Lab Partner

- 张浩淼 221098038

## 2.2 Conversation

- 我首先扮演了client的角色与张浩淼扮演的server进行了对话（张浩淼选择的偶数为3000）
  - server发送了消息"hello client"，我接收到了该消息并显示在了命令行输出里
  - 我发送了消息"hello I'm client"，server接收到了该消息并显示在了它的命令行输出里
  - 最后我用ctrl+D关闭了bytestream并退出

```

❖ lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend client cs144.keithw.org 3001
DEBUG: Network interface has Ethernet address 02:00:00:e1:10:0f and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:04:ba:63 and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address 12:d5:5d:7d:c5:01 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:31447...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.

```

```

❖ lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend client cs144.keithw.org 3001
DEBUG: Network interface has Ethernet address 02:00:00:e1:10:0f and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:04:ba:63 and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address 12:d5:5d:7d:c5:01 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:31447...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
hello client

```

```

Lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend client cs144.keithw.org 3001
DEBUG: Network interface has Ethernet address 02:00:00:e1:10:0f and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:04:ba:63 and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address 12:d5:5d:7d:c5:01 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:31447...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
hello client

hello I'm client

```

```

Lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend client cs144.keithw.org 3001
DEBUG: Network interface has Ethernet address 02:00:00:e1:10:0f and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:04:ba:63 and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address 12:d5:5d:7d:c5:01 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:31447...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
hello client

hello I'm client
DEBUG: Outbound stream to 172.16.0.100 finished.
DEBUG: minnow outbound stream to 172.16.0.100:1234 finished (0 seqnos still in flight).
DEBUG: minnow outbound stream to 172.16.0.100:1234 has been fully acknowledged.

```

```

Lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend client cs144.keithw.org 3001
DEBUG: Network interface has Ethernet address 02:00:00:e1:10:0f and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:04:ba:63 and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address 12:d5:5d:7d:c5:01 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:31447...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
hello client

hello I'm client
DEBUG: Outbound stream to 172.16.0.100 finished.
DEBUG: minnow outbound stream to 172.16.0.100:1234 finished (0 seqnos still in flight).
DEBUG: minnow outbound stream to 172.16.0.100:1234 has been fully acknowledged.
DEBUG: minnow inbound stream from 172.16.0.100:1234 finished cleanly.
DEBUG: Inbound stream from 172.16.0.100 finished.
DEBUG: minnow waiting for clean shutdown... DEBUG: minnow TCP connection finished cleanly.
done.
Exiting... done.
Lefty777@EDVAC-2023:~/minnow/build$

```

- 接下来我扮演了server的角色与张浩淼扮演的client进行了对话（我选择的偶数为3000）
  - 张浩淼发送了消息"hello server"，我接收到了该消息并显示在了命令行输出里
  - client发送了消息"hello I'm server"，client接收到了该消息并显示在了命令行输出里
  - 最后我用ctrl+D关闭bytestream并退出

```

Lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 3000
DEBUG: Network interface has Ethernet address 02:00:00:29:a5:b6 and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:2c:a5:1e and IP address 10.0.0.172
DEBUG: adding route 172.16.0.0/12 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 192.168.0.0/16 => 10.0.0.192 on interface 1
DEBUG: Network interface has Ethernet address 62:30:eb:f5:69:5b and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...

```



```

lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 3000
DEBUG: Network interface has Ethernet address 02:00:00:29:a5:b6 and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:2c:a5:1e and IP address 10.0.0.172
DEBUG: adding route 172.16.0.0/12 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 192.168.0.0/16 => 10.0.0.192 on interface 1
DEBUG: Network interface has Ethernet address 62:30:eb:f5:69:5b and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...
DEBUG: minnow new connection from 192.168.0.50:41995.
hello server
hello I'm server
DEBUG: minnow inbound stream from 192.168.0.50:41995 finished cleanly.
DEBUG: Inbound stream from 172.16.0.100 finished.

```

```

• lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 3000
DEBUG: Network interface has Ethernet address 02:00:00:29:a5:b6 and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:2c:a5:1e and IP address 10.0.0.172
DEBUG: adding route 172.16.0.0/12 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 192.168.0.0/16 => 10.0.0.192 on interface 1
DEBUG: Network interface has Ethernet address 62:30:eb:f5:69:5b and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...
DEBUG: minnow new connection from 192.168.0.50:41995.
hello server
hello I'm server
DEBUG: minnow inbound stream from 192.168.0.50:41995 finished cleanly.
DEBUG: Inbound stream from 172.16.0.100 finished.
DEBUG: Outbound stream to 172.16.0.100 finished.
DEBUG: minnow waiting for clean shutdown... DEBUG: minnow outbound stream to 192.168.0.50:41995 finished (0 seqnos still in flight).
DEBUG: minnow outbound stream to 192.168.0.50:41995 has been fully acknowledged.
DEBUG: minnow TCP connection finished cleanly.
done.
Exiting... done.
• lefty777@EDVAC-2023:~/minnow/build$

```

## 2.3 File Transfer

- 我首先扮演了client的角色，接收张浩淼发送的1MB文件（张浩淼选择的偶数为3000）
  - 我接收到了1MB文件并将其保存在了本地的 /tmp/zhm-received.txt 文件中
  - 我用 sha256sum 命令计算了接收后的文件的哈希值，并与张浩淼计算的发送文件的哈希值比较，结果一致
  - 最后我用ctrl+D关闭bytestream并退出

```

• lefty777@EDVAC-2023:~/minnow/build$ </dev/null ./apps/endtoend client cs144.keithw.org 3001 > /tmp/zhm-received.txt
DEBUG: Network interface has Ethernet address 02:00:00:90:c2:e5 and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:df:4e:31 and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address 56:3a:65:ee:30:19 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:22436...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
DEBUG: Outbound stream to 172.16.0.100 finished.
DEBUG: minnow outbound stream to 172.16.0.100:1234 finished (0 seqnos still in flight).
DEBUG: minnow outbound stream to 172.16.0.100:1234 has been fully acknowledged.

```

```

• lefty777@EDVAC-2023:~/minnow/build$ </dev/null ./apps/endtoend client cs144.keithw.org 3001 > /tmp/zhm-received.txt
DEBUG: Network interface has Ethernet address 02:00:00:90:c2:e5 and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:df:4e:31 and IP address 10.0.0.192
DEBUG: adding route 192.168.0.0/16 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 172.16.0.0/12 => 10.0.0.172 on interface 1
DEBUG: Network interface has Ethernet address 56:3a:65:ee:30:19 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:22436...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
DEBUG: Outbound stream to 172.16.0.100 finished.
DEBUG: minnow outbound stream to 172.16.0.100:1234 finished (0 seqnos still in flight).
DEBUG: minnow outbound stream to 172.16.0.100:1234 has been fully acknowledged.
DEBUG: minnow inbound stream from 172.16.0.100:1234 finished cleanly.
DEBUG: Inbound stream from 172.16.0.100 finished.
DEBUG: minnow waiting for clean shutdown...

```

```

lefty777@EDVAC-2023:/tmp$ sha256sum zhm-received.txt
bd73f788949b87a51ee81d1a4c146115a9a947398e7873dadbb5c4bcd872ef12  zhm-received.txt
lefty777@EDVAC-2023:/tmp$

```

```
done.
Exiting... done.
zippypika@MOSS:~/network/minnow/build$ sha256sum /tmp/big.txt
bd73f788949b87a51ee81d1a4c146115a9a947398e7873dadbb5c4bcd872ef12  /tmp/big.txt
```

- 接下来我扮演了server的角色，发送1MB文件给张浩淼（我选择的偶数为3000）
  - 我使用 `dd if=/dev/urandom bs=1M count=1 of=/tmp/big.txt` 命令生成了一个大小为1MB的随机文件，并将其发送给张浩淼
  - 张浩淼用 `sha256sum` 命令计算了我发送的文件的哈希值，并与张浩淼计算的接收文件的哈希值比较，结果一致
  - 最后我用`ctrl+D`关闭`bytestream`并退出

```
• lefty777@EDVAC-2023:~/minnow/build$ dd if=/dev/urandom bs=1M count=1 of=/tmp/big.txt
1+0 records in
1+0 records out
1048576 bytes (1.0 MB, 1.0 MiB) copied, 0.00370822 s, 283 MB/s
• lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 3000 < /tmp/big.txt
DEBUG: Network interface has Ethernet address 02:00:00:e2:26:e8 and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:fc:a3:87 and IP address 10.0.0.172
DEBUG: adding route 172.16.0.0/12 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 192.168.0.0/16 => 10.0.0.192 on interface 1
DEBUG: Network interface has Ethernet address ce:1e:1f:ae:31:cb and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...
```

```
• lefty777@EDVAC-2023:~/minnow/build$ dd if=/dev/urandom bs=1M count=1 of=/tmp/big.txt
1+0 records in
1+0 records out
1048576 bytes (1.0 MB, 1.0 MiB) copied, 0.00370822 s, 283 MB/s
• lefty777@EDVAC-2023:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 3000 < /tmp/big.txt
DEBUG: Network interface has Ethernet address 02:00:00:e2:26:e8 and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:fc:a3:87 and IP address 10.0.0.172
DEBUG: adding route 172.16.0.0/12 => (direct) on interface 0
DEBUG: adding route 10.0.0.0/8 => (direct) on interface 1
DEBUG: adding route 192.168.0.0/16 => 10.0.0.192 on interface 1
DEBUG: Network interface has Ethernet address ce:1e:1f:ae:31:cb and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...
DEBUG: minnow new connection from 192.168.0.50:44477.
DEBUG: minnow inbound stream from 192.168.0.50:44477 finished cleanly.
DEBUG: Inbound stream from 172.16.0.100 finished.
DEBUG: Outbound stream to 172.16.0.100 finished.
DEBUG: minnow waiting for clean shutdown... DEBUG: minnow outbound stream to 192.168.0.50:44477 finished (63000 seqnos still in flight).
DEBUG: minnow outbound stream to 192.168.0.50:44477 has been fully acknowledged.
DEBUG: minnow TCP connection finished cleanly.
done.
Exiting... done.
• lefty777@EDVAC-2023:~/minnow/build$
```

```
lefty777@EDVAC-2023:/tmp$ sha256sum big.txt
52d0ac23ee3cd933646b2da6638658c42967853f23db31958d60a2dcd932d7d2  big.txt
lefty777@EDVAC-2023:/tmp$ S
```

```
zippypika@MOSS:~/network/minnow/build$ sha256sum /tmp/big-received.txt
52d0ac23ee3cd933646b2da6638658c42967853f23db31958d60a2dcd932d7d2  /tmp/big-received.txt
```

## 2.4 Code Changes

我和张浩淼均未对源码作出修改，直接完成了测试

## 3 Remaining Bugs

目前我的代码已经通过了全部的测试，暂时未发现明显的bug