Check7 实验报告

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在本实验中，我们将利用之前的实验成果，构建一个真实的网络环境。通过整合 Checkpoint 0 到 Checkpoint 6 的成果，我们将实现网络栈（主机和路由器）之间的通信。本实验的主要目的是验证我们实现的网络协议的功能和性能，并与另一位同学的网络栈进行交互。

实验的结果是是成功的，证明我们之前的实现没有问题。我的实验伙伴是 佟一飞（221220134）。

1. 建立连接

在本机同时建立 client 和 server 的结果如下，符合预期：

```
lier@lier-K:~/minnow$ ./build/apps/endtoend client cs144.keithw.org 3001
DEBUG: Network interface has Ethernet address 02:00:00:e8:2a:53 and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:5c:27:c3 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 66:1e:51:e2:b1:f4 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:14825...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
```

```
lier@lier-K:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 3000
DEBUG: Network interface has Ethernet address 02:00:00:83:a9:5b and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:8c:89:4a 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 52:22:c2:8b:54:23 and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...
DEBUG: minnow new connection from 192.168.0.50:14825.
```

与伙伴的建立如下，我使用的 port 为 1145， 对方为 1144：

```
lier@lier-K:~/minnow/build$ ./apps/endtoend client cs144.keithw.org 1145
DEBUG: Network interface has Ethernet address 02:00:00:c6:97:d1 and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:8e:62:c7 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 c2:2f:88:fd:a4:d4 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:63641...
DEBUG: minnow connecting to 172.16.0.100:1234...
DEBUG: minnow successfully connected to 172.16.0.100:1234.
```

2. 传输文件：

在本机同时建立 client 和 server 的结果如下，符合预期：

```
lier@lier-K:~/minnow/build$ </dev/null ./apps/endtoend client cs144.keithw.org 3001 > /tmp/big-
received.txt
DEBUG: Network interface has Ethernet address 02:00:00:84:cf:c0 and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:3e:13:3a 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 12:08:2f:db:ea:1b and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:15652...
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.
```

```
lier@lier-K:~/minnow/build$ ./apps/endtoend server cs144.keithw.org 3000 < /tmp/big.txt
DEBUG: Network interface has Ethernet address 02:00:00:93:aa:0c and IP address 172.16.0.1
DEBUG: Network interface has Ethernet address 02:00:00:ad:a6:8b 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 86:b9:fb:26:09:bc and IP address 172.16.0.100
DEBUG: minnow listening for incoming connection...
DEBUG: minnow new connection from 192.168.0.50:15652.
DEBUG: minnow inbound stream from 192.168.0.50:15652 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 192.168.0.50:15652
 finished (63000 seqnos still in flight).
DEBUG: minnow outbound stream to 192.168.0.50:15652 has been fully acknowledged.
DEBUG: minnow TCP connection finished cleanly.
done.
Exiting... done.
```

最终结果的 sha 如下，符合预期：

```
lier@lier-K:~/minnow/build$ sha256sum /tmp/big.txt
40580124305ef636dcf7d6fbb423bd33fe30585938e4341ecbd372a0fd03e6eb  /tmp/big.txt
lier@lier-K:~/minnow/build$ sha256sum /tmp/big-received.txt
40580124305ef636dcf7d6fbb423bd33fe30585938e4341ecbd372a0fd03e6eb  /tmp/big-received.txt
```

与实验伙伴连接成功，sha 结果符合预期（与对方相同）：

```
lier@lier-K:~/minnow/build$ </dev/null ./apps/endtoend client cs144.keithw.org 1145 > /tmp/big-received.txt
DEBUG: Network interface has Ethernet address 02:00:00:bb:cf:7a and IP address 192.168.0.1
DEBUG: Network interface has Ethernet address 02:00:00:00:8f:cb 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 9a:57:0f:64:e9:a0 and IP address 192.168.0.50
DEBUG: Connecting from 192.168.0.50:9538...
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.
```

```
lier@lier-K:~/minnow$ sha256sum /tmp/big-received.txt
828c65ed799bcc319446661adae9405399ace8370cbc1aface71e3bf682fd875  /tmp/big-received.txt
```