TCP

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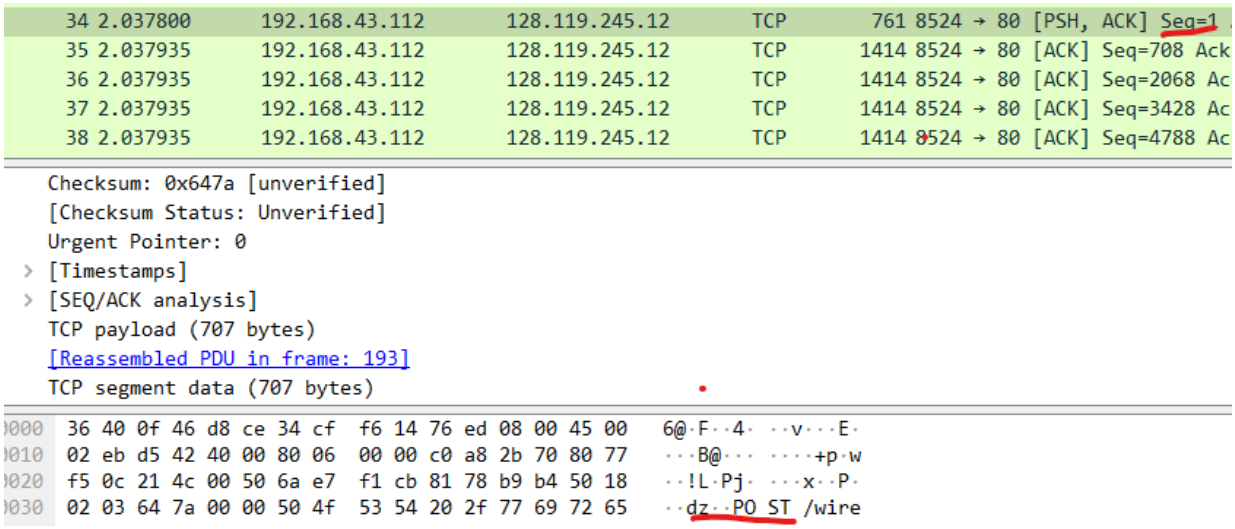
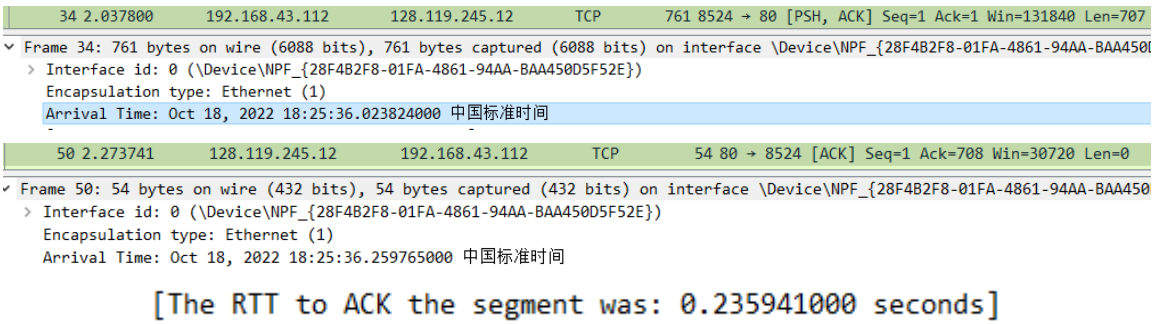
1.
```
192.168.43.112      128.119.245.12      TCP      66 8524 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
```
   - IP地址即为本机地址：192.168.43.112
   - TCP端口号为：8524
2.
   - IP地址为：128.119.245.12
   - TCP端口号为：80
3. 由于直接采用本机的实验数据包，故与第一问相同；
4.
   - 仍由上图，序列号为0；
   -
```
Flags: 0x002 (SYN)
    000. .... .... = Reserved: Not set
    ...0 .... .... = Nonce: Not set
    .... 0... .... = Congestion Window Reduced (CWR): Not set
    .... .0.. .... = ECN-Echo: Not set
    .... ..0. .... = Urgent: Not set
    .... ...0 .... = Acknowledgment: Not set
    .... .... 0... = Push: Not set
    .... .... .0.. = Reset: Not set
  > .... .... ..1. = Syn: Set
    .... .... ...0 = Fin: Not set
```
   通过标志段中的位来判断。
5.
```
128.119.245.12      192.168.43.112      TCP      66 80 → 8524 [SYN, ACK] Seq=0 Ack=1
```
   - 序列号为0；
   - ACK值为1；
   - ACK = Seq + 1；
   -
```
Flags: 0x012 (SYN, ACK)
    000. .... .... = Reserved: Not set
    ...0 .... .... = Nonce: Not set
    .... 0... .... = Congestion Window Reduced (CWR): Not set
    .... .0.. .... = ECN-Echo: Not set
    .... ..0. .... = Urgent: Not set
    .... ...1 .... = Acknowledgment: Set
    .... .... 0... = Push: Not set
    .... .... .0.. = Reset: Not set
  > .... .... ..1. = Syn: Set
    .... .... ...0 = Fin: Not set
```
   同样通过标志段置位；
6.



- 如图，序列号为1；

7.
   - 区段一：



序列号：1

发送时间：36.023824000

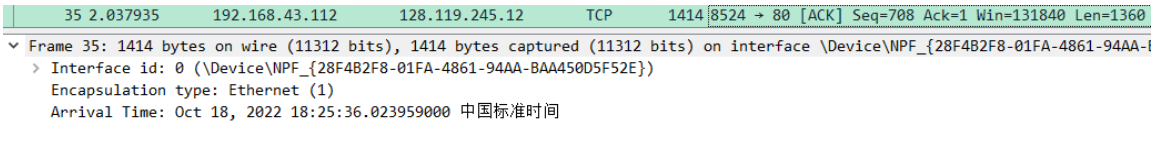
长度：707

到达时间：36.259765000

RTT：0.235941000

ERTT：0.235941000

   - 区段二：



序列号：708

发送时间：36.023959000

长度：1360

未接收到对应ACK包，无法分析。

   - 区段三：

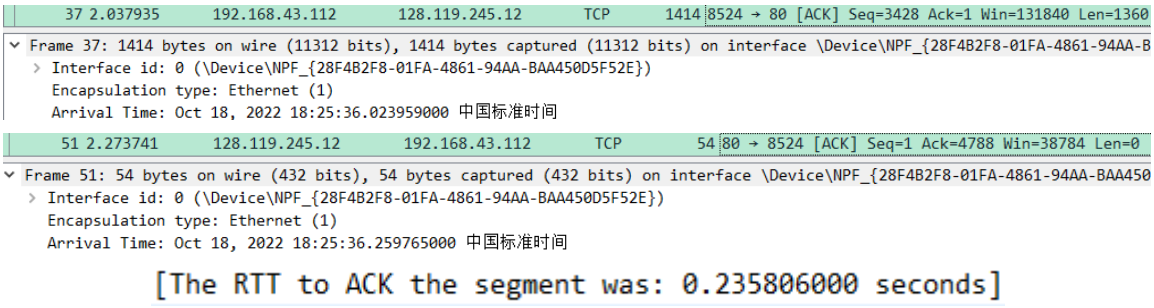
序列号：2068

发送时间：36.023959000

长度：1360

未接收到对应ACK包，无法分析。

- 区段四：



序列号：3428

发送时间：36.023959000

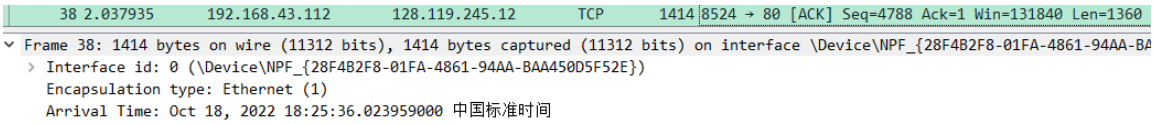
长度：1360

到达时间：36.259765000

RTT：0.235806000

ERTT：0.875 * 0.235941000 + 0.125 * 0.235806000 = 0.235924125

- 区段五：



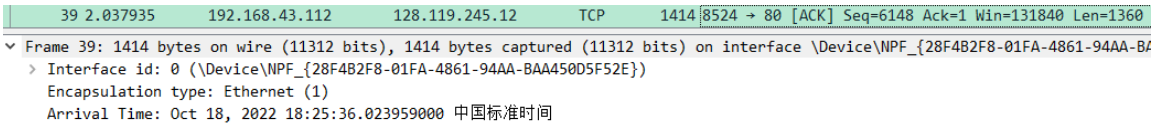
序列号：4788

发送时间：36.023959000

长度：1360

未接收到ACK。

- 区段六：



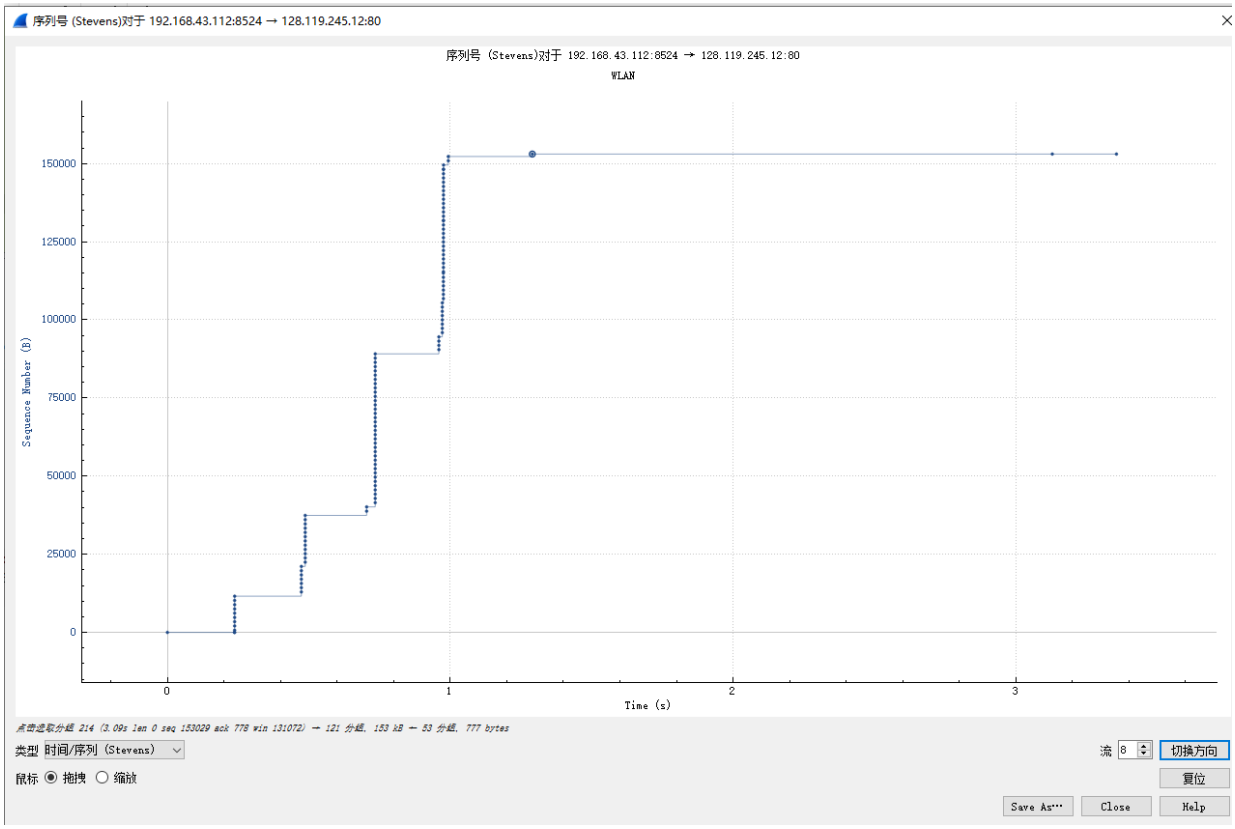
序列号：6148

发送时间：36.023959000

长度：1360

未接收到ACK。

8. 如上。
9. 对于服务器，win = 229， 对于主机，win = 131840。缺少接收器缓冲空间确实会限制发送方传送TCP区段，因为TCP采用的流量控制服务将会消除接收方缓存溢出的可能，使得发送方的速率下降至与接收方速率相匹配。
10. 没有重传区段，查看时间序列图呈现持续递增趋势：



11. 除了初始的707bytes外，一般确认1360bytes。有这种情况：

```
[ACK] Seq=1 Ack=8868 Win=46976 Len=0
[ACK] Seq=1 Ack=11588 Win=52480 Len=0
```

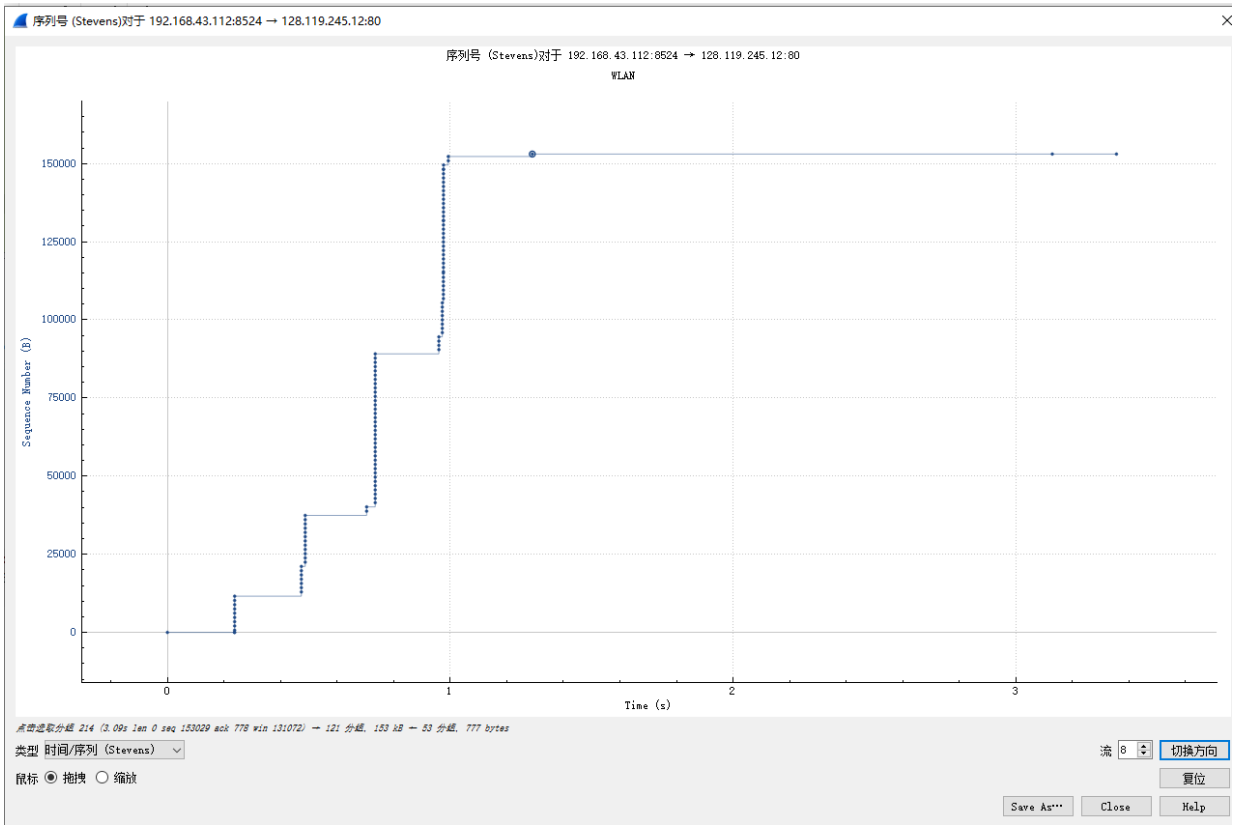
12. *平均吞吐量 = 总传输数据量（比特）F / 总时间 T*

```
193 2.793367    192.168.43.112    128.119.245.12    HTTP    839 POST /wireshark-labs/lab3-1-reply.htm HTTP/1.1  (text/plain)
> Frame 193: 839 bytes on wire (6712 bits), 839 bytes captured (6712 bits) on interface \Device\NPF_{28F4B2F8-01FA-4861-94AA-BAA450D5F52E}, id
> Ethernet II, Src: IntelCor_14:76:ed (34:cf:f6:14:76:ed), Dst: 36:40:0f:46:d8:ce (36:40:0f:46:d8:ce)
> Internet Protocol Version 4, Src: 192.168.43.112, Dst: 128.119.245.12
> Transmission Control Protocol, Src Port: 8524, Dst Port: 80, Seq: 152244, Ack: 1, Len: 785
> [116 Reassembled TCP Segments (153028 bytes): #34(707), #35(1360), #36(1360), #37(1360), #38(1360), #39(1360), #40(1360), #41(1360), #42(136
```

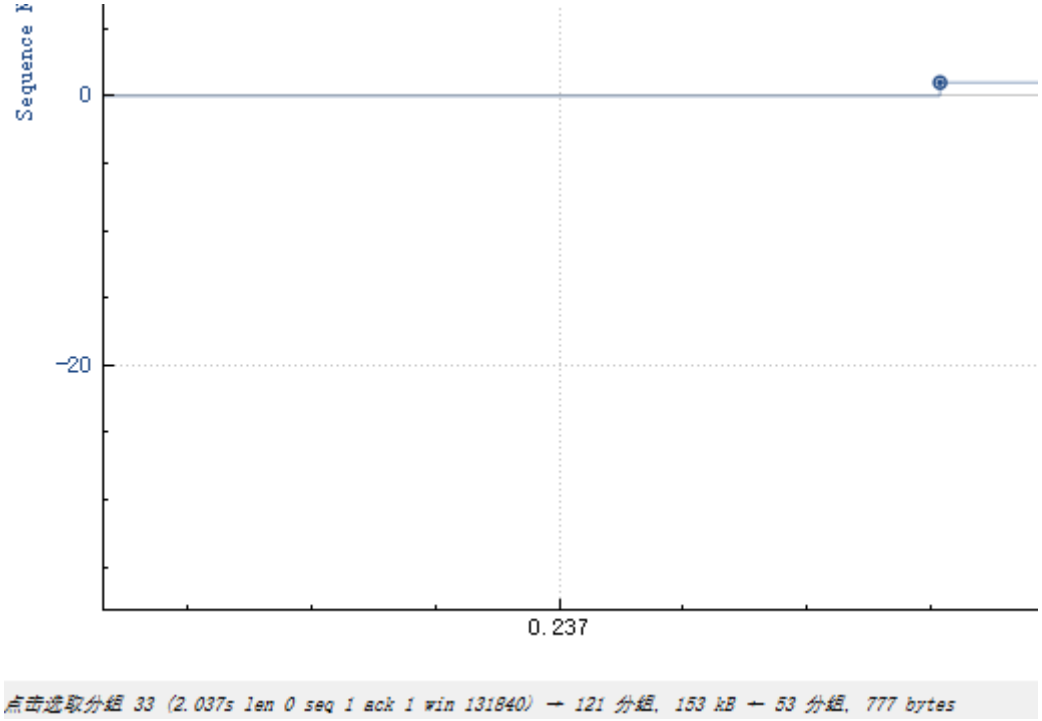
```
v [Timestamps]
    [Time since first frame in this TCP stream: 0.993182000 seconds]
```

平均吞吐量 = 153028 / 0.993182 = 154.078kb/s

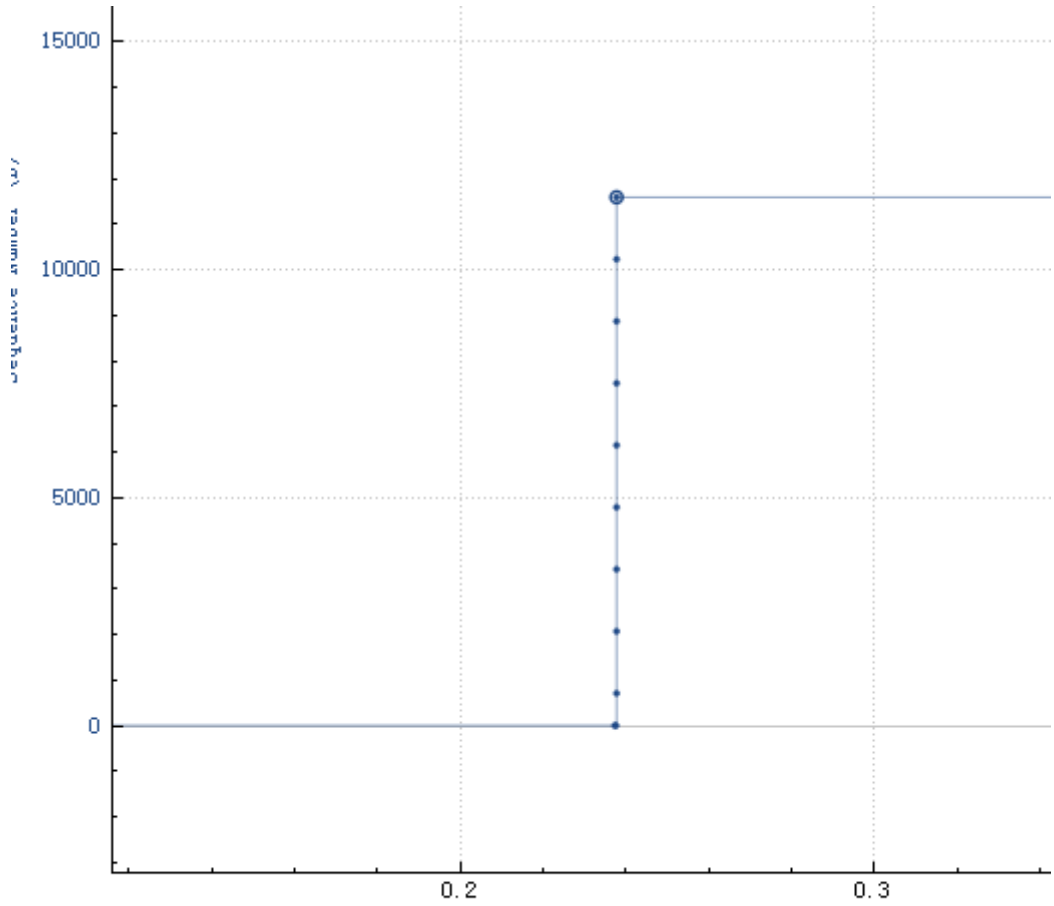
13.


序列号 (Stevens)对于 192.168.43.112:8524 → 128.119.245.12:80
序列号 (Stevens)对于 192.168.43.112:8524 → 128.119.245.12:80
WLAN
Sequence Number (B)
150000
125000
100000
75000
50000
25000
0
0
1
2
3
Time (s)
点击选取分组 214 (3.09s len 0 seq 153029 ack 778 win 131072) → 121 分组, 153 kB ← 53 分组, 777 bytes
类型 时间/序列 (Stevens)
流 8
切换方向
鼠标 抱拽 缩放
复位
Save As···
Close
Help

慢启动开始：

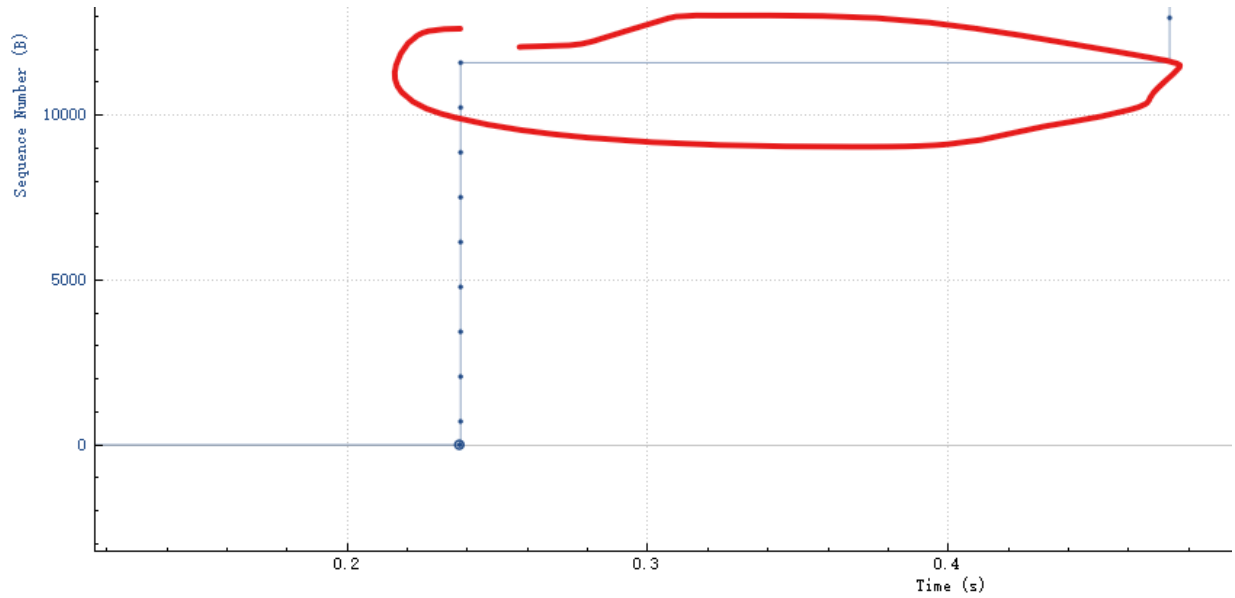

Sequence N
0
-20
0.237
点击选取分组 33 (2.037s len 0 seq 1 ack 1 win 131840) → 121 分组, 153 kB ← 53 分组, 777 bytes

慢启动结束：



点击选取分组 43 (2.038s len 1360 seq 11588 ack 1 win 131840) → 121 分组, 153 kB ← 53 分组, 777 bytes

拥塞避免:



点击选取分组 33 (2.037s len 0 seq 1 ack 1 win 131840) → 121 分组, 153 kB ← 53 分组, 777 bytes

与理想化行为相比，指数增长的速率非常大，几乎呈现直线型增长，而拥塞避免则相比之下也呈直线（几乎看不到线性）。除此之外，慢启动带来的时间延长也比理想化情况高很多，对于一些数据量小的文件，为了解决拥塞带来的慢启动时延可能反而会延长发送到达的时间，可见实际中并非时刻有所裨益。