

LAB4

牛庆源 PB21111733

• 1.and2.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
2	0.023172	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM=1
3	0.023265	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	0.026477	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=568
5	0.041737	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
6	0.053937	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	0.054026	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
8	0.054690	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460
9	0.077294	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	0.077405	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460
11	0.078157	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460
12	0.124085	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11680 Len=0

1.将文件传输到gaia.cs.umass.edu的客户端ip地址为192.168.1.102，端口号为1161

2.gaia.cs.umass.edu的IP地址是128.119.245.12，端口号为80

• 3.

No.	Time	Source	Destination	Protocol	Length	Info
381	12.970158	128.119.245.12	202.141.190.132	TCP	60	80 → 64146 [ACK] Seq=1 Ack=18268 Win=65792 Len=0
382	12.970158	128.119.245.12	202.141.190.132	TCP	60	80 → 64146 [ACK] Seq=1 Ack=24108 Win=77440 Len=0
383	12.970158	128.119.245.12	202.141.190.132	TCP	60	80 → 64146 [ACK] Seq=1 Ack=34328 Win=97920 Len=0
384	12.970158	128.119.245.12	202.141.190.132	TCP	60	80 → 64146 [ACK] Seq=1 Ack=31408 Win=92032 Len=0
385	12.970226	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=47468 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled...
386	12.970226	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [PSH, ACK] Seq=48928 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled...
387	12.970226	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=50388 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled...
388	12.970226	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=51848 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled...
389	12.970226	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=53308 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled...
390	12.970226	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=54768 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled...
391	12.970226	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=56228 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled...
392	12.970226	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=57688 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled...
393	12.970226	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=59148 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled...

本机客户端ip地址为202.141.190.132，端口号为64146

• 4.and5.

330	12.344860	202.141.190.132	128.119.245.12	TCP	66	64148 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
331	12.364554	128.119.245.12	202.141.190.132	TCP	66	80 → 64146 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1 WS=128

> **Flags: 0x002 (SYN)**

4.TCP SYN段序号为0（由seq=0可得），在flags标识SYN段

Acknowledgment Number: 1 (relative ack number)

Flags: 0x012 (SYN, ACK)
000. = Reserved: Not set
...0 = Accurate ECN: Not set
.... 0... = Congestion Window Reduced: 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
[TCP Flags:A..S.]

5.SYN,ACK段序列号为0（由seq=0可得），ACK为1，flags标识该段

6.

> Frame 334: 801 bytes on wire (6408 bits), 801 bytes captured (6408 bits) on interface \Device\NPF_{8F4CCA7D-03-...}

> Ethernet II, Src: LiteonTe_9d:af:b3 (74:4c:a1:9d:af:b3), Dst: VMware_9f:00:7f (00:50:56:9f:00:7f)

> Internet Protocol Version 4, Src: 202.141.190.132, Dst: 128.119.245.12

> Transmission Control Protocol, Src Port: 64146, Dst Port: 80, Seq: 1, Ack: 1, Len: 747

Source Port: 64146

Destination Port: 80

[Stream index: 9]

[Conversation completeness: Incomplete, DATA (15)]

[TCP Segment Len: 747]

Sequence Number: 1 (relative sequence number)

Sequence Number (raw): 311548425

[Next Sequence Number: 748 (relative sequence number)]

Acknowledgment Number: 1 (relative ack number)

Acknowledgment number (raw): 147694907

0101 = Header Length: 20 bytes (5)

Flags: 0x018 (PSH, ACK)

Window: 513

[Calculated window size: 131328]

[Window size scaling factor: 256]

Checksum: 0x3404 [unverified]

[Checksum Status: Unverified]

Urgent Pointer: 0

0030 02 01 34 04 00 00 50 4f 53 54 20 2f 77 69 72 65 ..4...PO ST /wire

0040 73 68 61 72 6b 2d 6c 61 62 73 2f 6c 61 62 33 2d shark-lab/lab3-

0050 31 2d 72 65 70 6c 79 2e 68 74 6d 20 48 54 54 50 1-reply. htm HTTP

0060 2f 31 2e 31 0d 0a 48 6f 73 74 3a 20 67 61 69 61 /1.1..Ho st: gaia

0070 2e 63 73 2e 75 6d 61 73 73 2e 65 64 75 0d 0a 43 .cs.umas.s.edu:.C

0080 6f 6e 6e 65 63 74 69 6f 6e 3a 20 6b 65 65 70 2d onnectio n: keep-

0090 61 6c 69 76 65 0d 0a 43 6f 6e 74 65 6e 74 2d 4c alive..C ontent-L

00a0 85 6e 67 74 68 3a 20 31 35 32 33 32 31 0d 0a 43 ength: 1 52321..C

00b0 61 63 68 65 2d 43 6f 6e 74 72 6f 6c 3a 20 6d 61 ache-con trol: ma

00c0 78 2d 61 67 65 3d 30 0d 0a 55 70 67 72 61 64 65 x-age=0..Upgrade

00d0 2d 49 6e 73 65 63 75 72 65 2d 52 65 71 75 65 73 -Insecu e-Request

00e0 74 73 3a 20 31 0d 0a 4f 72 69 67 69 6e 3a 20 68 ts: 1..O rigin: h

00f0 74 74 70 3a 2f 2f 67 61 69 61 2e 63 73 2e 75 6d ttp://ga ia.cs.um

0100 61 73 73 2e 65 64 75 0d 0a 43 6f 6e 74 65 6e 74 ass.edu..Content

0110 2d 54 79 70 65 3a 20 6d 75 6c 74 69 70 61 72 74 -Type: m ultipart

0120 2f 66 6f 72 6d 2d 64 61 74 61 3b 20 62 6f 75 6e /form-da ta; boun

0130 64 61 72 79 3d 2d 2d 2d 2d 57 65 62 4b 69 74 4e dary=---WebKitF

0140 6f 72 6d 42 6f 75 6e 64 61 72 79 58 39 6b 41 4e ormBound aryX9kAN

0150 41 6b 77 59 42 37 68 42 76 4a 6f 0d 0a 55 73 65 AkwYB7h vjo..Use

0160 72 2d 41 67 65 6e 74 3a 20 4d 6f 7a 69 6c 6c 61 r-Agent: Mozilla

0170 2f 35 2e 30 20 28 57 69 6e 64 6f 77 73 20 4e 54 /5.0 (Wi ndows NT

0180 20 31 30 2e 30 3b 20 57 69 6e 36 34 3b 20 78 36 .0.0; W in64; x6

0190 34 29 20 41 70 70 6c 65 57 65 62 4b 69 74 2f 35 4) Apple WebKit/5

01a0 33 37 2e 33 36 20 28 4b 48 54 4d 4c 2c 20 6c 69 37.36 (K HTML, li

01b0 6b 65 20 47 65 63 6b 6f 29 20 43 68 72 6f 6d 65 ke Gecko) Chrome

01c0 2f 31 31 38 2e 30 2e 30 2e 30 20 53 61 66 61 72 /118.0.0 .0 Safar

post存在于PSH,ACK段，其序列号为1（seq=1）

7.

334	12.364869	202.141.190.132	128.119.245.12	TCP	801	64146 → 80 [PSH, ACK] Seq=1 Ack=1 Win=131328 Len=747 [TCP segment of a reassembled PDU]
335	12.364954	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=748 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
336	12.364954	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=2208 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
337	12.364954	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=3668 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
338	12.364954	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=5128 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
339	12.364954	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=6588 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
340	12.364954	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=8048 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
341	12.364954	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=9508 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
342	12.364954	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=10968 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
343	12.364954	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=12428 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
344	12.395713	128.119.245.12	202.141.190.132	TCP	66	80 → 64147 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM WS=128
345	12.395798	202.141.190.132	128.119.245.12	TCP	54	64147 → 80 [ACK] Seq=1 Ack=1 Win=131328 Len=0

前6个段的序列号为1 748 2208 3668 5128 6588，

分段1在12.364869s发送，

剩下五个分段在12.364954s并发送

351	12.661227	128.119.245.12	202.141.190.132	TCP	60	80 → 64146 [ACK] Seq=1 Ack=748 Win=30720 Len=0
352	12.661265	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=13888 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
353	12.661321	128.119.245.12	202.141.190.132	TCP	60	80 → 64146 [ACK] Seq=1 Ack=6588 Win=42496 Len=0

收到了两个ACK分别为748和6588，分别为第二段和第六段的序列号，即第一段和第五段返回的

ACK，收到的时间分别为12.661227s和12.661321s，

依据时间差计算得到第一段和第五段的RTT分别为0.296358s和0.296367s

第一段的EstimatedRTT1 = SampleRTT1 = 0.296358s

第五段的EstimatedRTT5 = 0.875 * EstimatedRTT1 + 0.125 * SampleRTT5 = 0.296359s

8.

由题7图可知第一段为747bytes，剩下都为1460bytes

9.

80 → 64146 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM WS=128

the minimum amount of available buffer space 是 29200bytes (win)

由题八答可知最大为1460bytes不超过29200bytes所以没有限制

10.

341	12.364954	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=9508 Ack=1 Win=131328 Len=1460
342	12.364954	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=10968 Ack=1 Win=131328 Len=1460
343	12.364954	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=12428 Ack=1 Win=131328 Len=1460
344	12.395713	128.119.245.12	202.141.190.132	TCP	66	80 → 64147 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS
345	12.395798	202.141.190.132	128.119.245.12	TCP	54	64147 → 80 [ACK] Seq=1 Ack=1 Win=131328 Len=0
346	12.402099	128.119.245.12	202.141.190.132	TCP	60	80 → 64137 [FIN, ACK] Seq=778 Ack=153070 Win=244608 L
347	12.402123	202.141.190.132	128.119.245.12	TCP	54	[TCP Dup ACK 96#1] 64137 → 80 [ACK] Seq=153070 Ack=1
349	12.642135	128.119.245.12	202.141.190.132	TCP	66	80 → 64148 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS
350	12.642230	202.141.190.132	128.119.245.12	TCP	54	64148 → 80 [ACK] Seq=1 Ack=1 Win=131328 Len=0
351	12.661227	128.119.245.12	202.141.190.132	TCP	60	80 → 64146 [ACK] Seq=1 Ack=748 Win=30720 Len=0
352	12.661265	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=13888 Ack=1 Win=131328 Len=1460
353	12.661321	128.119.245.12	202.141.190.132	TCP	60	80 → 64146 [ACK] Seq=1 Ack=6588 Win=42496 Len=0
354	12.661321	128.119.245.12	202.141.190.132	TCP	60	80 → 64146 [ACK] Seq=1 Ack=13888 Win=57088 Len=0
355	12.661360	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=15348 Ack=1 Win=131328 Len=1460
356	12.661360	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [PSH, ACK] Seq=16808 Ack=1 Win=131328 Len=
357	12.661360	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=18268 Ack=1 Win=131328 Len=1460
358	12.661360	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=19728 Ack=1 Win=131328 Len=1460
359	12.661360	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=21188 Ack=1 Win=131328 Len=1460
360	12.661360	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=22648 Ack=1 Win=131328 Len=1460
361	12.661360	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=24108 Ack=1 Win=131328 Len=1460
362	12.661360	202.141.190.132	128.119.245.12	TCP	1514	64146 → 80 [ACK] Seq=25568 Ack=1 Win=131328 Len=1460

由标记的内容可知seq是在不断增大的（由12.364954s到12.661265s到12.661360s时，seq仍然在一直增大），因此没有重传

11.

66	80 → 64146 [ACK] Seq=1 Ack=64988 Win=162176 Len=0 SLE=82508 SRE=83255
66	80 → 64146 [ACK] Seq=1 Ack=66448 Win=165120 Len=0 SLE=82508 SRE=83255
66	80 → 64146 [ACK] Seq=1 Ack=72288 Win=176768 Len=0 SLE=82508 SRE=83255
66	80 → 64146 [ACK] Seq=1 Ack=79588 Win=178432 Len=0 SLE=82508 SRE=83255
60	80 → 64146 [ACK] Seq=1 Ack=83255 Win=181632 Len=0
60	80 → 64146 [ACK] Seq=1 Ack=90555 Win=179584 Len=0
60	80 → 64146 [ACK] Seq=1 Ack=97855 Win=179584 Len=0

Ack差为1460bytes的整数倍

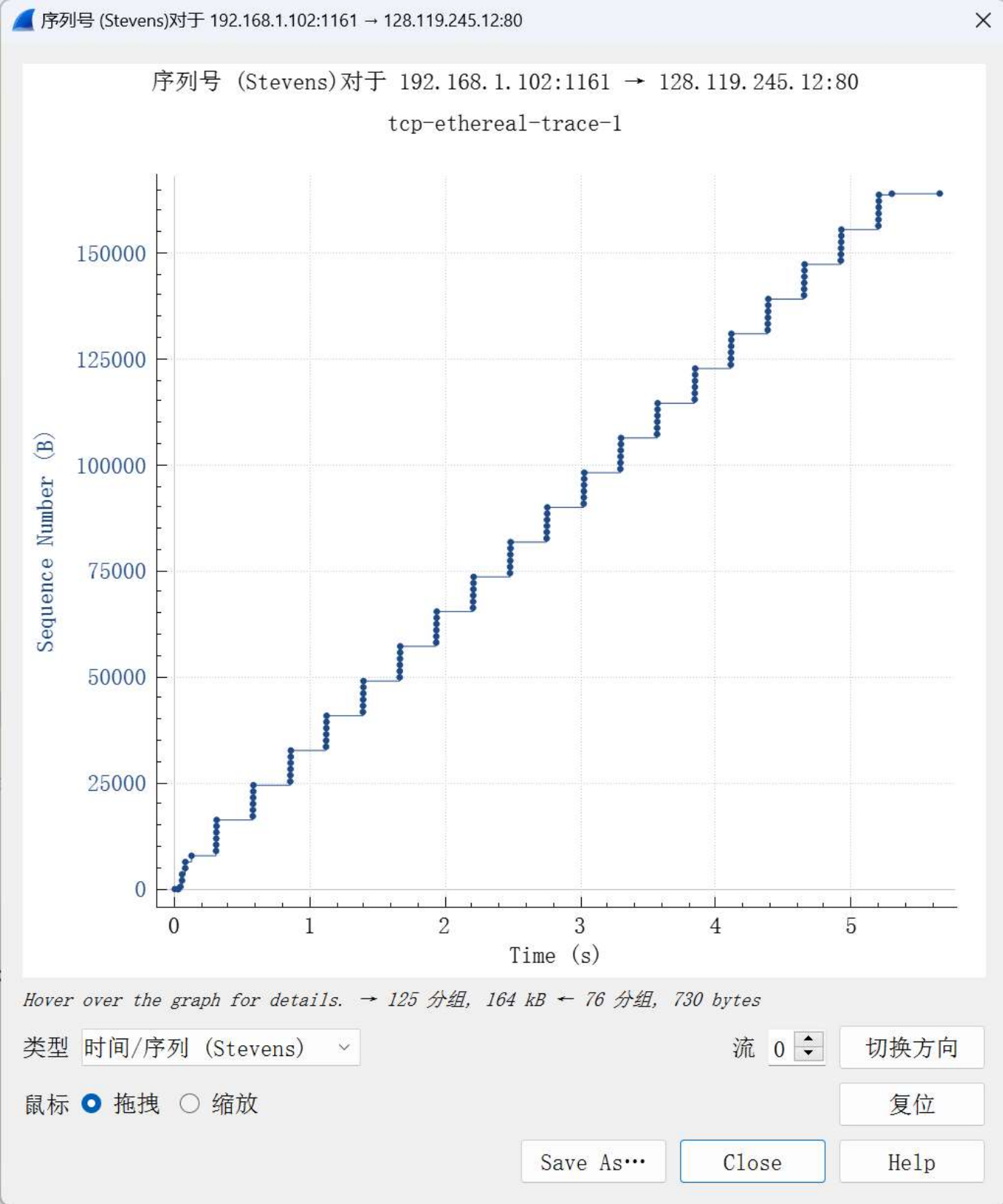
12.

331	12.364554	128.119.245.12	202.141.190.132	TCP	66	80 → 64146 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM WS=128
489	13.565270	128.119.245.12	202.141.190.132	TCP	60	80 → 64146 [ACK] Seq=1 Ack=153069 Win=264960 Len=0

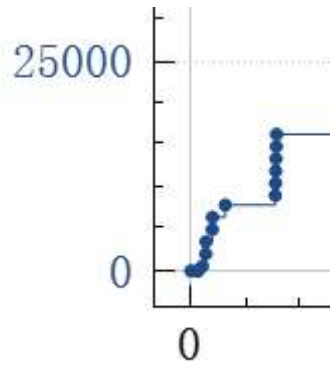
由第一个和最后一个ack信息可以计算得到

$$\frac{153069-1}{13.565270-12.364554} = 127.48kb/s$$

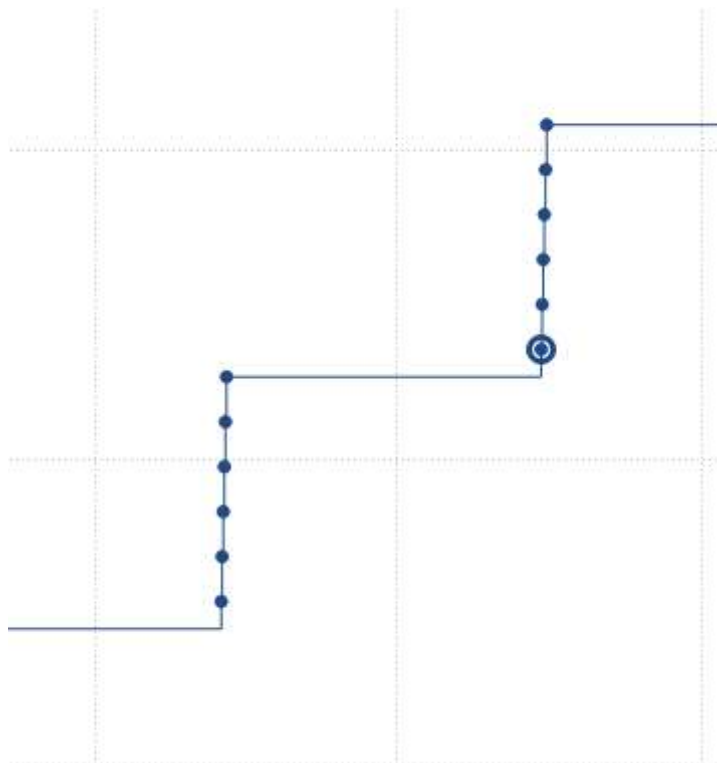
13.



慢启动阶段为



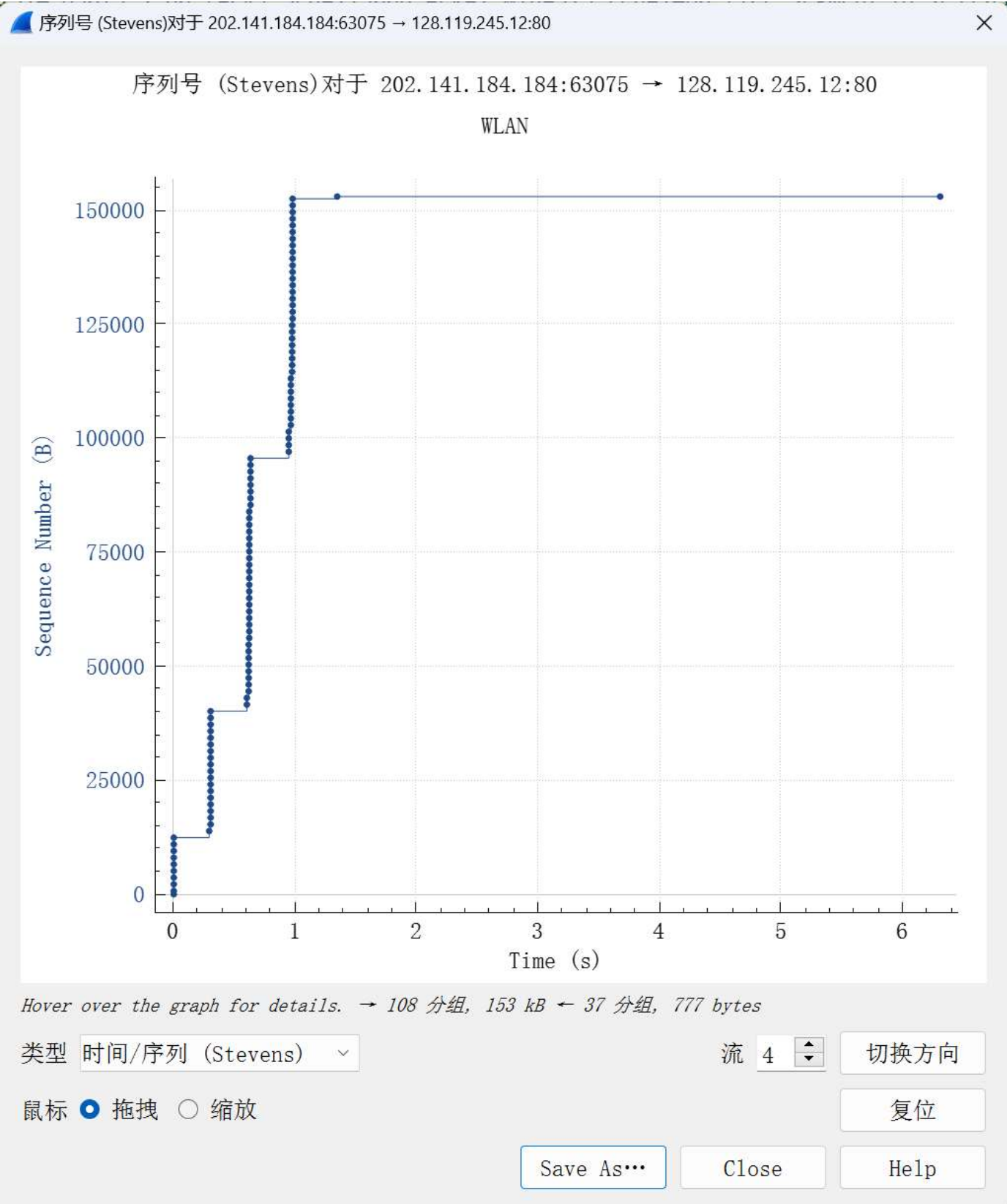
后续都为拥塞避免（类似下图）



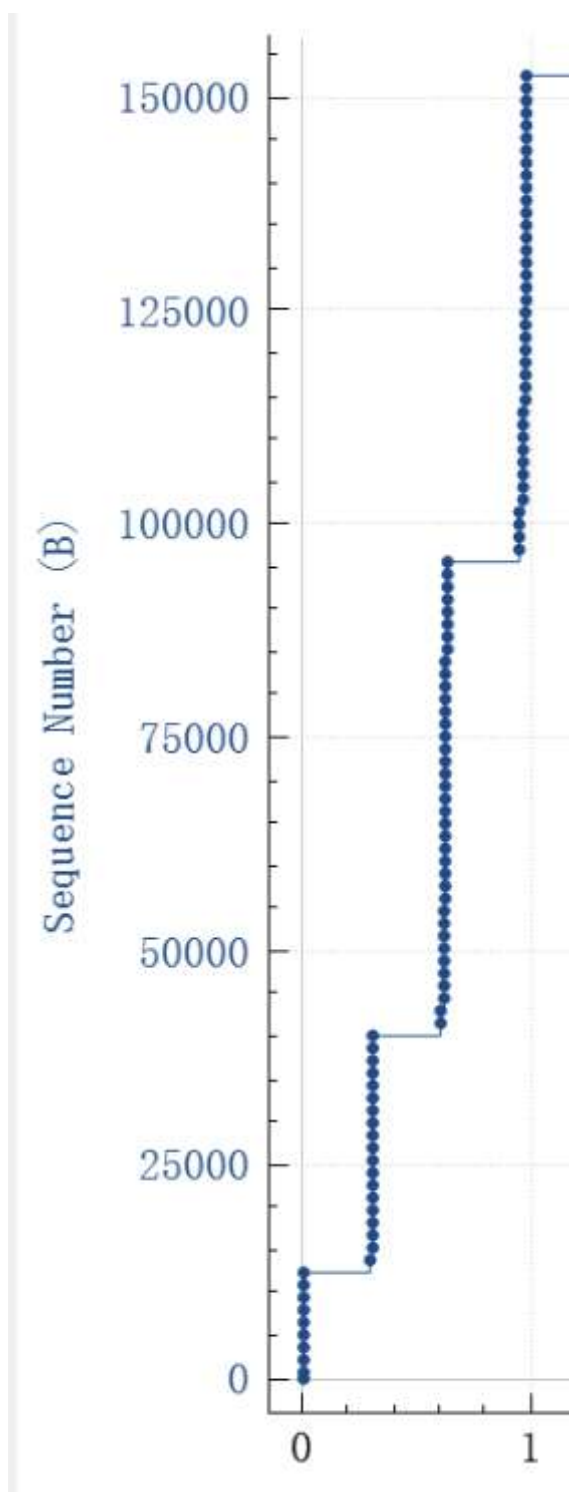
区别为在拥塞避免阶段每隔一个RTT拥塞窗口增加5，而不是1

- 14.

（这题是后面重新抓包后做的，可能与之前数据有所偏差）



慢启动阶段为下图，每隔一个RTT，增长约为指数速度增长



后续为拥塞避免阶段

区别为慢启动阶段不是严格的指数速度增长