

计网lab4

回答1-2题

```
> Frame 4: 619 bytes on wire (4952 bits), 619 bytes captured (4952 bits) on 0
> Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:c0:00:00:00:00)
> Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
√ Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 565
  Source Port: 1161
  Destination Port: 80
  [Stream index: 0]
  [Conversation completeness: Incomplete, DATA (15)]
  [TCP Segment Len: 565]
  Sequence Number: 1 (relative sequence number)
  Sequence Number (raw): 232129013
  [Next Sequence Number: 566 (relative sequence number)]
  Acknowledgment Number: 1 (relative ack number)
  Acknowledgment number (raw): 883061786
  0101 .... = Header Length: 20 bytes (5)
> Flags: 0x018 (PSH, ACK)
  Window: 17520
  [Calculated window size: 17520]
  [Window size scaling factor: -2 (no window scaling used)]
```

1、将文件传输到 `gaia.cs.umass.edu` 的客户端计算机（源）使用的 IP 地址和TCP 端口号是什么？

Src: 192.168.1.102

Source Port: 1161

IP为192.168.1.102

TCP端口号为1161

2、`gaia.cs.umass.edu` 的 IP 地址是什么？ 在哪个端口号上发送和接收此连接的TCP 区段？

Dst: 128.119.245.12

Destination Port: 80

IP为128.119.245.12

TCP接受端口号为80

3、客户端计算机（源）将文件传输到 `gaia.cs.umass.edu` 所使用的 IP 地址和TCP 端口号是多少？

```
228 2023-10-29 12:07:57.717427 100.64.174.81 128.119.245.12 TCP 1434 8683 → 80 [PSH, ACK] Seq=49048 Ack=1 Win=131072 Len=1380
```

IP为100.64.174.81

TCP端口号为8683

回答4

```
> Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 bits) on 0
> Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:c0:00:00:af:73)
> Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
v Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 0, Len: 0
  Source Port: 1161
  Destination Port: 80
  [Stream index: 0]
  [Conversation completeness: Incomplete, DATA (15)]
  [TCP Segment Len: 0]
  Sequence Number: 0 (relative sequence number)
  Sequence Number (raw): 232129012
  [Next Sequence Number: 1 (relative sequence number)]
  Acknowledgment Number: 0
  Acknowledgment number (raw): 0
  0111 .... = Header Length: 28 bytes (7)
> Flags: 0x002 (SYN)
  Window: 16384
  [Calculated window size: 16384]
  Checksum: 0xf6e9 [unverified]
```

4、用于在客户端计算机和 `gaia.cs.umass.edu` 之间启动 TCP 连接的 TCP SYN 区段的序列号是什么？段中标识该段为SYN段的内容是什么？

Sequence Number: 0 (relative sequence number)
Sequence Number (raw): 232129012

相对序列号是0，绝对序列号是232129012

```
✓ Flags: 0x002 (SYN)
  000. .... = Reserved: Not set
  ...0 .... = Accurate ECN: Not set
  .... 0... = Congestion Window Reduced: 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
```

flag的SYN位是1，所以该段是SYN段

回答5

```
✓ Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 0, Ack: 1, Len: 0
  Source Port: 80
  Destination Port: 1161
  [Stream index: 0]
  [Conversation completeness: Incomplete, DATA (15)]
  [TCP Segment Len: 0]
  Sequence Number: 0 (relative sequence number)
  Sequence Number (raw): 883061785
  [Next Sequence Number: 1 (relative sequence number)]
  Acknowledgment Number: 1 (relative ack number)
  Acknowledgment number (raw): 232129013
  0111 .... = Header Length: 28 bytes (7)
  > Flags: 0x012 (SYN, ACK)
  Window: 5840
  [Calculated window size: 5840]
```

5、gaia.cs.umass.edu 发送给客户端计算机以回复 SYN 的 SYNACK 区段的序列号是多少？ SYNACK 区段中的 Acknowledgment 栏位的值是多少？ Gaia.cs.umass.edu 是如何确定此 Acknowledgment 的数值的？ 该段中标识该段为SYNACK 段的内容是什么？

Sequence Number: 0 (relative sequence number)
Sequence Number (raw): 883061785

相对序列号为0，绝对序列号为883061785

Acknowledgment Number: 1 (relative ack number)
Acknowledgment number (raw): 232129013

Acknowledgment栏位值为1（绝对值为232129013）

Gaia.cs.umass.edu确定Acknowledgment 的数值是根据客户端的
SequenceNumber (0) + 1 ((232129012) + 1) 来的

```
✓ 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
```

flags中ACK和SYN位都是1，所以是SYNACK段

回答6

```
> Frame 4: 619 bytes on wire (4952 bits), 619 bytes captured (4952 bits)
> Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:c
> Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
✓ Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 565
  Source Port: 1161
  Destination Port: 80
  [Stream index: 0]
  [Conversation completeness: Incomplete, DATA (15)]
  [TCP Segment Len: 565]
  Sequence Number: 1 (relative sequence number)
  Sequence Number (raw): 232129013
  [Next Sequence Number: 566 (relative sequence number)]
  Acknowledgment Number: 1 (relative ack number)
  Acknowledgment number (raw): 883061786
  0101 .... = Header Length: 20 bytes (5)
  > Flags: 0x018 (PSH, ACK)
  Window: 17520
  [Calculated window size: 17520]
  [Window size scaling factor: -2 (no window scaling used)]
```

6、包含 HTTP POST 命令的 TCP 区段的序列号是多少？请注意，为了找到POST 命令，您需要深入了解 Wireshark 窗口底部的数据包内容字段，在其DATA 栏位中查找带有“POST”的区段。

Sequence Number: 1 (relative sequence number)
Sequence Number (raw): 232129013

序列号为1（绝对序列号为232129013）

7、将包含 HTTP POST 的 TCP 区段视为 TCP 连接中的第一个区段。在这个TCP 连线中前六个 TCP 区段的序列号是什么（包括包含 HTTP POST 的段）？每区段发送的时间是什么时候？收到的每个区段的 ACK 是什么时候？鉴于发送每个 TCP 区段的时间与收到确认的时间之间的差异，六个区段中每个区段的 RTT 值是多少？收到每个 ACK 后，EstimatedRTT 值（参见本节中的第 3.5.3 节，第 242 页）是什么？假设第一个 EstimatedRTT 的值等于第一个区段的测量 RTT，然后使用课本第 242 页的 EstimatedRTT 公式计算所有后续区段。

4	0.026477	192.168.1.102	128.119.245.12	TCP	619 1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
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
13	0.124185	192.168.1.102	128.119.245.12	TCP	1201 1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147
14	0.169118	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 Ack=4946 Win=14600 Len=0
15	0.217299	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 Ack=6406 Win=17520 Len=0
16	0.267802	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 Ack=7866 Win=20440 Len=0

如上图标绿的部分即为前六个TCP区段，对应的ACK报文编号分别为6, 9, 12, 14, 15, 16，其信息填入下表格：

	序列号	发送时间	ACK接收时间	RTT	EstimatedRTT
1	1	0.026477	0.053937	0.027460	0.027460
2	566	0.041737	0.077294	0.035557	0.028472
3	2026	0.054026	0.124085	0.070059	0.033670
4	3486	0.054690	0.169118	0.114428	0.043765
5	4946	0.077405	0.217299	0.139894	0.055781
6	6406	0.078157	0.267802	0.189645	0.072514

8、前六个 TCP 区段的长度是多少

4	2004-08-21 21:44:20.596858	192.168.1.102	128.119.245.12	TCP	619 1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
5	2004-08-21 21:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
6	2004-08-21 21:44:20.624318	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	2004-08-21 21:44:20.624407	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
8	2004-08-21 21:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460
9	2004-08-21 21:44:20.647675	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	2004-08-21 21:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460
11	2004-08-21 21:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460

分别为565，1460，1460，1460，1460，1460

9、对于整个跟踪包，收到的最小可用缓冲区空间量是多少？缺少接收器缓冲区空间是否会限制发送方传送 TCP 区段？

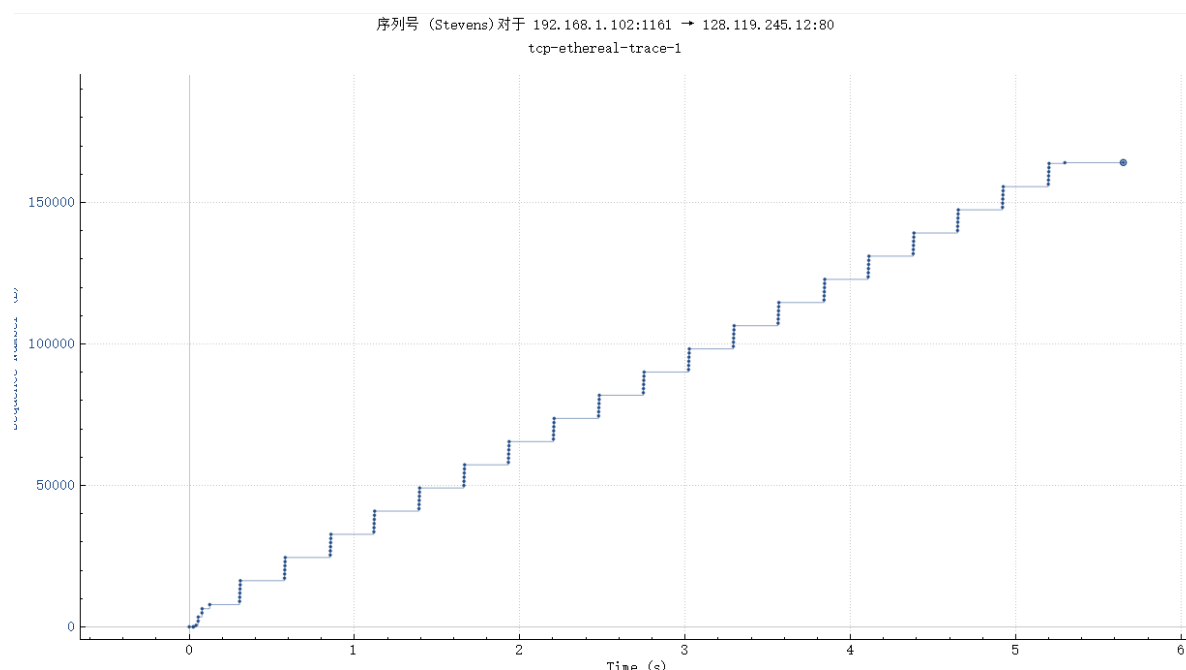
No.	Time	Source	Destination	Protocol	Length	Info
1	2004-08-21 21:44:20.570381	192.168.1.102	128.119.245.12	TCP	62	1161 → 80 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM
2	2004-08-21 21:44:20.593553	128.119.245.12	192.168.1.102	TCP	62	80 → 1161 [SYN, ACK] Seq=0 Ack=1 Win=0 Len=0 MSS=1460 SACK_PERM
3	2004-08-21 21:44:20.593646	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	2004-08-21 21:44:20.596858	192.168.1.102	128.119.245.12	TCP	619	1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
5	2004-08-21 21:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
6	2004-08-21 21:44:20.624318	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
7	2004-08-21 21:44:20.624407	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=2026 Ack=1 Win=17520 Len=1460
8	2004-08-21 21:44:20.625071	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460
9	2004-08-21 21:44:20.647675	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
10	2004-08-21 21:44:20.647786	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=4946 Ack=1 Win=17520 Len=1460
11	2004-08-21 21:44:20.648538	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460
12	2004-08-21 21:44:20.694466	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
13	2004-08-21 21:44:20.694566	192.168.1.102	128.119.245.12	TCP	1201	1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147
14	2004-08-21 21:44:20.739499	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=4946 Win=14600 Len=0
15	2004-08-21 21:44:20.787680	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=6406 Win=17520 Len=0
16	2004-08-21 21:44:20.838183	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=7866 Win=20440 Len=0
17	2004-08-21 21:44:20.875188	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=9013 Win=23360 Len=0
18	2004-08-21 21:44:20.875313	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=9013 Ack=1 Win=17520 Len=1460

如图标红，最小可用缓冲区空间量为5840bytes

不会限制，接收方缓冲区一直有空间，而且请求方发送的TCP报文长度小于缓冲区剩余

10、在跟踪文件中是否有重传的区段？为了回答这个问题，您检查了什么（在跟踪包中）？

没有重传的区段



查看TCP数据段的时间序列图，可以看到所有的序列号都是随时间单调递增的，如果存在重传数据段，则该段的序列号应该小于相邻序列号

11、接收方通常在 ACK 中确认多少数据？您是否可以识别接收方每隔一个接收到的区段才发送确认的情况（参见本文第 250 页的表 3.2）。

- Options: (8 bytes), Maximum segment size, No-Operation (NOP), No-Operation (NOP), SACK
 - > TCP Option - Maximum segment size: 1460 bytes
 - > TCP Option - No-Operation (NOP)
 - > TCP Option - No-Operation (NOP)
 - > TCP Option - SACK permitted
- [Timestamps]

1460bytes

80	2004-08-21	21:44:22.501261	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 Ack=58165 Win=62780 Len=0
81	2004-08-21	21:44:22.501480	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=58165 Ack=1 Win=17520 Len=1460
82	2004-08-21	21:44:22.502260	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=59625 Ack=1 Win=17520 Len=1460
83	2004-08-21	21:44:22.503138	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=61085 Ack=1 Win=17520 Len=1460
84	2004-08-21	21:44:22.504017	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=62545 Ack=1 Win=17520 Len=1460
85	2004-08-21	21:44:22.505151	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=64005 Ack=1 Win=17520 Len=1460
86	2004-08-21	21:44:22.505967	192.168.1.102	128.119.245.12	TCP	946 1161 → 80 [PSH, ACK] Seq=65465 Ack=1 Win=17520 Len=892
87	2004-08-21	21:44:22.599450	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 Ack=61085 Win=62780 Len=0

可以，例如这里的ACK=58165和61085，相差2920是1460的两倍

12、TCP 连接的吞吐量（每单位时间传输的字节数）是多少？
解释你如何计算这个值。

3	2004-08-21	21:44:20.593646	192.168.1.102	128.119.245.12	TCP	54 1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0
4	2004-08-21	21:44:20.596858	192.168.1.102	128.119.245.12	TCP	619 1161 → 80 [PSH, ACK] Seq=1 Ack=1 Win=17520 Len=565
5	2004-08-21	21:44:20.612118	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [PSH, ACK] Seq=566 Ack=1 Win=17520 Len=1460
200	2004-08-21	21:44:25.959852	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 Ack=162309 Win=62780 Len=0
201	2004-08-21	21:44:26.018268	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 Ack=164041 Win=62780 Len=0
202	2004-08-21	21:44:26.026211	128.119.245.12	192.168.1.102	TCP	60 80 → 1161 [ACK] Seq=1 Ack=164091 Win=62780 Len=0
203	2004-08-21	21:44:26.031556	128.119.245.12	192.168.1.102	TCP	784 80 → 1161 [PSH, ACK] Seq=1 Ack=164091 Win=62780 Len=730

第一个TCP数据段是4号，为1字节，时间是21:44:20.596858

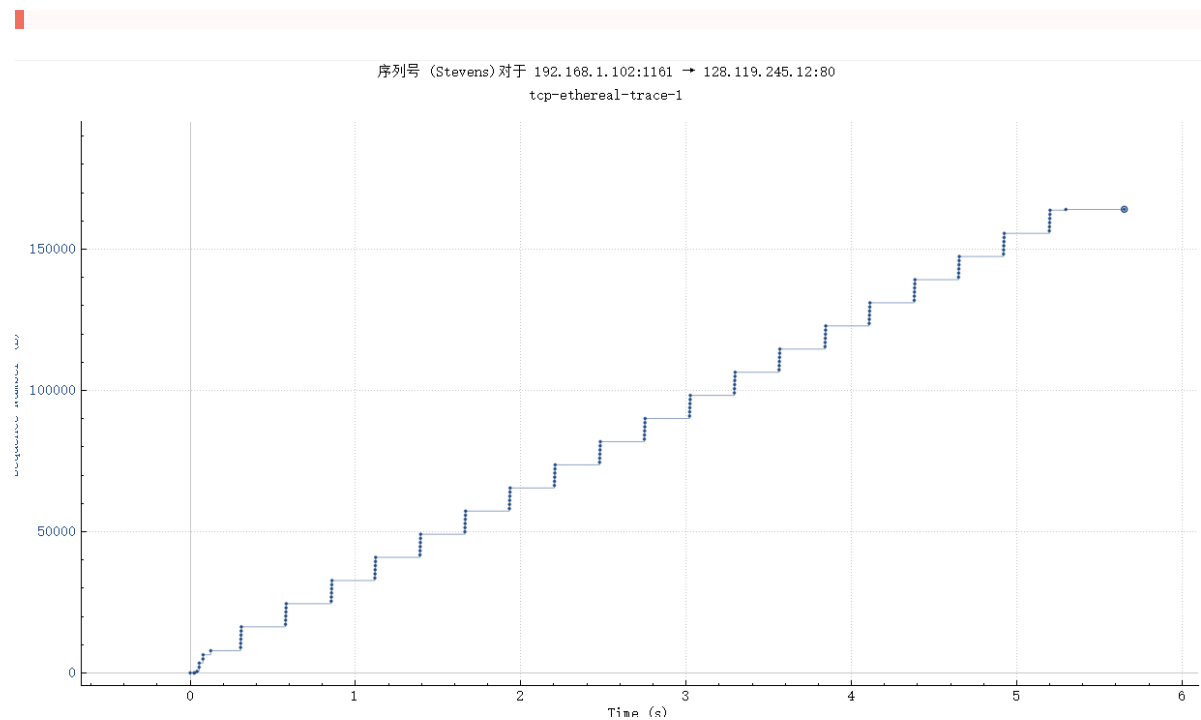
最后一个确认是202号，为164091字节，时间是21:44:26.026211

总数据为164091-1=164090字节，总时间为26.026211-

20.596858=5.429353s

所以吞吐量为 $\frac{164090}{5.429353} \approx 30.22KB/s$

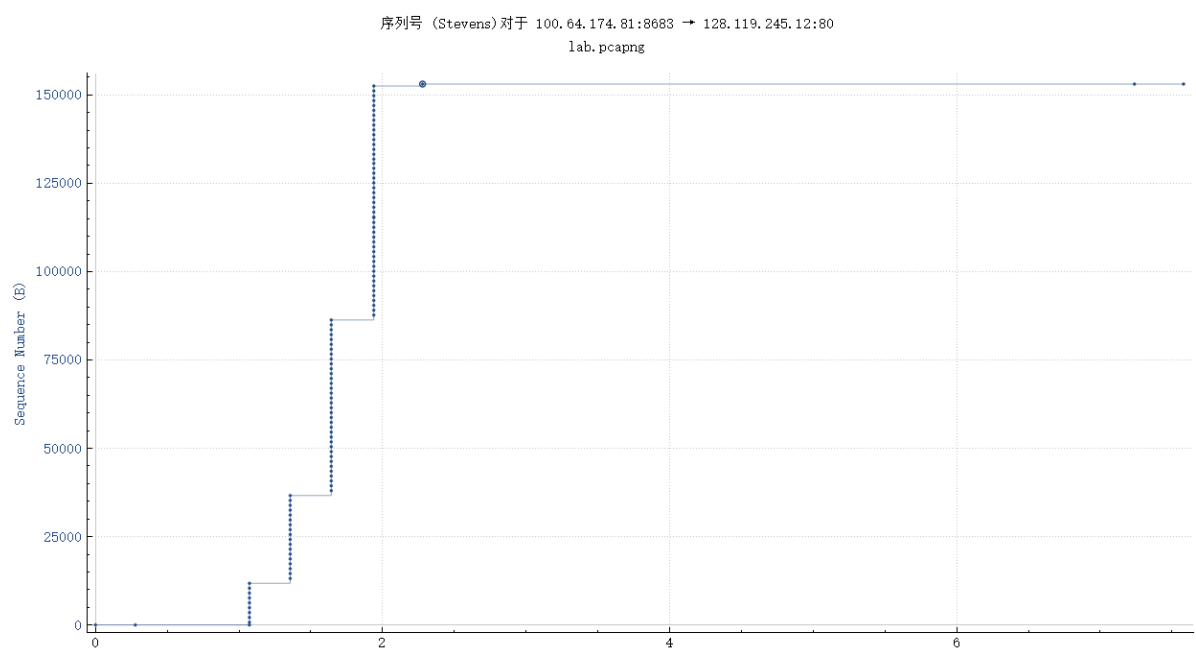
13、使用时序图（Stevens）绘图工具查看从客户端发送到 gaia.cs.umass.edu 服务器的区段的序列号与时间关系图。您能否确定 TCP 的慢启动阶段的开始和结束位置，以及拥塞避免接管的位置？评论测量数据与我们在文本中研究的 TCP 的理想化行为的不同之处。



如图，慢启动大约是0s~0.1s，大约0.3s进入拥塞避免阶段

与TCP理想化行为不同之处：慢启动之后每次发送6个报文，而非线性增长

14、根据你使用 Wireshark 所收集到的资料（将文件从计算机传输到gaia.cs.umass.edu 时的跟踪包信息），回答问题 13 中的两个问题。



慢启动大约是1.1s~1.7s，大概1.9s进入拥塞避免阶段

与TCP理想化行为不同之处：在拥塞避免阶段没有线性增加