CS305 Lab7

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Student Id: 11712121

1. Select one UDP packet from your trace. From this packet,determine

- 1. how many fields there are in the UDP header.

  Solution:

  There are 4 fileds in the UDP header

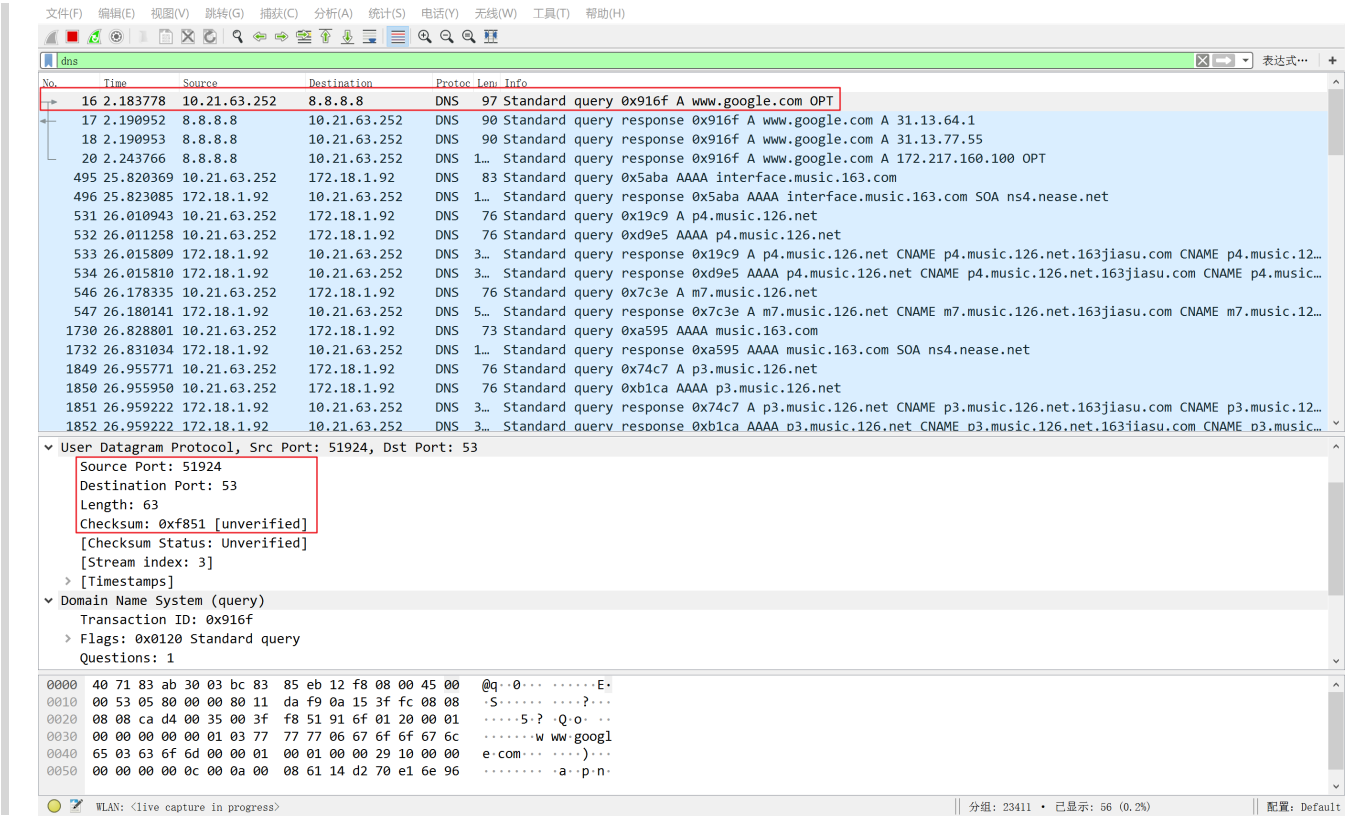
```
eveneko@DESKTOP-MMVJRV3 /mnt/c/Users/Eveneko dig @8.8.8.8 www.google.com

; <<>> DiG 9.11.3-1ubuntu1.9-Ubuntu <<>> @8.8.8.8 www.google.com
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 37231
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;www.google.com.                        IN      A

;; ANSWER SECTION:
www.google.com.         104     IN      A       31.13.64.1

;; Query time: 7 msec
;; SERVER: 8.8.8.8#53(8.8.8.8)
;; WHEN: Thu Oct 31 17:35:58 DST 2019
;; MSG SIZE  rcvd: 48
```



- 2. the name of each fields in the UDP header.

Solution:

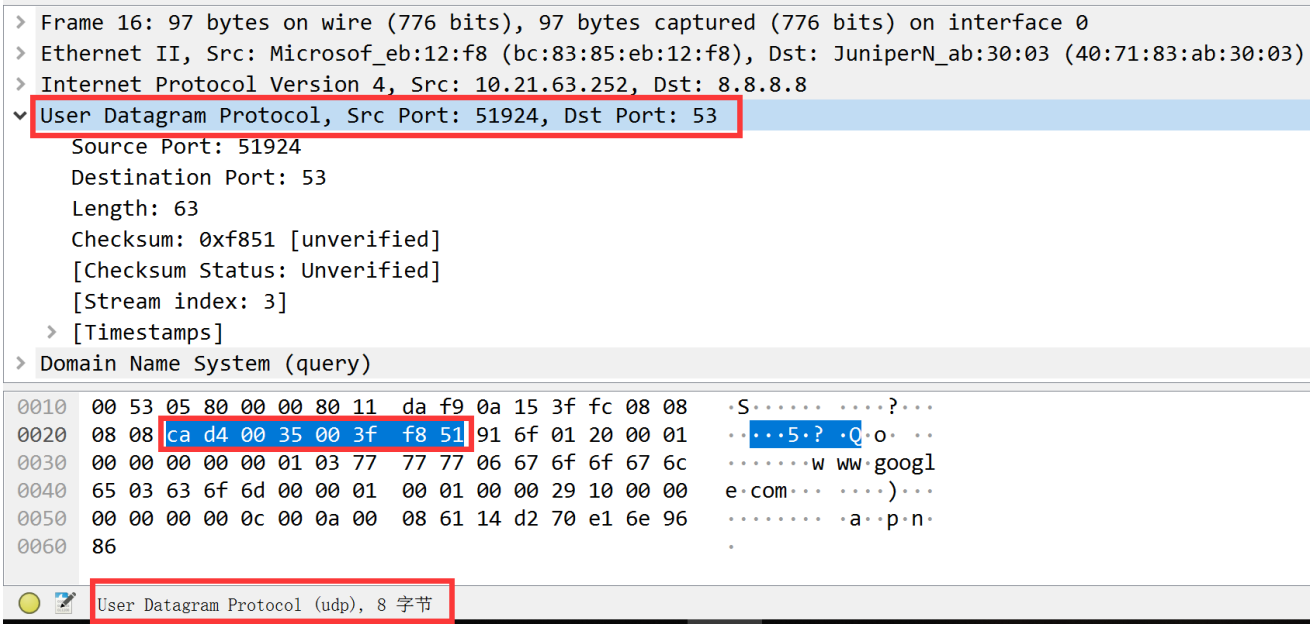
There are

  - Source Port
  - Destination
  - Length
  - Checksum

- 3. the length (in bytes) of each fields in the UDP header.

Solution:

The length of UDP header is 8 bytes. So each fields in the UDP header is 2 bytes.



- 4. What is the maximum number of bytes that can be included in a UDP payload? (Hint: the answer to this question can be determined by your answer to 3) above)

  Solution:

  There 2 bytes to record the length. Also the length of UDP header is 8 bytes, and the length of IP header is 20 bytes. The maximum number of bytes is $2^{16} - 1 - 8 - 20 = 65507$

- 5. What is the largest possible source port number? (Hint: same as the hint in 4) above)

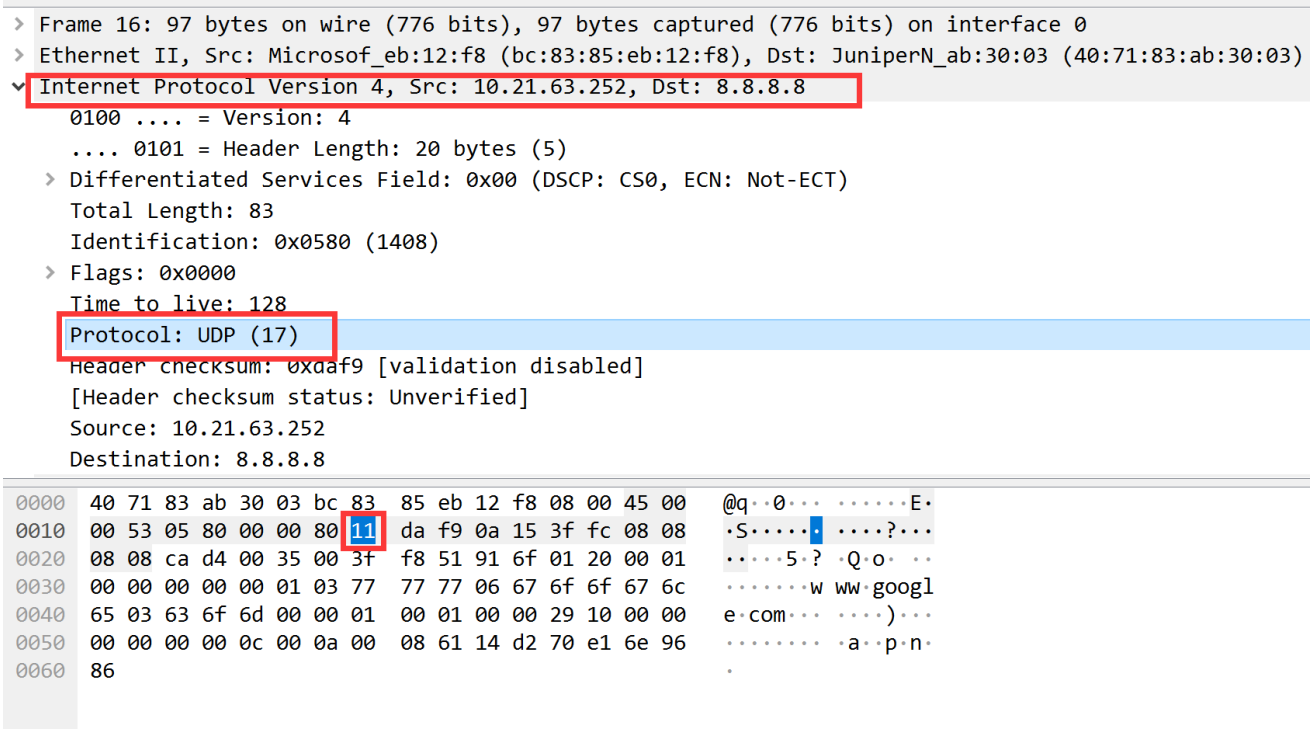
  Solution:

  The largest possible source port number is $2^{16} - 1 = 65535$

- 6. What is the protocol number for UDP? (Give your answer in both hexadecimal and decimal notation.)

  Solution:

  The IP protocol number for UDP is 0x11 hex, which is 17 in decimal value.



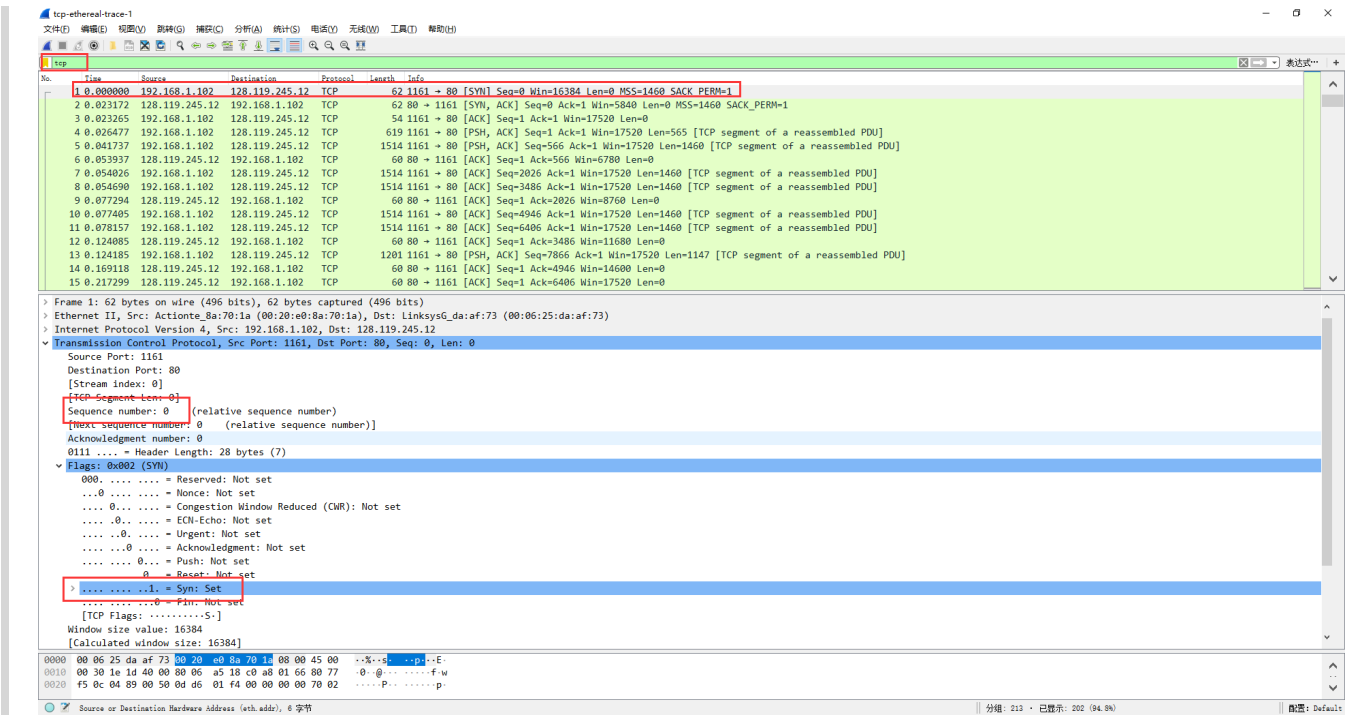
2. Wireshark Lab: TCP v7.0

   4. What is the sequence number of the TCP SYN segment that is used to initiate the TCP connection between the client computer and gaia.cs.umass.edu? What is it in the segment that identifies the segment as a SYN segment?

      Solution:

      Sequence number of the TCP SYN segment is used to initiate the TCP connection between the client computer and gaia.cs.umass.edu. The value is 0.

      The SYN segment flag is set 1 in the segment that identifies the segment as a SYN segment.

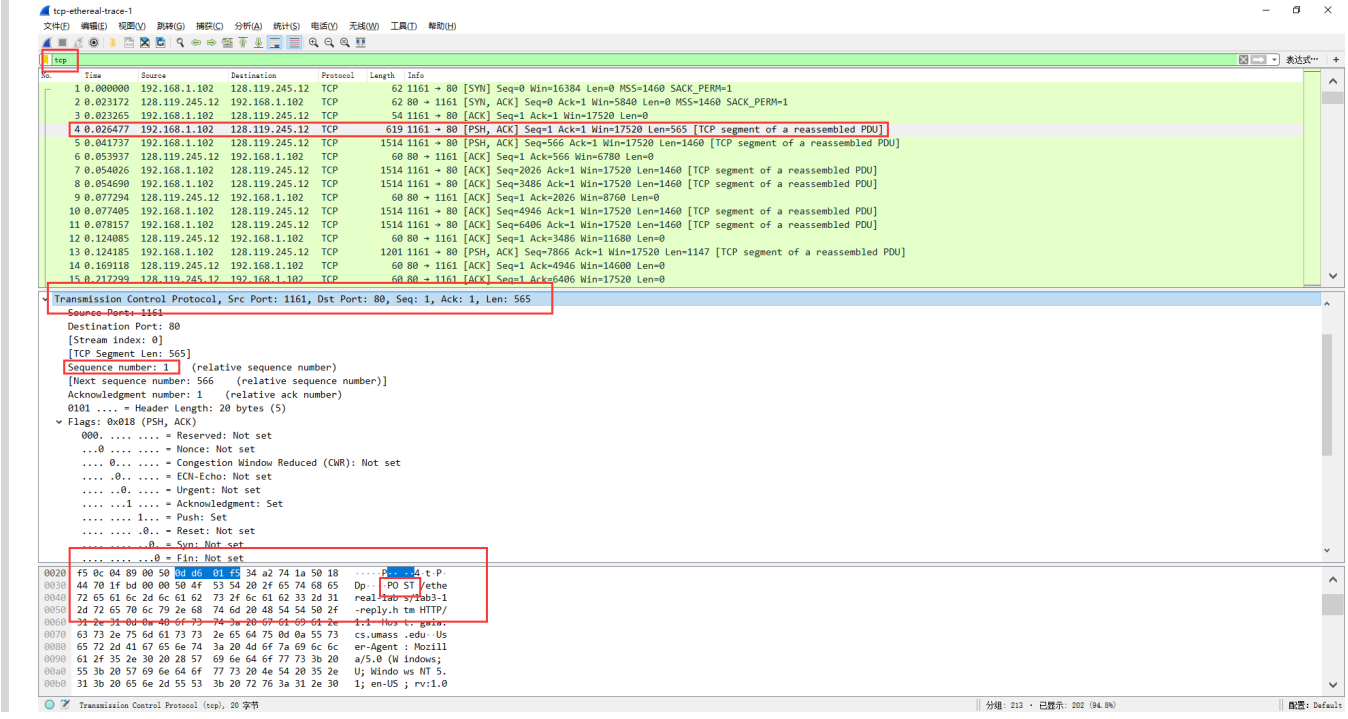


6. What is the sequence number of the TCP segment containing the HTTP POST command? Note that in order to find the POST command, you'll need to dig into the packet content field at the bottom of the Wireshark window, looking for a segment with a "POST" within its DATA field.

Solution:

The 4th segment is the TCP segment containing the HTTP POST command.

The sequence number of the TCP segment containing the HTTP POST command is 1.



7. Consider the TCP segment containing the HTTP POST as the first segment in the TCP connection. What are the sequence numbers of the first six segments in the TCP connection (including the segment containing the HTTP POST)? At what time was each segment sent? When was the ACK for each segment received? Given the difference between when each TCP segment was sent, and when its acknowledgement was received, what is the RTT value

for each of the six segments? What is the EstimatedRTT value (see Section 3.5.3, page 242 in text) after the receipt of each ACK? Assume that the value of the EstimatedRTT is equal to the measured RTT for the first segment, and then is computed using the EstimatedRTT equation on page 242 for all subsequent segments.

Note: Wireshark has a nice feature that allows you to plot the RTT for each of the TCP segments sent. Select a TCP segment in the "listing of captured packets" window that is being sent from the client to the gaia.cs.umass.edu server. Then select: Statistics->TCP Stream Graph->Round Trip Time Graph.

> **Solution:**
> The first six segments in the TCP connection is 4th, 5th, 7th, 8th, 10th, 11th.

	Segment 1	**Segment 2**	**Segment 3**	**Segment 4**	**Segment 5**	**Segment 6**
sequence number	1	566	2026	3486	4946	6406
send time	0.026477	0.041737	0.054026	0.054690	0.077405	0.078157
ACK receive time	0.053937	0.077294	0.124085	0.169118	0.217299	0.267802
RTT	0.02746	0.035557	0.070059	0.11443	0.13989	0.18964
EstimatedRTT	0.02746	0.0285	0.0337	0.0438	0.0558	0.0725

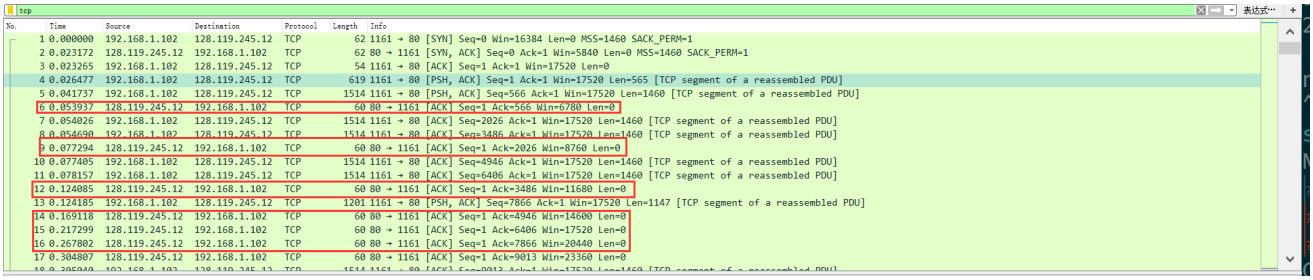
> EstimatedRTT = 0.875 * EstimatedRTT + 0.125 * SampleRTT
> EstimatedRTT1 = RRT1 = 0.02746 s
> EstimatedRTT2 = 0.875 * EstimatedRTT1 + 0.125 * RTT2 = 0.875 * 0.02746 + 0.125 * 0.03557 ≈ 0.0285 s
> EstimatedRTT3 = 0.875 * EstimatedRTT2 + 0.125 * RTT3 = 0.875 * 0.0285 + 0.125 * 0.070059 ≈ 0.0337 s
> EstimatedRTT4 = 0.875 * EstimatedRTT3 + 0.125 * RTT4 = 0.875 * 0.0337 + 0.125 * 0.11442 ≈ 0.0438 s
> EstimatedRTT5 = 0.875 * EstimatedRTT4 + 0.125 * RTT5 = 0.875 * 0.0438 + 0.125 * 0.13989 ≈ 0.0558 s
> EstimatedRTT6 = 0.875 * EstimatedRTT5 + 0.125 * RTT6 = 0.875 * 0.0558 + 0.125 * 0.18964 ≈ 0.0725 s

> Segment 1-6:

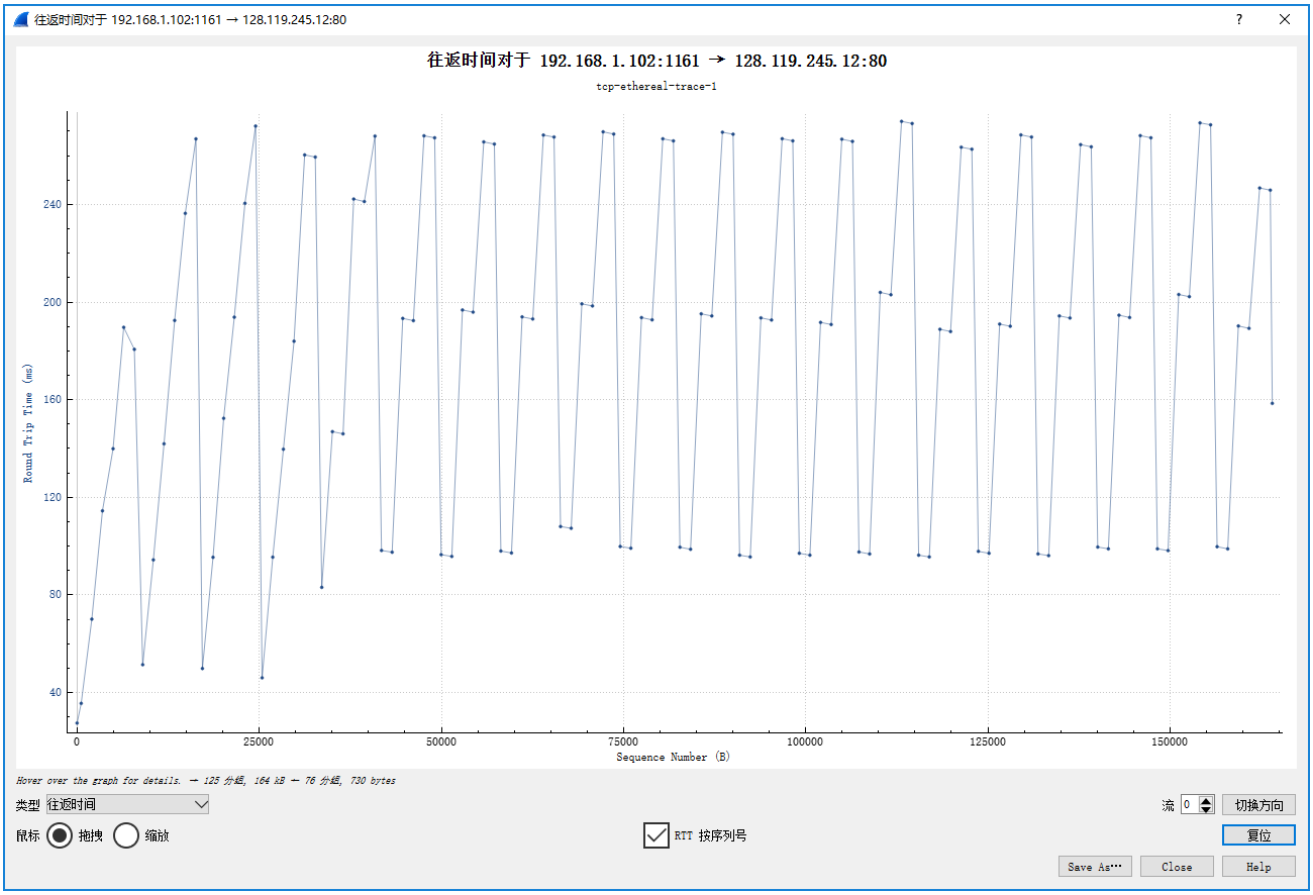
tcp

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=565 [TCP segment of a reassembled PDU]
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 [TCP segment of a reassembled PDU]
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 [TCP segment of a reassembled PDU]
8	0.054690	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
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 [TCP segment of a reassembled PDU]
11	0.078157	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
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 [TCP segment of a reassembled PDU]
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

ACK 1-6:



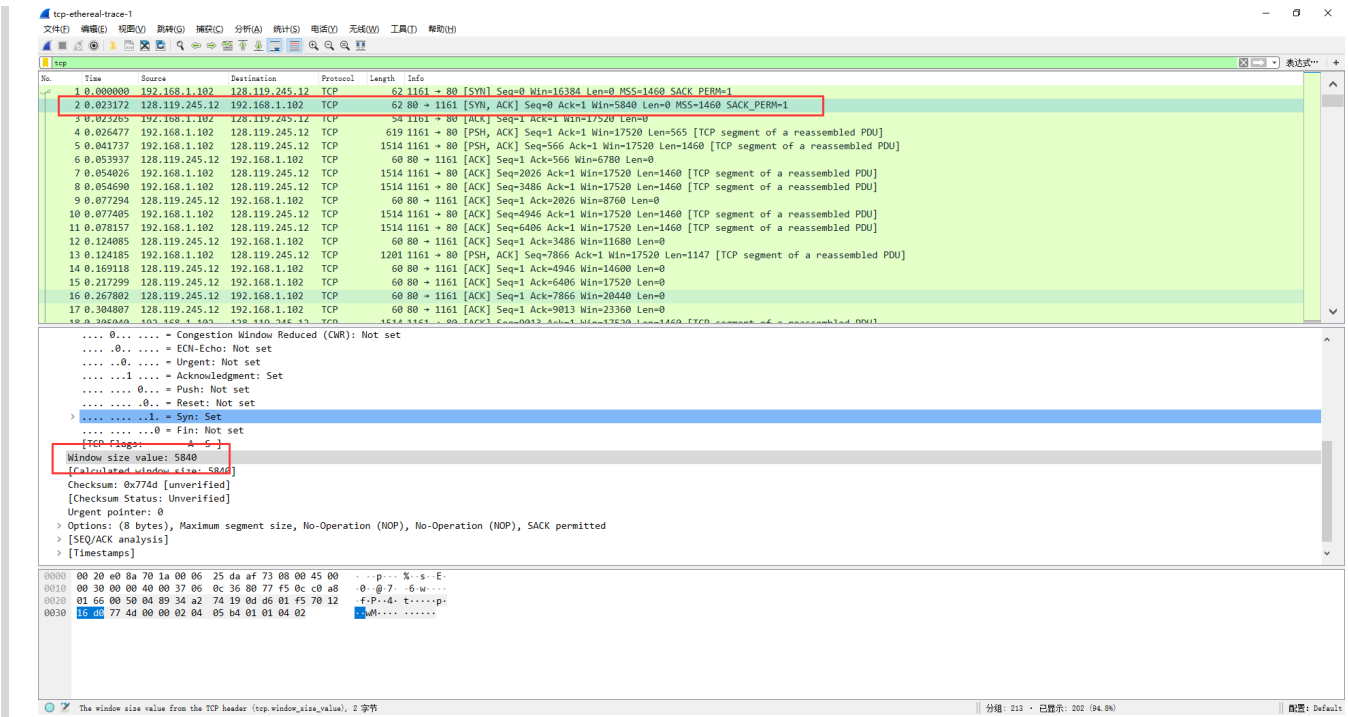
RTT Graph

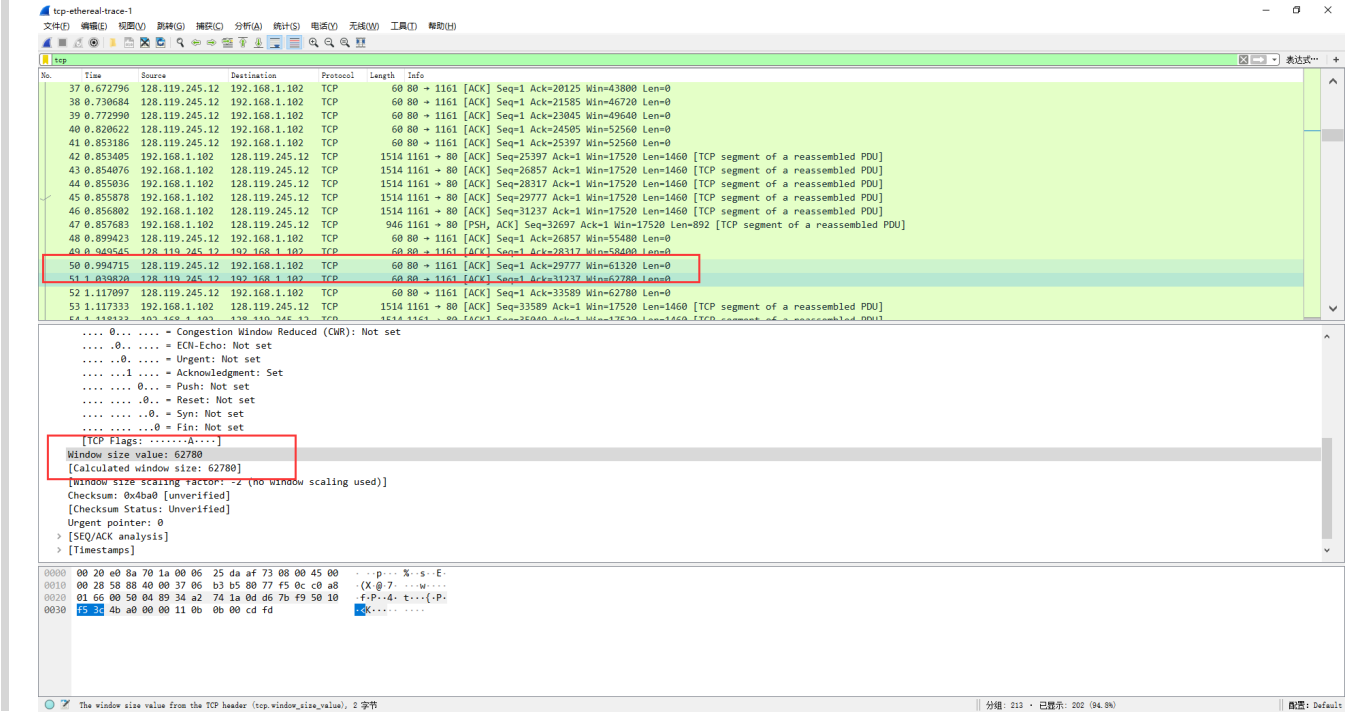


9. What is the minimum amount of available buffer space advertised at the received for the entire trace? Does the lack of receiver buffer space ever throttle the sender?

Solution:

The minimum amount of available buffer space at the received for the entire trace is 5840. It is showed in the first acknowledgement from the server. The server does not throttle the sender due to the lack of receiver buffer space. Because the window size is gradually increased from 5840 to 62780, the window size is always larger than the capacity of the packet sent by the sender.

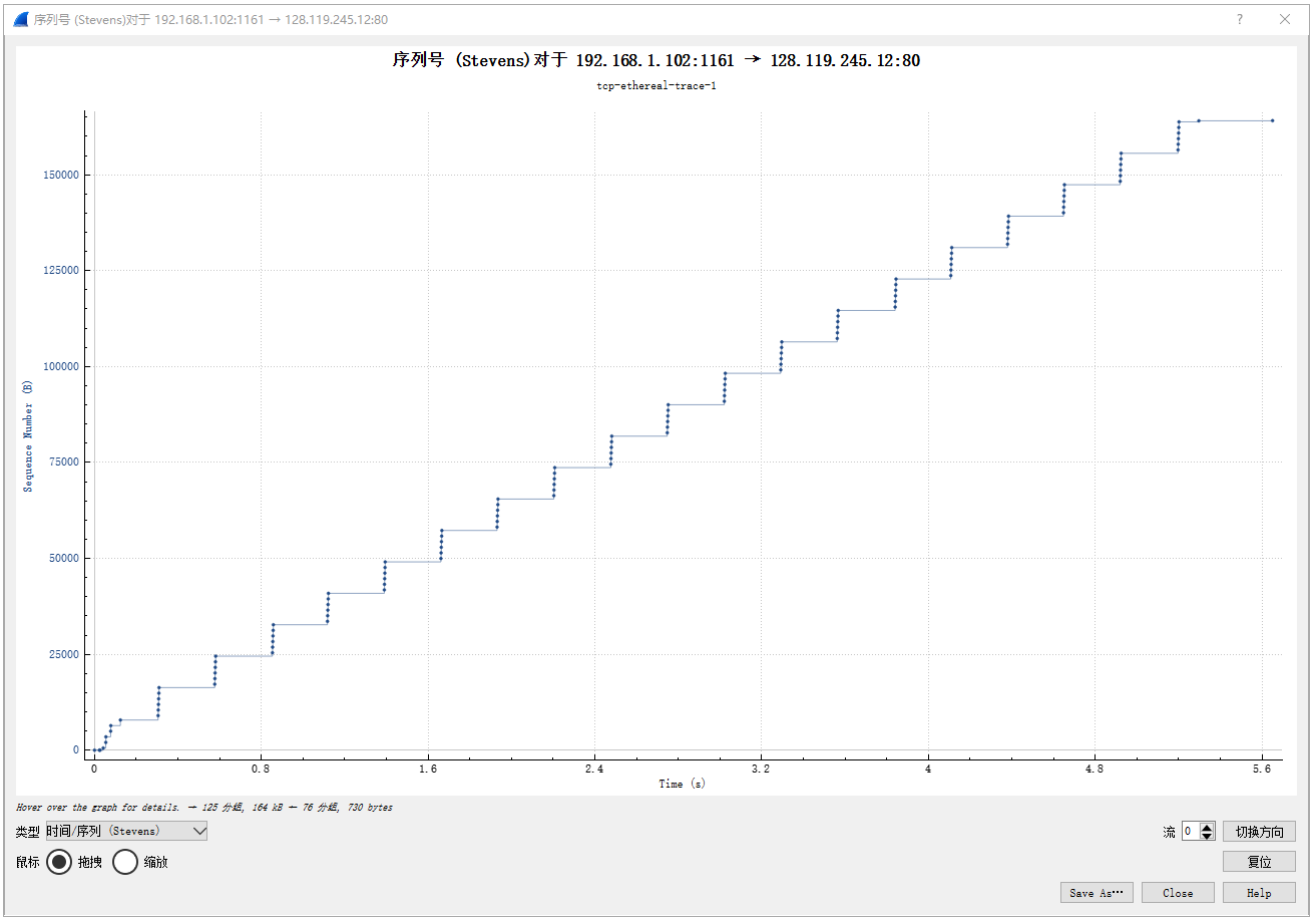




10. Are there any retransmitted segments in the trace file? What did you check for (in the trace) in order to answer this question?

Solution:

No, no retransmitted segment. And the above conclusion can be drawn from the serial number of the TCP segment. It can be seen from the Time-Sequence-Graph (Stevens) that the sequence number sent from the source to the destination is gradually increased. If there is a retransmitted segment, the sequence number should have a packet smaller than its adjacent packet sequence number. Such a packet is not seen in the figure, so there is no packet that is retransmitted.

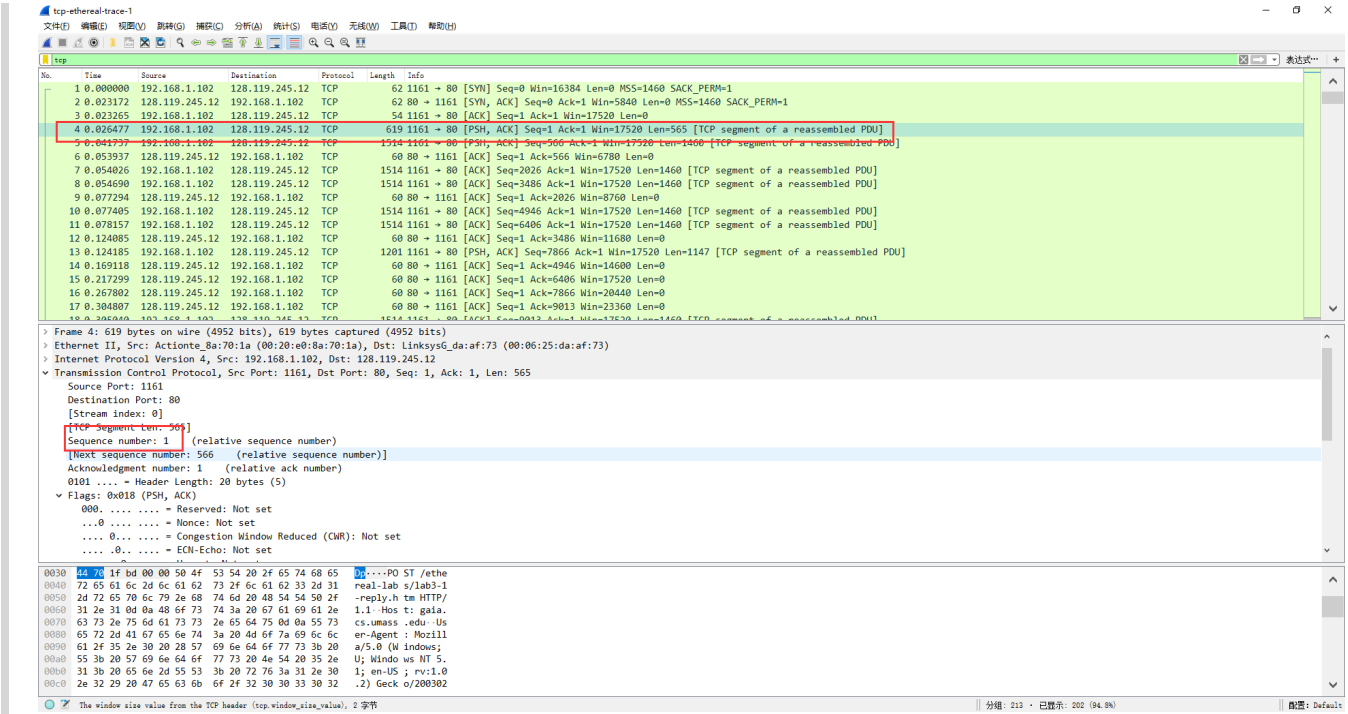


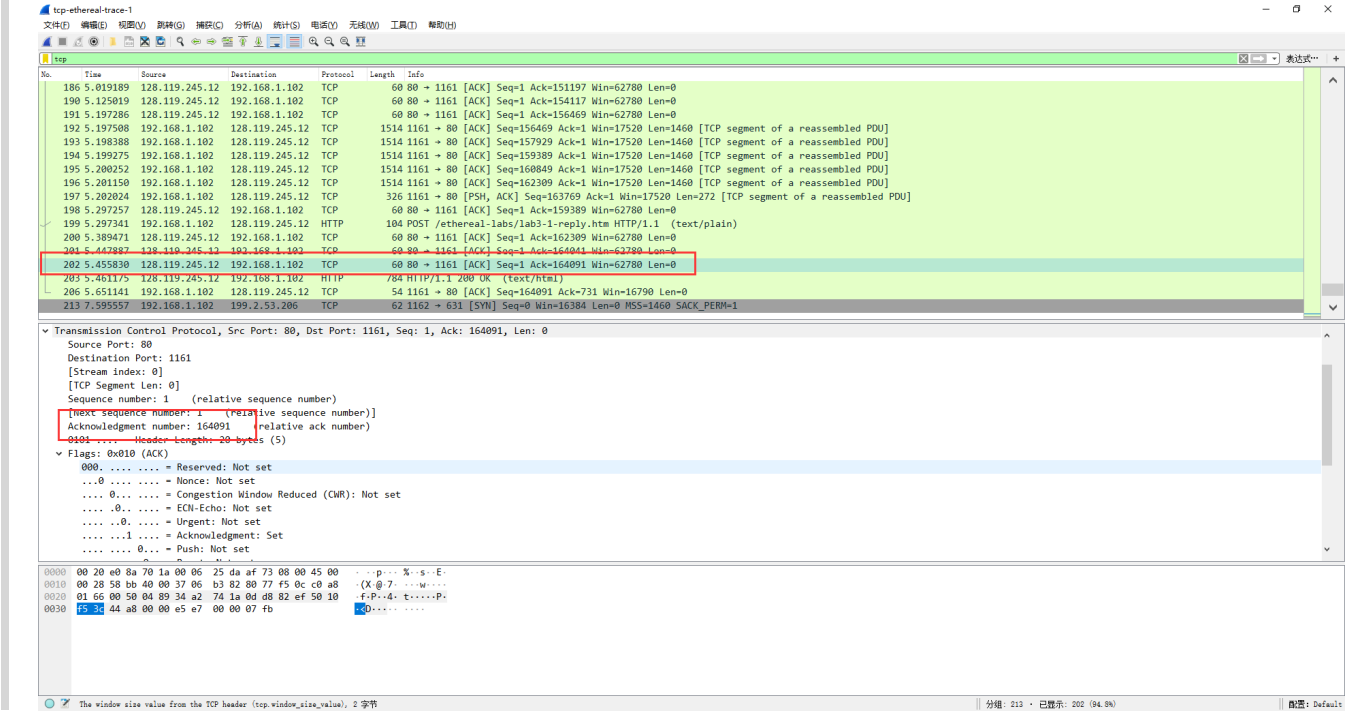
12. What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value.

Solution:

The total amount of data transferred is the difference between the sequence number of the first TCP segment (1 byte of the 4th segment) and the ACK of the last sequence number (164091 bytes of the 202nd segment). Therefore, the total data is 164091-1 = 164090 bytes. The whole transmission time is the difference of the time instant of the first TCP segment (0.026477 second for 4th segment) and the time instant of the last ACK (5.455830 second for 202th segment). Therefore, the total transmission time is 5.455830 - 0.026477 = 5.4294 seconds.

Therefore, the throught for TCP connection is the radio between the total amount data and the total time. Throught = 164090 bytes / 5.4294 seconds ≈ 30222.49 Byte/second


tcp-ethereal-trace-1
文件(F) 编辑(E) 视图(V) 跳转(G) 捕获(C) 分析(A) 统计(S) 电话(Y) 无线(W) 工具(T) 帮助(H)
tcp
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=565 [TCP segment of a reassembled PDU]
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 [TCP segment of a reassembled PDU]
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 [TCP segment of a reassembled PDU]
8 0.054690 192.168.1.102 128.119.245.12 TCP 1514 1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
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 [TCP segment of a reassembled PDU]
11 0.078157 192.168.1.102 128.119.245.12 TCP 1514 1161 → 80 [ACK] Seq=6406 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
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 [TCP segment of a reassembled PDU]
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
17 0.304807 128.119.245.12 192.168.1.102 TCP 60 80 → 1161 [ACK] Seq=1 Ack=9013 Win=23360 Len=0
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:da:af:73)
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]
[TCP Segment Len: 565]
Sequence number: 1 (relative sequence number)
[Next sequence number: 566 (relative sequence number)]
Acknowledgment number: 1 (relative ack number)
0101 .... = Header Length: 20 bytes (5)
Flags: 0x018 (PSH, ACK)
000. .... = Reserved: Not set
...0 .... = Nonce: Not set
.... 0... .... = Congestion Window Reduced (CWR): Not set
.... .0.. .... = ECN-Echo: Not set
0030 44 70 1f bd 00 00 50 4f 53 54 20 2f 65 74 68 65 Dp····PO ST /ethe
0040 72 65 61 6c 2d 6c 61 62 73 2f 6c 61 62 33 2d 31 real-lab s/lab3-1
0050 2d 72 65 70 6c 79 2e 68 74 6d 20 48 54 54 50 2f -reply.h tm HTTP/
0060 31 2e 31 0d 0a 48 6f 73 74 3a 20 67 61 69 61 2e 1.1··Hos t: gaia.
0070 63 73 2e 75 6d 61 73 73 2e 65 64 75 0d 0a 55 73 cs.umass .edu··Us
0080 65 72 2d 41 67 65 6e 74 3a 20 4d 6f 7a 69 6c 6c er-Agent : Mozill
0090 61 2f 35 2e 30 20 28 57 69 6e 64 6f 77 73 3b 20 a/5.0 (W indows;
00a0 55 3b 20 57 69 6e 64 6f 77 73 20 4e 54 20 35 2e U; Windo ws NT 5.
00b0 31 3b 20 65 6e 2d 55 53 3b 20 72 76 3a 31 2e 30 1; en-US ; rv:1.0
00c0 2e 32 29 20 47 65 63 6b 6f 2f 32 30 30 33 30 32 .2) Geck o/200302
The window size value from the TCP header (tcp.window_size_value), 2 字节
分组: 213 · 已显示: 202 (94.9%)
配置: Default


tcp-ethereal-trace-1
文件(F) 编辑(E) 视图(V) 跳转(G) 捕获(C) 分析(A) 统计(S) 电话(Y) 无线(W) 工具(T) 帮助(H)
tcp
No. Time Source Destination Protocol Length Info
186 5.019189 128.119.245.12 192.168.1.102 TCP 60 80 → 1161 [ACK] Seq=1 Ack=151197 Win=62780 Len=0
190 5.125019 128.119.245.12 192.168.1.102 TCP 60 80 → 1161 [ACK] Seq=1 Ack=154117 Win=62780 Len=0
191 5.197286 128.119.245.12 192.168.1.102 TCP 60 80 → 1161 [ACK] Seq=1 Ack=156469 Win=62780 Len=0
192 5.197508 192.168.1.102 128.119.245.12 TCP 1514 1161 → 80 [ACK] Seq=156469 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
193 5.198388 192.168.1.102 128.119.245.12 TCP 1514 1161 → 80 [ACK] Seq=157929 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
194 5.199275 192.168.1.102 128.119.245.12 TCP 1514 1161 → 80 [ACK] Seq=159389 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
195 5.200252 192.168.1.102 128.119.245.12 TCP 1514 1161 → 80 [ACK] Seq=160849 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
196 5.201150 192.168.1.102 128.119.245.12 TCP 1514 1161 → 80 [ACK] Seq=162309 Ack=1 Win=17520 Len=1460 [TCP segment of a reassembled PDU]
197 5.202024 192.168.1.102 128.119.245.12 TCP 326 1161 → 80 [PSH, ACK] Seq=163769 Ack=1 Win=17520 Len=272 [TCP segment of a reassembled PDU]
198 5.297257 128.119.245.12 192.168.1.102 TCP 60 80 → 1161 [ACK] Seq=1 Ack=159389 Win=62780 Len=0
199 5.297341 192.168.1.102 128.119.245.12 HTTP 104 POST /ethereal-labs/lab3-1-reply.htm HTTP/1.1 (text/plain)
200 5.389471 128.119.245.12 192.168.1.102 TCP 60 80 → 1161 [ACK] Seq=1 Ack=162309 Win=62780 Len=0
201 5.447887 128.119.245.12 192.168.1.102 TCP 60 80 → 1161 [ACK] Seq=1 Ack=164041 Win=62780 Len=0
202 5.455830 128.119.245.12 192.168.1.102 TCP 60 80 → 1161 [ACK] Seq=1 Ack=164091 Win=62780 Len=0
203 5.461175 128.119.245.12 192.168.1.102 HTTP 784 HTTP/1.1 200 OK (text/html)
206 5.651141 192.168.1.102 128.119.245.12 TCP 54 1161 → 80 [ACK] Seq=164091 Ack=731 Win=16790 Len=0
213 7.595557 192.168.1.102 199.2.53.206 TCP 62 1162 → 631 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1
Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 1, Ack: 164091, Len: 0
Source Port: 80
Destination Port: 1161
[Stream index: 0]
[TCP Segment Len: 0]
Sequence number: 1 (relative sequence number)
[Next sequence number: 1 (relative sequence number)]
Acknowledgment number: 164091 (relative ack number)
0101 .... = Header Length: 20 bytes (5)
Flags: 0x010 (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
0000 00 20 e0 8a 70 1a 00 06 25 da af 73 08 00 45 00 · ··p··· %··s··E·
0010 00 28 58 bb 40 00 37 06 b3 82 80 77 f5 0c c0 a8 ·(X·@·7· ···w····
0020 01 66 00 50 04 89 34 a2 74 1a 0d d8 82 ef 50 10 ·f·P··4· t·····P·
0030 f5 3c 44 a8 00 00 e5 e7 00 00 07 fb ·<D····· ····
The window size value from the TCP header (tcp.window_size_value), 2 字节
分组: 213 · 已显示: 202 (94.9%)
配置: Default