

# GS1023 – REDE DE COMPUTADORES

## Computer Networking – J. F. Kurose and K. W. Ross – 7th Edition Chapter 3 – Camada de Transporte

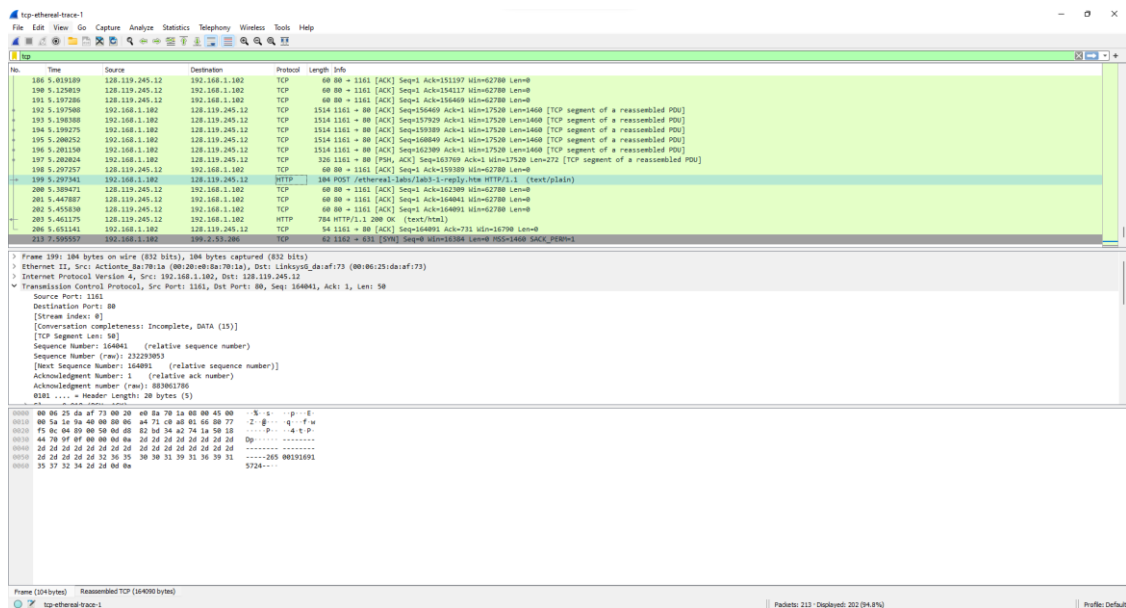
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1. What is the IP address and TCP port number used by the client computer (source) that is transferring the file to [gaia.cs.umass.edu](http://gaia.cs.umass.edu)? To answer this question, it's probably easiest to select an HTTP message and explore the details of the TCP packet used to carry this HTTP message, using the “details of the selected packet header window” (refer to Figure 2 in the “Getting Started with Wireshark” Lab if you're uncertain about the Wireshark windows).

IP do client: 192.168.1.102  
TCP src port: 1161  
TCP dst port: 80

2. What is the IP address of [gaia.cs.umass.edu](http://gaia.cs.umass.edu)? On what port number is it sending and receiving TCP segments for this connection?

IP do server: 128.119.245.12  
TCP src port: 80  
TCP dst port: 1161



tcp-ethereal-trace-1

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No.	Time	Source	Destination	Protocol	Length	Info
186	5.491589	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Acks=15197 Win=42788 Len=0
188	5.127819	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Acks=15412 Win=42788 Len=0
191	5.197286	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Acks=15649 Win=42788 Len=0
192	5.197588	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=15649 Acks=1 Win=17528 Len=1468 [TCP segment of a reassembled PDU]
193	5.198388	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=157929 Acks=1 Win=17528 Len=1468 [TCP segment of a reassembled PDU]
194	5.199275	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=159389 Acks=1 Win=17528 Len=1468 [TCP segment of a reassembled PDU]
195	5.200612	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=160849 Acks=1 Win=17528 Len=1468 [TCP segment of a reassembled PDU]
196	5.201558	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=162389 Acks=1 Win=17528 Len=1468 [TCP segment of a reassembled PDU]
197	5.202824	192.168.1.102	128.119.245.12	TCP	326	1161 → 80 [PSH, ACK] Seq=163769 Acks=1 Win=17528 Len=272 [TCP segment of a reassembled PDU]
198	5.207257	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Acks=159389 Win=42788 Len=0
199	5.297341	192.168.1.102	128.119.245.12	HTTP	1084	POST /etherlab-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 Acks=162389 Win=42788 Len=0
201	5.443787	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Acks=164841 Win=42788 Len=0
202	5.455838	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Acks=164891 Win=42788 Len=0
203	5.461279	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=1 Acks=164901 Acks=731 Win=16790 Len=0
213	7.595957	192.168.1.102	199.2.53.206	TCP	82	1162 → 831 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1

> Frame 203: 784 bytes on wire (6272 bits), 784 bytes captured (6272 bits) on interface 0

> Ethernet II, Src: Linksys, Dest: 08:00:27:00:00:00, Dst: Aclionts\_Ra70:1a (08:20:e0:8a:70:1a)

> Internet Protocol Version 4, Src: 128.119.245.12, Dst: 192.168.1.102

> Transmission Control Protocol, Src Port: 80, Dst Port: 1161, Seq: 1, Acks: 164891, Len: 780

Source Port: 80

Destination Port: 1161

[Stream index: 8]

[Conversation completeness: Incomplete, DATA (15)]

[TCP Segment Len: 780]

Sequence Number: 1 (relative sequence number)

Sequence Number (raw): 688061780

[Next Sequence Number: 731 (relative sequence number)]

Acknowledgment Number: 164891 (relative ack number)

Acknowledgment Number (raw): 232295103

0101 .... = Header Length: 20 bytes (5)

0101 00 20 e0 8a 70 1a 00 00 25 da af 73 00 00 45 00 ... p S s E

0102 83 02 50 bc 40 00 07 00 07 a7 07 75 00 00 48 05 ... . . . . w

0103 01 00 00 50 0a 09 3a 42 7a 1a 0d 02 02 0f 50 18 ... f P a t . . P

0104 15 0c 20 00 00 0a 54 50 2f 31 02 30 20 32 02 ... . . . . .

0105 30 30 20 4f 40 0a 0a 44 61 74 65 3a 20 53 61 74 ... . . . . .

0106 2c 20 31 20 01 75 07 20 52 30 30 0a 20 31 ... . . . . .

0107 3a 3a 3a 3a 32 20 20 47 44 0a 0a 05 05 72 70 ... . . . . .

0108 05 72 3a 20 43 70 81 63 68 05 2f 32 20 38 26 34 ... . . . . .

0109 30 20 52 65 64 20 40 61 74 20 4c 09 6a 75 70 ... . . . . .

0110 20 00 0a 4c 61 73 7a 20 44 6f 6a 09 09 69 65 64 ... . . . . .

0111 3a 20 51 61 74 6c 20 32 31 20 41 63 07 20 32 ... . . . . .

0112 30 3a 20 30 31 3a 3a 30 3a 31 3a 20 47 44 0a 04 ... . . . . .

0113 0a 45 61 61 67 64 65 61 62 50 62 32 31 61 ... . . . . .

0114 30 2d 33 35 37 37 62 53 30 30 22 04 0a 41 63 63 ... . . . . .

0115 05 70 20 52 61 6a 07 65 73 3a 20 82 62 79 74 ... . . . . .

0116 77 00 0a 43 6f 6a 70 65 6a 7a 2d 4c 0f 6a 67 74 ... . . . . .

0117 00 0a 30 3a 31 30 0a 0a 40 65 65 70 2d 41 6c 69 ... . . . . .

0118 70 65 3a 20 78 6f 6a 65 6f 75 7a 5d 51 30 2c ... . . . . .

0119 64 62 78 3d 31 30 30 0a 0a 43 6f 6a 65 63 74 ... . . . . .

0120 6f 6a 6a 3a 20 40 65 65 70 2d 41 6c 07 70 65 6d ... . . . . .

0121 0a 43 6f 6a 74 65 6a 74 2d 54 79 70 65 3a 20 74 ... . . . . .

Content-Type: text

Packets: 213 / Displayed: 202 (94.8%)

Profile: Default

3. What is the IP address and TCP port number used by your client computer (source) to transfer the file to gaia.cs.umass.edu?

IP do client: 192.168.15.31

TCP src port: 58146

TCP dst port: 80

IP do server: 128.119.245.12

TCP src port: 80

TCP dst port: 58146

ethernet

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No.	Time	Source	Destination	Protocol	Length	Info
720	3.533226	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=17113 Win=153852 Len=0
723	3.533226	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=83145 Win=159776 Len=0
722	3.533226	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=60809 Win=161536 Len=0
723	3.533267	192.168.15.31	128.119.245.12	TCP	17470	58146 → 80 [PSH, ACK] Seq=105905 Acks=1 Win=262556 Len=17424 [TCP segment of a reassembled PDU]
724	3.533396	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=73329 Win=176128 Len=0
725	3.533429	192.168.15.31	128.119.245.12	HTTP	7175	POST /udreshark-labs/lab3-1-reply.htm HTTP/1.1 (text/plain)
726	3.533995	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=83781 Win=178848 Len=0
727	3.533995	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=82841 Win=178568 Len=0
731	3.542549	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=13493 Win=181888 Len=0
732	3.542788	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=90561 Win=174902 Len=0
730	3.609358	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=90813 Win=184832 Len=0
731	3.609358	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=99845 Win=187776 Len=0
732	3.609358	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=100817 Win=190720 Len=0
733	3.609358	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=111801 Win=210944 Len=0
734	3.609358	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=112133 Win=211888 Len=0
735	3.700762	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=154537 Win=219776 Len=0
736	3.702272	128.119.245.12	192.168.15.31	TCP	60	80 → 58146 [ACK] Seq=1 Acks=118341 Win=225536 Len=0

> Frame 725: 7175 bytes on wire (57400 bits), 7175 bytes captured (57400 bits) on interface 0

> Ethernet II, Src: Sigiliga, Dest: 0a:00:00:00:00:00, Dst: Tellesco\_20:72:4e (f4:5a:20:72:72:4e)

> Internet Protocol Version 4, Src: 192.168.15.31, Dst: 128.119.245.12

> Transmission Control Protocol, Src Port: 58146, Dst Port: 80, Seq: 145929, Acks: 1, Len: 7121

Source Port: 58146

Destination Port: 80

[Stream index: 2]

[Conversation completeness: Incomplete, DATA (15)]

[TCP Segment Len: 7121]

Sequence Number: 145929 (relative sequence number)

Sequence Number (raw): 1518067402

[Next Sequence Number: 153900 (relative sequence number)]

Acknowledgment Number: 1 (relative ack number)

Acknowledgment Number (raw): 1205680596

0101 .... = Header Length: 20 bytes (5)

0101 4e 5a 20 72 72 4e 0a 00 07 9e 8c 63 00 00 45 00 ... t "nd g . . . E

0102 00 00 01 c2 40 00 00 00 00 00 00 00 00 00 00 00 ... . . . . .

0103 15 0c 43 22 00 50 5a 82 95 8a 47 69 39 64 50 18 ... . . . . .

0104 04 62 45 52 00 00 20 68 61 61 64 20 62 65 65 6a 20 ... . . . . .

0105 74 6f 20 68 65 72 2c 6d 6a 20 20 20 20 20 20 20 ... . . . . .

0106 20 20 20 41 6a 6a 20 6d 65 6a 74 6f 6f 6f 65 6a 64 ... . . . . .

0107 20 6d 65 20 74 6f 20 68 69 6d 3a 8d 0a 20 20 20 ... . . . . .

0108 20 20 20 20 20 30 50 60 20 67 61 76 65 20 6d 65 ... . . . . .

0109 20 61 20 67 6f 6f 6a 20 65 60 61 72 61 63 74 65 ... . . . . .

0110 72 2c 6d 0a 20 20 20 20 20 20 20 20 20 20 20 20 ... . . . . .

0111 74 20 71 61 69 6a 20 40 20 63 6f 76 6c 64 20 6a ... . . . . .

0112 6f 74 20 73 77 69 6d 2e 0a 0a 0d 0a 20 20 20 20 ... . . . . .

0113 20 20 20 20 20 48 65 20 71 6f 76 74 20 74 68 65 ... . . . . .

0114 20 77 6f 72 64 20 49 20 68 61 6a 20 6e 6f 74 20 ... . . . . .

0115 67 6f 6a 65 6d 0a 20 20 20 20 20 20 20 20 20 ... . . . . .

0116 28 57 65 20 69 6a 6f 77 29 69 74 20 74 6f 20 62 ... . . . . .

0117 65 20 74 72 75 65 7a 6a 0a 20 20 20 20 20 20 ... . . . . .

0118 20 20 49 66 20 73 68 65 20 73 68 6f 75 6c 64 20 ... . . . . .

0119 70 75 73 68 20 74 6a 65 20 6d 61 74 74 65 72 20 ... . . . . .

0120 6f 6a 2c 6d 0a 20 20 20 20 20 20 20 20 20 20 20 ... . . . . .

Frame (7175 bytes) Reassembled TCP (153949 bytes)

Transmission Control Protocol

Packets: 1495 / Displayed: 78 (5.2%) / Dropped: 0 (0.0%)

Profile: Default



tcp-ethereal-trace-1

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tcp

No.	Time	Source	Destination	Protocol	Length	Info
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	199.2.55.206	TCP	62	1162 → 631 [SYN] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM=1

[Conversation completeness: Incomplete, DATA (15)]

[TCP Segment Len: 50]

Sequence Number: 164041 (relative sequence number)

Sequence Number (raw): 232293053

[Next Sequence Number: 164091 (relative sequence number)]

Acknowledgment Number: 1 (relative ack number)

Acknowledgment number (raw): 883861786

0101 .... = Header Length: 20 bytes (5)

Flags: 0x018 (PSH, ACK)

0000 00 06 25 da af 72 00 20 e0 8a 70 1a 00 00 45 00 ...:..p...E:  
 0010 00 5a 1e 9a 40 00 00 00 a4 71 c0 a8 01 60 00 77 ...Z:..q...f-w  
 0020 f5 0c 04 00 00 50 00 d8 02 bd 34 a2 74 1a 50 18 ...P...4:t:P  
 0030 44 70 9f 0f 00 00 00 0a 2d 2d 2d 2d 2d 2d 2d 2d Dp.....  
 0040 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d .....  
 0050 2d 2d 2d 2d 2d 2d 32 36 35 30 30 31 39 31 36 39 31 -----265 00191691  
 0060 35 37 32 34 2d 00 0a 5724----

Frame (104 bytes) Reassembled TCP (164090 bytes)

Transmission Control Protocol: Protocol

Packets: 213 · Displayed: 202 (94.8%)

Profile: Default

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.

Pacote 448, seq. 1

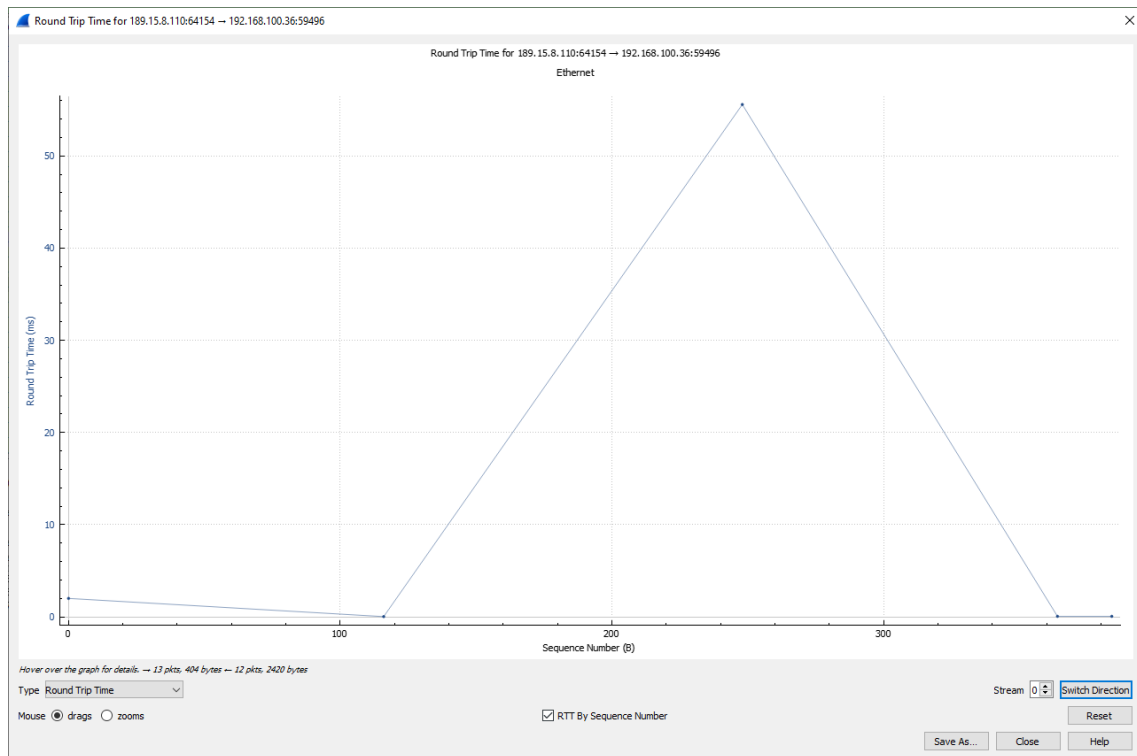
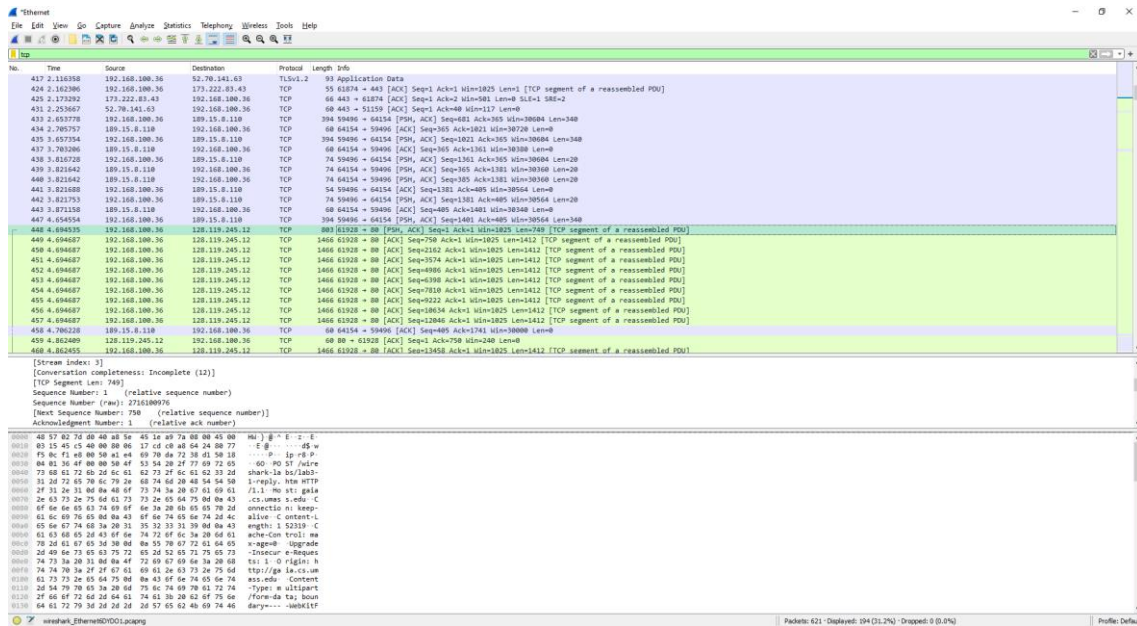
Pacote 449, seq. 750, ack = 4.694687, seq. = 4.862509. RTT = 0.167822

Pacote 450, seq. 2162, ack = 4.694687, seq. = 4.862660. RTT = 0.167973

Pacote 451, seq. 3574, ack = 4.694687, seq. = 4.862660. RTT = 0.167973

Pacote 452, seq. 4986, ack = 4.694687, seq. = 4.862660. RTT = 0.167973

Pacote 453, seq. 6398, ack = 4.694687, seq. = 4.862660. RTT = 0.167973



8. What is the length of each of the first six TCP segments?

O segmento que contém o HTTP POST tem 50 bytes

No.	Time	Source	Destination	Protocol	Length	Info
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	5.455838	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)

> Frame 199: 104 bytes on wire (832 bits), 104 bytes captured (832 bits)  
 > Ethernet II, Src: Actionte\_8a:70:1a (00:20:e0:8a:70:1a), Dst: Linksys6\_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: 164041, Ack: 1, Len: 50  
   Source Port: 1161  
   Destination Port: 80  
   [Stream index: 0]  
   [Conversation completeness: Incomplete, DATA (15)]  
   [TCP Segment Len: 50]

```

0000  00 06 25 da af 73 00 20 e0 8a 70 1a 08 00 45 00  ...%..s...p...E...
0010  00 5a 1e 9a 40 00 00 06 a4 71 c0 a8 01 66 80 77  -Z...@...q...f.w...
0020  f5 0c 04 89 00 50 0d d8 82 bd 34 a2 74 1a 18    ....P...4..t...
0030  44 70 9f 0f 00 00 0d 0a 2d 2d 2d 2d 2d 2d 2d 2d  Dp.....
0040  2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d 2d  ....
0050  2d 2d 2d 2d 2d 32 36 35 30 30 31 39 31 36 39 31  ----265 00191691
0060  35 37 32 34 2d 2d 0d 0a                          5724----
  
```

Frame (104 bytes)    Reassembled TCP (164090 bytes)  
 TCP Segment Len (tcp.len), 1 byte(s)    Packets: 213 · Displayed: 213 (100.0%)    Profile: Default

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?

Tamanho mínimo do buffer é de 5840 bytes. Nesse trace o remetente não fica sem espaço.

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	0.077495	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=6046 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]

Acknowledgment Number: 1 (relative ack number)  
 Acknowledgment number (raw): 232120013  
 0111 .... = Header Length: 28 bytes (7)  
 > Flags: 0x012 (SYN, ACK)  
 Window: 5840  
 [Calculated window size: 5840]  
 Checksum: 0x774d [unverified]  
 [Checksum Status: Unverified]  
 Urgent Pointer: 0  
 > Options: (0 bytes), Maximum segment size, No-Operation (NOP), No-Operation (NOP), SACK permitted

```

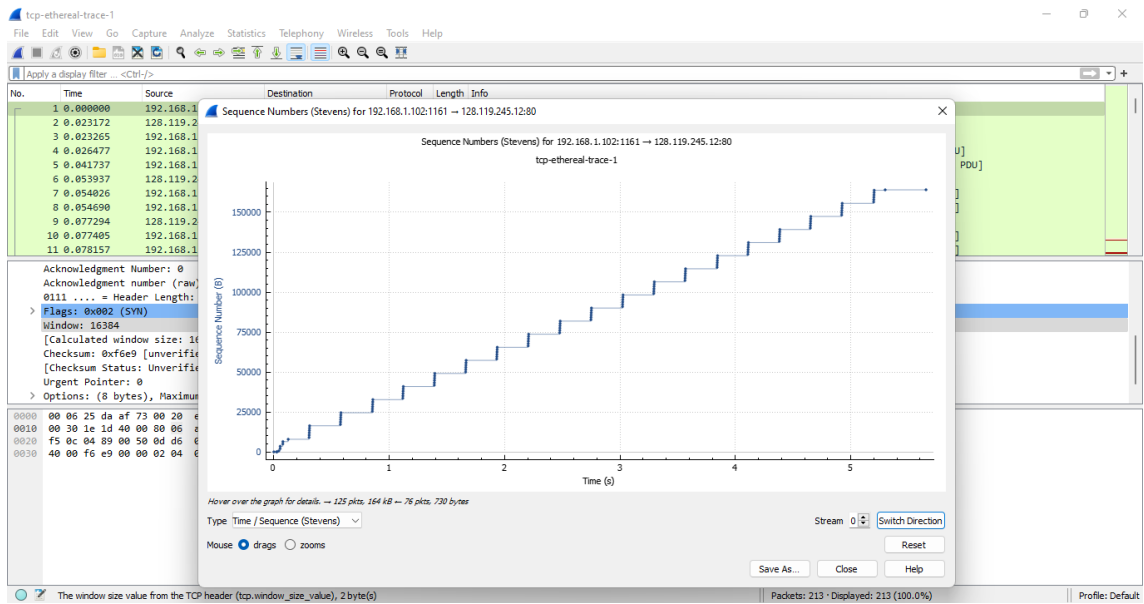
0000  00 20 e0 8a 70 1a 00 06 25 da af 73 00 00 45 00  ...p...%..s...E...
0010  00 30 00 00 40 00 37 06 8c 36 00 77 f5 0c 00 a8  -@...@?...6.w...
0020  01 66 00 50 04 89 34 a2 74 19 ad d6 01 f5 12    -f...4..t.....
0030  16 d0 77 4d 00 00 02 04 05 b4 01 01 04 02      ..w.....
  
```

TCP Segment Len (tcp.len), 1 byte(s)    Packets: 213 · Displayed: 213 (100.0%)    Profile: Default

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

Como é possível ver no gráfico, o sequence number é sempre crescente, o que indica que não houve retransmissão.



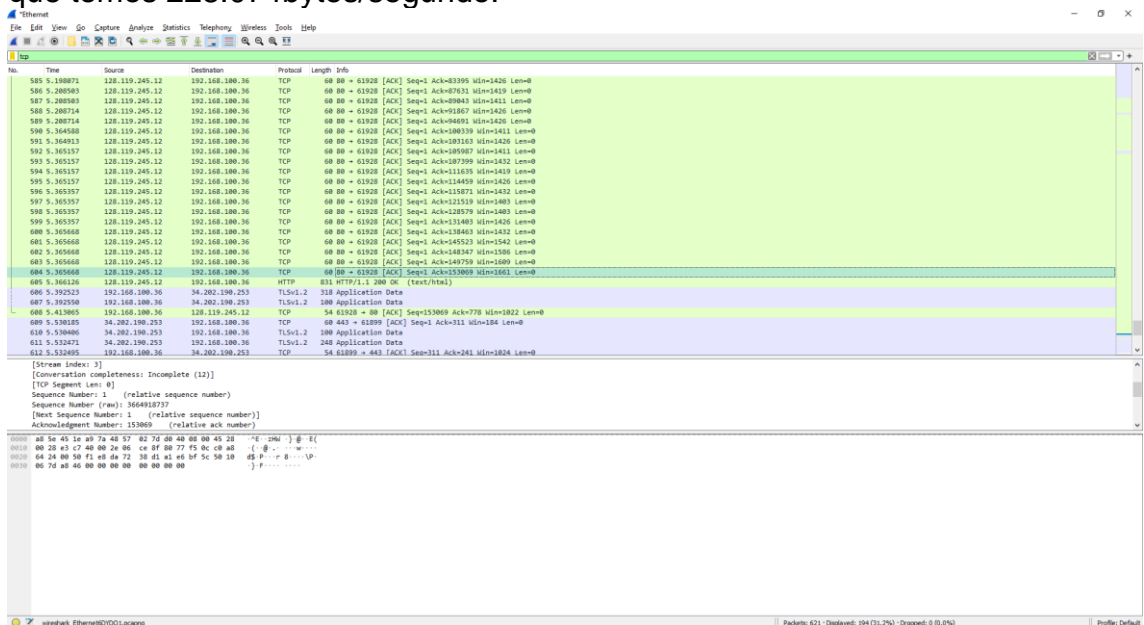


11. How much data does the receiver typically acknowledge in an ACK? Can you identify cases where the receiver is ACKing every other received segment (see Table 3.2 on page 250 in the text).

Em sua maioria, são recebidos  $1460 \times 2$  bytes = 2920 bytes.

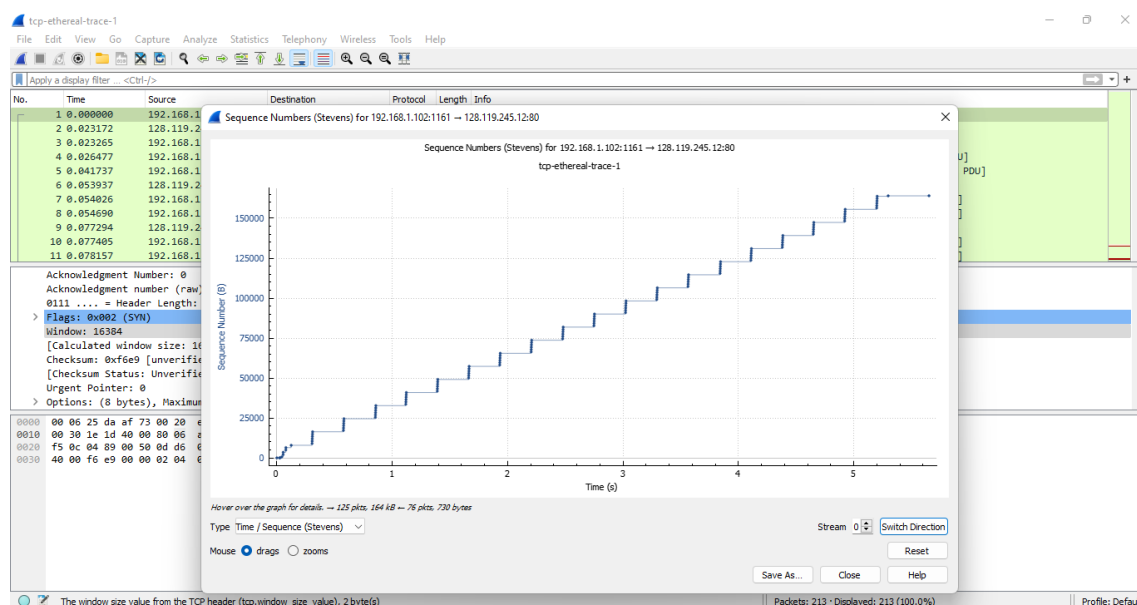
12. What is the throughput (bytes transferred per unit time) for the TCP connection? Explain how you calculated this value.

Para calcular o valor de bytes por unidade de tempo devemos pegar a primeira sequência e ultimo ack =  $153069 - 1 = 153068$  bytes. Depois avaliamos os tempos da primeira e última =  $5.365668 - 4.694535 = 0,671133$ , o que significa que temos 228.074 bytes/segundo.



13. Use the Time-Sequence-Graph(Stevens) plotting tool to view the sequence number versus time plot of segments being sent from the client to the gaia.cs.umass.edu server. Can you identify where TCP's slowstart phase begins and ends, and where congestion avoidance takes over? Comment on ways in which the measured data differs from the idealized behavior of TCP that we've studied in the text.

A partida lenta se inicia no início da transmissão e é finalizada por volta do segundo 0.1. o protocolo não executa com base no seu comportamento idealizado pois o objeto é muito pequeno, assim não é mascarado pela partida lenta da conexão TCP.



14. Answer each of two questions above for the trace that you have gathered when you transferred a file from your computer to gaia.cs.umass.edu