

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? 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).

Computador do cliente (source), endereço IP: 192.168.0.26, número da porta TCP: 63036.

2. What is the IP address of gaia.cs.umass.edu? On what port number is it sending and receiving TCP segments for this connection?

Computador de destino (gaia.cs.umass.edu), endereço IP: 128.119.245.12, número da porta TCP: 80.

No.	Time	Source	Destination	Protocol	Length	Info
137	16.776949	192.168.0.26	128.119.245.12	TCP	66	63037 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
138	16.930790	192.168.0.26	108.158.134.115	TCP	55	62872 → 443 [ACK] Seq=1 Ack=1 Win=513 Len=1 [TCP segment of a reassembled PDU]
139	16.947437	128.119.245.12	192.168.0.26	TCP	60	80 → 63023 [ACK] Seq=2 Ack=3 Win=229 Len=0
140	16.959129	128.119.245.12	192.168.0.26	TCP	66	80 → 63036 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1 WS=128
141	16.959288	192.168.0.26	128.119.245.12	TCP	54	63036 → 80 [ACK] Seq=1 Ack=1 Win=131328 Len=0
142	16.959902	192.168.0.26	128.119.245.12	TCP	782	63036 → 80 [PSH, ACK] Seq=1 Ack=1 Win=131328 Len=728 [TCP segment of a reassembled PDU]
143	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=729 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
144	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=2189 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
145	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=3649 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
146	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=5109 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
147	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=6569 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
148	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=8029 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
149	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=9489 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
150	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=10949 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
151	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=12409 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
152	16.969341	128.119.245.12	192.168.0.26	TCP	66	80 → 63037 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1 WS=128

> Frame 142: 782 bytes on wire (6256 bits), 782 bytes captured (6256 bits) on interface \Device\NPF_{974E1B06-0849-479E-B9AA-4DC9F63482A4}, id 0

> Ethernet II, Src: Inventus_5f:e7:34 (a4:63:a1:5f:e7:34), Dst: Kaonmedi_00:06:8b (98:77:e7:00:06:8b)

> Internet Protocol Version 4, Src: 192.168.0.26, Dst: 128.119.245.12

> Transmission Control Protocol, Src Port: 63036, Dst Port: 80, Seq: 1, Ack: 1, Len: 728


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0000  98 77 e7 00 06 8b a4 63 a1 5f e7 34 08 00 45 00  :w.....c...4...E:
0010  03 00 b8 cd 40 00 80 06 08 e4 c0 a8 00 1a 80 77  :...@...w
0020  f5 0c f6 3c 00 50 ea d1 18 fe 7b df 5e 66 50 18  :...P...{^fP
0030  02 01 c8 1b 00 00 50 4f 53 54 20 2f 77 69 72 65  :...PO ST /wire
0040  73 68 61 72 6b 2d 6c 61 62 73 2f 6c 61 62 33 2d  :shark-la bs/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 6d 0a 43  :.cs.umass.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 6d 0a 43 6f 6e 74 65 6e 74 2d 4c  :alive..C ontent-L
00a0  65 6e 67 74 68 3a 20 31 35 32 33 32 31 0d 0a 43  :ength: 1 52321..C

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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?

Computador do cliente (source), endereço IP: 192.168.0.26, número da porta TCP: 63036.

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?

No.	Time	Source	Destination	Protocol	Length	Info
137	16.776949	192.168.0.26	128.119.245.12	TCP	66	63037 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
138	16.930790	192.168.0.26	108.158.134.115	TCP	55	62872 → 443 [ACK] Seq=1 Ack=1 Win=513 Len=1 [TCP segment of a reassembled PDU]
139	16.947437	128.119.245.12	192.168.0.26	TCP	60	80 → 63023 [ACK] Seq=2 Ack=3 Win=229 Len=0
140	16.959129	128.119.245.12	192.168.0.26	TCP	66	80 → 63036 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1 WS=128
141	16.959288	192.168.0.26	128.119.245.12	TCP	54	63036 → 80 [ACK] Seq=1 Ack=1 Win=131328 Len=0
142	16.959902	192.168.0.26	128.119.245.12	TCP	782	63036 → 80 [PSH, ACK] Seq=1 Ack=1 Win=131328 Len=728 [TCP segment of a reassembled PDU]
143	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=729 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
144	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=2189 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
145	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=3649 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
146	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=5109 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
147	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=6569 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
148	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=8029 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
149	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=9489 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
150	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=10949 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
151	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=12409 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
152	16.969341	128.119.245.12	192.168.0.26	TCP	66	80 → 63037 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1 WS=128

Acknowledgment Number: 1 (relative ack number)
Acknowledgment number (raw): 2078236262
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
....0. = Urgent: Not set
....1... = Acknowledgment: Set
....1... = Push: Set
....0... = Reset: Not set
....0. = Syn: Not set
....0... = Fin: Not set
[TCP Flags:AP...]

O número de sequência TCP SYN é usado para iniciar a conexão TCP entre o cliente e gaia.cs.umass.edu. O valor é 0 nesse caso.

A SYN flag em 1 indica que esse segmento é do tipo SYN.

5. What is the sequence number of the SYNACK segment sent by gaia.cs.umass.edu to the client computer in reply to the SYN? What is the value of the Acknowledgement field in the SYNACK segment? How did gaia.cs.umass.edu determine that value? What is it in the segment that identifies the segment as a SYNACK segment?

Número de sequência do segmento SYNACK de gaia.cs.umass.edu para o computador cliente em resposta ao SYN tem o valor de 1 neste rastreamento. O valor do campo de confirmação no segmento SYNACK é 1. O valor do campo de reconhecimento no segmento SYNACK é determinado por gaia.cs.umass.edu adicionando 1 ao número de sequência inicial do segmento SYN do computador cliente (ou seja, o número de sequência do segmento SYN iniciado pelo computador cliente é 0.). O sinalizador SYN e o sinalizador de confirmação no segmento são definidos como 1 e indicam que este segmento é um segmento SYNACK.

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.

No.	Time	Source	Destination	Protocol	Length	Info
137	16.776949	192.168.0.26	128.119.245.12	TCP	66	63037 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
138	16.930790	192.168.0.26	108.158.134.115	TCP	55	62872 → 443 [ACK] Seq=1 Ack=1 Win=513 Len=1 [TCP segment of a reassembled PDU]
139	16.947437	128.119.245.12	192.168.0.26	TCP	60	80 → 63023 [ACK] Seq=2 Ack=3 Win=229 Len=0
140	16.959129	128.119.245.12	192.168.0.26	TCP	66	80 → 63036 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1 WS=128
141	16.959288	192.168.0.26	128.119.245.12	TCP	54	63036 → 80 [ACK] Seq=1 Ack=1 Win=131328 Len=0
142	16.959902	192.168.0.26	128.119.245.12	TCP	782	63036 → 80 [PSH, ACK] Seq=1 Ack=1 Win=131328 Len=728 [TCP segment of a reassembled PDU]
143	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=729 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
144	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=2189 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
145	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=3649 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
146	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=5109 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
147	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=6569 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
148	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=8029 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
149	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=9489 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
150	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=10949 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
151	16.960168	192.168.0.26	128.119.245.12	TCP	1514	63036 → 80 [ACK] Seq=12409 Ack=1 Win=131328 Len=1460 [TCP segment of a reassembled PDU]
152	16.969341	128.119.245.12	192.168.0.26	TCP	66	80 → 63037 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1 WS=128

> Frame 142: 782 bytes on wire (6256 bits), 782 bytes captured (6256 bits) on interface \Device\NPF_{974E1BD6-0849-479E-B9AA-4DC9F63482A4}, id 0

> Ethernet II, Src: Inventus_5f:e7:34 (a4:63:a1:5f:e7:34), Dst: Kaonmedi_00:06:8b (98:77:e7:00:06:8b)

> Internet Protocol Version 4, Src: 192.168.0.26, Dst: 128.119.245.12

> Transmission Control Protocol, Src Port: 63036, Dst Port: 80, Seq: 1, Ack: 1, Len: 728

Source Port: 63036

Destination Port: 80

[Stream index: 33]

[Conversation completeness: Incomplete, DATA (15)]

[TCP Segment Len: 728]

Sequence Number: 1 (relative sequence number)

Sequence Number (raw): 3939571966

[Next Sequence Number: 729 (relative sequence number)]

Acknowledgment Number: 1 (relative ack number)

Acknowledgment number (raw): 2078236262

0101 = Header Length: 20 bytes (5)

O segmento nº 4 é o segmento TCP que contém o comando HTTP POST. O número de sequência deste segmento tem o valor de 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.

No.	Time	Source	Destination	Protocol	Length	Info
392	17.484544	192.168.0.26	128.119.245.12	HTTP	535	POST /wireshark-labs/lab3-1-reply.htm HTTP/1.1 (text/plain)
352	17.663621	128.119.245.12	192.168.0.26	HTTP	831	HTTP/1.1 200 OK (text/html)
3	0.084221	2804:14d:a483:90d3::...	2606:1901:0:47fc::...	TCP	75	62840 → 443 [ACK] Seq=1 Ack=1 Win=514 Len=1 [TCP segment of a reassembled PDU]
5	0.127357	2606:1901:0:47fc::...	2804:14d:a483:90d3::...	TCP	86	443 → 62840 [ACK] Seq=1 Ack=2 Win=265 Len=0 SLE=1 SRE=2
6	0.147856	192.168.0.26	52.111.225.2	TCP	54	63006 → 443 [ACK] Seq=1 Ack=52 Win=512 Len=0

No.	Time	Source	Destination	Protocol	Length	Info
17	3.180406	2804:14d:a483:90d3::...	2606:4700:3032::ac4...	TCP	75	62842 → 443 [ACK] Seq=1 Ack=1 Win=512 Len=1 [TCP segment of a reassembled PDU]
18	3.218422	2606:4700:3032::ac4...	2804:14d:a483:90d3::...	TCP	86	443 → 62842 [ACK] Seq=1 Ack=2 Win=70 Len=0 SLE=1 SRE=2
21	3.854887	192.168.0.26	20.189.173.11	TCP	55	62386 → 443 [ACK] Seq=1 Ack=1 Win=517 Len=1 [TCP segment of a reassembled PDU]
22	4.066140	20.189.173.11	192.168.0.26	TCP	66	443 → 62386 [ACK] Seq=1 Ack=2 Win=2052 Len=0 SLE=1 SRE=2
24	4.888462	2804:14d:a483:90d3::...	2600:1419::5c7a:b69b	TCP	74	63034 → 443 [FIN, ACK] Seq=1 Ack=25 Win=512 Len=0
25	4.888612	2600:1419::5c7a:b69b	2804:14d:a483:90d3::...	TCP	74	443 → 63034 [FIN, ACK] Seq=25 Ack=1 Win=291 Len=0
26	4.888709	2804:14d:a483:90d3::...	2600:1419::5c7a:b69b	TCP	74	63034 → 443 [ACK] Seq=2 Ack=26 Win=512 Len=0
27	4.889500	2600:1419::5c7a:b69b	2804:14d:a483:90d3::...	TCP	74	[TCP Retransmission] 443 → 63034 [FIN, ACK] Seq=25 Ack=1 Win=291 Len=0
28	4.889556	2804:14d:a483:90d3::...	2600:1419::5c7a:b69b	TCP	74	[TCP Dup ACK 26#1] 63034 → 443 [ACK] Seq=2 Ack=26 Win=512 Len=0
29	4.937142	2600:1419::5c7a:b69b	2804:14d:a483:90d3::...	TCP	74	443 → 63034 [ACK] Seq=26 Ack=2 Win=291 Len=0
32	8.778284	128.119.245.12	192.168.0.26	TCP	60	80 → 63023 [FIN, ACK] Seq=1 Ack=2 Win=229 Len=0
33	8.778376	192.168.0.26	128.119.245.12	TCP	54	63023 → 80 [ACK] Seq=2 Ack=2 Win=513 Len=0
46	10.045738	192.168.0.26	151.101.177.2	TCP	55	62651 → 443 [ACK] Seq=1 Ack=1 Win=1026 Len=1 [TCP segment of a reassembled PDU]
47	10.086074	151.101.177.2	192.168.0.26	TCP	66	443 → 62651 [ACK] Seq=1 Ack=2 Win=290 Len=0 SLE=1 SRE=2
49	10.298950	192.168.0.26	52.111.225.2	TCP	54	63006 → 443 [ACK] Seq=1 Ack=103 Win=517 Len=0
50	10.678801	2804:14d:a483:90d3::...	2600:1419:4c00:187::...	TCP	75	62908 → 443 [ACK] Seq=1 Ack=1 Win=517 Len=1 [TCP segment of a reassembled PDU]

Número de sequência do segmento 1: 302

Número de sequência do segmento 2: 352

$\text{EstimatedRTT} = 0.875 * \text{EstimatedRTT} + 0.125 * \text{SampleRTT}$

EstimatedRTT after the receipt of the ACK of segment 1:

EstimatedRTT = RTT for Segment 1 = 4.899500 second

EstimatedRTT after the receipt of the ACK of segment 2:

$\text{EstimatedRTT} = 0.875 * 4.899500 + 0.125 * 0.035557 = 0.0285$

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

Comprimento do primeiro segmento TCP (contendo o HTTP POST): 565 bytes Comprimento de cada um dos outros cinco segmentos TCP: 1460 bytes (MSS)

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

A quantidade mínima de espaço de buffer (janela do receptor) anunciada em gaia.cs.umass.edu para o trace inteiro é de 5840 bytes, o que mostra na primeira confirmação do servidor. Esta janela do receptor cresce de forma constante até um máximo tamanho do buffer do receptor de 62780 bytes. O remetente nunca é estrangulado devido à falta de espaço de buffer do receptor inspecionando esse rastreamento.

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

Não há segmentos retransmitidos no arquivo de rastreamento. Podemos verificar isso por verificando os números de sequência dos segmentos TCP no arquivo de rastreamento. No TimeSequence-Graph (Stevens) deste trace, todos os números de sequência da fonte (192.168.1.102) para o destino (128.119.245.12) estão aumentando monotonamente com respeito ao tempo. Se houver um segmento retransmitido, o número de sequência deste segmento retransmitido deve ser menor do que os de seus segmentos vizinhos.

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).

ACK 1 566 566

ACK 2 2026 1460

ACK 3 3486 1460

ACK 4 4946 1460

ACK 5 6406 1460

ACK 6 7866 1460

ACK 7 9013 1147

ACK 8 10473 1460

ACK 9 11933 1460

ACK 10 13393 1460

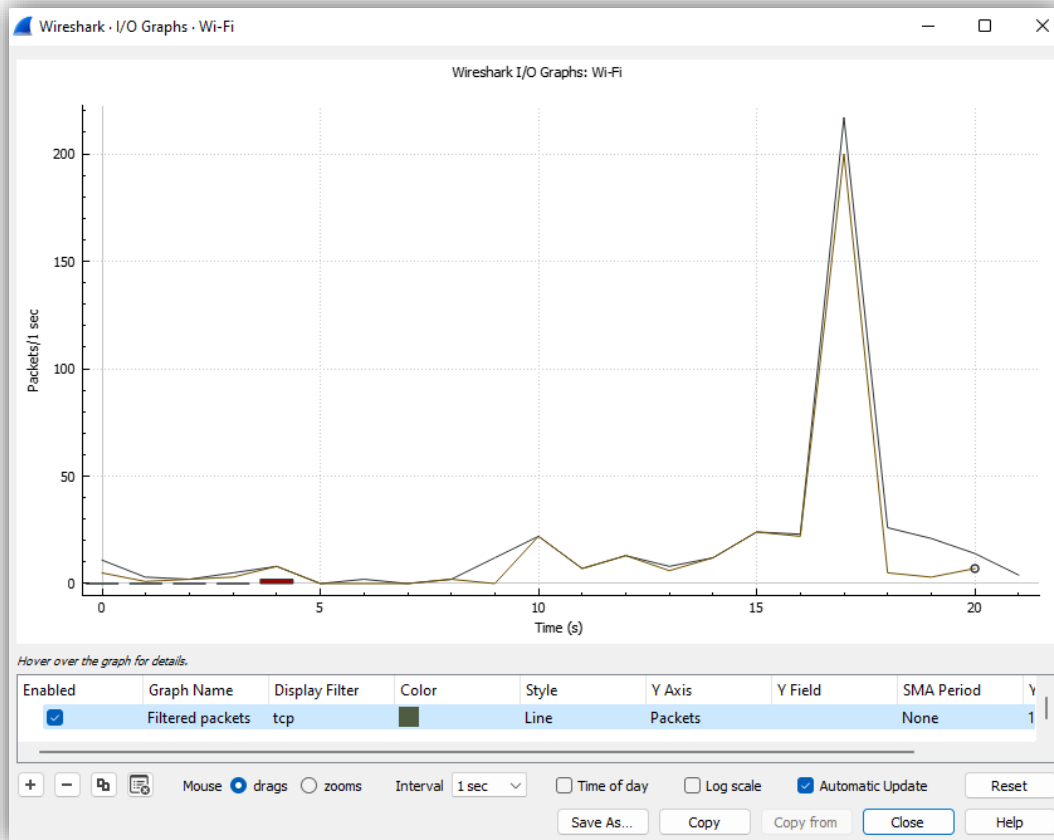
ACK 11 14853 1460

ACK 12 16313 1460

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

O cálculo da taxa de transferência TCP depende em grande parte da seleção de período de tempo médio. Como um cálculo de taxa de transferência comum, nesta questão, selecionamos o período de tempo médio como todo o tempo de conexão. Então, o rendimento médio para esta conexão TCP é calculada como a razão entre a quantidade total de dados e a quantidade total tempo de transmissão. A quantidade total de dados transmitidos pode ser calculada pela diferença entre o número de sequência do primeiro segmento TCP (ou seja, 1 byte para o segmento nº 4) e o número de sequência reconhecido do último ACK (164091 bytes para o nº 202 segmento). Portanto, os dados totais são $164.091 - 1 = 164.090$ bytes. O todo tempo de transmissão é a diferença do instante de tempo do primeiro segmento TCP (ou seja, 0,026477 segundo para o segmento nº 4) e o instante de tempo do último ACK (ou seja, 5,455830 segundo para o segmento nº 202). Portanto, o tempo total de transmissão é $5,455830 - 0,026477 = 5,4294$ segundos. Assim, a taxa de transferência para a conexão TCP é calculada como $164090/5,4294 = 30,222$ KByte/s.

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.



O congestionamento começa no segundo 200 quando os pacotes são enviados.

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

O congestionamento começa quando é transferido o arquivo alice.txt