

Lab 3

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Từ câu 1 → 7 em sử dụng file [http-ethereal-trace-5](#)

Từ câu 8 → 15 em sử dụng file [tcp-ethereal-trace-1](#)

1. Chọn một gói tin UDP, xác định các trường (field) trong UDP header?

The image shows a Wireshark packet capture. The top pane displays a list of 73 packets. The bottom pane shows the details of the selected packet (No. 92), which is a User Datagram Protocol (UDP) packet. The details pane is expanded to show the UDP header fields:

- Source Port: 4334
- Destination Port: 161
- Length: 58
- Checksum: 0x65f8 [unverified]

The packet is identified as a Simple Network Management Protocol (SNMP) packet.

- **Source Port:** 4334
- **Destination Port:** 161
- **Length:** 58
- **Checksum:** 0x65f8 [unverified]

2. Qua thông tin hiển thị của Wireshark, xác định độ dài (tính theo byte) của mỗi trường trong UDP header?

- Vì có trường Length: 58 (bytes) và **UDP payload: 50 bytes**, có 4 trường → Mỗi trường có $(58 - 50) / 4 = 2$ bytes

3. Giá trị của trường Length là độ dài của cái gì?

- Giá trị trường Length là độ dài của toàn packet (bao gồm 4 trường UDP và payload)

4. Số bytes lớn nhất mà payload của UDP có thể chứa?

- IPv4: 65,507 bytes
- IPv6: 65,527 bytes

5. Giá trị lớn nhất có thể có của port nguồn?

- Vì trường port có 2 bytes = 16 bits → Giá trị port tối đa $2^{16} - 1 = 65535$

6. Xác định protocol number của UDP (cả hệ 10 lẫn hệ 16)? Để trả lời câu hỏi này, chúng ta cần phải xem trường Protocol của IP header.

No.	Time	Source	Destination	Protocol	Length Info
1	0.000000	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
2	0.016960	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
11	3.016971	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
12	3.034127	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
13	6.033719	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
14	6.050808	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
15	9.050463	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
16	9.067492	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
17	12.067214	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
18	12.085147	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
19	12.320565	192.168.1.100	192.168.1.255	NBNS	92 Name query NB NOHO<20>
20	12.320600	192.168.1.102	192.168.1.100	NBNS	104 Name query response NB 192.168.1.102
56	15.084928	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
57	15.102314	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
58	17.856210	192.168.1.102	192.168.1.255	NBNS	92 Name query NB WORKGROUP<1b>
59	18.102656	192.168.1.104	192.168.1.102	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
60	18.119969	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
69	18.605453	192.168.1.102	192.168.1.255	NBNS	92 Name query NB WORKGROUP<1b>
71	19.355486	192.168.1.102	192.168.1.255	NBNS	92 Name query NB WORKGROUP<1b>
72	21.120381	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
73	21.137866	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0

Internet Protocol Version 4, Src: 192.168.1.102, Dst: 192.168.1.104	0000 00 30 c1 61 eb ed 00 08 74 4f 36 23 08 00 45 00	0 a ... t06#E.
0100 = Version: 4	0010 00 4e 02 fd 00 00 80 11 00 00 c0 a8 01 66 c0 a8	0 N.... f..
.... 0101 = Header Length: 20 bytes (5)	0020 01 68 10 ee 00 a1 00 3d 65 f8 30 30 02 01 00 04	0 h.... e 00...
► Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)	0030 06 70 75 62 6c 69 63 a0 23 02 02 18 fb 02 01 00	0 public #.....
Total Length: 78	0040 02 01 00 30 17 30 15 06 11 2b 06 01 04 01 0b 02	0 0 0 +.....
Identification: 0x02fd (765)	0050 03 09 04 02 01 02 02 02 01 00 05 00	0
► 0000 = Flags: 0x0		
...0 0000 0000 0000 = Fragment Offset: 0		
Time to Live: 128		
Protocol: UDP (17)		
Header Checksum: 0x0000 [validation disabled]		
[Header checksum status: Unverified]		
Source Address: 192.168.1.102		
Destination Address: 192.168.1.104		
[Stream index: 0]		
► User Datagram Protocol, Src Port: 4334, Dst Port: 161		
Simple Network Management Protocol		

- Protocol: "17"** (hệ 10) và **"0x11"** (hệ 16)

7. Kiểm tra một cặp gói tin gồm: gói tin do máy mình gửi và gói tin phản hồi của gói tin đó. Miêu tả mối quan hệ về port number

của 2 gói tin.

Source Port (Cổng nguồn): Là số cổng của thiết bị gửi gói tin trong một kết nối mạng. Nó được sử dụng để xác định ứng dụng hoặc dịch vụ cụ thể đang gửi dữ liệu trên máy tính nguồn.

- **Destination Port** (Cổng đích): Là số cổng của thiết bị nhận gói tin. Nó giúp xác định ứng dụng hoặc dịch vụ cụ thể trên thiết bị đích mà gói tin sẽ được chuyển đến.

Với:

- IP client: 192.168.1.102
- IP server: 192.168.1.104

- Gửi từ máy đến server

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.168.1.102	192.168.1.104	SNMP	92	get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
2	0.016960	192.168.1.104	192.168.1.102	SNMP	93	get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
11	3.016971	192.168.1.102	192.168.1.104	SNMP	92	get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
12	3.034127	192.168.1.104	192.168.1.102	SNMP	93	get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
13	6.033719	192.168.1.102	192.168.1.104	SNMP	92	get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
14	6.050808	192.168.1.104	192.168.1.102	SNMP	93	get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
15	9.050463	192.168.1.102	192.168.1.104	SNMP	92	get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
16	9.067492	192.168.1.104	192.168.1.102	SNMP	93	get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
17	12.067214	192.168.1.102	192.168.1.104	SNMP	92	get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
18	12.085147	192.168.1.104	192.168.1.102	SNMP	93	get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
19	12.320565	192.168.1.100	192.168.1.255	NBNS	92	Name query NB NOHO<20>
20	12.320600	192.168.1.102	192.168.1.100	NBNS	104	Name query response NB 192.168.1.102
56	15.084928	192.168.1.102	192.168.1.104	SNMP	92	get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
57	15.102314	192.168.1.104	192.168.1.102	SNMP	93	get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
58	17.856210	192.168.1.102	192.168.1.255	NBNS	92	Name query NB WORKGROUP<1b>
59	18.102656	192.168.1.102	192.168.1.104	SNMP	92	get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
60	18.119969	192.168.1.104	192.168.1.102	SNMP	93	get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
69	18.605453	192.168.1.102	192.168.1.255	NBNS	92	Name query NB WORKGROUP<1b>
71	19.355486	192.168.1.102	192.168.1.255	NBNS	92	Name query NB WORKGROUP<1b>
72	21.120381	192.168.1.102	192.168.1.104	SNMP	92	get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
73	21.137866	192.168.1.104	192.168.1.102	SNMP	93	get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0

Frame 1: 92 bytes on wire (736 bits), 92 bytes captured (736 bits)	0000	00 30 c1 61 eb ad 00 08 74 4f 36 23 08 00 45 00	0 a t06# . E .
Ethernet II, Src: Dell_4f:36:23 (00:08:74:4f:36:23), Dst: HewlettPacka_61:eb:ad (00:0c:29:61:eb:ad)	0010	00 4e 02 fd 00 00 00 11 00 00 c0 a8 01 66 c0 a8	. N f
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 192.168.1.104	0020	01 68 10 ee 00 a1 00 3a 65 f8 30 30 02 01 00 04	. h e 00
User Datagram Protocol, Src Port: 4434, Dst Port: 161	0030	06 70 75 62 6c 69 63 a0 23 02 02 18 fb 02 01 00	. p u b l i c : #
Simple Network Management Protocol	0040	02 01 00 30 17 30 15 06 11 2b 06 01 04 01 0b 02	. . . 0 0 . . +
version: version-1 (0)	0050	03 09 04 02 01 02 02 02 01 00 05 00
community: public			
data: get-request (0)			
[Response In: 2]			

- Source port: 4434
- Destination port: 161

- Gửi từ server về máy

No.	Time	Source	Destination	Protocol	Length Info
1	0.000000	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
2	0.016960	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
11	3.016971	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
12	3.034127	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
13	6.037719	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
14	6.050808	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
15	9.050463	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
16	9.067492	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
17	12.067214	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
18	12.085147	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
19	12.320565	192.168.1.100	192.168.1.255	NBNS	92 Name query NB NOHX<20>
20	12.320600	192.168.1.102	192.168.1.100	NBNS	104 Name query response NB 192.168.1.102
56	15.084928	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
57	15.102314	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
58	17.856210	192.168.1.102	192.168.1.255	NBNS	92 Name query NB WORKGROUP<1b>
59	18.102656	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
60	18.119969	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
69	18.605453	192.168.1.102	192.168.1.255	NBNS	92 Name query NB WORKGROUP<1b>
71	19.355486	192.168.1.102	192.168.1.255	NBNS	92 Name query NB WORKGROUP<1b>
72	21.120381	192.168.1.102	192.168.1.104	SNMP	92 get-request 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0
73	21.137866	192.168.1.104	192.168.1.102	SNMP	93 get-response 1.3.6.1.4.1.11.2.3.9.4.2.1.2.2.1.0

▶ Frame 2: 93 bytes on wire (744 bits), 93 bytes captured (744 bits) ▶ Ethernet II, Src: HewlettPacka_61:eb:ed (00:30:c1:61:eb:ed), Dst: Dell_4f:36:23 (00:13:c2:4f:36:23) ▶ Internet Protocol Version 4, Src: 192.168.1.104, Dst: 192.168.1.102 ▶ User Datagram Protocol, Src Port: 161, Dst Port: 4334 ▶ Simple Network Management Protocol version: version-1 (0) community: public data: get-response (2) [Response To: 1] [Time: 0.016960000 seconds]	0000 00 08 74 4f 36 23 00 30 c1 61 eb ed 08 00 45 00 ..t06# 0 .a...E 0010 00 4f ed a2 00 00 3c 11 0c dd c0 a8 01 68 c0 a8 ..0...<...h... 0020 01 66 00 a1 10 ee 00 3b f3 f2 30 31 02 01 00 04 ..f....;S01... 0030 06 70 75 62 6c 69 63 a2 24 02 02 18 fb 02 01 00 ..public \$..... 0040 02 01 00 30 18 30 16 06 11 2b 06 01 04 01 0b 02 ...0 0...+..... 0050 03 09 04 02 01 02 02 02 01 00 04 01 10
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- Source port: 161
- Destination port: 4334
- Vậy gửi từ port nào từ client đến port nào của server thì khi nhận cũng sẽ nhận tương ứng
- Client (4434) - Server (80)

8. Tìm địa chỉ IP và TCP port của máy khách gửi file cho gaia.cs.umass.edu?

No.	Time	Source	Destination	Protocol	Length Info
1	0.000000	192.168.1.102	128.119.245.12	TCP	62 1161 → 80 [SYN, ACK] Seq=0 Win=16384 Len=0 MSS=1460 SACK_PERM
2	0.023172	128.119.245.12	192.168.1.102	TCP	62 80 → 1161 [ACK] Seq=0 Ack=1 Win=5840 Len=0 MSS=1460 SACK_PERM
3	0.023465	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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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	1281 1161 → 80 [PSH, ACK] Seq=7866 Ack=1 Win=17520 Len=1147 [TCP PDU reassembled in 199]
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
18	0.305040	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=9013 Ack=1 Win=17520 Len=1460 [TCP PDU reassembled in 199]
19	0.305813	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=10473 Ack=1 Win=17520 Len=1460 [TCP PDU reassembled in 199]
20	0.306692	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=11933 Ack=1 Win=17520 Len=1460 [TCP PDU reassembled in 199]
21	0.307571	192.168.1.102	128.119.245.12	TCP	1514 1161 → 80 [ACK] Seq=13393 Ack=1 Win=17520 Len=1460 [TCP PDU reassembled in 199]

010. = Flags: 0x2, Don't fragment ...0 0000 0000 0000 = Fragment Offset: 0 Time to Live: 128 Protocol: TCP (6) Header Checksum: 0xa518 [validation disabled] [Header checksum status: Unverified] Source Address: 192.168.1.102 Destination Address: 128.119.245.12 [Stream index: 0] ▶ Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 0, Len: 0 Source Port: 1161 Destination Port: 80 [Stream index: 0] [Stream Packet Number: 1] [Conversation completeness: Incomplete, DATA (15)] [TCP Segment Len: 0] Sequence Number: 0 (relative sequence number)	0000 00 06 25 da af 73 00 20 e0 8a 70 1a 08 00 45 00 ..% .s .ip .E 0010 00 30 1e 1d 40 00 80 06 a5 18 c0 a8 01 66 80 77 ..0 @.....f.w 0020 f5 0c 04 80 00 50 0d d6 01 f4 00 00 00 00 70 02 ..P.....p 0030 40 00 f6 e9 00 00 02 04 05 b4 01 01 04 02
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- IP: 192.168.1.102
- TCP port: 1161

9. Tìm địa chỉ IP của gaia.cs.umass.edu? Kết nối TCP dùng để gửi và nhận các segments sử dụng port nào?

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
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
8	0.054698	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460 [TCP PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]

Frame 1: 62 bytes on wire (496 bits), 62 bytes captured (496 bits) on interface 0
Ethernet II, Src: ActiontecE8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysC0:30:1e:1d:40:00:00:06
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 0, Len: 0

- IP: 128.119.245.12
- Port: 80

10. TCP SYN segment sử dụng sequence number nào để khởi tạo kết nối TCP giữa máy khách và gaia.cs.umass.edu? Thành phần nào trong segment cho ta biết segment đó là TCP SYN segment?

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
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
8	0.054698	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460 [TCP PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]

...0 0000 0000 0000 = Fragment Offset: 0
Time to Live: 128
Protocol: TCP (6)
Header Checksum: 0xa518 [validation disabled]
[Header checksum status: Unverified]
Source Address: 192.168.1.102
Destination Address: 128.119.245.12
[Stream index: 0]
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 0, Len: 0
Source Port: 1161
Destination Port: 80
[Stream index: 0]
[Stream Packet Number: 1]
[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)
000. = Reserved: Not set
...0 = Accurate ECN: Not set
...0 = Congestion Window Reduced: Not set
...0 = ECH-Echo: Not set
...0 = Urgent: Not set
...0 = Acknowledgment: Not set
...0 = Push: Not set
...0 = Reset: Not set

- TCP SYN segment sử dụng:
 - Sequence number: 0 (relative sequence number)
 - Sequence number (raw): 232129012

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
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]

[Stream index: 0]
[Stream Packet Number: 1]
[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)
0000 = 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
....0... = Syn: Set
....0... = Fin: Not set
[TCP Flags:S.]

0000 00 06 25 da af 73 00 20 e0 8a 70 1a 00 00 45 00 % s p E
0010 00 30 1e 1d 40 00 80 06 a5 18 c0 a8 01 66 80 77 0 @ 7 6 w
0020 f5 0c 04 89 00 50 d6 01 f4 00 00 00 70 02 f P 4 t p
0030 40 00 f6 e9 00 00 02 04 05 b4 01 01 04 02 wM

- Thành phần TCP Flags cho ta thấy flag Syn được set là 1

11. Tìm sequence number của SYNACK segment được gửi bởi gaia.cs.umass.edu đến máy khách để trả lời cho SYN segment?
 Tìm giá trị của Acknowledgement trong SYNACK segment?

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
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
3	0.023265	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0

Source Port: 80
Destination Port: 1161
[Stream index: 0]
[Stream Packet Number: 2]
[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)
0000 = 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
....0... = Syn: Set
....0... = Fin: Not set
[TCP Flags:A..S.]
Window: 5840
[Calculated window size: 5840]
Checksum: 0x774d [unverified]
[Checksum Status: Unverified]
Urgent Pointer: 0
Options: (8 bytes), Maximum segment size, No-Operation (NOP), No-Operation (NOP), SA
[Timestamps]
▼ [SEQ/ACK analysis]
[This is an ACK to the segment in frame: 1]
[The RTT to ACK the segment was: 0.023172000 seconds]
[irTT: 0.023265000 seconds]

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 0c 36 80 77 f5 0c e0 a8 0 @ 7 6 w
0020 01 66 00 50 04 89 34 a2 74 19 0d d6 01 f5 70 12 f P 4 t p
0030 16 d0 77 4d 00 00 02 04 05 b4 01 01 04 02 wM

- Sequence number: 0 (relative sequence number)
- Sequence number (raw): 88301785

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
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
3	0.023265	192.168.1.102	128.119.245.12	TCP	54	1161 → 80 [ACK] Seq=1 Ack=1 Win=17520 Len=0


```

Source Port: 80
Destination Port: 1161
[Stream index: 0]
[Stream Packet Number: 2]
[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)
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.]
Window: 5840
[Calculated window size: 5840]
Checksum: 0x774d [unverified]
[Checksum Status: Unverified]
Urgent Pointer: 0
Options: (8 bytes), Maximum segment size, No-Operation (NOP), No-Operation (NOP), SA
[Timestamps]
[SEQ/ACK analysis]
[This is an ACK to the segment in frame: 1]
[The RTT to ACK the segment was: 0.023172000 seconds]
[iRTT: 0.023265000 seconds]

```

- Acknowledgement number: 1 (relative ack number)
- Acknowledgement number (raw): 232129013

12. Tìm sequence number của TCP segment có chứa lệnh HTTP POST?

No.	Time	Source	Destination	Protocol	Length	Info
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 PDU reassembled in 199]
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 PDU reassembled in 199]


```

...0 0000 0000 0000 = Fragment Offset: 0
Time to Live: 128
Protocol: TCP (6)
Header Checksum: 0xa2e7 [validation disabled]
[Header checksum status: Unverified]
Source Address: 192.168.1.102
Destination Address: 128.119.245.12
[Stream index: 0]
Transmission Control Protocol, Src Port: 1161, Dst Port: 80, Seq: 1, Ack: 1, Len: 565
[TCP Segment Len: 565]
[Conversation completeness: Incomplete, DATA (15)]
Sequence Number: 1 (relative sequence number)
Sequence Number (raw): 232129013
[Next Sequence Number: 200 (relative sequence number)]
Acknowledgment Number: 1 (relative ack number)
Acknowledgment number (raw): 883061786
0101 .... = Header Length: 20 bytes (5)
Flags: 0x018 (PSH, 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
...1 .... = Push: Set
...0 .... = Reset: Not set
...0 .... = Syn: Not set
...0 .... = Fin: Not set
[TCP Flags: .....AP...]
Window: 17520

```

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

13. Giả thiết rằng TCP segment chứa lệnh HTTP POST là segment đầu tiên của kết nối TCP. Tìm sequence number của 6 segments đầu tiên (tính cả segment có chứa HTTP POST)? Thời gian mà mỗi segment được gửi? Thời gian ACK cho mỗi segment được nhận? Đưa ra sự khác nhau giữa thời gian mà mỗi segment được gửi và thời gian ACK cho mỗi segment được nhận, tính RTT cho 6 segments? Tính EstimatedRTT sau khi nhận mỗi ACK? Giả sử EstimatedRTT bằng với RTT cho segment đầu tiên, sau đó tính EstimatedRTT với công thức trong giáo trình trang 239 cho các segment tiếp theo.

- 6 sequences của HTTP POST (các giá trị tính bằng s kể từ khi client kết nối đến server)

Em sử dụng thêm filter `ip.src_host == "192.168.1.102"` để lọc ra request gửi từ máy client

No.	Time	Source	Destination	Protocol	Length	Info
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]

- Thời gian 6 ACK mà server gửi về tương ứng

Em sử dụng thêm filter `ip.src_host == "128.119.245.12"` để lọc ra request gửi từ server

No.	Time	Source	Destination	Protocol	Length	Info
6	0.053937	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
9	0.077294	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
12	0.124085	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
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

- Bảng giá trị thời gian

STT	Client → Server (s)	Server → Client (s)	RTT (s)
1	0.026477000	0.053937000	0.02746
2	0.041737000	0.077294000	0.035557
3	0.054026000	0.124085000	0.070059
4	0.054690000	0.169118000	0.114428

STT	Client → Server (s)	Server → Client (s)	RTT (s)
5	0.077405000	0.217299000	0.139894
6	0.078157000	0.267802000	0.189645

Với $RTT = \text{"Server"} \rightarrow \text{"Client"} - \text{"Client"} \rightarrow \text{"Server"}$

- Công thức

$$\text{EstimatedRTT}_{\text{new}} = (1 - \alpha) \times \text{EstimatedRTT}_{\text{old}} + \alpha \times \text{sampleRTT}$$

- Chọn

D

- Tính toán

$$\text{EstimatedRTT}_1 = 0.027460$$

$$\text{EstimatedRTT}_2 = (1 - 0.125) \times 0.027460 + 0.125 \times 0.035557 = 0.02404875 + 0.004444625 = 0.031205375$$

$$\text{EstimatedRTT}_3 = (1 - 0.125) \times 0.031205375 + 0.125 \times 0.070059 = 0.027804700625 + 0.008757375 = 0.036562075625$$

$$\text{EstimatedRTT}_4 = (1 - 0.125) \times 0.036562075625 + 0.125 \times 0.114428 = 0.03174156609375 + 0.0143035 = 0.04604506609375$$

$$\text{EstimatedRTT}_5 = (1 - 0.125) \times 0.04604506609375 + 0.125 \times 0.139894 = 0.04028943453320313 + 0.01748675 = 0.05777618453320313$$

$$\text{EstimatedRTT}_6 = (1 - 0.125) \times 0.05777618453320313 + 0.125 \times 0.189645 = 0.05055316121415273 + 0.023705625 = 0.07425878621415273$$

- Vậy giá trị RTT của mỗi packet

STT	Estimated RTT (s)
1	0.027460
2	0.031205375
3	0.036562075625
4	0.04604506609375
5	0.05777618453320313

STT	Estimated RTT (s)
6	0.07425878621415273

14. Tìm độ dài của 6 segment đầu tiên?

No.	Time	Source	Destination	Protocol	Length	Info
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 PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]
8	0.054698	192.168.1.102	128.119.245.12	TCP	1514	1161 → 80 [ACK] Seq=3486 Ack=1 Win=17520 Len=1460 [TCP PDU reassembled in 199]
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 PDU reassembled in 199]
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 PDU reassembled in 199]

STT	Length (byte)
1	619
2	1514
3	1514
4	1514
5	1514
6	1514

15. Tìm lượng buffer còn trống nhỏ nhất mà bên nhận thông báo cho bên gửi trong suốt file trace?

No.	Time	Source	Destination	Protocol	Length	Info
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
6	0.053937	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=566 Win=6780 Len=0
9	0.077294	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=2026 Win=8760 Len=0
12	0.124085	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=3486 Win=11680 Len=0
14	0.169111	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=4946 Win=14600 Len=0
15	0.217209	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
24	0.356437	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=10473 Win=26280 Len=0
25	0.400164	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=11933 Win=29200 Len=0
26	0.448613	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=13393 Win=32120 Len=0
27	0.500029	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=14853 Win=35040 Len=0
28	0.545052	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=16313 Win=37960 Len=0
29	0.576417	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=17205 Win=37960 Len=0
36	0.626496	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=18665 Win=40880 Len=0
37	0.672796	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=20125 Win=43800 Len=0
38	0.730684	128.119.245.12	192.168.1.102	TCP	60	80 → 1161 [ACK] Seq=1 Ack=21585 Win=46720 Len=0

...0	Accurate ECN: Not set	0000	00 20 e0 8a 70 1a 00 06	25 da af 73 08 00 45 00	p % s E
...0	Congestion Window Reduced: Not set	0010	00 30 00 00 40 00 37 06	0c 36 80 77 f5 0c c0 a8	@ 7 6 w...
...0	ECN-Echo: Not set	0020	01 65 00 50 04 89 34 a2	74 19 0d d6 01 f5 70 12	f.P..4. t....p.
...0	Urgent: Not set	0030	16 d8 77 4d 00 00 02 04	05 b4 01 01 04 02	wM....
...1	Acknowledgment: Set				
...0	Push: Not set				
...0	Reset: Not set				
...1	Syn: Set				
...0	Fin: Not set				
[TCP Flags:A..S.]					
Window: 5840					
[calculated window size: 5840]					
Checksum: 0x774d [unverified]					
[Checksum Status: Unverified]					
Urgent Pointer: 0					
Options: (8 bytes), Maximum segment size, No-Operation (NOP), No-Operation (NOP), SA					
[Timestamps]					
[SEQ/ACK analysis]					
[This is an ACK to the segment in frame: 1]					
[The RTT to ACK the segment was: 0.023172000 seconds]					
[iRTT: 0.023265000 seconds]					

- Lượng buffer nhỏ nhất còn trống (trường window) mà server gửi cho client khi bắt tay có giá trị là 5840

