Exercise 1 – Basic network stuff

Difficulty: **Easy**

Use the `arp` command and paste the output from the arp table on your system:

```
C:\Users\Acer>arp -a

Interface: 192.168.0.14 --- 0xe
  Internet Address      Physical Address      Type
  192.168.0.1           0c-b9-37-27-d3-30     dynamic
  192.168.0.13          ce-cf-df-05-67-ca     dynamic
  192.168.0.15          3c-a0-67-8e-75-ed     dynamic
  192.168.0.255         ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static

Interface: 172.23.112.1 --- 0x2a
  Internet Address      Physical Address      Type
  172.23.123.81         00-15-5d-b1-13-fe     dynamic
  172.23.127.255        ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.255.250       01-00-5e-7f-ff-fa     static

C:\Users\Acer>
```

Use the `route` command and paste the output from the routing table on your system:

```
C:\Users\Acer>route print
===========================================================================
Interface List
 16...b4 a9 fc 48 09 56 ......Realtek PCIe GbE Family Controller
 15...12 63 c8 bb aa d9 ......Microsoft Wi-Fi Direct Virtual Adapter
 17...22 63 c8 bb aa d9 ......Microsoft Wi-Fi Direct Virtual Adapter #2
 14...10 63 c8 bb aa d9 ......Qualcomm Atheros QCA9377 Wireless Network Adapter
  1...........................Software Loopback Interface 1
 42...00 15 5d 96 c8 a4 ......Hyper-V Virtual Ethernet Adapter
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0      192.168.0.1     192.168.0.14     55
        127.0.0.0        255.0.0.0         On-link         127.0.0.1    331
        127.0.0.1  255.255.255.255         On-link         127.0.0.1    331
  127.255.255.255  255.255.255.255         On-link         127.0.0.1    331
     172.23.112.0    255.255.240.0         On-link      172.23.112.1   5256
     172.23.112.1  255.255.255.255         On-link      172.23.112.1   5256
   172.23.127.255  255.255.255.255         On-link      172.23.112.1   5256
      192.168.0.0    255.255.255.0         On-link      192.168.0.14    311
     192.168.0.14  255.255.255.255         On-link      192.168.0.14    311
    192.168.0.255  255.255.255.255         On-link      192.168.0.14    311
        224.0.0.0        240.0.0.0         On-link         127.0.0.1    331
        224.0.0.0        240.0.0.0         On-link      192.168.0.14    311
        224.0.0.0        240.0.0.0         On-link      172.23.112.1   5256
  255.255.255.255  255.255.255.255         On-link         127.0.0.1    331
  255.255.255.255  255.255.255.255         On-link      192.168.0.14    311
  255.255.255.255  255.255.255.255         On-link      172.23.112.1   5256
===========================================================================
Persistent Routes:
  None

IPv6 Route Table
===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
  1    331 ::1/128                  On-link
 14    311 fe80::/64                On-link
 42   5256 fe80::/64                On-link
 14    311 fe80::b44c:619c:3325:5dc5/128
                                    On-link
 42   5256 fe80::ed38:8738:f6e6:5e8a/128
                                    On-link
  1    331 ff00::/8                 On-link
```

Use the **traceroute** command on your system and observe the hops to Google's DNS, 8.8.8.8. Paste the full output from the command bellow showing all the hops from your system to 8.8.8.8.

```
C:\Users\Acer>tracert 8.8.8.8

Tracing route to dns.google [8.8.8.8]
over a maximum of 30 hops:

  1     7 ms     1 ms     1 ms  192.168.0.1
  2    10 ms     9 ms     8 ms  10.181.224.1
  3     *        *        *     Request timed out.
  4     *        *        *     Request timed out.
  5     *        *        *     Request timed out.
  6     *        *        *     Request timed out.
  7     *        *        *     Request timed out.
  8    10 ms    13 ms     9 ms  ctel-78-157-16-209.cabletel.com.mk [78.157.16.209]
  9    31 ms    31 ms    29 ms  195.3.114.153
 10    28 ms    29 ms    30 ms  lg22-9070.as8447.a1.net [195.3.64.57]
 11     *        *        *     Request timed out.
 12    33 ms    35 ms    31 ms  lg59-9071.as8447.a1.net [80.120.167.46]
 13    35 ms    34 ms    32 ms  172.253.51.153
 14    36 ms    36 ms    37 ms  142.251.65.227
 15    33 ms    32 ms    32 ms  dns.google [8.8.8.8]

Trace complete.

C:\Users\Acer>
```

Why would you need to use the `ping` command?

Answer:

```
C:\Users\Acer>ping -t google.com

Pinging google.com [142.250.201.206] with 32 bytes of data:
Reply from 142.250.201.206: bytes=32 time=32ms TTL=109
Reply from 142.250.201.206: bytes=32 time=31ms TTL=109
Reply from 142.250.201.206: bytes=32 time=31ms TTL=109
Reply from 142.250.201.206: bytes=32 time=33ms TTL=109
Reply from 142.250.201.206: bytes=32 time=31ms TTL=109
Reply from 142.250.201.206: bytes=32 time=30ms TTL=109
Reply from 142.250.201.206: bytes=32 time=31ms TTL=109
Reply from 142.250.201.206: bytes=32 time=31ms TTL=109

Ping statistics for 142.250.201.206:
    Packets: Sent = 8, Received = 8, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 30ms, Maximum = 33ms, Average = 31ms
Control-C
^C
C:\Users\Acer>
```

Write down the TCP/UDP ports of the most commonly used services bellow in the form of TCP[PORT] or UDP[PORT].

As an example, the first two answers have been filled in:

- HTTP – TCP80
- SNMP – UDP161
- HTTPS – Port 443
- DNS client – Port range 1024-65535
- DNS zone transfer – TCP port 53
- SMTP – TCP port 25
- SSH – TCP port 22
- FTP – TCP port 21
- Telnet – TCP port 23
- MSSQL – TCP port 1433
- MySQL -TCP port 3306
- PostreSQL – TCP port 5432
- RDP (Remote Desktop Protocol) – TCP port 3389
- NTP – TCP 123
- NFS – TCP port 2049

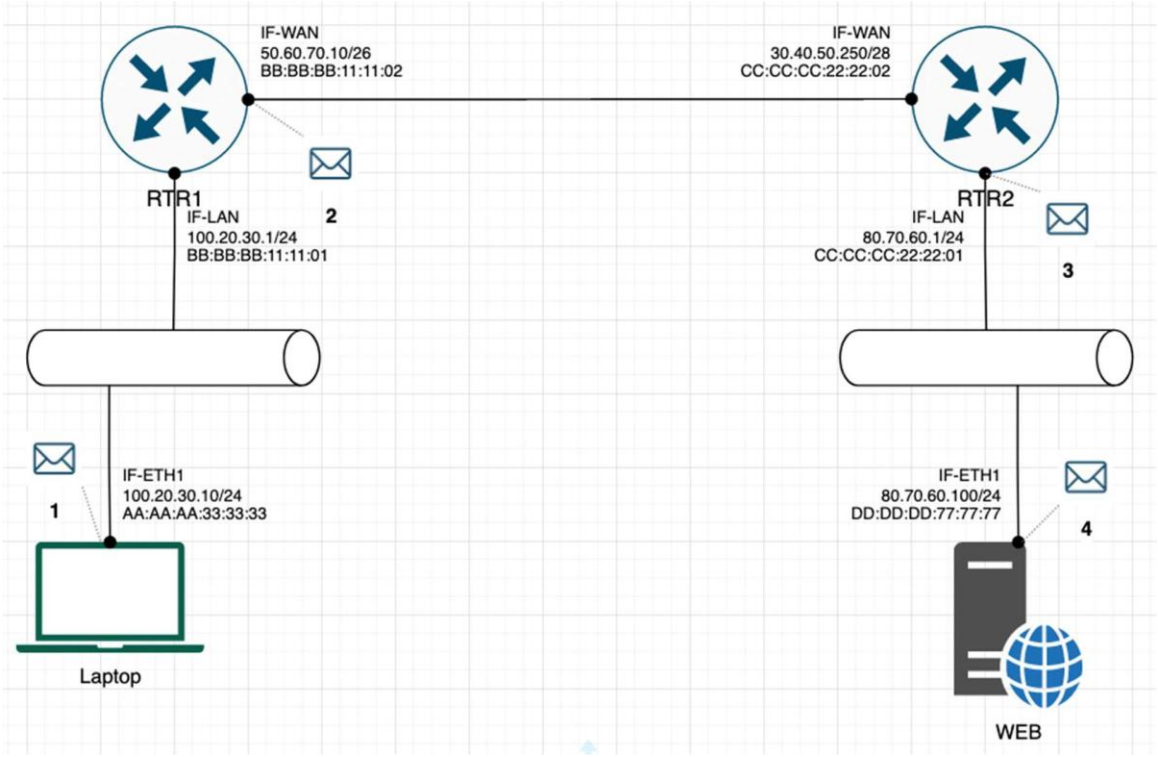
Exercise 2 – TCP/IP Basics

Difficulty: **Medium**

Refer to the exhibit and answer the questions below.

The letter symbol ✉, represents the IP packet as it travels across the network.
In the example shown, the laptop attempts to communicate with the web server in question. During its travel the packet will be forwarded across the network nodes and will eventually end up across six network interfaces before it reaches the web server. Each

packet as part of the TCP/IP Stack contains fields for the source and destination MAC Address, IP Address and the TCP/UDP Port.



For each of the packet locations shown, 1 to 4 write down the source and destination MAC addresses of the packet as it travels across the network interfaces.

1. The laptop initiates communication with the web server and prepares a packet. What would the packet look like at this stage?
   - SRC IP: Laptop's IP
   - DST IP : Web server's IP address
   - SRC MAC : Laptop's MAC address
   - DST MAC : MAC address of the first router interface facing the laptop

2. RTR1 receives the packet on its IF-LAN interface, prepares it accordingly and forwards it out its IF-WAN. What would the packet look like at this stage?
   - SRC IP : Laptop's IP adress
   - DST IP : Web server's IP address
   - SRC MAC : MAC address of the first router's interface facing laptop (LAN)
   - DST MAC : MAC address of the second router's interface facing the first router

3. RTR2 receives the packet on its IF-WAN interface, prepares it accordingly and forwards it out via IF-LAN. What would the packet look like at this stage?
   - SRC IP: Laptop's IP adress
   - DST IP : Web server's IP adress
   - SRC MAC: MAC address of the second router's interface facing the first router
   - DST MAC : MAC address of the second router's interface facing the web server

4. The web server receives the packet and prepares a response packet back. What would the packet look like at this stage?
    - SRC IP : Web server's IP address
    - DST IP : Laptop's IP address
    - SRC MAC : Web servers MAC address
    - DST MAC : MAC address of the second router's interface facing the web server

Since we are talking about web traffic (www) in the example, which transport layer protocol will most probably be used?

- ❑ **TCP**
- ❑ UDP

If we do a traffic analysis with a network packet monitoring tool like WireShark, what can we expect to see for the source and destination ports when the laptop sends the packet?

- SRC PORT: Port from 1024 and above
- DST PORT: HTTPS Port 443 (it depend of the service)

Similarly, and vice versa, what can we expect to see as destination ports when the Web server sends a response packet back?

- SRC PORT: HTTPS 443 (it depend of the service)
- DST PORT: Port from 1024 and above

How many broadcast domains are there in the exhibit shown? 2

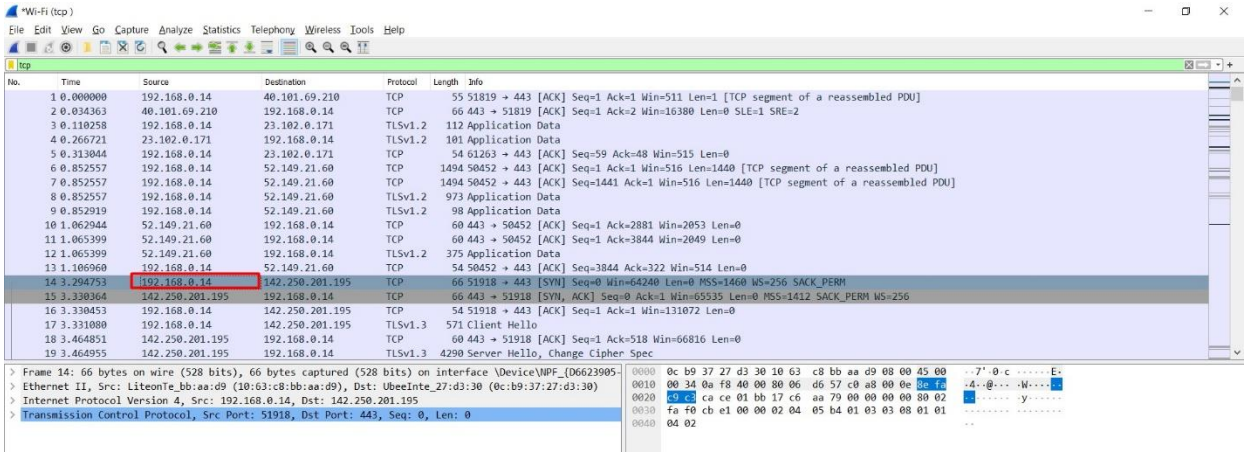
Exercise 3 – Traffic analysis and identifying the OSI layers of the network packets

Difficulty: **Hard**

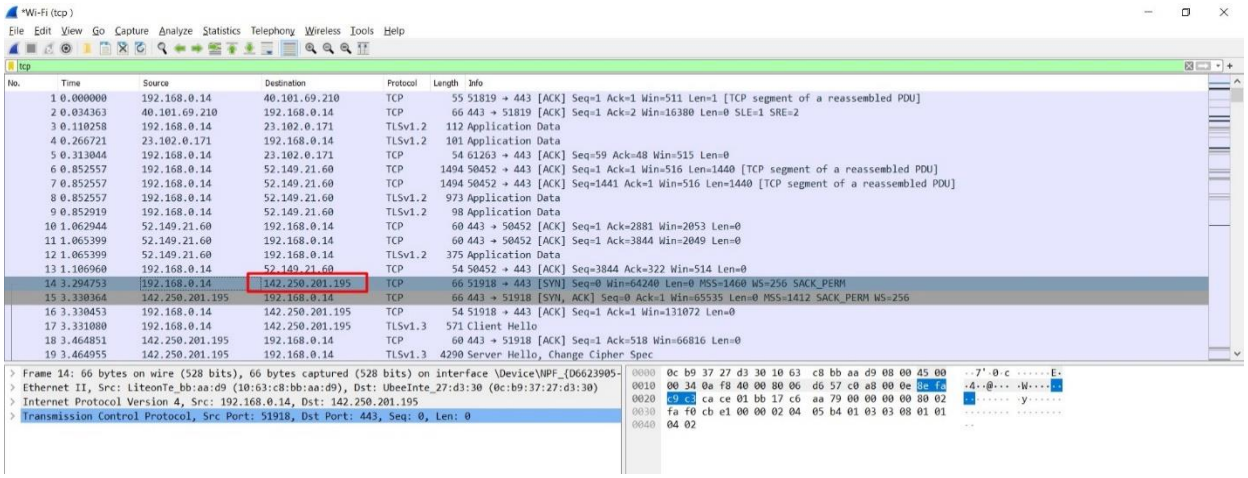
Prerequisite:
Search online and get familiar with the TCP's three-way handshake. Learn how to capture the three way handshake using Wireshark.
Install Wireshark on your computer and use it to capture traffic against a website or a server or your choice. It is recommended that you capture traffic against a simple website.
Name and the IP address of the website you plan to capture traffic:

Analyze the TCP's three-way handshake and using screenshots from the Wireshark window answer the questions bellow:

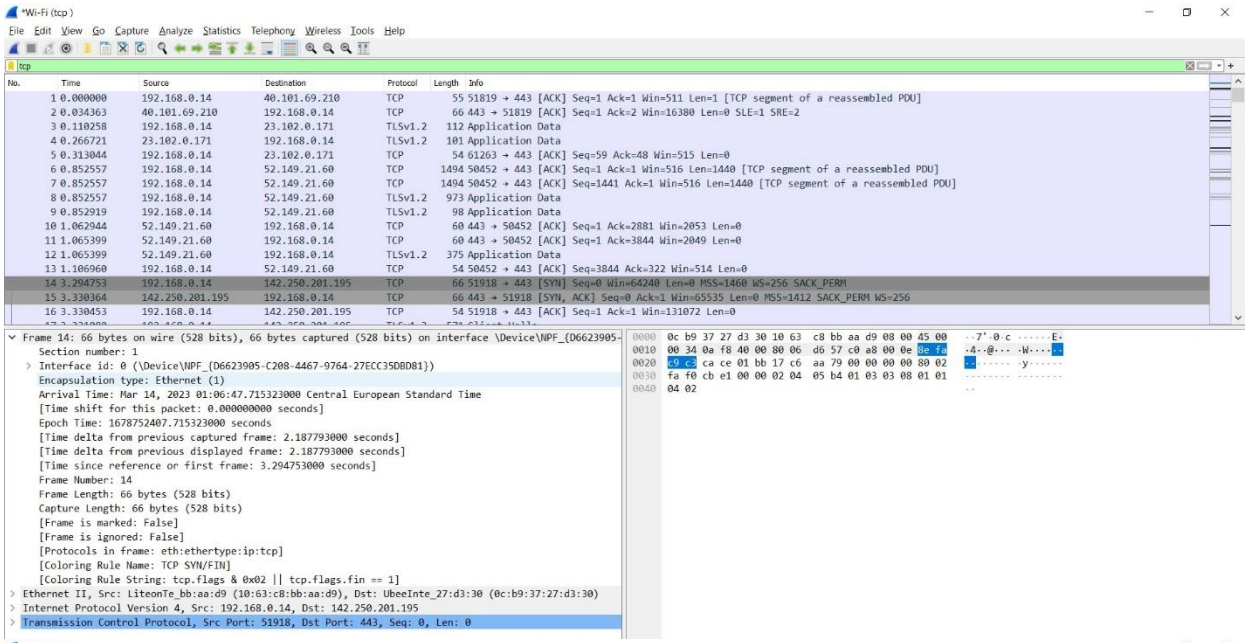
1. What is the source IP (of the initiating host):

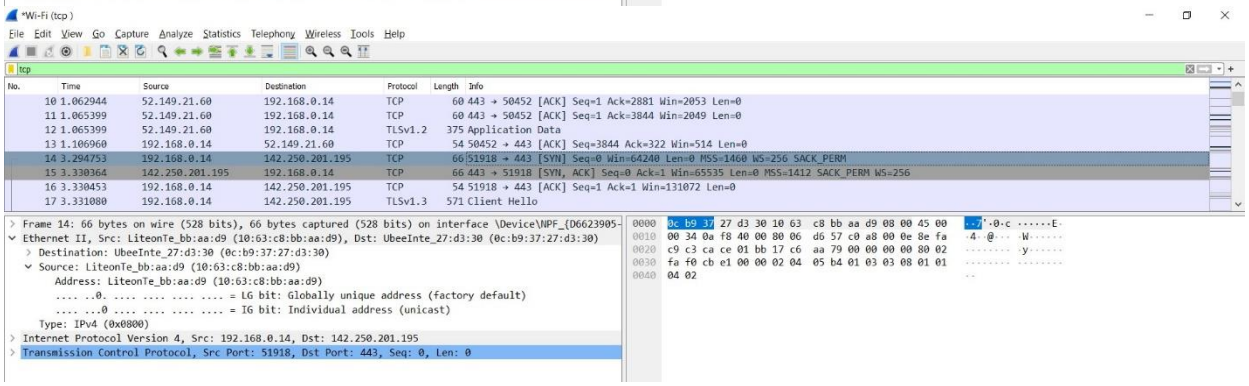


2. What is the destination IP? (target website):

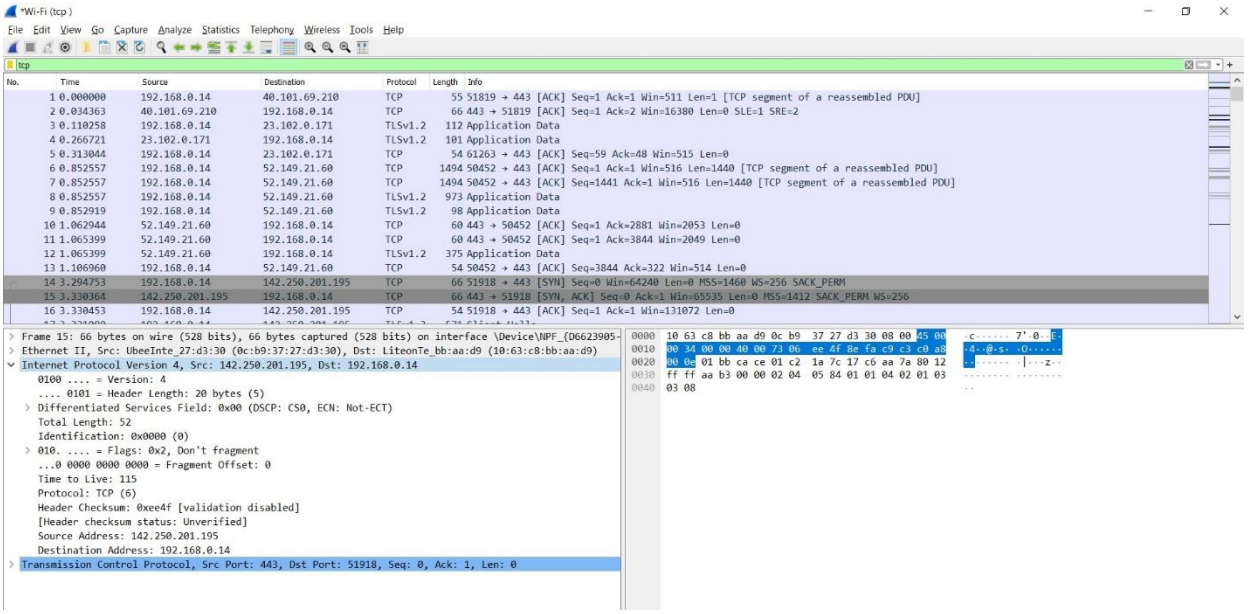


Identify the Network Interface (Layer 1 & 2) section of the SYN packet and paste a screenshot from it:

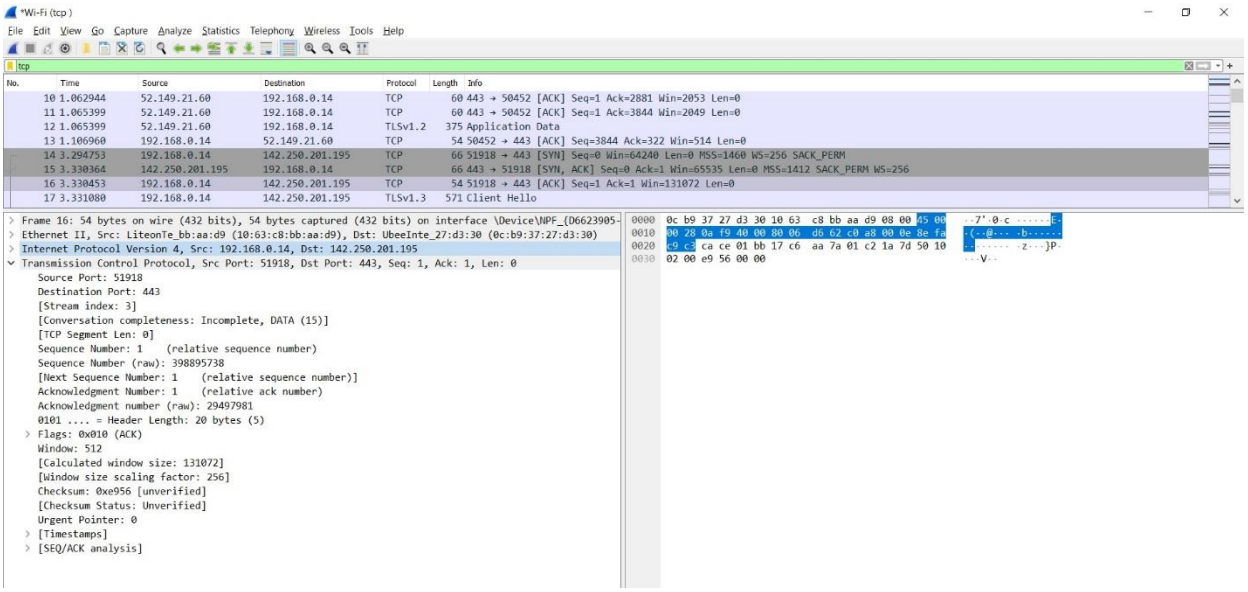




Identify the Network Layer 3 section of the SYN/ACK packet and paste a screenshot from it:



Identify the Transport Layer 4 section of the ACK packet and paste a screenshot from it bellow:



Look closely at the L2 section of the three-way handshake packet details. Each of them shows the source and destination MAC address of the packets.
Who is the owner of the destination MAC address of the SYN packet?

0CB93727D330 lookup MAC address

SELECT LOOKUP TYPE: ◉ LOOKUP MAC ○ LOOKUP VENDOR

example: 00:0B:14

Results for MAC address 0C:B9:37:27:D3:30

Found 1 result

MAC Address	0C:B9:37:27:D3:30
Vendor	Ubee Interactive Co., Limited
Address	Flat/RM 1202, 12/F, AT Tower North Point Hong Kong 180 HK
Block Size	MA-L
Block Range	0C:B9:37:00:00:00 - 0C:B9:37:FF:FF:FF

Exercise 4 – Hacking mockup (for Bonus points)

Difficulty: **Very hard**

Use Wireshark to capture the packet's application layer data and discover the implications of using unencrypted communication over a network.
It is recommended that you use your own Linux Virtual Machine on your system on which you need to confiture a telnet server.
From your own system try to login with a Telnet on the target VM all while capturing the traffic with a Wireshark. As a proof of competition for this exercise paste in bellow a screenshot of the application layer data containing visible username and password.