



Linnéuniversitetet

Kalmar Växjö

Report

Assignment 1

IDV701

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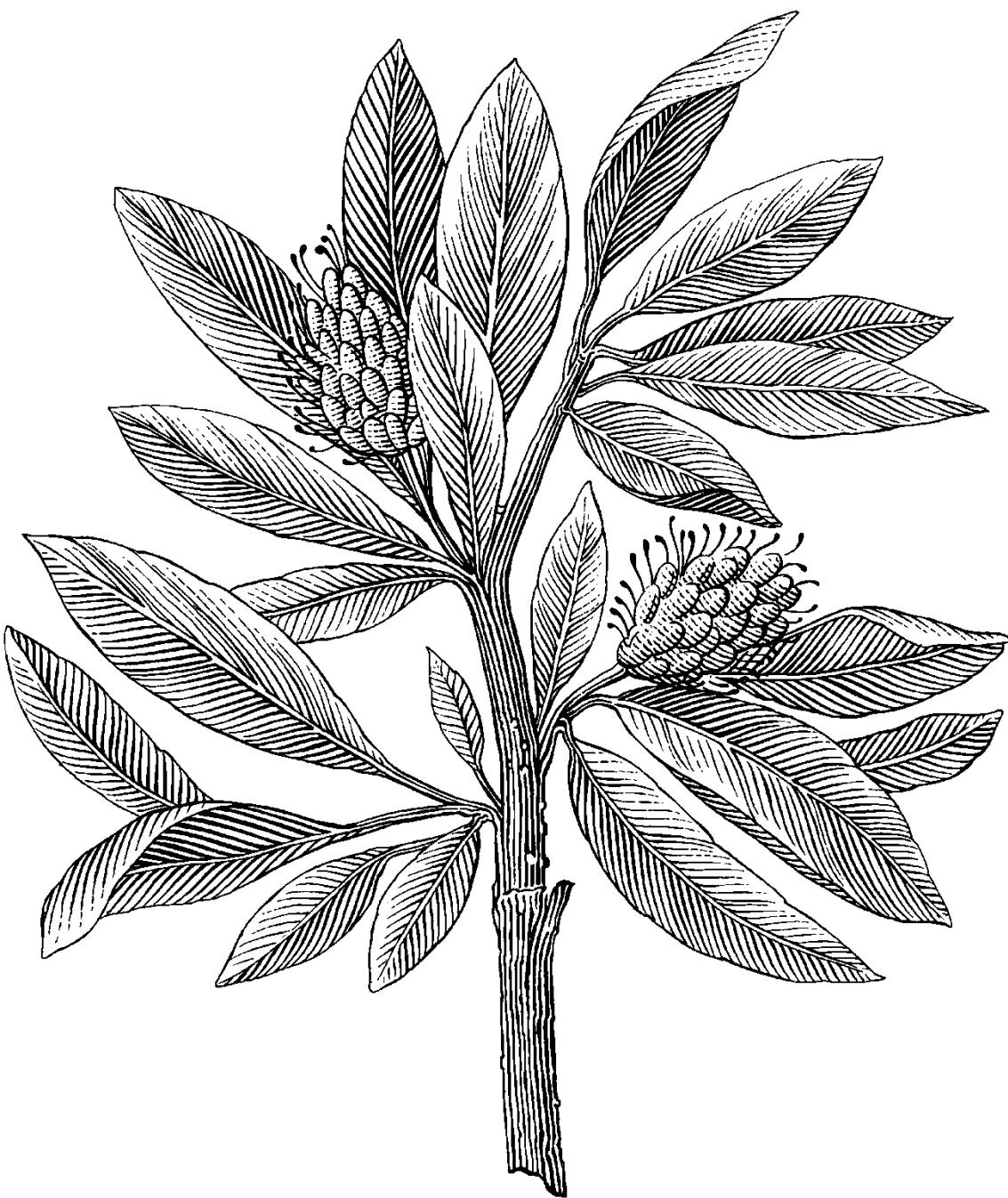
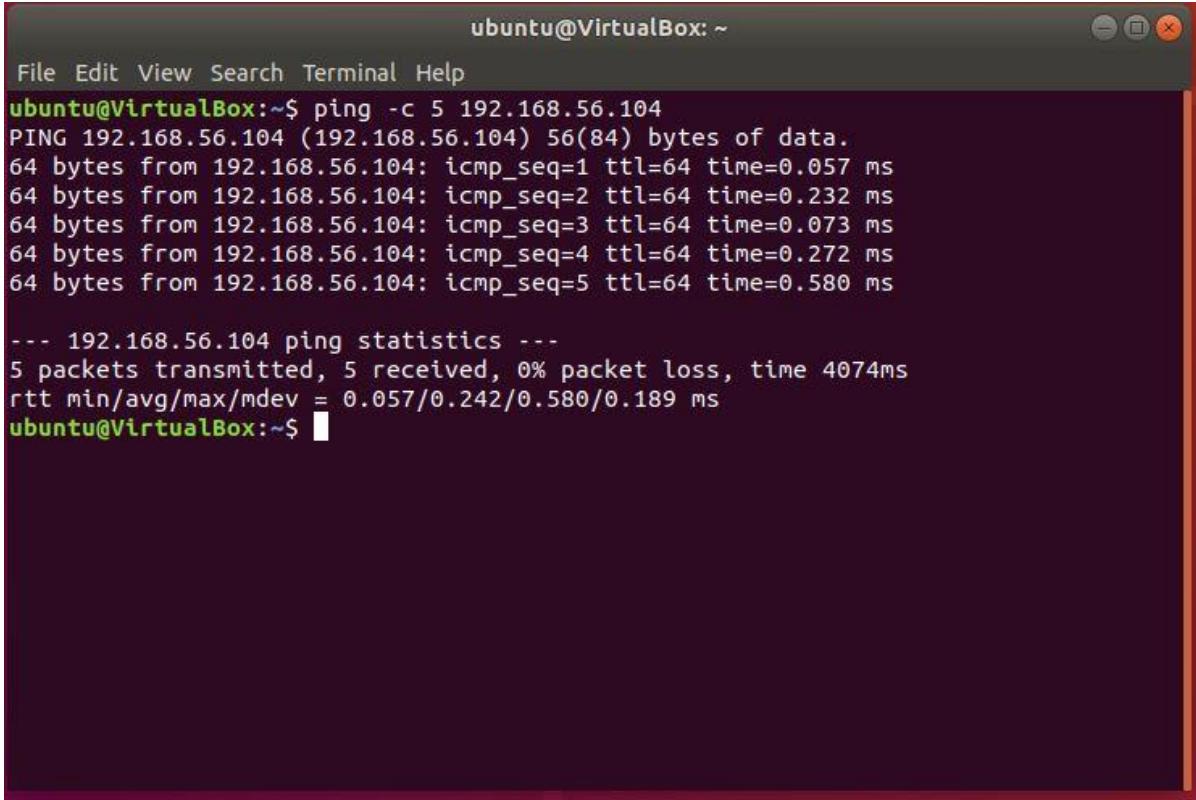


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1 Problem 1



The screenshot shows a terminal window titled "ubuntu@VirtualBox: ~". The window contains the following text:

```
ubuntu@VirtualBox:~$ ping -c 5 192.168.56.104
PING 192.168.56.104 (192.168.56.104) 56(84) bytes of data.
64 bytes from 192.168.56.104: icmp_seq=1 ttl=64 time=0.057 ms
64 bytes from 192.168.56.104: icmp_seq=2 ttl=64 time=0.232 ms
64 bytes from 192.168.56.104: icmp_seq=3 ttl=64 time=0.073 ms
64 bytes from 192.168.56.104: icmp_seq=4 ttl=64 time=0.272 ms
64 bytes from 192.168.56.104: icmp_seq=5 ttl=64 time=0.580 ms

--- 192.168.56.104 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4074ms
rtt min/avg/max/mdev = 0.057/0.242/0.580/0.189 ms
ubuntu@VirtualBox:~$
```

1.1 As it was asked in the requirements, I have pinged with the Ip address by the given command line. Moving on, I have used the given version of Ubuntu in google drive where I have downloaded it. Therefore, all the network data are as default. However, when I wanted to set up the Ubuntu, I have change adapter 1 from Host-only Adopter to NAT to be able to download the updates and java JDK before doing the tasks. Then, I have changed it to the Host-only Adopter afterward.

All in all, the given screenshot will demonstrate the process of pinging from the virtual machine to the host machine.

2 Problem 2

```
Run: ClientAssistant -> UDPechoServer(1)

C:\Program Files\jdk-13.0.2\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2020.2.3\lib\idea_rt.jar=59000:C:\Program Files\JetBrains\IntelliJ IDEA 2020.2.3\bin" -Dfile.encoding=UTF-8 -classpath C:\Users\AI

The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
.....
Process finished with exit code 0
```

```
Ubuntu 18.04.3 (JDK8, Python3) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal
root@VirtualBox:/media/sf_Server
File Edit View Search Terminal Help
ubuntu@VirtualBox:~$ sudo -i
root@VirtualBox:~# cd /media
root@VirtualBox:/media# ls
sf_Server ubuntu
root@VirtualBox:/media# cd sf_Server
root@VirtualBox:/media/sf_Server# ls
UDPEchoServer.java
root@VirtualBox:/media/sf_Server# javac UDPEchoServer.java
root@VirtualBox:/media/sf_Server# java -cp . UDPEchoServer
===== The server has started successfully =====
"UDP echo request from" -> 192.168.56.1 , "using port" -> 50796
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
"UDP echo request from" -> 192.168.56.1 , "using port" -> 50796
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
"UDP echo request from" -> 192.168.56.1 , "using port" -> 50796
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
"UDP echo request from" -> 192.168.56.1 , "using port" -> 50796
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
```

```

Command Prompt
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C:\Users\Ali>cd c:\Users\Ali\IdeaProjects\1DV701\src

c:\Users\Ali\IdeaProjects\1DV701\src>dir
 Volume in drive C is Acer
 Volume Serial Number is 90D8-4A71

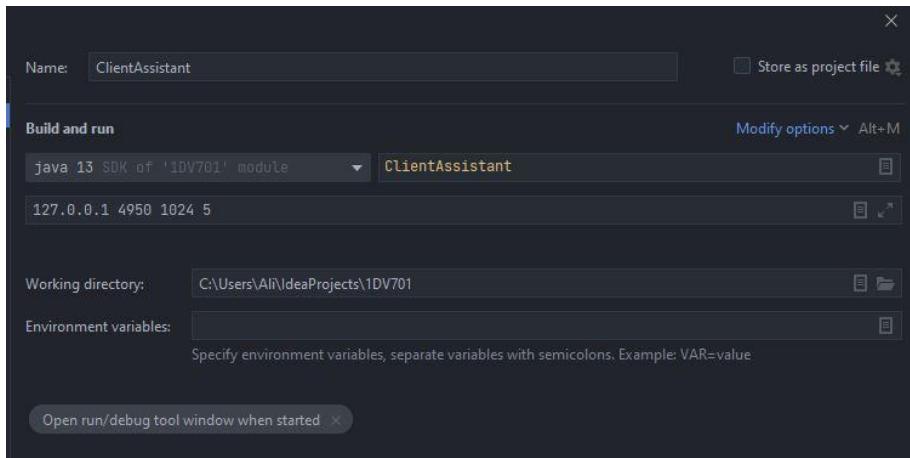
 Directory of c:\Users\Ali\IdeaProjects\1DV701\src

02/06/2021  05:03 PM    <DIR>      .
02/06/2021  05:03 PM    <DIR>      ..
02/06/2021  05:02 PM           525 ClientAssistant.java
02/06/2021  05:02 PM           6,299 TCPEchoClient.java
02/06/2021  05:02 PM           3,871 TCPEchoServer.java
02/06/2021  05:02 PM           6,142 UDPEchoClient.java
               4 File(s)   16,837 bytes
              2 Dir(s)  9,312,378,880 bytes free

c:\Users\Ali\IdeaProjects\1DV701\src>javac ClientAssistant.java

c:\Users\Ali\IdeaProjects\1DV701\src>java -cp . ClientAssistant 192.168.56.104 4950 1024 5
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
=====

```



2.1 The first two pictures will demonstrate the output of both UDP Server and Client in IntelliJ to make sure the code is working there before proceeding with running them in *cmd* and *ubuntu*. As it is obvious in the first two pictures both were successfully worked.

Consequently, I have created a shared folder on my desktop called server then I have inserted the UDP server class in there. As a result, as it is obvious in the screenshot of the *ubuntu* I have navigated to its directory. Therefore, I have first compiled the code and then I have run the successful code.

Regarding the *cmd*, I followed the same process by going to the src folder. After compiling the code, there is a difference at this stage. That is, apart from the command line that I have used to run the code, I was required to add the argument after it.

In the last picture, the arguments have been mentioned.

When the client has connected to the server in the Ubuntu terminal it will print the status of the connection like the Ip, port, buffer size, and message length.

Lastly, implementing the code without exception handling will not be a wise choice. Consequently, some exceptions were vital to be covered in the implementation. The following will show the exceptions which were handled:

- ◆ The count of the arguments.

First and foremost, the program arguments need to be filled out otherwise an error message will be displayed.

- ◆ Ip address

The Ip address has special conditions. What I mean by this is that it is required to check to see if the provided Ip address has been separated by dots using regex and split. Apart from that, it should check the range of the given Ip address (from 0 to 255).

- ◆ Port Number

Port number is expected to be in the range of 1 until 65535. Also, since the type of the port number has been set as an integer if the given value has been set as a string it will be false.

- ◆ Invalid message

A message which has been sent will be considered invalid if it does not contain any data (empty). Also, if the message length is greater than 65507.

- ◆ Transfer rate

The transfer rate which is the last argument has been set as an integer. Therefore, other types are not supported. Moving on, if the value is less than 0 it will display an error message and it will exit the system.

- ◆ The size of the buffer

Lastly, the buffer size should be set in a specific range. What I mean by this is that if the buffer size is an analogical digit (a huge number) and less than 0, it will be considered wrong.

All in all, the above arguments were the main concepts that were covered by the error handling. Mainly, they have been covered by using try-catch block and throwing an exception if necessary. Apart from that a simple error handling using if condition can be seen in the implementation. Some exception like OutOfMemoryError for the buffer size is noticeable as well along with using general exception (Exception e).

2.2 VG 1

2.2.1 Discussion

2.3 VG 2

2.3.1 Discussion

3 Problem 3

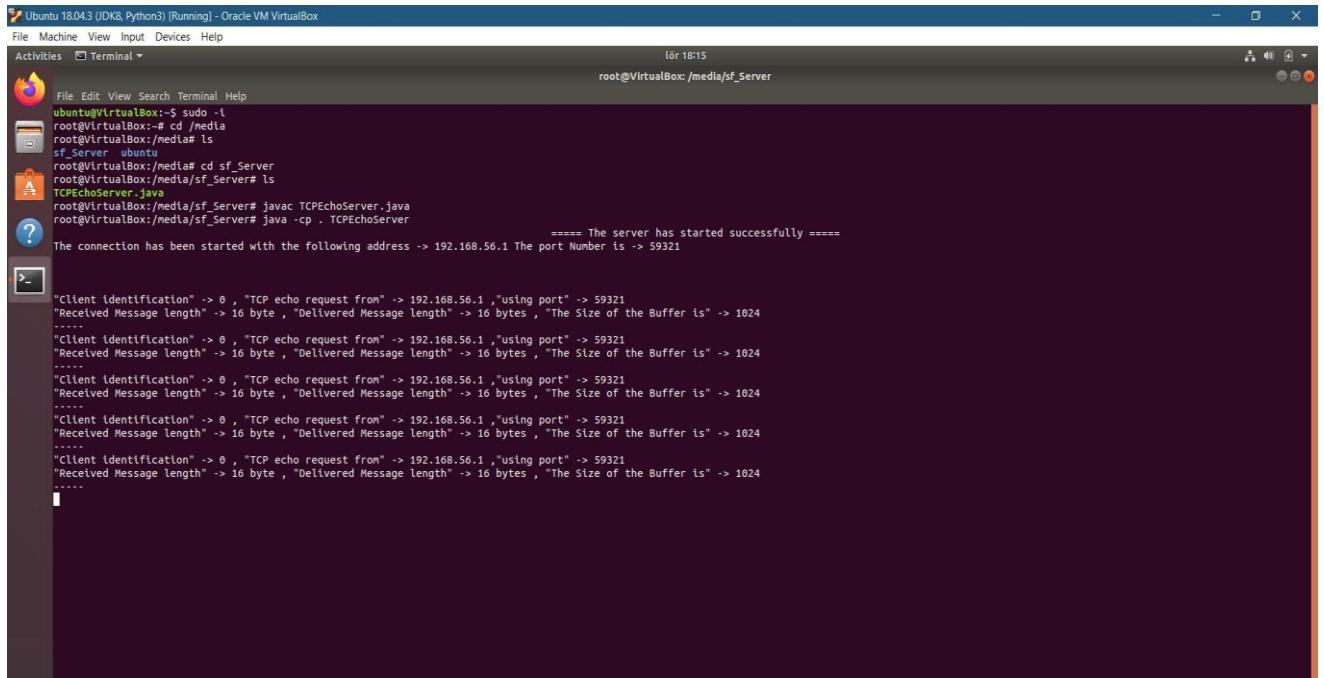
The screenshot shows two terminal windows in the IntelliJ IDEA interface. The top window is titled 'TCPEchoServer ()' and the bottom window is titled 'ClientAssistant'. Both windows show command-line output.

TCPEchoServer ()

```
"C:\Program Files\jdk-13.0.2\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2020.2.3\lib\idea_rt.jar=59250:C:\Program Files\JetBrains\IntelliJ IDEA 2020.2.3\bin" -Dfile.encoding=UTF-8 -classpath C:\Users\AI
The connection has been started with the following address -> 127.0.0.1. The port Number is -> 59250
=====
Client identification" -> 0 , "TCP echo request from" -> 127.0.0.1 , "using port" -> 59250
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
=====
"Client identification" -> 0 , "TCP echo request from" -> 127.0.0.1 , "using port" -> 59250
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
=====
"Client identification" -> 0 , "TCP echo request from" -> 127.0.0.1 , "using port" -> 59250
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
=====
"Client identification" -> 0 , "TCP echo request from" -> 127.0.0.1 , "using port" -> 59250
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
=====
"Client identification" -> 0 , "TCP echo request from" -> 127.0.0.1 , "using port" -> 59250
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
=====
"Client identification" -> 0 , "TCP echo request from" -> 127.0.0.1 , "using port" -> 59250
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
=====
"Client identification" -> 0 , "TCP echo request from" -> 127.0.0.1 , "using port" -> 59250
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
=====
```

ClientAssistant

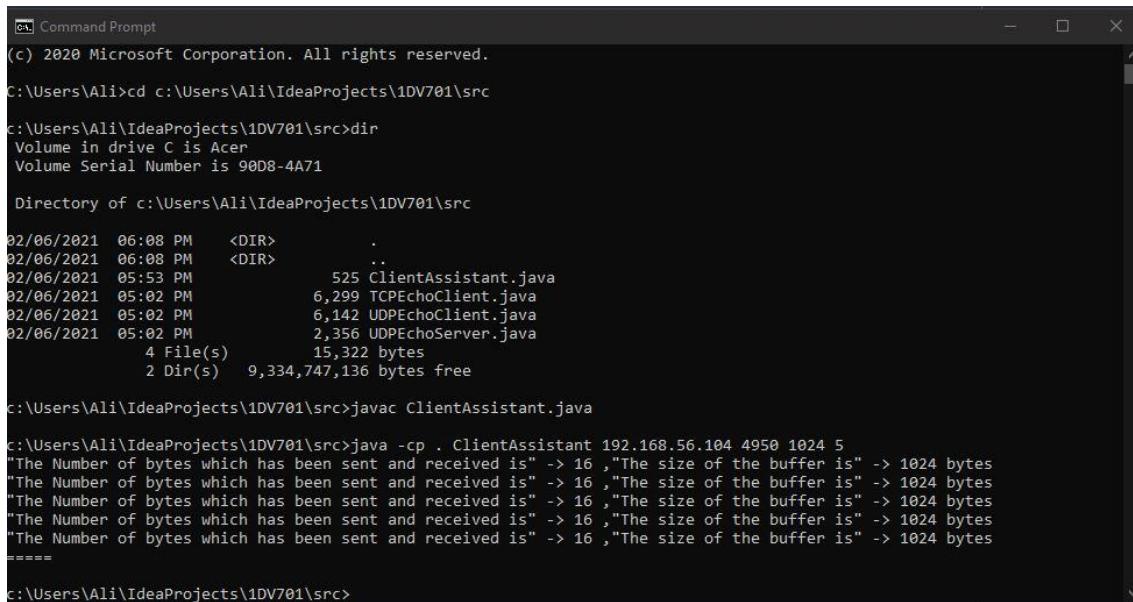
```
"C:\Program Files\jdk-13.0.2\bin\java.exe" "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA 2020.2.3\lib\idea_rt.jar=59250:C:\Program Files\JetBrains\IntelliJ IDEA 2020.2.3\bin" -Dfile.encoding=UTF-8 -classpath C:\Users\AI
The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
=====
Process finished with exit code 0
```



Ubuntu 18.04.3 (JDK& Python3) [Running] - Oracle VM VirtualBox

```
File Machine View Input Devices Help
Activities Terminal
File Edit View Search Terminal Help
ubuntu@VirtualBox:~$ sudo -l
root@VirtualBox:~/media
root@VirtualBox:~/media#
root@VirtualBox:~/media#
sf_Server ubuntu
root@VirtualBox:~/media# cd sf_Server
root@VirtualBox:~/media/sf_Server# ls
TCPEchoServer.java
root@VirtualBox:~/media/sf_Server# javac TCPEchoServer.java
root@VirtualBox:~/media/sf_Server# java -cp . TCPEchoServer
===== The server has started successfully =====
The connection has been started with the following address -> 192.168.56.1 The port Number is -> 59321

Client identification" -> 0 , "TCP echo request from" -> 192.168.56.1 , "using port" -> 59321
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
.....
"Client identification" -> 0 , "TCP echo request from" -> 192.168.56.1 , "using port" -> 59321
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
.....
"Client identification" -> 0 , "TCP echo request from" -> 192.168.56.1 , "using port" -> 59321
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
.....
"Client identification" -> 0 , "TCP echo request from" -> 192.168.56.1 , "using port" -> 59321
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
.....
"Client identification" -> 0 , "TCP echo request from" -> 192.168.56.1 , "using port" -> 59321
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
.....
"Client identification" -> 0 , "TCP echo request from" -> 192.168.56.1 , "using port" -> 59321
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
.....
```



Command Prompt

```
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C:\Users\Ali>cd c:\Users\Ali\IdeaProjects\1DV701\src
c:\Users\Ali\IdeaProjects\1DV701\src>dir
Volume in drive C is Acer
Volume Serial Number is 90D8-4A71

Directory of c:\Users\Ali\IdeaProjects\1DV701\src

02/06/2021  06:08 PM    <DIR>          .
02/06/2021  06:08 PM    <DIR>          ..
02/06/2021  05:53 PM           525 ClientAssistant.java
02/06/2021  05:02 PM           6,299 TCPEchoClient.java
02/06/2021  05:02 PM           6,142 UDPEchoClient.java
02/06/2021  05:02 PM           2,356 UDPEchoServer.java
               4 File(s)        15,322 bytes
               2 Dir(s)   9,334,747,136 bytes free

c:\Users\Ali\IdeaProjects\1DV701\src>javac ClientAssistant.java

c:\Users\Ali\IdeaProjects\1DV701\src>java -cp . ClientAssistant 192.168.56.104 4950 1024 5
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
=====

c:\Users\Ali\IdeaProjects\1DV701\src>
```

```

Ubuntu 18.04.3 (DK8, Python3) [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal
root@VirtualBox: /media/sf_Server
root@VirtualBox: /media/sf_Server
root@VirtualBox: /media/sf_Server#
root@VirtualBox: /media/sf_Server# ls
sf_Server  ubuntu
root@VirtualBox: /media/sf_Server# sc sf_Server
Command 'sc' not found, but can be installed with:
apt install sc

root@VirtualBox: /media/sf_Server#
root@VirtualBox: /media/sf_Server# cd sf_Server
root@VirtualBox: /media/sf_Server# ls
TCPEchoServer.java
root@VirtualBox: /media/sf_Server# javac TCPEchoServer.java
root@VirtualBox: /media/sf_Server# java -cp . TCPEchoServer
===== The server has started successfully =====
The connection has been started with the following address -> 192.168.56.1 The port Number is -> 59500

"Client Identification" -> 0 , "TCP echo request From" -> 192.168.56.1 , "using port" -> 59500
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
=====
"Client Identification" -> 0 , "TCP echo request From" -> 192.168.56.1 , "using port" -> 59500
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
=====
"Client Identification" -> 0 , "TCP echo request From" -> 192.168.56.1 , "using port" -> 59500
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
=====
"Client Identification" -> 0 , "TCP echo request From" -> 192.168.56.1 , "using port" -> 59500
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
=====
"Client Identification" -> 0 , "TCP echo request From" -> 192.168.56.1 , "using port" -> 59500
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
=====
The connection has been started with the following address -> 192.168.56.1 The port Number is -> 59501

```

```

Command Prompt
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C:\Users\Ali>cd c:\Users\Ali\IdeaProjects\1DV701\src

c:\Users\Ali\IdeaProjects\1DV701\src>dir
 Volume in drive C is Acer
 Volume Serial Number is 90D8-4A71

 Directory of c:\Users\Ali\IdeaProjects\1DV701\src

02/06/2021  06:08 PM    <DIR>      .
02/06/2021  06:08 PM    <DIR>      ..
02/06/2021  05:53 PM           525 ClientAssistant.java
02/06/2021  05:02 PM           6,299 TCPEchoClient.java
02/06/2021  05:02 PM           6,142 UDPEchoClient.java
02/06/2021  05:02 PM           2,356 UDPEchoServer.java
               4 File(s)     15,322 bytes
               2 Dir(s)   9,334,747,136 bytes free

c:\Users\Ali\IdeaProjects\1DV701\src>javac ClientAssistant.java

c:\Users\Ali\IdeaProjects\1DV701\src>java -cp . ClientAssistant 192.168.56.104 4950 1024 5
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
"The Number of bytes which has been sent and received is" -> 16 , "The size of the buffer is" -> 1024 bytes
=====
c:\Users\Ali\IdeaProjects\1DV701\src>

```



```
The connection has been started with the following address -> 192.168.56.1 The port Number is -> 59506

"Client identification" -> 5 , "TCP echo request from" -> 192.168.56.1 ,using port" -> 59506
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
"Client identification" -> 5 , "TCP echo request from" -> 192.168.56.1 ,using port" -> 59506
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
"Client identification" -> 5 , "TCP echo request from" -> 192.168.56.1 ,using port" -> 59506
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
"Client identification" -> 5 , "TCP echo request from" -> 192.168.56.1 ,using port" -> 59506
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
"Client identification" -> 5 , "TCP echo request from" -> 192.168.56.1 ,using port" -> 59506
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
"Client identification" -> 5 , "TCP echo request from" -> 192.168.56.1 ,using port" -> 59506
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
The connection has been started with the following address -> 192.168.56.1 The port Number is -> 59507

"Client identification" -> 6 , "TCP echo request from" -> 192.168.56.1 ,using port" -> 59507
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
"Client identification" -> 6 , "TCP echo request from" -> 192.168.56.1 ,using port" -> 59507
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
"Client identification" -> 6 , "TCP echo request from" -> 192.168.56.1 ,using port" -> 59507
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
"Client identification" -> 6 , "TCP echo request from" -> 192.168.56.1 ,using port" -> 59507
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
"Client identification" -> 6 , "TCP echo request from" -> 192.168.56.1 ,using port" -> 59507
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 1024
-----
```

```
The connection has been started with the following address -> 192.168.56.1 The port Number is -> 59508

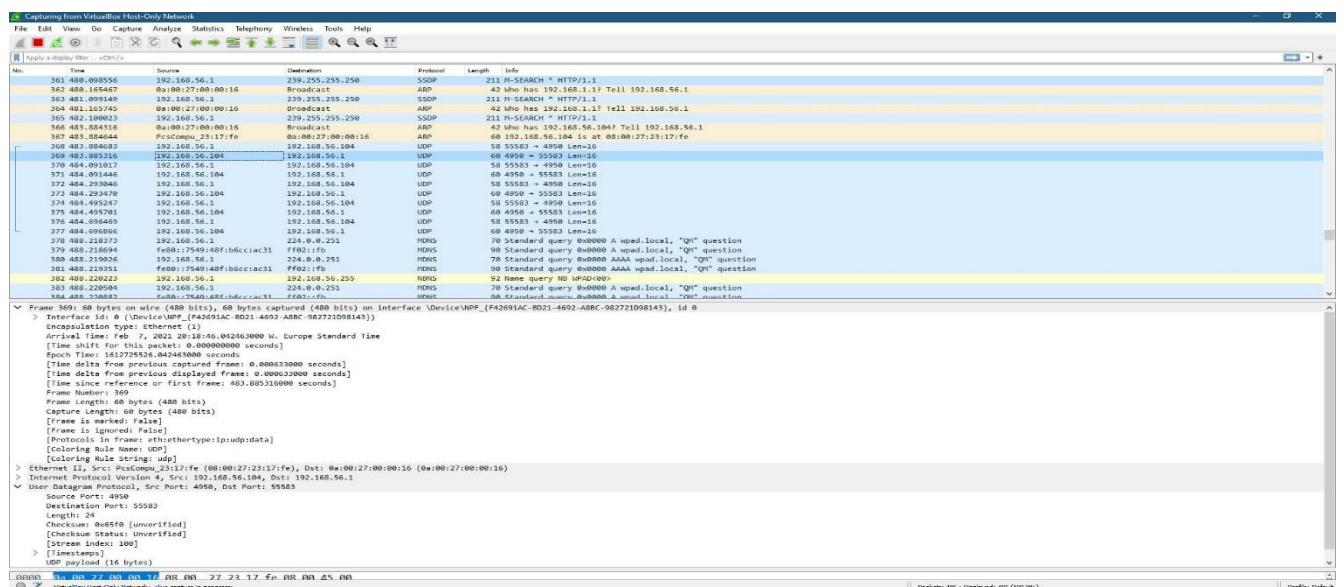
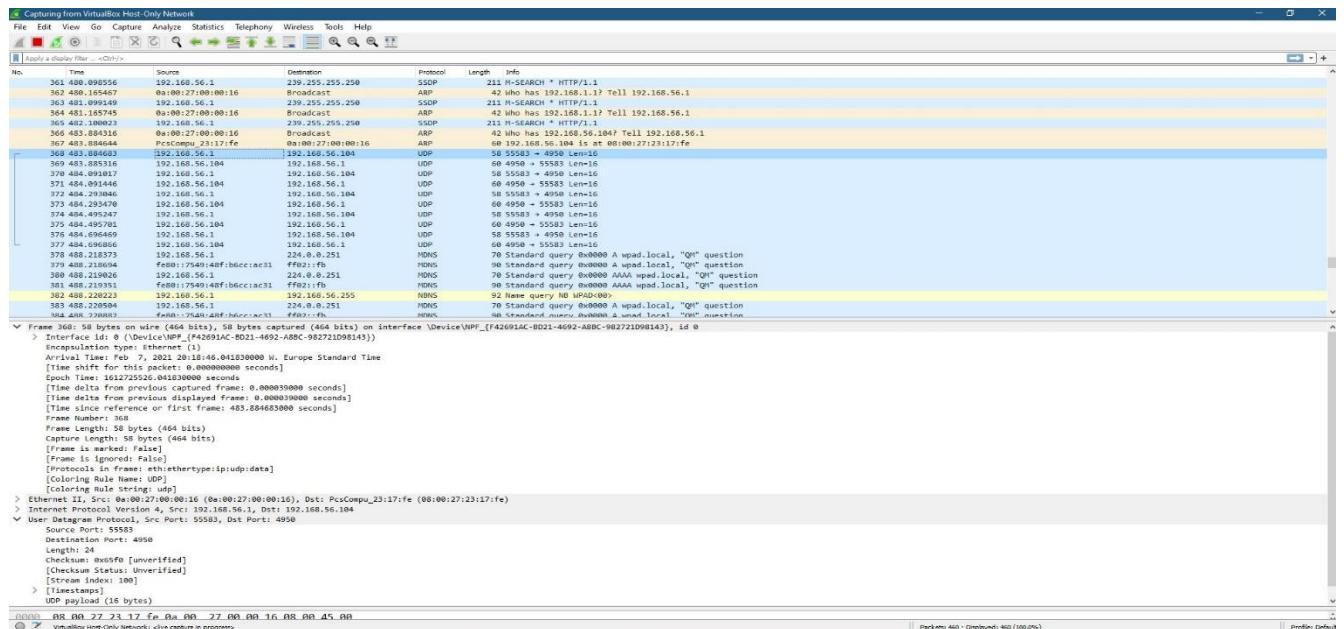
"Client identification" -> 7 , "TCP echo request from" -> 192.168.56.1 , "using port" -> 59508
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 10
-----
"Client identification" -> 7 , "TCP echo request from" -> 192.168.56.1 , "using port" -> 59508
"Received Message length" -> 16 byte , "Delivered Message length" -> 16 bytes , "The Size of the Buffer is" -> 10
-----
java.net.SocketException: Connection reset
    at java.base/java.net.SocketInputStream.read(SocketInputStream.java:186)
    at java.base/java.net.SocketInputStream.read(SocketInputStream.java:140)
    at java.base/java.io.DataInputStream.read(DataInputStream.java:100)
    at TCPClientThread.run(TCPEchoServer.java:75)
    at TCPEchoServer.main(TCPEchoServer.java:24)
```

3.1 As it is visible in the picture, I have first run the code with just one client to capture the output of both TCP client and server.

Consequently, I have repeated the same process. However, this time the output has changed significantly. That is, the client would not abort automatically. Therefore, I have aborted the connection by using *ctrl c*. Consequently, for the client 7 screenshot, it can be visible that as soon as I have aborted the connection an exception has been thrown (Socket Exception). Moving on, if the mentioned command were not entered in the *cmd*, it would continue its execution for infinite.

Regarding the *cmd* screenshot, for each round 5 messages will be sent. In the implementation, I have generated a method called *slowdown* which will cause a delay (Thread.sleep(1000 / transferRate)).

4 Problem 4



File Edit View Analyze Statistics Telephone Wireless Tools Help

Apply as display filter: <none>

Time Source Destination Protocol Length Info

219 345. 000096 192.168.56.104 192.168.56.1 TCP 54 45528 -> 4550 [ACK] Seq=1 Ack=1 Win=64256 Len=8 PSS=1446 SACK_PERT=1 HS=328

219 345. 000096 192.168.56.1 192.168.56.104 TCP 54 45528 -> 4550 [ACK] Seq=1 Ack=1 Win=2102272 Len=8

219 345. 001837 192.168.56.1 192.168.56.104 TCP 54 45528 -> 4550 [PSH, ACK] Seq=1 Ack=1 Win=2102272 Len=16

228 345. 108659 192.168.56.104 192.168.56.1 TCP 68 4550 -> 45528 [ACK] Seq=1 Ack=17 Win=64256 Len=8

221 345. 109177 192.168.56.104 192.168.56.1 TCP 70 4550 -> 45528 [PSH, ACK] Seq=17 Ack=1 Win=84256 Len=16

222 345. 146705 192.168.56.1 192.168.56.104 TCP 54 45528 -> 4550 [ACK] Seq=17 Ack=1 Win=2102272 Len=8

223 345. 146705 192.168.56.104 192.168.56.1 TCP 70 4550 -> 45528 [PSH, ACK] Seq=17 Ack=17 Win=2102272 Len=8

224 345. 329018 192.168.56.1 192.168.56.104 TCP 68 4550 -> 45528 [ACK] Seq=17 Ack=33 Win=64256 Len=16

225 345. 329014 192.168.56.104 192.168.56.1 TCP 70 4550 -> 45528 [PSH, ACK] Seq=17 Ack=33 Win=64256 Len=16

226 345. 368666 192.168.56.1 192.168.56.104 TCP 54 45528 -> 4550 [ACK] Seq=33 Ack=33 Win=2102272 Len=16

227 345. 521389 192.168.56.1 192.168.56.104 TCP 70 45528 -> 4550 [PSH, ACK] Seq=33 Ack=33 Win=2102272 Len=16

228 345. 521785 192.168.56.104 192.168.56.1 TCP 68 4550 -> 45528 [ACK] Seq=33 Ack=8 Win=64256 Len=8

228 345. 521785 192.168.56.1 192.168.56.104 TCP 70 4550 -> 45528 [PSH, ACK] Seq=33 Ack=8 Win=64256 Len=16

229 345. 562092 192.168.56.1 192.168.56.104 TCP 54 45528 -> 4550 [ACK] Seq=49 Ack=9 Win=2102272 Len=8

231 345. 723737 192.168.56.1 192.168.56.104 TCP 70 45528 -> 4550 [PSH, ACK] Seq=49 Ack=9 Win=2102272 Len=16

232 345. 724168 192.168.56.104 192.168.56.1 TCP 70 4550 -> 45528 [ACK] Seq=49 Ack=9 Win=64256 Len=16

233 345. 905219 192.168.56.1 192.168.56.104 TCP 54 45528 -> 4550 [ACK] Seq=55 Ack=10 Win=2102272 Len=8

234 345. 905219 192.168.56.1 192.168.56.104 TCP 70 4550 -> 45528 [PSH, ACK] Seq=55 Ack=5 Win=2102272 Len=16

235 345. 925572 192.168.56.104 192.168.56.1 TCP 70 4550 -> 45528 [PSH, ACK] Seq=55 Ack=5 Win=64256 Len=16

236 345. 967422 192.168.56.1 192.168.56.104 TCP 54 45528 -> 4550 [ACK] Seq=81 Ack=81 Win=2102272 Len=8

237 346. 127543 192.168.56.1 192.168.56.104 TCP 54 45528 -> 4550 [PSH, ACK] Seq=81 Ack=81 Win=2102272 Len=8

▼ Frame 221: 70 bytes on wire (560 bits), 70 bytes captured (560 bits) on interface \Device\NPF_{f12691ac-0d21-4692-ab8c-982721098143}, id 8

> Interface id: 0 (\Device\NPF_{f12691ac-0d21-4692-ab8c-982721098143})
Encapsulation type: Ethernet (1)
Arrival time: Fri, 27.08.16, 08:27:13.175979000 W. Europe Standard Time
[Time shift for this packet: 0.000000000 seconds]
[Time delta from previous captured frame: 0.000519000 seconds]
[Time delta from previous displayed frame: 0.000519000 seconds]
[Time since reference or first frame: 0.00051779000 seconds]
Frame Number: 221
Frame Length: 70 bytes (560 bits)
Capture Length: 70 bytes (560 bits)
[Frame is marked: False]
[Frame is broadcast: False]
[Protocol is frame: ether|ethertype:ip:tcp|data]
[Coloring Rule Name: TCP]
[Coloring Rule String: tcp]

> Ethernet II, Src: PC\Compu_23-17-fe (08:27:23:17:fe), Dst: 0a:00:27:00:00:16 (0a:00:27:00:00:16)
> Internet Protocol Version 4, Src: 192.168.56.104, Dst: 192.168.56.1
Transmission Control Protocol, Src Port: 4550, Dst Port: 61620, Seq: 1, Ack: 17, Len: 16
Source Port: 4550
Destination Port: 61620
[Stream index: 0]
[TCP Segments Len: 1]
Sequence Number 1 (relative sequence number)
Sequence Number (Raw): 14072000
[Next Sequence Number: 1 (relative sequence number)]
Acknowledgment Number: 17 (relative ack number)
Acknowledgment Number (Raw): 748919803
Offset + Header Length: 20 bytes (5)

0a:00:27:00:00:16.00: 27.23.17. fe.08:00:45:00
VirtualBox Host-Only Network: eth0 capture in progress
Packets: 394 - Displayed: 394 (100%)

Capturing from VirtualBox Host-Only Network

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

No. Time Source Destination Protocol Length Info

| | | | | | |
|-----|------------|----------------|----------------|-----|--|
| 217 | 345.089318 | 192.168.56.104 | 192.168.56.1 | TCP | 66 0x5555 = 61620 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1468 SACK_PER=1 Window Scale Option |
| 218 | 345.089596 | 192.168.56.1 | 192.168.56.104 | TCP | 54 0x51520 = 4956 [ACK] Seq=1 Ack=1 Win=2102272 Len=0 |
| 219 | 345.180197 | 192.168.56.1 | 192.168.56.104 | TCP | 70 0x51520 = 4956 [PSH, ACK] Seq=1 Ack=1 Win=2102272 Len=16 |
| 220 | 345.180658 | 192.168.56.104 | 192.168.56.1 | TCP | 66 0x4f4f0 = 4956 [ACK] Seq=17 Ack=1 Win=642456 Len=0 |
| 221 | 345.180661 | 192.168.56.104 | 192.168.56.1 | TCP | 70 0x4f4f0 = 4956 [ACK] Seq=17 Ack=1 Win=642456 Len=0 |
| 222 | 345.180662 | 192.168.56.104 | 192.168.56.1 | TCP | 54 0x51520 = 4956 [ACK] Seq=17 Ack=1 Win=2102272 Len=0 |
| 223 | 345.319715 | 192.168.56.1 | 192.168.56.104 | TCP | 70 0x51520 = 4956 [PSH, ACK] Seq=17 Ack=17 Win=2102272 Len=16 |
| 224 | 345.320816 | 192.168.56.104 | 192.168.56.1 | TCP | 66 0x4f4f0 = 4956 [ACK] Seq=17 Ack=33 Win=642456 Len=0 |
| 225 | 345.320816 | 192.168.56.104 | 192.168.56.1 | TCP | 70 0x4f4f0 = 4956 [PSH, ACK] Seq=17 Ack=33 Win=642456 Len=16 |
| 226 | 345.320816 | 192.168.56.104 | 192.168.56.1 | TCP | 54 0x51520 = 4956 [ACK] Seq=33 Ack=33 Win=2102272 Len=0 |
| 227 | 345.320816 | 192.168.56.104 | 192.168.56.1 | TCP | 70 0x4f4f0 = 4956 [PSH, ACK] Seq=33 Ack=33 Win=2102272 Len=16 |
| 228 | 345.322612 | 192.168.56.104 | 192.168.56.1 | TCP | 66 0x51520 = 4956 [ACK] Seq=32 Ack=40 Win=642456 Len=0 |
| 229 | 345.521765 | 192.168.56.104 | 192.168.56.1 | TCP | 70 0x4f4f0 = 4956 [PSH, ACK] Seq=33 Ack=40 Win=642456 Len=16 |
| 230 | 345.562982 | 192.168.56.1 | 192.168.56.104 | TCP | 54 0x51520 = 4956 [ACK] Seq=40 Ack=40 Win=2102272 Len=0 |
| 231 | 345.723738 | 192.168.56.1 | 192.168.56.104 | TCP | 70 0x51520 = 4956 [PSH, ACK] Seq=49 Ack=49 Win=2102272 Len=16 |
| 232 | 345.723738 | 192.168.56.104 | 192.168.56.1 | TCP | 70 0x4f4f0 = 4956 [ACK] Seq=49 Ack=49 Win=642456 Len=0 |
| 233 | 345.723768 | 192.168.56.104 | 192.168.56.1 | TCP | 54 0x51520 = 4956 [ACK] Seq=49 Ack=49 Win=2102272 Len=0 |
| 234 | 345.935219 | 192.168.56.104 | 192.168.56.1 | TCP | 70 0x51520 = 4956 [PSH, ACK] Seq=65 Ack=65 Win=2102272 Len=16 |
| 235 | 345.925578 | 192.168.56.104 | 192.168.56.1 | TCP | 70 0x4f4f0 = 4956 [PSH, ACK] Seq=65 Ack=65 Win=642456 Len=0 |
| 236 | 345.967422 | 192.168.56.104 | 192.168.56.1 | TCP | 54 0x51520 = 4956 [ACK] Seq=81 Ack=81 Win=2102272 Len=0 |
| 237 | 346.127543 | 192.168.56.1 | 192.168.56.104 | TCP | 54 0x51520 = 4956 [FIN, ACK] Seq=81 Ack=81 Win=2102272 Len=0 |

v Frame 221: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface \Device\WPF_{742691AC-B021-4692-A8BC-982721D98143}, id 8

Interface index: 0 (\Device\WPF_{742691AC-B021-4692-A8BC-982721D98143})
Encapsulation type: Ethernet (1)
Arrival Time: Feb 7, 2021 20:42:01.715782000s Europe Standard Time
[Time shift for this packet: 0.000000000 seconds]
Epoch Time: 1612720801.715782000s
[Time delta from previous captured frame: 0.040835000 seconds]
[Time delta from previous displayed frame: 0.040835000 seconds]
[Time since reference or first frame: 345.149562000 seconds]
Frame Number: 222
Frame Length: 54 bytes (432 bits)
Capture Length: 54 bytes (432 bits)
[Frame is marked: False]
[Frame is lost: False]
[Frame is ignored: False]
[Protocols in frame: ether|ip|tcp]
[Coloring Rule Name: TCP]
[Coloring Rule String: "top"]

Ethernet II, Src: Giga-Byte_00:27:90:00:00:16 (00:27:90:00:00:16), Dst: PciCompu_23:17:1f:fe (00:27:90:23:17:1f)

Internet Protocol Version 4, Src: 192.168.56.1, Dst: 192.168.56.104

Transmission Control Protocol, Src Port: 61620, Dst Port: 4956, Seq: 17, Ack: 17, Len: 0

Source Port: 61620
Destination Port: 4956
[Stream index: 0]
[TOS Segment Len: 0]
Sequence Number: 17 (relative sequence number)
Sequence Number (raw): 74091003
[Next Sequence Number: 17 (relative sequence number)]
Acknowledgment Number: 17 (relative ack number)
Acknowledgment Number (raw): 14072824
0101 + Header Length: 20 bytes (5)

00:00:00.00 . 00:00:27.17 . fo 00 . 00:27 . 00 . 00 . 00 . 45 . 00 .

Y:\VirtualBox\Host\Network\syscap01.pcapng

Packets: 427 - Dissected: 427 (100%)

Profile: Default

| | | | | |
|-----------------|----------------|----------------|-----|--|
| 941 1334.571655 | 192.168.56.1 | 192.168.56.104 | TCP | 66 60143 → 4950 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 942 1334.571933 | 192.168.56.104 | 192.168.56.1 | TCP | 66 4950 → 60143 [PSH, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460 WS=128 |
| 943 1334.572023 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60143 → 4950 [ACK] Seq=1 Ack=1 Win=2102272 Len=0 |
| 944 1334.574176 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60143 → 4950 [PSH, ACK] Seq=1 Ack=1 Win=2102272 Len=16 |
| 945 1334.574358 | 192.168.56.104 | 192.168.56.1 | TCP | 66 4950 → 60143 [ACK] Seq=1 Ack=1 Win=64256 Len=0 |
| 946 1334.574361 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60143 → 4950 [ACK] Seq=1 Ack=1 Win=2102272 Len=16 |
| 947 1334.631615 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60143 → 4950 [ACK] Seq=17 Ack=17 Win=2102272 Len=0 |
| 948 1334.798836 | 192.168.56.1 | 192.168.56.104 | TCP | 60 60143 → 4950 [PSH, ACK] Seq=17 Ack=17 Win=2102272 Len=16 |
| 949 1334.799092 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60143 [ACK] Seq=17 Ack=33 Win=64256 Len=0 |
| 950 1334.799255 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60143 [PSH, ACK] Seq=17 Ack=33 Win=64256 Len=16 |
| 951 1334.840150 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60143 → 4950 [ACK] Seq=31 Ack=33 Win=2102272 Len=0 |
| 952 1335.000731 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60143 → 4950 [PSH, ACK] Seq=33 Ack=33 Win=2102272 Len=16 |
| 953 1335.001083 | 192.168.56.104 | 192.168.56.1 | TCP | 66 4950 → 60143 [ACK] Seq=33 Ack=49 Win=64256 Len=0 |
| 954 1335.001127 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60143 [PSH, ACK] Seq=33 Ack=49 Win=64256 Len=16 |
| 955 1335.041628 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60143 → 4950 [ACK] Seq=49 Ack=49 Win=2102272 Len=0 |
| 956 1335.201456 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60143 → 4950 [PSH, ACK] Seq=49 Ack=49 Win=2102272 Len=16 |
| 957 1335.201809 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60143 [PSH, ACK] Seq=49 Ack=65 Win=64256 Len=16 |
| 958 1335.241431 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60143 → 4950 [ACK] Seq=65 Ack=65 Win=2102272 Len=0 |
| 959 1335.250270 | 192.168.56.1 | 192.168.56.104 | TCP | 70 4950 → 60143 [PSH, ACK] Seq=65 Ack=65 Win=2102272 Len=16 |
| 960 1335.409322 | 192.168.56.104 | 192.168.56.1 | TCP | 54 4950 → 60143 [PSH, ACK] Seq=65 Ack=65 Win=64256 Len=16 |
| 961 1335.444542 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60143 → 4950 [ACK] Seq=81 Ack=81 Win=2102272 Len=0 |
| 962 1335.604888 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60143 → 4950 [FIN, ACK] Seq=81 Ack=81 Win=2102272 Len=0 |
| 963 1335.605536 | 192.168.56.104 | 192.168.56.1 | TCP | 68 4950 → 60143 [FIN, ACK] Seq=81 Ack=82 Win=64256 Len=0 |
| 964 1335.605566 | 192.168.56.1 | 192.168.56.104 | TCP | 70 4950 → 60143 [PSH, ACK] Seq=82 Ack=82 Win=2102272 Len=0 |
| 965 1335.605636 | 192.168.56.1 | 192.168.56.104 | TCP | 66 60145 → 4950 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 966 1335.605884 | 192.168.56.104 | 192.168.56.1 | TCP | 66 4950 → 60145 [PSH, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460 SACK_PERM=1 WS=128 |
| 967 1335.605876 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60145 → 4950 [ACK] Seq=1 Ack=1 Win=2102272 Len=0 |
| 968 1335.606268 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60145 → 4950 [PSH, ACK] Seq=1 Ack=1 Win=2102272 Len=16 |
| 969 1335.606401 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60145 [ACK] Seq=1 Ack=17 Win=64256 Len=0 |
| 970 1335.607613 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60145 [PSH, ACK] Seq=1 Ack=17 Win=64256 Len=16 |
| 971 1335.647580 | 192.168.56.1 | 192.168.56.104 | TCP | 50 60145 → 4950 [ACK] Seq=17 Ack=17 Win=2102272 Len=0 |
| 972 1335.809412 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60145 → 4950 [PSH, ACK] Seq=17 Ack=17 Win=2102272 Len=16 |

| | | | | |
|------------------|----------------|----------------|-----|---|
| 973 1335.809692 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60145 [ACK] Seq=17 Ack=33 Win=64256 Len=0 |
| 974 1335.809846 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60145 [PSH, ACK] Seq=17 Ack=33 Win=64256 Len=16 |
| 975 1335.849998 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60145 → 4950 [ACK] Seq=33 Ack=33 Win=2102272 Len=0 |
| 976 1336.011593 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60145 → 4950 [PSH, ACK] Seq=33 Ack=33 Win=2102272 Len=16 |
| 977 1336.011873 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60145 [ACK] Seq=33 Ack=49 Win=64256 Len=0 |
| 978 1336.012166 | 192.168.56.1 | 192.168.56.104 | TCP | 70 4950 → 60145 [PSH, ACK] Seq=33 Ack=49 Win=64256 Len=16 |
| 979 1336.053129 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60145 → 4950 [ACK] Seq=49 Ack=49 Win=2102272 Len=0 |
| 980 1336.213387 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60145 → 4950 [PSH, ACK] Seq=49 Ack=49 Win=2102272 Len=16 |
| 981 1336.213572 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60145 [ACK] Seq=49 Ack=65 Win=64256 Len=0 |
| 982 1336.213749 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60145 [PSH, ACK] Seq=49 Ack=65 Win=64256 Len=16 |
| 983 1336.253777 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60145 → 4950 [ACK] Seq=65 Ack=65 Win=2102272 Len=0 |
| 984 1336.414759 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60145 → 4950 [PSH, ACK] Seq=65 Ack=65 Win=2102272 Len=16 |
| 985 1336.415153 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60145 [PSH, ACK] Seq=65 Ack=81 Win=64256 Len=16 |
| 986 1336.456155 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60145 → 4950 [ACK] Seq=81 Ack=81 Win=2102272 Len=0 |
| 987 1336.616592 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60145 → 4950 [FIN, ACK] Seq=81 Ack=81 Win=2102272 Len=0 |
| 988 1336.616895 | 192.168.56.1 | 192.168.56.104 | TCP | 60 4950 → 60145 [FIN, ACK] Seq=81 Ack=82 Win=64256 Len=0 |
| 989 1336.616983 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60145 → 4950 [ACK] Seq=82 Ack=82 Win=2102272 Len=0 |
| 990 1336.617023 | 192.168.56.1 | 192.168.56.104 | TCP | 60 60146 → 4950 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 991 1336.617023 | 192.168.56.1 | 192.168.56.104 | TCP | 65 4950 → 60146 [ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460 SACK_PERM=1 WS=128 |
| 992 1336.617415 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60146 → 4950 [ACK] Seq=1 Ack=1 Win=2102272 Len=0 |
| 993 1336.617687 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60146 → 4950 [PSH, ACK] Seq=1 Ack=1 Win=2102272 Len=16 |
| 994 1336.617845 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60146 [ACK] Seq=1 Ack=17 Win=64256 Len=0 |
| 995 1336.618377 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60146 [PSH, ACK] Seq=1 Ack=17 Win=64256 Len=16 |
| 996 1336.658374 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60146 → 4950 [ACK] Seq=17 Ack=17 Win=2102272 Len=0 |
| 997 1336.819373 | 192.168.56.104 | 192.168.56.1 | TCP | 70 60146 → 4950 [PSH, ACK] Seq=17 Ack=17 Win=2102272 Len=16 |
| 998 1336.819738 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60146 [ACK] Seq=17 Ack=33 Win=64256 Len=0 |
| 999 1336.819955 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60146 [PSH, ACK] Seq=17 Ack=33 Win=64256 Len=16 |
| 1000 1336.862745 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60146 → 4950 [ACK] Seq=33 Ack=33 Win=2102272 Len=0 |
| 1001 1337.022257 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60146 → 4950 [PSH, ACK] Seq=33 Ack=33 Win=2102272 Len=16 |
| 1002 1337.02647 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60146 [ACK] Seq=33 Ack=49 Win=64256 Len=0 |
| 1003 1337.022889 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60146 [PSH, ACK] Seq=33 Ack=49 Win=64256 Len=16 |

| | | | | |
|------------------|----------------|----------------|-----|---|
| 1004 1337.063278 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60146 → 4950 [ACK] Seq=49 Ack=49 Win=2102272 Len=0 |
| 1005 1337.224279 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60146 → 4950 [PSH, ACK] Seq=49 Ack=49 Win=2102272 Len=16 |
| 1006 1337.224799 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60146 [ACK] Seq=49 Ack=65 Win=64256 Len=0 |
| 1007 1337.225182 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60146 [PSH, ACK] Seq=49 Ack=65 Win=64256 Len=16 |
| 1008 1337.265466 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60146 → 4950 [ACK] Seq=65 Ack=65 Win=2102272 Len=0 |
| 1009 1337.426674 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60146 → 4950 [PSH, ACK] Seq=65 Ack=65 Win=2102272 Len=16 |
| 1010 1337.427856 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60146 [ACK] Seq=65 Ack=81 Win=64256 Len=16 |
| 1011 1337.467378 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60146 → 4950 [ACK] Seq=81 Ack=81 Win=2102272 Len=0 |
| 1012 1337.629230 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60146 → 4950 [ACK] Seq=82 Ack=82 Win=2102272 Len=0 |
| 1013 1337.629563 | 192.168.56.104 | 192.168.56.1 | TCP | 66 4950 → 60147 [ACK] Seq=82 Ack=82 Win=64256 Len=0 |
| 1014 1337.629598 | 192.168.56.1 | 192.168.56.104 | TCP | 60 4950 → 60147 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 1016 1337.629890 | 192.168.56.104 | 192.168.56.1 | TCP | 66 4950 → 60147 [SYN] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460 SACK_PERM=1 WS=128 |
| 1017 1337.629948 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60147 → 4950 [ACK] Seq=1 Ack=1 Win=2102272 Len=0 |
| 1018 1337.630222 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60147 → 4950 [PSH, ACK] Seq=1 Ack=1 Win=2102272 Len=16 |
| 1019 1337.630359 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60147 [ACK] Seq=1 Ack=17 Win=64256 Len=0 |
| 1020 1337.631654 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60147 [PSH, ACK] Seq=1 Ack=17 Win=64256 Len=16 |
| 1021 1337.671798 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60147 → 4950 [ACK] Seq=17 Ack=17 Win=2102272 Len=0 |
| 1022 1337.827666 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60147 → 4950 [PSH, ACK] Seq=17 Ack=17 Win=2102272 Len=16 |
| 1023 1337.833026 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60147 [ACK] Seq=17 Ack=33 Win=64256 Len=0 |
| 1024 1337.831369 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60147 [PSH, ACK] Seq=17 Ack=33 Win=64256 Len=16 |
| 1025 1337.873769 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60147 → 4950 [ACK] Seq=33 Ack=33 Win=2102272 Len=0 |
| 1026 1338.034366 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60147 → 4950 [PSH, ACK] Seq=33 Ack=33 Win=2102272 Len=16 |
| 1027 1338.034587 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60147 [ACK] Seq=33 Ack=81 Win=64256 Len=0 |
| 1028 1338.034751 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60147 [PSH, ACK] Seq=33 Ack=81 Win=64256 Len=16 |
| 1029 1338.074790 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60147 → 4950 [ACK] Seq=49 Ack=49 Win=2102272 Len=0 |
| 1030 1338.235988 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60147 → 4950 [PSH, ACK] Seq=49 Ack=49 Win=2102272 Len=16 |
| 1031 1338.236248 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60147 [ACK] Seq=49 Ack=65 Win=64256 Len=0 |
| 1032 1338.236451 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60147 [PSH, ACK] Seq=49 Ack=65 Win=64256 Len=16 |
| 1033 1338.276388 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60147 → 4950 [ACK] Seq=65 Ack=65 Win=2102272 Len=0 |
| 1034 1338.437584 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60147 → |

| | | | | |
|--------------------|----------------|----------------|-----|--|
| 1037 1338..638473 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60147 → 4950 [FIN, ACK] Seq=81 Ack=81 Win=2102272 Len=0 |
| 1038 1338..638994 | 192.168.56.1 | 192.168.56.104 | TCP | 66 60148 → 4950 [SYN] Seq=0 Win=64240 Len=0 MSS=1468 WS=256 SACK_PERM=1 |
| 1039 1338..639172 | 192.168.56.104 | 192.168.56.1 | TCP | 66 4950 → 60148 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1468 SACK_PERM=1 WS=128 |
| 1040 1338..639241 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60148 → 4950 [ACK] Seq=1 Ack=1 Win=2102272 Len=0 |
| 1041 1338..639283 | 192.168.56.104 | 192.168.56.1 | TCP | 66 4950 → 60147 [FIN, ACK] Seq=81 Ack=82 Win=64256 Len=0 |
| 1042 1338..639349 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60147 → 4950 [ACK] Seq=82 Ack=82 Win=2102272 Len=0 |
| 1043 1338..841592 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60148 → 4950 [PSH, ACK] Seq=1 Ack=1 Win=2102272 Len=16 |
| 1044 1338..639672 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60148 [ACK] Seq=1 Ack=17 Win=64256 Len=0 |
| 1045 1338..640139 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60148 [PSH, ACK] Seq=1 Ack=17 Win=64256 Len=16 |
| 1046 1338..6909023 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60148 → 4950 [ACK] Seq=17 Ack=17 Win=2102272 Len=0 |
| 1047 1338..841363 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60148 → 4950 [PSH, ACK] Seq=17 Ack=17 Win=2102272 Len=16 |
| 1048 1338..841592 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60148 [ACK] Seq=17 Ack=33 Win=64256 Len=0 |
| 1049 1338..841732 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60148 [PSH, ACK] Seq=17 Ack=33 Win=64256 Len=16 |
| 1050 1338..888183 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60148 → 4950 [ACK] Seq=33 Ack=33 Win=2102272 Len=0 |
| 1051 1339..842681 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60148 → 4950 [PSH, ACK] Seq=33 Ack=33 Win=2102272 Len=16 |
| 1052 1339..842999 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60148 [ACK] Seq=33 Ack=49 Win=64256 Len=0 |
| 1053 1339..843159 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60148 [PSH, ACK] Seq=33 Ack=49 Win=64256 Len=16 |
| 1054 1339..884841 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60148 → 4950 [ACK] Seq=49 Ack=49 Win=2102272 Len=0 |
| 1055 1339..2445460 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60148 → 4950 [PSH, ACK] Seq=49 Ack=49 Win=2102272 Len=16 |
| 1056 1339..2448181 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60148 [ACK] Seq=49 Ack=65 Win=64256 Len=0 |
| 1057 1339..2450902 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60148 [PSH, ACK] Seq=49 Ack=65 Win=64256 Len=16 |
| 1058 1339..2850292 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60148 → 4950 [ACK] Seq=65 Ack=65 Win=2102272 Len=0 |
| 1059 1339..446627 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60148 → 4950 [PSH, ACK] Seq=65 Ack=65 Win=2102272 Len=16 |
| 1060 1339..447139 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60148 [PSH, ACK] Seq=65 Ack=81 Win=64256 Len=16 |
| 1061 1339..487387 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60148 → 4950 [ACK] Seq=81 Ack=81 Win=2102272 Len=0 |
| 1062 1339..648998 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60148 → 4950 [FIN, ACK] Seq=81 Ack=81 Win=2102272 Len=0 |
| 1063 1339..648478 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60148 [FIN, ACK] Seq=81 Ack=82 Win=64256 Len=0 |
| 1064 1339..648519 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60148 → 4950 [ACK] Seq=82 Ack=82 Win=2102272 Len=0 |
| 1065 1339..649199 | 192.168.56.1 | 192.168.56.104 | TCP | 66 60149 → 4950 [SYN] Seq=0 Win=64240 Len=0 MSS=1468 WS=256 SACK_PERM=1 |
| 1066 1339..649362 | 192.168.56.104 | 192.168.56.1 | TCP | 66 4950 → 60149 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1468 SACK_PERM=1 WS=128 |
| 1067 1339..649420 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60149 → 4950 [ACK] Seq=1 Ack=1 Win=2102272 Len=0 |
| 1068 1339..649679 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60149 → 4950 [PSH, ACK] Seq=1 Ack=1 Win=2102272 Len=16 |

| | | | | |
|--------------------|-------------------|----------------|-----|--|
| 1069 1339..649795 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60149 [ACK] Seq=1 Ack=17 Win=64256 Len=0 |
| 1070 1339..651697 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60149 [PSH, ACK] Seq=1 Ack=17 Win=64256 Len=16 |
| 1071 1339..692395 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60149 → 4950 [ACK] Seq=17 Ack=17 Win=2102272 Len=0 |
| 1072 1339..778220 | 08:00:27.00:00:16 | Broadcast | ARP | 42 Who has 192.168.1.1? Tell 192.168.56.1 |
| 1073 1339..853585 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60149 → 4950 [PSH, ACK] Seq=17 Ack=17 Win=2102272 Len=16 |
| 1074 1339..854221 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60149 [ACK] Seq=17 Ack=33 Win=64256 Len=0 |
| 1075 1339..854623 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60149 [PSH, ACK] Seq=17 Ack=33 Win=64256 Len=16 |
| 1076 1339..895823 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60149 → 4950 [ACK] Seq=33 Ack=33 Win=2102272 Len=0 |
| 1077 1340..057532 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60149 → 4950 [PSH, ACK] Seq=33 Ack=33 Win=2102272 Len=16 |
| 1078 1340..057932 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60149 [ACK] Seq=33 Ack=40 Win=64256 Len=0 |
| 1079 1340..058248 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60149 [PSH, ACK] Seq=33 Ack=40 Win=64256 Len=16 |
| 1080 1340..099930 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60149 → 4950 [ACK] Seq=49 Ack=49 Win=2102272 Len=0 |
| 1081 1340..259647 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60149 → 4950 [PSH, ACK] Seq=49 Ack=49 Win=2102272 Len=16 |
| 1082 1340..260145 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60149 [ACK] Seq=49 Ack=65 Win=64256 Len=0 |
| 1083 1340..260371 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60149 [PSH, ACK] Seq=49 Ack=65 Win=64256 Len=16 |
| 1084 1340..300555 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60149 → 4950 [ACK] Seq=65 Ack=65 Win=2102272 Len=0 |
| 1085 1340..462484 | 192.168.56.1 | 192.168.56.104 | TCP | 70 60149 → 4950 [PSH, ACK] Seq=65 Ack=65 Win=2102272 Len=16 |
| 1086 1340..462913 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60149 [PSH, ACK] Seq=65 Ack=81 Win=64256 Len=16 |
| 1087 1340..5026490 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60149 → 4950 [ACK] Seq=81 Ack=81 Win=2102272 Len=0 |
| 1088 1340..664029 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60149 → 4950 [ACK] Seq=81 Ack=82 Win=2102272 Len=0 |
| 1089 1340..664434 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60149 [FIN, ACK] Seq=81 Ack=82 Win=64256 Len=0 |
| 1090 1340..664480 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60149 → 4950 [ACK] Seq=82 Ack=82 Win=2102272 Len=0 |
| 1091 1340..665899 | 192.168.56.1 | 192.168.56.104 | TCP | 66 60150 → 4950 [SYN] Seq=0 Win=64240 Len=0 MSS=1468 WS=256 SACK_PERM=1 |
| 1092 1340..665183 | 192.168.56.104 | 192.168.56.1 | TCP | 66 4950 → 60150 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1468 SACK_PERM=1 WS=128 |
| 1093 1340..6651230 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60150 → 4950 [ACK] Seq=1 Ack=1 Win=2102272 Len=0 |
| 1094 1340..665461 | 192.168.56.104 | 192.168.56.1 | TCP | 70 60150 → 4950 [PSH, ACK] Seq=1 Ack=1 Win=2102272 Len=16 |
| 1095 1340..665560 | 192.168.56.104 | 192.168.56.1 | TCP | 60 4950 → 60150 [ACK] Seq=1 Ack=17 Win=64256 Len=0 |
| 1096 1340..665845 | 192.168.56.104 | 192.168.56.1 | TCP | 70 4950 → 60150 [PSH, ACK] Seq=1 Ack=17 Win=64256 Len=16 |
| 1097 1340..689993 | 08:00:27.00:00:16 | Broadcast | ARP | 42 Who has 192.168.1.1? Tell 192.168.56.1 |
| 1098 1340..706131 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60150 → 4950 [ACK] Seq=17 Ack=17 Win=2102272 Len=0 |
| 1099 1340..813859 | 192.168.56.1 | 192.168.56.104 | TCP | 54 60150 → 4950 [RST, ACK] Seq=17 Ack=17 Win=0 Len=0 |

4.1 The above pictures will demonstrate the data which has been stored while the client has successfully connected to the server.

The first four pictures will demonstrate in detail the connection between client and server for both TCP and UDP in Wireshark. However, the rest of the pictures are belonging to the TCP where multiple clients have been connected to the server.

Some terms are noticeable in the Wireshark like ACK, SYN, and PSH. Firstly, I will write a general concept for them based on different sources (References will be included at the end). Consequently, I will use them to illustrate their usage in the provided screenshots.

➤ ACK

The definition of the ACK is when the machine is dispatching the packet with fact that the ACK is acknowledging the information which has been dispatched and has been received now from the other machine. However, as soon as the connection has been recognized in TCP, the entire packet will contain an ACK. Also, this will apply to the information that has been already acknowledged.

Reference:

<https://osqa-ask.wireshark.org/questions/20423/pshack-wireshark-capture#:~:text=ACK%20means%20that%20the%20machine,data%20that%20it's%20already%20acknowledged.>

➤ SYN

SYN is a bit that its usage can be seen in the TCP header that has been described in the transmission control protocol. The functionality of the SYN is visible in indicating the beginning of a TCP session. Moving on, in the case of using the filter TCP, the SYN will most likely be highlighted as an out-of-order packet declared by the Wireshark. Usually, when the SYN is equal to 1 it means that it just wants to show only SYN packets.

Reference:

<https://osqa-ask.wireshark.org/questions/37630/wireshark-syn-ack-fin-get>

<https://osqa-ask.wireshark.org/questions/59957/filter-for-dropped-unexpected-syn-packets#:~:text=The%20SYN%20that%20gets%20dropped,you%20use%20the%20filter%20tcp.&text=syn%20%3D%201%20to%20display.analysis.>

➤ PSH

Regarding the PSH is considered a flag in the TCP header which will notify the host that it is required to push the information as soon as possible to the receiving application. Moving on, The PSH is referred to as a pointer to the sender. The information that is visible in the connection can be referred to as a stream of octets.

Reference:

<https://www.linkedin.com/pulse/tcp-flag-options-priyanka-kumari/>

<https://osqa-ask.wireshark.org/questions/20423/pshack-wireshark-capture#:~:text=PSH%20is%20an%20indication%20by,do%20so%20at%20that%20point.&text=The%20data%20that%20flows%20on,as%20a%20stream%20of%20octets.>

Regarding the TCP screenshots, a message has been from the Host machine to the virtual machine. However, there are some noticeable data like SYN which is 0 based on the screenshot. Naturally, the server will show a reaction by acknowledging a message (SYN) where seq is equal to 1 and ACK is 1 as well. After the reply from the client, the connection will be formatted. As expected, the length would be 16 in this case. After sending and receiving the messages between server and client, the rate of the ACK has will change dramatically to 81.

In this case, the data will be transferred from source to destination in the protocol.

Differences between UDP and TCP:

| UDP | TCP |
|---|--|
| No news of hand shaking. | It is not fast. |
| It will carry out error analysis. However, it will skip flawed packets. | Its header size is 20 bytes. |
| It has only one mechanism for error analysis. | Its type is connection-oriented protocol. |
| There is no need for segments acknowledgement. | The delivery is insured. |
| There will be no insurance regarding the data delivery. | It will use SYN, ACK which are known as handshake protocol. |
| It is considered connectionless protocol. | It is complicated since it needs three packets to establish a socket connection. |
| Its type is not connection based. | Segments acknowledgment. |
| Its messages involve packets which have been sent one after another. | very useful for error checking. |
| It is much faster when it comes to the error recovery due to the reason that it is not attempted. | The messages can travel across the internet from one pc to another. |
| Its header size is 8 bytes. | It has the capability of reading information as streams of bytes. |
| It is impossible to notice any order in its protocol. | It will cause delay in transmission when the network is overfilled. |
| It is considered simple since there is no way to track and follow the messages order. | Data packets will be organized in special order. |

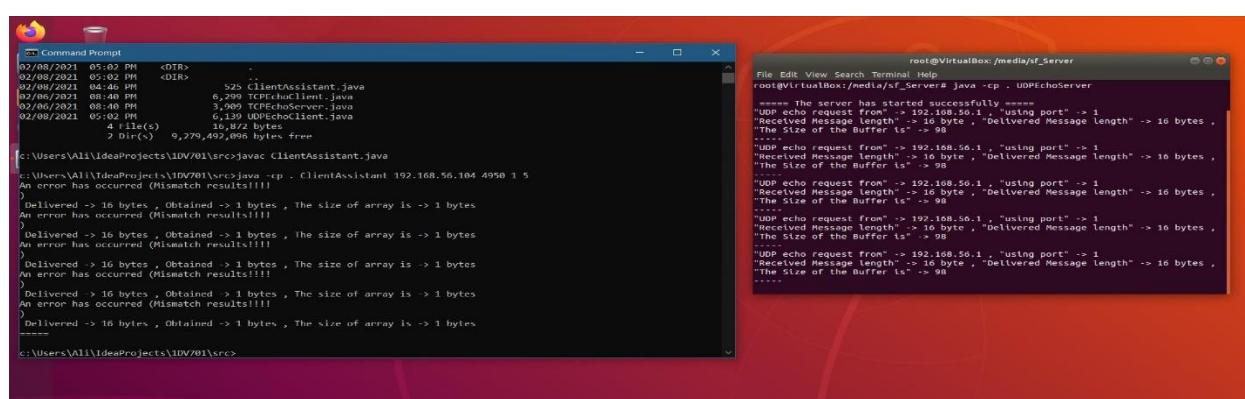
Reference:

<https://www.guru99.com/tcp-vs-udp-understanding-the-difference.html#:~:text=TCP%20is%20a%20connection%20oriented,speed%20of%20UDP%20is%20faster&text=TCP%20does%20error%20checking%20and,20it%20discards%20erroneous%20packets.>

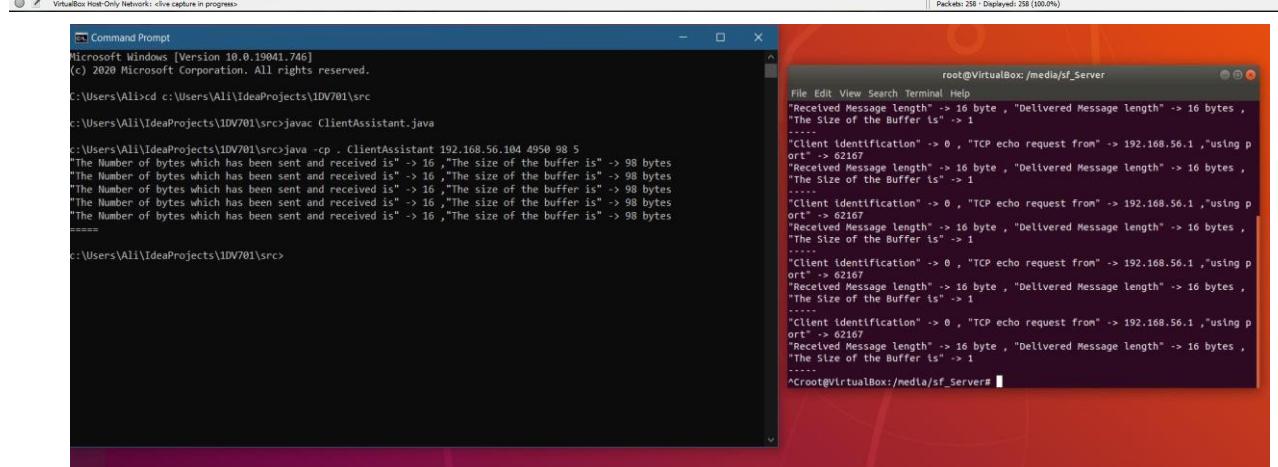
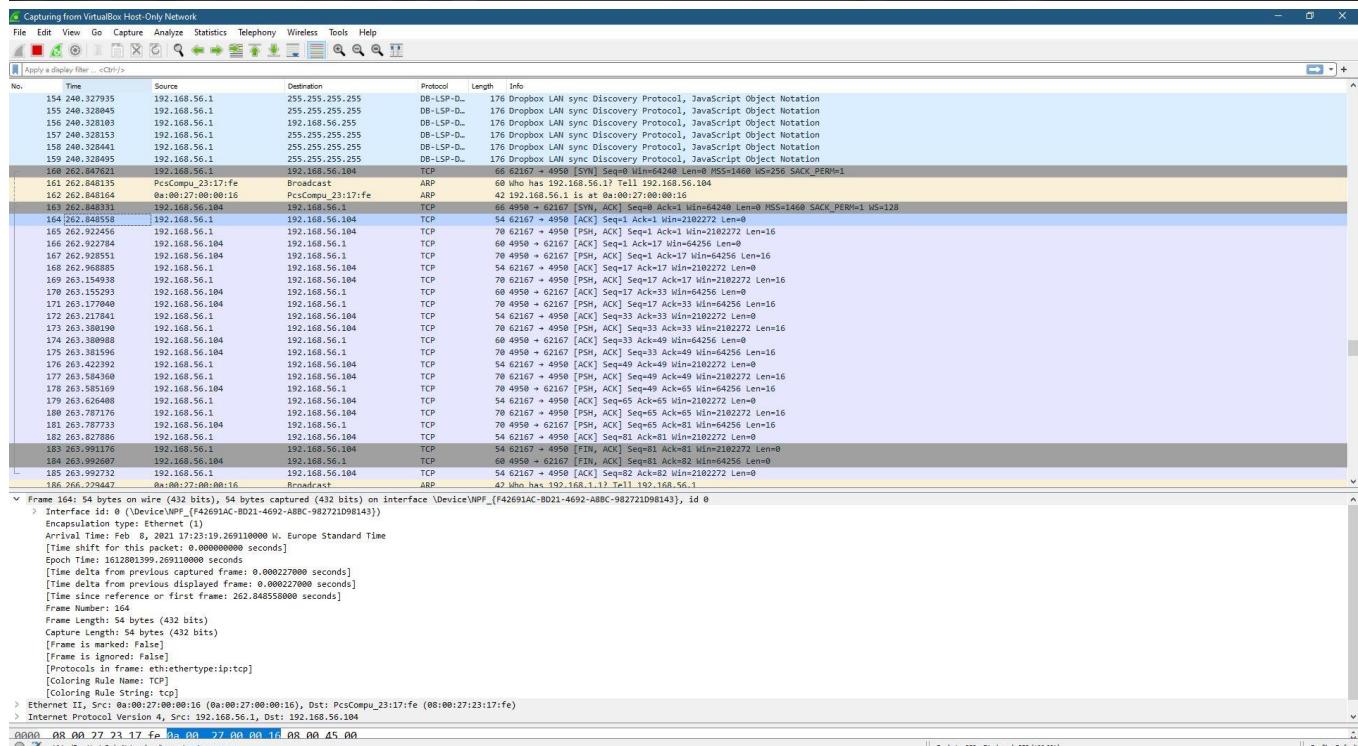
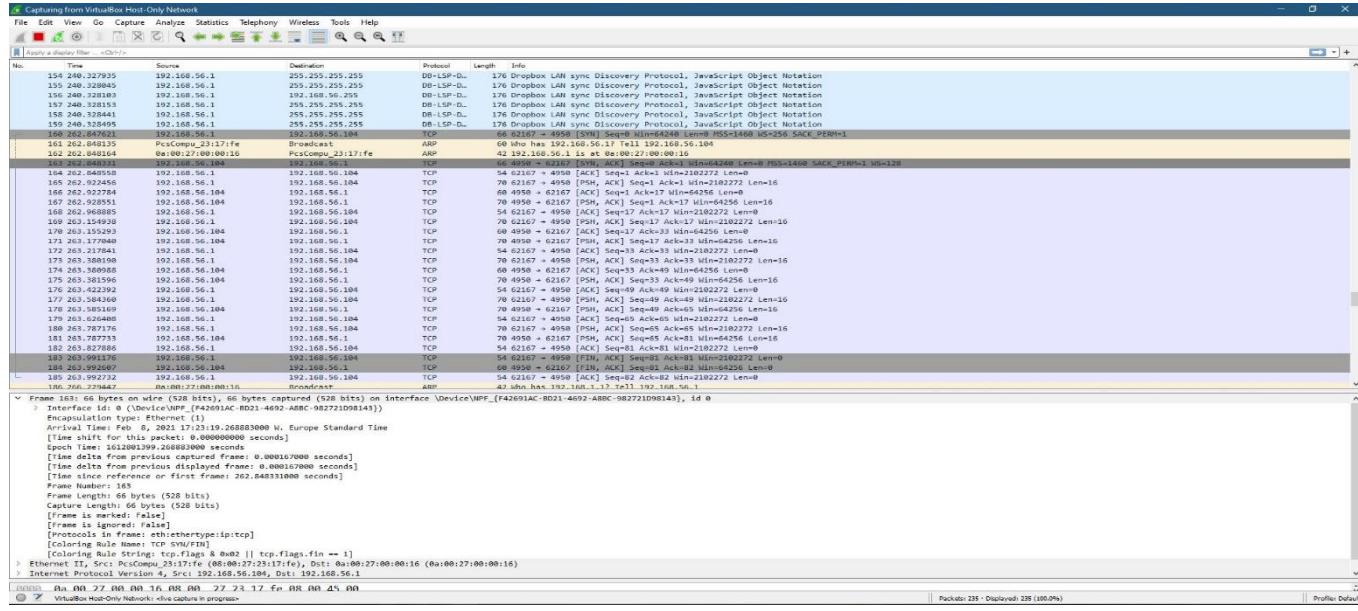
5 Problem 5

UDP: buffer for server is 1 and client is 98.

UDP: buffer for server is 98 and client is 1.



TCP: buffer for server is 1 and client is 98.



TCP: buffer for server is 98 and client is 1.

Capturing from VirtualBox Host-Only Network

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter - [Gethash]

| No. | Time | Source | Destination | Protocol | Length | Info |
|-----|--------------------|-------------------|-------------------|-------------|--|--|
| 138 | 18.168.79916 | 192.168.56.1 | 192.168.56.255 | DB-LSP-D... | 176 | Dropbox LSN sync Discovery Protocol, JavaScript Object Notation |
| 139 | 18.168.79916 | 192.168.56.1 | 255.255.255.255 | DB-LSP-D... | 176 | Dropbox LSN sync Discovery Protocol, JavaScript Object Notation |
| 140 | 18.168.79953 | 192.168.56.1 | 255.255.255.255 | DB-LSP-D... | 176 | Dropbox LSN sync Discovery Protocol, JavaScript Object Notation |
| 141 | 18.168.009246 | 192.168.56.1 | 255.255.255.255 | DB-LSP-D... | 176 | Dropbox LSN sync Discovery Protocol, JavaScript Object Notation |
| 142 | 18.97479 | 192.168.56.1 | 192.168.56.104 | TCP | 66 | 62288 + 4956 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1 |
| 143 | 18.974799 | PcsCompu_23:17:fe | Broadcast | ARP | 60 | bho has 192.168.56.17 Tell 192.168.56.16 |
| 144 | 18.980821 | 00:00:27:00:00:16 | PcsCompu_23:17:fe | ARP | 42 | 192.168.56.17 bho has 00:00:27:00:00:16 Tell 00:00:27:00:00:16 |
| 145 | 18.980821 | 192.168.56.1 | 192.168.56.104 | TCP | 66 | 62288 + 4956 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM=1 WS=128 |
| 146 | 18.983749 | 192.168.56.1 | 192.168.56.104 | TCP | 54 | 62288 + 4956 [ACK] Seq=1 Win=2192272 Len=0 |
| 147 | 18.994741 | 192.168.56.1 | 192.168.56.104 | TCP | 70 | 62288 + 4956 [PSH, ACK] Seq=1 Ack=1 Win=2192272 Len=16 |
| 148 | 18.168.950508 | 192.168.56.1 | 192.168.56.1 | TCP | 60 | 4950 + 62288 [ACK] Seq=1 Ack=17 Win=4256 Len=0 |
| 149 | 18.168.950503 | 192.168.56.1 | 192.168.56.1 | TCP | 70 | 4950 + 62288 [ACK] Seq=1 Ack=17 Win=4256 Len=16 |
| 150 | 18.168.13104 | 192.168.56.1 | 192.168.56.104 | TCP | 54 | 62288 + 4956 [ACK] Seq=17 Ack=21 Win=2192272 Len=0 |
| 151 | 18.168.301759 | 192.168.56.1 | 192.168.56.104 | TCP | 70 | 62288 + 4956 [PSH, ACK] Seq=17 Ack=17 Win=2192272 Len=16 |
| 152 | 18.301982 | 192.168.56.104 | 192.168.56.1 | TCP | 60 | 4950 + 62288 [ACK] Seq=17 Ack=33 Win=4256 Len=0 |
| 153 | 18.302624 | 192.168.56.104 | 192.168.56.1 | TCP | 70 | 4950 + 62288 [PSH, ACK] Seq=17 Ack=33 Win=4256 Len=16 |
| 154 | 18.302624 | 192.168.56.1 | 192.168.56.104 | TCP | 54 | 62288 + 4956 [ACK] Seq=33 Ack=33 Win=2192272 Len=0 |
| 155 | 18.503825 | 192.168.56.1 | 192.168.56.104 | TCP | 70 | 62288 + 4956 [PSH, ACK] Seq=33 Ack=33 Win=2192272 Len=0 |
| 156 | 18.168.594164 | 192.168.56.104 | 192.168.56.1 | TCP | 60 | 4950 + 62288 [ACK] Seq=33 Ack=49 Win=4256 Len=0 |
| 157 | 18.504377 | 192.168.56.104 | 192.168.56.1 | TCP | 70 | 4950 + 62288 [PSH, ACK] Seq=49 Ack=49 Win=4256 Len=16 |
| 158 | 18.168.544566 | 192.168.56.1 | 192.168.56.1 | TCP | 54 | 62288 + 4956 [ACK] Seq=49 Ack=49 Win=2192272 Len=0 |
| 159 | 18.168.749399 | 192.168.56.1 | 192.168.56.104 | TCP | 70 | 62288 + 4956 [PSH, ACK] Seq=49 Ack=49 Win=2192272 Len=16 |
| 160 | 18.780022 | 192.168.56.104 | 192.168.56.1 | TCP | 60 | 4950 + 62288 [ACK] Seq=49 Ack=49 Win=4256 Len=0 |
| 161 | 18.780944 | 192.168.56.104 | 192.168.56.1 | TCP | 70 | 4950 + 62288 [PSH, ACK] Seq=49 Ack=49 Win=4256 Len=16 |
| 162 | 18.749856 | 192.168.56.1 | 192.168.56.104 | TCP | 54 | 62288 + 4956 [ACK] Seq=65 Ack=65 Win=2192272 Len=0 |
| 163 | 18.168.749399 | 192.168.56.1 | 192.168.56.104 | TCP | 70 | 62288 + 4956 [PSH, ACK] Seq=65 Ack=65 Win=2192272 Len=16 |
| 164 | 18.780944 | 192.168.56.104 | 192.168.56.1 | TCP | 60 | 4950 + 62288 [ACK] Seq=65 Ack=65 Win=4256 Len=0 |
| 165 | 18.780944 | 192.168.56.1 | 192.168.56.104 | TCP | 70 | 4950 + 62288 [PSH, ACK] Seq=65 Ack=65 Win=4256 Len=16 |
| 166 | 18.780944 | 192.168.56.104 | 192.168.56.1 | TCP | 54 | 62288 + 4956 [ACK] Seq=81 Ack=81 Win=2192272 Len=0 |
| 167 | 18.115105 | 192.168.56.1 | 192.168.56.104 | TCP | 54 | 62288 + 4956 [FIN, ACK] Seq=81 Ack=81 Win=2192272 Len=0 |
| 168 | 18.116608 | 192.168.56.1 | 192.168.56.1 | TCP | 60 | 4950 + 62288 [ACK] Seq=81 Ack=82 Win=64240 Len=0 |
| 169 | 18.116608 | 192.168.56.104 | 192.168.56.1 | TCP | 70 | 4950 + 62288 [FIN, ACK] Seq=81 Ack=82 Win=2192272 Len=0 |
| 170 | 18.168.116710 | 192.168.56.1 | 192.168.56.104 | TCP | 54 | 62288 + 4956 [ACK] Seq=81 Ack=82 Win=2192272 Len=0 |
| 171 | 00:00:27:00:00:15 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:15 | |
| 172 | 00:00:27:00:00:15 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:15 | |
| 173 | 00:00:27:00:00:16 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:16 | |
| 174 | 00:00:27:00:00:17 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:17 | |
| 175 | 00:00:27:00:00:18 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:18 | |
| 176 | 00:00:27:00:00:19 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:19 | |
| 177 | 00:00:27:00:00:20 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:20 | |
| 178 | 00:00:27:00:00:21 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:21 | |
| 179 | 00:00:27:00:00:22 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:22 | |
| 180 | 00:00:27:00:00:23 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:23 | |
| 181 | 00:00:27:00:00:24 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:24 | |
| 182 | 00:00:27:00:00:25 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:25 | |
| 183 | 00:00:27:00:00:26 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:26 | |
| 184 | 00:00:27:00:00:27 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:27 | |
| 185 | 00:00:27:00:00:28 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:28 | |
| 186 | 00:00:27:00:00:29 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:29 | |
| 187 | 00:00:27:00:00:30 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:30 | |
| 188 | 00:00:27:00:00:31 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:31 | |
| 189 | 00:00:27:00:00:32 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:32 | |
| 190 | 00:00:27:00:00:33 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:33 | |
| 191 | 00:00:27:00:00:34 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:34 | |
| 192 | 00:00:27:00:00:35 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:35 | |
| 193 | 00:00:27:00:00:36 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:36 | |
| 194 | 00:00:27:00:00:37 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:37 | |
| 195 | 00:00:27:00:00:38 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:38 | |
| 196 | 00:00:27:00:00:39 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:39 | |
| 197 | 00:00:27:00:00:40 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:40 | |
| 198 | 00:00:27:00:00:41 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:41 | |
| 199 | 00:00:27:00:00:42 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:42 | |
| 200 | 00:00:27:00:00:43 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:43 | |
| 201 | 00:00:27:00:00:44 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:44 | |
| 202 | 00:00:27:00:00:45 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:45 | |
| 203 | 00:00:27:00:00:46 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:46 | |
| 204 | 00:00:27:00:00:47 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:47 | |
| 205 | 00:00:27:00:00:48 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:48 | |
| 206 | 00:00:27:00:00:49 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:49 | |
| 207 | 00:00:27:00:00:50 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:50 | |
| 208 | 00:00:27:00:00:51 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:51 | |
| 209 | 00:00:27:00:00:52 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:52 | |
| 210 | 00:00:27:00:00:53 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:53 | |
| 211 | 00:00:27:00:00:54 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:54 | |
| 212 | 00:00:27:00:00:55 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:55 | |
| 213 | 00:00:27:00:00:56 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:56 | |
| 214 | 00:00:27:00:00:57 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:57 | |
| 215 | 00:00:27:00:00:58 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:58 | |
| 216 | 00:00:27:00:00:59 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:59 | |
| 217 | 00:00:27:00:00:60 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:60 | |
| 218 | 00:00:27:00:00:61 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:61 | |
| 219 | 00:00:27:00:00:62 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:62 | |
| 220 | 00:00:27:00:00:63 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:63 | |
| 221 | 00:00:27:00:00:64 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:64 | |
| 222 | 00:00:27:00:00:65 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:65 | |
| 223 | 00:00:27:00:00:66 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:66 | |
| 224 | 00:00:27:00:00:67 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:67 | |
| 225 | 00:00:27:00:00:68 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:68 | |
| 226 | 00:00:27:00:00:69 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:69 | |
| 227 | 00:00:27:00:00:70 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:70 | |
| 228 | 00:00:27:00:00:71 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:71 | |
| 229 | 00:00:27:00:00:72 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:72 | |
| 230 | 00:00:27:00:00:73 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:73 | |
| 231 | 00:00:27:00:00:74 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:74 | |
| 232 | 00:00:27:00:00:75 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:75 | |
| 233 | 00:00:27:00:00:76 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:76 | |
| 234 | 00:00:27:00:00:77 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:77 | |
| 235 | 00:00:27:00:00:78 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:78 | |
| 236 | 00:00:27:00:00:79 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:79 | |
| 237 | 00:00:27:00:00:80 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:80 | |
| 238 | 00:00:27:00:00:81 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:81 | |
| 239 | 00:00:27:00:00:82 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:82 | |
| 240 | 00:00:27:00:00:83 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:83 | |
| 241 | 00:00:27:00:00:84 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:84 | |
| 242 | 00:00:27:00:00:85 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:85 | |
| 243 | 00:00:27:00:00:86 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:86 | |
| 244 | 00:00:27:00:00:87 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:87 | |
| 245 | 00:00:27:00:00:88 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:88 | |
| 246 | 00:00:27:00:00:89 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:89 | |
| 247 | 00:00:27:00:00:90 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:90 | |
| 248 | 00:00:27:00:00:91 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:91 | |
| 249 | 00:00:27:00:00:92 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:92 | |
| 250 | 00:00:27:00:00:93 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:93 | |
| 251 | 00:00:27:00:00:94 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:94 | |
| 252 | 00:00:27:00:00:95 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:95 | |
| 253 | 00:00:27:00:00:96 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:96 | |
| 254 | 00:00:27:00:00:97 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:97 | |
| 255 | 00:00:27:00:00:98 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:98 | |
| 256 | 00:00:27:00:00:99 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:99 | |
| 257 | 00:00:27:00:00:100 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:100 | |
| 258 | 00:00:27:00:00:101 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:101 | |
| 259 | 00:00:27:00:00:102 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:102 | |
| 260 | 00:00:27:00:00:103 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:103 | |
| 261 | 00:00:27:00:00:104 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:104 | |
| 262 | 00:00:27:00:00:105 | Broadcast | ARP | 42 | bho has 192.168.56.1 Tell 00:00:27:00:00:105 | |
| 263 | 00:00:27:00:00: | | | | | |

5.1 The above pictures will illustrate the data which were capture by the Wireshark for both UTC and UDP.

As it was asked in the requirements we were required to see and analyze the functionality of both TCP and UDP by setting different buffer sizes. In my case, I have chosen my range from 1 to 100. What I mean by this is that, I have run them multiple times, and I have chosen their values close to 1 for one of them and close to 100 for the other one. The Wireshark has captured interesting information from both. A significant difference between UDP and TCP is that in the UDP I have received an error message in the terminal which has indicated that an error has occurred (Mismatch results!!!!). The reason for this is that the length of the message is not the same as the received message. What I mean by this is that the delivered (sent) is 16 bytes and the obtained (received) is 1.

However, the TCP has worked flawlessly without giving any message indicating that any error has happened. One of the reasons could be due to the reason that the TCP can operate independently. As a result, by looking at the output from both terminals, the data is indicating that the received and sent numbers of bytes is 16 when the buffer size has been set to both 1 and 98. Opposite to the UDP, TCP will receive the messages not based on the size of the buffer. These are pros and cons of TCP and UDP which are noticeable:

- ❖ TCP can assist you to develop a connection to different types of computers.
- ❖ UDP will not restrict to connection-based communication.
- ❖ TCP is not ideal for using broadcast or multicast transmission.
- ❖ UDP will get harm in case of packet loss.
- ❖ TCP is not known for having any block boundaries.
- ❖ UDP has less delay.

Reference:

<https://www.guru99.com/tcp-vs-udp-understanding-the-difference.html#:~:text=TCP%20is%20a%20connection%2Doriented,speed%20of%20UDP%20is%20faster&text=TCP%20does%20error%20checking%20and,ut%20it%20discards%20erroneous%20packets.>