Wireshark Tutorial

For Wireshark Video: https://www.youtube.com/watch?v=PYrCS21sPbA

https://www.youtube.com/watch?v=jvuiI1Leg6w

What is Wireshark?

Wireshark is an open-source packet analyzer, which is used for **education, analysis, software development, communication protocol development, and network troubleshooting**.

It is used to track the packets so that each one is filtered to meet our specific needs. It is commonly called as a **sniffer, network protocol analyzer, and network analyzer**. It is also used by network security engineers to examine security problems.

Wireshark is a free to use application which is used to apprehend the data back and forth. It is often called as a free packet sniffer computer application. It puts the network card into an unselective mode, i.e., to accept all the packets which it receives.

Uses of Wireshark:

Wireshark can be used in the following ways:

1. It is used by network security engineers to examine security problems.
2. It allows the users to watch all the traffic being passed over the network.
3. It is used by network engineers to troubleshoot network issues.
4. It also helps to troubleshoot latency issues and malicious activities on your network.
5. It can also analyze dropped packets.
6. It helps us to know how all the devices like laptop, mobile phones, desktop, switch, routers, etc., communicate in a local network or the rest of the world.

What is a packet?

A packet is a unit of data which is transmitted over a network between the origin and the destination. Network packets are small, i.e., maximum **1.5 Kilobytes for Ethernet packets and 64 Kilobytes for IP packets**. The data packets in the Wireshark can be viewed online and can be analyzed offline.

History of Wireshark:

In the late 1990's **Gerald Combs**, a computer science graduate of the University of Missouri-Kansas City was working for the small ISP (Internet Service Provider). The protocol at that time did not complete the primary requirements. So, he started writing **ethereal** and released the first version around 1998. The Network integration services owned the Ethernet trademark.

Combos still held the copyright on most of the ethereal source code, and the rest of the source code was re-distributed under the GNU GPL. He did not own the Ethereal trademark, so he changed the name to Wireshark. He used the contents of the ethereal as the basis.

Wireshark has won several industry rewards over the years including eWeek, InfoWorld, PC Magazine and also as a top-rated packet sniffer. Combos continued the work and released the new version of the software. There are around 600 contributed authors for the Wireshark product website.

Functionality of Wireshark:

Wireshark is similar to tcpdump in networking. **Tcpdump** is a common packet analyzer which allows the user to display other packets and TCP/IP packets, being transmitted and received over a network attached to the computer. It has a graphic end and some sorting and filtering functions. Wireshark users can see all the traffic passing through the network.

Wireshark can also monitor the unicast traffic which is not sent to the network's MAC address interface. But, the switch does not pass all the traffic to the port. Hence, the promiscuous mode is not sufficient to see all the traffic. The various network taps or **port mirroring** is used to extend capture at any point.

Port mirroring is a method to monitor network traffic. When it is enabled, the switch sends the copies of all the network packets present at one port to another port.

What is color coding in Wireshark?

The packets in the Wireshark are highlighted with **blue**, **black**, and **green color**. These colors help users to identify the types of traffic. It is also called as **packet colorization**. The kinds of coloring rules in the Wireshark are **temporary rules** and **permanent rules**.

- The temporary rules are there until the program is in active mode or until we quit the program.
- The permanent color rules are available until the Wireshark is in use or the next time you run the Wireshark. The steps to apply color filters will be discussed later in this topic.

Features of Wireshark

- It is multi-platform software, i.e., it can run on Linux, Windows, OS X, FreeBSD, NetBSD, etc.
- It is a standard three-pane packet browser.
- It performs deep inspection of the hundreds of protocols.
- It often involves live analysis, i.e., from the different types of the network like the Ethernet, loopback, etc., we can read live data.
- It has sort and filter options which makes ease to the user to view the data.
- It is also useful in VoIP analysis.
- It can also capture raw USB traffic.
- Various settings, like timers and filters, can be used to filter the output.
- It can only capture packet on the PCAP (an application programming interface used to capture the network) supported networks.
- Wireshark supports a variety of well-documented capture file formats such as the PcapNg and Libpcap. These formats are used for storing the captured data.
- It is the no.1 piece of software for its purpose. It has countless applications ranging from the **tracing down, unauthorized traffic, firewall settings, etc**.

Installation of Wireshark Software

Below are the steps to install the Wireshark software on the computer:

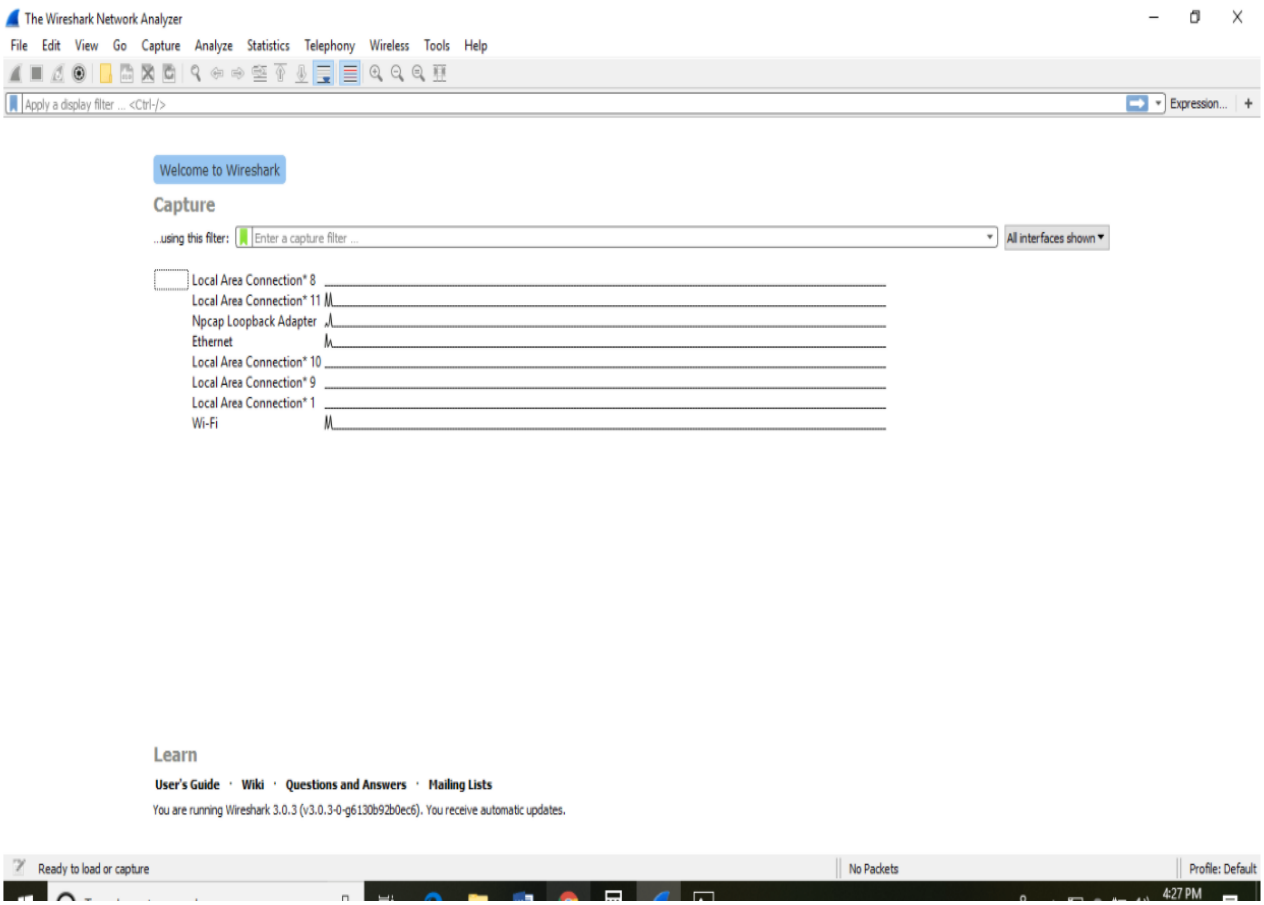
- Open the web browser.
- Search for '**Download Wireshark**.'
- Select the Windows installer according to your system configuration, either 32-bt or 64-bit. Save the program and close the browser.

- Now, open the software, and follow the install instruction by accepting the license.
- The Wireshark is ready for use.

On the network and Internet settings option, we can check the interface connected to our computer.

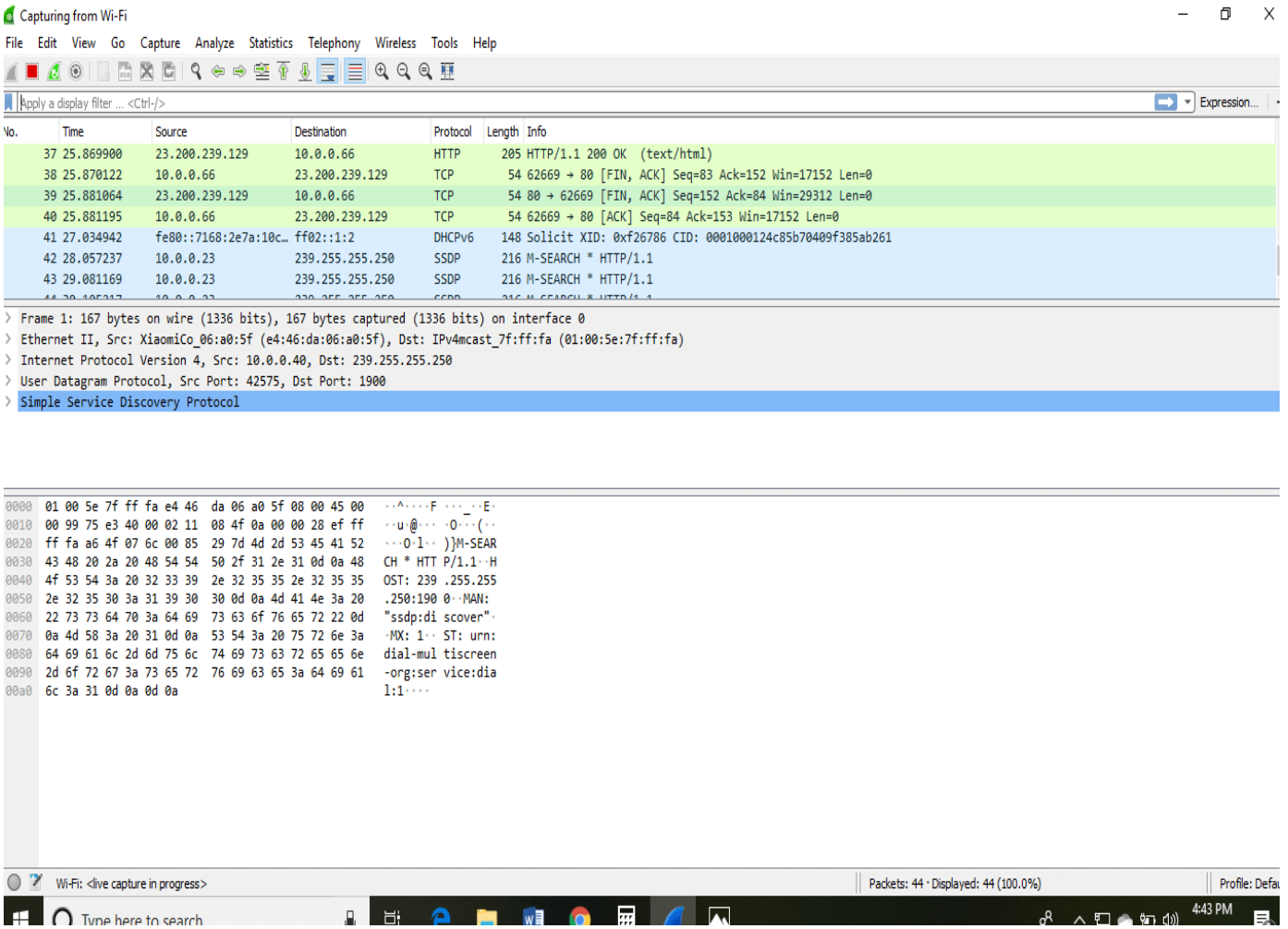
If you are Linux users, then you will find Wireshark in its package repositories.

By selecting the current interface, we can get the traffic traversing through that interface. The version used here is **3.0.3**. This version will open as:



The Wireshark software window is shown above, and all the processes on the network are carried within this screen only.

The options given on the list are the Interface list options. The number of interface options will be present. Selection of any option will determine all the traffic. **For example,** from the above fig. select the Wi-Fi option. After this, a new window opens up, which will show all the current traffic on the network. Below is the image which tells us about the live capture of packets and our Wireshark will look like:



The above arrow shows the packet content written in hexadecimal or the ASCII format. And the information above the packet content, are the details of the packet header.

It will continue listening to all the data packets, and you will get much data. If you want to see a particular data, then you can click on the red button. The traffic will be stationary, and you can note the parameters like time, source, destination, the protocol being used, length, and the Info. To view in-depth detail, you can click on that particular address; a lot of the information will be displayed below that.

There will be detailed information on HTTP packets, TCP packets, etc. The red button is shown below:

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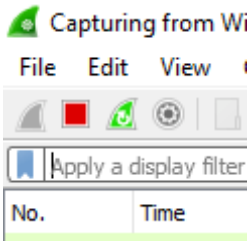
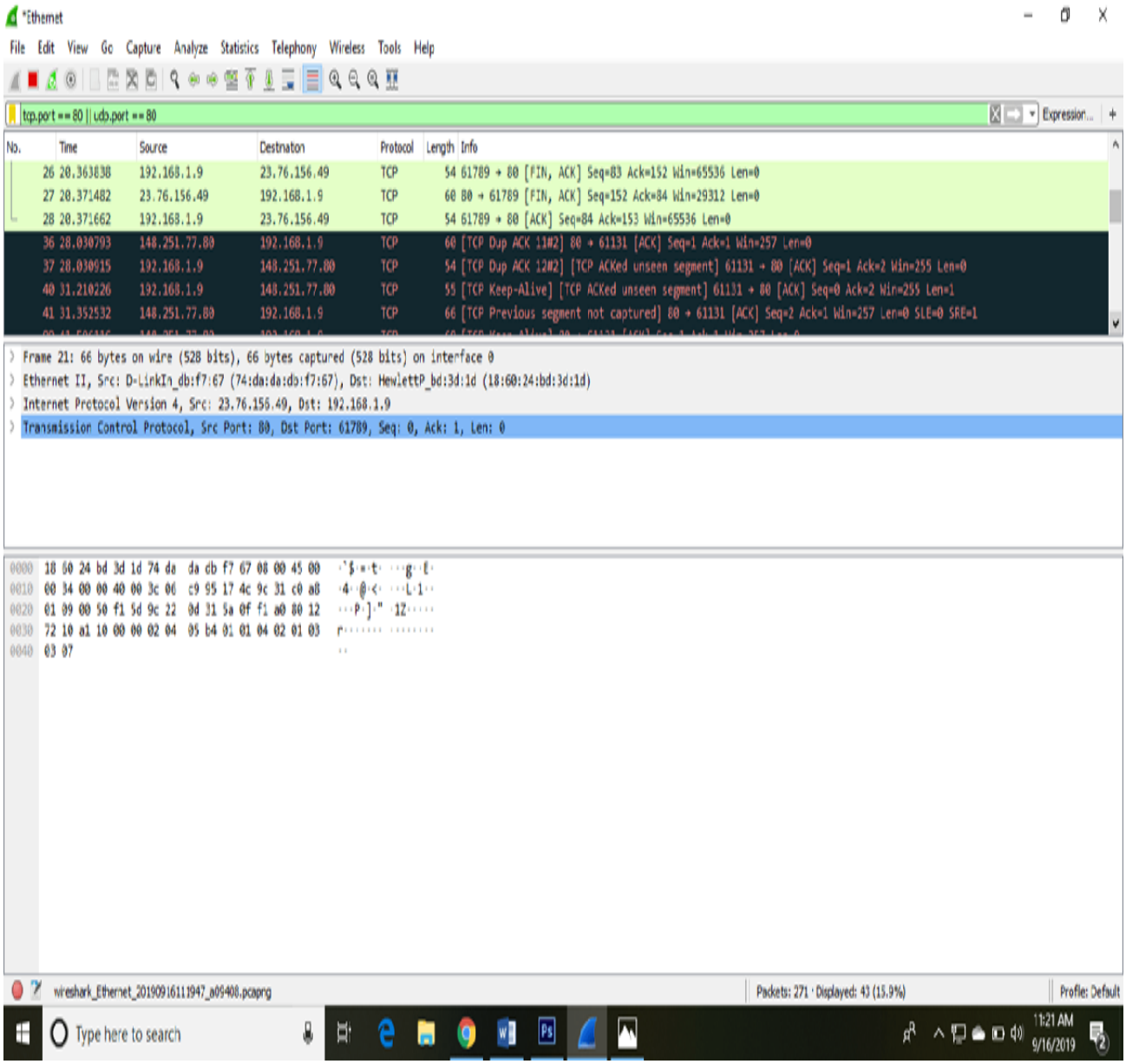


he screen/interface of the Wireshark is divided into five parts:

- First part contains a menu bar and the options displayed below it. This part is at the top of the window. File and the capture menus options are commonly used in Wireshark. The capture menu allows to start the capturing process. And the File menu is used to open and save a capture file.
- The second part is the packet listing window. It determines the packet flow or the captured packets in the traffic. It includes the packet number, time, source, destination, protocol, length, and info. We can sort the packet list by clicking on the column name.
- Next comes the packet header- detailed window. It contains detailed information about the components of the packets. The protocol info

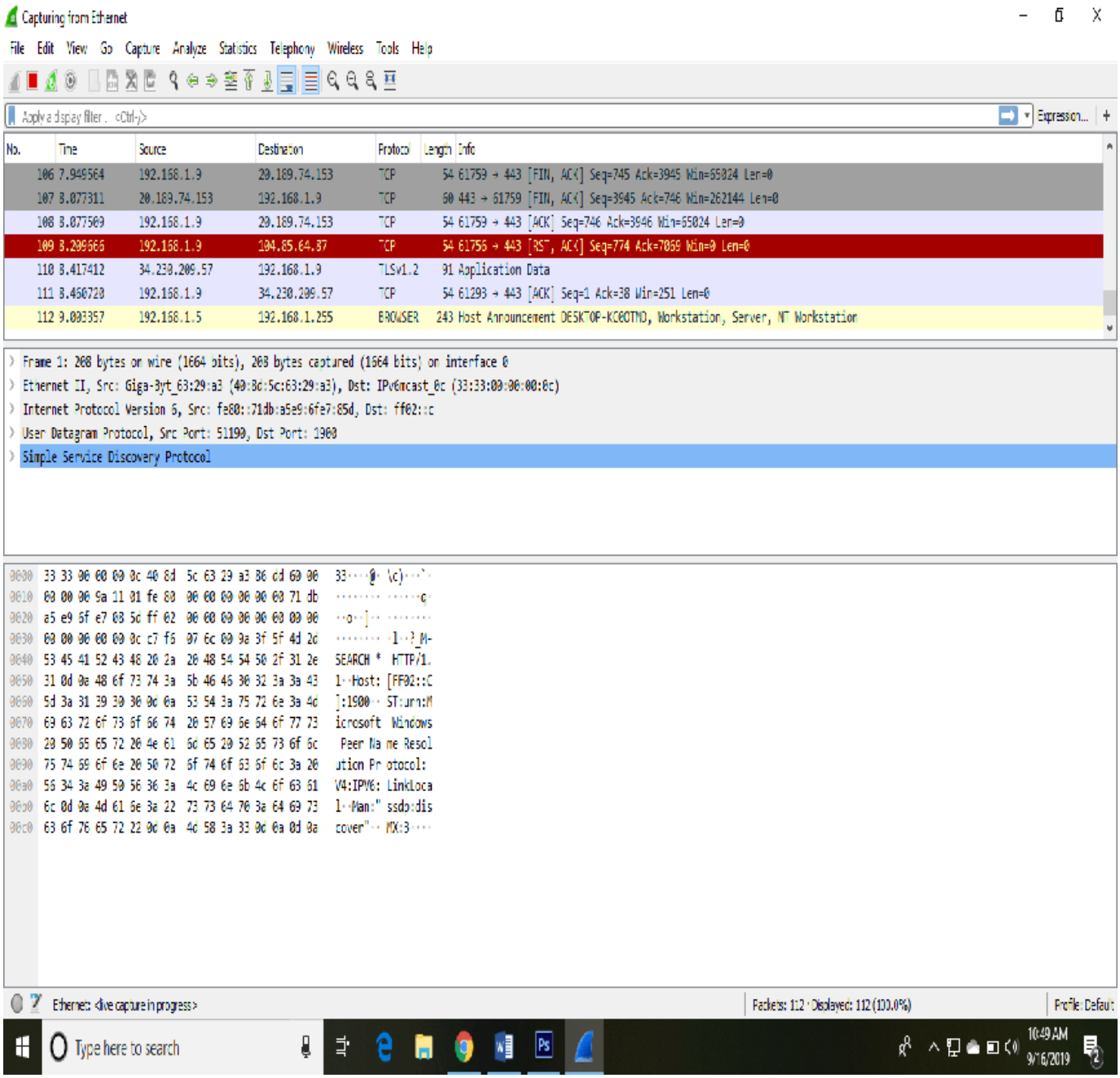
can also be expanded or minimized according to the information required.

- The bottom window called the packet contents window, which displays the content in ASCII and hexadecimal format.
- At last, is the filter field which is at the top of the display. The captured packets on the screen can be filtered based on any component according to your requirements. For example, if we want to see only the packets with the HTTP protocol, we can apply filters to that option. All the packets with HTTP as the protocol will only be displayed on the screen, shown below:

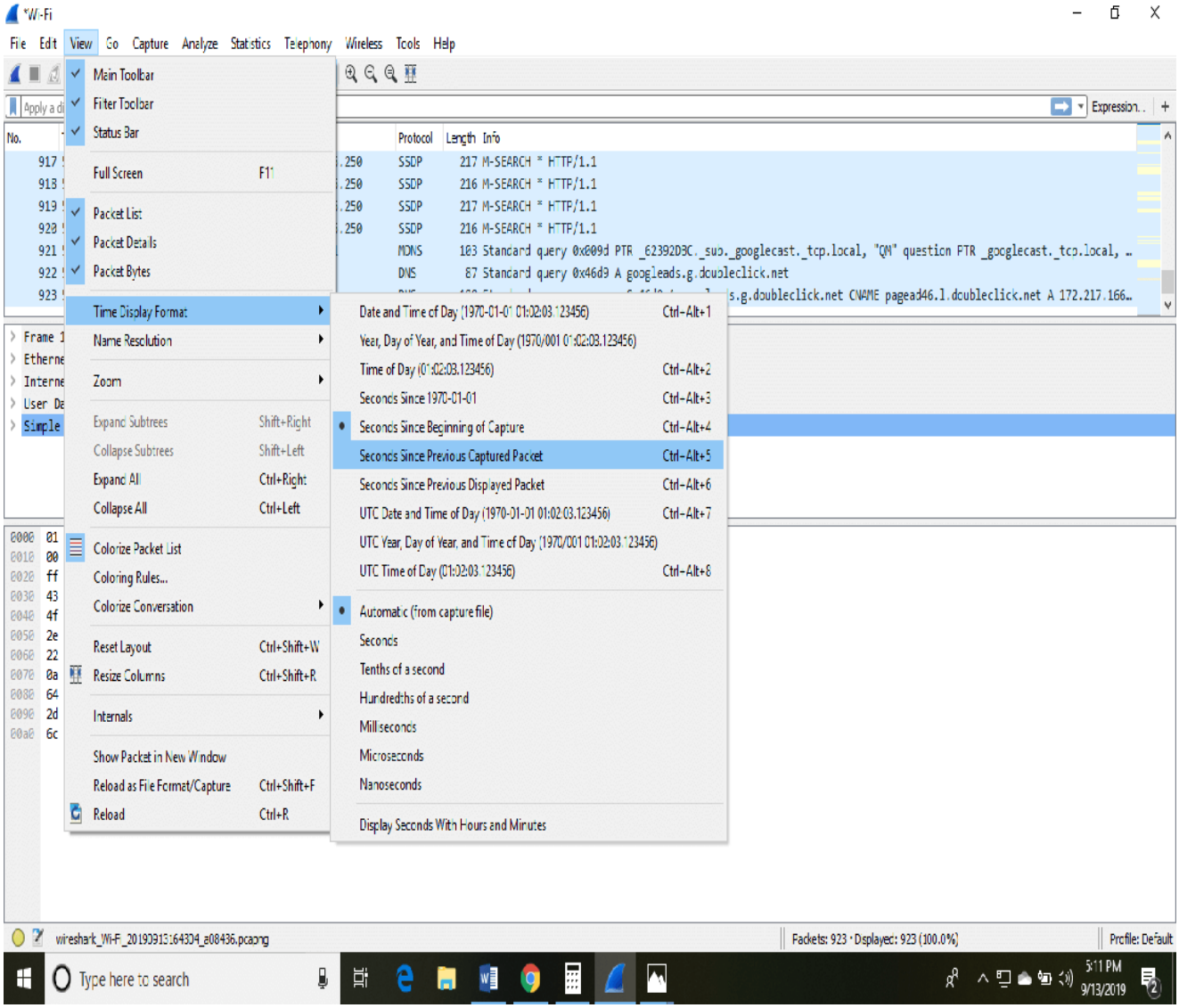


You can also select the connection to which your computer is connected. For example, in this PC, we have chosen the current network, i.e., the ETHERNET.

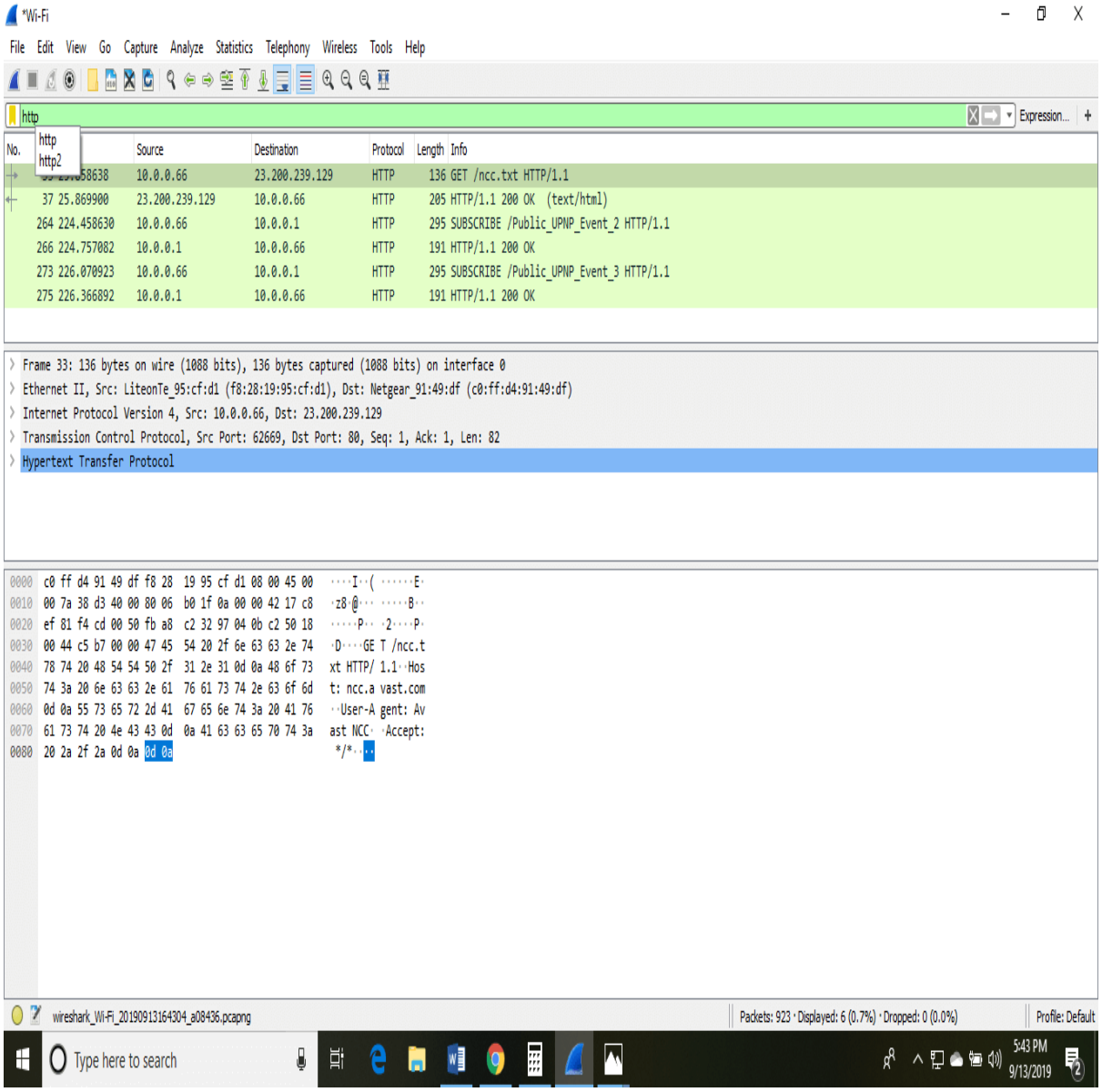
After connecting, you can watch the traffic below:



In view option on the menu bar, we can also change the view of the interface. You can change the number of things in the view menu. You can also enable or disable any option according to the requirements.

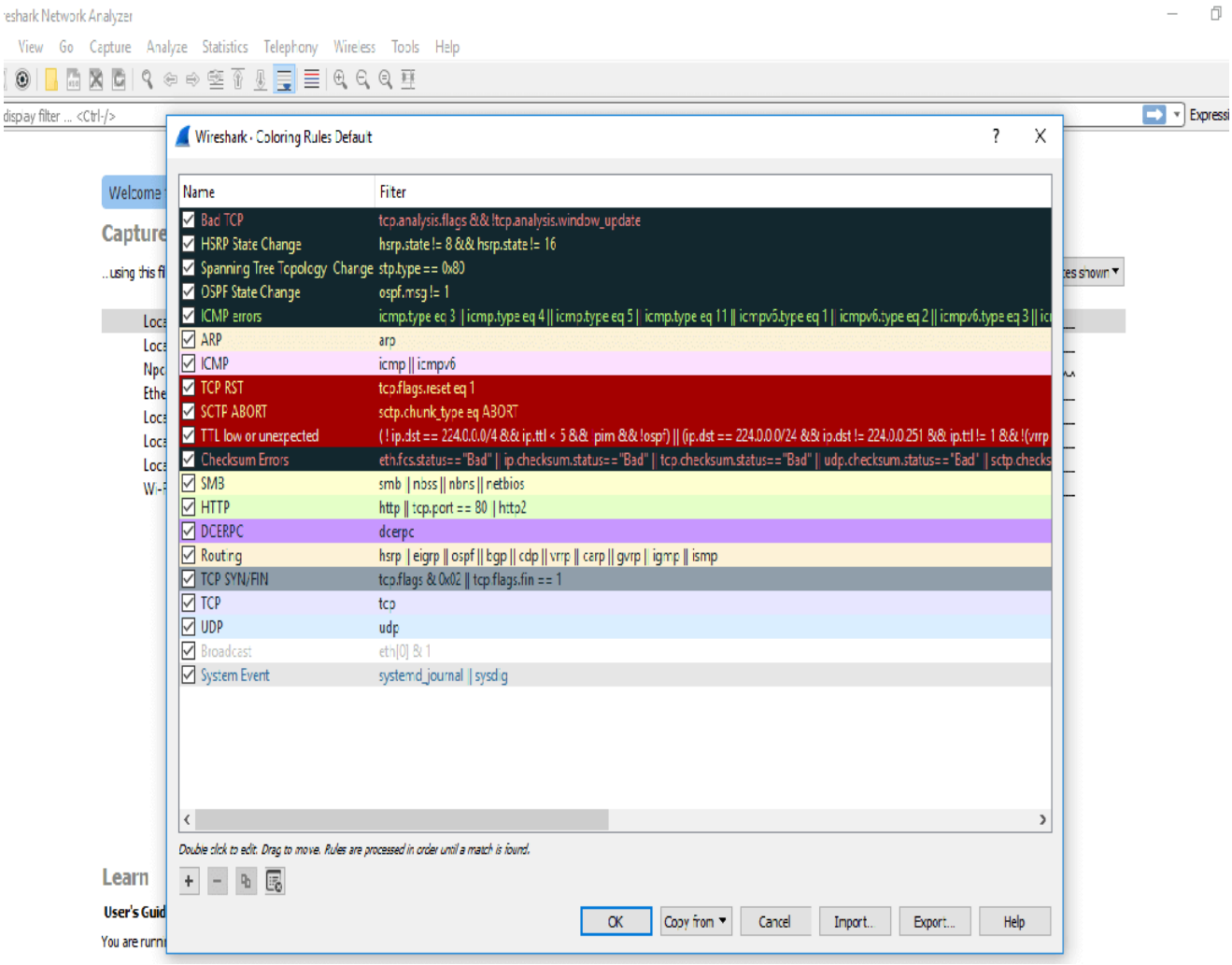


There is a filter block below the menu bar, from where a large amount of data can be filtered. For example, if we apply a filter for HTTP, only the interfaces with the HTTP will be listed.



If you want to filter according to the source, right-click on the source you want to filter and select 'Apply as Filter' and choose '...and filter.'

Steps for the permanent colorization are: click on the 'View' option on the menu bar and select 'Coloring Rules.' The table will appear like the image shown below:



For the network administrator job, advanced knowledge of Wireshark is considered as the requirements. So, it is essential to understand the concepts of the software. It contains these 20 default coloring rules which can be added or removed according to the requirements.

Select the option '**View**' and then choose '**Colorize Packet List**,' which is used to **toggle the color on and off**.

Note: If you are not sure about the version of your desktop or the laptop, then you can download the 32-bit Wireshark which will run almost 99% on every type of computers

Now let's start with this basics-

Basic concepts of the Network Traffic

IP Addresses: It was designed for the devices to communicate with each other on a local network or over the Internet. It is used for host or network interface identification. It provides the location of the host and capacity of establishing the path to the host in that network. Internet Protocol is the set of predefined rules or terms under which the communication should be conducted. The types of IP addresses are **IPv4 and IPv6**.

- IPv4 is a **32-bit address** in which each group represents 8 bits ranging from 0 to 255.
- IPv6 is a 128-bit address.

IP addresses are assigned to the host either dynamically or static IP address. Most of the private users have dynamic IP address while business users or servers have a static IP address. Dynamic address changes whenever the device is connected to the Internet.

Computer Ports: The computer ports work in combination with the IP address directing all outgoing and incoming packets to their proper places. There are well-known ports to work with like **FTP** (File Transfer Protocol), which has port no. 21, etc. All the ports have the purpose of directing all packets in the predefined direction.

Protocol: The Protocol is a set of predefined rules. They are considered as the standardized way of communication. One of the most used protocol is **TCP/IP**. It stands for **Transmission Control Protocol/ Internet Protocol**.

OSI model: OSI model stands for **Open System Interconnect**. OSI model has seven layers, namely, **Application layer, Presentation layer, Session layer, Transport layer, Network layer, Data link layer, and the physical layer**. OSI model gives a detail representation and explanation of the transmission and reception of data through the layers. OSI model supports both connectionless and connection-oriented communication mode over the network layer. The OSI model was developed by ISO (International Standard Organization).

Most used Filters in Wireshark

Whenever we type any commands in the filter command box, it turns **green** if your command is **correct**. It turns **red** if it is **incorrect** or the Wireshark does not recognize your command.

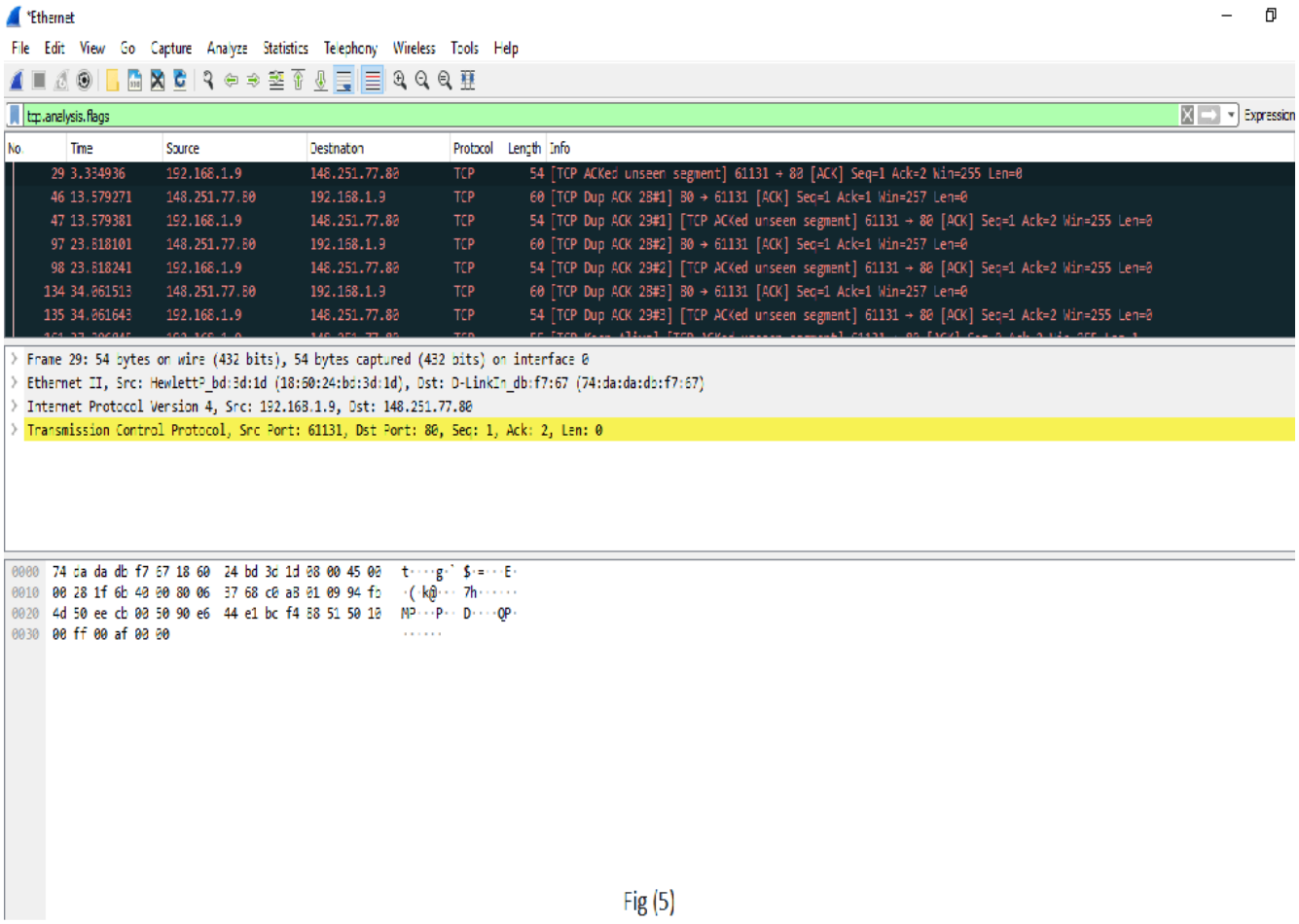


Fig (5)

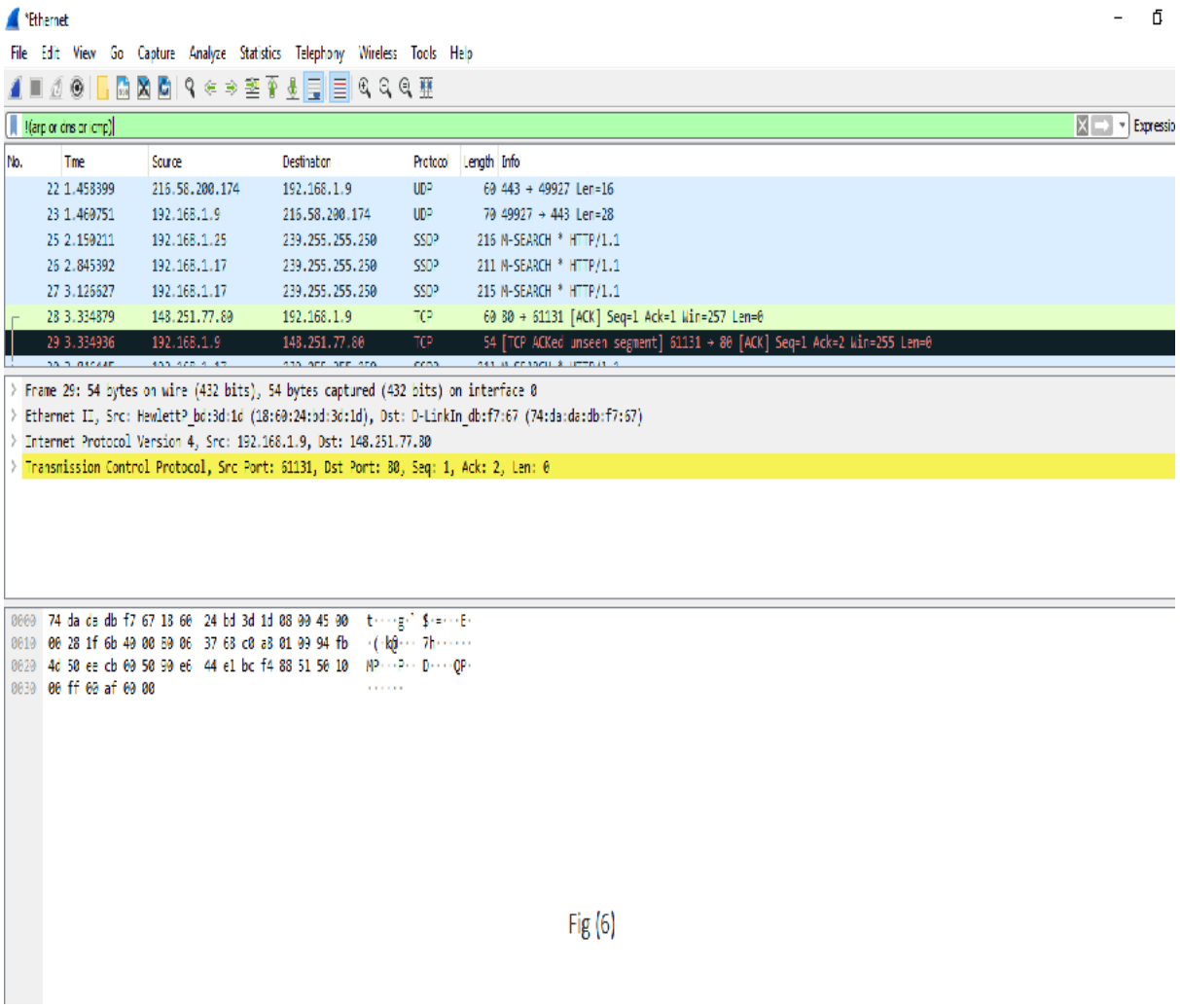

*Ethernet
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
!(arp or dns or icmp)
Expressio
No. Time Source Destination Protocol Length Info
22 1.458399 216.58.200.174 192.168.1.9 UDP 60 443 → 49927 Len=16
23 1.460751 192.168.1.9 216.58.200.174 UDP 70 49927 → 443 Len=28
25 2.159211 192.168.1.25 239.255.255.250 SSDP 216 M-SEARCH * HTTP/1.1
26 2.845392 192.168.1.17 239.255.255.250 SSDP 211 M-SEARCH * HTTP/1.1
27 3.126627 192.168.1.17 239.255.255.250 SSDP 215 M-SEARCH * HTTP/1.1
28 3.334879 148.251.77.80 192.168.1.9 TCP 60 80 → 61131 [ACK] Seq=1 Ack=1 Win=257 Len=0
29 3.334936 192.168.1.9 148.251.77.80 TCP 54 [TCP ACKed unseen segment] 61131 → 80 [ACK] Seq=2 Ack=2 Win=255 Len=0
Frame 29: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface 0
Ethernet II, Src: Hewlett_bc:3d:1d (18:60:24:bd:3c:1d), Dst: D-LinkIn_db:f7:67 (74:da:da:db:f7:67)
Internet Protocol Version 4, Src: 192.168.1.9, Dst: 148.251.77.80
Transmission Control Protocol, Src Port: 61131, Dst Port: 80, Seq: 1, Ack: 2, Len: 0
0000 74 da da db f7 67 18 60 24 bd 3d 1d 08 00 45 00
0010 00 28 1f 6b 40 00 80 06 37 68 c0 a8 01 09 94 fb
0020 4c 50 ee cb 00 50 00 e6 44 e1 bc f4 88 51 50 10
0030 00 ff 60 af 00 00

Fig (6)

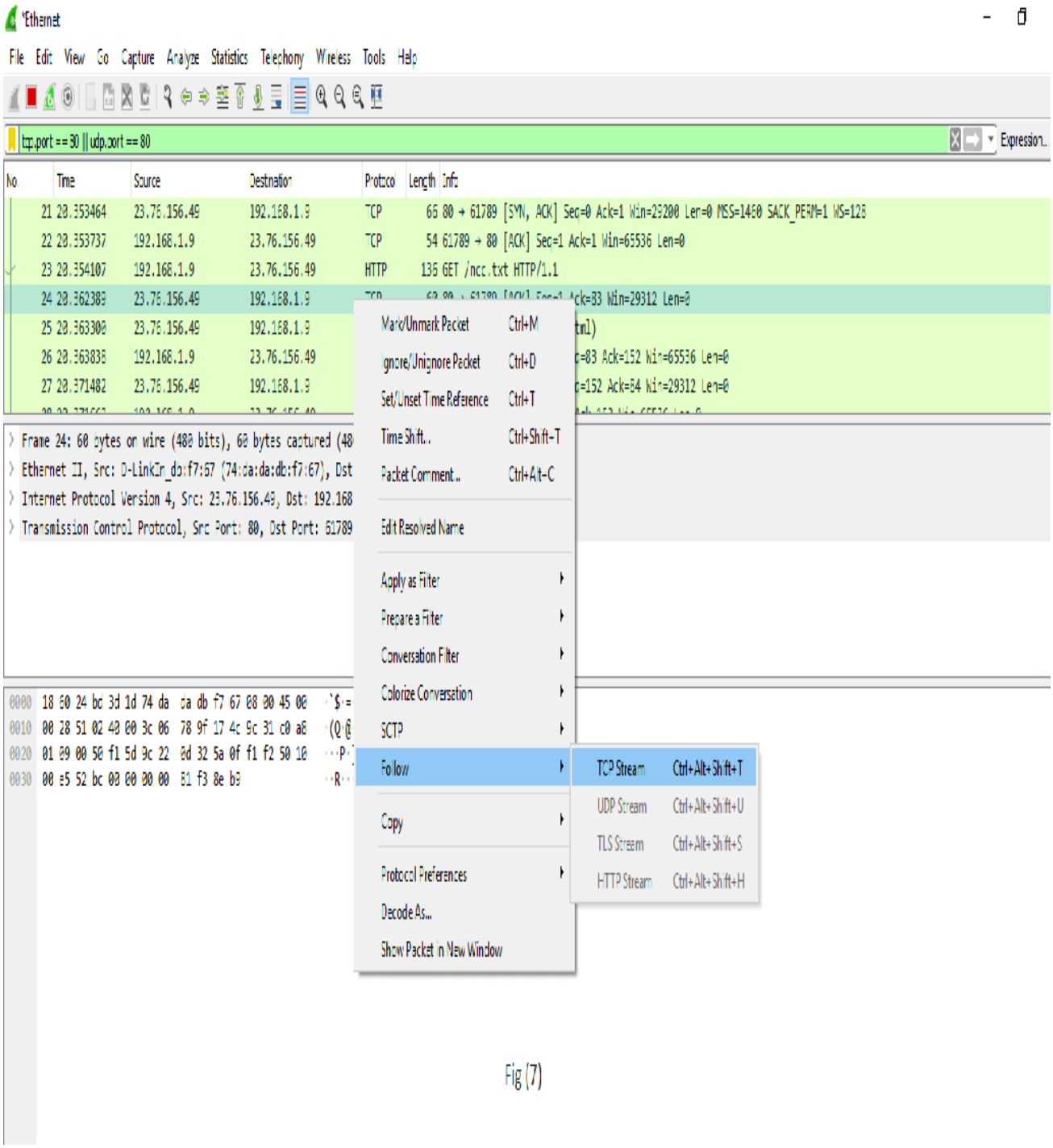

*Ethernet
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
tcp.port == 80 || udp.port == 80
Expression...
No. Time Source Destination Protocol Length Info
21 28.353464 23.76.156.49 192.168.1.9 TCP 66 80 → 61789 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1 WS=128
22 28.353737 192.168.1.9 23.76.156.49 TCP 54 61789 → 80 [ACK] Seq=1 Ack=1 Win=65536 Len=0
23 28.354107 192.168.1.9 23.76.156.49 HTTP 135 GET /ncc.txt HTTP/1.1
24 28.362383 23.76.156.49 192.168.1.9
25 28.363308 23.76.156.49 192.168.1.9
26 28.363838 192.168.1.9 23.76.156.49
27 28.371482 23.76.156.49 192.168.1.9
Frame 24: 60 bytes on wire (480 bits), 60 bytes captured (48
Ethernet II, Src: D-LinkIn_db:f7:67 (74:da:da:db:f7:67), Dst
Internet Protocol Version 4, Src: 23.76.156.49, Dst: 192.168
Transmission Control Protocol, Src Port: 80, Dst Port: 61789
0000 18 e0 24 bc 3d 1d 74 da da db f7 67 08 00 45 00
0010 00 28 51 02 40 00 3c 06 78 9f 17 4c 9c 31 c0 a8
0020 01 09 00 50 f1 5d 9c 22 0d 32 5a 0f f1 f2 50 10
0030 00 e5 52 bc 00 00 00 00 81 f3 8e b9
Mark/Unmark Packet Ctrl+M
Ignore/Unignore Packet Ctrl+D
Set/Unset Time Reference Ctrl+T
Time Shift... Ctrl+Shift-T
Packet Comment... Ctrl+Alt-C
Edit Resolved Name
Apply as Filter
Prepare a Filter
Conversation Filter
Colorize Conversation
SCTP
Follow
Copy
Protocol Preferences
Decode As...
Show Packet in New Window
TCP Stream Ctrl+Alt+Shift+T
UDP Stream Ctrl+Alt+Shift+U
TLS Stream Ctrl+Alt+Shift+S
HTTP Stream Ctrl+Alt+Shift+H

Fig (7)

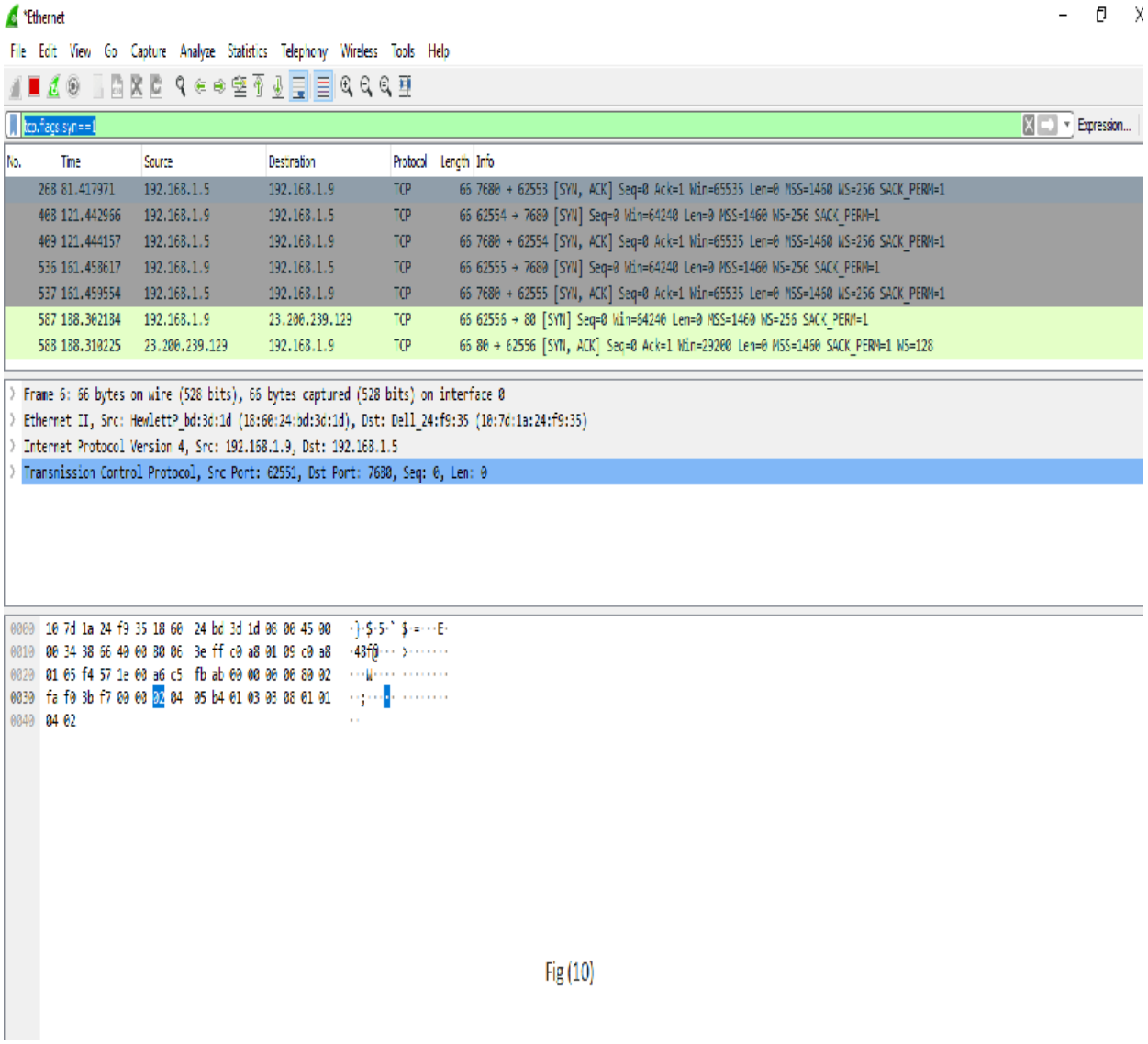

*Ethernet
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
tcp.flags.syn==1
Expression...
No. Time Source Destination Protocol Length Info
268 81.417971 192.168.1.5 192.168.1.9 TCP 66 7680 → 62553 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1
408 121.442956 192.168.1.9 192.168.1.5 TCP 66 62554 → 7680 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
409 121.444157 192.168.1.5 192.168.1.9 TCP 66 7680 → 62554 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1
536 161.458617 192.168.1.9 192.168.1.5 TCP 66 62555 → 7680 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
537 161.459554 192.168.1.5 192.168.1.9 TCP 66 7680 → 62555 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM=1
567 188.302184 192.168.1.9 23.200.239.129 TCP 66 62556 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
568 188.319225 23.200.239.129 192.168.1.9 TCP 66 80 → 62556 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1460 SACK_PERM=1 WS=128
Frame 6: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0
Ethernet II, Src: Hewlett?_bd:3c:1d (18:60:24:bd:3c:1d), Dst: Dell_24:f9:35 (18:7d:1a:24:f9:35)
Internet Protocol Version 4, Src: 192.168.1.9, Dst: 192.168.1.5
Transmission Control Protocol, Src Port: 62551, Dst Port: 7680, Seq: 0, Len: 0
0000 18 7d 1a 24 f9 35 18 60 24 bd 3d 1d 08 00 45 00
0010 00 34 38 66 40 00 80 06 3e ff c0 a8 01 09 c0 a8
0020 01 05 f4 57 1e 00 a6 c5 fb ab 00 00 00 00 80 02
0030 fa f0 3b f7 00 00 02 04 05 b4 01 03 03 08 01 01
0040 04 02

Fig (10)

Below is the list of filters used in Wireshark:

Filters	Description
ip.addr Example- ip.addr==10.0.10.142 ip.src ip.dst	It is used to specify the IP address as the source or the destination. This example will filter based on this IP address as a source and a destination. If we want for a particular source or destination then, It is used for the source filter. It is used for the destination.
protocol Example- dns or http 'Dns and http' is never used.	This command filters based on the protocol. It requires the packet to be either dns protocol or http protocol and will display the traffic based on this. We would not use the command 'dns and http' because it requires the packet to be both, dns as well as http, which is impossible.
tcp.port Example: tcp.port==443	It sets filter based on the specific port number. It will filter all the packets with this port number.
4. udp.port	It is same as tcp.port. Instead, udp is used.
tcp.analysis.flags example is shown in **fig(5)**.	Wireshark can flag TCP problems. This command will only display the issues that Wireshark identifies. Example, packet loss, tcp segment not captured, etc. are some of the problems. It quickly identifies the problem and is widely used.
6.!() For example, !(arp or dns or icmp) This is shown in **fig (6)**.	It is used to filter the list of protocols or applications, in which we are not interested. It will remove arp, dns, and icmp, and only the remaining will be left or it clean the things that may not be helpful.
Select any packet. Right-click on it and select 'Follow' and then select' TCP stream.' Shown in fig. (7).	It is used if you want to work on a single connection on a TCP conversation. Anything related to the single TCP connection will be displayed on the screen.
tcp contains the filter For example- tcp contains Facebook Or udp contains Facebook	It is used to display the packets which contain such words. In this, Facebook word in any packet in this trace file i.e., finding the devices, which are talking to Facebook. This command is useful if you are looking for a username, word, etc.
http.request For the responses or the response code, you can type http.response.code==200	It will display all the http requests in the trace file. You can see all the servers, the client is involved.
tcp.flags.syn==1 This is shown in fig (10). tcp.flags.reset	This will display all the packets with the sync built-in tcp header set to 1. This will show all the packets with tcp resets.

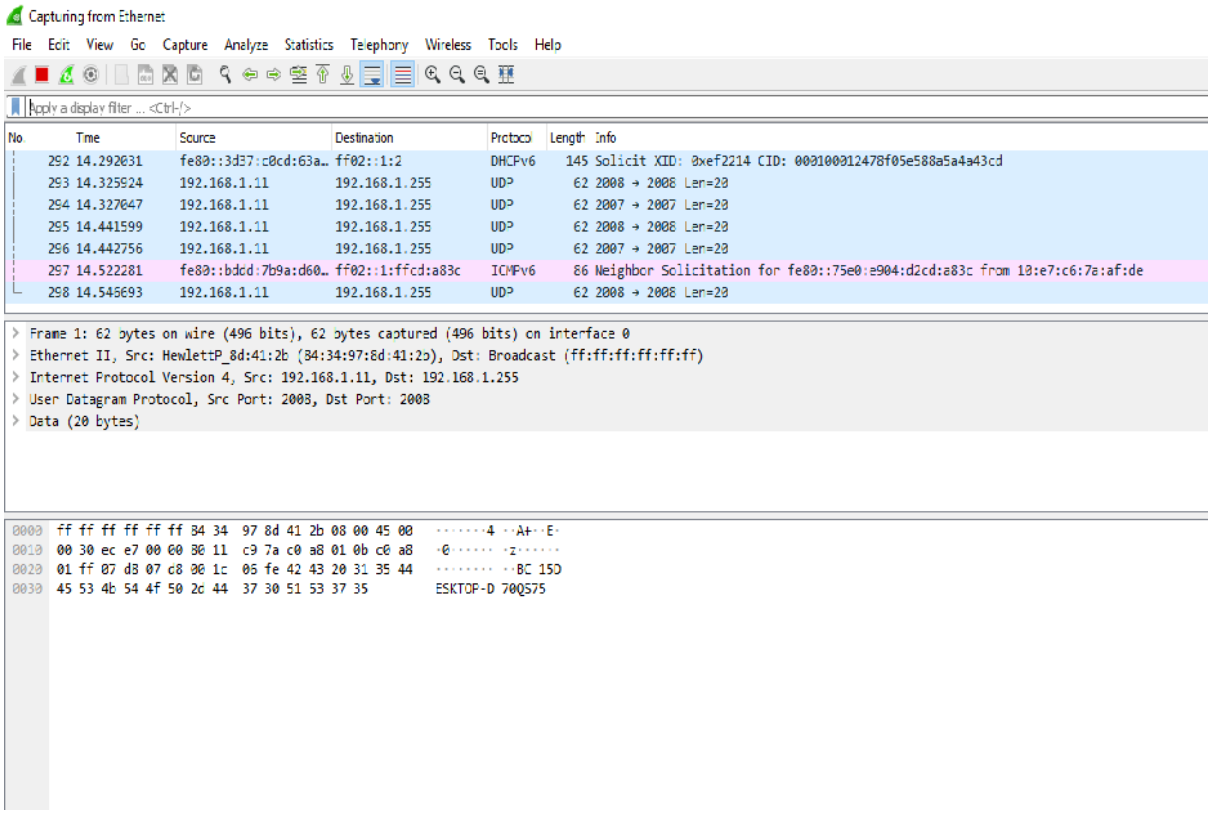
Wireshark packet sniffing

Wireshark is a packet sniffing program that administrators can use to isolate and troubleshoot problems on the network. It can also be used to capture sensitive data like usernames and passwords. It can also be used in wrong way (hacking) to ease drop.

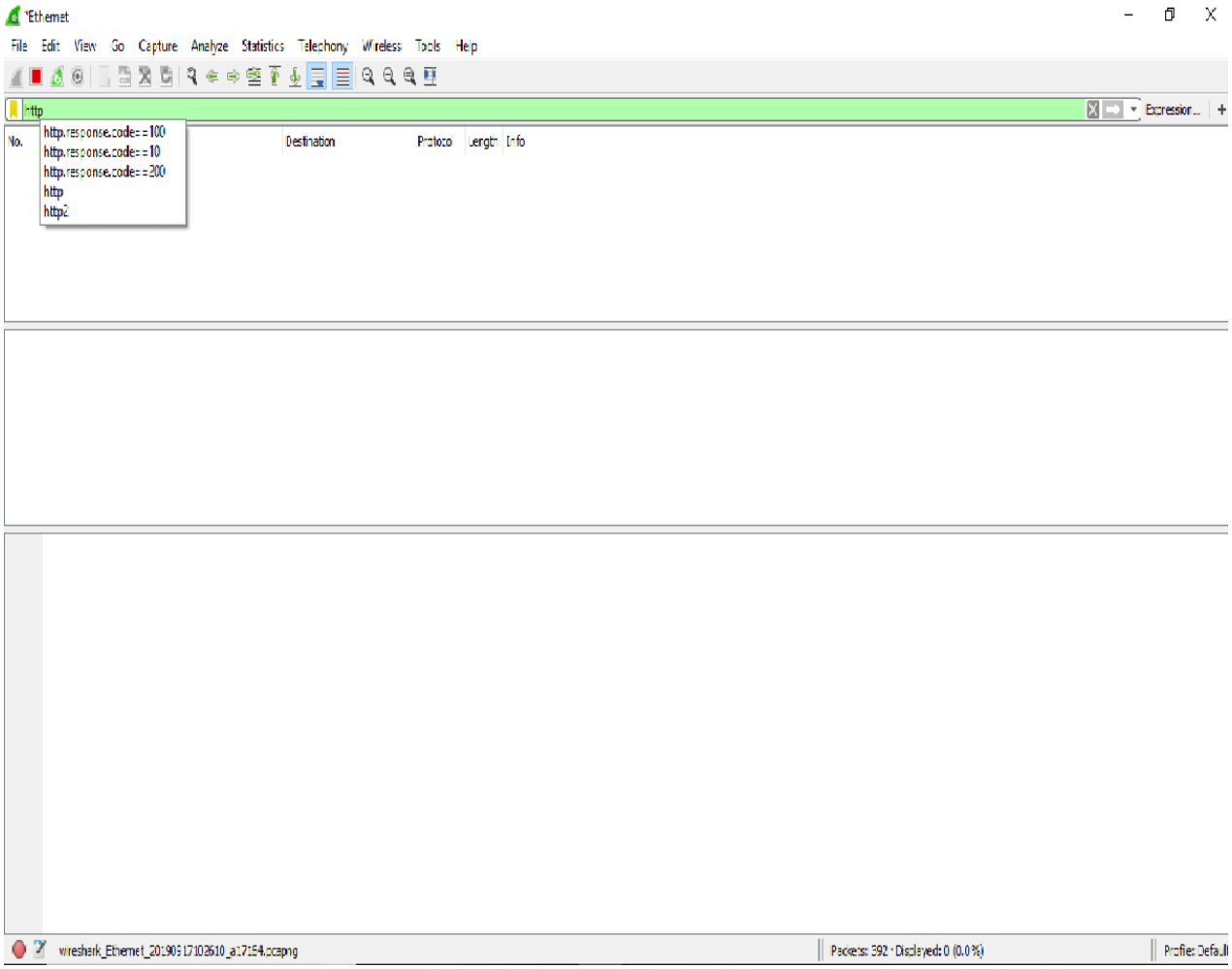
Packet sniffing is defined as the process to capture the packets of data flowing across a computer network. The Packet sniffer is a device or software used for the process of sniffing.

Below are the steps for packet sniffing:

- Open the Wireshark Application.
- Select the current interface. Here in this example, interface is Ethernet that we would be using.
- The network traffic will be shown below, which will be continuous. To stop or watch any particular packet, you can press the red button below the menu bar.



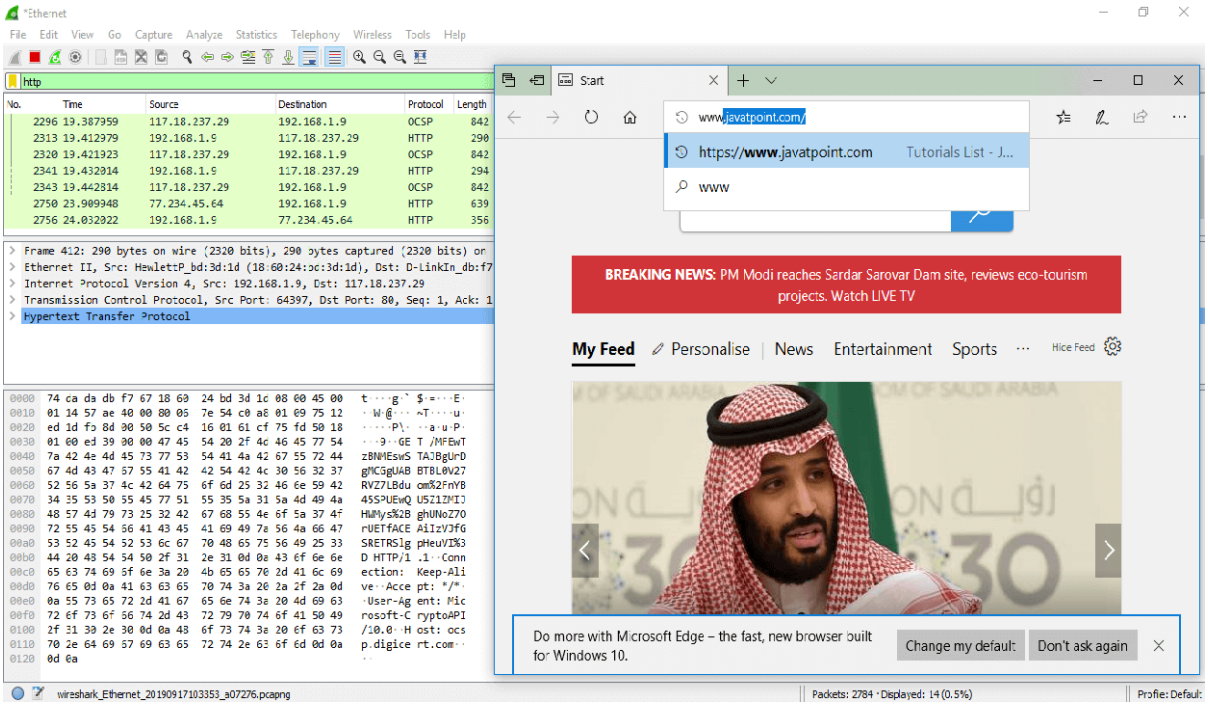
Apply the filter by the name 'http.' After the filter is applied, the screen will look as:

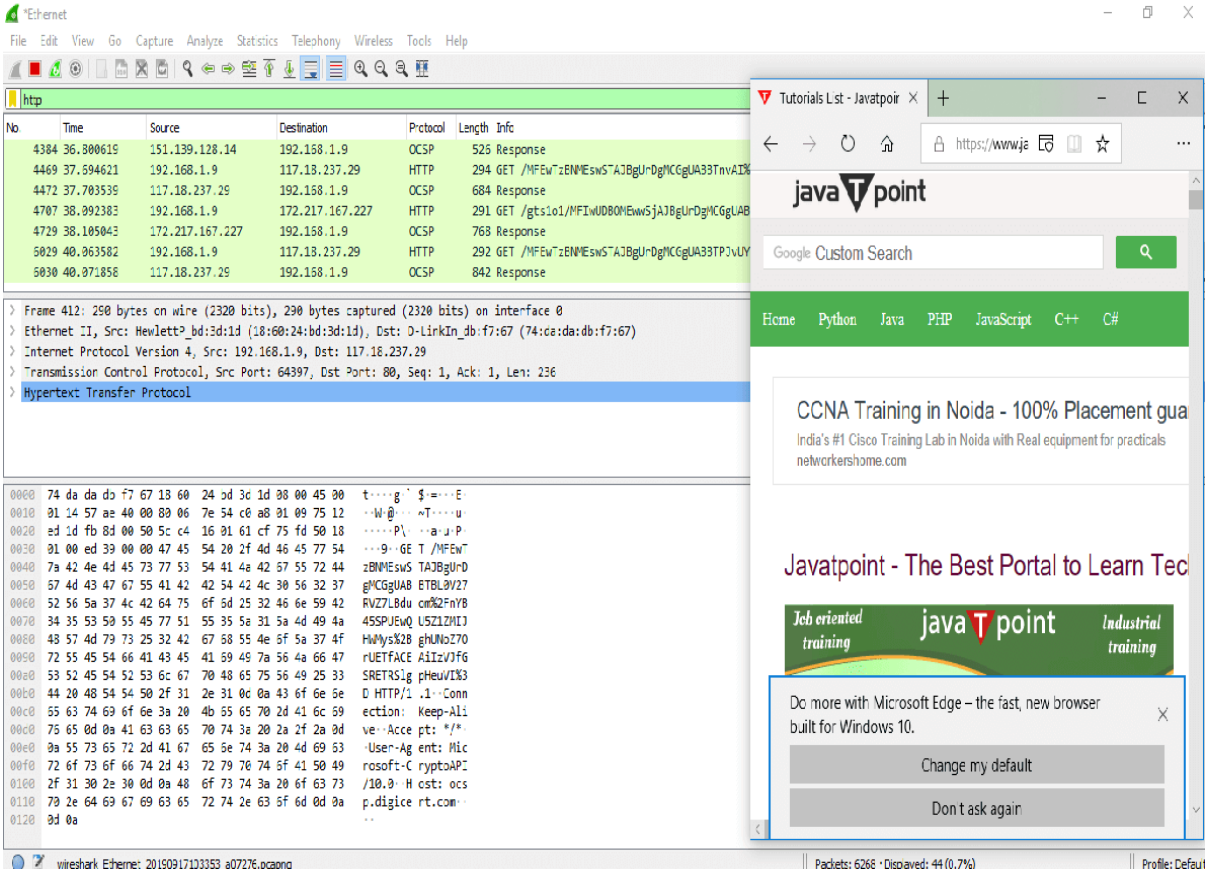


The above screen is blank, i.e.; there is no network traffic as of now.

Open the browser. In this example, we have opened the 'Internet Explorer.' You can choose any browser.

As soon as we open the browser, and type any address of the website, the traffic will start showing, and exchange of the packets will also start. The image for this is shown below:



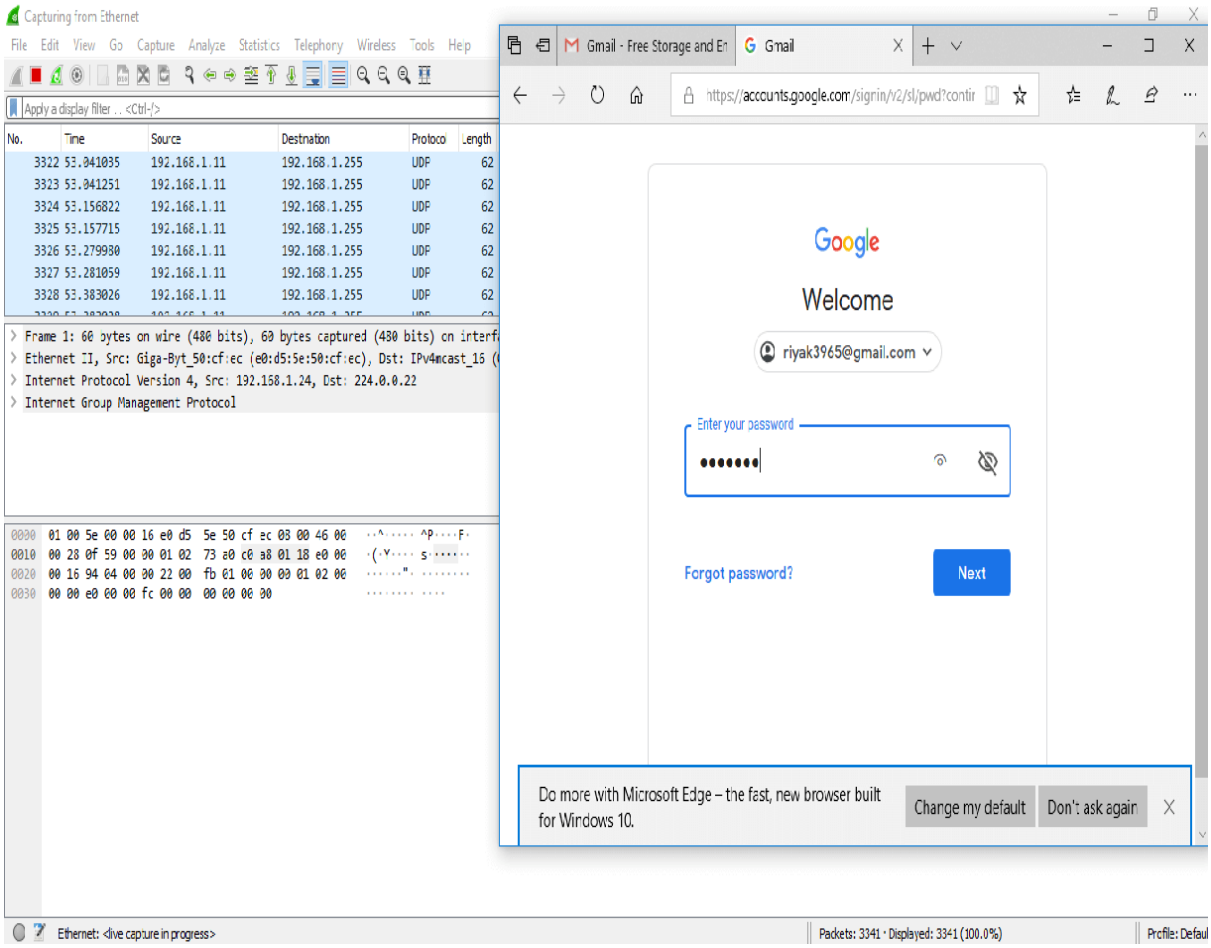


The above process explained is called as **packet sniffing**.

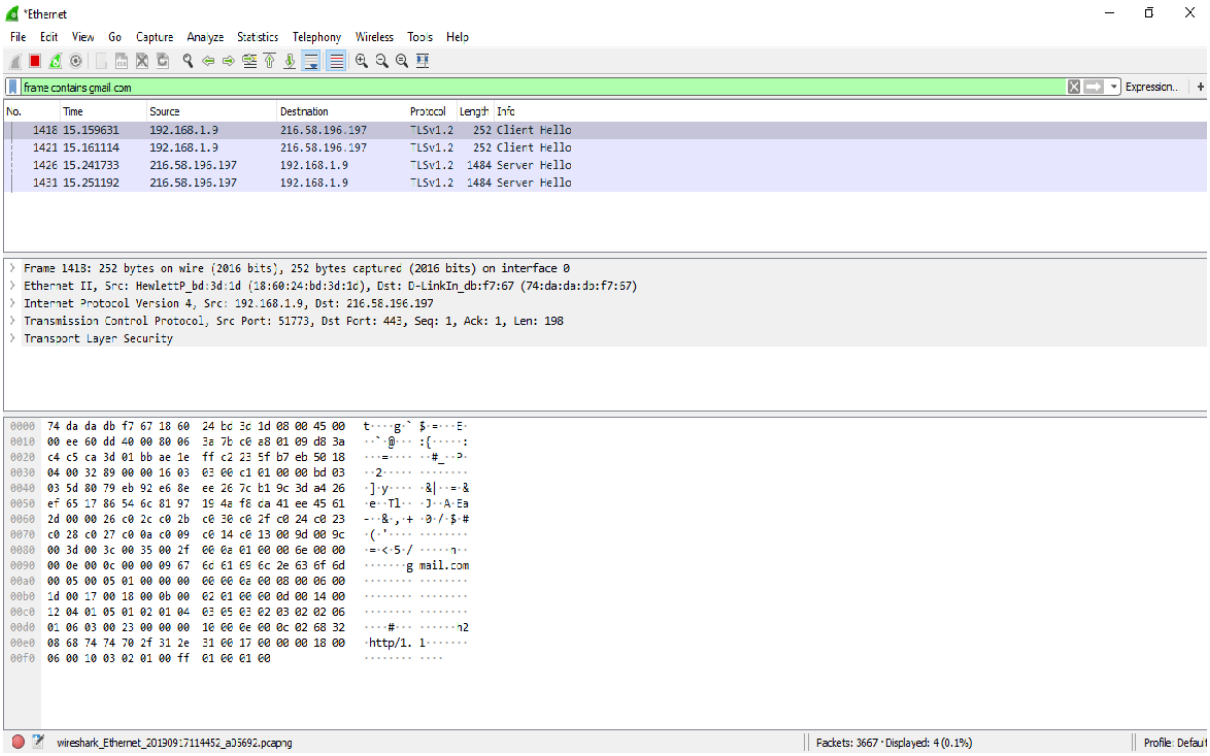
Username and password sniffing

It is the process used to know the passwords and username for the particular website. Let's take an example of gmail.com. Below are the steps:

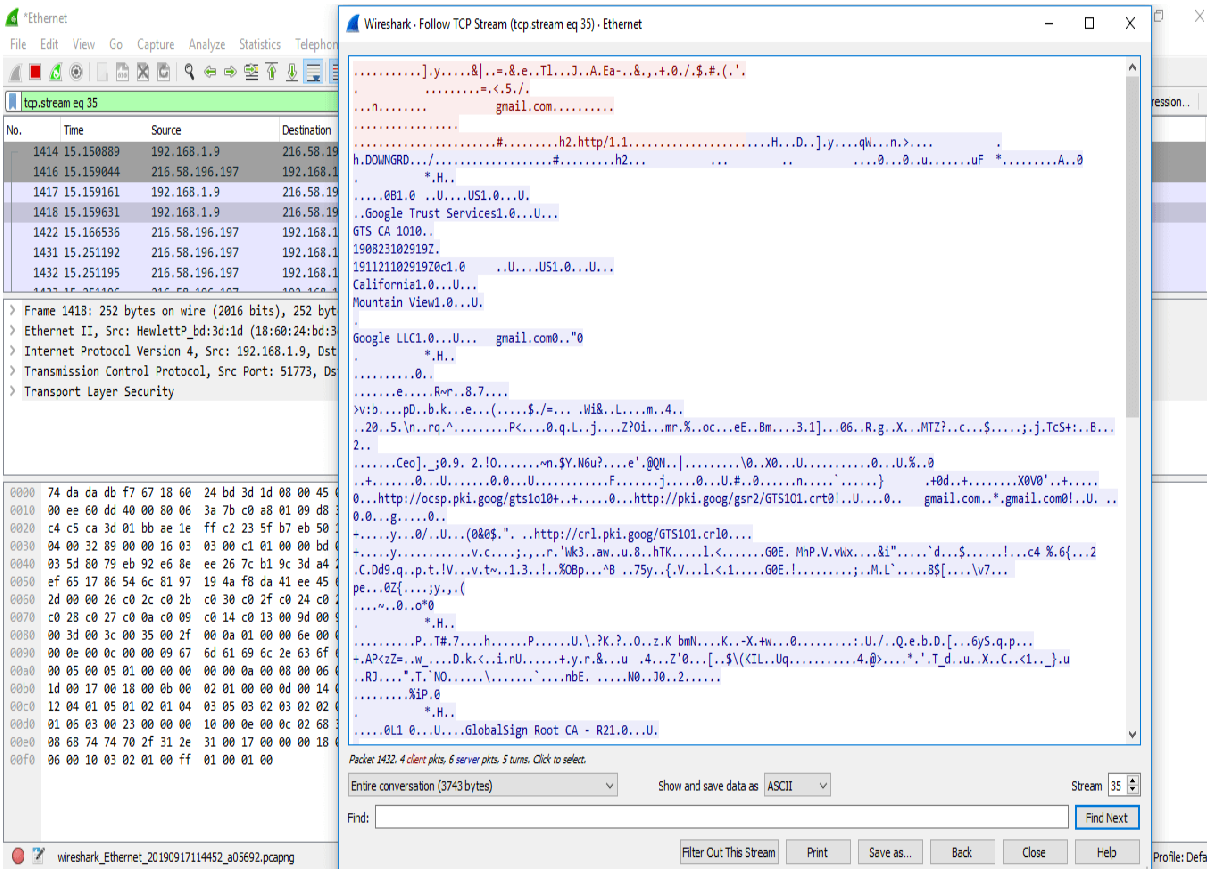
- Open the Wireshark and select the suitable interface.
- Open the browser and enter the web address. Here, we have entered gmail.com, which is highly secured. Enter your email address and the password. The image is shown below:



- Now, go to the Wireshark and on the filters block, enter 'frame contains gmail.com.' Then you can see some traffic.



- Right-click on the particular network and select 'Follow', and then 'TCP Stream.' You can see that all the data is secured in the encrypted form.



In the arrow shown above, the 'show and save data as' has many choices. These options are- **ASCII, C Arrays, EBCDIC (Extended Binary Coded Decimal Interchange Code)**, etc. EBCDIC is used in mainframe and mid-range IBM computer operating systems.

Wireshark Statistics

The Wireshark provides a wide domain of statistics. They are listed below:

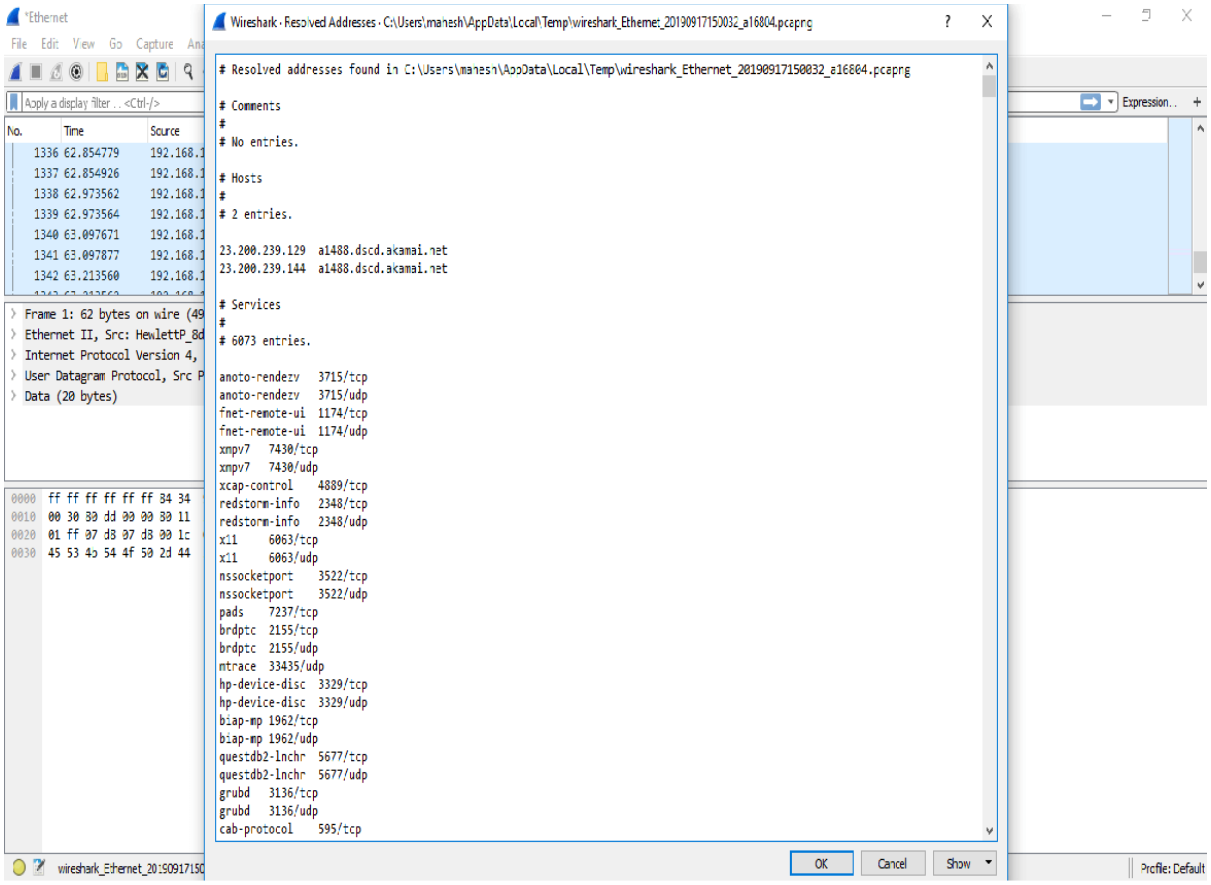


Fig (b)

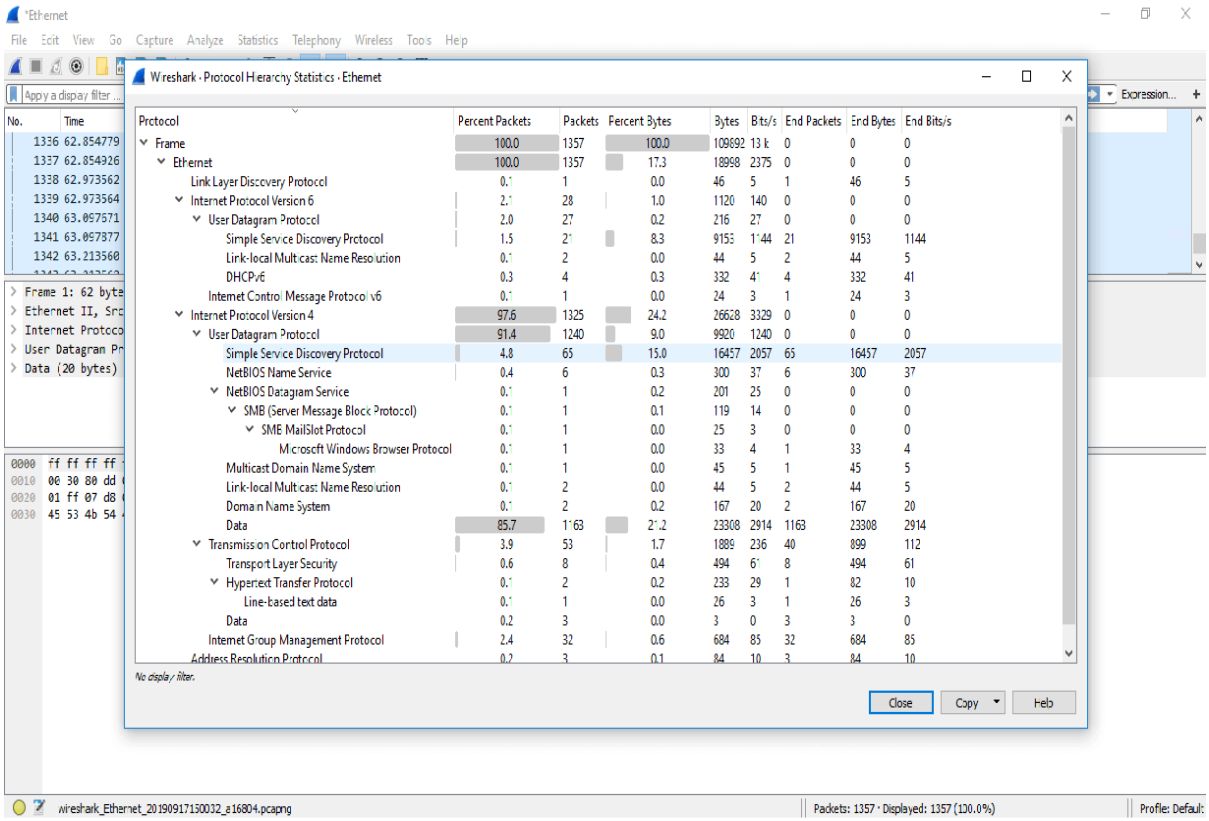

*Ethernet
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Wireshark · Protocol Hierarchy Statistics · Ethernet
Protocol
Percent Packets
Packets
Percent Bytes
Bytes
Bits/s
End Packets
End Bytes
End Bits/s
Frame 100.0 1357 100.0 109692 13 k 0 0 0
Ethernet 100.0 1357 17.3 18998 2375 0 0 0
Link Layer Discovery Protocol 0.1 1 0.0 46 5 1 46 5
Internet Protocol Version 6 2.1 28 1.0 1120 140 0 0 0
User Datagram Protocol 2.0 27 0.2 216 27 0 0 0
Simple Service Discovery Protocol 1.5 21 8.3 9153 1144 21 9153 1144
Link-local Multicast Name Resolution 0.1 2 0.0 44 5 2 44 5
DHCPv6 0.3 4 0.3 332 41 4 332 41
Internet Control Message Protocol v6 0.1 1 0.0 24 3 1 24 3
Internet Protocol Version 4 97.6 1325 24.2 26628 3329 0 0 0
User Datagram Protocol 91.4 1240 9.0 9920 1240 0 0 0
Simple Service Discovery Protocol 4.8 65 15.0 16457 2057 65 16457 2057
NetBIOS Name Service 0.4 6 0.3 300 37 6 300 37
NetBIOS Datagram Service 0.1 1 0.2 201 25 0 0 0
SMB (Server Message Block Protocol) 0.1 1 0.1 119 14 0 0 0
SMB MailSlot Protocol 0.1 1 0.0 25 3 0 0 0
Microsoft Windows Browser Protocol 0.1 1 0.0 33 4 1 33 4
Multicast Domain Name System 0.1 1 0.0 45 5 1 45 5
Link-local Multicast Name Resolution 0.1 2 0.0 44 5 2 44 5
Domain Name System 0.1 2 0.2 167 20 2 167 20
Data 85.7 1163 21.2 23308 2914 1163 23308 2914
Transmission Control Protocol 3.9 53 1.7 1889 236 40 899 112
Transport Layer Security 0.6 8 0.4 494 61 8 494 61
Hypertext Transfer Protocol 0.1 2 0.2 233 29 1 82 10
Line-based text data 0.1 1 0.0 26 3 1 26 3
Data 0.2 3 0.0 3 0 3 3 0
Internet Group Management Protocol 2.4 32 0.6 684 85 32 684 85
Address Resolution Protocol 0.2 3 0.1 84 10 3 84 10
No display filter.
Close
Copy
Help
wireshark_Ethernet_20190917150032_a16804.pcapng
Packets: 1357 · Displayed: 1357 (100.0%)
Profile: Default

Fig (c)

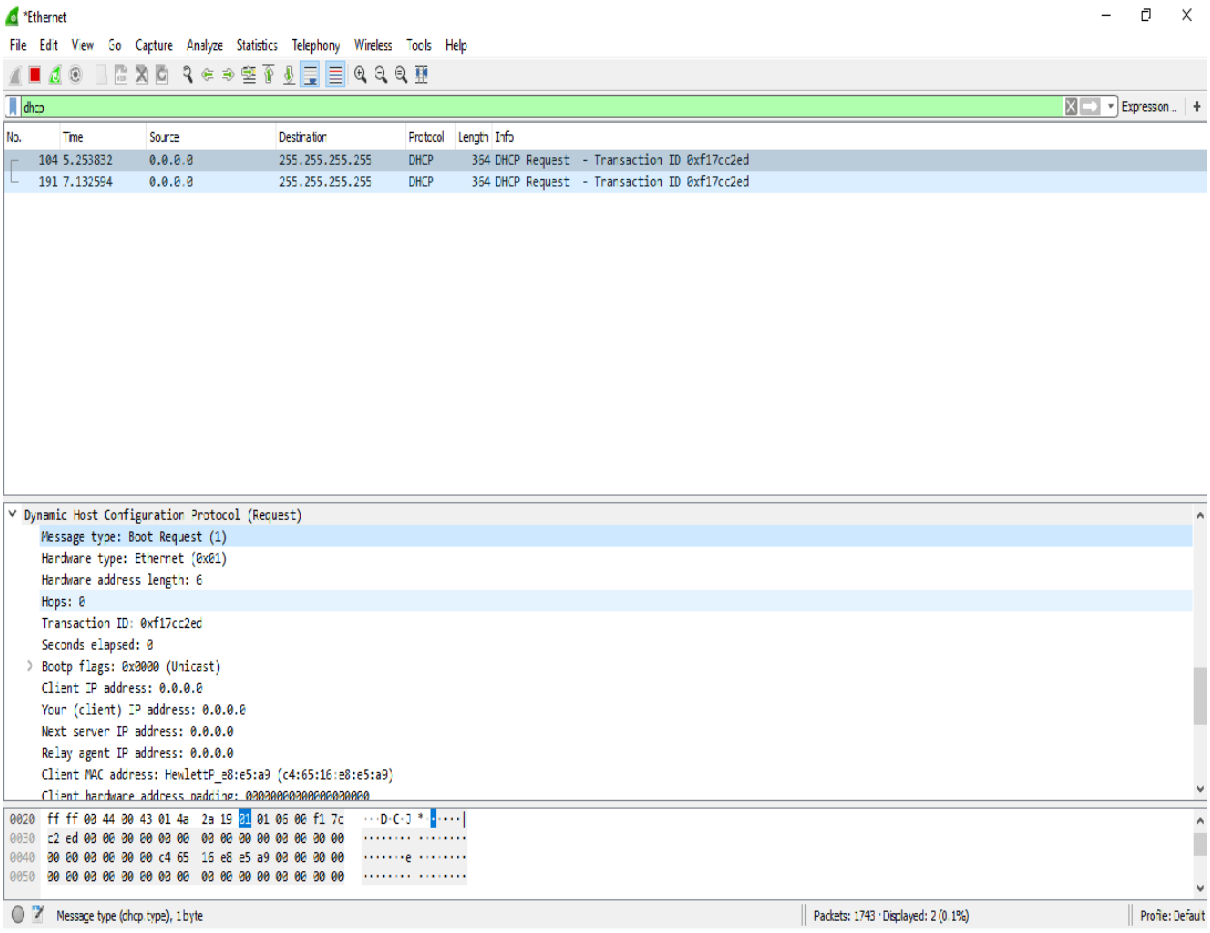


Fig (d)

Below is the list of statistics of Wireshark along with the description:

Capture file properties	It includes file, time, capture, interfaces (current interface in use), and Statistics (measurements).
Resolved addresses	This option includes all the types of the Top IP addresses and DNS that were resolved in your packet capture. It gives the idea of the different accessed resources during the packet capture process. It is shown in fig (b).
Protocol hierarchy	It is named as the tree of all the protocols listed in the capture process. The image is shown above in fig (c).

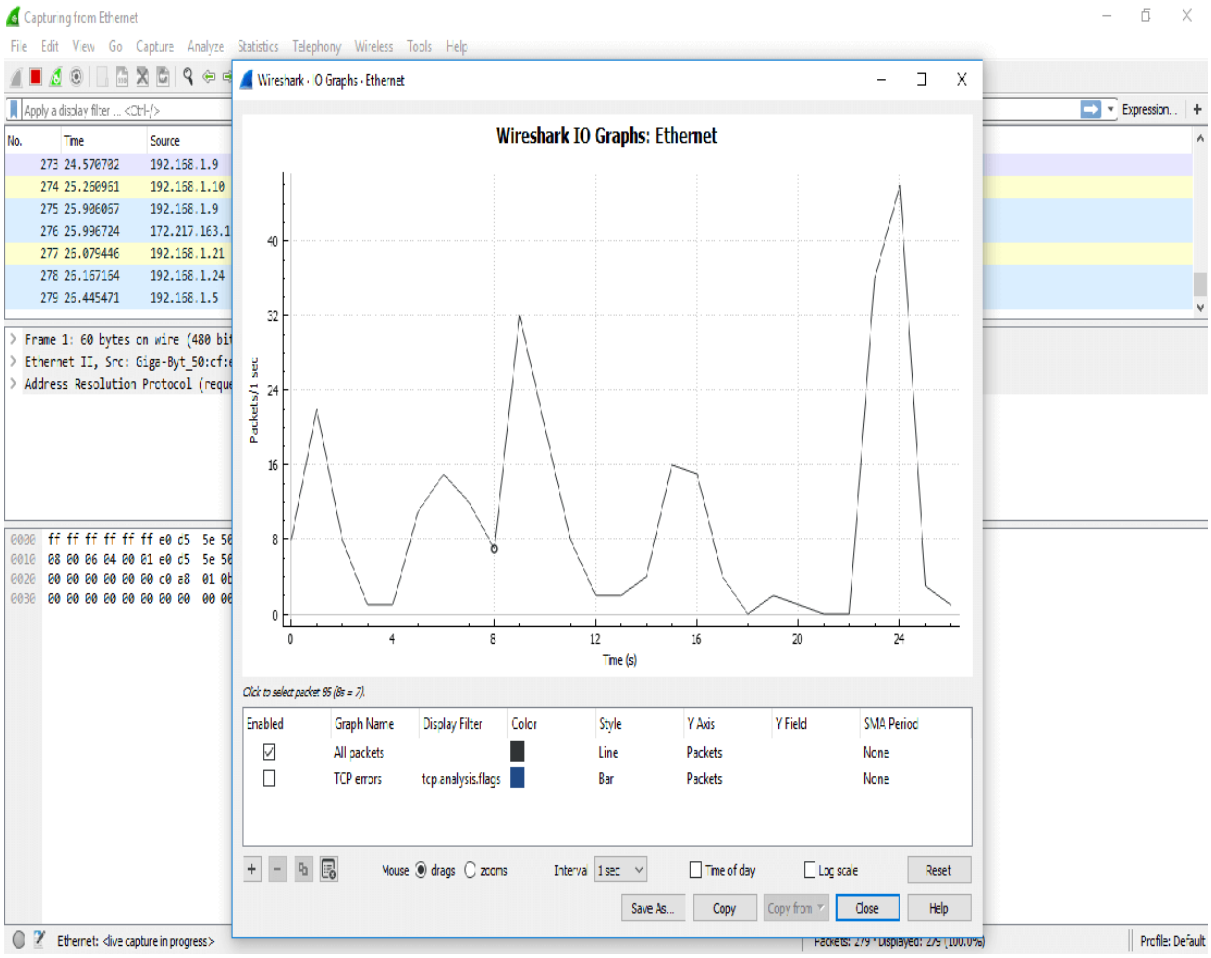
Conversations	Each row of the list gives the statistical value of a particular conversation.
Endpoints	It is defined as a logical endpoint of the separate protocol traffic of the specified protocol layer. For example0 IP address will send and receive all types of the packet to the particular IP addresses.
Packet lengths	It simply displays the characteristics of different packets lengths determined in the network.
I/O Graphs	It is the term used to display the graph of the captured packets. You can also apply filters during this process. The process is explained below in detail.
Service Response Time	It is the type of information which is available for many protocols. It is defined as the time it takes between the request and the response time. The protocol for which this service is available are: AFP (Apple Filing Protocol) CAMEL DCE-RPC DIAMETER FC (Fiber Channel) GTP (GPRS Tunneling Protocol) H.225 RAS LDAP (Lightweight Directory Access Protocol) MEGACO MGCP (Media Gateway Control Protocol) NCP (NetWare Core Protocol) ONC-RPC RADIUS SCSI SMB (Server Message Block Protocol)

	SMB2 (Server Message Block Protocol version 2)
DHCP (BOOTP) Statistics	It is implemented as the option of BOOTP. DHCP is client/server protocol, dynamically used to assign IP addresses to a DHCP client. If DHCP does not work, then some computer system uses APIPA (Automatic Private IP Address) to assign the IP addresses.
ONC-RPC Programs	It stands for Open Network Computing-Remote Procedure Call. It can use TCP and UDP as its transport protocol. ONC-RPC cannot be applied directly to filter in a capture process, but you can use TCP or UDP to filter on that one. It is shown in fig (d).
29West	It is defined as ULLM technology. It stands for Ultra-Low Latency Messaging.
ANCP	It stands for **Access Node Control Protocol**. It is an L2CP (Layer 2 Control Protocol) and a TCP based one. It has its

	adjacency layer which decides the messages exchange by the ANCP endpoints with the use of 'Capabilities.'
BACnet	It was designed specially to meet the communication needs of control systems and building automation. It is used for applications such as fire detecting systems, light control, etc. It provides the structure to exchange information despite the particular building service it performs.
Collectd	It is used to monitor the traffic on the specific TCP port.
DNS	It stands for Domain Name Server, which gives a detailed analysis of the DNS traffic. It provides the list of the codes returned in DNS. You can also view the errors through the traffic.
Flow-graph	It is a method to check connections between the client and the server. It is an efficient way to verify the connections between two endpoints. It also assists us with troubleshooting capabilities.
HART-IP	It gives the detail for the response, request, publishes, and error packets. It stands for Highway Addressable Remote Transducer over IP stats.
HPFEEDS	It determines the 'payload size per channel and Opcodes.'
HTTP	It has four options: • Packet counter (request types and response codes) • Requests (based on URL and the host)

	• Load distribution (based on server address and host) • Request sequences (sequences the HTTP's capture request as a tree)
HTTP2	It is the HTTP version 2.
Sametime	It is used to analyze the slow network traffic when the server and client have the sametime.
TCP Stream Graphs	It is explained below in detail:
UDP Multicast Streams	Through this command, stream parameters and burst parameters can be set. It includes OSPF, IGMP, and video streams.
F5	It includes the virtual server distribution and the tmm distribution. It specifies the tcpdump commands.
IPv4 Statistics **IPv6 Statistics**	These options determine all addresses, destination and ports, IP protocol types, and the source and destination address.

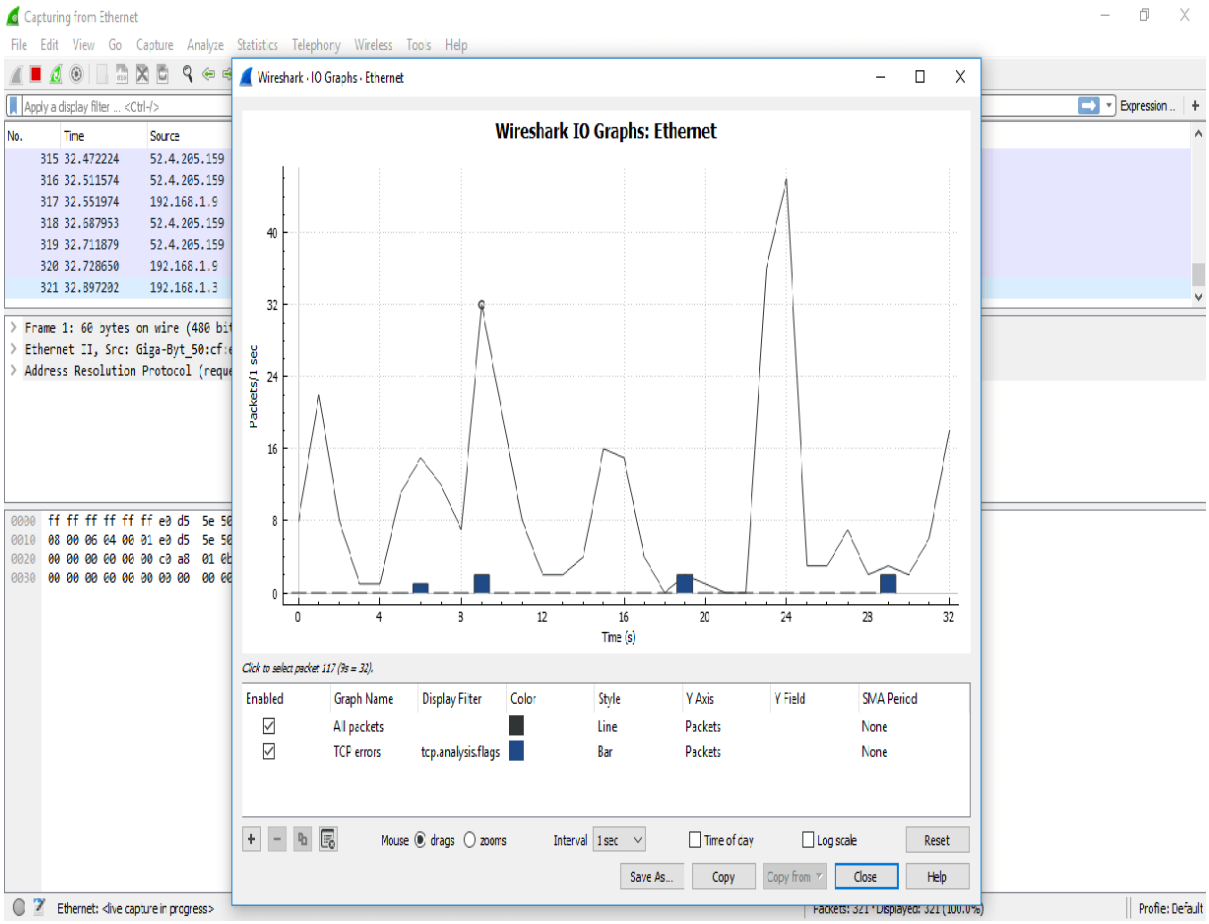
I/O GRAPHS



t shows the graph for the network traffic. The graph will look similar but changes as per the traffic involved. There is a table below the figure, which has some filters. Using the '+' sign, you can add more filters and use '-sign you can remove the existing filters. You can also change the color. For every particular filter, you can add a colored layer, which increases the visibility of the graph.

The tick option under the 'Enabled,' displays the layer according to your requirements.

For example, we have applied the filter 'TCP errors' and the changes can be viewed easily. The image is shown below:



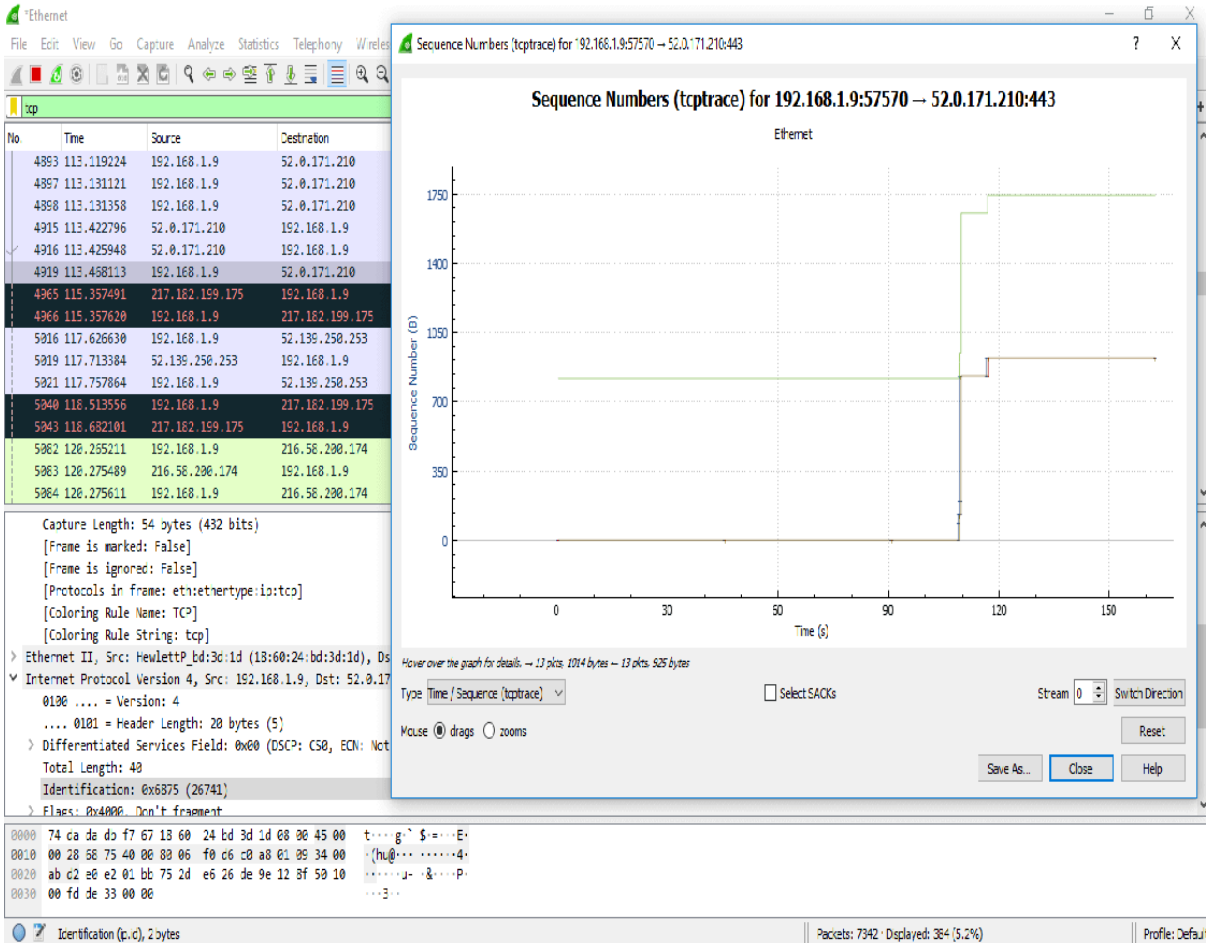
If you click on the particular point on the graph, you can watch the corresponding packet will be shown on the screen of the network traffic. You can also apply a filter on the particular port.

Another category of the graph comes under the option '**TCP Stream graphs**.'

It gives the visualization of the TCP sequence number with time.

Below are the steps to understand the **TCP Stream graphs**:

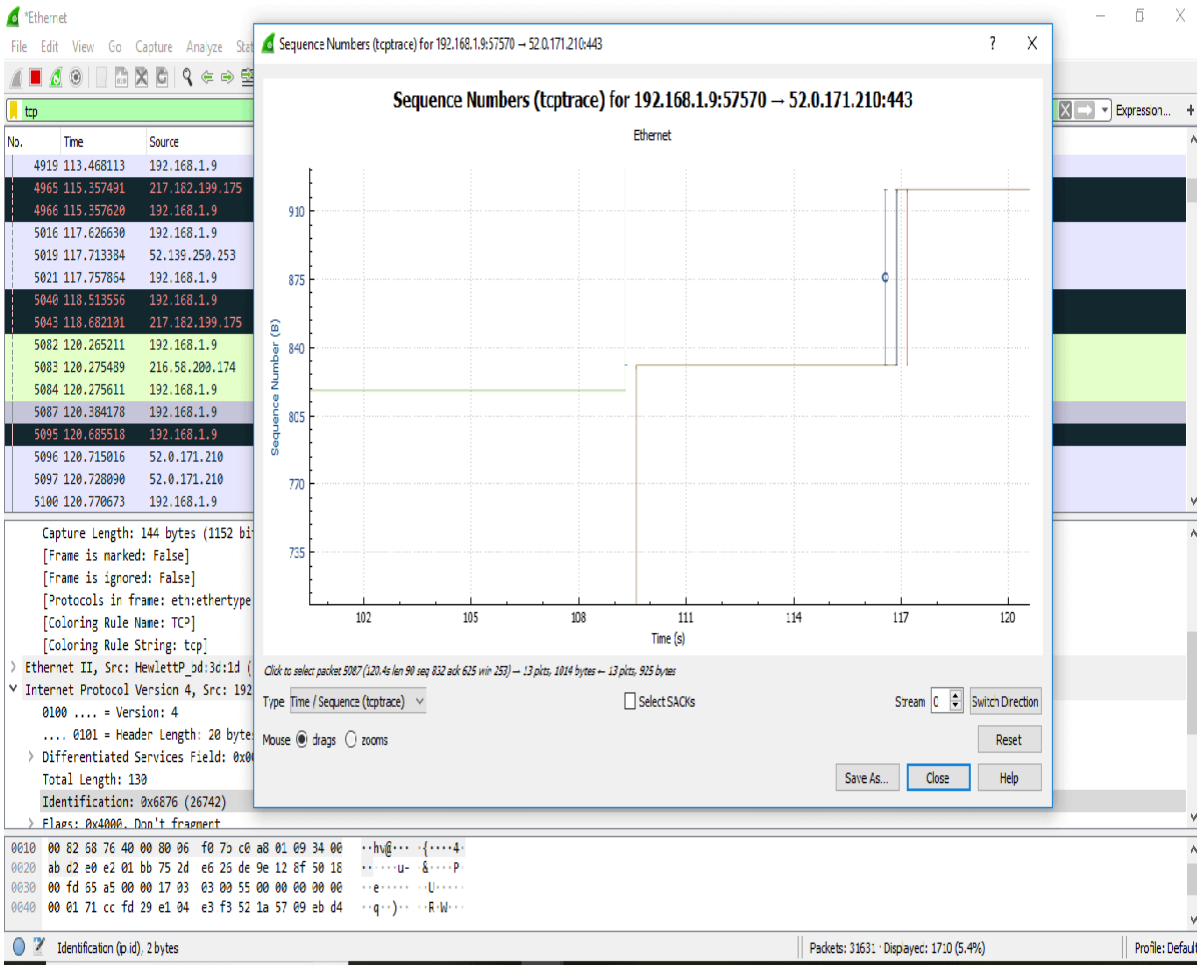
- Open the Wireshark. Click on the interface to watch the network traffic.
- Apply the filter as 'tcp.'
- Click on the option 'Statistics 'on the menu bar and select '**TCP Stream graphs**' and select 'Time sequence (tcptrace). You can also choose other options in the 'TCP Stream graphs' category depending on your requirements. Now the screen will look as:



Now, as you zoom on the graph, you will notice the points in detail. The lines shown are the packets. The length along the Y-axis shows how big the packet is. You can also see the green line going up and then comes at the same level. This means that the data has been ACK (Acknowledged). Here going up means that more data is being sent.

The data is being sent and then ACK, this is the proper use of the TCP. The flat line here signifies that nothing is happening.

The green line above is called '**received window**.' The gap between the received window and the packet, defines how much space is in the received buffer.



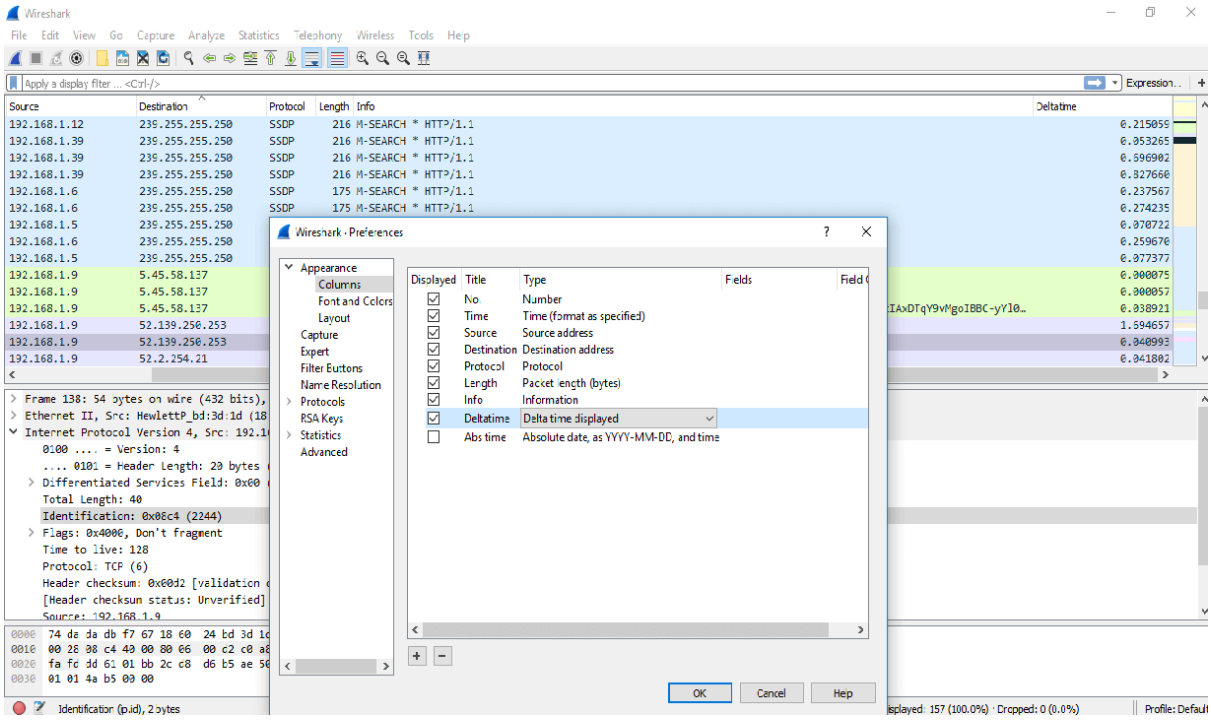
ACTS ABOUT WIRESHARK/ IMPORTANT STEPS/ MOST USED

Below are the facts or points implemented in real life:

Adding a delta column: To add any column, below are the steps:

- On any of the column menu, right-click and choose 'Column Preferences' and then select 'Column.'
- Click on the '+' sign, and add the column by name like delta-time and under the 'Type' category, select the delta time or delta time displayed.

The screen will then look as:



Below the captured packets, the data you see in the **square brackets** is the information that is not available in the packet itself. It is something that Wireshark displays for your benefit. If you want to add anything from this screen to the column area, you can right-click and select 'Apply as column.' That option will be added to the capture screen.

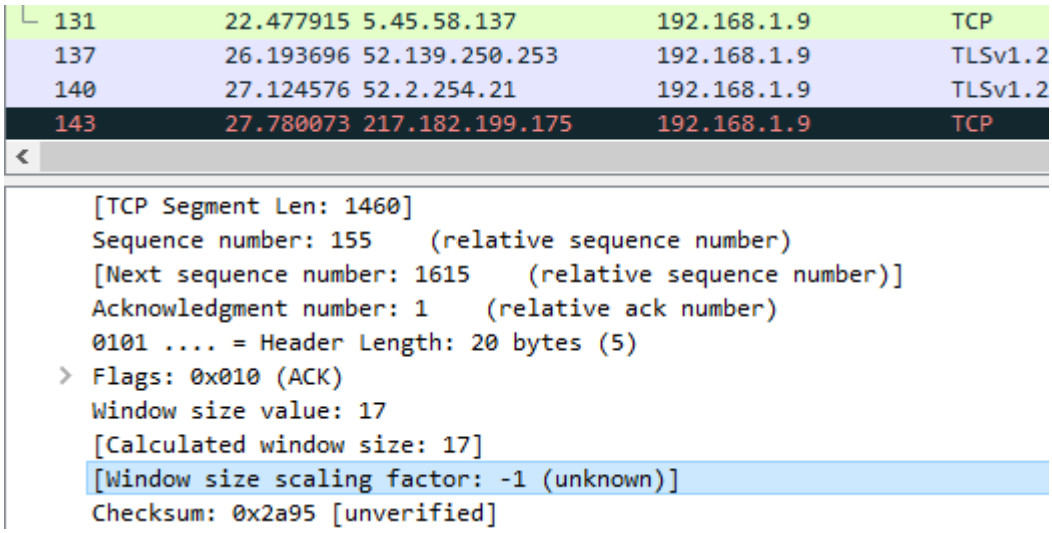
The most important is:

3 Way-Handshake

-
    -
        - When you are capturing your data, analyze the problem, you will get the three-way handshake.
        - It contains good options like the TCP options.
        - From this, you can determine the shift time and figure out if you have captured packets on the client-side or the server-side. There is a little delay between SYN and SYN-

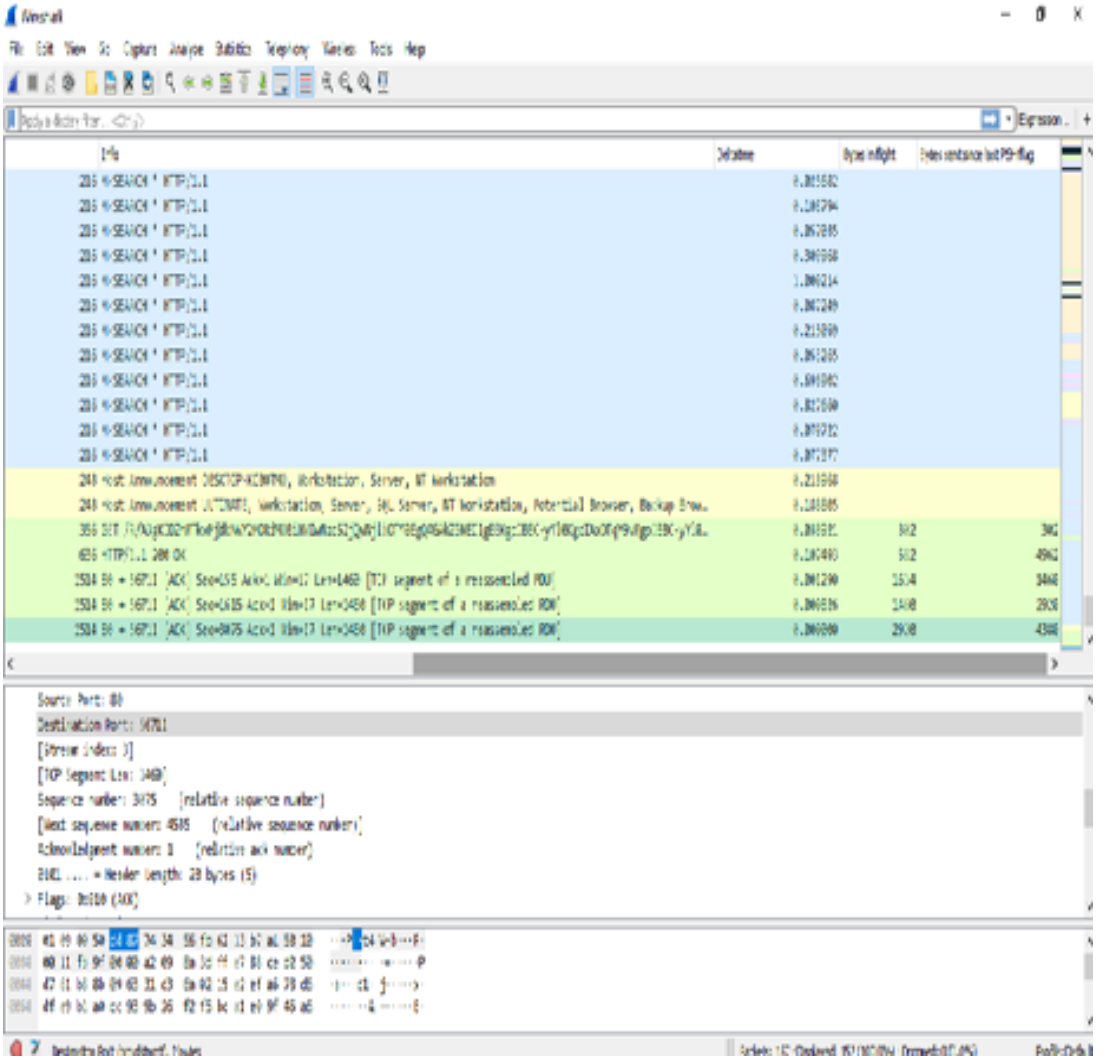
ACK packet at server-side while there is a more delay between the SYN and SYN-ACK at the client-side. There is a delay at the server-side only between the SYN-ACK and ACK. The SYN has to reach to the client. After the three-way handshake, the data has to reach the server.

You can also notice the difference in the TCP options between the SYN and SYN-ACK packets. The window scaling factor is also essential, as shown below:

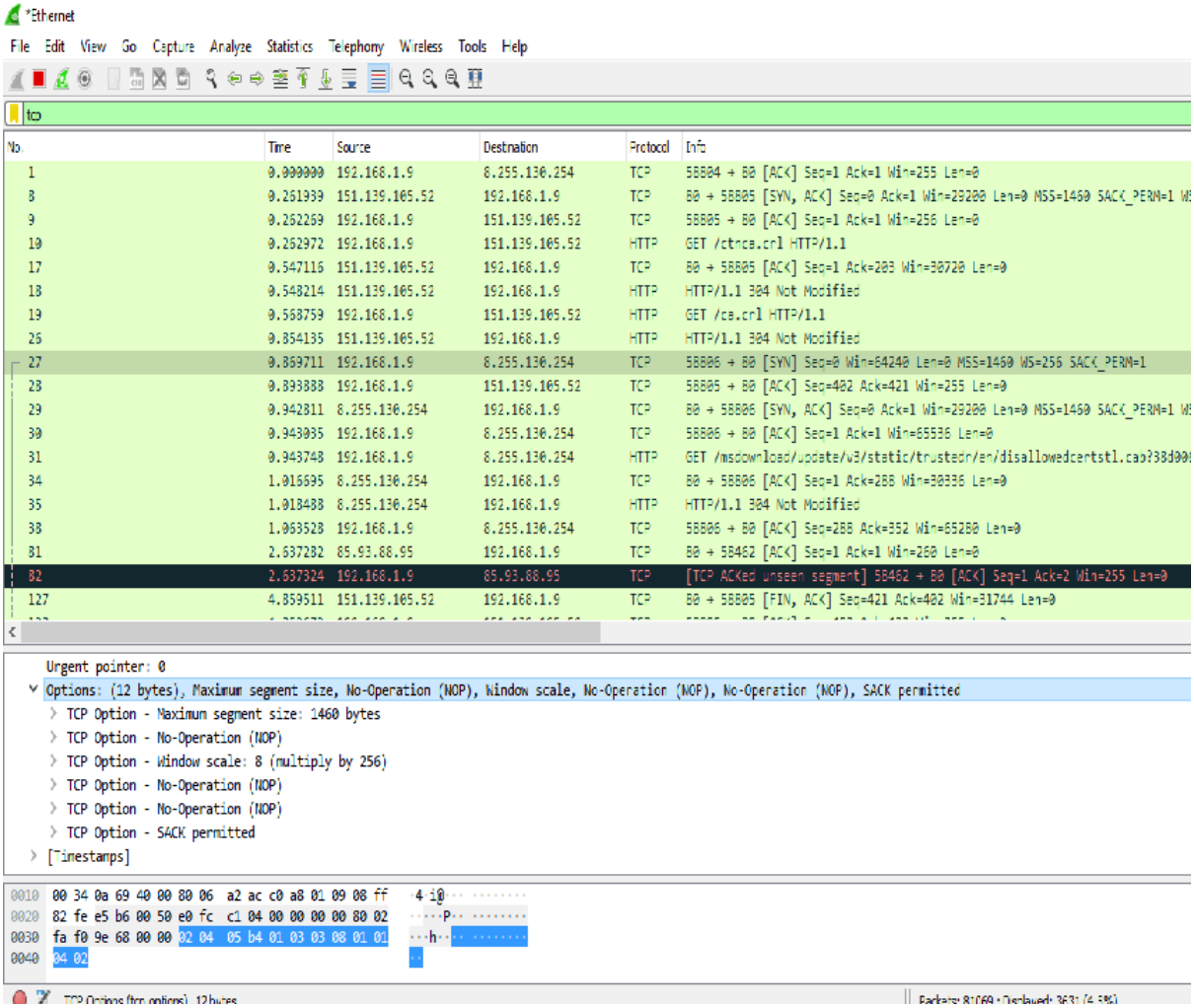


Without three-way handshake, you cannot view the window scaling factor.

-
    -
        - One sequence number means 1 byte of data. It also has an importance of the TCP Stream Graphs which is already explained above.
        - Under the TCP options, capture window, you can see the information about the 'PSH byte' and 'Bytes in flight.' Right-click on that and choose 'Apply as Column.' You can see both the columns and data according to it. The image for this is shown below:



- In TCP Header, three-way handshake MSS (Maximum Header Size) means that the maximum amount of data it can receive of TCP payload. The image is shown below:



-
    -
        - MSS 1460 implies that this is per packet amount of data. This size varies from packet to packet. Something like a router, firewall, etc. will do MSS clamping because it knows what is going forward. It checks the value greater than 8000 bytes and brings down it to an appropriate level so that it can go across without fragmentation or being dropped.
        - The data with the 0 is the ax coming back in the capture window. You can notice that the data and ACK are different at each point. If we are on the acknowledgment side, we know that we have to send the ACK after two packets. A sender can send X amount of packets

depending on its congestion window. A sender can send packets at once also. After the packets will go at the receiver and then the acknowledgment comes back. The sender can send all packets before the ACK reaches it. If the buffer has less space left, then the sender has to send the packets according to space. The ACK arrives on time, and if there is a delay in the ACK, syncing will be delayed. So above it's, just a perspective example explained.

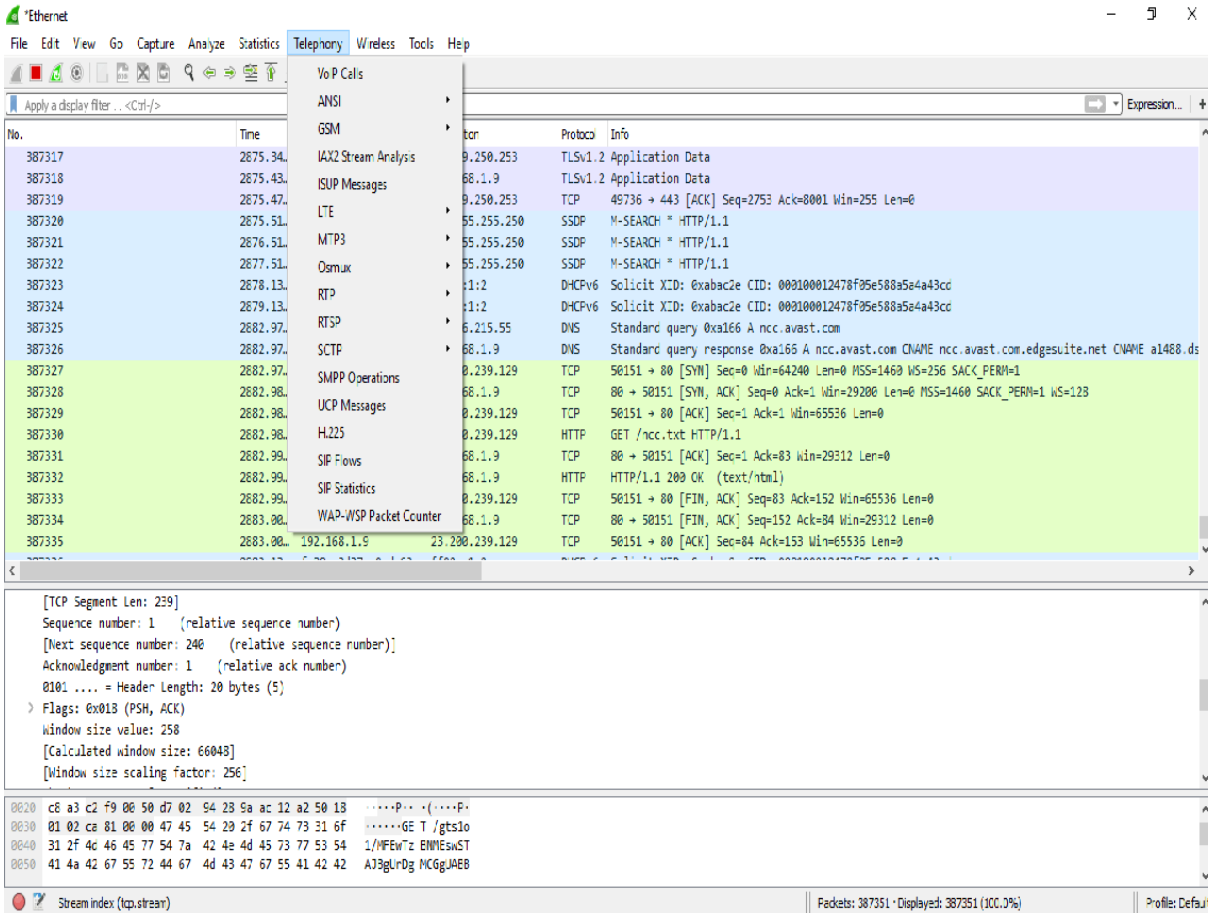
Some Facts about Wireshark:

-
    -
        - We do recommend not to disable the default settings of the TCP and Wireshark unless you know what you?re doing.
        - If there are the blank page and slow loading, then it is unusable.
        - It is good to capture packets from both ends.
        - Lean on your provider when you have the data.
        - It is a LIVE CAPTURE software used widely.
        - It can also capture packets from a set of captured one's.
        - There are many protocols dissectors.
        - The list of commonly used Endpoints or IP endpoints is: Bluetooth (MAC 48-bit addresses), Ethernet, fiber channel, USB, UDP, FDDI, IPv4, IPv6, JXTA, NCP, TCP, etc.
        - Name resolutions are used to convert numerical values into the human-readable format. There are two ways- network services resolution and resolve from Wireshark configuration files. It is only possible when capturing is not in progress. It can be resolved after the packet is added to the list. To rebuild the list with correct resolved names you can use **View-> Reload**.
        - In ARP, Wireshark asks the OS to convert the Ethernet address to the IP address.

- Since it is a live capture process, so it is important to set the correct time and zone on your computer.

TELEPHONY

The Telephony is the option on the menu bar. The image is shown below:



The options are explained below:

VoIP calls	It stands for Voice over Internet Protocol. It gives the list of all the detected VoIP calls in the captured traffic. It shows the **start time, stop time, initial speaker, protocol, duration, packet, state**.
ANSI	It stands for American National Standards Institute. ANSI standards are developed by organizations who are authorized by it.

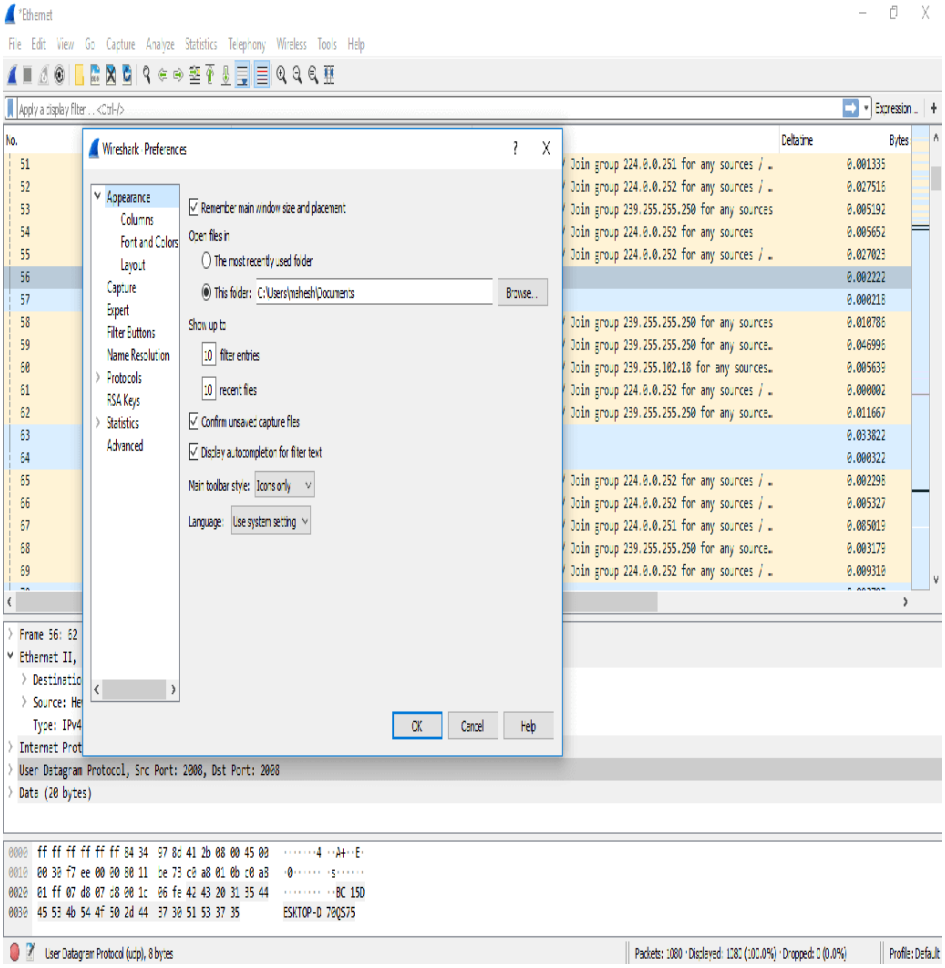
GSM	It stands for Global System for Mobile. It has various options. It has multiple options, which are used to view the messages count over the traffic. For this, you have to connect your phone to the computer through the USB-TTL converter, verify the layer. After you have to load layer 1 Firmware into the osmocon. Run mobile and specify the interface for sending GSM TAP to listen to the interface through Wireshark.
IAX2 Stream Analysis	It shows the graph with the forward and the reverse streams.
ISUP Messages	It stands for **ISDN User Parts**. It is used to establish and release calls between telephone exchanges. It shows the messages by count and direction.
LTE	It stands for **Long Term Evolution**. It uses RRC (Radio Resource Control) protocol, which controls MAC and RLC layers in the LTE interface. It shows the statistics of the captured LTE MAC and LTE RLC traffic.
MTP3	It provides messaging routing between signaling points in the SS7 network. It shows its statistics and summary. It stands for **Message Transfer Part**.
Osmux	It is a multiplex protocol, which reduces the bandwidth by substituting the voice and signaling traffic. If it is not detected then Wireshark display this information of Osmux on UDP packets or flow.
RTP	It is called as RTP streams. It starts with the sequence number, packet number, and further stats are created based on the jitter, packet size, arrival time, and delay. It stands for **Real-time Transport Protocol**.
RTSP	It stands for Real-Time Streaming Protocol. It provides information about the packet counter of response packets and requests packets.

SCTP	It stands for Stream Control Transmission Protocol. It is designed to transmit PSTN signaling messages over IP networks. It is only applicable for broader applications.
SMPP Operations	It stands for Short Messages Peer to Peer. It determines the response, request, and operations of SMPP.
UCP Messages	It is used to determine whether the captured packet is UCP or Nacks.
H.225	It is a streamed packetization and signaling protocol used for packet-based multimedia communication systems.
SIP Flows	It stands for Session Initiation Protocol. There is no need for any regular connection or multiples lines. Instead, it is installed on your current internet connection. It works with VoIP.
SIP Statistics	It gives information about the request methods and all of the SIP requests over a connection.
WAP-WSP Packet Counter	WSP stands for **Wireless Session Protocol**. It indicates the packets counts for all the Extended post methods, status codes, and PDU types. WAP uses short messages as a carrier.

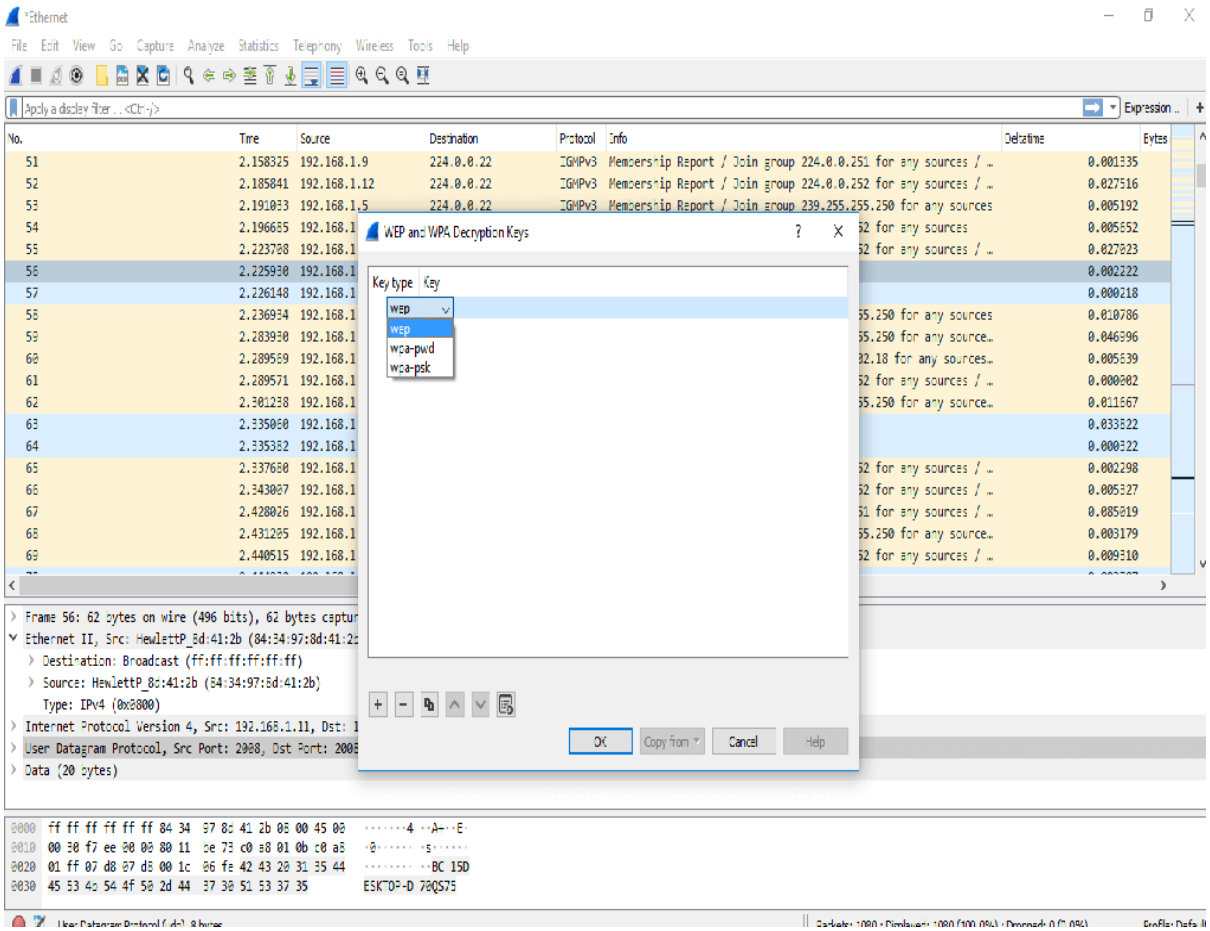
WIRESHARK DECRYPTION

The decryption process is used for the data to be in a readable format. Below are the steps for the decryption process.

-
    -
        - Open the Wireshark and then select the particular interface as explained above.
        - Go to the 'Edit' option and select the 'Preferences' option.
        - A dialogue will appear as shown below:



-
    -
        - Select the 'Protocol' option in the left column.
        - From the drop-down list, select the 'IEEE 802.11' option. Check the box of decryption and click on the Edit option under it.
        - A box will appear. Click on the option shown below:



-
    -
        - Select the option **wpa-pwd** and set the password accordingly.
        - The data will be decrypted.
        - But the above decryption process is only possible if there is a proper handshake.