

Practical-5

AIM Experiments on Packet capture tool: Wireshark

Packet Sniffer

- Sniffs messages being sent/received from/by your computer
- Store and display the contents of the various protocol fields in the messages
- Passive program
 - never sends packets itself
 - no packets addressed to it
 - receives a copy of all packets (sent/received)

Packet Sniffer Structure Diagnostic Tools

- Tcpdump
 - E.g. tcpdump -enx host 10.129.41.2 -w exe3.out
- Wireshark
 - wireshark -r exe3.out

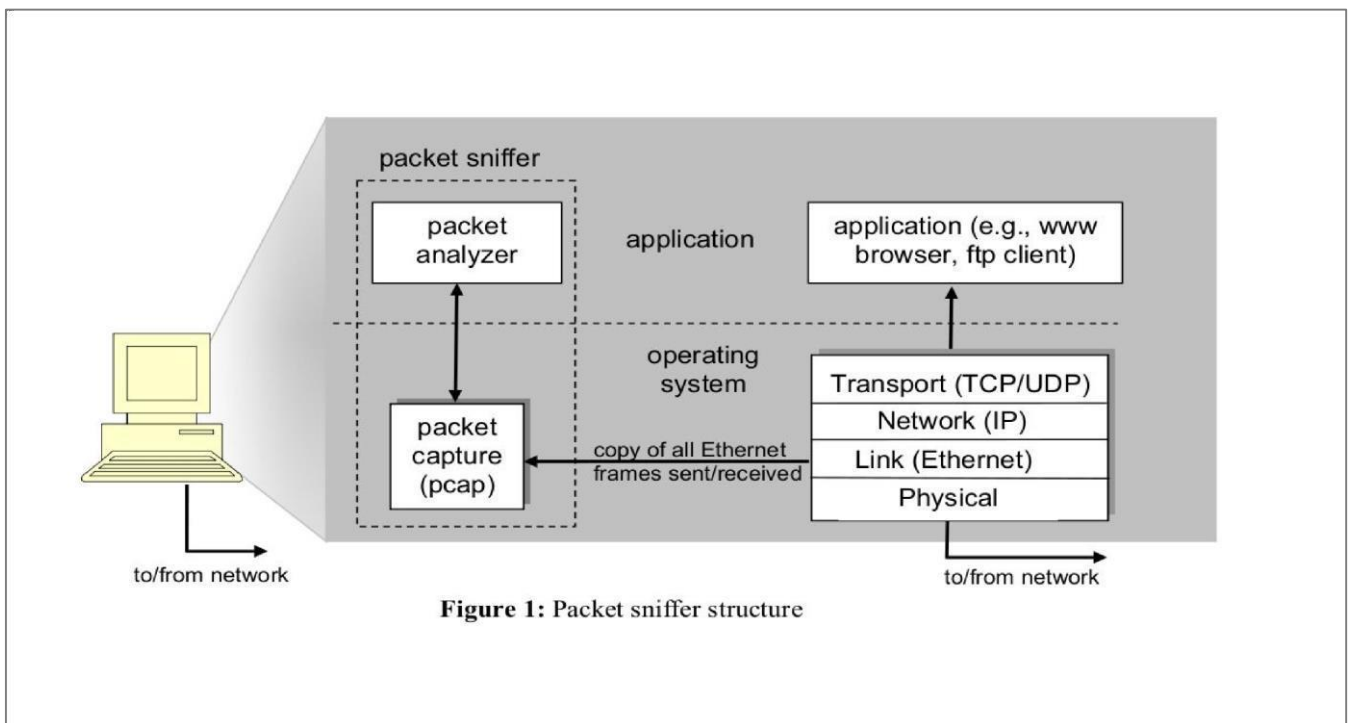


Figure 1: Packet sniffer structure

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DESCRIPTION:

WIRESHARK

Wireshark, a network analysis tool formerly known as Ethereal, captures packets in real time and display them in human-readable format. Wireshark includes filters, color coding, and other features that let you dig deep into network traffic and inspect individual packets. You can use Wireshark to inspect a suspicious program's network traffic, analyze the traffic flow on your network, or troubleshoot network problems.

What we can do with Wireshark:

- Capture network traffic
- Decode packet protocols using dissectors
- Define filters – capture and display
- Watch smart statistics
- Analyze problems
- Interactively browse that traffic

Wireshark used for:

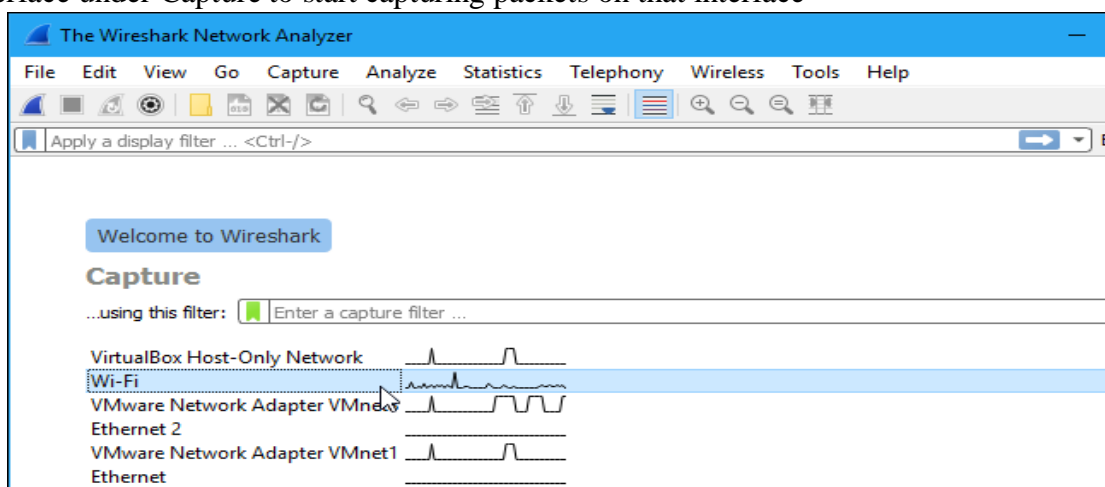
- Network administrators: troubleshoot network problems
- Network security engineers: examine security problems
- Developers: debug protocol implementations
- People: learn **network protocol internals**

Getting Wireshark

Wireshark can be downloaded for Windows or macOS from [its official website](#). For Linux or another UNIX-like system, Wireshark will be found in its package repositories. For Ubuntu, Wireshark will be found in the Ubuntu Software Center.

Capturing Packets

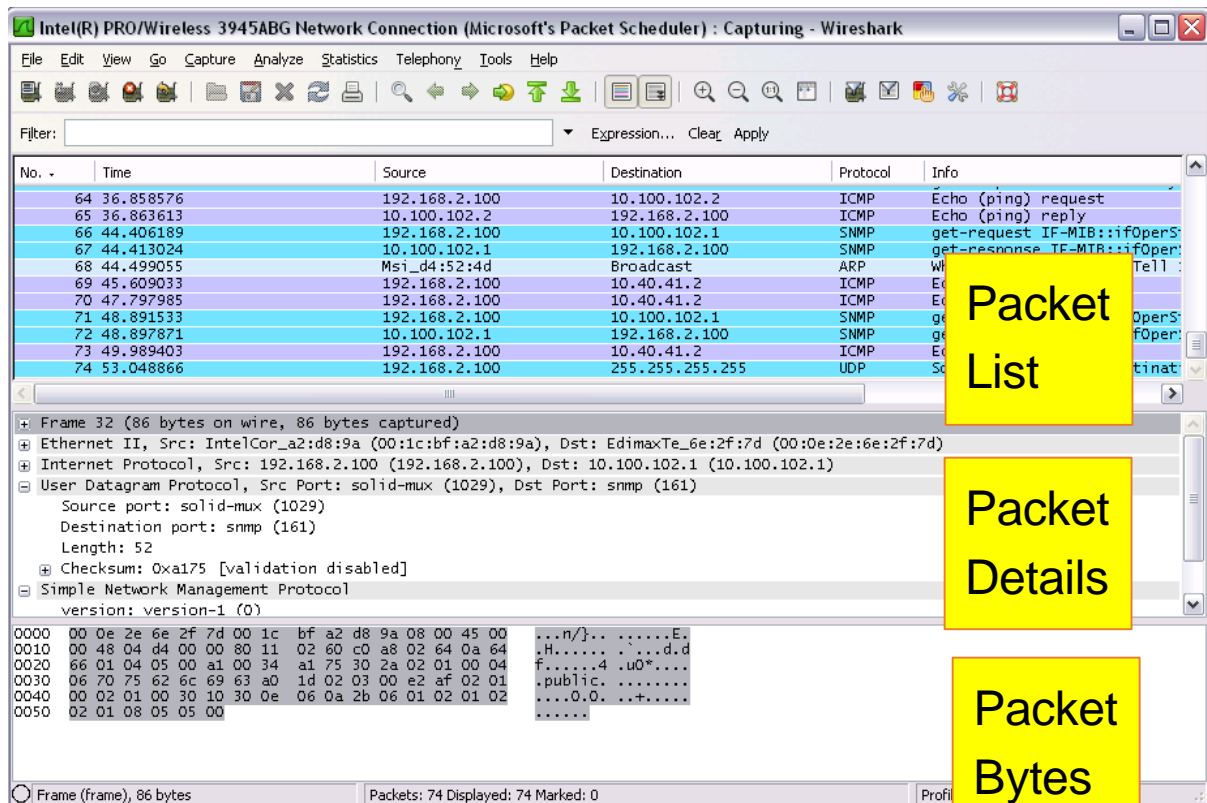
After downloading and installing Wireshark, launch it and double-click the name of a network interface under Capture to start capturing packets on that interface



As soon as you click the interface's name, you'll see the packets start to appear in real time. Wireshark captures each packet sent to or from your system.

If you have promiscuous mode enabled—it's enabled by default—you'll also see all the other packets on the network instead of only packets addressed to your network adapter. To check if promiscuous mode is enabled, click Capture > Options and verify the "Enable promiscuous mode on all interfaces" checkbox is activated at the bottom of this window.

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Click the red “Stop” button near the top left corner of the window when you want to stop capturing traffic.

The “Packet List” Pane

The packet list pane displays all the packets in the current capture file. The “Packet List” pane Each line in the packet list corresponds to one packet in the capture file. If you select a line in this pane, more details will be displayed in the “Packet Details” and “Packet Bytes” panes.

The “Packet Details” Pane

The packet details pane shows the current packet (selected in the “Packet List” pane) in a more detailed form. This pane shows the protocols and protocol fields of the packet selected in the “Packet List” pane. The protocols and fields of the packet shown in a tree which can be expanded and collapsed.

The “Packet Bytes” Pane

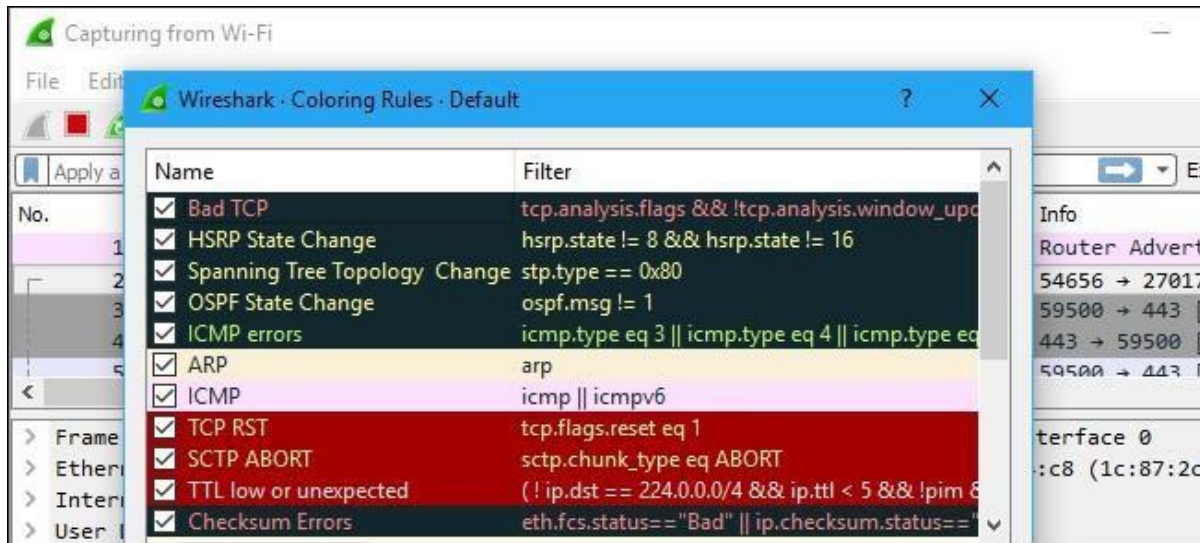
The packet bytes pane shows the data of the current packet (selected in the “Packet List” pane) in a hexdump style.

Color Coding

You’ll probably see packets highlighted in a variety of different colors. Wireshark uses colors to help you identify the types of traffic at a glance. By default, light purple is TCP traffic, light blue is UDP traffic, and black identifies packets with errors—for example, they could have been delivered out of order.

To view exactly what the color codes mean, click View > Coloring Rules. You can also customize and modify the coloring rules from here, if you like.

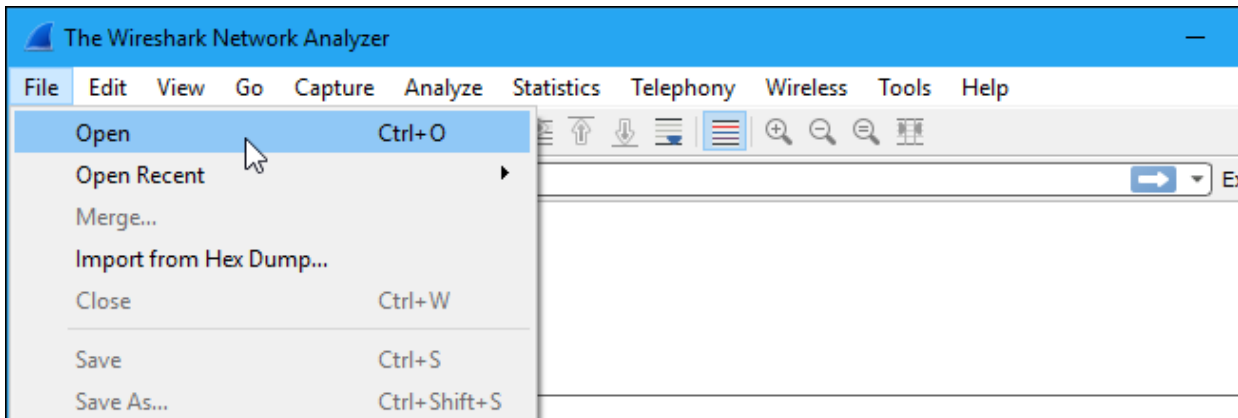
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Sample Captures

If there's nothing interesting on your own network to inspect, Wireshark's wiki has you covered. The wiki contains a [page of sample capture files](#) that you can load and inspect. Click File > Open in Wireshark and browse for your downloaded file to open one.

You can also save your own captures in Wireshark and open them later. Click File > Save to save your captured packets.

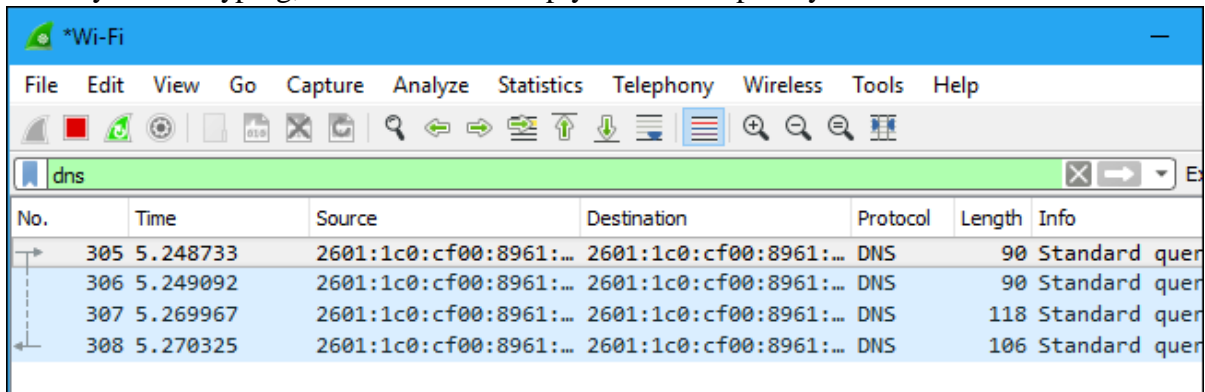


Filtering Packets

If you're trying to inspect something specific, such as the traffic a program sends when phoning home, it helps to close down all other applications using the network so you can narrow down the traffic. Still, you'll likely have a large amount of packets to sift through. That's where Wireshark's filters come in.

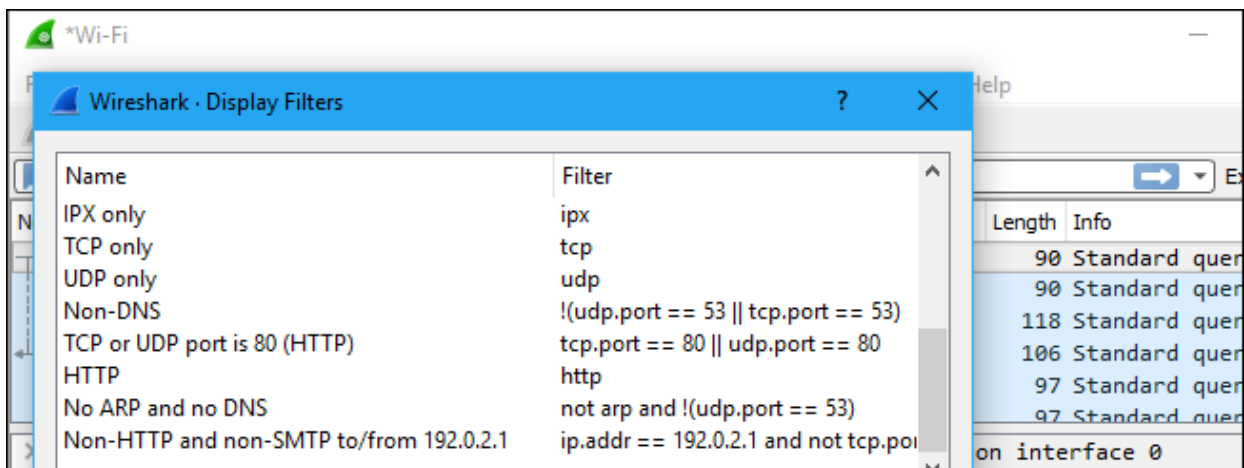
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The most basic way to apply a filter is by typing it into the filter box at the top of the window and clicking Apply (or pressing Enter). For example, type “dns” and you’ll see only DNS packets. When you start typing, Wireshark will help you autocomplete your filter.



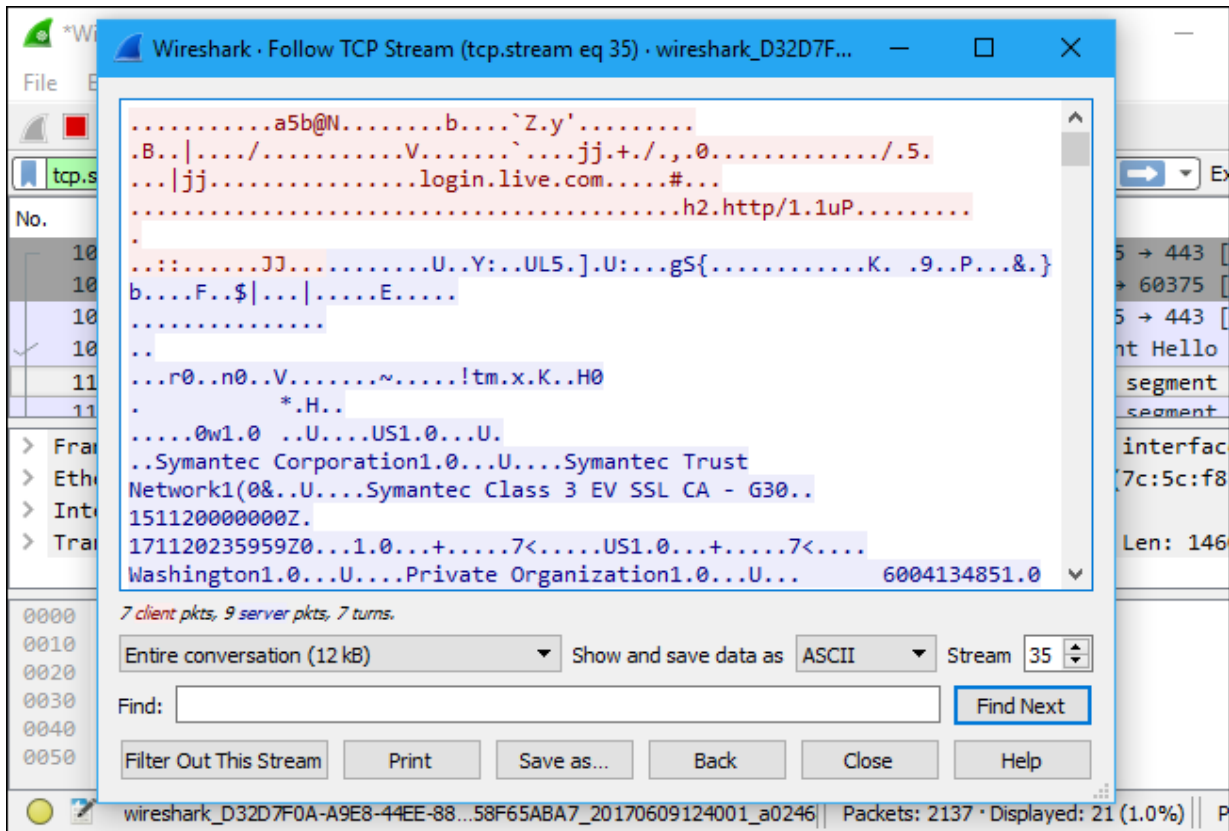
You can also click Analyze > Display Filters to choose a filter from among the default filters included in Wireshark. From here, you can add your own custom filters and save them to easily access them in the future.

For more information on Wireshark’s display filtering language, read the [Building display filter expressions](#) page in the official Wireshark documentation.

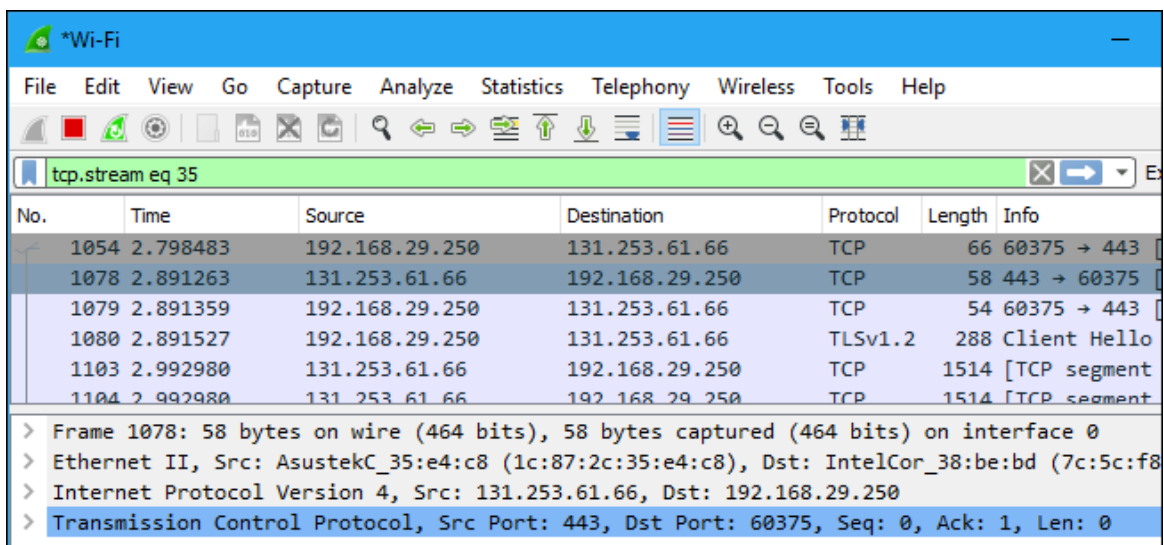


Another interesting thing you can do is right-click a packet and select Follow > TCP Stream. You’ll see the full TCP conversation between the client and the server. You can also click other protocols in the Follow menu to see the full conversations for other protocols, if applicable.

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Close the window and you'll find a filter has been applied automatically. Wireshark is showing you the packets that make up the conversation.



Inspecting Packets

Click a packet to select it and you can dig down to view its details.

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***Wi-Fi**

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

tcp.stream eq 35

No.	Time	Source	Destination	Protocol	Length	Info
1054	2.798483	192.168.29.250	131.253.61.66	TCP	66	60375 → 443
1078	2.891263	131.253.61.66	192.168.29.250	TCP	58	443 → 60375
1079	2.891359	192.168.29.250	131.253.61.66	TCP	54	60375 → 443
1080	2.891527	192.168.29.250	131.253.61.66	TLSv1.2	288	Client Hello

▼ Frame 1054: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0
 Interface id: 0 (\Device\NPF_{D32D7F0A-A9E8-44EE-88DC-DFD58F65ABA7})
 Encapsulation type: Ethernet (1)
 Arrival Time: Jun 9, 2017 12:40:04.140141000 Pacific Daylight Time
 [Time shift for this packet: 0.000000000 seconds]
 Epoch Time: 1497037204.140141000 seconds

0000 1c 87 2c 35 e4 c8 7c 5c f8 38 be bd 08 00 45 00 ...5...|\ .8....E.
 0010 00 34 0b 5d 40 00 80 06 4f 85 c0 a8 1d fa 83 fd .4.]@... O.....
 0020 3d 42 eb d7 01 bb 22 52 7b 69 00 00 00 80 02 =B...."R {i.....
 0030 fa f0 48 ef 00 00 02 04 05 b4 01 03 03 08 01 01 ..H.....
 0040 04 02 ..

Encapsulation type (frame.encap_type) | Packets: 8136 · Displayed: 21 (0.3%)

You can also create filters from here — just right-click one of the details and use the Apply as Filter submenu to create a filter based on it.

***Wi-Fi**

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

tcp.stream eq 35

No.	Time	Source	Destination	Protocol	Length	Info
1054	2.798483	192.168.29.250	131.253.61.66	TCP	66	60375 → 443
1078	2.891263	131.253.61.66	192.168.29.250	TCP	58	443 → 60375
1079	2.891359	192.168.29.250	131.253.61.66	TCP	54	60375 → 443
1080	2.891527	192.168.29.250	131.253.61.66	TLSv1.2	288	Client Hello

Source Port: 60375

- Expand Subtrees Shift+Right
- Expand All Ctrl+Right
- Collapse All Ctrl+Left
- Apply as Column
- Apply as Filter
 - Selected
 - Not Selected
 - ...and Selected
 - ...or Selected
 - ...and not Selected
- Prepare a Filter
- Conversation Filter
- Colorize with Filter
- Follow

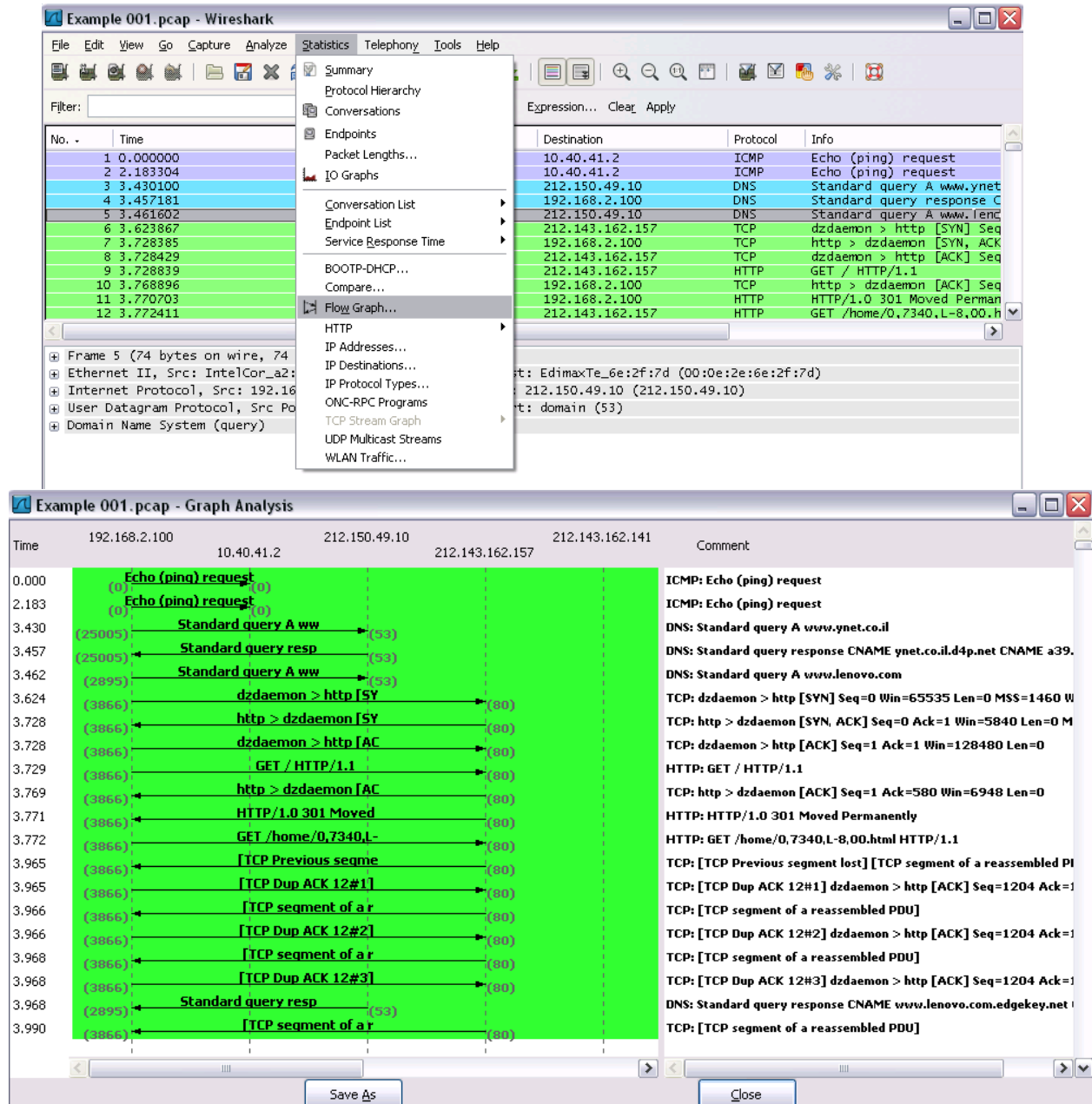
0000 1c 87 2c 35 e4 c8 7c 5c f8 38 be bd 08 00 45 00 ...5...|\ .8....E.
 0010 00 34 0b 5d 40 00 80 06 4f 85 c0 a8 1d fa 83 fd .4.]@... O.....
 0020 3d 42 eb d7 01 bb 22 52 7b 69 00 00 00 80 02 =B...."R {i.....
 0030 fa f0 48 ef 00 00 02 04 05 b4 01 03 03 08 01 01 ..H.....
 0040 04 02 ..

6 · Displayed: 21 (0.2%)

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Wireshark is an extremely powerful tool, and this tutorial is just scratching the surface of what you can do with it. Professionals use it to debug network protocol implementations, examine security problems and inspect network protocol internals.

Flow Graph: Gives a better understanding of what we see.



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CAPTURING AND ANALYSING PACKETS USING WIRESHARK TOOL

To filter, capture, view, packets in Wireshark Tool.

Capture 100 packets from the Ethernet: IEEE 802.3 LAN Interface and save it.

Procedure

- Select Local Area Connection in Wireshark.
- Go to capture → option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Save the packets.

Output

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	Pegatron_e0:87:9e	Broadcast	ARP	60	Who has 172.16.9.94? Tell 172.16.9.138
2	0.000180	RealtekS_55:2c:b8	Broadcast	ARP	60	Who has 172.16.10.36? Tell 172.16.10.50
3	0.000294	RealtekS_55:2c:b8	Broadcast	ARP	60	Who has 172.16.11.36? Tell 172.16.10.50
4	0.000295	RealtekS_55:2c:b8	Broadcast	ARP	60	Who has 172.16.8.37? Tell 172.16.10.50
5	0.000296	RealtekS_55:2c:b8	Broadcast	ARP	60	Who has 172.16.9.37? Tell 172.16.10.50
6	0.000296	RealtekS_55:2c:b8	Broadcast	ARP	60	Who has 172.16.11.37? Tell 172.16.10.50
7	0.001460	fe80::4968:12a7:5e3...	ff02::1:3	LLMNR	95	Standard query 0xae2b A TLFL3-HDC101701
8	0.001622	172.16.8.95	224.0.0.252	LLMNR	75	Standard query 0xae2b A TLFL3-HDC101701
9	0.001623	172.16.8.95	224.0.0.252	LLMNR	75	Standard query 0x28c0 AAAA TLFL3-HDC101701
10	0.001625	fe80::4968:12a7:5e3...	ff02::1:3	LLMNR	95	Standard query 0x28c0 AAAA TLFL3-HDC101701
11	0.045051	fe80::4968:12a7:5e3...	ff02::1:3	LLMNR	95	Standard query 0xae2b A TLFL3-HDC101701

▶ Frame 7: 95 bytes on wire (760 bits), 95 bytes captured (760 bits) on interface 0

▶ Ethernet II, Src: Dell_35:10:a8 (50:9a:4c:35:10:a8), Dst: IPv6mcast_01:00:03 (33:33:00:01:00:03)

▶ Internet Protocol Version 6, Src: fe80::4968:12a7:5e36:523e, Dst: ff02::1:3

▲ User Datagram Protocol, Src Port: 62374, Dst Port: 5355

Source Port: 62374

Destination Port: 5355

Length: 41

Checksum: 0x90e0 [unverified]

[Checksum Status: Unverified]

[Stream index: 0]

▶ Link-local Multicast Name Resolution (query)

0000	33 33 00 01 00 03 50 9a	4c 35 10 a8 86 dd 60 00	33...P L5....
0010	00 00 00 29 11 01 fe 80	00 00 00 00 00 00 49 68	...).....Ih
0020	12 a7 5e 36 52 3e ff 02	00 00 00 00 00 00 00 00	..^6R>.....
0030	00 00 00 01 00 03 f3 a6	14 eb 00 29 90 e0 ae 2b)....+
0040	00 00 00 01 00 00 00 00	00 00 0f 54 4c 46 4c 33TLFL3
0050	2d 48 44 43 31 30 31 37	30 31 00 00 01 00 01	-HDC1017 01....

1. Create a Filter to display only TCP/UDP packets, inspect the packets and provide the flow graph

Procedure

- Select Local Area Connection in Wireshark.
- Go to capture → option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Search TCP packets in search bar.
- To see flow graph click Statistics→Flow graph.
- Save the packets.

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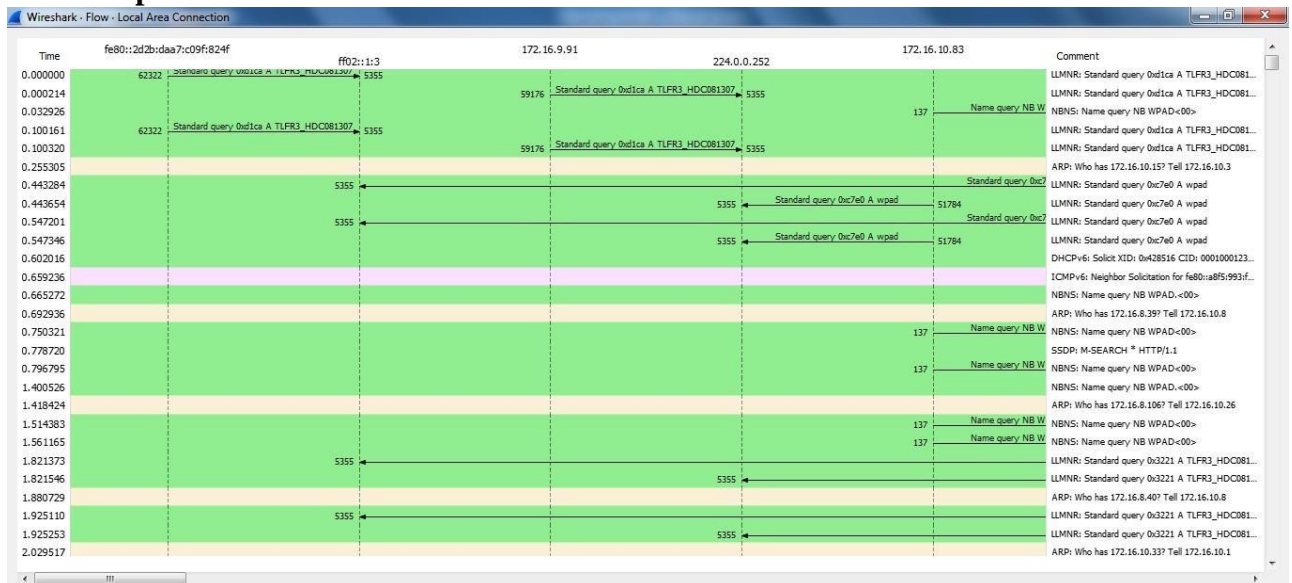
No.	Time	Source	Destination	Protocol	Length	Info
123	4.557832	fe80::8532:3a9f:aff...	fe80::5c2b:19eb:d33...	TCP	74	1509 → 2869 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
126	4.557993	172.16.9.106	172.16.9.96	TCP	60	1506 → 2869 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
1095	30.718732	172.16.8.83	172.16.9.96	TCP	66	51526 → 2869 [SYN, ECN, CWR] Seq=0 Win=8192 Len=0 MSS=1460 WS=256 SACK_PERM=1
1096	30.718794	172.16.9.96	172.16.8.83	TCP	66	2869 → 51526 [SYN, ACK] Seq=0 Ack=1 Win=8192 Len=0 MSS=1460 WS=256 SACK_PERM=1
1097	30.719129	172.16.8.83	172.16.9.96	TCP	60	51526 → 2869 [ACK] Seq=1 Ack=1 Win=65536 Len=0
1099	30.719919	172.16.9.96	172.16.8.83	TCP	278	2869 → 51526 [PSH, ACK] Seq=1 Ack=133 Win=65536 Len=224 [TCP segment of a reassembled PDU]
1100	30.719986	172.16.9.96	172.16.8.83	TCP	1514	2869 → 51526 [ACK] Seq=225 Ack=133 Win=65536 Len=1460 [TCP segment of a reassembled PDU]
1101	30.720279	172.16.8.83	172.16.9.96	TCP	60	51526 → 2869 [ACK] Seq=133 Ack=1685 Win=65536 Len=0
1102	30.720510	172.16.8.83	172.16.9.96	TCP	60	51526 → 2869 [ACK] Seq=133 Ack=1685 Win=65536 Len=0
1103	30.720662	172.16.8.83	172.16.9.96	TCP	60	51526 → 2869 [ACK] Seq=133 Ack=1685 Win=65536 Len=0

▶ Frame 123: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface 0
 ▶ Ethernet II, Src: Realtek5_b2:60:90 (00:e0:4c:b2:60:90), Dst: IntelCor_13:ed:7c (00:27:0e:13:ed:7c)
 ▶ Internet Protocol Version 6, Src: fe80::8532:3a9f:aff1:b3ca, Dst: fe80::5c2b:19eb:d33d:a1cd
 ▶ Transmission Control Protocol, Src Port: 1509, Dst Port: 2869, Seq: 1, Ack: 1, Len: 0

```

0000  00 27 0e 13 ed 7c 00 e0 4c b2 60 90 86 dd 60 00  .....L.....
0010  00 00 00 14 06 80 fe 80 00 00 00 00 00 85 32  .....2
0020  3a 9f af f1 b3 ca fe 80 00 00 00 00 00 5c 2b  .....+
0030  19 eb d3 3d a1 cd 05 e5 00 35 3b ef f1 2f bf d2  .....S.../..
0040  67 35 50 14 00 00 3e de 00 00                gSP>
  
```

Flow Graph



2. Create a Filter to display only ARP packets and inspect the packets. Procedure

- Go to capture → option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Search ARP packets in search bar.
- Save the packets.

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Output

arp						
No.	Time	Source	Destination	Protocol	Length	Info
6	0.255305	Foxconn_c9:c5:f0	Broadcast	ARP	60	Who has 172.16.10.15? Tell 172.16.10.3
14	0.692936	Foxconn_d0:ac:46	Broadcast	ARP	60	Who has 172.16.8.39? Tell 172.16.10.8
19	1.418424	Foxconn_c9:c9:91	Broadcast	ARP	60	Who has 172.16.8.106? Tell 172.16.10.26
24	1.880729	Foxconn_d0:ac:46	Broadcast	ARP	60	Who has 172.16.8.40? Tell 172.16.10.8
27	2.029517	Giga-Byt_92:d2:ef	Broadcast	ARP	60	Who has 172.16.10.33? Tell 172.16.10.1
41	2.509905	Giga-Byt_7c:c5:34	Broadcast	ARP	60	Who has 172.16.9.82? Tell 172.16.9.111
44	2.602358	Foxconn_c9:c8:24	Broadcast	ARP	60	Who has 172.16.8.139? Tell 172.16.10.22
46	2.743021	Dell_35:11:11	Broadcast	ARP	60	Who has 172.16.8.118? Tell 172.16.10.195
56	3.201822	Giga-Byt_92:d2:ef	Broadcast	ARP	60	Who has 172.16.10.34? Tell 172.16.10.1
60	3.237061	Giga-Byt_7c:c5:34	Broadcast	ARP	60	Who has 172.16.9.82? Tell 172.16.9.111
71	3.428062	Dell_35:11:11	Broadcast	ARP	60	Who has 172.16.8.118? Tell 172.16.10.195
Frame 119: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0						
Ethernet II, Src: IntelCor_13:ed:7c (00:27:0e:13:ed:7c), Dst: RealtekS_b2:60:90 (00:e0:4c:b2:60:90)						
Address Resolution Protocol (reply)						
0000 00 e0 4c b2 60 90 00 27 0e 13 ed 7c 08 06 00 01 ..L.`.'...						
0010 08 00 06 04 00 02 00 27 0e 13 ed 7c ac 10 09 60						
0020 00 e0 4c b2 60 90 ac 10 09 6a ..L.`....j						

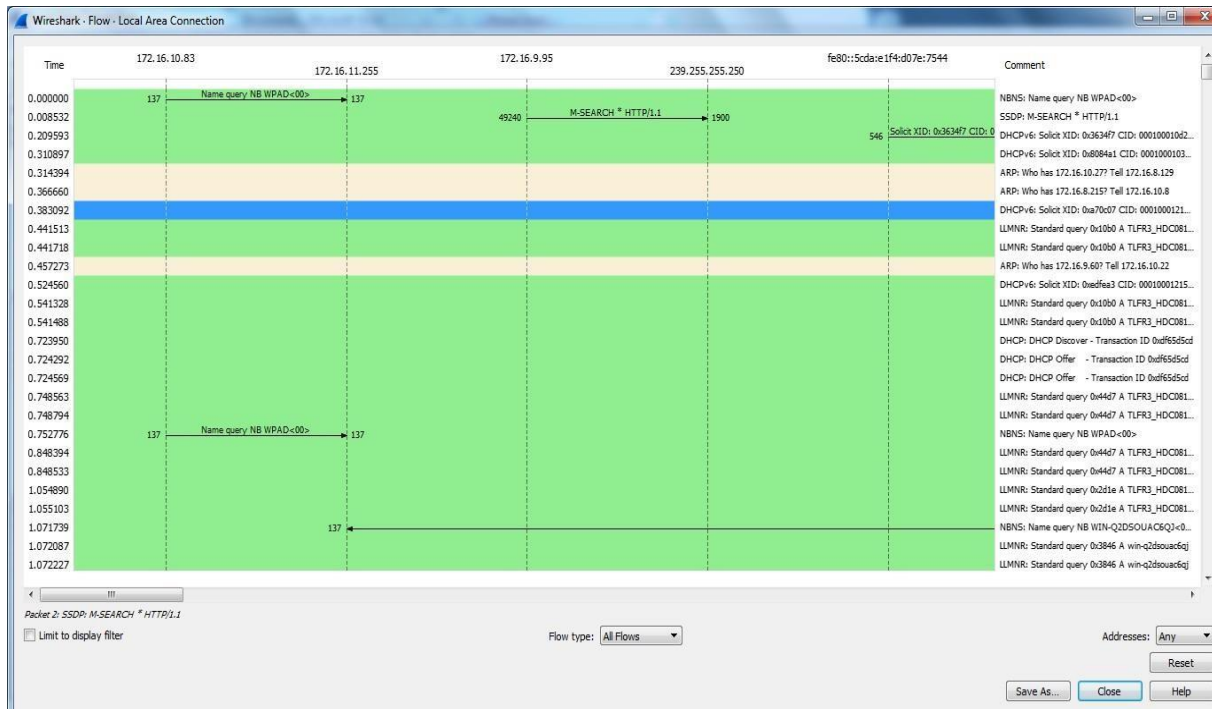
3. Create a Filter to display only DNS packets and provide the flow graph.

Procedure

- Go to capture → option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Search DNS packets in search bar.
- To see flow graph click Statistics→Flow graph.
- Save the packets.

*Local Area Connection						
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help						
Filter: dns						
No.	Time	Source	Destination	Protocol	Length	Info
989	32.977988	172.16.9.96	172.16.8.1	DNS	74	Standard query 0x9e40 A www.google.com
990	32.978738	172.16.8.1	172.16.9.96	DNS	90	Standard query response 0x9e40 A www.google.com A 172.217.163.132
1199	37.273599	172.16.9.96	172.16.8.1	DNS	79	Standard query 0xb58b A accounts.google.com
1200	37.273822	172.16.9.96	172.16.8.1	DNS	75	Standard query 0x6af4 A ssl.gstatic.com
1201	37.273837	172.16.8.1	172.16.9.96	DNS	95	Standard query response 0xb58b A accounts.google.com A 172.217.163.141
1202	37.273978	172.16.8.1	172.16.9.96	DNS	91	Standard query response 0x6af4 A ssl.gstatic.com A 172.217.26.163
1203	37.274368	172.16.9.96	172.16.8.1	DNS	77	Standard query 0xe76d A fonts.gstatic.com
1204	37.274841	172.16.8.1	172.16.9.96	DNS	129	Standard query response 0xe76d A fonts.gstatic.com CHAIN gstaticdssl.l.google.com A 172.217.160.131
1738	38.875063	172.16.9.96	172.16.8.1	DNS	80	Standard query 0x7a60 A accounts.youtube.com
1739	38.875294	172.16.8.1	172.16.9.96	DNS	124	Standard query response 0x7a60 A accounts.youtube.com CHAIN www3.l.google.com A 172.217.167.142
Frame 989: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface 0						
Ethernet II, Src: IntelCor_13:ed:7c (00:27:0e:13:ed:7c), Dst: Caswell_f2:b4:a1 (08:35:71:f2:b4:a1)						
Internet Protocol Version 4, Src: 172.16.9.96, Dst: 172.16.8.1						
User Datagram Protocol, Src Port: 62278, Dst Port: 53						
Domain Name System (query)						
0000 08 35 71 f2 b4 a1 00 27 0e 13 ed 7c 08 00 45 00 ..Sq..... ..E						
0010 00 3c 37 bb 00 00 11 00 00 ac 10 09 60 ac 10 ...<7..... ..						
0020 00 01 f3 46 00 35 00 28 69 bb 9e 40 01 00 00 01 ...F.S.(1-0... ..						
0030 00 00 00 00 00 00 00 77 77 06 67 6f 6f 67 6c ...www.googl... ..						
0040 65 03 63 6f 6d 00 01 00 01 ..e.com... ..						

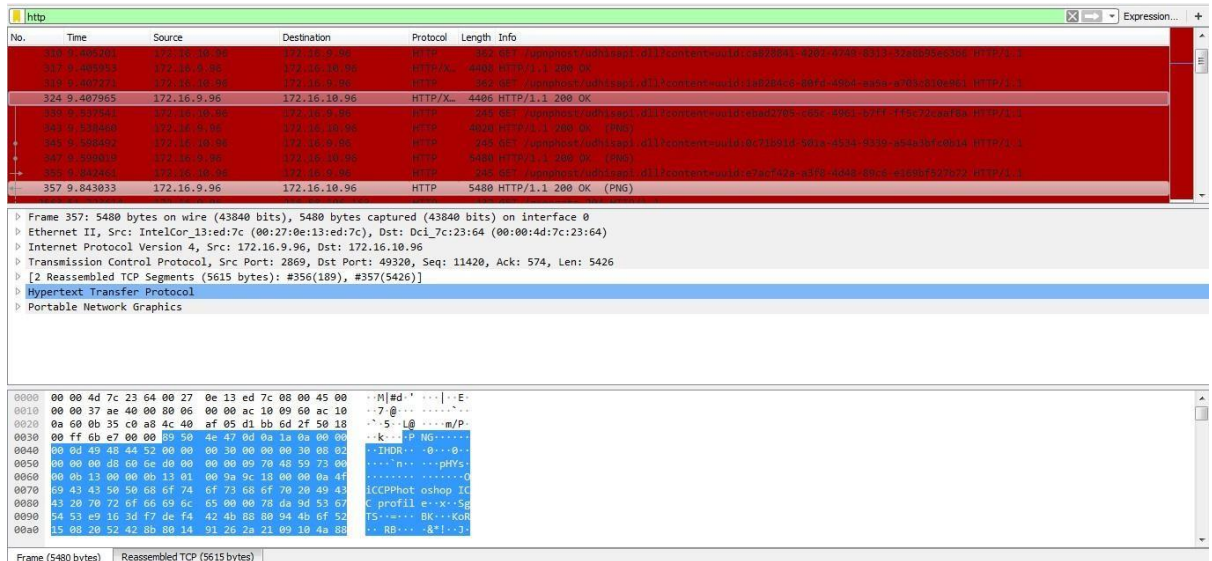
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4. Create a Filter to display only HTTP packets and inspect the packets

Procedure

- Select Local Area Connection in Wireshark.
- Go to capture → option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Search HTTP packets in search bar.
- Save the packets.

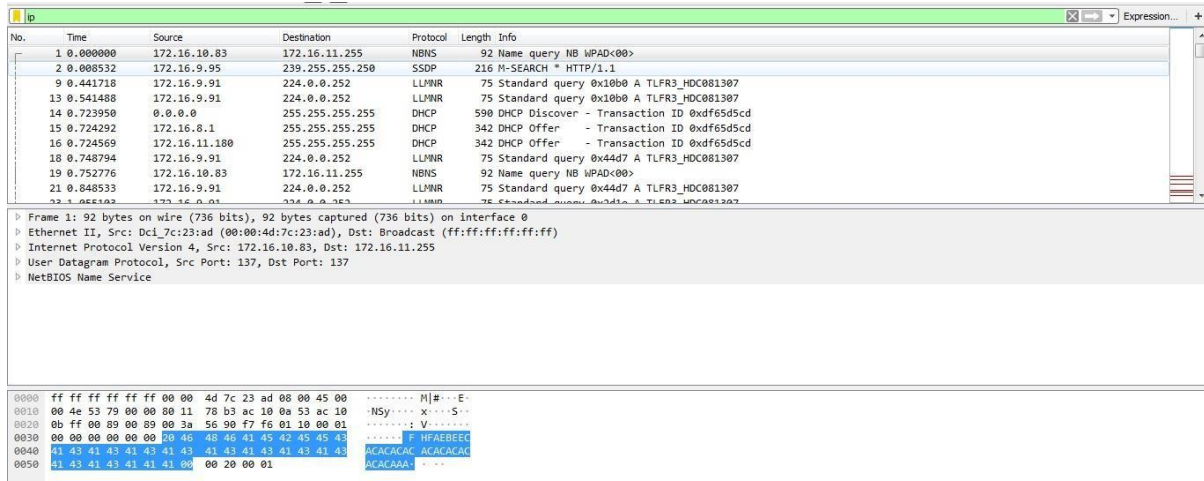


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5. Create a Filter to display only IP/ICMP packets and inspect the packets.

Procedure

- Select Local Area Connection in Wireshark.
- Go to capture → option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Search ICMP/IP packets in search bar.
- Save the packets

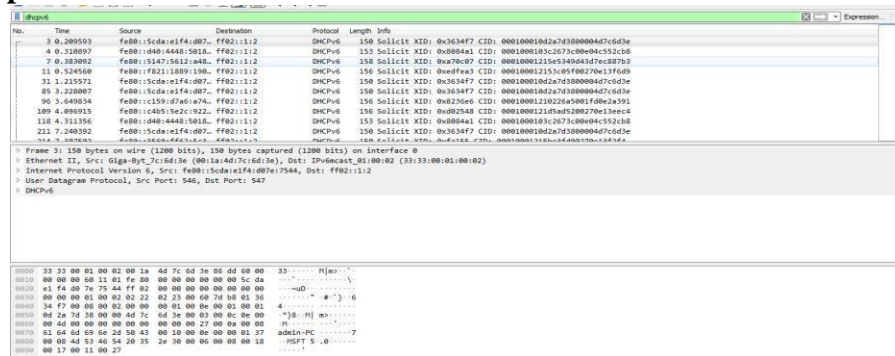


6. Create a Filter to display only DHCP packets and inspect the packets.

Procedure

- Select Local Area Connection in Wireshark.
- Go to capture → option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Search DHCP packets in search bar.
- Save the packets

Output



Student observation:

1. What is promiscuous mode?
2. Does ARP packets has transport layer header? Explain.
3. Which transport layer protocol is used by DNS?
4. What is the port number used by http protocol?
5. What is a broadcast ip address?

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1. What is promiscuous mode?

Promiscuous mode is a network interface card (NIC) setting where the NIC passes all packets it receives to the computer's network stack, regardless of the destination MAC address. Normally, a NIC only processes frames addressed directly to it, broadcast addresses, or multicast addresses. When switched to promiscuous mode, it intercepts all network traffic on the segment, which is particularly useful for network monitoring, intrusion detection, and packet sniffing. It enables network administrators and security professionals to analyze traffic in detail, but it also poses security risks if misused, because it exposes all network data passing through the interface. Some operating systems and hardware require administrative privileges to enable this mode, and in switched Ethernet networks, additional configurations like port mirroring are often necessary to view all traffic.

2. Does ARP packets have transport layer header? Explain.

ARP (Address Resolution Protocol) packets do not contain transport layer headers because ARP operates directly on the network layer (Layer 3) with a specific payload structure. ARP is used to map IP addresses to MAC addresses so that subsequent data packets can be delivered correctly on the local network. Its message structure includes hardware type, protocol type, hardware and protocol addresses, and the operation type (request or reply), but it doesn't utilize protocols from the TCP or UDP transport layers, which reside above the network layer in the OSI model. Therefore, ARP packets are independent of the transport layer and do not have transport layer headers like TCP or UDP headers.

3. Which transport layer protocol is used by DNS?

The Domain Name System (DNS) primarily uses the User Datagram Protocol (UDP) at the transport layer. DNS queries and responses commonly operate on UDP port 53 because it provides a fast, connectionless method suitable for the typically small query/response message size. However, DNS can also use TCP (also on port 53) when the response data exceeds DNS over UDP's size limit or if reliable transmission is needed, such as during zone transfers between DNS servers.

4. What is the port number used by HTTP protocol?

The HTTP protocol traditionally uses port number 80. When a client sends a request to a web server without specifying a port, it defaults to port 80 for HTTP traffic. In secure scenarios, HTTPS (HTTP over SSL/TLS) uses port 443. These well-known port numbers are standardized and recognized universally for web traffic.

5. What is a broadcast IP address?

A broadcast IP address is a special IP address used to send data to all hosts within a specific subnet simultaneously. It allows a device to transmit a message that all other devices in the subnet will receive. The broadcast address is derived by taking the subnet's network address and setting all host bits to 1. For example, in a subnet with network address 192.168.1.0 and subnet mask 255.255.255.0 (/24), the broadcast address would be 192.168.1.255. This address ensures that any packet sent to it over the network will be received by all hosts within that subnet, making it useful for network-wide announcements or management packets.