

# CS23532 - COMPUTER NETWORKS

## Practical-5

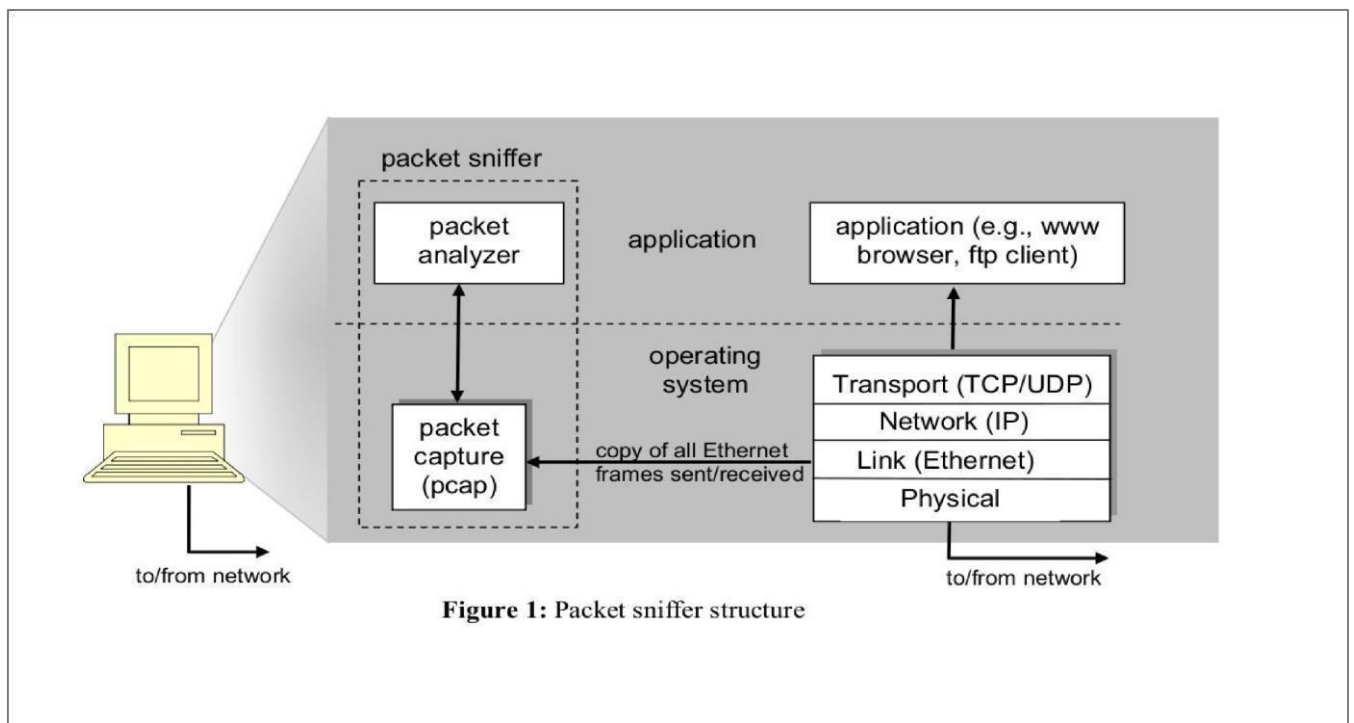
### AIM Experiments on Packet capture tool: Wireshark

#### 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



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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:

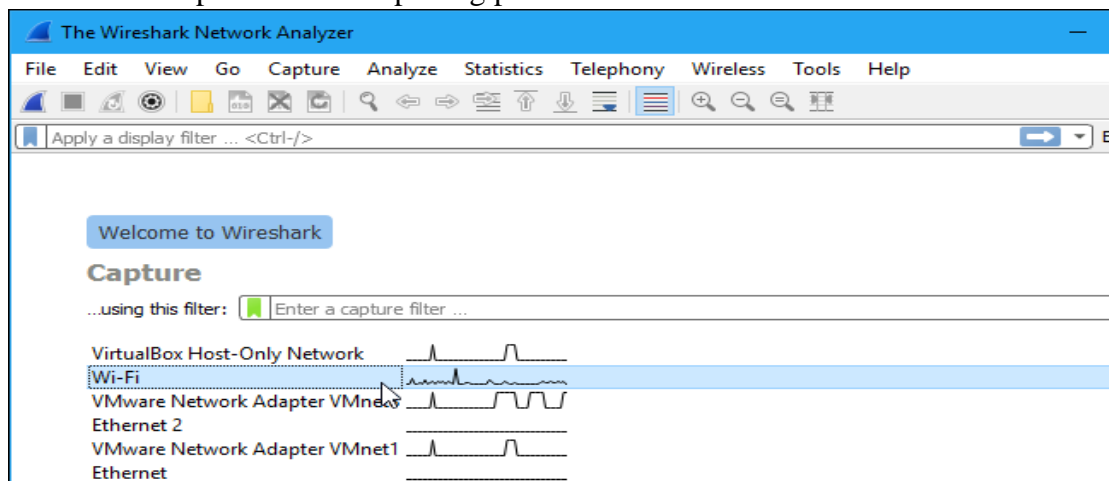
- Network administrators: troubleshoot network problems
- Network security engineers: examine security problems
- Developers: debug protocol implementations
- People: learn **network protocol internals**

### 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

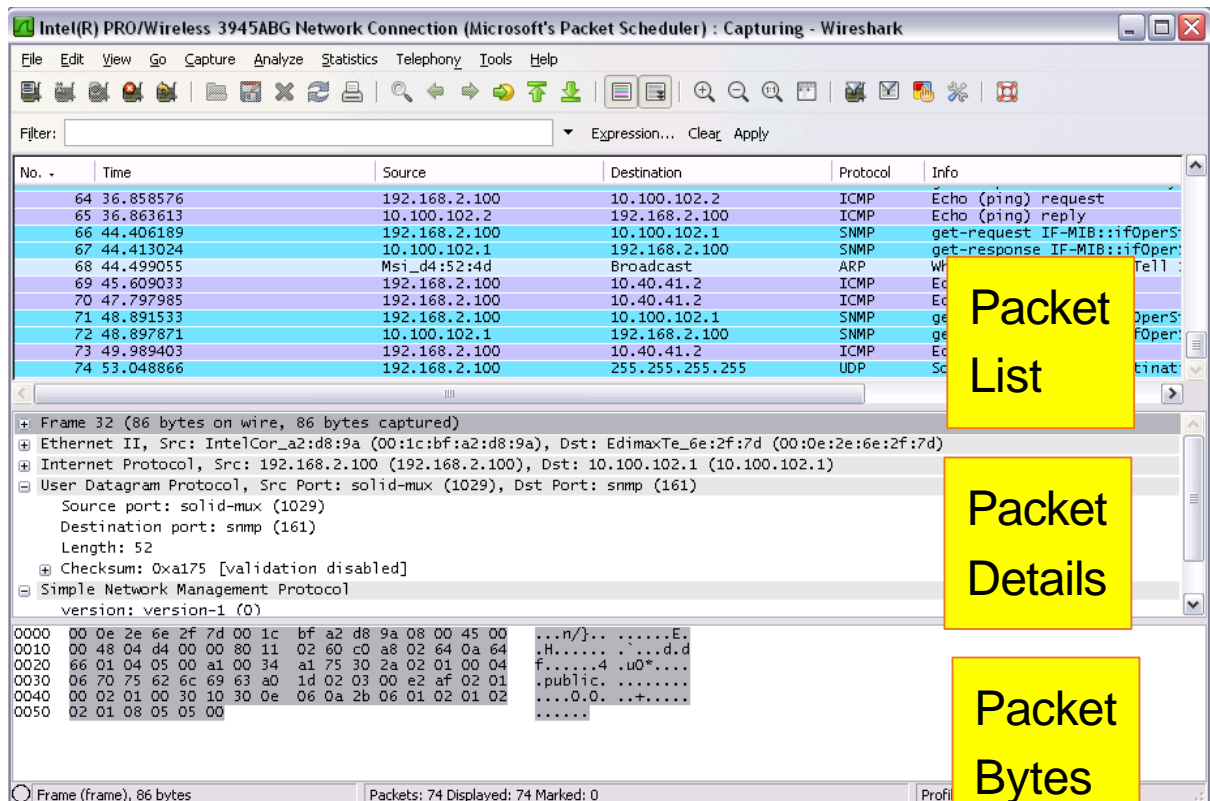
After downloading and installing Wireshark, launch it and double-click the name of a network interface under Capture to start capturing packets on that interface



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 are done 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 pane and —Packet Bytes pane.

## 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

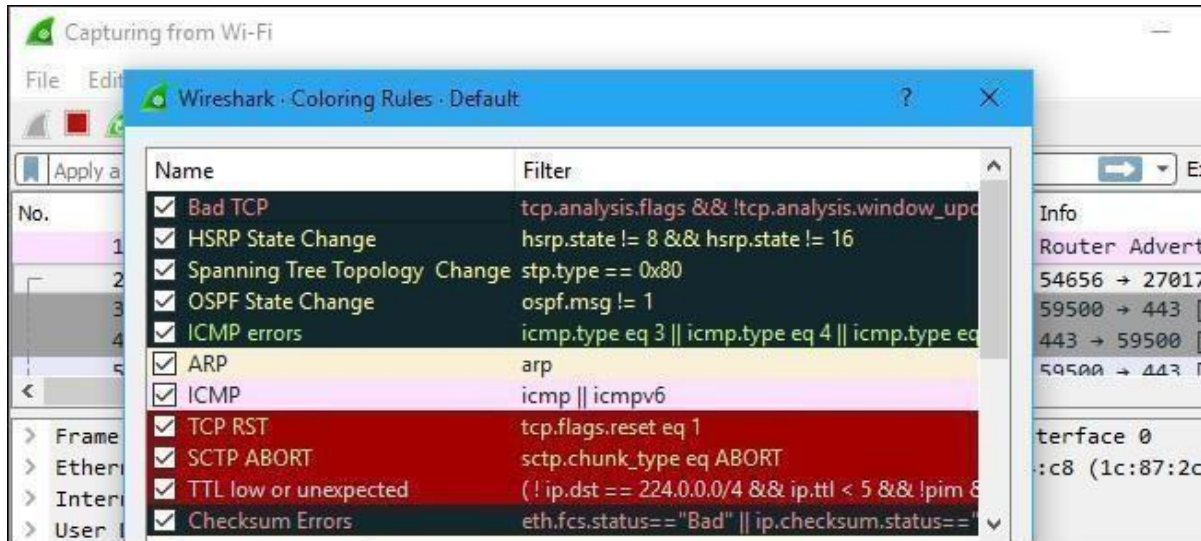
The packet bytes pane shows the data of the current packet (selected in the —Packet List pane) in a hexdump style.

## 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.

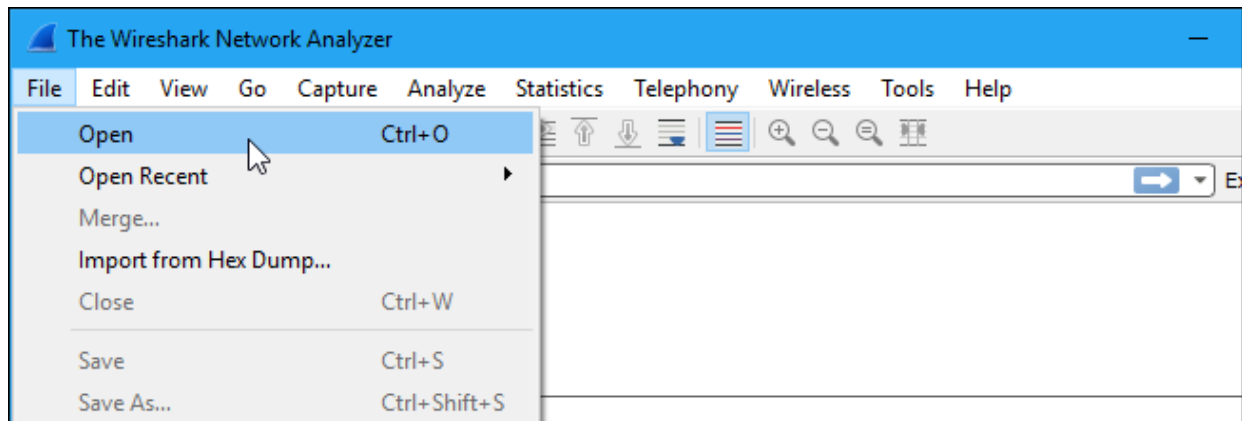
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### Sample Captures

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.

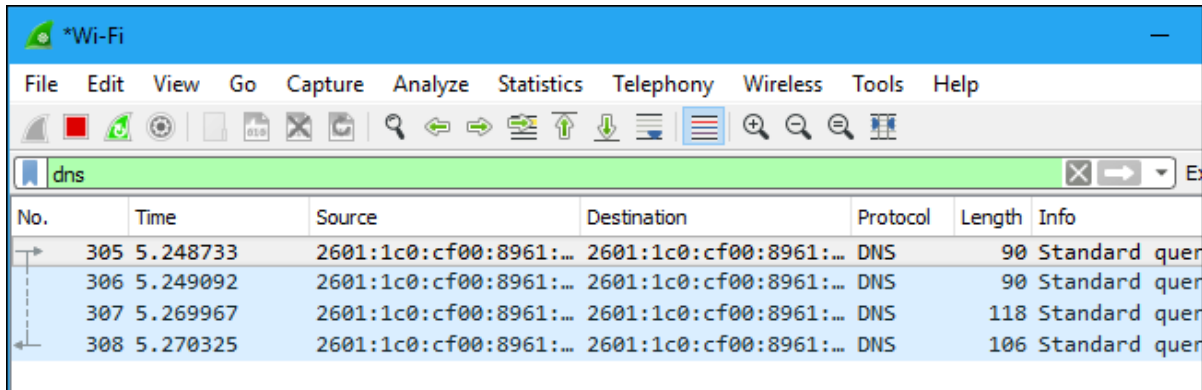


### Filtering Packets

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.

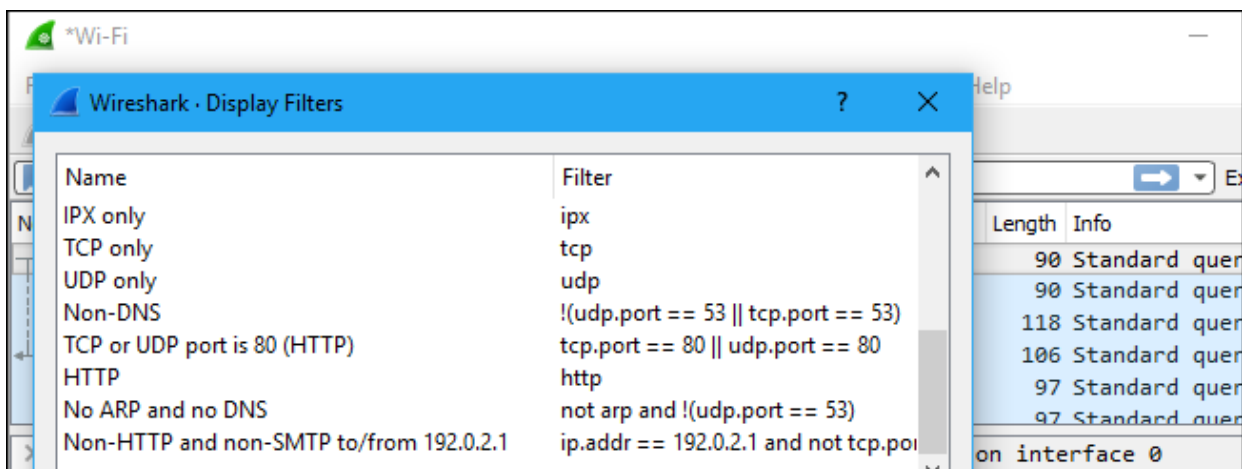
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The most basic way to apply a filter is by typing it into the filter box at the top of the window and clicking Apply (or pressing Enter). For example, type `—dns` and you'll see only DNS packets. When you start typing, Wireshark will help you autocomplete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



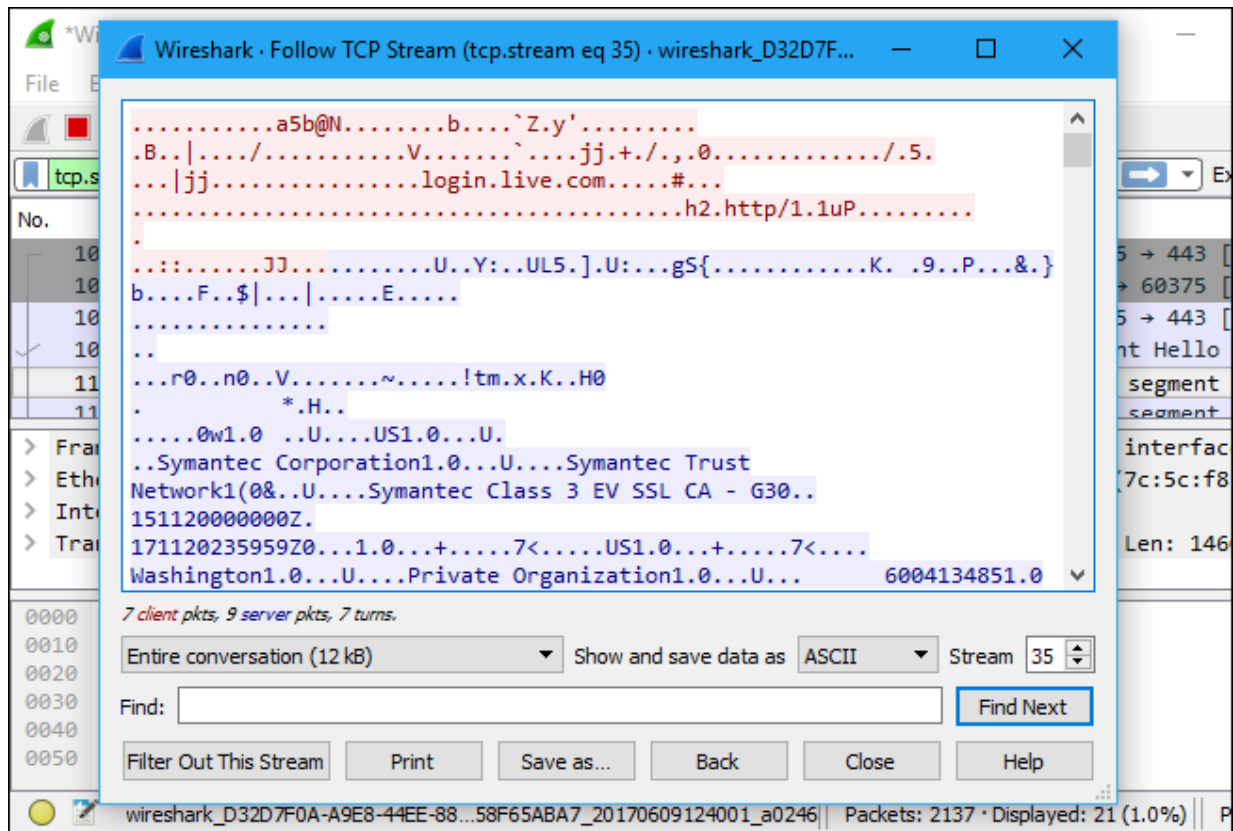
You can also click Analyze > Display Filters to choose a filter from among the default filters included in Wireshark. From here, you can add your own custom filters and save them to easily access them in the future.

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

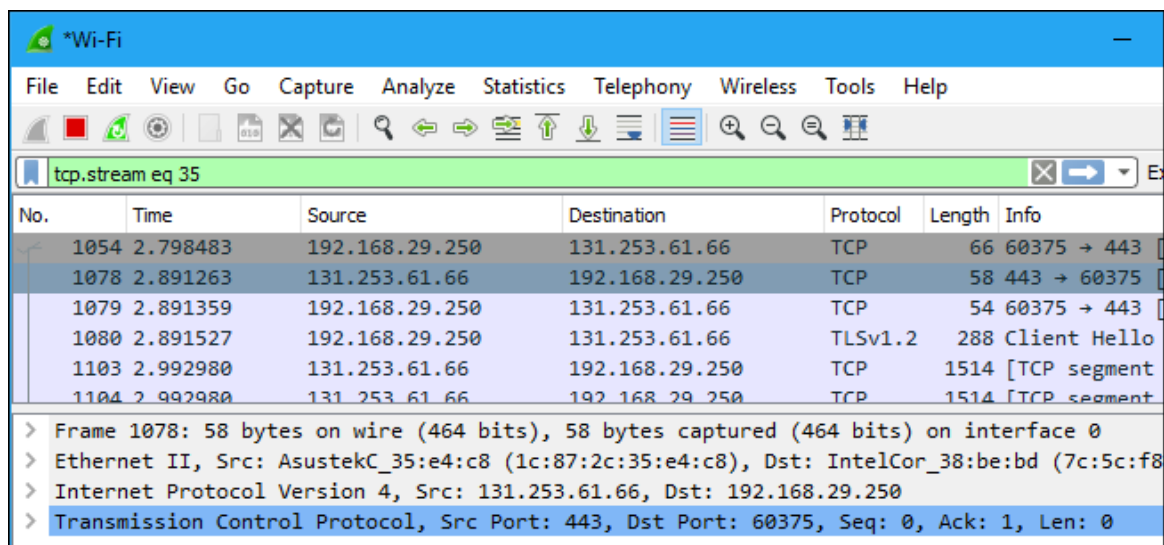


Another interesting thing you can do is right-click a packet and select Follow > TCP Stream. You'll see the full TCP conversation between the client and the server. You can also click other protocols in the Follow menu to see the full conversations for other protocols, if applicable.

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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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Wireshark interface showing packet capture details for frame 1054. The packet list shows a TCP reset (RST) from 192.168.29.250 to 131.253.61.66. The packet details pane shows the encapsulation type as Ethernet (1) and the arrival time as Jun 9, 2017 12:40:04.140141000 Pacific Daylight Time. The packet bytes pane shows the raw data in hexadecimal and ASCII.

| No.  | Time     | Source         | Destination    | Protocol | Length | Info   |
|------|----------|----------------|----------------|----------|--------|--|
| 1054 | 2.798483 | 192.168.29.250 | 131.253.61.66  | TCP      | 66     | 60375 → 443 [RST] Seq=1511457588 Win=0 Len=0 |
| 1078 | 2.891263 | 131.253.61.66  | 192.168.29.250 | TCP      | 58     | 443 → 60375 [ACK] Seq=1511457588 Win=0 Len=0 |
| 1079 | 2.891359 | 192.168.29.250 | 131.253.61.66  | TCP      | 54     | 60375 → 443 [ACK] Seq=1511457588 Win=0 Len=0 |
| 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.]@...0.....  
 0020 3d 42 eb d7 01 bb 22 52 7b 69 00 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.

Wireshark interface showing the context menu for the packet list. The 'Apply as Filter' option is selected, and the 'Selected' submenu item is highlighted. The packet list shows a TCP reset (RST) from 192.168.29.250 to 131.253.61.66. The packet details pane shows the encapsulation type as Ethernet (1) and the arrival time as Jun 9, 2017 12:40:04.140141000 Pacific Daylight Time. The packet bytes pane shows the raw data in hexadecimal and ASCII.

| No.  | Time     | Source         | Destination    | Protocol | Length | Info   |
|------|----------|----------------|----------------|----------|--------|--|
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| 1078 | 2.891263 | 131.253.61.66  | 192.168.29.250 | TCP      | 58     | 443 → 60375 [ACK] Seq=1511457588 Win=0 Len=0 |
| 1079 | 2.891359 | 192.168.29.250 | 131.253.61.66  | TCP      | 54     | 60375 → 443 [ACK] Seq=1511457588 Win=0 Len=0 |
| 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
- Prepare a Filter
- Conversation Filter
- Colorize with Filter
- Follow

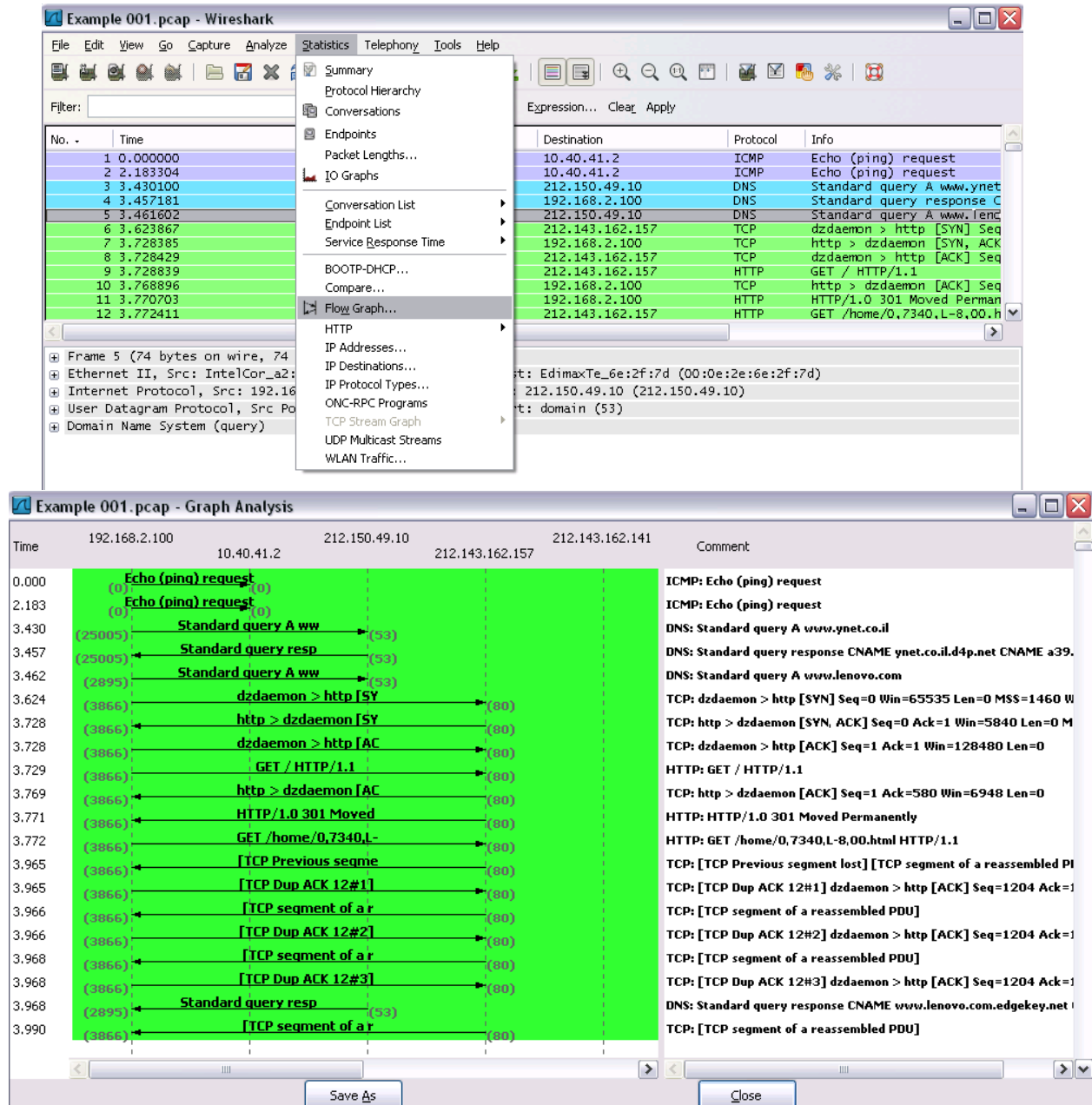
Selected  
 Not Selected  
 ...and Selected  
 ...or Selected  
 ...and not Selected

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::2d0b:bd37:c600... | 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 33 | .....TLFL3      |
| 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

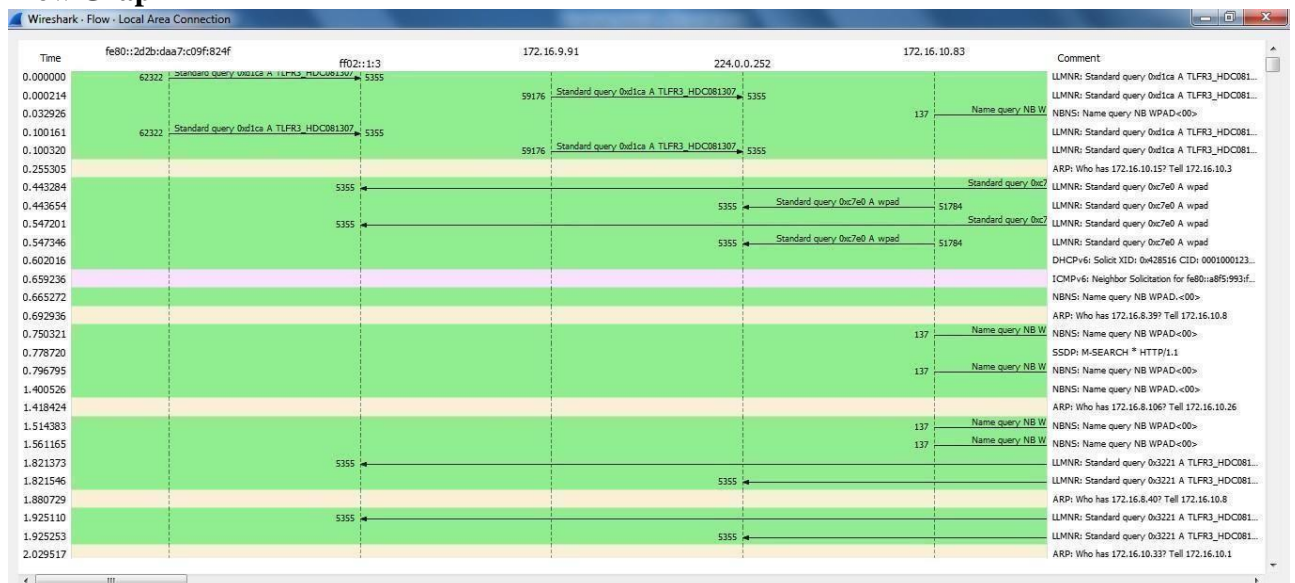
### Procedure

- 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   | 30.728279 | 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<br>Ethernet II, Src: Realtek5_b2:60:90 (00:e0:4c:b2:60:90), Dst: IntelCor_13:ed:7c (00:27:0e:13:ed:7c)<br>Internet Protocol Version 6, Src: fe80::8532:3a9f:aff1:b3ca, Dst: fe80::5c2b:19eb:d33d:a1cd<br>Transmission Control Protocol, Src Port: 1509, Dst Port: 2869, Seq: 1, Ack: 1, Len: 0 |           |                        |                        |          |        |  |

## 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  | 3.430663 | 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

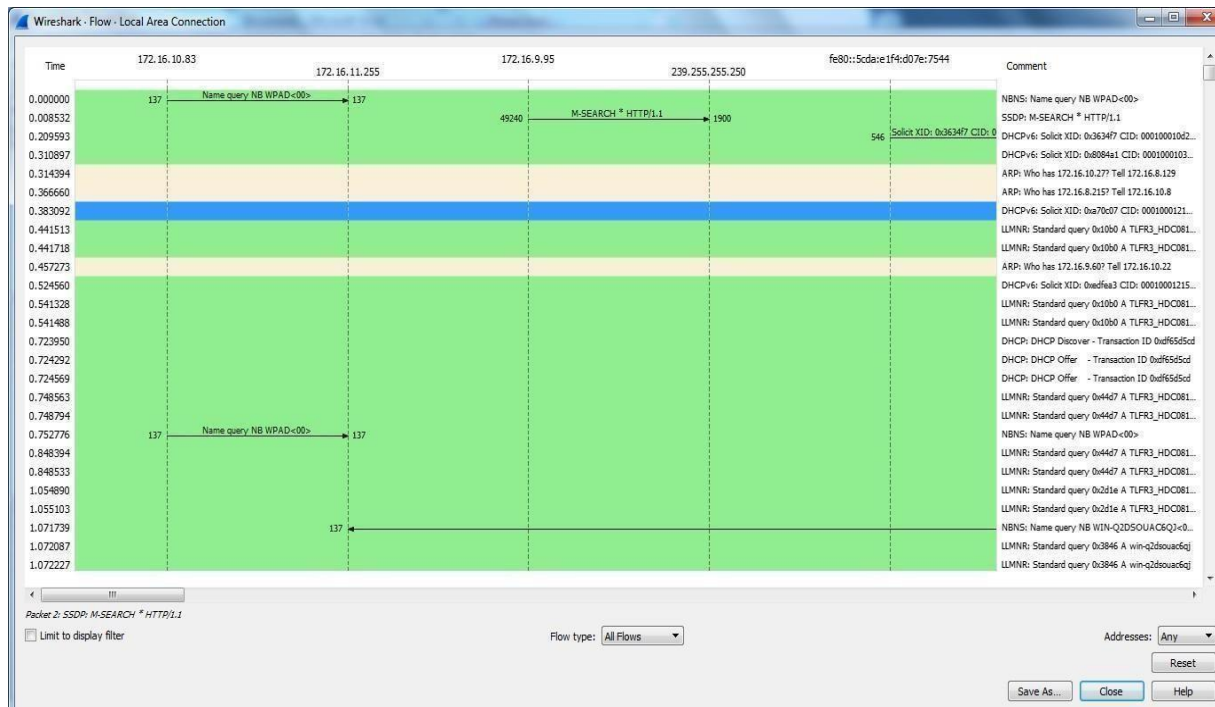
- Go to capture → option
- Select stop capture automatically after 100 packets.
- Then click Start capture.
- Search DNS packets in search bar.
- To see flow graph click Statistics→Flow graph.
- Save the packets.

| *Local Area Connection   |           |             |             |          |        |  |
|--|-----------|-------------|-------------|----------|--------|--|
| File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help |           |             |             |          |        |  |
| 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   | 37.274541 | 172.16.8.1  | 172.16.9.96 | DNS      | 129    | Standard query response 0xe76d A fonts.gstatic.com CNAME gstaticadssl.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 CNAME www3.l.google.com A 172.217.167.142      |
| 1744   | 38.883663 | 172.16.9.96 | 172.16.8.1  | DNS      | 76     | Standard query 0x8e33 A www.google.com   |

▶ 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 | 00 35 71 f2 b4 a1 00 27 0e 13 ed 7c 08 00 45 00 | 5q.....         | ..E |
| 0010 | 00 3c 37 bb 00 00 11 00 00 ac 10 09 60 ac 10    | <2.....         | ..  |
| 0020 | 00 01 f3 46 00 35 00 28 69 bb 9e 40 01 00 00 01 | ..F.5.(1..@.... |     |
| 0030 | 00 00 00 00 00 00 00 00 77 77 06 67 6f 6f 67 6c | ....www.googl   |     |
| 0040 | 65 03 63 6f 6d 00 00 01 00 01                   | e.com           |     |

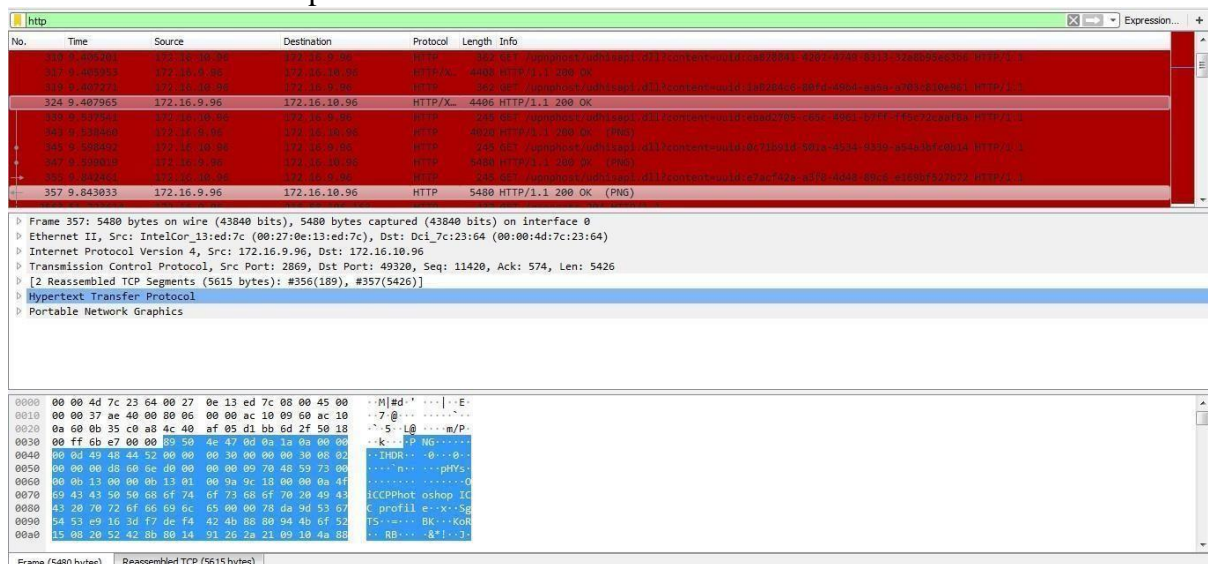
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## 4. Create a Filter to display only HTTP packets and inspect the packets

### 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.



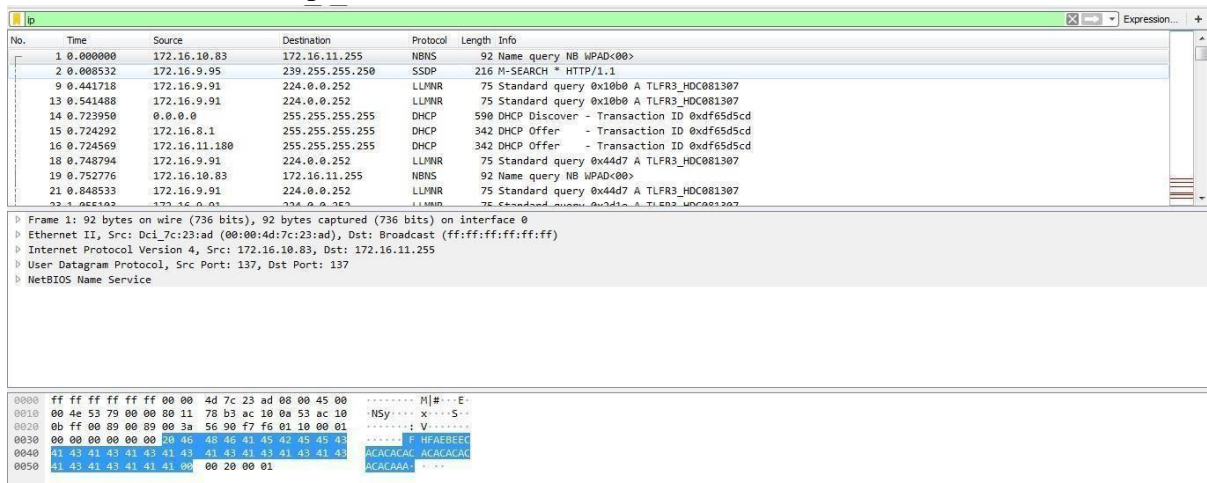


# CS23532 - COMPUTER NETWORKS

## 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

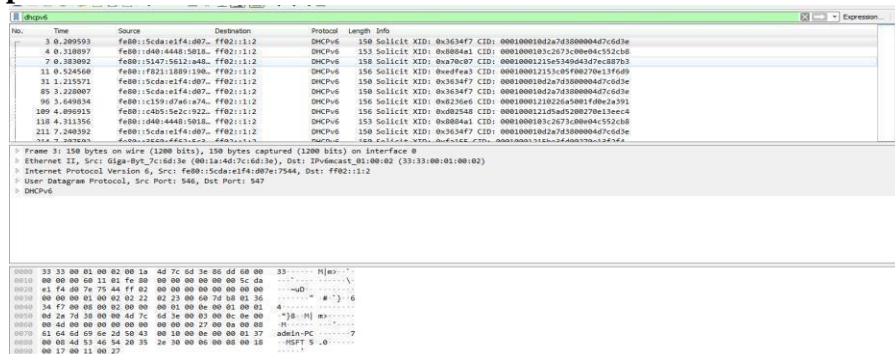


## 6. Create a Filter to display only DHCP packets and inspect the packets.

### 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?