Mawlana Bhashani Science and Technology University

Lab-Report

Report No: 05

Course code: ICT-4202

Course title: Wireless and Mobile Communication Lab

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Experiment No: 05

Experiment Name: Comparative Analysis of Wired and Wireless data using Wireshark

Objectives:

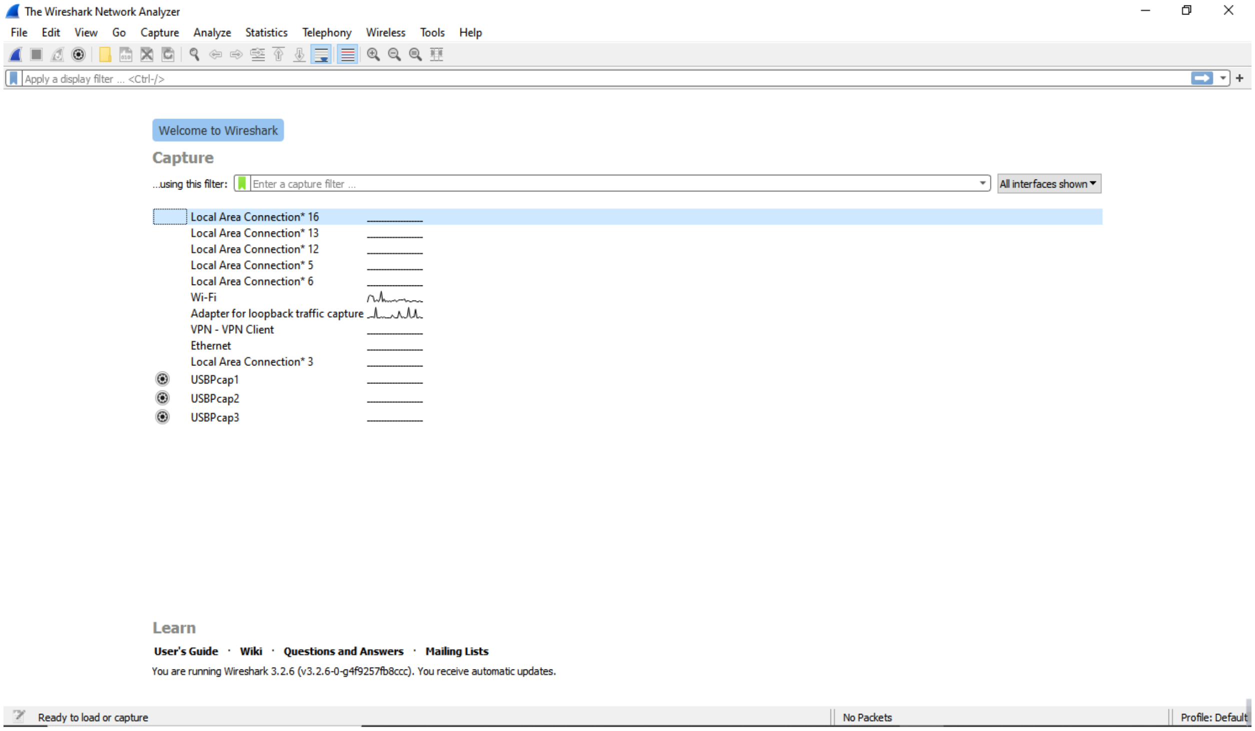
- Capture live packet data from a network interface.
- Display packets with very detailed protocol information.
- Filter packets on many criteria.
- Compare between Ethernet and wireless data packets while filtering
- Compare between Ethernet and wireless data packets in all panels
- Create various statistics.
- Compare Statistics between wired and wireless transmission

Capturing Packets:

By clicking Capture menu the process of capturing will be started. It will show the available interfaces list. Then, we need to start Capturing on interface that has IP address

The packet capture will display the details of each packet as they were transmitted over the wireless LAN. Same process goes for Ethernet cable.

Capturing can be stopped by clicking on Stop the running capture button on the main toolbar.

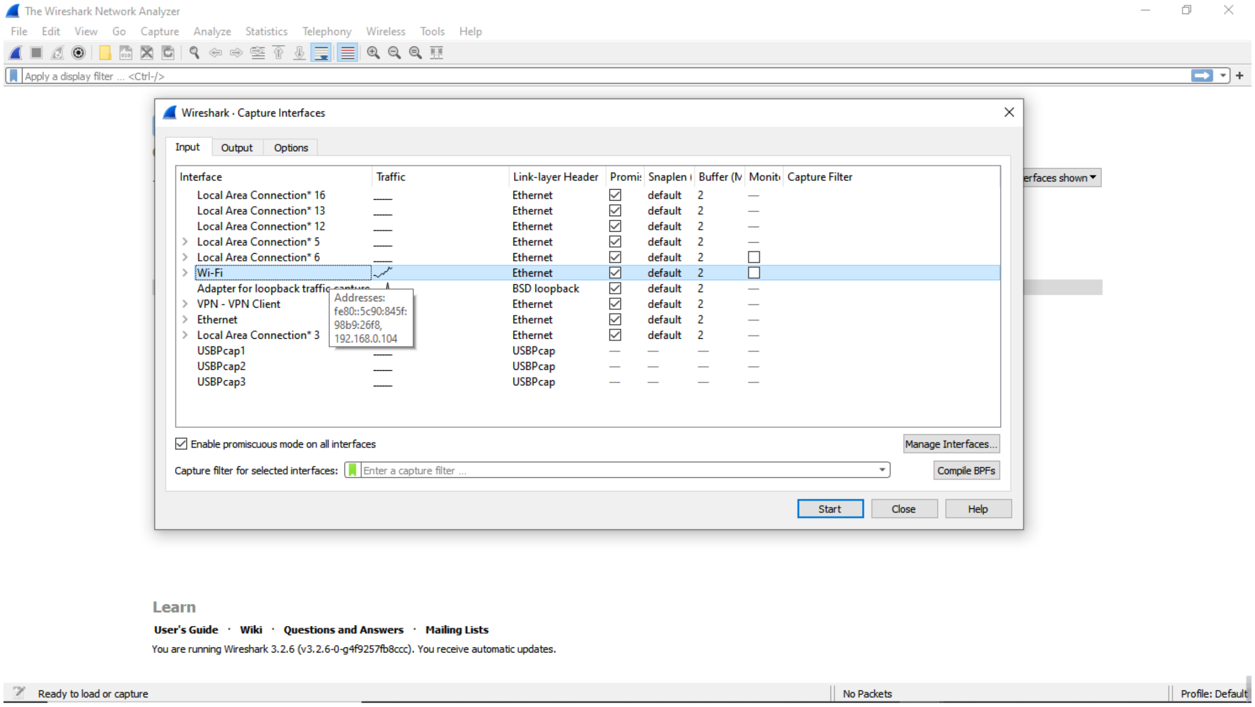


Local Area Connection* 16
Local Area Connection* 13
Local Area Connection* 12
Local Area Connection* 5
Local Area Connection* 6
Wi-Fi
Adapter for loopback traffic capture
VPN - VPN Client
Ethernet
Local Area Connection* 3
USBPcap1
USBPcap2
USBPcap3

You are running Wireshark 3.2.6 (v3.2.6-0-g4f9257fb8ccc). You receive automatic updates.

Ready to load or capture | No Packets | Profile: Default

Figure 01: Wireshark Interface List


The Wireshark Network Analyzer
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>
Wireshark · Capture Interfaces
Input
Output
Options

Interface	Traffic	Link-layer Header	Promi:	Snaplen (	Buffer (M	Monit	Capture Filter
Local Area Connection* 16		Ethernet	☑	default	2	—	
Local Area Connection* 13		Ethernet	☑	default	2	—	
Local Area Connection* 12		Ethernet	☑	default	2	—	
› Local Area Connection* 5		Ethernet	☑	default	2	—	
› Local Area Connection* 6		Ethernet	☑	default	2	□	
› Wi-Fi		Ethernet	☑	default	2	□	
Adapter for loopback traffic capture		BSD loopback	☑	default	2	—	
› VPN - VPN Client		Ethernet	☑	default	2	—	
› Ethernet		Ethernet	☑	default	2	—	
› Local Area Connection* 3		Ethernet	☑	default	2	—	
USBPcap1		USBPcap	—	—	—	—	
USBPcap2		USBPcap	—	—	—	—	
USBPcap3		USBPcap	—	—	—	—	

Addresses: fe80::5c90:845f:98b9:26f8, 192.168.0.104

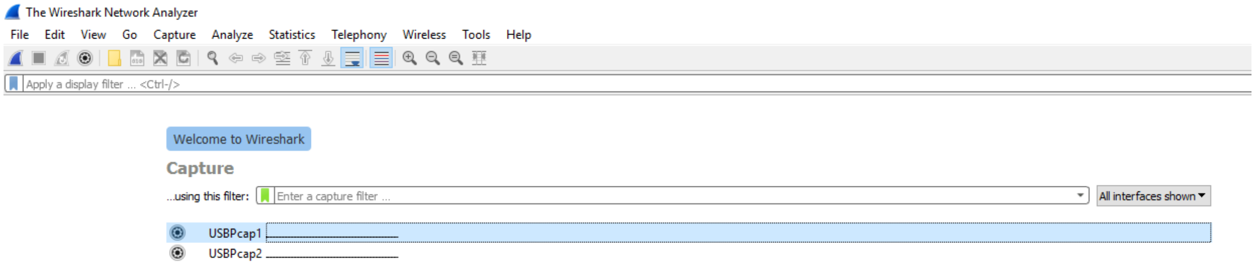
☑ Enable promiscuous mode on all interfaces

Capture filter for selected interfaces: Enter a capture filter ...

You are running Wireshark 3.2.6 (v3.2.6-0-g4f9257fb8ccc). You receive automatic updates.

Ready to load or capture | No Packets | Profile: Default

Figure 02-A: Start Capturing Interface that has IP address

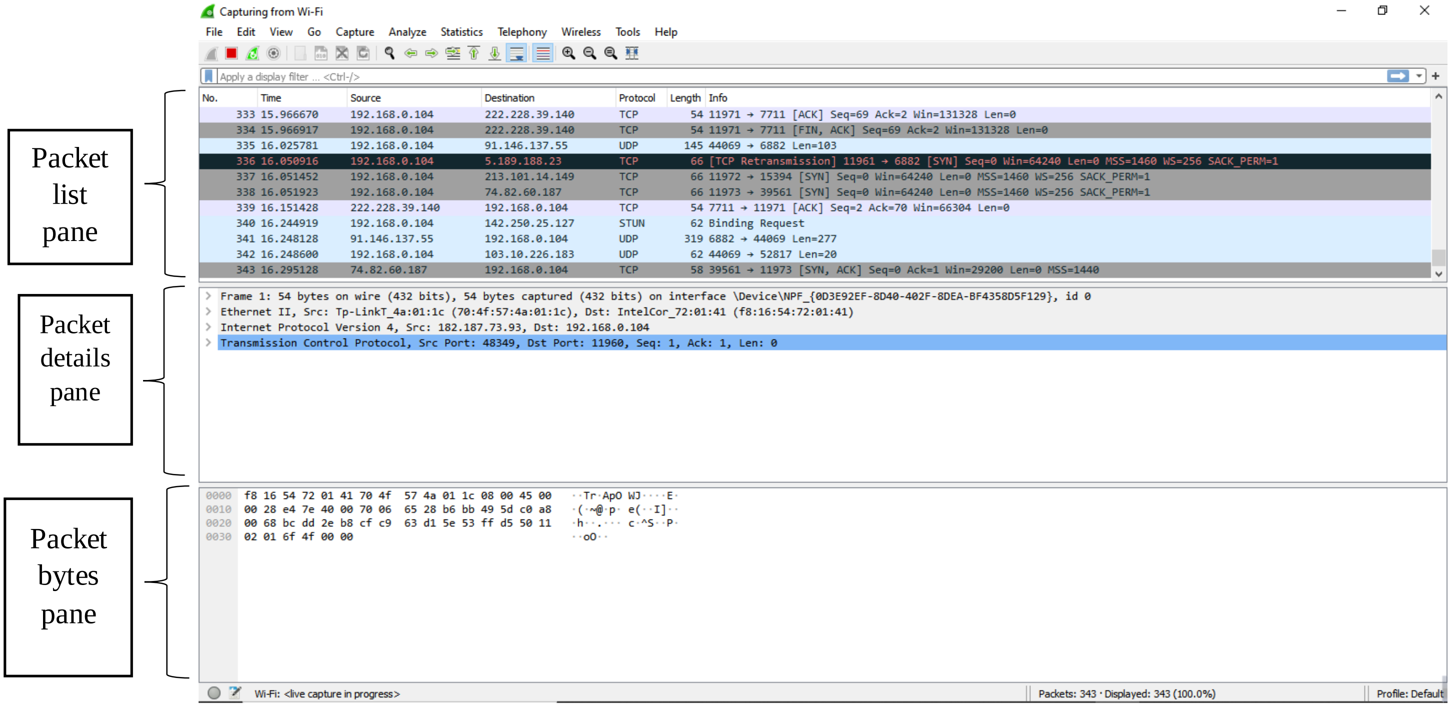

The Wireshark Network Analyzer
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>
Welcome to Wireshark
Capture

...using this filter: Enter a capture filter ...

USBPcap1

USBPcap2

Figure 02-B: Start Capturing Interface that has for USB Tethering(Wired)

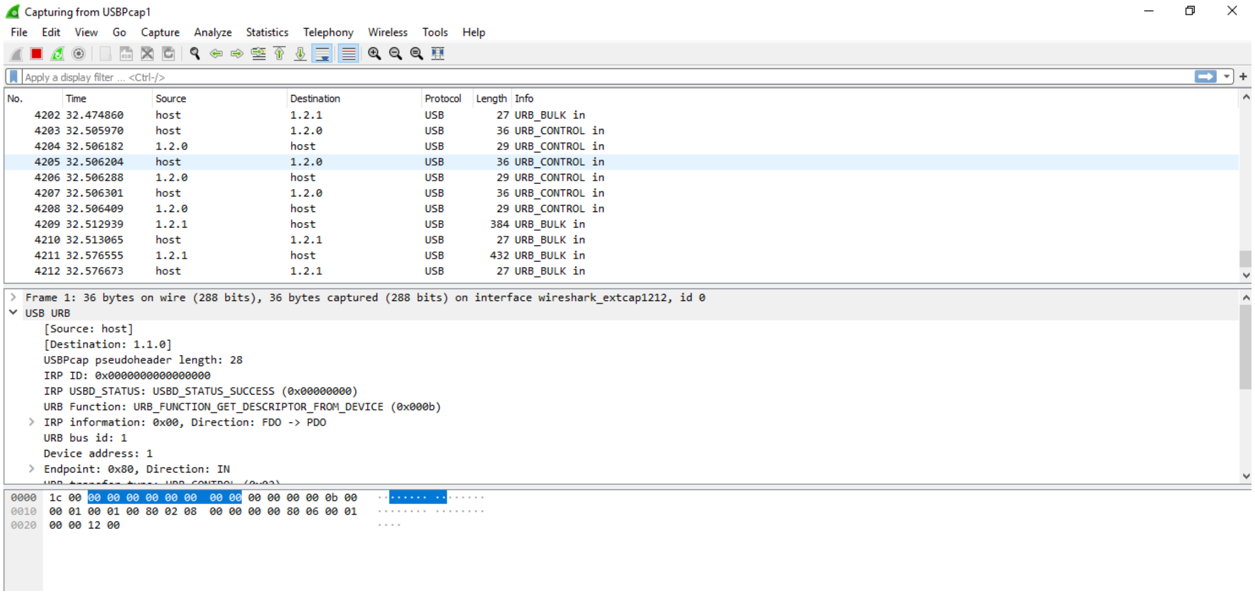

Packet list pane
Packet details pane
Packet bytes pane
Capturing from Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>
Wi-Fi: <live capture in progress>
Packets: 343 · Displayed: 343 (100.0%)
Profile: Default

```
No.     Time        Source          Destination      Protocol Length Info
    333 15.966670   192.168.0.104   222.228.39.140   TCP        54 11971 → 7711 [ACK] Seq=69 Ack=2 Win=131328 Len=0
    334 15.966917   192.168.0.104   222.228.39.140   TCP        54 11971 → 7711 [FIN, ACK] Seq=69 Ack=2 Win=131328 Len=0
    335 16.025781   192.168.0.104   91.146.137.55    UDP       145 44069 → 6882 Len=103
    336 16.050916   192.168.0.104   5.189.188.23     TCP        66 [TCP Retransmission] 11961 → 6882 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
    337 16.051452   192.168.0.104   213.101.14.149   TCP        66 11972 → 15394 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
    338 16.051923   192.168.0.104   74.82.60.187     TCP        66 11973 → 39561 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
    339 16.151428   222.228.39.140  192.168.0.104    TCP        54 7711 → 11971 [ACK] Seq=2 Ack=70 Win=66304 Len=0
    340 16.244919   192.168.0.104   142.250.25.127   STUN       62 Binding Request
    341 16.248128   91.146.137.55   192.168.0.104    UDP       319 6882 → 44069 Len=277
    342 16.248600   192.168.0.104   103.10.226.183   UDP        62 44069 → 52817 Len=20
    343 16.295128   74.82.60.187    192.168.0.104    TCP        58 39561 → 11973 [SYN, ACK] Seq=0 Ack=1 Win=29200 Len=0 MSS=1440
```

```
> Frame 1: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface \Device\NPF_{0D3E92EF-8D40-402F-8DEA-BF4358D5F129}, id 0
> Ethernet II, Src: Tp-LinkT_4a:01:1c (70:4f:57:4a:01:1c), Dst: IntelCor_72:01:41 (f8:16:54:72:01:41)
> Internet Protocol Version 4, Src: 182.187.73.93, Dst: 192.168.0.104
> Transmission Control Protocol, Src Port: 48349, Dst Port: 11960, Seq: 1, Ack: 1, Len: 0
```

```
0000  f8 16 54 72 01 41 70 4f  57 4a 01 1c 08 00 45 00   ··Tr·ApO WJ····E·
0010  00 28 e4 7e 40 00 70 06  65 28 b6 bb 49 5d c0 a8   ·(·~@·p· e(··I]··
0020  00 68 bc dd 2e b8 cf c9  63 d1 5e 53 ff d5 50 11   ·h··.··· c·^S··P·
0030  02 01 6f 4f 00 00                                  ··oO··
```

Figure 03-A: A sample packet capture window(wireless)

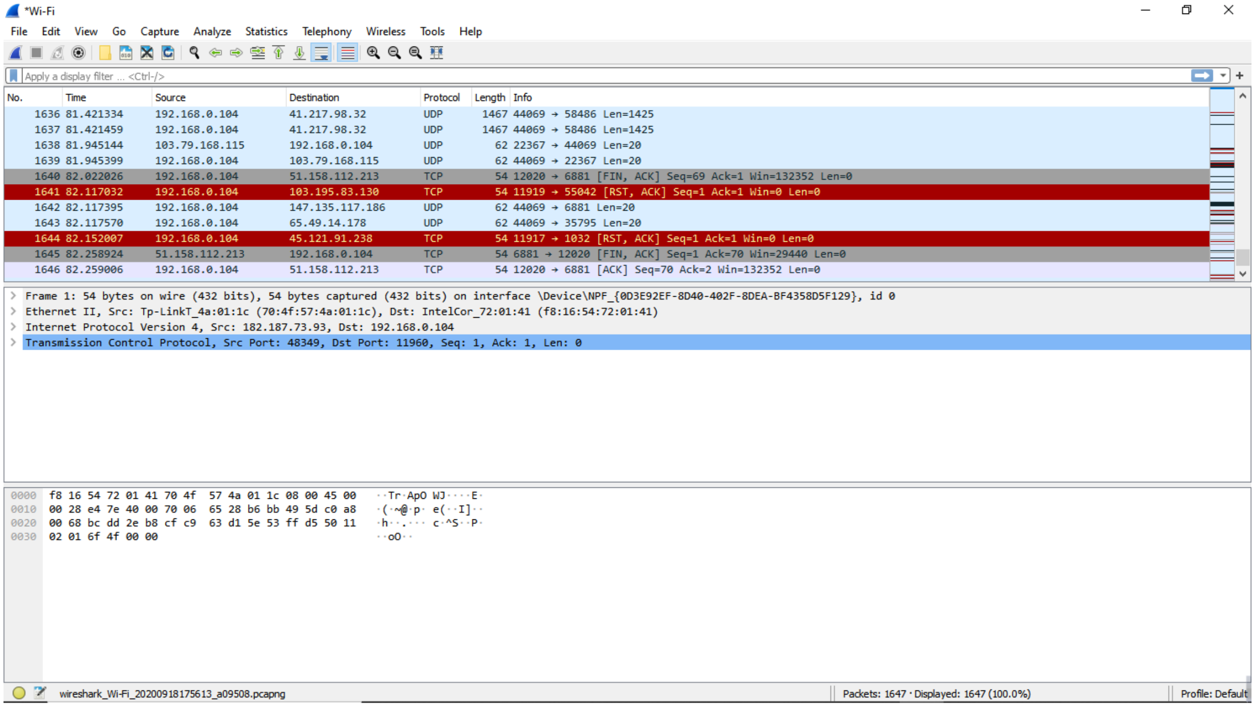

Capturing from USBPcap1
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>

```
No.     Time        Source     Destination  Protocol Length Info
   4202 32.474860   host       1.2.1        USB        27 URB_BULK in
   4203 32.505970   host       1.2.0        USB        36 URB_CONTROL in
   4204 32.506182   1.2.0      host         USB        29 URB_CONTROL in
   4205 32.506204   host       1.2.0        USB        36 URB_CONTROL in
   4206 32.506288   1.2.0      host         USB        29 URB_CONTROL in
   4207 32.506301   host       1.2.0        USB        36 URB_CONTROL in
   4208 32.506409   1.2.0      host         USB        29 URB_CONTROL in
   4209 32.512939   1.2.1      host         USB       384 URB_BULK in
   4210 32.513065   host       1.2.1        USB        27 URB_BULK in
   4211 32.576555   1.2.1      host         USB       432 URB_BULK in
   4212 32.576673   host       1.2.1        USB        27 URB_BULK in
```

```
> Frame 1: 36 bytes on wire (288 bits), 36 bytes captured (288 bits) on interface wireshark_extcap1212, id 0
v USB URB
    [Source: host]
    [Destination: 1.1.0]
    USBPcap pseudoheader length: 28
    IRP ID: 0x0000000000000000
    IRP USBD_STATUS: USBD_STATUS_SUCCESS (0x00000000)
    URB Function: URB_FUNCTION_GET_DESCRIPTOR_FROM_DEVICE (0x000b)
  > IRP information: 0x00, Direction: FDO -> PDO
    URB bus id: 1
    Device address: 1
  > Endpoint: 0x80, Direction: IN
    URB transfer type: URB_CONTROL (0x02)
```

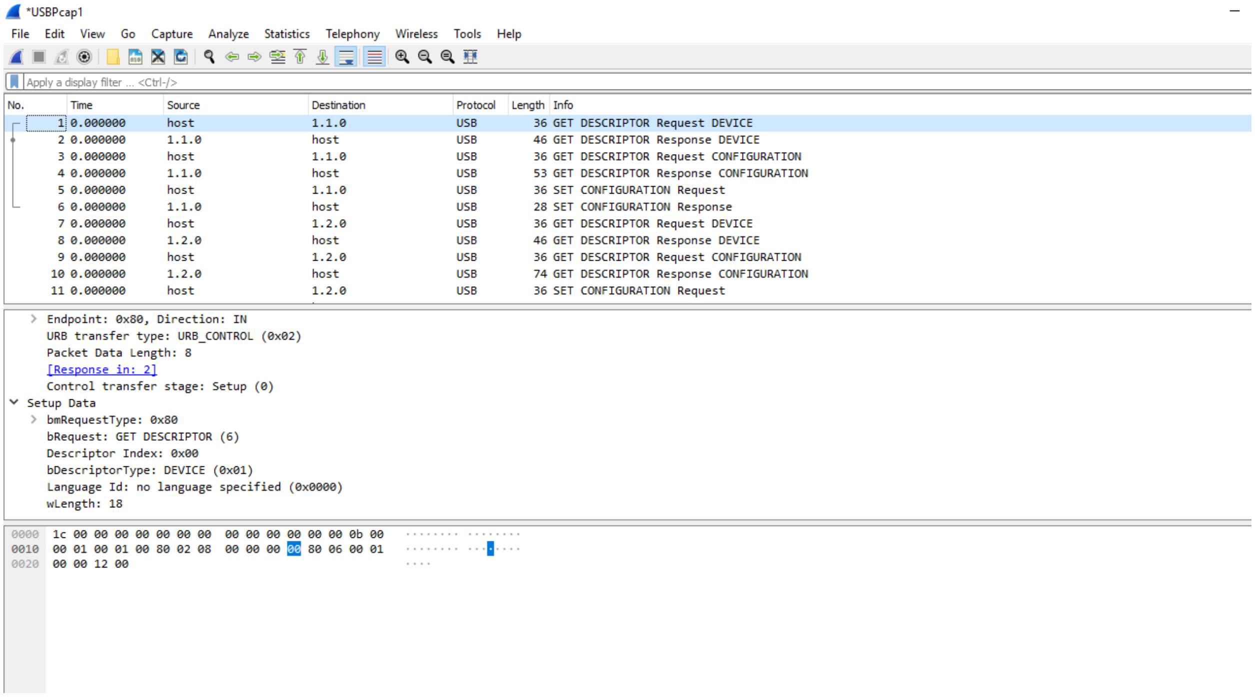
```
0000  1c 00 00 00 00 00 00 00  00 00 00 00 00 00 0b 00   ········ ········
0010  00 01 00 01 00 80 02 08  00 00 00 00 80 06 00 01   ········ ········
0020  00 00 12 00                                        ····
```

Figure 03-B: A sample packet capture window for Wired Data Pack


*Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter … <Ctrl-/>

```
No.   Time       Source          Destination      Protocol Length Info
 1636 81.421334  192.168.0.104   41.217.98.32     UDP      1467 44069 → 58486 Len=1425
 1637 81.421459  192.168.0.104   41.217.98.32     UDP      1467 44069 → 58486 Len=1425
 1638 81.945144  103.79.168.115  192.168.0.104    UDP        62 22367 → 44069 Len=20
 1639 81.945399  192.168.0.104   103.79.168.115   UDP        62 44069 → 22367 Len=20
 1640 82.022026  192.168.0.104   51.158.112.213   TCP        54 12020 → 6881 [FIN, ACK] Seq=69 Ack=1 Win=132352 Len=0
 1641 82.117032  192.168.0.104   103.195.83.130   TCP        54 11919 → 55042 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
 1642 82.117395  192.168.0.104   147.135.117.186  UDP        62 44069 → 6881 Len=20
 1643 82.117570  192.168.0.104   65.49.14.178     UDP        62 44069 → 35795 Len=20
 1644 82.152007  192.168.0.104   45.121.91.238    TCP        54 11917 → 1032 [RST, ACK] Seq=1 Ack=1 Win=0 Len=0
 1645 82.258924  51.158.112.213  192.168.0.104    TCP        54 6881 → 12020 [FIN, ACK] Seq=1 Ack=70 Win=29440 Len=0
 1646 82.259006  192.168.0.104   51.158.112.213   TCP        54 12020 → 6881 [ACK] Seq=70 Ack=2 Win=132352 Len=0

> Frame 1: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface \Device\NPF_{0D3E92EF-8D40-402F-8DEA-BF4358D5F129}, id 0
> Ethernet II, Src: Tp-LinkT_4a:01:1c (70:4f:57:4a:01:1c), Dst: IntelCor_72:01:41 (f8:16:54:72:01:41)
> Internet Protocol Version 4, Src: 182.187.73.93, Dst: 192.168.0.104
> Transmission Control Protocol, Src Port: 48349, Dst Port: 11960, Seq: 1, Ack: 1, Len: 0

0000  f8 16 54 72 01 41 70 4f  57 4a 01 1c 08 00 45 00   ··Tr·ApO WJ····E·
0010  00 28 e4 7e 40 00 70 06  65 28 b6 bb 49 5d c0 a8   ·(·~@·p· e(··I]··
0020  00 68 bc dd 2e b8 cf c9  63 d1 5e 53 ff d5 50 11   ·h··.··· c·^S··P·
0030  02 01 6f 4f 00 00                                  ··oO··

wireshark_Wi-Fi_20200918175613_a09508.pcapng    Packets: 1647 · Displayed: 1647 (100.0%)    Profile: Default
```

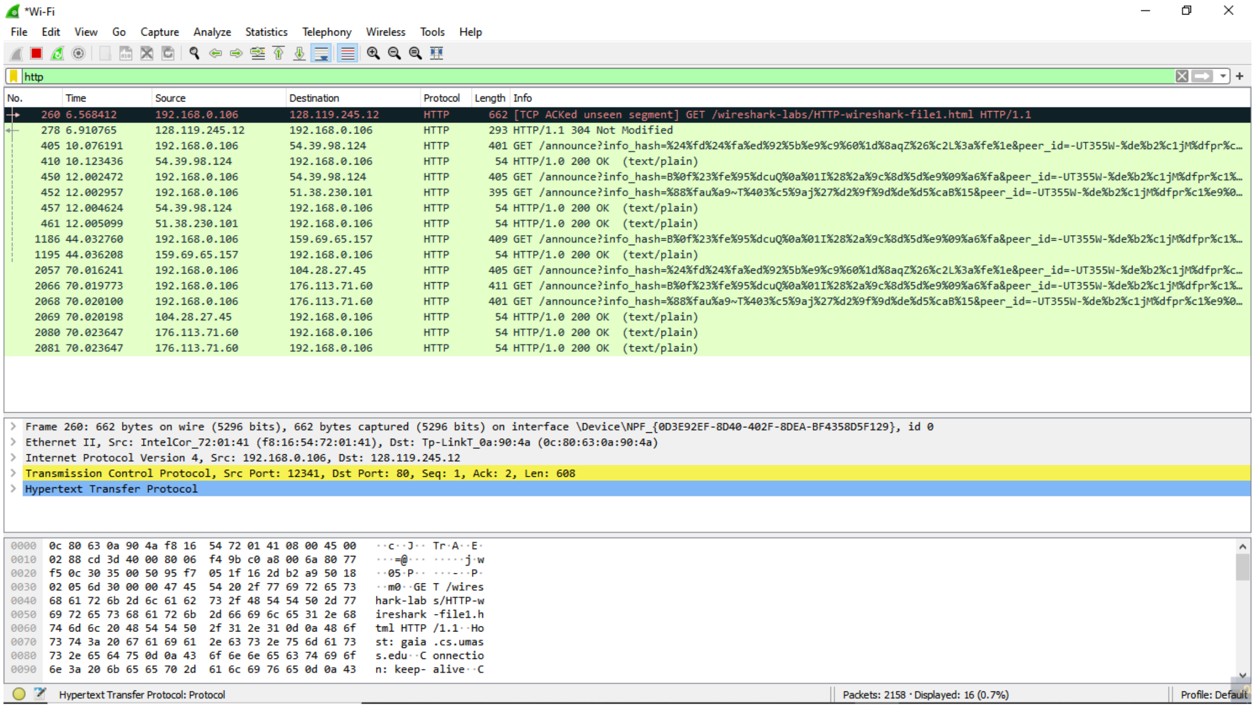
Figure 04-A: Stopping Capture(wireless)


*USBPcap1
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter … <Ctrl-/>

```
No.  Time      Source  Destination  Protocol  Length Info
   1 0.000000  host    1.1.0        USB       36 GET DESCRIPTOR Request DEVICE
   2 0.000000  1.1.0   host         USB       46 GET DESCRIPTOR Response DEVICE
   3 0.000000  host    1.1.0        USB       36 GET DESCRIPTOR Request CONFIGURATION
   4 0.000000  1.1.0   host         USB       53 GET DESCRIPTOR Response CONFIGURATION
   5 0.000000  host    1.1.0        USB       36 SET CONFIGURATION Request
   6 0.000000  1.1.0   host         USB       28 SET CONFIGURATION Response
   7 0.000000  host    1.2.0        USB       36 GET DESCRIPTOR Request DEVICE
   8 0.000000  1.2.0   host         USB       46 GET DESCRIPTOR Response DEVICE
   9 0.000000  host    1.2.0        USB       36 GET DESCRIPTOR Request CONFIGURATION
  10 0.000000  1.2.0   host         USB       74 GET DESCRIPTOR Response CONFIGURATION
  11 0.000000  host    1.2.0        USB       36 SET CONFIGURATION Request

  > Endpoint: 0x80, Direction: IN
    URB transfer type: URB_CONTROL (0x02)
    Packet Data Length: 8
    [Response in: 2]
    Control transfer stage: Setup (0)
v Setup Data
  > bmRequestType: 0x80
    bRequest: GET DESCRIPTOR (6)
    Descriptor Index: 0x00
    bDescriptorType: DEVICE (0x01)
    Language Id: no language specified (0x0000)
    wLength: 18

0000  1c 00 00 00 00 00 00 00  00 00 00 00 00 00 0b 00   ········ ········
0010  00 01 00 01 00 80 02 08  00 00 00 00 80 06 00 01   ········ ········
0020  00 00 12 00                                        ····
```

Figure 04-B: Stopping Capture for Wi-Fi (Wired)

Filtering:



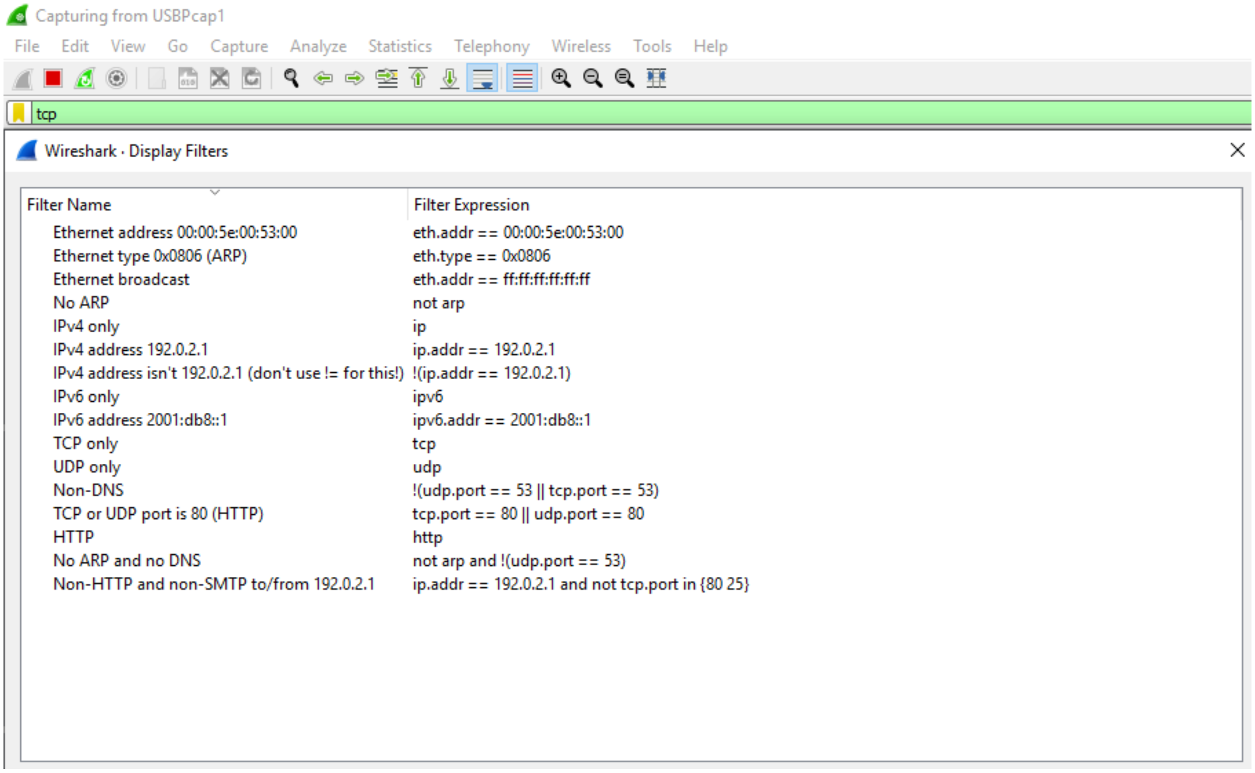
```
No.   Time        Source          Destination     Protocol Length Info
  260 6.568412    192.168.0.106   128.119.245.12  HTTP      662 [TCP ACKed unseen segment] GET /wireshark-labs/HTTP-wireshark-file1.html HTTP/1.1
  278 6.910765    128.119.245.12  192.168.0.106   HTTP      293 HTTP/1.1 304 Not Modified
  405 10.076191   192.168.0.106   54.39.98.124    HTTP      401 GET /announce?info_hash=%24%fd%24%fa%ed%92%5b%e9%c9%60%1d%8aqZ%26%c2L%3a%fe%1e&peer_id=-UT355W-%de%b2%c1jM%dfpr%c…
  410 10.123436   54.39.98.124    192.168.0.106   HTTP       54 HTTP/1.0 200 OK  (text/plain)
  450 12.002472   192.168.0.106   54.39.98.124    HTTP      405 GET /announce?info_hash=B%0f%23%fe%95%dcuQ%0a%01I%28%2a%9c%8d%5d%e9%09%a6%fa&peer_id=-UT355W-%de%b2%c1jM%dfpr%c1%…
  452 12.002957   192.168.0.106   51.38.230.101   HTTP      395 GET /announce?info_hash=%88%fau%a9~T%403%c5%9aj%27%d2%9f%9d%de%d5%caB%15&peer_id=-UT355W-%de%b2%c1jM%dfpr%c1%e9%0…
  457 12.004624   54.39.98.124    192.168.0.106   HTTP       54 HTTP/1.0 200 OK  (text/plain)
  461 12.005099   51.38.230.101   192.168.0.106   HTTP       54 HTTP/1.0 200 OK  (text/plain)
 1186 44.032760   192.168.0.106   159.69.65.157   HTTP      409 GET /announce?info_hash=B%0f%23%fe%95%dcuQ%0a%01I%28%2a%9c%8d%5d%e9%09%a6%fa&peer_id=-UT355W-%de%b2%c1jM%dfpr%c1%…
 1195 44.036208   159.69.65.157   192.168.0.106   HTTP       54 HTTP/1.0 200 OK  (text/plain)
 2057 70.016241   192.168.0.106   104.28.27.45    HTTP      405 GET /announce?info_hash=%24%fd%24%fa%ed%92%5b%e9%c9%60%1d%8aqZ%26%c2L%3a%fe%1e&peer_id=-UT355W-%de%b2%c1jM%dfpr%c…
 2066 70.019773   192.168.0.106   176.113.71.60   HTTP      411 GET /announce?info_hash=B%0f%23%fe%95%dcuQ%0a%01I%28%2a%9c%8d%5d%e9%09%a6%fa&peer_id=-UT355W-%de%b2%c1jM%dfpr%c1%…
 2068 70.020100   192.168.0.106   176.113.71.60   HTTP      401 GET /announce?info_hash=%88%fau%a9~T%403%c5%9aj%27%d2%9f%9d%de%d5%caB%15&peer_id=-UT355W-%de%b2%c1jM%dfpr%c1%e9%0…
 2069 70.020198   104.28.27.45    192.168.0.106   HTTP       54 HTTP/1.0 200 OK  (text/plain)
 2080 70.023647   176.113.71.60   192.168.0.106   HTTP       54 HTTP/1.0 200 OK  (text/plain)
 2081 70.023647   176.113.71.60   192.168.0.106   HTTP       54 HTTP/1.0 200 OK  (text/plain)
```

```
> Frame 260: 662 bytes on wire (5296 bits), 662 bytes captured (5296 bits) on interface \Device\NPF_{0D3E92EF-8D40-402F-8DEA-BF4358D5F129}, id 0
> Ethernet II, Src: IntelCor_72:01:41 (f8:16:54:72:01:41), Dst: Tp-LinkT_0a:90:4a (0c:80:63:0a:90:4a)
> Internet Protocol Version 4, Src: 192.168.0.106, Dst: 128.119.245.12
> Transmission Control Protocol, Src Port: 12341, Dst Port: 80, Seq: 1, Ack: 2, Len: 608
> Hypertext Transfer Protocol
```

```
0000  0c 80 63 0a 90 4a f8 16  54 72 01 41 08 00 45 00   ··c··J·· Tr·A··E·
0010  02 88 cd 3d 40 00 80 06  f4 9b c0 a8 00 6a 80 77   ···=@··· ·····j·w
0020  f5 0c 30 35 00 50 95 f7  05 1f 16 2d b2 a9 50 18   ··05·P·· ···-··P·
0030  02 05 6d 30 00 00 47 45  54 20 2f 77 69 72 65 73   ··m0··GE T /wires
0040  68 61 72 6b 2d 6c 61 62  73 2f 48 54 54 50 2d 77   hark-lab s/HTTP-w
0050  69 72 65 73 68 61 72 6b  2d 66 69 6c 65 31 2e 68   ireshark -file1.h
0060  74 6d 6c 20 48 54 54 50  2f 31 2e 31 0d 0a 48 6f   tml HTTP /1.1··Ho
0070  73 74 3a 20 67 61 69 61  2e 63 73 2e 75 6d 61 73   st: gaia .cs.umas
0080  73 2e 65 64 75 0d 0a 43  6f 6e 6e 65 63 74 69 6f   s.edu··C onnectio
0090  6e 3a 20 6b 65 65 70 2d  61 6c 69 76 65 0d 0a 43   n: keep- alive··C
```

Hypertext Transfer Protocol: Protocol | Packets: 2158 · Displayed: 16 (0.7%) | Profile: Default

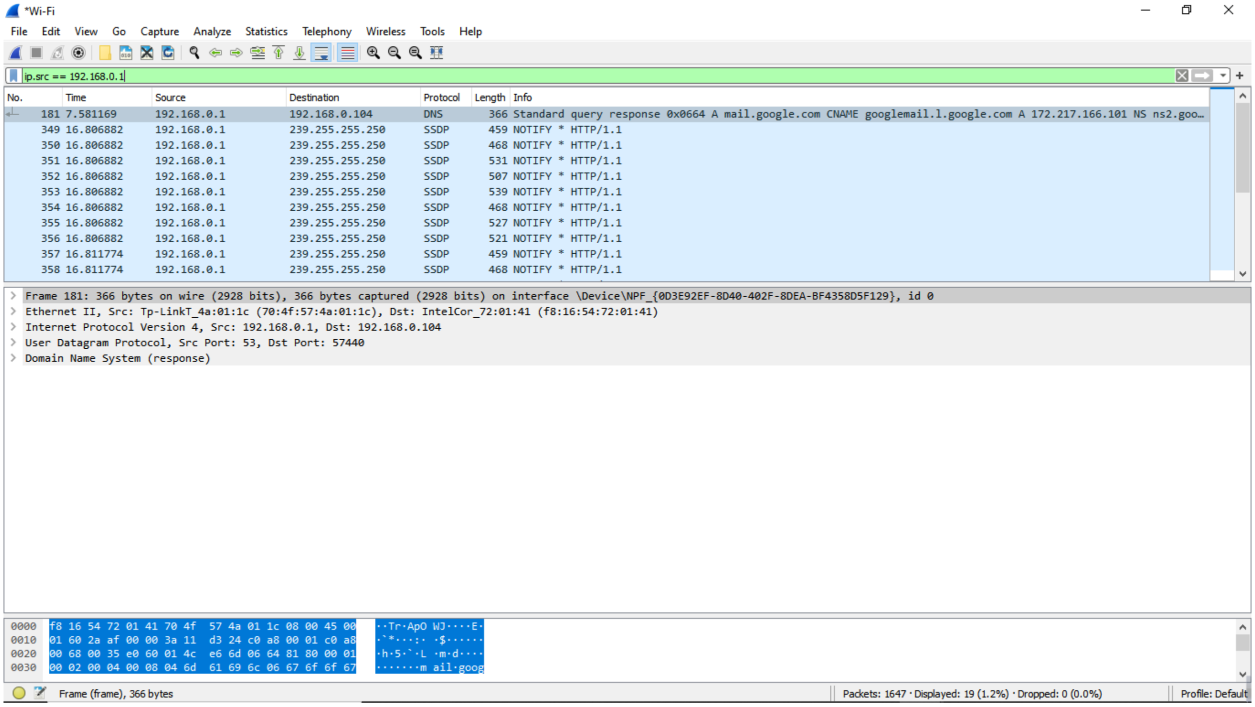
Figure 05-A: Filter by HTTP Protocol(wireless)



Filter Name	Filter Expression
Ethernet address 00:00:5e:00:53:00	eth.addr == 00:00:5e:00:53:00
Ethernet type 0x0806 (ARP)	eth.type == 0x0806
Ethernet broadcast	eth.addr == ff:ff:ff:ff:ff:ff
No ARP	not arp
IPv4 only	ip
IPv4 address 192.0.2.1	ip.addr == 192.0.2.1
IPv4 address isn't 192.0.2.1 (don't use != for this!)	!(ip.addr == 192.0.2.1)
IPv6 only	ipv6
IPv6 address 2001:db8::1	ipv6.addr == 2001:db8::1
TCP only	tcp
UDP only	udp
Non-DNS	!(udp.port == 53 || tcp.port == 53)
TCP or UDP port is 80 (HTTP)	tcp.port == 80 || udp.port == 80
HTTP	http
No ARP and no DNS	not arp and !(udp.port == 53)
Non-HTTP and non-SMTP to/from 192.0.2.1	ip.addr == 192.0.2.1 and not tcp.port in {80 25}

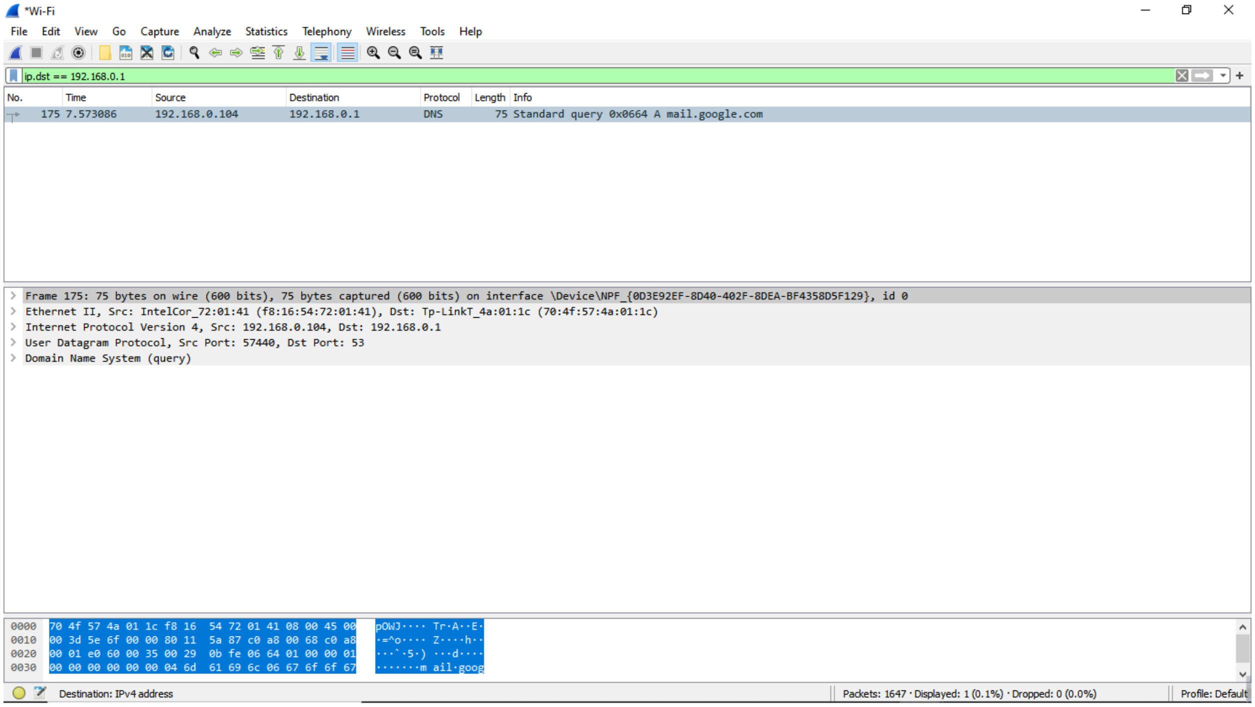
Figure 05-B: Filter by Protocol (Wired Data Packages)

A source filter can be applied to restrict the packet view in wireshark to only those packets that have source IP as mentioned in the filter.



```
ip.src == 192.168.0.1

No.   Time       Source        Destination      Protocol Length Info
  181 7.581169   192.168.0.1   192.168.0.104    DNS      366 Standard query response 0x0664 A mail.google.com CNAME googlemail.l.google.com A 172.217.166.101 NS ns2.goo…
  349 16.806882  192.168.0.1   239.255.255.250  SSDP     459 NOTIFY * HTTP/1.1
  350 16.806882  192.168.0.1   239.255.255.250  SSDP     468 NOTIFY * HTTP/1.1
  351 16.806882  192.168.0.1   239.255.255.250  SSDP     531 NOTIFY * HTTP/1.1
  352 16.806882  192.168.0.1   239.255.255.250  SSDP     507 NOTIFY * HTTP/1.1
  353 16.806882  192.168.0.1   239.255.255.250  SSDP     539 NOTIFY * HTTP/1.1
  354 16.806882  192.168.0.1   239.255.255.250  SSDP     468 NOTIFY * HTTP/1.1
  355 16.806882  192.168.0.1   239.255.255.250  SSDP     527 NOTIFY * HTTP/1.1
  356 16.806882  192.168.0.1   239.255.255.250  SSDP     521 NOTIFY * HTTP/1.1
  357 16.811774  192.168.0.1   239.255.255.250  SSDP     459 NOTIFY * HTTP/1.1
  358 16.811774  192.168.0.1   239.255.255.250  SSDP     468 NOTIFY * HTTP/1.1

> Frame 181: 366 bytes on wire (2928 bits), 366 bytes captured (2928 bits) on interface \Device\NPF_{0D3E92EF-8D40-402F-8DEA-BF4358D5F129}, id 0
> Ethernet II, Src: Tp-LinkT_4a:01:1c (70:4f:57:4a:01:1c), Dst: IntelCor_72:01:41 (f8:16:54:72:01:41)
> Internet Protocol Version 4, Src: 192.168.0.1, Dst: 192.168.0.104
> User Datagram Protocol, Src Port: 53, Dst Port: 57440
> Domain Name System (response)

0000  f8 16 54 72 01 41 70 4f  57 4a 01 1c 08 00 45 00   ··Tr·ApO WJ····E·
0010  01 60 2a af 00 00 3a 11  d3 24 c0 a8 00 01 c0 a8   ·`*···:· ·$······
0020  00 68 00 35 e0 60 01 4c  e6 6d 06 64 81 80 00 01   ·h·5·`·L ·m·d····
0030  00 02 00 04 00 08 04 6d  61 69 6c 06 67 6f 6f 67   ·······m ail·goog

Frame (frame), 366 bytes     Packets: 1647 · Displayed: 19 (1.2%) · Dropped: 0 (0.0%)     Profile: Default
```

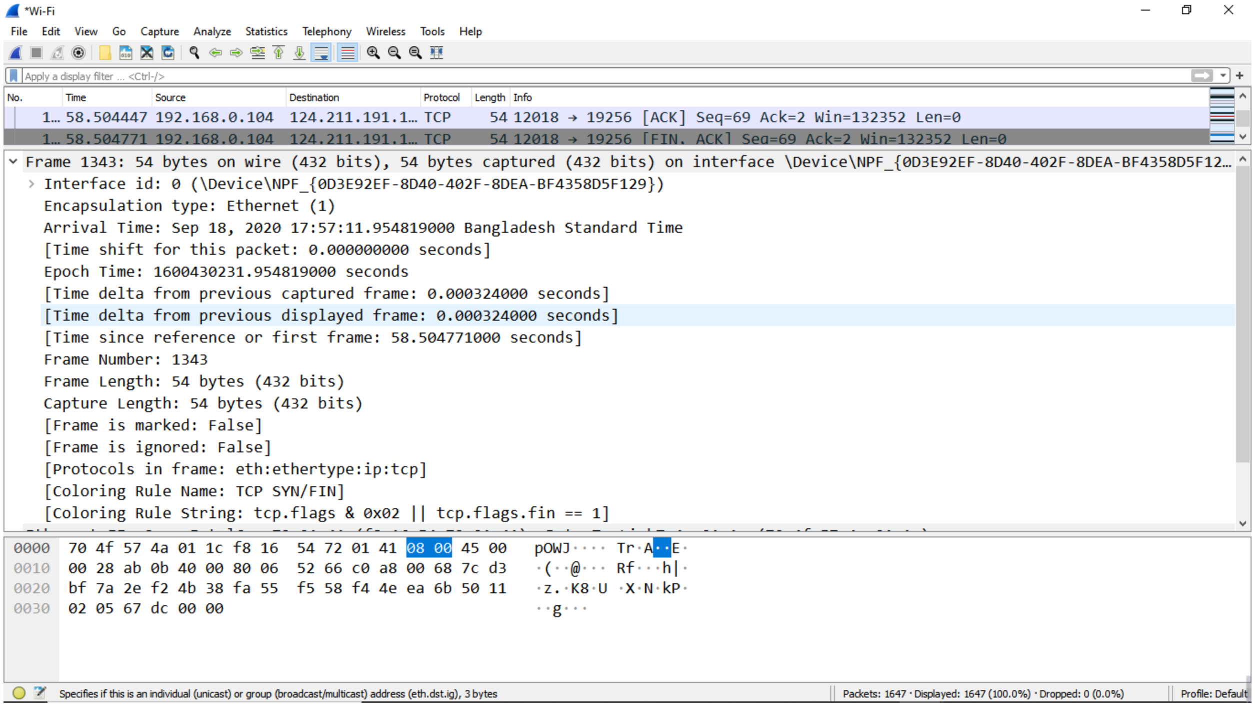
Figure 06: Source IP filter



```
ip.dst == 192.168.0.1

No.   Time       Source          Destination   Protocol Length Info
  175 7.573086   192.168.0.104   192.168.0.1   DNS       75 Standard query 0x0664 A mail.google.com

> Frame 175: 75 bytes on wire (600 bits), 75 bytes captured (600 bits) on interface \Device\NPF_{0D3E92EF-8D40-402F-8DEA-BF4358D5F129}, id 0
> Ethernet II, Src: IntelCor_72:01:41 (f8:16:54:72:01:41), Dst: Tp-LinkT_4a:01:1c (70:4f:57:4a:01:1c)
> Internet Protocol Version 4, Src: 192.168.0.104, Dst: 192.168.0.1
> User Datagram Protocol, Src Port: 57440, Dst Port: 53
> Domain Name System (query)

0000  70 4f 57 4a 01 1c f8 16  54 72 01 41 08 00 45 00   pOWJ···· Tr·A··E·
0010  00 3d 5e 6f 00 00 80 11  5a 87 c0 a8 00 68 c0 a8   ·=^o···· Z····h··
0020  00 01 e0 60 00 35 00 29  0b fe 06 64 01 00 00 01   ···`·5·) ···d····
0030  00 00 00 00 00 00 04 6d  61 69 6c 06 67 6f 6f 67   ·······m ail·goog

Destination: IPv4 address     Packets: 1647 · Displayed: 1 (0.1%) · Dropped: 0 (0.0%)     Profile: Default
```

Figure 07: Destination IP filter

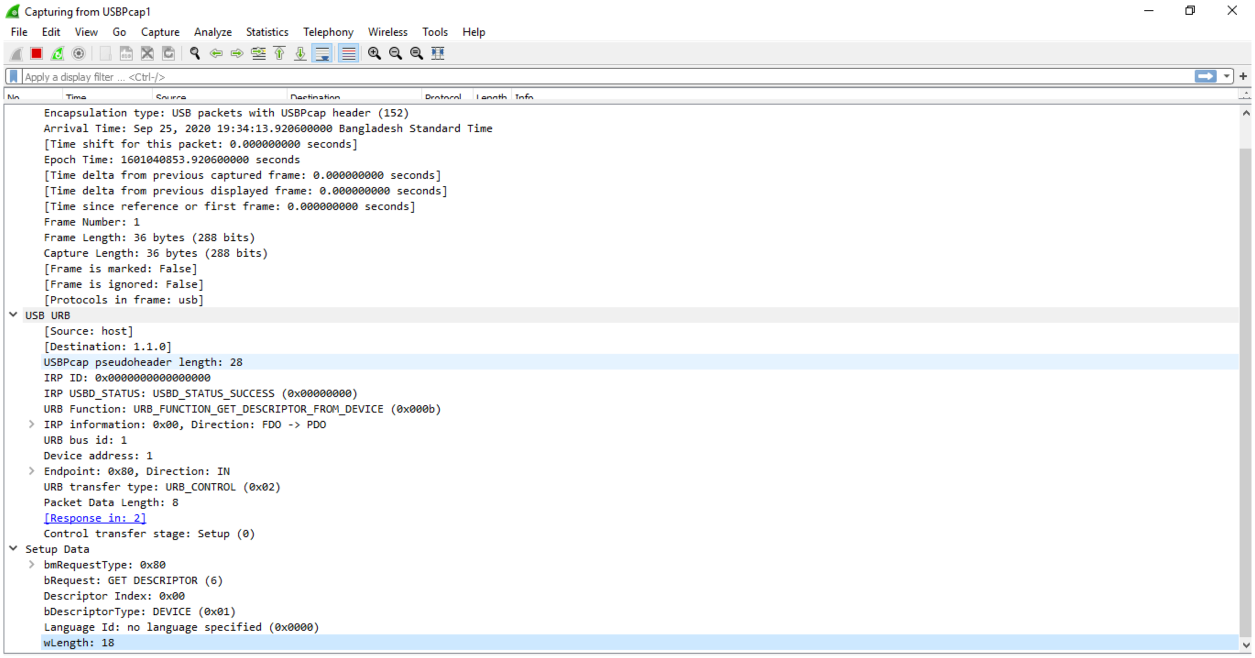
- **Packets and protocols can be analyzed after capture**
- **Individual fields in protocols can be easily seen**
- **Graphs and flow diagrams can be helpful in analysis**



*Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>

```
No.   Time       Source         Destination      Protocol Length Info
1…    58.504447  192.168.0.104  124.211.191.1…   TCP      54 12018 → 19256 [ACK] Seq=69 Ack=2 Win=132352 Len=0
1…    58.504771  192.168.0.104  124.211.191.1…   TCP      54 12018 → 19256 [FIN, ACK] Seq=69 Ack=2 Win=132352 Len=0

Frame 1343: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface \Device\NPF_{0D3E92EF-8D40-402F-8DEA-BF4358D5F12…
  Interface id: 0 (\Device\NPF_{0D3E92EF-8D40-402F-8DEA-BF4358D5F129})
  Encapsulation type: Ethernet (1)
  Arrival Time: Sep 18, 2020 17:57:11.954819000 Bangladesh Standard Time
  [Time shift for this packet: 0.000000000 seconds]
  Epoch Time: 1600430231.954819000 seconds
  [Time delta from previous captured frame: 0.000324000 seconds]
  [Time delta from previous displayed frame: 0.000324000 seconds]
  [Time since reference or first frame: 58.504771000 seconds]
  Frame Number: 1343
  Frame Length: 54 bytes (432 bits)
  Capture Length: 54 bytes (432 bits)
  [Frame is marked: False]
  [Frame is ignored: False]
  [Protocols in frame: eth:ethertype:ip:tcp]
  [Coloring Rule Name: TCP SYN/FIN]
  [Coloring Rule String: tcp.flags & 0x02 || tcp.flags.fin == 1]

0000  70 4f 57 4a 01 1c f8 16  54 72 01 41 08 00 45 00   pOWJ····  Tr·A··E·
0010  00 28 ab 0b 40 00 80 06  52 66 c0 a8 00 68 7c d3   ·(··@···  Rf···h|·
0020  bf 7a 2e f2 4b 38 fa 55  f5 58 f4 4e ea 6b 50 11   ·z.·K8·U  ·X·N·kP·
0030  02 05 67 dc 00 00                                  ··g···

Specifies if this is an individual (unicast) or group (broadcast/multicast) address (eth.dst.ig), 3 bytes | Packets: 1647 · Displayed: 1647 (100.0%) · Dropped: 0 (0.0%) | Profile: Default
```

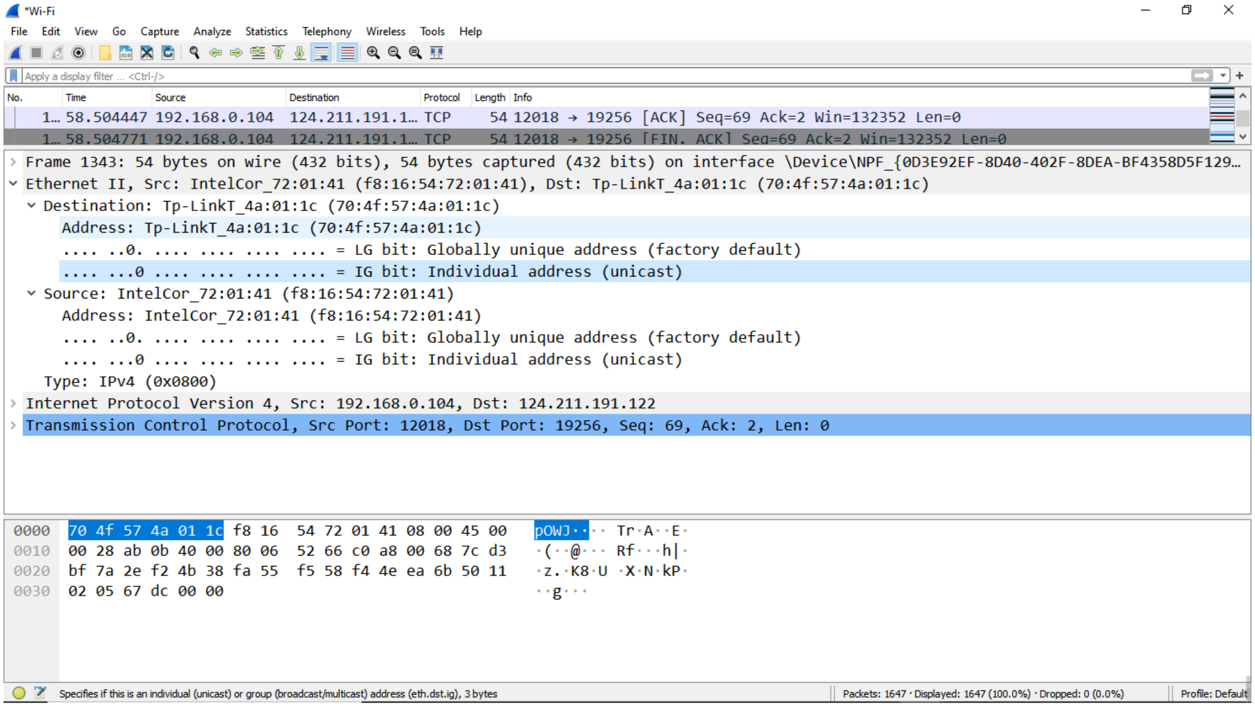
Figure 08-A: Packet Details Pane(Frame segment) in wireless



Capturing from USBPcap1
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>
No. Time Source Destination Protocol Length Info

```
  Encapsulation type: USB packets with USBPcap header (152)
  Arrival Time: Sep 25, 2020 19:34:13.920600000 Bangladesh Standard Time
  [Time shift for this packet: 0.000000000 seconds]
  Epoch Time: 1601040853.920600000 seconds
  [Time delta from previous captured frame: 0.000000000 seconds]
  [Time delta from previous displayed frame: 0.000000000 seconds]
  [Time since reference or first frame: 0.000000000 seconds]
  Frame Number: 1
  Frame Length: 36 bytes (288 bits)
  Capture Length: 36 bytes (288 bits)
  [Frame is marked: False]
  [Frame is ignored: False]
  [Protocols in frame: usb]
USB URB
  [Source: host]
  [Destination: 1.1.0]
  USBPcap pseudoheader length: 28
  IRP ID: 0x0000000000000000
  IRP USBD_STATUS: USBD_STATUS_SUCCESS (0x00000000)
  URB Function: URB_FUNCTION_GET_DESCRIPTOR_FROM_DEVICE (0x000b)
  IRP information: 0x00, Direction: FDO -> PDO
  URB bus id: 1
  Device address: 1
  Endpoint: 0x80, Direction: IN
  URB transfer type: URB_CONTROL (0x02)
  Packet Data Length: 8
  [Response in: 2]
  Control transfer stage: Setup (0)
Setup Data
  bmRequestType: 0x80
  bRequest: GET DESCRIPTOR (6)
  Descriptor Index: 0x00
  bDescriptorType: DEVICE (0x01)
  Language Id: no language specified (0x0000)
  wLength: 18
```

Figure 08-B: Packet Details Pane (Frame segment) for Wired Data Packages.


*Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>

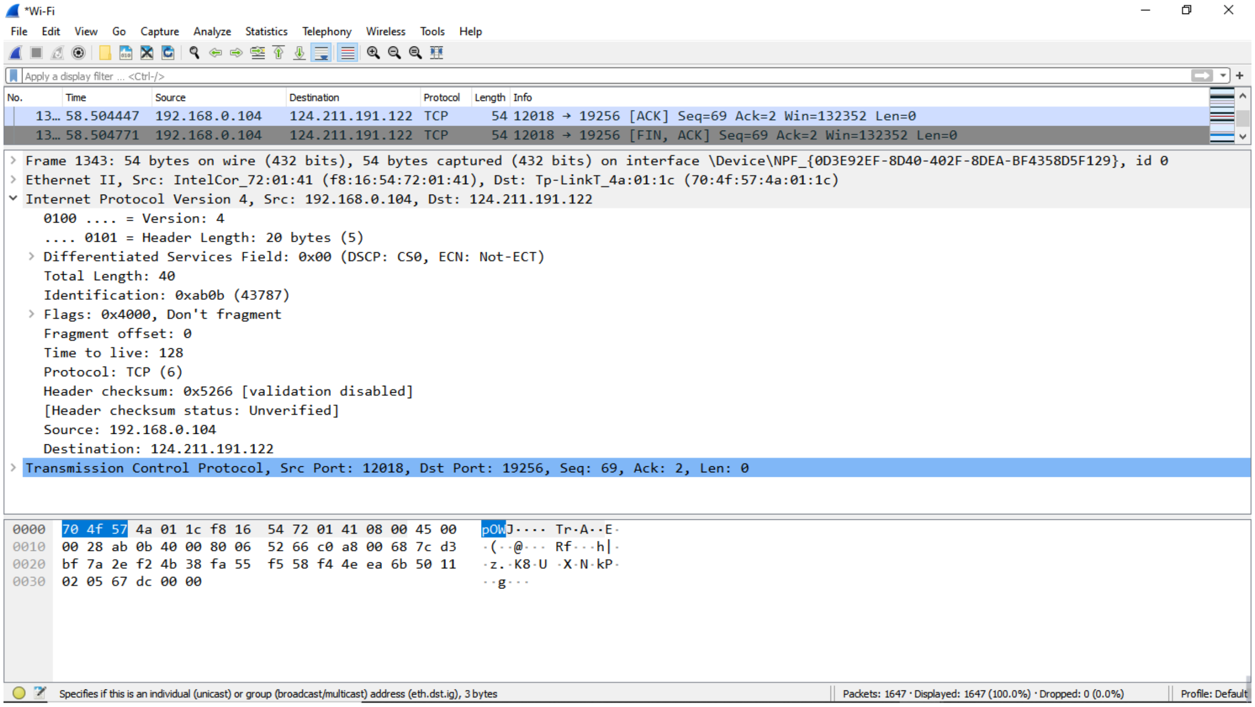
```
No.   Time       Source         Destination     Protocol Length Info
1…    58.504447  192.168.0.104  124.211.191.1…  TCP      54 12018 → 19256 [ACK] Seq=69 Ack=2 Win=132352 Len=0
1…    58.504771  192.168.0.104  124.211.191.1…  TCP      54 12018 → 19256 [FIN, ACK] Seq=69 Ack=2 Win=132352 Len=0
```

```
> Frame 1343: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface \Device\NPF_{0D3E92EF-8D40-402F-8DEA-BF4358D5F129…
v Ethernet II, Src: IntelCor_72:01:41 (f8:16:54:72:01:41), Dst: Tp-LinkT_4a:01:1c (70:4f:57:4a:01:1c)
  v Destination: Tp-LinkT_4a:01:1c (70:4f:57:4a:01:1c)
      Address: Tp-LinkT_4a:01:1c (70:4f:57:4a:01:1c)
      .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
      .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
  v Source: IntelCor_72:01:41 (f8:16:54:72:01:41)
      Address: IntelCor_72:01:41 (f8:16:54:72:01:41)
      .... ..0. .... .... .... .... = LG bit: Globally unique address (factory default)
      .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
> Internet Protocol Version 4, Src: 192.168.0.104, Dst: 124.211.191.122
> Transmission Control Protocol, Src Port: 12018, Dst Port: 19256, Seq: 69, Ack: 2, Len: 0
```

```
0000  70 4f 57 4a 01 1c f8 16  54 72 01 41 08 00 45 00   pOWJ··· Tr·A··E·
0010  00 28 ab 0b 40 00 80 06  52 66 c0 a8 00 68 7c d3   ·(··@··· Rf···h|·
0020  bf 7a 2e f2 4b 38 fa 55  f5 58 f4 4e ea 6b 50 11   ·z.·K8·U ·X·N·kP·
0030  02 05 67 dc 00 00                                  ··g···
```

Specifies if this is an individual (unicast) or group (broadcast/multicast) address (eth.dst.ig), 3 bytes | Packets: 1647 · Displayed: 1647 (100.0%) · Dropped: 0 (0.0%) | Profile: Default

Figure 09: Packet Details Pane (Ethernet Segment)-wireless


*Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>

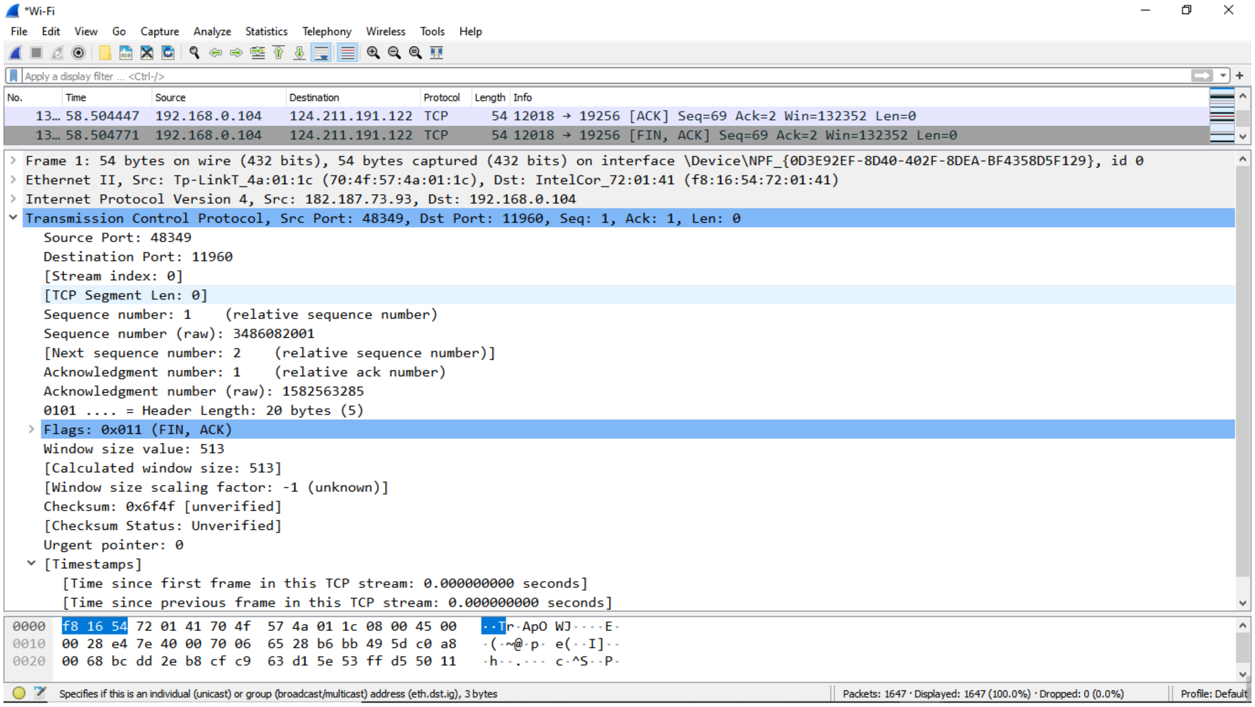
```
No.   Time       Source         Destination      Protocol Length Info
13…   58.504447  192.168.0.104  124.211.191.122  TCP      54 12018 → 19256 [ACK] Seq=69 Ack=2 Win=132352 Len=0
13…   58.504771  192.168.0.104  124.211.191.122  TCP      54 12018 → 19256 [FIN, ACK] Seq=69 Ack=2 Win=132352 Len=0
```

```
> Frame 1343: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface \Device\NPF_{0D3E92EF-8D40-402F-8DEA-BF4358D5F129}, id 0
> Ethernet II, Src: IntelCor_72:01:41 (f8:16:54:72:01:41), Dst: Tp-LinkT_4a:01:1c (70:4f:57:4a:01:1c)
v Internet Protocol Version 4, Src: 192.168.0.104, Dst: 124.211.191.122
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 40
    Identification: 0xab0b (43787)
  > Flags: 0x4000, Don't fragment
    Fragment offset: 0
    Time to live: 128
    Protocol: TCP (6)
    Header checksum: 0x5266 [validation disabled]
    [Header checksum status: Unverified]
    Source: 192.168.0.104
    Destination: 124.211.191.122
> Transmission Control Protocol, Src Port: 12018, Dst Port: 19256, Seq: 69, Ack: 2, Len: 0
```

```
0000  70 4f 57 4a 01 1c f8 16  54 72 01 41 08 00 45 00   pOWJ···· Tr·A··E·
0010  00 28 ab 0b 40 00 80 06  52 66 c0 a8 00 68 7c d3   ·(··@··· Rf···h|·
0020  bf 7a 2e f2 4b 38 fa 55  f5 58 f4 4e ea 6b 50 11   ·z.·K8·U ·X·N·kP·
0030  02 05 67 dc 00 00                                  ··g···
```

Specifies if this is an individual (unicast) or group (broadcast/multicast) address (eth.dst.ig), 3 bytes | Packets: 1647 · Displayed: 1647 (100.0%) · Dropped: 0 (0.0%) | Profile: Default

Figure 10: Packet Details Pane(IP segment)-wireless


*Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter … <Ctrl-/>

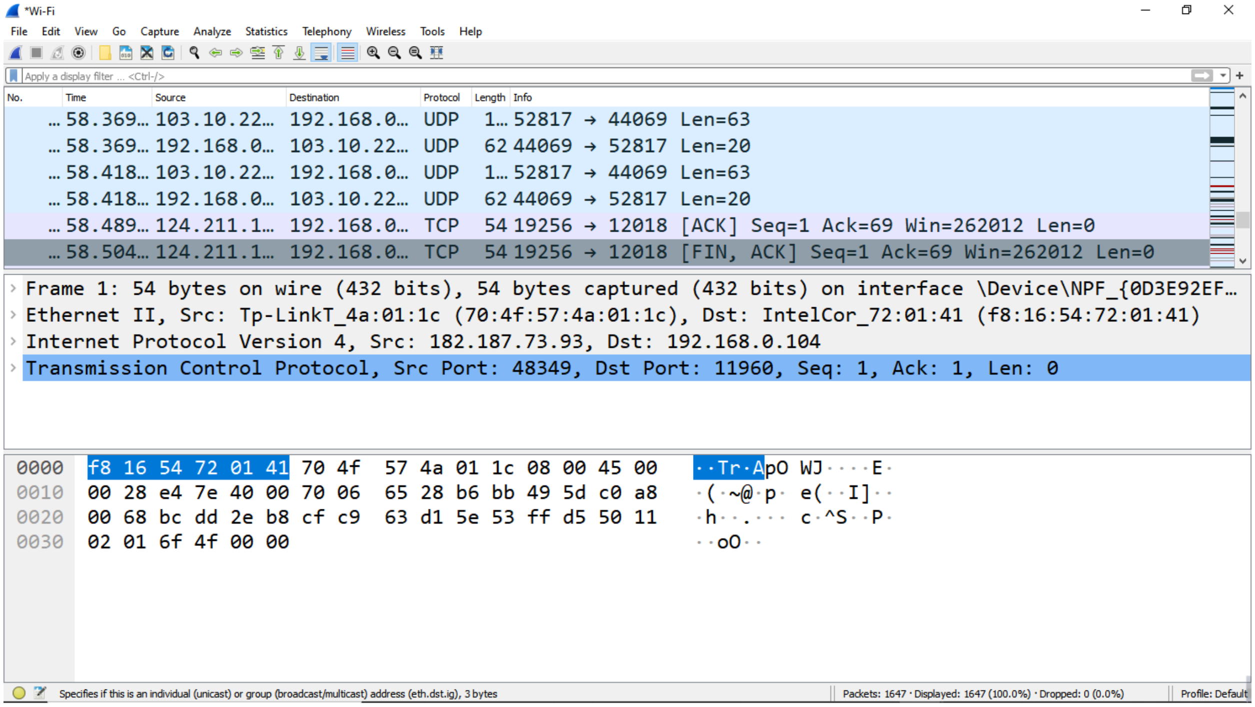
```
No.      Time        Source          Destination      Protocol  Length Info
   13… 58.504447  192.168.0.104  124.211.191.122  TCP     54 12018 → 19256 [ACK] Seq=69 Ack=2 Win=132352 Len=0
   13… 58.504771  192.168.0.104  124.211.191.122  TCP     54 12018 → 19256 [FIN, ACK] Seq=69 Ack=2 Win=132352 Len=0
```

```
> Frame 1: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface \Device\NPF_{0D3E92EF-8D40-402F-8DEA-BF4358D5F129}, id 0
> Ethernet II, Src: Tp-LinkT_4a:01:1c (70:4f:57:4a:01:1c), Dst: IntelCor_72:01:41 (f8:16:54:72:01:41)
> Internet Protocol Version 4, Src: 182.187.73.93, Dst: 192.168.0.104
v Transmission Control Protocol, Src Port: 48349, Dst Port: 11960, Seq: 1, Ack: 1, Len: 0
    Source Port: 48349
    Destination Port: 11960
    [Stream index: 0]
    [TCP Segment Len: 0]
    Sequence number: 1    (relative sequence number)
    Sequence number (raw): 3486082001
    [Next sequence number: 2    (relative sequence number)]
    Acknowledgment number: 1    (relative ack number)
    Acknowledgment number (raw): 1582563285
    0101 .... = Header Length: 20 bytes (5)
  > Flags: 0x011 (FIN, ACK)
    Window size value: 513
    [Calculated window size: 513]
    [Window size scaling factor: -1 (unknown)]
    Checksum: 0x6f4f [unverified]
    [Checksum Status: Unverified]
    Urgent pointer: 0
  v [Timestamps]
      [Time since first frame in this TCP stream: 0.000000000 seconds]
      [Time since previous frame in this TCP stream: 0.000000000 seconds]
```

```
0000  f8 16 54 72 01 41 70 4f  57 4a 01 1c 08 00 45 00   ··Tr·ApO WJ····E·
0010  00 28 e4 7e 40 00 70 06  65 28 b6 bb 49 5d c0 a8   ·(·~@·p· e(··I]··
0020  00 68 bc dd 2e b8 cf c9  63 d1 5e 53 ff d5 50 11   ·h··.··· c·^S··P·
```

```
Specifies if this is an individual (unicast) or group (broadcast/multicast) address (eth.dst.ig), 3 bytes    Packets: 1647 · Displayed: 1647 (100.0%) · Dropped: 0 (0.0%)    Profile: Default
```

Figure 11: Packet Details Pane (TCP Segment)-wireless


*Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter … <Ctrl-/>

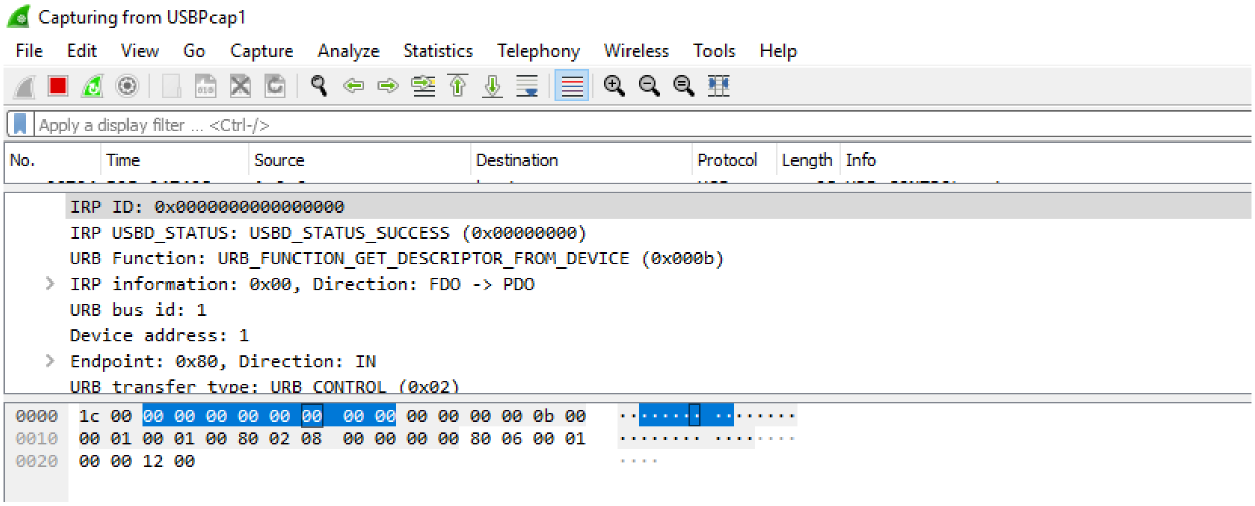
```
No.  Time       Source        Destination   Protocol  Length Info
  … 58.369… 103.10.22…  192.168.0…  UDP  1… 52817 → 44069 Len=63
  … 58.369… 192.168.0…  103.10.22…  UDP  62 44069 → 52817 Len=20
  … 58.418… 103.10.22…  192.168.0…  UDP  1… 52817 → 44069 Len=63
  … 58.418… 192.168.0…  103.10.22…  UDP  62 44069 → 52817 Len=20
  … 58.489… 124.211.1…  192.168.0…  TCP  54 19256 → 12018 [ACK] Seq=1 Ack=69 Win=262012 Len=0
  … 58.504… 124.211.1…  192.168.0…  TCP  54 19256 → 12018 [FIN, ACK] Seq=1 Ack=69 Win=262012 Len=0
```

```
> Frame 1: 54 bytes on wire (432 bits), 54 bytes captured (432 bits) on interface \Device\NPF_{0D3E92EF…
> Ethernet II, Src: Tp-LinkT_4a:01:1c (70:4f:57:4a:01:1c), Dst: IntelCor_72:01:41 (f8:16:54:72:01:41)
> Internet Protocol Version 4, Src: 182.187.73.93, Dst: 192.168.0.104
> Transmission Control Protocol, Src Port: 48349, Dst Port: 11960, Seq: 1, Ack: 1, Len: 0
```

```
0000  f8 16 54 72 01 41 70 4f  57 4a 01 1c 08 00 45 00   ··Tr·ApO WJ····E·
0010  00 28 e4 7e 40 00 70 06  65 28 b6 bb 49 5d c0 a8   ·(·~@·p· e(··I]··
0020  00 68 bc dd 2e b8 cf c9  63 d1 5e 53 ff d5 50 11   ·h··.··· c·^S··P·
0030  02 01 6f 4f 00 00                                  ··oO··
```

```
Specifies if this is an individual (unicast) or group (broadcast/multicast) address (eth.dst.ig), 3 bytes    Packets: 1647 · Displayed: 1647 (100.0%) · Dropped: 0 (0.0%)    Profile: Default
```

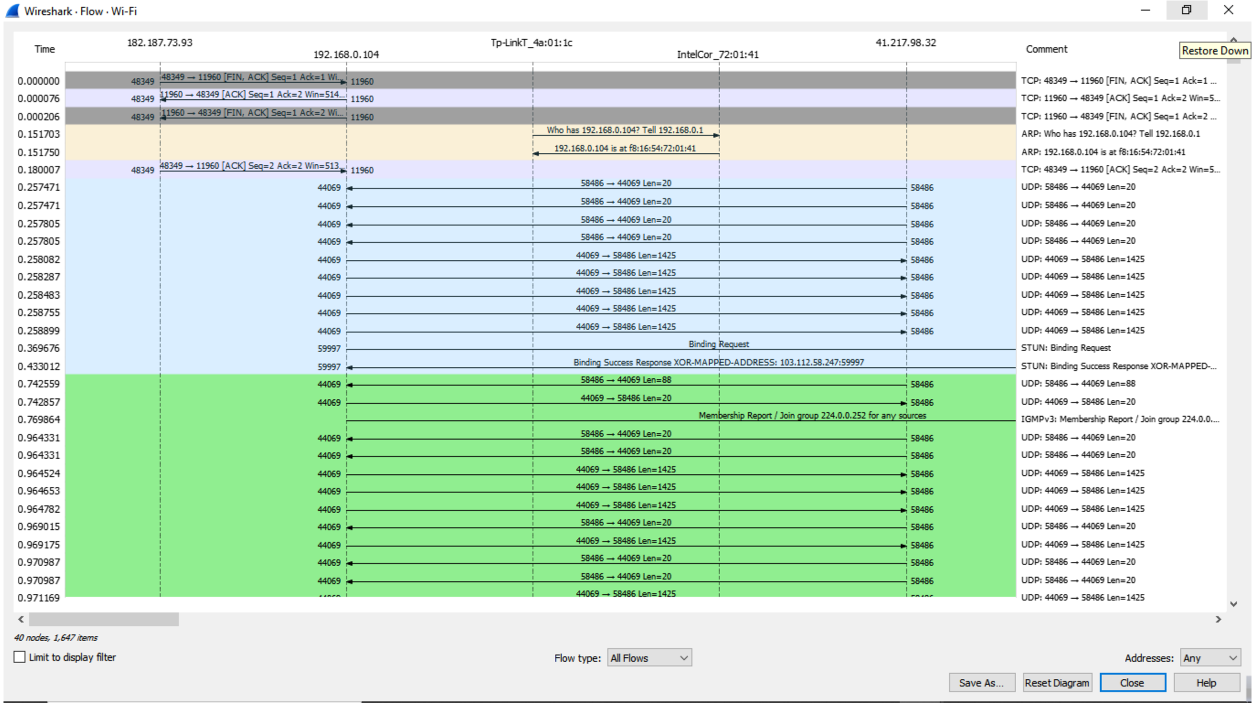
Figure 12-A: Packet Byte Pane(wireless)


Capturing from USBPcap1
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter … <Ctrl-/>
No.
Time
Source
Destination
Protocol
Length
Info

```
  IRP ID: 0x0000000000000000
  IRP USBD_STATUS: USBD_STATUS_SUCCESS (0x00000000)
  URB Function: URB_FUNCTION_GET_DESCRIPTOR_FROM_DEVICE (0x000b)
> IRP information: 0x00, Direction: FDO -> PDO
  URB bus id: 1
  Device address: 1
> Endpoint: 0x80, Direction: IN
  URB transfer type: URB_CONTROL (0x02)
```

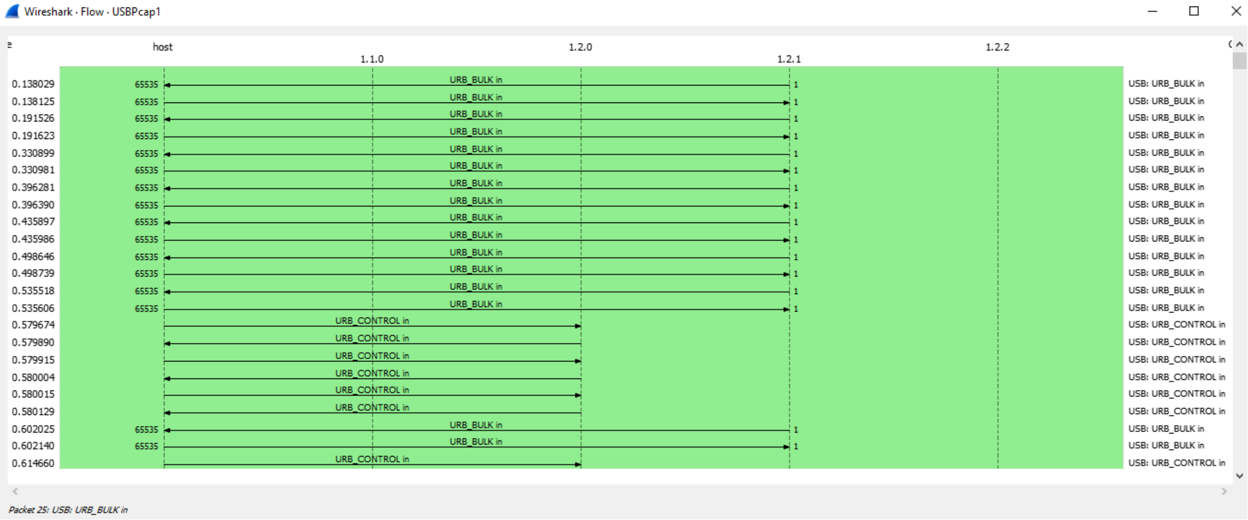
```
0000  1c 00 00 00 00 00 00 00  00 00 00 00 00 00 0b 00   ········ ········
0010  00 01 00 01 00 80 02 08  00 00 00 00 80 06 00 01   ········ ········
0020  00 00 12 00                                        ····
```

Figure 12-B: Packet Byte Pane for Wireless (USB Tethering)



```
Time       Comment
0.000000   TCP: 48349 → 11960 [FIN, ACK] Seq=1 Ack=1 ...
0.000076   TCP: 11960 → 48349 [ACK] Seq=1 Ack=2 Win=5...
0.000206   TCP: 11960 → 48349 [FIN, ACK] Seq=1 Ack=2 ...
0.151703   ARP: Who has 192.168.0.104? Tell 192.168.0.1
0.151750   ARP: 192.168.0.104 is at f8:16:54:72:01:41
0.180007   TCP: 48349 → 11960 [ACK] Seq=2 Ack=2 Win=5...
0.257471   UDP: 58486 → 44069 Len=20
0.257471   UDP: 58486 → 44069 Len=20
0.257805   UDP: 58486 → 44069 Len=20
0.257805   UDP: 58486 → 44069 Len=20
0.258082   UDP: 44069 → 58486 Len=1425
0.258287   UDP: 44069 → 58486 Len=1425
0.258483   UDP: 44069 → 58486 Len=1425
0.258755   UDP: 44069 → 58486 Len=1425
0.258899   UDP: 44069 → 58486 Len=1425
0.369676   STUN: Binding Request
0.433012   STUN: Binding Success Response XOR-MAPPED-...
0.742559   UDP: 58486 → 44069 Len=88
0.742857   UDP: 44069 → 58486 Len=20
0.769864   IGMPv3: Membership Report / Join group 224.0.0....
0.964331   UDP: 58486 → 44069 Len=20
0.964331   UDP: 58486 → 44069 Len=20
0.964524   UDP: 44069 → 58486 Len=1425
0.964653   UDP: 44069 → 58486 Len=1425
0.964782   UDP: 44069 → 58486 Len=1425
0.969015   UDP: 58486 → 44069 Len=20
0.969175   UDP: 44069 → 58486 Len=1425
0.970987   UDP: 58486 → 44069 Len=20
0.970987   UDP: 58486 → 44069 Len=20
0.971169   UDP: 44069 → 58486 Len=1425
```

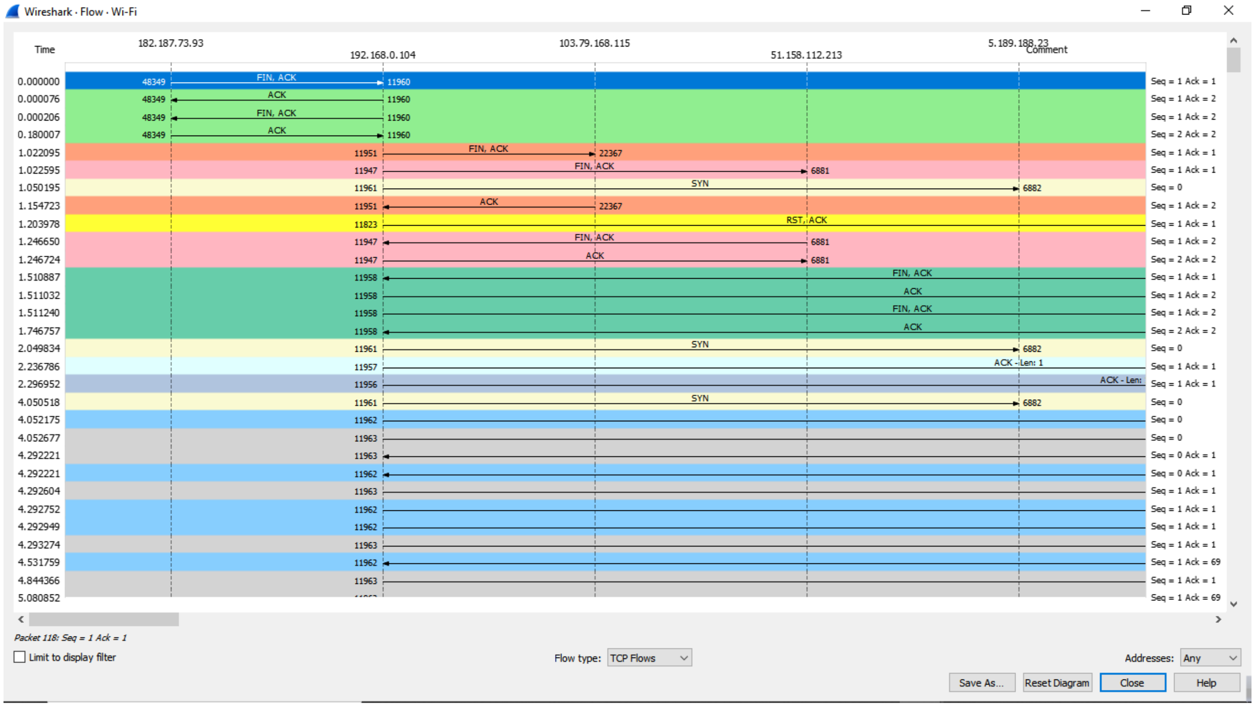
Figure 13: Statistics- Flow Graph(All Flows)- Wireless



Time	host		1.2.1	
0.138029	65535	URB_BULK in	1	USB: URB_BULK in
0.138125	65535	URB_BULK in	1	USB: URB_BULK in
0.191526	65535	URB_BULK in	1	USB: URB_BULK in
0.191623	65535	URB_BULK in	1	USB: URB_BULK in
0.330899	65535	URB_BULK in	1	USB: URB_BULK in
0.330981	65535	URB_BULK in	1	USB: URB_BULK in
0.396281	65535	URB_BULK in	1	USB: URB_BULK in
0.396390	65535	URB_BULK in	1	USB: URB_BULK in
0.435897	65535	URB_BULK in	1	USB: URB_BULK in
0.435986	65535	URB_BULK in	1	USB: URB_BULK in
0.498646	65535	URB_BULK in	1	USB: URB_BULK in
0.498739	65535	URB_BULK in	1	USB: URB_BULK in
0.535518	65535	URB_BULK in	1	USB: URB_BULK in
0.535606	65535	URB_BULK in	1	USB: URB_BULK in
0.579674		URB_CONTROL in		USB: URB_CONTROL in
0.579890		URB_CONTROL in		USB: URB_CONTROL in
0.579915		URB_CONTROL in		USB: URB_CONTROL in
0.580004		URB_CONTROL in		USB: URB_CONTROL in
0.580015		URB_CONTROL in		USB: URB_CONTROL in
0.580129		URB_CONTROL in		USB: URB_CONTROL in
0.602025	65535	URB_BULK in	1	USB: URB_BULK in
0.602140	65535	URB_BULK in	1	USB: URB_BULK in
0.614660		URB_CONTROL in		USB: URB_CONTROL in

Packet 25: USB: URB_BULK in

Figure 13-A: Statistics- Flow Graph -All Flows for Wi-Fi (Wired Data Packages)



Time	182.187.73.93	192.168.0.104		103.79.168.115	51.158.112.213	5.189.188.23	Comment
0.000000	48349	11960	FIN, ACK				Seq = 1 Ack = 1
0.000076	48349	11960	ACK				Seq = 1 Ack = 2
0.000206	48349	11960	FIN, ACK				Seq = 1 Ack = 2
0.180007	48349	11960	ACK				Seq = 2 Ack = 2
1.022095		11951	FIN, ACK	22367			Seq = 1 Ack = 1
1.022595		11947	FIN, ACK		6881		Seq = 1 Ack = 1
1.050195		11961	SYN			6882	Seq = 0
1.154723		11951	ACK	22367			Seq = 1 Ack = 2
1.203978		11823	RST, ACK				Seq = 1 Ack = 1
1.246650		11947	FIN, ACK		6881		Seq = 1 Ack = 2
1.246724		11947	ACK		6881		Seq = 2 Ack = 2
1.510887		11958	FIN, ACK				Seq = 1 Ack = 1
1.511032		11958	ACK				Seq = 1 Ack = 2
1.511240		11958	FIN, ACK				Seq = 1 Ack = 2
1.746757		11958	ACK				Seq = 2 Ack = 2
2.049834		11961	SYN			6882	Seq = 0
2.236786		11957	ACK - Len: 1				Seq = 1 Ack = 1
2.296952		11956	ACK - Len:				Seq = 1 Ack = 1
4.050518		11961	SYN			6882	Seq = 0
4.052175		11962					Seq = 0
4.052677		11963					Seq = 0
4.292221		11963					Seq = 0 Ack = 1
4.292221		11962					Seq = 0 Ack = 1
4.292604		11963					Seq = 1 Ack = 1
4.292752		11962					Seq = 1 Ack = 1
4.292949		11962					Seq = 1 Ack = 1
4.293274		11963					Seq = 1 Ack = 1
4.531759		11962					Seq = 1 Ack = 69
4.844366		11963					Seq = 1 Ack = 1
5.080852							Seq = 1 Ack = 69

Packet 118: Seq = 1 Ack = 1

☐ Limit to display filter

Flow type: TCP Flows

Addresses: Any

Figure 13-B: Statistics- Flow Graph(TCP Flows)-wireless

Conclusion:

By using wireshark both wired and wireless data transmission can be captured very easily. We can capture the transmission in wired connection in multiple ways, but wireshark made it simple for the user. So whenever we need to troubleshoot any problem or analysis of any kind of protocol transmission we can use wireshark very conveniently. There we can see the data transmission flow is little bit faster and more secure in wired connection than the wireless. The statistical flow graph also covers the comparison between all flows in the network.