实验报告 Lab 5

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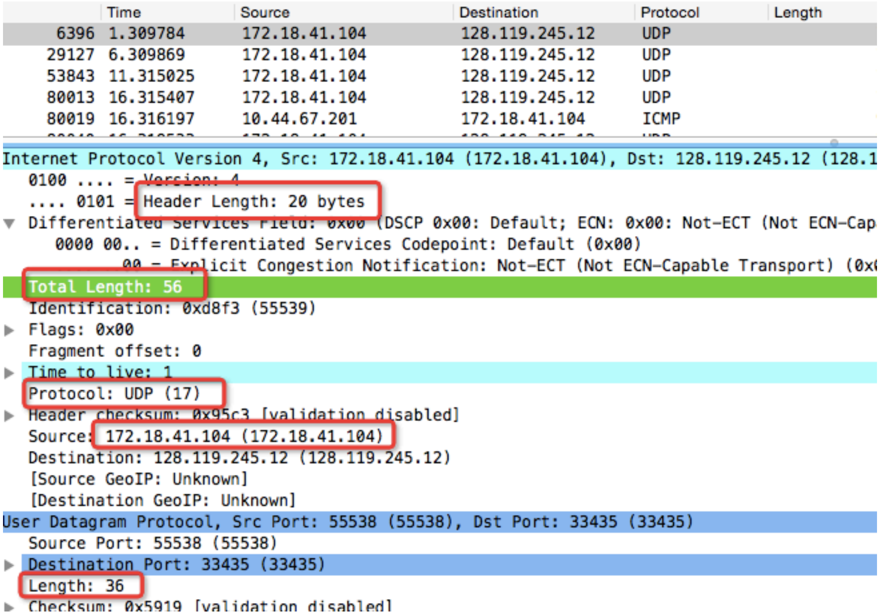
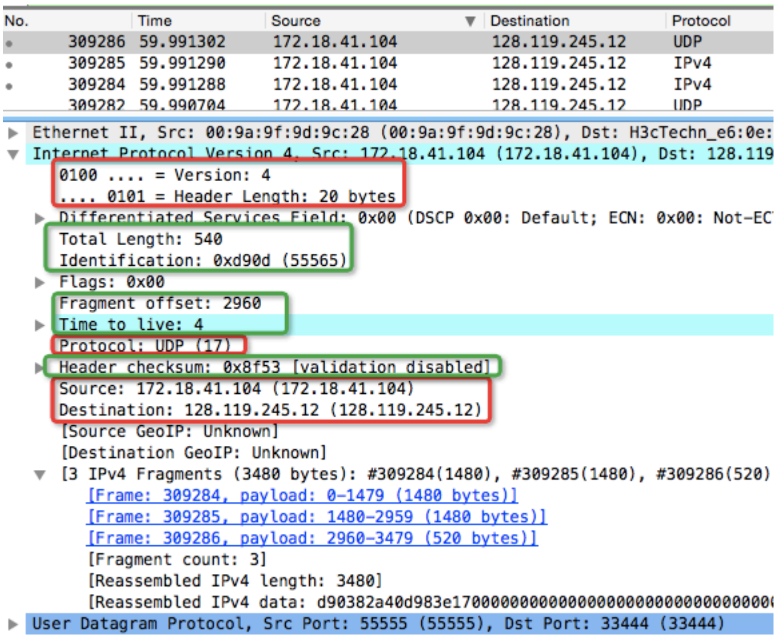
A look at the captured trace



```
         Time       Source           Destination       Protocol   Length
  6396  1.309784   172.18.41.104    128.119.245.12    UDP
 29127  6.309869   172.18.41.104    128.119.245.12    UDP
 53843  11.315025  172.18.41.104    128.119.245.12    UDP
 80013  16.315407  172.18.41.104    128.119.245.12    UDP
 80019  16.316197  10.44.67.201     172.18.41.104     ICMP

Internet Protocol Version 4, Src: 172.18.41.104 (172.18.41.104), Dst: 128.119.245.12 (128.1
   0100 .... = Version: 4
   .... 0101 = Header Length: 20 bytes
 ▼ Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00: Not-ECT (Not ECN-Cap
      0000 00.. = Differentiated Services Codepoint: Default (0x00)
      .... ..00 = Explicit Congestion Notification: Not-ECT (Not ECN-Capable Transport) (0x
   Total Length: 56
   Identification: 0xd8f3 (55539)
 ▶ Flags: 0x00
   Fragment offset: 0
 ▶ Time to live: 1
   Protocol: UDP (17)
 ▶ Header checksum: 0x95c3 [validation disabled]
   Source: 172.18.41.104 (172.18.41.104)
   Destination: 128.119.245.12 (128.119.245.12)
   [Source GeoIP: Unknown]
   [Destination GeoIP: Unknown]
User Datagram Protocol, Src Port: 55538 (55538), Dst Port: 33435 (33435)
   Source Port: 55538 (55538)
 ▶ Destination Port: 33435 (33435)
   Length: 36
 ▶ Checksum: 0x5919 [validation disabled]
```

Figure 1: UDP segment

1. the IP address of my computer: `172.18.41.104`,see figure 1.(Note: use traceroute on mac os)
2. upper layer protocol field: `UDP (17)`,see figure 1
3. bytes are in the IP header:20 bytes,bytes are in the payload of the IP datagram:36 bytes.Total length:56 bytes.See figure 1
4. The more fragments bit = 0, so the data is not fragmented.



```
No.       Time        Source           Destination       Protocol
309286  59.991302   172.18.41.104    128.119.245.12    UDP
309285  59.991290   172.18.41.104    128.119.245.12    IPv4
309284  59.991288   172.18.41.104    128.119.245.12    IPv4
309282  59.990704   172.18.41.104    128.119.245.12    UDP
▶ Ethernet II, Src: 00:9a:9f:9d:9c:28 (00:9a:9f:9d:9c:28), Dst: H3cTechn_e6:0e:
▼ Internet Protocol Version 4, Src: 172.18.41.104 (172.18.41.104), Dst: 128.119
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes
  ▶ Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00: Not-EC
    Total Length: 540
    Identification: 0xd90d (55565)
  ▶ Flags: 0x00
    Fragment offset: 2960
  ▶ Time to live: 4
    Protocol: UDP (17)
  ▶ Header checksum: 0x8f53 [validation disabled]
    Source: 172.18.41.104 (172.18.41.104)
    Destination: 128.119.245.12 (128.119.245.12)
    [Source GeoIP: Unknown]
    [Destination GeoIP: Unknown]
  ▼ [3 IPv4 Fragments (3480 bytes): #309284(1480), #309285(1480), #309286(520)
      [Frame: 309284, payload: 0-1479 (1480 bytes)]
      [Frame: 309285, payload: 1480-2959 (1480 bytes)]
      [Frame: 309286, payload: 2960-3479 (520 bytes)]
      [Fragment count: 3]
      [Reassembled IPv4 length: 3480]
      [Reassembled IPv4 data: d90382a40d983e17000000000000000000000000000000000
▶ User Datagram Protocol, Src Port: 55555 (55555), Dst Port: 33444 (33444)
```

Figure 2: Internet Protocol portion

5. always change:Identification, Header checksum ,fragment offset.some point green rect in figure 2.

6. Stay constant

    Version (since we are using IPv4 for all packets)

    header length (since these are 20 bytes)

    source IP (since we are sending from the same source)

    destination IP (since we are sending to the same dest)

    Differentiated Services (since all packets are UDP they use the same Type of Service class)

    Upper Layer Protocol (since these are UDP packets).some point red rect in figure 2.

   Must constant

    Version (since we are using IPv4 for all packets)

    header length (since these are 20 bytes)

    source IP (since we are sending from the same source)

    destination IP (since we are sending to the same dest)

    Differentiated Services (since all packets are UDP they use the same Type of Service class)

    Upper Layer Protocol (since these are UDP packets),some point red rect in figure 2.

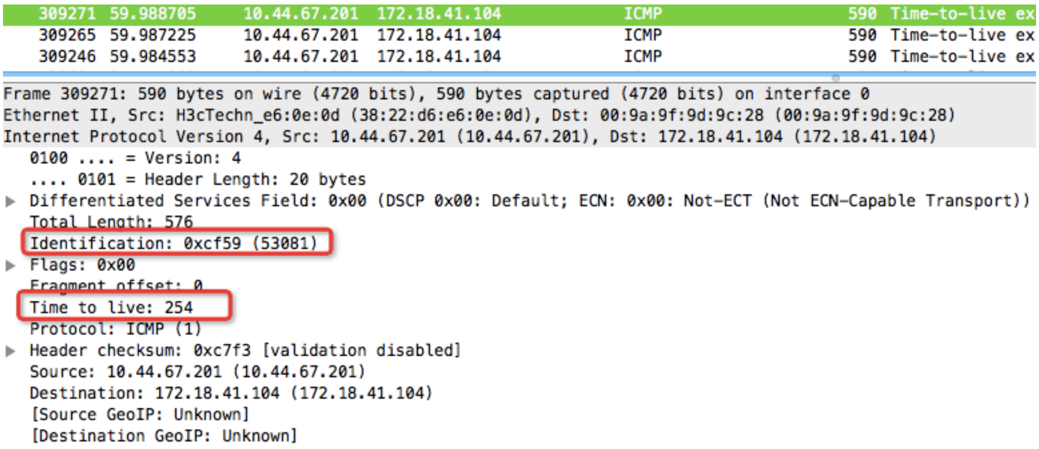
   Must change

    Identification(IP packets must have different id)

    Time to live (traceroute increments each subsequent packet)

    Header checksum (since header changes, so must checksum)

7. Identification field.The IP header Identification increment with each UDP segment.



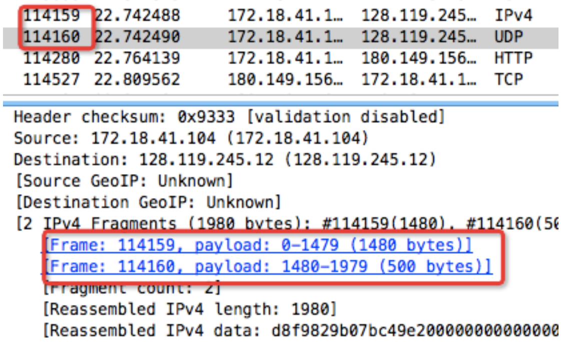
```
309271  59.988705    10.44.67.201  172.18.41.104       ICMP              590  Time-to-live ex
309265  59.987225    10.44.67.201  172.18.41.104       ICMP              590  Time-to-live ex
309246  59.984553    10.44.67.201  172.18.41.104       ICMP              590  Time-to-live ex

Frame 309271: 590 bytes on wire (4720 bits), 590 bytes captured (4720 bits) on interface 0
Ethernet II, Src: H3cTechn_e6:0e:0d (38:22:d6:e6:0e:0d), Dst: 00:9a:9f:9d:9c:28 (00:9a:9f:9d:9c:28)
Internet Protocol Version 4, Src: 10.44.67.201 (10.44.67.201), Dst: 172.18.41.104 (172.18.41.104)
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes
  ▶ Differentiated Services Field: 0x00 (DSCP 0x00: Default; ECN: 0x00: Not-ECT (Not ECN-Capable Transport))
    Total Length: 576
    Identification: 0xcf59 (53081)
  ▶ Flags: 0x00
    Fragment offset: 0
    Time to live: 254
    Protocol: ICMP (1)
  ▶ Header checksum: 0xc7f3 [validation disabled]
    Source: 10.44.67.201 (10.44.67.201)
    Destination: 172.18.41.104 (172.18.41.104)
    [Source GeoIP: Unknown]
    [Destination GeoIP: Unknown]
```

Figure 3: ICMP TTL- exceeded replies

8. Identification :`53081`,TTL:`254`.

9. Identification always change.But TTL always constant.
   Because the identification field is a unique value for each packets except a case that when two or more IP datagrams have the same identification value, then it means that these IP datagrams are fragments of a single large IP datagram, and the TTL of first hop router is always the same,the distance between my computer and router is constant.

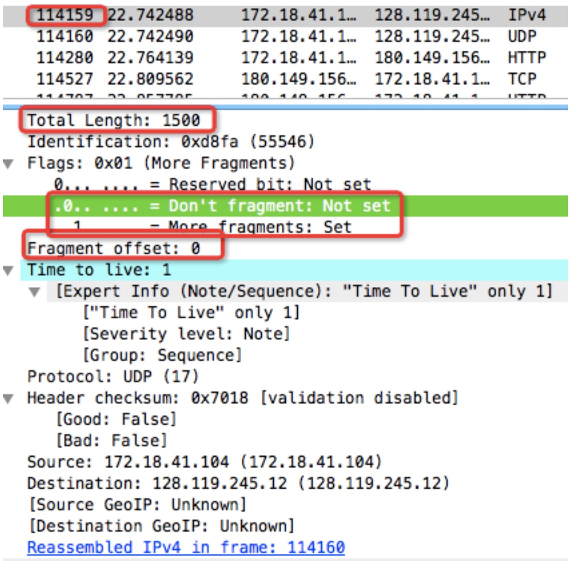
10. Packet size of 2000 cause fragmentation,see figure 4.



```
114159  22.742488    172.18.41.1…  128.119.245…  IPv4
114160  22.742490    172.18.41.1…  128.119.245…  UDP
114280  22.764139    172.18.41.1…  180.149.156…  HTTP
114527  22.809562    180.149.156…  172.18.41.1…  TCP

Header checksum: 0x9333 [validation disabled]
Source: 172.18.41.104 (172.18.41.104)
Destination: 128.119.245.12 (128.119.245.12)
[Source GeoIP: Unknown]
[Destination GeoIP: Unknown]
[2 IPv4 Fragments (1980 bytes): #114159(1480), #114160(5
    [Frame: 114159, payload: 0-1479 (1480 bytes)]
    [Frame: 114160, payload: 1480-1979 (500 bytes)]
    [Fragment count: 2]
    [Reassembled IPv4 length: 1980]
    [Reassembled IPv4 data: d8f9829b07bc49e20000000000000
```

Figure 4: 2000 bytes fragmentation

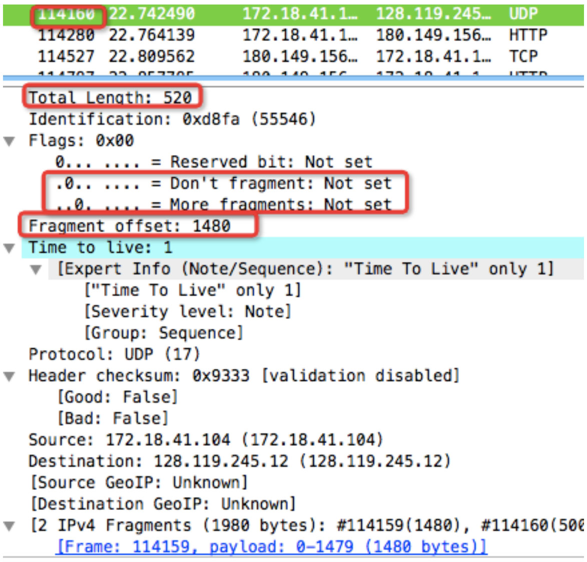
11. From flags field for more fragments is set, indicating the datagram has been fragmented. From fragment offset is 0, incicating this is the first fragment. And total length is 1500.



```
114159 22.742488    172.18.41.1…  128.119.245…  IPv4
114160 22.742490    172.18.41.1…  128.119.245…  UDP
114280 22.764139    172.18.41.1…  180.149.156…  HTTP
114527 22.809562    180.149.156…  172.18.41.1…  TCP
114707 22.857705    180.149.156…  172.18.41.1…  HTTP
  Total Length: 1500
  Identification: 0xd8fa (55546)
▼ Flags: 0x01 (More Fragments)
     0... .... = Reserved bit: Not set
     .0.. .... = Don't fragment: Not set
     ..1. .... = More fragments: Set
  Fragment offset: 0
▼ Time to live: 1
  ▼ [Expert Info (Note/Sequence): "Time To Live" only 1]
        ["Time To Live" only 1]
        [Severity level: Note]
        [Group: Sequence]
  Protocol: UDP (17)
▼ Header checksum: 0x7018 [validation disabled]
     [Good: False]
     [Bad: False]
  Source: 172.18.41.104 (172.18.41.104)
  Destination: 128.119.245.12 (128.119.245.12)
  [Source GeoIP: Unknown]
  [Destination GeoIP: Unknown]
  Reassembled IPv4 in frame: 114160
```

Figure 5: first fragment

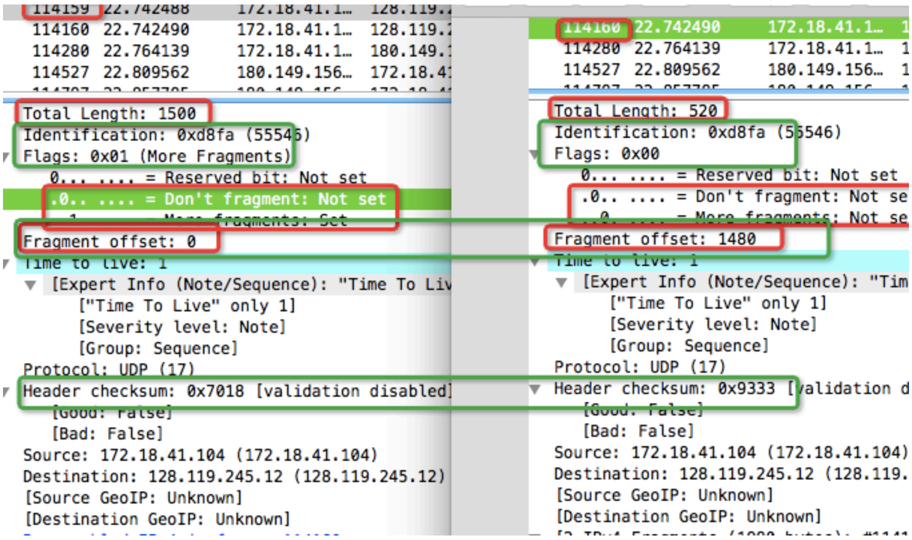
12. From fragment offset is 1480 not 0,so isn't first fragment. From flags field for more fragments is not set, indicating the datagram has no more fragments.



```
114160 22.742490    172.18.41.1…  128.119.245…  UDP
114280 22.764139    172.18.41.1…  180.149.156…  HTTP
114527 22.809562    180.149.156…  172.18.41.1…  TCP
114707 22.857705    180.149.156…  172.18.41.1…  HTTP
  Total Length: 520
  Identification: 0xd8fa (55546)
▼ Flags: 0x00
     0... .... = Reserved bit: Not set
     .0.. .... = Don't fragment: Not set
     ..0. .... = More fragments: Not set
  Fragment offset: 1480
▼ Time to live: 1
  ▼ [Expert Info (Note/Sequence): "Time To Live" only 1]
        ["Time To Live" only 1]
        [Severity level: Note]
        [Group: Sequence]
  Protocol: UDP (17)
▼ Header checksum: 0x9333 [validation disabled]
     [Good: False]
     [Bad: False]
  Source: 172.18.41.104 (172.18.41.104)
  Destination: 128.119.245.12 (128.119.245.12)
  [Source GeoIP: Unknown]
  [Destination GeoIP: Unknown]
▼ [2 IPv4 Fragments (1980 bytes): #114159(1480), #114160(50
     [Frame: 114159, payload: 0-1479 (1480 bytes)]
```

Figure 6: second fragment

13. changed:total length, flags, fragment offset, checksum.some point in green rect see figure 7.

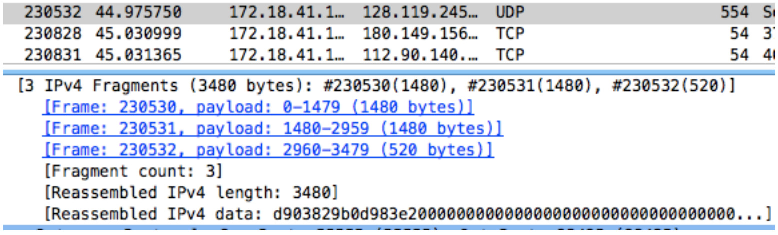


```
114159 22.742488      172.18.41.1…  128.119.…
114160 22.742490      172.18.41.1…  128.119.2
114280 22.764139      172.18.41.1…  180.149.1
114527 22.809562      180.149.156…  172.18.41

Total Length: 1500
Identification: 0xd8fa (55546)
Flags: 0x01 (More Fragments)
   0... .... = Reserved bit: Not set
   .0.. .... = Don't fragment: Not set
   ..1. .... = More fragments: Set
Fragment offset: 0
Time to live: 1
   [Expert Info (Note/Sequence): "Time To Liv
      ["Time To Live" only 1]
      [Severity level: Note]
      [Group: Sequence]
Protocol: UDP (17)
Header checksum: 0x7018 [validation disabled]
   [Good: False]
   [Bad: False]
Source: 172.18.41.104 (172.18.41.104)
Destination: 128.119.245.12 (128.119.245.12)
[Source GeoIP: Unknown]
[Destination GeoIP: Unknown]
```

```
114160 22.742490      172.18.41.1…  1
114280 22.764139      172.18.41.1…  1
114527 22.809562      180.149.156…  1

Total Length: 520
Identification: 0xd8fa (55546)
Flags: 0x00
   0... .... = Reserved bit: Not set
   .0.. .... = Don't fragment: Not se
   ..0. .... = More fragments: Not se
Fragment offset: 1480
Time to live: 1
   [Expert Info (Note/Sequence): "Tim
      ["Time To Live" only 1]
      [Severity level: Note]
      [Group: Sequence]
Protocol: UDP (17)
Header checksum: 0x9333 [validation d
   [Good: False]
   [Bad: False]
Source: 172.18.41.104 (172.18.41.104)
Destination: 128.119.245.12 (128.119.
[Source GeoIP: Unknown]
[Destination GeoIP: Unknown]
```

Figure 7: changed fields

14. Packet size of 3500 has 3 fragments see figure 8.



```
230532 44.975750    172.18.41.1…  128.119.245…  UDP        554  S
230828 45.030999    172.18.41.1…  180.149.156…  TCP         54  3
230831 45.031365    172.18.41.1…  112.90.140.…  TCP         54  4

[3 IPv4 Fragments (3480 bytes): #230530(1480), #230531(1480), #230532(520)]
   [Frame: 230530, payload: 0-1479 (1480 bytes)]
   [Frame: 230531, payload: 1480-2959 (1480 bytes)]
   [Frame: 230532, payload: 2960-3479 (520 bytes)]
   [Fragment count: 3]
   [Reassembled IPv4 length: 3480]
   [Reassembled IPv4 data: d903829b0d983e2000000000000000000000000000000000...]
```

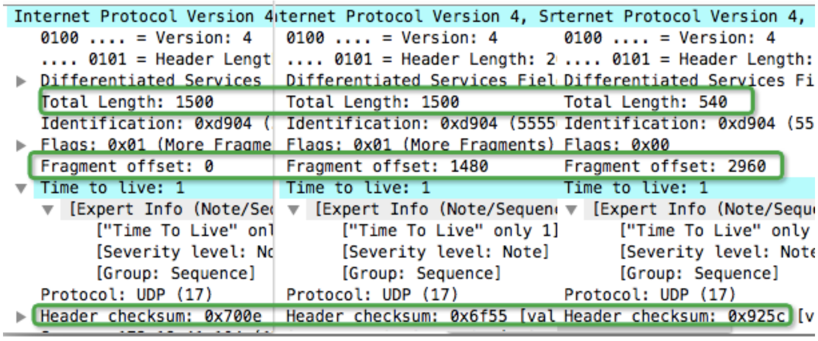
Figure 8: changed fields

15. Fields have changed among the fragments are `Total length`, `Fragment offset`, `Header checksum`.
Detail:

    Total length of first fragment and second fragment was the same value 1500,the last is 540.

    Fragment offset of three fragments are `0, 1480, 2960`.

    Header checksum are unique in each fragment.



```
Internet Protocol Version 4iternet Protocol Version 4, Srternet Protocol Version 4,
   0100 .... = Version: 4     0100 .... = Version: 4       0100 .... = Version: 4
   .... 0101 = Header Lengt   .... 0101 = Header Length: 2 .... 0101 = Header Length:
 ▶ Differentiated Services    Differentiated Services Fiel Differentiated Services Fi
   Total Length: 1500         Total Length: 1500           Total Length: 540
   Identification: 0xd904 (   Identification: 0xd904 (5555 Identification: 0xd904 (55
 ▶ Flags: 0x01 (More Fragme   Flags: 0x01 (More Fragments) Flags: 0x00
   Fragment offset: 0         Fragment offset: 1480        Fragment offset: 2960
 ▼ Time to live: 1            Time to live: 1              Time to live: 1
   ▼ [Expert Info (Note/Se  ▼ [Expert Info (Note/Sequen ▼ [Expert Info (Note/Sequ
        ["Time To Live" onl      ["Time To Live" only 1]      ["Time To Live" only
        [Severity level: No      [Severity level: Note]       [Severity level: Note
        [Group: Sequence]        [Group: Sequence]            [Group: Sequence]
   Protocol: UDP (17)         Protocol: UDP (17)           Protocol: UDP (17)
 ▶ Header checksum: 0x700e    Header checksum: 0x6f55 [val Header checksum: 0x925c [v
```

Figure 9: changed fields