Wireshark 抓包分析

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UDP 抓包分析：

实验：

```
Frame 515: 305 bytes on wire (2440 bits), 305 bytes captured (2440 bits) on interface \Device\NPF_{18A477C5-5DE8-4478-9608-B22608F0B26F}, id 0
  Interface id: 0 (\Device\NPF_{18A477C5-5DE8-4478-9608-B22608F0B26F})
  Encapsulation type: Ethernet (1)
  Arrival Time: Oct 25, 2020 17:38:30.381736000 中国标准时间
  [Time shift for this packet: 0.000000000 seconds]
  Epoch Time: 1603618710.381736000 seconds
  [Time delta from previous captured frame: 0.000094000 seconds]
  [Time delta from previous displayed frame: 0.000094000 seconds]
  [Time since reference or first frame: 15.608380000 seconds]
  Frame Number: 515
  Frame Length: 305 bytes (2440 bits)
  Capture Length: 305 bytes (2440 bits)
  [Frame is marked: False]
  [Frame is ignored: False]
  [Protocols in frame: eth:ethertype:ip:udp:data]
0000  ff ff ff ff ff ff 38 ba  f8 e7 d3 30 08 00 45 00   ......8· ···0··E·
0010  01 23 81 f2 00 00 80 11  33 16 c0 a8 01 72 c0 a8   ·#······ 3····r··
0020  01 ff d6 83 d6 83 01 0f  9c cb 00 4c 41 50 54 4f   ········ ···LAPTO
0030  50 2d 44 4a 36 38 33 41  54 42 00 b6 1f 8a 9e 00   P-DJ683A TB······
0040  00 00 80 b6 1f 8a 9e 00  00 00 64 b6 1f 8a 9e 00   ········ ··d·····
0050  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
0060  00 00 f0 9d d4 ca 7e 02  00 00 e0 b5 1f 8a 9e 00   ·····~·· ········
0070  00 00 00 00 c2 c6 05 00  00 00 33 27 00 00 00 00   ········ ··3'····
0080  00 00 e0 9d d4 ca 7e 02  00 00 30 ea c3 c6 7e 02   ·····~·· ··0···~·
0090  00 00 01 00 00 00 00 00  00 00 01 00 00 00 00 00   ········ ········
00a0  00 00 d6 86 86 e1 fc 7f  00 00 07 a7 03 7b 39 36   ········ ·····{96
00b0  62 66 64 33 37 35 2d 37  66 32 32 2d 34 63 31 37   bfd375-7 f22-4c17
00c0  2d 61 62 39 39 2d 37 65  61 31 33 36 35 30 66 31   -ab99-7e a13650f1
00d0  39 34 7d 00 1f 8a 9e 00  00 00 64 b6 1f 8a 9e 00   94}····· ··d·····
00e0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00f0  00 00 00 00 c2 c6 7e 02  00 00 c0 b7 1f 8a 1c 00   ·····~·· ········
0100  00 00 00 00 00 00 00 00  00 00 01 00 00 00 00 00   ········ ········
0110  00 00 60 b6 1f 8a 9e 00  00 00 00 00 00 00 00 00   ··`····· ········
```

图一：总体图（数据帧结构的基本信息，帧数，帧长，时间等）

```
    Frame Number: 515
    Frame Length: 305 bytes (2440 bits)
    Capture Length: 305 bytes (2440 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:udp:data]
    [Coloring Rule Name: UDP]
    [Coloring Rule String: udp]
Ethernet II, Src: IntelCor_e7:d3:30 (38:ba:f8:e7:d3:30), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  > Destination: Broadcast (ff:ff:ff:ff:ff:ff)
  > Source: IntelCor_e7:d3:30 (38:ba:f8:e7:d3:30)
    Type: IPv4 (0x0800)
> Internet Protocol Version 4, Src: 192.168.1.114, Dst: 192.168.1.255
> User Datagram Protocol, Src Port: 54915, Dst Port: 54915
> Data (263 bytes)
0000  ff ff ff ff ff ff 38 ba  f8 e7 d3 30 08 00 45 00   ......8· ···0··E·
0010  01 23 81 f2 00 00 80 11  33 16 c0 a8 01 72 c0 a8   ·#······ 3····r··
0020  01 ff d6 83 d6 83 01 0f  9c cb 00 4c 41 50 54 4f   ········ ···LAPTO
0030  50 2d 44 4a 36 38 33 41  54 42 00 b6 1f 8a 9e 00   P-DJ683A TB······
0040  00 00 80 b6 1f 8a 9e 00  00 00 64 b6 1f 8a 9e 00   ········ ··d·····
0050  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
0060  00 00 f0 9d d4 ca 7e 02  00 00 e0 b5 1f 8a 9e 00   ·····~·· ········
0070  00 00 00 00 c2 c6 05 00  00 00 33 27 00 00 00 00   ········ ··3'····
0080  00 00 e0 9d d4 ca 7e 02  00 00 30 ea c3 c6 7e 02   ·····~·· ··0···~·
0090  00 00 01 00 00 00 00 00  00 00 01 00 00 00 00 00   ········ ········
00a0  00 00 d6 86 86 e1 fc 7f  00 00 07 a7 03 7b 39 36   ········ ·····{96
00b0  62 66 64 33 37 35 2d 37  66 32 32 2d 34 63 31 37   bfd375-7 f22-4c17
00c0  2d 61 62 39 39 2d 37 65  61 31 33 36 35 30 66 31   -ab99-7e a13650f1
00d0  39 34 7d 00 1f 8a 9e 00  00 00 64 b6 1f 8a 9e 00   94}····· ··d·····
00e0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00f0  00 00 00 00 c2 c6 7e 02  00 00 c0 b7 1f 8a 1c 00   ·····~·· ········
0100  00 00 00 00 00 00 00 00  00 00 01 00 00 00 00 00   ········ ········
0110  00 00 60 b6 1f 8a 9e 00  00 00 00 00 00 00 00 00   ··`····· ········
```

图二：以太网协议字段（Destinationation 和 Source，以及网络类型）

```
Internet Protocol Version 4, Src: 192.168.1.114, Dst: 192.168.1.255
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 291
    Identification: 0x81f2 (33266)
  > Flags: 0x0000
    Fragment offset: 0
    Time to live: 128
    Protocol: UDP (17)
    Header checksum: 0x3316 [validation disabled]
    [Header checksum status: Unverified]
    Source: 192.168.1.114
    Destination: 192.168.1.255
> User Datagram Protocol, Src Port: 54915, Dst Port: 54915
```

```
0000  ff ff ff ff ff ff 38 ba  f8 e7 d3 30 08 00 45 00   ......8· ···0··E·
0010  01 23 81 f2 00 00 80 11  33 16 c0 a8 01 72 c0 a8   ·#······ 3····r··
0020  01 ff d6 83 d6 83 01 0f  9c cb 00 4c 41 50 54 4f   ········ ···LAPTO
0030  50 2d 44 4a 36 38 33 41  54 42 00 b6 1f 8a 9e 00   P-DJ683A TB······
0040  00 00 80 b6 1f 8a 9e 00  00 00 64 b6 1f 8a 9e 00   ········ ··d·····
0050  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
0060  00 00 f0 9d d4 ca 7e 02  00 00 e0 b5 1f 8a 9e 00   ······~· ········
0070  00 00 00 00 c2 c6 05 00  00 00 33 27 00 00 00 00   ········ ··3'····
0080  00 00 e0 9d d4 ca 7e 02  00 00 30 ea c3 c6 7e 02   ······~· ··0···~·
0090  00 00 01 00 00 00 00 00  00 00 01 00 00 00 00 00   ········ ········
00a0  00 00 d6 86 86 e1 fc 7f  00 00 07 a7 03 7b 39 36   ········ ·····{96
00b0  62 66 64 33 37 35 2d 37  66 32 32 2d 34 63 31 37   bfd375-7 f22-4c17
00c0  2d 61 62 39 39 2d 37 65  61 31 33 36 35 30 66 31   -ab99-7e a13650f1
00d0  39 34 7d 00 1f 8a 9e 00  00 00 64 b6 1f 8a 9e 00   94}····· ··d·····
00e0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00f0  00 00 00 00 c2 c6 7e 02  00 00 c0 b7 1f 8a 1c 00   ····~· ·· ········
0100  00 00 00 00 00 00 00 00  00 00 01 00 00 00 00 00   ········ ········
0110  00 00 60 b6 1f 8a 9e 00  00 00 00 00 00 00 00 00   ··`····· ········
```

图三：网络协议层字段（版本，头长度，DSCP（长度和身份），符号位，偏移为 0 不占位，时间 128，协议， 头部检验未开启，最后依次是源地址和目的地址）

```
> Frame 515: 305 bytes on wire (2440 bits), 305 bytes captured (2440 bits) o
> Ethernet II, Src: IntelCor_e7:d3:30 (38:ba:f8:e7:d3:30), Dst: Broadcast (f
> Internet Protocol Version 4, Src: 192.168.1.114, Dst: 192.168.1.255
v User Datagram Protocol, Src Port: 54915, Dst Port: 54915
    Source Port: 54915
    Destination Port: 54915
    Length: 271
    Checksum: 0x9ccb [unverified]
    [Checksum Status: Unverified]
    [Stream index: 3]
  > [Timestamps]
> Data (263 bytes)
```

```
0020  01 ff d6 83 d6 83 01 0f  9c cb 00 4c 41 50 54 4f   ···· ···· ···LAPTO
0030  50 2d 44 4a 36 38 33 41  54 42 00 b6 1f 8a 9e 00   P-DJ683A TB·····
0040  00 00 80 b6 1f 8a 9e 00  00 00 64 b6 1f 8a 9e 00   ·····  ··d·····
0050  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ·····  ·····
0060  00 00 f0 9d d4 ca 7e 02  00 00 e0 b5 1f 8a 9e 00   ·····~· ·····
0070  00 00 00 00 c2 c6 05 00  00 00 33 27 00 00 00 00   ·····  ··3'····
0080  00 00 e0 9d d4 ca 7e 02  00 00 30 ea c3 c6 7e 02   ·····~· ··0···~·
0090  00 00 01 00 00 00 00 00  00 00 01 00 00 00 00 00   ·····  ·····
00a0  00 00 d6 86 86 e1 fc 7f  00 00 07 a7 03 7b 39 36   ·····  ·····{96
00b0  62 66 64 33 37 35 2d 37  66 32 32 2d 34 63 31 37   bfd375-7 f22-4c17
00c0  2d 61 62 39 39 2d 37 65  61 31 33 36 35 30 66 31   -ab99-7e a13650f1
00d0  39 34 7d 00 1f 8a 9e 00  00 00 64 b6 1f 8a 9e 00   94}····· ··d·····
00e0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ·····  ·····
00f0  00 00 00 00 c2 c6 7e 02  00 00 c0 b7 1f 8a 1c 00   ····~· ·· ·····
0100  00 00 00 00 00 00 00 00  00 00 01 00 00 00 00 00   ·····  ·····
0110  00 00 60 b6 1f 8a 9e 00  00 00 00 00 00 00 00 00   ··`····· ·····
0120  00 00 7a 99 bb d1 fc 7f  00 00 00 00 00 60 7f d1   ··z····· ·····`··
0130  07                                                 ·
```

图四：UDP 层数据协议（源端口，目的端口，长度，校验位未开启，数据流索引为 3，时间戳）

```
Data (263 bytes)
```

```
0020  01 ff d6 83 d6 83 01 0f  9c cb 00 4c 41 50 54 4f   ........ ...LAPTO
0030  50 2d 44 4a 36 38 33 41  54 42 00 b6 1f 8a 9e 00   P-DJ683A TB......
0040  00 00 80 b6 1f 8a 9e 00  00 00 64 b6 1f 8a 9e 00   ........ ..d.....
0050  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ........ ........
0060  00 00 f0 9d d4 ca 7e 02  00 00 e0 b5 1f 8a 9e 00   ......~. ........
0070  00 00 00 00 c2 c6 05 00  00 00 33 27 00 00 00 00   ........ ..3'....
0080  00 00 e0 9d d4 ca 7e 02  00 00 30 ea c3 c6 7e 02   ......~. ..0...~.
0090  00 00 01 00 00 00 00 00  00 00 01 00 00 00 00 00   ........ ........
00a0  00 00 d6 86 86 e1 fc 7f  00 00 07 a7 03 7b 39 36   ........ .....{96
00b0  62 66 64 33 37 35 2d 37  66 32 32 2d 34 63 31 37   bfd375-7 f22-4c17
00c0  2d 61 62 39 39 2d 37 65  61 31 33 36 35 30 66 31   -ab99-7e a13650f1
00d0  39 34 7d 00 1f 8a 9e 00  00 00 64 b6 1f 8a 9e 00   94}..... ..d.....
00e0  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ........ ........
00f0  00 00 00 00 c2 c6 7e 02  00 00 c0 b7 1f 8a 1c 00   ......~. ........
0100  00 00 00 00 00 00 00 00  00 00 01 00 00 00 00 00   ........ ........
0110  00 00 60 b6 1f 8a 9e 00  00 00 00 00 00 00 00 00   ..`..... ........
0120  00 00 7a 99 bb d1 fc 7f  00 00 00 00 00 60 7f d1   ..z..... .....`..
0130  07                                                .
```

图五：UDP 数据

TCP 抓包分析：

实验：

```
Frame 293: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits) on interface \Device\NPF_{18A477C5-5DE8-4478-9608-B22608F0B26F}, id 0
  Interface id: 0 (\Device\NPF_{18A477C5-5DE8-4478-9608-B22608F0B26F})
  Encapsulation type: Ethernet (1)
  Arrival Time: Oct 25, 2020 17:38:30.163867000 中国标准时间
  [Time shift for this packet: 0.000000000 seconds]
  Epoch Time: 1603618710.163867000 seconds
  [Time delta from previous captured frame: 0.000093000 seconds]
  [Time delta from previous displayed frame: 0.000093000 seconds]
  [Time since reference or first frame: 15.390511000 seconds]
  Frame Number: 293
  Frame Length: 1514 bytes (12112 bits)
  Capture Length: 1514 bytes (12112 bits)
  [Frame is marked: False]
  [Frame is ignored: False]
  [Protocols in frame: eth:ethertype:ip:tcp]
  [Coloring Rule Name: TCP]
  [Coloring Rule String: tcp]
```

```
0000  54 bf 64 83 7d c6 74 05  a5 8b 79 59 08 00 45 14   T·d·}·t· ··yY··E·
0010  05 dc ae 2f 40 00 2d 06  4e 44 65 c8 23 af c0 a8   ···/@·-· NDe·#···
0020  01 75 01 bb c6 2e c2 f8  a3 0c 5b 7c 77 0d 50 10   ·u····.· ··[|w·P·
0030  01 5f 24 76 00 00 e0 49  e9 9e ea e3 41 10 59 13   ·_$v···I ····A·Y·
0040  7d 7a 5b 9f 93 5f a7 e3  52 6c ef 0e 56 d8 8c f0   }z[··_·· Rl··V···
0050  d2 fa ed 0f 1a 6f e6 44  c7 27 18 18 82 a4 e2 76   ·····o·D ·'·····v
0060  cc 1e 3c 52 1c 13 fd 95  1f 3f c4 59 6b 56 68 a8   ··<R···· ·?·YkVh·
0070  e9 32 84 6e 80 b5 48 c5  ef c5 1e 89 59 7c 36 22   ·2·n··H· ····Y|6"
0080  56 bc 69 ea dc b1 d7 3a  be 3c d9 25 a2 3d 8b 75   V·i····: ·<·%·=·u
0090  01 da de ed ff 6f 80 03  d4 ab f9 8e 94 be 7b 43   ·····o·· ······{C
00a0  23 78 e5 dc 2f 22 9c 2e  4c f4 a3 ba 48 66 a3 df   #x··/"·. L···Hf··
00b0  05 3f 90 45 70 32 9e 00  bf 20 39 0e 9a 43 07 45   ·?·Ep2·· · 9··C·E
00c0  88 47 b3 e6 14 55 40 fb  9b fa 0d 9d ea 99 30 0e   ·G···U@· ······0·
00d0  45 01 2d 16 98 eb 59 5a  7c 78 23 98 df 89 0c 67   E·-···YZ |x#····g
00e0  cb 0d 58 24 a4 40 d2 6f  ff 96 df 5c ff b0 a2 29   ··X$·@·o ···\···)
00f0  3e 5c 1a 6b 37 3f 41 8b  db 4d 66 61 0b e7 88 83   >\·k7?A· ·Mfa····
0100  bc 4d e6 54 b6 62 9b 4b  af b1 96 90 5f 7e 4a fa   ·M·T·b·K ····_~J·
0110  d7 8e 56 2e fe 3a 60 95  4c 51 a4 7e 42 a4 c7 9c   ··V..:`· LQ·~B···
0120  e5 cd f9 de 62 3b 42 a1  65 12 a7 e2 10 58 17 92   ····b;B· e····X··
0130  ac 82 57 2f b9 9b 51 08  0d db 4c ea 64 00 08 91   ··W/··Q· ··L·d···
0140  5c 25 b5 95 e4 2f b9 25  e6 31 fa a9 6c 37 df 88   \%···/·% ·1··l7··
```

图六：总体图（数据帧结构的基本信息，帧数，帧长，时间等）

```
25013 1373.433640   192.168.1.117   182.61.200.6    TCP      66 51056 → 443 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
25014 1373.461979   182.61.200.6    192.168.1.117   TCP      66 443 → 51056 [SYN, ACK] Seq=0 Ack=1 Win=8192 Len=0 MSS=1452 WS=32 SACK_PERM=1
25015 1373.461979   182.61.200.6    192.168.1.117   TCP      60 443 → 51050 [ACK] Seq=1032 Ack=5202 Win=39680 Len=0
25016 1373.462131   192.168.1.117   182.61.200.6    TCP      54 51056 → 443 [ACK] Seq=1 Ack=1 Win=132096 Len=0
25017 1373.462684   192.168.1.117   182.61.200.6    TLSv1.2  571 Client Hello
25018 1373.489377   182.61.200.6    192.168.1.117   TLSv1.2  933 Application Data
25019 1373.491402   182.61.200.6    192.168.1.117   TCP      60 443 → 51056 [ACK] Seq=1 Ack=518 Win=30336 Len=0
25020 1373.491488   182.61.200.6    192.168.1.117   TLSv1.2  150 Server Hello
25021 1373.491488   182.61.200.6    192.168.1.117   TLSv1.2  60 Change Cipher Spec
25022 1373.491545   192.168.1.117   182.61.200.6    TCP      54 51056 → 443 [ACK] Seq=518 Ack=103 Win=131840 Len=0
25023 1373.491579   182.61.200.6    192.168.1.117   TLSv1.2  99 Encrypted Handshake Message
```

```
Sequence number (raw): 2722702923
[Next sequence number: 1    (relative sequence number)]
Acknowledgment number: 0
Acknowledgment number (raw): 0
1000 .... = Header Length: 32 bytes (8)
> Flags: 0x002 (SYN)
Window size value: 64240
[Calculated window size: 64240]
Checksum: 0x4088 [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
> Options: (12 bytes), Maximum segment size, No-Operation (NOP), Window scale, No-Operation (NOP), No-Operation (NOP), SACK permitted
v [Timestamps]
    [Time since first frame in this TCP stream: 0.000000000 seconds]
    [Time since previous frame in this TCP stream: 0.000000000 seconds]
```

```
000  74 05 a5 8b 79 59 54 bf  64 83 7d c6 08 00 45 00   t···yYT· d·}···E·
010  00 34 f5 90 40 00 80 06  00 00 c0 a8 01 75 b6 3d   ·4··@··· ·····u·=
020  c8 06 c7 70 01 bb a2 49  26 4b 00 00 00 00 80 02   ···p···I &K······
030  fa f0 40 88 00 00 02 04  05 b4 01 03 03 08 01 01   ··@····· ········
040  04 02                                              ··
```

图七：TCP 三次握手-SYN

```
25014 1373.461979   182.61.200.6    192.168.1.117   TCP      66 443 → 51056 [SYN, ACK] Seq=0 Ack=1 Win=8192 Len=0 MSS=1452 WS=32 SACK_PERM=1
25015 1373.461979   182.61.200.6    192.168.1.117   TCP      60 443 → 51050 [ACK] Seq=1032 Ack=5202 Win=39680 Len=0
25016 1373.462131   192.168.1.117   182.61.200.6    TCP      54 51056 → 443 [ACK] Seq=1 Ack=1 Win=132096 Len=0
25017 1373.462684   192.168.1.117   182.61.200.6    TLSv1.2  571 Client Hello
25018 1373.489377   182.61.200.6    192.168.1.117   TLSv1.2  933 Application Data
25019 1373.491402   182.61.200.6    192.168.1.117   TCP      60 443 → 51056 [ACK] Seq=1 Ack=518 Win=30336 Len=0
25020 1373.491488   182.61.200.6    192.168.1.117   TLSv1.2  150 Server Hello
25021 1373.491488   182.61.200.6    192.168.1.117   TLSv1.2  60 Change Cipher Spec
25022 1373.491545   192.168.1.117   182.61.200.6    TCP      54 51056 → 443 [ACK] Seq=518 Ack=103 Win=131840 Len=0
25023 1373.491579   182.61.200.6    192.168.1.117   TLSv1.2  99 Encrypted Handshake Message
```

```
1000 .... = Header Length: 32 bytes (8)
> Flags: 0x012 (SYN, ACK)
Window size value: 8192
[Calculated window size: 8192]
Checksum: 0xcdeb [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
> Options: (12 bytes), Maximum segment size, No-Operation (NOP), Window scale, No-Operation (NOP), No-Operation (NOP), SACK permitted
v [SEQ/ACK analysis]
    [This is an ACK to the segment in frame: 25013]
    [The RTT to ACK the segment was: 0.028339000 seconds]
    [iRTT: 0.028491000 seconds]
v [Timestamps]
    [Time since first frame in this TCP stream: 0.028339000 seconds]
    [Time since previous frame in this TCP stream: 0.028339000 seconds]
```

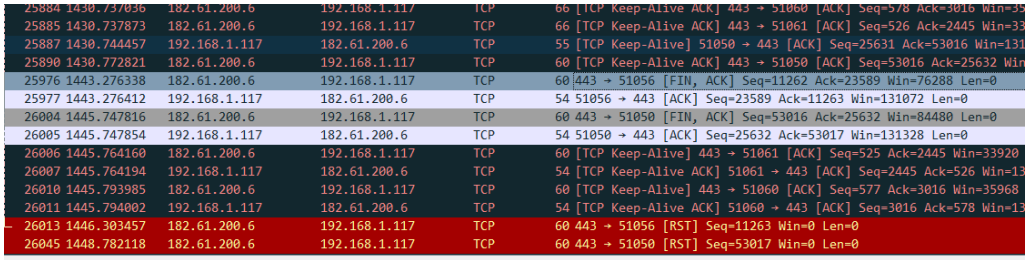
图八：TCP 三次握手-[SYN,ACK]

```
25013 1373.433640   192.168.1.117   182.61.200.6    TCP      66 51056 → 443 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
25014 1373.461979   182.61.200.6    192.168.1.117   TCP      66 443 → 51056 [SYN, ACK] Seq=0 Ack=1 Win=8192 Len=0 MSS=1452 WS=32 SACK_PERM=1
25015 1373.461979   182.61.200.6    192.168.1.117   TCP      60 443 → 51050 [ACK] Seq=1032 Ack=5202 Win=39680 Len=0
25016 1373.462131   192.168.1.117   182.61.200.6    TCP      54 51056 → 443 [ACK] Seq=1 Ack=1 Win=132096 Len=0
25017 1373.462684   192.168.1.117   182.61.200.6    TLSv1.2  571 Client Hello
25018 1373.489377   182.61.200.6    192.168.1.117   TLSv1.2  933 Application Data
25019 1373.491402   182.61.200.6    192.168.1.117   TCP      60 443 → 51056 [ACK] Seq=1 Ack=518 Win=30336 Len=0
25020 1373.491488   182.61.200.6    192.168.1.117   TLSv1.2  150 Server Hello
25021 1373.491488   182.61.200.6    192.168.1.117   TLSv1.2  60 Change Cipher Spec
25022 1373.491545   192.168.1.117   182.61.200.6    TCP      54 51056 → 443 [ACK] Seq=518 Ack=103 Win=131840 Len=0
25023 1373.491579   182.61.200.6    192.168.1.117   TLSv1.2  99 Encrypted Handshake Message
```

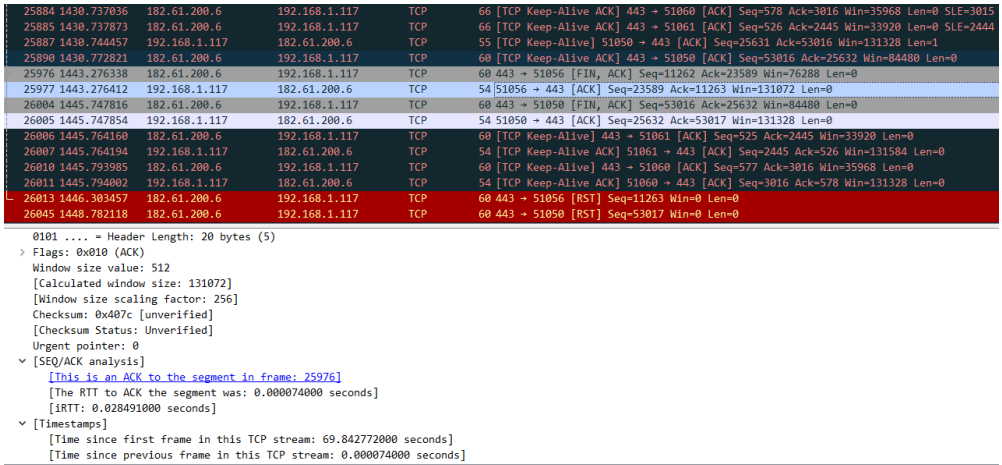
```
0101 .... = Header Length: 20 bytes (5)
> Flags: 0x010 (ACK)
Window size value: 1240
[Calculated window size: 39680]
[Window size scaling factor: 32]
Checksum: 0xa329 [unverified]
[Checksum Status: Unverified]
Urgent pointer: 0
v [SEQ/ACK analysis]
    [This is an ACK to the segment in frame: 25012]
    [The RTT to ACK the segment was: 0.028939000 seconds]
    [iRTT: 0.028052000 seconds]
v [Timestamps]
    [Time since first frame in this TCP stream: 2.013059000 seconds]
    [Time since previous frame in this TCP stream: 0.028939000 seconds]
```

```
0000  54 bf 64 83 7d c6 74 05  a5 8b 79 59 08 00 45 00   T·d·}·t· ··yY··E·
0010  00 28 c1 09 40 00 24 06  55 65 b6 3d c8 06 c0 a8   ·(··@·$· Ue·=····
0020  01 75 01 bb c7 6a f3 c3  b9 45 d9 ec 77 55 50 10   ·u···j·· ·E··wUP·
0030  04 d8 a3 29 00 00 00 00  c5 e1 23 31              ···)···· ··#1
```

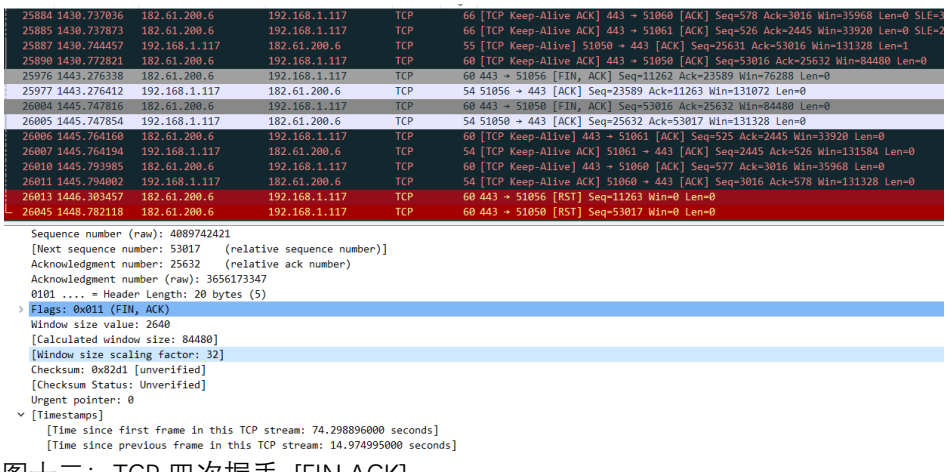
图九：TCP 三次握手-ACK



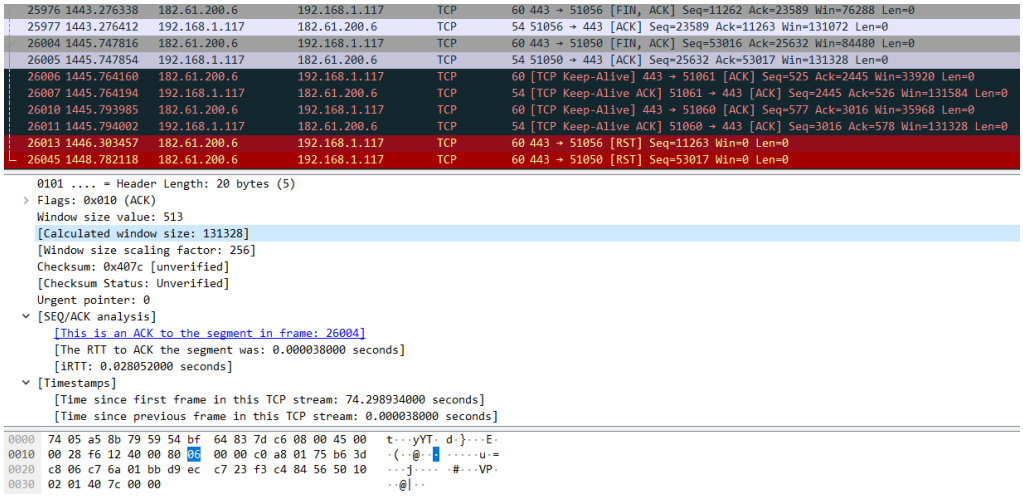
图十：TCP 四次握手-[FIN,ACK]



图十一：TCP 四次握手-ACK



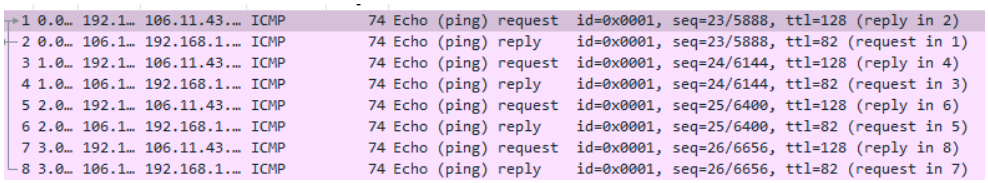
图十二：TCP 四次握手-[FIN,ACK]

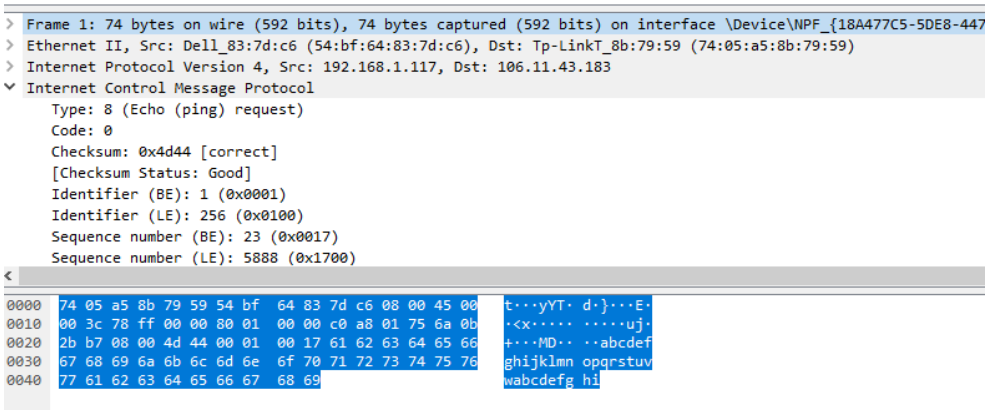


图十三：TCP 四次握手 ACK

ICMP 抓包分析：

实验：





图十四：ICMP 抓包分析（前述帧结构，物理层协议，网络层协议不在详细解释，主要不同的是网络控制信息协议相关内容（类型，编码，校验和经校验正确，windows 下的 BE（大数端），LE（小数端）等）