

计算机网络 IP 实验

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由于在本机抓包体验不佳，本实验采用提供的 Trace 文件

P1

No.	Time	Source	Destination	Protocol	Length	Info
8	6.163045	192.168.1.102	128.59.23.100	ICMP	84	98 Echo (ping) request
9	6.176826	10.216.228.1	192.168.1.102	ICMP	84	70 Time-to-live exceeded
10	6.188629	192.168.1.102	128.59.23.100	ICMP	84	98 Echo (ping) request

Total Length: 84
Identification: 0x32d0 (13008)
Flags: 0x00
...0 0000 0000 0000 = Fragment Offset: 0
Time to Live: 1
Protocol: ICMP (1)
Header Checksum: 0x2d2c [validation disabled]
[Header checksum status: Unverified]
Source Address: 192.168.1.102
Destination Address: 128.59.23.100
Internet Control Message Protocol

0000 00 06 25 da af 73 00 20 e0 8a 70 1a 08 00 45 00 ..%.s. .p..E.

192.168.1.102

P2

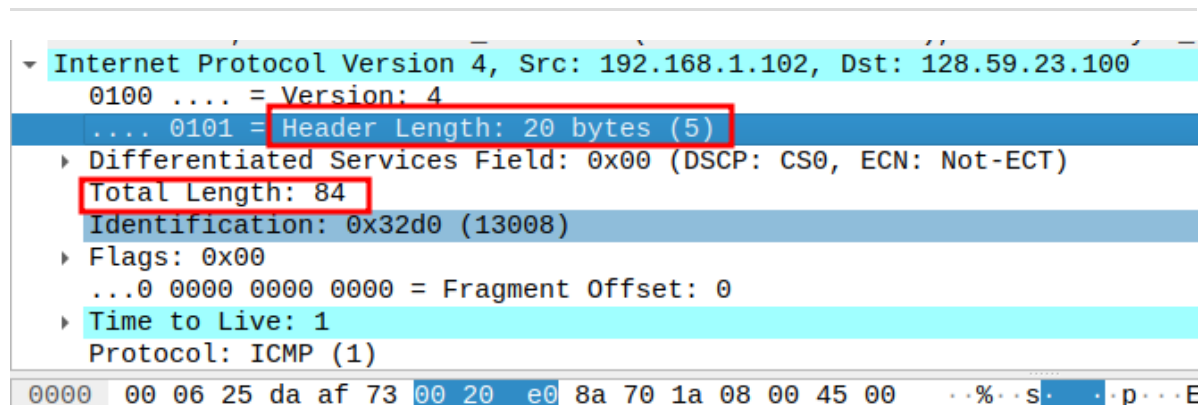
Total Length: 84
Identification: 0x32d0 (13008)
Flags: 0x00
...0 0000 0000 0000 = Fragment Offset: 0
Time to Live: 1
Protocol: ICMP (1)
Header Checksum: 0x2d2c [validation disabled]
[Header checksum status: Unverified]
Source Address: 192.168.1.102
Destination Address: 128.59.23.100
Internet Control Message Protocol

0000 00 06 25 da af 73 00 20 e0 8a 70 1a 08 00 45 00 ..%.s. .p..E.
0010 00 54 32 d0 00 00 01 01 2d 2c c0 a8 01 66 80 3b .T2... ,...f;
0020 17 64 08 00 f7 ca 03 00 50 03 37 32 20 aa aa aa .d.... P.72 ...
0030 aa aa aa aa aa aa aa aa aa aa aa aa aa aa ..
0040 aa aa aa aa aa aa aa aa aa aa aa aa aa aa ..
0050 aa aa aa aa aa aa aa aa aa aa aa aa aa aa ..
0060 aa aa ..

Protocol (ip.proto), 1 byte(s)

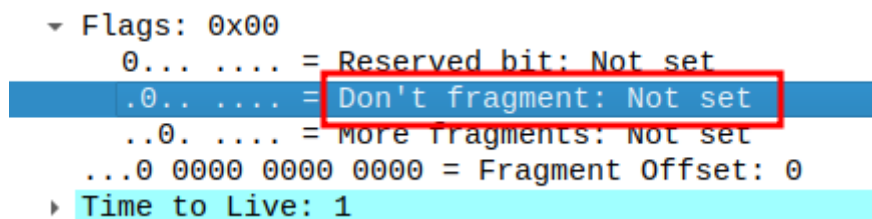
如图所示

P3



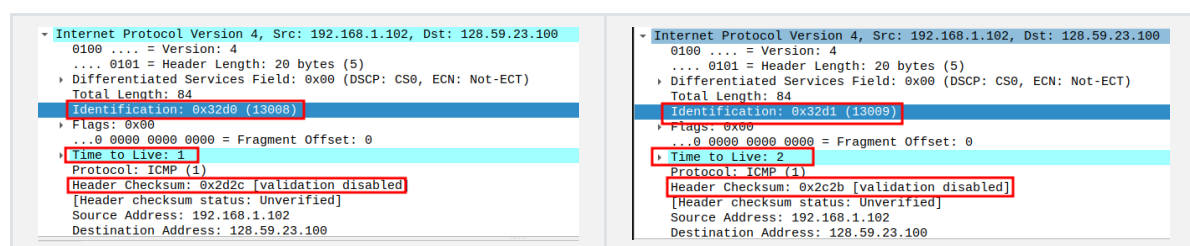
头部 20 字节，载荷 64 字节

P4



如图所示，没有分片

P5



如图所示，Identification, Time to Live & Header Checksum

P6

- 保持不变：Version, Service, Total Length, Header Length, Protocol, flag, offset, Source & Destination Address
- 必须不变：Version, Source Address, Destination Address
- 必须改变：TTL, Identification, checksum, data

P7

同 P5 图，每次增加 1

P8

```
▸ Frame 9: 70 bytes on wire (560 bits), 70 bytes captured
▸ Ethernet II, Src: LinksysG_da:af:73 (00:06:25:da:af:73),
▾ Internet Protocol Version 4, Src: 10.216.228.1, Dst: 192.168.1.102
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    ▾ Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
        1100 00.. = Differentiated Services Codepoint: Class Selector 6
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
    Total Length: 56
    Identification: 0x9d7c (40316)
    ▸ Flags: 0x00
        ...0 0000 0000 0000 = Fragment Offset: 0
        Time to Live: 255
    Protocol: ICMP (1)
    Header Checksum: 0x6ca0 [validation disabled]
```

- Identification: 0x9d7c
- Time to Live: 255

P9

- TTL 对于同一个 first hop router 不变
- Identification 对于不同的数据报是不同的

P10

```
92 28.441... 192.168.1.102 128.59.23.100 IPv4 1514 Fragmented IP protocol (proto=ICMP 1, off=0, ID=32f9) [Reassembled]
93 28.442... 192.168.1.102 128.59.23.100 ICMP 562 Echo (ping) request id=0x0300, seq=30467/887, ttl=1 (no r
94 28.462... 10.216.228.1 192.168.1.102 ICMP 70 Time-to-live exceeded (Time to live exceeded in transit)
95 28.470... 192.168.1.102 128.59.23.100 IPv4 1514 Fragmented IP protocol (proto=ICMP 1, off=0, ID=32fa) [Reassembled]
96 28.471... 192.168.1.102 128.59.23.100 ICMP 562 Echo (ping) request id=0x0300, seq=30723/888, ttl=2 (no r
97 28.490... 192.168.1.102 128.59.23.100 IPv4 1514 Fragmented IP protocol (proto=ICMP 1, off=0, ID=32fb) [Reassembled]
98 28.491... 192.168.1.102 128.59.23.100 ICMP 562 Echo (ping) request id=0x0300, seq=30979/889, ttl=3 (no r
99 28.520... 192.168.1.102 128.59.23.100 IPv4 1514 Fragmented IP protocol (proto=ICMP 1, off=0, ID=32fc) [Reassembled]
100 28.521... 192.168.1.102 128.59.23.100 ICMP 562 Echo (ping) request id=0x0300, seq=31235/890, ttl=4 (no r
101 28.530... 24.218.0.153 192.168.1.102 ICMP 70 Time-to-live exceeded (Time to live exceeded in transit)

0000 00.. = Differentiated Services Codepoint: Default (0)
.... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
Total Length: 1500
Identification: 0x32f9 (13049)
▾ Flags: 0x20, More fragments
    0... .... = Reserved bit: Not set
    .0... .... = Don't fragment: Not set
    ...1. .... = More fragments: Set
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 1
    Protocol: ICMP (1)
    Header Checksum: 0x077b [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.1.102
    Destination Address: 128.59.23.100
```

分片了。

P11

- 如上图所示

- More fragments flag 是 1
- 第一片载荷 1480 字节，第二片载荷 528 字节

P12

```

Total Length: 548
Identification: 0x32f9 (13049)
▼ Flags: 0x00
  0... .. = Reserved bit: Not set
  .0... .. = Don't fragment: Not set
  ..0... .. = More fragments: Not set
...0 0101 1100 1000 = Fragment Offset: 1480
▶ Time to Live: 1
Protocol: ICMP (1)
Header Checksum: 0x2a7a [validation disabled]
[Header checksum status: Unverified]

```

- Fragment Offset
- 没有了。标志位全为 0

P13

Total Length, Flags, Fragment Offset, Header Checksum

P14

212 39.227...	128.59.1.41	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to live exceeded in transit)
213 39.314...	128.59.23.100	192.168.1.102	IPv4	1514 Fragmented IP protocol (proto=ICMP 1, off=0, ID=0956) [Reassembled]
214 39.322...	128.59.23.100	192.168.1.102	ICMP	562 Echo (ping) reply id=0x0300, seq=40195/925, ttl=242 (no r...
215 41.038...	192.168.1.102	199.2.53.206	TCP	62 [TCP Retransmission] [TCP Port numbers reused] 1483 → 631
216 43.466...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol (proto=ICMP 1, off=0, ID=3323) [Reassembled]
217 43.466...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol (proto=ICMP 1, off=1480, ID=3323) [Reassembled]
218 43.467...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request id=0x0300, seq=40451/926, ttl=1 (no r...
219 43.485...	10.216.228.1	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to live exceeded in transit)
220 43.492...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol (proto=ICMP 1, off=0, ID=3324) [Reassembled]
221 43.492...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol (proto=ICMP 1, off=1480, ID=3324) [Reassembled]
222 43.493...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request id=0x0300, seq=40707/927, ttl=2 (no r...
223 43.512...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol (proto=ICMP 1, off=0, ID=3325) [Reassembled]
224 43.512...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol (proto=ICMP 1, off=1480, ID=3325) [Reassembled]
225 43.513...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request id=0x0300, seq=40963/928, ttl=3 (no r...

3 个分片

P15

Total Length, Flags, Fragment Offset, Header Checksum