

# 计网Lab5 IP

使用 <http://gaia.cs.umass.edu/wireshark-labs/wireshark-traces.zip> 提供的 **ip-ethereal-trace-1** 来回答问题

Q1 您电脑的 IP 地址是什么?

No.	Time	Source	Destination	Protcl	Length	Info
1	0.000000	CnetTech_73:8d...	Broadcast	ARP	60	Who has 192.168.1.117? Tell 192.168.1.104
2	4.866867	192.168.1.100	192.168.1.1	SSH	174	M-SEARCH * HTTP/1.1
3	4.868147	192.168.1.100	192.168.1.1	SSH	175	M-SEARCH * HTTP/1.1
4	5.363536	192.168.1.100	192.168.1.1	SSH	174	M-SEARCH * HTTP/1.1
5	5.364799	192.168.1.100	192.168.1.1	SSH	175	M-SEARCH * HTTP/1.1
6	5.864428	192.168.1.100	192.168.1.1	SSH	174	M-SEARCH * HTTP/1.1
7	5.865461	192.168.1.100	192.168.1.1	SSH	175	M-SEARCH * HTTP/1.1
8	6.163045	192.168.1.102	128.59.23.100	ICMP	98	Echo (ping) request id=0x0300, seq=20483/848, ttl=
9	6.176826	10.216.228.1	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in tr
10	6.188629	192.168.1.102	128.59.23.100	ICMP	98	Echo (ping) request id=0x0300, seq=20739/849, ttl=
11	6.202957	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in tr
12	6.208597	192.168.1.102	128.59.23.100	ICMP	98	Echo (ping) request id=0x0300, seq=20995/850, ttl=
13	6.234505	24.128.190.197	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in tr
14	6.238695	192.168.1.102	128.59.23.100	ICMP	98	Echo (ping) request id=0x0300, seq=21251/851, ttl=

> Frame 8: 98 bytes on wire (784 bits), 98 bytes captured (784 bits)  
> Ethernet II, Src: Actionte\_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG\_da:af:73 (00:06:25:da:af:73)  
v Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.59.23.100  
    0100 .... = Version: 4  
    .... 0101 = Header Length: 20 bytes (5)  
    > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)  
    Total Length: 84  
    Identification: 0x32d0 (13008)  
    > 000. .... = Flags: 0x0  
    ...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

从第8个包的信息，可以看出电脑的ip地址是192.168.1.102

Q2 在 IP 包头中，上层协议字段的值是什么?

> Frame 8: 98 bytes on wire (784 bits), 98 bytes captured (784 bits)
> Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)
v Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.59.23.100
0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
Total Length: 84
Identification: 0x32d0 (13008)
> 000. .... = Flags: 0x0
...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

上层协议字段是ICMP(1)。

Q3 IP报头有多少字节？IP数据报的有效载荷有多少字节？解释你是如何确定有效载荷字节数的。

```
> Frame 8: 98 bytes on wire (784 bits), 98 bytes captured (784 bits)
> Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)
> Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.59.23.100
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 84
    Identification: 0x32d0 (13008)
> 000. .... = Flags: 0x0
    ...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
```

报头有20字节。

总长度84字节，所以有效载荷为  $84 - 20 = 64$  字节

Q4 该IP数据报是否已被分片？请解释您是如何确定数据报是否被分片的。

```
> Frame 8: 98 bytes on wire (784 bits), 98 bytes captured (784 bits)
> Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)
> Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.59.23.100
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 84
    Identification: 0x32d0 (13008)
> 000. .... = Flags: 0x0
    0... .... = Reserved bit: Not set
    .0.. .... = Don't fragment: Not set
    ..0. .... = More fragments: Not set
    ...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
```

Flags设置为0x0，More fragments未设置，Fragment Offset也设置为0。

Q5 在您的计算机发送的这一系列 ICMP 报文中，IP数据报中的哪些字段总是从一个数据报到下一个数据报不断变化？

```

> Frame 8: 98 bytes on wire (784 bits), 98 bytes captured (784 bits)
> Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)
< Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.59.23.100
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
  Total Length: 84
  Identification: 0x32d0 (13008)
  < 000. .... = Flags: 0x0
  0... .... = Reserved bit: Not set
  .0.. .... = Don't fragment: Not set
  ..0. .... = More fragments: Not set
  ...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

> Frame 10: 98 bytes on wire (784 bits), 98 bytes captured (784 bits)
> Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)
< Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.59.23.100
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
  Total Length: 84
  Identification: 0x32d1 (13009)
  < 000. .... = Flags: 0x0
  0... .... = Reserved bit: Not set
  .0.. .... = Don't fragment: Not set
  ..0. .... = More fragments: Not set
  ...0 0000 0000 0000 = Fragment Offset: 0
  > Time to Live: 2
  Protocol: ICMP (1)
  Header Checksum: 0x2c2b [validation disabled]
  [Header checksum status: Unverified]
  Source Address: 192.168.1.102
  Destination Address: 128.59.23.100
> Internet Control Message Protocol

```

由图可知，不同的两个IP数据报的 **Identification** 、 **Time to Live** 、 **Header Checksum** 总是在变化

Q6 哪些字段保持不变？哪些字段必须保持不变？哪些字段必须改变？为什么？

1. 依旧对比Q5中的两张图，分析得到如下结论

2. 保持不变的字段：

版本号 **Version** 、首部长度的 **Header Length** 、区分服务的 **Differentiated Services Field** 、上层协议的 **Protocol** 、总长度的 **Total Length** 、标志 **Flags** 、片段偏移 **Fragment Offset** 、源地址 **Source Address** 、目的地址 **Destination Address**

对于所有数据报，以下字段必须保持不变：

- **版本号 (Version)** ：由于使用的是 IPv4，版本号保持不变。
- **首部长度的 (Header Length)** ：鉴于数据报均无选项，其长度固定为 20 字节。
- **区分服务 (Differentiated Services Field)** ：所有数据报采用相同的服务类型。
- **协议 (Protocol)** ：全部数据报均为 ICMP 报文。
- **源地址 (Source Address)** ：审查的是来自同一源地址的报文。

- **目的地址 (Destination Address)**：所有报文的目标地址相同。

而以下字段根据情况发生变化：

- **标识 (Identification)**：不同数据包具有独特的标识。
- **首部校验和 (Header Checksum)**：由于其他字段变化，校验和也随之变动。
- **存活时间 (Time to Live, TTL)**：traceroute 程序发送的报文中，TTL 值会递增，导致该字段变化。

Q7 描述你在 IP 数据报的标识字段值中看到的模式。

每发送一个 ICMP Echo 报文时，标识 (Identification) 字段会递增 1

Q8 标识字段和 TTL 字段的值是多少？

No.	Time	Source	Destination	Protcl	Length	Info
9	6.176826	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in
40	11.1744...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in
65	16.1796...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in
94	28.4622...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in
135	33.4705...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in
179	38.4918...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in
219	43.4857...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in

  

```

> Frame 9: 70 bytes on wire (560 bits), 70 bytes captured (560 bits)
> Ethernet II, Src: LinksysG_da:af:73 (00:06:25:da:af:73), Dst: Actionte_8a:70:1a (00:20:e0:8a:70:1a)
> 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)
  Total Length: 56
  Identification: 0x9d7c (40316)
> 000. .... = Flags: 0x0
  0... .... = Reserved bit: Not set
  .0... .... = Don't fragment: Not set
  ..0. .... = More fragments: Not set
  ...0 0000 0000 0000 = Fragment Offset: 0
  Time to Live: 255
  Protocol: ICMP (1)
  Header Checksum: 0x6ca0 [validation disabled]
  [Header checksum status: Unverified]
  Source Address: 10.216.228.1
  Destination Address: 192.168.1.102
> Internet Control Message Protocol
  
```

标志字段Identification为0x9d7c，TTL字段为255

Q9 最近（第一跳）路由器向您的计算机发送的所有 ICMP TTL 超标回复中，这些值是否保持不变？为什么？

65	16.1796...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in tra
94	28.4622...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in tra
135	33.4705...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in tra
179	38.4918...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in tra
219	43.4857...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in tra
274	48.4930...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in tra
330	53.5010...	10.216.228.1	192.168.1.102	IC...	70	Time-to-live exceeded (Time to live exceeded in tra
21	6.334320	12.122.10.22	192.168.1.102	IC...	126	Time-to-live exceeded (Time to live exceeded in tra

  

> Frame 65: 70 bytes on wire (560 bits), 70 bytes captured (560 bits)

> Ethernet II, Src: LinksysG\_da:af:73 (00:06:25:da:af:73), Dst: Actionte\_8a:70:1a (00:20:e0:8a:70:1a)

> 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)

Total Length: 56

Identification: 0x9db8 (40376)

> 000. .... = Flags: 0x0

0... .... = Reserved bit: Not set

.0.. .... = Don't fragment: Not set

..0. .... = More fragments: Not set

...0 0000 0000 0000 = Fragment Offset: 0

Time to Live: 255

Protocol: ICMP (1)

Header Checksum: 0x6c64 [validation disabled]

[Header checksum status: Unverified]

Source Address: 10.216.228.1

Destination Address: 192.168.1.102

对比上图和Q8中的图发现，标识字段Identification每次都改变，因为每个不同数据报都有不同的标识，所以会一直变化；

TTL 字段保持不变，鉴于每个数据包的Identification值是唯一的，同时它们抵达同一服务器的跳数相等，且服务器配置一致，路由器处理数据报时 TTL 才会减 1，因此它们的TTL值保持恒定不变。

Q10 将pingplotter 中的“数据包大小”改为 2000 后，查找计算机发送的第一条ICMP Echo Request 报文。该报文是否被多个 IP 数据报分片？

包序号93如下：

92	28.4415...	192.168.1.102	128.59.23.100	IP...	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=32f9)
93	28.4421...	192.168.1.102	128.59.23.100	IC...	562	Echo (ping) request id=0x0300, seq=30467/887, ttl=64
95	28.4706...	192.168.1.102	128.59.23.100	IP...	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=32f9)

  

```

Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.59.23.100
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 548
    Identification: 0x32f9 (13049)
  > 000. .... = Flags: 0x0
    ...0 0000 1011 1001 = Fragment Offset: 1480
  > Time to Live: 1
    Protocol: ICMP (1)
    Header Checksum: 0x2a7a [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.1.102
    Destination Address: 128.59.23.100
  > [2 IPv4 Fragments (2008 bytes): #92(1480), #93(528)]
Internet Control Message Protocol
  Type: 8 (Echo (ping) request)
  Code: 0
  Checksum: 0xd0c6 [correct]
  [Checksum Status: Good]
  Identifier (BE): 768 (0x0300)
  Identifier (LE): 3 (0x0003)
  Sequence Number (BE): 30467 (0x7703)
  Sequence Number (LE): 887 (0x0377)
  > [No response seen]
  > Data (2000 bytes)

```

包序号92如下:

```

001. .... = Flags: 0x1, 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

```

从两张截图看出来，确实发生了分片。

Q11 打印出分片 IP 数据报的第一个片段。IP 报头中的哪些信息表明数据报已被分片？  
IP 报头中的哪些信息表明这是第一个片段还是后一个片段？该IP数据报有多长？

```

No.    Time          Source            Destination      Protocol Length Info
 92 28.441511    192.168.1.102    128.59.23.100    IPv4      1514    Fragmented IP protocol (proto=ICMP 1,
off=0, ID=32f9) [Reassembled in #93]
Frame 92: 1514 bytes on wire (12112 bits), 1514 bytes captured (12112 bits)
Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)
  Destination: LinksysG_da:af:73 (00:06:25:da:af:73)
  Source: Actionte_8a:70:1a (00:20:e0:8a:70:1a)
  Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.59.23.100
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
  Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
  Total Length: 1500
  Identification: 0x32f9 (13049)
  001. .... = Flags: 0x1, 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
  [Reassembled IPv4 in frame: 93]
Data (1480 bytes)
0000 08 00 d0 c6 03 00 77 03 37 20 aa aa aa aa .....w.76 .....

```

**More Fragments** 被设置表示已分片；

片位移 **Fragment Offset** 是0，表示这是第一个片；

**Total Length = 1500**，数据报长度为1500字节。

Q12 打印出分片 IP 数据报的第二个片段。IP 报头中的哪些信息表明这不是第一个数据报片段？是否有更多片段？如何判断？

```
No.      Time          Source            Destination      Protocol Length Info
 93 28.442185      192.168.1.102    128.59.23.100   ICMP      562    Echo (ping) request id=0x0300,
seq=30467/887, ttl=1 (no response found!)
Frame 93: 562 bytes on wire (4496 bits), 562 bytes captured (4496 bits)
Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)
Destination: LinksysG_da:af:73 (00:06:25:da:af:73)
Source: Actionte_8a:70:1a (00:20:e0:8a:70:1a)
Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.59.23.100
0100 .... = Version: 4
.... 0101 = Header Length: 20 bytes (5)
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
Total Length: 548
Identification: 0x32f9 (13049)
000. .... = Flags: 0x0
0... .... = Reserved bit: Not set
..0. .... = Don't fragment: Not set
..0. .... = More fragments: Not set
...0 0000 1011 001 = Fragment Offset: 1480
Time to Live: 1
Protocol: ICMP (1)
Header Checksum: 0x2a7a [validation disabled]
[Header checksum status: Unverified]
Source Address: 192.168.1.102
Destination Address: 128.59.23.100
[2 IPv4 Fragments (2008 bytes): #92(1480), #93(528)]
Internet Control Message Protocol
Type: 8 (Echo (ping) request)
Code: 0
Checksum: 0xd0c6 [correct]
[Checksum Status: Good]
Identifier (BE): 768 (0x0300)
Identifier (LE): 3 (0x0003)
Sequence Number (BE): 30467 (0x7703)
Sequence Number (LE): 887 (0x0377)
[No response seen]
Data (2008 bytes)
0000 37 36 20 aa aa aa aa aa aa aa aa aa aa aa aa 76 .....
0010 aa aa aa aa aa aa aa aa aa aa aa aa aa aa aa .....
0020 aa aa aa aa aa aa aa aa aa aa aa aa aa aa aa .....
```

**Fragment Offset** 字段表示为 1480 表明它不是第一个片段，**More fragments** 为 Not Set 可以知道没有更多片段了。

Q13 在第一个片段和第二个片段之间，IP 标头的哪些字段发生了变化？

从 Q11、Q12 打印截图中分析得到，**Total Length**、**More fragments**、**Fragment Offset**、**Header Checksum** 发生了变化。

Q14 从原始数据报生成了多少个片段？

No.	Time	Source	Destination	Protocol	Length	Info
216	43.4661...	192.168.1.102	128.59.23.100	IP...	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=332)
217	43.4668...	192.168.1.102	128.59.23.100	IP...	1514	Fragmented IP protocol (proto=ICMP 1, off=1480, ID=332)
218	43.4676...	192.168.1.102	128.59.23.100	ICMP	582	Echo (ping) request id=0x0300, seq=40451/926, ttl=1

> Frame 218: 582 bytes on wire (4656 bits), 582 bytes captured (4656 bits)

> Ethernet II, Src: Actionte\_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG\_da:af:73 (00:06:25:da:af:73)

> Destination: LinksysG\_da:af:73 (00:06:25:da:af:73)

> Source: Actionte\_8a:70:1a (00:20:e0:8a:70:1a)

Type: IPv4 (0x0800)

> Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.59.23.100

0100 .... = Version: 4

.... 0101 = Header Length: 20 bytes (5)

> Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)

Total Length: 568

Identification: 0x3323 (13091)

> 000. .... = Flags: 0x0

0... .... = Reserved bit: Not set

..0. .... = Don't fragment: Not set

..0. .... = More fragments: Not set

...0 0001 0111 0010 = Fragment Offset: 2960

> Time to Live: 1

Protocol: ICMP (1)

Header Checksum: 0x2983 [validation disabled]

[Header checksum status: Unverified]

Source Address: 192.168.1.102

Destination Address: 128.59.23.100

> [3 IPv4 Fragments (3508 bytes): #216(1480), #217(1480), #218(548)]

> Internet Control Message Protocol







```

Frame 218: 582 bytes on wire (4656 bits), 582 bytes captured (4656 bits)
Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:da:af:73)
> Destination: LinksysG_da:af:73 (00:06:25:da:af:73)
> Source: Actionte_8a:70:1a (00:20:e0:8a:70:1a)
Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 192.168.1.102, Dst: 128.59.23.100
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
  > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
  Total Length: 568
  Identification: 0x3323 (13091)
  000. .... = Flags: 0x0
    0... .... = Reserved bit: Not set
    .0.. .... = Don't fragment: Not set
    ..0. .... = More fragments: Not set
  ...0 0001 0111 0010 = Fragment Offset: 2960
  > Time to Live: 1
  Protocol: ICMP (1)
  Header Checksum: 0x2983 [validation disabled]
  [Header checksum status: Unverified]
  Source Address: 192.168.1.102
  Destination Address: 128.59.23.100
  > [3 IPv4 Fragments (3508 bytes): #216(1480), #217(1480), #218(548)]
Internet Control Message Protocol
Type: 8 (Echo (ping) request)

```

对比上面三张截图发生变化的字段：

- 数据报长度 **Total Length** ,
- 标志 **Flags** ,
- 片偏移 **Fragment Offset**
- 首部校验和 **Header Checksum**