

学号：	姓名：	班级：
实验题目： 实验九 IP		
实验学时：2h	实验日期： 2023. 04. 24	
实验目的： 学习 IP 的相关内容		
硬件环境： Windows10 家庭版		
软件环境： Wireshark		
实验步骤与内容： 实验内容： <ol style="list-style-type: none"> <li>1. Select the first ICMP Echo Request message sent by your computer, and expand the Internet Protocol part of the packet in the packet details window. What is the IP address of your computer?</li> <li>2. Within the IP packet header, what is the value in the upper layer protocol field?</li> <li>3. How many bytes are in the IP header? How many bytes are in the payload <i>of the</i> IP datagram? Explain how you determined the number of payload bytes.</li> <li>4. Has this IP datagram been fragmented? Explain how you determined whether or not the datagram has been fragmented.</li> <li>5. Which fields in the IP datagram always change from one datagram to the next within this series of ICMP messages sent by your computer?</li> <li>6. Which fields stay constant? Which of the fields <i>must</i> stay constant? Which fields must change? Why?</li> <li>7. Describe the pattern you see in the values in the Identification field of the IP datagram</li> <li>8. What is the value in the Identification field and the TTL field?</li> <li>9. Do these values remain unchanged for all of the ICMP TTL-exceeded replies sent to your computer by the nearest (first hop) router? Why?</li> <li>10. Find the first ICMP Echo Request message that was sent by your computer after you changed the <i>Packet Size</i> in <i>pingplotter</i> to be 2000. Has that message been fragmented across more than one IP datagram? [Note: if you find your packet has</li> </ol>		

not been fragmented, you should download the zip file <http://gaia.cs.umass.edu/wireshark-labs/wireshark-traces.zip> and extract the *ip-ethereal-trace-1* packet trace. If your computer has an Ethernet interface, a packet size of 2000 *should* cause fragmentation.3]

11. Print out the first fragment of the fragmented IP datagram. What information in the IP header indicates that the datagram been fragmented? What information in the IP header indicates whether this is the first fragment versus a latter fragment? How long is this IP datagram?

12. Print out the second fragment of the fragmented IP datagram. What information in the IP header indicates that this is not the first datagram fragment? Are there more fragments? How can you tell?

13. What fields change in the IP header between the first and second fragment?

14. How many fragments were created from the original datagram?

15. What fields change in the IP header among the fragments?

实验步骤：

本实验主要学习 IP，需要下载 PingPlotter 来对 IP 数据包进行跟踪，同时在跟踪过程中还需修改数据包大小。

1. 本机的 IP 地址是 192.168.1.102。

8	6.163045	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
9	6.176826	10.216.228.1	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
10	6.188629	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
11	6.202957	24.218.0.153	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
12	6.208597	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
13	6.234505	24.128.190.197	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
14	6.238695	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
15	6.257672	24.128.0.101	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
16	6.258750	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
17	6.286017	12.125.47.49	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
18	6.288750	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
19	6.307657	12.123.40.218	192.168.1.102	ICMP	126 Time-to-live exceeded (Time to
20	6.308748	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
21	6.334320	12.122.10.22	192.168.1.102	ICMP	126 Time-to-live exceeded (Time to
22	6.338804	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,

  

- > 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 (00:06:2f:00:06:73)
- ✓ 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

2. 上层协议是 ICMP，上层协议字段中的值是 1。



8	6.163045	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
9	6.176826	10.216.228.1	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
10	6.188629	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
11	6.202957	24.218.0.153	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
12	6.208597	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
13	6.234505	24.128.190.197	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
14	6.238695	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
15	6.257672	24.128.0.101	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
16	6.258750	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
17	6.286017	12.125.47.49	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
18	6.288750	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
19	6.307657	12.123.40.218	192.168.1.102	ICMP	126 Time-to-live exceeded (Time to
20	6.308748	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
21	6.334320	12.122.10.22	192.168.1.102	ICMP	126 Time-to-live exceeded (Time to
22	6.338804	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,

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:

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)

3. IP 标头有 20 字节，IP 数据包有 64 字节，有效负载字节数等于总长度减去标头长度。

8	6.163045	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
9	6.176826	10.216.228.1	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
10	6.188629	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
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13	6.234505	24.128.190.197	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
14	6.238695	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
15	6.257672	24.128.0.101	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
16	6.258750	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
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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:

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

4. IP 数据包没有分片，因为 Flag 中最后一位为 0，且 Fragment offset 为 0，这意味着该包是最后一个分片，且偏移量为 0，一个包就装下了所有的 data。

8	6.163045	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
9	6.176826	10.216.228.1	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
10	6.188629	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
11	6.202957	24.218.0.153	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
12	6.208597	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
13	6.234505	24.128.190.197	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
14	6.238695	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
15	6.257672	24.128.0.101	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
16	6.258750	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
17	6.286017	12.125.47.49	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to
18	6.288750	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
19	6.307657	12.123.40.218	192.168.1.102	ICMP	126 Time-to-live exceeded (Time to
20	6.308748	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,
21	6.334320	12.122.10.22	192.168.1.102	ICMP	126 Time-to-live exceeded (Time to
22	6.338804	192.168.1.102	128.59.23.100	ICMP	98 Echo (ping) request id=0x0300,

  

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 (00:06:25:00:06:73)  
 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)
v 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
  
```

5. Identification、TTL、Checksum 都会发生改变，如下图所示。

第一条消息：



365	53.758...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, seq=
361	53.728...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, seq=
358	53.714...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, seq=
355	53.678...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, seq=
352	53.658...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, seq=
349	53.628...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, seq=
345	53.608...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, seq=
342	53.584...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, seq=
339	53.558...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, seq=
336	53.528...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, seq=

  

Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:c^						
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: 0x3349 (13129)						
v 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: 12						
Protocol: ICMP (1)						
Header Checksum: 0x1e5d [validation disabled]						
[Header checksum status: Unverified]						
Source Address: 192.168.1.102						
Destination Address: 128.59.23.100						

## 第二条消息：

368	53.778...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, s
365	53.758...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, s
361	53.728...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, s
358	53.714...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, s
355	53.678...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, s
352	53.658...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, s
349	53.628...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, s
345	53.608...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, s
342	53.584...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, s
339	53.558...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, s
336	53.528...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request	id=0x0300, s

  

Ethernet II, Src: Actionte_8a:70:1a (00:20:e0:8a:70:1a), Dst: LinksysG_da:af:73 (00:06:25:c^						
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: 0x334a (13130)						
v 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: 13						
Protocol: ICMP (1)						
Header Checksum: 0xd5c [validation disabled]						
[Header checksum status: Unverified]						
Source Address: 192.168.1.102						
Destination Address: 128.59.23.100						

6. Version、Header Length、Total Length、source IP、Destination IP 不变，TTL、Header Checksum、Identification 变。因为发送方每发送一个 datagram，TTL++，Checksum 会随

datagram 中其他字节的变化而变化, Identification 也会++。

7. 标识号是不同的, 用于区分每个 IP 数据包和处理 IP 分片。

8. Identification 的值是 42507, TTL 是 224。

376	54.659...	67.99.58.194	192.168.1.102	ICMP	70 Time-to-live exceeded
321	49.827...	67.99.58.194	192.168.1.102	ICMP	70 Time-to-live exceeded
265	44.655...	67.99.58.194	192.168.1.102	ICMP	70 Time-to-live exceeded
211	39.164...	67.99.58.194	192.168.1.102	ICMP	70 Time-to-live exceeded
169	34.147...	67.99.58.194	192.168.1.102	ICMP	70 Time-to-live exceeded
128	29.140...	67.99.58.194	192.168.1.102	ICMP	70 Time-to-live exceeded
85	16.438...	67.99.58.194	192.168.1.102	ICMP	70 Time-to-live exceeded
31	6.432918	67.99.58.194	192.168.1.102	ICMP	70 Time-to-live exceeded
346	53.615...	24.218.0.153	192.168.1.102	ICMP	70 Time-to-live exceeded
290	48.610...	24.218.0.153	192.168.1.102	ICMP	70 Time-to-live exceeded
235	43.600...	24.218.0.153	192.168.1.102	ICMP	70 Time-to-live exceeded
184	38.554...	24.218.0.153	192.168.1.102	ICMP	70 Time-to-live exceeded
142	33.537...	24.218.0.153	192.168.1.102	ICMP	70 Time-to-live exceeded
101	28.530...	24.218.0.153	192.168.1.102	ICMP	70 Time-to-live exceeded
67	16.206	24.218.0.153	192.168.1.102	ICMP	70 Time-to-live exceeded

> Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)

Total Length: 56

Identification: 0xa60b (42507)

✓ 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: 244

Protocol: ICMP (1)

9. 标识字段都会更改, 因为标识字段是唯一值。当两个或多个 IP 数据报具有相同的标识值时, 则意味着这些 IP 数据报是单个大型 IP 数据报的片段。TTL 字段保持不变, 因为第一跳路由器的 TTL 始终相同。

第一条消息:



No.	Time	Source	Destination	Protocol	Length	Info
376	54.659...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
321	49.827...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
265	44.655...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
211	39.164...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
169	34.147...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
128	29.140...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
85	16.438...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
31	6.432918	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
346	53.615...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
290	48.610...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
235	43.600...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
184	38.554...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
142	33.537...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
101	28.530...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
67	16.206...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)

> Frame 376: 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: 67.99.58.194, 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: 0xa60b (42507)

> 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: 244

0000	00 20 e0 8a 70 1a
0010	00 38 a6 0b 00 00
0020	01 66 0b 00 da 45
0030	20 00 01 01 d0 16
0040	84 cb 03 00 c2 03

## 第二条消息:

321	49.827...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded
265	44.655...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded
211	39.164...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded
169	34.147...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded
128	29.140...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded
85	16.438...	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded
31	6.432918	67.99.58.194	192.168.1.102	ICMP	70	Time-to-live exceeded
346	53.615...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded
290	48.610...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded
235	43.600...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded
184	38.554...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded
142	33.537...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded
101	28.530...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded
67	16.206...	24.218.0.153	192.168.1.102	ICMP	70	Time-to-live exceeded

> Frame 321: 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

> Internet Protocol Version 4, Src: 67.99.58.194, 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: 0xa5e3 (42467)

> 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: 244

10. 信息会被分段, 因为收集跟踪的计算机中最大 IP 数据包长度为 1500 个字节。



93	28.442...	192.168.1.102	128.59.23.100	ICMP	562 Echo (ping) request id=0x0300, seq=30467/887,
94	28.462...	10.216.228.1	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to live exceeded i
95	28.470...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol (proto=ICMP 1, off=0, I
96	28.471...	192.168.1.102	128.59.23.100	ICMP	562 Echo (ping) request id=0x0300, seq=30723/888,
97	28.490...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol (proto=ICMP 1, off=0, I
98	28.491...	192.168.1.102	128.59.23.100	ICMP	562 Echo (ping) request id=0x0300, seq=30979/889,
99	28.520...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol (proto=ICMP 1, off=0, I
100	28.521...	192.168.1.102	128.59.23.100	ICMP	562 Echo (ping) request id=0x0300, seq=31235/890,

  

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

...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)]

[Frame: 92, payload: 0-1479 (1480 bytes)]

[Frame: 93, payload: 1480-2007 (528 bytes)]

[Fragment count: 2]

[Reassembled IPv4 length: 2008]

[Reassembled IPv4 data: 0800d0c603007703373620aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa

> Internet Control Message Protocol

0000

0010

0020

0030

0040

0050

0060

0070

0080

0090

00a0

00b0

00c0

00d0

00e0

00f0

Frame

11. Flags 中的 More fragment 不为 0 表示数据报分段，而 Fragment offset 为 0 表示是第一个片段，该数据报长度为 1480。

162	33.748...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol (proto=ICMP 1,
163	33.748...	192.168.1.102	128.59.23.100	ICMP	562 Echo (ping) request id=0x0300, seq=3
164	33.809...	12.123.40.218	192.168.1.102	IPv4	554 Fragmented IP protocol (proto=ICMP 1,
165	33.885...	12.122.10.22	192.168.1.102	IPv4	554 Fragmented IP protocol (proto=ICMP 1,
166	33.944...	12.122.12.54	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to live e
167	34.014...	192.205.32.106	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to live e
168	34.082...	216.140.10.30	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to live e
169	34.147...	67.99.58.194	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to live e
170	34.212...	128.59.1.41	192.168.1.102	ICMP	70 Time-to-live exceeded (Time to live e
171	34.299...	128.59.23.100	192.168.1.102	IPv4	1514 Fragmented IP protocol (proto=ICMP 1,
172	34.305...	128.59.23.100	192.168.1.102	ICMP	562 Echo (ping) reply id=0x0300, seq=3
173	34.312...	128.59.23.100	192.168.1.102	IPv4	1514 Fragmented IP protocol (proto=ICMP 1,

  

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

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: 0x3313 (13075)

▼ 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: 13

Protocol: ICMP (1)

Header Checksum: 0xfb60 [validation disabled]

[Header checksum status: Unverified]

Source Address: 192.168.1.102

Destination Address: 128.59.23.100

[Reassembled IPv4 in frame: 163]

12. 由 Fragment offset 为 1480 可知这是第二个数据报片段，而又因为 Flags 为 0 可表明之后没有其他片段，该数据报长度为 528。

92	28.441...	192.168.1.102	128.59.23.100	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=32f9)
93	28.442...	192.168.1.102	128.59.23.100	ICMP	562	Echo (ping) request id=0x0300, seq=30467/887, ttl=1 (
94	28.462...	10.216.228.1	192.168.1.102	ICMP	70	Time-to-live exceeded (Time to live exceeded in transi
95	28.470...	192.168.1.102	128.59.23.100	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=32fa)
96	28.471...	192.168.1.102	128.59.23.100	ICMP	562	Echo (ping) request id=0x0300, seq=30723/888, ttl=2 (
97	28.490...	192.168.1.102	128.59.23.100	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=32fb)
98	28.491...	192.168.1.102	128.59.23.100	ICMP	562	Echo (ping) request id=0x0300, seq=30979/889, ttl=3 (
99	28.520...	192.168.1.102	128.59.23.100	IPv4	1514	Fragmented IP protocol (proto=ICMP 1, off=0, ID=32fc)

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 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)]  
    [Frame: 92, payload: 0-1479 (1480 bytes)]  
    [Frame: 93, payload: 1480-2007 (528 bytes)]

00000006  
00100224  
00201764  
0030aa aa  
0040aa aa  
0050aa aa  
0060aa aa  
0070aa aa  
0080aa aa  
0090aa aa  
00a0aa aa  
00b0aa aa  
00c0aa aa  
00d0aa aa  
00e0aa aa  
00f0aa aa  
0100aa aa

13. Fragment Offser 和 Header Checksum 会发生改变。

14. 共有三个分片。

第一个：



216	43.466...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol
217	43.466...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol
218	43.467...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request id
219	43.485...	10.216.228.1	192.168.1.102	ICMP	70 Time-to-live exceeded (
220	43.492...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol
221	43.492...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol
222	43.493...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) request id
223	43.512...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP protocol

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

Total Length: 1500

Identification: 0x3323 (13091)

▼ 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

> [Expert Info (Note/Sequence): "Time To Live" only 1]

Protocol: ICMP (1)

Header Checksum: 0x0751 [validation disabled]

[Header checksum status: Unverified]

Source Address: 192.168.1.102

Destination Address: 128.59.23.100

[\[Reassembled IPv4 in frame: 218\]](#)

Data (1480 bytes)

第二个:

217	43.466...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP p
218	43.467...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) req
219	43.485...	10.216.228.1	192.168.1.102	ICMP	70 Time-to-live ex
220	43.492...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP p
221	43.492...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP p
222	43.493...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping) req
223	43.512...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented IP p

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

Total Length: 1500

Identification: 0x3323 (13091)

▼ 001. .... = Flags: 0x1, More fragments

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

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

..1. .... = More fragments: Set

...0 0000 1011 1001 = Fragment Offset: 1480

▼ Time to Live: 1

> [Expert Info (Note/Sequence): "Time To Live" only 1]

Protocol: ICMP (1)

Header Checksum: 0x0698 [validation disabled]

[Header checksum status: Unverified]

Source Address: 192.168.1.102

Destination Address: 128.59.23.100

[\[Reassembled IPv4 in frame: 218\]](#)

▼ Data (1480 bytes)



第三个:

218 43.467...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping)
219 43.485...	10.216.228.1	192.168.1.102	ICMP	70 Time-to-live
220 43.492...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented I
221 43.492...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented I
222 43.493...	192.168.1.102	128.59.23.100	ICMP	582 Echo (ping)
223 43.512...	192.168.1.102	128.59.23.100	IPv4	1514 Fragmented I

- > 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
  - > [Expert Info (Note/Sequence): "Time To Live" only 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)]
  - [\[Frame: 216, payload: 0-1479 \(1480 bytes\)\]](#)
  - [\[Frame: 217, payload: 1480-2959 \(1480 bytes\)\]](#)
  - [\[Frame: 218, payload: 2960-3507 \(548 bytes\)\]](#)

15.Fragment Offser 和 Header Checksum 会发生改变。

结论分析与体会:

通过本次实验,学习了 IP 的相关内容,巩固了课堂所学。通过具体查看相应封包,对数据包分段传送有了更清楚的认识。通过查看具体的数据报中的内容,来学习 IP 的知识,对 IP 相关知识的记忆更加直观和清晰。