山东大学 计算机科学与技术 学院

新兴网络技术与实践 课程实验报告

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实验题目：		
实验学时：2	实验日期：2025/4/23	
实验目的：		

实验结果：

1. What is the IP address of your host? What is the IP address of the destination host?

No.	Time	Source	Destination	Protoco	Lengt	Info
294	34.8174…	101.76.244.190	143.89.209.9	ICMP	74	Echo (ping) request id=0x0001, seq=1/256, ttl=128 (reply in 296)
296	35.0362…	143.89.209.9	101.76.244.190	ICMP	74	Echo (ping) reply id=0x0001, seq=1/256, ttl=41 (request in 294)
302	35.8322…	101.76.244.190	143.89.209.9	ICMP	74	Echo (ping) request id=0x0001, seq=2/512, ttl=128 (reply in 303)
303	36.0481…	143.89.209.9	101.76.244.190	ICMP	74	Echo (ping) reply id=0x0001, seq=2/512, ttl=41 (request in 302)
309	36.8378…	101.76.244.190	143.89.209.9	ICMP	74	Echo (ping) request id=0x0001, seq=3/768, ttl=128 (reply in 310)
310	37.0533…	143.89.209.9	101.76.244.190	ICMP	74	Echo (ping) reply id=0x0001, seq=3/768, ttl=41 (request in 309)
313	37.8411…	101.76.244.190	143.89.209.9	ICMP	74	Echo (ping) request id=0x0001, seq=4/1024, ttl=128 (reply in 314)
314	38.0590…	143.89.209.9	101.76.244.190	ICMP	74	Echo (ping) reply id=0x0001, seq=4/1024, ttl=41 (request in 313)
316	38.8466…	101.76.244.190	143.89.209.9	ICMP	74	Echo (ping) request id=0x0001, seq=5/1280, ttl=128 (reply in 319)
319	39.0621…	143.89.209.9	101.76.244.190	ICMP	74	Echo (ping) reply id=0x0001, seq=5/1280, ttl=41 (request in 316)
321	39.8499…	101.76.244.190	143.89.209.9	ICMP	74	Echo (ping) request id=0x0001, seq=6/1536, ttl=128 (reply in 322)
322	40.0734…	143.89.209.9	101.76.244.190	ICMP	74	Echo (ping) reply id=0x0001, seq=6/1536, ttl=41 (request in 321)
324	40.8691…	101.76.244.190	143.89.209.9	ICMP	74	Echo (ping) request id=0x0001, seq=7/1792, ttl=128 (reply in 327)
327	41.0926…	143.89.209.9	101.76.244.190	ICMP	74	Echo (ping) reply id=0x0001, seq=7/1792, ttl=41 (request in 324)
333	41.8751…	101.76.244.190	143.89.209.9	ICMP	74	Echo (ping) request id=0x0001, seq=8/2048, ttl=128 (reply in 335)
335	42.1039…	143.89.209.9	101.76.244.190	ICMP	74	Echo (ping) reply id=0x0001, seq=8/2048, ttl=41 (request in 333)
341	42.8945…	101.76.244.190	143.89.209.9	ICMP	74	Echo (ping) request id=0x0001, seq=9/2304, ttl=128 (reply in 343)
343	43.1193…	143.89.209.9	101.76.244.190	ICMP	74	Echo (ping) reply id=0x0001, seq=9/2304, ttl=41 (request in 341)
347	43.9131…	101.76.244.190	143.89.209.9	ICMP	74	Echo (ping) request id=0x0001, seq=10/2560, ttl=128 (reply in 348)
348	44.1432…	143.89.209.9	101.76.244.190	ICMP	74	Echo (ping) reply id=0x0001, seq=10/2560, ttl=41 (request in 347)

如图，这是十次 ping 的数据包捕获信息。

本地主机的 IP 地址式 101.76.244.190，目标 IP 地址是 143.89.209.9

2. Why is it that an ICMP packet does not have source and destination port numbers?

ICMP（Internet Control Message Protocol，网络控制报文协议）主要用于在 IP 主机、路由器之间传递控制消息，属于网络层协议，其设计目的并非为应用程序提供数据传输服务，而是用于网络设备之间传递网络状态信息、差错报告等，所以无需像传输层的 TCP（传输控制协议）和 UDP（用户数据报协议）那样通过源端口和目的端口来区分不同的应用程序进程。

3. Examine one of the ping request packets sent by your host. What are the ICMP type and code numbers? What other fields does this ICMP packet have? How many bytes are the checksum, sequence number and identifier fields?

```
Internet Control Message Protocol
    Type: 8 (Echo (ping) request)
    Code: 0
    Checksum: 0x4d5a [correct]
    [Checksum Status: Good]
    Identifier (BE): 1 (0x0001)
    Identifier (LE): 256 (0x0100)
    Sequence Number (BE): 1 (0x0001)
    Sequence Number (LE): 256 (0x0100)
    [Response frame: 296]
  Data (32 bytes)
      Data: 61626364656667686 96a6b6c6d6e6f707172737475767761626364656667686 9
      [Length: 32]
```

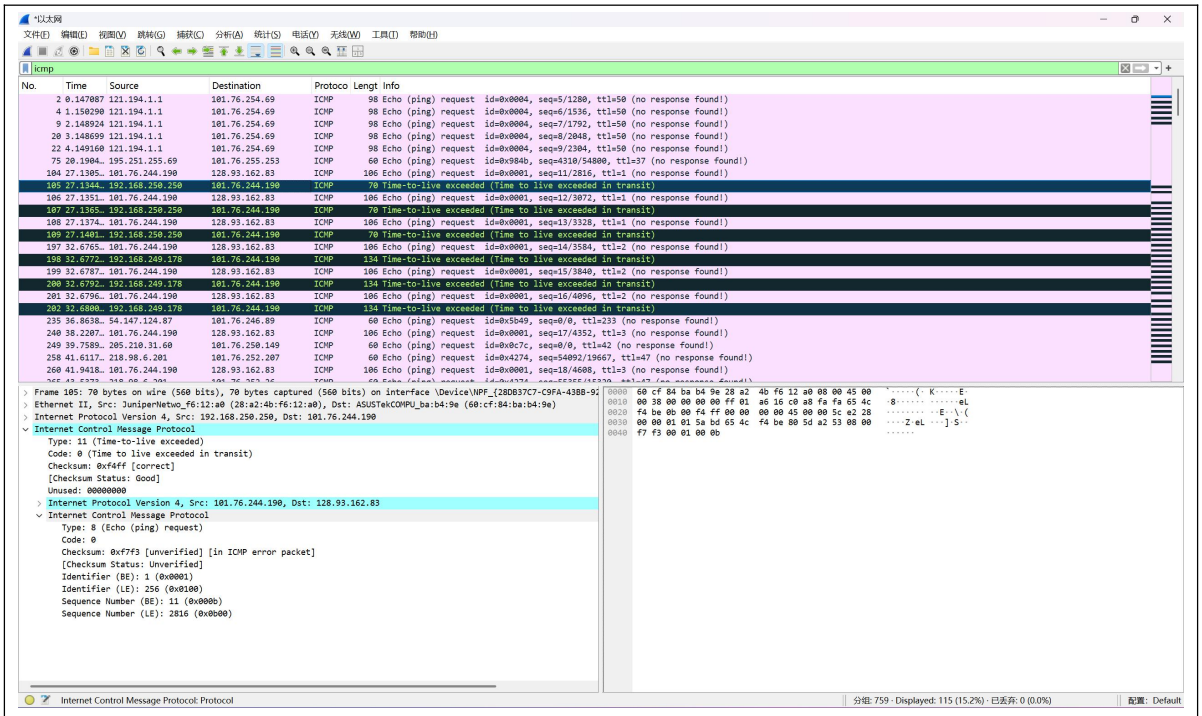
类型是 8，代码号是 0，校验和是 0x4d5a，序列号是 1（256），标识号是 1（256）各占 2 字节。

4. Examine the corresponding ping reply packet. What are the ICMP type and code numbers? What other fields does this ICMP packet have? How many bytes are the checksum, sequence number and identifier fields?

```
Internet Control Message Protocol
    Type: 0 (Echo (ping) reply)
    Code: 0
    Checksum: 0x555a [correct]
    [Checksum Status: Good]
    Identifier (BE): 1 (0x0001)
    Identifier (LE): 256 (0x0100)
    Sequence Number (BE): 1 (0x0001)
    Sequence Number (LE): 256 (0x0100)
    [Request frame: 294]
    [Response time: 218.788 ms]
  Data (32 bytes)
      Data: 61626364656667686 96a6b6c6d6e6f707172737475767761626364656667686 9
      [Length: 32]
```

多了一个 Response time 字段。校验和、序列号和标识号也都是 2 字节。

5. What is the IP address of your host? What is the IP address of the target destination host?



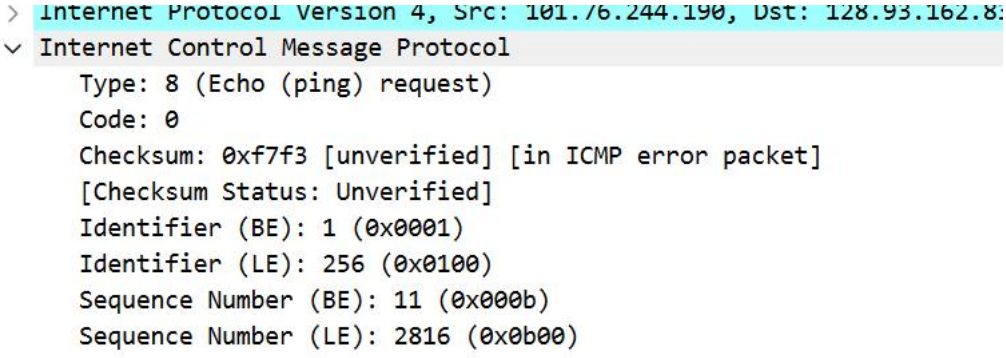
如图，这个是 tracert 的数据包捕获结果

我的主机地址是 101.76.244.190，目的地址是 128.93.162.83

6. If ICMP sent UDP packets instead (as in Unix/Linux), would the IP protocol number still be 01 for the probe packets? If not, what would it be?

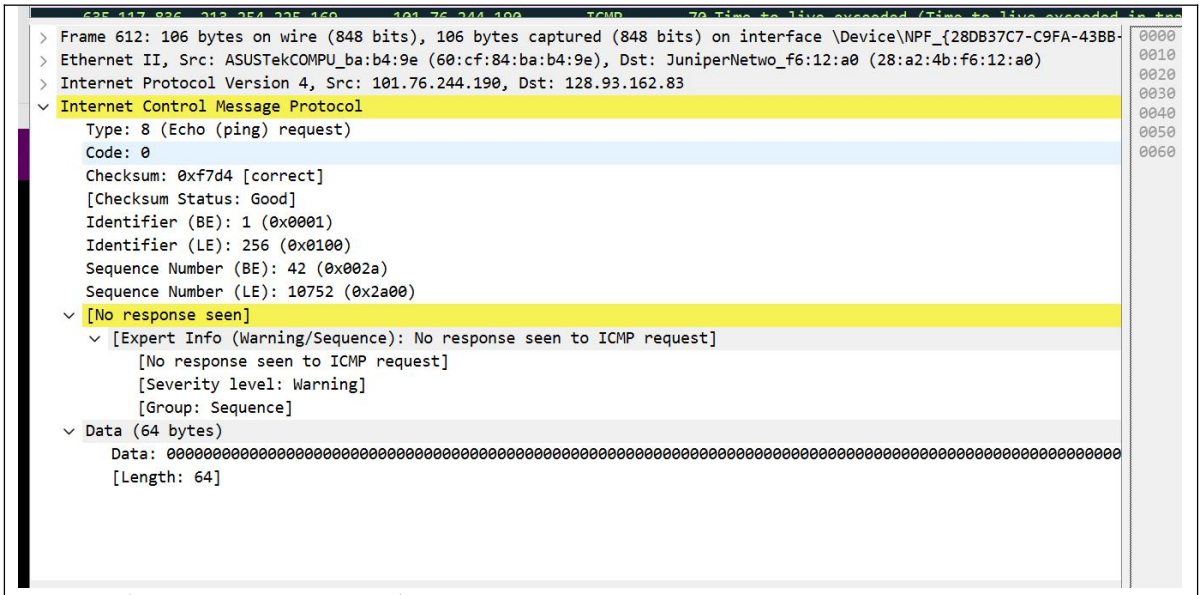
不会是 1，应该是 17

7. Examine the ICMP echo packet in your screenshot. Is this different from the ICMP ping query packets in the first half of this lab? If yes, how so?



没有 data 段，也没有返回时间段。

8. Examine the ICMP error packet in your screenshot. It has more fields than the ICMP echo packet. What is included in those fields?



多了一个 No response seen 字段

9. Examine the last three ICMP packets received by the source host. How are these packets different from the ICMP error packets? Why are they different?

与 ICMP 错误数据包不同，因为它们是目标主机对 ICMP 回显请求的响应，用于验证主机可达性，而 ICMP 错误数据包（如类型 11 的超时报文）则用于通知传输过程中的错误。

10. Within the tracert measurements, is there a link whose delay is significantly longer than others? Refer to the screenshot in Figure 4, is there a link whose delay is significantly longer than others? On the basis of the router names, can you guess the location of the two routers on the end of this link?

```
Tracing route to inria.fr [128.93.162.83]
over a maximum of 30 hops:

  1     4 ms     1 ms     2 ms  192.168.250.250
  2    <1 ms    <1 ms    <1 ms  192.168.249.178
  3     *        *        *     Request timed out.
  4     *        *        *     Request timed out.
  5     *        *        *     Request timed out.
  6     *        *        *     Request timed out.
  7    16 ms    15 ms     *     221.183.89.101
  8    17 ms    17 ms    17 ms  221.183.46.249
  9    55 ms    56 ms    56 ms  221.183.55.105
 10   189 ms   189 ms   188 ms  223.120.16.25
 11   186 ms   185 ms   186 ms  223.120.10.86
 12   283 ms   269 ms   263 ms  ae7.cr2-fra6.ip4.gtt.net [213.254.225.169]
 13   238 ms   246 ms   260 ms  ae7.cr6-par11.ip4.gtt.net [213.200.120.85]
 14   259 ms   257 ms   254 ms  ip4.gtt.net [212.222.6.69]
 15   268 ms   249 ms   250 ms  hu0-4-0-0-ren-nr-orsay-rtr-091.noc.renater.fr [193.51.180.131]
 16   263 ms   270 ms   268 ms  inria-rocquencourt-vl1631-te1-4-inria-rtr-021.noc.renater.fr [193.51.184.177]
 17   269 ms   252 ms   251 ms  unit240-reth1-vfw-ext-dc1.inria.fr [192.93.122.19]
 18   256 ms   266 ms   266 ms  prod-inriafr-cms.inria.fr [128.93.162.83]
```

2. **路由器位置推测**：

- “ae7.cr2 - fra6.ip4.gtt.net” 中的 “fra” 很可能是法兰克福（Frankfurt）的缩写，法兰克福是德国的一个重要城市，是欧洲的金融和交通枢纽之一，也是许多网络通信的重要节点。
- “ae7.cr6 - par11.ip4.gtt.net” 中的 “par” 很有可能是巴黎（Paris）的缩写，巴黎是法国的首都和最大城市，在欧洲的网络通信中也占据重要地位。
- 所以可以推测该链路两端的两个路由器分别位于德国法兰克福和法国巴黎附近。

问题及收获：

ICMP（Internet Control Message Protocol）的意义在于辅助 IP 协议进行网络通信的控制与管理，其作用主要体现在网络诊断（如通过 Ping 检测主机可达性）、路径探测（如 Traceroute 查看数据包传输路径）、以及传递差错信息（如目的不可达或 TTL 超时）。ICMP 的特点包括无连接性、不可靠传输、与 IP 协议紧密集成、消息类型丰富（如回显请求/应答、差错消息等），且通常不面向高层用户，而是供网络设备和协议使用，其简单高效的机制有助于维护网络的正常运行和故障排查。