



警示

1. 实验报告如有雷同，雷同各方当次实验成绩均以 0 分计。
2. 当次小组成员成绩只计学号、姓名登录在下表中的。
3. 在规定时间内未上交实验报告的，不得以其他方式补交，当次成绩按 0 分计。
4. 实验报告文件以 PDF 格式提交。

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【实验题目】静态路由实验

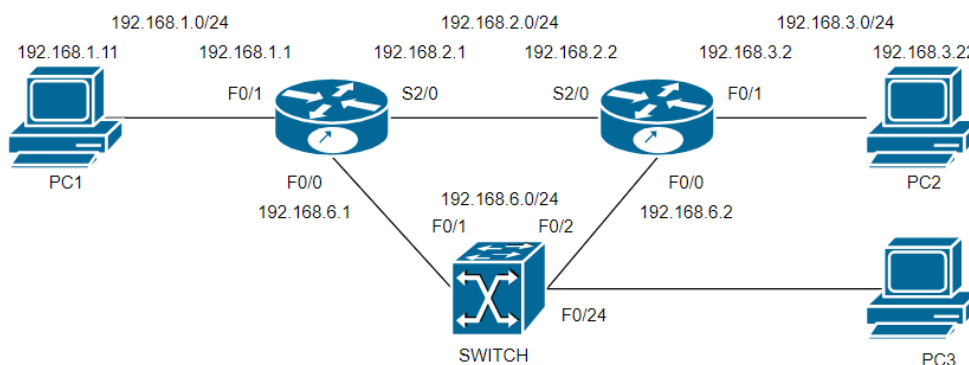
【实验目的】掌握静态路由的配置和使用方法，熟悉交换机端口镜像的方法以及如何用于监视端口。

【实验内容】

- (1) 阅读教材 P190-192 关于端口镜像的内容
- (2) 阅读教材 P233 实例 7-1
- (3) 阅读教材 P29，熟悉 Packet Tracer 使用实例
- (4) 完成教材 P273 习题 15

【实验记录】

实验拓扑图：



0. 配置 PC1 和 PC2 之间的静态路由

在路由器 1 上配置端口 0/1 和 serial 2/0 的 ip 地址并且配置静态路由

```
22-RSR20-1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
22-RSR20-1(config)#interface gigabitethernet 0/1
22-RSR20-1(config-if-GigabitEthernet 0/1)#ip address 192.168.1.1 255.255.255.0
22-RSR20-1(config-if-GigabitEthernet 0/1)#no shutdown
22-RSR20-1(config-if-GigabitEthernet 0/1)#exit
22-RSR20-1(config)#interface serial 2/0
22-RSR20-1(config-if-Serial 2/0)#ip address 192.168.2.1 255.255.255.0
22-RSR20-1(config-if-Serial 2/0)#no shutdown
22-RSR20-1(config-if-Serial 2/0)#ip address 192.168.2.2 255.255.255.0
```

在路由器 2 上配置端口 0/1 和 serial 2/0 的 ip 地址并且配置静态路由



```
22-RSR20-2#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
22-RSR20-2(config)#interface gigabitEthernet 0/1
22-RSR20-2(config-if-GigabitEthernet 0/1)#ip address 2.168.3.2 255.255.255.0
22-RSR20-2(config-if-GigabitEthernet 0/1)#no shutdown
22-RSR20-2(config-if-GigabitEthernet 0/1)#exit
22-RSR20-2(config)#interface serial 2/0
22-RSR20-2(config-if-Serial 2/0)#ip address 192.168.2.2 255.255.255.0
22-RSR20-2(config-if-Serial 2/0)#no shutdown
22-RSR20-2(config-if-Serial 2/0)#ip route 2.1.0 255.255.255.0 192.168.
% Invalid input detected at '^' marker.

22-RSR20-2#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
22-RSR20-2(config)#interface serial 2/0
22-RSR20-2(config-if-Serial 2/0)#ip address 192.168.2.1 255.255.255.0
22-RSR20-2(config-if-Serial 2/0)#no shutdown
22-RSR20-2(config-if-Serial 2/0)#exit
22-RSR20-2(config)#show ip route
```

在路由器 1 上配置端口 0/0 和 serial 2/0 的 ip 地址并且配置静态路由

```
22-RSR20-1(config)#interface gigabitEthernet 0/0
22-RSR20-1(config-if-GigabitEthernet 0/0)#ip address 192.168.6.1 255.255.255.0
22-RSR20-1(config-if-GigabitEthernet 0/0)#no shutdown
22-RSR20-1(config-if-GigabitEthernet 0/0)#exit
22-RSR20-1(config)#interface serial 2/0
22-RSR20-1(config-if-Serial 2/0)#ip address 192.168.2.1 255.255.255.0
22-RSR20-1(config-if-Serial 2/0)#no shutdown
22-RSR20-1(config-if-Serial 2/0)#exit
22-RSR20-1(config)#ip route 192.168.3.0 255.255.255.0 192.168.6.2
```

在路由器 2 上配置端口 0/0 和 serial 2/0 的 ip 地址并且配置静态路由

```
22-RSR20-2(config)#interface gigabitEthernet 0/0
22-RSR20-2(config-if-GigabitEthernet 0/0)#ip address 192.168.6.2 255.255.255.0
22-RSR20-2(config-if-GigabitEthernet 0/0)#no shutdown
22-RSR20-2(config-if-GigabitEthernet 0/0)#exit
22-RSR20-2(config)#interface serial 2/0
22-RSR20-2(config-if-Serial 2/0)#ip address 192.168.2.2 255.255.255.0
22-RSR20-2(config-if-Serial 2/0)#no shutdown
22-RSR20-2(config-if-Serial 2/0)#exit
22-RSR20-2(config)#ip route 192.168.1.0 255.255.255.0 192.168.6.1
```

配置交换机的端口镜像，0/24 端口为目的端口，0/1 为源端口

```
22-S5750-1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
22-S5750-1(config)#monitor session 1 source interface gigabitEthernet 0/1 both
22-S5750-1(config)#show monitor session 1
src-intf:
GigabitEthernet 0/1 frame-type Both
22-S5750-1(config)#monitor session 1 destination interface gigabitEthernet 0/24
22-S5750-1(config)#show monitor session 1
sess-num: 1
span-type: LOCAL_SPAN
src-intf:
GigabitEthernet 0/1 frame-type Both
dest-intf:
GigabitEthernet 0/24
```

1. 记录两台路由器的路由表

```
22-RSR20-1(config)#show ip route

Codes: C - connected, S - static, R - RIP, B - BGP
        O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candidate default

Gateway of last resort is no set
C    192.168.1.0/24 is directly connected, GigabitEthernet 0/1
C    192.168.1.1/32 is local host.
C    192.168.2.0/24 is directly connected, Serial 2/0
C    192.168.2.1/32 is local host.
S    192.168.3.0/24 [1/0] via 192.168.2.2
                                [1/0] via 192.168.6.2
C    192.168.6.0/24 is directly connected, GigabitEthernet 0/0
C    192.168.6.1/32 is local host.
```




```
22-RSR20-2(config)#show ip route

Codes: C - connected, S - static, R - RIP, B - BGP
        O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candidate default

Gateway of last resort is no set
S    192.168.1.0/24 [1/0] via 192.168.2.1
    [1/0] via 192.168.6.1
C    192.168.2.0/24 is directly connected, Serial 2/0
C    192.168.2.2/32 is local host.
C    192.168.3.0/24 is directly connected, GigabitEthernet 0/1
C    192.168.3.2/32 is local host.
C    192.168.6.0/24 is directly connected, GigabitEthernet 0/0
C    192.168.6.2/32 is local host.
```

可以看到，路由器 1 和路由器 2 都生成了两条静态路由

2. PC1 ping PC2，记录交换机的 MAC 地址表

```
22-S5750-1(config)#show mac-address-table
Vlan          MAC Address      Type      Interface
-----
1             5869.6c27.b885    DYNAMIC   GigabitEthernet 0/1
1             5869.6c27.bf25    DYNAMIC   GigabitEthernet 0/2
```

3. 清除 MAC 地址表，

```
22-S5750-1#clear mac-address-table dynamic
22-S5750-1#show mac-address-table
Vlan          MAC Address      Type      Interface
-----
```

PC1 ping PC2，启动 wireshark 捕获，在 PC3 查看结果

ARP 包、Echo 的请求包和响应包：

899	3267.096234	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=185/47360, ttl=63 (reply in 900)
900	3267.096566	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=185/47360, ttl=63 (request in 899)
901	3268.099338	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=186/47616, ttl=63 (reply in 902)
902	3268.099651	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=186/47616, ttl=63 (request in 901)
903	3268.465582	00:88:99:00:13:02	Broadcast	ARP	42 Who has 169.254.14.97? Tell 169.254.112.167	
904	3269.102965	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=187/47872, ttl=63 (reply in 905)
905	3269.103275	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=187/47872, ttl=63 (request in 904)
906	3269.361203	00:88:99:00:13:02	Broadcast	ARP	42 Who has 169.254.14.97? Tell 169.254.112.167	
907	3270.105675	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=188/48128, ttl=63 (reply in 908)
908	3270.105998	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=188/48128, ttl=63 (request in 907)
909	3270.360956	00:88:99:00:13:02	Broadcast	ARP	42 Who has 169.254.14.97? Tell 169.254.112.167	
910	3271.109032	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=189/48384, ttl=63 (reply in 911)
911	3271.109351	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=189/48384, ttl=63 (request in 910)

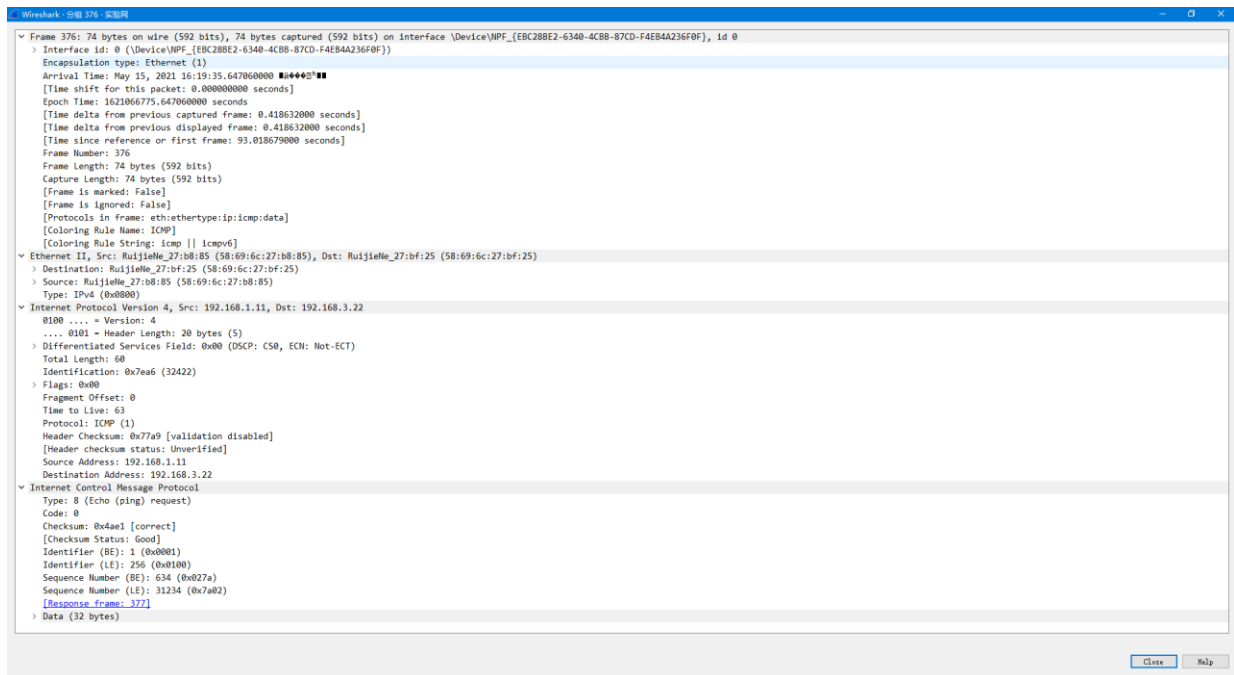
交换机的 MAC 地址表：

```
22-S5750-1(config)#show mac-address-table
Vlan          MAC Address      Type      Interface
-----
1             5869.6c27.b885    DYNAMIC   GigabitEthernet 0/1
1             5869.6c27.bf25    DYNAMIC   GigabitEthernet 0/2
```

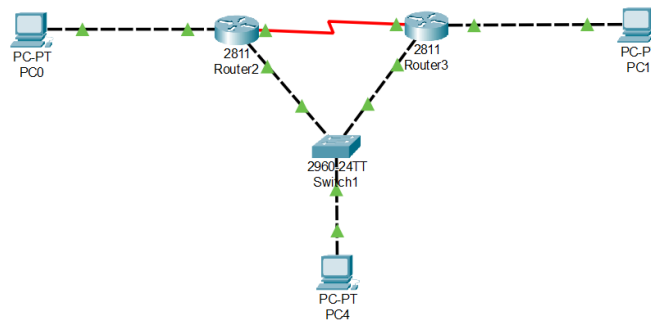
4. PC2 ping PC1，wireshark 捕获，可以捕获到 ARP 包、Echo 请求包和响应包

371	91.596561	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) reply	id=0x0001, seq=124/31744, ttl=63 (request in 370)
372	92.013822	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=633/30978, ttl=63 (reply in 373)
373	92.014148	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=633/30978, ttl=63 (request in 372)
374	92.599786	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) request	id=0x0001, seq=125/32000, ttl=63 (reply in 375)
375	92.600047	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) reply	id=0x0001, seq=125/32000, ttl=63 (request in 374)
376	93.018679	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=634/31234, ttl=63 (reply in 377)
377	93.018875	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=634/31234, ttl=63 (request in 376)
378	93.603817	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) request	id=0x0001, seq=126/32256, ttl=63 (reply in 379)
379	93.604134	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) reply	id=0x0001, seq=126/32256, ttl=63 (request in 378)
380	94.023000	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=635/31490, ttl=63 (reply in 381)
381	94.023311	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=635/31490, ttl=63 (request in 380)
382	94.608372	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) request	id=0x0001, seq=127/32512, ttl=63 (reply in 383)
383	94.608686	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) reply	id=0x0001, seq=127/32512, ttl=63 (request in 382)
384	95.027905	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=636/31746, ttl=63 (reply in 385)

查看 PC1 的 ARP 缓冲区，分析：



5. 和 7. 动画在视频内



6. 交换机的端口 F0/2 镜像到 F0/24, PC1 ping PC2

```
22-S5750-1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
22-S5750-1(config)#source interface gigabitethernet 0/2 both
22-S5750-1(config)#$destination interface gigabitethernet 0/24
22-S5750-1(config)#show monitor
sess-num: 1
span-type: LOCAL_SPAN
src-intf:
GigabitEthernet 0/2      frame-type Both
src-intf:
GigabitEthernet 0/1      frame-type Both
dest-intf:
GigabitEthernet 0/24
```

可以捕获到 ARP 包、Echo 请求包和响应包

66	15.072849	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1076/13316, ttl=63 (request in 65)
67	15.072849	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1076/13316, ttl=63
68	15.561993	0.0.0.0	255.255.255.255	DHCP	342 DHCP Discover - Transaction ID 0xd0b34963	
69	16.078286	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=1077/13572, ttl=63 (no response found!)
70	16.078286	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=1077/13572, ttl=63 (reply in 71)
71	16.078593	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1077/13572, ttl=63 (request in 70)
72	16.078593	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1077/13572, ttl=63
73	17.083207	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=1078/13828, ttl=63 (no response found!)
74	17.083207	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=1078/13828, ttl=63 (reply in 75)
75	17.083449	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1078/13828, ttl=63 (request in 74)
76	17.083449	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1078/13828, ttl=63
77	18.088641	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=1079/14084, ttl=63 (no response found!)
78	18.088641	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=1079/14084, ttl=63 (reply in 79)
79	18.088977	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1079/14084, ttl=63 (request in 78)
80	18.088977	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1079/14084, ttl=63
81	19.093879	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=1080/14340, ttl=63 (no response found!)
82	19.093879	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=1080/14340, ttl=63 (reply in 83)
83	19.094211	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1080/14340, ttl=63 (request in 82)
84	19.094211	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1080/14340, ttl=63
85	19.366215	0.0.0.0	255.255.255.255	DHCP	342 DHCP Discover - Transaction ID 0xd0b34963	
86	20.093373	192.168.1.11	192.168.3.22	DHCP	74 Echo (ping) request	id=0x0001, seq=1081/14596, ttl=63 (no response found!)
87	20.093373	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=1081/14596, ttl=63 (reply in 88)
88	20.099710	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1081/14596, ttl=63 (request in 87)
89	20.099710	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1081/14596, ttl=63

查看交换机的 MAC 地址表



```
22-S5750-1(config)#show mac-address-table
Vlan          MAC Address          Type          Interface
-----
1             5869.6c27.b885       DYNAMIC       GigabitEthernet 0/1
1             5869.6c27.bf25       DYNAMIC       GigabitEthernet 0/2
```

8. PC1 运行两条 ping 命令, 在 PC3 通过 wireshark 观察, 找出 Echo 请求分组、Echo 响应分组、Timestamp 的请求分组和响应分组

Ping -r 6 -l 200 192.168.3.22

1	0.000000	192.168.1.11	192.168.3.22	ICMP	270 Echo (ping) request	id=0x0001, seq=1188/41988, ttl=63 (no response found!)
2	0.000000	192.168.1.11	192.168.3.22	ICMP	270 Echo (ping) request	id=0x0001, seq=1188/41988, ttl=63 (reply in 3)
3	0.000340	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1188/41988, ttl=63 (request in 2)
4	0.000340	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1188/41988, ttl=63
5	1.002102	192.168.1.11	192.168.3.22	ICMP	270 Echo (ping) request	id=0x0001, seq=1189/42244, ttl=63 (no response found!)
6	1.002102	192.168.1.11	192.168.3.22	ICMP	270 Echo (ping) request	id=0x0001, seq=1189/42244, ttl=63 (reply in 7)
7	1.002420	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1189/42244, ttl=63 (request in 6)
8	1.002420	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1189/42244, ttl=63
9	2.005947	192.168.1.11	192.168.3.22	ICMP	270 Echo (ping) request	id=0x0001, seq=1190/42500, ttl=63 (no response found!)
10	2.005947	192.168.1.11	192.168.3.22	ICMP	270 Echo (ping) request	id=0x0001, seq=1190/42500, ttl=63 (reply in 11)
11	2.006262	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1190/42500, ttl=63 (request in 10)
12	2.006262	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1190/42500, ttl=63
13	3.011682	192.168.1.11	192.168.3.22	ICMP	270 Echo (ping) request	id=0x0001, seq=1191/42756, ttl=63 (no response found!)
14	3.011682	192.168.1.11	192.168.3.22	ICMP	270 Echo (ping) request	id=0x0001, seq=1191/42756, ttl=63 (reply in 15)
15	3.012040	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1191/42756, ttl=63 (request in 14)
16	3.012040	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1191/42756, ttl=63

Ping -s 4 -l 200 192.168.3.22

1	0.000000	192.168.1.11	192.168.3.22	ICMP	282 Echo (ping) request	id=0x0001, seq=1192/43012, ttl=63 (no response found!)
2	0.000000	192.168.1.11	192.168.3.22	ICMP	282 Echo (ping) request	id=0x0001, seq=1192/43012, ttl=63 (reply in 3)
3	0.000318	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1192/43012, ttl=63 (request in 2)
4	0.000318	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1192/43012, ttl=63
5	1.002919	192.168.1.11	192.168.3.22	ICMP	282 Echo (ping) request	id=0x0001, seq=1193/43268, ttl=63 (no response found!)
6	1.002919	192.168.1.11	192.168.3.22	ICMP	282 Echo (ping) request	id=0x0001, seq=1193/43268, ttl=63 (reply in 7)
7	1.003140	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1193/43268, ttl=63 (request in 6)
8	1.003140	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1193/43268, ttl=63
9	2.008941	192.168.1.11	192.168.3.22	ICMP	282 Echo (ping) request	id=0x0001, seq=1194/43524, ttl=63 (no response found!)
10	2.008941	192.168.1.11	192.168.3.22	ICMP	282 Echo (ping) request	id=0x0001, seq=1194/43524, ttl=63 (reply in 11)
11	2.009185	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1194/43524, ttl=63 (request in 10)
12	2.009185	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1194/43524, ttl=63
13	3.011813	192.168.1.11	192.168.3.22	ICMP	282 Echo (ping) request	id=0x0001, seq=1195/43780, ttl=63 (no response found!)
14	3.011813	192.168.1.11	192.168.3.22	ICMP	282 Echo (ping) request	id=0x0001, seq=1195/43780, ttl=63 (reply in 15)
15	3.012063	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1195/43780, ttl=63 (request in 14)
16	3.012063	192.168.3.22	192.168.1.11	ICMP	242 Echo (ping) reply	id=0x0001, seq=1195/43780, ttl=63

可以看到都可以捕获到 echo 请求和响应包, 但未捕获到 timestamp 请求和响应包

9. 删除路由器 1 上的静态路由, 并增加默认路由指向路由器 2 的以太网端口,

```
Enter configuration commands, one per line. End with CNTL/Z.
22-RSR20-1(config)#no ip route 192.168.3.0 255.255.255.0 192.168.6.2
22-RSR20-1(config)#no ip route 192.168.3.0 255.255.255.0 192.168.2.2
22-RSR20-1(config)#ip route 0.0.0.0 0.0.0.0 182.168.2.2
22-RSR20-1(config)#no ip route 0.0.0.0 0.0.0.0 182.168.2.2
22-RSR20-1(config)#ip route 0.0.0.0 0.0.0.0 192.168.2.2
22-RSR20-1(config)#show ip route

Codes: C - connected, S - static, R - RIP, B - BGP
        O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candidate default

Gateway of last resort is 192.168.2.2 to network 0.0.0.0
S* 0.0.0.0/0 [1/0] via 192.168.2.2
C 192.168.1.0/24 is directly connected, GigabitEthernet 0/1
C 192.168.1.1/32 is local host.
C 192.168.2.0/24 is directly connected, Serial 2/0
C 192.168.2.1/32 is local host.
C 192.168.6.0/24 is directly connected, GigabitEthernet 0/0
C 192.168.6.1/32 is local host.
```

用 PC1 ping PC2, wireshark 结果:



41	5.322609	192.168.1.11	101.227.169.159	TCP	66 [TCP Retransmission] 1774 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=256 SACK_PERM=1
42	5.339095	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
43	5.422640	192.168.1.11	121.51.191.195	UDP	340 53700 → 8000 Len=298
44	5.474115	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
45	5.924288	192.168.1.11	121.51.191.195	UDP	340 53700 → 8000 Len=298
46	6.159124	00:88:99:00:09:dc	RuijieNe_27:b8:86	ARP	42 Who has 192.168.1.1? Tell 192.168.1.11
47	6.160690	RuijieNe_27:b8:86	00:88:99:00:09:dc	ARP	60 192.168.1.1 is at 58:69:6c:27:b8:86
48	6.242323	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request id=0x0001, seq=1203/45828, ttl=64 (reply in 49)
49	6.260427	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply id=0x0001, seq=1203/45828, ttl=62 (request in 48)
50	6.304130	192.168.1.11	183.3.224.141	TCP	62 [TCP Retransmission] 1770 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 SACK_PERM=1
51	6.322323	192.168.1.11	182.254.42.91	TCP	66 1775 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=256 SACK_PERM=1
52	6.322625	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
53	6.339159	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
54	7.245870	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request id=0x0001, seq=1204/46084, ttl=64 (reply in 55)
55	7.264388	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply id=0x0001, seq=1204/46084, ttl=62 (request in 54)
56	7.323786	192.168.1.11	61.151.224.41	TCP	62 [TCP Retransmission] 1771 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 SACK_PERM=1
57	7.342640	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
58	8.251684	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request id=0x0001, seq=1205/46340, ttl=64 (reply in 59)
59	8.272410	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply id=0x0001, seq=1205/46340, ttl=62 (request in 58)
60	8.313197	192.168.1.11	120.241.21.115	TCP	66 1776 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=256 SACK_PERM=1
61	8.331229	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
62	8.430882	192.168.1.11	121.51.191.195	UDP	316 53700 → 8000 Len=274
63	8.478799	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
64	8.530885	192.168.1.11	121.51.191.195	UDP	348 53700 → 8000 Len=306
65	8.582941	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
66	8.631093	192.168.1.11	121.51.191.195	UDP	340 53700 → 8000 Len=298
67	8.681908	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
68	8.939290	192.168.1.11	121.51.191.195	UDP	316 53700 → 8000 Len=274
69	8.986950	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
70	9.140415	192.168.1.11	121.51.191.195	UDP	348 53700 → 8000 Len=306
71	9.140436	192.168.1.11	121.51.191.195	UDP	340 53700 → 8000 Len=298
72	9.195011	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
73	9.237250	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
74	9.256472	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request id=0x0001, seq=1206/46596, ttl=64 (reply in 75)
75	9.276392	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply id=0x0001, seq=1206/46596, ttl=62 (request in 74)
76	9.323090	192.168.1.11	182.254.42.91	TCP	66 [TCP Retransmission] 1775 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=256 SACK_PERM=1
77	9.339271	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
78	9.442556	192.168.1.11	121.51.191.195	UDP	316 53700 → 8000 Len=274
79	9.490907	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)
80	9.643548	192.168.1.11	121.51.191.195	UDP	348 53700 → 8000 Len=306
81	9.643599	192.168.1.11	121.51.191.195	UDP	340 53700 → 8000 Len=298
82	9.698933	192.168.6.2	192.168.1.11	ICMP	70 Destination unreachable (Network unreachable)

- ▼ Frame 58: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface \Device\NPF_{EBC28BE2-6340-4CBB-87CD-F4EB4A236F0F}, id 0
 - > Interface id: 0 (\Device\NPF_{EBC28BE2-6340-4CBB-87CD-F4EB4A236F0F})
 - Encapsulation type: Ethernet (1)
 - Arrival Time: May 15, 2021 08:43:40.418898000 毫秒
 - [Time shift for this packet: 0.000000000 seconds]
 - Epoch Time: 1621039420.418898000 seconds
 - [Time delta from previous captured frame: 0.909044000 seconds]
 - [Time delta from previous displayed frame: 0.909044000 seconds]
 - [Time since reference or first frame: 8.251684000 seconds]
 - Frame Number: 58
 - Frame Length: 74 bytes (592 bits)
 - Capture Length: 74 bytes (592 bits)
 - [Frame is marked: False]
 - [Frame is ignored: False]
 - [Protocols in frame: eth:ethertype:ip:icmp:data]
 - [Coloring Rule Name: ICMP]
 - [Coloring Rule String: icmp || icmpv6]
 - ▼ Ethernet II, Src: 00:88:99:00:09:dc (00:88:99:00:09:dc), Dst: RuijieNe_27:b8:86 (58:69:6c:27:b8:86)
 - > Destination: RuijieNe_27:b8:86 (58:69:6c:27:b8:86)
 - > Source: 00:88:99:00:09:dc (00:88:99:00:09:dc)
 - Type: IPv4 (0x0800)
 - ▼ Internet Protocol Version 4, Src: 192.168.1.11, Dst: 192.168.3.22
 - 0100 = Version: 4
 - 0101 = Header Length: 20 bytes (5)
 - > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
 - Total Length: 60
 - Identification: 0x042d (1069)
 - > Flags: 0x00
 - Fragment Offset: 0
 - Time to Live: 64
 - Protocol: ICMP (1)
 - Header Checksum: 0x0000 [validation disabled]
 - [Header checksum status: Unverified]
 - Source Address: 192.168.1.11
 - Destination Address: 192.168.3.22
 - ▼ Internet Control Message Protocol
 - Type: 8 (Echo (ping) request)
 - Code: 0
 - Checksum: 0x48a6 [correct]
 - [Checksum Status: Good]
 - Identifier (BE): 1 (0x0001)
 - Identifier (LE): 256 (0x0100)
 - Sequence Number (BE): 1205 (0x04b5)
 - Sequence Number (LE): 46340 (0xb504)
 - [Response frame: 59]
 - > Data (32 bytes)

可以看到可以捕获到 echo 的请求和响应包

删除路由器 2 上的静态路由，并增加默认路由指向路由器 1 的以太网端口



```
22-RSR20-2(config)#no ip route 192.168.1.0 255.255.255.0 192.168.2.1
22-RSR20-2(config)#no ip route 192.168.1.0 255.255.255.0 192.168.6.1
22-RSR20-2(config)#show ip route

Codes: C - connected, S - static, R - RIP, B - BGP
        O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candidate default

Gateway of last resort is no set
C    192.168.2.0/24 is directly connected, Serial 2/0
C    192.168.2.2/32 is local host.
C    192.168.3.0/24 is directly connected, GigabitEthernet 0/1
C    192.168.3.2/32 is local host.
C    192.168.6.0/24 is directly connected, GigabitEthernet 0/0
C    192.168.6.2/32 is local host.
22-RSR20-2(config)#ip route 0.0.0.0 0.0.0.0 192.168.2.1
22-RSR20-2(config)#show ip route

Codes: C - connected, S - static, R - RIP, B - BGP
        O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        ia - IS-IS inter area, * - candidate default

Gateway of last resort is 192.168.2.1 to network 0.0.0.0
S*   0.0.0.0/0 [1/0] via 192.168.2.1
C    192.168.2.0/24 is directly connected, Serial 2/0
C    192.168.2.2/32 is local host.
C    192.168.3.0/24 is directly connected, GigabitEthernet 0/1
C    192.168.3.2/32 is local host.
C    192.168.6.0/24 is directly connected, GigabitEthernet 0/0
C    192.168.6.2/32 is local host.
22-RSR20-2(config)#
```

用 PC1 ping PC2, wireshark 结果:

404	19.133014	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
405	19.191867	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
406	19.215275	192.168.1.11	183.232.246.167	TCP	66 [TCP Retransmission] 2514 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=256 SACK_PERM=1	
407	19.234116	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
408	19.292016	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
409	19.313428	192.168.1.11	111.30.176.113	UDP	340 53700 → 8000 Len=298	
410	19.383529	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
411	19.465967	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
412	19.526345	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
413	19.541380	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
414	19.551405	192.168.1.11	111.30.176.113	UDP	308 53700 → 8000 Len=266	
415	19.583756	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
416	19.656149	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
417	19.698428	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
418	19.707096	192.168.3.22	192.168.1.11	ICMP	74 Echo (ping) reply	id=0x0001, seq=1656/30726, ttl=62 (request in 368)
419	19.711370	192.168.1.11	192.168.3.22	ICMP	74 Echo (ping) request	id=0x0001, seq=1657/30982, ttl=64 (reply in 498)
420	19.713763	192.168.1.11	111.30.176.113	UDP	340 53700 → 8000 Len=298	
421	19.803490	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
422	19.805652	192.168.1.11	111.30.176.113	UDP	340 53700 → 8000 Len=298	
423	19.810967	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
424	19.878755	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
425	19.914484	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
426	19.937480	192.168.1.11	111.30.176.113	UDP	348 53700 → 8000 Len=306	
427	19.981295	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
428	20.011363	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
429	20.041443	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
430	20.107352	192.168.1.11	111.30.176.113	UDP	308 53700 → 8000 Len=266	
431	20.141728	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
432	20.156825	192.168.1.11	111.30.176.113	UDP	308 53700 → 8000 Len=266	
433	20.179405	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
434	20.215747	192.168.1.11	163.177.81.139	TCP	66 2516 → 80 [SYN] Seq=0 Win=8192 Len=0 MSS=1460 WS=256 SACK_PERM=1	
435	20.269776	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
436	20.308342	192.168.1.11	111.30.176.113	UDP	340 53700 → 8000 Len=298	
437	20.308402	192.168.1.11	111.30.176.113	UDP	340 53700 → 8000 Len=298	
438	20.352987	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
439	20.359731	192.168.1.11	111.30.176.113	UDP	340 53700 → 8000 Len=298	
440	20.395528	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
441	20.448221	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
442	20.455741	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
443	20.500282	192.168.2.2	192.168.1.11	ICMP	70 Redirect	(Redirect for host)
444	20.509329	192.168.1.11	111.30.176.113	UDP	348 53700 → 8000 Len=306	
445	20.557751	192.168.1.1	192.168.1.11	ICMP	70 Redirect	(Redirect for host)

可以看到, 可以捕获到 echo 的请求和响应包



```
▼ Frame 418: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface \Device\NPF_{EBC288E2-6340-4CBB-87CD-F4EB4A236F0F}, id 0
  > Interface id: 0 (\Device\NPF_{EBC288E2-6340-4CBB-87CD-F4EB4A236F0F})
    Encapsulation type: Ethernet (1)
    Arrival Time: May 15, 2021 08:53:02.650629000 ■■■■■■■■■■
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1621039982.650629000 seconds
    [Time delta from previous captured frame: 0.008668000 seconds]
    [Time delta from previous displayed frame: 0.008668000 seconds]
    [Time since reference or first frame: 19.707096000 seconds]
    Frame Number: 418
    Frame Length: 74 bytes (592 bits)
    Capture Length: 74 bytes (592 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:icmp:data]
    [Coloring Rule Name: ICMP]
    [Coloring Rule String: icmp || icmpv6]
  ▼ Ethernet II, Src: RuijieNe_27:b8:86 (58:69:6c:27:b8:86), Dst: 00:88:99:00:09:dc (00:88:99:00:09:dc)
    > Destination: 00:88:99:00:09:dc (00:88:99:00:09:dc)
    > Source: RuijieNe_27:b8:86 (58:69:6c:27:b8:86)
    Type: IPv4 (0x0800)
  ▼ Internet Protocol Version 4, Src: 192.168.3.22, Dst: 192.168.1.11
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 60
    Identification: 0x0f71 (3953)
    > Flags: 0x00
    Fragment Offset: 0
    Time to Live: 62
    Protocol: ICMP (1)
    Header Checksum: 0xe7de [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.3.22
    Destination Address: 192.168.1.11
  ▼ Internet Control Message Protocol
    Type: 0 (Echo (ping) reply)
    Code: 0
    Checksum: 0x4ee3 [correct]
    [Checksum Status: Good]
    Identifier (BE): 1 (0x0001)
    Identifier (LE): 256 (0x0100)
    Sequence Number (BE): 1656 (0x0678)
    Sequence Number (LE): 30726 (0x7806)
    [Request frame: 368]
    [Response time: 2323.095 ms]
```

10. PC1 ping 一个本拓扑结构外的 ip 地址

351	15.225176	192.168.1.11	192.168.3.15	ICMP	74 Echo (ping) request	id=0x0001, seq=1697/41222, ttl=64 (no response found!)
473	19.953383	192.168.1.11	192.168.3.15	ICMP	74 Echo (ping) request	id=0x0001, seq=1698/41478, ttl=64 (no response found!)
584	24.954410	192.168.1.11	192.168.3.15	ICMP	74 Echo (ping) request	id=0x0001, seq=1699/41734, ttl=64 (no response found!)
687	29.953940	192.168.1.11	192.168.3.15	ICMP	74 Echo (ping) request	id=0x0001, seq=1700/41990, ttl=64 (no response found!)
789	34.953121	192.168.1.11	192.168.3.15	ICMP	74 Echo (ping) request	id=0x0001, seq=1701/42246, ttl=64 (no response found!)
888	39.953065	192.168.1.11	192.168.3.15	ICMP	74 Echo (ping) request	id=0x0001, seq=1702/42502, ttl=64 (no response found!)
993	44.954108	192.168.1.11	192.168.3.15	ICMP	74 Echo (ping) request	id=0x0001, seq=1703/42758, ttl=64 (no response found!)
1098	49.954521	192.168.1.11	192.168.3.15	ICMP	74 Echo (ping) request	id=0x0001, seq=1704/43014, ttl=64 (no response found!)



```
Frame 473: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface \Device\NPF_{EBC28BE2-6340-4CBB-87CD-F4EB4A236F0F}, id 0
  Interface id: 0 (\Device\NPF_{EBC28BE2-6340-4CBB-87CD-F4EB4A236F0F})
  Encapsulation type: Ethernet (1)
  Arrival Time: May 15, 2021 08:57:02.327935000
  [Time shift for this packet: 0.000000000 seconds]
  Epoch Time: 1621040222.327935000 seconds
  [Time delta from previous captured frame: 0.037449000 seconds]
  [Time delta from previous displayed frame: 4.728207000 seconds]
  [Time since reference or first frame: 19.953383000 seconds]
  Frame Number: 473
  Frame Length: 74 bytes (592 bits)
  Capture Length: 74 bytes (592 bits)
  [Frame is marked: False]
  [Frame is ignored: False]
  [Protocols in frame: eth:ethertype:ip:icmp:data]
  [Coloring Rule Name: ICMP]
  [Coloring Rule String: icmp || icmpv6]
Ethernet II, Src: 00:88:99:00:09:dc (00:88:99:00:09:dc), Dst: RuijieNe_27:b8:86 (58:69:6c:27:b8:86)
  Destination: RuijieNe_27:b8:86 (58:69:6c:27:b8:86)
  Source: 00:88:99:00:09:dc (00:88:99:00:09:dc)
  Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 192.168.1.11, Dst: 192.168.3.15
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
  Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
  Total Length: 60
  Identification: 0x4d4f (19791)
  Flags: 0x00
  Fragment Offset: 0
  Time to Live: 64
  Protocol: ICMP (1)
  Header Checksum: 0x0000 [validation disabled]
  [Header checksum status: Unverified]
  Source Address: 192.168.1.11
  Destination Address: 192.168.3.15
Internet Control Message Protocol
  Type: 8 (Echo (ping) request)
  Code: 0
  Checksum: 0x46b9 [correct]
  [Checksum Status: Good]
  Identifier (BE): 1 (0x0001)
  Identifier (LE): 256 (0x0100)
  Sequence Number (BE): 1698 (0x06a2)
  Sequence Number (LE): 41478 (0xa206)
  [No response seen]
Data (32 bytes)
  Data: 6162636465666768696a6b6c6d6e6f7071727374757677616263646566676869
```

可以看到，PC1 一直再发出 echo request 包，但是无法获得 echo reply 包

学号	学生	自评分
19335118	梁冠轩	100
19335258	余世龍	100

【交实验报告】

上传实验报告：<ftp://222.200.180.109/> 截止日期（不迟于）：1 周之内

上传包括两个文件：

（1）小组实验报告。上传文件名格式：小组号_Ftp 协议分析实验.pdf （由组长负责上传）

例如：文件名“10_Ftp 协议分析实验.pdf”表示第 10 组的 Ftp 协议分析实验报告

（2）小组成员实验体会。每个同学单独交一份只填写了实验体会的实验报告。只需填写自己的学号和姓名。

文件名格式：小组号_学号_姓名_Ftp 协议分析实验.pdf （由组员自行上传）

例如：文件名“10_05373092_张三_Ftp 协议分析实验.pdf”表示第 10 组的 Ftp 协议分析实验报告。