实验报告

一、实验名称

Respond to ARP

二、实验目的

完成路由器（router）的一个功能：回复ARP请求

三、实验内容

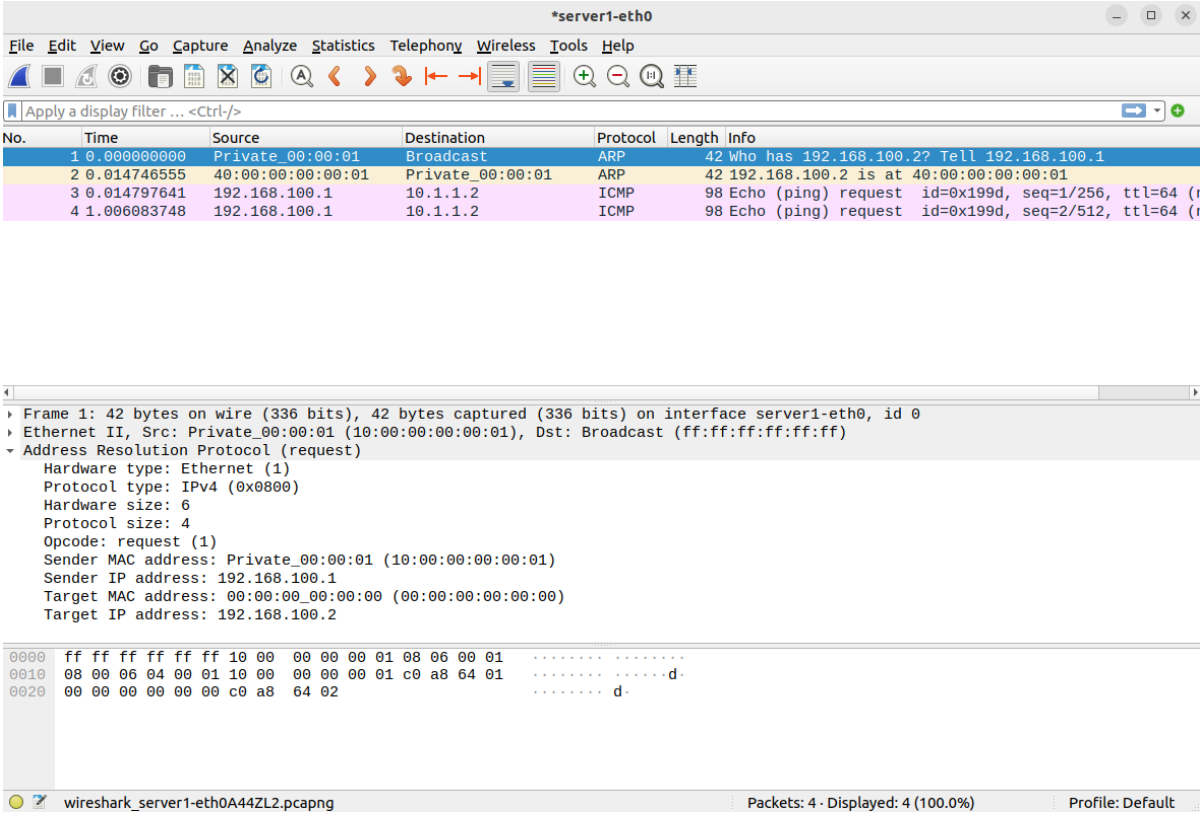
回复ARP请求的逻辑：

收到一个包时，先读取包头，如果是ARP请求，那么进入handle_arp_packet处理：先查看自身的接口，看有没有接口的IP是ARP包的目标IP，如果有，回复该ARP请求：使用create_ip_arp_reply来创建回复包（其中sender方填对应接口的信息，target方填ARP来源方的信息），并发向收到包的那个接口

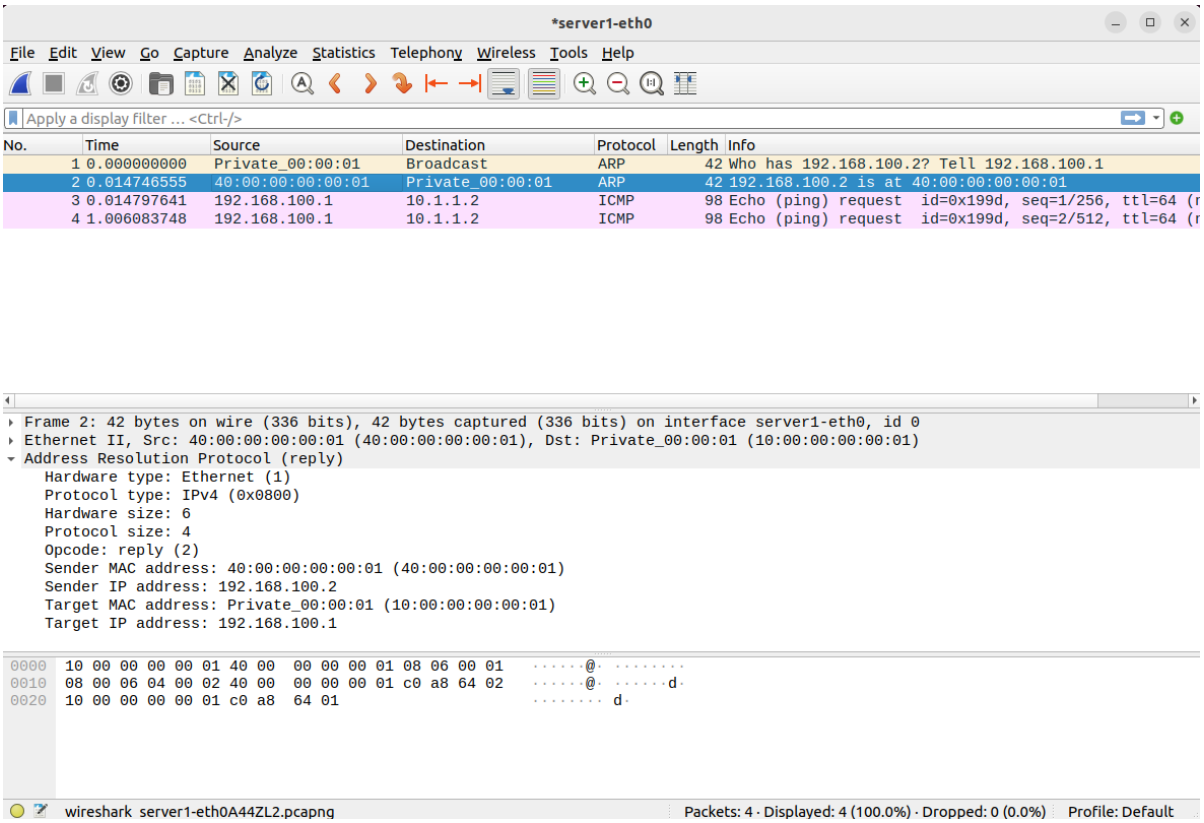
在mininet中测试：

server1 ping -c2 10.1.1.2

第一行：server1广播发了一个针对路由器地址的ARP请求，其中Target MAC address都是0，因为是请求的地址



第二行：路由器给server1发了一个ARP回复，源地址是路由器，并且MAC已经填好，目标地址是client



建立ARP table

在收到一个包时，将发送者的IP地址和MAC地址添加到arp_table中

其中arp_table使用dict数据结构，key是IP，value是MAC

四、实验结果

通过测试样例

```
Results for test scenario ARP request: 6 passed, 0 failed, 0 pending


Passed:
1   ARP request for 192.168.1.1 should arrive on router-eth0
2   Router should send ARP response for 192.168.1.1 on router-
    eth0
3   An ICMP echo request for 10.10.12.34 should arrive on
    router-eth0, but it should be dropped (router should only
    handle ARP requests at this point)
4   ARP request for 10.10.1.2 should arrive on router-eth1, but
    the router should not respond.
5   ARP request for 10.10.0.1 should arrive on on router-eth1
6   Router should send ARP response for 10.10.0.1 on router-eth1


All tests passed!
```

建立arp_table

测试样例的arp_table：

```
(syenv) uuu@Ubuntu22:~/net_lab/workspace/lab-3-xkxkzzZ$ sudo swyard -t testcases/myrouter1_testscenar
io.srpy myrouter.py
15:47:40 2024/04/14     INFO Starting test scenario testcases/myrouter1_testscenario.srpy
15:47:40 2024/04/14     INFO arp_table: {IPv4Address('192.168.1.100'): EthAddr('30:00:00:00:00:01')}
15:47:40 2024/04/14     INFO arp_table: {IPv4Address('192.168.1.100'): EthAddr('30:00:00:00:00:01'),
IPv4Address('10.10.1.1'): EthAddr('60:00:de:ad:be:ef')}
15:47:40 2024/04/14     INFO arp_table: {IPv4Address('192.168.1.100'): EthAddr('30:00:00:00:00:01'),
IPv4Address('10.10.1.1'): EthAddr('60:00:de:ad:be:ef'), IPv4Address('10.10.5.5'): EthAddr('70:00:ca:f
e:c0:de')}

Results for test scenario ARP request: 6 passed, 0 failed, 0 pending
```

自测：

client ping -c1 router
server1 ping -c1 router
server2 ping -c1 router

```
15:53:45 2024/04/14     INFO arp_table: {IPv4Address('10.1.1.1'): EthAddr('30:00
:00:00:00:01')}
15:54:23 2024/04/14     INFO arp_table: {IPv4Address('10.1.1.1'): EthAddr('30:00
:00:00:00:01'), IPv4Address('192.168.100.1'): EthAddr('10:00:00:00:00:01')}
15:55:20 2024/04/14     INFO arp_table: {IPv4Address('10.1.1.1'): EthAddr('30:00
:00:00:00:01'), IPv4Address('192.168.100.1'): EthAddr('10:00:00:00:00:01'), IPv4
Address('192.168.200.1'): EthAddr('20:00:00:00:00:01')}
```

arp_table不断添加表项，分别是client, server1, server2的IP与MAC

五、核心代码

```
class Router(object):
    def __init__(self, net: switchyard.llnetbase.LLNetBase):
        self.net = net
        # other initialization stuff here
        self.interfaces = self.net.interfaces()
        self.arp_table = {}

    def handle_arp_packet(self, recv):
        timestamp, ifaceName, packet = recv
        arp = packet.get_header(Arp)
        self.arp_table[arp.senderprotoaddr] = arp.senderhwaddr
        log_info("arp_table: {}".format(self.arp_table))
        for interface in self.interfaces:
            if(arp.targetprotoaddr == interface.ipaddr):
                arp_reply = create_ip_arp_reply(interface.ethaddr,
arp.senderhwaddr, interface.ipaddr, arp.senderprotoaddr)
                self.net.send_packet(ifaceName, arp_reply)
                return


    def handle_packet(self, recv: switchyard.llnetbase.ReceivedPacket):
        timestamp, ifaceName, packet = recv
        # TODO: your logic here
        arp = packet.get_header(Arp)
```

```
        if arp:
            self.handle_arp_packet(recv)
            return
```