

南京大学本科生实验报告

课程名称：计算机网络

任课教师：田臣/李文中

助教：

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1. 实验名称：IPv4 router lab_3

2. 实验内容

完成回应 ARP 逻辑：

用 `arp = packet.get_header(Arp)` 与 `if arp` :判断是否是 ARP 包
之后建包并发送回原地址

```
def handle_packet(self, recv: switchyard.llnetbase.ReceivedPacket):
    timestamp, ifaceName, packet = recv
    # TODO: your logic here
    all_intf = self.net.interfaces()
    arp = packet.get_header(Arp)
    print(table)
    if arp:#judge
        for intf in all_intf:
            if arp.targetprotoaddr == intf.ipaddr:
                print("Has a intf == arp tdst ip")
                table[arp.senderprotoaddr] = arp.senderhwaddr
                print(table)
                packet = create_ip_arp_reply(intf.ethaddr,arp.senderhwaddr,arp.targetprotoaddr,arp.senderprotoaddr)
                self.net.send_packet(intf.name,packet)
                log_info (f"Send packet {packet} to {intf.name}")
```

通过测试

```
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!
```

部署

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	Private_00:00:00:00:00:01	Broadcast	ARP	42	Who has 192.168.100.2? Tell 192.168.100.1
2	0.037347...	40:00:00:00:00:00	Private_00:00:00:00:00:01	ARP	42	192.168.100.2 is at 40:00:00:00:00:01
3	0.037369...	192.168.100.1	192.168.100.2	ICMP	98	Echo (ping) request id=0x0fce, seq=1/256, ttl=64 (no response found!)
4	1.017375...	192.168.100.1	192.168.100.2	ICMP	98	Echo (ping) request id=0x0fce, seq=2/512, ttl=64 (no response found!)

▶ Frame 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0						
Ethernet II, Src: Private_00:00:00:00:00:01 (10:00:00:00:00:01), Dst: Broadcast (ff:ff:ff:ff:ff:ff)						
▼ Address Resolution Protocol (request)						
Hardware type: Ethernet (1)						
Protocol type: IPv4 (0x0800)						
Hardware size: 6						
Protocol size: 4						
Opcode: request (1)						
Sender MAC address: Private_00:00:00:00:00:01 (10:00:00:00:00:01)						
Sender IP address: 192.168.100.1						
Target MAC address: 00:00:00:00:00:00 (00:00:00:00:00:00)						
Target IP address: 192.168.100.2						

可见 ARPrequest 包的 Target MAC 一开始为 0
Reply 的四个元素齐全

1	0.000000	Private_00:00:00:00:00:01	Broadcast	ARP	42	Who has 192.168.100.2? Tell 192.168.100.1
2	0.037347...	40:00:00:00:00:00	Private_00:00:00:00:00:01	ARP	42	192.168.100.2 is at 40:00:00:00:00:01
3	0.037369...	192.168.100.1	192.168.100.2	ICMP	98	Echo (ping) request id=0x0fce, seq=1/256, ttl=64 (no response found!)
4	1.017375...	192.168.100.1	192.168.100.2	ICMP	98	Echo (ping) request id=0x0fce, seq=2/512, ttl=64 (no response found!)

▶ Frame 2: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0						
Ethernet II, Src: 40:00:00:00:00:01 (40:00:00:00:00:01), Dst: Private_00:00:00:00:00:01 (10:00:00:00:00:01)						
▼ Address Resolution Protocol (reply)						
Hardware type: Ethernet (1)						
Protocol type: IPv4 (0x0800)						
Hardware size: 6						
Protocol size: 4						
Opcode: reply (2)						
Sender MAC address: 40:00:00:00:00:01 (40:00:00:00:00:01)						
Sender IP address: 192.168.100.2						
Target MAC address: Private_00:00:00:00:00:01 (10:00:00:00:00:01)						
Target IP address: 192.168.100.1						

ARP 表

代码：利用字典，当目的 IP 与接口 IP 相同时记录

```
if arp:#judge
    for intf in all_intf:
        if arp.targetprotoaddr == intf.ipaddr:
            print("Has a intf == arp tdst ip")
            table[arp.senderprotoaddr] = arp.senderhwaddr
            print(table)
```

操作：server1 ping192.168.100.2 server2 ping 192.168.200.2

可见 ARP 表以此加入了 server1 和 server2 的对应。

```
{}
{}
Has a intf == arp tdst ip
{IPv4Address('192.168.100.1'): EthAddr('10:00:00:00:00:01')}
20:24:26 2023/04/17 INFO Send packet Ethernet 40:00:00:00:00:01->10:00:00:00:00:01 ARP | Arp 40:00:00:00:00:01:192.168.100.2 10:00:00:00:00:01:192.168.100.1 to router-eth0
{IPv4Address('192.168.100.1'): EthAddr('10:00:00:00:00:01')}
{IPv4Address('192.168.100.1'): EthAddr('10:00:00:00:00:01')}
Has a intf == arp tdst ip
{IPv4Address('192.168.100.1'): EthAddr('10:00:00:00:00:01'), IPv4Address('192.168.200.1'): EthAddr('20:00:00:00:00:01')}
20:25:19 2023/04/17 INFO Send packet Ethernet 40:00:00:00:00:02->20:00:00:00:00:01 ARP | Arp 40:00:00:00:00:02:192.168.200.2 20:00:00:00:00:01:192.168.200.1 to router-eth1
```

3. 总结与感想

完成路由器 ARP 回应