

计网 lab3 实验报告

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一. 实验名称

ARP 应答

二. 实验目的

对分配给路由器接口的地址的 ARP(地址解析协议)请求进行响应。

三. 实验内容和核心代码

1. ARP 应答：

(1) 流程分析

①对于收到的一个包，首先判断是否是 arp 的 request 包。

```
if pkt.has_header(Arp)==True:
    arp = pkt.get_header(Arp)
    if arp.operation==ArpOperation.Request: #if it's an arp
request
```

②遍历路由器的所有端口，看是否有与目的 ip 匹配的条目，如有保存对应的 mac 地址。

```
srcip=arp.targetprotoaddr
my_interfaces = self.net.interfaces()
for intf in my_interfaces:
    if srcip == intf.ipaddr:
        srchw=intf.ethaddr
```

③若需要回复，创建 arp reply 包。根据匹配的 ip,mac 从接收端口发送。

```
dstip=arp.senderprotoaddr
arpre=create_ip_arp_reply(srchw, arp.senderhwaddr, srcip, dstip)
self.net.send_packet(dev,arpre) #from which port get then send it
at that port
```

(2) 测试结果

```
12:33:57 2020/04/07 INFO Starting test scenario lab_3/routertests1.srpy
Results for test scenario ARP request: 0 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 router-eth1
6 Router should send ARP response for 10.10.0.1 on router-eth1

All tests passed!

(syenv) njucs@njucs-VirtualBox:~/switchyard$ swyard -t lab_3/routertests1full.srpy lab_3/myrouter.py
12:34:06 2020/04/07 INFO Starting test scenario lab_3/routertests1full.srpy
Results for test scenario ARP request: 9 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 172.16.42.1 should arrive on router-eth2
5 Router should send ARP response for 172.16.42.1 on router-eth2
6 ARP request for 10.10.1.2 should arrive on router-eth1, but the router should not respond.
7 ARP request for 10.10.1.1 should arrive on router-eth1
8 ARP request for 10.10.0.1 should arrive on router-eth1
9 Router should send ARP response for 10.10.0.1 on router-eth1

All tests passed!
```

2.缓存 ARP 表:

利用字典，用 ip 地址作为 key,mac 地址作为 value，存储 ip 与 mac 的映射。

```
dic[str(arp.senderprotoaddr)] = str(arp.senderhwaddr)
log_info("add/update an entry ,ip :{} ,
mac, {}".format(arp.senderprotoaddr,arp.senderhwaddr) )
```

四. 结合 wireshark 分析:

1. 在 client 节点输入 `ping -c3 10.1.1.2`

如图，路由器收到一个广播的 arp 信息，在表中记录下一个新条目：

```
"Node: router"
root@njucs-VirtualBox:~/switchyard# source ./syenv/bin/activate
(syenv) root@njucs-VirtualBox:~/switchyard# swyard lab_3/myrouter.py
15:48:11 2020/04/07 INFO Saving iptables state and installing switchyard rules
15:48:11 2020/04/07 INFO Using network devices: router-eth1 router-eth2 router-eth0
15:48:34 2020/04/07 INFO add/update an entry ip :10.1.1.1 , mac:30:00:00:00:00:01
```

Capturing from client-eth0

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	10.1.1.1	10.1.1.1	ARP	42	Who-has 10.1.1.2 is at 40:00:00:00:00:03
2	0.05591998	10.1.1.1	10.1.1.2	ICMP	98	Echo (ping) request id=0x10f8, seq=1/256, ttl=64 (no response yet)
3	0.05593759	10.1.1.1	10.1.1.2	ICMP	98	Echo (ping) request id=0x10f8, seq=2/512, ttl=64 (no response yet)
4	1.027811149	10.1.1.1	10.1.1.2	ICMP	98	Echo (ping) request id=0x10f8, seq=3/768, ttl=64 (no response yet)
5	2.052404728	10.1.1.1	10.1.1.2	ICMP	98	Echo (ping) request id=0x10f8, seq=4/1024, ttl=64 (no response yet)

2. 在 server1 节点 `ping -c 1 10.1.1.1`

在 wireshark 中可以看到，收到的 arp 包源 ip 地址和 mac 地址分别为：
在 router 节点中也打印出增加了这一条目。

```
(sgeuv) root@njucs-VirtualBox:~/switchyard# swyard lab_3/myrouter.py
20:48:50 2020/04/07 INFO Saving iptables state and installing switchyard rules
20:48:51 2020/04/07 INFO Using network devices: router-eth2 router-eth1 router-eth0
20:49:51 2020/04/07 INFO add/update an entry ip :10.1.1.1 , mac,30:00:00:00:00:01
20:53:19 2020/04/07 INFO add/update an entry ip :192.168.100.1 , mac,10:00:00:00:00:01
```

Wireshark - Packet 1 - server1-eth0

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	Private_00:00:01	Broadcast	ARP	42	Who has 192.168.100.2? Tell 192.168.100.1
2	0.003652573	40:00:00:00:00:01	Private_00:00:01	ARP	42	192.168.100.2 is at 40:00:00:00:00:01
3	0.003666291	192.168.100.1	10.1.1.1	ICMP	98	Echo (ping) request id=0x0a4c, seq=1/256, ...

Frame 1: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0
Ethernet II, Src: Private_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_00:00:01 (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