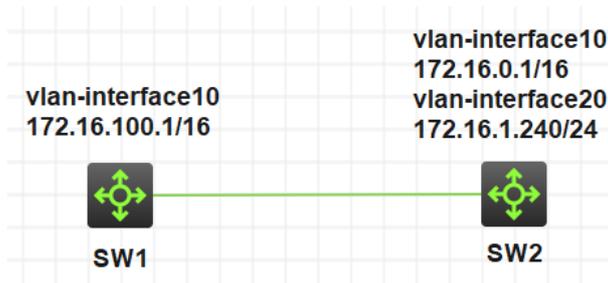


# 交换机16位掩码（大网段）地址跨3层ping不通24位掩码（小网段）地址

ARP VLAN 倪民 2020-12-01 发表

## 组网及说明



SW1上起vlan-interface10，地址为172.16.100.1，掩码16位，已配置到vlan-interface20的路由ip route-static 0.0.0.0 0 172.16.0.1。

SW2上起vlan-interface10，地址为172.16.0.1，掩码16位。

SW2上起vlan-interface20，地址为172.16.1.240，掩码24位。

## 问题描述

SW1 ping 172.16.0.1 可以通，ping 172.16.1.240 不通。

```
[SW1]ping 172.16.0.1
Ping 172.16.0.1 (172.16.0.1): 56 data bytes, press CTRL_C to break
56 bytes from 172.16.0.1: icmp_seq=0 ttl=255 time=1.000 ms
56 bytes from 172.16.0.1: icmp_seq=1 ttl=255 time=0.000 ms
56 bytes from 172.16.0.1: icmp_seq=2 ttl=255 time=0.000 ms
56 bytes from 172.16.0.1: icmp_seq=3 ttl=255 time=0.000 ms
56 bytes from 172.16.0.1: icmp_seq=4 ttl=255 time=0.000 ms
--- Ping statistics for 172.16.0.1 ---
5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss
round-trip min/avg/max/std-dev = 0.000/0.200/1.000/0.400 ms
[SW1]Nov 27 17:41:36:142 2020 SW1 PING/6/PING_STATISTICS: Ping statistics for 172.16.0.1:
5 packet(s) transmitted, 5 packet(s) received, 0.0% packet loss, round-trip min/avg/max/s
td-dev = 0.000/0.200/1.000/0.400 ms.
```

```
[SW1]ping 172.16.1.240
Ping 172.16.1.240 (172.16.1.240): 56 data bytes, press CTRL_C to break
Request time out
--- Ping statistics for 172.16.1.240 ---
5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss
[SW1]Nov 27 17:42:26:797 2020 SW1 PING/6/PING_STATISTICS: Ping statistics for 172.16.1.24
0: 5 packet(s) transmitted, 0 packet(s) received, 100.0% packet loss.
```

## 过程分析

从抓包信息看，SW1 ping 172.16.1.240 时未往外发任何icmp报文。

257	198.252285	172.16.100.1	172.16.0.1	ICMP	102	Echo (ping) request
260	198.253239	172.16.0.1	172.16.100.1	ICMP	102	Echo (ping) reply
261	198.455613	172.16.100.1	172.16.0.1	ICMP	102	Echo (ping) request
262	198.455957	172.16.0.1	172.16.100.1	ICMP	102	Echo (ping) reply
263	198.657950	172.16.100.1	172.16.0.1	ICMP	102	Echo (ping) request
264	198.658275	172.16.0.1	172.16.100.1	ICMP	102	Echo (ping) reply
266	198.860015	172.16.100.1	172.16.0.1	ICMP	102	Echo (ping) request
267	198.860346	172.16.0.1	172.16.100.1	ICMP	102	Echo (ping) reply
268	199.061916	172.16.100.1	172.16.0.1	ICMP	102	Echo (ping) request
269	199.062244	172.16.0.1	172.16.100.1	ICMP	102	Echo (ping) reply

再查看arp报文情况，发现SW1向外发送了arp请求，直接询问172.16.1.240对应的mac地址但没有回应，而不是向网关172.16.0.1发送arp请求。

213	171.522637	9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.1.240? Tell 172.16.100.1
217	173.471831	9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.1.240? Tell 172.16.100.1
219	174.471760	9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.1.240? Tell 172.16.100.1
254	198.252668	9a:e8:52:58:02:02	Broadcast	ARP	46	Who has 172.16.100.1? Tell 172.16.0.1
259	198.252904	9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.100.1? Tell 172.16.100.1
273	201.155977	9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.1.240? Tell 172.16.100.1
275	202.484742	9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.1.240? Tell 172.16.100.1
279	203.483968	9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.1.240? Tell 172.16.100.1
339	242.253089	9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.1.240? Tell 172.16.100.1
342	243.590175	9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.1.240? Tell 172.16.100.1
344	244.498851	9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.1.240? Tell 172.16.100.1
399	280.165889	9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.1.240? Tell 172.16.100.1

## 解决方法

SW1 ping 172.16.1.240 时，会用16位掩码进行运算，认为该地址和自己位于同一网段，因此不会进行三层转发，不经过网关，直接访问即可。这时SW1就会在VLAN10内广播arp请求，但请求的地址实际位于VLAN20内，所以得不到回应，SW1也就无法获取目标的MAC，最终导致不会往外发送ICMP报文。

```

|_ 9a:e8:4e:d7:01:02 Broadcast ARP 46 Who has 172.16.1.240? Tell 172.16.100.1
-----
Frame 404: 46 bytes on wire (368 bits), 46 bytes captured (368 bits)
Ethernet II, Src: 9a:e8:4e:d7:01:02 (9a:e8:4e:d7:01:02), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
802.1Q Virtual LAN, PRI: 0, DEI: 0, ID: 10
Address Resolution Protocol (request)

```

如果将SW2的vlan-interface20改成172.10.1.1/24, SW1ping172.10.1.1时会发现此网址和自己非同网段, 则SW1会向网关SW2 vlan-interface10发送ARP, 由此完成一次3层转发。

Source	Destination	Protcl	Length	Info
9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.0.1? Tell 172.16.100.1
9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.0.1? Tell 172.16.100.1
9a:e8:52:58:02:02	9a:e8:4e:...	ARP	46	172.16.0.1 is at 9a:e8:52:58:02:02
9a:e8:52:58:02:02	9a:e8:4e:...	ARP	46	172.16.0.1 is at 9a:e8:52:58:02:02
9a:e8:4e:d7:01:02	Broadcast	ARP	46	Who has 172.16.0.1? Tell 172.16.100.1
9a:e8:52:58:02:02	9a:e8:4e:...	ARP	46	172.16.0.1 is at 9a:e8:52:58:02:02
9a:e8:52:58:02:02	Broadcast	ARP	46	Who has 172.16.100.1? Tell 172.16.0.1
9a:e8:4e:d7:01:02	9a:e8:52:...	ARP	46	172.16.100.1 is at 9a:e8:4e:d7:01:02
9a:e8:4e:d7:01:02	Broadcast	ARP	46	ARP Announcement for 172.16.100.1
9a:e8:52:58:02:02	Broadcast	ARP	46	ARP Announcement for 172.16.0.1
9a:e8:52:58:02:02	Broadcast	ARP	46	ARP Announcement for 172.10.1.1

```

Ti Source Destination Protocol Length Info
--
172.16.100.1 172.10.1.1 ICMP 102 Echo (ping) request id=0x00ee, seq=0/0, ttl=255 (reply in 1342)
172.10.1.1 172.16.100.1 ICMP 102 Echo (ping) reply id=0x00ee, seq=0/0, ttl=255 (request in 1341)
172.16.100.1 172.10.1.1 ICMP 102 Echo (ping) request id=0x00ee, seq=1/256, ttl=255 (reply in 1344)
172.10.1.1 172.16.100.1 ICMP 102 Echo (ping) reply id=0x00ee, seq=1/256, ttl=255 (request in 1343)
172.16.100.1 172.10.1.1 ICMP 102 Echo (ping) request id=0x00ee, seq=2/512, ttl=255 (reply in 1346)
172.10.1.1 172.16.100.1 ICMP 102 Echo (ping) reply id=0x00ee, seq=2/512, ttl=255 (request in 1345)
172.16.100.1 172.10.1.1 ICMP 102 Echo (ping) request id=0x00ee, seq=3/768, ttl=255 (reply in 1348)
172.10.1.1 172.16.100.1 ICMP 102 Echo (ping) reply id=0x00ee, seq=3/768, ttl=255 (request in 1347)
172.16.100.1 172.10.1.1 ICMP 102 Echo (ping) request id=0x00ee, seq=4/1024, ttl=255 (reply in 1351)
172.10.1.1 172.16.100.1 ICMP 102 Echo (ping) reply id=0x00ee, seq=4/1024, ttl=255 (request in 1350)
-----
Frame 1350: 102 bytes on wire (816 bits), 102 bytes captured (816 bits)
Ethernet II, Src: 9a:e8:4e:d7:01:02 (9a:e8:4e:d7:01:02), Dst: 9a:e8:52:58:02:02 (9a:e8:52:58:02:02)
802.1Q Virtual LAN, PRI: 0, DEI: 0, ID: 10
Internet Protocol Version 4, Src: 172.16.100.1, Dst: 172.10.1.1
Internet Control Message Protocol

```