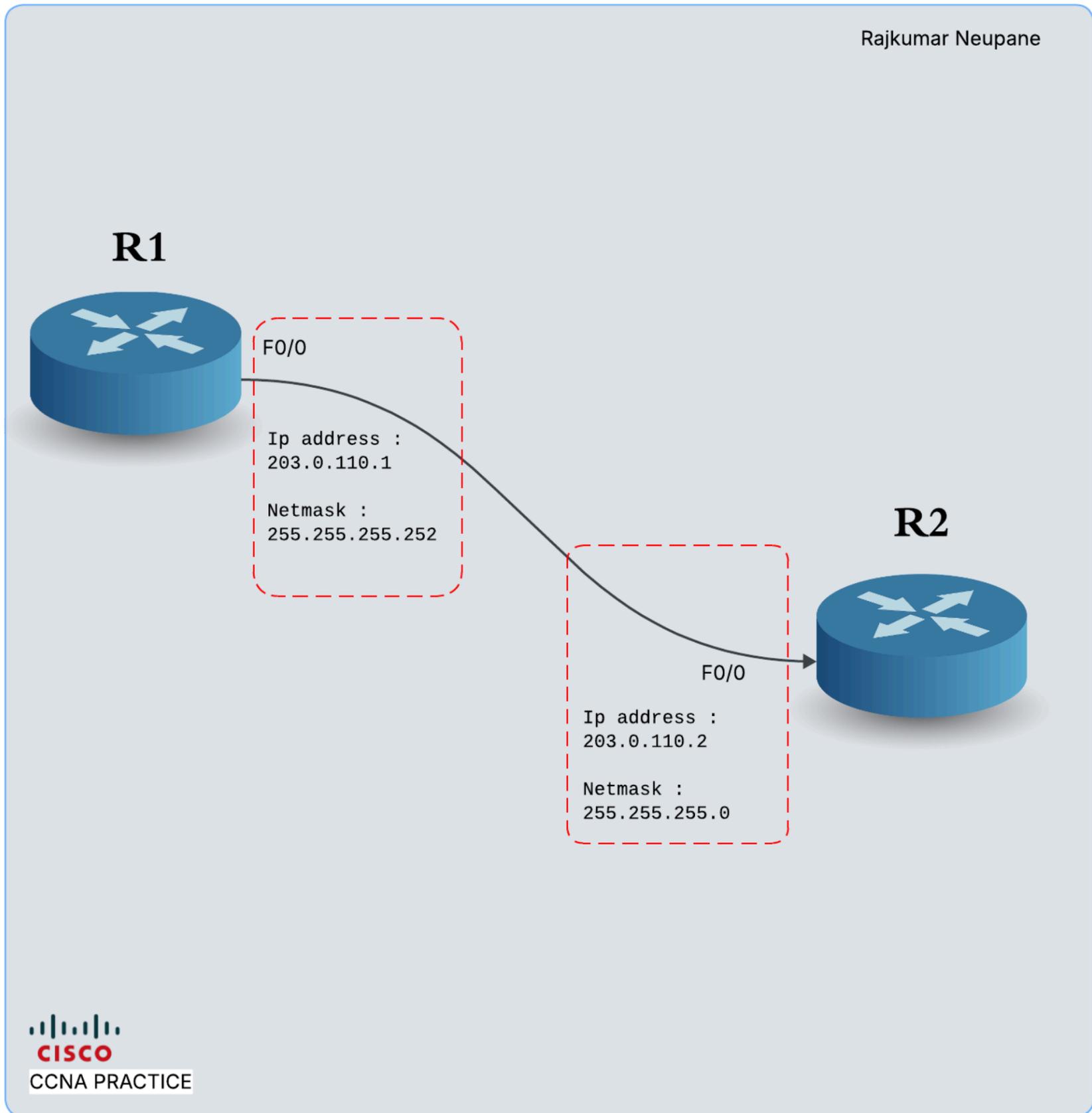# ICMP Behavior Across Different Subnets

Observation 1: Routers with Different Subnet Masks

In this scenario, I noticed that even if two routers' interfaces are connected to each other **but have different subnet masks**, the ICMP messages (ping) are still working fine.

Network Diagram

R1

F0/0

Ip address :
203.0.110.1

Netmask :
255.255.255.252

R2

F0/0

Ip address :
203.0.110.2

Netmask :
255.255.255.0

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CCNA PRACTICE

Ping from R2 to R1

```
Router#ping 203.0.113.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms
```

Show Config on R1

```
Router#show int g0/0/0
GigabitEthernet0/0/0 is up, line protocol is up (connected)
  Hardware is ISR4331-3x1GE, address is 0004.9ae6.6501 (bia 0004.9ae6.6501)
  Internet address is 203.0.113.1/30
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not supported
  Full Duplex, 1000Mbps, link type is auto,  media type is Auto Select
```

Show Config on R2

```
Router#show int g0/0/0
GigabitEthernet0/0/0 is up, line protocol is up (connected)
  Hardware is ISR4331-3x1GE, address is 0090.2b93.4a01 (bia 0090.2b93.4a01)
  Internet address is 203.0.113.2/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
```

ICMP Echo Request from Both Sides

```
Router#ping 203.0.113.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/0/0 ms

Router#

Router#ping 203.0.113.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 3/3/4 ms

Router#
```

Analysis

From Router 1 Perspective:

- Usable IP addresses: `203.0.113.1` and `203.0.113.2`

From Router 2 Perspective:

- Subnet provides `2^8 - 2` usable IP addresses
- IP range includes both R1 and R2 addresses

**Why does the ping succeed even though the subnets are technically different?**

- Because they are both ends of the same link, when one router sends an **ARP request**, the other router responds with its **ARP reply**.
- ARP resolution allows ICMP ping requests to succeed, even with mismatched subnet masks.

Observation 2: Router and PC in Different Subnets

Does this mean a router and a PC in different subnets can communicate? Let's test it.

Network Setup

- **PC0:** `192.168.2.2 /24`
- **Router1 g0/0/0:** `192.168.2.1 /30`
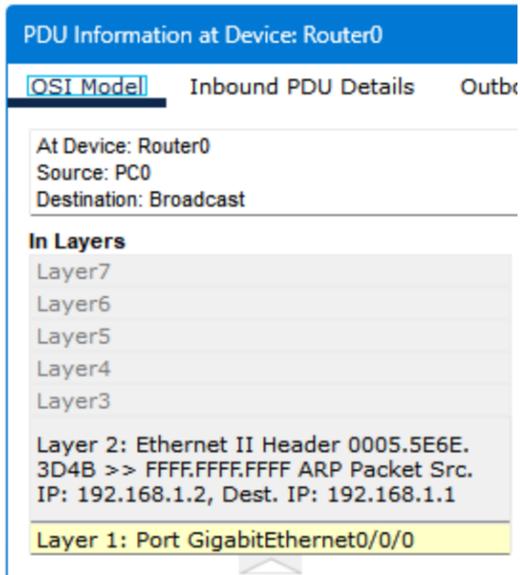- **Router1 Loopback1:** `1.1.1.1 /30`
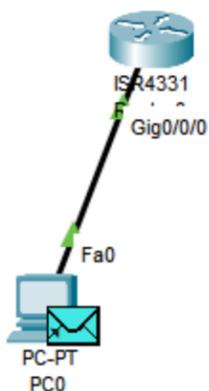
Sending ICMP Echo Request from PC0 to Router Loopback1
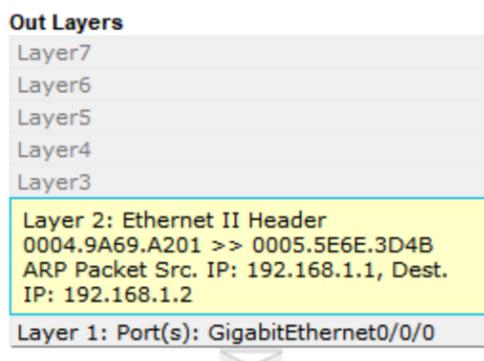
```
C:\>ping 1.1.1.1

Pinging 1.1.1.1 with 32 bytes of data:

Reply from 1.1.1.1: bytes=32 time=4ms TTL=255
```

Explanation:

1. The router is the **default gateway** for PC0.
2. PC0 sends an **ARP request** (broadcast MAC) to resolve the router's MAC.

3. The router responds with its **interface MAC**.

Result

- The ICMP ping succeeds.

```
C:\>ping 1.1.1.1

Pinging 1.1.1.1 with 32 bytes of data:

Reply from 1.1.1.1: bytes=32 time=4ms TTL=255
Reply from 1.1.1.1: bytes=32 time=17ms TTL=255
Reply from 1.1.1.1: bytes=32 time<1ms TTL=255
Reply from 1.1.1.1: bytes=32 time<1ms TTL=255

Ping statistics for 1.1.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 17ms, Average = 5ms

C:\>
```

Conclusion:

Even if devices are in different subnets, ICMP can succeed **if the device sends traffic to its default gateway**, and the gateway resolves the MAC correctly via ARP.

✅ **Key Takeaways:**

- Subnet mismatch between directly connected routers doesn't always block ICMP.
- ARP plays a key role in allowing ICMP traffic at Layer 2.
- For a PC and router, different subnets can communicate if the router acts as the default gateway.
- On a direct connection, as long as the IP you set overlaps the other device's subnet and you know the other device's IP, **communication can work**, even if your subnet doesn't "match" exactly.