

## MAC Address Assessment

This investigative report aims to answer the question of why the MAC address changes with the topology below. The report provides several screenshots of evidence, indicating the change of MAC address.

In the following topology, a client, a switch, a router, a router, a switch, and a client are illustrated in a sequence from left to right. The topology was physically built in N251 where:

- PC0 – Router0 corresponds to 10.0.0.0 network
- Router0 – Router1 corresponds to 11.0.0.0 network
- Router1 – PC1 corresponds to 12.0.0.0 network

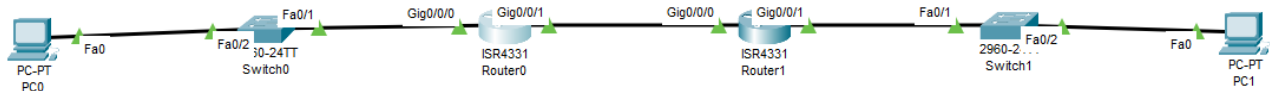


Figure 1: Topology

Figure 2 displays all configuration information from PC0 where:

- IPv4 address is 10.0.0.2
- MAC address is 34-17-EB-BE-78-2F

The table was accessed through Command Prompt by using the ipconfig /all command.

```
Command Prompt

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix  . : 
    Description . . . . . : Intel(R) 82579LM Gigabit Network Connection
    Physical Address. . . . . : 34-17-EB-BE-78-2F
    DHCP Enabled. . . . . : No
    Autoconfiguration Enabled . . . . : Yes
    Link-local IPv6 Address . . . . . : fe80::85d8:8fa2:92cf:6017%15(Preferred)
    IPv4 Address. . . . . : 10.0.0.2(Preferred)
    Subnet Mask . . . . . : 255.0.0.0
    Default Gateway . . . . . : 10.0.0.1
    DHCPv6 IAID . . . . . : 53745643
    DHCPv6 Client DUID. . . . . : 00-01-00-01-25-7C-72-C8-34-17-EB-BE-78-2F
    DNS Servers . . . . . : fec0:0:0:ffff::1%1
                           fec0:0:0:ffff::2%1
                           fec0:0:0:ffff::3%1
    NetBIOS over Tcpip. . . . . : Enabled

Ethernet adapter Ethernet 2:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : 
    Description . . . . . : TeamViewer VPN Adapter
    Physical Address. . . . . : 00-FF-80-DB-BF-F0
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes

C:\Users\Student>
```

Figure 2: Configuration of PC0

Figure 3 displays the information from PC1 where:

- IPv4 address is 12.0.0.2
- MAC address is 34-17-EB-BE-B1-C0

```
Ethernet adapter Ethernet:  
  
Connection-specific DNS Suffix . :  
Description . . . . . : Intel(R) 82579LM Gigabit Network Connection  
Physical Address. . . . . : 34-17-EB-BE-B1-C0  
DHCP Enabled. . . . . : No  
Autoconfiguration Enabled . . . . : Yes  
Link-local IPv6 Address . . . . . : fe80::c52b:7dff:ab:bdf1%15(Preferred)  
IPv4 Address. . . . . : 12.0.0.2(Preferred)  
Subnet Mask . . . . . : 255.0.0.0  
Default Gateway . . . . . : 12.0.0.1  
DHCPv6 IAID . . . . . : 53745643  
DHCPv6 Client DUID. . . . . : 00-01-00-01-25-7C-75-D3-34-17-EB-BE-B1-C0
```

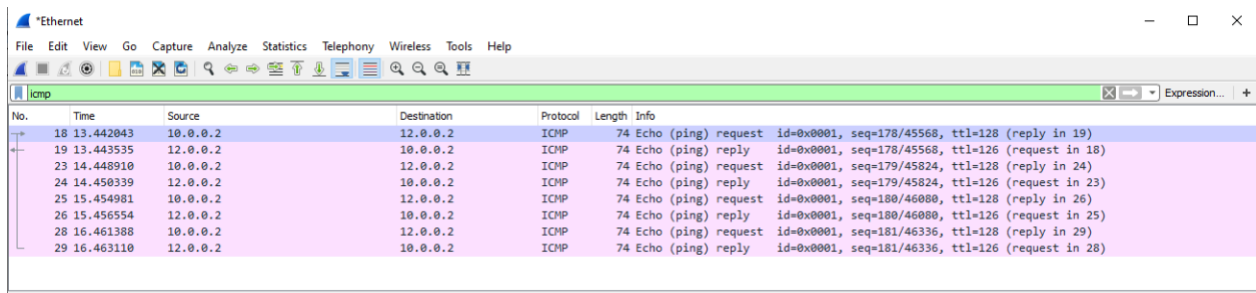
Figure 3: Configuration of PC1

To initiate communication between PC0 and PC1, PC0 sends packets of data to PC1 by deploying ping command. Figure 4 indicates that *ping 12.0.0.2* was issued from PC0 and that the data were transmitted successfully.

```
Command Prompt  
Approximate round trip times in milli-seconds:  
Minimum = 2ms, Maximum = 2ms, Average = 2ms  
  
C:\Users\Student>ping 12.0.0.2  
  
Pinging 12.0.0.2 with 32 bytes of data:  
Reply from 12.0.0.2: bytes=32 time=1ms TTL=126  
Reply from 12.0.0.2: bytes=32 time=1ms TTL=126  
Reply from 12.0.0.2: bytes=32 time=1ms TTL=126  
Reply from 12.0.0.2: bytes=32 time=1ms TTL=126  
  
Ping statistics for 12.0.0.2:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 1ms, Maximum = 1ms, Average = 1ms  
  
C:\Users\Student>ping 12.0.0.2  
  
Pinging 12.0.0.2 with 32 bytes of data:  
Reply from 12.0.0.2: bytes=32 time=1ms TTL=126  
Reply from 12.0.0.2: bytes=32 time=1ms TTL=126  
Reply from 12.0.0.2: bytes=32 time=1ms TTL=126  
Reply from 12.0.0.2: bytes=32 time=1ms TTL=126  
  
Ping statistics for 12.0.0.2:  
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
Minimum = 1ms, Maximum = 1ms, Average = 1ms  
  
C:\Users\Student>
```

Figure 4: PC0 sends data to PC1

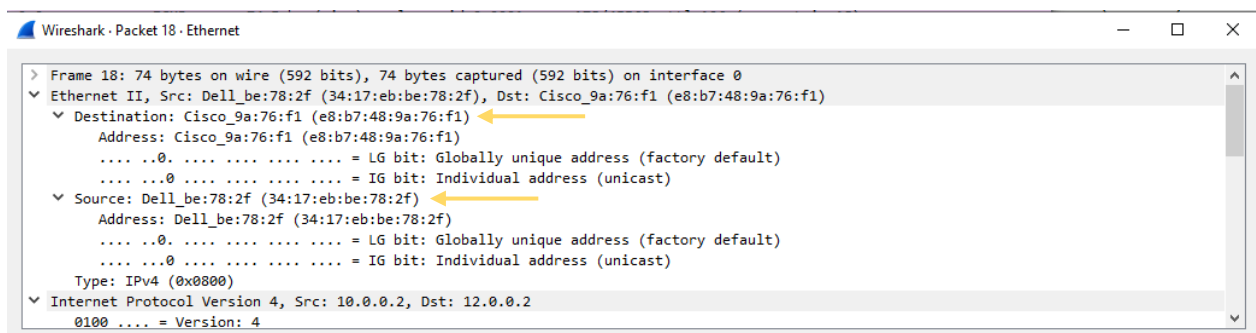
In Wireshark, a tool used for analyzing packets, information about packets sent from PC0 (10.0.0.2) to PC1 (12.0.0.2) were captured in the following figure.



No.	Time	Source	Destination	Protocol	Length	Info
18	13.442043	10.0.0.2	12.0.0.2	ICMP	74	Echo (ping) request id=0x0001, seq=178/45568, ttl=128 (reply in 19)
19	13.443935	12.0.0.2	10.0.0.2	ICMP	74	Echo (ping) reply id=0x0001, seq=178/45568, ttl=126 (request in 18)
23	14.448910	10.0.0.2	12.0.0.2	ICMP	74	Echo (ping) request id=0x0001, seq=179/45824, ttl=128 (reply in 24)
24	14.450339	12.0.0.2	10.0.0.2	ICMP	74	Echo (ping) reply id=0x0001, seq=179/45824, ttl=126 (request in 23)
25	15.454981	10.0.0.2	12.0.0.2	ICMP	74	Echo (ping) request id=0x0001, seq=180/46080, ttl=128 (reply in 26)
26	15.456554	12.0.0.2	10.0.0.2	ICMP	74	Echo (ping) reply id=0x0001, seq=180/46080, ttl=126 (request in 25)
28	16.461388	10.0.0.2	12.0.0.2	ICMP	74	Echo (ping) request id=0x0001, seq=181/46336, ttl=128 (reply in 29)
29	16.463110	12.0.0.2	10.0.0.2	ICMP	74	Echo (ping) reply id=0x0001, seq=181/46336, ttl=126 (request in 28)

Figure 5: Packets travel between PC0 and PC1 captured in Wireshark on PC0

In Packet 18 (request to PC1), the source MAC address 34:17:eb:be:78:2f is that of PC0 and the destination MAC address e8:b7:48:9a:76:f1 is that of Router0, the default gateway of PC0. Since PC1 is on a remote network, the packets must be forwarded from the default gateway of local host.

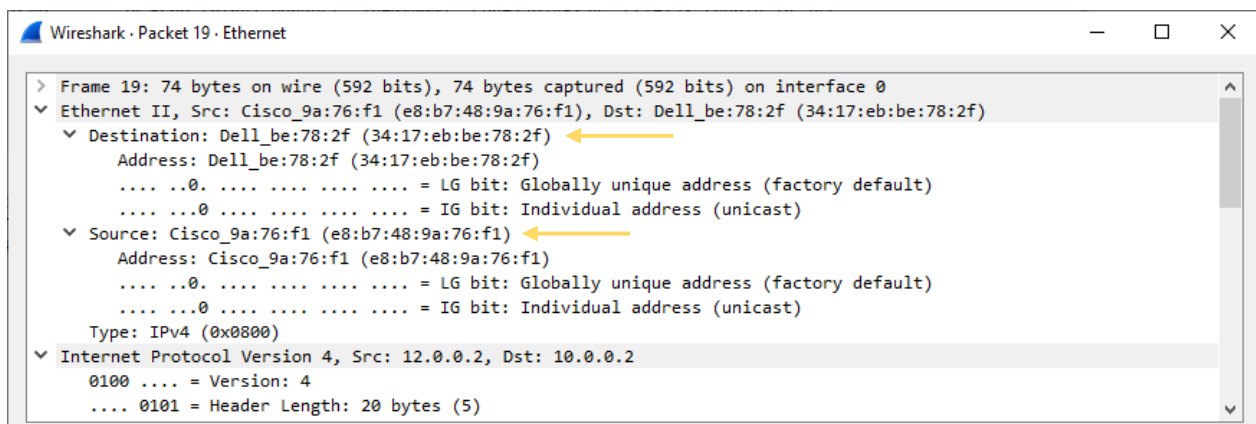


```

> Frame 18: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface 0
  Ethernet II, Src: Dell_be:78:2f (34:17:eb:be:78:2f), Dst: Cisco_9a:76:f1 (e8:b7:48:9a:76:f1)
    Destination: Cisco_9a:76:f1 (e8:b7:48:9a:76:f1)
      Address: Cisco_9a:76:f1 (e8:b7:48:9a:76:f1)
      ... ..0. .... = LG bit: Globally unique address (factory default)
      ... ..0. .... = IG bit: Individual address (unicast)
    Source: Dell_be:78:2f (34:17:eb:be:78:2f)
      Address: Dell_be:78:2f (34:17:eb:be:78:2f)
      ... ..0. .... = LG bit: Globally unique address (factory default)
      ... ..0. .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
  Internet Protocol Version 4, Src: 10.0.0.2, Dst: 12.0.0.2
    0100 .... = Version: 4
  
```

Figure 6: Source and destination MAC addresses indicate that packets traveled from PC0 to Router0

In Packet 19 (reply from PC1), the source MAC address e8:b7:48:9a:76:f1 is that of Router1 while the destination MAC address is that of PC0.

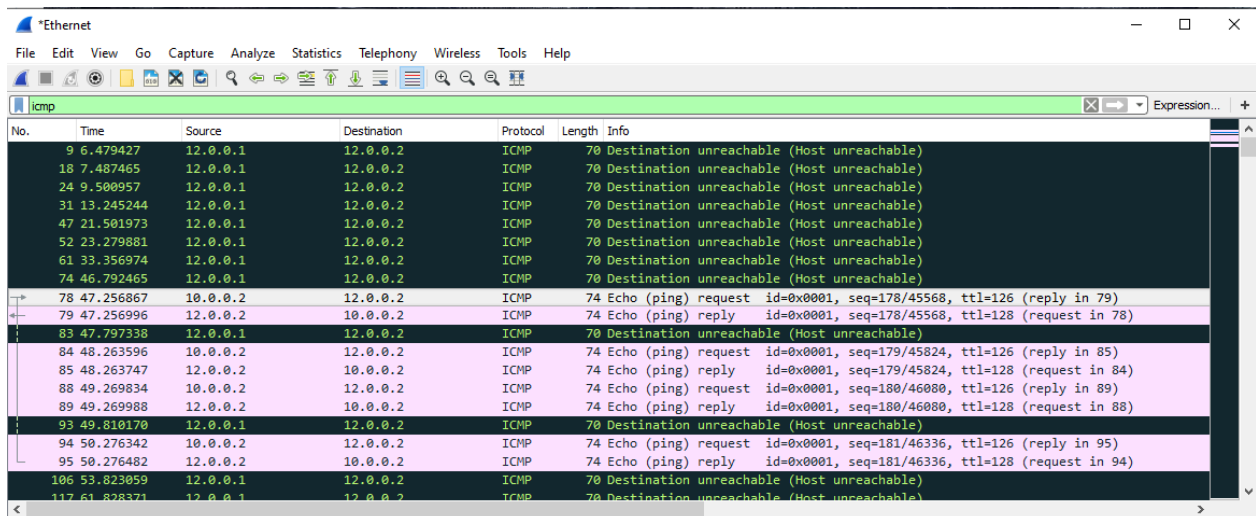


```

> Frame 19: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface 0
  Ethernet II, Src: Cisco_9a:76:f1 (e8:b7:48:9a:76:f1), Dst: Dell_be:78:2f (34:17:eb:be:78:2f)
    Destination: Dell_be:78:2f (34:17:eb:be:78:2f)
      Address: Dell_be:78:2f (34:17:eb:be:78:2f)
      ... ..0. .... = LG bit: Globally unique address (factory default)
      ... ..0. .... = IG bit: Individual address (unicast)
    Source: Cisco_9a:76:f1 (e8:b7:48:9a:76:f1)
      Address: Cisco_9a:76:f1 (e8:b7:48:9a:76:f1)
      ... ..0. .... = LG bit: Globally unique address (factory default)
      ... ..0. .... = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
  Internet Protocol Version 4, Src: 12.0.0.2, Dst: 10.0.0.2
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  
```

Figure 7: Source and destination MAC addresses indicate that packets traveled from Router1 to PC0

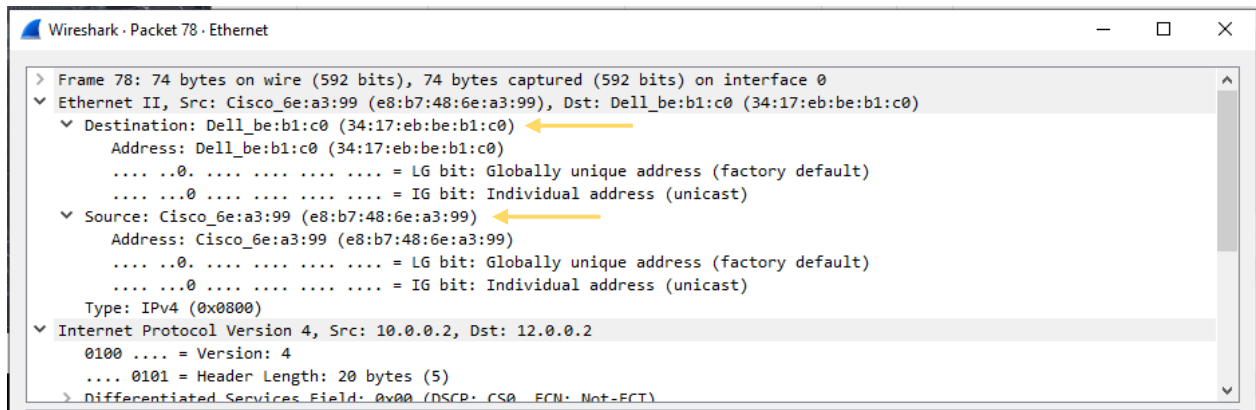
Let's examine the MAC address captured from PC1. The following figure displays packets captured between PC0 and PC1.



No.	Time	Source	Destination	Protocol	Length	Info
9	6.479427	12.0.0.1	12.0.0.2	ICMP	70	Destination unreachable (Host unreachable)
18	7.487465	12.0.0.1	12.0.0.2	ICMP	70	Destination unreachable (Host unreachable)
24	9.500957	12.0.0.1	12.0.0.2	ICMP	70	Destination unreachable (Host unreachable)
31	13.245244	12.0.0.1	12.0.0.2	ICMP	70	Destination unreachable (Host unreachable)
47	21.501973	12.0.0.1	12.0.0.2	ICMP	70	Destination unreachable (Host unreachable)
52	23.279881	12.0.0.1	12.0.0.2	ICMP	70	Destination unreachable (Host unreachable)
61	33.356974	12.0.0.1	12.0.0.2	ICMP	70	Destination unreachable (Host unreachable)
74	46.792465	12.0.0.1	12.0.0.2	ICMP	70	Destination unreachable (Host unreachable)
78	47.256867	10.0.0.2	12.0.0.2	ICMP	74	Echo (ping) request id=0x0001, seq=178/45568, ttl=126 (reply in 79)
79	47.256996	12.0.0.2	10.0.0.2	ICMP	74	Echo (ping) reply id=0x0001, seq=178/45568, ttl=128 (request in 78)
83	47.797338	12.0.0.1	12.0.0.2	ICMP	70	Destination unreachable (Host unreachable)
84	48.263596	10.0.0.2	12.0.0.2	ICMP	74	Echo (ping) request id=0x0001, seq=179/45824, ttl=126 (reply in 85)
85	48.263747	12.0.0.2	10.0.0.2	ICMP	74	Echo (ping) reply id=0x0001, seq=179/45824, ttl=128 (request in 84)
88	49.269834	10.0.0.2	12.0.0.2	ICMP	74	Echo (ping) request id=0x0001, seq=180/46080, ttl=126 (reply in 89)
89	49.269988	12.0.0.2	10.0.0.2	ICMP	74	Echo (ping) reply id=0x0001, seq=180/46080, ttl=128 (request in 88)
93	49.810170	12.0.0.1	12.0.0.2	ICMP	70	Destination unreachable (Host unreachable)
94	50.276342	10.0.0.2	12.0.0.2	ICMP	74	Echo (ping) request id=0x0001, seq=181/46336, ttl=126 (reply in 95)
95	50.276482	12.0.0.2	10.0.0.2	ICMP	74	Echo (ping) reply id=0x0001, seq=181/46336, ttl=128 (request in 94)
106	53.823059	12.0.0.1	12.0.0.2	ICMP	70	Destination unreachable (Host unreachable)
117	61.828371	12.0.0.1	12.0.0.2	ICMP	70	Destination unreachable (Host unreachable)

Figure 8: Packets travel between PC0 and PC1 captured in Wireshark on PC1

In Packet 78 (request from PC0), the source MAC address e8:b7:48:6e:a3:99 is an unknown address which is likely be that of Router1 and the destination MAC address 34:17:eb:be:b1:c0 is that of PC1.



```

Wireshark · Packet 78 · Ethernet
> Frame 78: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface 0
  Ethernet II, Src: Cisco_6e:a3:99 (e8:b7:48:6e:a3:99), Dst: Dell_be:b1:c0 (34:17:eb:be:b1:c0)
    Destination: Dell_be:b1:c0 (34:17:eb:be:b1:c0)
      Address: Dell_be:b1:c0 (34:17:eb:be:b1:c0)
      ... .. = LG bit: Globally unique address (factory default)
      ... .. = IG bit: Individual address (unicast)
    Source: Cisco_6e:a3:99 (e8:b7:48:6e:a3:99)
      Address: Cisco_6e:a3:99 (e8:b7:48:6e:a3:99)
      ... .. = LG bit: Globally unique address (factory default)
      ... .. = IG bit: Individual address (unicast)
    Type: IPv4 (0x0800)
  Internet Protocol Version 4, Src: 10.0.0.2, Dst: 12.0.0.2
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    > Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
  
```

Figure 9: Source and destination MAC addresses indicate that packets traveled from Router1 to PC1

In Packet 79 (reply from PC1), the source MAC address 34:17:eb:be:b1:c0 is that of PC1 and the destination MAC address e8:b7:48:6e:a3:99 is that of Router1.

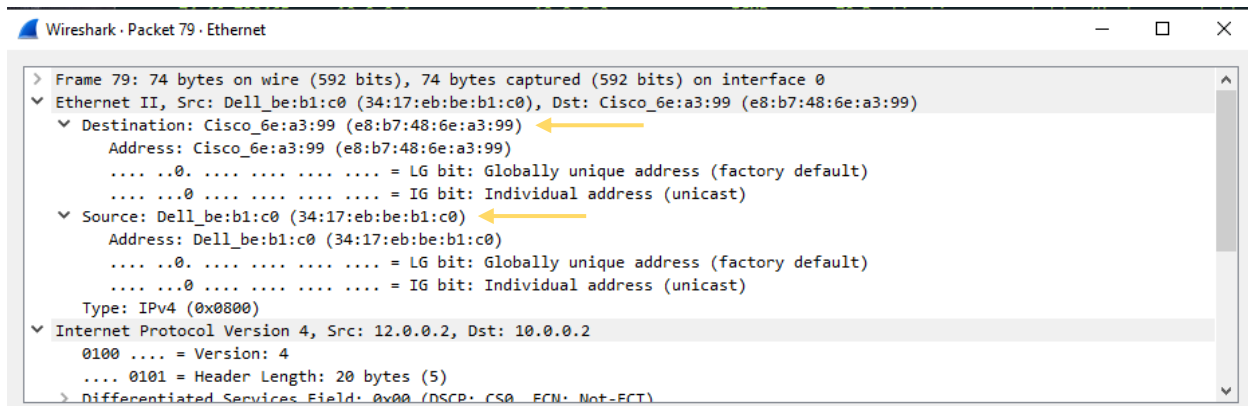


Figure 10: Source and destination MAC addresses indicate that packets traveled from PC1 to Router1

The screenshots of evidence documented in the report indicate that packets do not travel between the two hosts directly because the two hosts are in different networks.

The following process flow diagram briefly illustrates how packets travel from PC0 to PC1. The source and destination MAC addresses change constantly according to which node serves as the source and which node serves as the destination.

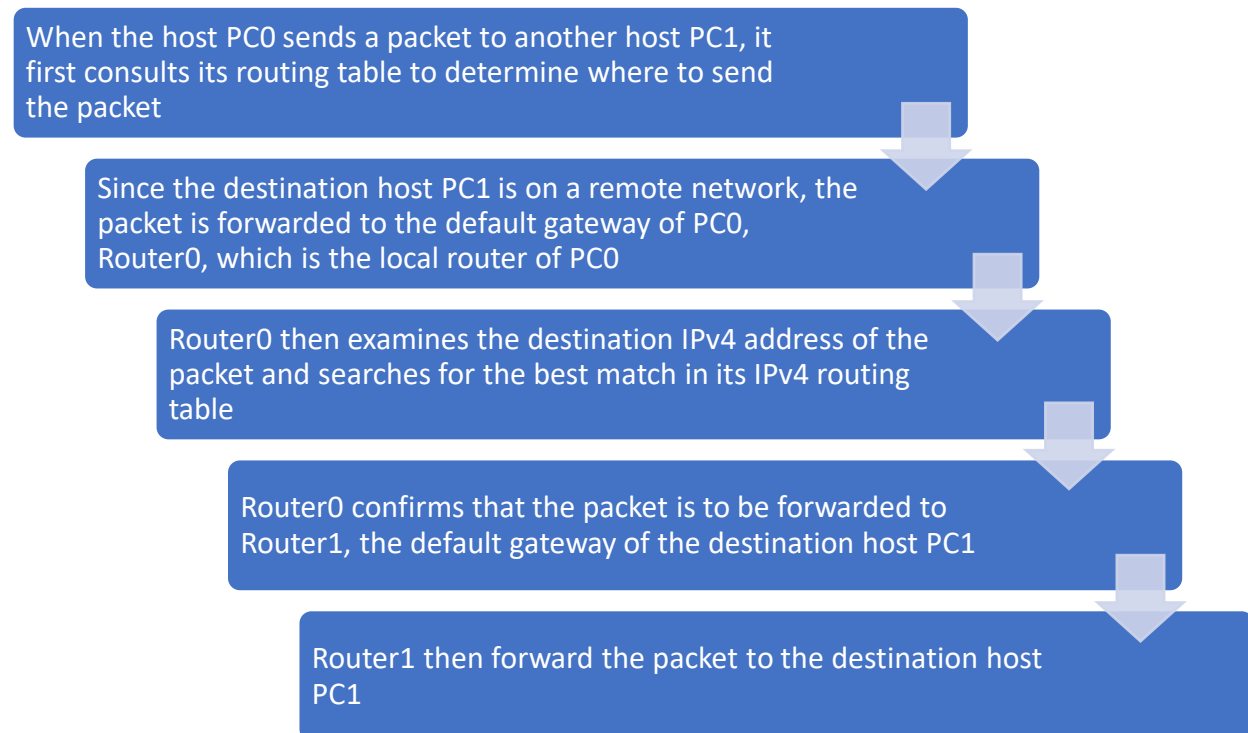


Figure 11: Process flow diagram of packets traveling from PC0 to PC1