Troubleshooting Basic Connectivity

Interconnecting Cisco Networking Devices, Part 2 (ICND2) v2.0

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Troubleshooting IPv4 Network Connectivity

Troubleshooting Basic Connectivity

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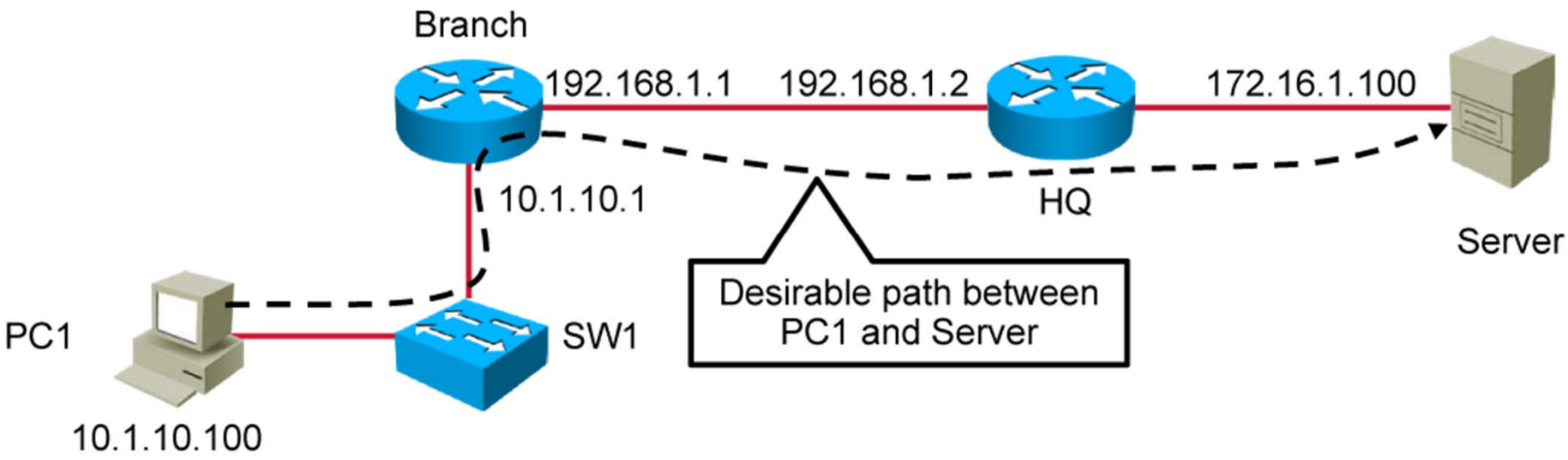
Components of Troubleshooting End-to-End Connectivity



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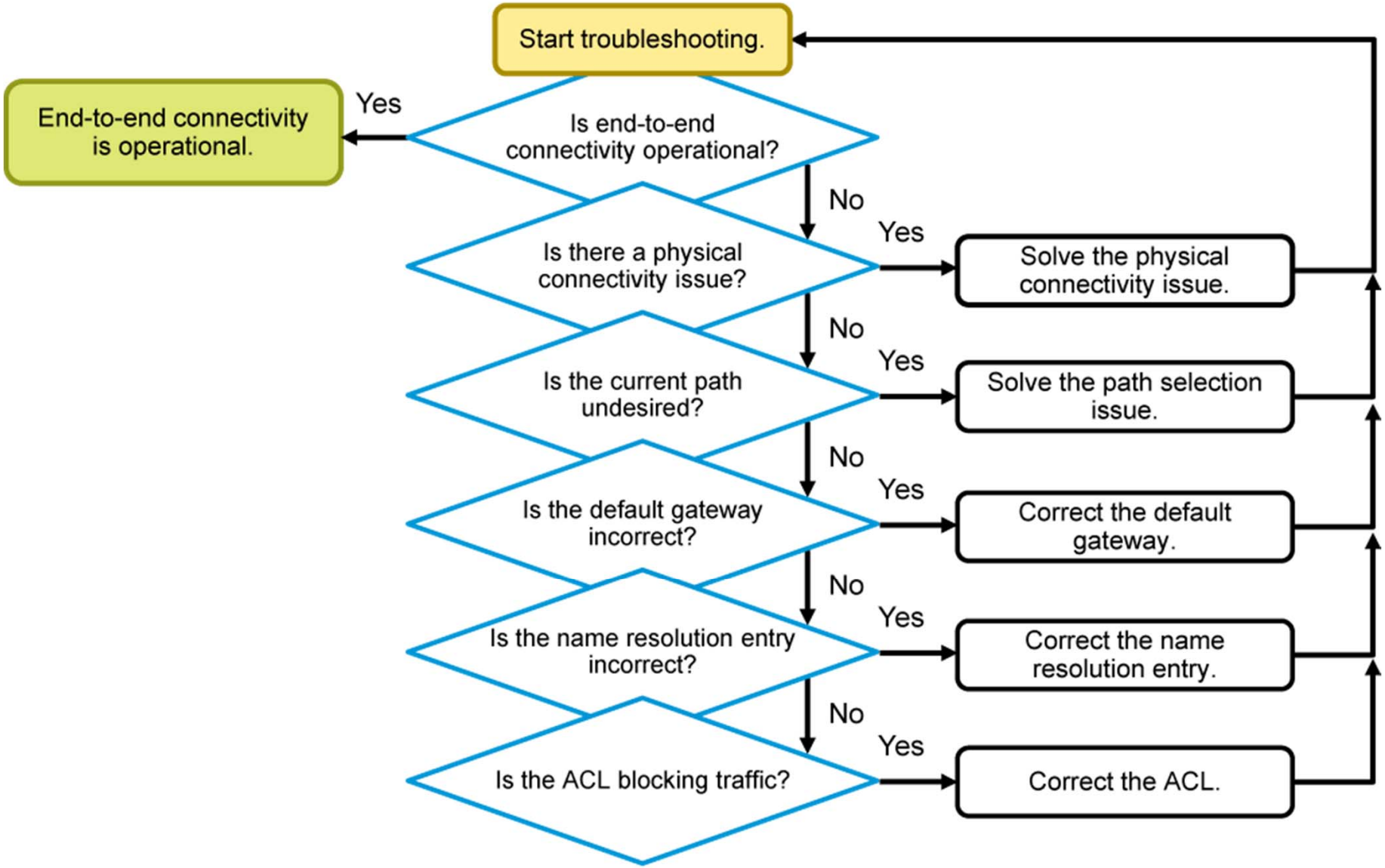
Components of Troubleshooting End-to-End Connectivity (Cont.)



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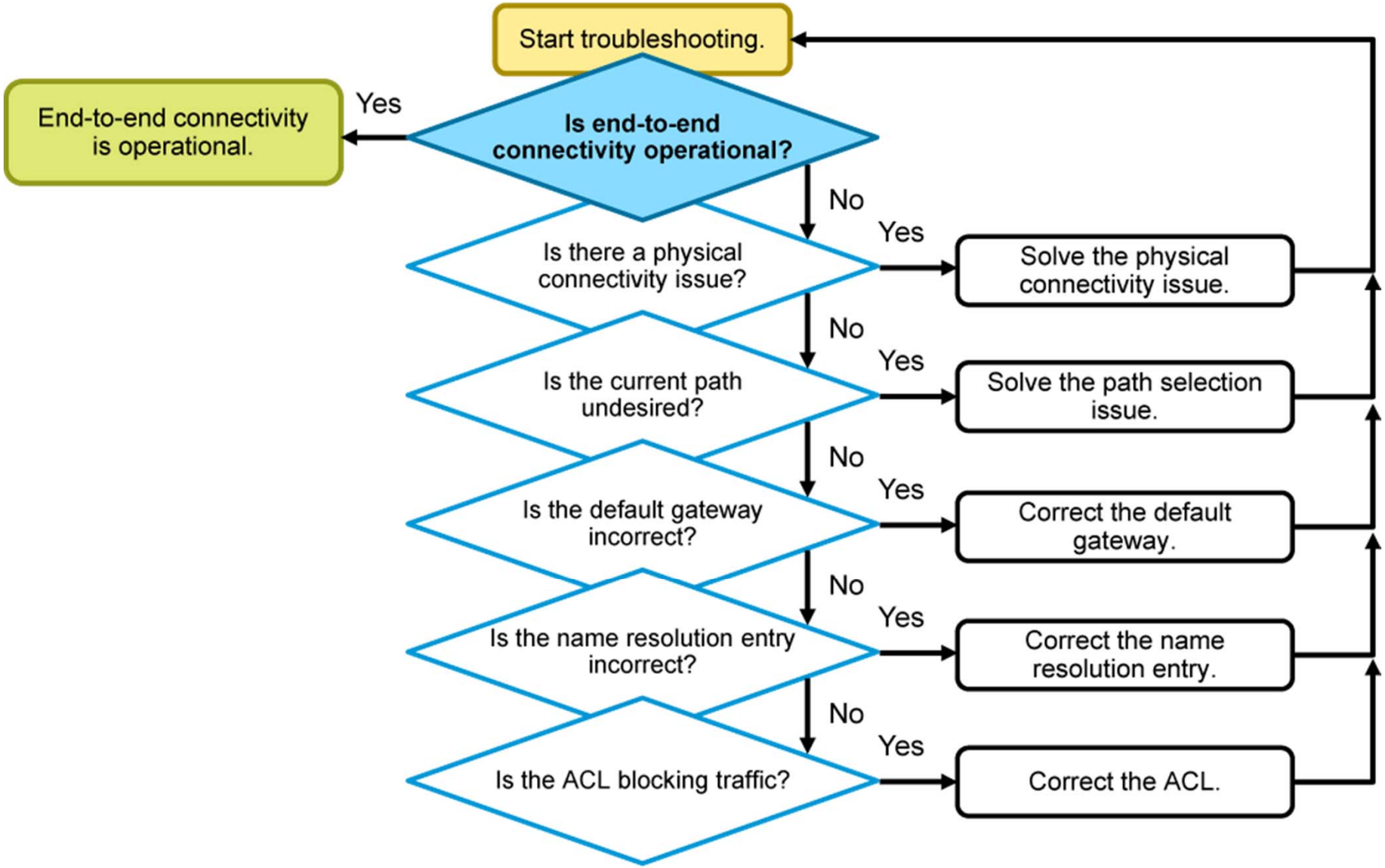
Verification of End-to-End Connectivity



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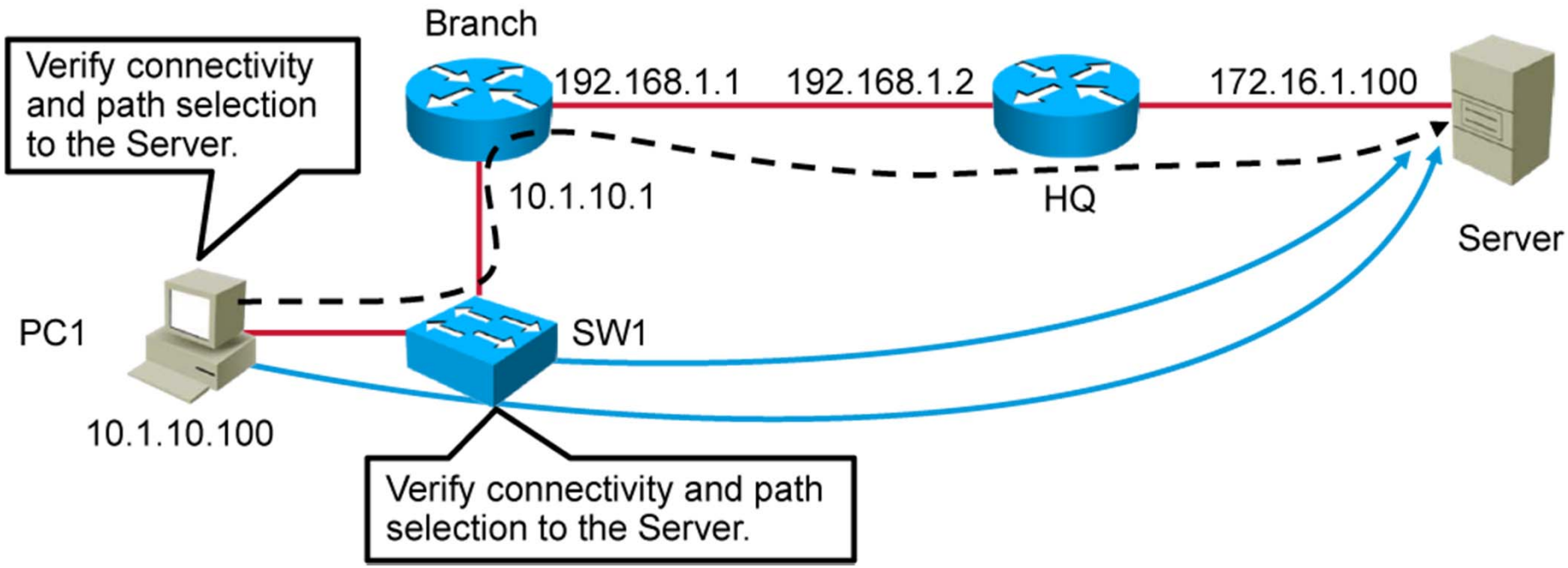
Verification of End-to-End Connectivity (Cont.)



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Verification of End-to-End Connectivity (Cont.)

```
C:\Windows\system32>ping 172.16.1.100

Pinging 172.16.1.100 with 32 bytes of data:
Reply from 172.16.1.100: bytes=32 time=8ms TTL=254
Reply from 172.16.1.100: bytes=32 time=1ms TTL=254
Reply from 172.16.1.100: bytes=32 time=1ms TTL=254
Reply from 172.16.1.100: bytes=32 time=1ms TTL=254

Ping statistics for 172.16.1.100:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round-trip times in milliseconds:
    Minimum = 1ms, Maximum = 8ms, Average = 2ms
```

- Successful ping from PC1

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Verification of End-to-End Connectivity (Cont.)

```
C:\Windows\system32>tracert 172.16.1.100

Tracing route to 172.16.1.100 over a maximum of 30 hops

  1     1 ms    <1 ms    <1 ms  10.1.10.1
  2    10 ms     2 ms     1 ms  192.168.1.2
  3    13 ms     2 ms     1 ms  172.16.1.100

Trace complete.
```

- Successful trace from PC1

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Verification of End-to-End Connectivity (Cont.)

```
SW1#ping 172.16.1.100

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.100, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/4/9 ms
```

- Successful ping from switch

```
SW1#traceroute 172.16.1.100

Type escape sequence to abort.
Tracing the route to 172.16.1.100

  1 10.1.1.1 0 msec 0 msec 0 msec
  2 192.168.1.2 1 msec 1 msec  1 msec
  3 172.16.1.100 1 msec 1 msec 1 msec
```

- Successful trace from switch

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Verification of End-to-End Connectivity (Cont.)

The **telnet** command can be used to test transport layer connectivity for any port.

```
SW1#telnet 172.16.1.100
Trying 172.16.1.100 ... Open
```

- Use Telnet to connect to the standard Telnet TCP port.

```
SW1#telnet 172.16.1.100 80
Trying 172.16.1.100, 80 ... Open
```

- Using Telnet to connect to TCP port 80 tests availability of the HTTP service.

```
SW1#telnet 172.16.1.100 25
Trying 172.16.1.100, 25 ...
Percent connection refused by remote host
```

- Using Telnet to connect to TCP port 25 tests availability of the SMTP service.

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Verification of End-to-End Connectivity (Cont.)

```
C:\Windows\system32>arp -a
Interface: 10.1.10.100 --- 0xd
  Internet Address      Physical Address      Type
  10.1.10.1             54-75-d0-8e-9a-d8     dynamic
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.252           01-00-5e-00-00-fc     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static
```

- Host-based tool: **arp**

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Verification of End-to-End Connectivity (Cont.)

```
SW1#show mac address-table
          Mac Address Table
-------------------------------------------
Vlan    Mac Address       Type        Ports
 All    0100.0ccc.cccc    STATIC      CPU
 All    0100.0ccc.cccd    STATIC      CPU
   1    5475.d08e.9ad8    DYNAMIC     Fa0/13
  10    000c.29bc.4654    DYNAMIC     Fa0/1
  10    000f.34f9.9201    DYNAMIC     Fa0/1
  10    5475.d08e.9ad8    DYNAMIC     Fa0/13
Total Mac Addresses for this criterion: 6
```

- Switch tool: **show mac address-table**

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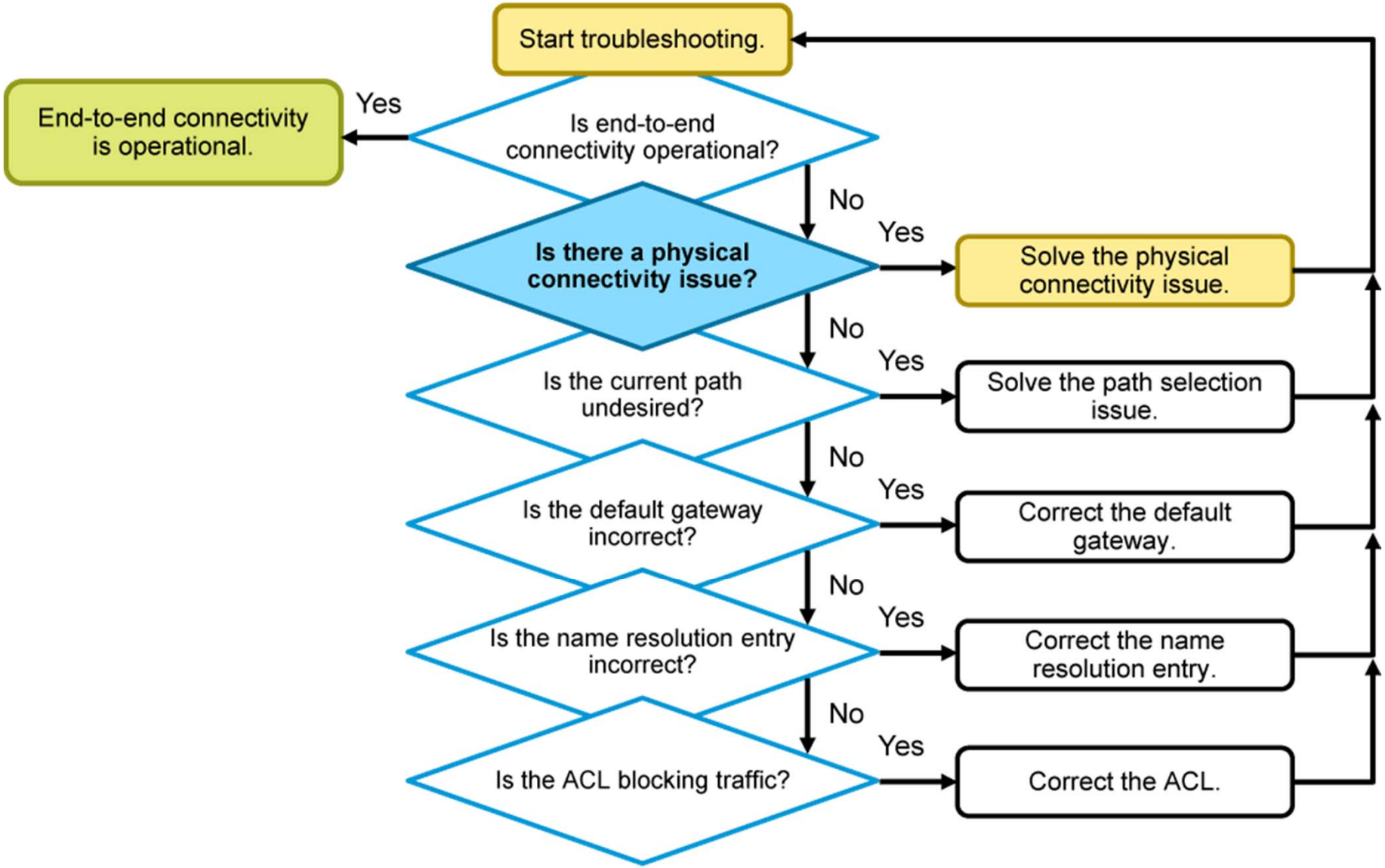
Verification of Physical Connectivity Issue



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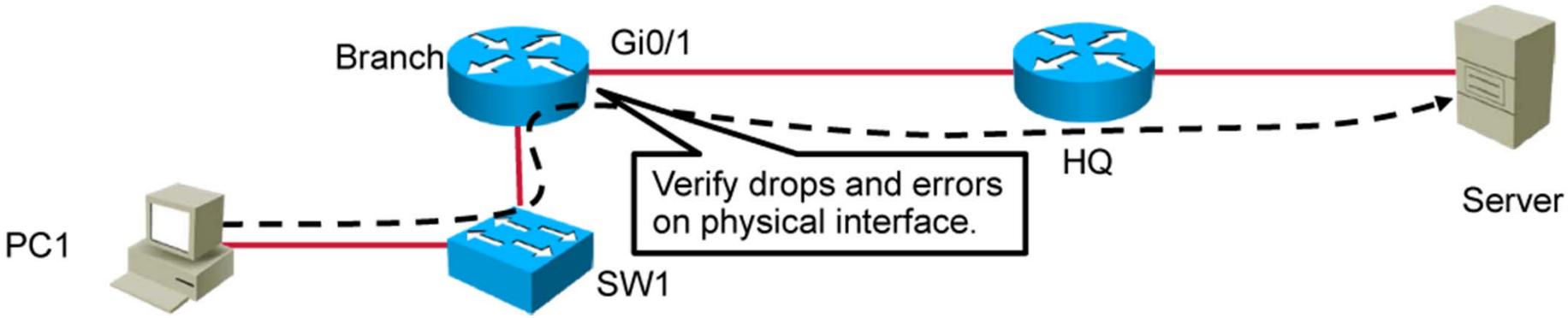
Verification of Physical Connectivity Issue (Cont.)




```
Branch#show interfaces GigabitEthernet 0/1
GigabitEthernet0/1 is up, line protocol is up
<output omitted>
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
 <output omitted>
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
 <output omitted>
     0 output errors, 0 collisions, 1 interface resets
     0 unknown protocol drops
```

- Displays drops and errors on physical interface

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Verification of Physical Connectivity Issue (Cont.)

- A common cause for performance problems in Ethernet-based networks is a duplex or speed mismatch between two ends of a link.
- Duplex configuration guidelines:
  - Point-to-point Ethernet links should always run in full-duplex mode.
  - Half-duplex is not common anymore and mostly encountered if hubs are used.
  - Autonegotiation of speed and duplex is recommended on ports connected to noncritical end points.
  - Manually set the speed and duplex on links between networking devices and ports connected to critical end points.
  - Half-duplex on both ends performs better than a duplex mismatch.

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Verification of Physical Connectivity Issue (Cont.)

```
SW1#show interfaces FastEthernet 0/1
FastEthernet0/1 is up, line protocol is up (connected)
  Hardware is Fast Ethernet, address is 0017.0e6c.8e81 (bia 0017.0e6c.8e81)
  <output omitted>
  Full-duplex, 100Mb/s, media type is 10/100BaseTX
   <output omitted>
```

- Displays duplex and speed settings

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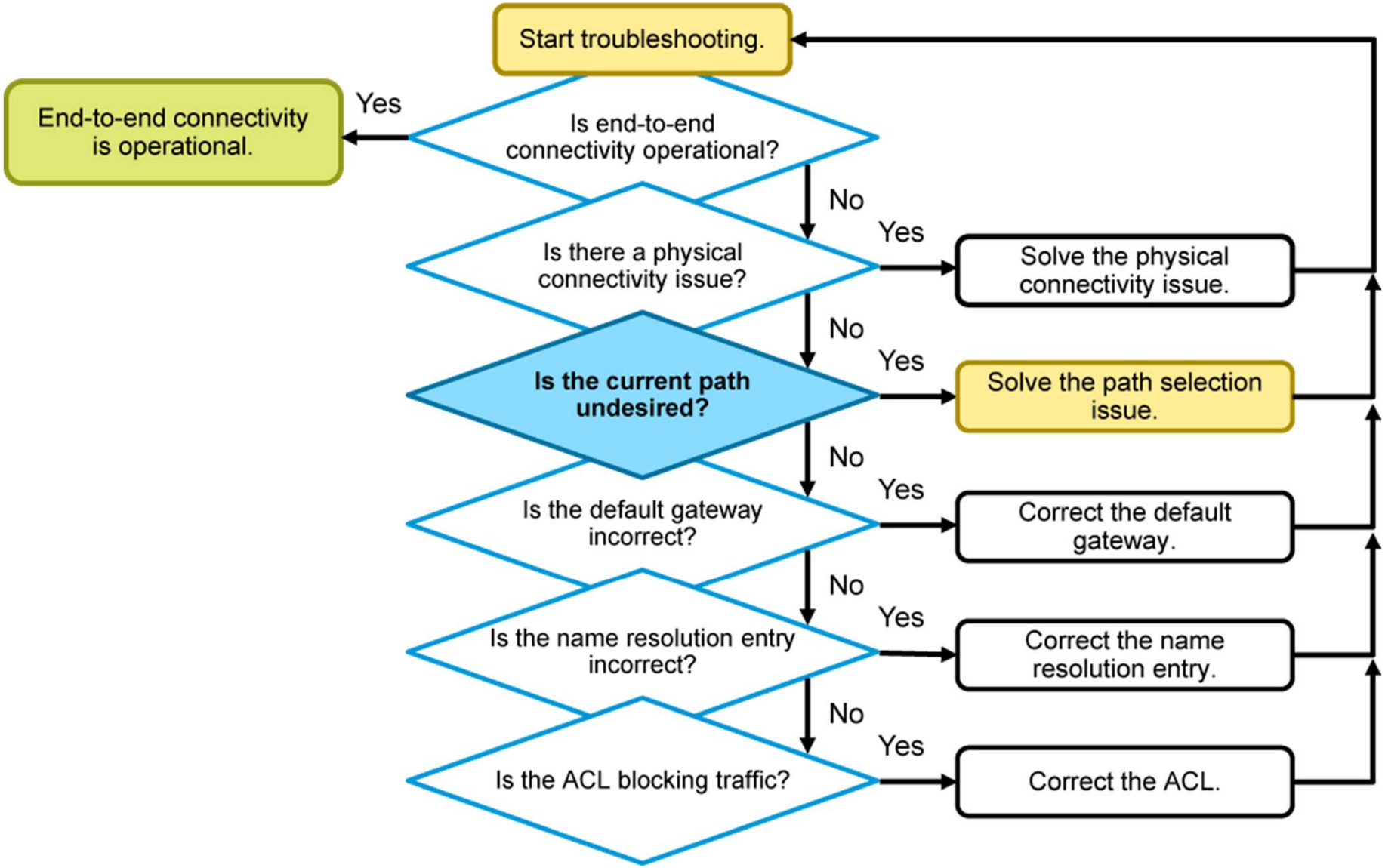
Identification of Current and Desired Path



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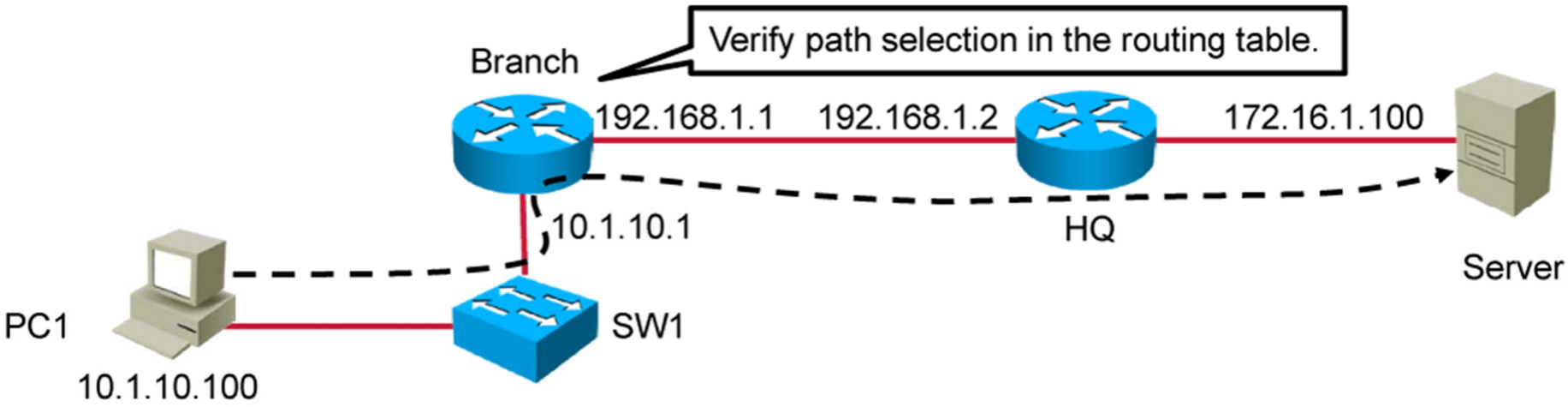
Identification of Current and Desired Path (Cont.)




```
Branch#show ip route
<output omitted>
C        10.1.10.0/24 is directly connected, GigabitEthernet0/0.10
L        10.1.10.1/32 is directly connected, GigabitEthernet0/0.10
C        10.1.20.0/24 is directly connected, GigabitEthernet0/0.20
L        10.1.20.1/32 is directly connected, GigabitEthernet0/0.20
      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C        192.168.1.0/24 is directly connected, GigabitEthernet0/1
L        192.168.1.1/32 is directly connected, GigabitEthernet0/1
```

- Displays routing table

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Identification of Current and Desired Path (Cont.)

- **Directly connected:** Router attaches to this network
- **Local host routes:** Local IP address on the router interface
- **Static routing:** Entered manually by a system administrator
- **Dynamic routing:** Learned by exchange of routing information
- **Default route:** Statically or dynamically learned—used when no explicit route to network is known

```
Router#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su- IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static
route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       + - replicated route, % - next hop override
<output omitted>
```

- Displays routing table codes

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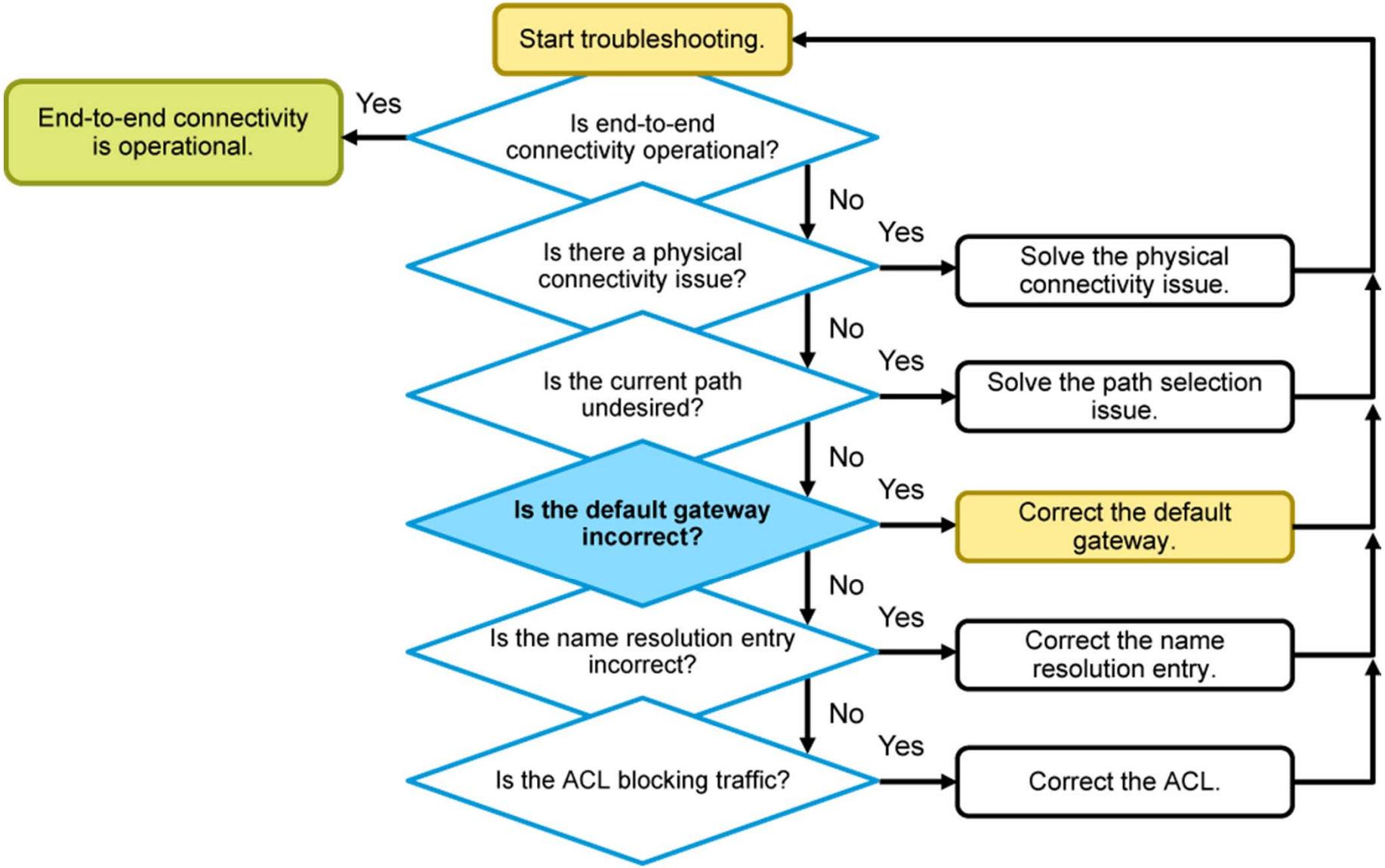
Default Gateway Issues



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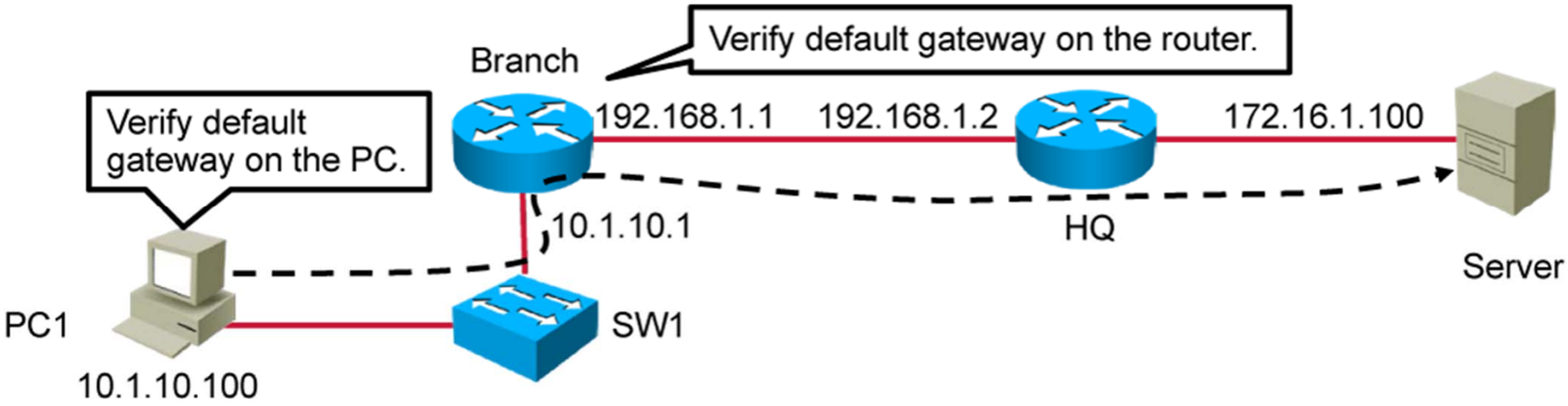
Default Gateway Issues (Cont.)




```
Branch#show ip route
<output omitted>
Gateway of last resort is 192.168.1.2 to network 0.0.0.0
S*    0.0.0.0/0 [1/0] via 192.168.1.2
      10.0.0.0/8 is variably subnetted, 6 subnets, 2 masks
<output omitted>
```

- Correctly set default gateway on the router

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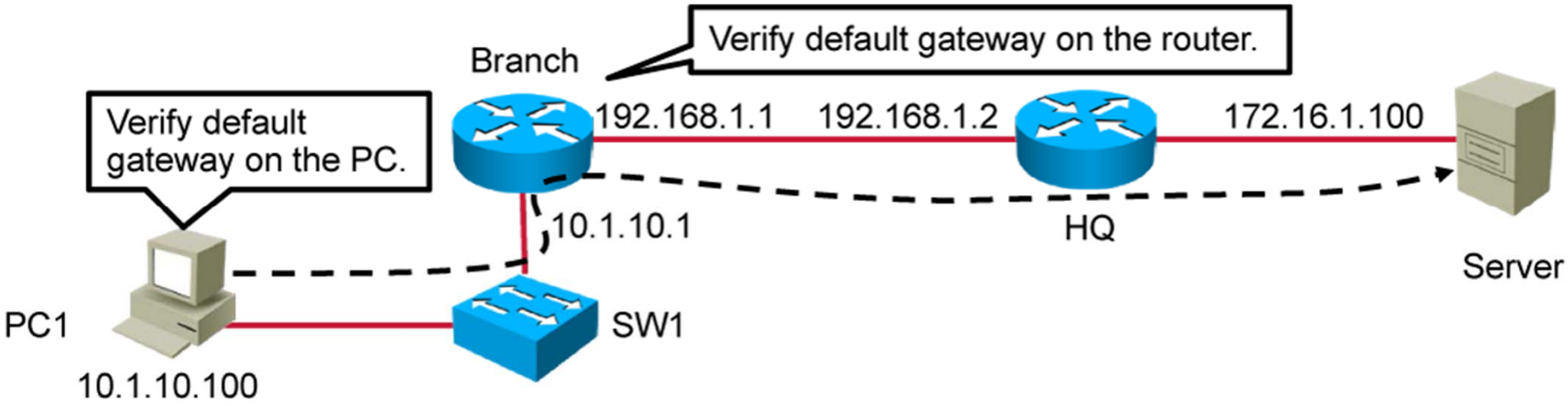
Default Gateway Issues (Cont.)




```
C:\Windows\system32>route print
<output omitted>
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0      10.2.10.1      10.1.10.100      11
<output omitted>
```

- Incorrectly set default gateway on the host

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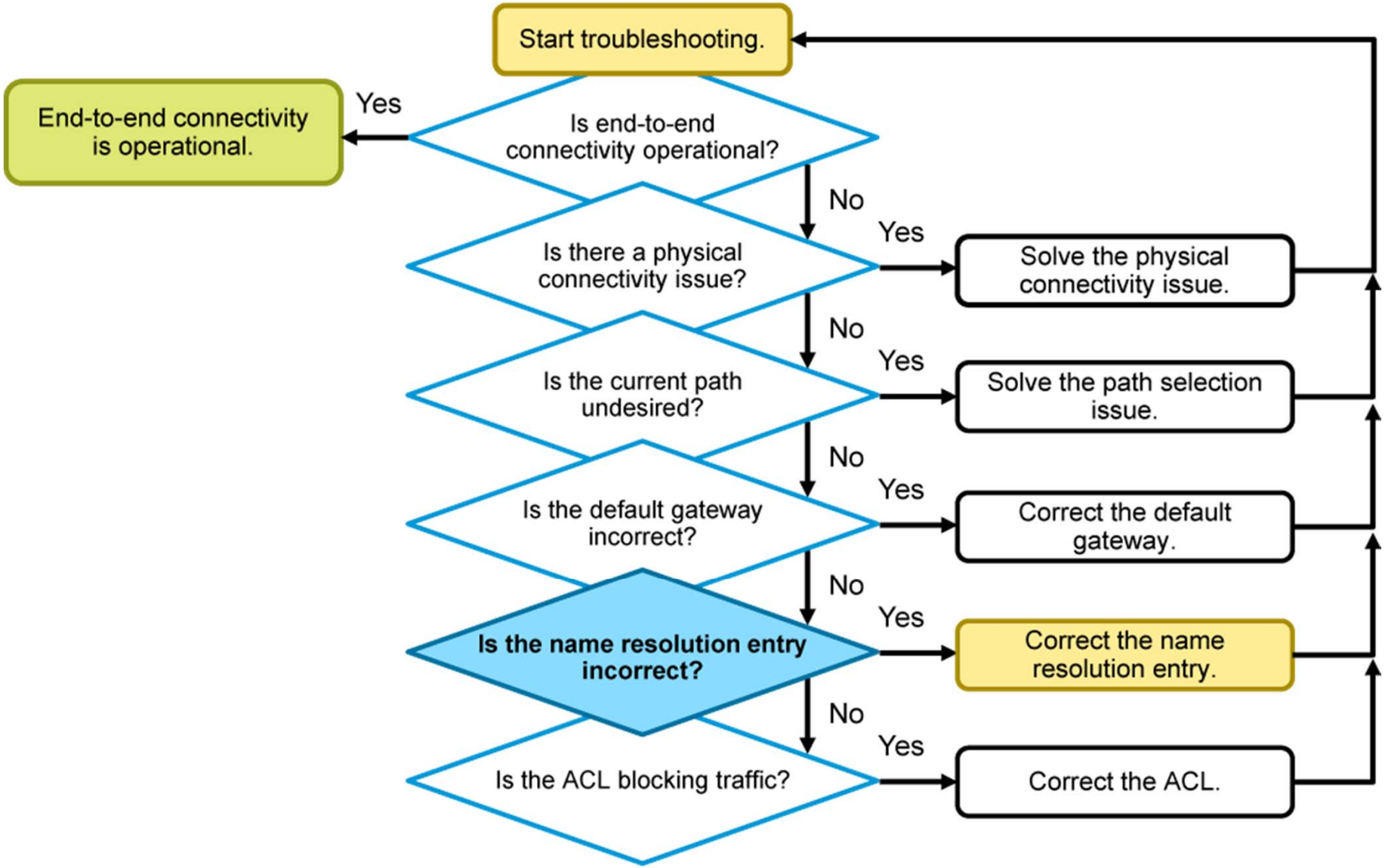
Name Resolution Issues



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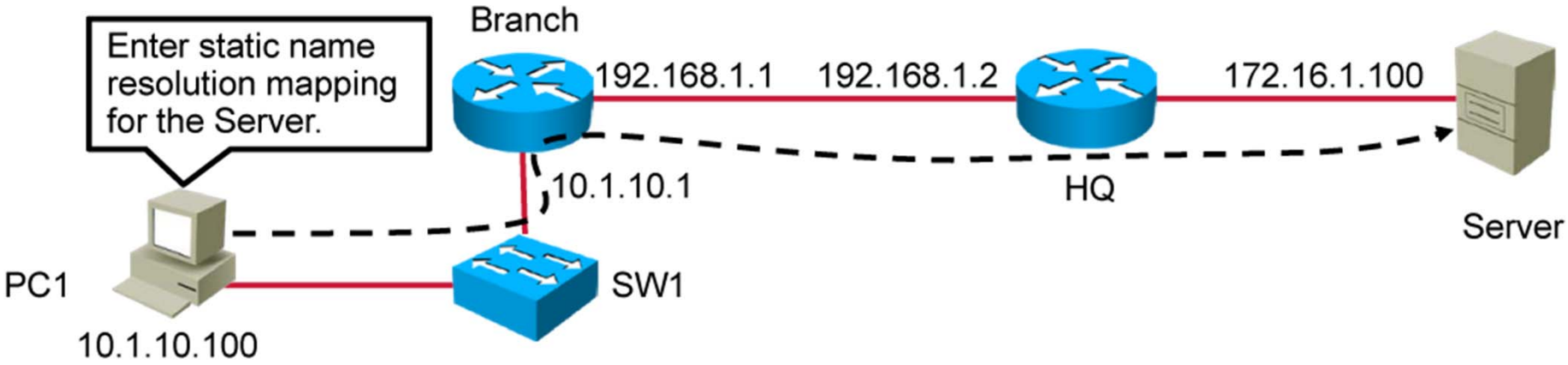
Name Resolution Issues (Cont.)




```
172.16.1.100      Server
```

- Enter name for IP mapping in the hosts file on the PC.

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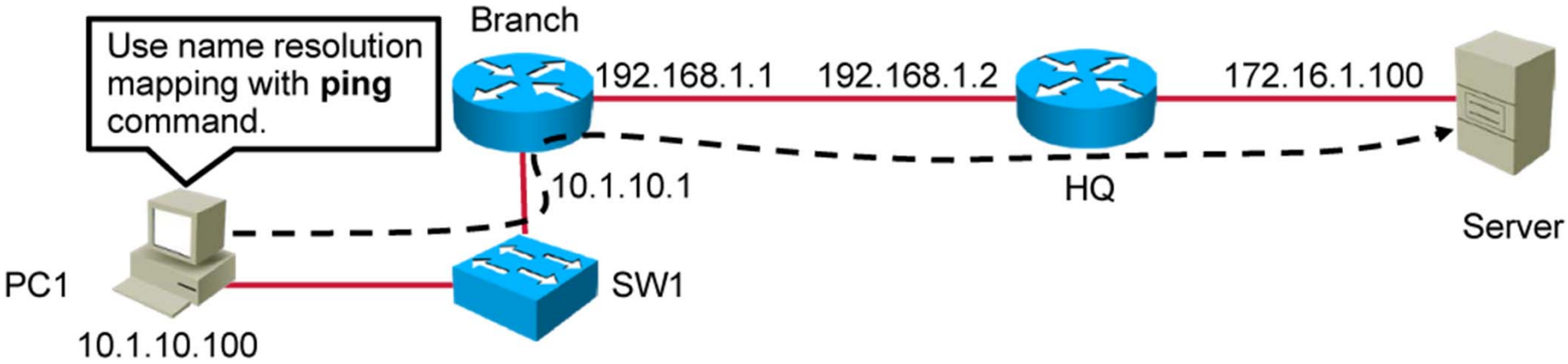
Name Resolution Issues (Cont.)




```
C:\Windows\system32>ping Server
Pinging Server [172.16.1.100] with 32 bytes of data:
Reply from 172.16.1.100: bytes=32 time=47ms TTL=254
Reply from 172.16.1.100: bytes=32 time=36ms TTL=254
Reply from 172.16.1.100: bytes=32 time=36ms TTL=254
Reply from 172.16.1.100: bytes=32 time=36ms TTL=254
Ping statistics for 172.16.1.100:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 36ms, Maximum = 47ms, Average = 38ms
```

- Verifies connectivity of the server, using the **ping** command and the host name as the destination

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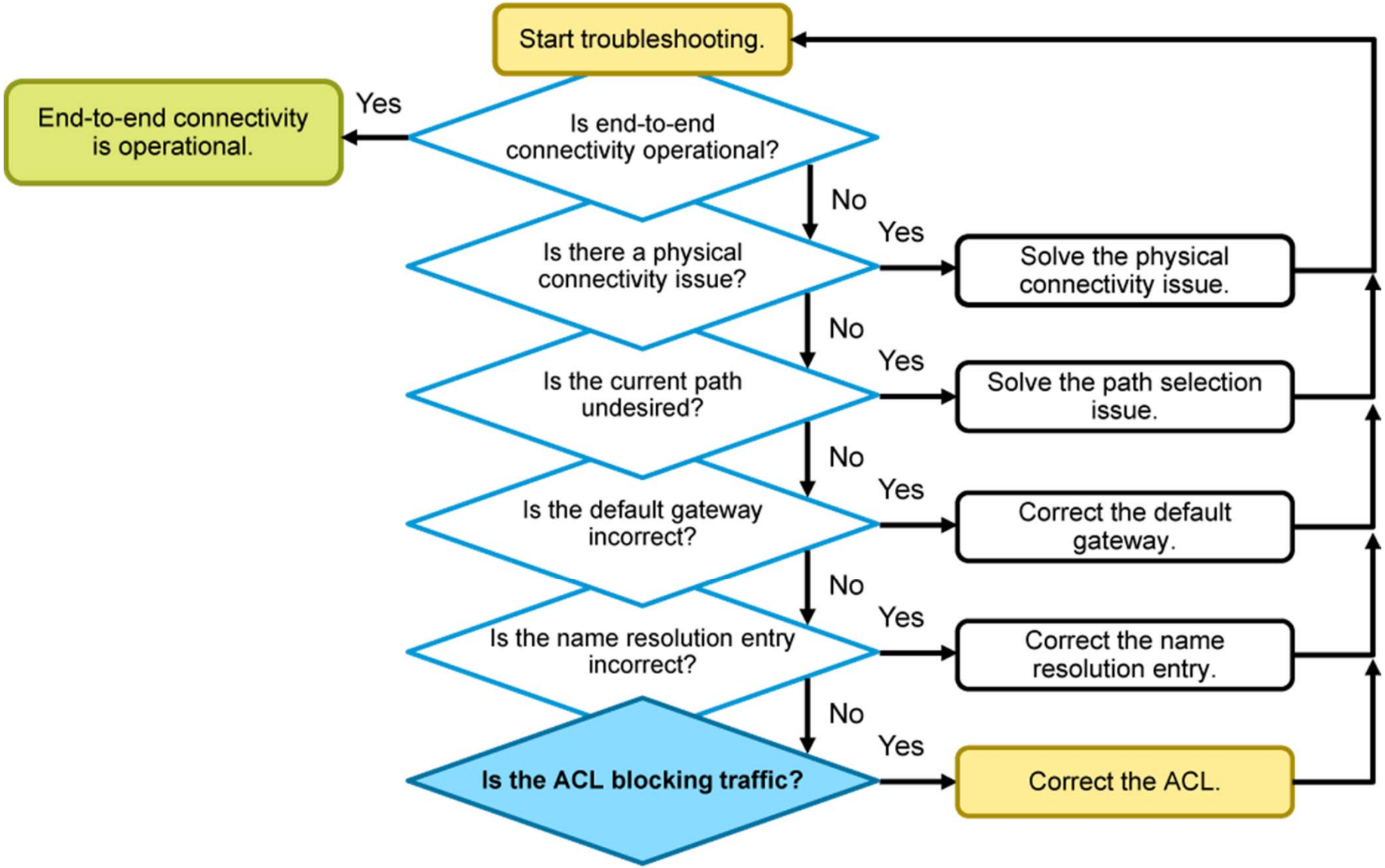
ACL Issues



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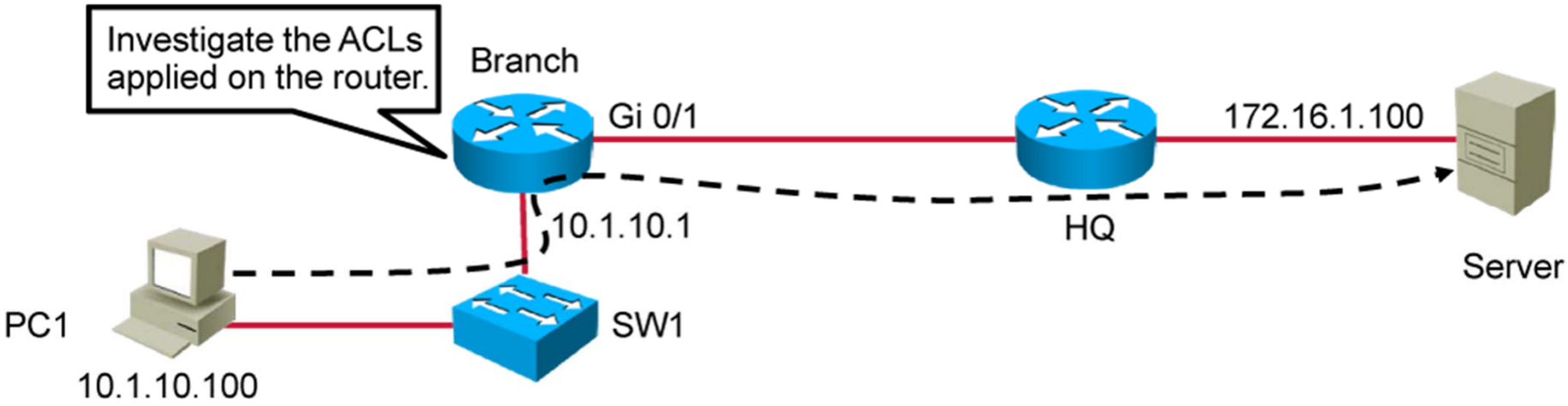
ACL Issues (Cont.)




```
Branch#show ip access-lists
Extended IP access list Outbound
    10 permit icmp any any (5 matches)
```

- Displays ACLs that are configured on the router. In this example, there is an ACL named "Outbound" that is implicitly denying Telnet.

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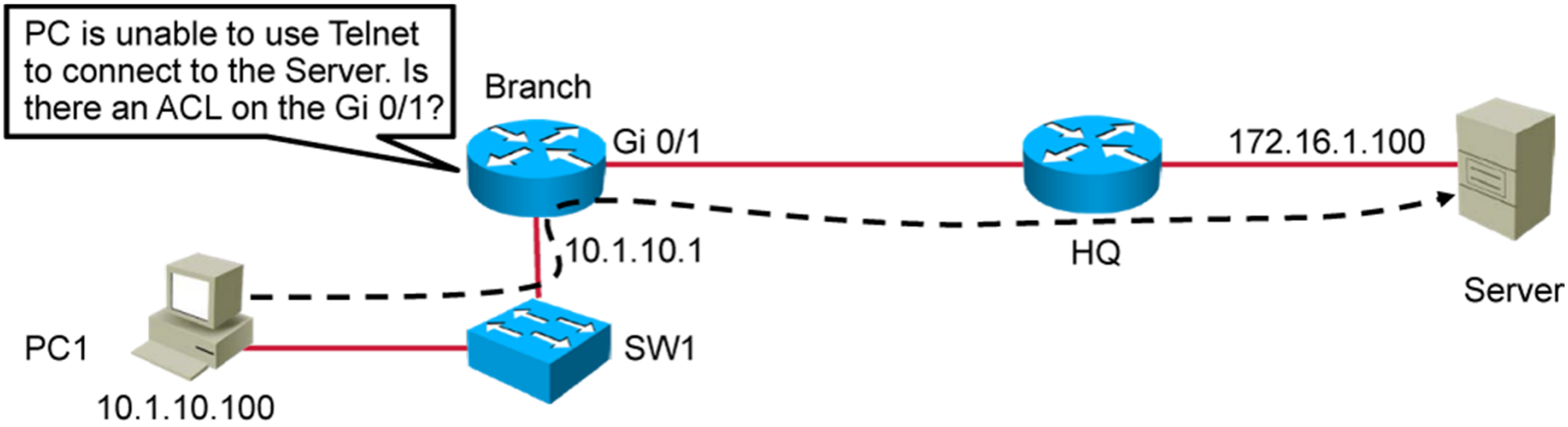
ACL Issues (Cont.)




```
Branch#show ip interface GigabitEthernet 0/1 | include access list
  Outgoing access list is Outbound
  Inbound  access list is not set
```

- Displays placement of the ACL on the interface

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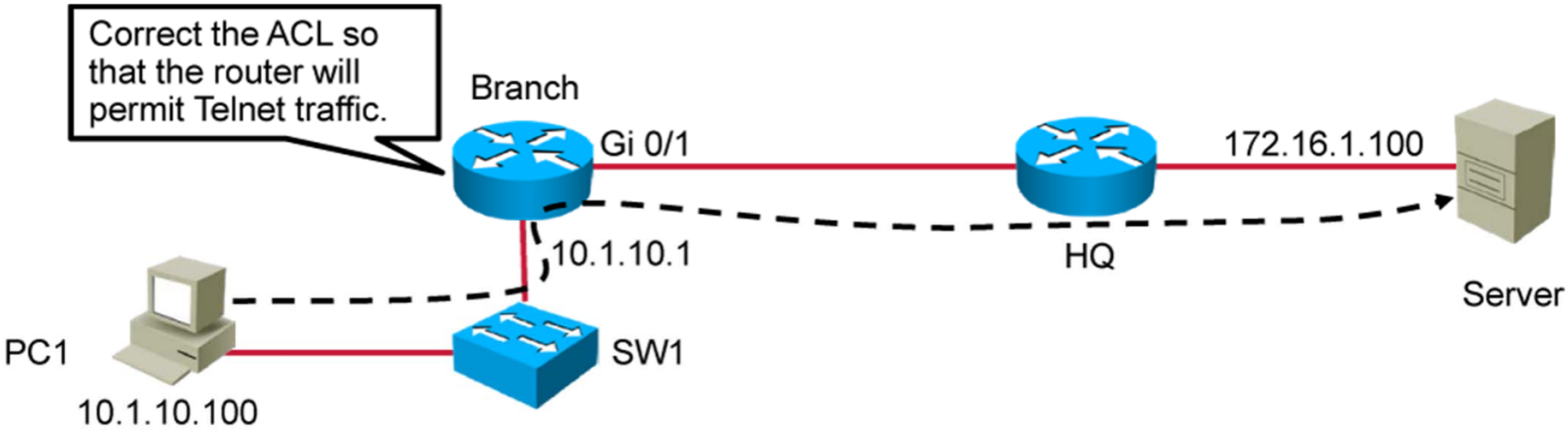
ACL Issues (Cont.)




```
Branch(config)#ip access-list extended Outbound
Branch(config-ext-nacl)#permit tcp any any eq 23
```

- Adds the ACL entry to allow Telnet

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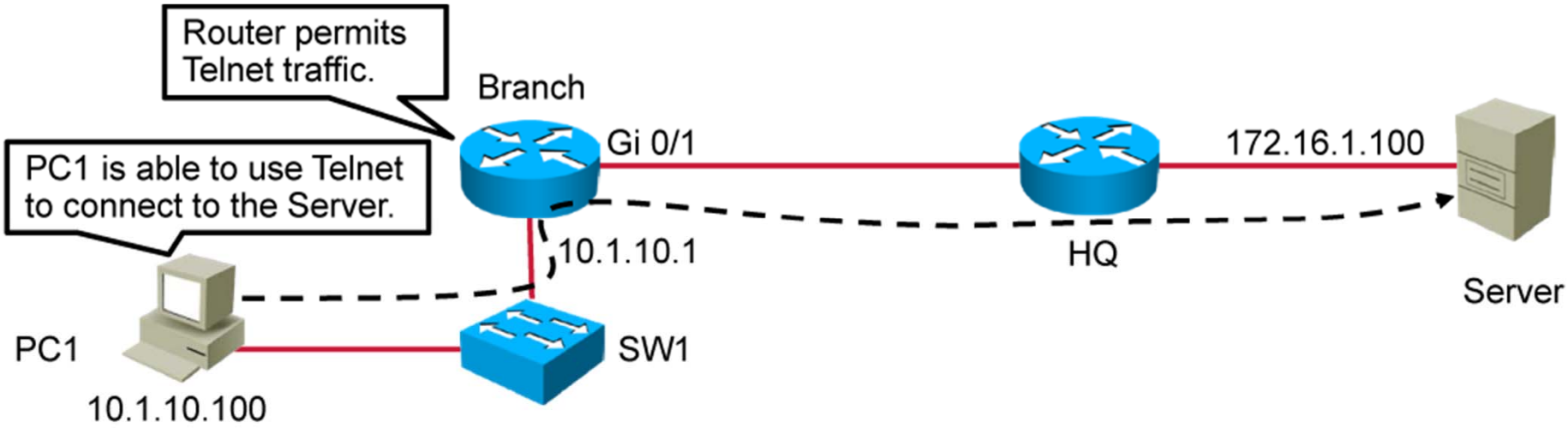
ACL Issues (Cont.)




```
Branch#show ip access-lists
Extended IP access list Outbound
    10 permit icmp any any (5 matches)
    20 permit tcp any any eq telnet (17 matches)
```

- Displays the corrected ACLs that are configured on the router

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Summary

- First test end-to-end connectivity by using the **ping**, **traceroute,** or **telnet** commands.
- Isolate physical connectivity issues by examining the output of the **show interface** command.
- Make sure devices are determining the correct path from source to the destination.
- If there is no exact route to the destination, verify the default gateway on the devices.
- Adjust the name resolution entry to represent the current scenario.
- Adjust ACL entries to allow end-to-end connectivity.

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Troubleshooting IPv6 Network Connectivity

Troubleshooting Basic Connectivity

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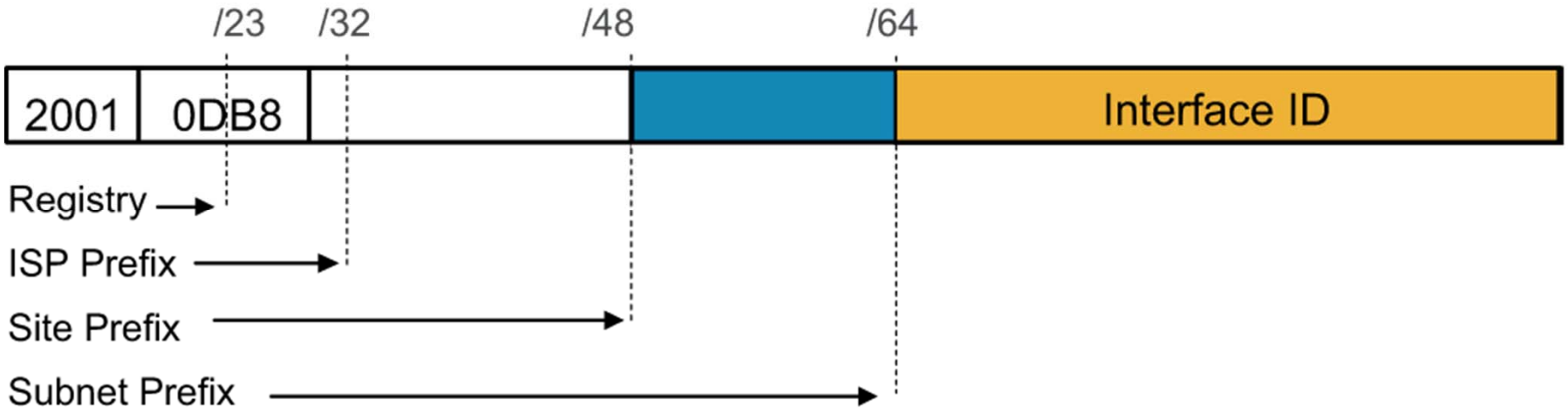
IPv6 Unicast Addresses

- **Global:** Starts with 2000::/3 and assigned by IANA



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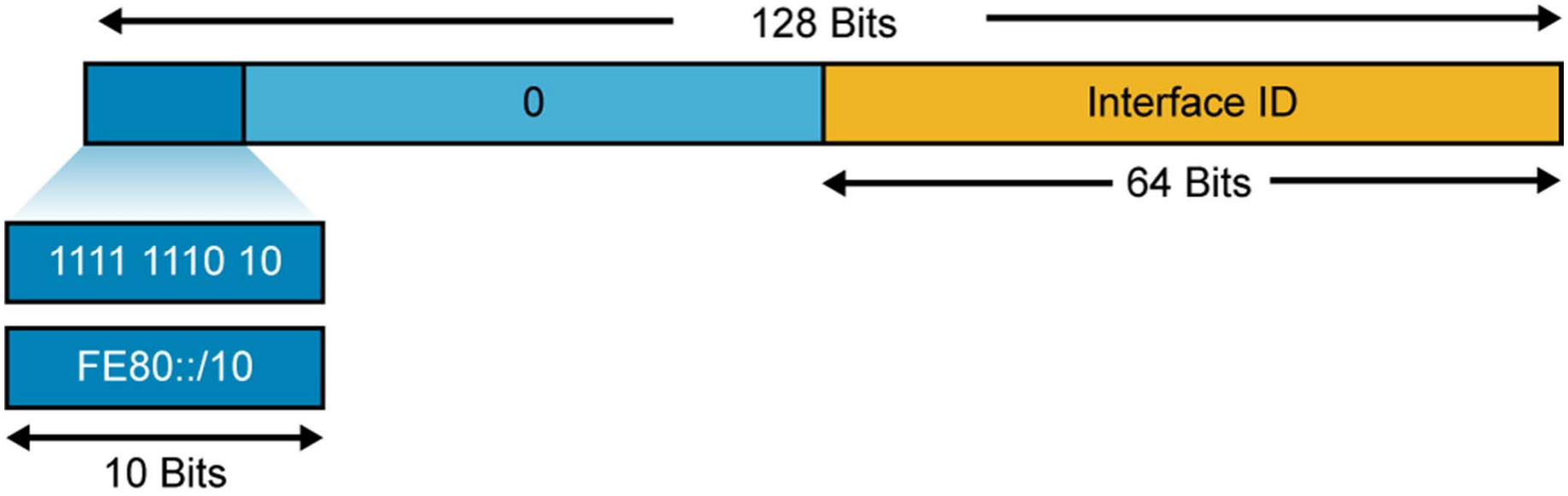
IPv6 Unicast Addresses (Cont.)

- **Private:** link-local (starts with FE80::/10)



- **Loopback:** (::1)
- **Unspecified:** (::)
- **Reserved:** Used by the IETF

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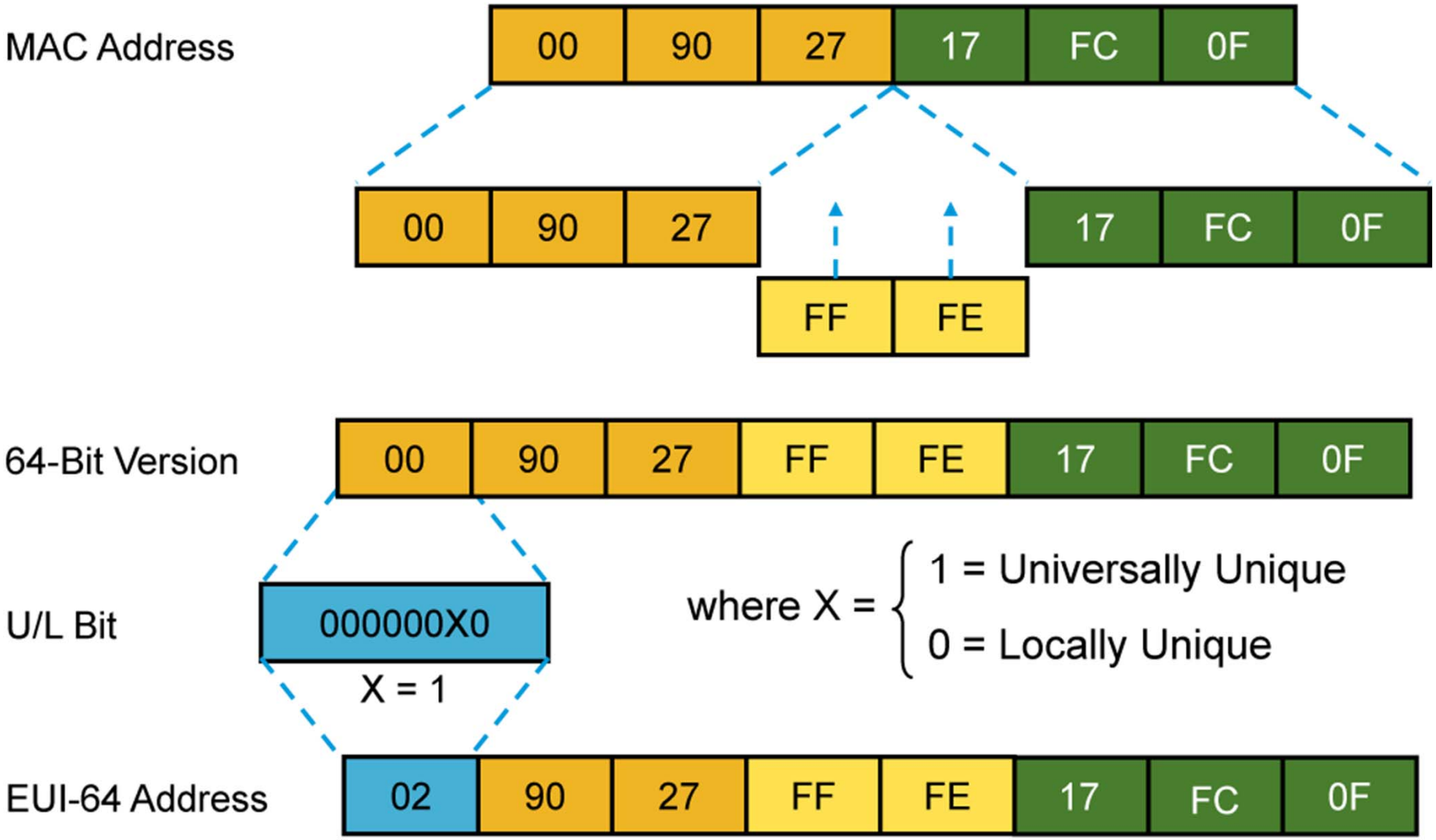
IPv6 Unicast Addresses (Cont.)



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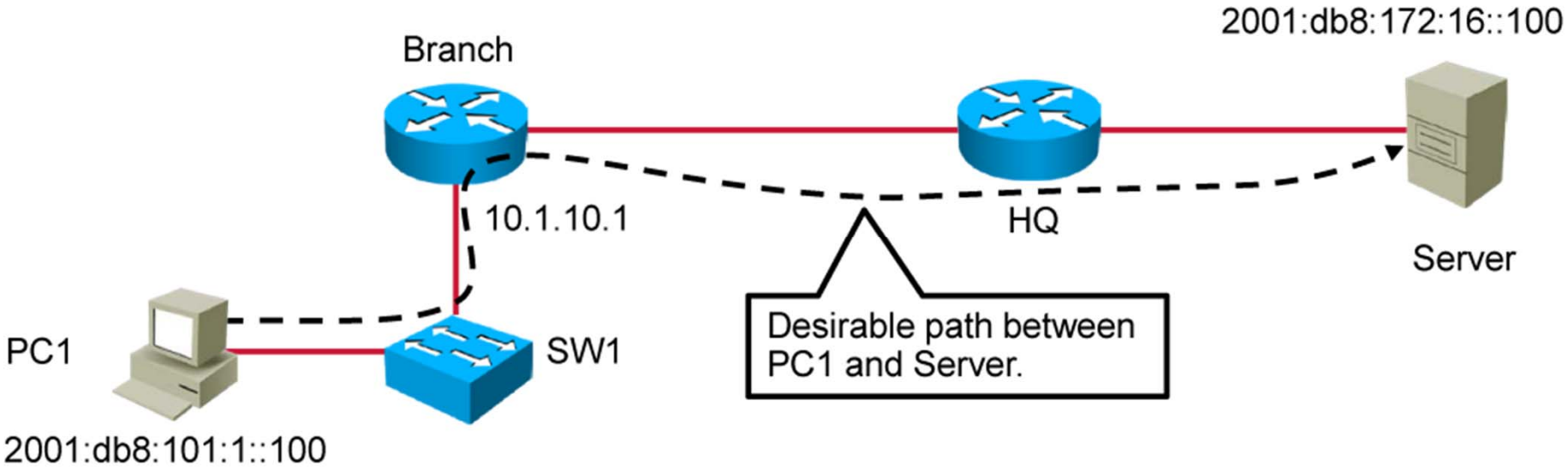
Troubleshooting End-to-End IPv6 Connectivity



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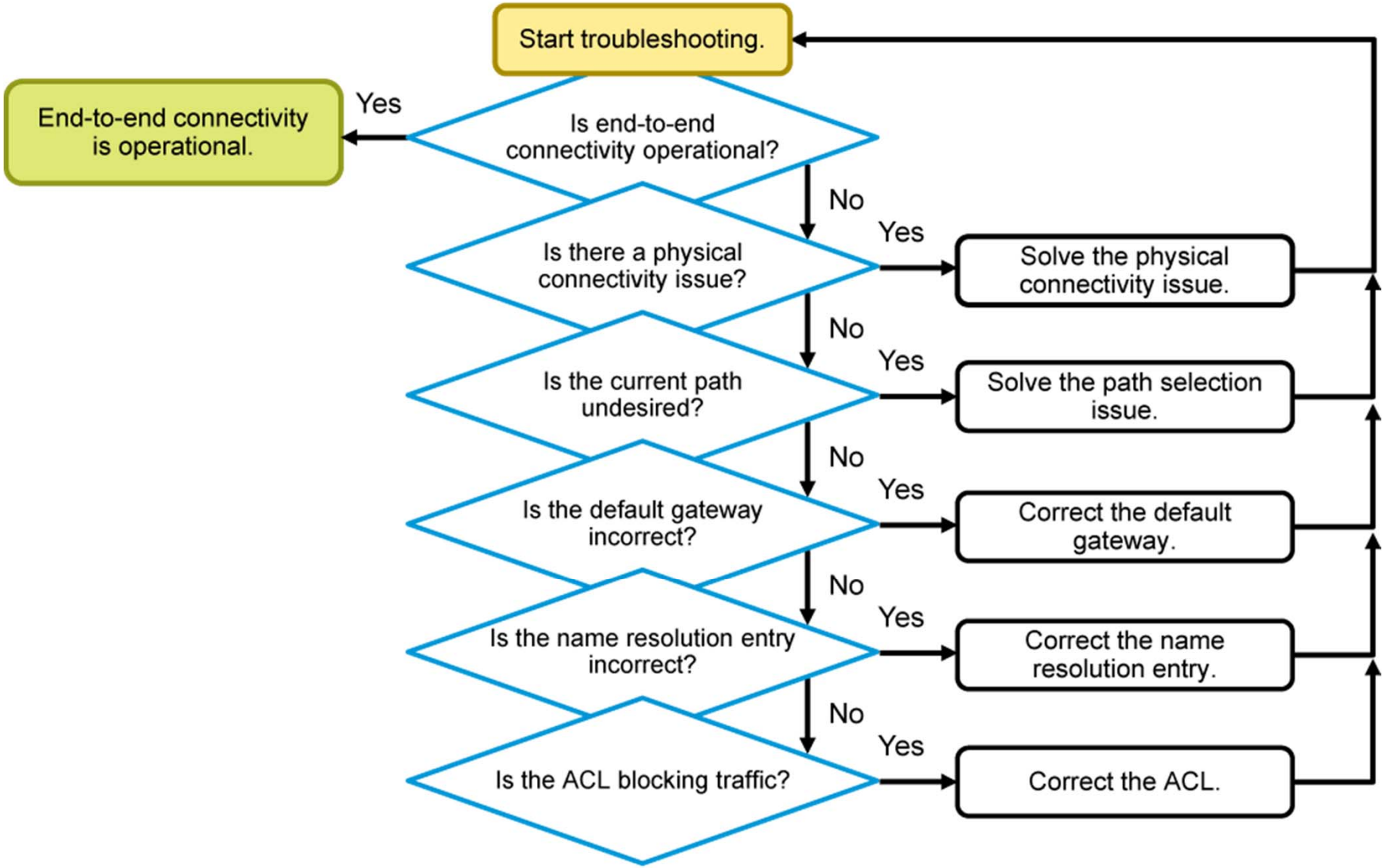
Components of Troubleshooting End-to-End IPv6 Connectivity (Cont.)



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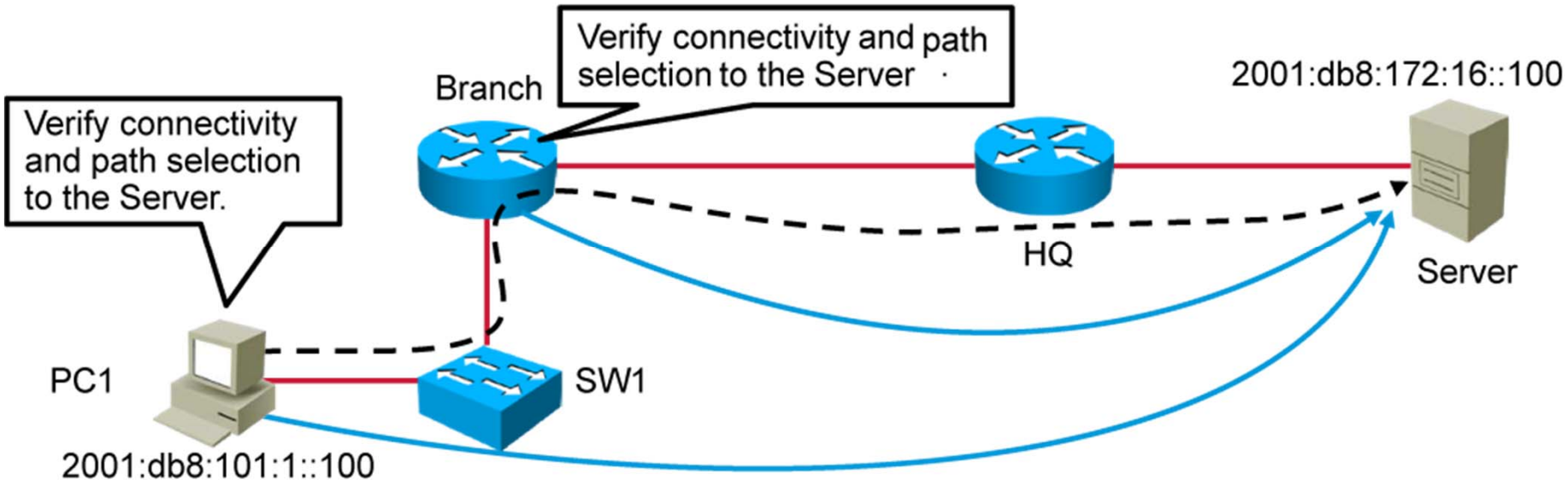
Verification of End-to-End IPv6 Connectivity




```
C:\Windows\system32>ping 2001:DB8:172:16::100
```

- The ping utility on the PC can be used to test IPv6 connectivity.

```
C:\Windows\system32>tracert 2001:DB8:172:16::100
```

- The traceroute utility on a PC allows observation of the IPv6 path.

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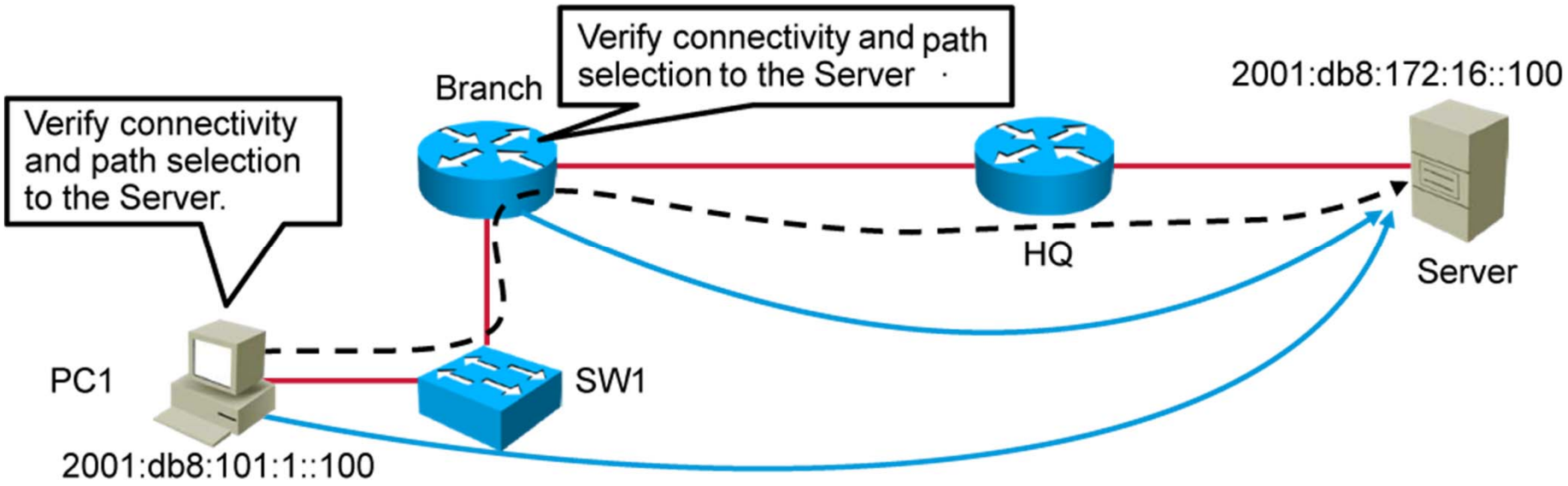
Verification of End-to-End IPv6 Connectivity (Cont.)




```
Branch#ping 2001:DB8:172:16::100
```

- The ping utility on the router can be used to test IPv6 connectivity.

```
Branch#traceroute 2001:DB8:172:16::100
```

- Successful trace from a router to verify the IPv6 path

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Verification of End-to-End IPv6 Connectivity (Cont.)

The **telnet** command can be used to test transport layer connectivity for any TCP port over IPv6.

```
C:\Windows\system32>telnet 2001:DB8:172:16::100

HQ#
```

- Use Telnet to connect to the standard Telnet TCP port from a PC.

```
C:\Windows\system32>telnet 2001:DB8:172:16::100 80

HTTP/1.1 400 Bad Request
Date: Wed, 26 Sep 2012 07:27:10 GMT
Server: cisco-IOS
Accept-Ranges: none

400 Bad Request

Connection to host lost.
```

- Use Telnet to connect to TCP port 80, which tests availability of the HTTP service.

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Verification of End-to-End IPv6 Connectivity (Cont.)

```
C:\Windows\system32>netsh interface ipv6 show neighbor
Interface 13: LAB
Internet Address                          Physical Address   Type
----------------------------------------  -----------------  ---------
fe80::9c5a:e957:a865:bde9                 00-0c-29-36-fd-f7  Stale
fe80::fa66:f2ff:fe31:7250                 f8-66-f2-31-72-50  Reachable (Router)
ff02::2                                   33-33-00-00-00-02  Permanent
ff02::16                                  33-33-00-00-00-16  Permanent
ff02::1:2                                 33-33-00-01-00-02  Permanent
ff02::1:3                                 33-33-00-01-00-03  Permanent
ff02::1:ff05:f9fb                         33-33-ff-05-f9-fb  Permanent
ff02::1:ff31:7250                         33-33-ff-31-72-50  Permanent
ff02::1:ff65:bde9                         33-33-ff-65-bd-e9  Permanent
ff02::1:ff67:bae4                         33-33-ff-67-ba-e4  Permanent
```

- Neighbor discovery table on a PC

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Verification of End-to-End IPv6 Connectivity (Cont.)

```
Branch#show ipv6 neighbors
IPv6 Address                              Age Link-layer Addr State Interface
FE80::21E:7AFF:FE79:7A81                    8 001e.7a79.7a81  STALE Gi0/1
2001:DB8:101:1:A083:AEE4:E7C5:2CCA         46 000c.2936.fdf7  STALE Gi0/0
2001:DB8:209:165::2                         0 001e.7a79.7a81  REACH Gi0/1
2001:DB8:101:1:C31:CD87:7505:F9FB           0 000c.2952.51fd  REACH Gi0/0
```

- Neighbor discovery table on a router

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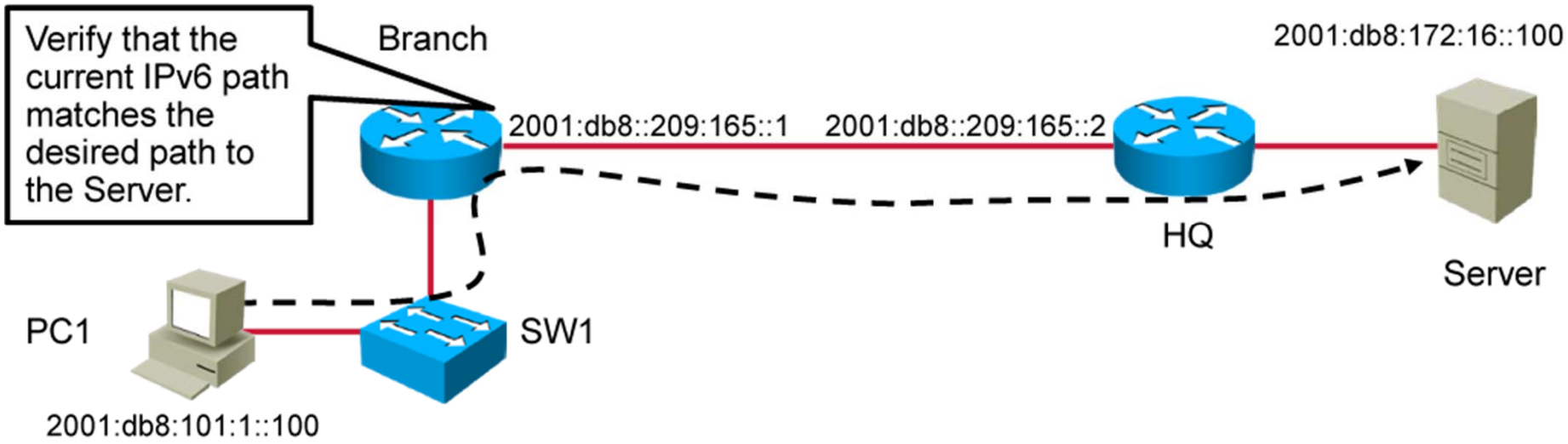
Identification of Current and Desired IPv6 Path




```
Branch#show ipv6 route
IPv6 Routing Table - default - 6 entries
<output omitted>
S   ::/0 [1/0]
     via 2001:DB8:209:165::2
C   2001:DB8:101:1::/64 [0/0]
     via GigabitEthernet0/0, directly connected
L   2001:DB8:101:1::1/128 [0/0]
     via GigabitEthernet0/0, receive
<output omitted>
```

- Verifies path selection on the Branch router

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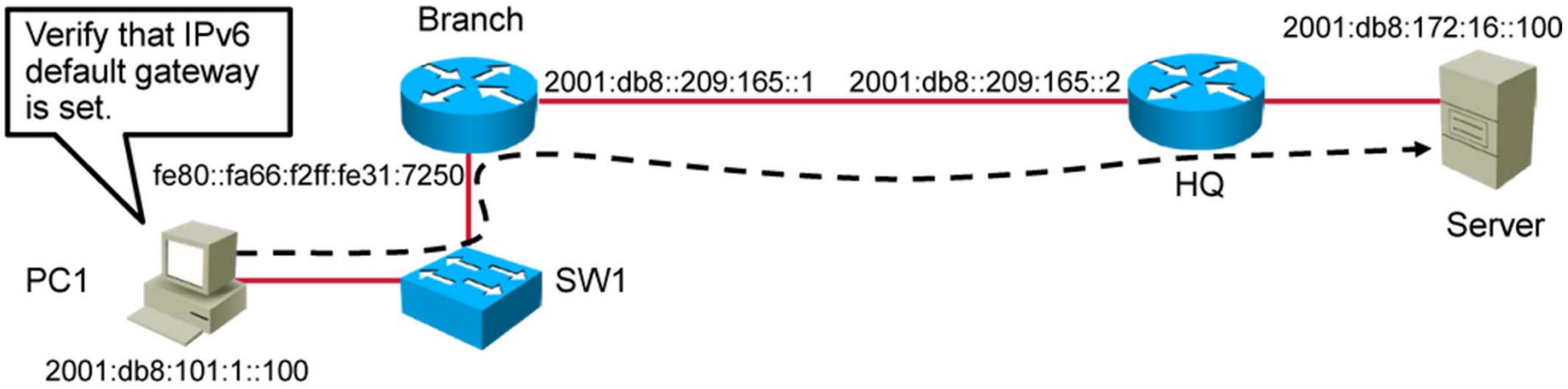
Default Gateway Issues in IPv6




```
C:\Windows\system32>ipconfig
Windows IP Configuration
   Connection-specific DNS Suffix  . :
   IPv6 Address. . . . . . . . . . . : 2001:db8:101:1:dd42:a044:fa67:bae4
   Temporary IPv6 Address. . . . . . : 2001:db8:101:1:c31:cd87:7505:f9fb
   Link-local IPv6 Address . . . . . : fe80::dd42:a044:fa67:bae4%13
   IPv4 Address. . . . . . . . . . . : 10.1.1.100
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::fa66:f2ff:fe31:7250%13
                                       10.1.1.1
```

- Verifies the default gateway on a PC

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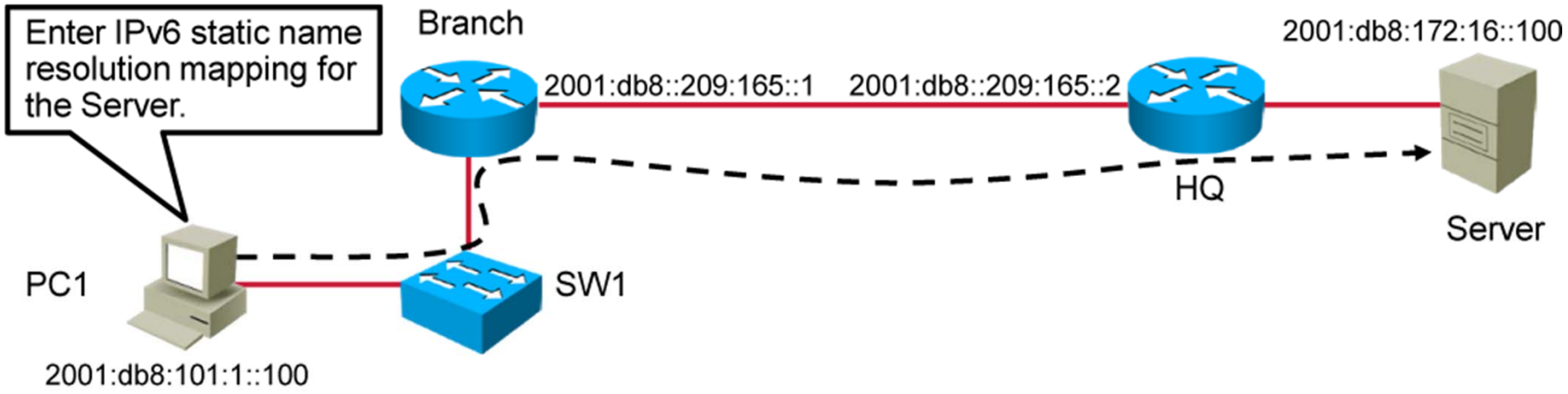
Name Resolution Issues in IPv6




```
2001:DB8:AC10:100::64      Server6
```

- Enter name to IPv6 mapping in the hosts file on the PC.

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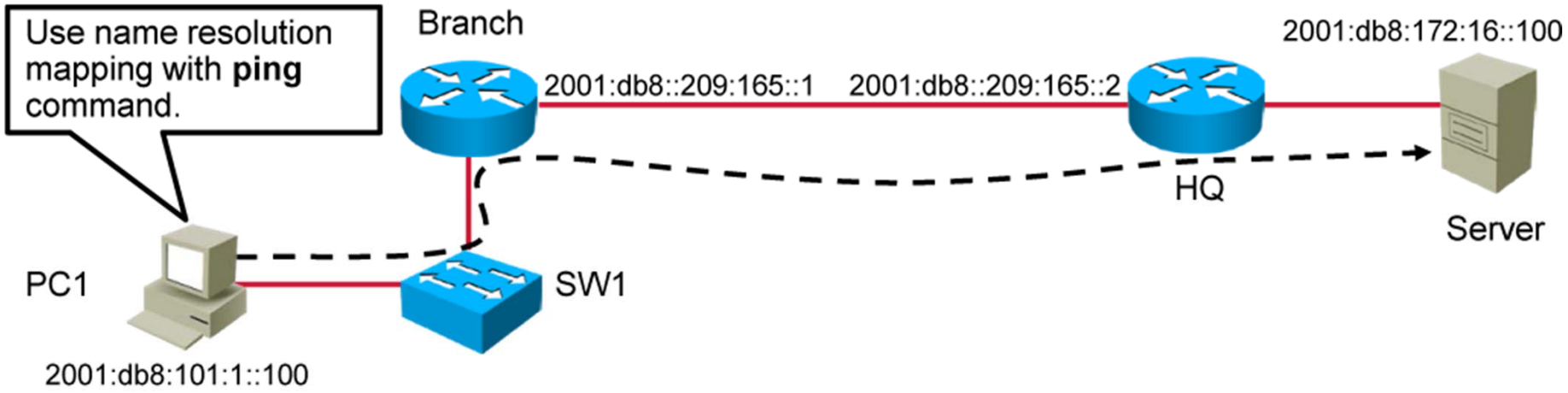
Name Resolution Issues in IPv6 (Cont.)




```
C:\Windows\system32>ping Server6
Pinging Server [2001:db8:172:16::100] with 32 bytes of data:
Reply from 2001:db8:172:16::100: time=54ms
Reply from 2001:db8:172:16::100: time=46ms
Reply from 2001:db8:172:16::100: time=46ms
Reply from 2001:db8:172:16::100: time=45ms
Ping statistics for 2001:db8:172:16::100:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 45ms, Maximum = 54ms, Average = 47ms
```

- Verify connectivity of the server using the **ping** command and the host name as the destination.

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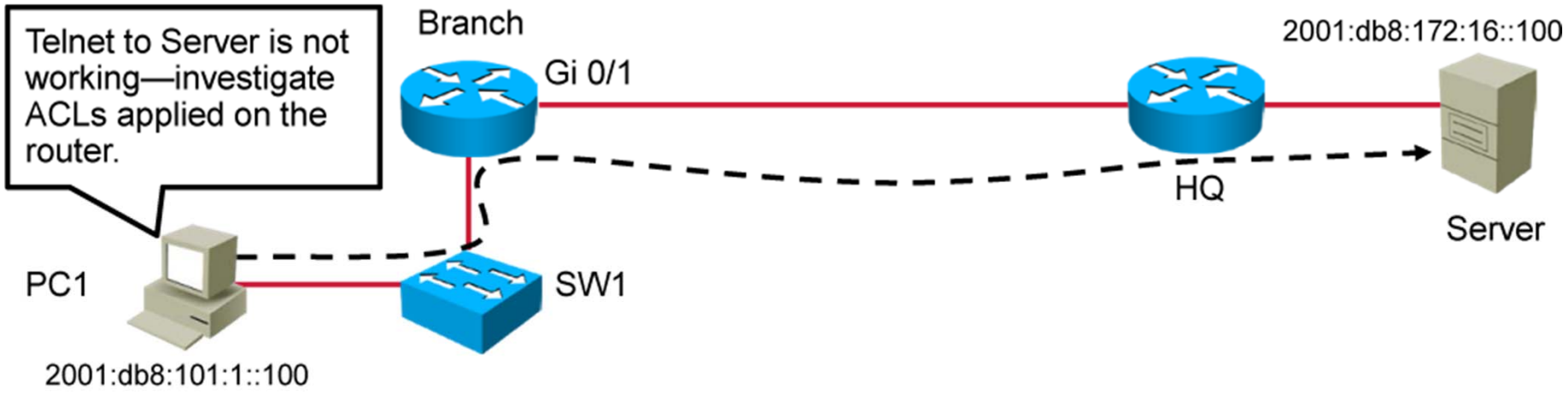
ACL Issues in IPv6




```
Branch#show ipv6 access-list
IPv6 access list Outbound
    permit icmp any any (44 matches) sequence 10
```

- Displays IPv6 ACLs configured on the router

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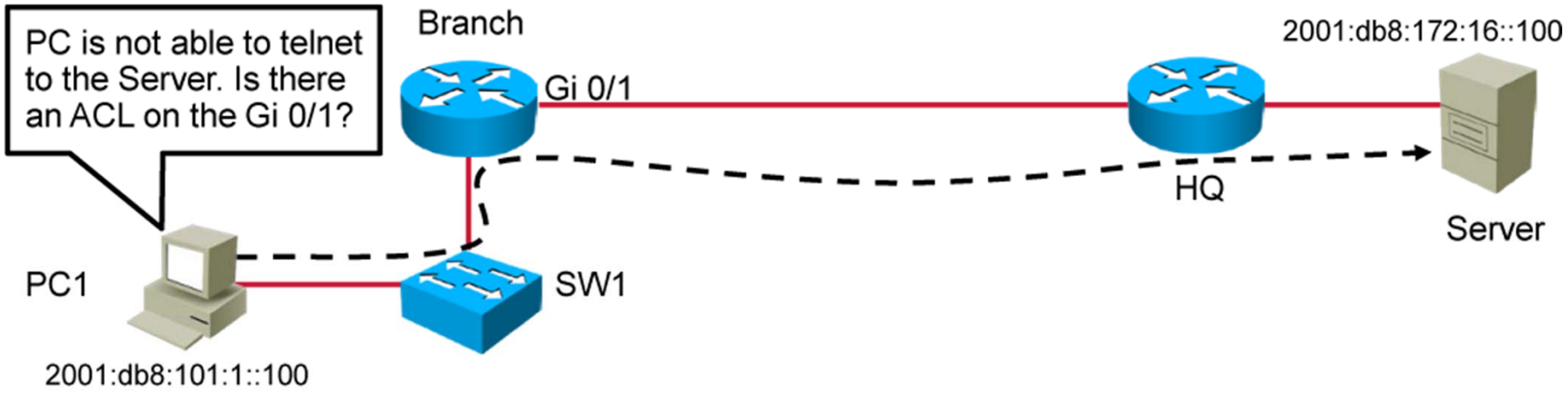
ACL Issues in IPv6 (Cont.)




```
Branch#show ipv6 interface GigabitEthernet0/1 | include access list
  Outbound access list Outbound
```

- Displays placement of the ACL on the interface

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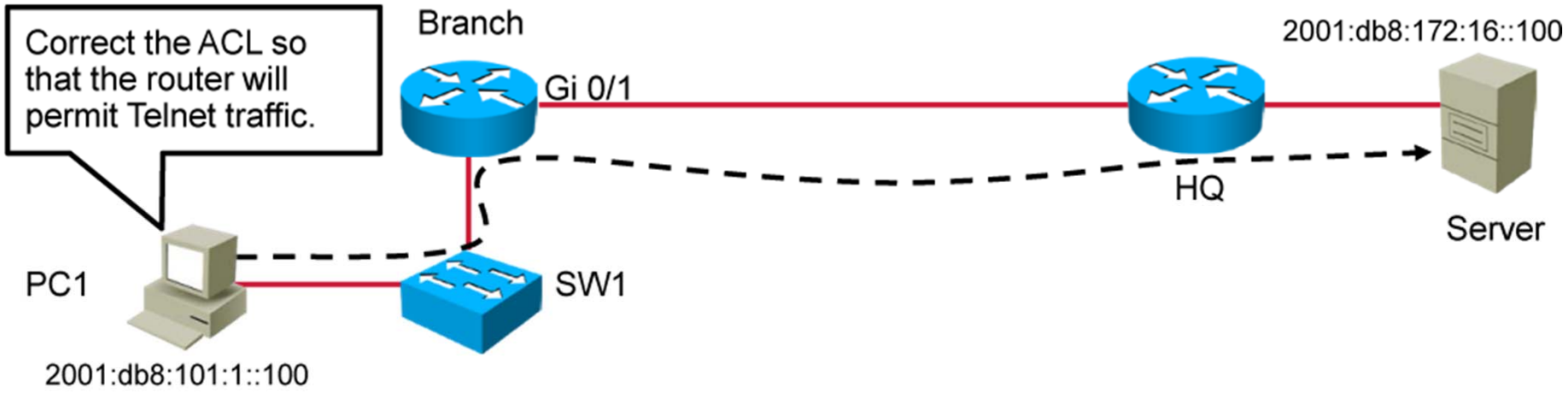
ACL Issues in IPv6 (Cont.)




```
Branch(config)#ipv6 access-list extended Outbound
Branch(config-ext-nacl)#permit tcp any any eq 23
```

- Adds an ACL entry to allow Telnet

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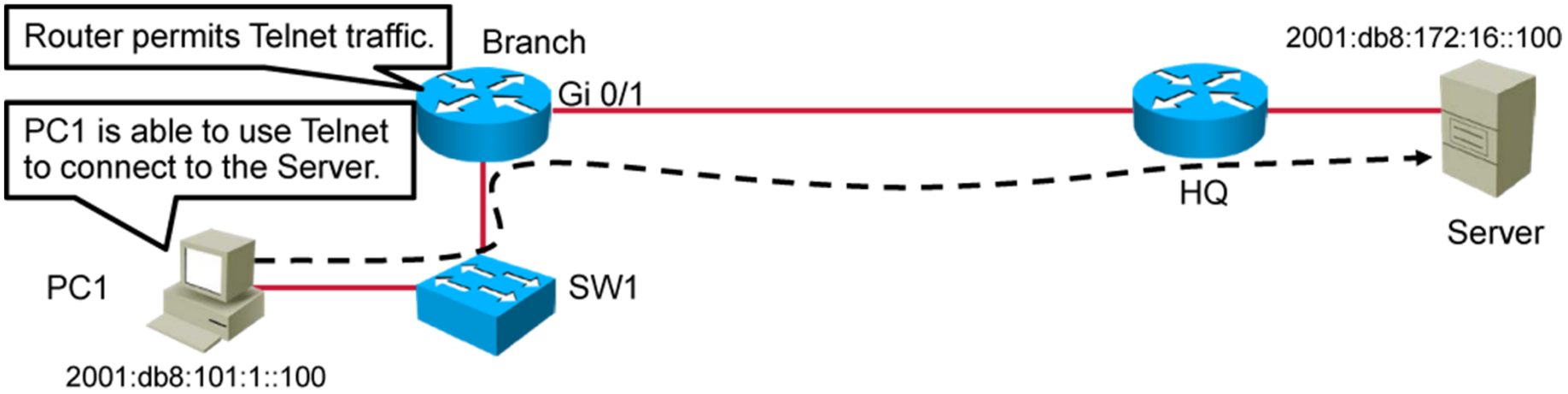
ACL Issues in IPv6 (Cont.)




```
Branch#show ipv6 access-list
IPv6 access list Outbound
    permit icmp any any (44 matches) sequence 10
    permit tcp any any eq telnet (7 matches) sequence 20
```

- Displays corrected ACLs configured on the router

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Summary

- For troubleshooting end-to-end IPv6 connectivity, you can use the same structured approach as for IPv4.
- Use the **ping**, **traceroute**, and **telnet** utilities to verify end-to-end IPv6 connectivity.
- Use the **show ipv6 route** command to verify the current IPv6 path on a router.
- The IPv6 gateway on a PC should be set using stateless autoconfiguration or manually.
- Each host should have a DNS server that is configured. The server can be accessed using either IPv4 or IPv6.
- Use the **show ipv6 access-list** and **show ipv6 interfaces** commands to verify whether there are any IPv6 ACLs that are configured to deny traffic.

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Module Summary

- Physical connectivity must be verified.
- The current path must be equal to the desired path.
- End devices must be configured with the correct gateway.
- End devices must be configured with the correct name resolution entry.
- It is important to ensure that an ACL is not blocking traffic.
- End-to-end connectivity must be verified.

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