

# CCNA 200-301, Volume 2

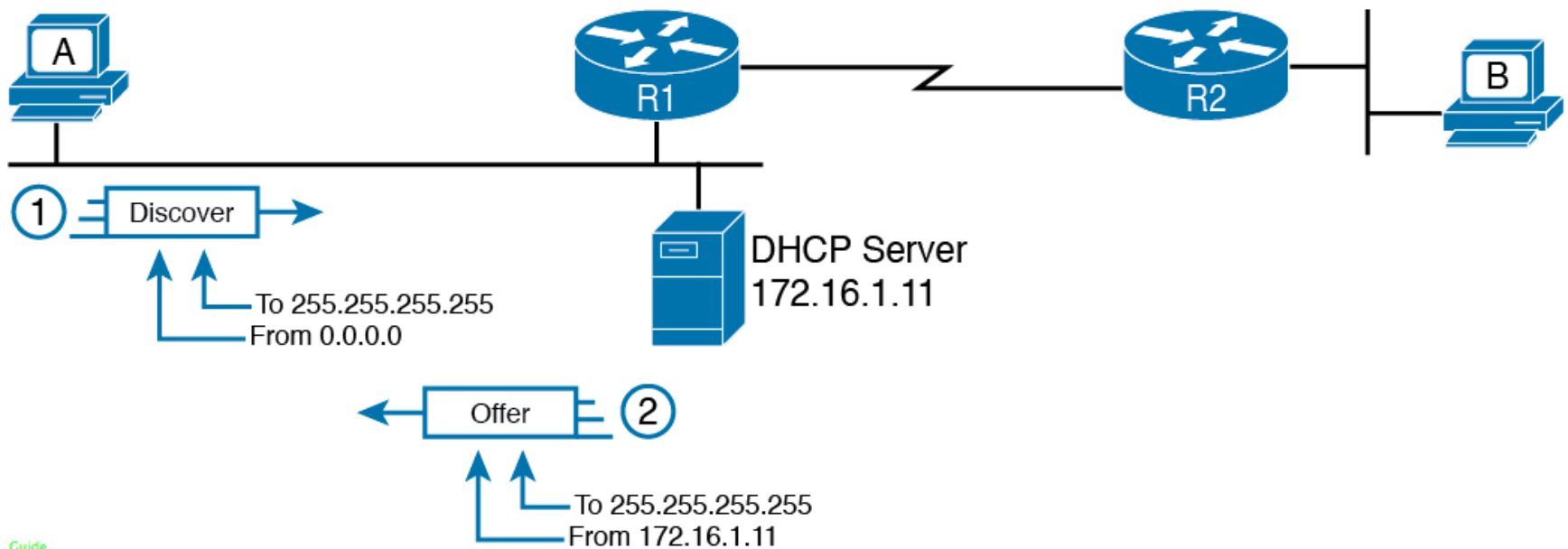
Chapter 7

**Implementing DHCP**

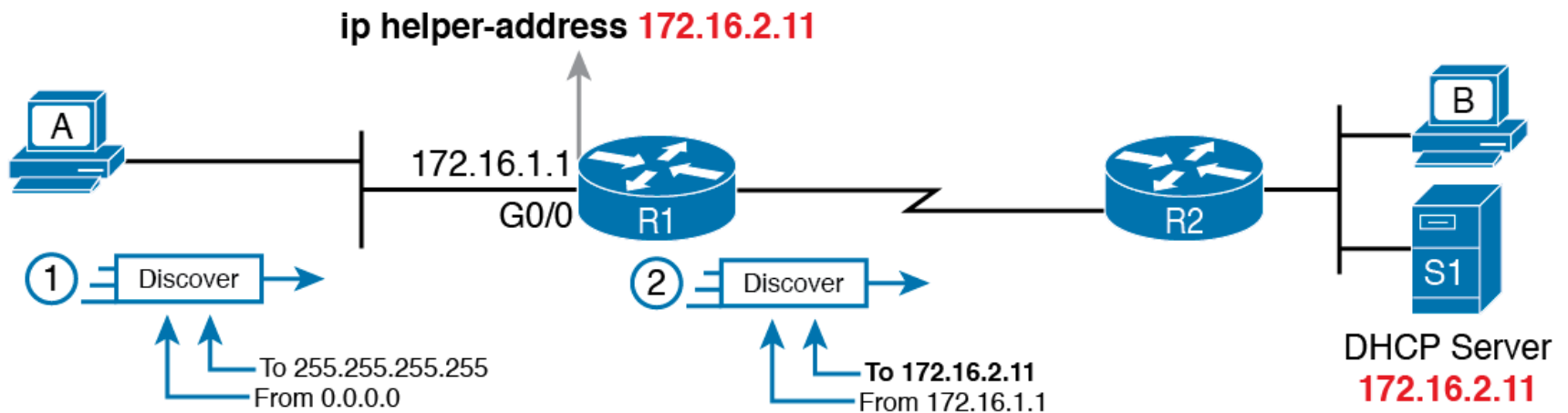
# Objectives

- Identify IP parameters for Client OS (Windows, macOS, Linux)
- Explain the role of DHCP and DNS within the network
- Configure and verify DHCP client and relay

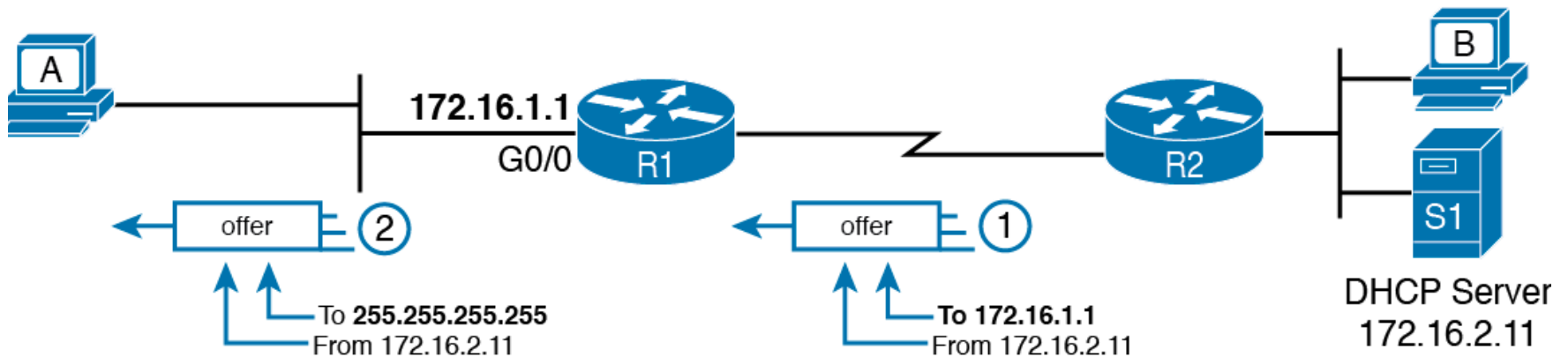
# DHCP Discover and Offer



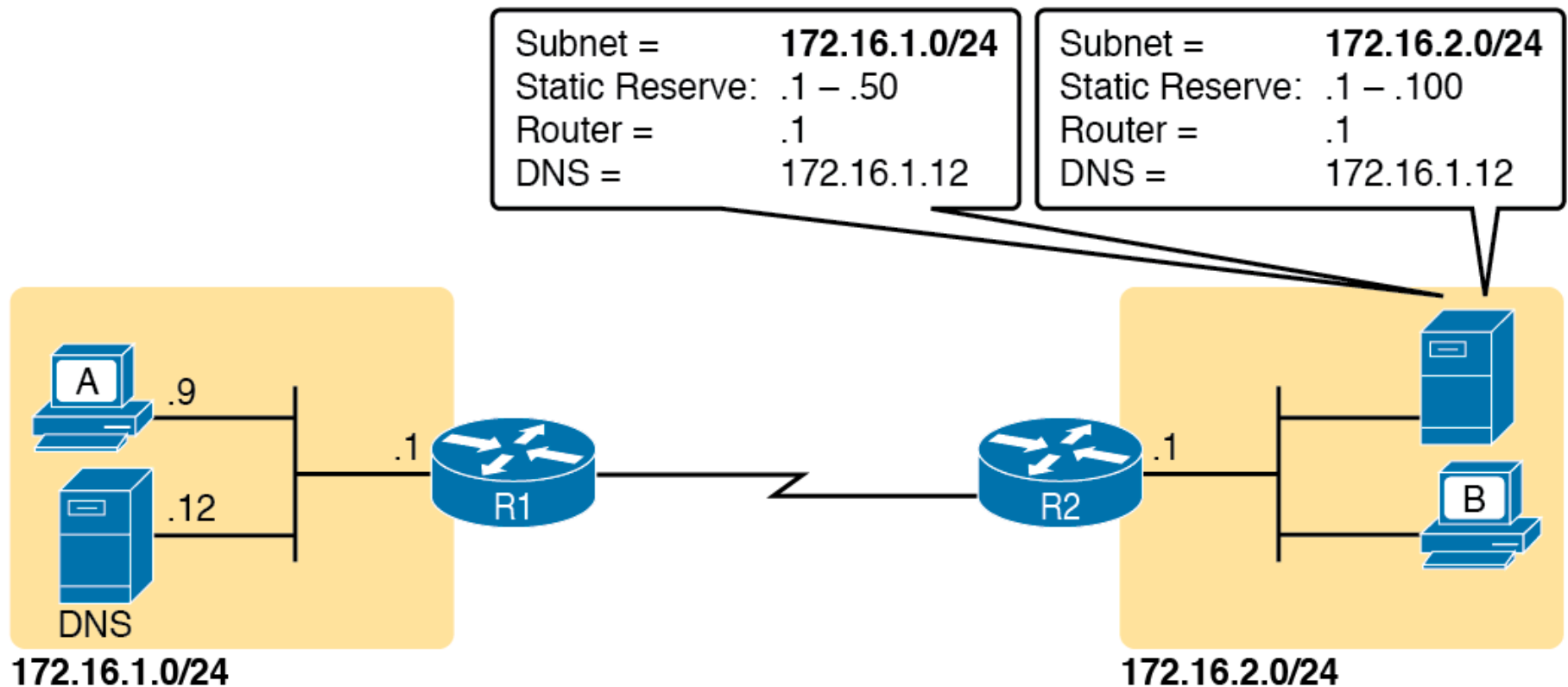
# IP Helper Address Effect



# IP Helper Address for the Offer Message Returned from the DHCP Server



# Preconfiguration on a DHCP Server



# Listing the Current Helper Address Setting with `show ip interface`

```
R1# show ip interface g0/0
GigabitEthernet0/0 is up, line protocol is up
  Internet address is 172.16.1.1/24
  Broadcast address is 255.255.255.255
  Address determined by non-volatile memory
  MTU is 1500 bytes
  Helper address is 172.16.2.11
! Lines omitted for brevity (about 20 lines)
```

# Switch Dynamic IP Address Configuration with DHCP

```
Emma# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Emma(config)# interface vlan 1
Emma(config-if)# ip address dhcp
Emma(config-if)# no shutdown
Emma(config-if)# ^Z
Emma#
00:38:20: %LINK-3-UPDOWN: Interface Vlan1, changed state to up
00:38:21: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up
```



# Verifying DHCP-Learned IP Address on a Switch

```
Emma# show interfaces vlan 1
Vlan1 is up, line protocol is up
  Hardware is EtherSVI, address is 0019.e86a.6fc0 (bia 0019.e86a.6fc0)
  Internet address is 192.168.1.101/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
    reliability 255/255, txload 1/255, rxload 1/255
! lines omitted for brevity
```

# Verifying DHCP-Learned Information on a Switch

```
Emma# show dhcp lease
```

```
Temp IP addr: 192.168.1.101    for peer on Interface: Vlan1
```

```
Temp sub net mask: 255.255.255.0
```

```
    DHCP Lease server: 192.168.1.1, state: 3 Bound
```

```
    DHCP transaction id: 1966
```

```
    Lease: 86400 secs,  Renewal: 43200 secs,  Rebind: 75600 secs
```

```
Temp default-gateway addr: 192.168.1.1
```

```
    Next timer fires after: 11:59:45
```

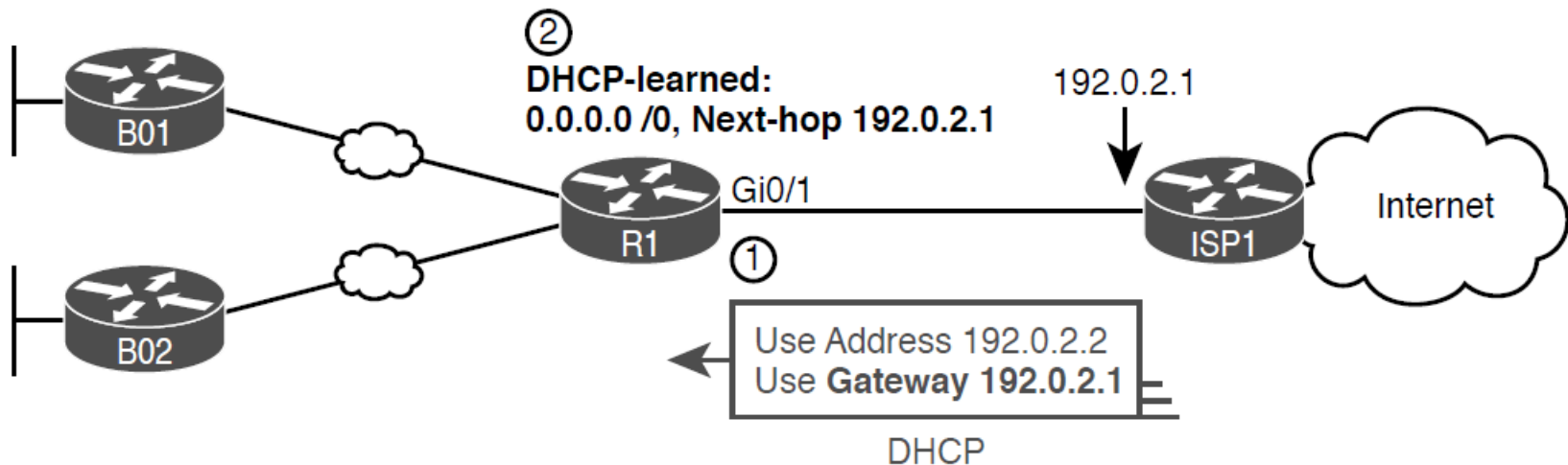
```
    Retry count: 0    Client-ID: cisco-0019.e86a.6fc0-Vl11
```

```
    Hostname: Emma
```

```
Emma# show ip default-gateway
```

```
192.168.1.1
```

# Enterprise Router Building and Advertising Default Routes with DHCP Client

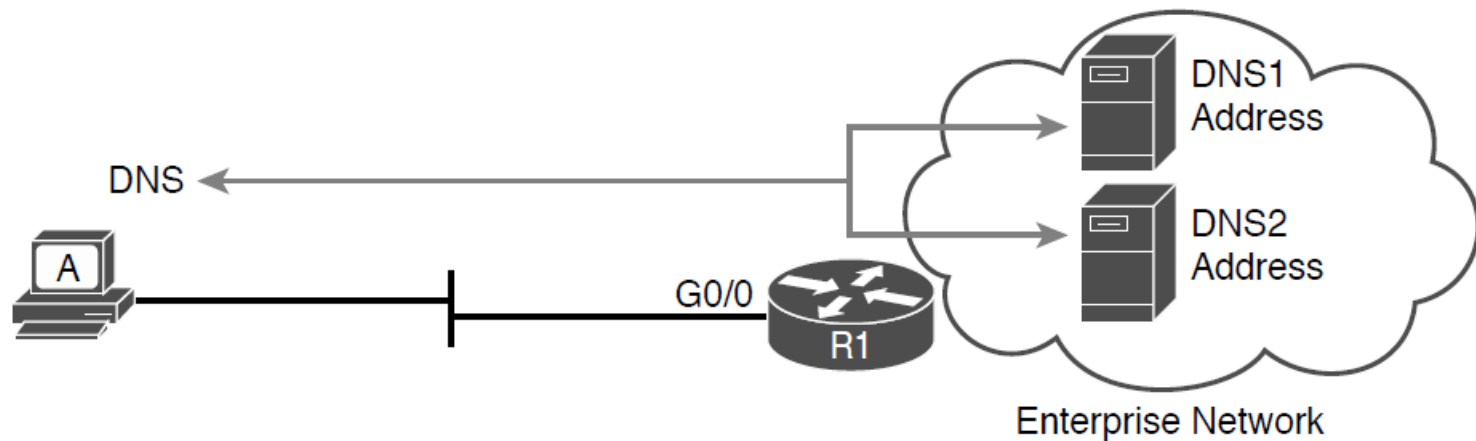


# Learning an Address and Default Static Route with DHCP

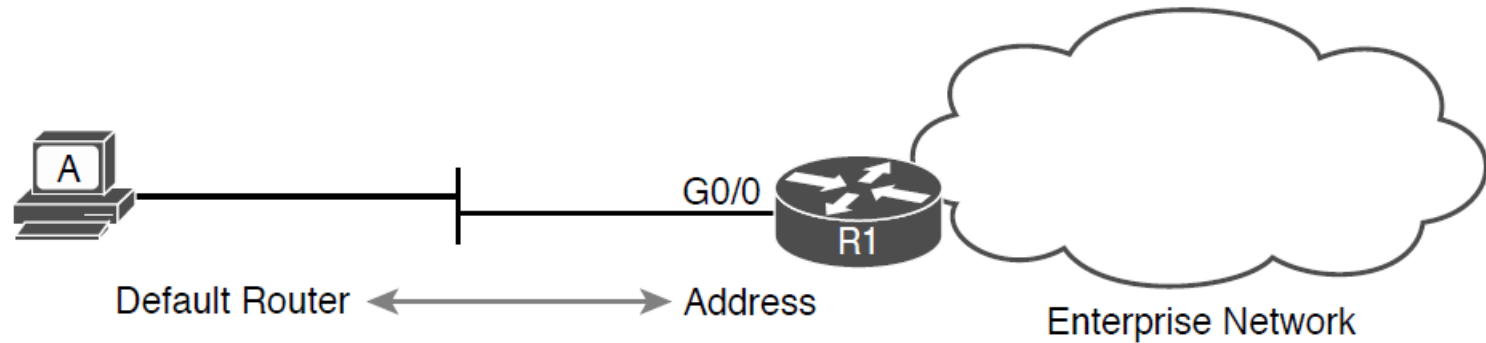
```
R1# configure terminal
R1(config)# interface gigabitethernet0/1
R1(config-if)# ip address dhcp
R1(config-if)# end
R1#
R1# show ip route static
! Legend omitted
Gateway of last resort is 192.0.2.1 to network 0.0.0.0

S*    0.0.0.0/0 [254/0] via 192.0.2.1
```

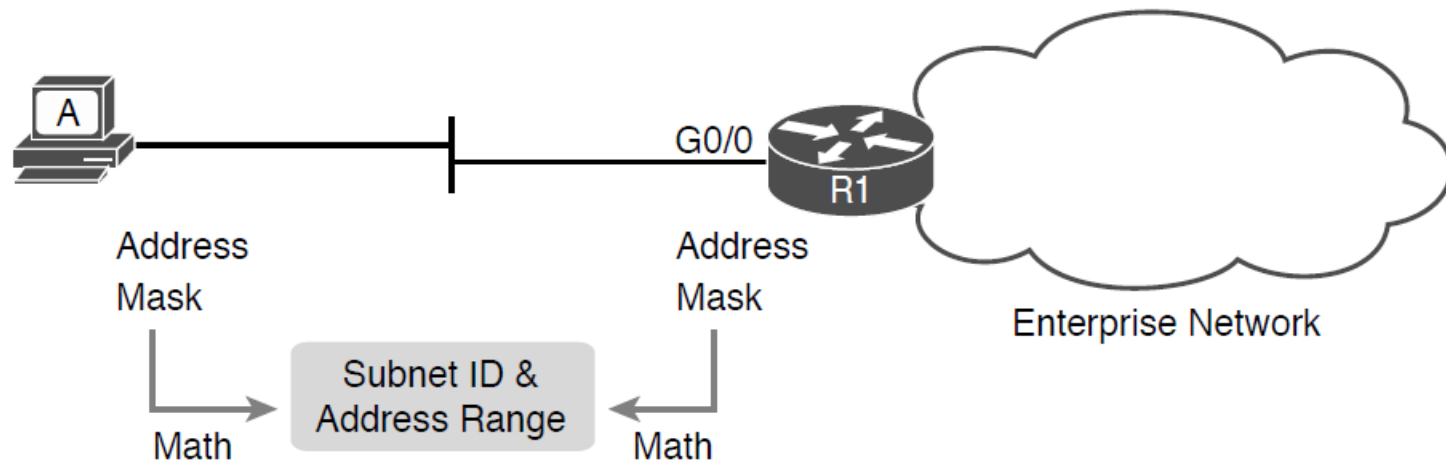
# Host A Needs to Know the IP Address of the DNS Servers



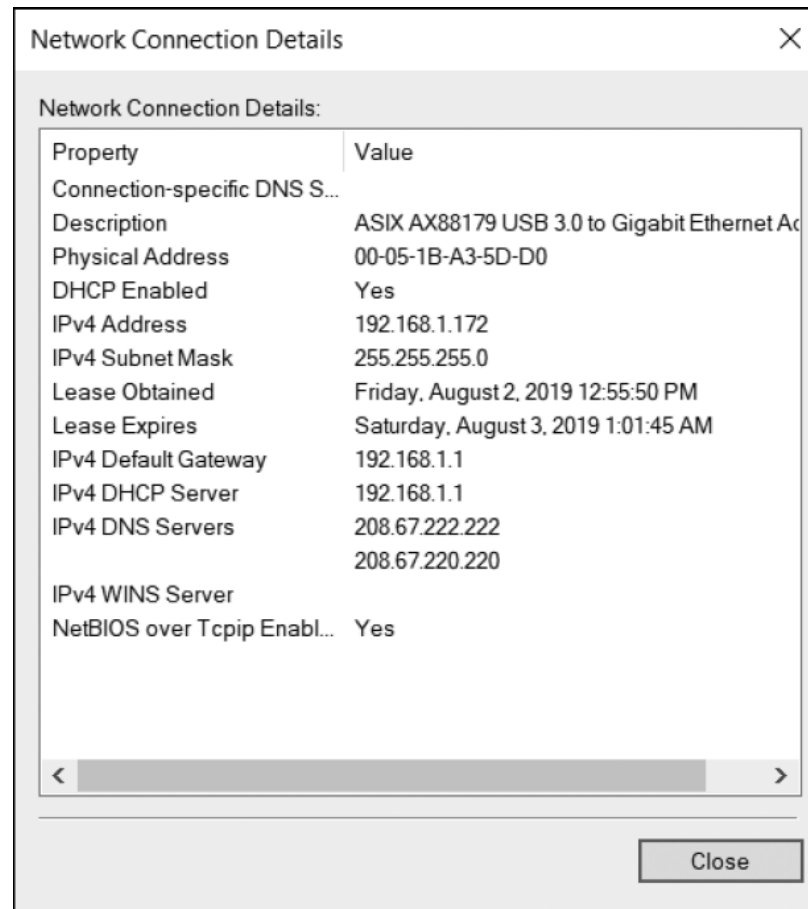
# Host Default Router Setting Should Equal Router Interface Address



# The Need for Subnet Agreement Between Host and Default Router



# IP Address, Mask, and Default Router Settings on Windows





# ipconfig (Windows)

```
C:\DOCUME1\OWNER> ipconfig
```

```
Windows IP Configuration
```

```
Ethernet adapter Ethernet3:
```

```
    Connection-specific DNS Suffix  . :
```

```
    IPv4 Address. . . . . : 192.168.1.172
```

```
    Subnet Mask . . . . . : 255.255.255.0
```

```
    Default Gateway . . . . . : 192.168.1.1
```

# ipconfig /all (Windows)

```
C:\DOCUMENT1\OWNER> ipconfig /all
! Lines omitted for brevity
Ethernet adapter Ethernet 3:

    Connection-specific DNS Suffix  . : 
    Description . . . . . : ASIX AX88179 USB 3.0 to Gigabit Ethernet
Adapter
    Physical Address. . . . . : 00-05-1B-A3-5D-D0
    DHCP Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    IPv4 Address. . . . . : 192.168.1.172 (Preferred)
    Subnet Mask . . . . . : 255.255.255.0
    Lease Obtained. . . . . : Friday, August 2, 2019 12:55:50 PM
    Lease Expires . . . . . : Saturday, August 3, 2019 1:01:45 AM
    Default Gateway . . . . . : 192.168.1.1
    DHCP Server . . . . . : 192.168.1.1
    DNS Servers . . . . . : 208.67.222.222
                           208.67.220.220
    NetBIOS over Tcpip. . . . . : Enabled
```

# netstat -rn Command (Windows)

```
C:\DOCUME1\OWNER> netstat -rn
```

```
IPv4 Route Table
```

```
=====
```

```
Active Routes:
```

Network	Destination	Netmask	Gateway	Interface	Metric
	0.0.0.0	0.0.0.0	192.168.1.1	192.168.1.172	25
	127.0.0.0	255.0.0.0	On-link	127.0.0.1	331
	127.0.0.1	255.255.255.255	On-link	127.0.0.1	331
127.255.255.255	255.255.255.255	255.255.255.255	On-link	127.0.0.1	331
	169.254.0.0	255.255.0.0	On-link	169.254.244.178	291
169.254.244.178	255.255.255.255	255.255.255.255	On-link	169.254.244.178	291
169.254.255.255	255.255.255.255	255.255.255.255	On-link	169.254.244.178	291
	192.168.1.0	255.255.255.0	On-link	192.168.1.172	281
192.168.1.172	255.255.255.255	255.255.255.255	On-link	192.168.1.172	281
192.168.1.255	255.255.255.255	255.255.255.255	On-link	192.168.1.172	281

```
! Lines omitted for brevity
```

# IP Address, Mask, and Default Router Settings on macOS



# ifconfig (macOS)

```
Wendell-Odoms-iMac:~ wendellodom$ ifconfig en0
en0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    options=10b<RXCSUM,TXCSUM,VLAN_HWTAGGING,AV>
    ether 0c:4d:e9:a9:9c:41
    inet 192.168.1.102 netmask 0xffffffff broadcast 192.168.1.255
! IPv6 details omitted for brevity
    media: autoselect (1000baseT <full-duplex,flow-control,energy-efficient-ethernet>)
    status: active
```

# networksetup -getinfo and networksetup -getdnsservers (macOS)

```
Wendell-Odoms-iMac:~ wendellodom$ networksetup -getinfo Ethernet
```

```
DHCP Configuration
```

```
IP address: 192.168.1.102
```

```
Subnet mask: 255.255.255.0
```

```
Router: 192.168.1.1
```

```
Client ID:
```

```
IPv6: Automatic
```

```
IPv6 IP address: none
```

```
IPv6 Router: none
```

```
Ethernet Address: 0c:4d:e9:a9:9c:41
```

```
Wendell-Odoms-iMac:~ wendellodom$ networksetup -getdnsservers Ethernet
```

```
8.8.8.4
```

```
8.8.8.8
```

# netstat -rn (macOS)

```
C:\DOCUME1\OWNER> netstat -rn
```

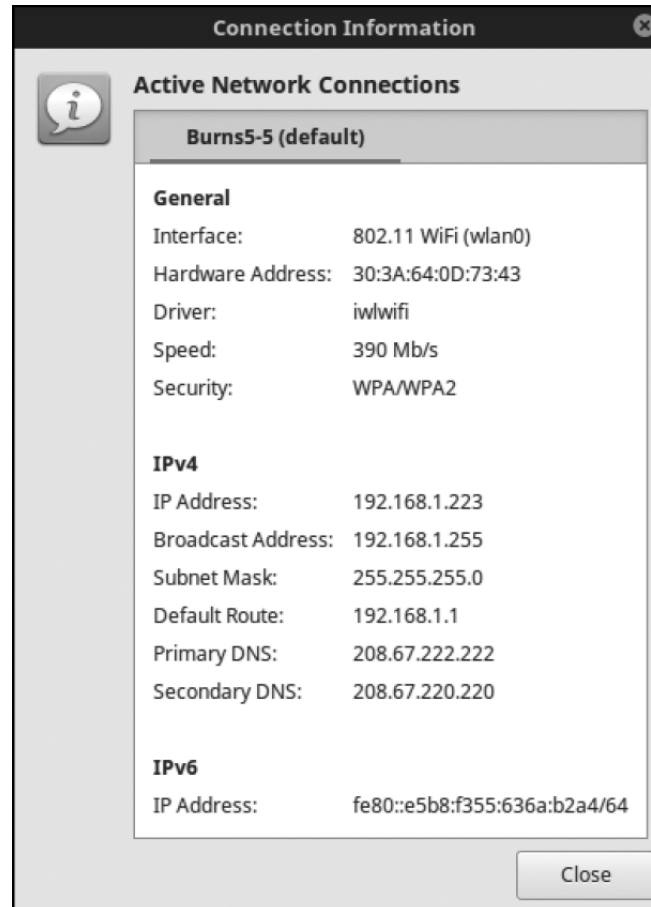
Routing tables

Internet:

Destination	Gateway	Flags	Refs	Use	Netif	Expire
default	192.168.1.1	UGSc	92	0	en0	
127	127.0.0.1	UCS	0	0	lo0	
127.0.0.1	127.0.0.1	UH	4	1950	lo0	
169.254	link#5	UCS	2	0	en0	!
169.254.210.104	0:5:1b:a3:5d:d0	UHLW	0	0	en0	!
192.168.1	link#5	UCS	9	0	en0	!
192.168.1.1/32	link#5	UCS	1	0	en0	!
192.168.1.1	60:e3:27:fb:70:97	UHLWIr	12	2502	en0	1140
192.168.1.102/32	link#5	UCS	0	0	en0	!

! lines omitted for brevity

# IP Address, Mask, and Default Router Settings on Linux





# ifconfig and ip address Commands (Linux)

```
chris@LL ~ $ ifconfig wlan0
```

```
wlan0      Link encap:Ethernet  HWaddr 30:3a:64:0d:73:43  
           inet addr:192.168.1.223  Bcast:192.168.1.255  Mask:255.255.255.0  
           inet6 addr: fe80::e5b8:f355:636a:b2a4/64 Scope:Link  
           UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
           RX packets:2041153 errors:0 dropped:0 overruns:0 frame:0  
           TX packets:712814 errors:0 dropped:0 overruns:0 carrier:0  
           collisions:0 txqueuelen:1000  
  
           RX bytes:2677874115 (2.6 GB)  TX bytes:134076542 (134.0 MB)
```

```
chris@LL ~ $ ip address
```

```
3: wlan0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP group default  
qlen 1000  
    link/ether 30:3a:64:0d:73:43 brd ff:ff:ff:ff:ff:ff  
    inet 192.168.1.223/24 brd 192.168.1.255 scope global wlan0  
        valid_lft forever preferred_lft forever  
    inet6 fe80::e5b8:f355:636a:b2a4/64 scope link  
        valid_lft forever preferred_lft forever
```

# netstat -rn and ip route Commands (Linux)

```
chris@LL ~ $ netstat -rn
```

```
Kernel IP routing table
```

Destination	Gateway	Genmask	Flags	MSS Window	irtt	Iface
0.0.0.0	192.168.1.1	0.0.0.0	UG	0 0	0	wlan0
169.254.0.0	0.0.0.0	255.255.0.0	U	0 0	0	wlan0
192.168.1.0	0.0.0.0	255.255.255.0	U	0 0	0	wlan0

```
chris@LL ~ $ ip route
```

```
default via 192.168.1.1 dev wlan0 proto static metric 600
169.254.0.0/16 dev wlan0 scope link metric 1000
192.168.1.0/24 dev wlan0 proto kernel scope link src 192.168.1.223 metric 600
chris@LL ~ $
```