# Chapter 8: DHCP

## Routing & Switching

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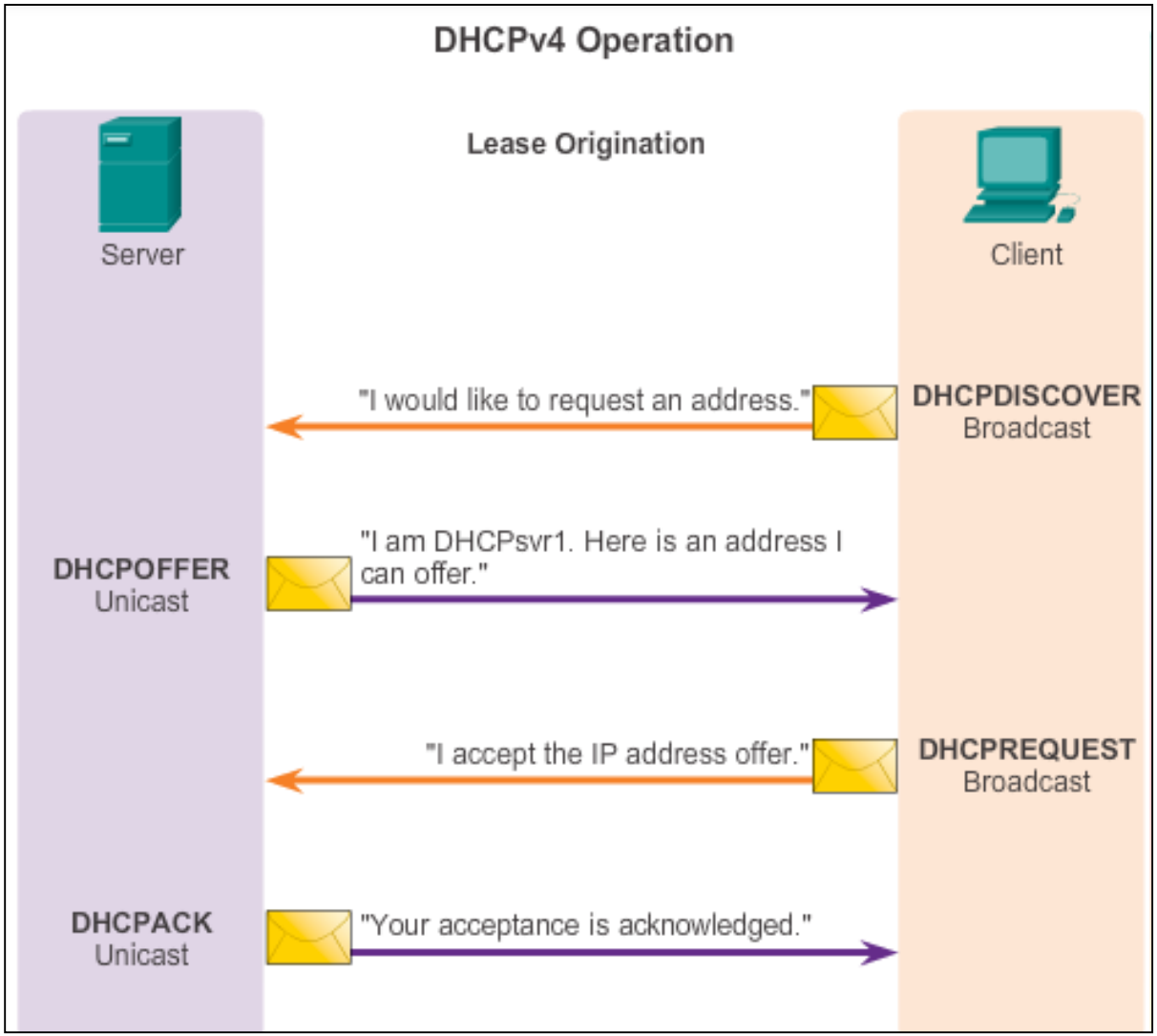
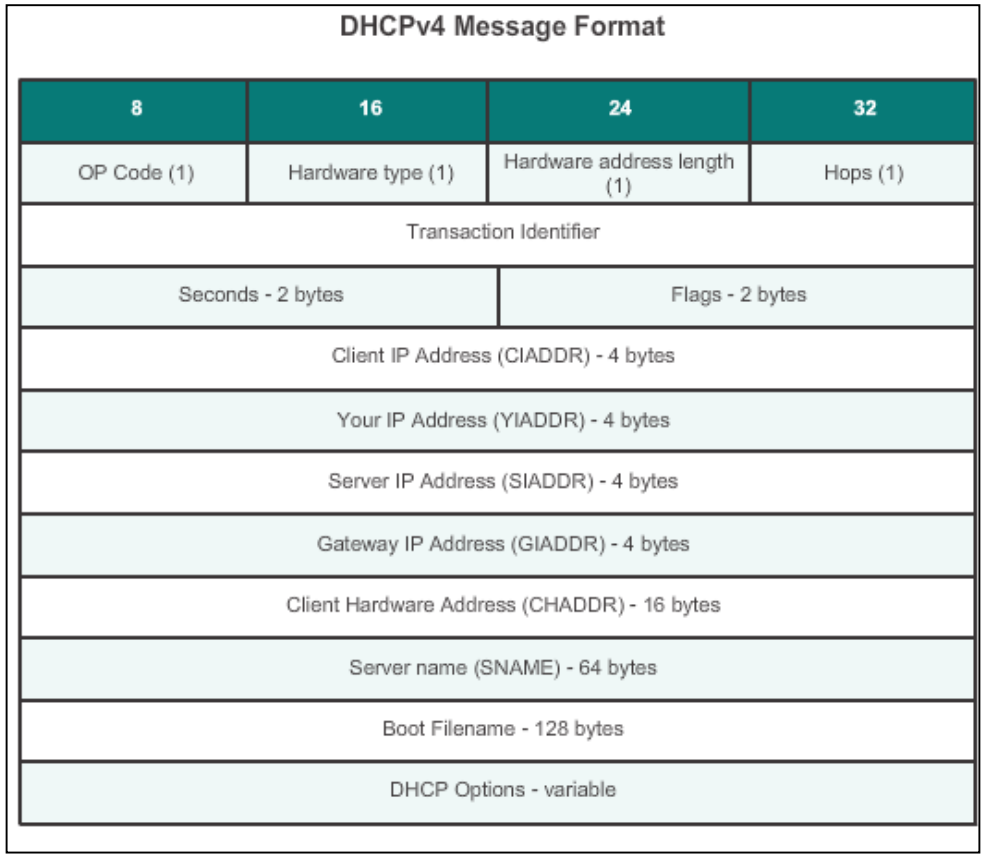
# DHCPv4 Operation



# DHCPv4 Message Format




Operaatio koodi (OPCode)
Onko kyseessä pyyntö, kuittaus, tarjous, vastaus

Fyysisen osoitteen tyyppi , 8b (Htype)
Esim Ethernetmac

Fyysisen osoitteen pituus , 8b (Hlen)
Mac = 6B

Hyppyjen määrä , 8b (Hops)
aluksi nolla, mutta mahdolliset välittäjät lisäävät arvoa

Tapahtumanumero , 32b (Trans_id)
yhdistää pyynnön ja vastauksen

Aika , 16b (Secs)
Aika, joka on kulunut, työaseman IP-osoitteen hankinnasta

Liput , 16b (Flags)
käytetään esim. halutessa vastaus levitysviestinä

Työaseman IP , 32b (Ciaddr)
IP-osoitteen uusinnassa osoite tässä kentässä

Sinun IP , 32b (Yiaddr)
palvelimen työasemalle tarjoama osoite

Palvelimen IP , 32b (Siaddr)
palvelimen IP

Reitittimen IP , 32b (Giaddr)
jos palvelin ja työasema eri aliverkoissa

Työaseman MAC , 128b (Chaddr)
usein palvelin tarjoaa aina samalle MAC:llesamaa IP:tä

Palvelimen nimi (SNAME)

Bootfilename

Optiot , muuttuva
esim. dns, domain-nimi, jne

# Configuring a DHCPv4 Server

A Cisco router running the Cisco IOS software can be configured to act as a DHCPv4 server. To set up DHCP:

1. Exclude addresses from the pool.
2. Set up the DHCP pool name.
3. Define the range of addresses and subnet mask. Use the **`default-router`** command for the default gateway. Optional parameters that can be included in the *pool – dns server*, *domain-name*.

```
R1(config)# ip dhcp excluded-address 192.168.10.1 192.168.10.9
R1(config)# ip dhcp excluded-address 192.168.10.254
R1(config)# ip dhcp pool LAN-POOL-1
R1(dhcp-config)# network 192.168.10.0 255.255.255.0
R1(dhcp-config)# default-router 192.168.10.1
R1(dhcp-config)# dns-server 192.168.11.5
R1(dhcp-config)# domain-name example.com
R1(dhcp-config)# end
R1#
```

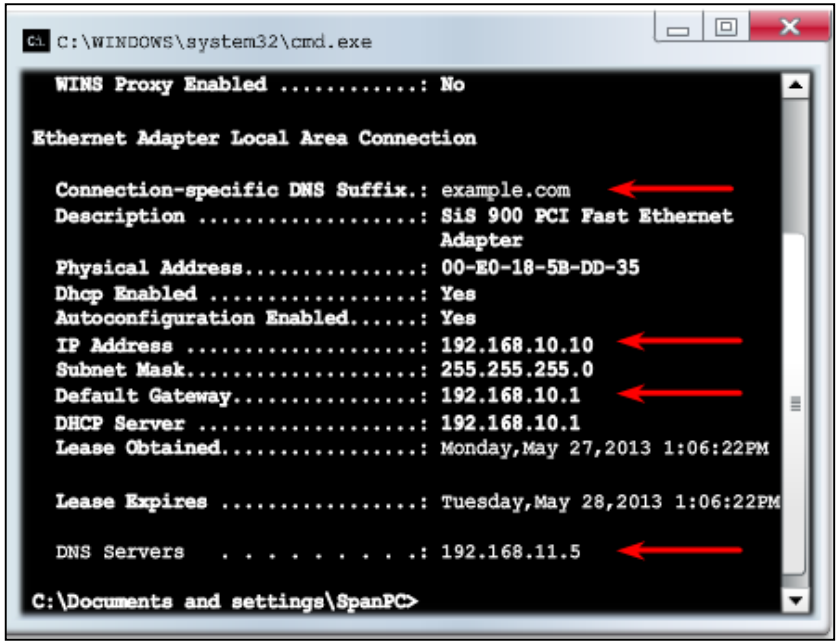
To disable DHCP, use the **no service dhcp** command.

# Verifying a DHCPv4 Server

- Commands to verify DHCP:

```
show running-config | section dhcp
show ip dhcp binding
show ip dhcp server statistics
```

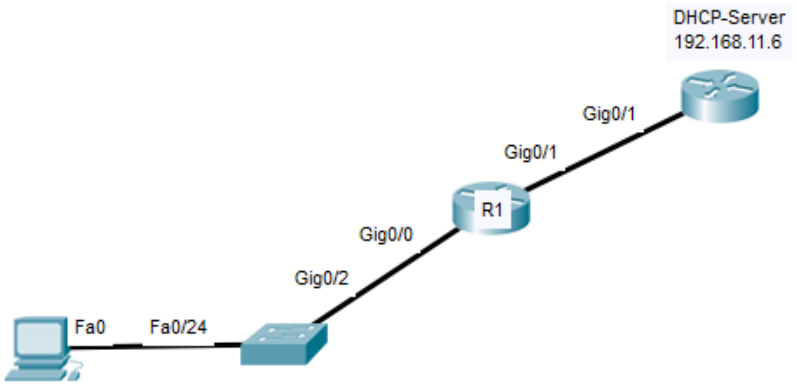
- On the PC, issue the **ipconfig /all** command.



# DHCPv4 Relay

Using an IP helper address enables a router to forward DHCPv4 broadcasts to the DHCPv4 server. Acting as a relay.

```
R1(config)# interface g0/0
R1(config-if)# ip helper-address 192.168.11.6
R1(config-if)# end
R1# show ip interface g0/0
GigabitEthernet0/0 is up, line protocol is up
  Internet address is 192.168.10.1/24
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is 192.168.11.6
<Output omitted>
```



# Configuring a Router as a DHCPv4 Client


```
SOHO(config)# interface g0/1
SOHO(config-if)# ip address dhcp
SOHO(config-if)# no shutdown
SOHO(config-if)#
*Jan 31 17:31:11.507: %DHCP-6-ADDRESS_ASSIGN: Interface
GigabitEthernet0/1 assigned DHCP address 209.165.201.12, mask
255.255.255.224, hostname SOHO
SOHO(config-if)# end
SOHO# show ip interface g0/1
GigabitEthernet0/1 is up, line protocol is up
  Internet address is 209.165.201.12/27
  Broadcast address is 255.255.255.255
  Address determined by DHCP
  <Output omitted>
```

## Troubleshoot DHCPv4

# Debugging DHCPv4

### Verifying DHCPv4 Using Router debug Commands

```
R1(config)# access-list 100 permit udp any any eq 67
R1(config)# access-list 100 permit udp any any eq 68
R1(config)# end
R1# debug ip packet 100
IP packet debugging is on for access list 100
*IP: s=0.0.0.0 (GigabitEthernet0/1), d=255.255.255.255, len 333,
rcvd 2
*IP: s=0.0.0.0 (GigabitEthernet0/1), d=255.255.255.255, len 333,
stop process pak for forus packet
*IP: s=192.168.11.1 (local), d=255.255.255.255
(GigabitEthernet0/1), len 328, sending broad/multicast

<Output omitted>

Router1# debug ip dhcp server events
DHCPD: returned 192.168.10.11 to address pool LAN-POOL-1
DHCPD: assigned IP address 192.168.10.12 to client
0100.0103.85e9.87.
DHCPD: checking for expired leases.
DHCPD: the lease for address 192.168.10.10 has expired.
DHCPD: returned 192.168.10.10 to address pool LAN-POOL-1
```

# DHCPv6

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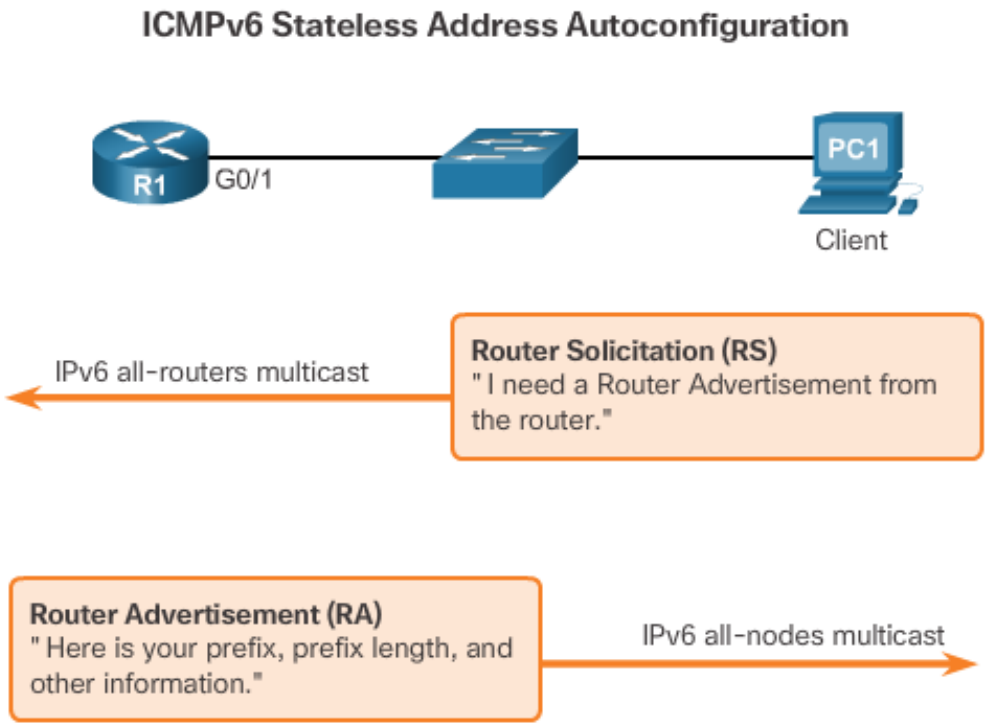
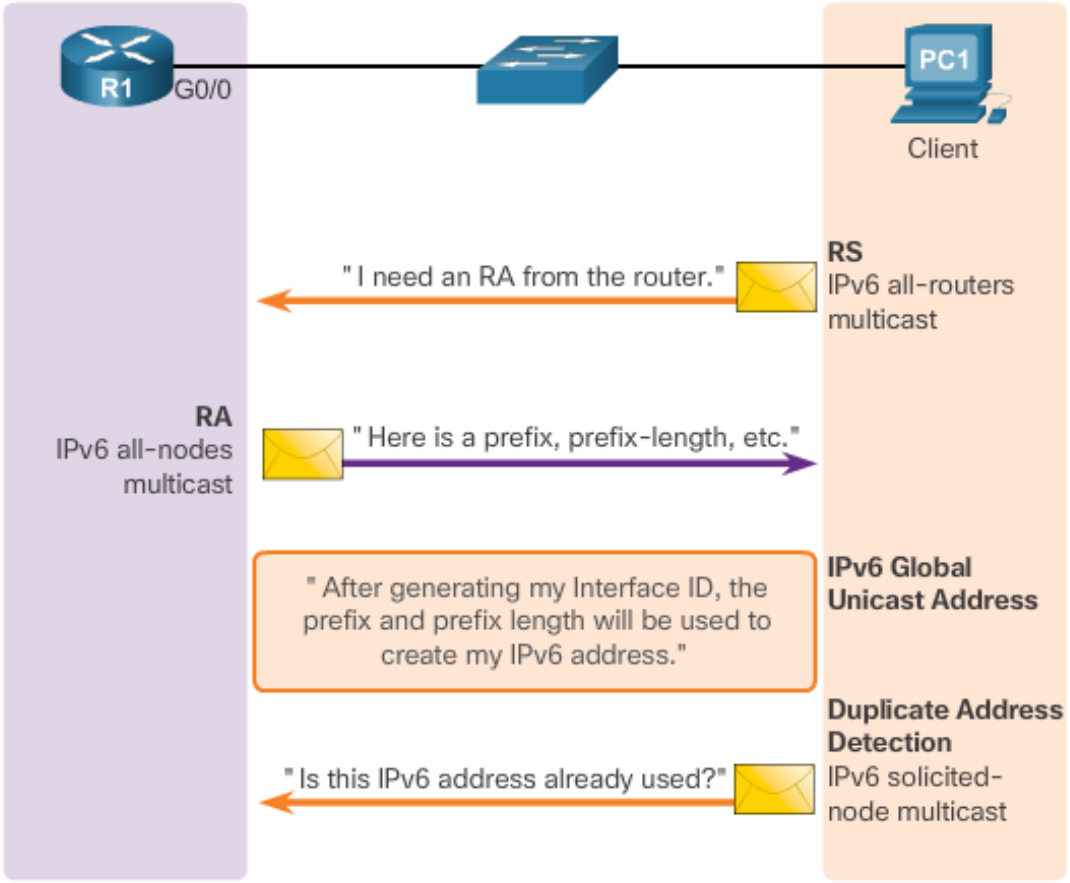
# Stateless Address Autoconfiguration (SLAAC)

- SLAAC uses ICMPv6 Router Solicitation and Router Advertisement messages to provide addressing and other configuration information that would normally be provided by a DHCP server:

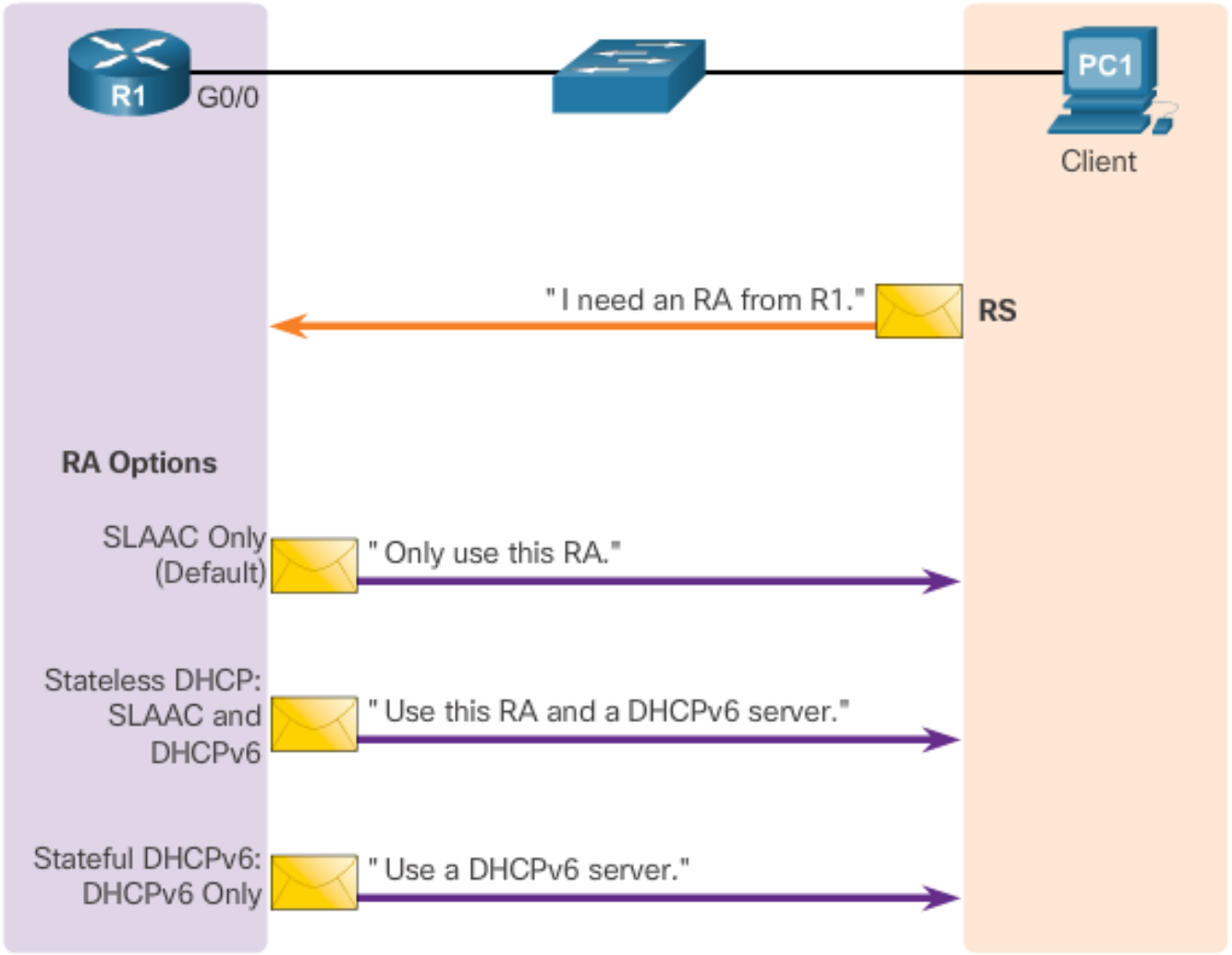


# SLAAC Operation

- A router must have IPv6 routing enabled before it can send RA messages: Router(config)# **`ipv6 unicast-routing`**

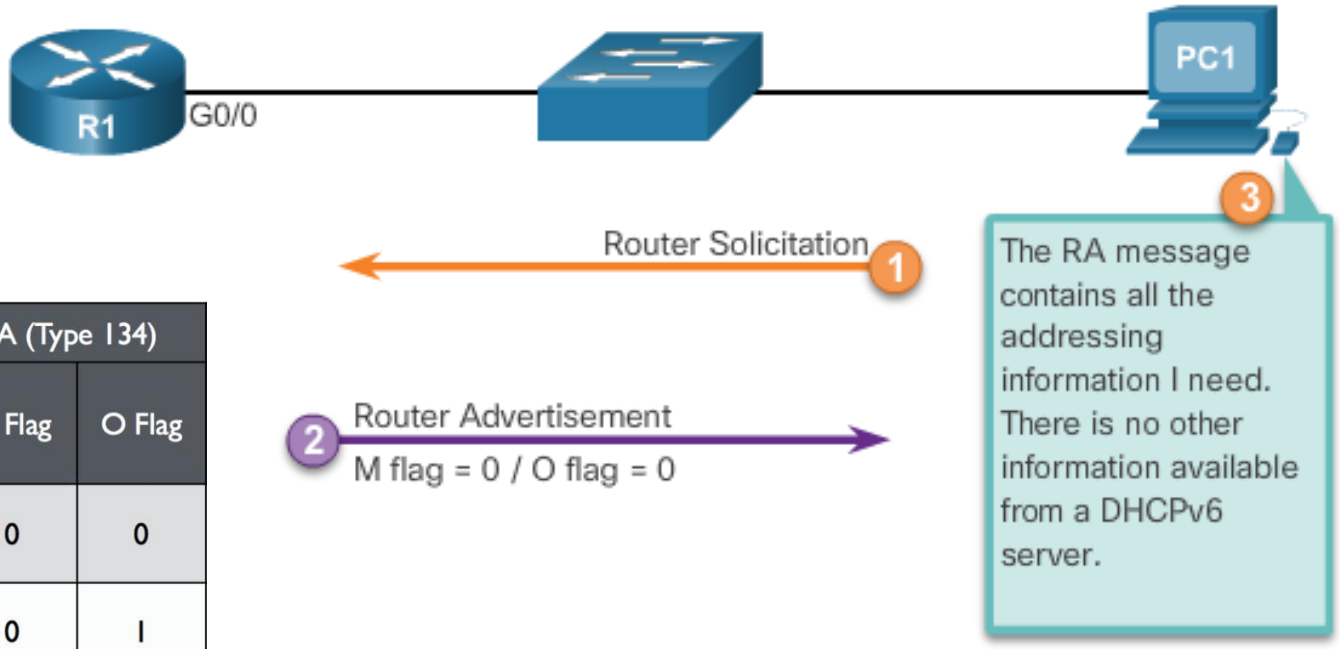


# SLAAC and DHCPv6



# SLAAC Option

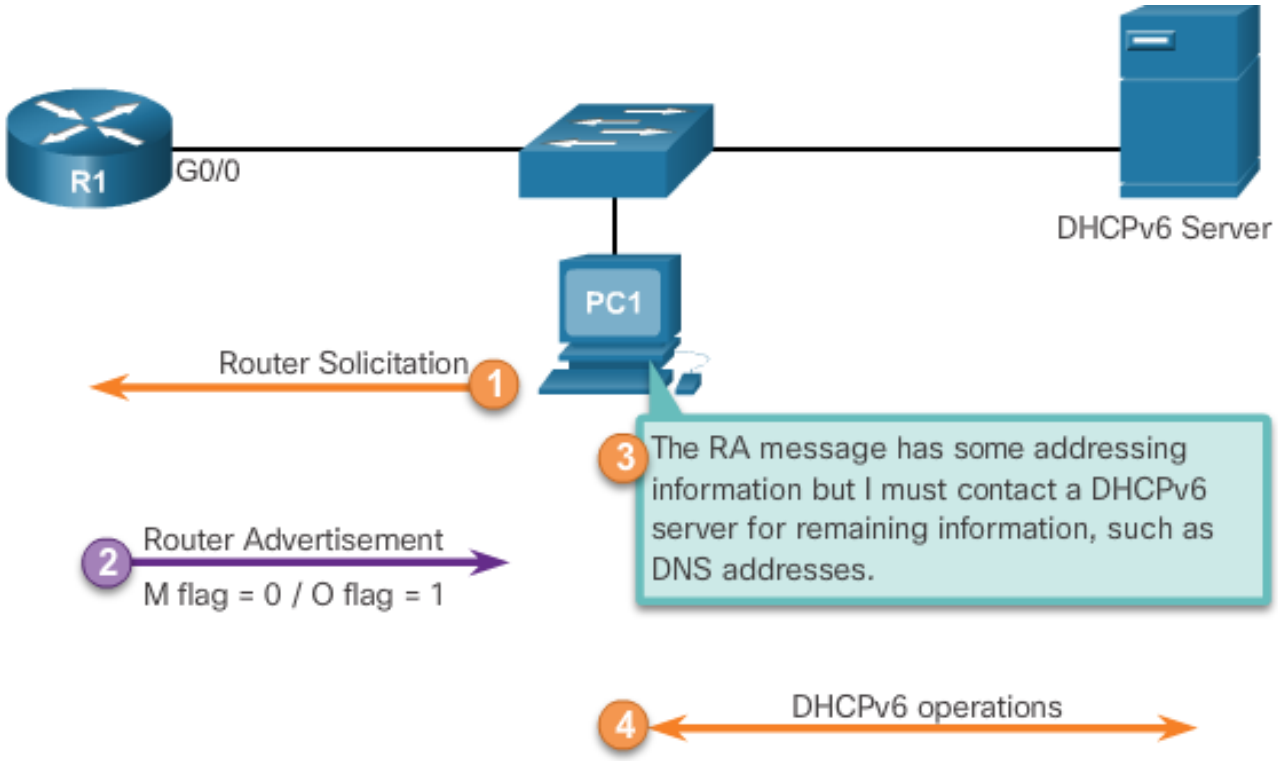
- SLAAC is the default option on Cisco routers. Both the M flag and the O flag are set to 0 in the RA, as shown in the figure.




| Auto-address Configuration Method | ICMPv6 RA (Type 134) | | |
|---|---|---|---|
| | A Flag | M Flag | O Flag |
| SLAAC | 1 | 0 | 0 |
| Stateless DHCPv6 | 1 | 0 | 1 |
| Stateful DHCPv6 | 0 | 1 | N/R |

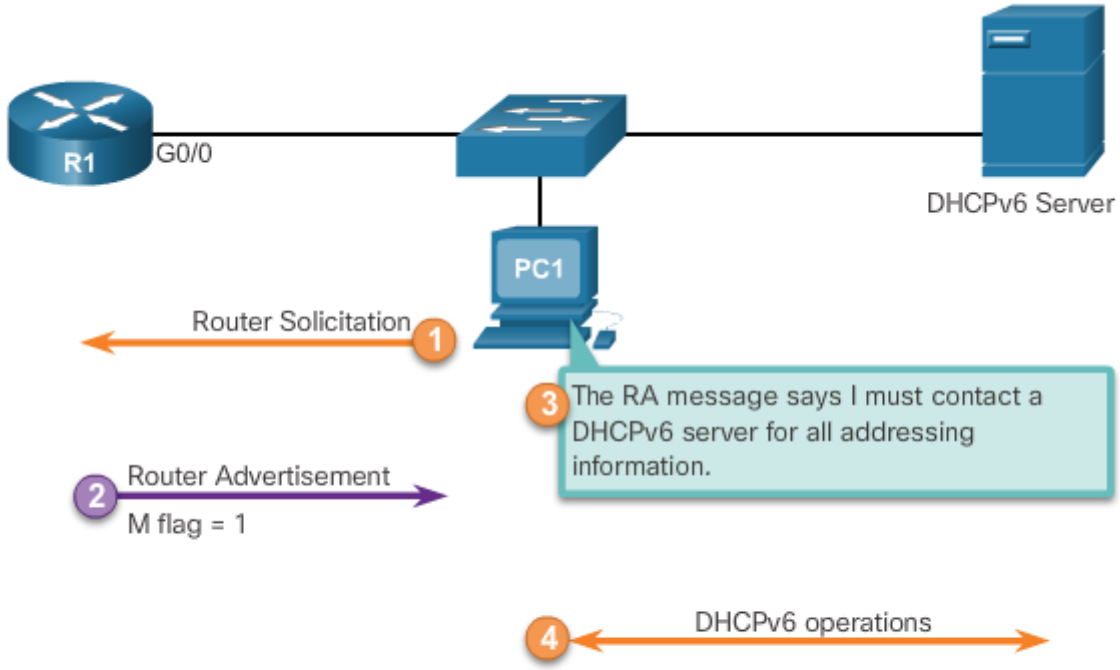
# Stateless DHCPv6 Option

- To modify the RA message sent on the interface of a router to indicate stateless DHCPv6, use the following command: **Router(config-if)# `ipv6 nd other-config-flag`**

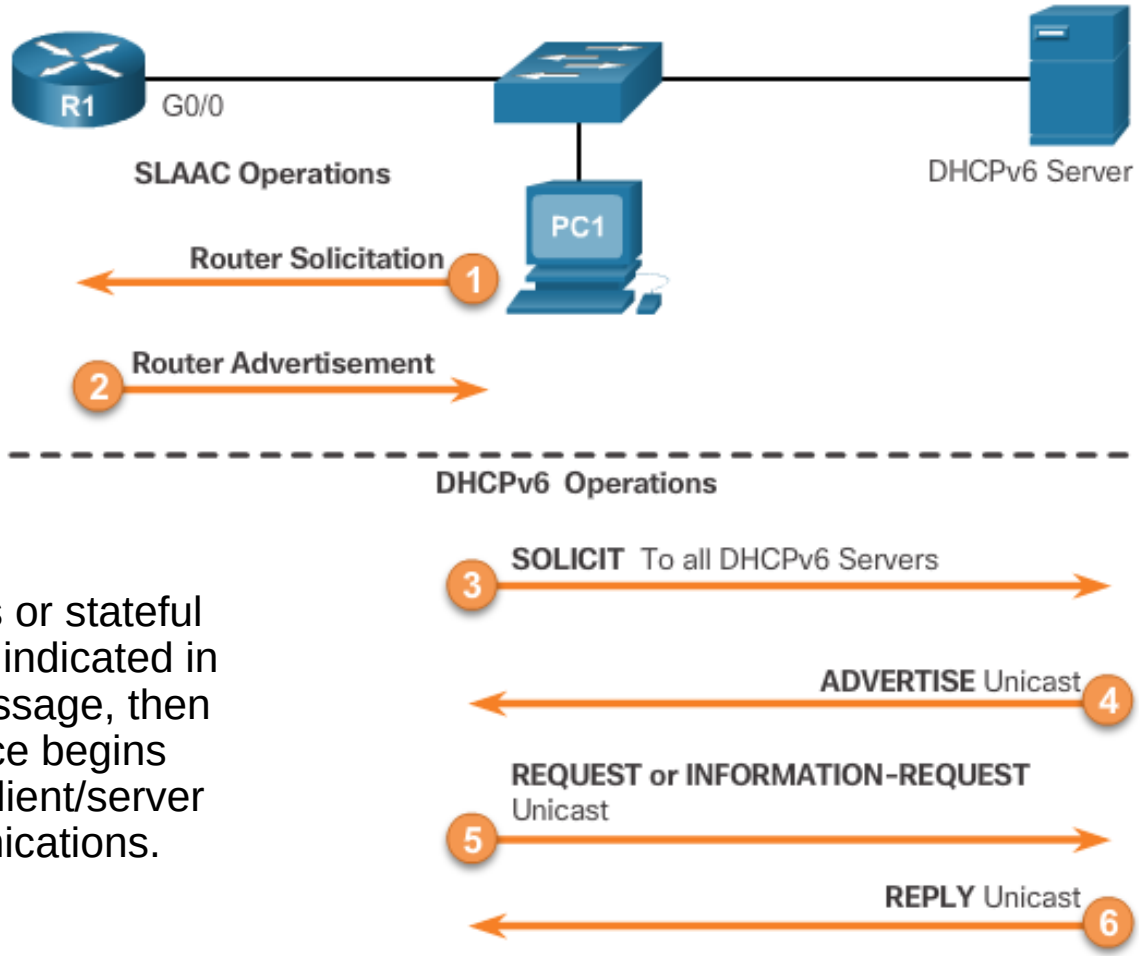


# Stateful DHCPv6 Option

- This option is the most similar to DHCPv4. In this case, the RA message informs the client not to use the information in the RA message. All addressing information and configuration information must be obtained from a stateful DHCPv6 server. **Router(config-if)# `ipv6 nd managed-config-flag`**

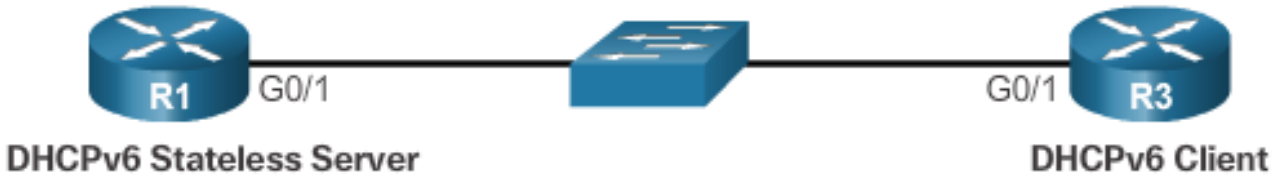


# DHCPv6 Operations



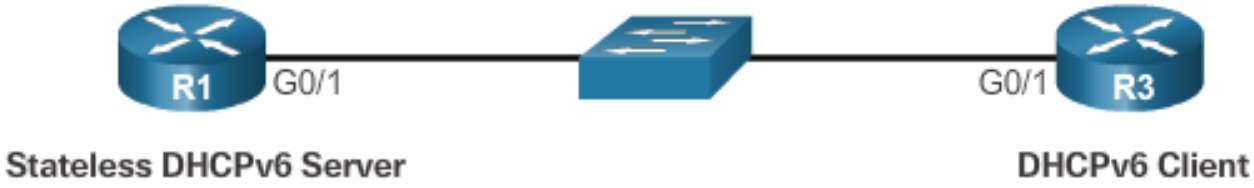

If stateless or stateful DHCPv6 is indicated in the RA message, then the device begins DHCPv6 client/server communications.

# Configuring a Router as a Stateless DHCPv6 Server




```
R1(config)# ipv6 unicast-routing
R1(config)# ipv6 dhcp pool IPV6-STATELESS
R1(config-dhcpv6)# dns-server 2001:db8:cafe:aaaa::5
R1(config-dhcpv6)# domain-name example.com
R1(config-dhcpv6)# exit
R1(config)# interface g0/1
R1(config-if)# ipv6 address 2001:db8:cafe:1::1/64
R1(config-if)# ipv6 dhcp server IPV6-STATELESS
R1(config-if)# ipv6 nd other-config-flag
```

# Configuring a Router as a Stateless DHCPv6 Client




```
R3(config)# interface g0/1
R3(config-if)# ipv6 enable
R3(config-if)# ipv6 address autoconfig
R3(config-if)#
```

# Verifying Stateless DHCPv6


```
R1# show ipv6 dhcp pool
DHCPv6 pool: IPV6-STATELESS
  DNS server: 2001:DB8:CAFE:AAAA::5
  Domain name: example.com
  Active clients: 0
R1#
```

Verify the stateless DHCP client using the following commands:

- **show ipv6 interface**
- **debug ipv6 dhcp detail**

## Stateful DHCPv6 Server

# Configuring a Router as a Stateful DHCPv6 Server

**Step 1. Enable IPv6 Routing**

```
Router(config)# ipv6 unicast-routing
```

**Step 2. Configure a DHCPv6 Pool**

```
Router(config)# ipv6 dhcp pool pool-name
Router(config-dhcpv6)#
```

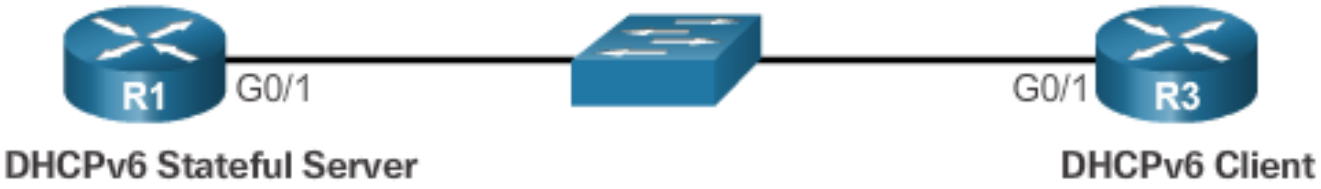
**Step 3. Configure Pool Parameters**

```
Router(config-dhcpv6)# address prefix/length [lifetime
                       {valid-lifetime preferred-lifetime
                       | infinite}]
Router(config-dhcpv6)# dns-server dns-server-address
Router(config-dhcpv6)# domain-name domain-name
```

**Step 4. Configure the DHCPv6 Interface**

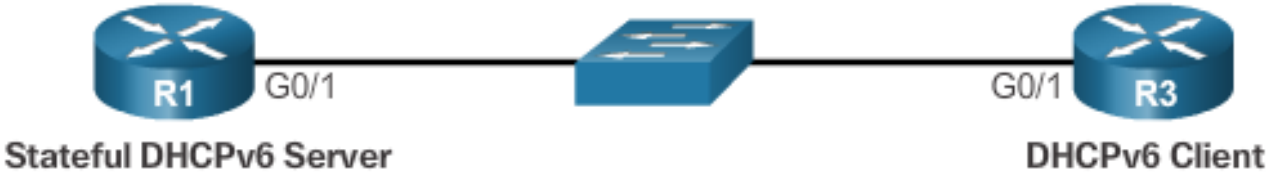
```
Router(config)# interface type number
Router(config-if)# ipv6 dhcp server pool-name
Router(config-if)# ipv6 nd managed-config-flag
```

# Configuring a Router as a Stateful DHCPv6 Server




```
R1(config)# ipv6 unicast-routing
R1(config)# ipv6 dhcp pool IPV6-STATEFUL
R1(config-dhcpv6)# address prefix 2001:DB8:CAFE:1::/64
                    lifetime infinite
R1(config-dhcpv6)# dns-server 2001:db8:cafe:aaaa::5
R1(config-dhcpv6)# domain-name example.com
R1(config-dhcpv6)# exit
R1(config)# interface g0/1
R1(config-if)# ipv6 address 2001:db8:cafe:1::1/64
R1(config-if)# ipv6 dhcp server IPV6-STATEFUL
R1(config-if)# ipv6 nd managed-config-flag
```

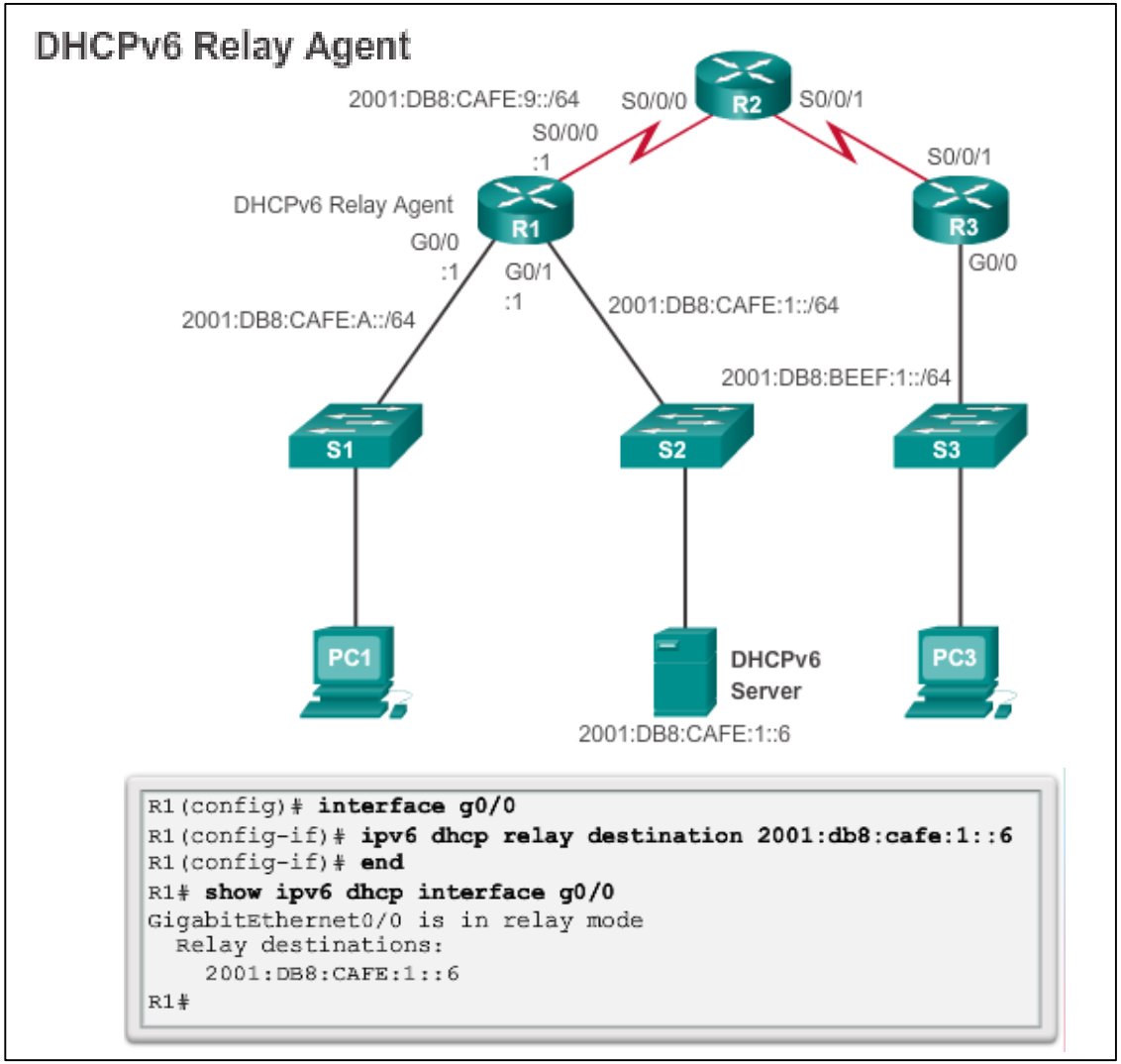
# Configuring a Router as a Stateful DHCPv6 Client




```
R3(config)# interface g0/1
R3(config-if)# ipv6 enable
R3(config-if)# ipv6 address dhcp
R3(config-if)#
```

## Stateful DHCPv6

# Configuring a Router as a DHCPv6 Relay Agent




```
R1(config)# interface g0/0
R1(config-if)# ipv6 dhcp relay destination 2001:db8:cafe:1::6
R1(config-if)# end
R1# show ipv6 dhcp interface g0/0
GigabitEthernet0/0 is in relay mode
  Relay destinations:
    2001:DB8:CAFE:1::6
R1#
```