

CHAPTER 9 DHCP

Routing & Switching

CHAPTER 9

9.0 Introduction

9.1 Dynamic Host Configuration Protocol v4

9.2 Dynamic Host Configuration Protocol v6

9.3 Summary

DHCP

- Berfungsi memberikan IP address kepada Host secara dinamis
- DHCP beroperasi secara klien-server
- Untuk setting IP address, ada 2 cara:
 - Manual, user langsung input kan IP address sendiri
 - DHCP, user akan menerima IP address dari DHCP server, sehingga user tidak perlu menginputkan manual lagi

KONFIGURASI DHCP SERVER

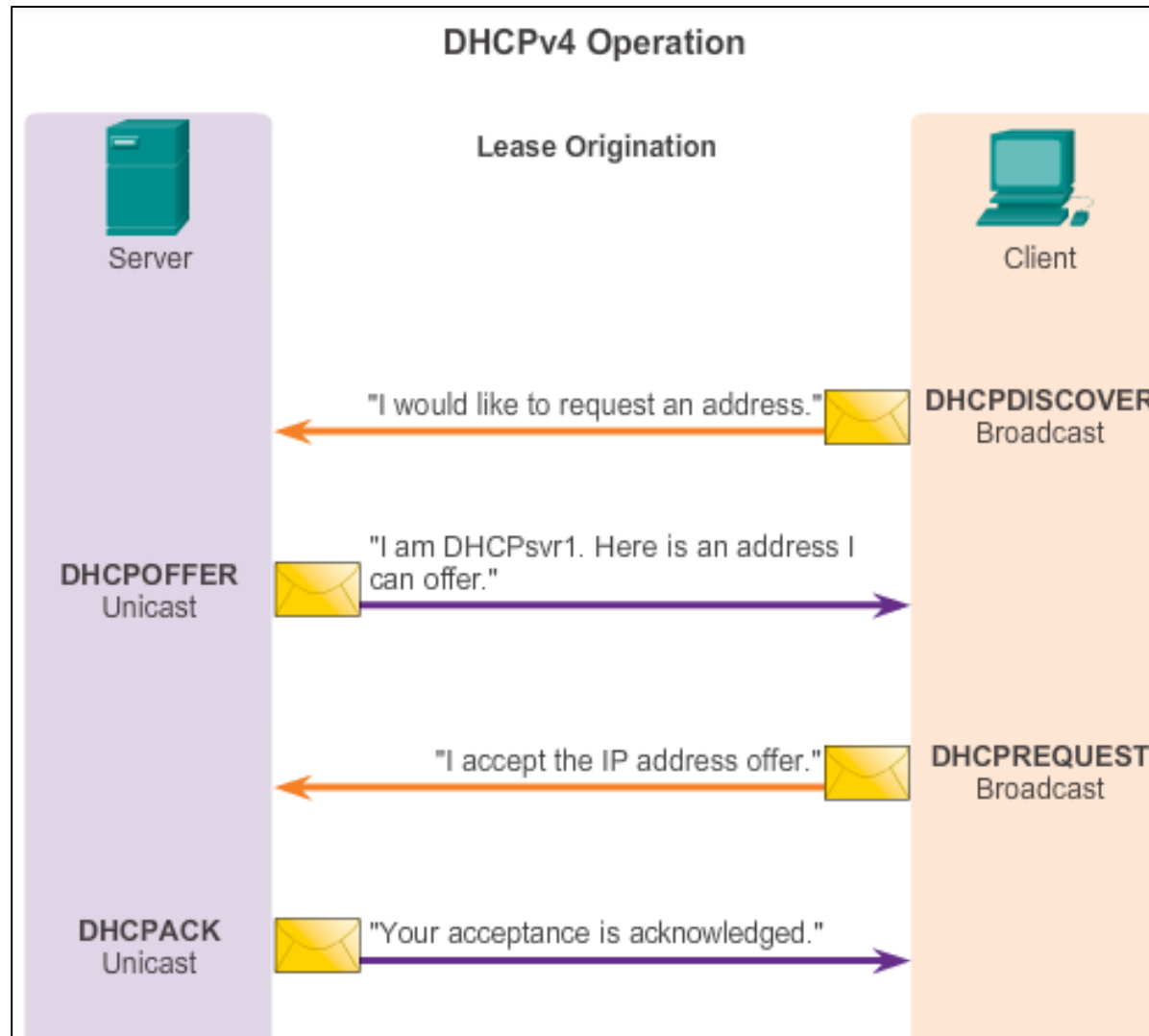
Konfigurasi	Deskripsi
R1 (config) #ip dhcp pool NetworkA	Membuat nama DHCP pool
R1 (dhcp-config) #network 192.168.1.0 255.255.255.0	Menentukan network dan subnet mask DHCP pool
R1 (dhcp-config) #default-router 192.168.1.1	Setting default gateway klien
R1 (dhcp-config) #dns 8.8.8.8	Setting Domain Name Server
	Setting domain name
	Lama waktu IP digunakan oleh klien, pada konfigurasi tersebut dipinjamkan ke klien selama 12 jam. Default lease satu hari. Sebelum habis waktunya, klien meminta request ke server untuk renew
	Menentukan range ip address yang tidak dilease ke klien. Untuk konfigurasi ini di atur dalam konfigurasi

INTRODUCING DHCPV4

DHCPv4 uses three different address allocation methods:

- **Manual Allocation** – The administrator assigns a pre-allocated IPv4 address to the client, and DHCPv4 communicates only the IPv4 address to the device.
- **Automatic Allocation** – DHCPv4 automatically assigns a static IPv4 address permanently to a device, selecting it from a pool of available addresses.
- **Dynamic Allocation** – DHCPv4 dynamically assigns, or leases, an IPv4 address from a pool of addresses for a limited period of time chosen by the server, or until the client no longer needs the address. This method is the most commonly used.

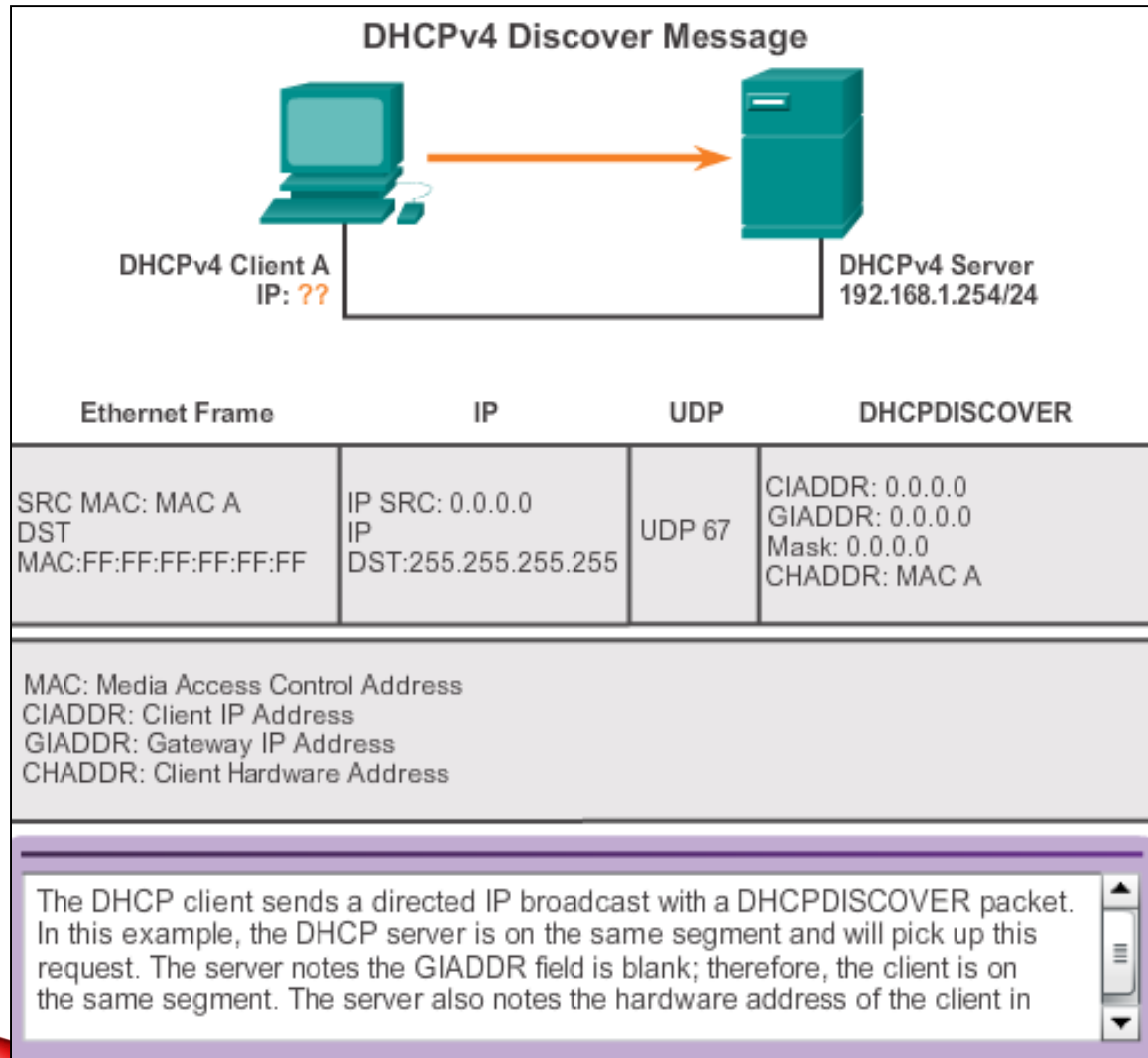
DHCPV4 OPERATION



DHCPV4 MESSAGE FORMAT

DHCPv4 Message Format			
8	16	24	32
OP Code (1)	Hardware type (1)	Hardware address length (1)	Hops (1)
Transaction Identifier			
Seconds - 2 bytes		Flags - 2 bytes	
Client IP Address (CIADDR) - 4 bytes			
Your IP Address (YIADDR) - 4 bytes			
Server IP Address (SIADDR) - 4 bytes			
Gateway IP Address (GIADDR) - 4 bytes			
Client Hardware Address (CHADDR) - 16 bytes			
Server name (SNAME) - 64 bytes			
Boot Filename - 128 bytes			
DHCP Options - variable			

DHCPV4 OPERATION FORMAT DHCPV4 DISCOVER AND OFFER MESSAGES



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:

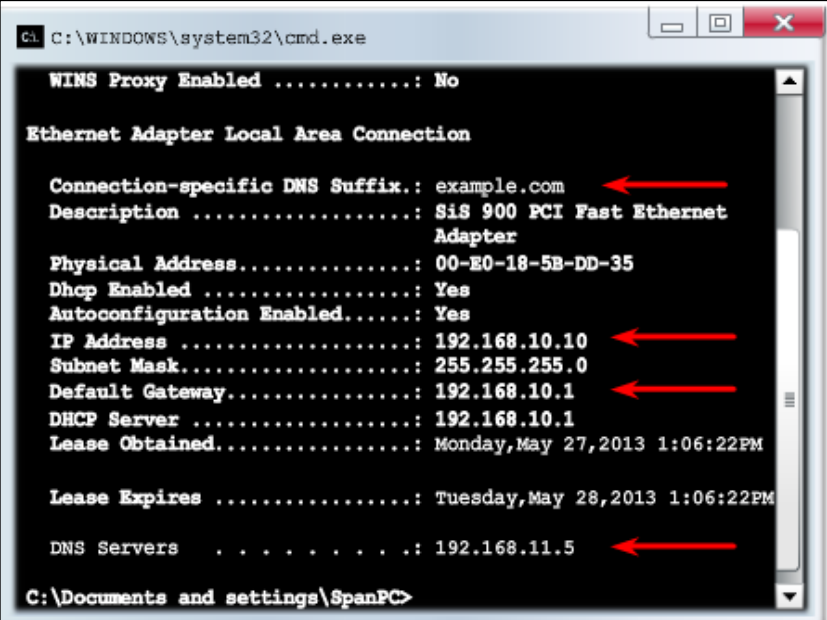
1. Exclude addresses from the pool.
2. Set up the DHCP pool name.
3. Define the range of addresses and subnet mask. Use the **default-router** command for the default gateway. Optional parameters that can be included in the *pool – dns server, domain-name*.

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

```
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 #
```

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



```

c:\WINDOWS\system32\cmd.exe

WINS Proxy Enabled .....: No

Ethernet Adapter Local Area Connection

Connection-specific DNS Suffix.: example.com
Description .....: SiS 900 PCI Fast Ethernet
Adapter
Physical Address.....: 00-E0-18-5B-DD-35
Dhcp Enabled .....: Yes
Autoconfiguration Enabled.....: Yes
IP Address .....: 192.168.10.10
Subnet Mask.....: 255.255.255.0
Default Gateway.....: 192.168.10.1
DHCP Server .....: 192.168.10.1
Lease Obtained.....: Monday, May 27, 2013 1:06:22PM

Lease Expires .....: Tuesday, May 28, 2013 1:06:22PM

DNS Servers . . . . .: 192.168.11.5

C:\Documents and settings\SpanPC>
  
```

DHCPV4 OPERATION

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>
  
```

TROUBLESHOOTING TASKS

Troubleshooting Task 1:	Resolve conflicts.
Troubleshooting Task 2:	Verify physical connectivity.
Troubleshooting Task 3:	Test with a static IPv4 address.
Troubleshooting Task 4:	Verify switch port configuration.
Troubleshooting Task 5:	Test from the same subnet or VLAN.

VERIFYING THE ROUTER DHCPV4 CONFIGURATION

Verifying DHCPv4 Relay and DHCPv4 Services

```
R1# show running-config | section interface GigabitEthernet0/0
interface GigabitEthernet0/0
  ip address 192.168.10.1 255.255.255.0
  ip helper-address 192.168.11.6
  duplex auto
  speed auto
R1#

R1# show running-config | include no service dhcp
R1#
```

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
```

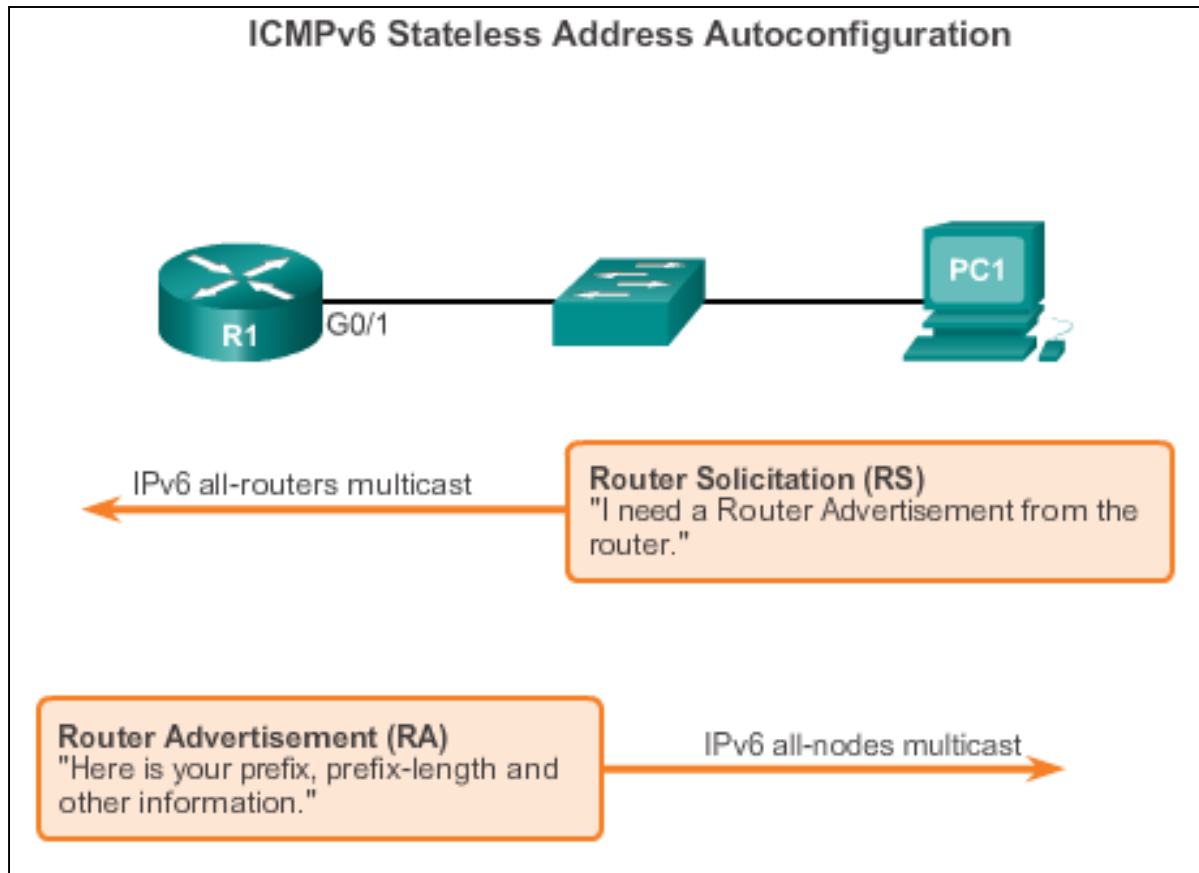
<Output omitted>

```
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
```

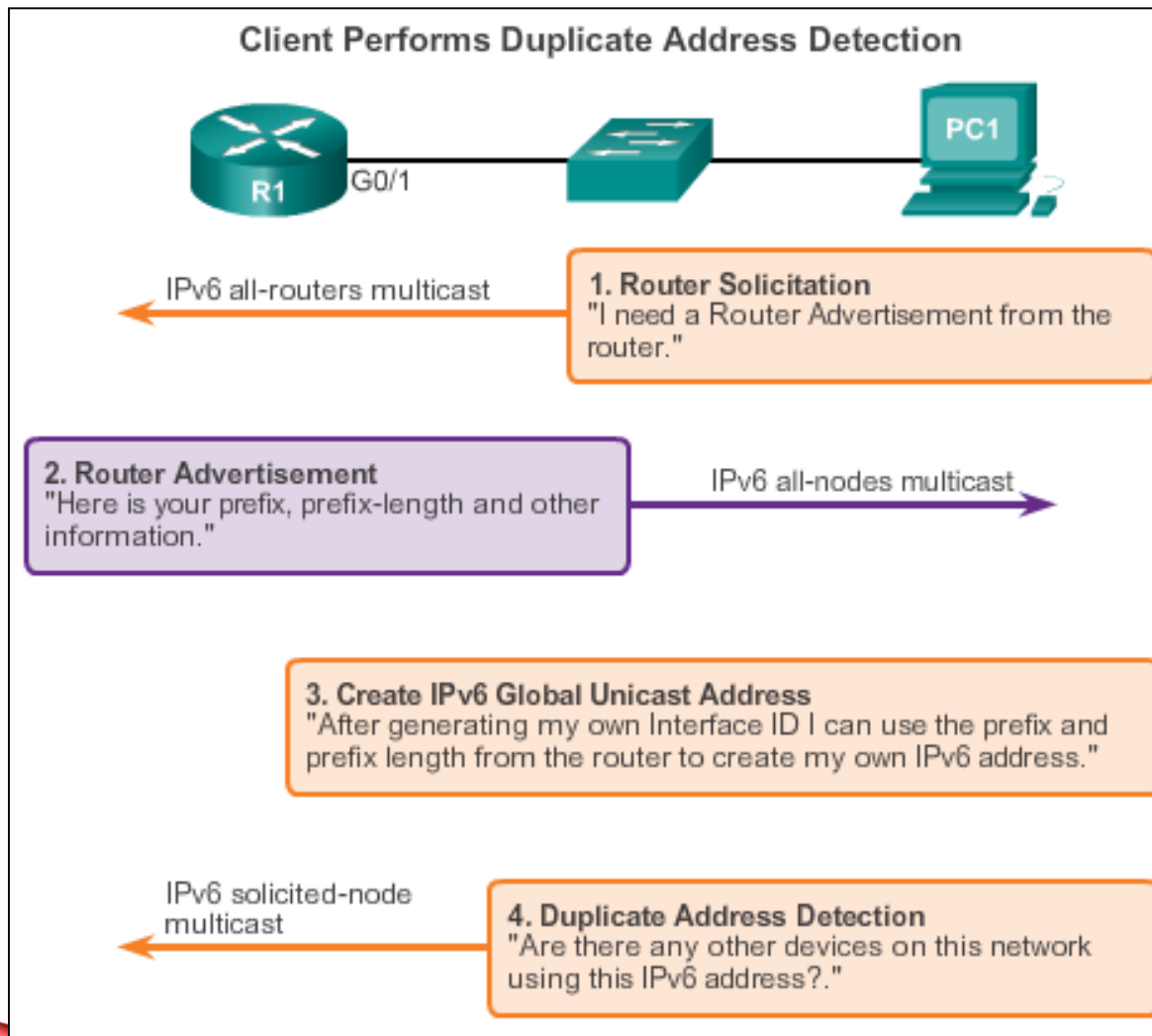
7.2 DYNAMIC HOST CONFIGURATION PROTOCOL V6

STATELESS ADDRESS AUTOCONFIGURATION

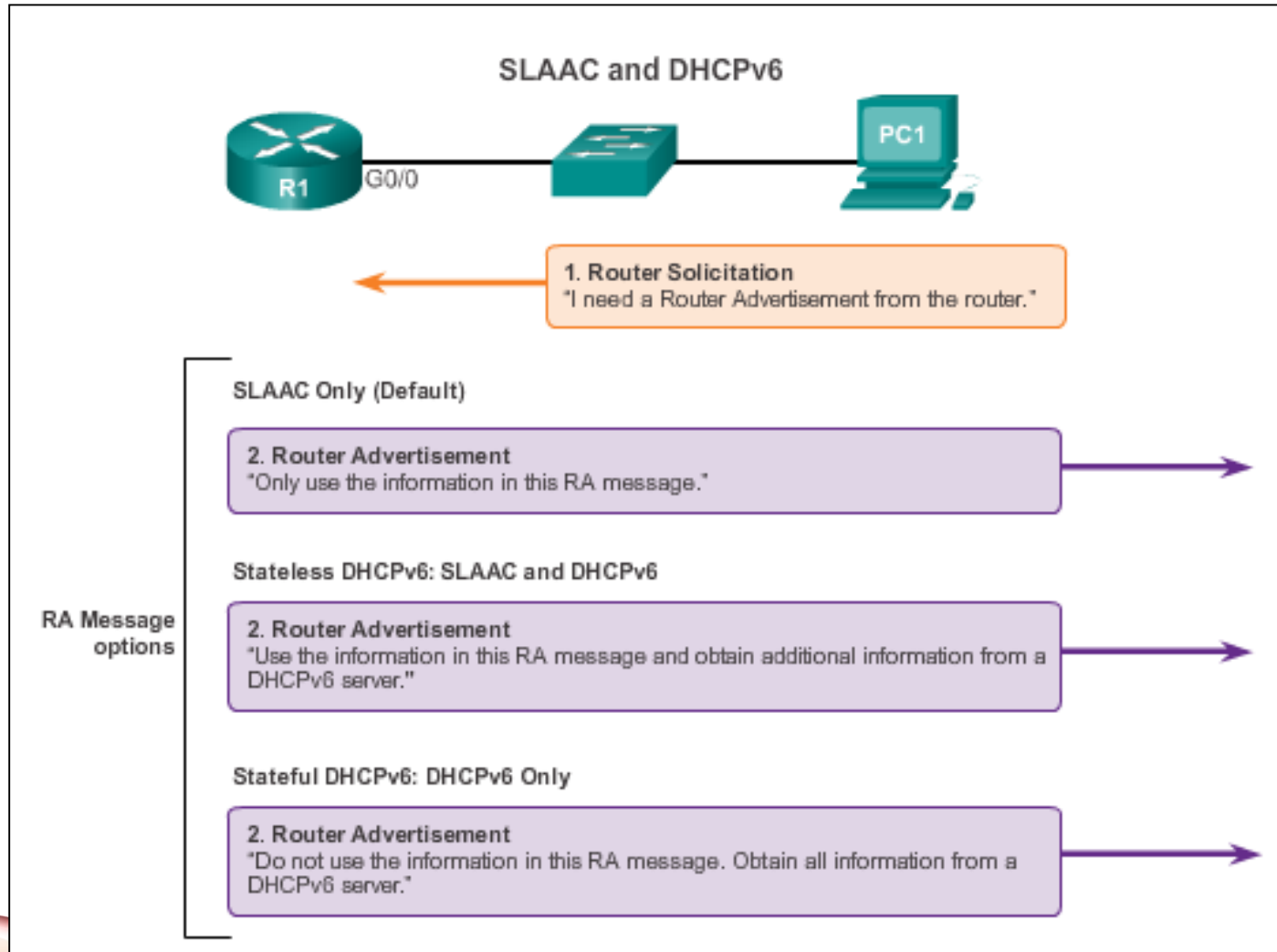
Stateless Address Autoconfiguration (SLAAC) is a method in which a device can obtain an IPv6 global unicast address without the services of a DHCPv6 server.



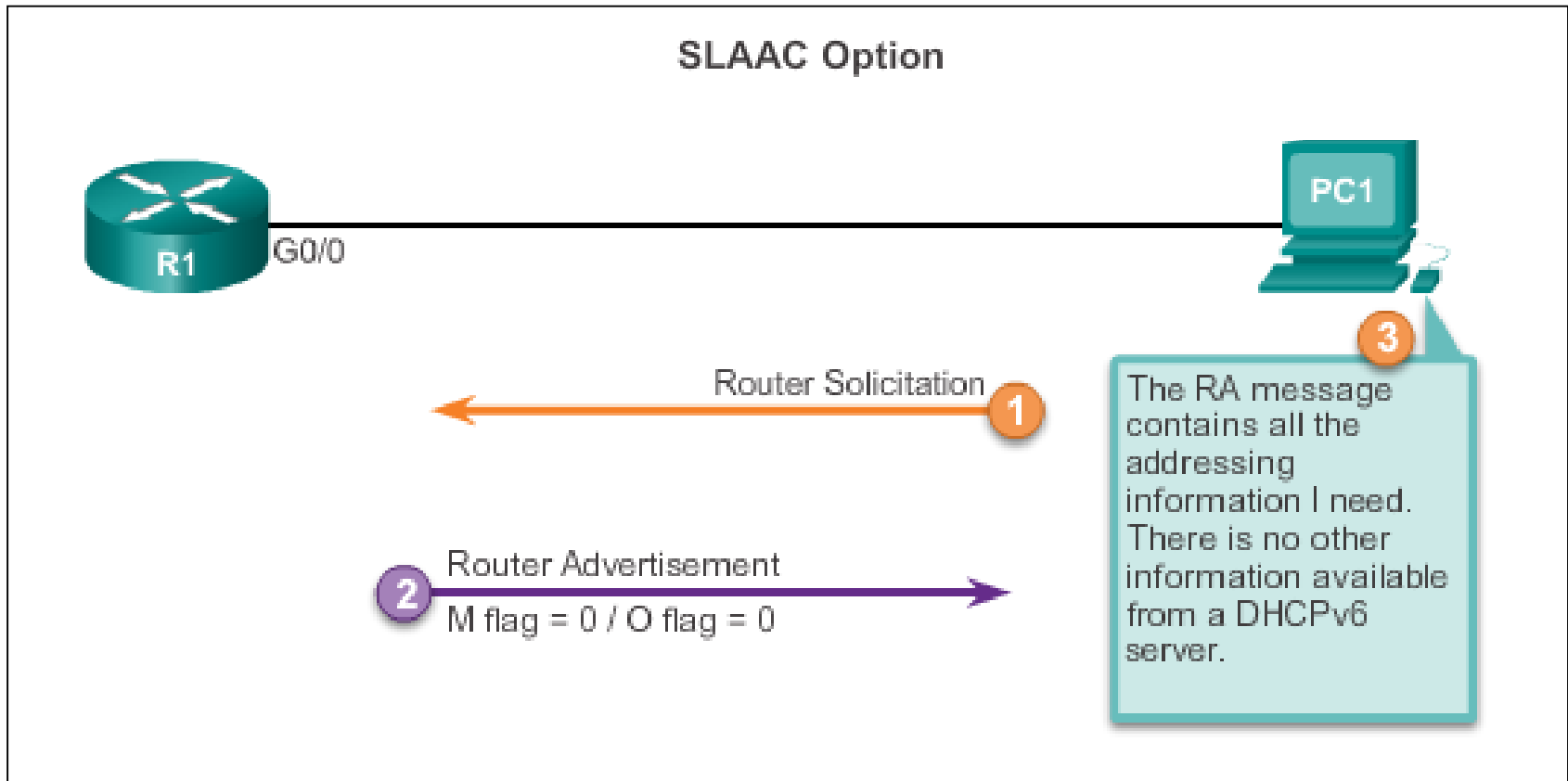
SLAAC OPERATION



SLAAC AND DHCPV6

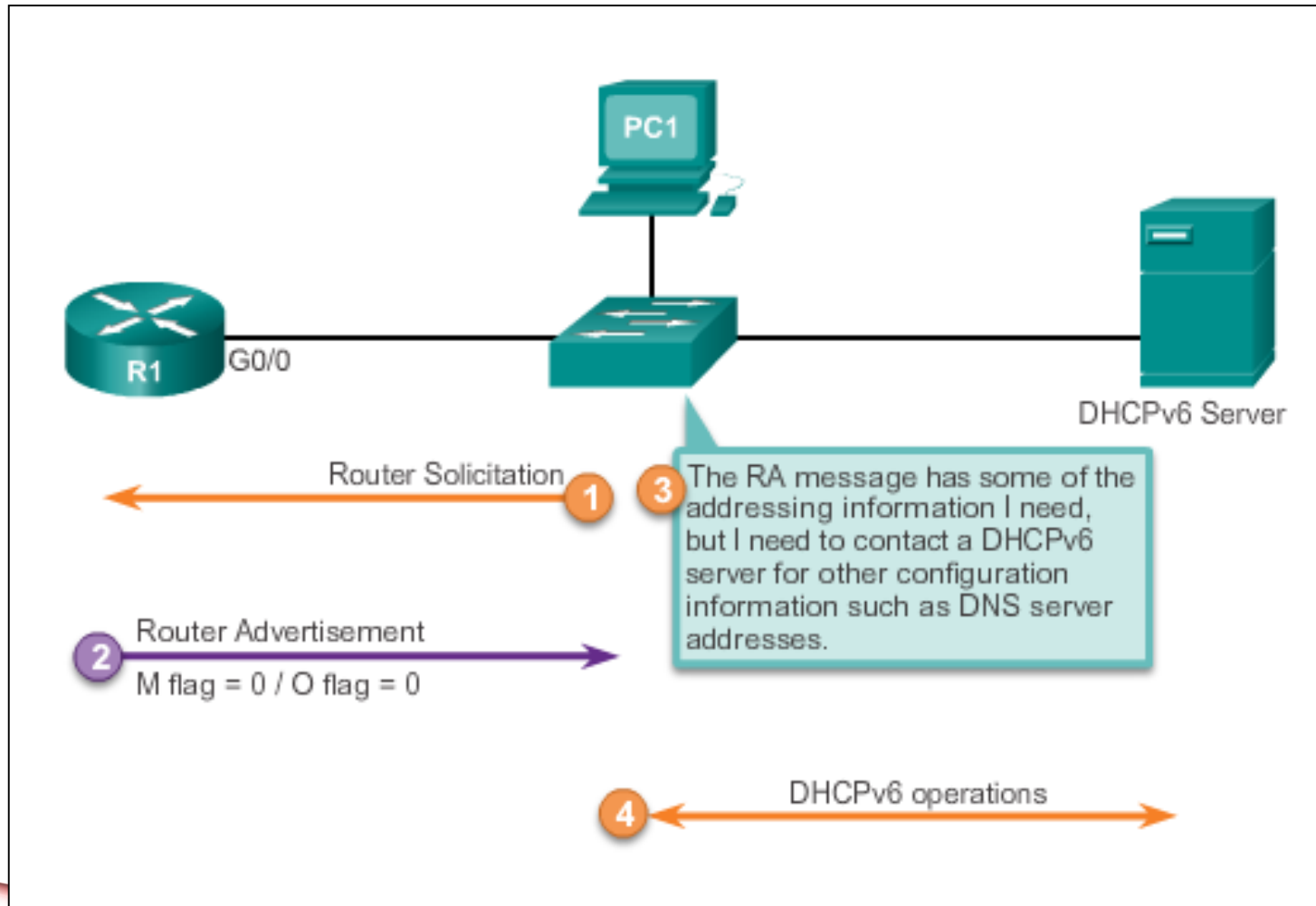


SLAAC OPTION

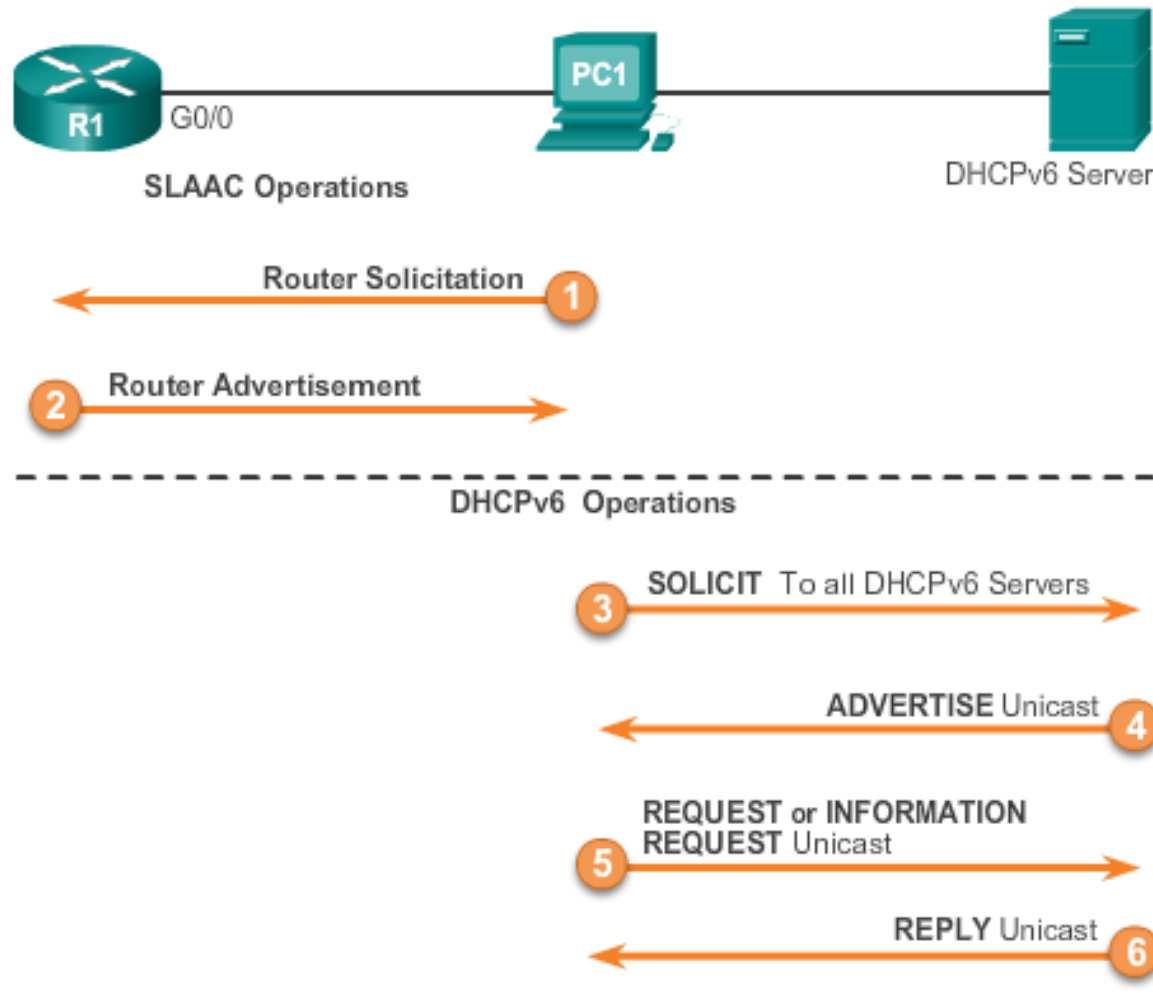


STATELESS DHCP OPTION

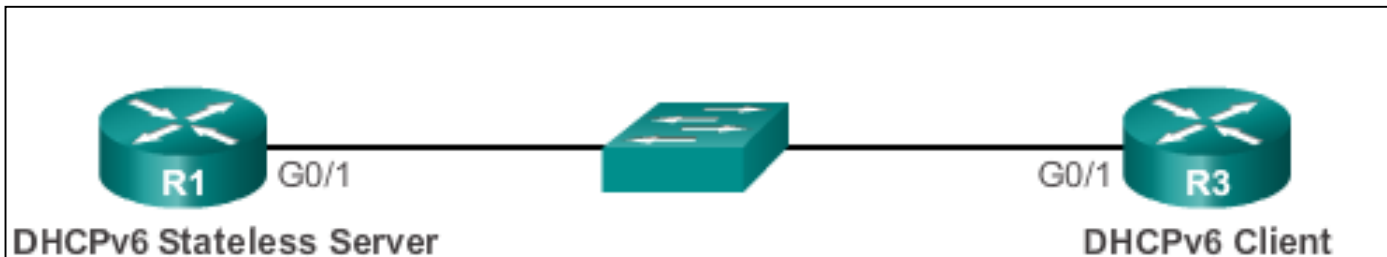
Stateless DHCPv6 Option



DHCPV6 OPERATIONS



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



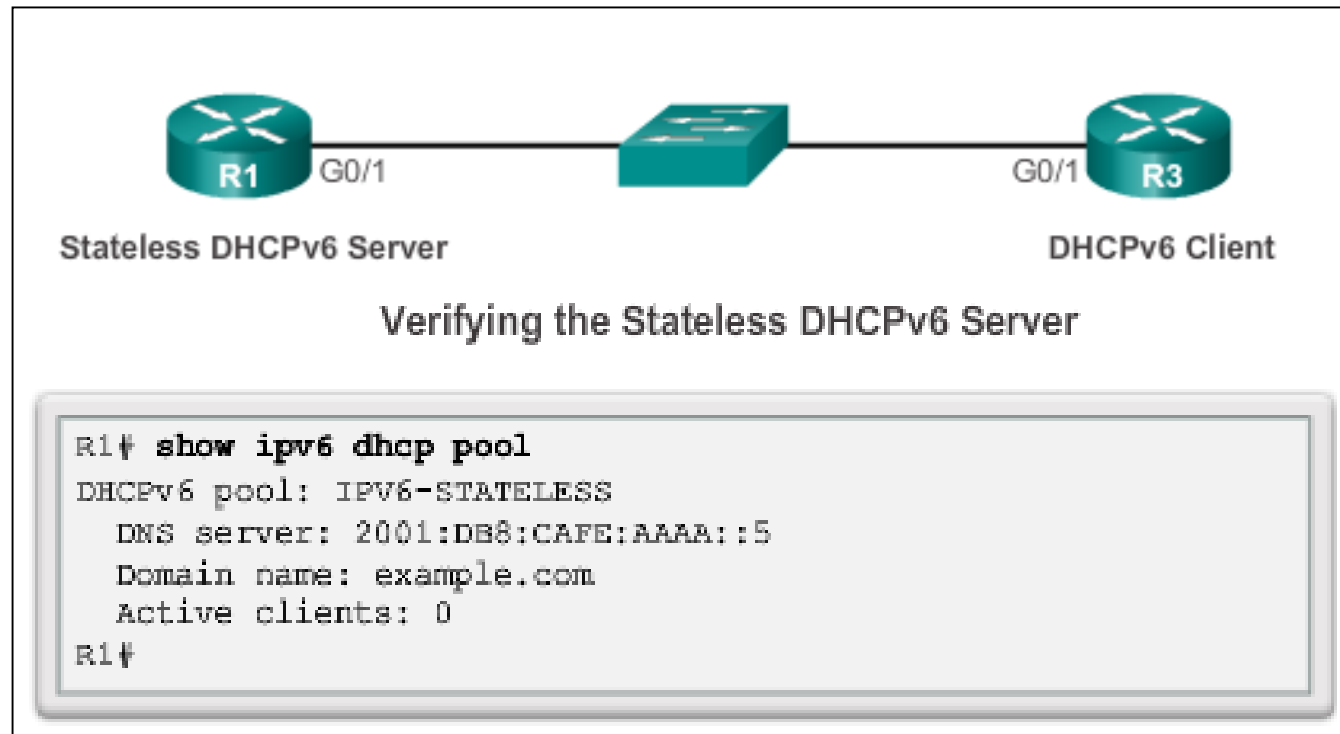
Stateless DHCPv6 Server

DHCPv6 Client

Configuring a Router as 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

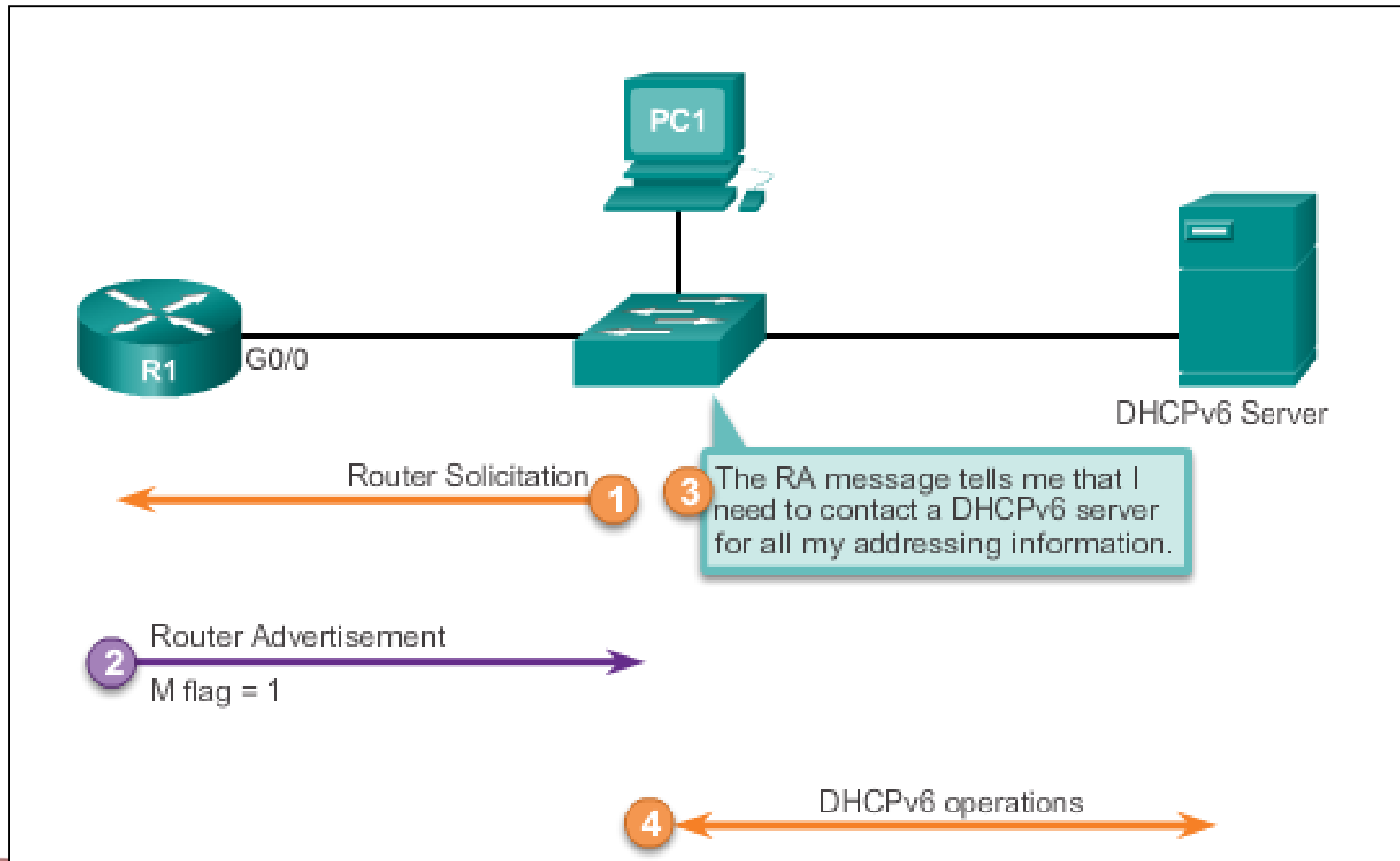


Verify the stateless DHCP client using the following commands:

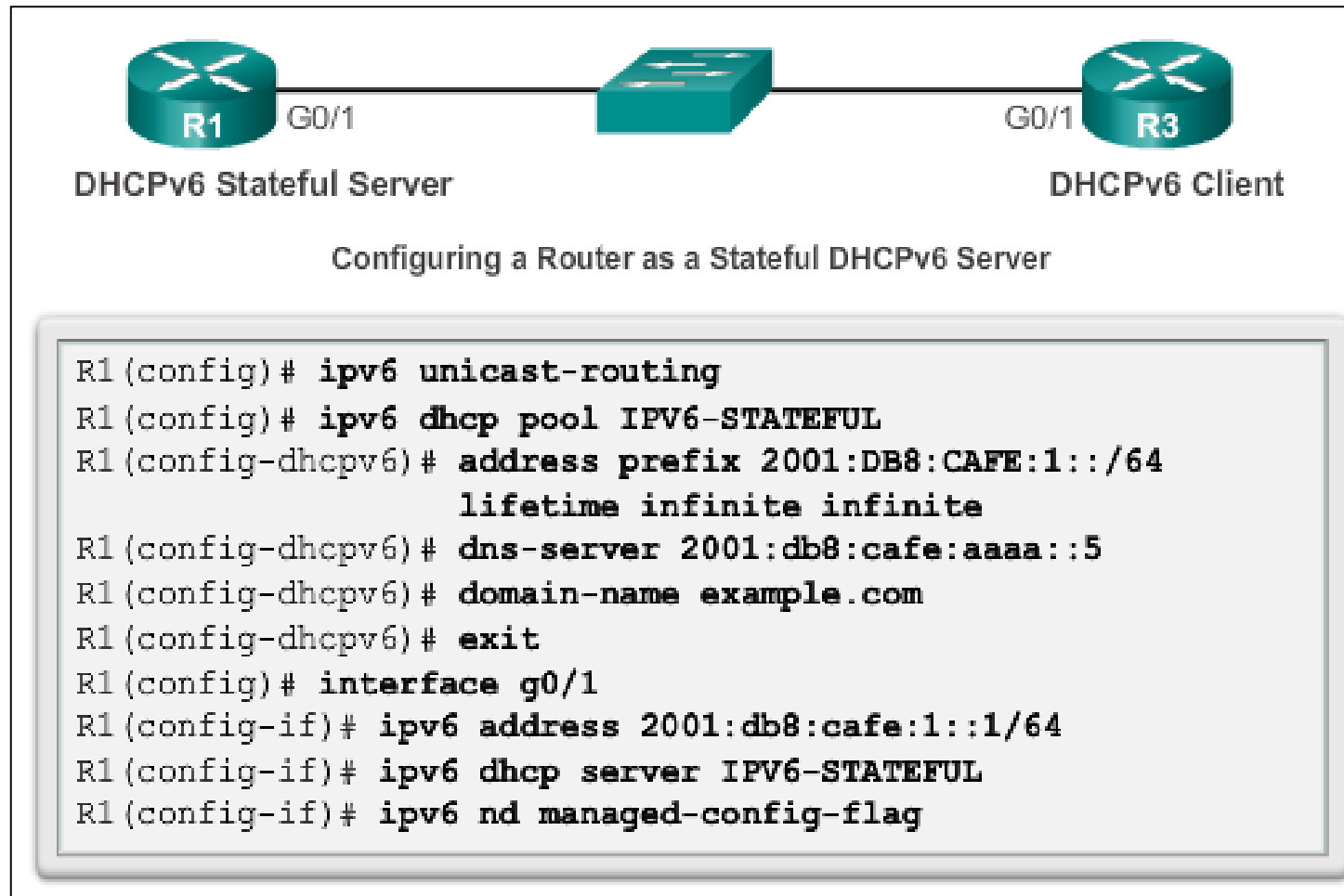
- **show IPv6 interface**
- **debug ipv6 dhcp detail**

STATEFUL DHCP OPTION

Stateful DHCPv6 Option



STATEFUL DHCPV6 CONFIGURING A ROUTER AS A STATEFUL DHCPV6 SERVER



VERIFYING STATEFUL DHCPV6

- Verify the stateful DHCPv6 server using the following commands:

```
show ipv6 dhcp pool
```

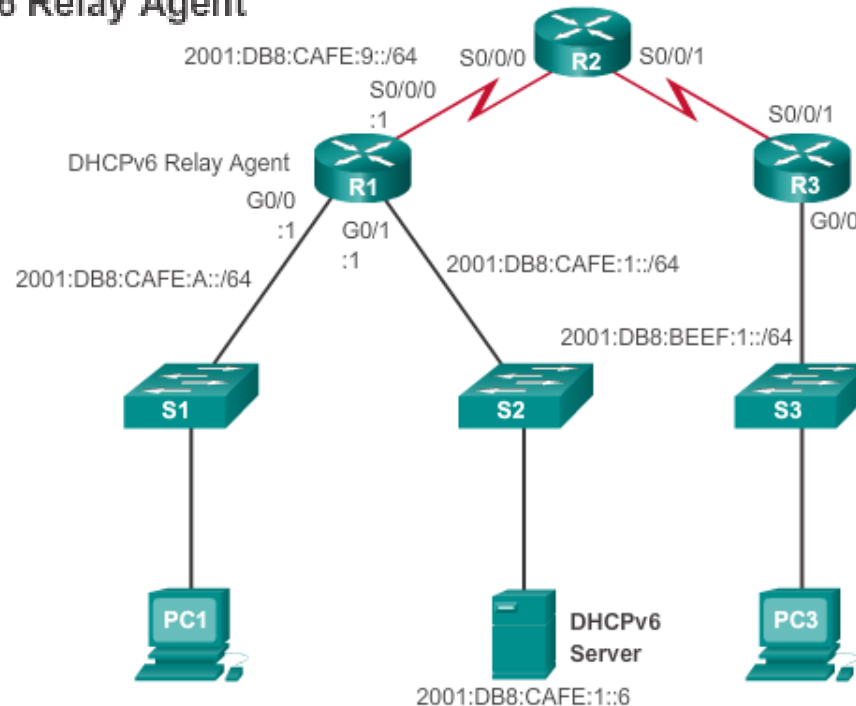
```
show ipv6 dhcp binding
```

- Verify the stateful DHCPv6 client using the `show ipv6 interface` command.

```
R3# show ipv6 interface g0/1
GigabitEthernet0/1 is up, line protocol is up
  IPv6 is enabled, link-local address is
FE80::32F7:DFE:FE25:2DE1
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:CAFE:1:5844:47B2:2603:C171, subnet is
2001:DB8:CAFE:1:5844:47B2:2603:C171/128
  Joined group address(es):
    FF02::1
    FF02::1:FF03:C171
    FF02::1:FF25:2DE1
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds (using 30000)
  ND NS retransmit interval is 1000 milliseconds
  Default router is FE80::D68C:B5FF:FECE:A0C1 on
```

STATEFUL DHCPV6 CONFIGURING A ROUTER AS A STATEFUL DHCPV6 RELAY AGENT

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#
```

TROUBLESHOOTING TASKS

Troubleshooting Task 1:	Resolve conflicts.
Troubleshooting Task 2:	Verify allocation method.
Troubleshooting Task 3:	Test with a static IPv6 address.
Troubleshooting Task 4:	Verify switch port configuration.
Troubleshooting Task 5:	Test from the same subnet or VLAN.

TROUBLESHOOTING DHCPV6

VERIFYING THE ROUTER DHCPV6 CONFIGURATION

```
R1 (config)# ipv6 unicast-routing
R1 (config)# ipv6 dhcp pool IPV6-STATEFUL
R1 (config-dhcpv6)# address prefix 2001:DB8:CAFE:1::/64 lifetime
infinite 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
```

Stateless DHCPv6 Services

```
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
```

DEBUGGING DHCPV6

```
R1# debug ipv6 dhcp detail
    IPv6 DHCP debugging is on (detailed)
R1#
*Feb  3 21:27:41.123: IPv6 DHCP: Received SOLICIT from
FE80::32F7:DFE:FE25:2DE1 on GigabitEthernet0/1
*Feb  3 21:27:41.123: IPv6 DHCP: detailed packet contents
*Feb  3 21:27:41.123:   src FE80::32F7:DFE:FE25:2DE1
(GigabitEthernet0/1)
*Feb  3 21:27:41.127:   dst FF02::1:2
*Feb  3 21:27:41.127:   type SOLICIT(1), xid 13190645
*Feb  3 21:27:41.127:   option ELAPSED-TIME(8), len 2
*Feb  3 21:27:41.127:     elapsed-time 0
*Feb  3 21:27:41.127:   option CLIENTID(1), len 10
*Feb  3 21:27:41.127:     000
*Feb  3 21:27:41.127: IPv6 DHCP: Using interface pool IPV6-
STATEFUL
*Feb  3 21:27:41.127: IPv6 DHCP: Creating binding for
FE80::32F7:DFE:FE25:2DE1 in pool IPV6-STATEFUL
<Output omitted>
```


7.3 SUMMARY

CHAPTER 7: SUMMARY

- All nodes on a network require a unique IP address to communicate with other devices.
- DHCPv4 includes three different address allocation methods:
 - **Manual Allocation**
 - **Automatic Allocation**
 - **Dynamic Allocation**
- There are two methods available for the dynamic configuration of IPv6 global unicast addresses:
 - **Stateless Address Autoconfiguration (SLAAC)**
 - **Dynamic Host Configuration Protocol for IPv6 (Stateful DHCPv6)**

CHAPTER 7: SUMMARY (CONT.)

The same tasks are involved when troubleshooting DHCPv4 and DHCPv6:

- Resolve address conflicts.
- Verify physical connectivity.
- Test connectivity using a static IP address.
- Verify the switch port configuration.
- Test the operation on the same subnet or VLAN.

TERIMA KASIH



Thank you very much for your kind attention